



RADIO TEST REPORT

Test Report No. : 13619652H-A-R1

Applicant : TOYOTA MOTOR CORPORATION

Type of EUT : Smart LF Oscillator

Model Number of EUT : TMLF19T-2

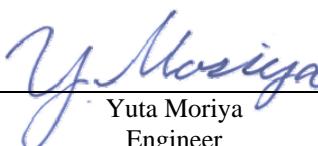
FCC ID : NI4TMLF19T-2

Test regulation : FCC Part 15 Subpart C: 2021

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.
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 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.
10. This report is a revised version of 13619652H-A. 13619652H-A is replaced with this report.

Date of test: December 9 to 15, 2020

Representative test engineer: 
Yuta Moriya
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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Report Cover Page - 13-EM-F0429 Issue # 17.0

REVISION HISTORY

Original Test Report No.: 13619652H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13619652H-A	January 26, 2021	-	-
1	13619652H-A-R1	March 10, 2021	P.36	Exchange "with" and "without".

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Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	LIMS	Laboratory Information Management System
AC	Alternating Current	MCS	Modulation and Coding Scheme
AFH	Adaptive Frequency Hopping	MRA	Mutual Recognition Arrangement
AM	Amplitude Modulation	N/A	Not Applicable
Amp, AMP	Amplifier	NIST	National Institute of Standards and Technology
ANSI	American National Standards Institute	NS	No signal detect.
Ant, ANT	Antenna	NSA	Normalized Site Attenuation
AP	Access Point	NVLAP	National Voluntary Laboratory Accreditation Program
ASK	Amplitude Shift Keying	OBW	Occupied Band Width
Atten., ATT	Attenuator	OFDM	Orthogonal Frequency Division Multiplexing
AV	Average	P/M	Power meter
BPSK	Binary Phase-Shift Keying	PCB	Printed Circuit Board
BR	Bluetooth Basic Rate	PER	Packet Error Rate
BT	Bluetooth	PHY	Physical Layer
BT LE	Bluetooth Low Energy	PK	Peak
BW	BandWidth	PN	Pseudo random Noise
Cal Int	Calibration Interval	PRBS	Pseudo-Random Bit Sequence
CCK	Complementary Code Keying	PSD	Power Spectral Density
Ch., CH	Channel	QAM	Quadrature Amplitude Modulation
CISPR	Comite International Special des Perturbations Radioelectriques	QP	Quasi-Peak
CW	Continuous Wave	QPSK	Quadrature Phase Shift Keying
DBPSK	Differential BPSK	RBW	Resolution Band Width
DC	Direct Current	RDS	Radio Data System
D-factor	Distance factor	RE	Radio Equipment
DFS	Dynamic Frequency Selection	RF	Radio Frequency
DQPSK	Differential QPSK	RMS	Root Mean Square
DSSS	Direct Sequence Spread Spectrum	RSS	Radio Standards Specifications
DUT	Device Under Test	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
ETSI	European Telecommunications Standards Institute	Vert.	Vertical
EU	European Union	WLAN	Wireless LAN
EUT	Equipment Under Test		
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		

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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 Saganuma

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 : TMLF19T-2
Serial Number : Refer to SECTION 4.2
Rating : DC 12.0 V (Max 1.71 A (ave.))
Receipt Date : November 24, 2020
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

Smart LF Oscillator, model: TMLF19T-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 : 125 kHz
Modulation : ASK
Antenna type : Coil Antenna

Smart LF Oscillator (model: TMLF19T-2) consists of the following parts:

- Computer Assy, Smart Key (ECU)
- D Door Antenna (Door Antenna)
- P Door Antenna (Door Antenna)
- Back Door Antenna (Trunk Antenna)
- Fr Antenna (Room Antenna)
- Rr1 Antenna (Room Antenna)
- Rr2 Antenna (Room Antenna)
- Immobilizer 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 January 12, 2021 and effective February 11, 2021

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

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

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	10.9 dB 125 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	0.7 dB 58.499 MHz, Vertical, QP <Mode 5>	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 Bandwidth)						
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 15.31 (e)

This EUT provides stable voltage constantly to RF Module 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
		3.2 dB
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
10 m	1 GHz to 18 GHz	5.2 dB

Antenna Terminal test

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

3.5 Test Location

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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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

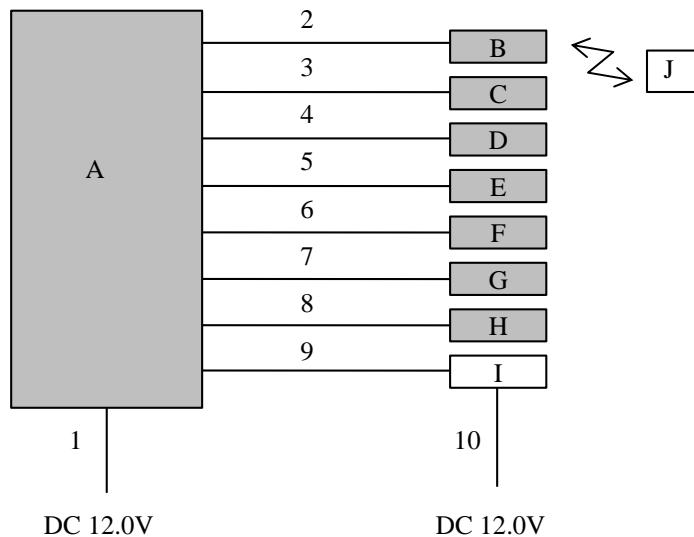
Test mode	Remarks
1) Tx 125 kHz D Door Antenna	Representative antenna by comparing D Door Antenna and P Door Antenna
2) Tx 125 kHz Back Door Antenna	-
3) Tx 125 kHz Fr Antenna	Representative antenna by comparing Fr Antenna, Rr1 Antenna and Rr2Antenna
4) Tx 125 kHz Immobilizer Antenna	-
5) Tx 125 kHz D Door + P door Antenna	-
6) Tx 125 kHz D Door Antenna (Min Power)	carrier level and worst spurious emission (for Mode 1)
7) Tx 125 kHz Back Door Antenna (Min Power)	carrier level and worst spurious emission (for Mode 2)
8) Tx 125 kHz Fr Antenna (Min Power)	carrier level and worst spurious emission (for Mode 3)

