



# EMI TEST REPORT


Test Report No. : 12812450H-B

**Applicant** : DENSO TEN Limited  
**Type of Equipment** : Car Audio  
**Model No.** : FT0093A  
**FCC ID** : BABFT0093A  
**Test regulation** : FCC Part 15 Subpart B: 2018 Class B  
ICES-003 Issue 6: 2016 + Amendment 1: 2017 Class B  
**Test Result** : Complied (Refer to SECTION 3.2)

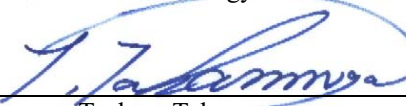
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers 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. The information provided from the customer for this report is identified in SECTION 1.

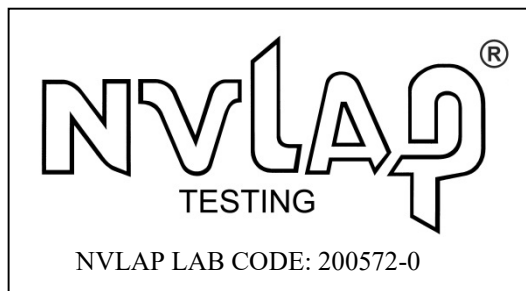
**Date of test:** April 12 and 13, 2019

**Representative test engineer:**

  
Akihiko Maeda  
Engineer  
Consumer Technology Division

**Approved by:**

  
Tsubasa Takayama  
Leader  
Consumer Technology Division



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. \*As for the range of Accreditation in NVLAP, you may refer to the WEB address, [http://japan.ul.com/resources/emc\\_accruited/](http://japan.ul.com/resources/emc_accruited/)

- 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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## **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  
Facsimile Number : +81-78-671-7160  
Contact Person : Daisuke Fukii

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No. and FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. 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 (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : Car Audio  
Model No. : FT0093A  
Serial No. : Refer to SECTION 4.2  
Rating : DC 12.0 V  
Receipt Date of Sample : April 1, 2019  
(Information from test lab.)  
Country of Mass-production : Thailand  
Condition of EUT : Engineering 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: FT0093A (referred to as the EUT in this report) is a Car Audio.

### **General Specification**

Clock frequency(ies) in the system : 26MHz

### **Radio Specification**

#### **[Bluetooth (Ver. 2.1 with EDR function)]**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz to 2480 MHz  
Modulation : FHSS  
Antenna type : Inverted - F PCB antenna  
Antenna Gain : -7.8 dBi

#### **[Broadcast Receiver]**

Radio Type : Receiver  
Frequency of Operation : AM: 530 kHz - 1710 kHz  
FM: 87.75 MHz - 107.9 MHz

Channel spacing : AM: 10 kHz

FM: 0.2 MHz

Antenna connector type : JASO D501-89

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### **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	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	Class B	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	Class B	N/A	6.22 dB 455.905 MHz, Horizontal, QP (Mode 2)	Complied a)	-
Antenna Terminal	FCC: ANSI C63.4: 2014 12. Measurement of unintentional radiators other than ITE IEEE 187:2003 ----- IC: -	Class B	N/A	18.35 dB 5457.440 MHz	Complied b)	-
<p>*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.</p> <p>a) Refer to APPENDIX 1 (data of Radiated Emission)  b) Refer to APPENDIX 1 (data of Antenna Terminal Conducted Emission)</p>						
<p>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.</p>						

#### **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) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.9 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 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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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, and Test set up

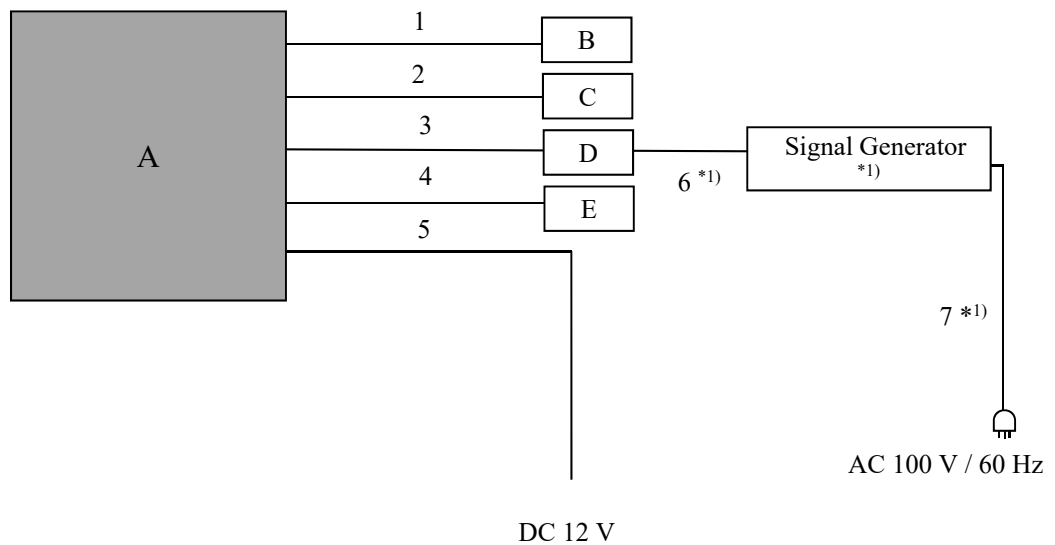
Refer to APPENDIX.

