RADIO TEST REPORT

Test Report No. 15745796H-A-R1

Customer	**OMRON Corporation**
Description of EUT	**RFID Amplifier Unit**
Model Number of EUT	**Amplifier: V640-HAM11-ETN-V5** **Antenna: V640-HS61**
FCC ID	**E4EV640HAM11EV5**
Test Regulation	**FCC Part 15 Subpart C**
Test Result	**Complied**
Issue Date	**June 16, 2025**
Remarks	**-**

Representative test engineer	Approved by
Hiroyuki Furutaka Engineer	Satofumi Matsuyama Engineer

CERTIFICATE 5107.02

☐ 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".

UL Japan, Inc. Ise EMC Lab.
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REVISION HISTORY

Original Test Report No. 15745796H-A

This report is a revised version of 15745796H-A. 15745796H-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15745796H-A	May 21, 2025	-
1	15745796H-A-R1	June 16, 2025	Correction of the Receipt Date in SECTION 2.1; From “March 28, April 15 and 23, 2025” to “March 28, 2025”
1	15745796H-A-R1	June 16, 2025	Correction and addition of the following contents due to the additional Conducted Emission test (without Standard Ferrite Core): - SECTION 2.1: Test date - SECTION 3.3: Worst margin - SECTION 4.2: Configuration and Peripherals - APPENDIX 1: Test data - APPENDIX 2: Test instruments - APPENDIX 3: Photographs of test setup *Others, specification of with Standard Ferrite Core or without Standard Ferrite Core

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS PAGE

SECTION 1: Customer Information

Company Name	OMRON Corporation
Address	Sensor Development Dept. 2-2-1, Nishi-Kusatsu, Kusatsu-City, Shiga-Pref., 525-0035 Japan
Telephone Number	+81-77-565-5342
Contact Person	Tadamasa Yokoi

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	RFID Amplifier Unit
Model Number	Amplifier: V640-HAM11-ETN-V5 Antenna: V640-HS61
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	March 28, 2025
Test Date	April 7 to June 10, 2025

2.2 Product Description

General Specification

Rating	DC 24 V
Operating temperature	0 deg. C to 40 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	134.2 kHz
Type of Modulation	ASK

2.3 Variant model(s)

Tested model: V640-HAM11-ETN-V5 has variant models:
- V640-HAM11-ETN-V5-2
- V640-HAM11-ETN-V5-3
- V640-HAM11-ETN-V5-4

The difference of these models is only the IP address default settings.
Hardware and software are identical.

SECTION 3: Test Summary

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 15.209 Radiated emission limits; general requirements.
*Also the EUT complies with FCC Part 15 Subpart B.	

3.2 Reference Standards

ANSI/USEMCSC C63.2-2023
ANSI C63.4-2014+C63.4a-2017
ANSI C63.5-2017
ANSI C63.10-2020
ANSI/USEMCSC C63.10/Cor 1:2023
ANSI/USEMCSC C63.10a-2024 for ISED
ANSI C63.25.1-2018
RSS-Gen Issue 5/Amendment 1/Amendment 2 for ISED

3.3 Summary of Test Results

Item	Specification	Worst margin	Results	Remarks
Conducted Emission	<FCC> Section 15.207 <ISED> RSS-Gen 8.8	1.02 dB 0.47782 MHz, QP Phase L	Complied	Conducted
Electric Field Strength of Fundamental Emission	<FCC> Section 15.209 <ISED> RSS-210 8.2 RSS-Gen 8.9	12.0 dB 134.2 kHz, 0 deg. Peak with Duty factor	Complied	Radiated
Electric Field Strength of Spurious Emission	<FCC> Section 15.209 <ISED> RSS-210 8.3 RSS-Gen 8.9	0.8 dB 58.700 MHz, Vertical, QP	Complied	Radiated
-20 dB Bandwidth	<FCC> Reference data <ISED> -	N/A	Complied	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.				

FCC Part 15.31 (e)
This EUT provides stable voltage constantly to RF Module regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
The EUT has an external antenna connector, but it is installed by the professionals.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.4 Addition to standard

Item	Specification	Worst margin	Results	Remarks
99 % emission bandwidth	-	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.

3.5 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.