* EUT was set by the software as follows;
 Software: S19T-2-01_max V1.00 (for maximum output)
 S19T-2-01_min V1.00 (for minimum output)
 (Date: December 9, 2020, 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.

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	Computer Assy, Smart Key (ECU)	TMLF19T-2(19ADX)	19ECU2006	-	EUT
B	Immobilizer Antenna	19PA0	19ENG2001	-	EUT
C	D Door Antenna	19DA0	19DRD2001	-	EUT
D	P Door Antenna	19DA1	19DRP2001	-	EUT
E	Back Door Antenna	12TA0	19BK2001	-	EUT
F	Fr Antenna	19WA0	19LF2001	-	EUT
G	Rr1 Antenna	19WA0	19LF2002	-	EUT
H	Rr2 Antenna	19WA0	19LF2003	-	EUT
I	Low Frequency Evaluation Bench	-	19SEB2001	-	-
J	Electronic Key	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Immobilizer Ant. Cable	1.0	Unshielded	Unshielded	-
3	D Door Ant. Cable	1.0	Unshielded	Unshielded	-
4	P Door Ant. Cable	1.0	Unshielded	Unshielded	-
5	Back Door Ant. Cable	1.0	Unshielded	Unshielded	-
6	Fr Ant. Cable	1.0	Unshielded	Unshielded	-
7	Rr1 Ant. Cable	1.0	Unshielded	Unshielded	-
8	Rr2 Ant. Cable	1.0	Unshielded	Unshielded	-
9	Switch BOX Cable	0.5	Unshielded	Unshielded	-
10	DC 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., and 135 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 Ohmes. 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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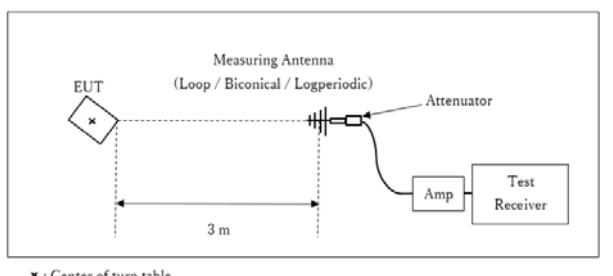
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[Test Setup]

Below 1 GHz



- 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.
- This EUT has two modes which transponder key is inserted or not. The worst case was confirmed with and without transponder key, as a result, the test without transponder key was the worst case. Therefore the test without transponder key was performed only.

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: December 9 and 10, 2020
December 15, 2020

Test engineer: Shinya Watanabe
Yuta Moriya

UL Japan, Inc.

Ise EMC Lab.

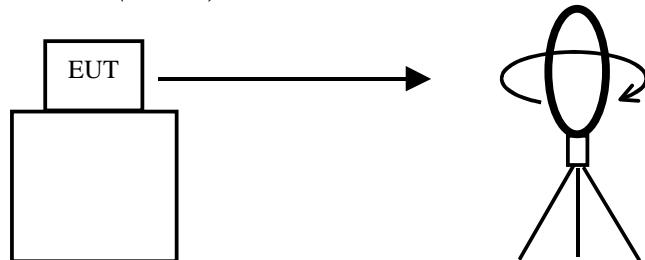
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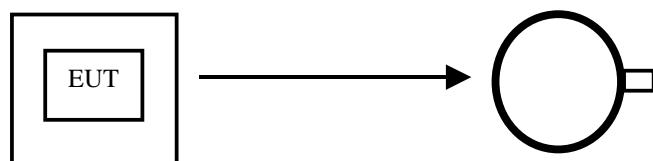
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

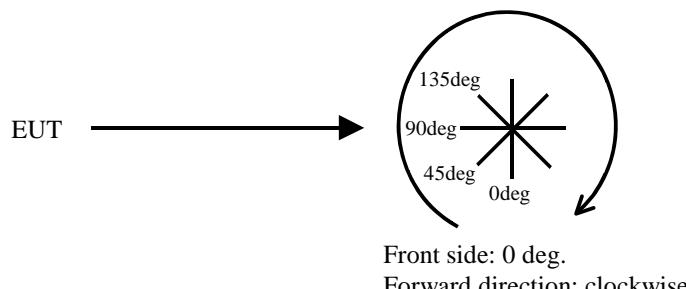


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



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SECTION 6: -26 dB Bandwidth

Test Procedure

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

<Other Mode except for Mode 4>

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

<Mode 4>

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	100 kHz	1 kHz	3 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	Max Hold	Spectrum Analyzer

Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1

Test result : Pass

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APPENDIX 1: Test data

Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 15, 2020
 Temperature / Humidity 25 deg. C / 30 % RH
 Engineer Yuta Moriya
 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	0.12500	PK	96.5	18.9	-74.0	32.3	-	9.2	45.6	36.4	Fundamental
0deg	0.12500	PK	77.9	18.9	-74.0	32.3	-	-9.4	45.6	55.0	Fundamental(Mode6)
0deg	0.25000	PK	78.6	18.9	-74.0	32.3	-	-8.8	39.6	48.4	
0deg	0.37500	PK	69.7	18.8	-73.9	32.3	-	-17.7	36.1	53.8	
0deg	0.50000	QP	45.8	18.8	-33.9	32.2	-	-1.6	33.6	35.2	
0deg	0.62500	QP	67.4	18.8	-33.9	32.2	-	20.0	31.7	11.6	
0deg	0.62500	QP	57.7	18.8	-33.9	32.2	-	10.3	31.7	21.3	(Mode6)
0deg	0.75000	QP	37.4	18.8	-33.9	32.2	-	-9.9	30.1	40.0	
0deg	0.87500	QP	46.9	18.8	-33.9	32.2	-	-0.4	28.7	29.2	
0deg	1.00000	QP	38.8	18.8	-33.9	32.2	-	-8.5	27.6	36.1	
0deg	1.12500	QP	54.4	18.8	-33.9	32.2	-	7.1	26.5	19.4	
0deg	1.25000	QP	31.0	18.8	-33.8	32.2	-	-16.3	25.6	41.9	

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

PK with Duty 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	0.12500	AV	96.5	18.9	-74.0	32.3	0.0	9.2	25.6	16.4	
0deg	0.12500	AV	77.9	18.9	-74.0	32.3	0.0	-9.4	25.6	35.0	(Mode6)
0deg	0.25000	AV	78.6	18.9	-74.0	32.3	0.0	-8.8	19.6	28.4	
0deg	0.37500	AV	69.7	18.8	-73.9	32.3	0.0	-17.7	16.1	33.8	

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

PK or QP

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	0.12500	PK	96.5	18.9	6.0	32.3	-	89.2	-	-	Fundamental
0deg	0.12500	PK	77.9	18.9	6.0	32.3	-	70.6	-	-	Fundamental(Mode6)

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

* 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.

*For Mode 6 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 1 (ECU: Max Power) were confirmed.

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Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 15, 2020
 Temperature / Humidity 25 deg. C / 30 % RH
 Engineer Yuta Moriya
 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	0.12500	PK	95.8	18.9	-74.0	32.3	-	8.5	45.6	37.1	Fundamental
0deg	0.12500	PK	75.0	18.9	-74.0	32.3	-	-12.3	45.6	57.9	Fundamental(Mode7)
0deg	0.25000	PK	83.2	18.9	-74.0	32.3	-	-4.2	39.6	43.8	
0deg	0.37500	PK	67.3	18.8	-73.9	32.3	-	-20.1	36.1	56.2	
0deg	0.50000	QP	62.1	18.8	-33.9	32.2	-	14.7	33.6	18.9	
0deg	0.62500	QP	63.3	18.8	-33.9	32.2	-	15.9	31.7	15.7	
0deg	0.62500	QP	54.6	18.8	-33.9	32.2	-	7.2	31.7	24.4	(Mode7)
0deg	0.75000	QP	57.1	18.8	-33.9	32.2	-	9.8	30.1	20.3	
0deg	0.87500	QP	45.0	18.8	-33.9	32.2	-	-2.3	28.7	31.1	
0deg	1.00000	QP	53.8	18.8	-33.9	32.2	-	6.5	27.6	21.1	
0deg	1.12500	QP	52.0	18.8	-33.9	32.2	-	4.7	26.5	21.8	
0deg	1.25000	QP	42.9	18.8	-33.8	32.2	-	-4.4	25.6	30.0	

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

PK with Duty 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	0.12500	AV	95.8	18.9	-74.0	32.3	0.0	8.5	25.6	17.1	
0deg	0.12500	AV	75.0	18.9	-74.0	32.3	0.0	-12.3	25.6	37.9	(Mode7)
0deg	0.25000	AV	83.2	18.9	-74.0	32.3	0.0	-4.2	19.6	23.8	
0deg	0.37500	AV	67.3	18.8	-73.9	32.3	0.0	-20.1	16.1	36.2	

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

PK or QP

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	0.12500	PK	95.8	18.9	6.0	32.3	-	88.5	-	-	Fundamental
0deg	0.12500	PK	75.0	18.9	6.0	32.3	-	67.7	-	-	Fundamental(Mode7)

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

* 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.

* For Mode 7 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 2 (ECU: Max Power) were confirmed.

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Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 15, 2020
 Temperature / Humidity 25 deg. C / 30 % RH
 Engineer Yuta Moriya
 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	0.12500	PK	96.7	18.9	-74.0	32.3	-	9.3	45.6	36.3	Fundamental
0deg	0.12500	PK	72.3	18.9	-74.0	32.3	-	-15.0	45.6	60.6	Fundamental(Mode8)
0deg	0.25000	PK	60.3	18.9	-74.0	32.3	-	-27.1	39.6	66.7	
0deg	0.37500	PK	73.1	18.8	-73.9	32.3	-	-14.3	36.1	50.4	
0deg	0.50000	QP	47.6	18.8	-33.9	32.2	-	0.2	33.6	33.4	
0deg	0.62500	QP	69.9	18.8	-33.9	32.2	-	22.5	31.7	9.1	
0deg	0.62500	QP	57.3	18.8	-33.9	32.2	-	9.9	31.7	21.7	(Mode8)
0deg	0.75000	QP	35.2	18.8	-33.9	32.2	-	-12.1	30.1	42.2	
0deg	0.87500	QP	54.2	18.8	-33.9	32.2	-	6.9	28.7	21.9	
0deg	1.00000	QP	43.1	18.8	-33.9	32.2	-	-4.2	27.6	31.8	
0deg	1.12500	QP	58.1	18.8	-33.9	32.2	-	10.8	26.5	15.7	
0deg	1.25000	QP	30.5	18.8	-33.8	32.2	-	-16.8	25.6	42.4	

