EMI TEST REPORT

Test Report No. : 13367629H-A-R2

Applicant	:	**DENSO CORPORATION**
Type of EUT	:	**Cockpit Control Unit (CCU)**
Model Number of EUT	:	**DNNS117**
FCC ID	:	**HYQDNNS117**
Test regulation	:	**FCC Part 15 Subpart B: 2020** **ICES-003 Issue 6: 2016 (updated April 2019)**
Test Result	:	**Complied (Refer to SECTION 3.2)**

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3. This sample tested is in compliance with the limits of the above regulation.
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7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13367629H-A-R1. 13367629H-A-R1 is replaced with this report.

Date of test: June 6 to 15, 2020

Representative test engineer:
Hiroki Numata
Engineer
Consumer Technology Division

Approved by:
Tsubasa Takayama
Leader
Consumer Technology Division

CERTIFICATE 5107.02

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

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REVISION HISTORY

Original Test Report No.: 13367629H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13367629H-A	August 5, 2020	-	-
1	13367629H-A-R1	October 20, 2020	P.1	Deletion of “Class B” from test regulation
1	13367629H-A-R1	October 20, 2020	P.1	Correction of test date from June 7 and 16, 2020 to June 6 to 15, 2020
1	13367629H-A-R1	October 20, 2020	P.7	Section 3.1: Correction of Test Specification for FCC Part 15 Subpart B Section 3.2: Correction of Limits
1	13367629H-A-R1	October 20, 2020	P.10	Correction of Cable No. from 28 to 25
1	13367629H-A-R1	October 20, 2020	P.11	Deletion of Cable No. 25-27, and Correction of Cable No. from 28 to 25
1	13367629H-A-R1	October 20, 2020	P.14	Correction of VBW for Below 1 GHz from 100 kHz to 300 kHz
1	13367629H-A-R1	October 20, 2020	P.19-22	Correction of vertical axis label
1	13367629H-A-R1	October 20, 2020	P.21	Deletion of “Pola.” data
2	13367629H-A-R2	October 21, 2020	P.16, 18	Correction of CALCULATION formula

Reference: Abbreviations (Including words undescribed in this report)

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

CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1 Showa-cho, Kariya-shi, Aichi ken, 448-8661 Japan
Telephone Number	:	+81-566-20-3304
Facsimile Number	:	+81-566-25-4920
Contact Person	:	Naoto Makino

The information provided from the customer is as follows;
- Applicant, Type 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
- 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

Type	:	Cockpit Control Unit (CCU)
Model Number	:	DNNS117
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 13.2 V
Receipt Date	:	May 21, 2020
Country of Mass-production	:	Japan
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab

2.2 Product Description

Model: DNNS117 (referred to as the EUT in this report) is a Cockpit Control Unit (CCU).

General Specification

Feature of EUT:

Clock frequency(ies) in the system : 3.1 GHz (max.)

Radio Specification

[AM/FM (incl.RBDS)/XM Radio]

	AM	FM (incl. RBDS)	XM
Equipment type	Receiver		
Frequency of operation	530 kHz to 1710 kHz	87.75 MHz to 107.9 MHz	2333.465 MHz to 2344.045 MHz
Antenna connector type	GT13		

[WLAN (IEEE802.11b/g/n-20) / Bluetooth (Ver4.2 BR/EDR)]

	IEEE802.11b	IEEE802.11g/n (20 M band)	Bluetooth
Equipment type	Transceiver		
Frequency of operation	2412 MHz to 2462 MHz	2412 MHz to 2462 MHz	2402 MHz to 2480 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)	FHSS (GFSK, π/4-DQPSK, 8-DPSK)
Channel spacing	5MHz		1 MHz
Antenna type	ASSEMBLY Bluetooth/WiFi Antenna		
Antenna Connector type	MHF PLUG		
Antenna Gain	-4.15 dBi		1.35 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart B FCC Part 15 final revised on June 26, 2020 and effective July 27, 2020
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart B Unintentional Radiators
Test specification	:	ICES-003 Issue 6: 2016 (updated April 2019)
Title	:	Spectrum Management and Telecommunications Interference-Causing Equipment Standard Information Technology Equipment (Including Digital Apparatus) – Limits and Methods of Measurement

* The revision does not affect the test result conducted before its effective date.

