



EMI TEST REPORT

Test Report No.: 14574161H-D-R1

Customer	DENSO TEN Limited
Description of EUT	Car Navigation
Model Number of EUT	TN0022A
FCC ID	BABTN0022A
Test Regulation	FCC Part 15 Subpart B
Test Result	Complied (Refer to SECTION 3)
Issue Date	January 11, 2023
Remarks	For Permissive change

Representative test engineer

K. Okazaki

Kiyoshiro Okazaki
Engineer

Approved by

Ryota Yamanaka

Ryota Yamanaka
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".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 21.0

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- The information provided from the customer for this report is identified in SECTION 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

REVISION HISTORY

Original Test Report No.: 14574161H-D

This report is a revised version of 14574161H-D. 14574161H-D is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14574161H-D	December 9, 2022	-
1	14574161H-D-R1	January 11, 2023	P.7: Correction of Worst margin of Antenna Terminal

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	GPS	Global Positioning System
AAN	Asymmetric Artificial Network	Hori.	Horizontal
AC	Alternating Current	ICES	Interference-Causing Equipment Standard
AM	Amplitude Modulation	I/O	Input/Output
AMN	Artificial Mains Network	IEC	International Electrotechnical Commission
Amp, AMP	Amplifier	IEEE	Institute of Electrical and Electronics Engineers
ANSI	American National Standards Institute	IF	Intermediate Frequency
Ant, ANT	Antenna	ILAC	International Laboratory Accreditation Conference
AP	Access Point	ISED	Innovation, Science and Economic Development Canada
ASK	Amplitude Shift Keying	ISN	Impedance Stabilization Network
Atten., ATT	Attenuator	ISO	International Organization for Standardization
AV	Average	JAB	Japan Accreditation Board
BPSK	Binary Phase-Shift Keying	LAN	Local Area Network
BR	Bluetooth Basic Rate	LCL	Longitudinal Conversion Loss
BT	Bluetooth	LIMS	Laboratory Information Management System
BT LE	Bluetooth Low Energy	LISN	Line Impedance Stabilization Network
BW	BandWidth	MRA	Mutual Recognition Arrangement
C.F	Correction Factor	N/A	Not Applicable
Cal Int	Calibration Interval	NIST	National Institute of Standards and Technology
CAV	CISPR AV	NS	No signal detect.
CCK	Complementary Code Keying	NSA	Normalized Site Attenuation
CDN	Coupling Decoupling Network	OBW	Occupied BandWidth
Ch., CH	Channel	OFDM	Orthogonal Frequency Division Multiplexing
CISPR	Comite International Special des Perturbations Radioelectriques	PER	Packet Error Rate
Corr.	Correction	PK	Peak
CPE	Customer premise equipment	P _{LT}	long-term flicker severity
CW	Continuous Wave	POHC(A)	Partial Odd Harmonic Current
DBPSK	Differential BPSK	Pol., Pola.	Polarization
DC	Direct Current	PR-ASK	Phase Reversal ASK
DET	Detector	P _{ST}	short-term flicker severity
D-factor	Distance factor	QAM	Quadrature Amplitude Modulation
Dmax	maximum absolute voltage change during an observation period	QP	Quasi-Peak
DQPSK	Differential QPSK	QPSK	Quadrature Phase Shift Keying
DSSS	Direct Sequence Spread Spectrum	r.m.s., RMS	Root Mean Square
DUT	Device Under Test	RBW	Resolution BandWidth
EDR	Enhanced Data Rate	RE	Radio Equipment
e.i.r.p., EIRP	Equivalent Isotropically Radiated Power	REV	Reverse
EM clamp	Electromagnetic clamp	RF	Radio Frequency
EMC	ElectroMagnetic Compatibility	RFID	Radio Frequency Identifier
EMI	ElectroMagnetic Interference	RNSS	Radio Navigation Satellite Service
EMS	ElectroMagnetic Susceptibility	RSS	Radio Standards Specifications
EN	European Norm	Rx	Receiving
e.r.p., ERP	Effective Radiated Power	SINAD	Ratio of (Signal + Noise + Distortion) to (Noise + Distortion)
ETSI	European Telecommunications Standards Institute	S/N	Signal to Noise ratio
EU	European Union	SA, S/A	Spectrum Analyzer
EUT	Equipment Under Test	SG	Signal Generator
Fac.	Factor	SVSWR	Site-Voltage Standing Wave Ratio
FCC	Federal Communications Commission	THC(A)	Total Harmonic Current
FHSS	Frequency Hopping Spread Spectrum	THD(%)	Total Harmonic Distortion
FM	Frequency Modulation	TR, T/R	Test Receiver
Freq.	Frequency	Tx	Transmitting
FSK	Frequency Shift Keying	VBW	Video BandWidth
Fund	Fundamental	Vert.	Vertical
FWD	Forward	WLAN	Wireless LAN
GFSK	Gaussian Frequency-Shift Keying	xDSL	Generic term for all types of DSL technology
GNSS	Global Navigation Satellite System		(DSL: Digital Subscriber Line)

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SECTION 1: Customer information

Company Name	DENSO TEN Limited
Address	2-28, Goshō-dori 1-Chome, Hyogo-ku, Kobe, 652-8510 Japan
Telephone Number	+81-78-682-2159
Contact Person	Kaoru Abe

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	Car Navigation
Model Number	TN0022A
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	November 10, 2022
Test Date	November 17 to 20, 2022

2.2 Product Description

General Specification

Rating	DC 12 V
Clock frequency (ies) in the system	7.3333333 GHz (max.)

Radio Specification

WLAN (IEEE802.11b / 11g / 11n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz to 2462 MHz
Type of Modulation	11b: DSSS (CCK, DQPSK, DBPSK) 11g/n-20: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Gain	-1.59 dBi (Peak)

Bluetooth (BR / EDR / Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	BT: FHSS (GFSK, $\pi/4$ DQPSK, 8 DPSK) BT LE: GFSK
Antenna Gain	-1.7 dBi (Peak)

WLAN (IEEE802.11a / 11n-20 / 11ac-20 / 11n-40 / 11ac-40 / 11ac-80)

Equipment Type	Transceiver	
Frequency of Operation	20 MHz Band:	5180 MHz to 5240 MHz 5745 MHz to 5825 MHz
	40 MHz Band:	5190 MHz to 5230 MHz 5755 MHz to 5795 MHz
	80 MHz Band:	5210 MHz 5775 MHz
Type of Modulation	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM (IEEE802.11ac only))	
Antenna Gain	2.92 dBi (Peak) (ANT 1) / 2.11 dBi (Peak) (ANT 2)	

[AM / FM (incl. RBDS) / SDARS]

Equipment Type	Receiver
Frequency of Operation	AM, HD_AM: 530 kHz to 1710 kHz FM, RBDS/HD_FM: 87.75 MHz to 107.9 MHz SDARS: 2320 MHz to 2345 MHz
Type of Modulation	AM FM SDARS: QPSK (Sat) / COFDM (Terr)
Antenna Connector Type	HFC IV

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart B The latest version on the first day of the testing period
Title	FCC 47CFR Part15 Radio Frequency Device Subpart B Unintentional Radiators

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result	Remarks
Conducted emission	ANSI C63.4: 2014 +C63.4a:2017 7. AC power - line conducted emission measurements IEEE 187:2003	Part 15 Subpart B 15.107(a)	N/A	-	N/A	*1)
Radiated emission	ANSI C63.4: 2014 +C63.4a:2017 8. Radiated emission measurements IEEE 187:2003	Part 15 Subpart B 15.109(a)	N/A	5.54 dB (4999.899 MHz, Vertical, AV, Mode 3)	Complied a)	-
Antenna Terminal	ANSI C63.4: 2014 +C63.4a:2017 12. Measurement of unintentional radiators other than ITE IEEE 187:2003	Part 15 Subpart B 15.111(a)	N/A	16.05 dB 3159.831 MHz, Mode 5	Complied b)	-

* Note: UL Japan, Inc.'s EMI Work Procedure: Work Instructions-ULID-003591.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

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

b) Refer to APPENDIX 1 (data of Antenna Terminal Conducted Emission)

3.3 Addition to standard

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 $k = 2$.

