RADIO TEST REPORT

Test Report No. 15698330S-A-R1

Customer	**NIDEC INSTRUMENTS CORPORATION**
Description of EUT	**Contactless IC card reader**
Model Number of EUT	**ICM0M0-209**
FCC ID	**2BOKGICM0M0005**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**April 18, 2025**
Remarks	**-**

Representative test engineer	Approved by
M. Ikudome	K. Takeyama
Miku Ikudome Engineer	Kazutaka Takeyama Leader

CERTIFICATE 1266.03

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☒ There is no testing item of "Non-accreditation".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 24.0

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REVISION HISTORY

Original Test Report No. 15698330S-A

This report is a revised version of 15698330S-A. 15698330S-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15698330S-A	April 17, 2025	-
1	15698330S-A-R1	April 18, 2025	p.9, annotation correction “* After the comparison of the test data between Transmitting mode Type A and Type B, with Tag and without Tag, the tests were performed with the worst case.”

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	ICES	Interference-Causing Equipment Standard
AC	Alternating Current	IEC	International Electrotechnical Commission
AFH	Adaptive Frequency Hopping	IEEE	Institute of Electrical and Electronics Engineers
AM	Amplitude Modulation	IF	Intermediate Frequency
Amp, AMP	Amplifier	ILAC	International Laboratory Accreditation Conference
ANSI	American National Standards Institute	ISED	Innovation, Science and Economic Development Canada
Ant, ANT	Antenna	ISO	International Organization for Standardization
AP	Access Point	JAB	Japan Accreditation Board
ASK	Amplitude Shift Keying	LAN	Local Area Network
Atten., ATT	Attenuator	LIMS	Laboratory Information Management System
AV	Average	MCS	Modulation and Coding Scheme
BPSK	Binary Phase-Shift Keying	MRA	Mutual Recognition Arrangement
BR	Bluetooth Basic Rate	N/A	Not Applicable
BT	Bluetooth	NIST	National Institute of Standards and Technology
BT LE	Bluetooth Low Energy	NS	No signal detect.
BW	BandWidth	NSA	Normalized Site Attenuation
Cal Int	Calibration Interval	NVLAP	National Voluntary Laboratory Accreditation Program
CCK	Complementary Code Keying	OBW	Occupied Band Width
Ch., CH	Channel	OFDM	Orthogonal Frequency Division Multiplexing
CISPR	Comite International Special des Perturbations Radioelectriques	P/M	Power meter
CW	Continuous Wave	PCB	Printed Circuit Board
DBPSK	Differential BPSK	PER	Packet Error Rate
DC	Direct Current	PHY	Physical Layer
D-factor	Distance factor	PK	Peak
DFS	Dynamic Frequency Selection	PN	Pseudo random Noise
DQPSK	Differential QPSK	PRBS	Pseudo-Random Bit Sequence
DSSS	Direct Sequence Spread Spectrum	PSD	Power Spectral Density
EDR	Enhanced Data Rate	QAM	Quadrature Amplitude Modulation
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	QP	Quasi-Peak
EMC	ElectroMagnetic Compatibility	QPSK	Quadri-Phase Shift Keying
EMI	ElectroMagnetic Interference	RBW	Resolution Band Width
EN	European Norm	RDS	Radio Data System
ERP, e.r.p.	Effective Radiated Power	RE	Radio Equipment
EU	European Union	RF	Radio Frequency
EUT	Equipment Under Test	RMS	Root Mean Square
Fac.	Factor	RSS	Radio Standards Specifications
FCC	Federal Communications Commission	Rx	Receiving
FHSS	Frequency Hopping Spread Spectrum	SA, S/A	Spectrum Analyzer
FM	Frequency Modulation	SG	Signal Generator
Freq.	Frequency	SVSWR	Site-Voltage Standing Wave Ratio
FSK	Frequency Shift Keying	TR	Test Receiver
GFSK	Gaussian Frequency-Shift Keying	Tx	Transmitting
GNSS	Global Navigation Satellite System	VBW	Video BandWidth
GPS	Global Positioning System	Vert.	Vertical
Hori.	Horizontal	WLAN	Wireless LAN

CONTENTS PAGE

SECTION 1: Customer Information

Company Name	NIDEC INSTRUMENTS CORPORATION
Address	5329,Shimosuwa-machi, Suwa-gun, Nagano, 393-8511 Japan
Telephone Number	+81-266-27-4715
Contact Person	Junro Takeuchi

The information provided by the customer is as follows;
- Customer, Description of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer Information
- SECTION 2: Equipment Under Test (EUT) other than the Receipt Date and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Contactless IC card reader
Model Number	ICM0M0-209
Serial Number	Refer to SECTION 4.2
Condition	Production model
Modification	No Modification by the test lab
Receipt Date	February 17 and April 10, 2025
Test Date	February 22 to April 10, 2025

2.2 Product Description

General Specification

Rating	DC 5 V (DC 5.25 V - 4.75 V)
Operating Temperature	-10 deg. C to +60 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	13.56 MHz
Type of Modulation	ASK

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
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.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.207	15.9 dB 27.12000 MHz, AV, L1	Complied	-
	<ISED> RSS-Gen 8.8	<ISED> RSS-Gen 8.8			
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(a)	43.9 dB 13.560 MHz, Vertical	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED> RSS-210 B.6 (a)			
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(b)(c)	21.6 dB 13.771 MHz, Vertical	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6 (a)			
20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section15.215(c)	See data	Complied	Radiated
	<ISED> -	<ISED> -			
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.209, Section 15.225 (d)	1.7 dB 54.236 MHz, Vertical	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6 (a) RSS-Gen 8.9			
Frequency Tolerance	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(e)	See data	Complied	Radiated
	<ISED> RSS-Gen 6.11, 8.11	<ISED> RSS-210 B.6 (b)			
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.					