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

PK with Duty 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	0.12500	AV	96.7	18.9	-74.0	32.3	0.0	9.3	25.6	16.3	
0deg	0.12500	AV	72.3	18.9	-74.0	32.3	0.0	-15.0	25.6	40.6	(Mode8)
0deg	0.25000	AV	60.3	18.9	-74.0	32.3	0.0	-27.1	19.6	46.7	
0deg	0.37500	AV	73.1	18.8	-73.9	32.3	0.0	-14.3	16.1	30.4	

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

PK or QP

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	0.12500	PK	96.7	18.9	6.0	32.3	-	89.3	-	-	Fundamental
0deg	0.12500	PK	72.3	18.9	6.0	32.3	-	65.0	-	-	Fundamental(Mode8)

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

* 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.

*For Mode 8 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 3 (ECU: Max Power) were confirmed.

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Radiated Emission below 30 MHz (Fundamental and Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 15, 2020
 Temperature / Humidity 25 deg. C / 30 % RH
 Engineer Yuta Moriya
 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	0.12500	PK	98.7	18.9	-74.0	32.3	-	11.4	45.6	34.2	Fundamental
0deg	0.25000	PK	64.7	18.9	-74.0	32.3	-	-22.7	39.6	62.3	
0deg	0.37500	PK	66.7	18.8	-73.9	32.3	-	-20.7	36.1	56.8	
0deg	0.50000	QP	42.5	18.8	-33.9	32.2	-	-4.9	33.6	38.5	
0deg	0.62500	QP	49.5	18.8	-33.9	32.2	-	2.1	31.7	29.5	
0deg	0.75000	QP	31.1	18.8	-33.9	32.2	-	-16.2	30.1	46.3	
0deg	0.87500	QP	50.6	18.8	-33.9	32.2	-	3.3	28.7	25.5	
0deg	1.00000	QP	45.6	18.8	-33.9	32.2	-	-1.7	27.6	29.3	
0deg	1.12500	QP	36.3	18.8	-33.9	32.2	-	-11.0	26.5	37.5	
0deg	1.25000	QP	30.4	18.8	-33.8	32.2	-	-16.9	25.6	42.5	

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

PK with Duty 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	0.12500	AV	98.7	18.9	-74.0	32.3	0.0	11.4	25.6	14.2	
0deg	0.25000	AV	64.7	18.9	-74.0	32.3	0.0	-22.7	19.6	42.3	
0deg	0.37500	AV	66.7	18.8	-73.9	32.3	0.0	-20.7	16.1	36.8	

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

PK or QP

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	0.12500	PK	98.7	18.9	6.0	32.3	-	91.4	-	-	-Fundamental

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

* 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 below 30 MHz (Fundamental and Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 15, 2020
 Temperature / Humidity 25 deg. C / 30 % RH
 Engineer Yuta Moriya
 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	0.12500	PK	102.0	18.9	-74.0	32.3	-	14.7	45.6	30.9	Fundamental
0deg	0.25000	PK	68.3	18.9	-74.0	32.3	-	-19.1	39.6	58.7	
0deg	0.37500	PK	76.3	18.8	-73.9	32.3	-	-11.1	36.1	47.2	
0deg	0.50000	QP	44.1	18.8	-33.9	32.2	-	-3.3	33.6	36.9	
0deg	0.62500	QP	65.5	18.8	-33.9	32.2	-	18.1	31.7	13.5	
0deg	0.75000	QP	35.5	18.8	-33.9	32.2	-	-11.8	30.1	41.9	
0deg	0.87500	QP	37.1	18.8	-33.9	32.2	-	-10.2	28.7	39.0	
0deg	1.00000	QP	32.7	18.8	-33.9	32.2	-	-14.6	27.6	42.2	
0deg	1.12500	QP	55.0	18.8	-33.9	32.2	-	7.7	26.5	18.8	
0deg	1.25000	QP	31.0	18.8	-33.8	32.2	-	-16.3	25.6	41.9	

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

PK with Duty 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	0.12500	AV	102.0	18.9	-74.0	32.3	0.0	14.7	25.6	10.9	
0deg	0.25000	AV	68.3	18.9	-74.0	32.3	0.0	-19.1	19.6	38.7	
0deg	0.37500	AV	76.3	18.8	-73.9	32.3	0.0	-11.1	16.1	27.2	

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

PK or QP

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	0.12500	PK	102.0	18.9	6.0	32.3	-	94.7	-	-	-Fundamental

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

* 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 above 30 MHz (Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date December 10, 2020
 Temperature / Humidity 20 deg. C / 37 % RH
 Engineer Shinya Watanabe
 Mode Mode 1