Radiated emission

Measurement distance	Frequency range		Uncertainty (+/-)
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	Test Receiver	5.0 dB
		Spectrum analyzer	4.9 dB
	6 GHz to 18 GHz	Test Receiver	5.3 dB
		Spectrum analyzer	5.2 dB
1 m	10 GHz to 26.5 GHz	Spectrum analyzer	5.5 dB
	26.5 GHz to 40 GHz	Spectrum analyzer	5.4 dB
0.5 m	26.5 GHz to 40 GHz	Spectrum analyzer	5.4 dB
10 m	1 GHz to 18 GHz	Test Receiver	5.3 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
Antenna terminal conducted emission	2.7 dB

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	-	-

3.6 Test data, Test instruments, and Test set up

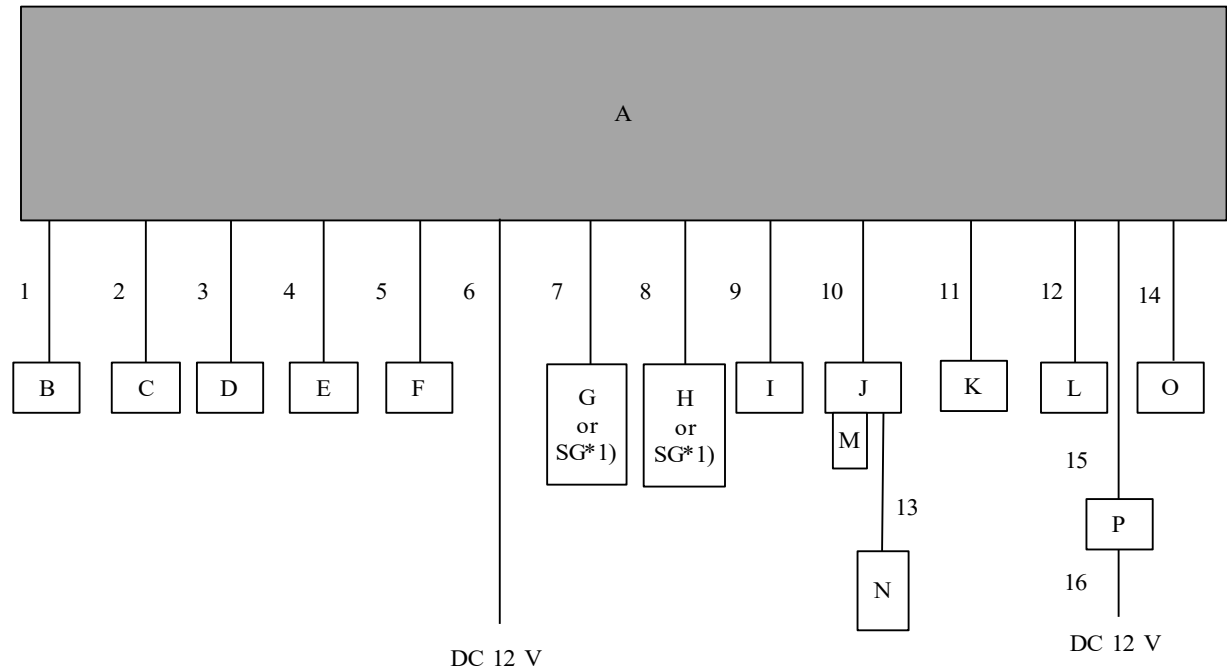
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	1. FM Main Port Receiving mode (Local / Other) (Radiated Emission test) 2. FM Sub Port Receiving mode (Local / Other) (Radiated Emission test) 3. USB Memory Play mode (Radiated Emission test) 4. FM Main Port Tuning mode (Antenna Terminal test) 5. FM Sub Port Tuning mode (Antenna Terminal test)
Software(s)	NANE01.035205C

4.2 Configuration and peripherals



*1) SG(Signal Generator): Used only for Mode 1 and 2

* 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	Car Navigation	TN0022A	AU300046	DENSO TEN Limited	EUT
B	Switch	-	-	-	-
C	DCM	19MC DCM	E-033720026/001	DENSO Corporation	-
D	Steering Switch	84250-33500	56	TOYOTA	-
E	Low noise Amp	ZX60-242GLN-S+	S 2036302044	Mini-Circuits	-
F	GPS Antenna	23D90051	No.10	DENSO TEN Limited	-
G	FM/AM connector (Main)	86300-30C30	PTA00491	DENSO TEN Limited	-
H	FM/AM connector (Sub)	86300-30C70	PU106544	DENSO TEN Limited	-
I	Back Camera	867B0-78070	E-033720063/010	Panasonic	-
J	USB/AUX socket	86190-12040	No.30	Kojima Industries Corporation	-
K	Mic	86730-78010	033722017/021	Panasonic	-
L	Mic	86730-78010	033722017/022	Panasonic	-
M	USB Memory	RUF3-K8GA-BK/N	P90611	SONY	-
N	iPod touch	MC547J/A	CCQ50WDDCPC	Apple	-
O	Speaker Dummy	-	-	-	-
P	TSS Camera	ECM20-2251-E07	No.5	DENSO TEN Limited	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	2.4	Unshielded	Unshielded	-
2	Signal Cable	2.4	Unshielded	Unshielded	-
3	Signal Cable	2.4	Unshielded	Unshielded	-
4	Signal Cable	1.0	Unshielded	Unshielded	-
5	GNSS Antenna Cable	2.6	Shielded	Shielded	-
6	DC Cable	3.4	Unshielded	Unshielded	-
7	Signal Cable	2.6	Unshielded	Unshielded	-
8	Signal Cable	2.6	Unshielded	Unshielded	-
9	Signal Cable	2.4	Unshielded	Unshielded	-
10	USB Cable	2.0	Shielded	Shielded	-
11	Signal Cable	2.5	Unshielded	Unshielded	-
12	Signal Cable	2.5	Unshielded	Unshielded	-
13	Audio Cable	1.0	Shielded	Shielded	-
14	Speaker Cable	3.2	Unshielded	Unshielded	-
15	Signal Cable	2.4	Unshielded	Unshielded	-
16	DC Cable	3.4	Unshielded	Unshielded	-

SECTION 5: Radiated Emission

5.1 Operating environment

Date : See data
Test place : See data
Temperature : See data
Humidity : See data
Test engineer : See data

5.2 Test configuration

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 EUT was set on the edge of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

Photographs of the set up are shown in APPENDIX 3

5.3 Test conditions

Frequency range : 30 MHz to 200 MHz (Biconical antenna)
200 MHz to 1000 MHz (Logperiodic antenna)
1000 MHz to 40000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring antenna 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 with the Test Receiver, or the Spectrum Analyzer.

The radiated emission measurements were made with the following detector function of the Test Receiver and the Spectrum Analyzer.

The test of Local oscillator spurious has been measured up to appropriate frequency based on the result of the antenna terminal test.

Test antenna was aimed at the emission source for receiving the maximum signal and always kept. (above 1 GHz)

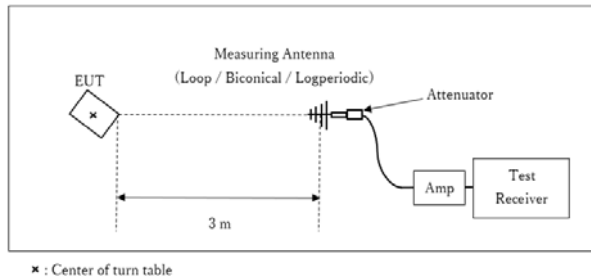
Frequency	Below 1 GHz	Above 1 GHz *1)
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP: BW 120 kHz	PK: RBW: 1 MHz / VBW: 3 MHz AV *2): RBW: 1 MHz / VBW: 10 Hz

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.
Distance Factor: See Figure 1.

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

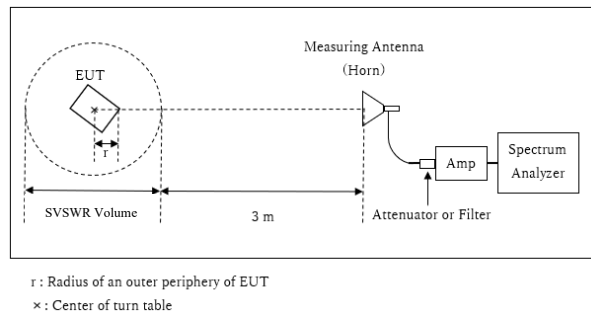
Figure 1: Test Setup

Below 1 GHz



Test Distance: 3 m

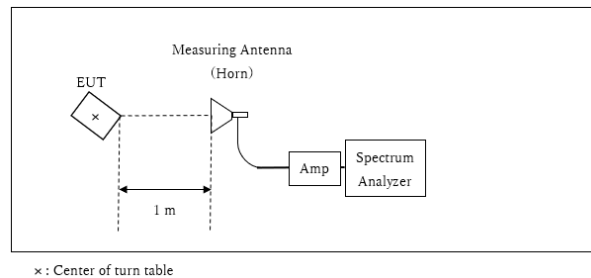
1 GHz to 10 GHz



Distance Factor: $20 \times \log (3.20 \text{ m}^* / 3.0 \text{ m}) = 0.70 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.20 \text{ m}$

SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.8 \text{ m}$

10 GHz to 40 GHz



Distance Factor: $20 \times \log (1.0 \text{ m}^* / 3.0 \text{ m}) = -9.54 \text{ dB}$
*Test Distance: 1 m

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

6.5 Test result

Summary of the test results: Pass

The limit is rounded down to one decimal place.