FCC Part 15.31 (e)

The EUT has its own regulator.
The EUT is constantly provided with voltage through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.
However, the supply voltage was varied and tested at 95 % and 105 % 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.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % emission bandwidth	<ISED>RSS-Gen 6.7	-	N/A	-	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.					

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

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.
Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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

Item	Frequency range	Uncertainty (+/-)
Conducted Emission (AC Mains) LISN	150 kHz to 30 MHz	3.0 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz to 30 MHz	3.3 dB
	30 MHz to 200 MHz	4.8 dB
	200 MHz to 1 GHz	6.1 dB
	1 GHz to 6 GHz	4.7 dB
	6 GHz to 18 GHz	5.3 dB
	18 GHz to 40 GHz	5.5 dB

Antenna terminal test	Uncertainty (+/-)
Frequency Measurement (13.56 MHz)	1.6 x 10^-7
Bandwidth Measurement	0.012 %
Temperature	2.2 deg.C.
Humidity	3.4 %
Voltage	0.92 %

3.5 Test Location

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 Japan
Telephone: +81-463-50-6400
A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test room	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber (SAC1)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber (SAC2)	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber (SAC3)	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber (SAC4)	8.1 x 5.1 x 3.55	8.1 x 5.1	-
Wireless anechoic chamber 1 (WAC1)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
Wireless anechoic chamber 2 (WAC2)	9.5 x 6.0 x 5.4	9.5 x 6.0	3 m
No.1 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	2.55 x 4.1 x 2.5	-	-
No.2 Measurement room	4.5 x 3.5 x 2.5	-	-
Wireless shielded room 1	3.0 x 4.5 x 2.7	3.0 x 4.5	-
Wireless shielded room 2	3.0 x 4.5 x 2.7	3.0 x 4.5	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

The mode is used:

Test mode	Remarks
1) 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. *Power of the EUT was set by the software as follows; Software: CardReaderUtility Version: 3245-02Y (Date: 2024.12 11, Storage location: Driven by connected PC) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.	

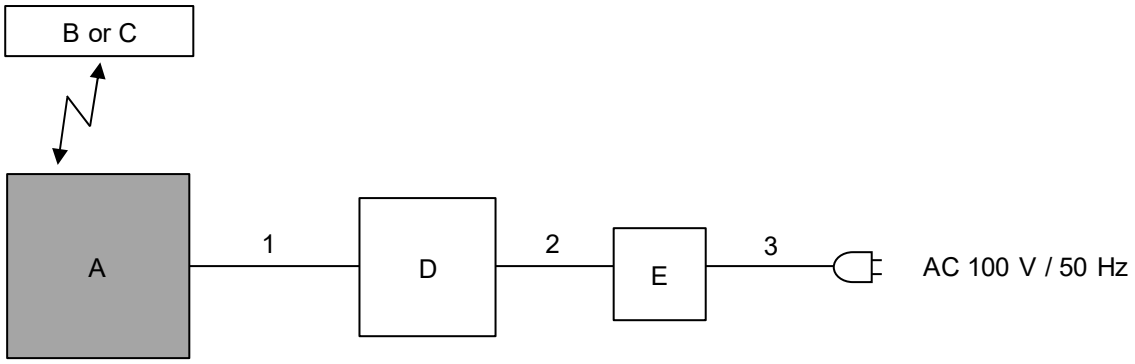
Test Item	Operating mode*
Conducted Emission	Tx Mod on, with Tag (Type A)
Electric Field Strength of Fundamental Emission	Tx Mod on, with Tag (Type A)
Spectrum Mask	Tx Mod on, with Tag (Type A)
20 dB Bandwidth and 99 % Occupied Bandwidth	Tx Mod on, with Tag (Type A)
Electric Field Strength of Spurious Emission	Tx Mod on, with Tag (Type A)
Frequency Tolerance	Tx Mod off

* After the comparison of the test data between Transmitting mode Type A and Type B, with Tag and without Tag, the tests were performed with the worst case.

Frequency Tolerance	
Temperature	-20 deg. C to +50 deg. C Step 10 deg. C
Voltage	Normal Voltage DC 5 V Maximum Voltage DC 5.25 V (DC 5 V +5 %) Minimum Voltage DC 4.75 V (DC 5 V -5 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage	