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result	Remarks
Conducted emission	**FCC:** ANSI C63.4: 2014 7. AC power - line conducted emission measurements IEEE 187: 2003 **ISED:** ICES-003 Issue 6: 2016 (updated April 2019)	**FCC:**Part 15 Subpart B 15.107(a)	N/A	N/A	N/A	*1)
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements IEEE 187: 2003 **ISED:** ICES-003 Issue 6: 2016 (updated April 2019)	**FCC:** Part 15 Subpart B 15.109(a)	N/A	3.73 dB 216.000 MHz, QP, Hori, Mode 1	Complied# a)	-
Antenna Terminal	**FCC:** ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE IEEE 187: 2003 **IC:** -	**FCC:** Part 15 Subpart B 15.111(a)	N/A	38.71 dB 73.652 MHz, PK (Mode 3, Main port)	Complied b)	-

*Note: UL Japan, Inc's EMI Work Procedure 13-EM-W0420.
*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)

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.

3.3 Addition to standard

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 $k = 2$.

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)	5.2 dB
		(Vertical)	6.3 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		5.5 dB
	26.5 GHz to 40 GHz		5.5 dB
0.5 m	26.5 GHz to 40 GHz		5.5 dB
10 m	1 GHz to 18 GHz		5.2 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
Antenna terminal conducted emission / Power density / Burst power	2.6 dB

3.5 Test Location

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* A2LA Certificate Number: 5107.02/ FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 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.

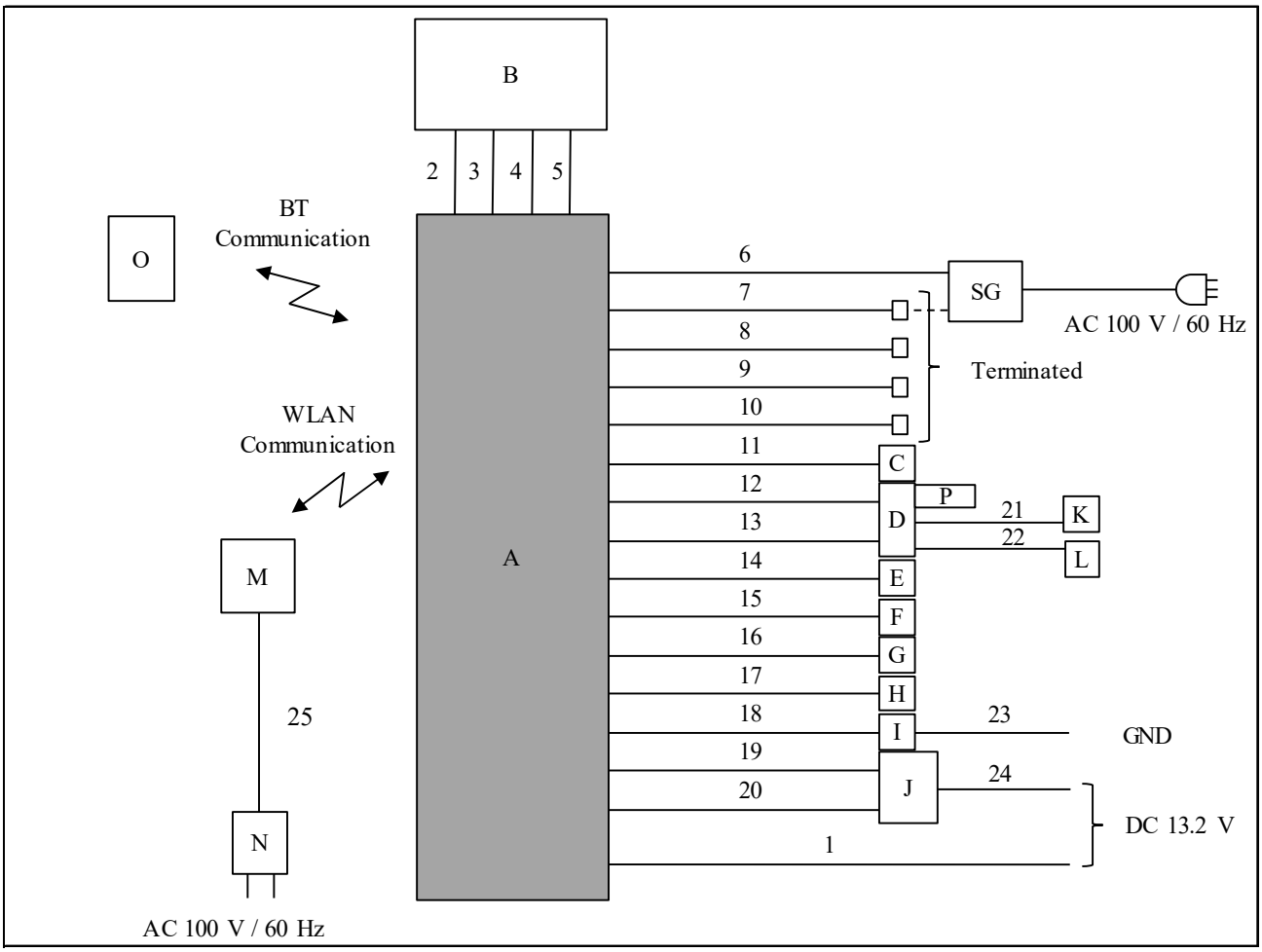
SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Mode	Remarks
Mode 1: FM Receiving (Local) mode	Radiated emission test
Mode 2: FM Receiving (Other) mode	Radiated emission test
Mode 3: FM Tuning mode	Antenna terminal test

