FCC CFR47 PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

RFID MODULE

MODEL NUMBER: RI20A

FCC ID: ACJ9TGRI20A

REPORT NUMBER: 13489138H-A-R1

ISSUE DATE: April 19, 2021

Prepared for
PANASONIC CORPORATION OF NORTH AMERICA
Two Riverfront Plaza, 9th Floor, Newark, NJ 07102-5490

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CERTIFICATE 5107.02

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

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/25/2021	Initial Issue	T. Shimada
1	04/19/2021	Corrected Model of NFC module	T. Shimada

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PANASONIC CORPORATION OF NORTH AMERICA
Two Riverfront Plaza, 9th Floor, Newark, NJ 07102-5490

EUT DESCRIPTION: RFID MODULE

MODEL: RI20A

SERIAL NUMBER: 0LTSA00140

DATE TESTED: February 1 and 2, 2021

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass

UL Japan, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Japan, Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Japan, Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Japan, Inc. will constitute fraud and shall nullify the document. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body. This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released For UL Japan, Inc. By:

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Leader
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN.

UL Japan, Inc. is accredited by A2LA Certificate Number: 5107.02
FCC Test Firm Registration Number: 199967
ISED Lab Company Number: 2973C / CAB identifier: JP0002
The full scope of accreditation can be viewed at http://japan.ul.com/resources/emc_accredited/

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4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

EMI

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

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.4 dB
	0.15 MHz to 30 MHz	2.9 dB

Radiated emission

Measurement distance	Frequency range		Uncertainty (+/-)
3 m	9 kHz to 30 MHz		3.3 dB
10 m			3.2 dB
3 m	30 MHz to 200 MHz	(Horizontal)	4.8 dB
		(Vertical)	5.0 dB
	200 MHz to 1000 MHz	(Horizontal)	5.2 dB
		(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz	(Horizontal)	4.8 dB
		(Vertical)	4.8 dB
	200 MHz to 1000 MHz	(Horizontal)	5.0 dB
		(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz		4.9 dB
	6 GHz to 18 GHz		5.2 dB
1 m	10 GHz to 26.5 GHz		5.5 dB
	26.5 GHz to 40 GHz		5.5 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %

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5. TEST PROCEDURE AND RESULTS

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.207	19.04 dB 0.56485 MHz, L, QP	Complied a)	-
	<ISED>RSS-Gen 8.8	<ISED>RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.225(a)	78.52 dB 13.56000 MHz QP, 135 deg.	Complied b)	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED>RSS-210 B.6			
Spectrum Mask	ANSI C63.10:2013 6 Standard test methods	Section 15.225(b)(c)	46.68 dB 14.01000 MHz, QP, 135 deg.	Complied b)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
20 dB Bandwidth	ANSI C63.10:2013 6 Standard test methods	Section15.215(c)	See data	Complied c)	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	ANSI C63.10:2013 6 Standard test methods	Section 15.209, Section 15.225 (d)	23.0 dB 567.349 MHz, Vertical, QP	Complied d)	Radiated
	<ISED>RSS-Gen 6.4, 6.13	<ISED>RSS-210 B.6			
Frequency Tolerance	ANSI C63.10:2013 6 Standard test methods	Section 15.225(e)	See data	Complied e)	Radiated
	<ISED>RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6			

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

a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
c) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99% Occupied Bandwidth)
d) Refer to APPENDIX 1 (data of Spurious emission)
e) Refer to APPENDIX 1 (data of Frequency Tolerance)

Symbols:
Complied The data of this test item has enough margin, more than the measurement uncertainty.
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	<IC>RSS-Gen 6.7	-	See data	- a)	Radiated

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

a) Refer to APPENDIX 1 (data of 20dB Bandwidth and 99% Occupied Bandwidth)

Symbols:
Complied The data of this test item has enough margin, more than the measurement uncertainty.
Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is an RFID module that is embedded inside Panasonic HF RFID Reader model FZ-VRFG211.
The radio module is manufactured by NXP.

6.2. MAXIMUM TRANSMITTER FIELD STRENGTH

The field strength of the transmitter is as follows:

Frequency Range (MHz)	Mode	Output Power (dBuV/m @ 30m)
13.56	1) Transmitting mode (Tx) Type A Without Tag	5.38
13.56	3) Transmitting mode (Tx) Type B Without Tag	4.98
13.56	5) Transmitting mode (Tx) FeliCa 212 kbps Without Tag	4.80
13.56	7) Transmitting mode (Tx) FeliCa 424 kbps Without Tag	4.82

The mode is used

Mode	Remarks
Transmitting mode (Tx)	1) Type A without Tag 2) Type A with Tag 3) Type B without Tag 4) Type B with Tag 5) FeliCa 212 kbps Without Tag 6) FeliCa 212 kbps with Tag 7) FeliCa 424 kbps Without Tag 8) FeliCa 424 kbps with Tag
This EUT has two modes; With Tag and Without Tag. Also, the Tag has 4 types (Type A, Type B, FeliCa (212 kbps), FeliCa (424 kbps)). The worst case was confirmed on two modes and type of Tag. RADIATED EMISSION TEST was performed only without Tag as its result was the worst one.	

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Loop antenna.
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.

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was ACM ACM12.52 MIC Test Tool Version 1.03.

6.5. WORST-CASE CONFIGURATION AND MODE

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

6.6. MODIFICATIONS

No modifications were made during testing.

6.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Tablet PC	Panasonic	FM-201SDV2SER	0LTSA00399	-
HF RFID Reader	Panasonic	FZ-VRFG211	0LTSA00140	-
NFC module	Panasonic	RI20A	*1)	-
AC Adapter	Panasoinc	CF-AA5713A	5713AM720X009527WB	-
Tag	Type A	-	-	-
	Type B	-	-	-
	FeliCa(212 kbps)	-	-	-
	FeliCa(424 kbps)	-	-	-

*1) This item is controlled with HF RFID Reader.

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	DC	1	DC	Un-Shielded	1.4 m	N/A
2	AC	1	AC	Un-Shielded	2.0 m	N/A

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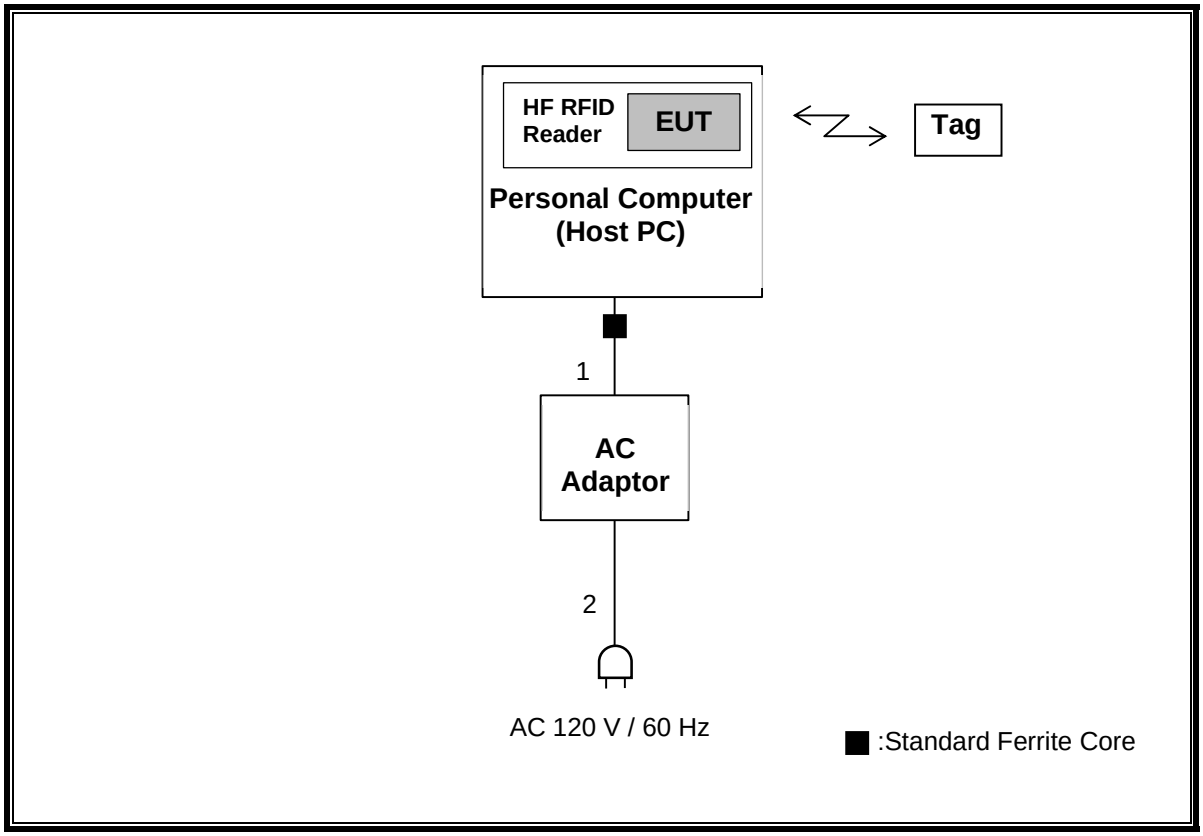
TEST SETUP

The EUT is installed in a host tablet computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



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7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	2020/03/10	12
CE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2020/05/25	24
CE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	2021/01/15	12
CE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	2021/01/07	12
CE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	2020/06/18	12
CE	MLS-23	141357	LISN(AMN)	Schwarzbeck Mess - Elektronik	NSLK8127	8127-729	2020/07/22	12
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	2020/12/07	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	2020/11/06	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	2021/02/03	12
RE	MLA-23	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	2020/09/02	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	VHA 91031302	2020/08/31	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	2021/02/02	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	2020/05/26	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	2020/12/06	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2020/08/18	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MCC-13	141222	Coaxial Cable	Fujikura,HP,Mini-Circits,Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	2020/02/25	12
RE	MLPA-02	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	2020/12/04	12
RE	MCC-219	159670	Coaxial Cable	UL Japan Inc.	-	-	2020/11/17	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	2020/11/13	12
RE	MSA-15	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	2020/10/15	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	2020/08/18	12
RE	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	2020/12/18	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	2020/03/10	12
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2020/05/25	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	2021/01/15	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	2021/01/07	12
RE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
RE	MOS-33	MOS-33	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2020/07/10	12
FT	MFC-01	141498	Microwave Counter	ADVANTEST	R5373	120100309	2020/06/17	12
FT	MCH-06	141430	Temperature and Humidity Chamber	Espec	PL-1KT	14007630	2020/04/15	12
FT	MLPA-09	202512	Loop Antenna	UL Japan	-	-	-	-
FT	MOS-33	MOS-33	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2020/07/10	12

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***Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

Test item:

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

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8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

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In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in § 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.10-2013

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 9 kHz to 1000 MHz.

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.

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.

