



RADIO TEST REPORT

Test Report No. 14157352H-H-R1

Customer	Keyence Corporation
Description of EUT	Safety Interlocking Switch
Model Number of EUT	GS-M9
FCC ID	RF41682A
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied (Refer to SECTION 3)
Issue Date	July 13, 2022
Remarks	-

Representative Test Engineer

Yuichiro Yamazaki
Engineer

Approved By

Satofumi Matsuyama
Engineer



CERTIFICATE 5107.02

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REVISION HISTORY

Original Test Report No.: 14157352H-H

This report is a revised version of 14157352H-H. 14157352H-H is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14157352H-H	May 27, 2022	-
1	14157352H-H-R1	July 13, 2022	P.10 Correction of the No.1 Cable name in the List of cables used table for Conducted emission test; From DC Cable to DC + Signal Cable
1	14157352H-H-R1	July 13, 2022	P.10, 11 Addition of the P/N in the Remarks for Item B in the List of cables used table
1	14157352H-H-R1	July 13, 2022	P.21 Test equipment: Correction of "MSA-04" to "MSA-14"

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

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SECTION 1: Customer Information

Company Name	Keyence Corporation
Address	1-3-14, Higashinakajima, Higashiyodogawa-ku, Osaka, 533-8555, Japan
Telephone Number	+81-6-6379-1111
Contact Person	Katsuya Ota

The information provided from 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

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	Safety Interlocking Switch
Model Number	GS-M9
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	April 27, 2022
Test Date	May 10 and 12, 2022

2.2 Product Description

General Specification

Rating	DC 24 V
Operating temperature	-20 deg. C to 55 deg. C

Radio Specification

Equipment Type	Transceiver
Frequency of Operation	125 kHz
Type of Modulation	ASK

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C FCC Part 15 final revised on April 1, 2022 and effective May 2, 2022
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 Procedures and results

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 8.8	<FCC> Section 15.207 <ISED> RSS-Gen 8.8	-	N/A	25.66 dB 20.49860 MHz, AV, Phase L / 20.44590 MHz, AV, Phase N	Complied a)
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.12	<FCC> Section 15.209 <ISED> RSS-210 7.2 RSS-Gen 8.9	Radiated	N/A	37.9 dB 125 kHz, 0 deg. Peak with Duty factor	Complied b)
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.6, 6.13	<FCC> Section 15.209 <ISED> RSS-210 7.3 RSS-Gen 8.9	Radiated	N/A	24.8 dB 30.484 MHz, Vertical, QP	Complied b)
-20 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Reference data <ISED> -	Radiated	N/A	N/A	Complied c)

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

a) Refer to APPENDIX 1 (data of Conducted Emission)

b) Refer to APPENDIX 1 (data of Radiated emission)

c) Refer to APPENDIX 1 (data of -20 dB Bandwidth / 99 % emission bandwidth)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration

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

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	Remarks	Deviation	Worst margin	Results
99 % emission bandwidth	RSS-Gen 6.7	-	Radiated	N/A	N/A	-

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

Test Item	Frequency range		Uncertainty (+/-)	
Conducted emission AMN (LISN)	0.15 MHz to 30 MHz		3.3 dB	
Radiated emission	3 m	9 kHz to 30 MHz		
	10 m	3.2 dB		
	3 m	30 MHz to 200 MHz	Horizontal	4.8 dB
			Vertical	5.0 dB
		200 MHz to 1000 MHz	Horizontal	5.1 dB
			Vertical	6.2 dB
	10 m	30 MHz to 200 MHz	Horizontal	4.8 dB
			Vertical	4.8 dB
		200 MHz to 1000 MHz	Horizontal	5.0 dB
			Vertical	5.0 dB
	3 m	1 GHz to 6 GHz		4.9 dB
		6 GHz to 18 GHz		5.2 dB
	1 m	10 GHz to 26.5 GHz		5.4 dB
26.5 GHz to 40 GHz		5.4 dB		
10 m	1 GHz to 18 GHz		5.4 dB	
-20 dB Bandwidth / 99 % emission bandwidth		-	0.96 %	

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan

Telephone: +81-596-24-8999

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 m × 3.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

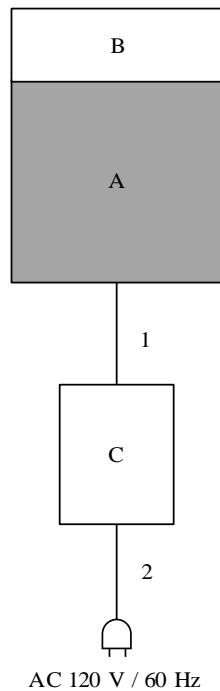
SECTION 4: Operation of EUT during testing