Conducted emission

Item	Frequency range	Unit	Calculated Uncertainty (+/-)
AMN (LISN)	0.15 MHz to 30 MHz	dB	3.3

Radiated emission

Measurement distance	Frequency range		Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz		dB	3.3
10 m			dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	dB	5.0
		Vertical	dB	5.0
	200 MHz to 1000 MHz	Horizontal	dB	5.2
		Vertical	dB	6.2
10 m	30 MHz to 200 MHz	Horizontal	dB	5.5
		Vertical	dB	5.4
	200 MHz to 1000 MHz	Horizontal	dB	5.5
		Vertical	dB	5.5

-20 dB Bandwidth and 99% Occupied Bandwidth

Item	Unit	Calculated Uncertainty (+/-)
Bandwidth (OBW)	%	0.96

3.6 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

* Size of vertical conducting plane (for Conducted Emission test): 2.0 x 3.0 m for No.1, No.2, No.3, No.4, and No.5 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.7 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

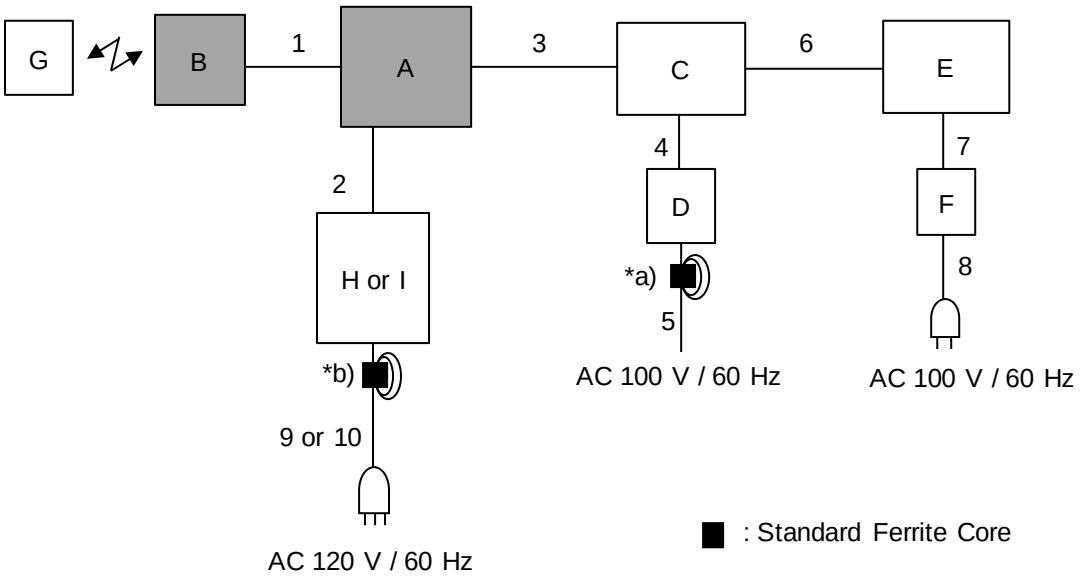
4.1. Operating Mode(s)

Test mode	Remarks
1) Tx 134.2 kHz Transmitting mode	-
*Power of the EUT was set by the software as follows; Software: V640 Demo Soft Version: 1.0 (Date: 2025.04.07, 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.	

*This EUT has two modes which transponder is attached or not. The worst case was confirmed with and without transponder attached. The result is below;.
- Below 30 MHz: The test without transponder attached was performed.
- Above 30 MHz: The test with transponder attached was performed.

4.2 Configuration and Peripherals

Conducted Emission



*a) Standard Ferrite Core Model No. ZCAT3035-1330 (Manufacture TDK) 2 cm from Item D, 3 turns
*b) Standard Ferrite Core Model No. ZCAT3035-1330 (Manufacture TDK) 4 cm from Item H, 3 turns
Standard Ferrite Core: b) was only attached when using the recommended power supply (No. H).

