



# RADIO TEST REPORT

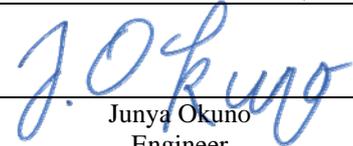
**Test Report No. : 13582538H-A**

**Applicant** : TOYOTA MOTOR CORPORATION  
**Type of EUT** : Smart LF Oscillator  
**Model Number of EUT** : TMLF19D-2  
**FCC ID** : NI4TMLF19D-2  
**Test regulation** : FCC Part 15 Subpart C: 2020  
**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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio 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.

**Date of test:** November 19 to December 2, 2020

**Representative test engineer:**

  
Junya Okuno  
Engineer

Consumer Technology Division

**Approved by:**

  
Motoya Imura  
Leader

Consumer Technology Division



CERTIFICATE 5107.02

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

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## **REVISION HISTORY**

**Original Test Report No.: 13582538H-A**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13582538H-A	December 21, 2020	-	-

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## Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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## **SECTION 1: Customer information**

Company Name : TOYOTA MOTOR CORPORATION  
Address : 1, Toyota-Cho, Toyota, Aichi, 471-8572 Japan  
Telephone Number : +81-565-94-0902  
Facsimile Number : +81-565-94-1161  
Contact Person : Shinji Suganuma

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 : Smart LF Oscillator  
Model Number : TMLF19D-1  
Serial Number : Refer to SECTION 4.2  
Rating : DC 12.0 V (Max 0.5 A)  
Receipt Date : October 29, 2020  
Country of Mass-production : Japan  
Condition : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification : No Modification by the test lab

### **2.2 Product Description**

Smart LF Oscillator, model: TMLF19D-2 is a transmitter that is installed in a motor vehicle and is used as part of Smart System.

### **Radio Specification**

Radio Type : Transmitter  
Frequency of Operation : 134.2 kHz  
Modulation : ASK  
Antenna type : Ferrite Antenna Coil (for Outside Antenna, Inside Antenna, Rear Antenna)  
Loop Antenna Coil (for Immobilizer Antenna)

Smart LF Oscillator (model: TMLF19D-2) consists of the following parts:

- Smart ECU
- Immobilizer Antenna
- Inside Antenna
- Outside Antenna
- Rear Antenna

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### **SECTION 3: Test specification, procedures & results**

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on October 13, 2020

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.209 Radiated emission limits; general requirements.

#### **3.2 Procedures and results**

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
Conducted Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 8.8	<FCC> Section 15.207 <ISED> RSS-Gen 8.8	-	N/A	N/A	N/A *1)
Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.12	<FCC> Section 15.209 <ISED> RSS-210 7.2 RSS-Gen 8.9	Radiated	N/A	4.9 dB 134.2 kHz, 0 deg. Peak with Duty factor <Mode 5>	Complied a)
Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> RSS-Gen 6.5, 6.6, 6.13	<FCC> Section 15.209 <ISED> RSS-210 7.3 RSS-Gen 8.9	Radiated	N/A	12.3 dB 30.176 MHz, Vertical, QP <Mode 1>	Complied a)
-26 dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <ISED> -	<FCC> Reference data <ISED> -	Radiated	N/A	N/A	Complied b)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.  
\*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

a) Refer to APPENDIX 1 (data of Radiated emission)  
b) Refer to APPENDIX 1 (data of -26 dB Bandwidth and 99 % Occupied Band Width)

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.

#### **FCC Part 15.31 (e)**

The EUT provides stable voltage constantly to the wireless transmitter regardless of input voltage.  
Instead of a new battery, DC power supply was used for the test.  
That does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
99 % Occupied Band Width	RSS-Gen 6.7	-	Radiated	N/A	N/A	-

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

Other than above, 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 following 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	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
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
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		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
10 m	1 GHz to 18 GHz	5.2 dB

#### Antenna Terminal test

Test Item	Uncertainty (+/-)
-26 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %

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### 3.5 Test Location

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

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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 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.

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## SECTION 4: Operation of EUT during testing