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.003	QP	39.6	18.4	7.1	38.8	26.3	40.0	13.7	
Hori.	44.745	QP	35.2	13.1	7.4	38.8	16.7	40.0	23.3	
Hori.	55.497	QP	47.3	9.1	7.5	38.8	25.1	40.0	14.9	
Hori.	60.499	QP	47.0	7.6	7.6	38.8	23.4	40.0	16.6	
Hori.	176.048	QP	46.6	15.8	8.6	38.9	32.1	43.5	11.4	
Hori.	191.995	QP	44.5	16.3	8.8	38.9	30.7	43.5	12.9	
Vert.	30.003	QP	51.7	18.4	7.1	38.8	38.4	40.0	1.6	
Vert.	44.745	QP	40.7	13.1	7.4	38.8	22.3	40.0	17.7	
Vert.	55.497	QP	53.5	9.1	7.5	38.8	31.3	40.0	8.8	
Vert.	60.499	QP	60.9	7.6	7.6	38.8	37.3	40.0	2.8	
Vert.	176.048	QP	45.3	15.8	8.6	38.9	30.9	43.5	12.7	
Vert.	191.995	QP	50.1	16.3	8.8	38.9	36.3	43.5	7.3	

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.

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date December 10, 2020
 Temperature / Humidity 20 deg. C / 37 % RH
 Engineer Shinya Watanabe
 Mode Mode 6

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.003	QP	36.4	18.4	7.1	38.8	23.2	40.0	16.8	
Vert.	30.003	QP	47.2	18.4	7.1	38.8	34.0	40.0	6.0	

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.

*For Mode 6 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 1 (ECU: Max Power) were confirmed.

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Radiated Emission above 30 MHz (Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 09, 2020
 Temperature / Humidity 21 deg. C / 38 % RH
 Engineer Shinya Watanabe
 Mode Mode 2

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	32.6	18.5	7.1	32.2	26.0	40.0	14.0	
Hori.	53.499	QP	31.2	9.8	7.5	32.2	16.4	40.0	23.6	
Hori.	60.999	QP	45.7	7.5	7.6	32.2	28.6	40.0	11.4	
Hori.	64.499	QP	42.8	6.8	7.7	32.2	25.2	40.0	14.8	
Hori.	182.495	QP	32.0	16.3	9.1	32.0	25.3	43.5	18.3	
Hori.	182.995	QP	30.1	16.3	9.1	32.0	23.4	43.5	20.1	
Vert.	30.000	QP	44.5	18.5	7.1	32.2	37.9	40.0	2.1	
Vert.	53.499	QP	41.6	9.8	7.5	32.2	26.8	40.0	13.2	
Vert.	60.999	QP	51.8	7.5	7.6	32.2	34.8	40.0	5.2	
Vert.	64.499	QP	51.9	6.8	7.7	32.2	34.3	40.0	5.8	
Vert.	182.495	QP	36.4	16.3	9.1	32.0	29.7	43.5	13.8	
Vert.	182.995	QP	35.2	16.3	9.1	32.0	28.5	43.5	15.1	

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.

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date December 10, 2020
 Temperature / Humidity 20 deg. C / 37 % RH
 Engineer Shinya Watanabe
 Mode Mode 7

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	33.6	18.4	7.1	38.8	20.4	40.0	19.7	
Vert.	30.000	QP	44.1	18.4	7.1	38.8	30.8	40.0	9.2	

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.

*For Mode 7 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 2 (ECU: Max Power) were confirmed.

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Radiated Emission above 30 MHz (Spurious Emission)

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date December 09, 2020
 Temperature / Humidity 21 deg. C / 38 % RH
 Engineer Shinya Watanabe
 Mode Mode 3

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	32.5	18.5	7.1	32.2	25.8	40.0	14.2	
Hori.	53.999	QP	30.7	9.6	7.5	32.2	15.7	40.0	24.3	
Hori.	61.498	QP	46.0	7.4	7.7	32.2	28.8	40.0	11.2	
Hori.	64.998	QP	40.8	6.7	7.7	32.2	23.0	40.0	17.0	
Hori.	180.495	QP	36.3	16.2	9.0	32.0	29.4	43.5	14.1	
Hori.	182.995	QP	34.4	16.3	9.1	32.0	27.7	43.5	15.8	
Vert.	30.000	QP	44.5	18.5	7.1	32.2	37.9	40.0	2.1	
Vert.	53.999	QP	40.9	9.6	7.5	32.2	25.9	40.0	14.1	
Vert.	61.498	QP	51.5	7.4	7.7	32.2	34.4	40.0	5.6	
Vert.	64.998	QP	49.7	6.7	7.7	32.2	32.0	40.0	8.0	
Vert.	180.495	QP	44.1	16.2	9.0	32.0	37.3	43.5	6.2	
Vert.	182.995	QP	42.2	16.3	9.1	32.0	35.5	43.5	8.0	

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.

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4
 Date December 10, 2020
 Temperature / Humidity 20 deg. C / 37 % RH
 Engineer Shinya Watanabe
 Mode Mode 8

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	34.4	18.4	7.1	38.8	21.1	40.0	18.9	
Vert.	30.000	QP	46.1	18.4	7.1	38.8	32.8	40.0	7.2	

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.

*For Mode 8 (ECU: Min Power), only the carrier level and worst spurious emission of Mode 3 (ECU: Max Power) were confirmed.

