



EMI TEST REPORT

Test Report No.: 14420120H-B-R1

Customer	DENSO TEN Limited
Description of EUT	Car Audio
Model Number of EUT	TN0041A
FCC ID	BABTN0041A
Test Regulation	FCC Part 15 Subpart B
Test Result	Complied (Refer to SECTION 3)
Issue Date	November 10, 2022
Remarks	-

Representative test engineer

Masaya Minami
Engineer

Approved by

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

ANNOUNCEMENT

- This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
- The results in this report apply only to the sample tested.
- This sample tested is in compliance with the limits of the above regulation.
- The test results in this test report are traceable to the national or international standards.
- This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
- This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
- The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
- The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
- 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.: 14420120H-B

This report is a revised version of 14420120H-B. 14420120H-B is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	14420120H-B	September 5, 2022	-
1	14420120H-B-R1	November 10, 2022	P.5 Correction of Antenna gain (Bluetooth (BR/EDR)) from 2.40 dBi to -2.40 dBi
1	14420120H-B-R1	November 10, 2022	P.9 Correction of Shield information for Cable No.3 and 5 from "Unshielded" to Shielded"
1	14420120H-B-R1	November 10, 2022	P.13, 14, 17 Deletion of Atmosphere data
1	14420120H-B-R1	November 10, 2022	P.15, 19, 20 Correction of Comment from "Local" to "Receive"
1	14420120H-B-R1	November 10, 2022	P.16, 18 Correction of Temperature from "222 deg. C" to "22 deg. C"
1	14420120H-B-R1	November 10, 2022	P.21 Addition of Test equipment to use on No.2 Semi Anechoic Chamber

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)

CONTENTS	PAGE
SECTION 1: Customer information	5
SECTION 2: Equipment under test (EUT).....	5
SECTION 3: Test specification, procedures & results	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Radiated Emission.....	10
SECTION 6: Antenna Terminal.....	12
APPENDIX 1: Test data	13
Radiated Emission	13
Antenna Terminal Conducted Emission	19
APPENDIX 2: Test instruments	21
APPENDIX 3: Photographs of test setup.....	23
Radiated Emission	23
Antenna Terminal Conducted Tests.....	27

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 Audio
Model Number	TN0041A
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	July 25, 2022
Test Date	July 26 to August 2, 2022

2.2 Product Description

General Specification

Rating	DC 12 V
Clock frequency (ies) in the system	Main 216 MHz

Radio Specification

[Bluetooth (BR / EDR)]

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8 DPSK)
Antenna Gain	-2.40 dBi

[AM/FM]

Equipment Type	Receiver
Frequency of Operation	AM: 530 kHz to 1710 kHz FM: 87.75 MHz to 107.90 MHz
Type of Modulation	AM FM
Antenna Connector Type	JASO
Impedance	75 ohm

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 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 8. Radiated emission measurements IEEE 187:2003	Part 15 Subpart B 15.109(a)	N/A	4.81 dB 815.999 MHz, Hori., Mode 1	Complied a)	-
Antenna Terminal	ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE IEEE 187:2003	Part 15 Subpart B 15.111(a)	N/A	22.75 dB 124.794 MHz	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 $k = 2$.

Conducted emission

Using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.7 dB
	0.15 MHz to 30 MHz	3.3 dB

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		5.1 dB
	6 GHz to 18 GHz		5.4 dB
1 m	10 GHz to 26.5 GHz		5.4 dB
	26.5 GHz to 40 GHz		5.4 dB
0.5 m	26.5 GHz to 40 GHz		5.4 dB
10 m	1 GHz to 18 GHz		5.4 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.

