EMI TEST REPORT

Test Report No. : 13198340H-C-R1

Applicant	:	**DENSO TEN Limited**
Type of EUT	:	**Car Audio**
Model Number of EUT	:	**TN0020A**
FCC ID	:	**BABTN0020A**
Test regulation	:	**FCC Part 15 Subpart B: 2020** **ICES-003 Issue 6: 2016 (updated April 2019)**
Test Result	:	**Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers EMC technical requirements. It does not cover administrative issues such as Manual or non-EMC test related Requirements. (if applicable)
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 13198340H-C. 13198340H-C is replaced with this report.

Date of test: June 19 and 20, 2020

Representative test engineer:
Ken Fujita
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".

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

REVISION HISTORY

Original Test Report No.: 13198340H-C

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13198340H-C	July 31, 2020	-	-
1	13198340H-C-R1	October 30, 2020	P.24	Deletion of Power Meter (Local ID: MPM-22) and Addition of Pre Amplifier (Local ID: MPA-22)

CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	DENSO TEN Limited
Address	:	2-28, Gosho-dori 1-Chome, Hyogo-ku, Kobe, 652-8510 JAPAN
Telephone Number	:	+81-78-682-2159
Facsimile Number	:	+81-78-671-7160
Contact Person	:	Daisuke Fukii

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	:	Car Audio
Model Number	:	TN0020A
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 12V
Receipt Date	:	June 15, 2020
Country of Mass-production	:	Thailand
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: TN0020A (referred to as the EUT in this report) are Car Audio.
There are 2 types, Left-hand steering wheel (LHD) and Right-hand steering wheel (RHD).
The EUT is Right-hand steering wheel type.

General Specification

Clock frequency(ies)	:	32.768 kHz, 24 MHz, 2.64 GHz (MAX): SoC 4 MHz: Security IC 8 MHz: CAN MICON 20 MHz: BT Module 37 MHz: LVDS IC 42 MHz: Video Dec 55.46667 MHz: DAB TUNER 62.4 MHz: Radio/Audio DSP
Operating Temperature	:	-20 deg. C - +65 deg. C

Radio Specification

[Bluetooth (Ver.5.0 + EDR)]

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480MHz
Type of Modulation	:	GFSK, PI/4-DQPSK, 8DPSK
Antenna Type	:	Inverted F PCB Antenna
Antenna Gain	:	1.78 dBi max

[AM / FM (incl. RDS) / DAB]

Type of Receiver	:	Receiver
Frequency of Operation	:	AM: 531 kHz to 1602 kHz FM: 87.5 MHz to 108.0 MHz DAB (Band III): 174.928 MHz to 239.200 MHz
Channel spacing	:	AM: 9 kHz FM: 0.05 MHz RDS: 0.1 MHz
Antenna connector type	:	AM / FM / RDS: JASO DAB: HFC III

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 **IC:** ICES-003 Issue 6: 2016 + Amendment 1: 2017	**FCC:**Part 15 Subpart B 15.107(a)	N/A	-	N/A	*1)
Radiated emission	**FCC:** ANSI C63.4: 2014 8. Radiated emission measurements IEEE 187:2003 **IC:** ICES-003 Issue 6: 2016 + Amendment 1: 2017	**FCC:** Part 15 Subpart B 15.109(a)	N/A	19.41 dB 161.990 MHz, Vertical	Complied a)	*2)
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	14.23 dB 2317.029 MHz	Complied b)	*2)

*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.
*2) Measurements were limited up to 40 GHz according to the customer's request.

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

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
* 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.