4.1. Operating Mode(s)

Test mode	Remarks
1) Transmitting mode (Tx 125 kHz)	-
<p>*Power of the EUT was set by the software as follows; Software: Software for GS-M9 version 0.40 (Date: 2022.05 10, Storage location: EUT memory)</p> <p>*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.</p>	

4.2. Configuration and peripherals

[Conducted Emission test]



* 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	Sensor	GS-M9	#4C0N000232	Keyence Corporation	EUT *1)
B	Actuator	GS-MA9	#4C0N000156	Keyence Corporation	P/N: GS-MA9M *1), *2)
C	DC Power Supply	PMC35-2A	13090501	KIKUSUI ELECTRONICS CORP.	-

*1) Safety Interlocking Switch is composed of these items.

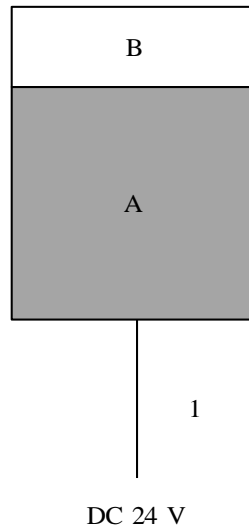
Although the Actuator and Sensor together function as a single component, the Actuator is also part of Safety Interlocking Switch.

*2) Used for pre-test only.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC + Signal Cable	3.0	Unshielded	Unshielded	-
2	AC Cable	2.0	Unshielded	Unshielded	-

[Radiated Emission test]



* 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	Sensor	GS-M9	#4C0N000232	Keyence Corporation	EUT *1)
B	Actuator	GS-MA9	#4C0N000156	Keyence Corporation	P/N: GS-MA9M *1)

*1) Safety Interlocking Switch is composed of these items.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC + Signal Cable	3.0	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.

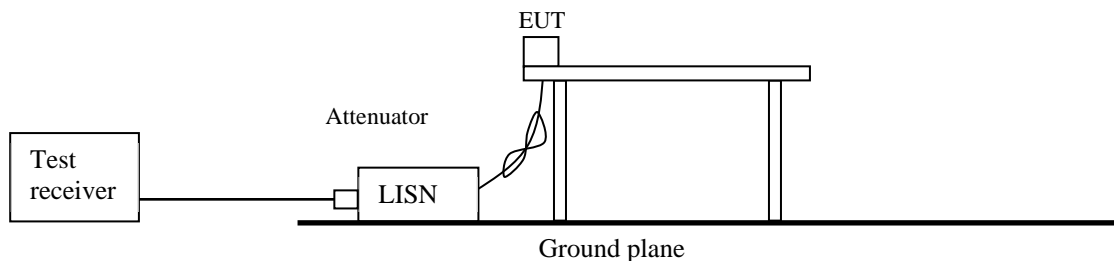
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

Figure 1: Test Setup



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.

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. 135 deg., and 180 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

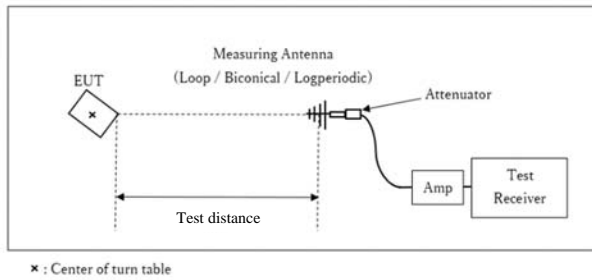
These tests were performed in semi anechoic chamber. Therefore, the measured level of emissions may be higher than if measurements were made without a ground plane.

However, test results were confirmed to pass against standard limit.

The 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 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0 \text{ dBuA/m}$, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

[Test Setup]
Below 1 GHz

Test Distance: 3 m



- 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.

- This EUT has two modes which an actuator is attached or not. The worst case was confirmed with and without an actuator.

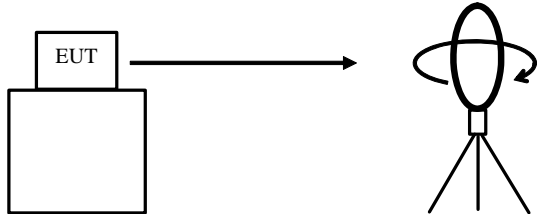
As a result, the test was performed only without the actuator since the test without an actuator was the worst case.