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

Description of EUT and Support Equipment

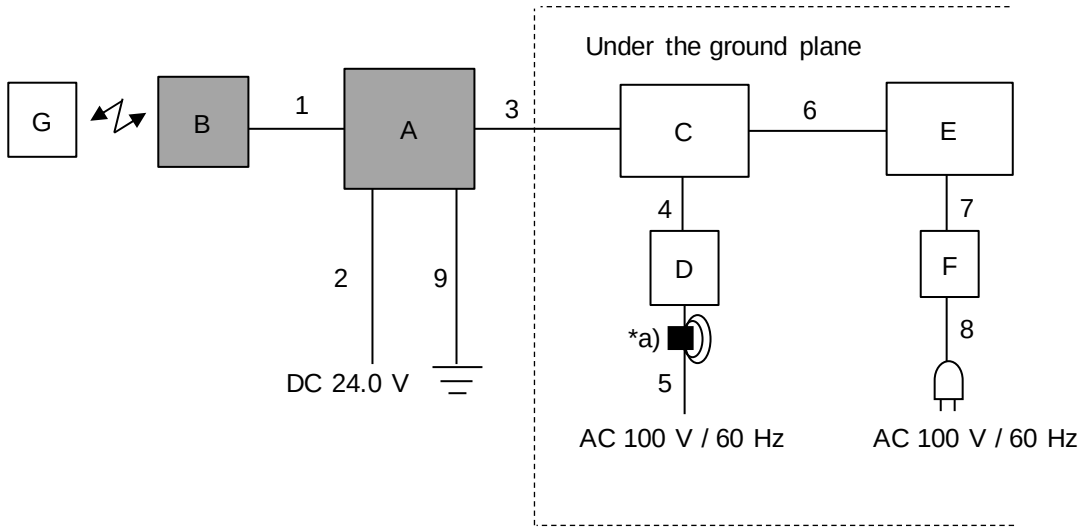
No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	RFID Amplifier	V640-HAM11-ETN-V5	No.28	OMRON Corporation	EUT
B	RFID Antenna	V640-HS61	No.2	OMRON Corporation	EUT
C	ETHERNET SWITCHING HUB	W4S1-05D	09824K	OMRON Corporation	-
D	DC Power Supply	S8VS-03024 /ED2	16724H	OMRON Corporation	-
E	Laptop PC	PR63PBAA337AD7X	6F053913H	TOSHIBA	-
F	AC Adapter	PA51770-1ACA	FX10800NSKACC	TOSHIBA	-
G	Transponder	RI-TRP-DR2B-40	-	Texas Instruments	-
H	DC Power Supply	S8VS-01524	No.18	OMRON Corporation	*1)
I	DC Power Supply	PL330QMD	48943	Thurlby Thandar Instruments Limited	*3)

List of Cables Used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	2.00	Shielded	Shielded	-
2	DC Cable	0.50 *1) *3) 2.50 *2)	Unshielded	Unshielded	-
3	LAN Cable	5.00	Shielded	Shielded	-
4	DC Cable	0.15	Unshielded	Unshielded	-
5	AC Cable	1.70	Unshielded	Unshielded	-
6	LAN Cable	2.00	Shielded	Shielded	-
7	DC Cable	1.70	Unshielded	Unshielded	-
8	AC Cable	0.80	Unshielded	Unshielded	-
9	AC Cable	1.70 *1)	Unshielded	Unshielded	-
	Earth Cable	5.00 *2)	Shielded	Shielded	-
10	AC Cable	1.50 *3)	Unshielded	Unshielded	-

*1) Used for Conducted Emission test (with Standard Ferrite Core)
*2) Used for Radiated Emission test
*3) Used for Conducted Emission test (without Standard Ferrite Core)

Radiated Emission



■ : Standard Ferrite Core

*a) Standard Ferrite Core Model No. ZCAT3035-1330 (Manufacture TDK) 2 cm from Item D, 3 turns

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

Description of EUT and Support Equipment

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	RFID Amplifier	V640-HAM11-ETN-V5	No.28	OMRON Corporation	EUT
B	RFID Antenna	V640-HS61	No.2	OMRON Corporation	EUT
C	ETHERNET SWITCHING HUB	W4S1-05D	09824K	OMRON Corporation	-
D	DC Power Supply	S8VS-03024 /ED2	16724H	OMRON Corporation	-
E	Laptop PC	PR63PBAA337AD7X	6F053913H	TOSHIBA	-
F	AC Adapter	PA51770-1ACA	FX10800NSKACC	TOSHIBA	-
G	Transponder	RI-TRP-DR2B-40	-	Texas Instruments	-

List of Cables Used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	2.00	Shielded	Shielded	-
2	DC Cable	2.50	Unshielded	Unshielded	-
3	LAN Cable	5.00	Shielded	Shielded	-
4	DC Cable	0.15	Unshielded	Unshielded	-
5	AC Cable	1.70	Unshielded	Unshielded	-
6	LAN Cable	2.00	Shielded	Shielded	-
7	DC Cable	1.70	Unshielded	Unshielded	-
8	AC Cable	0.80	Unshielded	Unshielded	-
9	Earth Cable	2.50	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