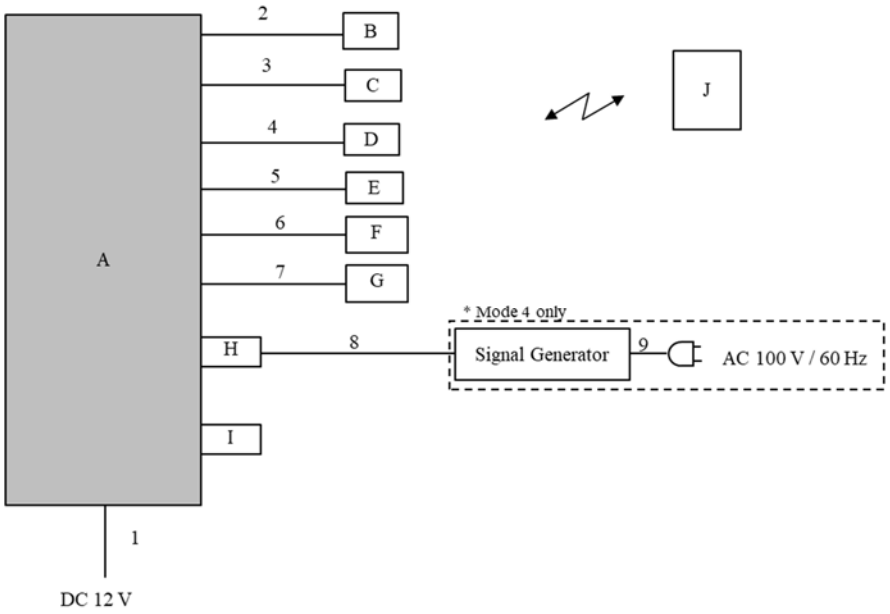
SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

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

Software : E-DA software V1.0.0

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	TN0020A	BS500031	DENSO TEN Limited	EUT
B	USB Memory	RUF3-K8GA-BK/N	P90611	BUFFALO	-
C	Steering switch	84250-58150-B0	884-6A93	TOKAI RIKA	-
D	Back Camera	86790-62010	5XC300003	Panasonic	-
E	MIC	-	No.5	HOSIDEN	-
F	Speaker Dummy	-	-	-	-
G	Switch Board	-	-	-	-
H	FM Dummy with JASO	FM: 828-00064-D5KAI	FM: No. 15	-	-
I	DAB SMA Connector with DC Cut	-	DC Cut: No.7 DAB SMA Connector: No.8	-	-
J	iPod touch	A1367	C3RJ4SLADT75	Apple	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	USB Cable	3.0	Shielded	Shielded	-
3	Signal Cable	3.7	Unshielded	Unshielded	-
4	Signal Cable	3.5	Unshielded	Unshielded	-
5	Signal Cable	3.8	Unshielded	Unshielded	-
6	Signal Cable	4.0	Unshielded	Unshielded	-
7	Signal Cable	3.5	Unshielded	Unshielded	-
8	FM Cable	2.0	Shielded	Shielded	-
9	AC Cable	3.0	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 - 40000 MHz (Horn antenna)
Test distance : 3 m (30 MHz - 10000 MHz) / 1 m (10000 MHz - 40000 MHz)
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

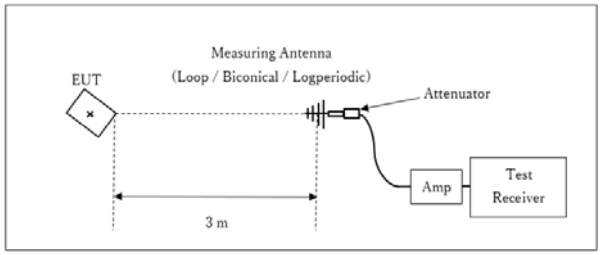
The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver.
The radiated emission 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 1 GHz	Above 1 GHz *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

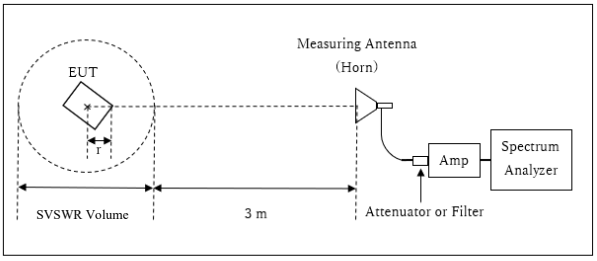
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

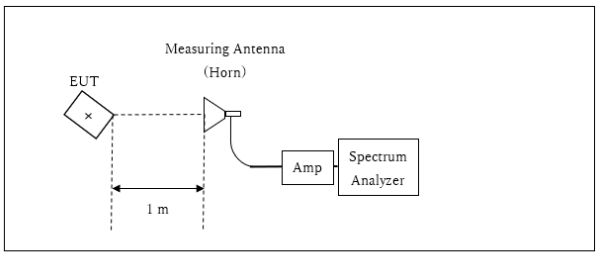


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.25 m*/3.0 m) = 0.70 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.25 m

SVSWR Volume: 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.75 m

10 GHz - 40 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 20, 2020 Test engineer: Ken Fujita

SECTION 6: Antenna Terminal

6.1 Operating environment

Test place : No.2 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.
Photographs of the set up are shown in APPENDIX 3.