4.2 Configuration and peripherals

Radiated emission tests



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

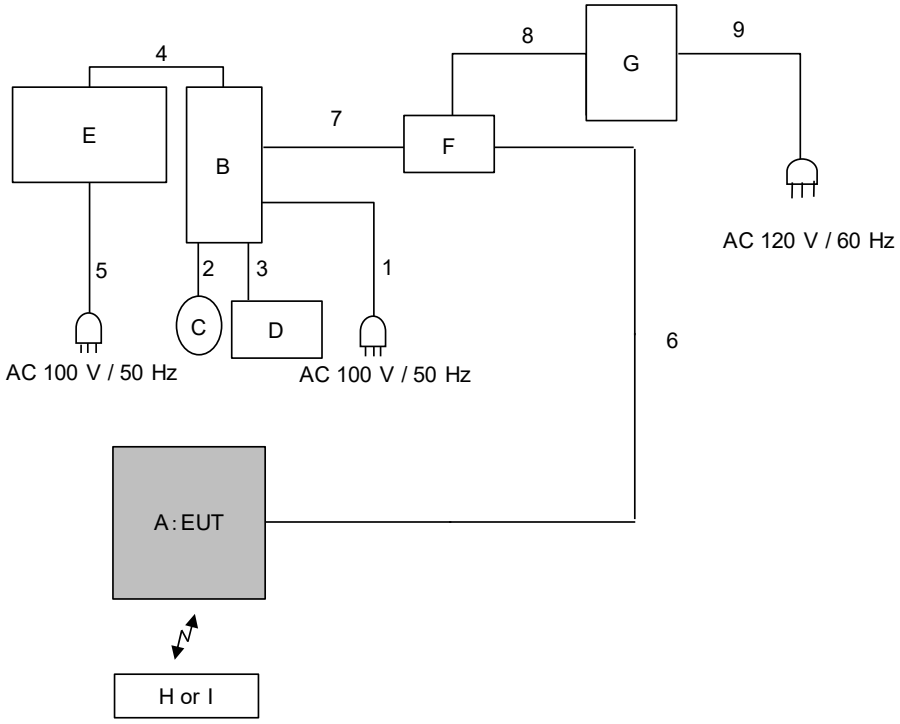
Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	Contactless IC card reader	ICM0M0-209	R-5010421	NIDEC INSTRUMENTS	EUT
B	Tag (Type A)	CVV2	No.1	Revolut	-
C	Tag (Type B)	CVC	No.1	Revolut	-
D	Laptop Computer	ThinkPad L580	PF1PMM0X	LENOVO	-
E	AC adaptor	ADLX45YCC2A	8SSA10E75842L1CZ9480J61	LENOVO	-

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB	5.0	Shielded	Shielded	-
2	DC	1.7	Unshielded	Unshielded	-
3	AC	0.8	Unshielded	Unshielded	-

Other tests



* 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	Contactless IC card reader	ICM0M0-209	R-5010421	NIDEC INSTRUMENTS	EUT
B	PC	Endeavor AT991	D11-0207001	EPSON	-
C	MOUSE	CP517768-01	HSA41800712	FUJITSU	-
D	KEYBOARD	128872-103	0754	FUJITSU	-
E	Display	LCD 172VXM	25223529NJ	NEC	-
F	Voltage Fluctuations JIG	-	-	-	-
G	Power Supply (DC)	PNA16-10A	ER001085 *1)	Kikusui Electronics Corp.	-
			ER001077 *2)		
H	Tag (Type A)	CVV2	No.1	Revolut	-
I	Tag (Type B)	CVC	No.1	Revolut	-

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	AC	3.0	Unshielded	Unshielded	-
2	MOUSE	1.8	Shielded	Shielded	-
3	KEYBOARD	1.5	Shielded	Shielded	-
4	Display	1.2	Shielded	Shielded	-
5	AC	1.5	Unshielded	Unshielded	-
6	USB	5.0	Shielded	Shielded	-
7	USB	1.0	Shielded	Shielded	-
8	DC	0.5	Unshielded	Unshielded	-
9	AC	2.0	Unshielded	Unshielded	-

*1) Used for Conducted emission test.
*2) Used for Frequency Tolerance and Bandwidth tests.

SECTION 5: Conducted Emission

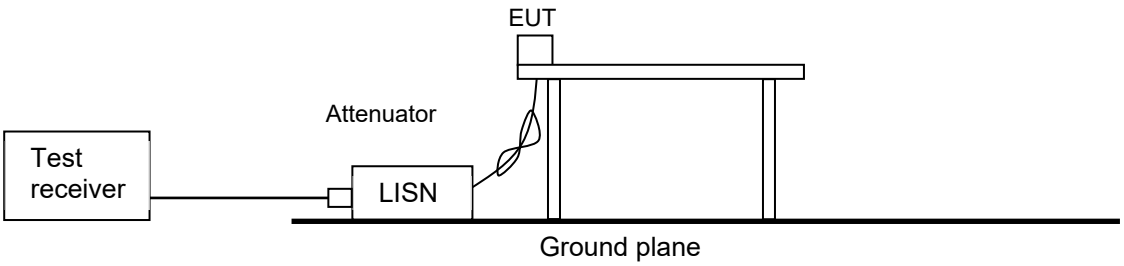
Test Procedure and conditions

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.

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 shielded room. The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

Figure 1: Test Setup



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 to 30 MHz
Test data : APPENDIX
Test result : Pass

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

Test Procedure

EUT was placed on a urethane platform of nominal size, 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.

[Limit conversion]

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.

[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 3 about Direction of the Loop Antenna.

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.

[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.

[Test instruments and test settings]

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

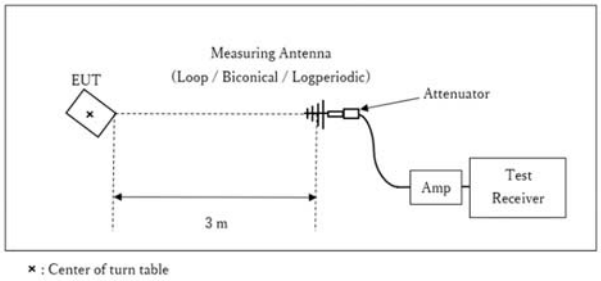
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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

Figure 2: Test Setup

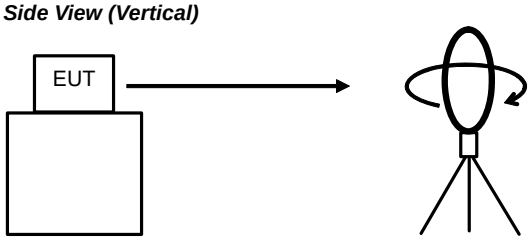
Below 1 GHz



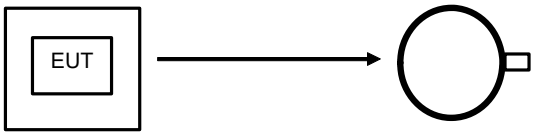
Test Distance: 3 m

Figure 3: Direction of the Loop Antenna

Side View (Vertical)

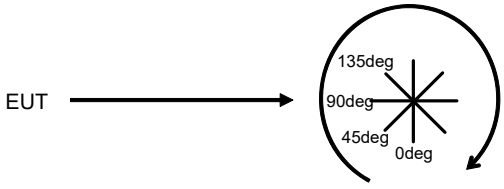


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

The test was made on EUT at the normal use position.