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

### 4.1 Operating Mode(s)

The mode(s) : 1. CD play mode : Radiated Emission test only  
2. USB play mode : Radiated Emission test only  
3. FM (Other) mode : Radiated Emission test only  
4. FM (Local) mode : Radiated Emission and Antenna Terminal tests)

### 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	Car Audio	FT0093A	BQ700001	DENSO TEN Limited	EUT
B	USB Memory	USM4GRB	-	SONY	-
C	Steering Switch	-	-	-	-
D	FM Dummy	828-00064-D5	-	-	-
E	Speaker	-	-	-	-

#### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	Signal Cable	0.9	Unshielded	Unshielded	-
3	BNC Cable(FM)	1.0	Shielded	Shielded	-
4	Speaker Cable	1.2	Unshielded	Unshielded	-
5	DC Cable	2.0	Unshielded	Unshielded	-
6	BNC Cable	1.5	Shielded	Shielded	*1)
7	AC Cable	1.9	Unshielded	Unshielded	*1)

\*1) Used only for Mode 3

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## **SECTION 5: Radiated Emission**

### **5.1 Operating environment**

Test place : No.3 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  
EUT position : Table top  
EUT operation mode : See Clause 4.1

### **5.4 Test procedure**

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

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

For Mode 3, test was performed under the condition that signal of FM 98.70 MHz from Signal Generator was input to the EUT.

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

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

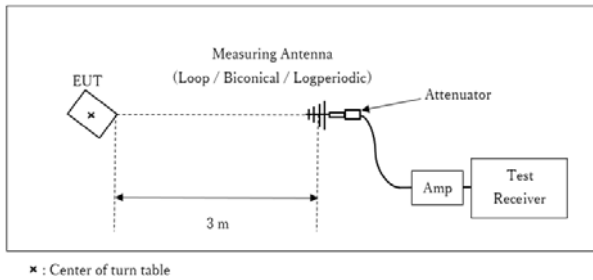
\*1) The measurement data was adjusted to a 3 m distance using the following Distance Factor.

Distance Factor:  $20 \times \log(3.1\text{m} / 3\text{m}) = 0.29\text{ dB}$

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

**Figure 2: Test Setup**

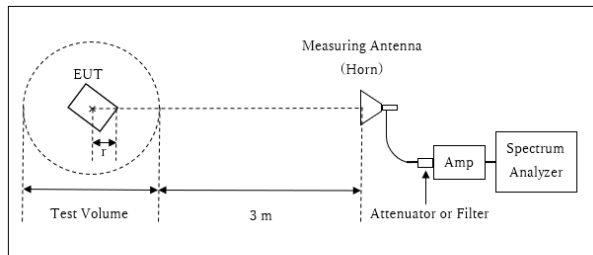
Below 1 GHz



× : 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:  $20 \times \log(3.1 \text{ m}^*/3.0 \text{ m}) = 0.29 \text{ dB}$

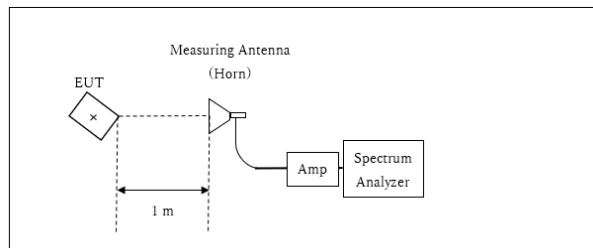
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.1 \text{ m}$

Test Volume: 2 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.9 \text{ m}$

10 GHz - 26.5 GHz



× : 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.