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

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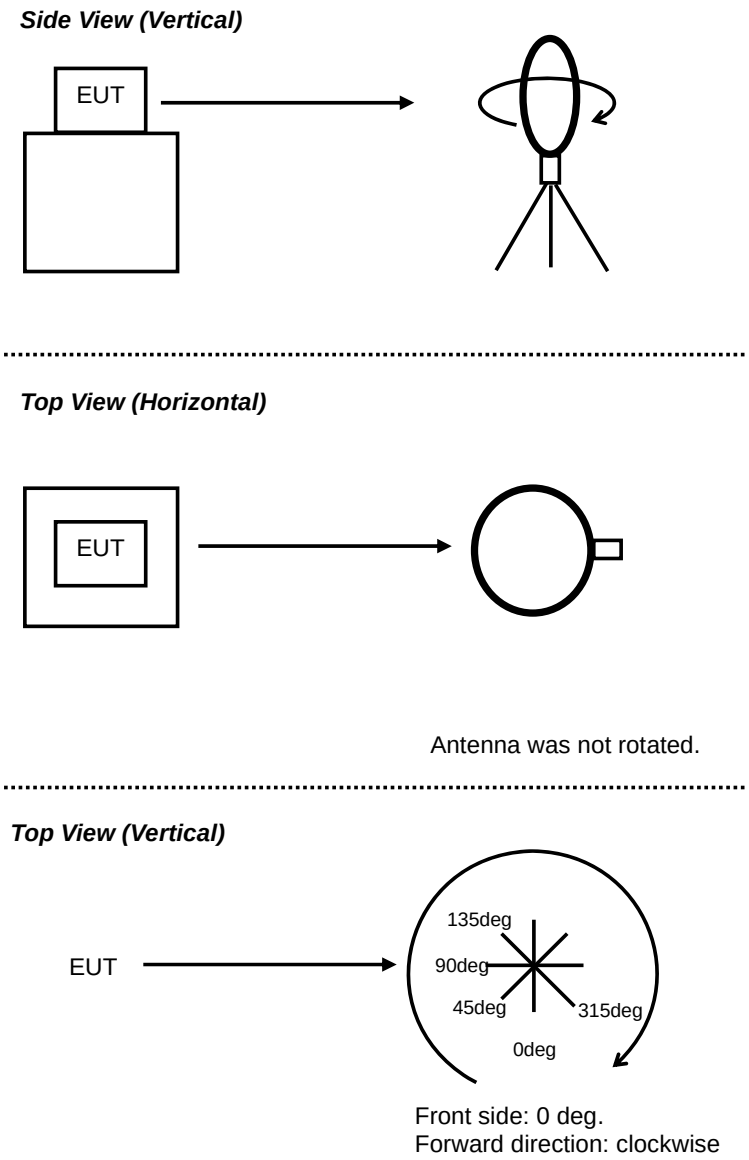
The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 - 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

Figure 1: Direction of the Loop Antenna



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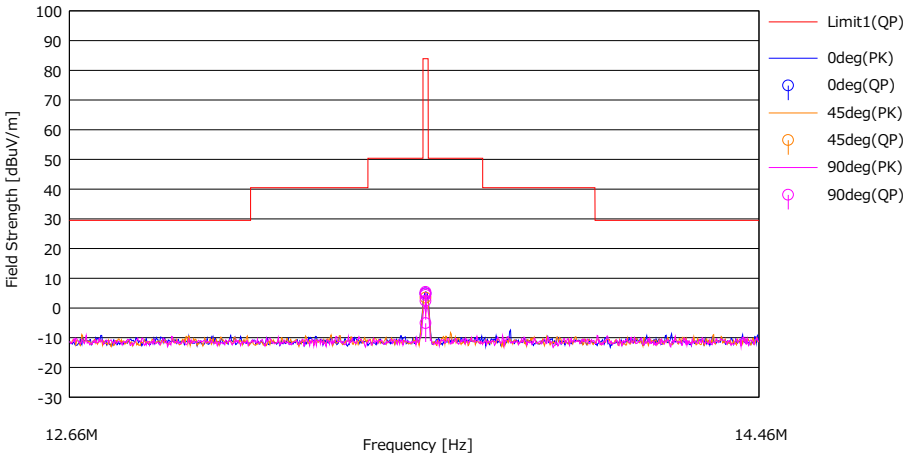
RESULTS

8.2. FUNDAMENTAL EMISSION and Spectrum Mask

Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 1 (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	13.56000	50.40	19.46	-32.97	32.01	4.88	83.90	79.02	0deg	0 deg
2	13.56000	49.00	19.46	-32.97	32.01	3.48	83.90	80.42	45deg	45 deg
3	13.56000	47.90	19.46	-32.97	32.01	2.38	83.90	81.52	90deg	90 deg
4	13.56000	50.90	19.46	-32.97	32.01	5.38	83.90	78.52	90deg	135 deg
5	13.56000	50.40	19.46	-32.97	32.01	4.88	83.90	79.02	90deg	315 deg
6	13.56000	40.40	19.46	-32.97	32.01	-5.12	83.90	89.02	90deg	Hori
7	13.56000	49.90	19.46	-32.97	32.01	4.38	83.90	79.52	90deg	135 deg with Tag

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

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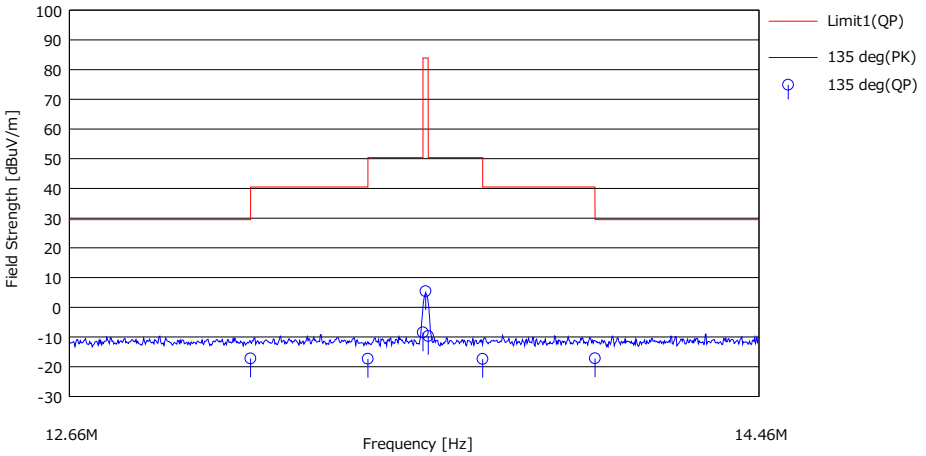
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 1 (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	13.11000	28.31	19.45	-32.99	32.01	-17.24	29.50	46.74	135 deg	
2	13.41000	28.18	19.46	-32.97	32.01	-17.34	40.50	57.84	135 deg	
3	13.55300	37.05	19.46	-32.97	32.01	-8.47	50.40	58.87	135 deg	
4	13.56000	50.90	19.46	-32.97	32.01	5.38	83.90	78.52	135 deg	
5	13.56700	35.86	19.46	-32.97	32.01	-9.66	50.40	60.06	135 deg	
6	13.71000	28.14	19.46	-32.96	32.01	-17.37	40.50	57.87	135 deg	
7	14.01000	28.31	19.46	-32.94	32.01	-17.18	29.50	46.68	135 deg	

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

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
135	13.56000	QP	50.90	19.46	7.03	32.01	-	45.38	-	-	Fundamental

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

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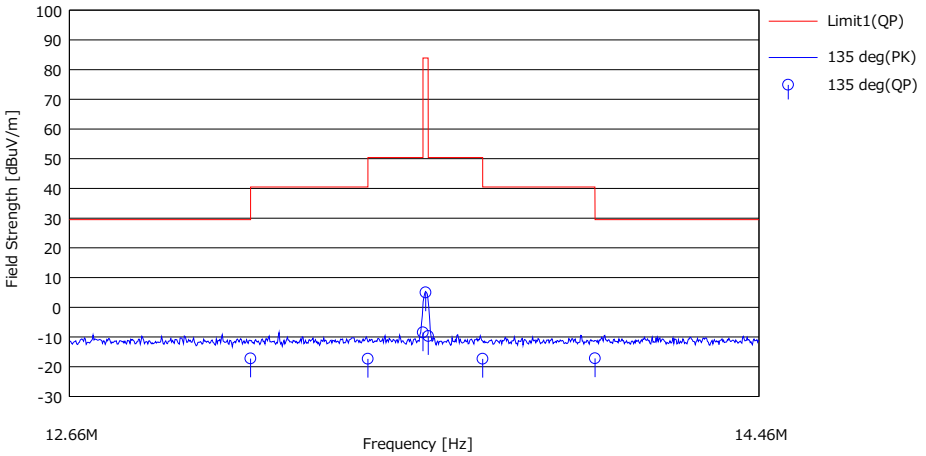
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 2 (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	13.11000	28.30	19.45	-32.99	32.01	-17.25	29.50	46.75	135 deg	
2	13.41000	28.16	19.46	-32.97	32.01	-17.36	40.50	57.86	135 deg	
3	13.55300	37.03	19.46	-32.97	32.01	-8.49	50.40	58.89	135 deg	
4	13.56000	50.50	19.46	-32.97	32.01	4.98	83.90	78.92	135 deg	
5	13.56700	35.82	19.46	-32.97	32.01	-9.70	50.40	60.10	135 deg	
6	13.71000	28.16	19.46	-32.96	32.01	-17.35	40.50	57.85	135 deg	
7	14.01000	28.30	19.46	-32.94	32.01	-17.19	29.50	46.69	135 deg	

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

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
135	13.56000	QP	50.50	19.46	7.03	32.01	-	44.98	-	-	Fundamental

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

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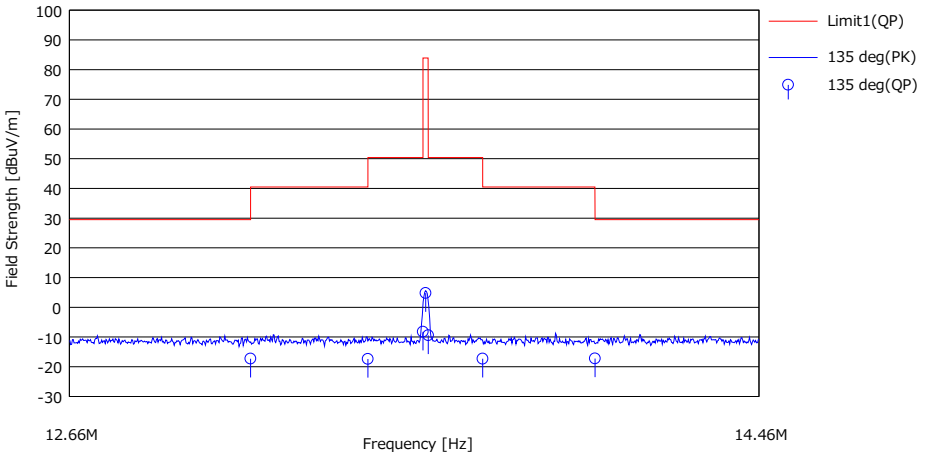
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 3 (FeliCa 212kbps)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	13.11000	28.27	19.45	-32.99	32.01	-17.28	29.50	46.78	135 deg	
2	13.41000	28.14	19.46	-32.97	32.01	-17.38	40.50	57.88	135 deg	
3	13.55300	37.30	19.46	-32.97	32.01	-8.22	50.40	58.62	135 deg	
4	13.56000	50.32	19.46	-32.97	32.01	4.80	83.90	79.10	135 deg	
5	13.56700	36.11	19.46	-32.97	32.01	-9.41	50.40	59.81	135 deg	
6	13.71000	28.21	19.46	-32.96	32.01	-17.30	40.50	57.80	135 deg	
7	14.01000	28.27	19.46	-32.94	32.01	-17.22	29.50	46.72	135 deg	

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

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
135	13.56000	QP	50.32	19.46	7.03	32.01	-	44.80	-	-	Fundamental