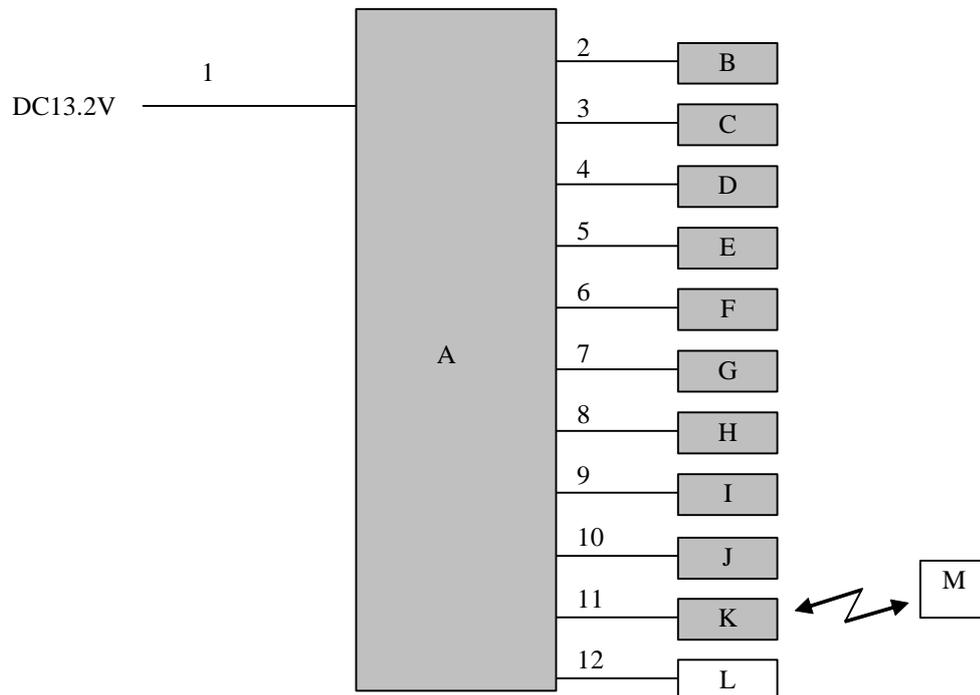
### 4.1 Operating Modes

Test mode	Remarks *1)
1) Tx 134.2 kHz Outside Antenna	Section 2 of Timing of transmission
2) Tx 134.2 kHz Inside Antenna	Section 2 of Timing of transmission
3) Tx 134.2 kHz Rear Antenna	Section 2 of Timing of transmission
4) Tx 134.2 kHz Immobilizer Antenna	Section 3 of Timing of transmission
5) Tx 134.2 kHz, Outside antenna B+C+D+E and Rear antenna I+J	Section 1 of Timing of transmission
* EUT was set by the software as follows; Software: 19CY_IDT_denpa_v01_200721 Version 01 (Date: 2020.7.21, Storage location: EUT memory)  *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

Justification : The system was configured in typical fashion (as a user would normally use it) for testing.

\*1) Refer to Timing of transmission in "Theory of Operation" for details.

### 4.2 Configuration and peripherals



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

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**Description of EUT and Support equipment**

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart ECU	TMLF19D-2	E19B2: No.103 *1) E19B2: No.134 *2)	-	EUT
B	Outside Antenna	D19B3	No.183	-	EUT
C	Outside Antenna	D19B3	No.184	-	EUT
D	Outside Antenna	D19B3	No.185	-	EUT
E	Outside Antenna	D19B3	No.186	-	EUT
F	Inside Antenna	18WA0	No.111	-	EUT
G	Inside Antenna	18WA0	No.112	-	EUT
H	Inside Antenna	18WA0	No.122	-	EUT
I	Rear Antenna	12TA0	No.065	-	EUT
J	Rear Antenna	12TA0	No.066	-	EUT
K	Immobilizer Antenna	18PA5	No.084	-	EUT
L	Switch BOX	19CY-MAX	No.019	-	-
M	Smart Key	19CY-031	-	-	-

\*1) Used for Mode 1, 2, 3, 4

\*2) Used for Mode 5

**List of cables used**

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.0	Unshielded	Unshielded	-
2	Antenna Cable	3.0	Unshielded	Unshielded	-
3	Antenna Cable	3.0	Unshielded	Unshielded	-
4	Antenna Cable	3.0	Unshielded	Unshielded	-
5	Antenna Cable	3.0	Unshielded	Unshielded	-
6	Antenna Cable	3.0	Unshielded	Unshielded	-
7	Antenna Cable	3.0	Unshielded	Unshielded	-
8	Antenna Cable	3.0	Unshielded	Unshielded	-
9	Antenna Cable	3.0	Unshielded	Unshielded	-
10	Antenna Cable	3.0	Unshielded	Unshielded	-
11	Antenna Cable	3.0	Unshielded	Unshielded	-
12	Signal Cable	3.0	Unshielded	Unshielded	-

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **Test Procedure**

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 Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

Frequency : From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg. 135 deg., and 180 deg.) and horizontal polarization.

\*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height 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.

The test was made with the detector (RBW / VBW) in the following table.

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

### **Test Antennas are used as below;**

Frequency	Below 30 MHz	30 MHz to 200 MHz	200 MHz to 1 GHz
Antenna Type	Loop	Biconical	Logperiodic

Frequency	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz
Instrument used	Test Receiver				
Detector	PK / AV	QP	PK / AV	QP	QP
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m

\*1) Distance Factor:  $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

\*2) Distance Factor:  $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to  $45.5 - 51.5 = -6.0 \text{ dBuA/m}$ , which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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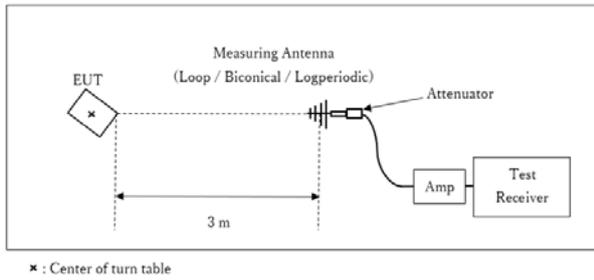
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[Test Setup]  
Below 1 GHz