Date: April 12, 2019  
April 13, 2019

Test engineer: Akihiko Maeda  
Takafumi Noguchi

## **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. Photographs of the set up are shown in Appendix 3.

### **6.3 Test conditions**

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

### **6.4 Test procedure**

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

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

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

### **6.5 Test result**

Summary of the test results: Pass

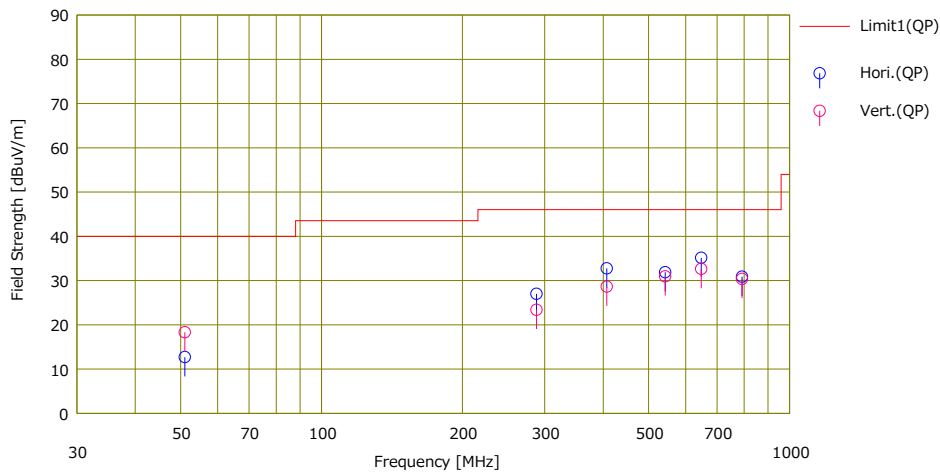
Date: April 12, 2019                      Test engineer: Akihiko Maeda  
          April 13, 2019                                           Takafumi Noguchi

**APPENDIX 1: Test data**

**Radiated Emission**

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 12, 2019  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Akihiko Maeda  
(Below 1 GHz)  
Mode Mode 1

Limit : FCC\_Part 15 Subpart B(15.109)\_Class B



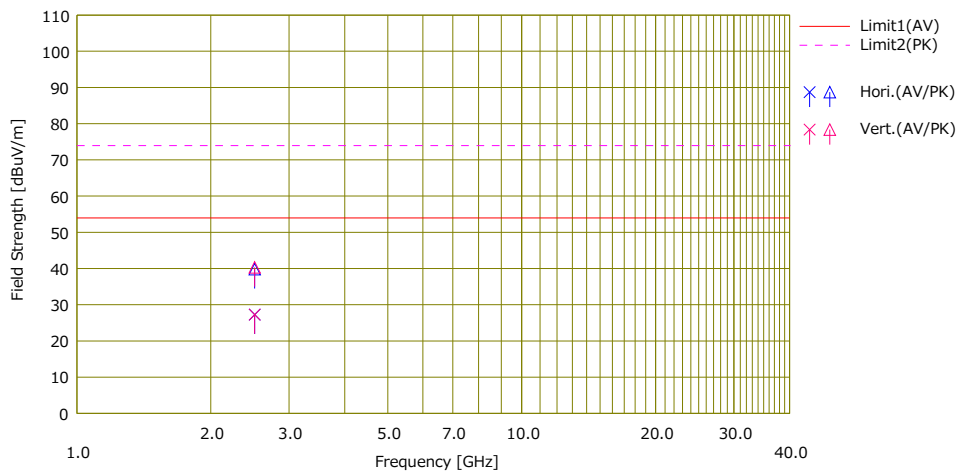
No.	Freq. [MHz]	Reading (QP)		Ant.Fac [dB]	Loss [dB]	Gain [dB]	Result (QP)		Limit (QP)	Margin (QP)	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBuV]	[dB/m]				[dBuV/m]	[dBuV/m]							
1	51.064	33.30	10.81	7.54	38.94	12.71	40.00	27.29	Hori.	389	221	BA			
2	287.998	42.60	13.33	9.98	38.92	26.99	46.00	19.01	Hori.	109	47	LA22			
3	407.007	44.60	15.90	10.85	38.61	32.74	46.00	13.26	Hori.	100	20	LA22			
4	542.676	40.90	17.72	11.72	38.47	31.87	46.00	14.13	Hori.	100	212	LA22			
5	648.004	41.90	19.28	12.34	38.38	35.14	46.00	10.86	Hori.	100	201	LA22			
6	791.990	35.30	20.81	13.12	38.35	30.88	46.00	15.12	Hori.	189	205	LA22			
7	51.064	38.90	10.81	7.54	38.94	18.31	40.00	21.69	Vert.	100	93	BA			
8	287.998	39.00	13.33	9.98	38.92	23.39	46.00	22.61	Vert.	100	202	LA22			
9	407.007	40.50	15.90	10.85	38.61	28.64	46.00	17.36	Vert.	144	158	LA22			
10	542.676	40.00	17.72	11.72	38.47	30.97	46.00	15.03	Vert.	113	337	LA22			
11	648.004	39.40	19.28	12.34	38.38	32.64	46.00	13.36	Vert.	123	157	LA22			
12	791.990	34.80	20.81	13.12	38.35	30.38	46.00	15.62	Vert.	120	198	LA22			

