RADIO TEST REPORT

Test Report No. 15116664S-C-R1

Customer	**Nintendo Co., Ltd.**
Description of EUT	**Game controller**
Model Number of EUT	**BEE-014**
FCC ID	**BKEBEE014**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**December 19, 2024**
Remarks	**RFID part**

Representative test engineer	Approved by
Y. Murakami	K. Noda
Yosuke Murakami Engineer	Kazuya Noda Leader

CERTIFICATE 1266.03

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

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 23.0

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REVISION HISTORY

Original Test Report No. 15116664S-C

This report is a revised version of 15116664S-C. 15116664S-C is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15116664S-C	August 8, 2024	-
1	15116664S-C-R1	December 19, 2024	Page 1 Added a note to remarks that it is an RFID part. Page 6 Corrected the worst margin of spectrum mask. Before: 30.2 dB, 12.712 MHz, Vertical, QP After: 37.2 dB, 13.553 MHz, Vertical, QP Page 14 Corrected the table size

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	Nintendo Co., Ltd.
Address	11-1 Hokotate-cho, Kamitoba, Minami-ku, Kyoto 601-8501, Japan
Telephone Number	+81-75-662-9600
Contact Person	Yosuke Ishikawa

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	Game controller
Model Number	BEE-014
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab.
Receipt Date	January 16, 2024
Test Date	June 14 to July 19, 2024

2.2 Product Description

General Specification

Rating	DC 5 V (*.Supply voltage from connector) (*. DC 3.89 V from Re-chargeable Li-ion battery for the internal circuit)
Operating temperature	5 deg. C to 35 deg. C

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer. The data provided by the customer is marked “a)” in the table below.

Bluetooth (Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	GFSK
Antenna Gain a)	1.93 dBi

Bluetooth (BR / EDR)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, π/4 DQPSK, 8 DPSK)
Antenna Gain a)	1.93 dBi

RFID

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.

* 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	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.207	8.6 dB 13.45404 MHz, QP, 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)	56.7 dB, 13.56000 MHz, Vertical, QP	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.12	<ISED> RSS-210 B.6			
Spectrum Mask	<FCC> ANSI C63.10:2013 6 Standard test methods	<FCC> Section 15.225(b)(c)	37.2 dB, 13.553 MHz, Vertical, QP	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6			
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)	4.8 dB 40.680 MHz, Vertical, QP	Complied	Radiated
	<ISED> RSS-Gen 6.4, 6.13	<ISED> RSS-210 B.6 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			
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.					

FCC Part 15.31 (e)

The EUT is supplied the power from battery or connector (from host device).
In either method, this EUT provides the stable voltage constantly to RF Part regardless of input voltage.
In the case of battery method, the test was performed with the full-charged battery other than the frequency tolerance test.
However, the supply voltage was varied and tested at 85 % and 115 % (Battery part), 90 % *1) and 115 % (Connector part) of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).
Therefore, this EUT complies with the requirement.
*1) EUT cannot operated by lower 90 % of the normal rated voltage.

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	3.2 dB
Radiated Emission (Measurement distance: 3 m)	9 kHz to 30 MHz	3.3 dB
	30 MHz to 200 MHz	4.9 dB
	200 MHz to 1 GHz	6.2 dB

Antenna terminal test	Uncertainty (+/-)
Bandwidth Measurement	0.012 %
Temperature	2.2 deg.C.
Voltage	0.74 %
Humidity	4.0 %
Frequency Measurement (Normal condition)	8.3 x 10^-8
Frequency Measurement (Extreme condition)	1.1 x 10^-7

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: NfcCertification Version: 0.2 (Date: 2024.01 16, Storage location: EUT memory) *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.	

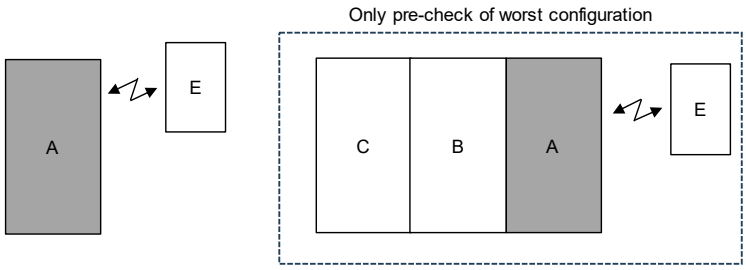
Test Item	Operating mode*
Conducted Emission	Tx Mod on (Type A), with Tag / Tx Mod on (Type A), without Tag, Antenna terminated
Electric Field Strength of Fundamental Emission	Tx Mod on (Type B), with Tag
Spectrum Mask	Tx Mod on (Type B), with Tag
20 dB Bandwidth and 99 % Occupied Bandwidth	Tx Mod on (Type A), without Tag
Electric Field Strength of Spurious Emission	Tx Mod on (Type B), with Tag
Frequency Tolerance	Tx Mod off

* After the comparison of the test data between 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	**Connector part** Normal Voltage DC 5 V Maximum Voltage DC 5.75 V (DC 5 V +15 %) Minimum Voltage DC 4.5 V (V_min) *1)
	Battery part Normal Voltage DC 3.89 V Maximum Voltage DC 4.474 V (DC 3.89 V +15 %) Minimum Voltage DC 3.306 V (DC 3.89 V -15 %)
*This EUT provides stable voltage constantly to RF Part regardless of input voltage. *1) The EUT cannot operate if a voltage of 85 % rated voltage is supplied, so the test was performed at the lowest operating voltage (DC 5 V -10 %).	