The test result is rounded off to one or two decimal places, so some differences might be observed.

SECTION 6: Antenna Terminal

6.1 Operating environment

Date : See data
Test place : See data
Temperature : See data
Humidity : See data
Test engineer : See data

6.2 Test configuration

EUT was placed on a wooden table of nominal size, 1.0 m by 1.5 m, raised 0.8 m from the ground.
Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

Frequency range : 30 MHz - 1000 MHz / 1000 MHz - 40000 MHz
Test distance : N/A
EUT position : Table top
EUT operation mode : See Clause 4.1

6.4 Test procedure

The Antenna Terminal was measured with a spectrum analyzer connected to the antenna port.

Frequency	Below 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer *1)
IF Bandwidth	PK: RBW: 100 kHz / VBW: 100 kHz	PK: RBW: 1 MHz / VBW: 3 MHz

*1) The Spectrum Analyzer was used in 3 dB resolution bandwidth.

6.5 Test result

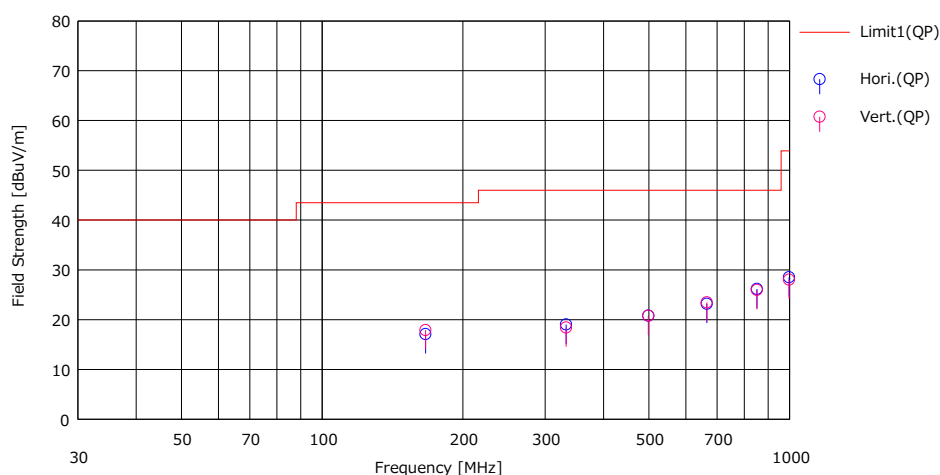
Summary of the test results: Pass

APPENDIX 1: Test data

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date November 17, 2022
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Masaya Minami
 (Below 1 GHz)
Mode Mode 1 Local

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading		Ant.Fac.	Loss	Gain	Result	Limit	Margin	Pols.	Height	Angle	Ant. Type	Comment
		[GHz]	[dBuV]				[dB/m]	[dB]	[dBuV/m]					
1	166398	21.80	15.58	7.86	28.16	17.08	43.50	26.42	Hori.	100	0	BA		
2	332759	22.90	15.17	8.87	27.93	19.01	46.00	26.99	Hori.	100	120	LA21		
3	499185	22.00	18.05	9.80	29.09	20.76	46.00	25.24	Hori.	100	0	LA21		
4	665585	22.50	19.53	10.40	29.27	23.16	46.00	22.84	Hori.	120	234	LA21		
5	852059	22.40	21.67	11.03	28.95	26.15	46.00	19.85	Hori.	100	170	LA21		
6	998395	23.00	22.49	11.54	28.52	28.51	53.90	25.39	Hori.	100	144	LA21		
7	166398	22.60	15.58	7.86	28.16	17.88	43.50	25.62	Vert.	100	332	BA		
8	332759	22.30	15.17	8.87	27.93	18.41	46.00	27.59	Vert.	107	102	LA21		
9	499185	22.00	18.05	9.80	29.09	20.76	46.00	25.24	Vert.	100	0	LA21		
10	665585	22.80	19.53	10.40	29.27	23.46	46.00	22.54	Vert.	100	358	LA21		
11	852059	22.20	21.67	11.03	28.95	25.95	46.00	20.05	Vert.	100	0	LA21		
12	998395	22.50	22.49	11.54	28.52	28.01	53.90	25.89	Vert.	136	223	LA21		

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

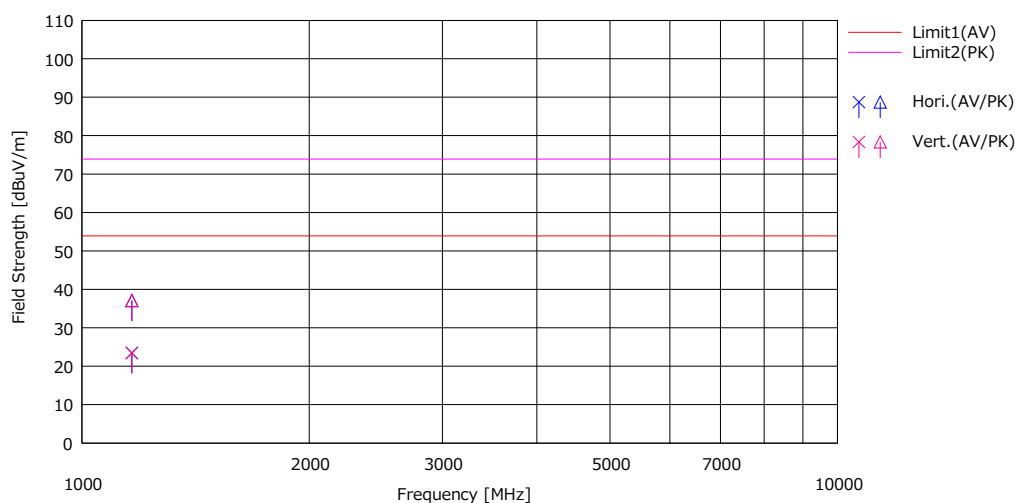
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
 (Above 1 GHz)
Mode Mode 1 Local

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	1164.766	30.80	44.40	25.20	2.54	35.10	23.44	37.04	53.90	73.90	30.46	36.86	Hori.	100	98	HA5	
2	1164.766	30.80	44.50	25.20	2.54	35.10	23.44	37.14	53.90	73.90	30.46	36.76	Vert.	100	150	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz - : HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

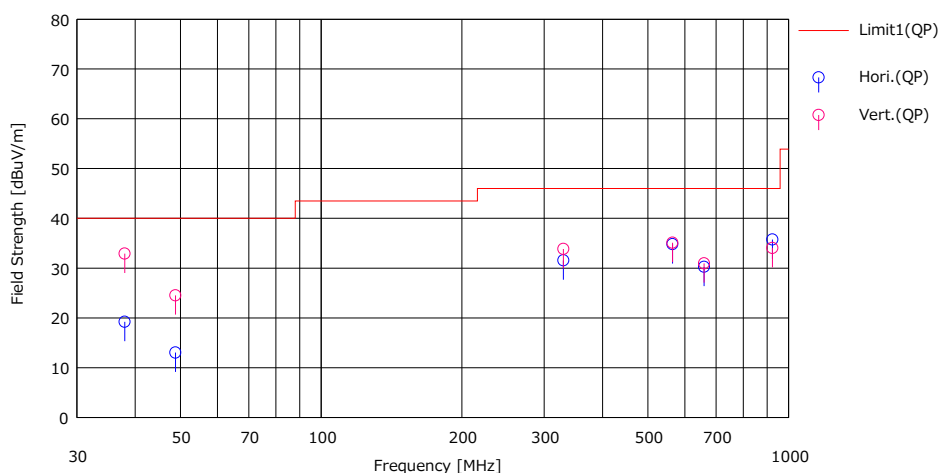
* No signal was detected above 10 GHz.