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

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 13, 2019  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Takafumi Noguchi  
(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	2510.828	31.13	43.69	27.58	2.77	34.22	27.26	39.82	54.00	74.00	26.74	34.18	Hori.	0	0	H20	
2	2510.828	31.14	44.18	27.58	2.77	34.22	27.27	40.31	54.00	74.00	26.73	33.69	Vert.	0	0	H20	

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)

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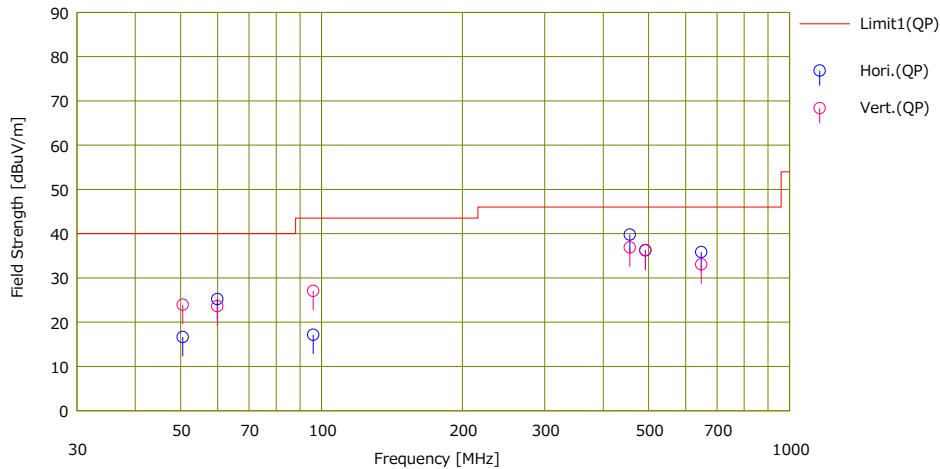
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Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 12, 2019  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Akihiko Maeda  
(Below 1 GHz)  
Mode Mode 2

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	Polz. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		[dBUV]				[dBUV/m]	[dBUV/m]	[dBUV/m]					
1	50.533	37.00	11.05	7.53	38.94	16.64	40.00	23.36	Hori.	400	214	BA	
2	59.920	48.20	8.30	7.68	38.97	25.21	40.00	14.79	Hori.	340	187	BA	
3	95.997	38.80	9.27	8.16	39.06	17.17	43.50	26.33	Hori.	247	217	BA	
4	455.905	50.60	16.58	11.18	38.58	39.78	46.00	6.22	Hori.	100	186	LA22	
5	492.004	45.90	17.45	11.41	38.55	36.21	46.00	9.79	Hori.	100	224	LA22	
6	647.994	42.60	19.28	12.34	38.38	35.84	46.00	10.16	Hori.	100	197	LA22	
7	50.533	44.30	11.05	7.53	38.94	23.94	40.00	16.06	Vert.	100	91	BA	
8	59.920	46.60	8.30	7.68	38.97	23.61	40.00	16.39	Vert.	100	269	BA	
9	95.997	48.70	9.27	8.16	39.06	27.07	43.50	16.43	Vert.	100	261	BA	
10	455.905	47.70	16.58	11.18	38.58	36.88	46.00	9.12	Vert.	100	248	LA22	
11	492.004	46.00	17.45	11.41	38.55	36.31	46.00	9.69	Vert.	100	248	LA22	
12	647.994	39.80	19.28	12.34	38.38	33.04	46.00	12.96	Vert.	100	193	LA22	

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))

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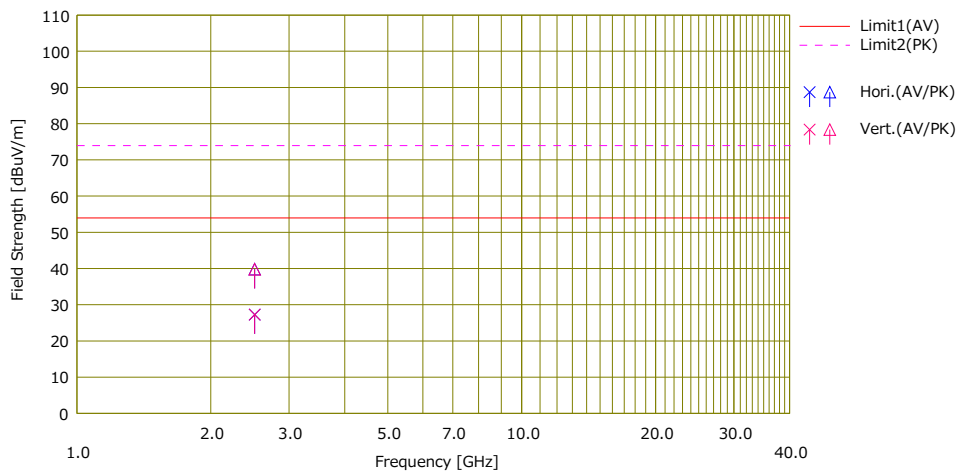
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Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 13, 2019  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Takafumi Noguchi  
(Above 1 GHz)  
Mode Mode 2