Software : F21SHM003-006

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	Remark
A	Cockpit Control Unit	DNNS117	86271VC600	DENSO CORPORATION	EUT
B	Center Information Display	DNNS092	SD-EU-HM-RHD-058	DENSO CORPORATION	-
C	GPS Antenna	86277AL150	8980044	-	-
D	AUX-Box	86257FL001	-	-	-
E	Speaker	-	-	-	-
F	Speaker	-	-	-	-
G	Speaker	-	-	-	-
H	Speaker	-	-	-	-
I	CAN Terminated	-	-	-	-
J	Meter	-	457300-7520	DENSO CORPORATION	-
K	iPod	A1238(MC297J)	8K131HXB9ZU	Apple	-
L	NFC Card Reader	ACR1251	RR395-0056500	Advanced Card Systems Ltd.	-
M	Wireless LAN access point	WSR-1166DHP3	30405090761250	BUFFALO	-
N	AC Adapter	WA-12M12FU	YMY2219629004623600	BUFFALO	-
O	iPod touch	A1367	C3RJ4SLADT75	Apple	-
P	USB Memory	USM4GR B	17116 DGMN	SONY	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	1.0	Unshielded	Unshielded	-
2	WLAN Cable	0.2	Shielded	Shielded	-
3	BT Cable	0.2	Shielded	Shielded	-
4	LVDS Cable	0.2	Shielded	Shielded	-
5	DC Cable	0.2	Unshielded	Unshielded	-
6	AM/FM Antenna Cable	1.4	Shielded	Shielded	-
7	XM Antenna Cable	1.4	Shielded	Shielded	-
8	USB Cable	1.5	Shielded	Shielded	-
9	USB Cable	1.5	Shielded	Shielded	-
10	Signal Cable	1.7	Unshielded	Unshielded	-
11	Antenna Cable	1.3	Shielded	Shielded	-
12	USB Cable	0.4	Shielded	Shielded	-
13	Signal Cable	1.7	Unshielded	Unshielded	-
14	Speaker Cable	1.5	Unshielded	Unshielded	-
15	Speaker Cable	1.5	Unshielded	Unshielded	-
16	Speaker Cable	1.5	Unshielded	Unshielded	-
17	Speaker Cable	1.9	Unshielded	Unshielded	-
18	Signal Cable	1.7	Unshielded	Unshielded	-
19	Signal Cable	1.7	Unshielded	Unshielded	-
20	Meter Cable	1.7	Shielded	Shielded	-
21	Audio Cable	1.5	Shielded	Shielded	-
22	USB Cable	1.0	Shielded	Shielded	-
23	DC Cable	3.0	Unshielded	Unshielded	-
24	DC Cable	3.0	Unshielded	Unshielded	-
25	DC Cable	2.0	Unshielded	Unshielded	-

SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.4 semi anechoic chamber
Temperature : See data
Humidity : 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 - 200 MHz (Biconical antenna) / 200 MHz - 1000 MHz (Logperiodic antenna)
1000 MHz - 20000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

