EMI TEST REPORT

Test Report No. : 12477308H-B-R2

Applicant	:	**DENSO CORPORATION**
Type of Equipment	:	**Navigation ECU**
Model No.	:	**DNNS096**
FCC ID	:	**HYQDNNS096**
Test regulation	:	**FCC Part 15 Subpart B: 2018 Class B** **ICES-003 Issue 6: 2016 + Amendment 1: 2017 Class B**
Test Result	:	**Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. This report is a revised version of 12477308H-B-R1. 12477308H-B-R1 is replaced with this report.

Date of test: September 27 to October 30, 2018

Representative test engineer:

Tomoki Matsui
Engineer
Consumer Technology Division

Approved by:

Satofumi Matsuyama
Engineer
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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REVISION HISTORY

Original Test Report No.: 12477308H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12477308H-B	November 16, 2018	-	-
1	12477308H-B-R1	November 21, 2018	P.4	Correction of Receipt Date of Sample from September 25, 2015 to September 25, 2018
1	12477308H-B-R1	November 21, 2018	P.13	Correction of test distance (1 GHz - 10 GHz): from 4.1 m to 3.7 m
1	12477308H-B-R1	November 21, 2018	P.14	Correction of Frequency range: from 1000 MHz - 15000 MHz to 1000 MHz - 18000 MHz
2	12477308H-B-R2	November 22, 2018	P.13	Correction of clause number from 6.5 to 5.5

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SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number	:	+81-566-61-4675
Facsimile Number	:	+81-566-25-9799
Contact Person	:	Hirofumi Toyono

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Navigation ECU
Model No.	:	DNNS096
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample	:	September 25, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: DNNS096 (referred to as the EUT in this report) is a Navigation ECU.

Feature of EUT:

Clock frequency(ies) in the system	:	12 MHz, 16.384 MHz, 25 MHz, 28.636 MHz, 53.946 MHz (Main PCB Oscillator) 26 MHz (BT Crystal) 2816 MHz - 3462.4 MHz (FM LO 1st)
Operating Temperature	:	-30 deg. C to 65 deg. C

Radio Specification

[Bluetooth Ver. 3.0 (with EDR)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS, GFSK, π/4DQPSK, 8DPSK
Antenna type	:	METAL PLATE Antenna
Antenna Gain	:	-4.3 dBi (Ave), -4.0 dBi (Max)

[GNSS]

Radio Type	:	Receiver
Frequency of Operation	:	GPS: 1575.42 MHz
Modulation	:	Spread Spectrum modulation, BPSK

[AM/FM Radio]

	AM	FM
Equipment type	Receiver	
Frequency of operation	530 kHz to 1710 kHz	87.7 MHz to 107.9 MHz
Antenna connector type	Receptacle Connector	

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart B FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart B Unintentional Radiators
Test specification	:	ICES-003 Issue 6: 2016 + Amendment 1: 2017
Title	:	Spectrum Management and Telecommunications Interference-Causing Equipment Standard Information Technology Equipment (Including Digital Apparatus) – Limits and Methods of Measurement

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	**FCC:** ANSI C63.4: 2014 7. AC power - line conducted emission measurements **IC:** ICES-003 Issue 6: 2016 + Amendment 1: 2017	Class B	N/A *1)	-	N/A
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements **IC:** ICES-003 Issue 6: 2016 + Amendment 1: 2017	Class B	N/A	1.2 dB 224.996 MHz, QP	Complied#
Antenna Terminal	**FCC:** ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE **IC:** -	Class B	N/A	6.3 dB 1332.475 MHz, PK	Complied

*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.

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

EMI
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
3 m	1 GHz to 6 GHz		5.0 dB
	6 GHz to 18 GHz		5.3 dB
1 m	10 GHz to 26.5 GHz		5.8 dB
	26.5 GHz to 40 GHz		5.8 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	2.7 dB

3.5 Test Location

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	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	2973C-1	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	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	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	2973C-4	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.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, Test set up and Signature of an official of the responsible party

Refer to APPENDIX.