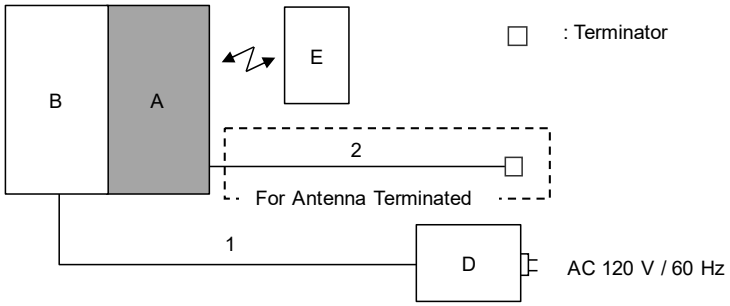
4.2 Configuration and peripherals

Radiated Emission test

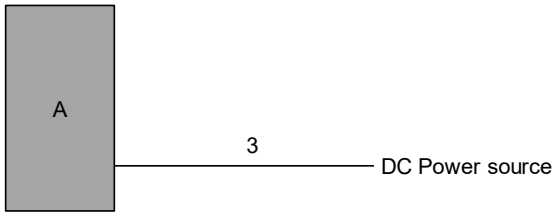


* The carrier level and noise levels were confirmed at each condition of standalone and connected by support equipment, and the test was made at the condition that has the maximum noise.

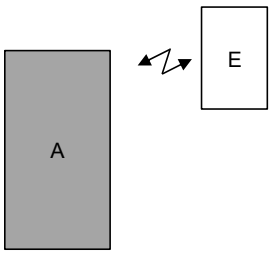
Conducted Emission test



Frequency Tolerance test



Other tests



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support Equipment

No.	Item	Model Number	Serial Number	Manufacturer	Remarks
A	Controller	BEE-014	HCL01000089873 *1) HCL01000090695 *2) HCL01000089798 *3) HCL01000089934 *4)	Nintendo Co., Ltd.	EUT
B	Charging Grip	BEE-010	HDL04000004020	Nintendo Co., Ltd.	-
C	Controller	BEE-012	HBL01000089217	Nintendo Co., Ltd.	-
D	AC Adaptor	NGN-01	HCL01000090015	Nintendo Co., Ltd.	-
E	Tag	-	-	-	Type A
		-	-	-	Type B
		-	-	-	Type F
		-	-	-	ISO 15693

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.5	Shielded	Shielded	-
2	Coaxial	0.15	Shielded	Shielded	*5)
3	DC	0.58	Unshielded	Unshielded	*3), *4)

*1) Used for Radiated Emission test, Conducted emission test (except for Antenna terminated) and Bandwidth measurement.
*2) Used for Conducted emission test (Antenna terminated).
*3) Used for Frequency Tolerance test (Battery part).
*4) Used for Frequency Tolerance test (Connector part).
*5) Cable for antenna terminated.

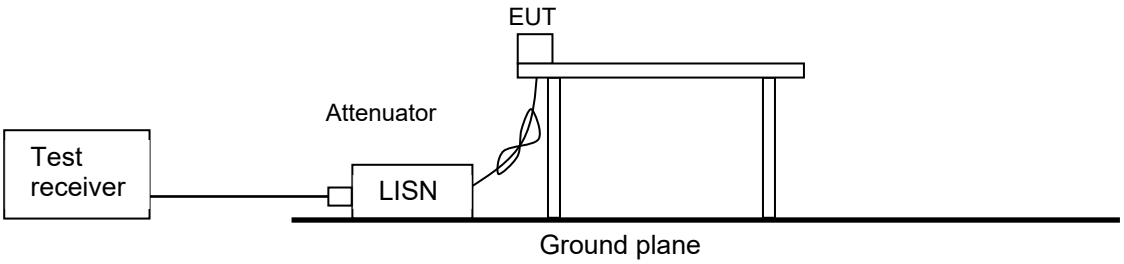
SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 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).
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.