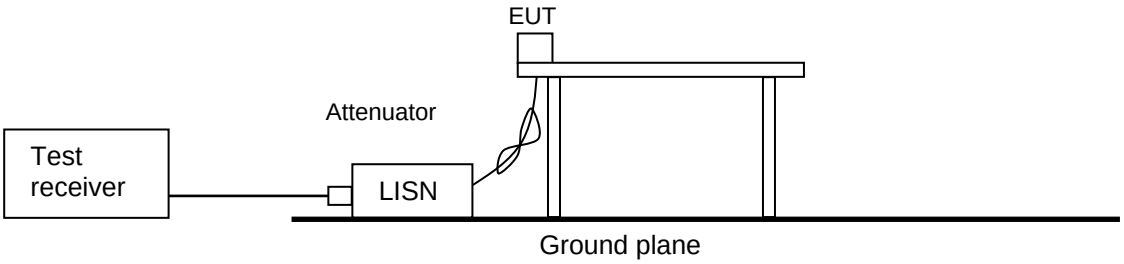
Test Procedure

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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 and Spurious Emission)

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., 180 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

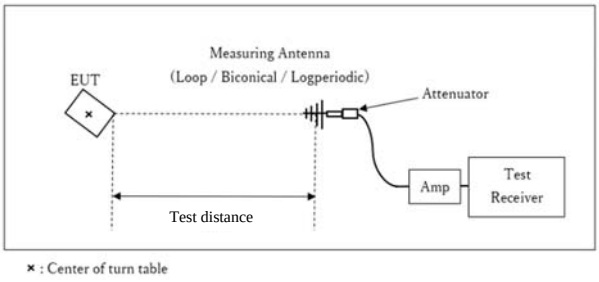
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

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

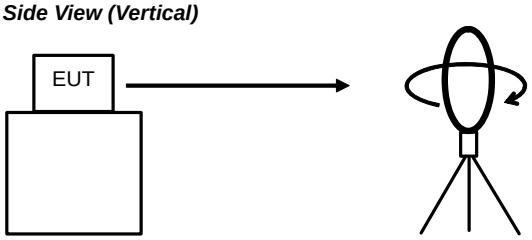
Below 1 GHz



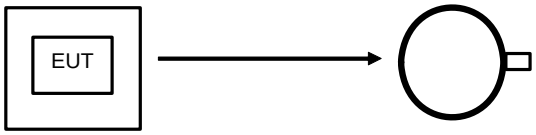
Test Distance: 3 m

Figure 3: Direction of the Loop Antenna

Side View (Vertical)

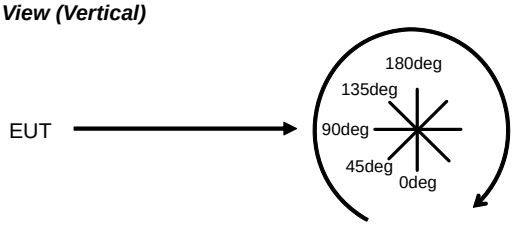


Top View (Horizontal)



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.

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: -20 dB Bandwidth

Test Procedure

The test was measured with a spectrum analyzer.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-20 dB Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX
Test result : Pass

SECTION 8: 99 % emission bandwidth

Test Procedure

The test was measured with a spectrum analyzer.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % emission bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Peak hold was applied as Worst-case measurement.							

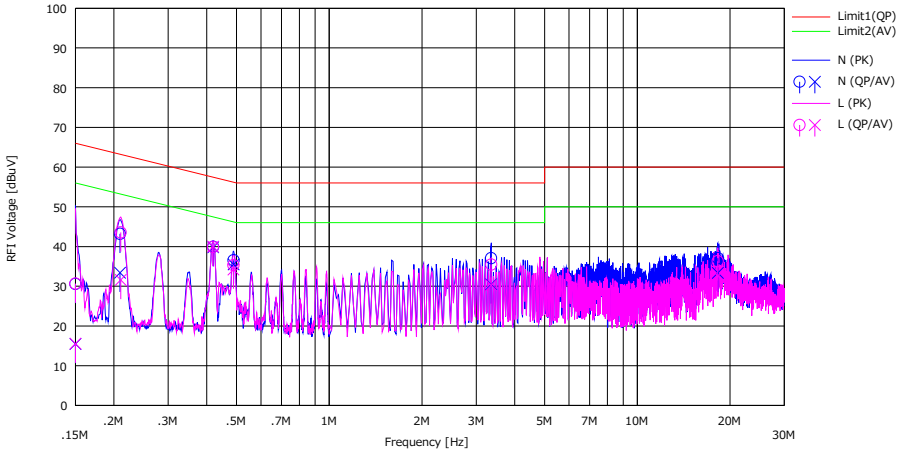
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2025
Temperature / Humidity	23 deg. C / 45 % RH
Engineer	Tomoya Sone
Mode	Mode 1 with Standard Ferrite Core