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

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

SECTION 7: Other tests

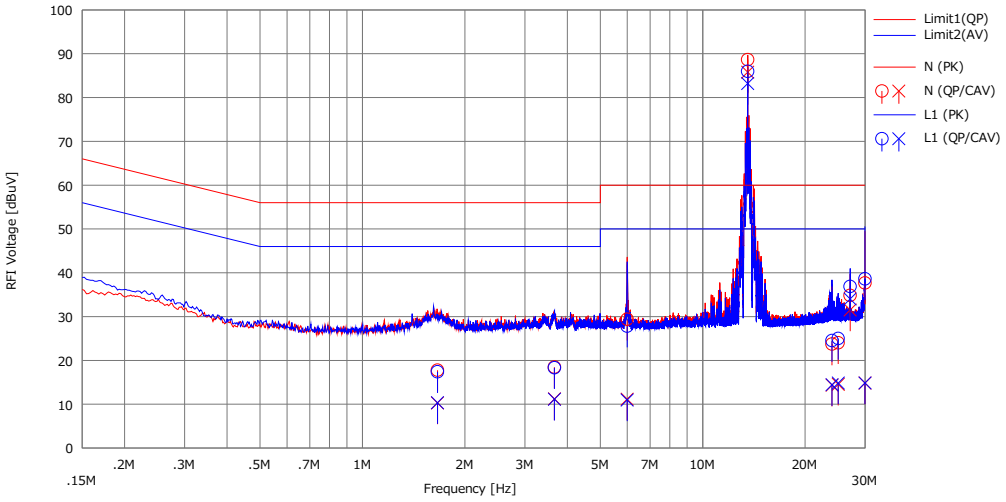
Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 kHz	3 kHz	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Frequency Tolerance	-	-	-	-	-	-	Frequency counter
*1) 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

APPENDIX 1: Test data

Conducted Emission

Test place	Shonan EMC Lab.
Shielded room	No.1
Date	April 10, 2025
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Toshinori Yamada
Mode	Tx Mod on, with Tag(Type A)

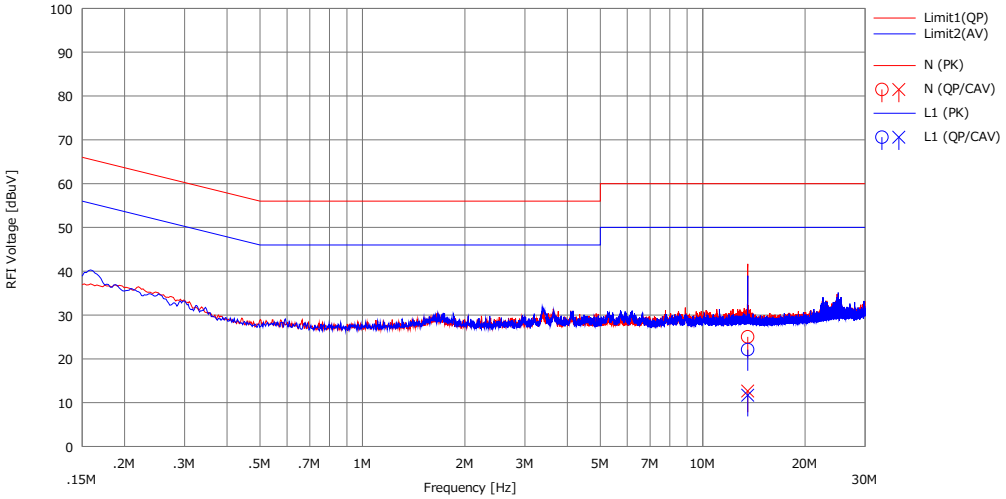


No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	1.66179	2.53	-4.95	15.24	17.77	10.29	56.00	46.00	38.2	35.7	N	
2	3.66815	3.08	-4.18	15.38	18.46	11.20	56.00	46.00	37.5	34.8	N	
3	5.99932	13.88	-4.37	15.52	29.40	11.15	60.00	50.00	30.6	38.8	N	
4	13.56000	72.75	69.89	15.90	88.65	85.79	60.00	50.00	-28.7	-35.8	N	13.56 MHz is NFC Carrier
5	23.99475	7.42	-1.96	16.32	23.74	14.36	60.00	50.00	36.2	35.6	N	
6	25.01626	7.66	-1.82	16.36	24.02	14.54	60.00	50.00	35.9	35.4	N	
7	27.12000	18.40	15.06	16.44	34.84	31.50	60.00	50.00	25.1	18.5	N	
8	29.99730	21.12	-1.72	16.55	37.67	14.83	60.00	50.00	22.3	35.1	N	
9	1.66179	2.15	-4.91	15.25	17.40	10.34	56.00	46.00	38.6	35.6	L1	
10	3.66815	2.93	-4.24	15.38	18.31	11.14	56.00	46.00	37.6	34.8	L1	
11	5.99932	12.29	-4.54	15.51	27.80	10.97	60.00	50.00	32.2	39.0	L1	
12	13.56000	70.17	67.39	15.82	85.99	83.21	60.00	50.00	-26.0	-33.3	L1	13.56 MHz is NFC Carrier
13	23.99475	8.41	-1.65	16.10	24.51	14.45	60.00	50.00	35.4	35.5	L1	
14	25.01626	8.86	-1.30	16.14	25.00	14.84	60.00	50.00	35.0	35.1	L1	
15	27.12000	20.66	17.81	16.22	36.88	34.03	60.00	50.00	23.1	15.9	L1	
16	29.99730	22.28	-1.46	16.32	38.60	14.86	60.00	50.00	21.4	35.1	L1	