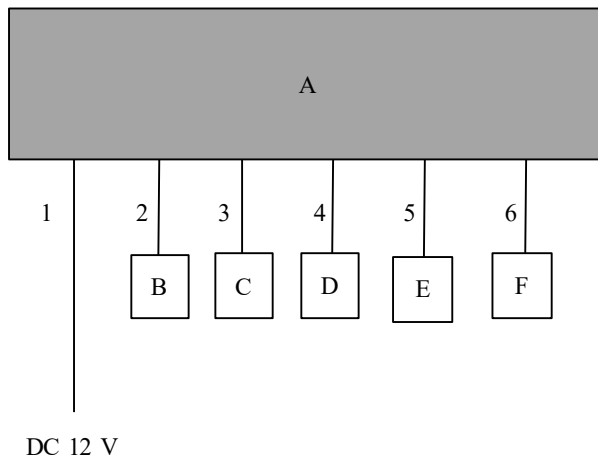
SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Remarks
mode 1: USB Memory Play mode	Radiated Emission test
mode 2: FM Receiving mode (Local / Other)	Radiated Emission test
mode 3: FM Seek mode	Antenna Terminal test only

Software(s)	TN0041A Version: 1.0
-------------	----------------------

4.2 Configuration and peripherals



* 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 Audio	TN0041A	BU600087	DENSO TEN Limited	EUT
B	Speaker	TS-F1600	-	Pioneer Corporation	-
C	AM/FM Antenna	-	-	-	-
D	switch	-	-	-	-
E	iPod	MC540J/A	C3RJ4SLADT75	Apple	-
F	USB Memory	RUF2 JV4GSWH	121101	BUFFLO	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Signal Cable	4.0	Unshielded	Unshielded	-
3	AM / FM Cable	2.4	Shielded	Shielded	-
4	Signal Cable	1.2	Unshielded	Unshielded	-
5	AUX Cable	1.6	Shielded	Shielded	-
6	USB Cable	2.0	Shielded	Shielded	-

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 18000 MHz (Horn antenna)
Test distance : 3 m (30 MHz to 1000 MHz) /
3.3 m (1000 MHz to 10000 MHz) /
1 m (10000 MHz to 18000 MHz)
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 Analyze

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.

For above 1 GHz, test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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

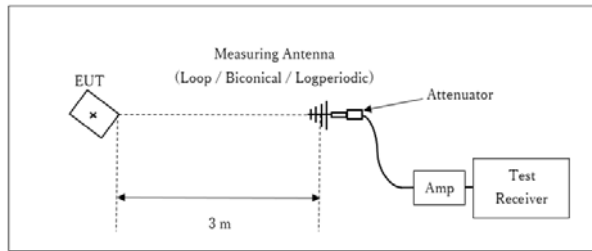
*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.

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

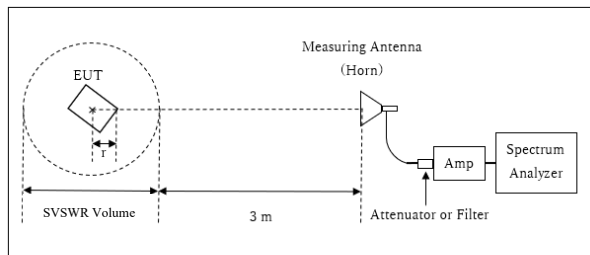
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz



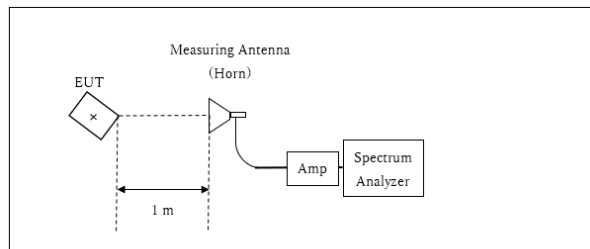
r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log(3.3 \text{ m}^*/3.0 \text{ m}) = 0.83 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.3 \text{ m}$

SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.7 \text{ m}$

10 GHz to 18 GHz



x : Center of turn table

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.