6.3 Test conditions

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

6.4 Test procedure

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

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

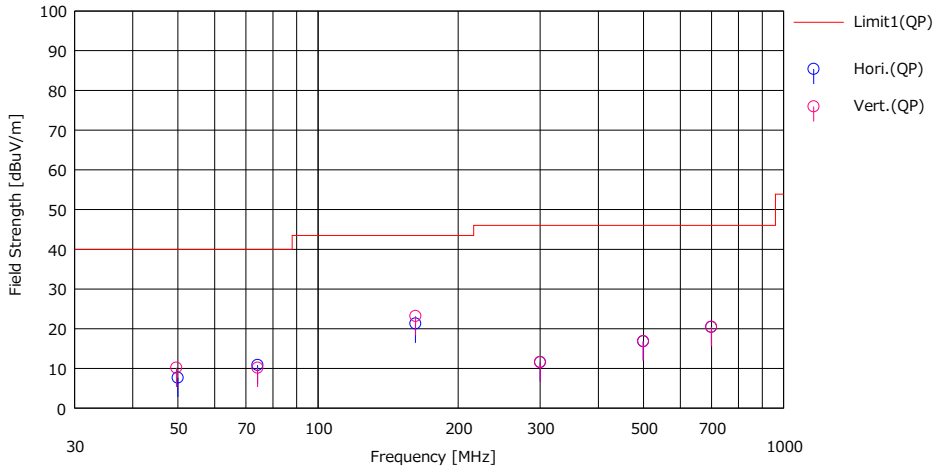
Date: June 19, 2020 Test engineer: Ken Fujita

APPENDIX 1: Test data

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Below 1 GHz)
Mode	Mode 1

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading (QP)	Ant.Fac	Loss	Gain	Result (QP)	Limit (QP)	Margin (QP)	Pola.	Height	Angle	Ant. Type	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]		
1	50.001	21.00	11.15	7.47	31.97	7.65	40.00	32.35	Hori.	100	0	BA	
2	74.183	28.60	6.40	7.80	31.95	10.85	40.00	29.15	Hori.	226	24	BA	
3	161.932	29.00	15.47	8.67	31.85	21.29	43.50	22.21	Hori.	199	340	BA	
4	300.120	20.10	13.50	9.72	31.75	11.57	46.00	34.43	Hori.	100	0	LA23	
5	499.579	20.10	17.68	10.92	31.87	16.83	46.00	29.17	Hori.	100	0	LA23	
6	699.358	20.80	19.78	11.95	32.08	20.45	46.00	25.55	Hori.	100	0	LA23	
7	49.651	23.40	11.28	7.46	31.97	10.17	40.00	29.83	Vert.	100	21	BA	
8	74.190	27.90	6.40	7.80	31.95	10.15	40.00	29.85	Vert.	100	35	BA	
9	161.981	30.90	15.47	8.67	31.85	23.19	43.50	20.31	Vert.	100	267	BA	
10	300.022	20.10	13.50	9.72	31.75	11.57	46.00	34.43	Vert.	100	0	LA23	
11	499.665	20.10	17.69	10.92	31.87	16.84	46.00	29.16	Vert.	100	0	LA23	
12	699.332	20.80	19.78	11.95	32.08	20.45	46.00	25.55	Vert.	100	0	LA23	