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):145539

Conducted Emission

Test place	Shonan EMC Lab.
Shielded room	No.1
Date	April 10, 2025
Temperature / Humidity	22 deg. C / 45 % RH
Engineer	Toshinori Yamada
Mode	Tx Mod on, Antenna terminated



No.	Freq.	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		〈QP〉	〈CAV〉		〈QP〉	〈CAV〉	〈QP〉	〈AV〉	〈QP〉	〈AV〉		
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	13.56000	9.12	-3.24	15.90	25.02	12.66	60.00	50.00	34.9	37.3	N	13.56 MHz is NFC Carrier
2	13.56000	6.30	-4.11	15.82	22.12	11.71	60.00	50.00	37.8	38.2	L1	13.56 MHz is NFC Carrier

Calculation:Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):145539

Fundamental Emission and Spectrum Mask

Test place	Shonan EMC Lab.
Semi Anechoic Chamber	SAC 1
Date	April 10, 2025
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Toshinori Yamada
Mode	Tx Mod on, with Tag(Type A)
Remarks	(Below 30 MHz) :Vertical polarization (antenna angle) of the worst case: 0 deg.

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30 m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	13.560	74.9	85.9	19.4	6.6	31.9	-40.0	29.0	40.0	83.9	54.9	43.9

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]
Distance factor: 40 x log (3 m / 30 m) = -40 dB

Spurious emission within the band

No.	FREQ	Test Receiver Reading		Antenna Factor	Loss	AMP GAIN	Distance factor	RESULT		LIMIT (30 m)	MARGIN	
		Hor	Ver					Hor	Ver		Hor	Ver
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]
1	12.924	41.3	52.0	19.5	6.6	31.9	-40.0	-4.6	6.2	29.5	34.1	23.4
2	13.029	37.3	47.8	19.5	6.6	31.9	-40.0	-8.6	1.95	29.5	38.1	27.6
3	13.110	29.9	30.8	19.5	6.6	31.9	-40.0	-16.0	-15.1	29.5	45.5	44.6
4	13.243	38.0	51.0	19.5	6.6	31.9	-40.0	-7.9	5.1	40.5	48.4	35.4
5	13.347	53.6	64.6	19.4	6.6	31.9	-40.0	7.7	18.74	40.5	32.8	21.8
6	13.410	41.8	52.7	19.4	6.6	31.9	-40.0	-4.1	6.8	40.5	44.6	33.7
7	13.454	51.7	63.2	19.4	6.6	31.9	-40.0	5.8	17.3	50.4	44.6	33.1
8	13.553	62.4	73.3	19.4	6.6	31.9	-40.0	16.5	27.43	50.4	33.9	23.0
9	13.567	58.0	70.8	19.4	6.6	31.9	-40.0	12.1	24.9	50.4	38.3	25.5
10	13.666	52.2	63.3	19.4	6.6	31.9	-40.0	6.3	17.4	50.4	44.1	33.0
11	13.710	41.7	52.8	19.4	6.6	31.9	-40.0	-4.2	6.93	40.5	44.7	33.6
12	13.771	53.6	64.8	19.4	6.6	31.9	-40.0	7.7	18.9	40.5	32.8	21.6
13	13.878	39.3	51.2	19.4	6.6	31.9	-40.0	-6.6	5.3	40.5	47.1	35.2
14	14.010	29.9	31.1	19.4	6.6	31.9	-40.0	-16.0	-14.8	29.5	45.5	44.3
15	14.090	36.9	48.2	19.4	6.6	31.9	-40.0	-9.0	2.3	29.5	38.5	27.2
16	14.195	41.1	52.1	19.4	6.6	31.9	-40.0	-4.8	6.24	29.5	34.3	23.3

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]+Distance factor[dB]
Distance factor: 40 x log (3 m / 30 m) = -40 dB

Outside filed strength frequencies
・Fc±7 kHz:13.553 MHz to 13.567 MHz
・Fc±150 kHz:13.410 MHz to 13.710 MHz
・Fc±450 kHz:13.110 MHz to 14.010 MHz
Fc = 13.56 MHz

Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC 1	SAC 1
Date	April 10, 2025	April 10, 2025
Temperature / Humidity	23 deg. C / 45 % RH	20 deg. C / 43 % RH
Engineer	Toshinori Yamada	Makoto Hosaka
	(Below 30 MHz)	(Above 30 MHz)
Mode	Tx Mod on, with Tag(Type A)	Tx Mod on, with Tag(Type A)
Remarks	(Below 30 MHz) :Vertical polarization (antenna angle) of the worst case: 90 deg.	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg.]	Remark
Hori.	27.120	QP	29.0	20.0	6.9	31.9	-40.0	-15.9	29.5	45.4	-	285	* Limit: 30 m
Hori.	40.680	QP	26.5	14.6	7.7	31.8	0.0	17.0	40.0	23.0	254	32	–
Hori.	54.237	QP	33.0	9.8	7.7	31.8	0.0	18.7	40.0	21.4	174	354	-
Hori.	189.834	QP	34.0	16.5	9.5	31.8	0.0	28.2	43.5	15.3	176	317	-
Hori.	216.950	QP	53.2	10.5	6.6	31.8	0.0	38.5	46.0	7.5	149	231	-
Hori.	406.783	QP	32.7	15.6	8.3	31.9	0.0	24.7	46.0	21.3	201	305	-
Vert.	27.120	QP	42.1	20.0	6.9	31.9	-40.0	-2.8	29.5	32.3	-	245	* Limit: 30 m
Vert.	40.682	QP	37.3	14.6	7.7	31.8	0.0	27.8	40.0	12.2	100	144	-
Vert.	54.236	QP	52.6	9.8	7.7	31.8	0.0	38.3	40.0	1.7	100	285	-
Vert.	59.028	QP	40.7	8.4	7.6	31.8	0.0	24.9	40.0	15.1	100	227	-
Vert.	81.356	QP	50.8	6.6	8.7	31.8	0.0	34.2	40.0	5.8	100	254	-
Vert.	94.916	QP	46.1	9.2	8.6	31.8	0.0	32.0	43.5	11.5	100	112	-
Vert.	122.03	QP	37.6	13.2	8.5	31.8	0.0	27.6	43.5	15.9	100	122	-
Vert.	216.95	QP	55.1	10.5	6.6	31.8	0.0	40.4	46.0	5.6	269	217	-
Vert.	244.07	QP	45.1	11.6	7.0	31.8	0.0	31.9	46.0	14.1	264	68	-
Vert.	271.19	QP	46.2	12.3	7.2	31.8	0.0	34.0	46.0	12.0	100	312	-
Vert.	433.90	QP	41.9	16.4	8.4	31.9	0.0	34.8	46.0	11.2	137	276	-

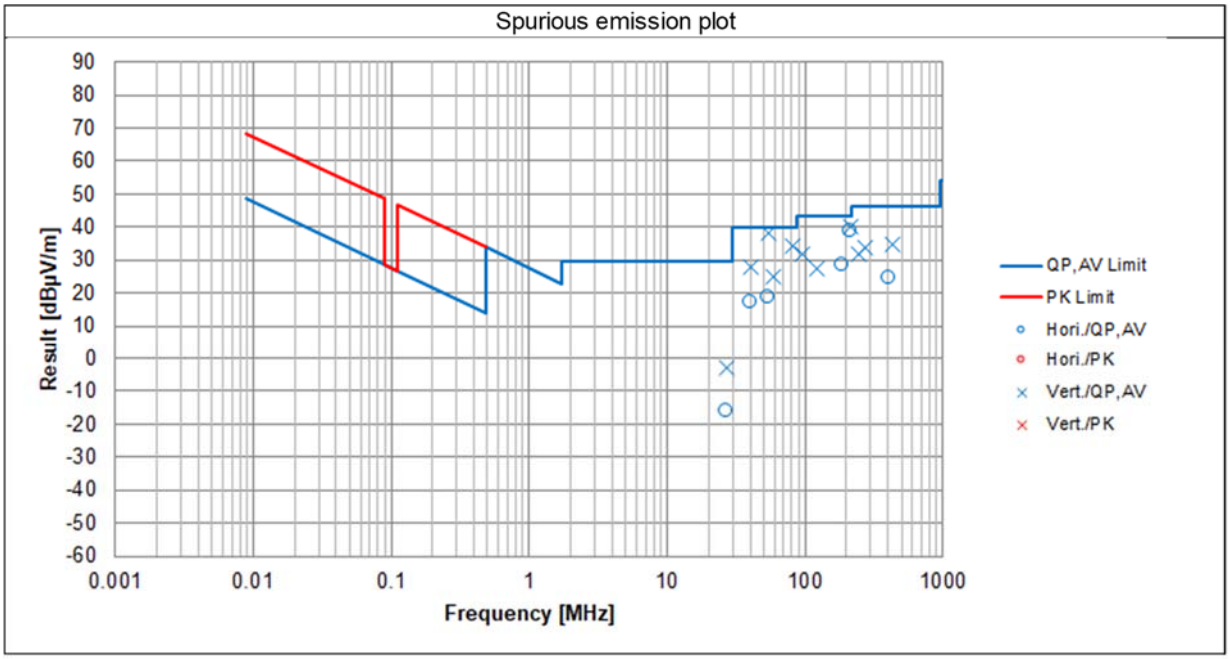
Result = Reading + Ant Factor + Loss (Cable+ATT+((ΔAF+BPF)(above 30 MHz))) - Gain(Amprifier) + Distance factor(below 30 MHz)