5.5 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 - 18000 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

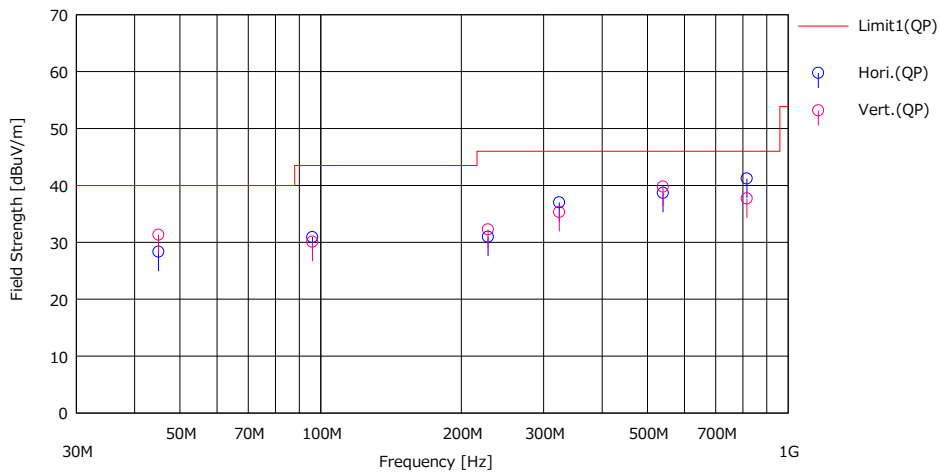
Summary of the test results: Pass

APPENDIX 1: Test data

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date August 2, 2022
Temperature / Humidity 21 deg. C / 62 % RH
Engineer Masaya Minami
 (Below 1 GHz)
Mode Mode 1

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
		[dBuV]				[QP]	[QP]	[QP]					
1	44.980	39.40	10.67	6.80	28.54	28.33	40.00	11.67	Hori.	355	254	BA	
2	95.979	42.40	9.61	7.31	28.43	30.89	43.50	12.61	Hori.	243	351	BA	
3	228.020	39.30	11.29	8.23	27.86	30.96	46.00	15.04	Hori.	107	184	LA17	
4	323.874	41.90	14.11	8.86	27.87	37.00	46.00	9.00	Hori.	100	140	LA17	
5	540.011	40.40	17.72	9.76	29.21	38.67	46.00	7.33	Hori.	100	95	LA17	
6	815.999	38.60	20.86	10.76	29.03	41.19	46.00	4.81	Hori.	100	181	LA17	
7	44.980	42.40	10.67	6.80	28.54	31.33	40.00	8.67	Vert.	100	359	BA	
8	95.979	41.60	9.61	7.31	28.43	30.09	43.50	13.41	Vert.	100	232	BA	
9	228.020	40.60	11.29	8.23	27.86	32.26	46.00	13.74	Vert.	100	207	LA17	
10	323.874	40.20	14.11	8.86	27.87	35.30	46.00	10.70	Vert.	100	104	LA17	
11	540.011	41.50	17.72	9.76	29.21	39.77	46.00	6.23	Vert.	100	195	LA17	
12	815.999	35.10	20.86	10.76	29.03	37.69	46.00	8.31	Vert.	100	112	LA17	