Radiated Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.2
November 17, 2022
23 deg. C / 40 % RH
Masaya Minami
(Below 1 GHz)
Mode 1 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading <QP>	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP>	Limit <QP>	Margin <QP>	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]					
1	37.982	25.30	15.71	6.74	28.55	19.20	40.00	20.80	Hori.	227	128	BA	
2	48.761	22.90	11.78	6.88	28.53	13.03	40.00	26.97	Hori.	337	239	BA	
3	330.002	35.50	15.09	8.86	27.91	31.54	46.00	14.46	Hori.	100	82	LA21	
4	564.863	35.60	18.38	10.06	29.25	34.79	46.00	11.21	Hori.	118	85	LA21	
5	659.994	29.70	19.45	10.37	29.27	30.25	46.00	15.75	Hori.	127	100	LA21	
6	924.003	31.00	22.21	11.29	28.77	35.73	46.00	10.27	Hori.	193	299	LA21	
7	37.982	39.00	15.71	6.74	28.55	32.90	40.00	7.10	Vert.	100	11	BA	
8	48.761	34.40	11.78	6.88	28.53	24.53	40.00	15.47	Vert.	100	125	BA	
9	330.002	37.80	15.09	8.86	27.91	33.84	46.00	12.16	Vert.	100	90	LA21	
10	564.863	35.90	18.38	10.06	29.25	35.09	46.00	10.91	Vert.	100	190	LA21	
11	659.994	30.40	19.45	10.37	29.27	30.95	46.00	15.05	Vert.	100	2	LA21	
12	924.003	29.30	22.21	11.29	28.77	34.03	46.00	11.97	Vert.	100	345	LA21	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

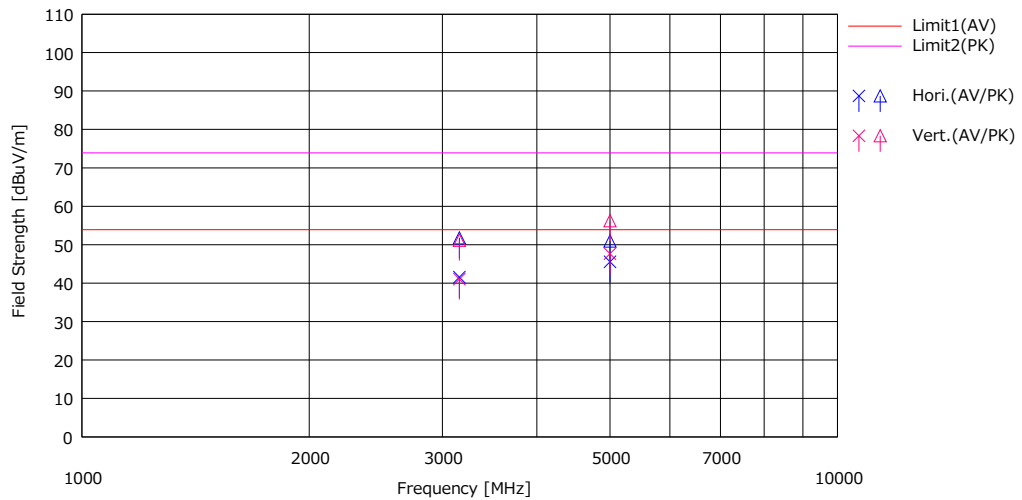
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
(1 GHz - 10 GHz)
Mode Mode 1 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	3159.894	41.70	51.90	28.60	3.82	32.55	41.57	51.77	53.90	73.90	12.33	22.13	Hori.	199	100	HA5	
2	4999.899	41.00	46.40	31.80	4.67	31.91	45.56	50.96	53.90	73.90	8.34	22.94	Hori.	211	149	HA5	
3	3159.894	41.20	51.30	28.60	3.82	32.55	41.07	51.17	53.90	73.90	12.83	22.73	Vert.	104	170	HA5	
4	4999.899	43.10	51.70	31.80	4.67	31.91	47.66	56.26	53.90	73.90	6.24	17.64	Vert.	122	171	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

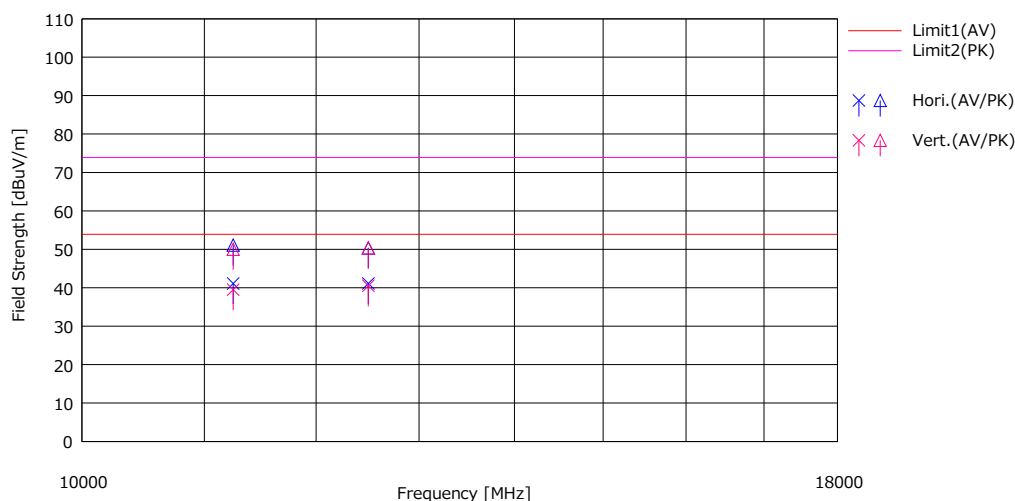
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
(Above 10GHz)
Mode Mode 1 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	11249.770	37.80	47.80	39.58	-2.51	33.77	41.10	51.10	53.90	73.90	12.80	22.80	Hori.	100	114	HA5	
2	12496.770	37.80	47.00	38.86	-2.10	33.45	41.11	50.31	53.90	73.90	12.79	23.59	Hori.	100	0	HA5	
3	11249.770	36.20	46.70	39.58	-2.51	33.77	39.50	50.00	53.90	73.90	14.40	23.90	Vert.	100	138	HA5	
4	12496.770	37.20	47.10	38.86	-2.10	33.45	40.51	50.41	53.90	73.90	13.39	23.49	Vert.	100	166	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

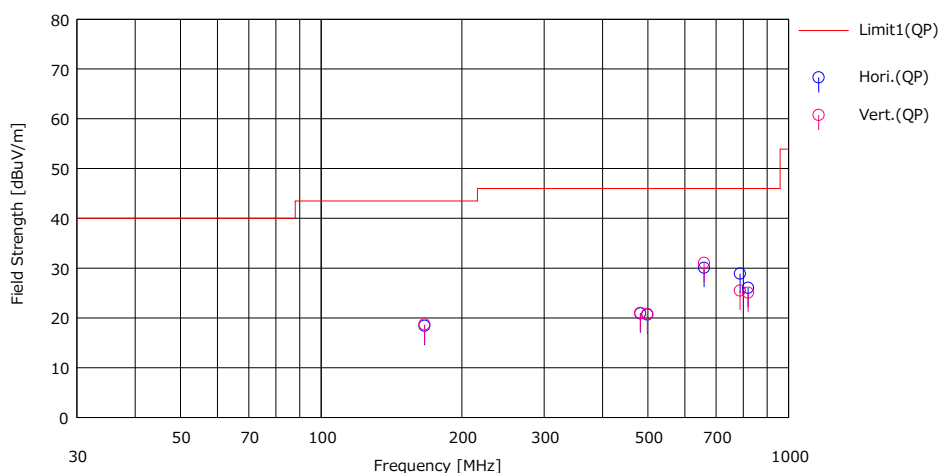
Except for the above table: adequate margin data below the limits.

* No signal was detected above 18 GHz.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date November 17, 2022
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Masaya Minami
 (Below 1 GHz)
Mode Mode 2 Local

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading <QP>	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result <QP>	Limit <QP>	Margin <QP>	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]					
1	166.399	23.10	15.58	7.86	28.16	18.38	43.50	25.12	Hori.	159	230	BA	
2	481.970	22.60	17.58	9.70	29.00	20.88	46.00	25.12	Hori.	100	209	LA21	
3	499.192	21.90	18.05	9.80	29.09	20.66	46.00	25.34	Hori.	100	0	LA21	
4	660.005	29.50	19.45	10.37	29.27	30.05	46.00	15.95	Hori.	127	95	LA21	
5	787.721	26.40	20.74	10.83	29.10	28.87	46.00	17.13	Hori.	113	204	LA21	
6	819.749	23.10	21.02	10.94	29.02	26.04	46.00	19.96	Hori.	100	174	LA21	
7	166.399	23.40	15.58	7.86	28.16	18.68	43.50	24.82	Vert.	100	4	BA	
8	481.970	22.70	17.58	9.70	29.00	20.98	46.00	25.02	Vert.	110	348	LA21	
9	499.192	22.00	18.05	9.80	29.09	20.76	46.00	25.24	Vert.	100	0	LA21	
10	660.005	30.50	19.45	10.37	29.27	31.05	46.00	14.95	Vert.	100	354	LA21	
11	787.721	23.00	20.74	10.83	29.10	25.47	46.00	20.53	Vert.	123	197	LA21	
12	819.749	22.10	21.02	10.94	29.02	25.04	46.00	20.96	Vert.	100	0	LA21	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