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Radiated Emission above 30 MHz (Spurious Emission)

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date December 10, 2020
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Shinya Watanabe
Mode Mode 4

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.500	QP	40.7	18.2	7.1	38.8	27.3	40.0	12.8	
Hori.	54.999	QP	45.8	9.3	7.5	38.8	23.7	40.0	16.3	
Hori.	59.999	QP	41.5	7.7	7.5	38.8	17.9	40.0	22.1	
Hori.	64.998	QP	45.0	6.7	7.6	38.9	20.5	40.0	19.5	
Hori.	177.996	QP	42.6	15.9	8.7	38.9	28.2	43.5	15.3	
Hori.	189.996	QP	39.8	16.2	8.8	38.9	25.9	43.5	17.7	
Hori.	224.996	QP	42.8	11.2	9.0	38.9	24.2	46.0	21.9	
Vert.	30.500	QP	51.5	18.2	7.1	38.8	38.1	40.0	2.0	
Vert.	54.999	QP	51.5	9.3	7.5	38.8	29.4	40.0	10.6	
Vert.	59.999	QP	55.8	7.7	7.5	38.8	32.3	40.0	7.8	
Vert.	64.998	QP	56.6	6.7	7.6	38.9	32.1	40.0	7.9	
Vert.	177.996	QP	41.1	15.9	8.7	38.9	26.7	43.5	16.8	
Vert.	189.996	QP	39.7	16.2	8.8	38.9	25.7	43.5	17.8	
Vert.	224.996	QP	42.4	11.2	9.0	38.9	23.7	46.0	22.3	

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 above 30 MHz (Spurious Emission)

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date December 10, 2020
Temperature / Humidity 20 deg. C / 37 % RH
Engineer Shinya Watanabe
Mode Mode 5

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.499	QP	38.5	18.2	7.1	38.8	25.1	40.0	14.9	
Hori.	53.491	QP	44.7	9.8	7.5	38.8	23.1	40.0	16.9	
Hori.	55.499	QP	51.9	9.1	7.5	38.8	29.7	40.0	10.3	
Hori.	58.499	QP	45.6	8.2	7.5	38.8	22.5	40.0	17.5	
Hori.	63.999	QP	52.0	6.9	7.6	38.8	27.7	40.0	12.4	
Hori.	85.998	QP	40.4	7.7	7.8	38.9	17.1	40.0	23.0	
Hori.	177.499	QP	45.5	15.9	8.7	38.9	31.1	43.5	12.4	
Hori.	202.496	QP	50.4	11.4	8.9	38.9	31.7	43.5	11.8	
Vert.	30.499	QP	49.5	18.2	7.1	38.8	36.0	40.0	4.0	
Vert.	53.491	QP	55.9	9.8	7.5	38.8	34.3	40.0	5.7	
Vert.	55.499	QP	61.0	9.1	7.5	38.8	38.8	40.0	1.2	
Vert.	58.499	QP	62.4	8.2	7.5	38.8	39.3	40.0	0.7	
Vert.	65.999	QP	59.4	6.6	7.6	38.9	34.8	40.0	5.2	
Vert.	85.998	QP	46.3	7.7	7.8	38.9	23.0	40.0	17.0	
Vert.	177.499	QP	49.7	15.9	8.7	38.9	35.3	43.5	8.3	
Vert.	202.496	QP	52.6	11.4	8.9	38.9	33.9	43.5	9.6	

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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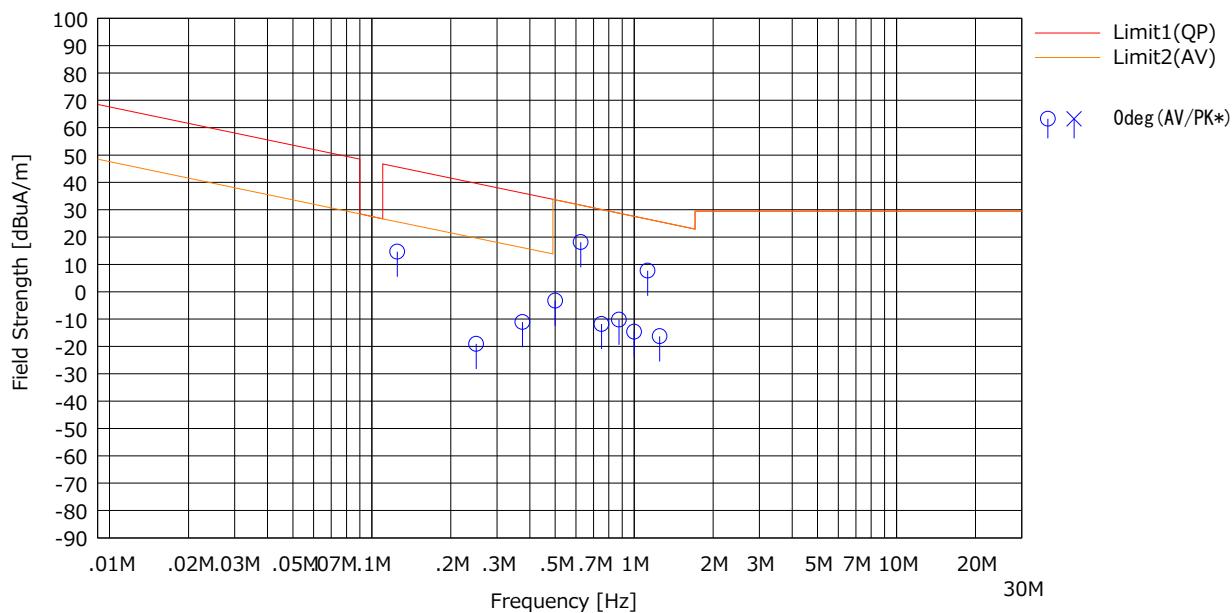
Facsimile : +81 596 24 8124