CHART: WITH FACTOR

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

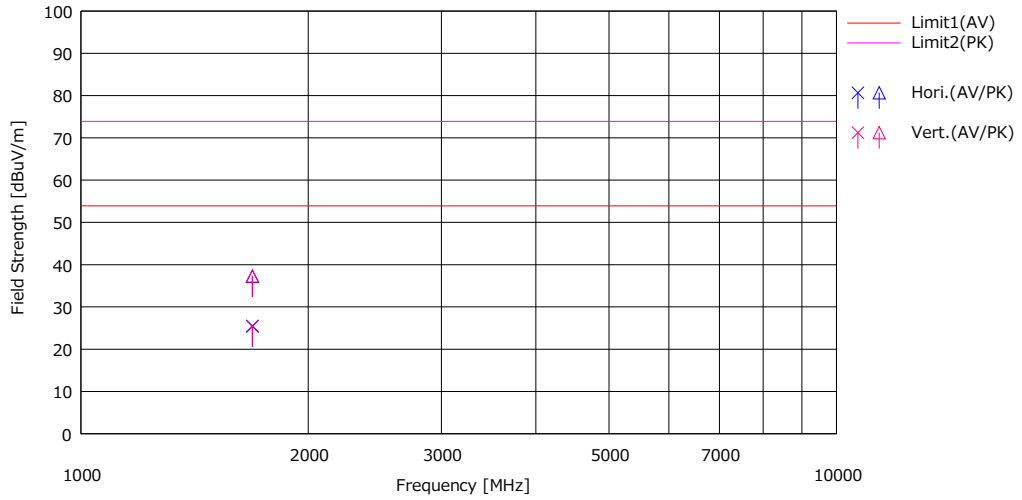
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

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

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 27, 2022
Temperature / Humidity 22deg. C / 55 % RH
Engineer Yuichiro Yamazaki
 (Above 1 GHz)
Mode Mode 1

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	1687.073	30.17	41.99	24.94	3.06	32.78	25.39	37.21	53.90	73.90	28.51	36.69	Hori.	100	0	H21	
2	1687.073	30.32	42.12	24.94	3.06	32.78	25.54	37.34	53.90	73.90	28.36	36.56	Vert.	100	0	H21	

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)

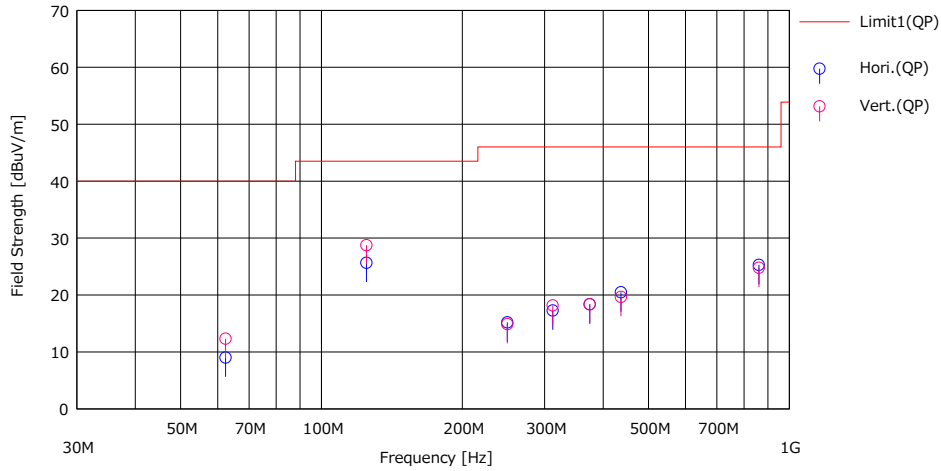
Except for the above table: adequate margin data below the limits.

* No signal was detected above 10 GHz.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date August 2, 2022
Temperature / Humidity 21 deg. C / 62 % RH
Engineer Masaya Minami
 (Below 1 GHz)
Mode Mode 2 Local