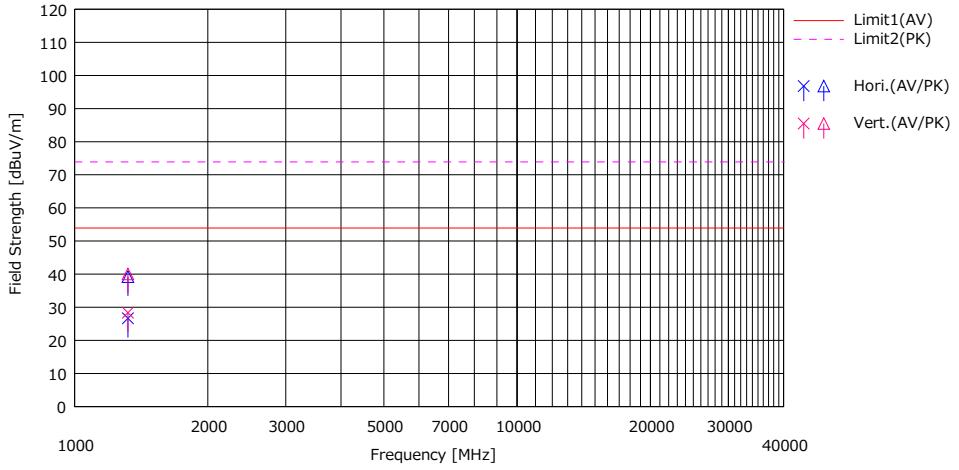
Except for the above table: adequate margin data below the limits.

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))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(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	1320.003	32.50	45.10	25.57	2.41	33.83	26.65	39.25	53.90	73.90	27.25	34.65	Hori.	130	131	H21	
2	1319.998	34.20	45.90	25.57	2.41	33.83	28.35	40.05	53.90	73.90	25.55	33.85	Vert.	214	176	H21	

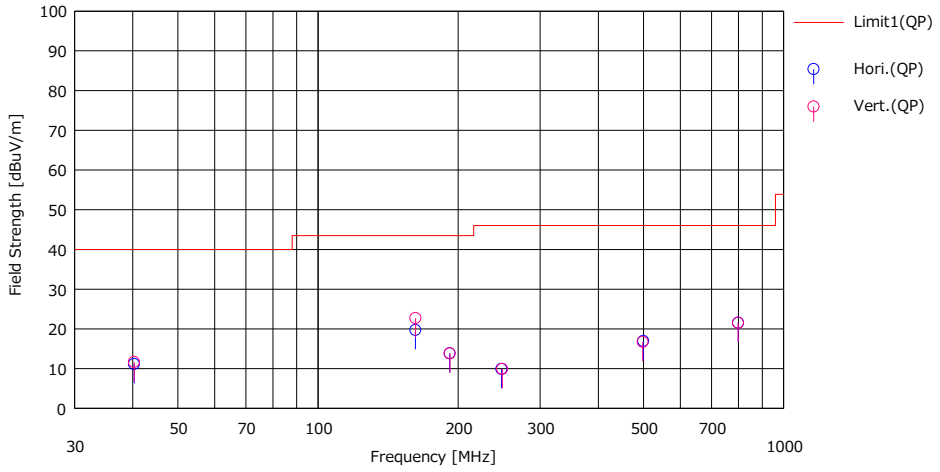
Except for the above table: adequate margin data below the limits.

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 + D-FACTOR) - GAIN(AMP))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Below 1 GHz)
Mode	Mode 2 (Other)

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	40.289	21.10	14.70	7.32	31.98	11.14	40.00	28.86	Hori.	100	0	BA	
2	161.966	27.40	15.47	8.67	31.85	19.69	43.50	23.81	Hori.	190	131	BA	
3	191.843	20.30	16.43	8.91	31.83	13.81	43.50	29.69	Hori.	100	0	BA	
4	247.865	20.50	11.78	9.36	31.79	9.85	46.00	36.15	Hori.	100	0	LA23	
5	499.860	20.20	17.69	10.92	31.87	16.94	46.00	29.06	Hori.	100	0	LA23	
6	799.351	19.90	20.78	12.42	31.59	21.51	46.00	24.49	Hori.	100	0	LA23	
7	40.277	21.60	14.71	7.32	31.98	11.65	40.00	28.35	Vert.	183	352	BA	
8	161.990	30.40	15.47	8.67	31.85	22.69	43.50	20.81	Vert.	100	69	BA	
9	191.987	20.30	16.45	8.91	31.83	13.83	43.50	29.67	Vert.	100	0	BA	
10	248.802	20.50	11.80	9.37	31.79	9.88	46.00	36.12	Vert.	100	0	LA23	
11	498.373	20.00	17.67	10.91	31.87	16.71	46.00	29.29	Vert.	100	0	LA23	
12	798.483	19.90	20.78	12.41	31.59	21.50	46.00	24.50	Vert.	100	0	LA23	