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	2510.828	31.14	43.71	27.58	2.77	34.22	27.27	39.84	54.00	74.00	26.73	34.16	Hori.	100	0	H2.0	
2	2510.828	31.14	43.66	27.58	2.77	34.22	27.27	39.79	54.00	74.00	26.73	34.21	Vert.	100	0	H2.0	

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)

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

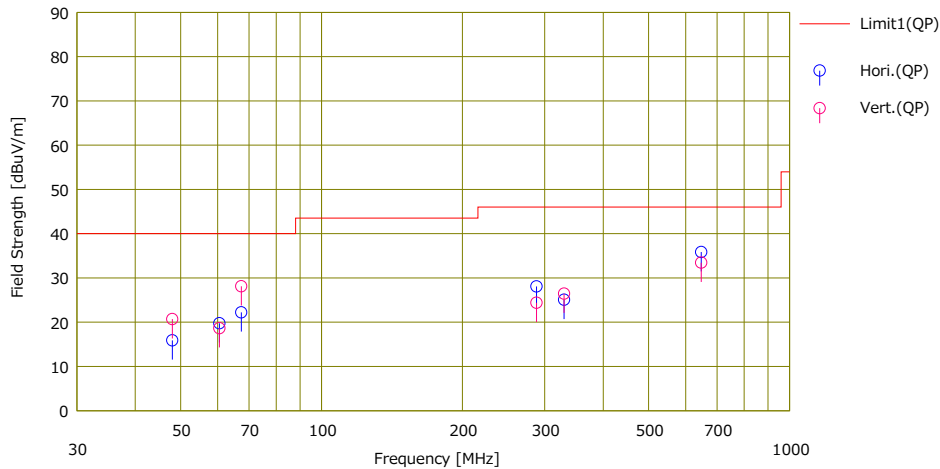
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 12, 2019  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Akihiko Maeda  
(Below 1 GHz)  
Mode Mode 3

Limit : FCC\_Part 15 Subpart B(15.109)\_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Margin [dB]	Polz. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(QP) [dBuV]	(QP) [dBuV/m]				(QP) [dBuV/m]	(QP) [dBuV/m]						
1	48.000	35.30	12.04	7.49	38.94	15.89	40.00	24.11	Hori.	341	288	BA		
2	60.496	42.90	8.13	7.69	38.97	19.75	40.00	20.25	Hori.	351	132	BA		
3	67.384	46.50	6.93	7.78	38.99	22.22	40.00	17.78	Hori.	275	171	BA		
4	287.996	43.70	13.33	9.98	38.92	28.09	46.00	17.91	Hori.	100	41	LA22		
5	329.997	39.00	14.57	10.30	38.81	25.06	46.00	20.94	Hori.	174	32	LA22		
6	647.993	42.60	19.28	12.34	38.38	35.84	46.00	10.16	Hori.	100	205	LA22		
7	48.000	40.10	12.04	7.49	38.94	20.69	40.00	19.31	Vert.	100	215	BA		
8	60.496	41.80	8.13	7.69	38.97	18.65	40.00	21.35	Vert.	100	240	BA		
9	67.384	52.40	6.93	7.78	38.99	28.12	40.00	11.88	Vert.	100	270	BA		
10	287.996	40.00	13.33	9.98	38.92	24.39	46.00	21.61	Vert.	100	198	LA22		
11	329.997	40.40	14.57	10.30	38.81	26.46	46.00	19.54	Vert.	100	65	LA22		
12	647.993	40.20	19.28	12.34	38.38	33.44	46.00	12.56	Vert.	112	157	LA22		

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))

**UL Japan, Inc.**

**Ise EMC Lab.**

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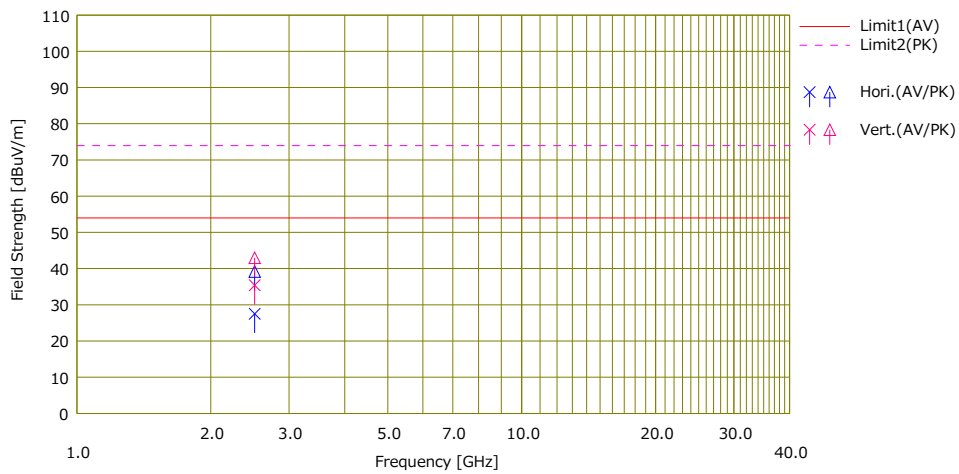
Facsimile : +81 596 24 8124