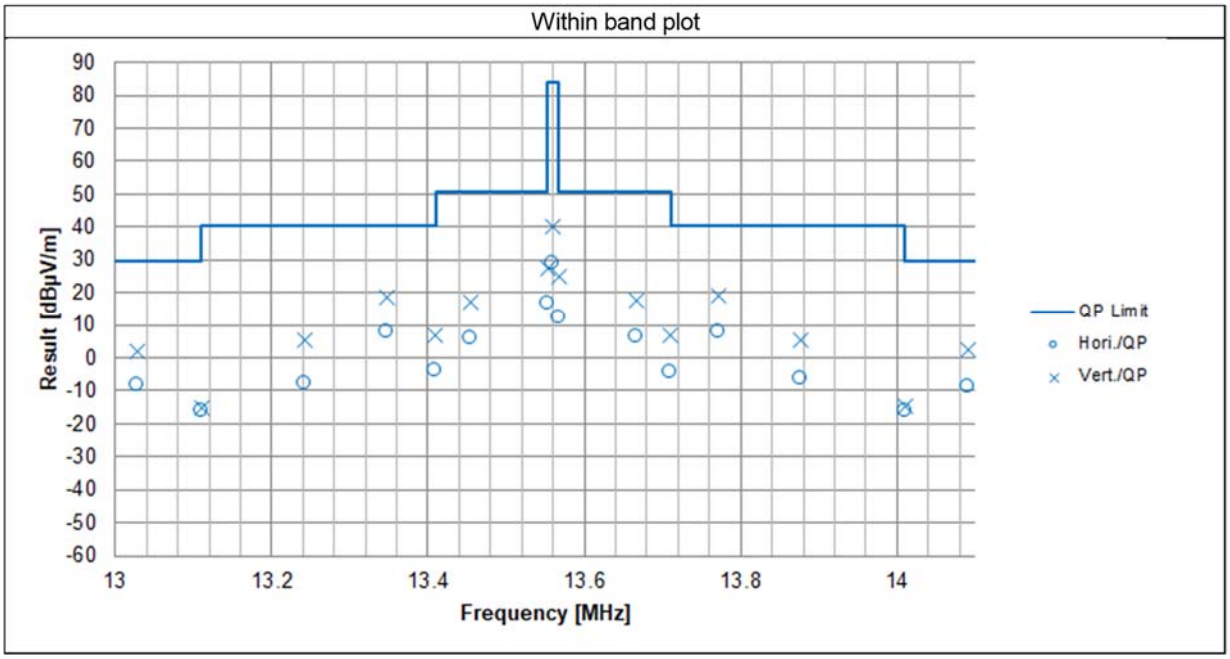
* Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).

* Carrier level (Result at 3 m): Hor= 69 dBuV/m, Ver= 80 dBuV/m

Radiated Spurious Emission
(Plot data, Worst case for Spurious Emission)
(Plot data, Worst case for Fundamental Emission)

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC 1	SAC 1
Date	April 10, 2025	April 10, 2025
Temperature / Humidity	23 deg. C / 45 % RH	20 deg. C / 43 % RH
Engineer	Toshinori Yamada	Makoto Hosaka
	(Below 30 MHz)	(Above 30 MHz)
Mode	Tx Mod on, with Tag(Type A)	Tx Mod on, with Tag(Type A)
Remarks	(Below 30 MHz) :Vertical polarization (antenna angle) of the worst case: 90 deg.	





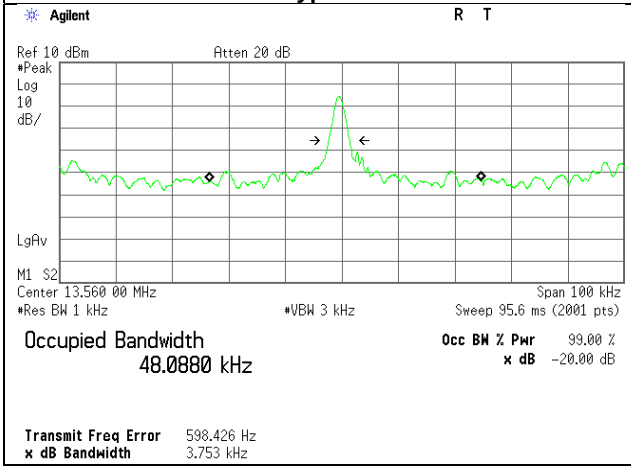
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

20 dB Bandwidth and 99 % Occupied Bandwidth

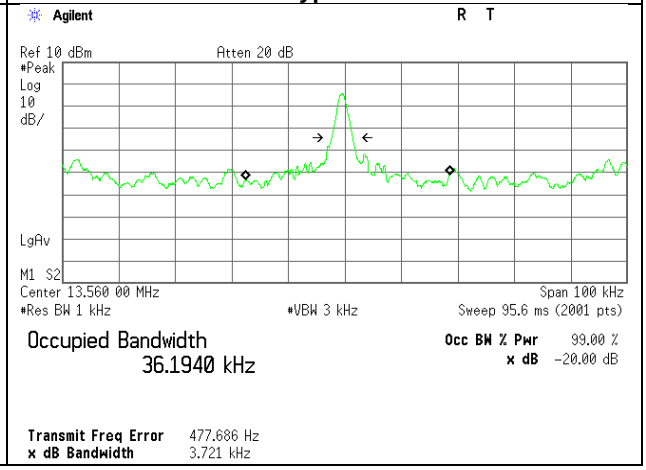
Test place	Shonan EMC Lab.
Shielded Room	No.1
Date	April 10, 2025
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Toshinori Yamada
Mode	Tx Mod on, with Tag(Type A ,Type B)

FREQ [MHz]	Mode	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	Tx Mod on, with Tag (Type A)	3.753	48.0880
	Tx Mod on, with Tag (Type B)	3.721	36.1940

Type A



Type B



*Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 – 5 % of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