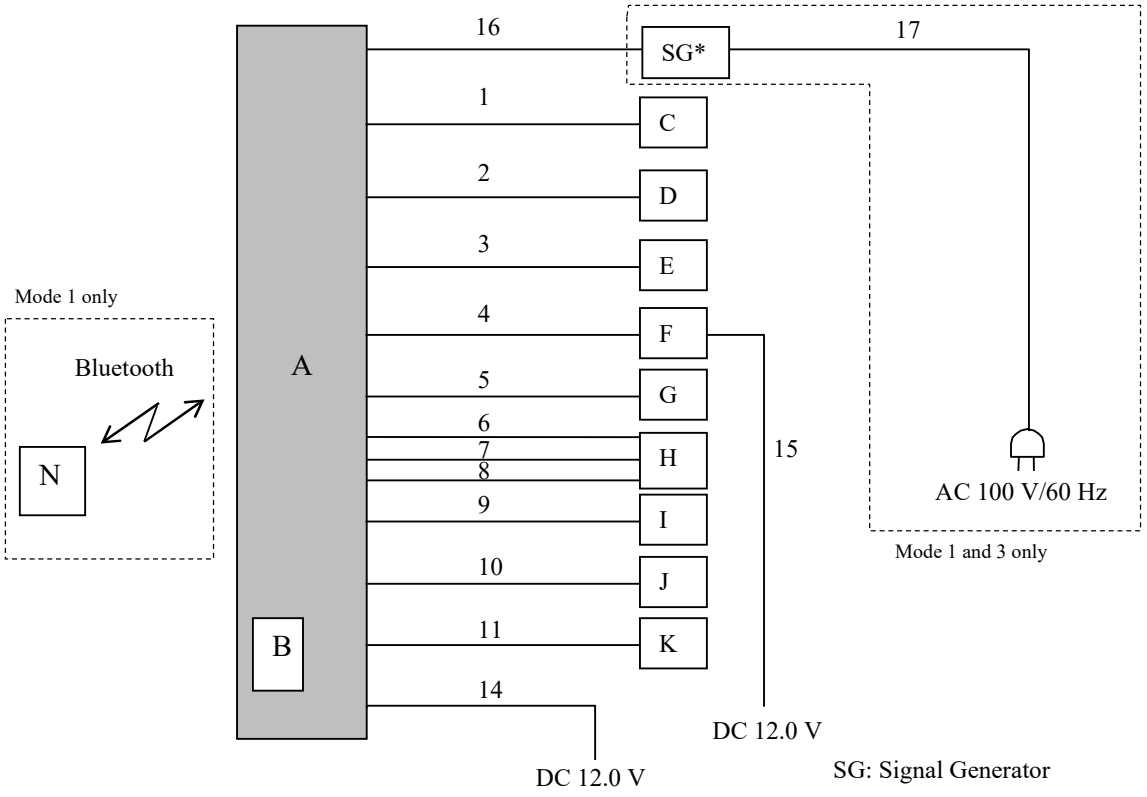
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

The mode(s) :
1. BT Communication + FM Receiving mode mode: Radiated Emission test only
2. USB Play + Navi mode: Radiated Emission test only
3. FM Receiving (Local) mode: Radiated Emission test only
4. FM Tuning mode: Antenna terminal conducted test only

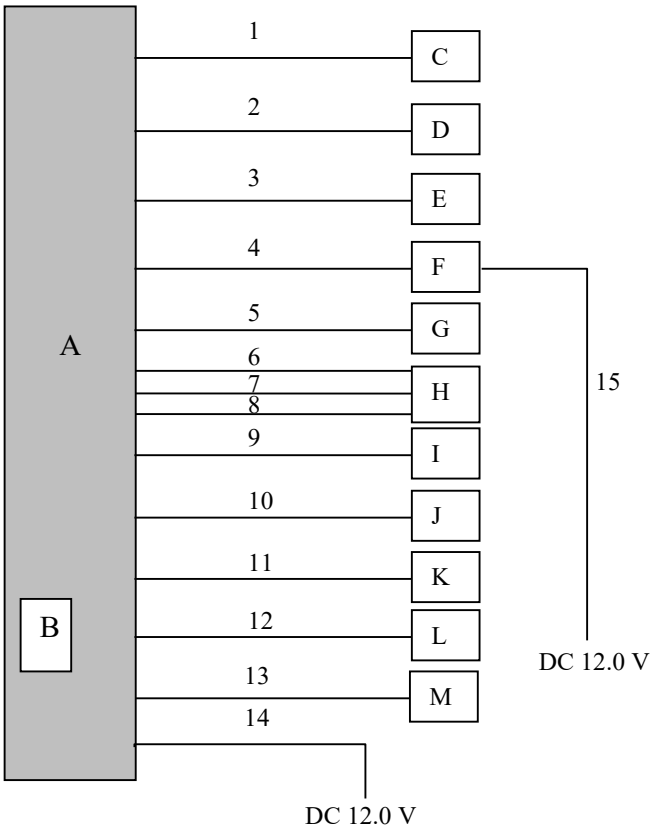
4.2 Configuration and peripherals

[Mode 1, 3 and 4]



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

[Mode 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	Navigation ECU	DNNS096	468147007000041	DENSO CORPROATION	EUT
B	Micro SD	-	1739CK3804BG	TOYOTA	-
C	Back Camera	GP-KD5330RC	45C00005	-	-
D	Speaker Dummy	-	-	-	-
E	Steering SW	-	-	-	-
F	A/C ECU	88650-47510	277400-0851	DENSO CORPORATION	-
G	USB Memory	-	E3A0000992E4	I.O DATA	-
H	Extension Box	GEX-0128	NEGE077316US	PIONEER Corporation	-
I	Microphone	-	-	-	-
J	Switch	-	-	-	-
K	GPS Antenna	-	14630002	-	-
L	Radio Antenna	-	-	-	-
M	Radio Antenna	-	-	-	-
N	iPad touch	A1367	CCQ50WDDCPC	Apple	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	3.5	Unshielded	Unshielded	-
2	Signal Cable	3.3	Unshielded	Unshielded	-
3	Signal Cable	3.3	Unshielded	Unshielded	-
4	Signal Cable	3.3	Unshielded	Unshielded	-
5	USB Cable	1.1	Shielded	Shielded	-
6	Signal Cable	0.7	Unshielded	Unshielded	-
7	Signal Cable	2.0	Shielded	Shielded	-
8	Signal Cable	3.0	Shielded	Shielded	-
9	Signal Cable	9.0	Unshielded	Unshielded	-
10	Signal Cable	9.0	Unshielded	Unshielded	-
11	GPS Cable	3.0	Shielded	Shielded	-
12	Antenna Cable	4.5	Shielded	Shielded	-
13	Antenna Cable	4.5	Shielded	Shielded	-
14	DC Cable	4.5	Unshielded	Unshielded	-
15	DC Cable	3.0	Unshielded	Unshielded	-
16	Antenna Cable	1.0	Shielded	Shielded	-
17	AC Cable	1.8	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 - 18000 MHz (Horn antenna)
Test distance : 3 m
EUT position : Table top
EUT operation mode : See Clause 4.1