## Radiated Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 13, 2019  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Takafumi Noguchi  
(Above 1 GHz)  
Mode Mode 3

Limit : FCC\_Part 15 Subpart B(15.109)\_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Limit		Margin		Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(AV) [dBuV]	(PK) [dBuV]				(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dBuV/m]	(PK) [dBuV/m]	(AV) [dB]	(PK) [dB]					
1	2510.828	31.40	43.07	27.58	2.77	34.22	27.53	39.20	54.00	74.00	26.47	34.80	Hori.	100	0	H20	
2	2510.828	39.26	46.84	27.58	2.77	34.22	35.39	42.97	54.00	74.00	18.61	31.03	Vert.	146	337	H20	

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)

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**Ise EMC Lab.**

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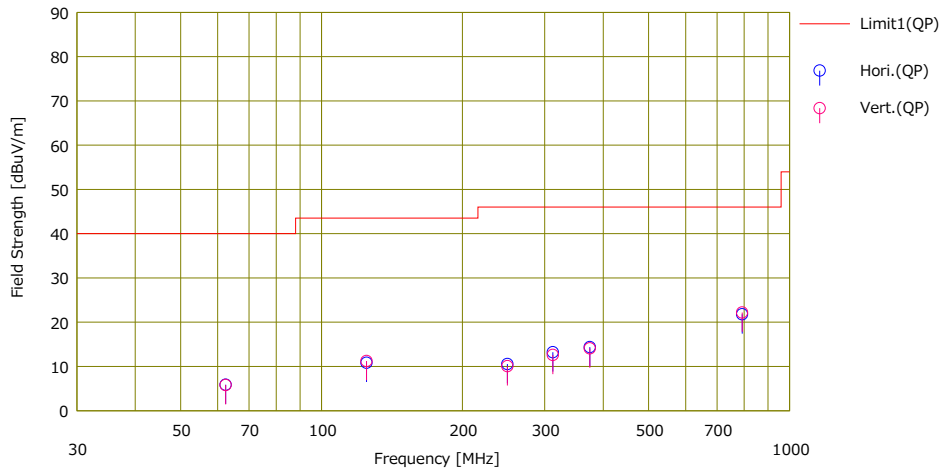
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 12, 2019  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Akihiko Maeda  
(Below 1 GHz)  
Mode Mode 4

Limit : FCC\_Part 15 Subpart B(15.109)\_Class B



No.	Freq. [MHz]	Reading		Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result		Margin [dB]	Pola. [H/V]	Height [cm]	Angle [deg]	Ant. Type	Comment
		(QP) [dBuV]	(QP) [dBuV/m]				(QP) [dBuV/m]	(QP) [dBuV/m]						
1	62.398	29.50	7.63	7.72	38.98	5.87	40.00	34.13	Hori.	300	188	BA		
2	124.799	28.00	13.43	8.49	39.09	10.83	43.50	32.67	Hori.	300	117	BA		
3	249.600	28.20	11.67	9.67	39.00	10.54	46.00	35.46	Hori.	100	296	LA22		
4	312.000	27.90	13.98	10.17	38.86	13.19	46.00	32.81	Hori.	100	34	LA22		
5	374.400	27.40	15.04	10.63	38.69	14.38	46.00	31.62	Hori.	100	151	LA22		
6	792.087	26.20	20.81	13.12	38.35	21.78	46.00	24.22	Hori.	100	57	LA22		
7	62.398	29.40	7.63	7.72	38.98	5.77	40.00	34.23	Vert.	100	64	BA		
8	124.799	28.40	13.43	8.49	39.09	11.23	43.50	32.27	Vert.	100	64	BA		
9	249.600	27.70	11.67	9.67	39.00	10.04	46.00	35.96	Vert.	100	3	LA22		
10	312.000	27.30	13.98	10.17	38.86	12.59	46.00	33.41	Vert.	100	9	LA22		
11	374.400	27.10	15.04	10.63	38.69	14.08	46.00	31.92	Vert.	100	1	LA22		
12	792.087	26.60	20.81	13.12	38.35	22.18	46.00	23.82	Vert.	100	347	LA22		

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))