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Frea. [MHz]	Reading	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margn	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[QP]				[dBuV]	[QP]	[dB]					
1	62.401	21.50	9.01	7.00	28.50	9.01	40.00	30.9	Hori.	272	352	BA	
2	124.794	35.40	11.07	7.53	28.34	25.66	43.50	17.8	Hori.	314	261	BA	
3	249.600	22.70	11.89	8.36	27.76	15.19	46.00	30.8	Hori.	195	113	LA17	
4	312.000	22.60	13.71	8.77	27.80	17.28	46.00	28.7	Hori.	215	86	LA17	
5	374.389	22.30	15.06	9.26	28.26	18.36	46.00	27.6	Hori.	221	58	LA17	
6	436.798	23.40	16.35	9.47	28.75	20.47	46.00	25.5	Hori.	187	138	LA17	
7	860.730	21.60	21.70	10.92	28.93	25.29	46.00	20.7	Hori.	166	125	LA17	Receive 107.3 MHz
8	62.401	24.80	9.01	7.00	28.80	12.31	40.00	27.6	Vert.	100	131	BA	
9	124.794	38.50	11.07	7.53	28.34	28.76	43.50	14.7	Vert.	100	104	BA	
10	249.600	22.40	11.89	8.36	27.76	14.89	46.00	31.1	Vert.	100	149	LA17	
11	312.000	23.50	13.71	8.77	27.80	18.18	46.00	27.8	Vert.	100	54	LA17	
12	374.389	22.30	15.06	9.26	28.26	18.36	46.00	27.6	Vert.	100	66	LA17	
13	436.798	22.60	16.35	9.47	28.75	19.67	46.00	26.3	Vert.	113	143	LA17	
14	860.730	21.10	21.70	10.92	28.93	24.79	46.00	21.2	Vert.	100	21	LA17	Receive 107.3 MHz

CHART: WITH FACTOR

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

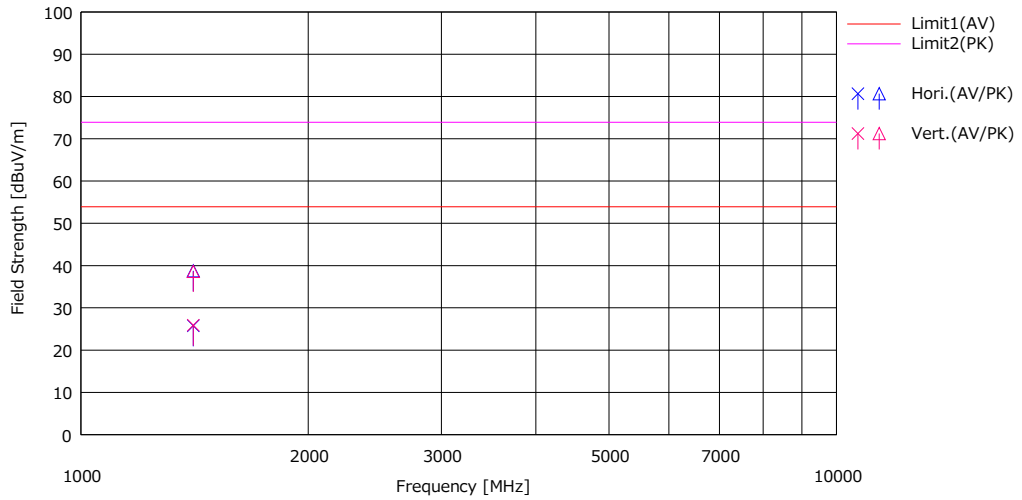
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

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

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 27, 2022
Temperature / Humidity 22deg. C / 55 % RH
Engineer Yuichiro Yamazaki
 (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	1409.033	30.94	43.95	25.50	2.85	33.54	25.75	38.76	53.90	73.90	28.15	35.14	Hori.	100	0	H21	
2	1409.033	31.09	43.80	25.50	2.85	33.54	25.90	38.61	53.90	73.90	28.00	35.29	Vert.	100	0	H21	

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)