Limit : FCC_Part 15 Subpart C(15.207)



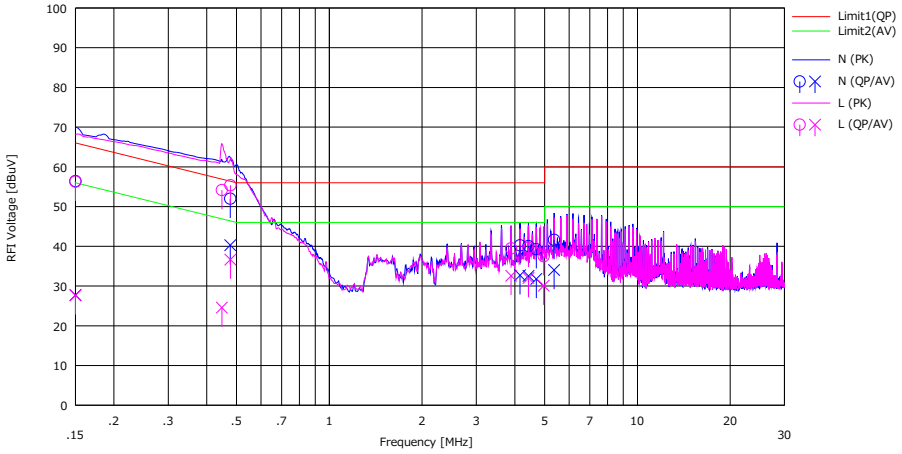
No.	Freq.	Reading ⟨QP⟩	Reading ⟨AV⟩	LISN	LOSS	Results ⟨QP⟩	Results ⟨AV⟩	Limit ⟨QP⟩	Limit ⟨AV⟩	Margin ⟨QP⟩	Margin ⟨AV⟩	Phase	Comment
	[MHz]	[dBuV]	[dBuV]	[dB]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	17.40	2.30	0.06	13.12	30.58	15.48	66.00	56.00	35.42	40.52	N	
2	0.20940	30.00	20.20	0.05	13.13	43.18	33.38	63.23	53.23	20.05	19.85	N	
3	0.42030	26.70	26.60	0.06	13.15	39.91	39.81	57.44	47.44	17.53	7.63	N	
4	0.48955	23.30	22.30	0.06	13.16	36.52	35.52	56.18	46.18	19.66	10.66	N	
5	3.35450	23.60	17.00	0.10	13.35	37.05	30.45	56.00	46.00	18.95	15.55	N	
6	18.26000	22.90	19.20	0.37	13.80	37.07	33.37	60.00	50.00	22.93	16.63	N	
7	0.15000	17.50	2.40	0.04	13.12	30.66	15.56	66.00	56.00	35.34	40.44	L	
8	0.21035	30.40	18.40	0.04	13.13	43.57	31.57	63.19	53.19	19.62	21.62	L	
9	0.41965	26.70	26.80	0.04	13.15	39.89	39.99	57.46	47.46	17.57	7.47	L	
10	0.48890	22.10	21.00	0.04	13.16	35.30	34.20	56.19	46.19	20.89	11.99	L	
11	3.35590	22.00	16.80	0.09	13.35	35.44	30.24	56.00	46.00	20.56	15.76	L	
12	18.24480	22.10	18.40	0.41	13.80	36.31	32.61	60.00	50.00	23.69	17.39	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 10, 2025
Temperature / Humidity	21 deg. C / 69 % RH
Engineer	Shousei Hamaguchi
Mode	Mode 1 without Standard Ferrite Core