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 2.0 m (Below 30 MHz) or 1.0 m by 1.5 m (Above 30 MHz), 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

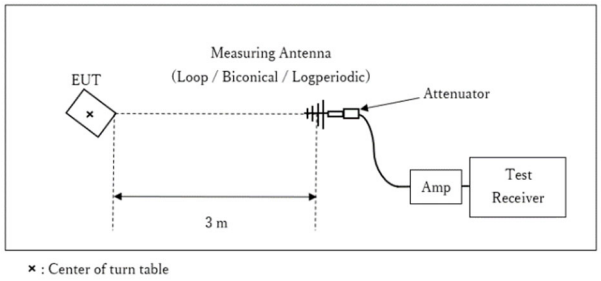
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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

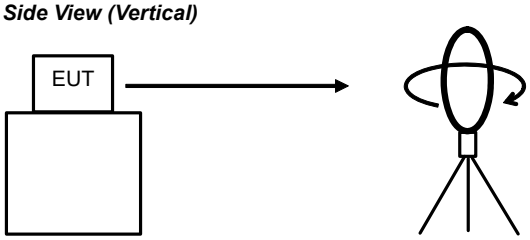
Below 1 GHz



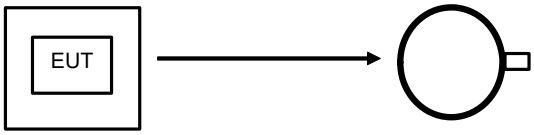
Test Distance: 3 m

Figure 3: Direction of the Loop Antenna

Side View (Vertical)

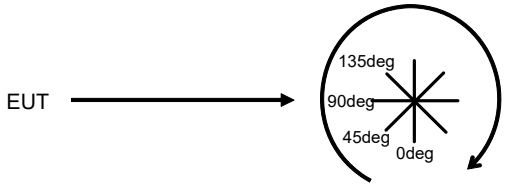


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

- The 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.

	Below 30 MHz	Above 30 MHz
Horizontal	Axis-Z	Axis-Z
Vertical	Axis-X	Axis-Z

Test results are rounded off and limit are rounded down, 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	2 MHz	13 kHz	39 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	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

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2024/07/19

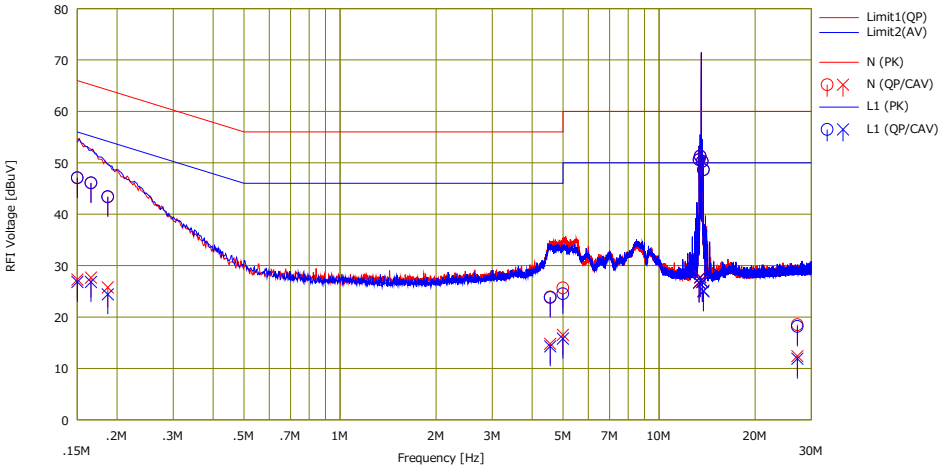
Mode : NFC Communication

Power : AC 120 V / 60 Hz (AC Adapter)
Temp./Humi. : 23 deg.C / 47 %RH

Remarks : With Tag : Type-A

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



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	0.15011	34.56	14.74	12.55	47.11	27.29	65.99	55.99	18.8	28.7	N	
2	0.16582	33.51	15.09	12.57	46.08	27.66	65.17	55.17	19.0	27.5	N	
3	0.18699	30.80	13.20	12.57	43.37	25.77	64.17	54.17	20.8	28.4	N	
4	4.55791	10.87	1.75	13.04	23.91	14.79	56.00	46.00	32.0	31.2	N	
5	4.99227	12.57	3.44	13.09	25.66	16.53	56.00	46.00	30.3	29.4	N	
6	13.34864	36.68	12.88	13.90	50.58	26.78	60.00	50.00	9.4	23.2	N	
7	13.45404	37.36	13.88	13.91	51.27	27.79	60.00	50.00	8.7	22.2	N	
8	13.66569	36.35	12.93	13.94	50.29	26.87	60.00	50.00	9.7	23.1	N	
9	13.77251	34.69	11.20	13.94	48.63	25.14	60.00	50.00	11.3	24.8	N	
10	27.12000	3.94	-2.16	14.56	18.50	12.40	60.00	50.00	41.5	37.6	N	
11	0.15011	34.49	14.26	12.57	47.06	26.83	65.99	55.99	18.9	29.1	L1	
12	0.16582	33.52	14.25	12.57	46.09	26.82	65.17	55.17	19.0	28.3	L1	
13	0.18699	30.83	11.83	12.58	43.41	24.41	64.17	54.17	20.7	29.7	L1	
14	4.55791	10.78	1.29	13.00	23.78	14.29	56.00	46.00	32.2	31.7	L1	
15	4.99227	11.48	2.75	13.04	24.52	15.79	56.00	46.00	31.4	30.2	L1	
16	13.34864	36.94	12.98	13.69	50.63	26.67	60.00	50.00	9.3	23.3	L1	
17	13.45404	37.61	13.97	13.70	51.31	27.67	60.00	50.00	8.6	22.3	L1	
18	13.66569	36.58	13.04	13.72	50.30	26.76	60.00	50.00	9.7	23.2	L1	
19	13.77251	34.93	11.25	13.72	48.65	24.97	60.00	50.00	11.3	25.0	L1	
20	27.12000	3.68	-2.60	14.48	18.16	11.88	60.00	50.00	41.8	38.1	L1	