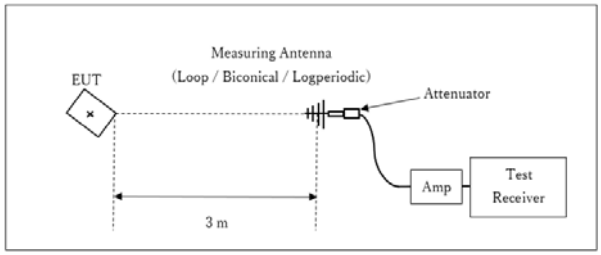
The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver. The radiated emission measurements were made with the following detector function of the Test Receiver.
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 1GHz	Above 1GHz *1)
Instrument used	Test Receiver	Test Receiver
IF Bandwidth	QP: BW 120 kHz	PK: BW 1 MHz, CISPR AV: BW 1 MHz

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

Figure 1: Test Setup

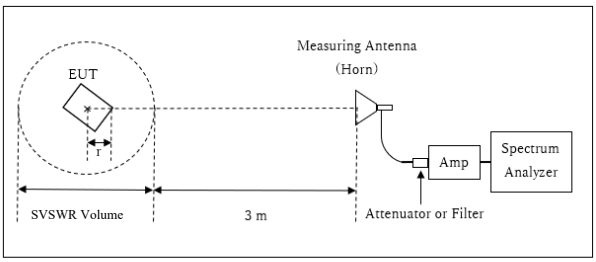
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 18 GHz

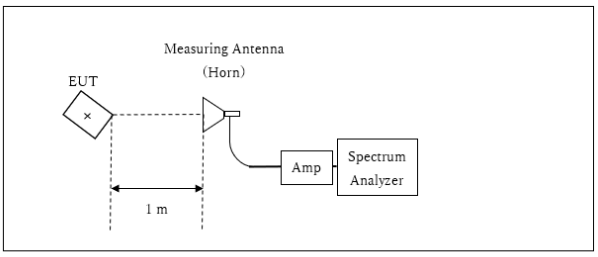


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.1 m*/3.0 m) = 0.29 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.1 m

SVSWR Volume: 2 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.90 m

18 GHz - 20 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m* / 3.0 m) = -9.54 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.

Date: June 15, 2020 Test engineer: Hiroki Numata

SECTION 6: Antenna Terminal

6.1 Operating environment

Test place : No.4 Measurement room
Temperature : See data
Humidity : 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 plane.
Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

Frequency range : 30 MHz - 1000 MHz / 1000 MHz - 2000 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: 300 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

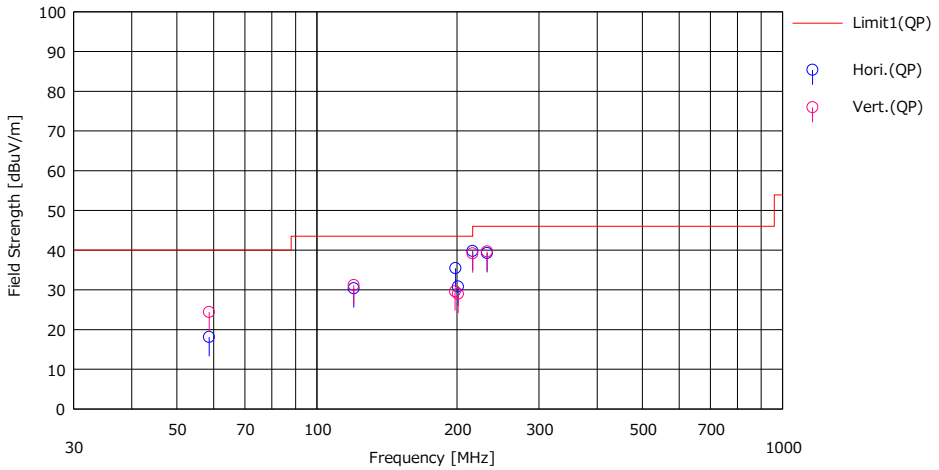
Date: June 6 and 7, 2020 Test engineer: Kiyoshiro Okazaki

APPENDIX 1: Test data

Radiated Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 15, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Hiroki Numata (Below 1 GHz)
Mode	Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