Test Distance: 3 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

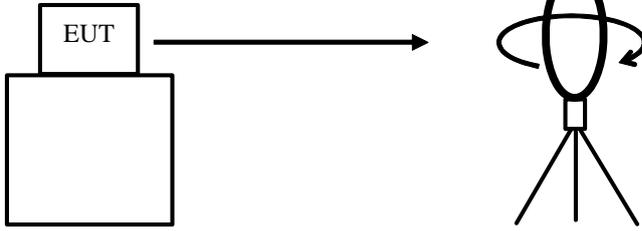
**Measurement range** : 9 kHz - 1 GHz  
**Test data** : APPENDIX 1  
**Test result** : Pass

Date: November 19, 2020  
November 25, 2020  
December 2, 2020

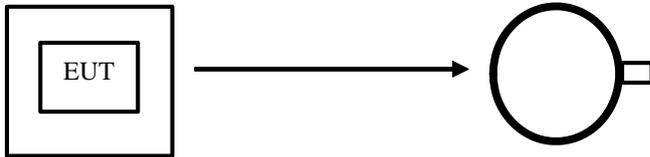
Test engineer: Akihiko Maeda  
Shinya Watanabe  
Junya Okuno

**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*



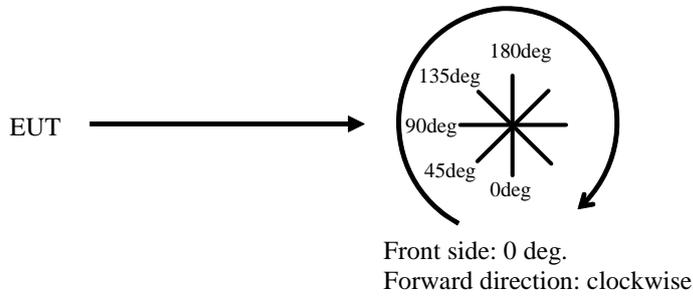
*Top View (Horizontal)*



Antenna was not rotated.

---

*Top View (Vertical)*



## **SECTION 6: -26 dB Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	50 kHz	510 Hz	1.6 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1  
Test result : Pass

## **SECTION 7: 99 % Occupied Bandwidth**

### **Test Procedure**

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer

\*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.  
Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1  
Test result : Pass

## APPENDIX 1: Test data

### Radiated Emission (Fundamental and Spurious Emission)

Report No. 13582538H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date November 19, 2020 November 25, 2020  
Temperature / Humidity 26 deg. C / 48 % RH 22 deg. C / 38 % RH  
Engineer Akihiko Maeda Shinya Watanabe  
(Above 30 MHz) (Below 30 MHz)  
Mode Mode 1

#### PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.4	19.4	-74.0	32.3	-	15.6	45.0	29.4	Fundamental
0deg	0.26840	PK	62.1	19.5	-74.0	32.3	-	-24.7	39.0	63.7	
0deg	0.40260	PK	66.8	19.5	-73.9	32.3	-	-19.9	35.5	55.4	
0deg	0.53680	QP	34.5	19.4	-33.9	32.2	-	-12.2	33.0	45.2	
0deg	0.67100	QP	54.1	19.4	-33.9	32.2	-	7.3	31.1	23.7	
0deg	0.80520	QP	32.3	19.5	-33.9	32.2	-	-14.3	29.5	43.8	
0deg	0.93940	QP	44.2	19.4	-33.9	32.2	-	-2.4	28.1	30.5	
0deg	1.07360	QP	30.6	19.5	-33.9	32.2	-	-16.0	26.9	43.0	
0deg	1.20780	QP	31.0	19.5	-33.9	32.2	-	-15.7	25.9	41.6	
0deg	1.34200	QP	30.7	19.5	-33.8	32.2	-	-15.9	25.0	40.9	
90deg	18.01980	QP	50.1	20.6	-33.2	32.2	-	5.3	29.5	24.3	
Hori.	30.176	QP	22.5	18.4	7.1	32.2	-	15.8	40.0	24.2	
Hori.	35.455	QP	22.5	16.5	7.2	32.2	-	14.0	40.0	26.0	
Hori.	49.066	QP	22.2	11.5	7.5	32.2	-	9.0	40.0	31.0	
Hori.	55.662	QP	22.4	9.1	7.6	32.2	-	6.9	40.0	33.1	
Hori.	77.310	QP	35.7	6.7	7.9	32.2	-	18.1	40.0	21.9	
Hori.	497.034	QP	21.4	17.6	11.4	32.0	-	18.5	46.0	27.6	
Vert.	30.176	QP	34.4	18.4	7.1	32.2	-	27.7	40.0	12.3	
Vert.	35.455	QP	33.1	16.5	7.2	32.2	-	24.6	40.0	15.4	
Vert.	49.144	QP	36.8	11.5	7.5	32.2	-	23.6	40.0	16.4	
Vert.	55.604	QP	33.8	9.1	7.6	32.2	-	18.3	40.0	21.7	
Vert.	77.289	QP	25.7	6.7	7.9	32.2	-	8.1	40.0	31.9	
Vert.	497.034	QP	21.4	17.6	11.4	32.0	-	18.5	46.0	27.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier)