Radiated Emission Plot data, Worst case

Report No. 13619652H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.4 No.3
 Date December 10, 2020 December 15, 2020
 Temperature / Humidity 20 deg. C / 37 % RH 25 deg. C / 30 % RH
 Engineer Shinya Watanabe Yuta Moriya
 Mode Mode 5 (above 30 MHz) Mode 5 (below 30 MHz)

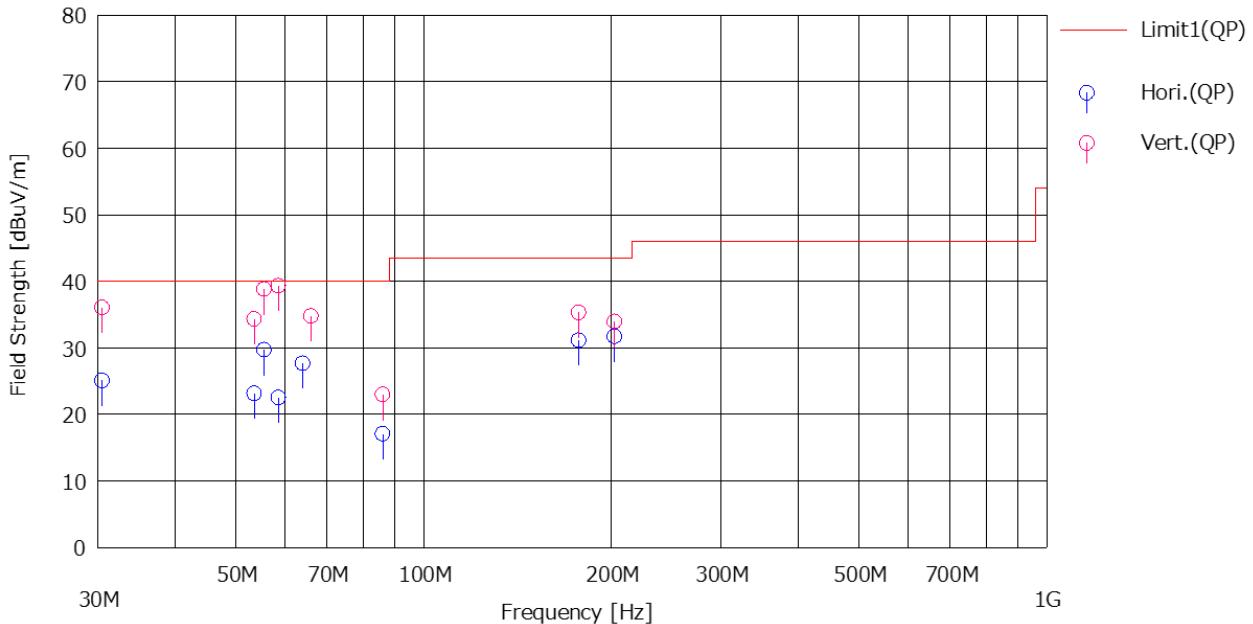
(below 30MHz)

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



* Data above 490 kHz were measured using a QP detector.

(above 30MHz)



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

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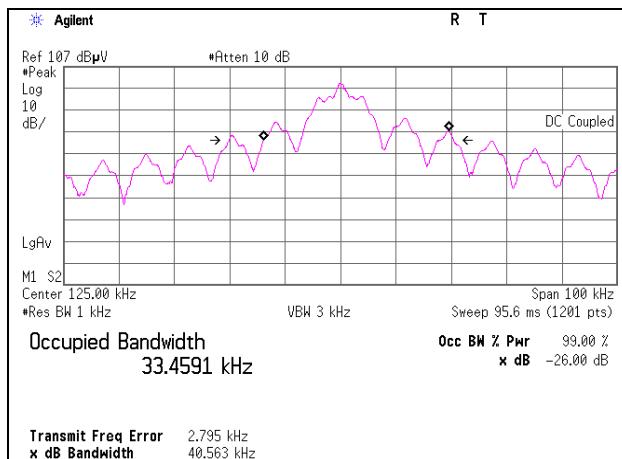
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date December 15, 2020
Temperature / Humidity 25 deg. C / 30 % RH
Engineer Yuta Moriya
Mode Mode 1

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
40.563	33.4591



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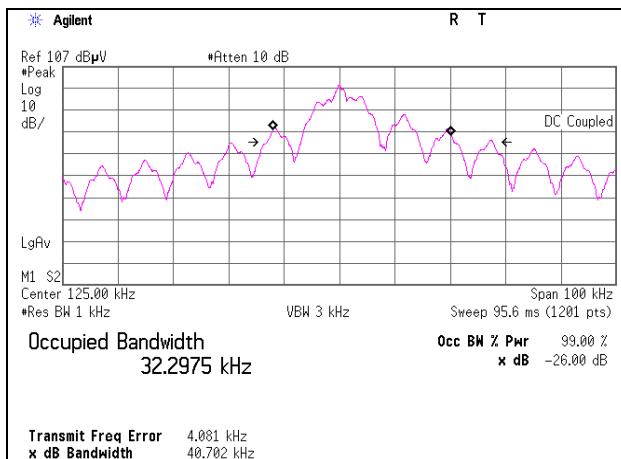
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date December 15, 2020
Temperature / Humidity 25 deg. C / 30 % RH
Engineer Yuta Moriya
Mode Mode 2