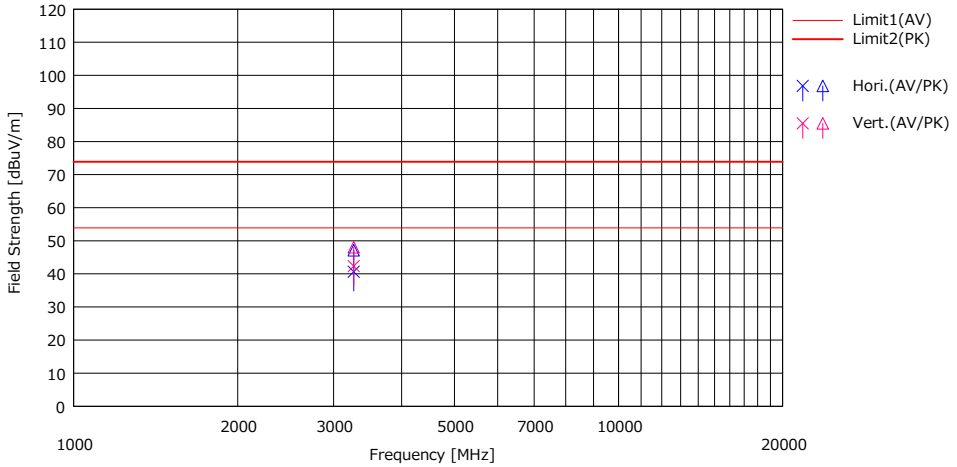
No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pol.a. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	58.672	34.30	8.17	7.59	31.96	18.10	40.00	21.90	Hori.	120	115	BA	
2	120.000	41.10	12.88	8.28	31.89	30.37	43.50	13.13	Hori.	174	72	BA	
3	198.503	41.70	16.59	8.97	31.82	35.44	43.50	8.06	Hori.	160	71	BA	
4	201.000	42.10	11.52	9.00	31.82	30.80	43.50	12.70	Hori.	121	234	LA23	
5	216.000	51.40	11.07	9.11	31.81	39.77	43.50	3.73	Hori.	155	142	LA23	
6	232.000	50.40	11.40	9.24	31.80	39.24	46.00	6.76	Hori.	157	222	LA23	
7	58.672	40.60	8.17	7.59	31.96	24.40	40.00	15.60	Vert.	100	313	BA	
8	120.000	41.90	12.88	8.28	31.89	31.17	43.50	12.33	Vert.	100	252	BA	
9	198.089	35.80	16.66	8.96	31.82	29.60	43.50	13.90	Vert.	100	273	BA	
10	201.000	40.29	11.52	9.00	31.82	28.99	43.50	14.51	Vert.	100	213	LA23	
11	216.000	50.80	11.07	9.11	31.81	39.17	43.50	4.33	Vert.	100	311	LA23	
12	232.000	50.80	11.40	9.24	31.80	39.64	46.00	6.36	Vert.	100	302	LA23	

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

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 15, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Hiroki Numata (Above 1 GHz)
Mode	Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



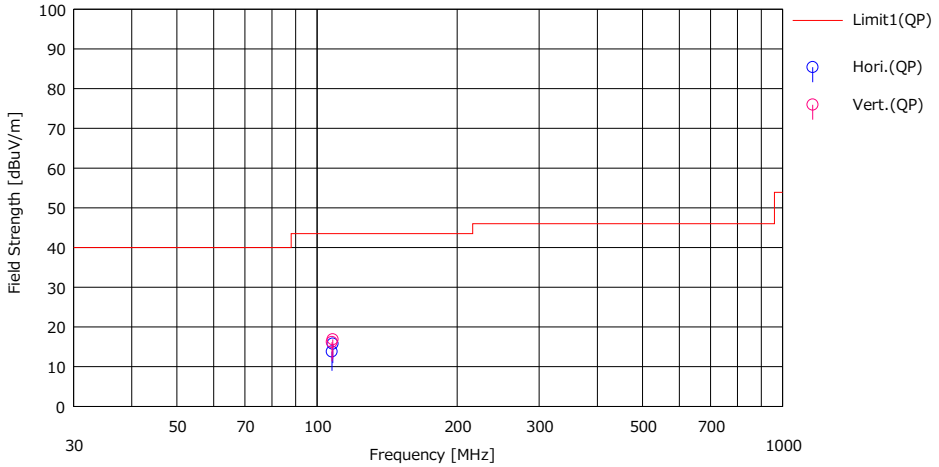
No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Pola.	Height	Angle	Ant. Type	Comment
		<AV>	<PK>				<AV>	<PK>	<AV>	<PK>	<AV>	<PK>					
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	[H/V]	[cm]	[deg]		
1	3266.617	40.50	47.00	28.62	3.07	31.56	40.63	47.13	53.90	73.90	13.27	26.77	Hori.	102	310	H21	
2	3266.617	42.20	47.90	28.62	3.07	31.56	42.33	48.03	53.90	73.90	11.57	25.87	Vert.	177	172	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.