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

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))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
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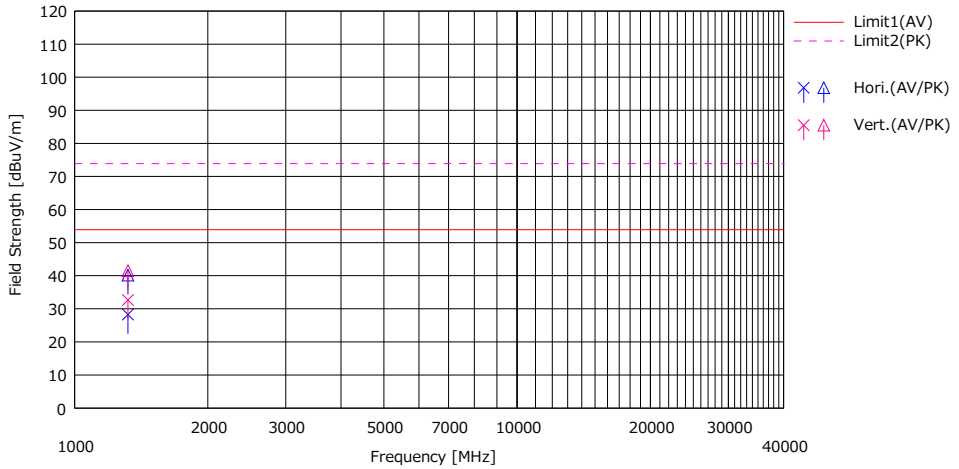
Engineer	Ken Fujita
	(Above 1 GHz)
Mode	Mode 2 (Other)

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	1320.274	34.10	46.00	25.57	2.41	33.82	28.26	40.16	53.90	73.90	25.64	33.74	Hori.	135	126	H21	
2	1319.995	38.50	47.40	25.57	2.41	33.83	32.65	41.55	53.90	73.90	21.25	32.35	Vert.	211	342	H21	

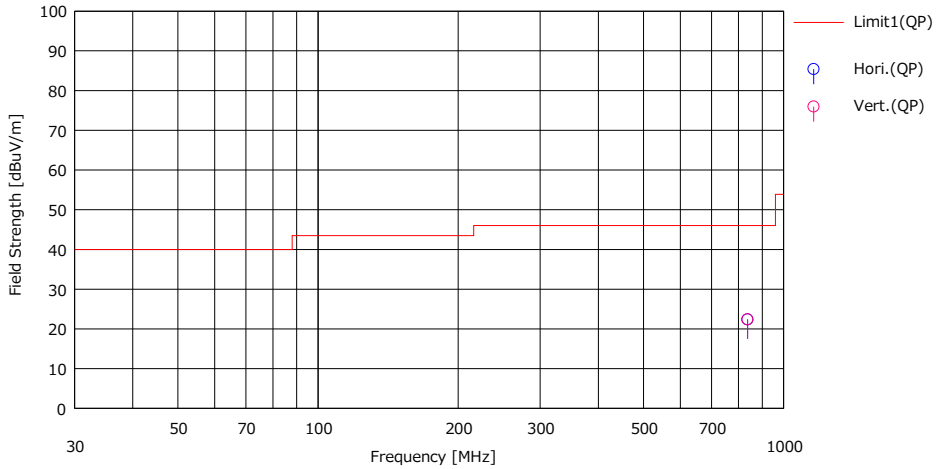
Except for the above table: adequate margin data below the limits.