#### PK with Duty factor

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.4	19.4	-74.0	32.3	0.0	15.6	25.0	9.4	
0deg	0.26840	PK	62.1	19.5	-74.0	32.3	0.0	-24.7	19.0	43.7	
0deg	0.40260	PK	66.8	19.5	-73.9	32.3	0.0	-19.9	15.5	35.4	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

#### Result of the fundamental emission at 3m without Distance factor

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.4	19.4	6.0	32.3	-	95.6	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

- \* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).
- \*The test result is rounded off to one or two decimal places, so some differences might be observed.

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## Radiated Emission (Fundamental and Spurious Emission)

Report No.	13582538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	November 19, 2020	November 25, 2020
Temperature / Humidity	26 deg. C / 48 % RH	22 deg. C / 38 % RH
Engineer	Akihiko Maeda (Above 30 MHz)	Shinya Watanabe (Below 30 MHz)
Mode	Mode 2	

**PK or QP**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.9	19.4	-74.0	32.3	-	16.0	45.0	28.9	Fundamental
0deg	0.26840	PK	60.7	19.5	-74.0	32.3	-	-26.1	39.0	65.1	
0deg	0.40260	PK	70.7	19.5	-73.9	32.3	-	-16.0	35.5	51.5	
0deg	0.53680	QP	43.6	19.4	-33.9	32.2	-	-3.2	33.0	36.2	
0deg	0.67100	QP	59.4	19.4	-33.9	32.2	-	12.7	31.1	18.3	
0deg	0.80520	QP	36.1	19.5	-33.9	32.2	-	-10.5	29.5	40.0	
0deg	0.93940	QP	41.9	19.4	-33.9	32.2	-	-4.8	28.1	32.9	
0deg	1.07360	QP	35.8	19.5	-33.9	32.2	-	-10.8	26.9	37.8	
0deg	1.20780	QP	41.0	19.5	-33.9	32.2	-	-5.7	25.9	31.6	
0deg	1.34200	QP	35.5	19.5	-33.8	32.2	-	-11.0	25.0	36.0	
90deg	18.19835	QP	50.8	20.7	-33.2	32.2	-	6.1	29.5	23.5	
Hori.	52.333	QP	21.9	10.3	7.5	32.2	-	7.5	40.0	32.5	
Hori.	77.301	QP	35.1	6.7	7.9	32.2	-	17.5	40.0	22.5	
Hori.	81.624	QP	27.7	7.2	8.0	32.2	-	10.7	40.0	29.3	
Hori.	109.616	QP	22.1	11.4	8.3	32.1	-	9.7	43.5	33.8	
Hori.	111.773	QP	22.5	11.7	8.3	32.1	-	10.4	43.5	33.2	
Hori.	334.589	QP	21.4	14.7	10.3	32.0	-	14.4	46.0	31.6	
Vert.	52.333	QP	23.5	10.3	7.5	32.2	-	9.1	40.0	30.9	
Vert.	77.307	QP	36.6	6.7	7.9	32.2	-	19.0	40.0	21.0	
Vert.	81.597	QP	30.8	7.2	8.0	32.2	-	13.8	40.0	26.2	
Vert.	109.616	QP	24.0	11.4	8.3	32.1	-	11.6	43.5	31.9	
Vert.	111.798	QP	27.7	11.7	8.3	32.1	-	15.6	43.5	27.9	
Vert.	334.589	QP	21.4	14.7	10.3	32.0	-	14.4	46.0	31.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.9	19.4	-74.0	32.3	0.0	16.0	25.0	8.9	
0deg	0.26840	PK	60.7	19.5	-74.0	32.3	0.0	-26.1	19.0	45.1	
0deg	0.40260	PK	70.7	19.5	-73.9	32.3	0.0	-16.0	15.5	31.5	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.9	19.4	6.0	32.3	-	96.0	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

\* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

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## Radiated Emission (Fundamental and Spurious Emission)

Report No.	13582538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	November 19, 2020	November 25, 2020
Temperature / Humidity	26 deg. C / 48 % RH	22 deg. C / 38 % RH
Engineer	Akihiko Maeda (Above 30 MHz)	Shinya Watanabe (Below 30 MHz)
Mode	Mode 3	