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**Ise EMC Lab.**

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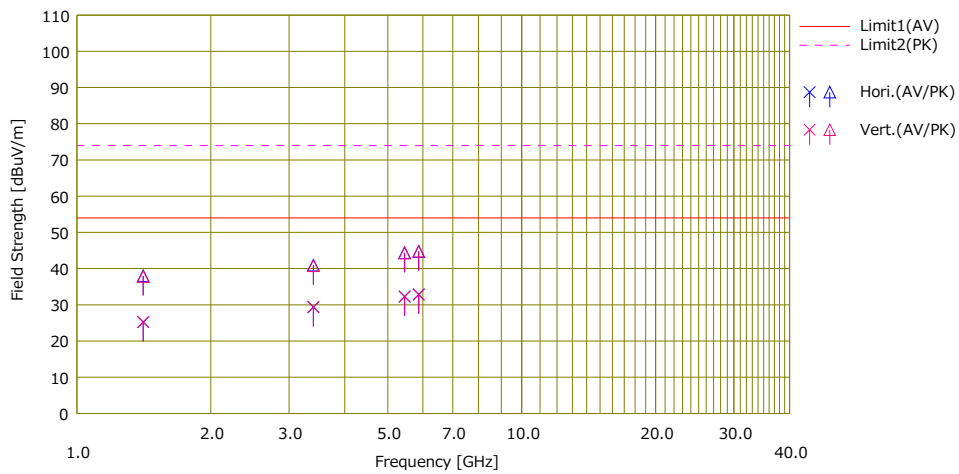
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 13, 2019  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Takafumi Noguchi  
(Above 1 GHz)  
Mode Mode 4

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	1409.479	32.60	45.40	25.47	2.11	34.98	25.20	38.00	54.00	74.00	28.80	36.00	Hori.	100	0	H2O	
2	3400.916	31.27	42.87	28.72	3.19	33.82	29.36	40.96	54.00	74.00	24.64	33.04	Hori.	100	0	H2O	
3	5457.440	29.82	41.99	31.65	4.01	33.23	32.25	44.42	54.00	74.00	21.75	29.58	Hori.	100	0	H2O	
4	5868.747	29.77	41.60	32.26	4.16	33.32	32.87	44.70	54.00	74.00	21.13	29.30	Hori.	100	0	H2O	
5	1409.479	32.67	45.22	25.47	2.11	34.98	25.27	37.82	54.00	74.00	28.73	36.18	Vert.	100	0	H2O	
6	3400.916	31.28	42.67	28.72	3.19	33.82	29.37	40.76	54.00	74.00	24.63	33.24	Vert.	100	0	H2O	
7	5457.440	29.84	41.82	31.65	4.01	33.23	32.27	44.25	54.00	74.00	21.73	29.75	Vert.	100	0	H2O	
8	5868.747	29.71	41.72	32.26	4.16	33.32	32.81	44.82	54.00	74.00	21.19	29.18	Vert.	100	0	H2O	

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)

**UL Japan, Inc.**

**Ise EMC Lab.**

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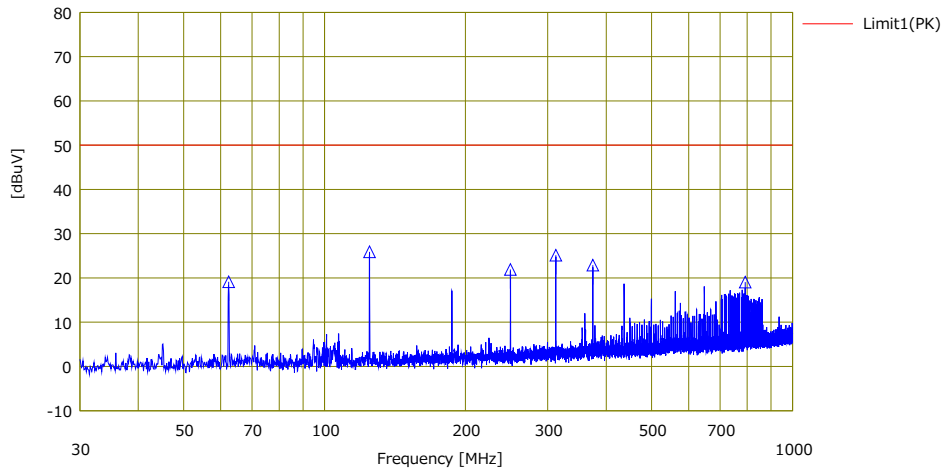
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Antenna Terminal Conducted Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 12, 2019  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Akihiko Maeda  
(Below 1 GHz)  
Mode Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result	Limit	Margin	Pola. [H/V]	Ant. Type	Comment
		(PK) [dBuV]				(PK) [dBuV]	(PK) [dB]				
1	62.398	50.30	0.00	7.81	38.98	19.13	50.00	30.87	-	-	
2	124.799	56.40	0.00	8.60	39.09	25.91	50.00	24.09	-	-	
3	249.600	51.10	0.00	9.81	39.00	21.91	50.00	28.09	-	-	
4	312.000	53.70	0.00	10.31	38.86	25.15	50.00	24.85	-	-	
5	374.400	50.80	0.00	10.77	38.69	22.88	50.00	27.12	-	-	
6	792.087	44.10	0.00	13.29	38.35	19.04	50.00	30.96	-	-	FM 98.70 MHz