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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan,Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2024/07/19

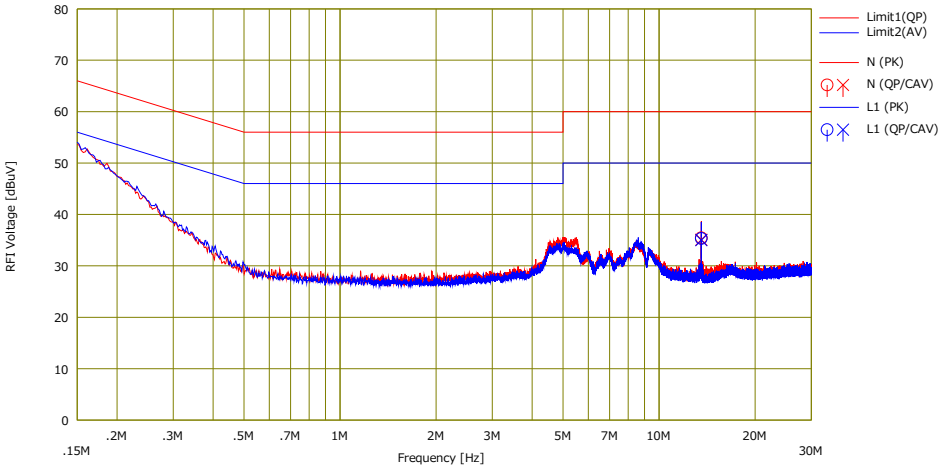
Mode : NFC Communication

Power : AC 120 V / 60 Hz (AC Adapter)
Temp./Humi. : 23 deg.C / 47 %RH

Remarks : Antenna Terminated

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Yusuke Tanikawara



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	21.53	21.16	13.93	35.46	35.09	60.00	50.00	24.5	14.9	N	
2	13.56000	21.60	21.27	13.71	35.31	34.98	60.00	50.00	24.6	15.0	L1	

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	No.2
Date	June 14, 2024
Temperature / Humidity	24 deg. C / 47 % RH
Engineer	Yusuke Tanikawara
Mode	NFC Communication with tag type B

Fundamental emission

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	61.80	73.20	19.43	6.55	31.96	-40.00	15.82	27.22	83.90	68.1	56.7

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

Limits (30 m)

・13.553 MHz to 13.567 MHz : 83.9 dBuV/m (FCC 15.225(a))

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	13.110	30.20	30.20	19.45	6.54	31.96	-40.00	-15.77	-15.77	29.50	45.3	45.3
2	13.410	30.30	30.70	19.44	6.55	31.96	-40.00	-15.67	-15.27	40.50	56.2	55.8
3	13.508	30.80	38.40	19.43	6.55	31.96	-40.00	-15.18	-7.58	50.40	65.6	58.0
4	13.553	46.90	59.20	19.43	6.55	31.96	-40.00	0.92	13.22	50.40	49.5	37.2
5	13.567	45.90	58.10	19.43	6.55	31.96	-40.00	-0.08	12.12	50.40	50.5	38.3
6	13.613	30.70	37.70	19.43	6.55	31.96	-40.00	-15.28	-8.28	50.40	65.7	58.7
7	13.710	30.20	30.30	19.42	6.55	31.96	-40.00	-15.79	-15.69	40.50	56.3	56.2
8	14.010	30.10	30.20	19.41	6.56	31.96	-40.00	-15.89	-15.79	29.50	45.4	45.3

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

Limits (30 m)

・13.410 MHz to 13.553 MHz and 13.567 MHz to 13.710 MHz : 50.4 dBuV/m (FCC 15.225(b))

・13.110 MHz to 13.410 MHz and 13.710 MHz to 14.010 MHz : 40.5 dBuV/m (FCC 15.225(c))

・Below 13.110 MHz and Above 14.010 MHz : 29.5 dBuV/m (FCC 15.225(d)and FCC 15.209)

*) Distance Factor: 40 x log (3 m / 30 m) = -40 dB

Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC2	WAC2
Date	June 14, 2024	June 24, 2024
Temperature / Humidity	24 deg. C / 47 % RH	24 deg. C / 49 % RH
Engineer	Yusuke Tanikawara	Yosuke Murakami
	(Below 30 MHz)	(Above 30 MHz)
Mode	NFC Communication with tag type B	