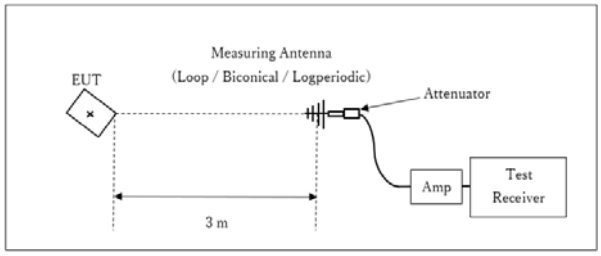
5.4 Test procedure

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.

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

Figure 1: Test Setup

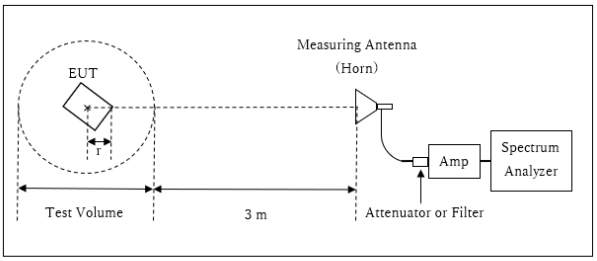
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

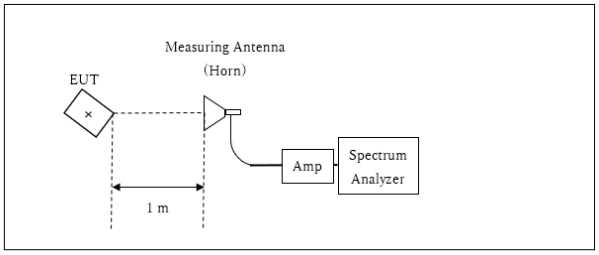


r : Radius of an outer periphery of EUT
× : Center of turn table

*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.
Distance Factor: 20 x log (3.7 m / 3.0 m) = 1.82 dB
* Test Distance: (3 + Test Volume /2) - r = 3.7 m

Test Volume : 3.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.8 m

10 GHz - 18 GHz



× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.5 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: October 29, 2018 Test engineer: Shuichi Ohyama
October 30, 2018 Hiroyuki Furutaka

SECTION 6: Antenna Terminal

6.1 Operating environment

Test place : No.3 Semi anechoic chamber
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.

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
IF Bandwidth	PK: RBW: 100 kHz / VBW: 100 kHz	PK: RBW: 1 MHz / VBW: 3 MHz

6.5 Test result

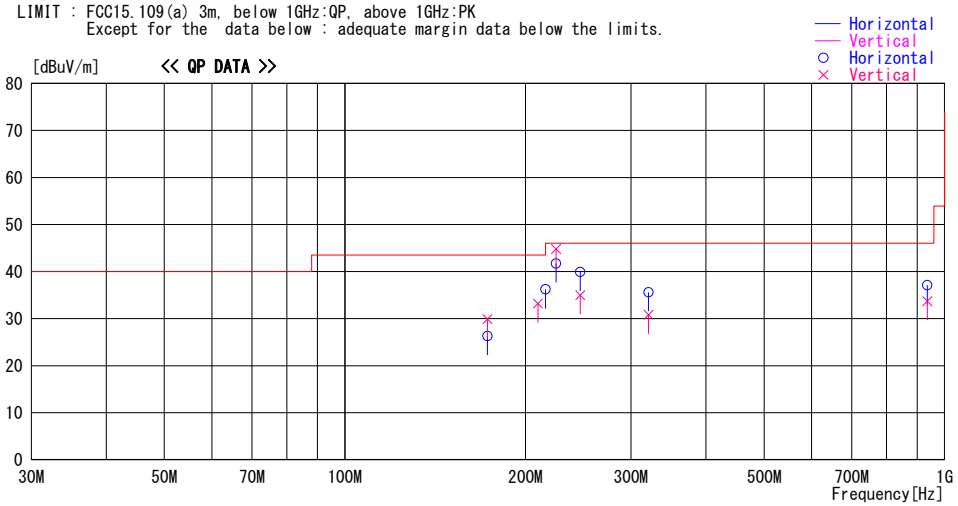
Summary of the test results: Pass

Date: September 27, 2018 Test engineer: Tomoki Matsui

APPENDIX 1: Test data

Radiated emission
(Mode 1)