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

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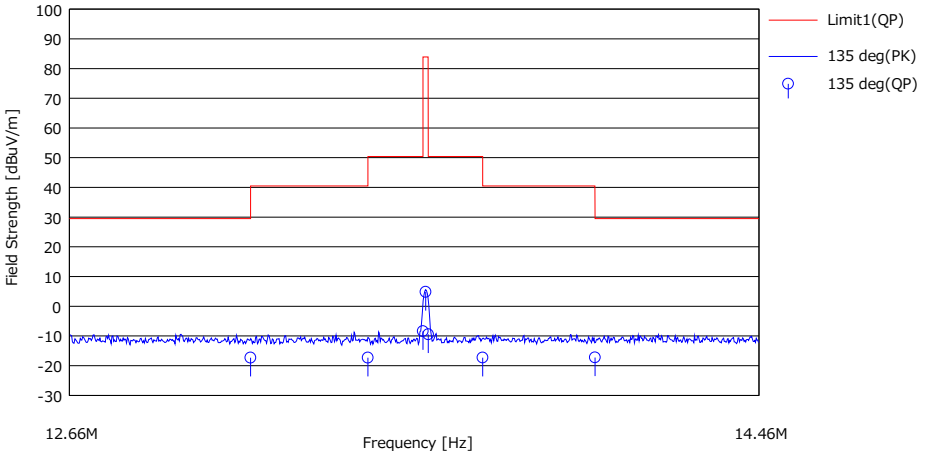
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 4 (FeliCa 424kbps)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	13.11000	28.25	19.45	-32.99	32.01	-17.30	29.50	46.80	135 deg	
2	13.41000	28.22	19.46	-32.97	32.01	-17.30	40.50	57.80	135 deg	
3	13.55300	37.12	19.46	-32.97	32.01	-8.40	50.40	58.80	135 deg	
4	13.56000	50.34	19.46	-32.97	32.01	4.82	83.90	79.08	135 deg	
5	13.56700	36.06	19.46	-32.97	32.01	-9.46	50.40	59.86	135 deg	
6	13.71000	28.22	19.46	-32.96	32.01	-17.29	40.50	57.79	135 deg	
7	14.01000	28.26	19.46	-32.94	32.01	-17.23	29.50	46.73	135 deg	

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

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
135	13.56000	QP	50.34	19.45	7.03	32.01	-	44.81	-	-	Fundamental

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

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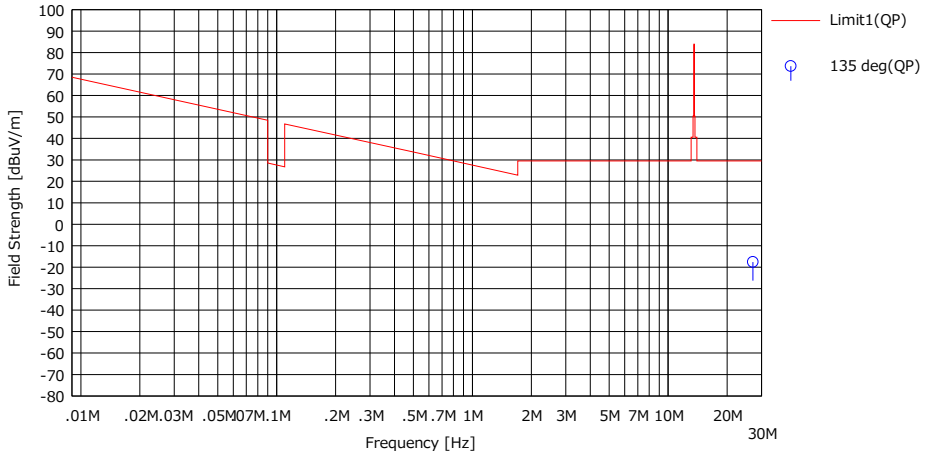
8.3. SPURIOUS EMISSIONS (0.009 MHz - 30 MHz)

Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 1 (Type A)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	27.12000	27.78	19.09	-32.46	31.99	-17.58	29.50	47.08	135 deg	

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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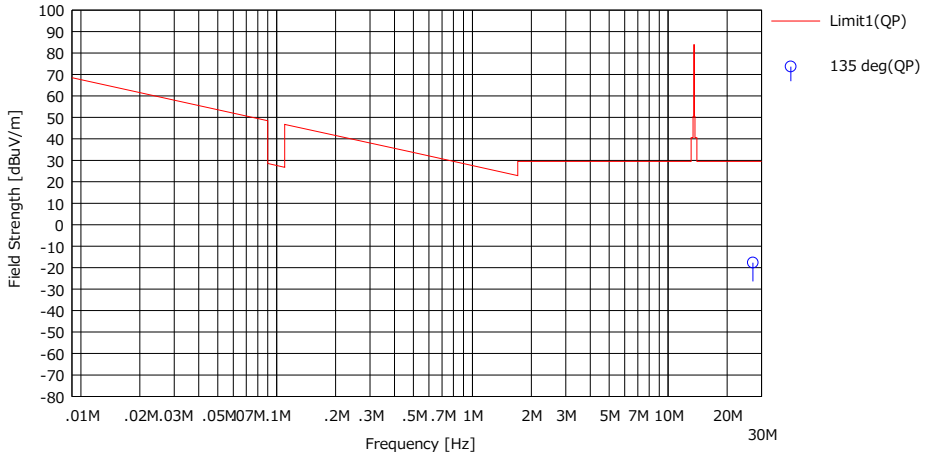
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 2 (Type B)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading <QP> [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP> [dBuV/m]	Limit <QP> [dBuV/m]	Margin <QP> [dB]	Antenna	Comment
1	27.12000	27.68	19.09	-32.46	31.99	-17.68	29.50	47.18	135 deg	

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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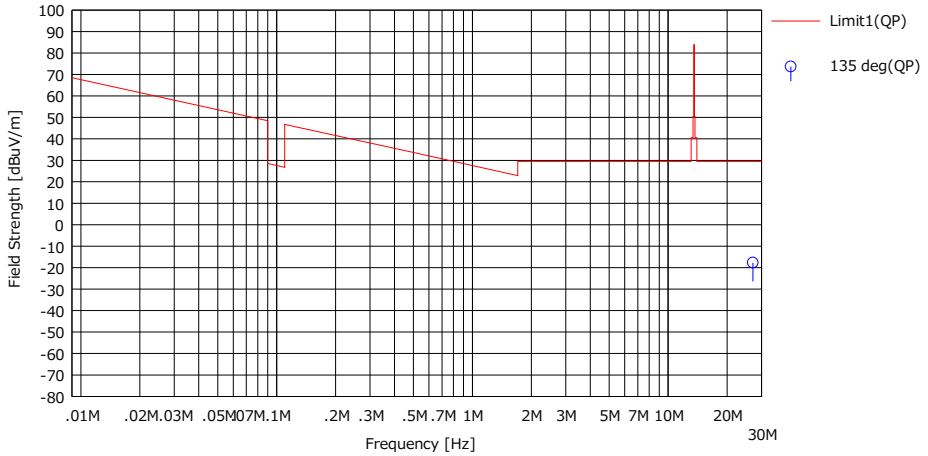
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 3 (FeliCa 212kbps)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading <QP> [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP> [dBuV/m]	Limit <QP> [dBuV/m]	Margin <QP> [dB]	Antenna	Comment
1	27.12000	27.66	19.09	-32.46	31.99	-17.70	29.50	47.20	135 deg	

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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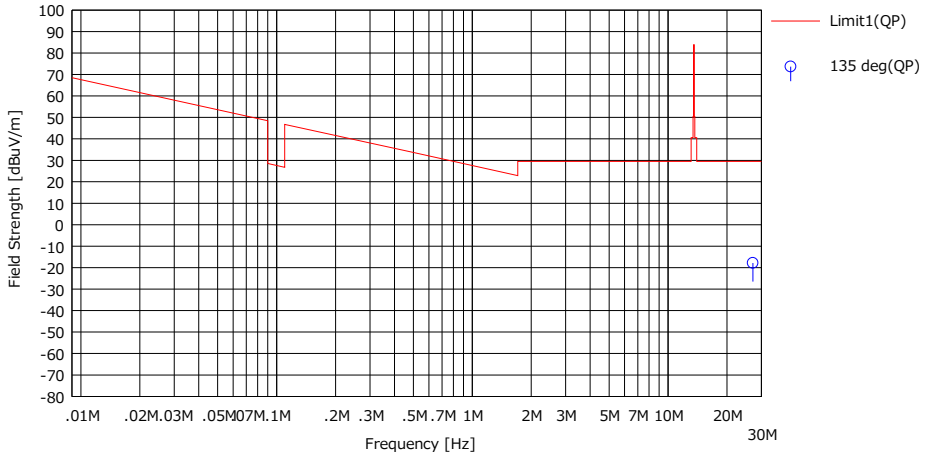
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 4 (FeliCa 424kbps)

Limit : FCC15.225(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



No.	Freq. [MHz]	Reading 〈QP〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈QP〉 [dBuV/m]	Limit 〈QP〉 [dBuV/m]	Margin 〈QP〉 [dB]	Antenna	Comment
1	27.12000	27.54	19.09	-32.46	31.99	-17.82	29.50	47.32	135 deg	

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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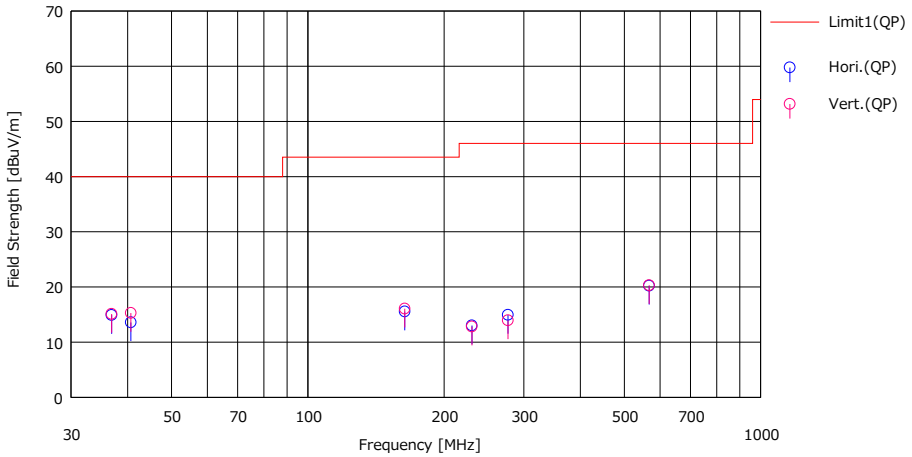
8.4. SPURIOUS EMISSION (30 MHz - 1000 MHz)

Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 1 (Type A)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	36.875	20.40	15.89	7.23	28.61	14.91	40.00	25.0	Hori.	100	0	BA	
2	40.680	20.40	14.49	7.29	28.60	13.58	40.00	26.4	Hori.	100	0	BA	
3	163.787	19.80	15.46	8.54	28.25	15.55	43.52	27.9	Hori.	100	0	BA	
4	230.434	20.50	11.34	9.08	27.91	13.01	46.02	33.0	Hori.	100	319	LA23	
5	276.843	20.10	13.23	9.42	27.81	14.94	46.02	31.0	Hori.	100	0	LA23	
6	567.349	20.20	18.29	11.05	29.34	20.20	46.02	25.8	Hori.	100	0	LA23	
7	36.875	20.60	15.89	7.23	28.61	15.11	40.00	24.8	Vert.	100	0	BA	
8	40.680	22.10	14.49	7.29	28.60	15.28	40.00	24.7	Vert.	100	280	BA	
9	163.787	20.30	15.46	8.54	28.25	16.05	43.52	27.4	Vert.	100	0	BA	
10	230.434	20.30	11.34	9.08	27.91	12.81	46.02	33.2	Vert.	100	6	LA23	
11	276.843	19.10	13.23	9.42	27.81	13.94	46.02	32.0	Vert.	100	0	LA23	
12	567.349	20.30	18.29	11.05	29.34	20.30	46.02	25.7	Vert.	100	130	LA23	