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.	27.12	QP	28.90	20.03	6.88	31.95	-40.00	-16.14	29.50	45.6	-	359	* Limit: 30m
Hori.	40.680	QP	44.90	11.38	6.38	32.93	0.00	29.73	40.00	10.3	327	355	
Hori.	827.143	QP	30.80	21.00	8.79	30.82	0.00	29.77	46.00	16.2	100	189	
Hori.	881.391	QP	29.50	22.09	8.86	30.51	0.00	29.94	46.00	16.1	161	345	
Hori.	908.511	QP	29.80	22.10	8.91	30.33	0.00	30.48	46.00	15.5	156	345	
Vert.	27.12	QP	30.90	20.03	6.88	31.95	-40.00	-14.14	29.50	43.6	-	359	* Limit: 30m
Vert.	39.832	QP	40.90	11.53	6.37	32.92	0.00	25.88	40.00	14.1	100	77	
Vert.	40.680	QP	50.40	11.38	6.38	32.93	0.00	35.23	40.00	**4.8**	100	78	
Vert.	41.528	QP	40.10	11.23	6.40	32.94	0.00	24.79	40.00	15.2	100	74	
Vert.	94.920	QP	48.10	9.25	6.97	33.21	0.00	31.11	43.50	12.4	100	83	
Vert.	122.040	QP	41.70	10.84	6.80	33.19	0.00	26.15	43.50	17.4	100	66	

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

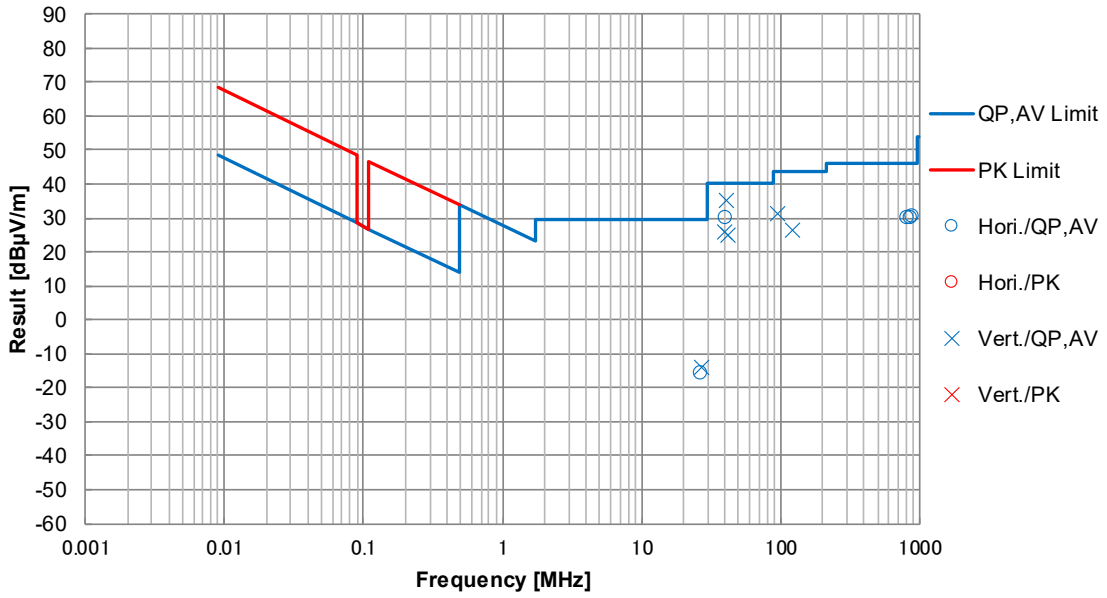
* Other frequency noises omitted in this report were not seen or have enough margin (more than 20 dB).

