



RADIO TEST REPORT

Test Report No. : 13881505H-A

Applicant : DAIHATSU MOTOR CO., LTD.
Type of EUT : Keyfree System
Model Number of EUT : DH19S-6
FCC ID : 2AVSADH19S-6
Test regulation : FCC Part 15 Subpart C: 2021
Test Result : Complied (Refer to SECTION 3)

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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: July 9 and 10, 2021

Representative test engineer: 
Kiyoshiro Okazaki
Engineer

Approved by: 
Tsubasa Takayama
Leader



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.: 13881505H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13881505H-A	July 16, 2021	-	-

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	:	DAIHATSU MOTOR CO., LTD.*
Address	:	2-1-1, Momozono, Ikeda-shi, Osaka, 563-8651, Japan
Telephone Number	:	+81-72-754-4526
Facsimile Number	:	+81-72-754-3857
Contact Person	:	Kouji Ozawa

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)
- 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.

*Remarks:

DAIHATSU MOTOR CO., LTD. designates DENSO CORPORATION and TOKAI RIKA CO., LTD. as manufacturer of the product (Immobilizer).

SECTION 2: Equipment under test (EUT)

2.1. Identification of EUT

Type	:	Keyfree System
Model Number	:	DH19S-6
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 12.0 V
Receipt Date	:	June 18, 2021
Country of Mass-production	:	Malaysia and Republic of Indonesia and Thailand
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2. Product Description

Model: DH19S-6 (referred to as the EUT in this report) is a Keyfree System.

Radio Specification

[Transmitter part]

Radio Type	:	LF Transmitter
Frequency of Operation	:	125 kHz
Oscillator frequency	:	4.0000 MHz (Ceramic)
Modulation	:	ASK (A1D)
Antenna type	:	Antenna (Outside Antenna D) Antenna (Outside Antenna P) Antenna (Outside Antenna B) Antenna (Inside Antenna Fr) Antenna (Inside Antenna Mi) Antenna (Inside Antenna Rr) Immobilizer Antenna
Antenna Specification	:	LF antenna: Ferrite antenna coil Immobilizer antenna: Loop antenna coil
Clock Frequency (maximum)	:	8 MHz

[Receiver part]

Frequency of Operation	:	433.92 MHz (Keyfree) 433.90 MHz (TPMS)
Oscillator frequency	:	33.600 MHz (Crystal)
Intermediate frequency	:	525 kHz (Keyfree) 1.05 MHz (TPMS)
Modulation	:	FSK (F1D)
Type of receiving system	:	Super-heterodyne
Antenna Specification	:	Internal antenna (Inverted F antenna)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 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.
*Also the EUT complies with FCC Part 15 Subpart B.

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	3.7 dB 125 kHz, 0 deg. Peak with Duty factor Mode 5 / Mode 6	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	2.6 dB 32.694 MHz, 0 deg., Vertical QP	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) 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 battery voltage (DC 12V) is provided to the EUT. Input voltage to RF part doesn't go through the regulator. So the test was performed with the supply voltage varied between 85 % and 115% of the nominal rated supply voltage (DC 12 V) and the variation of the input power 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.

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	-

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 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 $k=2$.

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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

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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