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

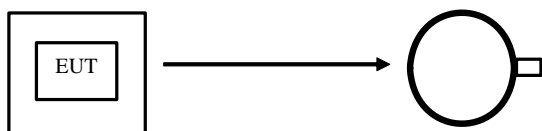
Measurement range : 9 kHz to 1 GHz
Test data : APPENDIX
Test result : Pass

Figure 2: Direction of the Loop Antenna

Side View (Vertical)

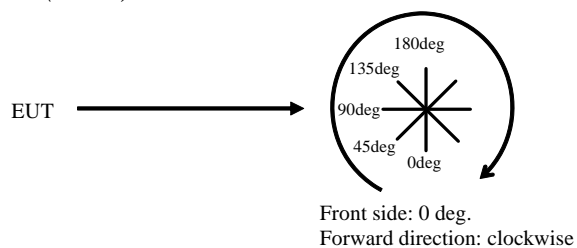


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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 1
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.

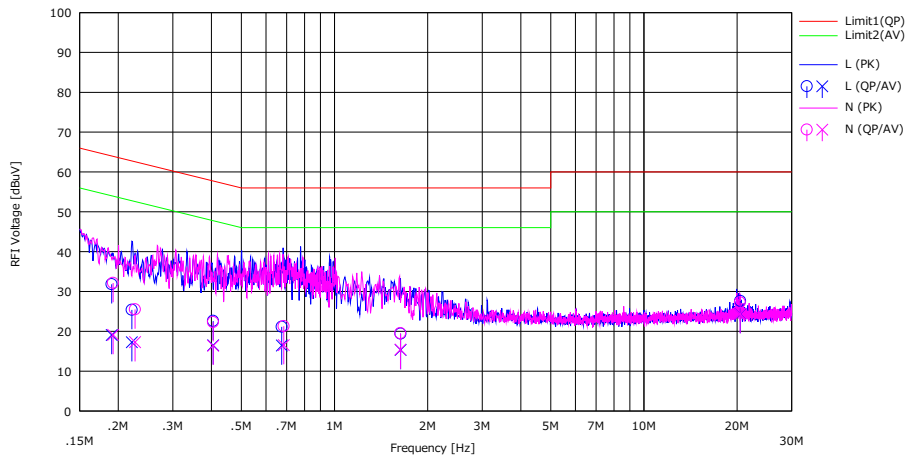
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 12, 2022 (Night)
Temperature / Humidity 24 deg. C / 54 % RH
Engineer Takumi Nishida
Mode Mode 1

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]				
1	0.19042	18.56	5.81	0.05	13.20	31.81	19.06	64.02	54.02	32.21	34.96	L	
2	0.22134	12.11	4.00	0.05	13.20	25.36	17.25	62.77	52.77	37.41	35.52	L	
3	0.40522	9.31	3.24	0.05	13.22	22.58	16.51	57.75	47.75	35.17	31.24	L	
4	0.67522	7.81	3.14	0.05	13.25	21.11	16.44	56.00	46.00	34.89	29.56	L	
5	1.63540	5.99	1.94	0.07	13.32	19.38	15.33	56.00	46.00	36.62	30.67	L	
6	20.49860	13.23	9.98	0.42	13.94	27.59	24.34	60.00	50.00	32.41	25.66	L	
7	0.19242	18.85	5.83	0.07	13.20	32.12	19.10	63.93	53.93	31.81	34.83	N	
8	0.22656	12.21	4.02	0.07	13.20	25.48	17.29	62.57	52.57	37.09	35.28	N	
9	0.40513	9.01	3.11	0.06	13.22	22.29	16.39	57.75	47.75	35.46	31.36	N	
10	0.68522	7.95	3.23	0.06	13.25	21.26	16.54	56.00	46.00	34.74	29.46	N	
11	1.63215	6.10	2.00	0.08	13.32	19.50	15.40	56.00	46.00	36.50	30.60	N	
12	20.44590	12.89	10.02	0.38	13.94	27.21	24.34	60.00	50.00	32.79	25.66	N	