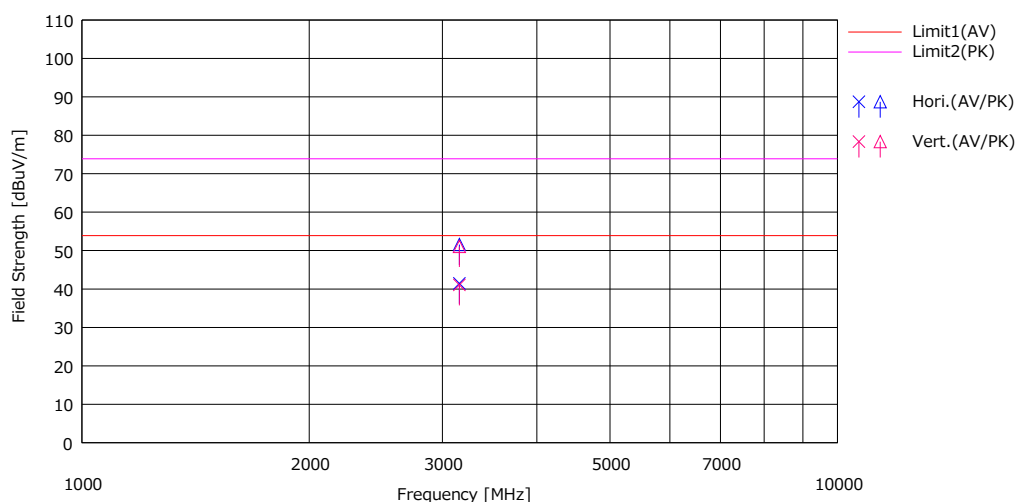
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
 (Above 1 GHz)
Mode Mode 2 Local

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	3159.831	41.60	51.70	28.60	3.82	32.55	41.47	51.57	53.90	73.90	12.43	22.33	Hori.	198	119	HA5	
2	3159.831	41.20	51.20	28.60	3.82	32.55	41.07	51.07	53.90	73.90	12.83	22.83	Vert.	121	172	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

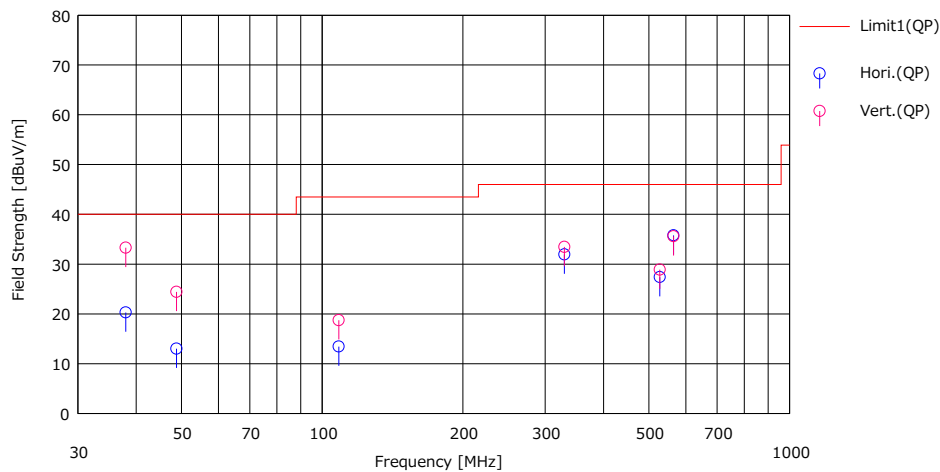
* No signal was detected above 10 GHz.

Radiated Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.2
November 17, 2022
23 deg. C / 40 % RH
Masaya Minami
(Below 1 GHz)
Mode 2 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading (QP)	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP)	Limit (QP)	Margin (QP)	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]					
1	37.998	26.40	15.70	6.74	28.55	20.29	40.00	19.71	Hori.	250	123	BA	
2	48.784	22.90	11.77	6.88	28.53	13.02	40.00	26.98	Hori.	331	225	BA	
3	108.521	22.80	11.58	7.44	28.39	13.43	43.50	30.07	Hori.	245	99	BA	
4	330.002	35.90	15.09	8.86	27.91	31.94	46.00	14.06	Hori.	100	82	LA21	
5	528.005	28.80	17.84	9.92	29.17	27.39	46.00	18.61	Hori.	100	224	LA21	
6	564.863	36.60	18.38	10.06	29.25	35.79	46.00	10.21	Hori.	126	95	LA21	
7	37.998	39.40	15.70	6.74	28.55	33.29	40.00	6.71	Vert.	100	16	BA	
8	48.784	34.30	11.77	6.88	28.53	24.42	40.00	15.58	Vert.	100	123	BA	
9	108.521	28.10	11.58	7.44	28.39	18.73	43.50	24.77	Vert.	100	73	BA	
10	330.002	37.40	15.09	8.86	27.91	33.44	46.00	12.56	Vert.	100	88	LA21	
11	528.005	30.30	17.84	9.92	29.17	28.89	46.00	17.11	Vert.	100	14	LA21	
12	564.863	36.40	18.38	10.06	29.25	35.59	46.00	10.41	Vert.	100	196	LA21	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

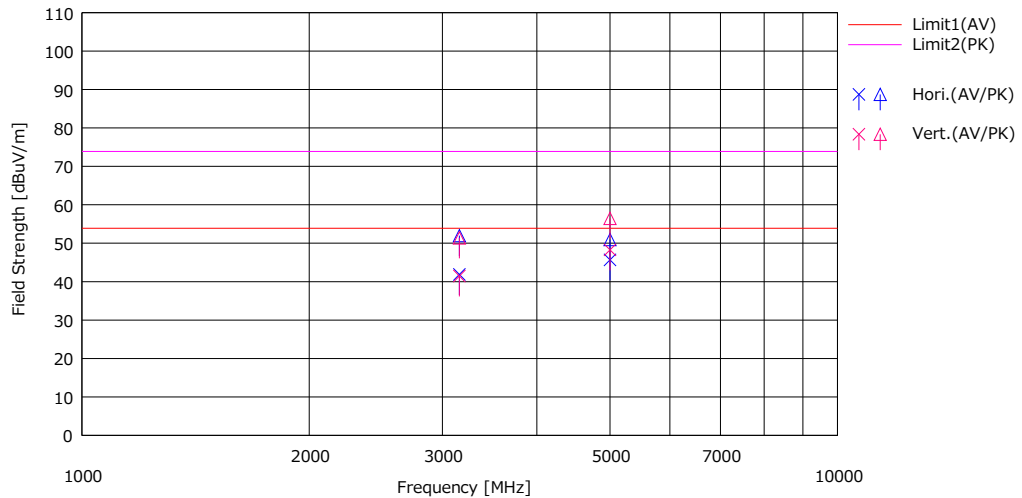
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
(1 GHz - 10 GHz)
Mode Mode 2 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	3159.894	42.00	52.10	28.60	3.82	32.55	41.87	51.97	53.90	73.90	12.03	21.93	Hori.	197	129	HA5	
2	4999.899	41.10	46.40	31.80	4.67	31.91	45.66	50.96	53.90	73.90	8.24	22.94	Hori.	211	150	HA5	
3	3159.894	41.60	51.50	28.60	3.82	32.55	41.47	51.37	53.90	73.90	12.43	22.53	Vert.	101	177	HA5	
4	4999.899	43.70	51.90	31.80	4.67	31.91	48.26	56.46	53.90	73.90	5.64	17.44	Vert.	122	172	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

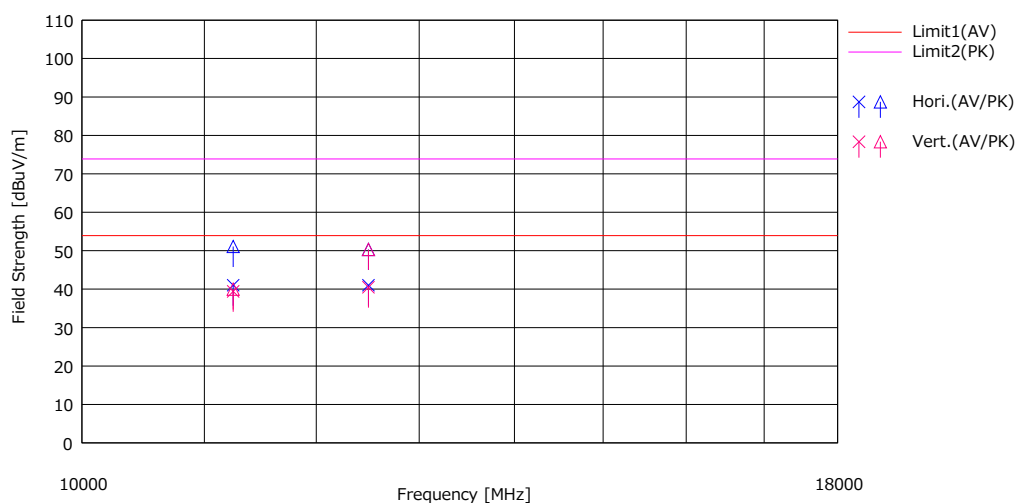
* No signal was detected above 10 GHz.