* Carrier level (Result at 3 m): Hor= 55.8 dBuV/m, Ver= 67.2 dBuV/m

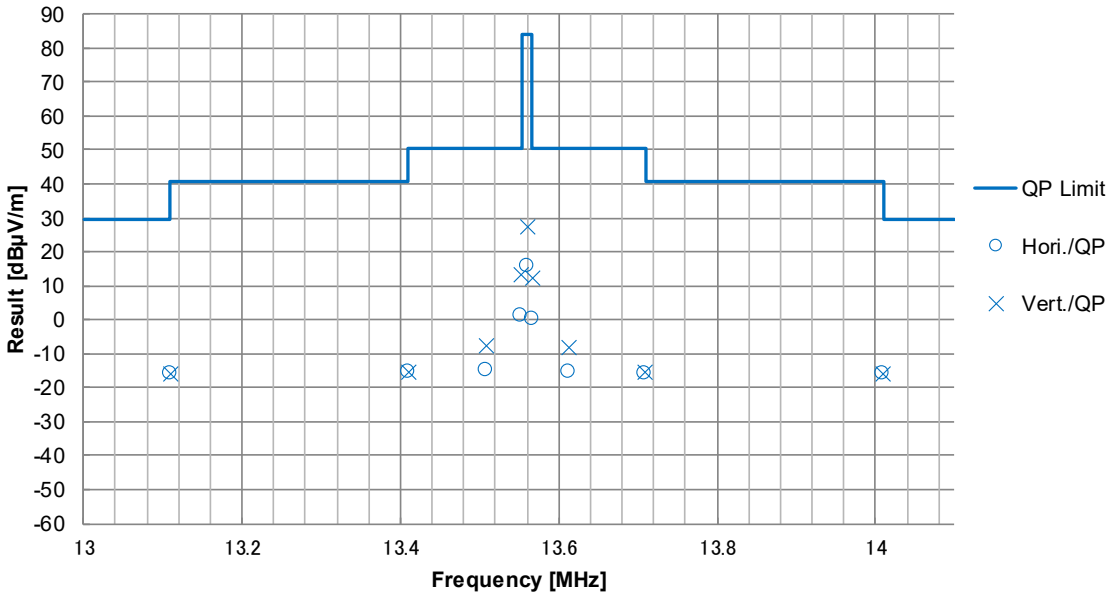
Radiated Spurious Emission

Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	SAC2	WAC2
Date	June 14, 2024	June 24, 2024
Temperature / Humidity	24 deg. C / 47 % RH	24 deg. C / 49 % RH
Engineer	Yusuke Tanikawara (Below 30 MHz)	Yosuke Murakami (Above 30 MHz)
Mode	NFC Communication with tag type B	

Spurious emission plot



Within band plot

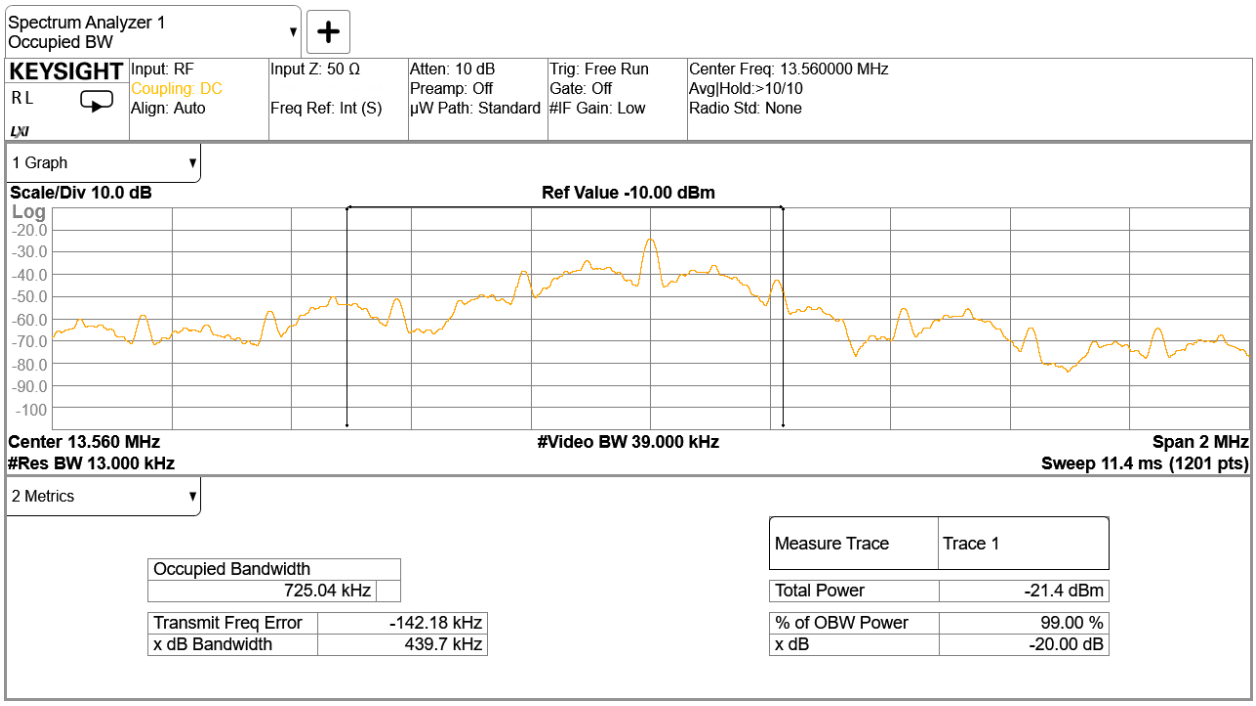


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

20 dB Bandwidth and 99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.1 Shielded room
Date	July 19, 2024
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Yosuke Murakami
Mode	Type A Transmitting

FREQ [MHz]	20 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
13.56	439.70	725.04



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. No.1 Shielded room
Date	July 19, 2024
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Yosuke Murakami
Voltage	Battery part