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 + D-FACTOR) - GAIN(AMP))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Below 1 GHz)
Mode	Mode 2 (Local)

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	836.965	20.10	21.10	12.55	31.40	22.35	46.00	23.65	Hori.	100	0	LA23	
2	836.965	20.10	21.10	12.55	31.40	22.35	46.00	23.65	Vert.	100	0	LA23	

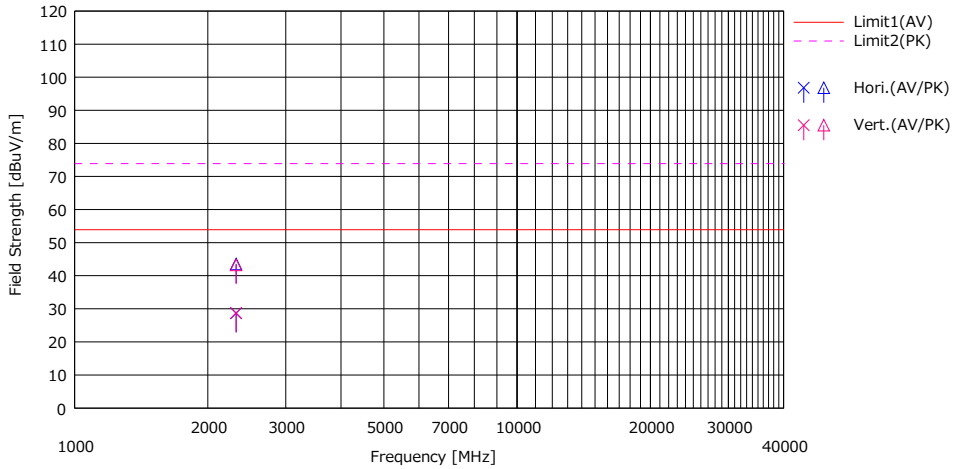
Except for the above table: adequate margin data below the limits.

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))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Above 1 GHz)
Mode	Mode 2 (Local)

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	2317.069	29.50	44.40	28.05	3.02	31.90	28.67	43.57	53.90	73.90	25.23	30.33	Hori.	100	50	H21	
2	2317.069	29.60	44.10	28.05	3.02	31.90	28.77	43.27	53.90	73.90	25.13	30.63	Vert.	100	159	H21	

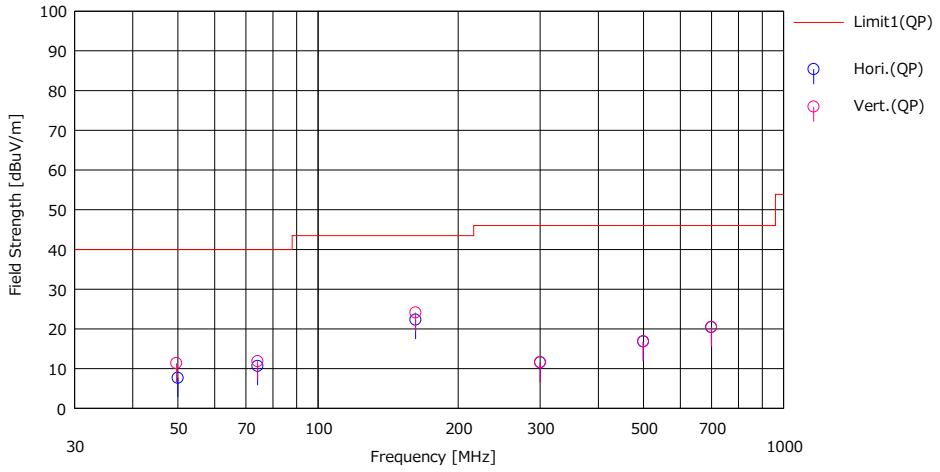
Except for the above table: adequate margin data below the limits.

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 + D-FACTOR) - GAIN(AMP))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Below 1 GHz)
Mode	Mode 3

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	50.001	21.00	11.15	7.47	31.97	7.65	40.00	32.35	Hori.	100	0	BA	
2	74.201	28.40	6.40	7.80	31.95	10.65	40.00	29.35	Hori.	244	45	BA	
3	162.020	30.00	15.47	8.67	31.85	22.29	43.50	21.21	Hori.	195	33	BA	
4	300.120	20.10	13.50	9.72	31.75	11.57	46.00	34.43	Hori.	100	0	LA23	
5	499.579	20.10	17.68	10.92	31.87	16.83	46.00	29.17	Hori.	100	0	LA23	
6	699.358	20.80	19.78	11.95	32.08	20.45	46.00	25.55	Hori.	100	0	LA23	
7	49.651	24.60	11.28	7.46	31.97	11.37	40.00	28.63	Vert.	100	353	BA	
8	74.190	29.60	6.40	7.80	31.95	11.85	40.00	28.15	Vert.	100	25	BA	
9	161.990	31.80	15.47	8.67	31.85	24.09	43.50	19.41	Vert.	100	325	BA	
10	300.022	20.10	13.50	9.72	31.75	11.57	46.00	34.43	Vert.	100	0	LA23	
11	499.665	20.10	17.69	10.92	31.87	16.84	46.00	29.16	Vert.	100	0	LA23	
12	699.332	20.80	19.78	11.95	32.08	20.45	46.00	25.55	Vert.	100	0	LA23	