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 29, 2018
Temperature / Humidity	21 deg. C / 43 % RH
Engineer	Shuichi Ohyama
	(Below 1 GHz)
Mode	Mode 1

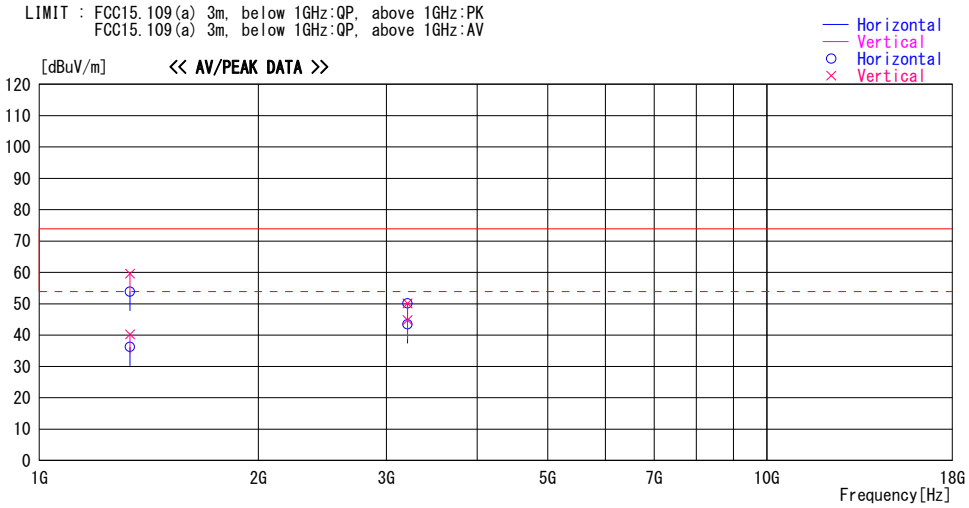


Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
172.856	36.9	QP	16.0	-23.0	29.9	150	100	Vert.	43.5	13.6	
172.856	33.3	QP	16.0	-23.0	26.3	70	189	Hori.	43.5	17.2	
209.898	44.7	QP	11.2	-22.7	33.2	300	100	Vert.	43.5	10.3	
215.996	47.8	QP	11.1	-22.7	36.2	268	146	Hori.	43.5	7.3	
224.996	53.2	QP	11.1	-22.6	41.7	223	151	Hori.	46.0	4.3	
224.996	56.3	QP	11.1	-22.6	44.8	344	100	Vert.	46.0	1.2	
246.942	45.8	QP	11.7	-22.5	35.0	337	100	Vert.	46.0	11.0	
246.942	50.7	QP	11.7	-22.5	39.9	272	164	Hori.	46.0	6.1	
321.017	43.3	QP	14.2	-21.9	35.6	184	137	Hori.	46.0	10.4	
321.017	38.5	QP	14.2	-21.9	30.8	16	100	Vert.	46.0	15.2	
935.989	32.8	QP	22.0	-17.7	37.1	50	105	Hori.	46.0	8.9	
935.989	29.4	QP	22.0	-17.7	33.7	133	100	Vert.	46.0	12.3	

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 & GAIN (CABLE + ATT - GAIN(AMP))

Radiated emission
(Mode 1)

Report No.	12477308H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	October 30, 2018	October 30, 2018
Temperature / Humidity	24 deg. C / 34 % RH	23 deg. C / 37 % RH
Engineer	Hiroyuki Furutaka	Shuichi Ohyama
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)
Mode	Mode 1	