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.	No.4
Semi Anechoic Chamber	No.1	May 12, 2022 (Day)
Date	May 10, 2022	22 deg. C / 66 % RH
Temperature / Humidity	25 deg. C / 35 % RH	Yuichiro Yamazaki
Engineer	Junya Okuno (Above 30 MHz)	(Below 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
Odeg	0.12500	PK	74.1	19.6	-73.8	32.2	-	-12.3	45.6	57.9	Fundamental
Odeg	0.25000	PK	42.8	19.6	-73.8	32.2	-	-43.6	39.6	83.2	Floor Noise
Odeg	0.37500	PK	45.3	19.5	-73.8	32.2	-	-41.2	36.1	77.3	
Odeg	0.50000	QP	35.7	19.5	-33.8	32.1	-	-10.7	33.6	44.3	
Odeg	0.62500	QP	34.9	19.4	-33.8	32.1	-	-11.6	31.7	43.3	
Odeg	0.75000	QP	31.5	19.4	-33.7	32.2	-	-15.0	30.1	45.1	Floor Noise
Odeg	0.87500	QP	32.5	19.4	-33.7	32.2	-	-14.0	28.7	42.7	
Odeg	1.00000	QP	31.0	19.4	-33.7	32.2	-	-15.5	27.6	43.1	Floor Noise
Odeg	1.12500	QP	31.4	19.4	-33.7	32.2	-	-15.1	26.5	41.6	
Odeg	1.25000	QP	30.7	19.4	-33.7	32.2	-	-15.8	25.6	41.4	Floor Noise
Hori.	75.636	QP	28.8	9.1	8.1	39.0	-	7.0	40.0	33.0	
Hori.	117.985	QP	30.0	10.6	8.6	39.1	-	10.1	43.5	33.4	
Hori.	170.743	QP	28.4	12.9	9.2	39.1	-	11.4	43.5	32.1	
Hori.	245.605	QP	28.1	11.8	9.9	39.0	-	10.8	46.0	35.2	
Hori.	416.341	QP	27.5	16.1	11.3	38.7	-	16.2	46.0	29.8	
Hori.	557.281	QP	27.6	17.8	12.2	38.5	-	19.1	46.0	26.9	
Vert.	30.484	QP	33.5	13.5	7.2	39.0	-	15.2	40.0	24.8	
Vert.	113.080	QP	32.0	10.3	8.6	39.1	-	11.8	43.5	31.7	
Vert.	170.743	QP	28.4	12.9	9.2	39.1	-	11.4	43.5	32.1	
Vert.	245.605	QP	28.1	11.8	9.9	39.0	-	10.8	46.0	35.2	
Vert.	416.341	QP	27.5	16.1	11.3	38.7	-	16.2	46.0	29.8	
Vert.	557.281	QP	27.6	17.8	12.2	38.5	-	19.1	46.0	26.9	

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

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
Odeg	0.12500	PK	74.1	19.6	-73.8	32.2	0.0	-12.3	25.6	37.9	Fundamental
Odeg	0.25000	PK	42.8	19.6	-73.8	32.2	0.0	-43.6	19.6	63.2	
Odeg	0.37500	PK	45.3	19.5	-73.8	32.2	0.0	-41.2	16.1	57.3	

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

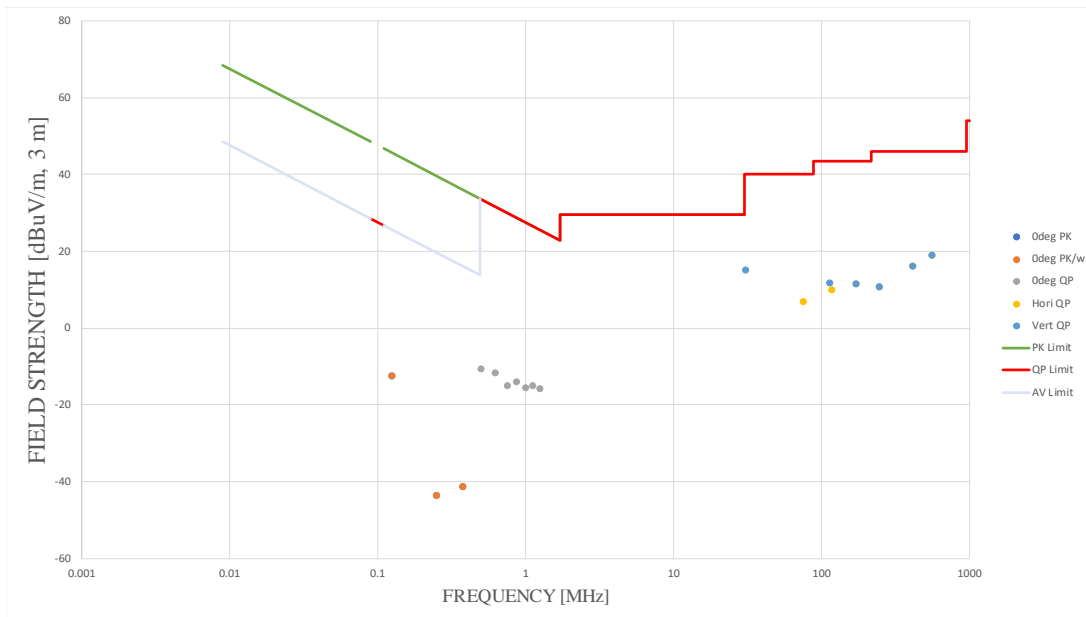
Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Odeg	0.12500	PK	74.1	19.6	6.2	32.2	-	67.7	-	-	Fundamental

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

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).