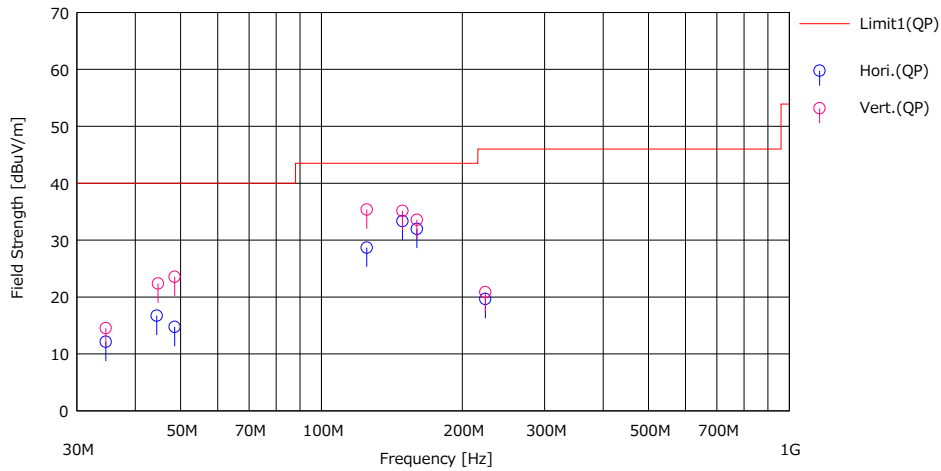
Except for the above table: adequate margin data below the limits.

* No signal was detected above 10 GHz.

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date August 2, 2022
Temperature / Humidity 21 deg. C / 62 % RH
Engineer Masaya Minami
 (Below 1 GHz)
Mode Mode 2 Other

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq. [MHz]	Reading	Ant.Fac [dBuV]	Loss [dB]	Gain [dB]	Result	Limit	Margn.	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[(QP)]				[(QP)]	[(QP)]	[(QP)]					
1	34.589	21.50	12.51	6.68	28.56	12.13	40.00	27.8	Hori.	272	352	BA	
2	44.450	27.70	10.76	6.80	28.54	16.72	40.00	23.2	Hori.	309	104	BA	
3	48.540	26.30	10.15	6.84	28.53	14.76	40.00	25.2	Hori.	300	275	BA	
4	124.999	38.40	11.09	7.53	28.34	28.68	43.50	14.8	Hori.	205	82	BA	
5	148.960	41.60	12.28	7.71	28.25	33.34	43.50	10.1	Hori.	361	85	BA	
6	160.000	39.80	12.58	7.79	28.20	31.97	43.50	11.5	Hori.	250	243	BA	
7	224.000	28.20	11.14	8.19	27.87	19.66	46.00	26.3	Hori.	100	138	LA17	
8	34.589	23.90	12.51	6.68	28.56	14.53	40.00	25.4	Vert.	100	252	BA	
9	44.740	33.40	10.71	6.80	28.54	22.37	40.00	17.6	Vert.	100	24	BA	
10	48.540	35.10	10.15	6.84	28.53	23.56	40.00	16.4	Vert.	100	166	BA	
11	124.999	45.10	11.09	7.53	28.34	35.38	43.50	8.1	Vert.	100	154	BA	
12	148.960	43.40	12.28	7.71	28.25	35.14	43.50	8.3	Vert.	100	131	BA	
13	160.000	41.40	12.58	7.79	28.20	33.57	43.50	9.9	Vert.	100	135	BA	
14	224.000	29.40	11.14	8.19	27.87	20.86	46.00	25.1	Vert.	113	149	LA17	