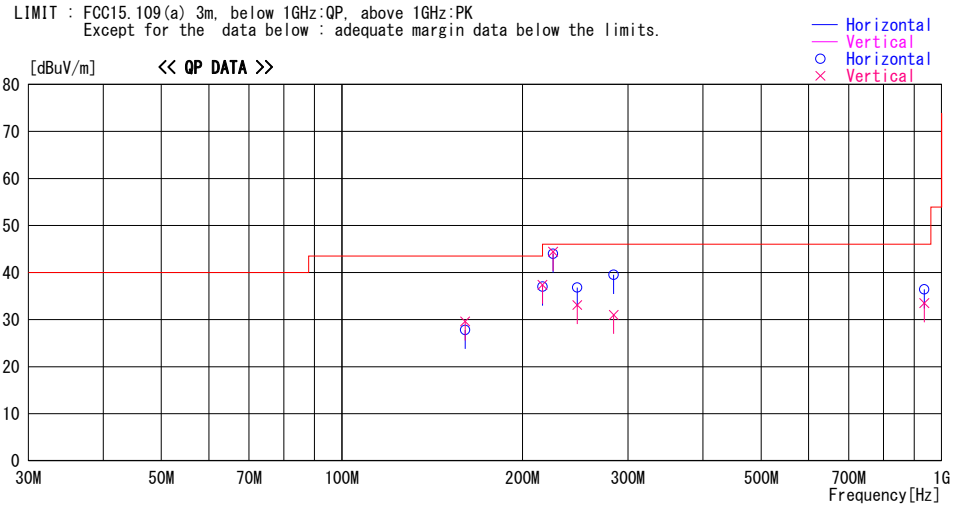


Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1332.450	62.8	PK	25.5	-28.7	59.6	23	137	Vert.	73.9	14.3	
1332.450	43.4	AV	25.5	-28.7	40.2	23	137	Vert.	53.9	13.7	
1332.450	57.0	PK	25.5	-28.7	53.8	342	115	Hori.	73.9	20.1	
1332.450	39.4	AV	25.5	-28.7	36.2	342	115	Hori.	53.9	17.7	
3206.410	40.9	PK	29.2	-25.3	44.8	167	135	Vert.	73.9	29.1	
3206.410	46.2	PK	29.2	-25.3	50.1	167	135	Vert.	73.9	23.8	
3206.419	46.2	PK	29.2	-25.3	50.1	236	109	Hori.	73.9	23.8	
3206.419	39.5	AV	29.2	-25.3	43.4	236	109	Hori.	53.9	10.5	

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 & GAIN (CABLE + Filter - GAIN(AMP) + D-factor)

Radiated emission
(Mode 2)

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 29, 2018
Temperature / Humidity	21 deg. C / 43 % RH
Engineer	Shuichi Ohyama
	(Below 1 GHz)
Mode	Mode 2

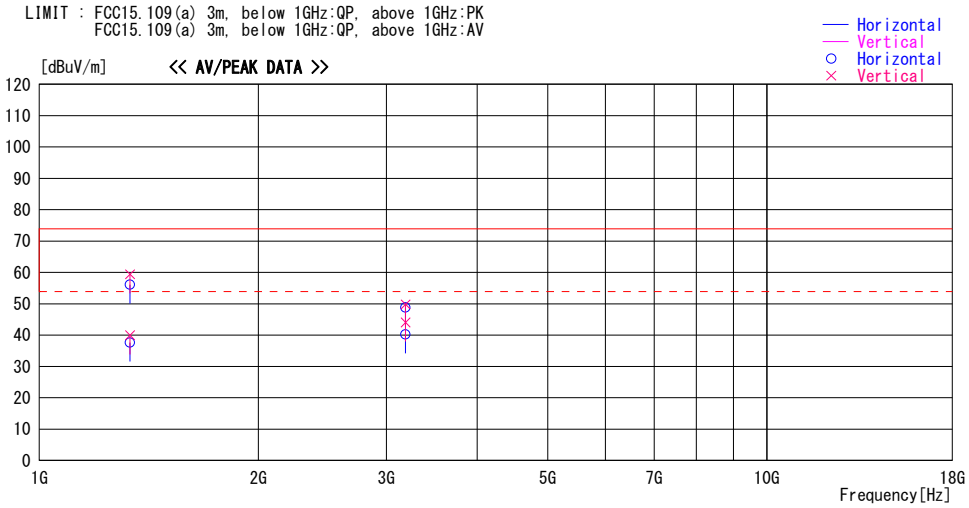


Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
160.509	35.4	QP	15.6	-23.2	27.8	92	203	Hori.	43.5	15.7	
160.509	37.2	QP	15.6	-23.2	29.6	8	100	Vert.	43.5	13.9	
215.989	48.6	QP	11.1	-22.7	37.0	71	157	Hori.	43.5	6.5	
215.989	49.0	QP	11.1	-22.7	37.4	182	100	Vert.	43.5	6.1	
224.996	55.5	QP	11.1	-22.6	44.0	73	145	Hori.	46.0	2.0	
224.996	55.9	QP	11.1	-22.6	44.4	359	100	Vert.	46.0	1.6	
246.941	47.6	QP	11.7	-22.5	36.8	276	146	Hori.	46.0	9.2	
246.941	43.9	QP	11.7	-22.5	33.1	120	100	Vert.	46.0	12.9	
283.980	48.4	QP	13.3	-22.2	39.5	56	146	Hori.	46.0	6.5	
283.980	39.9	QP	13.3	-22.2	31.0	293	164	Vert.	46.0	15.0	
935.995	32.1	QP	22.0	-17.7	36.4	46	106	Hori.	46.0	9.6	
935.995	29.2	QP	22.0	-17.7	33.5	134	100	Vert.	46.0	12.5	

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 & GAIN (CABLE + ATT - GAIN(AMP))

Radiated emission
(Mode 2)

Report No.	12477308H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	October 30, 2018	October 30, 2018
Temperature / Humidity	24 deg. C / 34 % RH	23 deg. C / 37 % RH
Engineer	Hiroyuki Furutaka	Shuichi Ohyama
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)
Mode	Mode 2	