Radiated Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 15, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Hiroki Numata (Below 1 GHz)
Mode	Mode 2

Limit : FCC_Part 15 Subpart B(15.109)_Class B



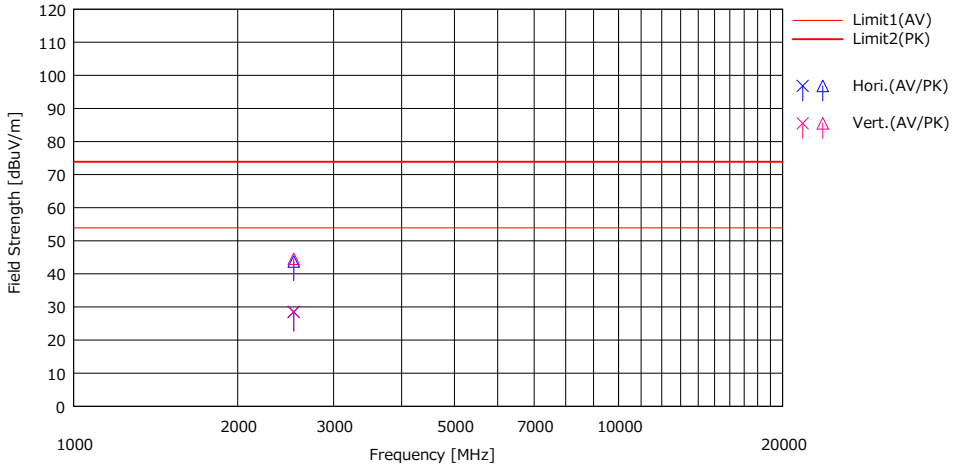
No.	Freq. [MHz]	Reading (QP) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (QP) [dBuV/m]	Limit (QP) [dBuV/m]	Margin (QP) [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
1	107.680	26.20	11.33	8.16	31.90	13.79	43.50	29.71	Hori.	124	249	BA	
2	108.120	28.10	11.40	8.16	31.90	15.76	43.50	27.74	Hori.	172	258	BA	
3	107.680	28.60	11.33	8.16	31.90	16.19	43.50	27.31	Vert.	100	130	BA	
4	108.120	29.20	11.40	8.16	31.90	16.86	43.50	26.64	Vert.	100	270	BA	

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

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 15, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Hiroki Numata (Above 1 GHz)
Mode	Mode 2

Limit : FCC_Part 15 Subpart B(15.109)_Class B



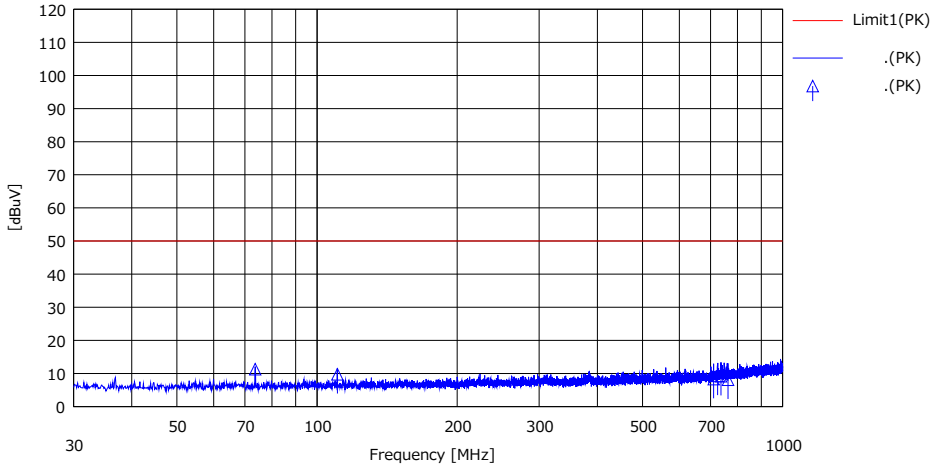
No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Pola.	Height	Angle	Ant. Type	Comment
		<AV>	<PK>				<AV>	<PK>	<AV>	<PK>	<AV>	<PK>					
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	[H/V]	[cm]	[deg]		
1	2535.927	29.80	45.10	27.73	2.73	31.81	28.45	43.75	53.90	73.90	25.45	30.15	Hori.	100	0	H21	
2	2535.927	29.90	45.90	27.73	2.73	31.81	28.55	44.55	53.90	73.90	25.35	29.35	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.