Test condition		Tested	Measured	Frequency	Result		Limit
Temp.	Voltage	timing	frequency	error			
[deg. C]	[V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	3.89	Power on	13.559841	-0.000159	-0.00117	-11.7	0.01
		+ 2 min.	13.559840	-0.000160	-0.00118	-11.8	0.01
		+ 5 min.	13.559838	-0.000162	-0.00119	-11.9	0.01
		+ 10 min.	13.559836	-0.000164	-0.00121	-12.1	0.01
40	3.89	Power on	13.559851	-0.000149	-0.00110	-11.0	0.01
		+ 2 min.	13.559848	-0.000152	-0.00112	-11.2	0.01
		+ 5 min.	13.559845	-0.000155	-0.00114	-11.4	0.01
		+ 10 min.	13.559843	-0.000157	-0.00116	-11.6	0.01
30	3.89	Power on	13.559875	-0.000125	-0.00092	-9.2	0.01
		+ 2 min.	13.559861	-0.000139	-0.00103	-10.3	0.01
		+ 5 min.	13.559858	-0.000142	-0.00105	-10.5	0.01
		+ 10 min.	13.559857	-0.000143	-0.00105	-10.5	0.01
20	3.89	Power on	13.559899	-0.000101	-0.00074	-7.4	0.01
		+ 2 min.	13.559884	-0.000116	-0.00086	-8.6	0.01
		+ 5 min.	13.559879	-0.000121	-0.00089	-8.9	0.01
		+ 10 min.	13.559878	-0.000122	-0.00090	-9.0	0.01
20	3.306 (3.89 V - 15 %)	Power on	13.559900	-0.000100	-0.00074	-7.4	0.01
		+ 2 min.	13.559887	-0.000113	-0.00083	-8.3	0.01
		+ 5 min.	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 10 min.	13.559884	-0.000116	-0.00086	-8.6	0.01
20	4.474 (3.89 V + 15 %)	Power on	13.559898	-0.000102	-0.00075	-7.5	0.01
		+ 2 min.	13.559880	-0.000120	-0.00088	-8.8	0.01
		+ 5 min.	13.559875	-0.000125	-0.00092	-9.2	0.01
		+ 10 min.	13.559872	-0.000128	-0.00094	-9.4	0.01
10	3.89	Power on	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 2 min.	13.559904	-0.000096	-0.00071	-7.1	0.01
		+ 5 min.	13.559900	-0.000100	-0.00074	-7.4	0.01
		+ 10 min.	13.559898	-0.000102	-0.00075	-7.5	0.01
0	3.89	Power on	13.559915	-0.000085	-0.00063	-6.3	0.01
		+ 2 min.	13.559915	-0.000085	-0.00063	-6.3	0.01
		+ 5 min.	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 10 min.	13.559913	-0.000087	-0.00064	-6.4	0.01
-10	3.89	Power on	13.559899	-0.000101	-0.00074	-7.4	0.01
		+ 2 min.	13.559910	-0.000090	-0.00066	-6.6	0.01
		+ 5 min.	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 10 min.	13.559916	-0.000084	-0.00062	-6.2	0.01
-20	3.89	Power on	13.559842	-0.000158	-0.00117	-11.7	0.01
		+ 2 min.	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 5 min.	13.559895	-0.000105	-0.00077	-7.7	0.01
		+ 10 min.	13.559898	-0.000102	-0.00075	-7.5	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 -20 deg. C.

Frequency Tolerance

Test place	Shonan EMC Lab. No.1 Shielded room
Date	July 19, 2024
Temperature / Humidity	24 deg. C / 57 % RH
Engineer	Yosuke Murakami
Voltage	Connector part