Limit: 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

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

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

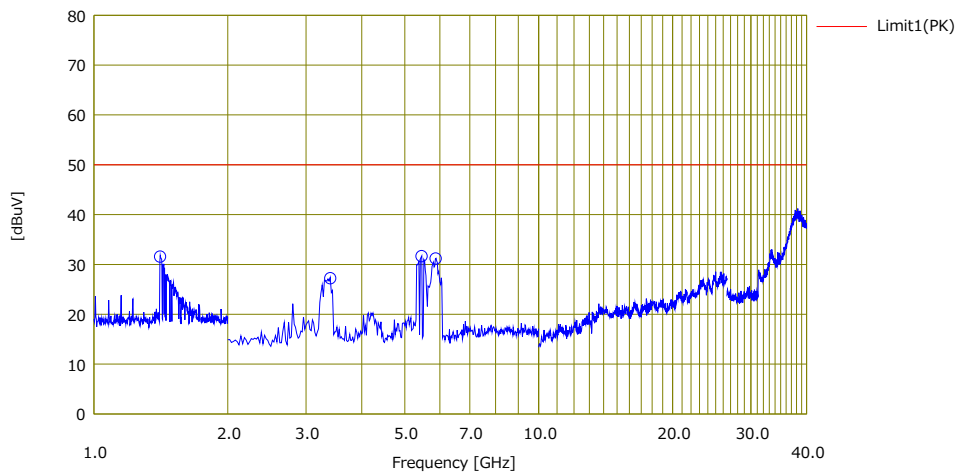
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Antenna Terminal Conducted Emission

Report No. 12812450H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date April 13, 2019  
Temperature / Humidity 23 deg. C / 36 % RH  
Engineer Takafumi Noguchi  
(Above 1 GHz)  
Mode Mode 4

Limit : FCC15.111 Antenna terminal measurement



No.	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV]	Limit	Margin	Pola. [H/V]	Ant. Type	Comment
							(PK) [dBuV]	(PK) [dB]			
1	1409.479	58.57	0.00	7.98	34.98	31.57	50.00	18.43	-	-	
2	3400.916	56.34	0.00	4.70	33.82	27.22	50.00	22.78	-	-	
3	5457.440	59.36	0.00	5.52	33.23	31.65	50.00	18.35	-	-	
4	5868.747	58.83	0.00	5.67	33.32	31.18	50.00	18.82	-	-	

Limit: 2 nW = -57 dBm = 50 dBuV

CHART: WITH FACTOR

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

**UL Japan, Inc.**

**Ise EMC Lab.**

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## **APPENDIX 2: Test instruments**

### **Test Instruments**

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/06/2018	04/30/2019	12
RE/AT	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	03/05/2019	03/31/2020	12
RE	148897	Attenuator	KEYSIGHT	8491A	MY52462349	12/20/2018	12/31/2019	12
RE/AT	141579	Pre Amplifier	AGILENT	8449B	3008A02142	01/21/2019	01/31/2020	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	06/07/2018	06/30/2019	12
RE/AT	141899	Spectrum Analyzer	AGILENT	E4448A	MY46180655	08/10/2018	08/31/2019	12
RE/AT	141550	Matching Pad Anritsu	ANRITSU	MB-009	40063	07/18/2018	07/31/2019	12
RE/AT	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	02/08/2019	02/29/2020	12
RE/AT	141323	Coaxial cable	UL Japan	-	-	07/03/2018	07/31/2019	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	03/25/2019	03/31/2020	12
RE	141424	Biconical Antenna	Schwarzbeck	BBA9106	1915	06/04/2018	06/30/2019	12
RE/AT	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/06/2018	08/31/2019	12
RE/AT	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE/AT	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE/AT	141547	DIGITAL HiTESTER	HIOKI	3805	60500120	02/25/2019	02/29/2020	12
RE/AT	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/11/2019	01/31/2020	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/26/2018	06/30/2020	24
RE	141517	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	152399	06/08/2018	06/30/2019	12
RE	141513	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	06/07/2018	06/30/2019	12
RE	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	11/08/2018	11/30/2019	12
RE/AT	141325	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	03/04/2019	03/31/2020	12
RE/AT	141577	Microwave System Power Amplifier	AGILENT	83050A	MY39500610	10/04/2018	10/31/2019	12
RE	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P/AMF-4F-2600	1871355 / 1871328	09/21/2018	09/30/2019	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

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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