Radiated Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.3
November 20, 2022
21 deg. C / 45 % RH
Hiroki Numata
(Above 10 GHz)
Mode 2 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	11249.770	37.70	47.80	39.58	-2.51	33.77	41.00	51.10	53.90	73.90	12.90	22.80	Hori.	100	114	HA5	
2	12496.770	37.70	47.00	38.86	-2.10	33.45	41.01	50.31	53.90	73.90	12.89	23.59	Hori.	100	21	HA5	
3	11249.770	36.10	36.70	39.58	-2.51	33.77	39.40	40.00	53.90	73.90	14.50	33.90	Vert.	100	133	HA5	
4	12496.770	37.20	47.00	38.86	-2.10	33.45	40.51	50.31	53.90	73.90	13.39	23.59	Vert.	100	163	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz - :
HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

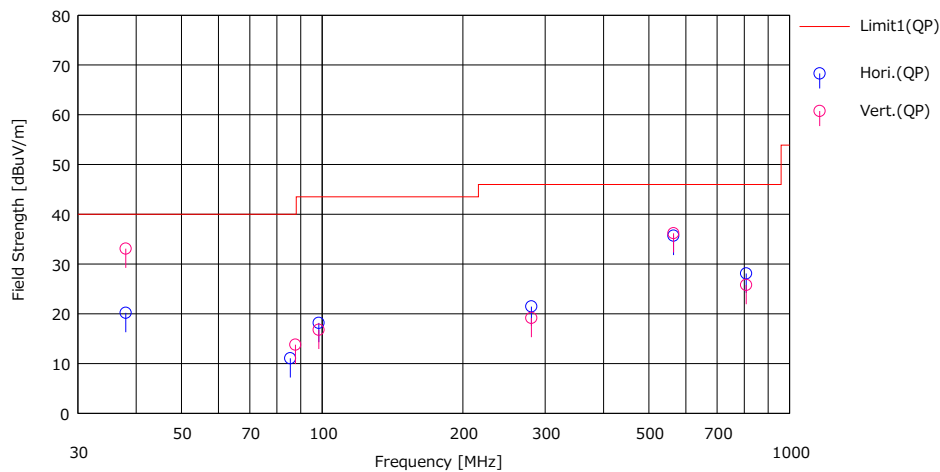
* No signal was detected above 18 GHz.

Radiated Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab.
No.2
November 17, 2022
23 deg. C / 40 % RH
Masaya Minami
(Below 1 GHz)
Mode 3

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading (QP)	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP)	Limit (QP)	Margin (QP)	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]				[dBuV/m]	[dBuV/m]	[dB]					
1	37.998	26.30	15.70	6.74	28.55	20.19	40.00	19.81	Hori.	252	122	BA	
2	85.422	24.50	7.76	7.24	28.45	11.05	40.00	28.95	Hori.	232	44	BA	
3	98.339	29.20	10.03	7.37	28.42	18.18	43.50	25.32	Hori.	145	85	BA	
4	280.399	26.70	13.93	8.58	27.74	21.47	46.00	24.53	Hori.	100	343	LA21	
5	564.863	36.50	18.38	10.06	29.25	35.69	46.00	10.31	Hori.	129	91	LA21	
6	808.002	25.30	20.95	10.90	29.05	28.10	46.00	17.90	Hori.	186	224	LA21	
7	37.998	39.20	15.70	6.74	28.55	33.09	40.00	6.91	Vert.	100	17	BA	
8	87.622	26.80	8.16	7.27	28.45	13.78	40.00	26.22	Vert.	100	314	BA	
9	98.339	27.80	10.03	7.37	28.42	16.78	43.50	26.72	Vert.	100	81	BA	
10	280.399	24.40	13.93	8.58	27.74	19.17	46.00	26.83	Vert.	100	60	LA21	
11	564.863	37.00	18.38	10.06	29.25	36.19	46.00	9.81	Vert.	100	184	LA21	
12	808.002	23.00	20.95	10.90	29.05	25.80	46.00	20.20	Vert.	100	170	LA21	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN

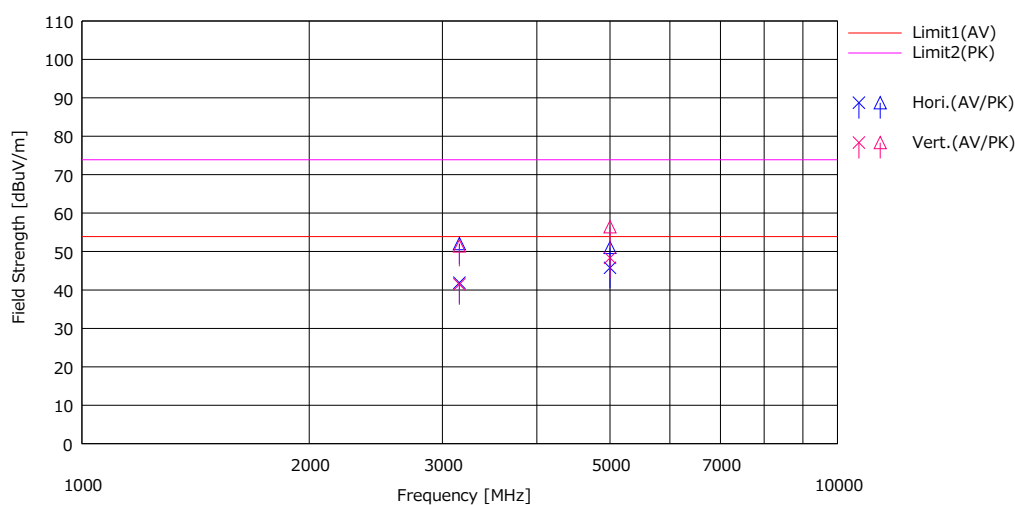
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
(1 GHz - 10 GHz)
Mode Mode 3

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Pola.	Height	Angle	Ant. Type	Comment
		(AV)	(PK)				(AV)	(PK)	(AV)	(PK)	(AV)	(PK)					
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	[H/V]	[cm]	[deg]		
1	3159.894	42.00	52.20	28.60	3.82	32.55	41.87	52.07	53.90	73.90	12.03	21.83	Hori.	198	129	HA5	
2	4999.899	41.20	46.50	31.80	4.67	31.91	45.76	51.06	53.90	73.90	8.14	22.84	Hori.	210	151	HA5	
3	3159.894	41.60	51.60	28.60	3.82	32.55	41.47	51.47	53.90	73.90	12.43	22.43	Vert.	105	174	HA5	
4	4999.899	43.80	51.90	31.80	4.67	31.91	48.36	56.46	53.90	73.90	5.54	17.44	Vert.	123	172	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz :- HORN

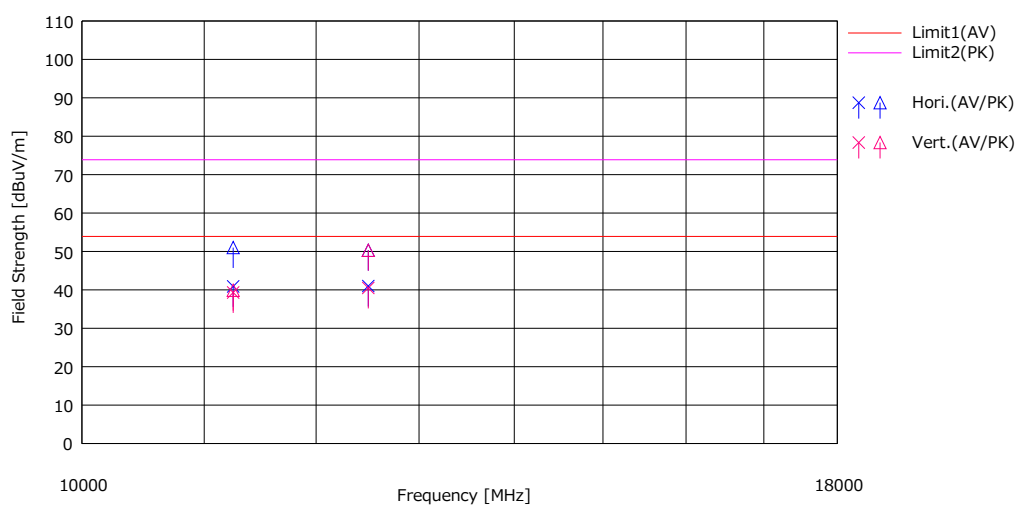
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

Except for the above table: adequate margin data below the limits.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date November 20, 2022
Temperature / Humidity 21 deg. C / 45 % RH
Engineer Hiroki Numata
 (Above 18 GHz)
Mode Mode 3