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	43.20	14.50	0.06	13.15	56.41	27.71	66.00	56.00	9.59	28.29	N	
2	0.47715	38.70	27.00	0.06	13.22	51.98	40.28	56.39	46.39	4.41	6.11	N	
3	4.16014	26.50	19.00	0.11	13.61	40.22	32.72	56.00	46.00	15.78	13.28	N	
4	4.42863	26.30	18.80	0.12	13.63	40.05	32.55	56.00	46.00	15.95	13.45	N	
5	4.69695	25.50	18.00	0.12	13.66	39.28	31.78	56.00	46.00	16.72	14.22	N	
6	5.36794	27.80	20.20	0.14	13.70	41.64	34.04	60.00	50.00	18.36	15.96	N	
7	0.15000	43.10	14.50	0.04	13.15	56.29	27.69	66.00	56.00	9.71	28.31	L	
8	0.44795	40.90	11.30	0.04	13.21	54.15	24.55	56.91	46.91	2.76	22.36	L	
9	0.47782	42.10	23.40	0.04	13.22	55.36	36.66	56.38	46.38	1.02	9.72	L	
10	3.89180	25.80	18.90	0.10	13.59	39.49	32.59	56.00	46.00	16.51	13.41	L	
11	4.42863	25.90	18.30	0.11	13.63	39.64	32.04	56.00	46.00	16.36	13.96	L	
12	4.96549	23.70	16.30	0.12	13.68	37.50	30.10	56.00	46.00	18.50	15.90	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Radiated Emission (Fundamental and Spurious Emission)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.1
Date	April 7, 2025	April 16, 2025
Temperature / Humidity	22 deg. C / 37 % RH	24 deg. C / 40 % RH
Engineer	Hiroyuki Furutaka	Yuta Moriya
	(Below 30 MHz)	(Above 30 MHz)
Mode	Mode 1	

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0deg	0.13420	PK	99.6	19.8	-74.1	32.3	-	13.0	45.0	32.0	Fundamental
0deg	0.26840	PK	48.8	20.0	-64.3	32.3	-	-27.8	39.0	66.8	
0deg	0.40260	PK	51.9	20.0	-64.4	32.2	-	-24.7	35.5	60.2	
0deg	0.53680	QP	39.4	20.0	-24.4	32.2	-	2.8	33.0	30.2	
0deg	0.67100	QP	40.5	20.0	-24.4	32.2	-	3.9	31.1	27.2	
0deg	0.80520	QP	36.4	20.1	-24.3	32.3	-	-0.1	29.5	29.6	
0deg	0.93940	QP	34.9	20.0	-24.3	32.3	-	-1.7	28.1	29.8	
0deg	1.07360	QP	34.4	20.0	-24.3	32.3	-	-2.2	27.0	29.2	
0deg	1.20780	QP	34.4	20.0	-24.3	32.3	-	-2.2	25.9	28.1	
0deg	1.34200	QP	33.0	20.0	-24.3	32.3	-	-3.6	25.0	28.6	
Hori.	58.700	QP	38.0	8.1	7.8	38.9	-	15.0	40.0	25.0	
Hori.	98.458	QP	42.6	9.8	8.4	39.0	-	21.8	43.5	21.7	
Hori.	101.880	QP	45.2	10.3	8.4	39.0	-	24.9	43.5	18.6	
Hori.	150.002	QP	42.5	15.0	9.0	39.0	-	27.5	43.5	16.0	
Hori.	250.000	QP	45.0	11.9	10.0	38.9	-	28.0	46.0	18.0	
Hori.	350.000	QP	42.1	15.1	10.8	38.7	-	29.3	46.0	16.7	
Hori.	450.000	QP	45.8	16.5	11.6	38.5	-	35.4	46.0	10.6	
Vert.	58.700	QP	62.2	8.1	7.8	38.9	-	39.2	40.0	***0.8***	
Vert.	98.458	QP	61.2	9.8	8.4	39.0	-	40.4	43.5	3.1	
Vert.	101.880	QP	61.3	10.3	8.4	39.0	-	41.0	43.5	2.5	
Vert.	150.002	QP	55.1	15.0	9.0	39.0	-	40.1	43.5	3.4	
Vert.	250.000	QP	55.4	11.9	10.0	38.9	-	38.4	46.0	7.6	
Vert.	350.000	QP	52.8	15.1	10.8	38.7	-	40.0	46.0	6.0	
Vert.	450.000	QP	49.9	16.5	11.6	38.5	-	39.5	46.0	6.5	

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

PK with Duty factor

Ant Deg [deg] or Polarity [Hori/Vert]	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
0deg	0.13420	PK	99.6	19.8	-74.1	32.3	0.0	13.0	25.0	12.0	Fundamental
0deg	0.26840	PK	48.8	20.0	-64.3	32.3	0.0	-27.8	19.0	46.8	
0deg	0.40260	PK	51.9	20.0	-64.4	32.2	0.0	-24.7	15.5	40.2	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amprifier) + Duty factor *
* Since the peak emission result satisfied the average limit, duty factor was omitted.