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
40.702	32.2975



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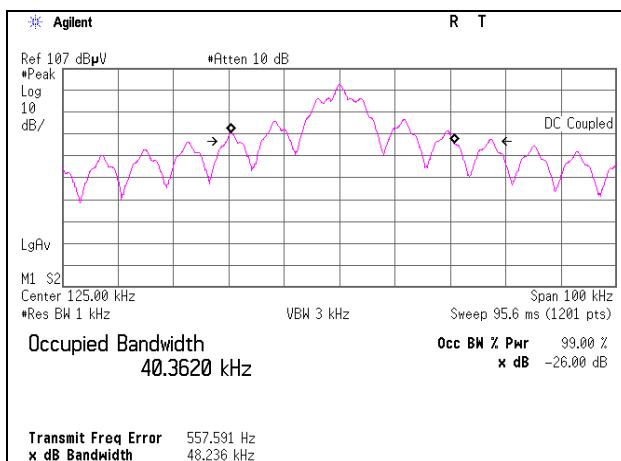
Telephone : +81 596 24 8999

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-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date December 15, 2020
Temperature / Humidity 25 deg. C / 30 % RH
Engineer Yuta Moriya
Mode Mode 3

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
48.236	40.3620



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-26 dB Bandwidth and 99 % Occupied Bandwidth

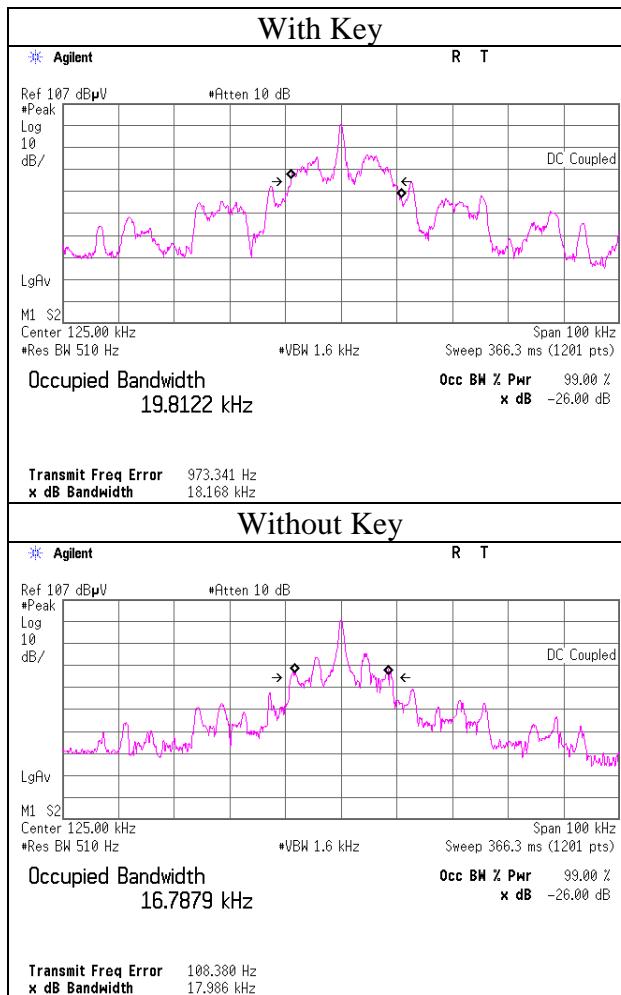
Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date December 15, 2020
Temperature / Humidity 25 deg. C / 30 % RH
Engineer Yuta Moriya
Mode Mode 4

< With Key >

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
18.168	19.8122

< Without Key >

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
17.986	16.7879



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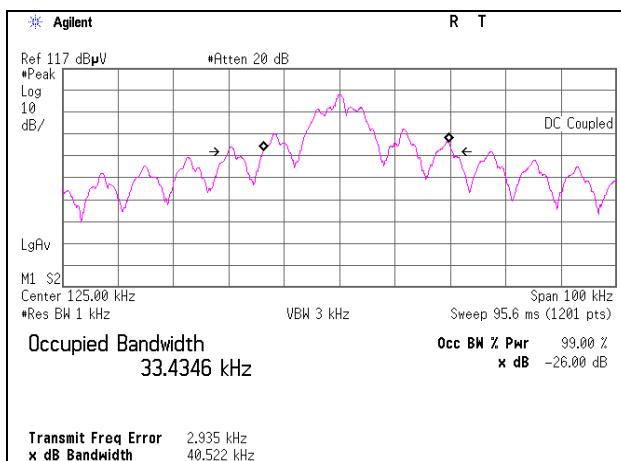
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

-26 dB Bandwidth and 99 % Occupied Bandwidth

Report No. 13619652H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date December 15, 2020
Temperature / Humidity 25 deg. C / 30 % RH
Engineer Yuta Moriya
Mode Mode 5

-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
40.522	33.4346



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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	MJM-12	142180	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI	141152	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/18/2020	12
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	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/25/2020	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0010	01/07/2020	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	03/10/2020	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	VHA 91031302	08/31/2020	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	09/02/2020	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/06/2020	12
RE	MPA-19	141585	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	02/10/2020	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	MCC-112	141216	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM14/sucoform141-PE/421-010/RFM-E321(SW)	-/00640	07/06/2020	12
RE	MLPA-02	142152	Loop Antenna	Rohde & Schwarz	HFH2-Z2	836553/009	12/04/2020	12
RE	MCC-219	159670	Coaxial Cable	UL Japan Inc.	-	-	11/17/2020	12
RE	MSA-15	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	10/15/2020	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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