**PK or QP**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.2	19.4	-74.0	32.3	-	15.4	45.0	29.6	Fundamental
0deg	0.26840	PK	60.0	19.5	-74.0	32.3	-	-26.8	39.0	65.8	
0deg	0.40260	PK	62.3	19.5	-73.9	32.3	-	-24.4	35.5	59.9	
0deg	0.53680	QP	53.5	19.4	-33.9	32.2	-	6.8	33.0	26.2	
0deg	0.67100	QP	49.5	19.4	-33.9	32.2	-	2.8	31.1	28.3	
0deg	0.80520	QP	31.5	19.5	-33.9	32.2	-	-15.1	29.5	44.6	
0deg	0.93940	QP	47.0	19.4	-33.9	32.2	-	0.4	28.1	27.8	
0deg	1.07360	QP	30.9	19.5	-33.9	32.2	-	-15.7	26.9	42.7	
0deg	1.20780	QP	42.9	19.5	-33.9	32.2	-	-3.8	25.9	29.7	
0deg	1.34200	QP	30.6	19.5	-33.8	32.2	-	-16.0	25.0	41.0	
90deg	18.02050	QP	51.1	20.6	-33.2	32.2	-	6.3	29.5	23.2	
Hori.	30.173	QP	22.3	18.4	7.1	32.2	-	15.6	40.0	24.4	
Hori.	35.517	QP	22.5	16.4	7.2	32.2	-	13.9	40.0	26.1	
Hori.	49.139	QP	22.8	11.5	7.5	32.2	-	9.6	40.0	30.4	
Hori.	55.904	QP	22.2	9.0	7.6	32.2	-	6.6	40.0	33.4	
Hori.	77.306	QP	35.2	6.7	7.9	32.2	-	17.6	40.0	22.4	
Hori.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	
Vert.	30.173	QP	34.0	18.4	7.1	32.2	-	27.3	40.0	12.7	
Vert.	35.473	QP	30.7	16.5	7.2	32.2	-	22.2	40.0	17.8	
Vert.	49.146	QP	38.6	11.5	7.5	32.2	-	25.4	40.0	14.6	
Vert.	55.576	QP	32.1	9.1	7.6	32.2	-	16.6	40.0	23.4	
Vert.	77.292	QP	29.7	6.7	7.9	32.2	-	12.1	40.0	27.9	
Vert.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.2	19.4	-74.0	32.3	0.0	15.4	25.0	9.6	
0deg	0.26840	PK	60.0	19.5	-74.0	32.3	0.0	-26.8	19.0	45.8	
0deg	0.40260	PK	62.3	19.5	-73.9	32.3	0.0	-24.4	15.5	39.9	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	102.2	19.4	6.0	32.3	-	95.4	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

\* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

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## Radiated Emission (Fundamental and Spurious Emission)

Report No.	13582538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	November 19, 2020	November 25, 2020
Temperature / Humidity	26 deg. C / 48 % RH	22 deg. C / 38 % RH
Engineer	Akihiko Maeda (Above 30 MHz)	Shinya Watanabe (Below 30 MHz)
Mode	Mode 4	

**PK or QP**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	96.2	19.4	-74.0	32.3	-	9.4	45.0	35.6	Fundamental
0deg	0.26840	PK	51.1	19.5	-74.0	32.3	-	-35.7	39.0	74.7	
0deg	0.40260	PK	61.2	19.5	-73.9	32.3	-	-25.5	35.5	61.0	
0deg	0.53680	QP	33.5	19.4	-33.9	32.2	-	-13.2	33.0	46.2	
0deg	0.67100	QP	48.9	19.4	-33.9	32.2	-	2.2	31.1	28.9	
0deg	0.80520	QP	32.4	19.5	-33.9	32.2	-	-14.2	29.5	43.7	
0deg	0.93940	QP	41.8	19.4	-33.9	32.2	-	-4.8	28.1	33.0	
0deg	1.07360	QP	32.3	19.5	-33.9	32.2	-	-14.4	26.9	41.3	
0deg	1.20780	QP	36.5	19.5	-33.9	32.2	-	-10.1	25.9	36.1	
0deg	1.34200	QP	32.2	19.5	-33.8	32.2	-	-14.4	25.0	39.3	
90deg	18.13280	QP	49.2	20.7	-33.2	32.2	-	4.4	29.5	25.1	
Hori.	30.172	QP	22.3	18.4	7.1	32.2	-	15.6	40.0	24.4	
Hori.	35.532	QP	22.5	16.4	7.2	32.2	-	14.0	40.0	26.1	
Hori.	49.019	QP	22.8	11.6	7.5	32.2	-	9.7	40.0	30.4	
Hori.	55.868	QP	22.2	9.0	7.6	32.2	-	6.6	40.0	33.4	
Hori.	77.321	QP	35.0	6.7	7.9	32.2	-	17.4	40.0	22.6	
Hori.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	
Vert.	31.198	QP	33.7	18.0	7.1	32.2	-	26.6	40.0	13.4	
Vert.	35.467	QP	30.5	16.5	7.2	32.2	-	22.0	40.0	18.0	
Vert.	49.116	QP	37.9	11.5	7.5	32.2	-	24.7	40.0	15.3	
Vert.	55.574	QP	32.0	9.1	7.6	32.2	-	16.5	40.0	23.5	
Vert.	77.723	QP	29.7	6.7	7.9	32.2	-	12.2	40.0	27.9	
Vert.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	96.2	19.4	-74.0	32.3	0.0	9.4	25.0	15.6	
0deg	0.26840	PK	51.1	19.5	-74.0	32.3	0.0	-35.7	19.0	54.7	
0deg	0.40260	PK	61.2	19.5	-73.9	32.3	0.0	-25.5	15.5	41.0	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	96.2	19.4	6.0	32.3	-	89.4	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

\* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

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## Radiated Emission (Fundamental and Spurious Emission)

Report No.	13582538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	November 19, 2020	December 2, 2020
Temperature / Humidity	26 deg. C / 48 % RH	24 deg. C / 46 % RH
Engineer	Akihiko Maeda (Above 30 MHz)	Junya Okuno (Below 30 MHz)
Mode	Mode 5	

**PK or QP**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	107.6	18.7	-74.0	32.3	-	20.1	45.0	24.9	Fundamental
0deg	0.26840	PK	53.5	18.7	-64.2	32.3	-	-24.4	39.0	63.4	
0deg	0.40260	PK	69.8	18.6	-64.3	32.3	-	-8.1	35.5	43.6	
0deg	0.53680	QP	33.5	18.6	-24.3	32.2	-	-4.4	33.0	37.4	
0deg	0.67100	QP	52.9	18.6	-24.3	32.2	-	15.0	31.1	16.1	
0deg	0.80520	QP	25.5	18.6	-24.3	32.2	-	-12.4	29.5	41.9	
0deg	0.93940	QP	43.3	18.6	-24.2	32.2	-	5.4	28.1	22.7	
0deg	1.07360	QP	22.7	18.6	-24.2	32.2	-	-15.2	26.9	42.1	
0deg	1.20780	QP	31.2	18.6	-24.2	32.2	-	-6.7	25.9	32.6	
0deg	1.34200	QP	22.1	18.6	-24.2	32.2	-	-15.8	25.0	40.8	
Hori.	31.198	QP	22.3	18.0	7.1	32.2	-	15.2	40.0	24.8	
Hori.	35.523	QP	22.5	16.4	7.2	32.2	-	13.9	40.0	26.1	
Hori.	49.116	QP	22.8	11.5	7.5	32.2	-	9.6	40.0	30.4	
Hori.	55.868	QP	22.2	9.0	7.6	32.2	-	6.6	40.0	33.4	
Hori.	77.296	QP	33.6	6.7	7.9	32.2	-	16.0	40.0	24.0	
Hori.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	
Vert.	30.742	QP	33.3	18.1	7.1	32.2	-	26.3	40.0	13.7	
Vert.	35.523	QP	31.0	16.4	7.2	32.2	-	22.4	40.0	17.6	
Vert.	49.116	QP	36.9	11.5	7.5	32.2	-	23.7	40.0	16.3	
Vert.	55.574	QP	29.2	9.1	7.6	32.2	-	13.7	40.0	26.3	
Vert.	77.723	QP	33.5	6.7	7.9	32.2	-	16.0	40.0	24.1	
Vert.	488.650	QP	21.6	17.5	11.4	32.0	-	18.4	46.0	27.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

**PK with Duty factor**

Ant Deg [deg] or Polarity [Hori/Vert]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	107.6	18.7	-74.0	32.3	0.0	20.1	25.0	4.9	
0deg	0.26840	PK	53.5	18.7	-64.2	32.3	0.0	-24.4	19.0	43.4	
0deg	0.40260	PK	69.8	18.6	-64.3	32.3	0.0	-8.1	15.5	23.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

\* Since the peak emission result satisfied the average limit, duty factor was omitted.

**Result of the fundamental emission at 3m without Distance factor**

Ant Deg [deg]	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
0deg	0.13420	PK	107.6	18.7	6.0	32.3	-	100.1	-	-	Fundamental

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

\* Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

\*The test result is rounded off to one or two decimal places, so some differences might be observed.