Result of the fundamental emission at 3 m without Distance factor

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
0deg	0.13420	PK	99.6	19.8	5.9	32.3	-	93.0	-	-	Fundamental

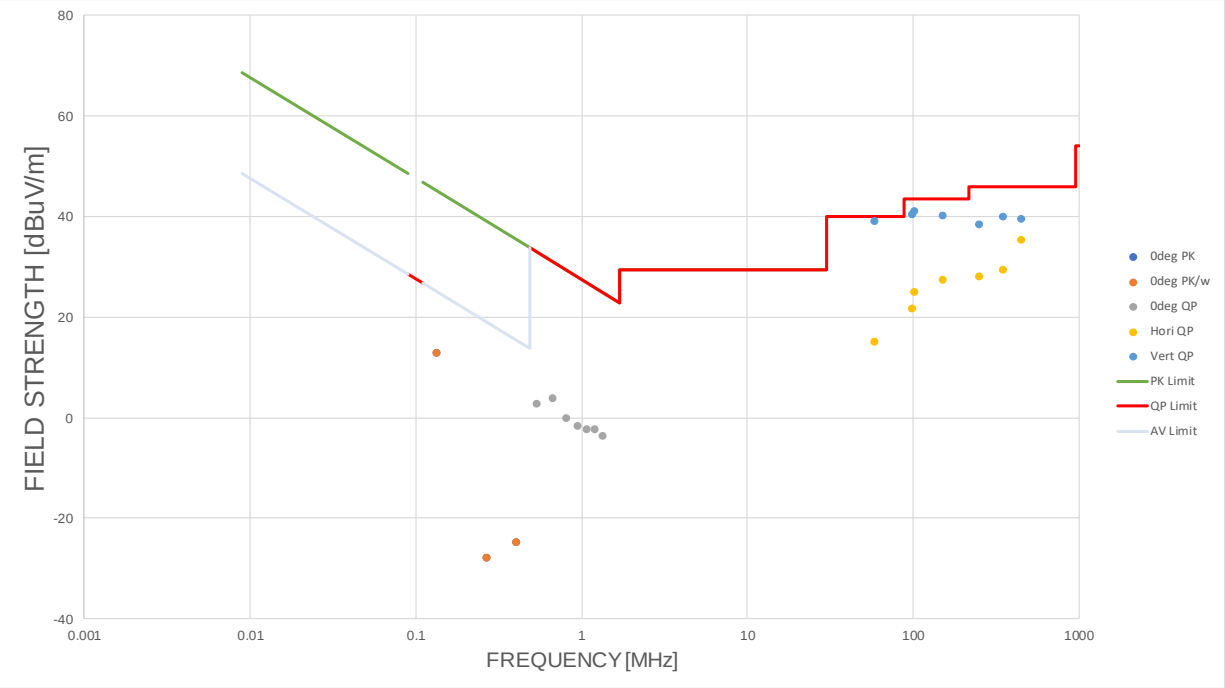
Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amprifier)

If Gain 0.0dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.
Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*It was confirmed that there were no differences in the spurious emission due to the input voltage.

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

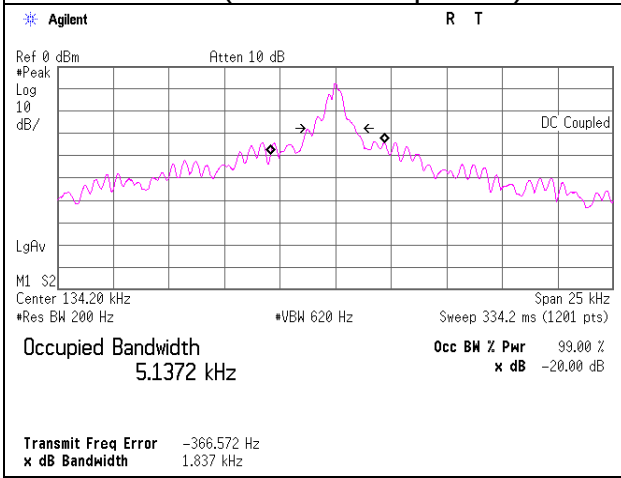
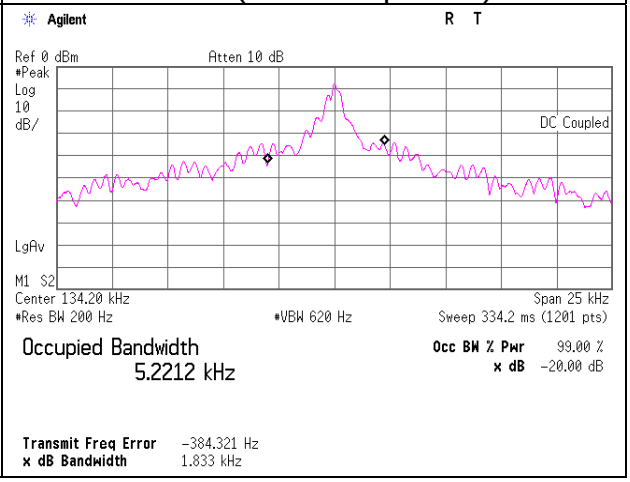
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	April 16, 2025
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Yuta Moriya
Mode	Mode 1