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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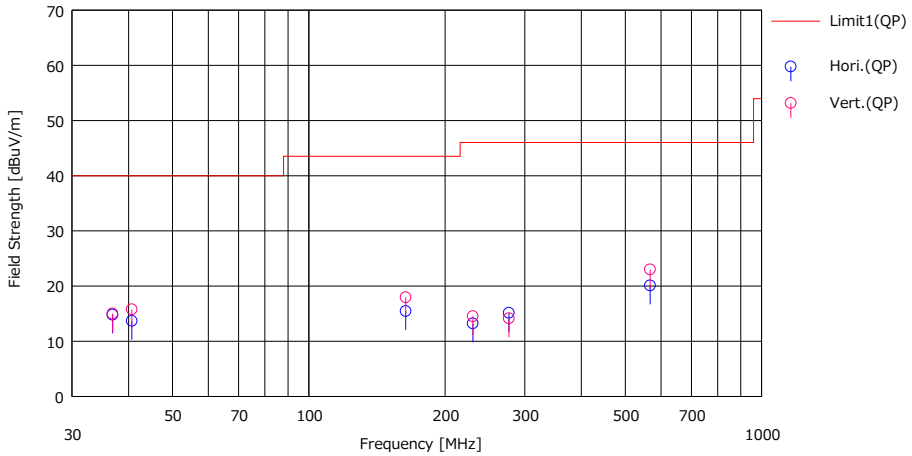
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 2 (Type A)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	36.875	20.30	15.89	7.23	28.61	14.81	40.00	25.1	Hori.	100	0	BA	
2	40.680	20.50	14.49	7.29	28.60	13.68	40.00	26.3	Hori.	100	0	BA	
3	163.787	19.70	15.46	8.54	28.25	15.45	43.52	28.0	Hori.	100	0	BA	
4	230.434	20.70	11.34	9.08	27.91	13.21	46.02	32.8	Hori.	100	300	LA23	
5	276.843	20.30	13.23	9.42	27.81	15.14	46.02	30.8	Hori.	100	0	LA23	
6	567.349	20.10	18.29	11.05	29.34	20.10	46.02	25.9	Hori.	100	0	LA23	
7	36.875	20.50	15.89	7.23	28.61	15.01	40.00	24.9	Vert.	100	0	BA	
8	40.680	22.60	14.49	7.29	28.60	15.78	40.00	24.2	Vert.	100	230	BA	
9	163.787	22.20	15.46	8.54	28.25	17.95	43.52	25.5	Vert.	100	0	BA	
10	230.434	22.00	11.34	9.08	27.91	14.51	46.02	31.5	Vert.	100	10	LA23	
11	276.843	19.30	13.23	9.42	27.81	14.14	46.02	31.8	Vert.	100	0	LA23	
12	567.349	23.00	18.29	11.05	29.34	23.00	46.02	23.0	Vert.	100	340	LA23	

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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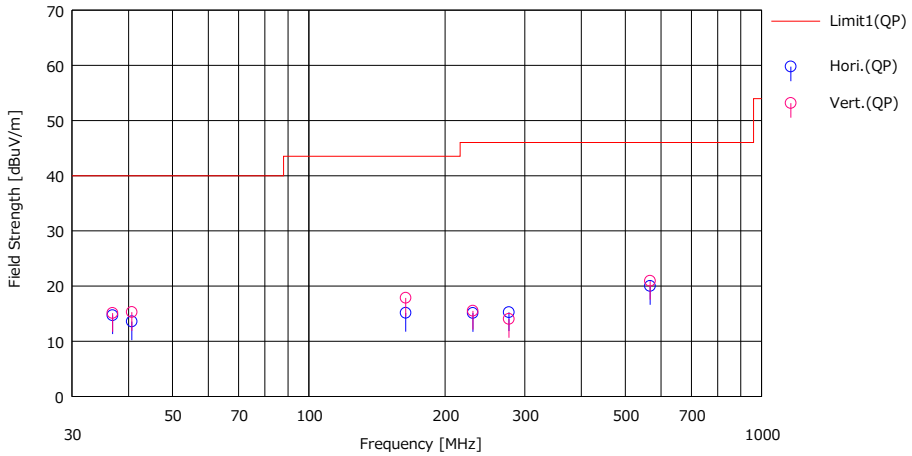
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 3 (FeliCa 212kbps)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	36.875	20.20	15.89	7.23	28.61	14.71	40.00	25.2	Hori.	100	0	BA	
2	40.680	20.40	14.49	7.29	28.60	13.58	40.00	26.4	Hori.	100	0	BA	
3	163.787	19.40	15.46	8.54	28.25	15.15	43.52	28.3	Hori.	100	0	BA	
4	230.434	22.60	11.34	9.08	27.91	15.11	46.02	30.9	Hori.	100	310	LA23	
5	276.843	20.40	13.23	9.42	27.81	15.24	46.02	30.7	Hori.	100	0	LA23	
6	567.349	20.00	18.29	11.05	29.34	20.00	46.02	26.0	Hori.	100	0	LA23	
7	36.875	20.60	15.89	7.23	28.61	15.11	40.00	24.8	Vert.	100	0	BA	
8	40.680	22.10	14.49	7.29	28.60	15.28	40.00	24.7	Vert.	100	214	BA	
9	163.787	22.10	15.46	8.54	28.25	17.85	43.52	25.6	Vert.	100	0	BA	
10	230.434	23.00	11.34	9.08	27.91	15.51	46.02	30.5	Vert.	100	13	LA23	
11	276.843	19.20	13.23	9.42	27.81	14.04	46.02	31.9	Vert.	100	0	LA23	
12	567.349	20.93	18.29	11.05	29.34	20.93	46.02	25.0	Vert.	100	300	LA23	

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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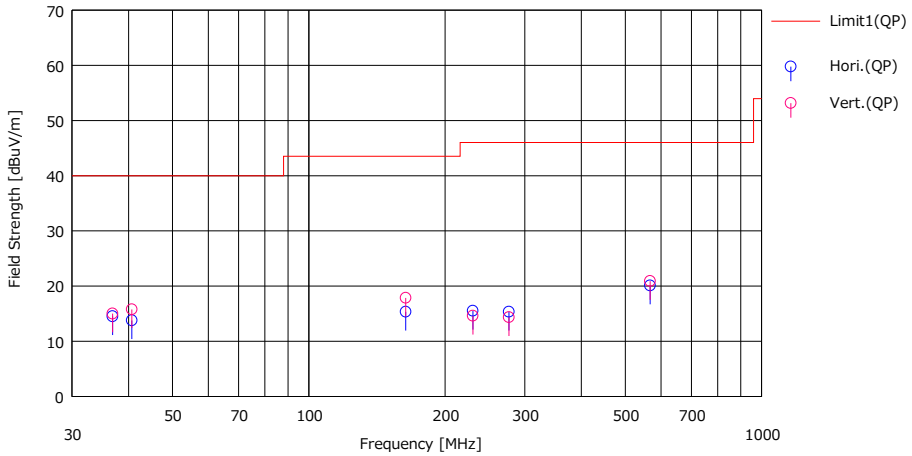
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 4 (FeliCa 424kbps)

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK



No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	36.875	20.00	15.89	7.23	28.61	14.51	40.00	25.4	Hori.	100	0	BA	
2	40.680	20.60	14.49	7.29	28.60	13.78	40.00	26.2	Hori.	100	0	BA	
3	163.787	19.60	15.46	8.54	28.25	15.35	43.52	28.1	Hori.	100	0	BA	
4	230.434	23.00	11.34	9.08	27.91	15.51	46.02	30.5	Hori.	100	298	LA23	
5	276.843	20.50	13.23	9.42	27.81	15.34	46.02	30.6	Hori.	100	0	LA23	
6	567.349	20.10	18.29	11.05	29.34	20.10	46.02	25.9	Hori.	100	0	LA23	
7	36.875	20.50	15.89	7.23	28.61	15.01	40.00	24.9	Vert.	100	0	BA	
8	40.680	22.60	14.49	7.29	28.60	15.78	40.00	24.2	Vert.	100	310	BA	
9	163.787	22.10	15.46	8.54	28.25	17.85	43.52	25.6	Vert.	100	0	BA	
10	230.434	22.10	11.34	9.08	27.91	14.61	46.02	31.4	Vert.	100	5	LA23	
11	276.843	19.50	13.23	9.42	27.81	14.34	46.02	31.6	Vert.	100	0	LA23	
12	567.349	20.90	18.29	11.05	29.34	20.90	46.02	25.1	Vert.	100	310	LA23	

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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9. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Notes:
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

TEST PROCEDURE

ANSI C63.10-2013

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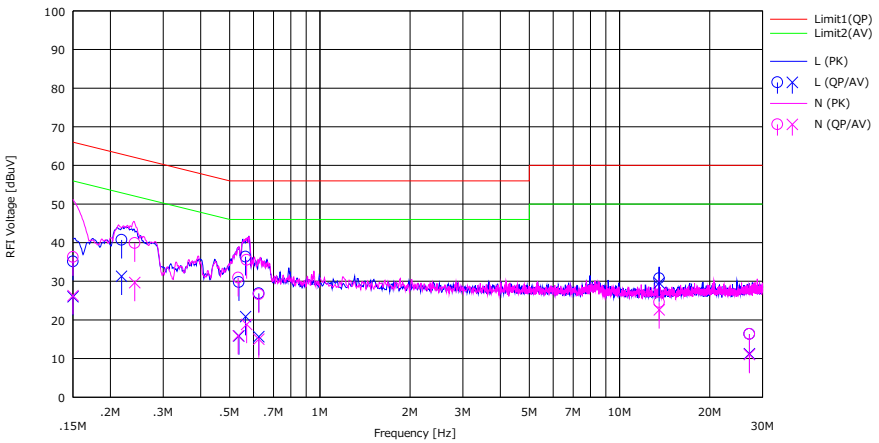
RESULTS

Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 1 (Type A)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈AV〉			〈QP〉	〈AV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	21.80	12.70	0.10	13.20	35.10	26.00	66.00	56.00	30.90	30.00	L	
2	0.21794	27.40	18.00	0.10	13.21	40.71	31.31	62.90	52.90	22.19	21.59	L	
3	0.53675	16.40	2.50	0.10	13.25	29.75	15.85	56.00	46.00	26.25	30.15	L	
4	0.56485	23.00	7.50	0.10	13.26	36.36	20.86	56.00	46.00	19.64	25.14	L	
5	0.62535	13.50	2.30	0.11	13.26	26.87	15.67	56.00	46.00	29.13	30.33	L	
6	13.56000	16.60	15.40	0.35	13.79	30.74	29.54	60.00	50.00	29.26	20.46	L	
7	27.12000	1.60	-3.50	0.68	14.08	16.36	11.26	60.00	50.00	43.64	38.74	L	
8	0.15000	23.00	13.00	0.07	13.20	36.27	26.27	66.00	56.00	29.73	29.73	N	
9	0.24116	26.60	16.40	0.06	13.21	39.87	29.67	62.06	52.06	22.19	22.39	N	
10	0.53402	17.60	2.60	0.06	13.25	30.91	15.91	56.00	46.00	25.09	30.09	N	
11	0.56955	22.20	5.50	0.06	13.26	35.52	18.82	56.00	46.00	20.48	27.18	N	
12	0.62535	13.30	1.70	0.06	13.26	26.62	15.02	56.00	46.00	29.38	30.98	N	
13	13.56000	10.50	8.50	0.30	13.79	24.59	22.59	60.00	50.00	35.41	27.41	N	
14	27.12000	1.70	-3.60	0.56	14.08	16.34	11.04	60.00	50.00	43.66	38.96	N	