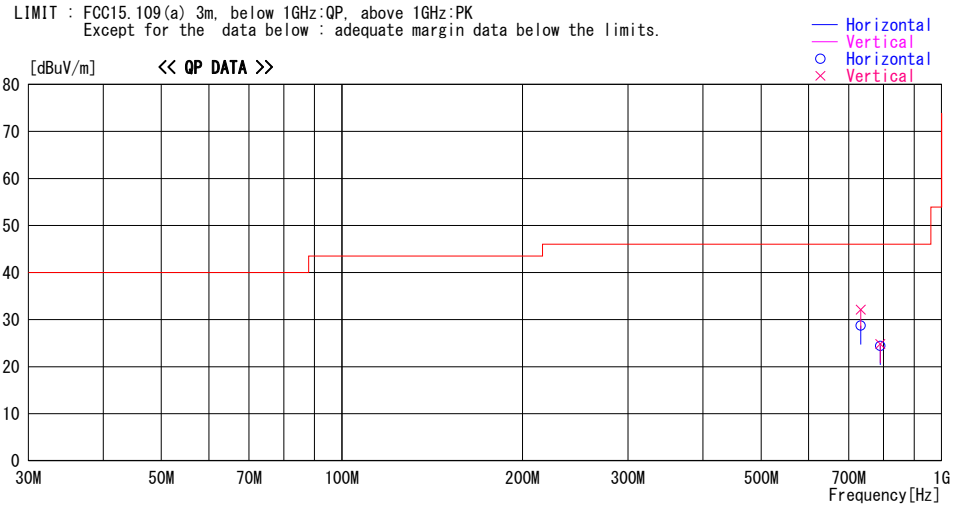


Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
1332.475	59.3	PK	25.5	-28.7	56.1	317	100	Hori.	73.9	17.8	
1332.475	40.8	AV	25.5	-28.7	37.6	317	100	Hori.	53.9	16.3	
1332.475	62.6	PK	25.5	-28.7	59.4	187	137	Vert.	73.9	14.5	
1332.475	43.1	AV	25.5	-28.7	39.9	187	137	Vert.	53.9	14.0	
3187.170	46.0	PK	29.1	-25.3	49.8	122	100	Vert.	73.9	24.1	
3187.170	36.4	AV	29.1	-25.3	40.2	282	167	Hori.	53.9	13.7	
3187.170	45.0	PK	29.1	-25.3	48.8	282	167	Hori.	73.9	25.1	
3187.170	40.2	AV	29.1	-25.3	44.0	122	100	Vert.	53.9	9.9	

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 & GAIN (CABLE + Filter - GAIN(AMP) + D-factor)

Radiated emission
(Mode 3)

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	October 30, 2018
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Shuichi Ohyama
	(Below 1 GHz)
Mode	Mode 3

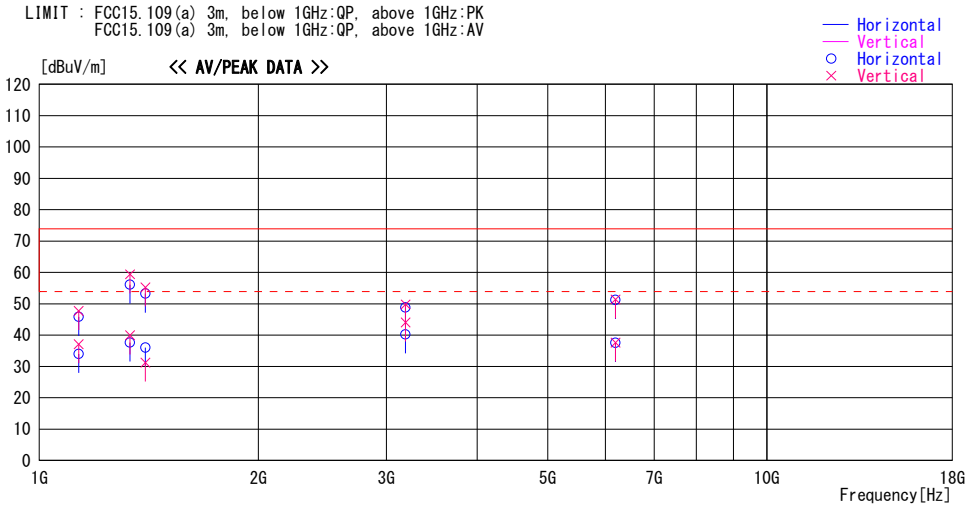


Frequency	Reading	DET	Antenna Factor	Loss& Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
733.017	28.2	QP	20.1	-19.6	28.7	167	132	Hori.	46.0	17.3	
733.017	31.6	QP	20.1	-19.6	32.1	223	100	Vert.	46.0	13.9	
790.383	22.6	QP	20.8	-19.0	24.4	129	100	Hori.	46.0	21.6	
790.383	23.0	QP	20.8	-19.0	24.8	330	100	Vert.	46.0	21.2	

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 & GAIN (CABLE + ATT - GAIN(AMP))

Radiated emission
(Mode 3)

Report No.	12477308H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	October 30, 2018	October 30, 2018
Temperature / Humidity	24 deg. C / 34 % RH	23 deg. C / 37 % RH
Engineer	Hiroyuki Furutaka	Shuichi Ohyama
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)
Mode	Mode 3	