-20 dB Bandwidth / 99 % emission bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 7, 2025
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Hiroyuki Furutaka
Mode	Mode 1

Mode	99 % emission bandwidth [kHz]	-20 dB Bandwidth [kHz]
1 (without transponder)	5.1372	1.837
1 (with transponder)	5.2212	1.833

Mode 1 (without transponder)	Mode 1 (with transponder)
	

*It was confirmed that there were no differences in the bandwidth due to the input voltage.

APPENDIX 2: Test instruments

Test Equipment (Tested on April 7 to 17, 2025)

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/ sucoform141-PE/ 421-010/ RFM-E321(SW)	-/00640	07/06/2024	12
CE	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/03/2024	12
CE	141357	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-729	07/09/2024	12
CE	141532	DIGITAL HiTESTER	HIOKI E. E. CORPORATION	3805	051201197	01/16/2025	12
CE	141538	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-732	07/14/2024	12
CE	141921	Terminator	TME	Termination	-	09/12/2024	12
CE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	06/05/2024	12
CE	142183	Measure	KOMELON	KMC-36	-	10/21/2024	12
CE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	244709	Thermo-Hygrometer	HIOKI E. E. CORPORATION	LR5001	231202103	01/19/2025	12
RE	141198	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	2513	07/10/2024	12
RE	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	11/11/2024	12
RE	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/ sucoform141-PE/ 421-010/ RFM-E321(SW)	-/00640	07/06/2024	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/23/2024	12
RE	141295	High Pass Filter 0.15-30MHz	Rohde & Schwarz	EZ-25/3	100041	02/14/2025	12
RE	141323	Coaxial cable	UL-ISE	-	-	09/13/2024	12
RE	141350	Coaxial Cable	Suhner/storm/Agilent/ TSJ	-	-	03/14/2025	12
RE	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/23/2024	12
RE	141530	Digital Tester	Fluke Corporation	FLUKE 26-3	78030621	02/25/2025	12
RE	141532	DIGITAL HiTESTER	HIOKI E. E. CORPORATION	3805	051201197	01/16/2025	12
RE	141568	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	2901	01/19/2025	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/14/2025	12
RE	141585	Pre Amplifier	L3 Narda-MITEQ	MLA-10K01-B01-35	1237616	02/26/2025	12
RE	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	11/13/2024	12
RE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	11/28/2024	12
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	05/17/2024	12
RE	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	12/06/2023	24
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/11/2023	24
RE	142183	Measure	KOMELON	KMC-36	-	10/21/2024	12
RE	142226	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/06/2024	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	207745	Coaxial Cable	UL-ISE	-	-	03/19/2025	12
RE	242170	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	00728	12/17/2024	12
RE	244709	Thermo-Hygrometer	HIOKI E. E. CORPORATION	LR5001	231202103	01/19/2025	12
RE	252514	Active Loop Antenna	Schwarzbeck Mess-Elektronik OHG	FMZB 1519-60 D	1519-60 D-067	09/26/2024	12

Test Equipment (Tested on June 10, 2025)

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	141222	Coaxial Cable	Fujikura,HP,Mini-Circits,Fujikura	3D-2W(12m)/ 5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	02/14/2025	12
CE	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/03/2024	12
CE	141358	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-730	07/09/2024	12
CE	141538	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-732	07/14/2024	12
CE	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/06/2024	12
CE	141936	Terminator	TME	CT-01BP	-	12/06/2024	12
CE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	05/07/2025	12
CE	142228	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
CE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	244707	Thermo-Hygrometer	HIOKI E. E. CORPORATION	LR5001	231202102	01/19/2025	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