Test condition		Tested timing	Measured frequency	Frequency error	Result		Limit
Temp. [deg. C]	Voltage [V]		[MHz]	[MHz]	[%]	[ppm]	[+/- %]
50	5	Power on	13.559876	-0.000124	-0.00091	-9.1	0.01
		+ 2 min.	13.559876	-0.000124	-0.00091	-9.1	0.01
		+ 5 min.	13.559877	-0.000123	-0.00091	-9.1	0.01
		+ 10 min.	13.559880	-0.000120	-0.00088	-8.8	0.01
40	5	Power on	13.559885	-0.000115	-0.00085	-8.5	0.01
		+ 2 min.	13.559879	-0.000121	-0.00089	-8.9	0.01
		+ 5 min.	13.559878	-0.000122	-0.00090	-9.0	0.01
		+ 10 min.	13.559877	-0.000123	-0.00091	-9.1	0.01
30	5	Power on	13.559905	-0.000095	-0.00070	-7.0	0.01
		+ 2 min.	13.559893	-0.000107	-0.00079	-7.9	0.01
		+ 5 min.	13.559890	-0.000110	-0.00081	-8.1	0.01
		+ 10 min.	13.559887	-0.000113	-0.00083	-8.3	0.01
20	5	Power on	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 2 min.	13.559913	-0.000087	-0.00064	-6.4	0.01
		+ 5 min.	13.559908	-0.000092	-0.00068	-6.8	0.01
		+ 10 min.	13.559905	-0.000095	-0.00070	-7.0	0.01
20	4.5 (V_min)	Power on	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 2 min.	13.559912	-0.000088	-0.00065	-6.5	0.01
		+ 5 min.	13.559909	-0.000091	-0.00067	-6.7	0.01
		+ 10 min.	13.559907	-0.000093	-0.00069	-6.9	0.01
20	5.75 (5 V +15 %)	Power on	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 2 min.	13.559911	-0.000089	-0.00066	-6.6	0.01
		+ 5 min.	13.559907	-0.000093	-0.00069	-6.9	0.01
		+ 10 min.	13.559905	-0.000095	-0.00070	-7.0	0.01
10	5	Power on	13.559938	-0.000062	-0.00046	-4.6	0.01
		+ 2 min.	13.559928	-0.000072	-0.00053	-5.3	0.01
		+ 5 min.	13.559924	-0.000076	-0.00056	-5.6	0.01
		+ 10 min.	13.559923	-0.000077	-0.00057	-5.7	0.01
0	5	Power on	13.559936	-0.000064	-0.00047	-4.7	0.01
		+ 2 min.	13.559941	-0.000059	-0.00044	-4.4	0.01
		+ 5 min.	13.559940	-0.000060	-0.00044	-4.4	0.01
		+ 10 min.	13.559939	-0.000061	-0.00045	-4.5	0.01
-10	5	Power on	13.559918	-0.000082	-0.00060	-6.0	0.01
		+ 2 min.	13.559937	-0.000063	-0.00046	-4.6	0.01
		+ 5 min.	13.559940	-0.000060	-0.00044	-4.4	0.01
		+ 10 min.	13.559940	-0.000060	-0.00044	-4.4	0.01
-20	5	Power on	13.559872	-0.000128	-0.00094	-9.4	0.01
		+ 2 min.	13.559914	-0.000086	-0.00063	-6.3	0.01
		+ 5 min.	13.559922	-0.000078	-0.00058	-5.8	0.01
		+ 10 min.	13.559922	-0.000078	-0.00058	-5.8	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)

*The test was begun from 50 deg. C and the temperature was lowered each -20 deg. C.

APPENDIX 2: Test instruments

Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS 4906	-/0901-269(RF Selector)	2024/04/01	12
CE	145539	LISN	Rohde & Schwarz	ENV216	100512	2024/02/06	12
CE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2023/08/25	12
CE	150923	Attenuator	JFW	50HF-003N	-	2024/02/13	12
CE	204924	Terminator	Weinschel - API Technologies Corp	M1459A	110107	2024/02/14	12
CE	207279	Tape Measure	ASKUL	-	-	-	-
CE,RE	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	Ver 3.1.0546	-	-
CE,FT	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2023/09/25	12
CE,FT	167990	Thermo-Hygrometer	CUSTOM. Inc	CTH-202	708Q08R	2023/08/01	12
RE	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2024/04/10	12
RE	145004	Pre Amplifier	SONOMA	310N	290212	2024/02/13	12
RE	145528	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	195	2024/04/10	12
RE	145536	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100218	2024/04/10	12
RE	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2024/03/22	12
RE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2024/04/19	12
RE	167096	Attenuator	JFW	50HF-006N	-	2024/02/13	12
RE	191838	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/08/03	12
RE	194601	Coaxial Cable	Fjikura	5D-2W	-	2023/12/08	12
RE	199783	Attenuator	JFW	50HF-006N	-	2024/06/14	12
RE	207277	Measuring	ASKUL	-	-	-	-
RE	207281	Tape Measure	ASKUL	-	-	-	-
RE	235267	Test Receiver	Rohde & Schwarz	ESW44	103018	2024/03/05	12
RE	235640	DIGITAL MULTIMETER	HIOKI E.E. CORPORATION	DT4261	230313157	2024/05/29	12
RE	235738	Thermo-Hygrometer	CUSTOM. Inc	CTH-230	-	2024/04/28	12
RE	236615	Semi-Anechoic Chamber	TDK	SWAC-02(NSA)	2	2024/05/10	12
RE	236724	Coaxial Cable	Hayashi-Repic co., Ltd.	SF106(HUBER+SUHNER)/LMR400UF/GL310C/GL310C	2000430/47753-2/47256-01-04/47256-01-02	2024/05/10	12
RE	236967	Pre Amplifier	TSJ (Techno Science Japan)	MLA-9K01-L01	23050010	2024/06/14	12
RE	239787	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHBB 9124+BBA9106	01908	2023/09/21	12
FT,BW	146424	Search coil	Langer	RF-R 400-1	02-0628	-	-
FT	183119	Microwave Counter	Keysight Technologies Inc	53151A	US40511493	2023/11/15	12
FT	201085	Constant Climate Cabinet	Espec	LHU-124	1013000486	2023/09/30	12
FT,BW	240499	Spectrum Analyzer	Keysight Technologies Inc	N9020B	MY59050557	2023/10/21	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