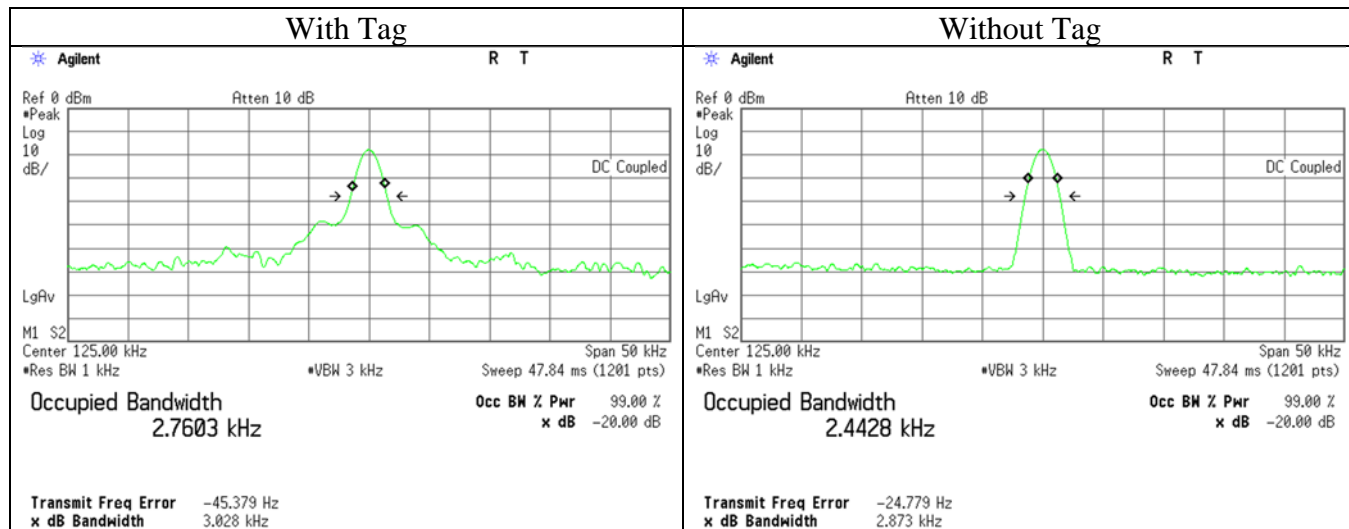
Radiated Spurious Emission (Plot data, Worst case for Spurious Emission)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.4
Date	May 10, 2022	May 12, 2022 (Day)
Temperature / Humidity	25 deg. C / 35 % RH	22 deg. C / 66 % RH
Engineer	Junya Okuno (Above 30 MHz)	Yuichiro Yamazaki (Below 30 MHz)
Mode	Mode 1	



-20 dB Bandwidth / 99 % Occupied Bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	May 12, 2022 (Night)
Temperature / Humidity	24 deg. C / 54 % RH
Engineer	Takumi Nishida
Mode	Mode 1



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.

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
CE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/17/2021	12
CE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/02/2021	12
CE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
CE	MLS-24	141358	LISN(AMN)	Schwarzbeck Mess-Elektronik OHG	NSLK8127	8127-730	07/18/2021	12
CE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
CE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
CE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/05/2021	12
RE	APANT08	146613	Loop Antenna	Rohde & Schwarz	HFH2-Z2	842906/011	10/06/2021	12
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	LA-17	160924	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	225	11/13/2021	12
RE	MAEC-01	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	06/08/2020	24
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MAT-08	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	11/09/2021	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/25/2022	12
RE	MCC-02	141350	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	-	03/08/2022	12
RE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW)	-/04178	06/02/2021	12
RE	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/28/2022	12
RE	MJM-25	142226	Measure	KOMELON	KMC-36	-	-	-
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	MMM-09	141533	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201195	01/16/2022	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
RE	MOS-27	141566	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	A08Q26	01/10/2022	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	04/04/2022	12
RE	MPA-19	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	02/28/2022	12
RE	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	01/10/2022	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/05/2021	12
RE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	10/14/2021	12
RE	YBA-03	197990	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHBB 9124 + BBA 9106	01365	11/13/2021	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