**UL Japan, Inc.**

**Ise EMC Lab.**

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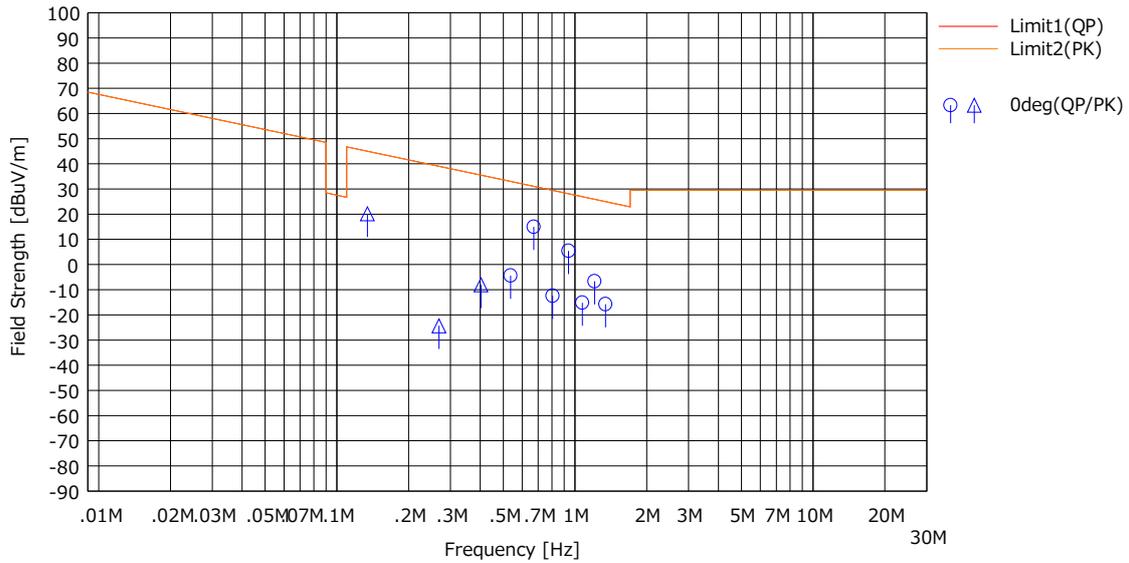
Facsimile : +81 596 24 8124

**Radiated Emission Plot data, Worst case**

Report No.	13582538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	November 19, 2020	December 2, 2020
Temperature / Humidity	26 deg. C / 48 % RH	24 deg. C / 46 % RH
Engineer	Akihiko Maeda (Above 30 MHz)	Junya Okuno (Below 30 MHz)
Mode	Mode 1	Mode 5

**(below 30MHz)**

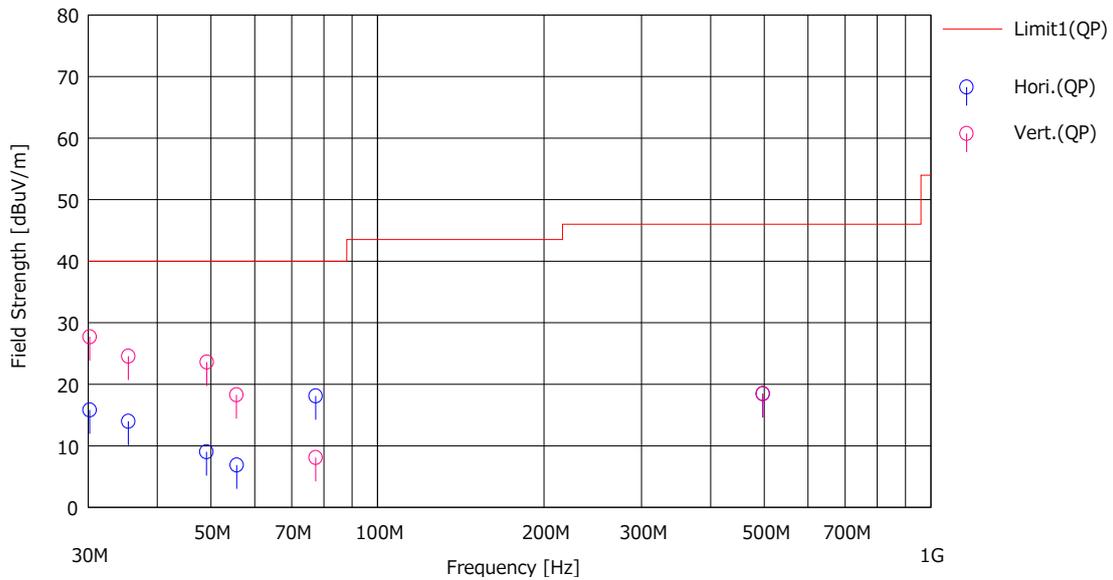
Limit : FCC15.209(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



\* Limit above 490 kHz was for QP detector.