Frequency Tolerance

Test place	Shonan EMC Lab.
Shielded Room	No.5
Date	February 22, 2025
Temperature / Humidity	24 deg. C / 35 % RH
Engineer	Miku Ikudome
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	13.559470	-0.000530	-0.00391	-39.1	0.01
		+ 2 min.	13.559439	-0.000561	-0.00414	-41.4	0.01
		+ 5 min.	13.559438	-0.000562	-0.00414	-41.4	0.01
		+ 10 min.	13.559446	-0.000554	-0.00409	-40.9	0.01
40	5	Power on	13.559440	-0.000560	-0.00413	-41.3	0.01
		+ 2 min.	13.559439	-0.000561	-0.00414	-41.4	0.01
		+ 5 min.	13.559442	-0.000558	-0.00412	-41.2	0.01
		+ 10 min.	13.559449	-0.000551	-0.00406	-40.6	0.01
30	5	Power on	13.559474	-0.000526	-0.00388	-38.8	0.01
		+ 2 min.	13.559467	-0.000533	-0.00393	-39.3	0.01
		+ 5 min.	13.559464	-0.000536	-0.00395	-39.5	0.01
		+ 10 min.	13.559462	-0.000538	-0.00397	-39.7	0.01
20	5	Power on	13.559529	-0.000471	-0.00347	-34.7	0.01
		+ 2 min.	13.559502	-0.000498	-0.00367	-36.7	0.01
		+ 5 min.	13.559481	-0.000519	-0.00383	-38.3	0.01
		+ 10 min.	13.559495	-0.000505	-0.00372	-37.2	0.01
20	4.75 (5 V -5 %)	Power on	13.559584	-0.000416	-0.00307	-30.7	0.01
		+ 2 min.	13.559538	-0.000462	-0.00341	-34.1	0.01
		+ 5 min.	13.559518	-0.000482	-0.00355	-35.5	0.01
		+ 10 min.	13.559507	-0.000493	-0.00364	-36.4	0.01
20	5.25 (5 V +5 %)	Power on	13.559545	-0.000455	-0.00336	-33.6	0.01
		+ 2 min.	13.559517	-0.000483	-0.00356	-35.6	0.01
		+ 5 min.	13.559507	-0.000493	-0.00364	-36.4	0.01
		+ 10 min.	13.559504	-0.000496	-0.00366	-36.6	0.01
10	5	Power on	13.559565	-0.000435	-0.00321	-32.1	0.01
		+ 2 min.	13.559564	-0.000436	-0.00322	-32.2	0.01
		+ 5 min.	13.559561	-0.000439	-0.00324	-32.4	0.01
		+ 10 min.	13.559560	-0.000440	-0.00324	-32.4	0.01
0	5	Power on	13.559746	-0.000254	-0.00187	-18.7	0.01
		+ 2 min.	13.559697	-0.000303	-0.00223	-22.3	0.01
		+ 5 min.	13.559669	-0.000331	-0.00244	-24.4	0.01
		+ 10 min.	13.559649	-0.000351	-0.00259	-25.9	0.01
-10	5	Power on	13.559792	-0.000208	-0.00153	-15.3	0.01
		+ 2 min.	13.559759	-0.000241	-0.00178	-17.8	0.01
		+ 5 min.	13.559727	-0.000273	-0.00201	-20.1	0.01
		+ 10 min.	13.559713	-0.000287	-0.00212	-21.2	0.01
-20	5	Power on	13.559796	-0.000204	-0.00150	-15.0	0.01
		+ 2 min.	13.559777	-0.000223	-0.00164	-16.4	0.01
		+ 5 min.	13.559763	-0.000237	-0.00175	-17.5	0.01
		+ 10 min.	13.559761	-0.000239	-0.00176	-17.6	0.01

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

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

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

APPENDIX 2: Test instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
BW	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2024/08/19	12
CE	248304	Attenuator	JFW	50HFFA-006-2/18N	-	2024/05/06	12
CE	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS 4906	-/0901-269(RF Selector)	2024/04/01	12
CE	145538	LISN	Rohde & Schwarz	ENV216	100511	2025/02/01	12
CE	145539	LISN	Rohde & Schwarz	ENV216	100512	2025/02/01	12
CE	145745	Terminator	TME	CT-01 BP	-	2024/11/21	12
CE,BW,RE	167990	Thermo-Hygrometer	CUSTOM. Inc	CTH-202	708Q08R	2024/08/11	12
CE,RE	145792	Digital Hitester	HIOKI E. E. CORPORATION	3805-50	80997812	2024/09/24	12
CE,RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	Ver 3.1.0546	-	-
CE,RE	207279	Tape Measure	ASKUL	-	-	-	-
CE,RE	213530	Test Receiver	Rohde & Schwarz	ESW44	103068	2025/02/12	12
FT	204927	Attenuator	Weinschel Corp.	54A-10	109972	2025/02/18	12
FT	146212	Digital Hitester	HIOKI E. E. CORPORATION	3805-50	80997828	2024/09/24	12
FT	183119	Microwave Counter	Keysight Technologies Inc	53151A	US40511493	2024/12/02	12
FT	145200	Temperature and Humidity Chamber	Espec	PL-1KT	14020837	2024/04/26	12
FT	175822	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2024/08/11	12
FT,BW	146178	Search coil	Langer	RF-R 400-1	02-0634	-	-
RE	144899	Attenuator	Inmet	18N-6dB	-	2024/11/21	12
RE	144959	Attenuator	JFW	50HF-003N	-	2024/08/22	12
RE	167096	Attenuator	JFW	50HF-006N	-	2025/02/19	12
RE	204953	Band pass Filter	Microwave Factory Co., Ltd.	MBP301	214379	2025/02/20	12
RE	146343	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	1748	2025/03/18	12
RE	194601	Coaxial Cable	Fjikura	5D-2W	-	2024/11/21	12
RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2024/04/01	12
RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2024/04/01	12
RE	236416	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VULP 9118 B	00974	2024/07/03	12
RE	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2024/04/10	12
RE	145003	Pre Amplifier	SONOMA	310N	290211	2025/02/19	12
RE	145568	Semi Anechoic Chamber(ME)	TDK	Semi Anechoic Chamber 3m/10m	1, 2, 3	2024/10/12	24
RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2025/04/04	12
RE	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2024/09/26	12

***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
BW: Bandwidth