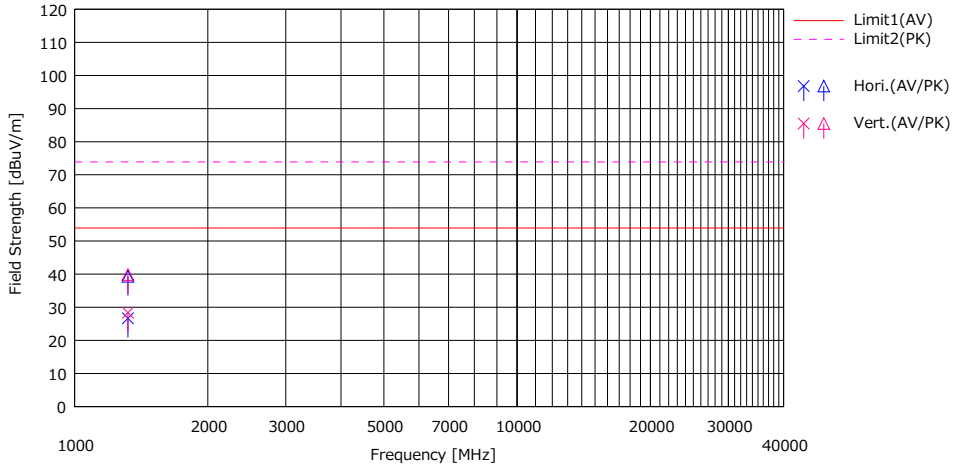
Except for the above table: adequate margin data below the limits.

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))

Radiated emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 20, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Ken Fujita
	(Above 1 GHz)
Mode	Mode 3

Limit : FCC_Part 15 Subpart B(15.109)_Class B



No.	Freq.	Reading		Ant.Fac	Loss	Gain	Result		Limit		Margin		Pola.	Height	Angle	Ant. Type	Comment
		(AV)	(PK)				(AV)	(PK)	(AV)	(PK)	(AV)	(PK)					
	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	[H/V]	[cm]	[deg]		
1	1320.012	32.50	45.20	25.57	2.41	33.83	26.65	39.35	53.90	73.90	27.25	34.55	Hori.	130	145	H21	
2	1319.989	34.20	45.70	25.57	2.41	33.83	28.35	39.85	53.90	73.90	25.55	34.05	Vert.	210	177	H21	

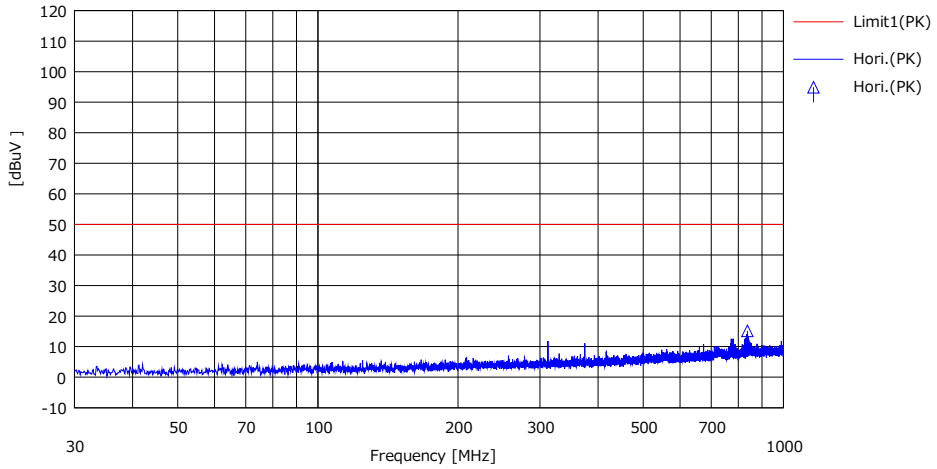
Except for the above table: adequate margin data below the limits.