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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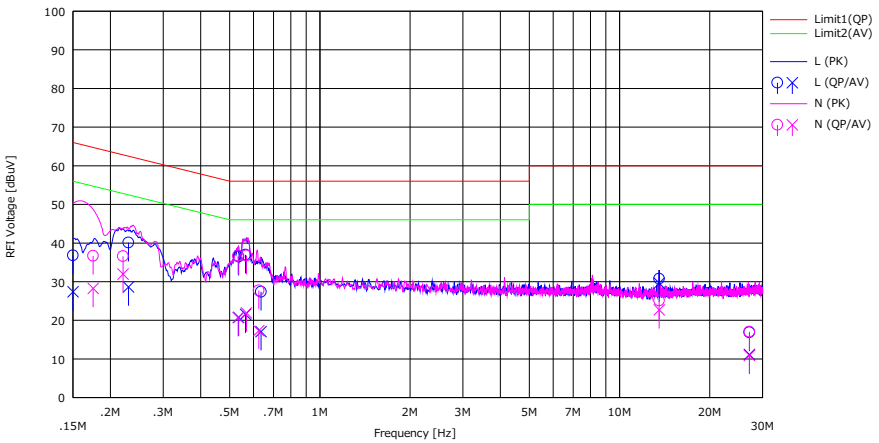
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 35 % RH
Engineer	Junya Okuno
Mode	Mode 2 (Type B)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	23.50	14.10	0.10	13.20	36.80	27.40	66.00	56.00	29.20	28.60	L	
2	0.22988	26.80	15.30	0.10	13.21	40.11	28.61	62.45	52.45	22.34	23.84	L	
3	0.53600	23.10	7.40	0.10	13.25	36.45	20.75	56.00	46.00	19.55	25.25	L	
4	0.56485	23.60	8.20	0.10	13.26	36.96	21.56	56.00	46.00	19.04	24.44	L	
5	0.63629	14.00	3.70	0.11	13.26	27.37	17.07	56.00	46.00	28.63	28.93	L	
6	13.56000	16.60	15.50	0.35	13.79	30.74	29.64	60.00	50.00	29.26	20.36	L	
7	27.12000	2.10	-3.60	0.68	14.08	16.86	11.16	60.00	50.00	43.14	38.84	L	
8	0.17521	23.40	15.00	0.06	13.21	36.67	28.27	64.71	54.71	28.04	26.44	N	
9	0.22043	23.30	18.70	0.06	13.21	36.57	31.97	62.80	52.80	26.23	20.83	N	
10	0.53352	23.40	7.40	0.06	13.25	36.71	20.71	56.00	46.00	19.29	25.29	N	
11	0.56839	23.40	8.60	0.06	13.26	36.72	21.92	56.00	46.00	19.28	24.08	N	
12	0.62535	14.40	4.00	0.06	13.26	27.72	17.32	56.00	46.00	28.28	28.68	N	
13	13.56000	11.00	8.60	0.30	13.79	25.09	22.69	60.00	50.00	34.91	27.31	N	
14	27.12000	2.40	-3.70	0.56	14.08	17.04	10.94	60.00	50.00	42.96	39.06	N	

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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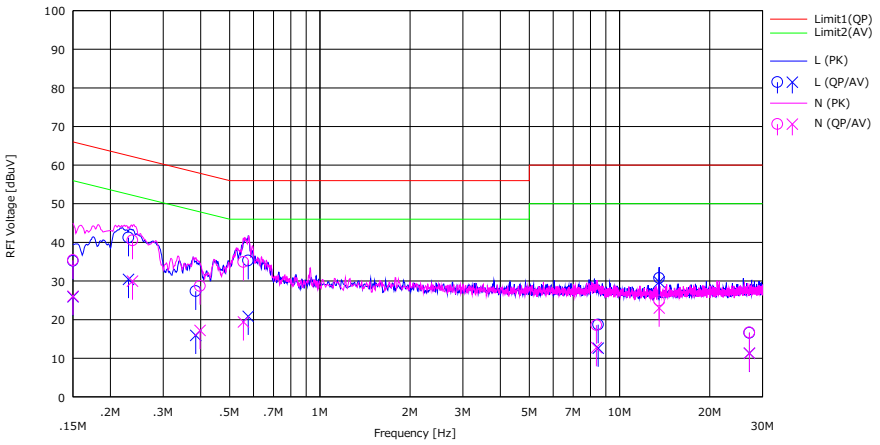
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 3 (FeliCa 212kbps)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	21.90	12.60	0.10	13.20	35.20	25.90	66.00	56.00	30.80	30.10	L	
2	0.22988	27.90	17.10	0.10	13.21	41.21	30.41	62.45	52.45	21.24	22.04	L	
3	0.38528	14.00	2.60	0.10	13.23	27.33	15.93	58.16	48.16	30.83	32.23	L	
4	0.57645	21.90	7.50	0.10	13.26	35.26	20.86	56.00	46.00	20.74	25.14	L	
5	8.48730	4.80	-1.30	0.25	13.65	18.70	12.60	60.00	50.00	41.30	37.40	L	
6	13.56000	16.60	15.60	0.35	13.79	30.74	29.74	60.00	50.00	29.26	20.26	L	
7	27.12000	1.80	-3.50	0.68	14.08	16.56	11.26	60.00	50.00	43.44	38.74	L	
8	0.15000	22.10	12.80	0.07	13.20	35.37	26.07	66.00	56.00	30.63	29.93	N	
9	0.23708	27.20	16.70	0.06	13.21	40.47	29.97	62.20	52.20	21.73	22.23	N	
10	0.39818	15.40	3.90	0.06	13.23	28.69	17.19	57.89	47.89	29.20	30.70	N	
11	0.55581	21.60	6.10	0.06	13.25	34.91	19.41	56.00	46.00	21.09	26.59	N	
12	8.37110	4.70	-1.10	0.21	13.64	18.55	12.75	60.00	50.00	41.45	37.25	N	
13	13.56000	10.80	8.90	0.30	13.79	24.89	22.99	60.00	50.00	35.11	27.01	N	
14	27.12000	2.00	-3.30	0.56	14.08	16.64	11.34	60.00	50.00	43.36	38.66	N	

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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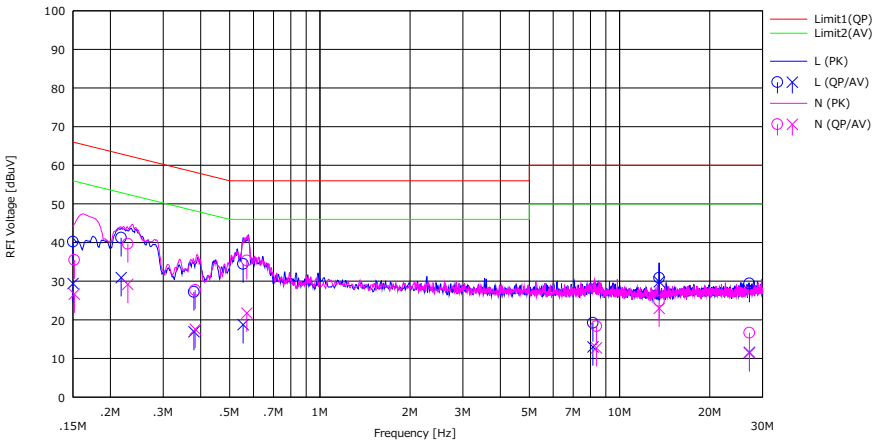
Report No.	13489138H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	February 01, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Junki Nagatomi
Mode	Mode 4 (FeliCa 424kbps)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq.	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP)	(AV)			(QP)	(AV)	(QP)	(AV)	(QP)	(AV)		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	26.90	16.10	0.10	13.20	40.20	29.40	66.00	56.00	25.80	26.60	L	
2	0.21727	27.90	17.60	0.10	13.21	41.21	30.91	62.92	52.92	21.71	22.01	L	
3	0.38003	13.90	3.60	0.10	13.23	27.23	16.93	58.28	48.28	31.05	31.35	L	
4	0.55452	21.10	5.40	0.10	13.25	34.45	18.75	56.00	46.00	21.55	27.25	L	
5	8.15030	5.30	-0.90	0.25	13.64	19.19	12.99	60.00	50.00	40.81	37.01	L	
6	13.56000	16.70	15.70	0.35	13.79	30.84	29.84	60.00	50.00	29.16	20.16	L	
7	27.12000	14.60	-3.20	0.68	14.08	29.36	11.56	60.00	50.00	30.64	38.44	L	
8	0.15157	22.20	13.40	0.07	13.20	35.47	26.67	65.91	55.91	30.44	29.24	N	
9	0.22860	26.40	15.90	0.06	13.21	39.67	29.17	62.50	52.50	22.83	23.33	N	
10	0.38390	14.40	4.30	0.06	13.23	27.69	17.59	58.19	48.19	30.50	30.60	N	
11	0.57068	22.00	8.40	0.06	13.26	35.32	21.72	56.00	46.00	20.68	24.28	N	
12	8.37110	4.50	-1.10	0.21	13.64	18.35	12.75	60.00	50.00	41.65	37.25	N	
13	13.56000	10.80	8.90	0.30	13.79	24.89	22.99	60.00	50.00	35.11	27.01	N	
14	27.12000	2.00	-3.20	0.56	14.08	16.64	11.44	60.00	50.00	43.36	38.56	N	

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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10. FREQUENCY STABILITY

LIMIT

§15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI C63.10-2013

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RESULTS

Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	120	Power on	13.559859	-0.000141	-0.00104	-10.4	0.01
		+ 2 min.	13.559863	-0.000137	-0.00101	-10.1	0.01
		+ 5 min.	13.559865	-0.000135	-0.00100	-10.0	0.01
		+ 10 min.	13.559869	-0.000131	-0.00097	-9.7	0.01
40	120	Power on	13.559858	-0.000142	-0.00105	-10.5	0.01
		+ 2 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
		+ 5 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
		+ 10 min.	13.559859	-0.000141	-0.00104	-10.4	0.01
30	120	Power on	13.559864	-0.000136	-0.00100	-10.0	0.01
		+ 2 min.	13.559863	-0.000137	-0.00101	-10.1	0.01
		+ 5 min.	13.559862	-0.000138	-0.00102	-10.2	0.01
		+ 10 min.	13.559861	-0.000139	-0.00103	-10.3	0.01
20	120	Power on	13.559872	-0.000128	-0.00094	-9.4	0.01
		+ 2 min.	13.559872	-0.000128	-0.00094	-9.4	0.01
		+ 5 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
		+ 10 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
20	102	Power on	13.559872	-0.000128	-0.00094	-9.4	0.01
	(120V -15%)	+ 2 min.	13.559870	-0.000130	-0.00096	-9.6	0.01
		+ 5 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
		+ 10 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
20	138	Power on	13.559873	-0.000127	-0.00094	-9.4	0.01
	(120V +15%)	+ 2 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
		+ 5 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
		+ 10 min.	13.559871	-0.000129	-0.00095	-9.5	0.01
10	120	Power on	13.559881	-0.000119	-0.00088	-8.8	0.01
		+ 2 min.	13.559881	-0.000119	-0.00088	-8.8	0.01
		+ 5 min.	13.559881	-0.000119	-0.00088	-8.8	0.01
		+ 10 min.	13.559881	-0.000119	-0.00088	-8.8	0.01
0	120	Power on	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 2 min.	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 5 min.	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 10 min.	13.559884	-0.000116	-0.00085	-8.5	0.01
-10	120	Power on	13.559872	-0.000129	-0.00095	-9.5	0.01
		+ 2 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 5 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 10 min.	13.559873	-0.000127	-0.00094	-9.4	0.01
-20	120	Power on	13.559840	-0.000160	-0.00118	-11.8	0.01
		+ 2 min.	13.559848	-0.000152	-0.00112	-11.2	0.01
		+ 5 min.	13.559847	-0.000153	-0.00113	-11.3	0.01
		+ 10 min.	13.559847	-0.000153	-0.00113	-11.3	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.