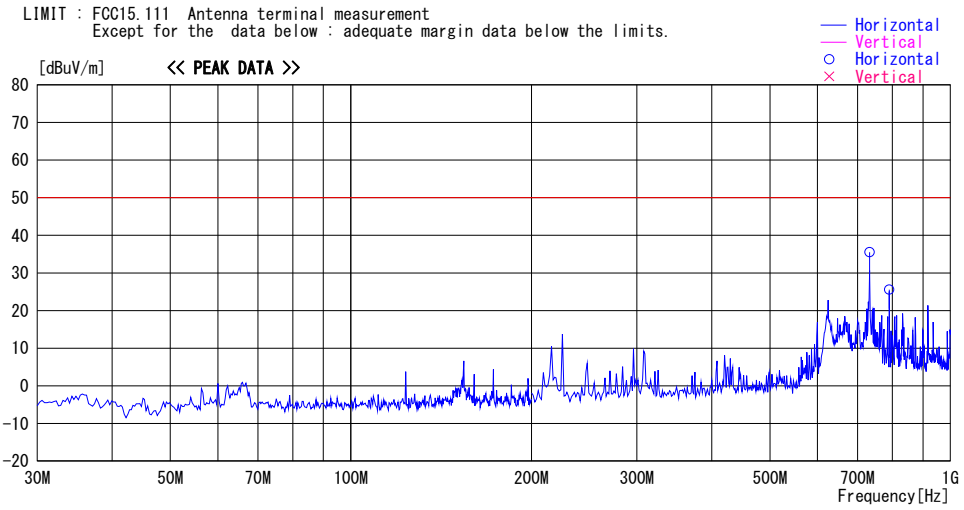


Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
1132.658	51.5	PK	23.8	-29.5	45.8	131	132	Hori.	73.9	28.1	
1132.658	39.7	AV	23.8	-29.5	34.0	131	132	Hori.	53.9	19.9	
1132.658	53.4	PK	23.8	-29.5	47.7	189	109	Vert.	73.9	26.2	
1132.658	42.8	AV	23.8	-29.5	37.1	189	109	Vert.	53.9	16.8	
1332.475	59.3	PK	25.5	-28.7	56.1	317	100	Hori.	73.9	17.8	
1332.475	40.8	AV	25.5	-28.7	37.6	317	100	Hori.	53.9	16.3	
1332.475	62.6	PK	25.5	-28.7	59.4	187	137	Vert.	73.9	14.5	
1332.475	43.1	AV	25.5	-28.7	39.9	187	137	Vert.	53.9	14.0	
1399.025	58.9	PK	24.7	-28.4	55.2	6	144	Vert.	73.9	18.7	
1399.025	39.7	AV	24.7	-28.4	36.0	223	166	Hori.	53.9	17.9	
1399.025	56.9	PK	24.7	-28.4	53.2	223	166	Hori.	73.9	20.7	
1399.025	34.9	AV	24.7	-28.4	31.2	6	144	Vert.	53.9	22.7	
3187.170	46.0	PK	29.1	-25.3	49.8	122	100	Vert.	73.9	24.1	
3187.170	36.4	AV	29.1	-25.3	40.2	282	167	Hori.	53.9	13.7	
3187.170	45.0	PK	29.1	-25.3	48.8	282	167	Hori.	73.9	25.1	
3187.170	40.2	AV	29.1	-25.3	44.0	122	100	Vert.	53.9	9.9	
6196.000	42.3	PK	32.9	-23.8	51.4	0	100	Vert.	73.9	22.5	
6196.000	42.1	PK	32.9	-23.8	51.2	0	100	Hori.	73.9	22.7	
6196.000	28.4	AV	32.9	-23.8	37.5	0	100	Hori.	53.9	16.4	
6196.000	28.5	AV	32.9	-23.8	37.6	0	100	Vert.	53.9	16.3	

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 & GAIN (CABLE - GAIN(AMP) + D-factor)

Antenna Terminal Conducted Emission

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 27, 2018
Temperature / Humidity	24 deg. C / 65 % RH
Engineer	Tomoki Matsui
Mode	Mode 4



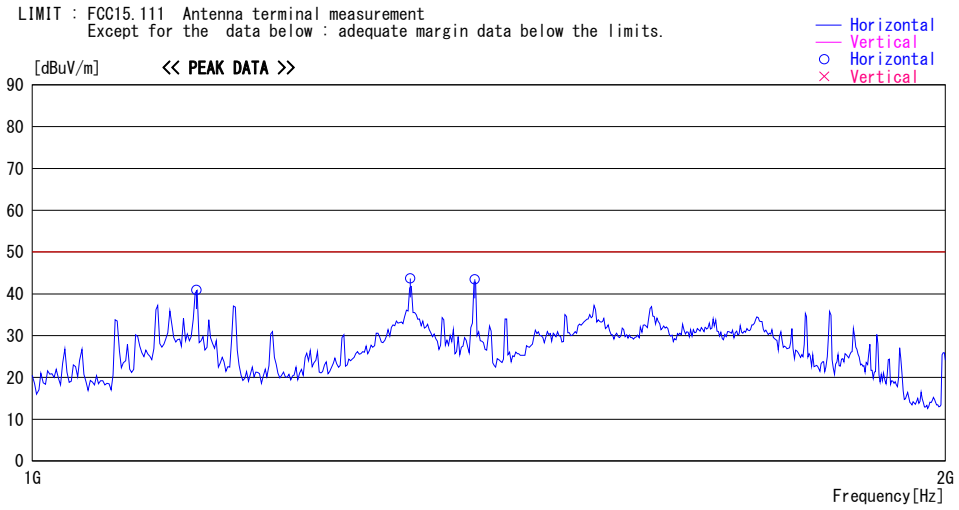
Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Polar.	Limit	Margin [dB]	Comment
733.017	59.9	PK	0.0	-24.4	35.5	-	50.0	14.5	
790.383	49.4	PK	0.0	-23.8	25.6	-	50.0	24.4	