Antenna Terminal Conducted Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 6, 2020
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Kiyoshiro Okazaki (Below 1 GHz)
Mode	Mode 3 (Main Port)

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading 〈PK〉 [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result 〈PK〉 [dBuV]	Limit *1) 〈PK〉 [dBuV]	Margin 〈PK〉 [dB]	Pola.	Ant. Type	Comment
1	73.652	35.20	0.00	8.04	31.95	11.29	50.00	38.71			
2	110.590	33.20	0.00	8.44	31.90	9.74	50.00	40.26			
3	711.018	28.10	0.00	12.23	32.03	8.30	50.00	41.70			
4	724.970	28.90	0.00	12.29	31.96	9.23	50.00	40.77			
5	737.256	28.70	0.00	12.35	31.89	9.16	50.00	40.84			
6	763.062	27.40	0.00	12.47	31.77	8.10	50.00	41.90			

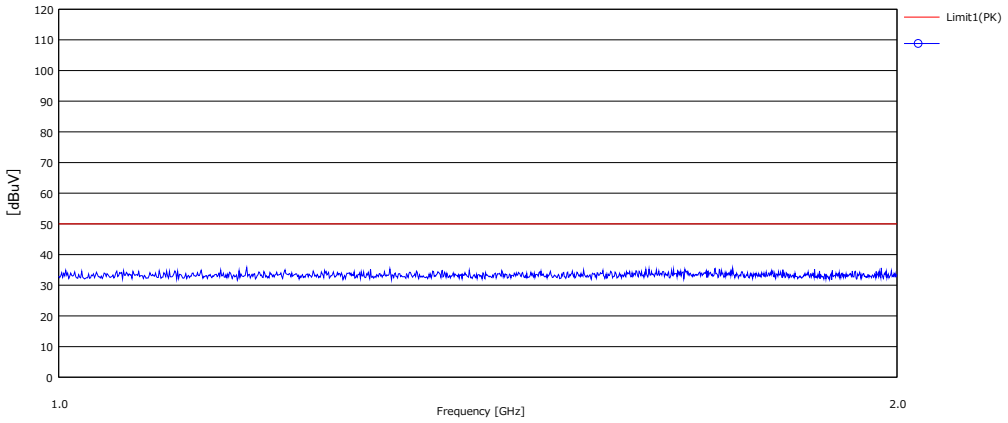
*Local frequency was not detected.

CHART: WITH FACTOR
CALCULATION: RESULT = READING + LOSS (CABLE + ATT) - GAIN(AMP))
*1) 2 nW = -57 dBm = 50 dBuV
Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 7, 2020
Temperature / Humidity	23 deg. C / 54 % RH
Engineer	Kiyoshiro Okazaki (Above 1 GHz)
Mode	Mode 3 (Main Port)

Limit : FCC15.111 Antenna terminal measurement



No signal detected

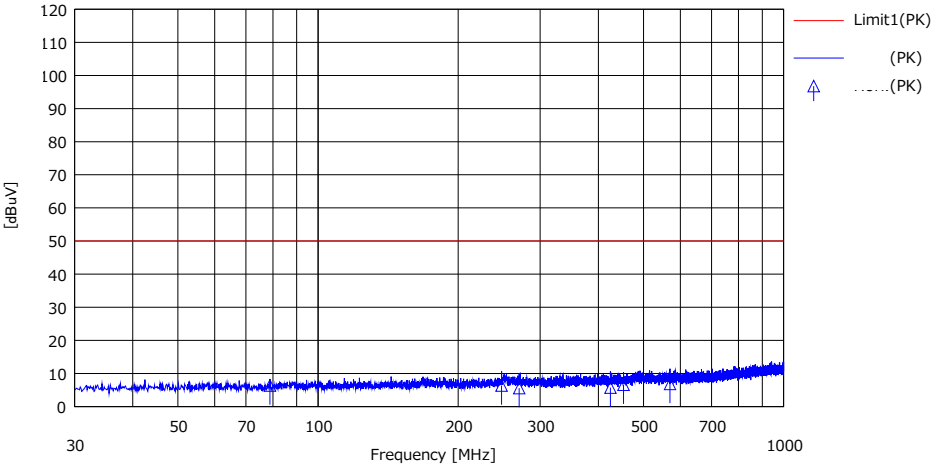
CHART: WITH FACTOR
CALCULATION: RESULT = READING + LOSS (CABLE + ATT) - GAIN(AMP))