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Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Tx 13.56 MHz (Battery Voltage Operation)

Test condition		Tested timing	Measured frequency	Frequency error	Result		Limit
Temp. [deg. C]	Voltage [V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
20	11.4	Power on	13.559872	-0.000128	-0.00095	-9.5	0.01
		+ 2 min.	13.559870	-0.000130	-0.00096	-9.6	0.01
		+ 5 min.	13.559870	-0.000130	-0.00096	-9.6	0.01
		+ 10 min.	13.559869	-0.000131	-0.00097	-9.7	0.01
20	9.68 (11.4V -15%)	Power on	13.559873	-0.000127	-0.00094	-9.4	0.01
		+ 2 min.	13.559870	-0.000130	-0.00096	-9.6	0.01
		+ 5 min.	13.559869	-0.000131	-0.00097	-9.7	0.01
		+ 10 min.	13.559869	-0.000131	-0.00097	-9.7	0.01
20	13.11 (11.4V +15%)	Power on	13.559871	-0.000129	-0.00095	-9.5	0.01
		+ 2 min.	13.559869	-0.000131	-0.00097	-9.7	0.01
		+ 5 min.	13.559868	-0.000132	-0.00097	-9.7	0.01
		+ 10 min.	13.559867	-0.000133	-0.00098	-9.8	0.01

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

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

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11. 20 dB BANDWIDTH and 99 % Occupied Bandwidth

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 5 % of the 20dB bandwidth and 99 % Occupied Bandwidth. The VBW is set to 3 times the RBW.
Because ASK modulation signal is CW-like signal that the RBW cannot be adjusting to meet 1% to 5% of OBW requirements. Therefore, the test was performed with RBW: 1 kHz, VBW: 3 kHz.
The sweep time is coupled. The spectrum analyzer internal 20dB bandwidth and 99 % Occupied Bandwidth function is utilized.

RESULTS

Frequency (MHz)	20dB Bandwidth (KHz)
13.56, Type A without Tag	5.23
13.56, Type A with Tag	5.18
13.56, Type B without Tag	5.23
13.56, Type B with Tag	5.19
13.56, FeliCa (212 kbps) without Tag	5.22
13.56, FeliCa (212 kbps) with Tag	4.50
13.56, FeliCa (424 kbps) without Tag	5.15
13.56, FeliCa (424 kbps) with Tag	5.53

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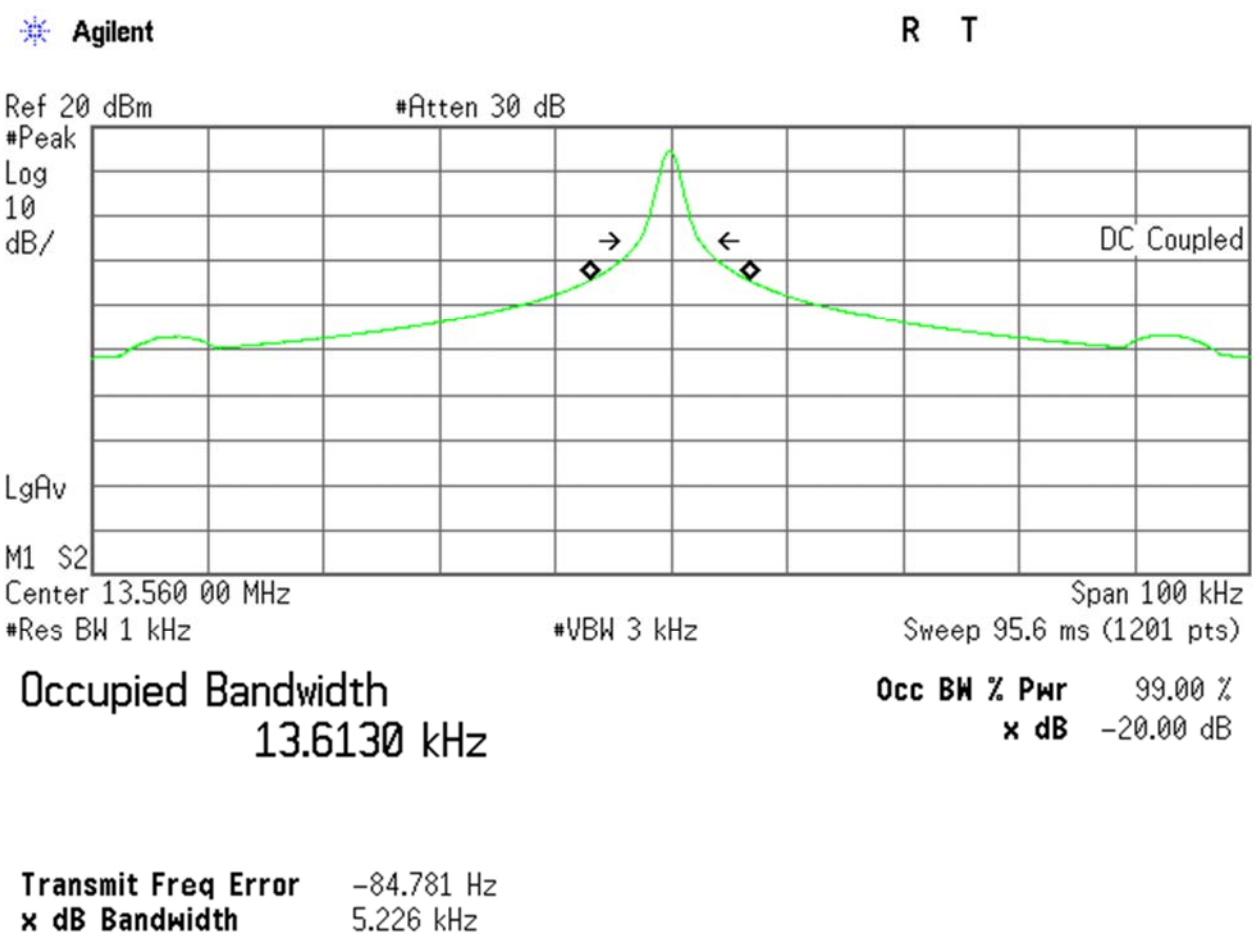
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 1 (Type A)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.23	13.61

Type A Without Tag



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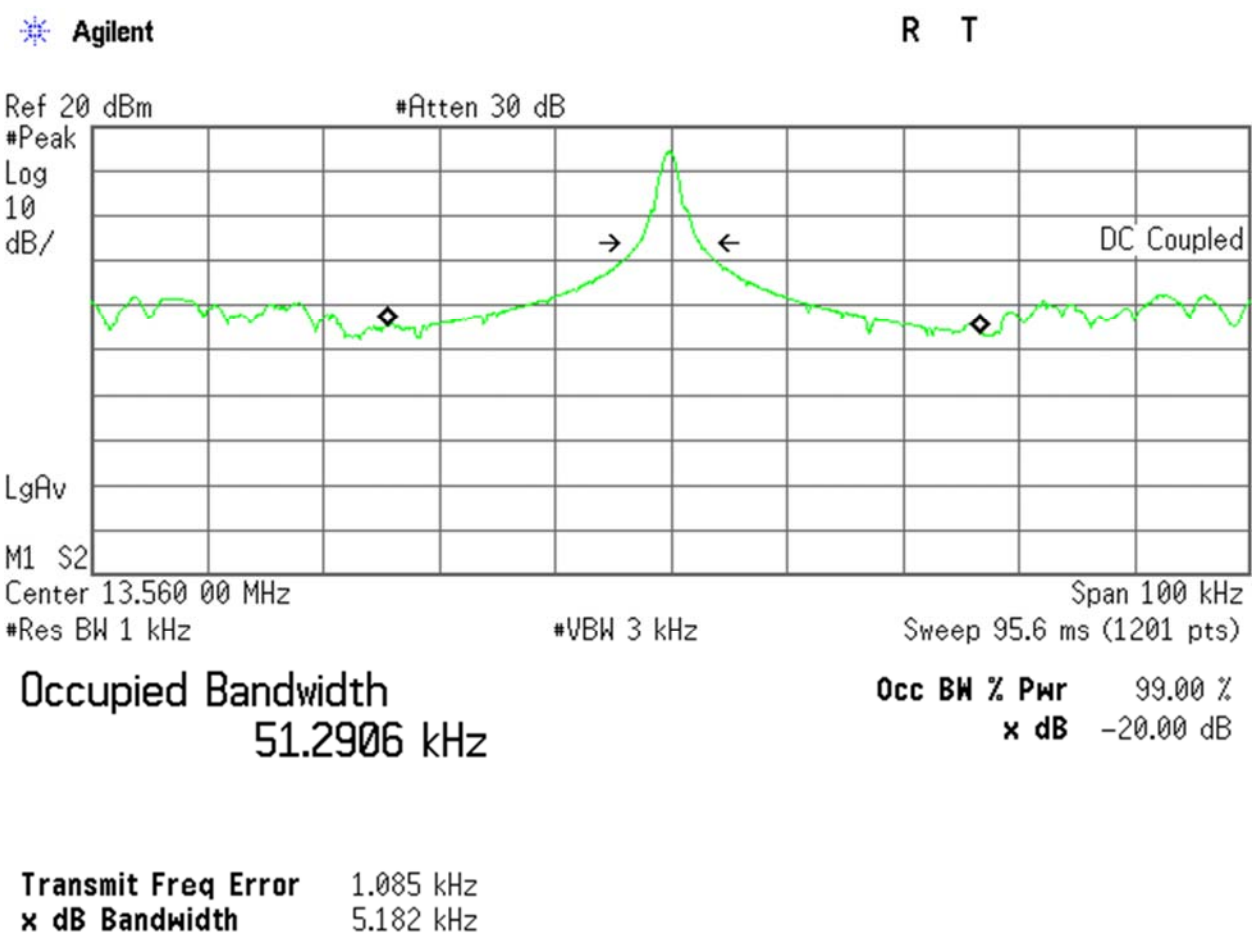
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 2 (Type A)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.18	51.29