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 + D-FACTOR) - GAIN(AMP))

Antenna Terminal Conducted Emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 19, 2020
Temperature / Humidity	23 deg. C /54 % RH
Engineer	Ken Fujita
	(Below 1 GHz)
Mode	Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBuV]	Limit*1) (PK) [dBuV]	Margin (PK) [dB]	Pola.	Height [cm]	Angle [deg]	Ant. Type	Comment
1	836.965	34.03	0.00	12.55	31.40	15.18	50.00	34.82					104.30MHz

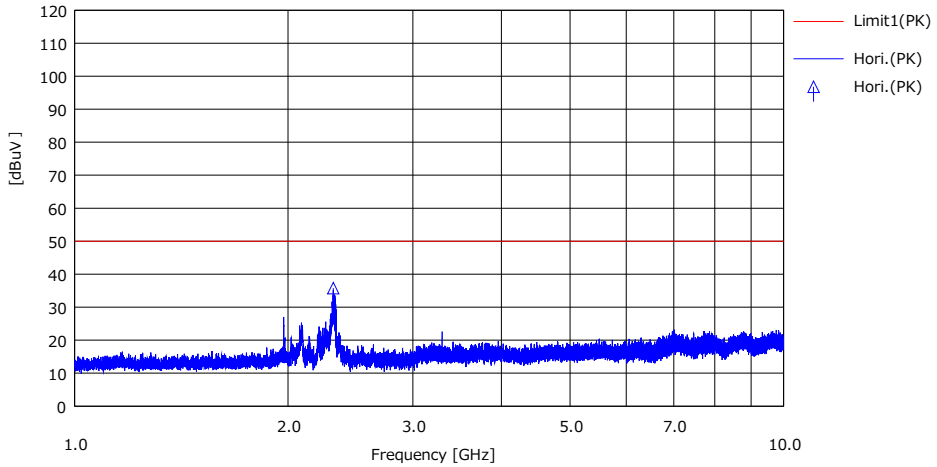
Except for the above table: adequate margin data below the limits.

CHART: WITH FACTOR
CALCULATION: RESULT = READING + LOSS (CABLE + ATT) - GAIN(AMP))
*1) 2 nW = -57 dBm = 50 dBuV

Antenna Terminal Conducted Emission

Report No.	13198340H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 19, 2020
Temperature / Humidity	23 deg. C /54 % RH
Engineer	Ken Fujita
	(1 GHz - 10 GHz)
Mode	Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading (PK) [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result (PK) [dBuV]	Limit*1) (PK) [dBuV]	Margin (PK) [dB]	Pola.	Height [cm]	Angle [deg]	Ant. Type	Comment
1	2317.069	58.53	0.00	3.41	26.17	35.77	50.00	14.23					

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

CHART: WITH FACTOR
CALCULATION: RESULT = READING + LOSS (CABLE + ATT) - GAIN(AMP))
*1) 2 nW = -57 dBm = 50 dBuV

*The test was performed up to 40 GHz, and 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
AT/RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
AT/RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
AT/RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
AT/RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
AT	MCC-241	196413	Microwave Cable	Huber+Suhner	SF101EA/11PC24/ 11PC24/2500MM	SN 800094/1EA	02/27/2020	12
AT	MCC-242	196409	Microwave Cable	HUBER+SUNER	SF101EA/11PC24/ 11PC24/2500MM	SN 800093/1EA	02/27/2020	12
AT	MPA-03	141577	Microwave System Power Amplifier	Keysight Technologies Inc	83050A	MY39500610	10/01/2019	12
AT/RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
AT/RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	03/24/2020	12
AT/RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2020	12
AT/RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/04/2020	12
AT/RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/02/2019	12
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
RE	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 / 1871328	09/27/2019	12
RE	MHA-29	141517	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	152399	09/19/2019	12
RE	MCC-224	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	11/22/2019	12
RE	MSG-14	141894	Signal Generator	Rohde & Schwarz	SMC100A	1411.4002k02	10/04/2019	12
RE	MTA-54	141936	Terminator	TME	CT-01BP	-	12/02/2019	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 test