*Limit: 2 nW = -57 dBm = 50 dBuV

Antenna Terminal Conducted Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 6, 2020
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Kiyoshiro Okazaki (Below 1 GHz)
Mode	Mode 3 (Sub Port)

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBuV]	Limit*1) (PK) [dBuV]	Margin (PK) [dB]	Pola.	Ant. Type	Comment
1	78.864	30.20	0.00	8.12	31.95	6.37	50.00	43.63		---	
2	247.827	28.50	0.00	9.62	31.79	6.33	50.00	43.67		---	
3	270.464	27.60	0.00	9.77	31.77	5.60	50.00	44.40		---	
4	424.678	26.80	0.00	10.76	31.82	5.74	50.00	44.26		---	
5	453.120	27.50	0.00	10.93	31.84	6.59	50.00	43.41		---	
6	570.100	27.20	0.00	11.56	31.94	6.82	50.00	43.18		---	

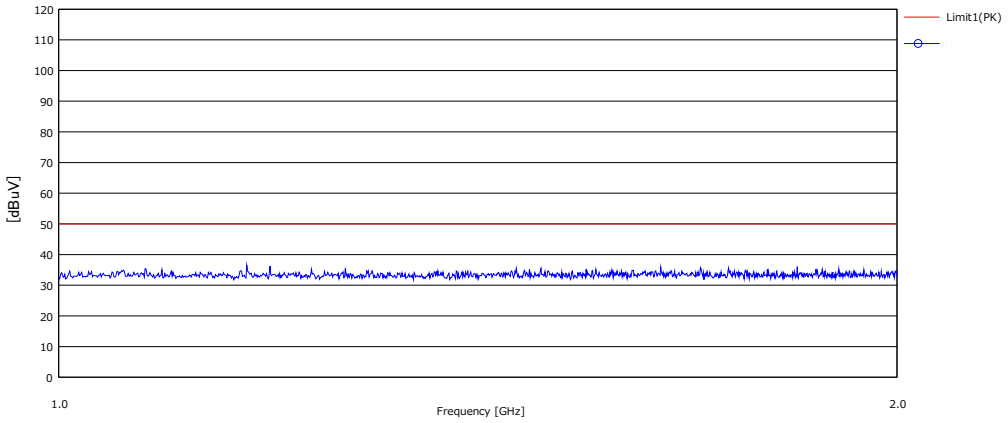
*Local frequency was not detected.

CHART: WITH FACTOR
CALCULATION: RESULT = READING + LOSS (CABLE + ATT) - GAIN(AMP))
*1) 2 nW = -57 dBm = 50 dBuV
Except for the above table: adequate margin data below the limits.

Antenna Terminal Conducted Emission

Report No.	13367629H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 7, 2020
Temperature / Humidity	23 deg. C / 54 % RH
Engineer	Kiyoshiro Okazaki (Above 1 GHz)
Mode	Mode 3 (Sub Port)

Limit : FCC15.111 Antenna terminal measurement



No signal detected

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

*Limit: 2 nW = -57 dBm = 50 dBuV

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
RE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-M EMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04 -SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	24
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1302	08/24/2019	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	08/24/2019	12
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	557	05/22/2020	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	650	10/16/2019	12
RE	MCC-246	199563	Microwave Cable	HUBER+SUNER	SF126E/11PC35/11PC35 /1000M,5000M	537061/126E / 537072/126E	06/11/2020	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170307	10/08/2019	12
AT	MDCB-02	141485	DC Block Filter	Keysight Technologies Inc	N9398C	51053	11/07/2019	12
AT	MMP-01	141550	Matching Pad Anritsu	ANRITSU	MB-009	40063	07/02/2020	12
AT	MPA-03	141577	Microwave System Power Amplifier	Keysight Technologies Inc	83050A	MY39500610	10/01/2019	12
AT	MAT-40	141308	Attenuator	Weinschel - API Technologies Corp	54A-20	S8132	10/09/2019	12
AT	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/03/2020	12
AT	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/21/2019	12
RE / AT	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
RE / AT	MCC-50	141397	Coaxial Cable	UL Japan	-	-	03/24/2020	12
RE / AT	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2020	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 Emission