CHART: WITH FACTOR

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

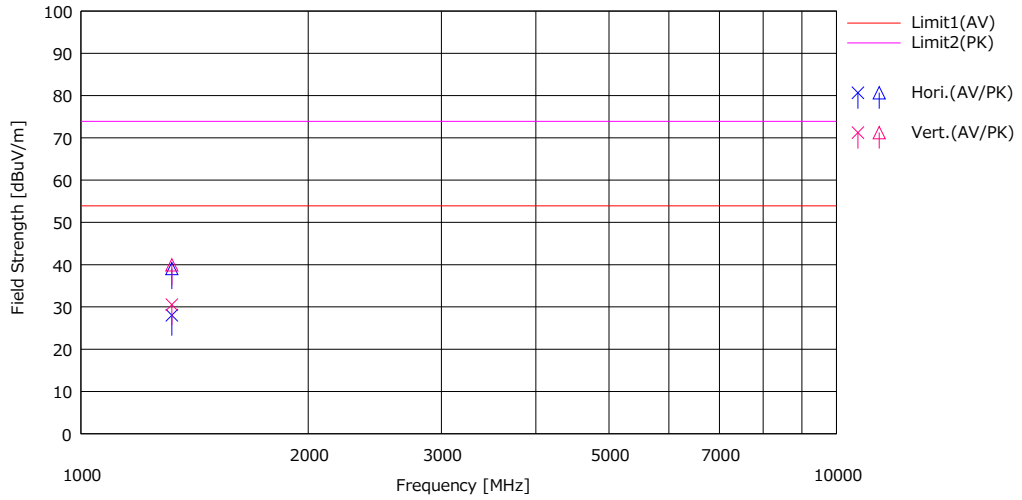
CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE + ATT) - GAIN(AMP)

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

Radiated Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 27, 2022
Temperature / Humidity 22deg. C / 55 % RH
Engineer Yuichiro Yamazaki
 (Above 1 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	1320.007	33.52	44.57	25.48	2.79	33.78	28.01	39.06	53.90	73.90	25.89	34.84	Hori.	100	212	H21	
2	1320.007	36.04	45.48	25.48	2.79	33.78	30.53	39.97	53.90	73.90	23.37	33.93	Vert.	133	354	H21	

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)

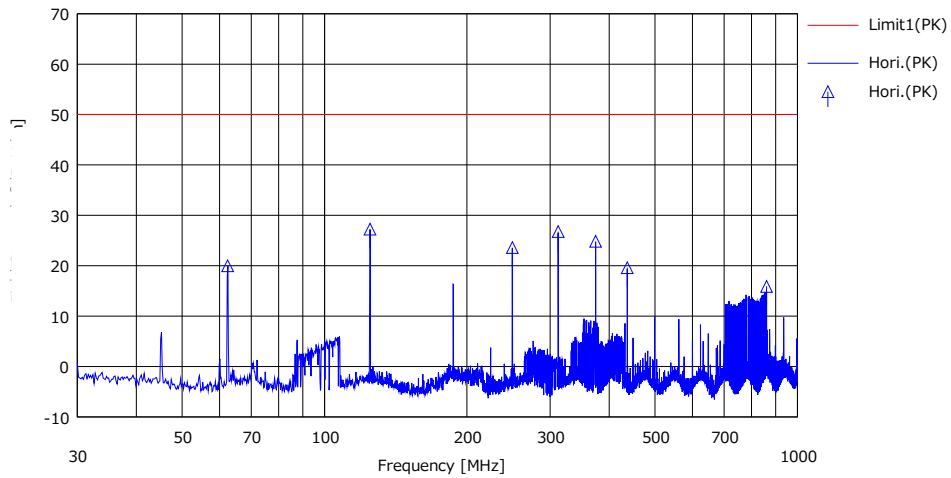
Except for the above table: adequate margin data below the limits.

* No signal was detected above 10 GHz.

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 26, 2022
Temperature / Humidity 24 deg. C / 55 % RH
Engineer Junki Nagatomi
 (Below 1 GHz)
Mode Mode 3

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margn	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBμV]				[dBμV]*	[PK]	[PK]					
1	62.401	51.96	0.00	0.11	32.09	19.98	50.00	30.02					
2	124.794	59.14	0.00	0.16	32.05	27.25	50.00	22.75					
3	249.600	55.36	0.00	0.24	32.01	23.59	50.00	26.41					
4	312.000	58.54	0.00	0.27	32.04	26.77	50.00	23.23					
5	374.389	56.65	0.00	0.30	32.11	24.84	50.00	25.16					
6	436.798	51.45	0.00	0.34	32.18	19.61	50.00	30.39					
7	860.730	46.89	0.00	0.48	31.48	15.89	50.00	34.11					Receive 107.3 MHz