**(above 30MHz)**

Limit : FCC15.209(a), 9-90kHz:PK, 110-490kHz:PK, other:QP



\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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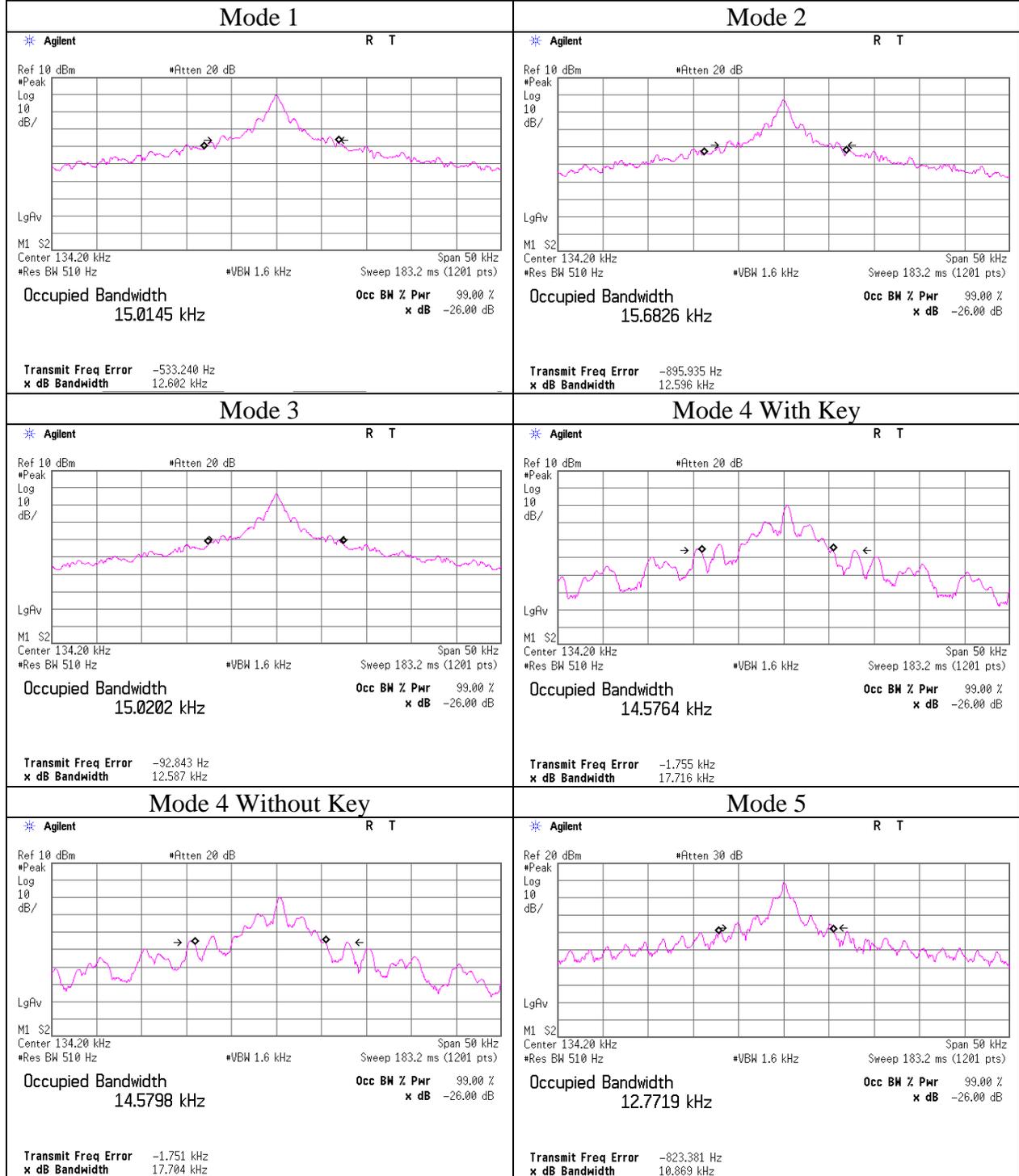
**-26 dB Bandwidth and 99 % Occupied Bandwidth**

Report No. 13582538H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date December 2, 2020  
Temperature / Humidity 24 deg. C / 46 % RH  
Engineer Junya Okuno  
Mode Mode 1 - 5

Mode	99 % Occupied Bandwidth [kHz]	-26 dB Bandwidth [kHz]
Mode 1	15.0145	12.602
Mode 2	15.6826	12.596
Mode 3	15.0202	12.587
Mode 4 With Key	14.5764	17.716
Mode 4 Without Key	14.5798	17.704
Mode 5	12.7719	10.869

**-26 dB Bandwidth and 99 % Occupied Bandwidth**

Report No. 13582538H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date December 2, 2020  
Temperature / Humidity 24 deg. C / 46 % RH  
Engineer Junya Okuno  
Mode Mode 1 - 5



## **APPENDIX 2: Test instruments**

### **Test equipment**

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/07/2020	12
RE	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1915	08/13/2020	12
RE	MLA-22	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-191	08/13/2020	12
RE	MAT-95	142314	Attenuator	Pasternack	PE7390-6	D/C 1504	06/17/2020	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/06/2020	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/10/2020	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/18/2020	12
RE	MJM-28	142229	Measure	KOMELON	KMC-36	-	-	-
RE	MLPA-02	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	-	-
RE	MCC-219	159670	Coaxial Cable	UL Japan Inc.	-	-	11/17/2020	12
RE	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010/RFM-E321(SW)	-/00640	07/06/2020	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	03/10/2020	12
RE	LP-01	146966	Loop Antenna	Rohde & Schwarz	HFH2-Z2	829425/014	01/17/2020	12
RE	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/04/2020	12
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/09/2020	12
RE	MHF-24	141295	High Pass Filter 0.15-30MHz	Rohde & Schwarz	EZ-25/3	100041	02/04/2020	12

\*Hyphens for Last Calibration Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

The expiration date of the calibration is the end of the expired month.

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

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

Test item:

**RE: Spurious emission**

**UL Japan, Inc.**

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