Type A With Tag



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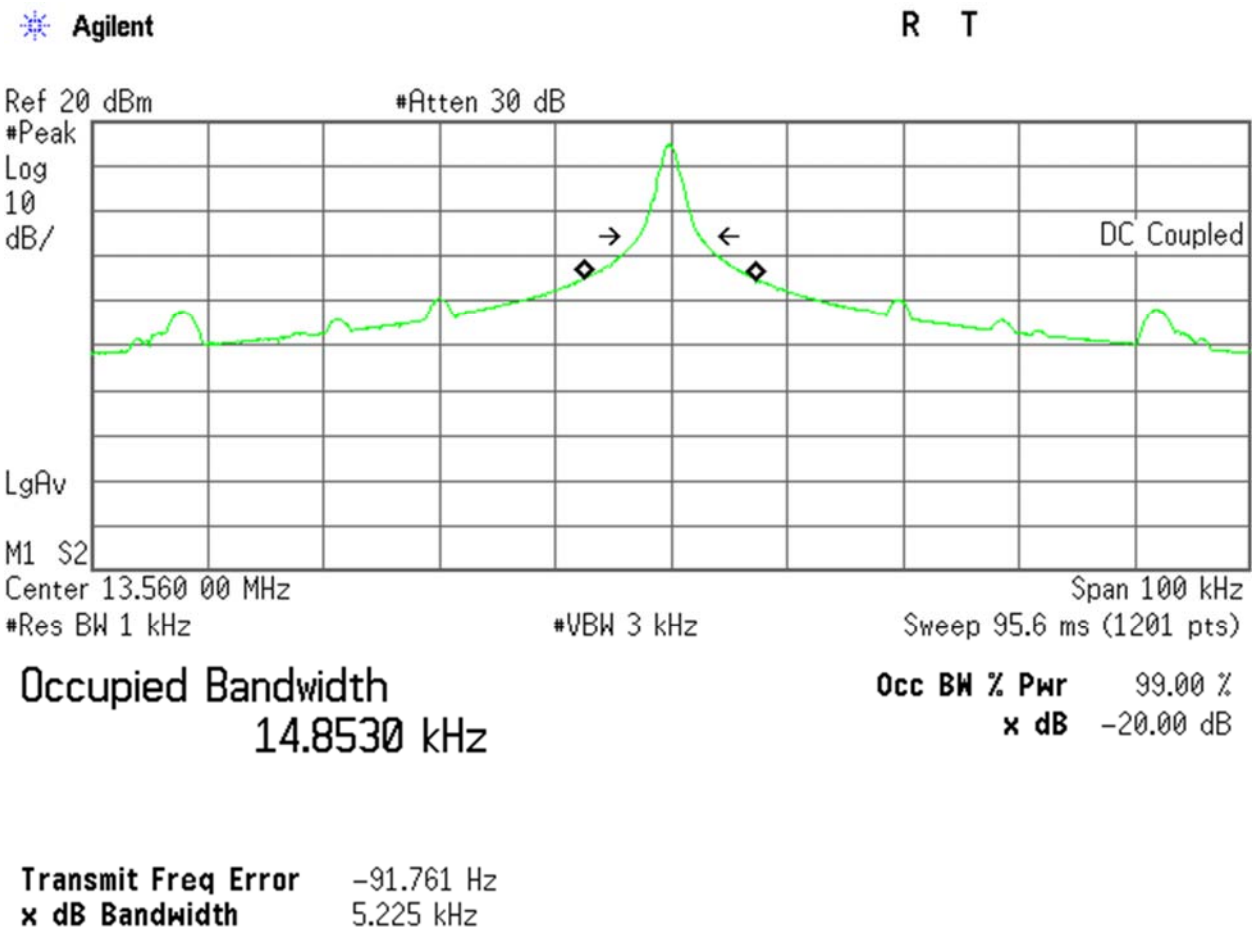
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 3 (Type B)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.23	14.85

Type B Without Tag



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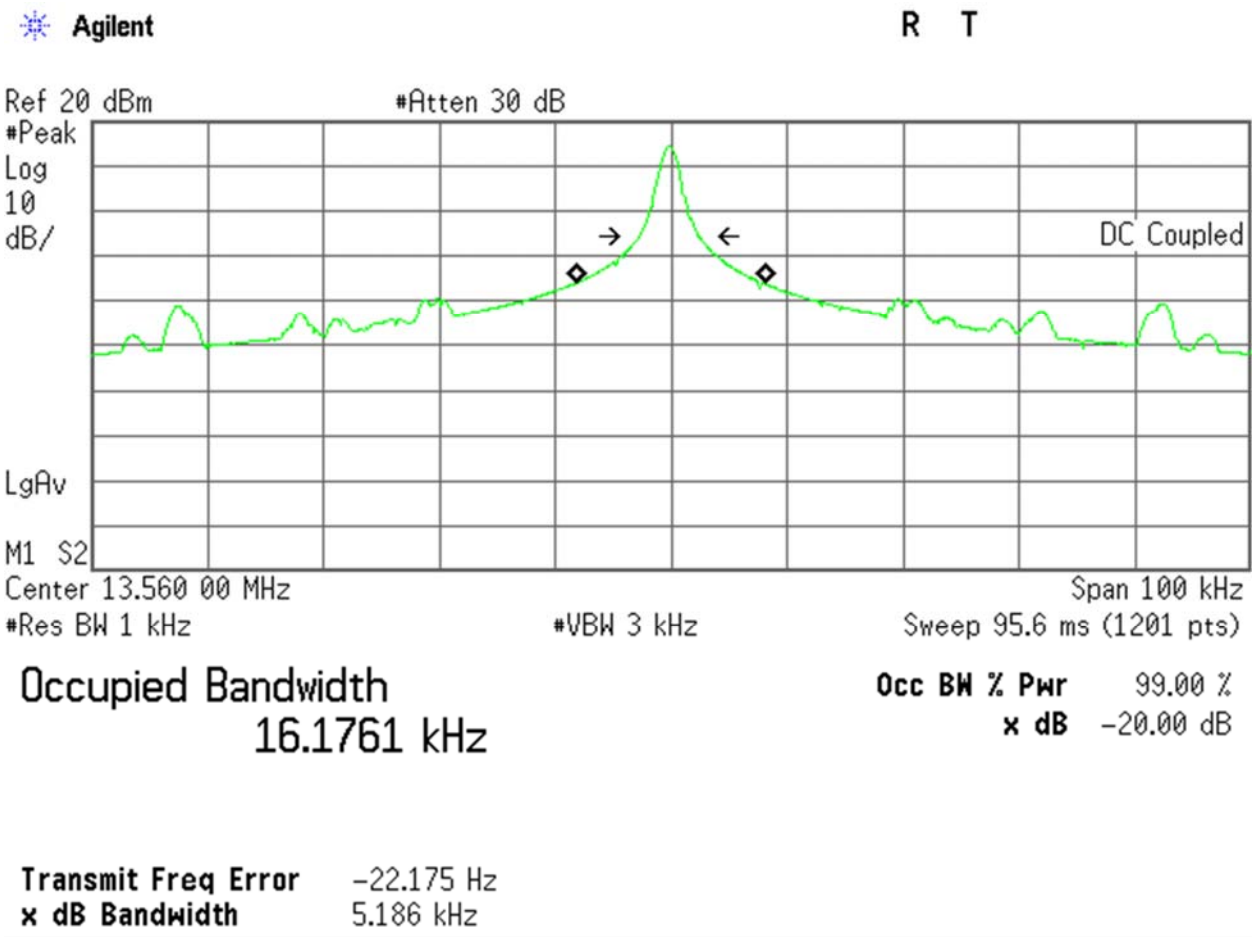
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 4 (Type B)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.19	16.18

Type B With Tag



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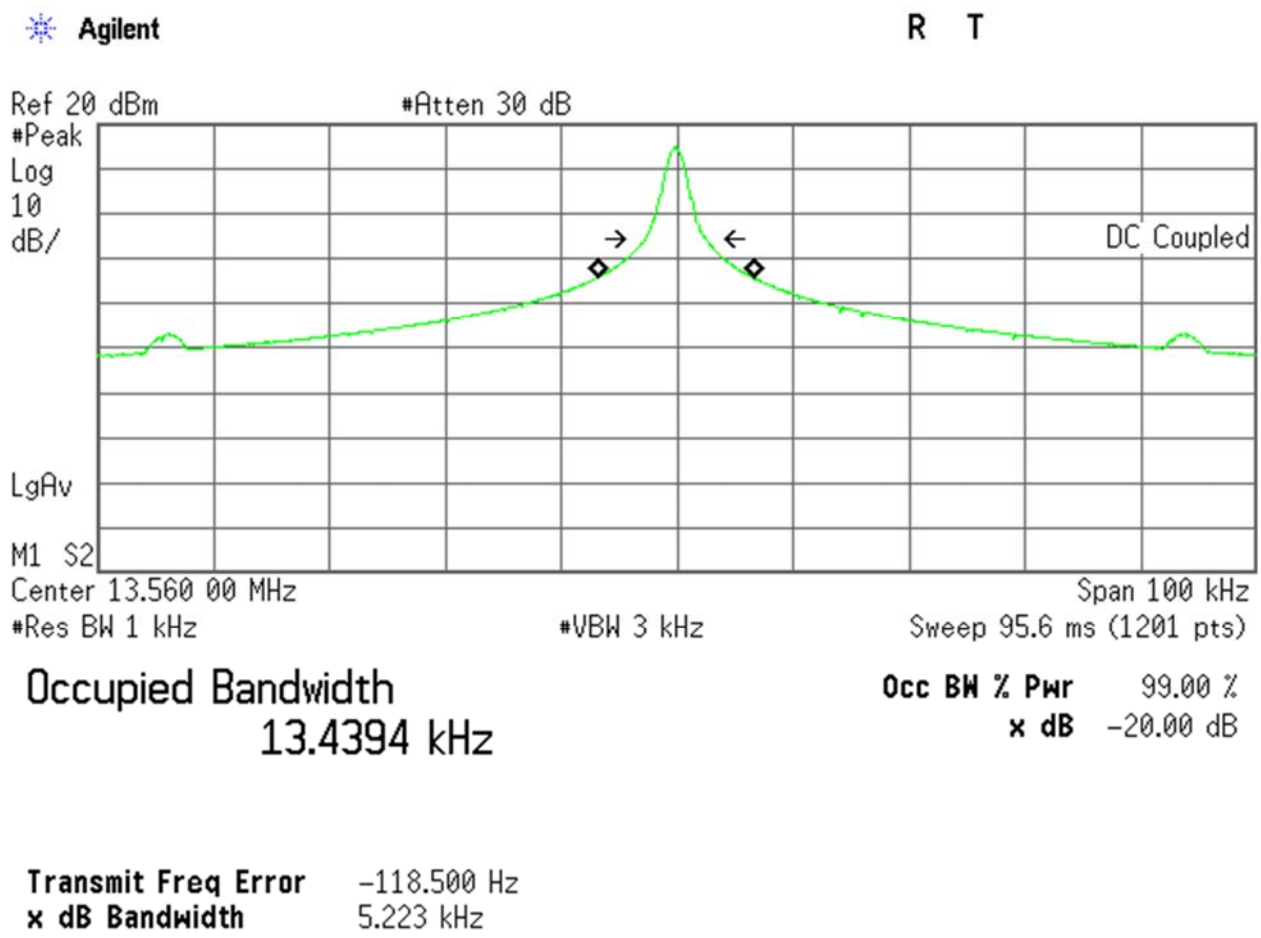
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 5 (FeliCa 212kbps)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.22	13.44