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

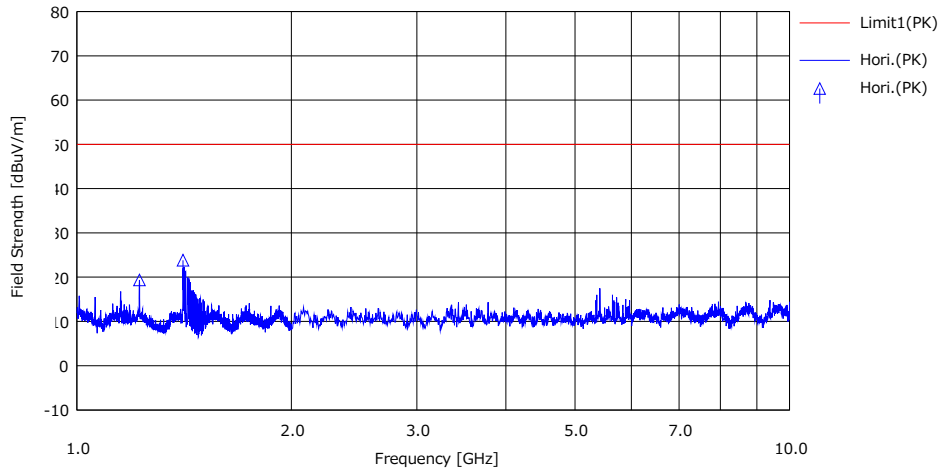
CALCULATION: RESULT = READING + LOSS (CABLE +ATT) - GAIN

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

Antenna Terminal Conducted Emission

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 26, 2022
Temperature / Humidity 24 deg. C / 55 % RH
Engineer Junki Nagatomi
 (Above 1 GHz)
Mode Mode 3

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading	Ant.Fac.	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant. Type	Comment
		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV]	[dBuV]	[dB]					
1	1223.996	52.93	0.00	0.48	34.04	19.37	50.00	30.6					
2	1409.033	56.87	0.00	0.51	33.54	23.84	50.00	26.1					Receive 87.75MHz

* 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

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

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

The test was performed up to 18 GHz

No signal was detected above 10 GHz

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-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/12/2021	24
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/15/2022	12
RE	MDCB-02	141485	DC Block Filter	Keysight Technologies Inc	N9398C	51053	11/19/2021	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/20/2022	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
RE	MMP-01	141550	Matching Pad Anritsu	Anritsu Corporation	MB-009	40063	07/28/2022	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/07/2021	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/31/2022	12
RE	MSG-14	141894	Signal Generator	Rohde & Schwarz	SMC100A	1411.4002k02	10/22/2021	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	2022/05/30	24
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	2021/12/19	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2022/08/12	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	2021/08/21	12
RE	MAT-112	220646	Attenuator	Huber+Suhner	6806 N-50-1	-	2022/06/07	12
RE	MCC-12	141317	Coaxial Cable	UL Japan	-	-	2022/09/27	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	2022/02/25	12
RE	LA-17	160924	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	225	2021/11/13	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	2022/07/29	12
AT	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
AT	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2022	24
AT	MCC-178	141227	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S305	03/15/2022	12
AT	MCC-38	141395	Coaxial Cable	UL Japan	-	-	11/19/2021	12
AT	MCC-54	141325	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	03/17/2022	12
AT	MDCB-02	141485	DC Block Filter	Keysight Technologies Inc	N9398C	51053	11/19/2021	12
AT	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
AT	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/16/2022	12
AT	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/10/2022	12
AT	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/07/2021	12
AT	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	04/04/2022	12
AT	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 / 1871328	09/30/2021	12
AT	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/10/2021	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:

RE: Radiated emission

AT: Antenna Terminal Conducted