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	11249.770	37.60	47.70	39.58	-2.51	33.77	40.90	51.00	53.90	73.90	13.00	22.90	Hori.	100	0	HA5	
2	12496.770	37.70	47.00	38.86	-2.10	33.45	41.01	50.31	53.90	73.90	12.89	23.59	Hori.	100	0	HA5	
3	11249.770	36.00	36.60	39.58	-2.51	33.77	39.30	39.90	53.90	73.90	14.60	34.00	Vert.	100	0	HA5	
4	12496.770	37.20	47.00	38.86	-2.10	33.45	40.51	50.31	53.90	73.90	13.39	23.59	Vert.	100	0	HA5	

CHART: WITH FACTOR

ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz - :
HORN

CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + D-factor) - GAIN(AMP)

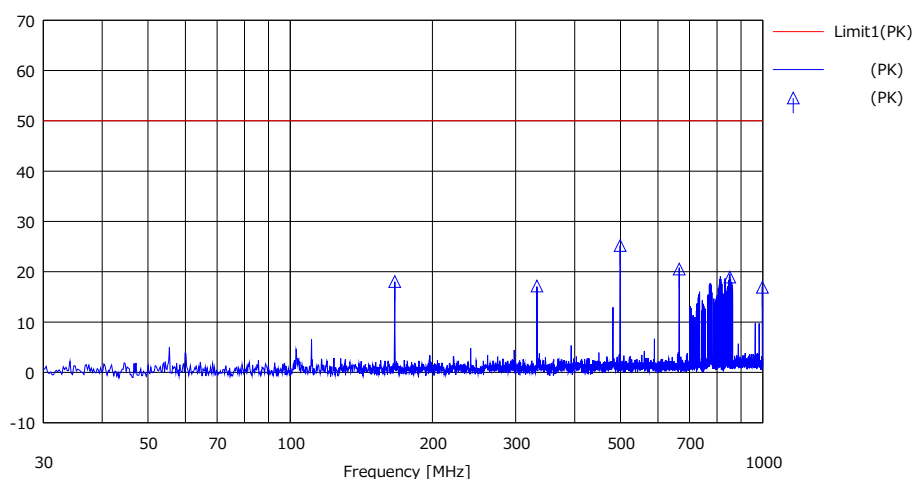
Except for the above table: adequate margin data below the limits.

* No signal was detected above 18 GHz.

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.5
Date November 17, 2022
Temperature / Humidity 25 deg. C / 45 % RH
Engineer Kiyoshiro Okazaki
Mode Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBμV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBμV]	Limit (PK) [dBμV]	Margin (PK) [dB]	Pol. [H/V]	Ant. Type	Comment
1	166.398	50.80	0.00	6.37	39.13	18.04	50.00	31.96			
2	332.759	49.37	0.00	6.61	38.82	17.16	50.00	32.84			
3	499.185	56.96	0.00	6.88	38.62	25.22	50.00	24.78			
4	665.585	52.10	0.00	6.86	38.42	20.54	50.00	29.46			
5	852.059	50.33	0.00	6.99	38.36	18.96	50.00	31.04			
6	998.395	47.71	0.00	7.09	37.88	16.92	50.00	33.08			

* 2 nW = -57 dBm = 50 dBμV

CHART: WITH FACTOR

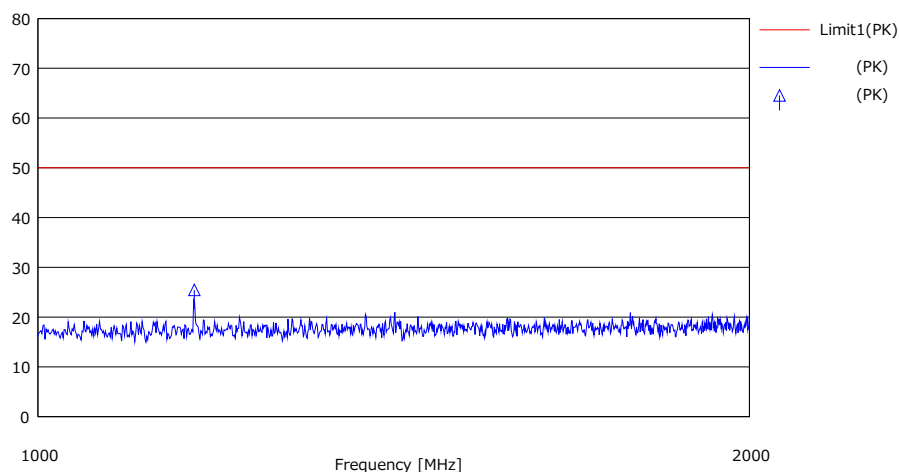
CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date November 18, 2022
Temperature / Humidity 22 deg. C / 42 % RH
Engineer Daiki Matsui
Mode Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBuV]	Limit. #) (PK) [dBuV]	Margin (PK) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	1164.766	47.73	0.00	9.19	31.44	25.48	50.00	24.52					

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

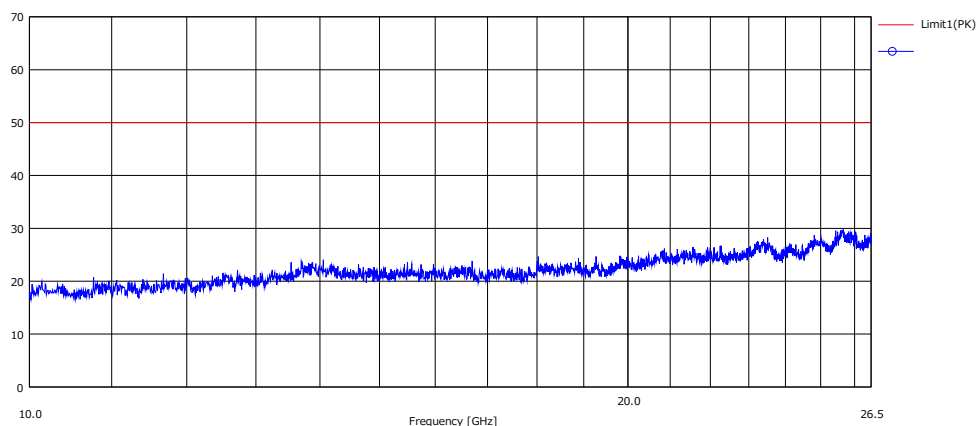
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 18, 2022
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Daiki Matsui
Mode	Mode 4

[illegible]

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)
 Except for the above table: adequate margin data below the limits.

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.5
Date	November 17, 2022
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 4

Limit : FCC15.111 Antenna terminal measurement

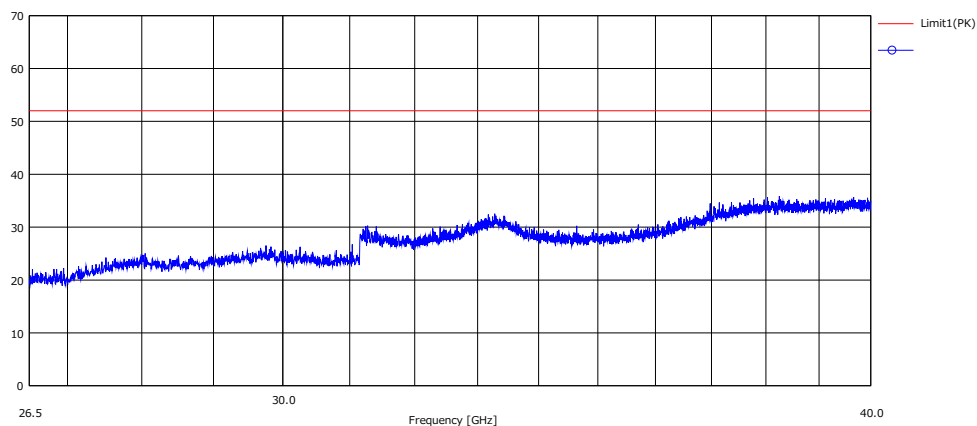
[illegible]

Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.5
Date	November 17, 2022
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 4

Limit : FCC15.111 Antenna terminal measurement

[illegible]

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

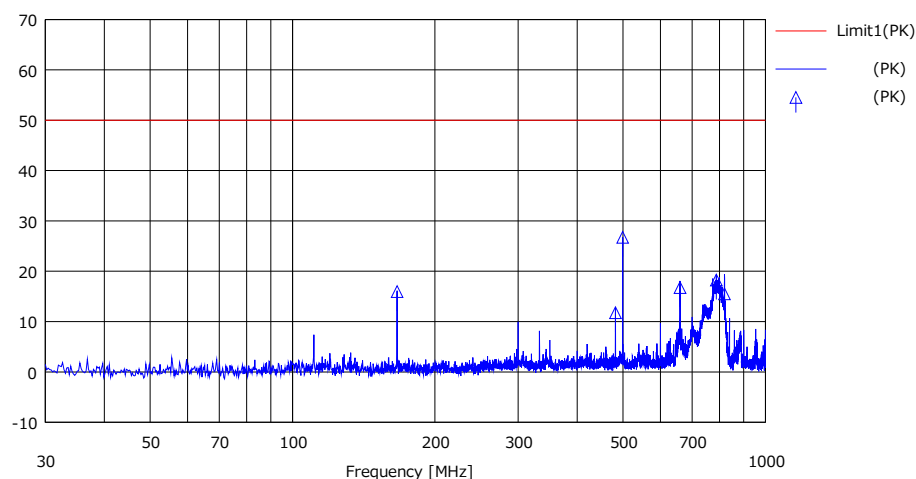
CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.5
Date November 17, 2022
Temperature / Humidity 25 deg. C / 45 % RH
Engineer Kiyoshiro Okazaki
Mode Mode 5