* 2nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Antenna Terminal Conducted Emission

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 27, 2018
Temperature / Humidity	24 deg. C / 65 % RH
Engineer	Tomoki Matsui
Mode	Mode 4



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Polar.	Limit [dBuV]	Margin [dB]	Comment
1132.658	73.3	PK	0.0	-32.4	40.9	-	50.0	9.1	
1332.475	75.3	PK	0.0	-31.6	43.7	-	50.0	6.3	
1399.025	74.9	PK	0.0	-31.4	43.5	-	50.0	6.5	

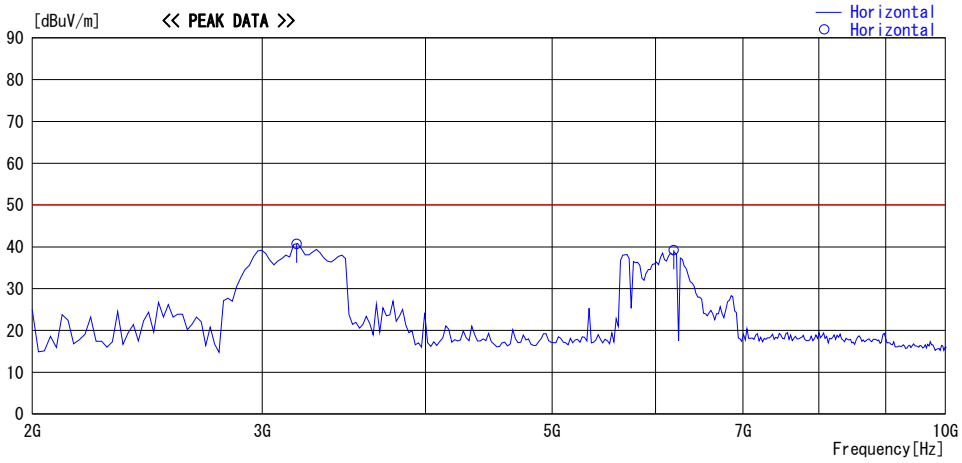
* 2nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

Antenna Terminal Conducted Emission

Report No.	12477308H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	September 27, 2018
Temperature / Humidity	24 deg. C / 65 % RH
Engineer	Tomoki Matsui
Mode	Mode 4

LIMIT : FCC15.111 Antenna terminal measurement
Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna Factor [dB/m]	Loss& Gain [dB]	Level [dBuV]	Polar.	Limit [dBuV]	Margin [dB]	Comment
3187.170	68.3	PK	0.0	-27.6	40.7	-	50.0	9.3	
6195.000	63.4	PK	0.0	-24.2	39.2	-	50.0	10.8	

* 2nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR
ANT TYPE: - 30 MHz: LOOP, 30 MHz - 200 MHz: BICONICAL, 200 MHz - 1000 MHz: LOGPERIODIC, 1000 MHz -: HORN
CALCULATION: RESULT = READING + LOSS & GAIN (CABLE + ATT - GAIN(AMP))

*No signal was detected above 10 GHz.

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	06/04/2018	06/30/2019	12
RE/AT	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/18/2017	12/31/2018	12
RE/AT	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE/AT	141532	DIGITAL HiTESTER	HIOKI	3805	51201197	01/09/2018	01/31/2019	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	06/04/2018	06/30/2019	12
RE	142183	Measure	KOMELON	KMC-36	-	-	-	-
RE/AT	141582	Pre Amplifier	SONOMA INSTRUMENT	11/5/1900	260834	02/27/2018	02/28/2019	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/06/2018	08/31/2019	12
RE/AT	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/24/2018	01/31/2019	12
AT	141580	MicroWave System Amplifier	AGILENT	83017A	MY39500779	03/13/2018	03/31/2019	12
AT	141417	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	05/07/2018	05/31/2019	12
AT	141900	Spectrum Analyzer	AGILENT	E4440A	MY46185823	11/16/2017	11/30/2018	12
AT	141485	DC Block Filter	AGILENT	N9398C	51053	12/12/2017	12/31/2018	12
RE	148898	Attenuator	KEYSIGHT	8491A	MY52462282	10/03/2018	10/31/2019	12
RE	141397	Coaxial Cable	UL Japan	-	-	06/13/2018	06/30/2019	12
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	01/30/2018	01/31/2019	12
RE	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	06/01/2018	06/30/2019	12
RE	141425	Biconical Antenna	Schwarzbeck	BBA9106	1302	06/01/2018	06/30/2019	12
RE	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141545	DIGITAL HiTESTER	HIOKI	3805	51201148	01/09/2018	01/31/2019	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	06/30/2020	24
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-180	1501	01/24/2018	01/31/2019	12
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/07/2018	04/20/2019	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	06/08/2018	06/30/2019	12
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/14/2018	06/30/2019	12
RE	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/19/2018	09/30/2019	12
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/04/2018	10/31/2019	12

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int 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.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item:

RE: Radiated emission
AT: Antenna Terminal Conducted test