Felica 212kbps Without Tag



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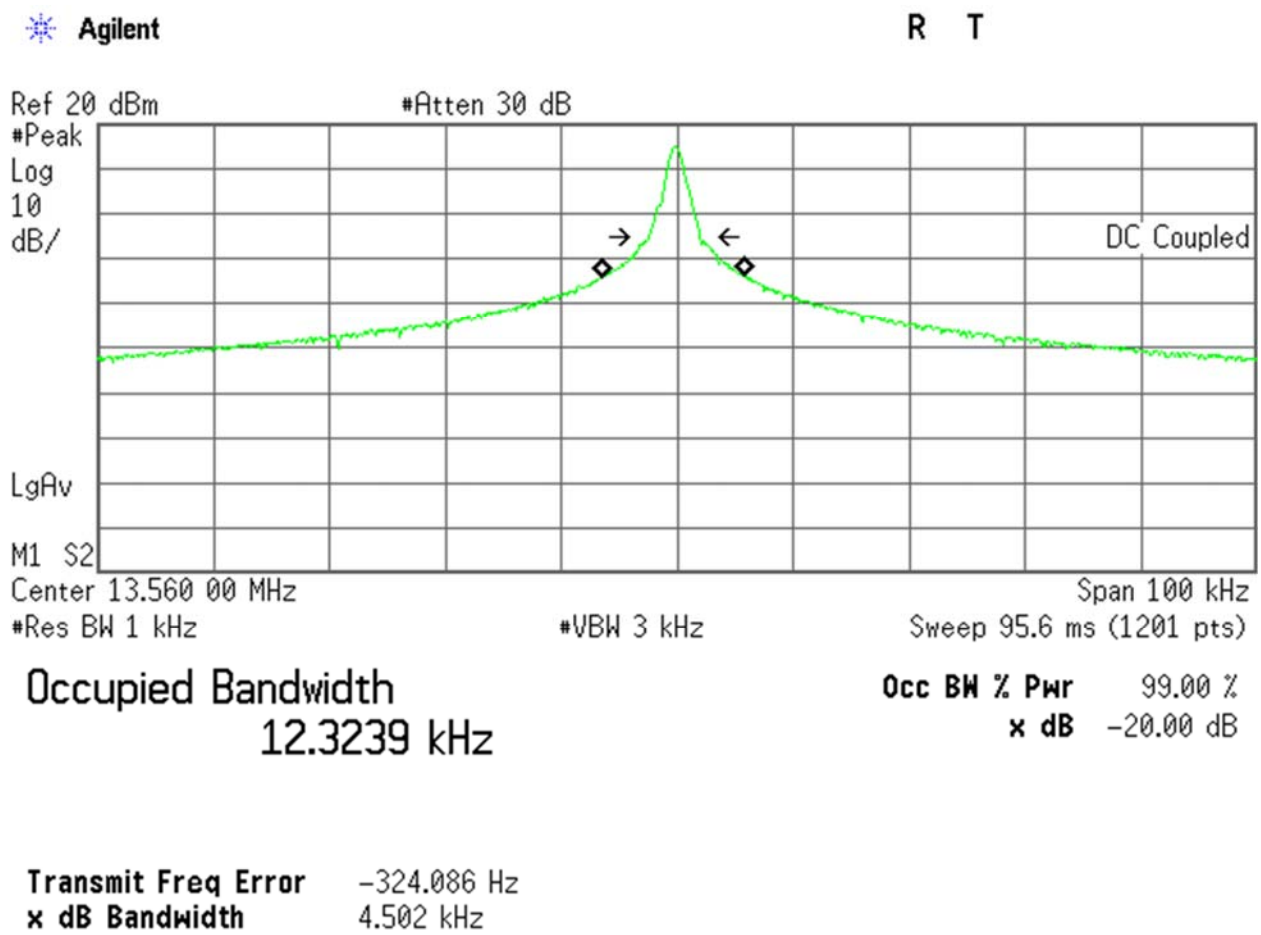
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 6 (FeliCa 212kbps)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	4.50	12.32

Felica 212kbps With Tag



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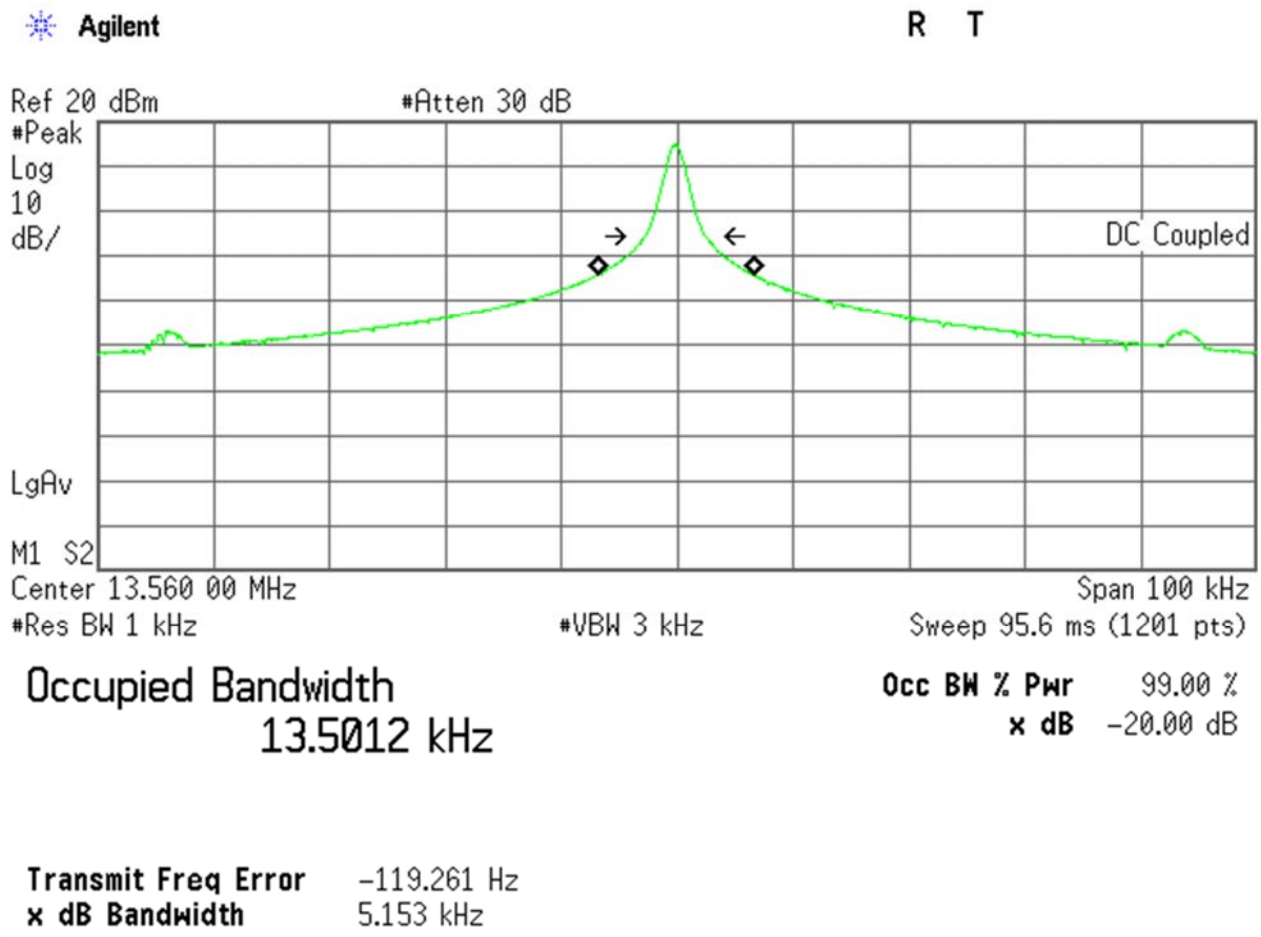
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 7 (FeliCa 424kbps)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.15	13.50

Felica 424kbps Without Tag



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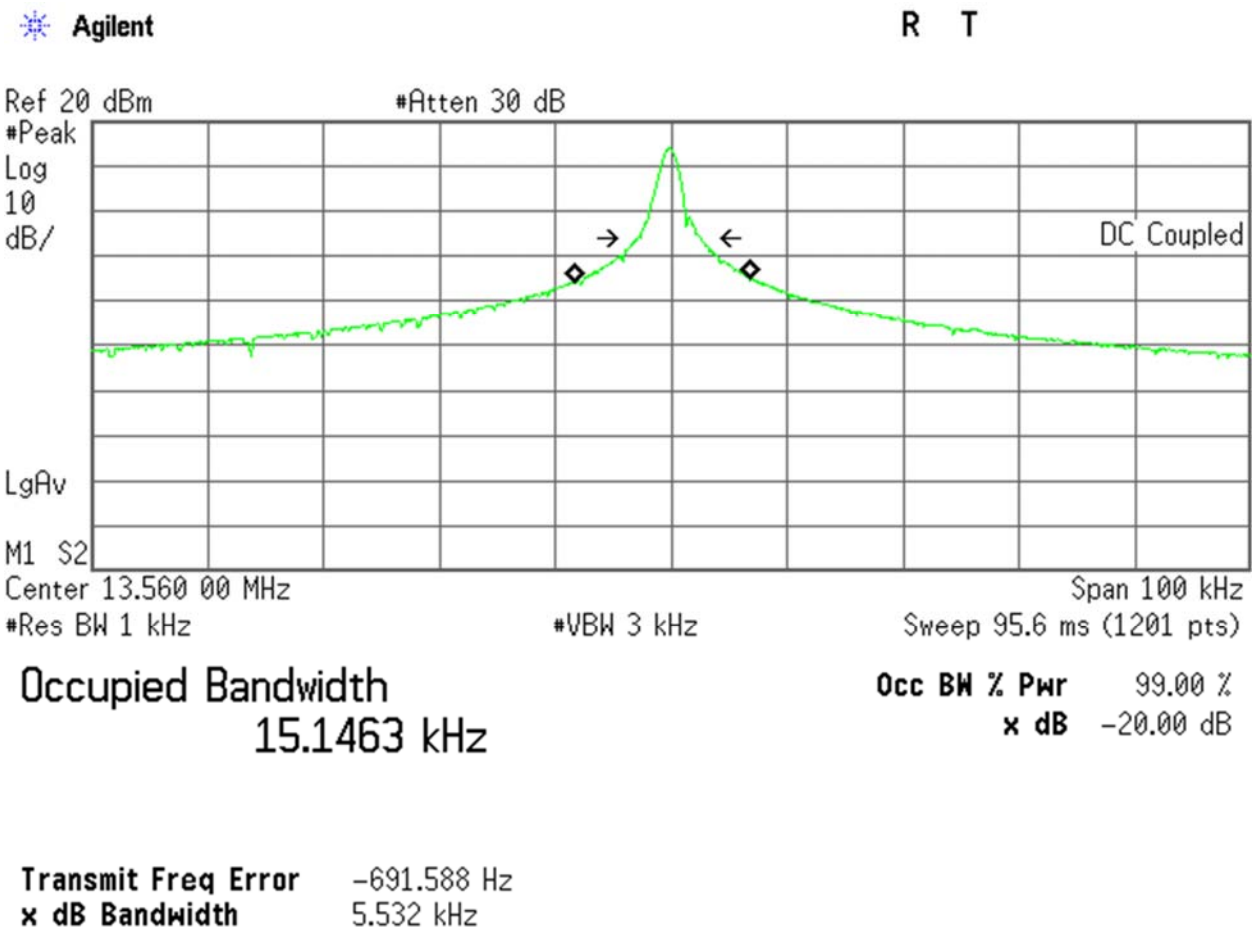
Report No.	13489138H
Test place	Ise EMC Lab.
Measurement Room	No.10
Date	February 02, 2021
Temperature / Humidity	22 deg. C / 36 % RH
Engineer	Yuta Moriya
Mode	Mode 8 (FeliCa 424kbps)

FREQ [MHz]	20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.56	5.53	15.15

Felica 424kbps With Tag



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