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK)	Ant Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK)	Limit (PK)	Margn (PK)	Pola. [H/V]	Ant. Type	Comment
		[dBuV]				[dBuV]	[dBuV]	[dB]			
1	166.399	48.71	0.00	6.37	39.13	15.95	50.00	34.05			
2	481.970	43.50	0.00	6.88	38.63	11.75	50.00	38.25			
3	499.192	58.47	0.00	6.88	38.62	26.73	50.00	23.27			
4	660.005	48.33	0.00	6.85	38.42	16.76	50.00	33.24			
5	787.721	49.74	0.00	6.93	38.41	18.26	50.00	31.74			
6	819.749	46.96	0.00	6.96	38.39	15.53	50.00	34.47			

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	November 18, 2022
Temperature / Humidity	22 deg. C / 42 % RH
Engineer	Daiki Matsui
Mode	Mode 5

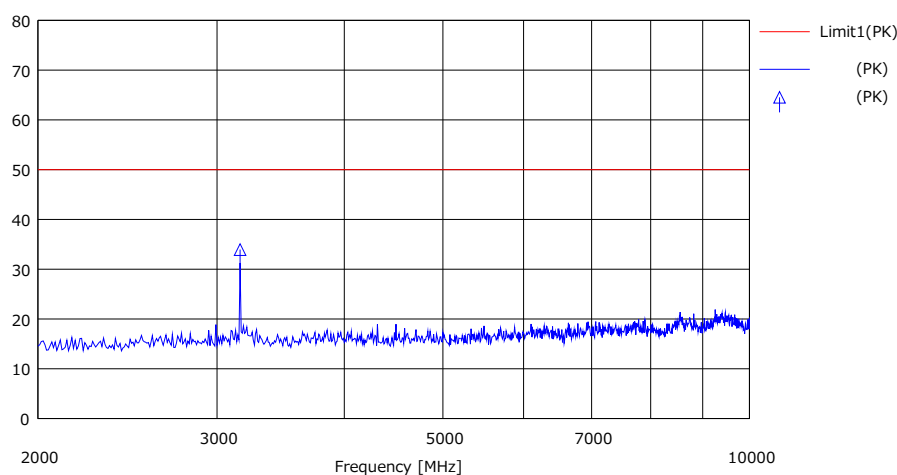
[illegible]

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)
 Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date November 18, 2022
Temperature / Humidity 22 deg. C / 42 % RH
Engineer Daiki Matsui
Mode Mode 5

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBuV]	Limit * (PK) [dBuV]	Margn (PK) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV]	[dBuV]	[dB]	[H/V]	[cm]	[deg]		
1	3159.831	59.79	0.00	7.01	32.85	33.95	50.00	16.05					

* 2 nW = -57 dBm = 50 dBuV

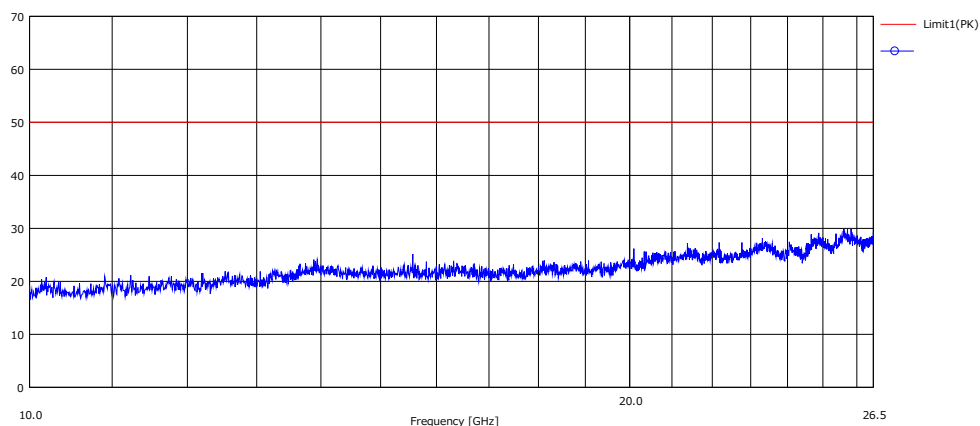
CHART: WITH FACTOR

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.5
Date	November 17, 2022
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 5

Limit : FCC15.111 Antenna terminal measurement

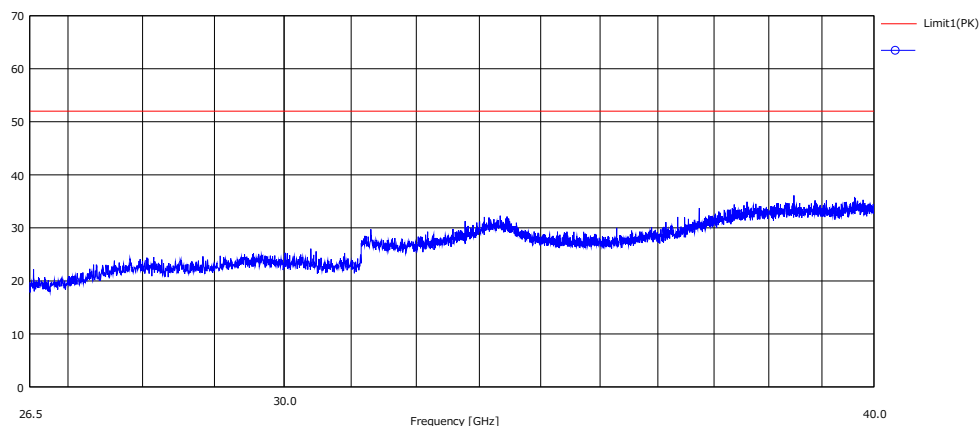
[illegible]

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)
 Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.5
Date	November 17, 2022
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 5

Limit : FCC15.111 Antenna terminal measurement

[illegible]

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

CALCULATION: RESULT = READING + LOSS (CABLE + Matching Pad + Filter) – GAIN (AMP)

Except for the above table: adequate margin data below the limits.

APPENDIX 2: Test instruments**Test equipment**

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/30/2022	24
RE	MAEC-03-SVSWR	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/01/2021	24
RE	MAT-112	220646	Attenuator	Huber+Suhner	6806 N-50-1	-	06/07/2022	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103B +BBA9106	08031	07/30/2022	12
RE	MCC-12	141317	Coaxial Cable	UL Japan	-	-	09/27/2022	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/15/2022	12
RE	MCC-54	141325	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	03/17/2022	12
RE	MHA-05	141511	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	253	09/20/2022	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170306	07/05/2022	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	10/03/2022	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MLA-21	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-190	07/30/2022	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/12/2022	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/16/2022	12
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/10/2022	12
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/17/2022	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/25/2022	12
RE	MPA-33	220253	Broadband Amplifier	SAGE Millimeter, Inc.	SBB-0115033218-2F2F-E3	0001	05/13/2022	12
RE	MSA-22	141978	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180899	03/24/2022	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	07/29/2022	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	07/25/2022	12
AT	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
AT	MCC-54	141325	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	03/17/2022	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/28/2022	12
AT	MDCB-02	141485	DC Block Filter	Keysight Technologies Inc	N9398C	51053	10/19/2022	12
AT	MJM-28	142229	Measure	KOMELON	KMC-36	-	-	-
AT	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/12/2022	12
AT	MMM-11	141546	Digital HiTESTER	HIOKI E.E. CORPORATION	3805	060100600	05/16/2022	12
AT	MMP-01	141550	Matching Pad Anritsu	Anritsu Corporation	MB-009	40063	07/28/2022	12
AT	MOS-17	141563	Thermo-Hygrometer	TFA	CTH-180	1005	01/10/2022	12
AT	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/19/2021	12
AT	MPA-19	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	02/28/2022	12
AT	MPA-33	220253	Broadband Amplifier	SAGE Millimeter, Inc.	SBB-0115033218-2F2F-E3	0001	05/13/2022	12
AT	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/31/2022	12
AT	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	02/18/2022	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:

RE: Radiated emission

AT: Antenna Terminal Conducted