* 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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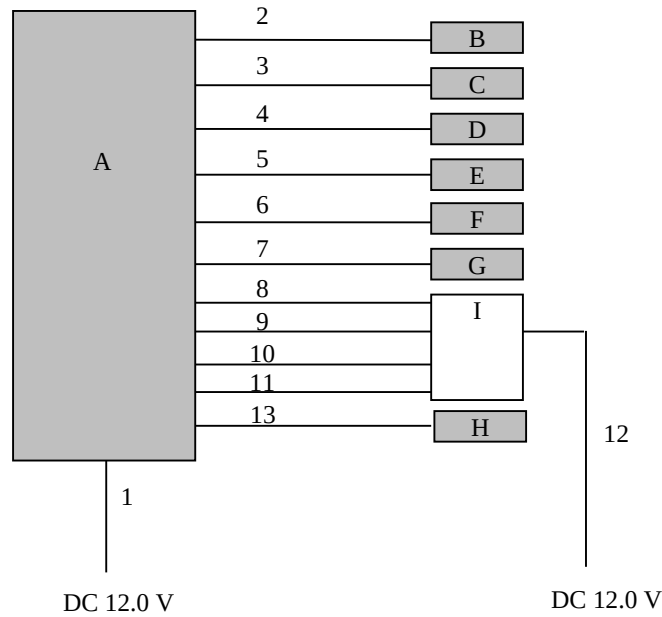
SECTION 4: Operation of EUT during testing

4.1. Operating Mode(s)

Test mode	Remarks
1) Tx 125 kHz Outside Antenna D	-
2) Tx 125 kHz Outside Antenna P	-
3) Tx 125 kHz Outside Antenna B	-
4) Tx 125 kHz Inside Antenna Fr	-
5) Tx 125 kHz Inside Antenna Rr	-
6) Tx 125 kHz Inside Antenna Mi	-
7) Tx 125 kHz Immobilizer Antenna	-
8) Tx 125 kHz Outside Antenna D+P	-
* EUT was set by the software as follows; Software: 200213_RadioTest_TypeA.s (Date: February 13, 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.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Body ECU	DH19S-6	No.519	DENSO CORPORATION	EUT
B	Antenna	Outside Antenna D	No.519-1	TOKAI RIKA CO., LTD.	EUT
C	Antenna	Outside Antenna P	No.519-2	TOKAI RIKA CO., LTD.	EUT
D	Antenna	Outside Antenna B	No.519-3	TOKAI RIKA CO., LTD.	EUT
E	Antenna	Inside Antenna Fr	No.519-4	TOKAI RIKA CO., LTD.	EUT
F	Antenna	Inside Antenna Rr	No.519-5	TOKAI RIKA CO., LTD.	EUT
G	Antenna	Immobilizer Antenna	No.519	TOKAI RIKA CO., LTD.	EUT
H	Antenna	Inside Antenna Mi	No.519-6	TOKAI RIKA CO., LTD.	EUT
I	Evaluation Bench	-	14	DENSO CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Antenna Cable (AND)	3.0	Unshielded	Unshielded	-
3	Antenna Cable (ANP)	3.0	Unshielded	Unshielded	-
4	Antenna Cable (ANB)	3.0	Unshielded	Unshielded	-
5	Antenna Cable (ANF)	3.0	Unshielded	Unshielded	-
6	Antenna Cable (ANR)	3.0	Unshielded	Unshielded	-
7	Antenna Cable	3.0	Unshielded	Unshielded	-
8	Signal Cable (CN-C)	3.0	Unshielded	Unshielded	-
9	Signal Cable (CN-K)	3.0	Unshielded	Unshielded	-
10	Signal Cable (CN-M)	3.0	Unshielded	Unshielded	-
11	Signal Cable (CN-P)	3.0	Unshielded	Unshielded	-
12	DC Cable	3.0	Unshielded	Unshielded	-
13	Antenna Cable (ANM)	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.

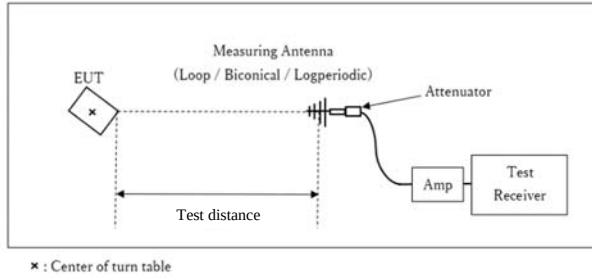
These tests were performed in semi anechoic chamber. Therefore, the measured level of emissions may be higher than if measurements were made without a ground plane.

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 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.

[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.

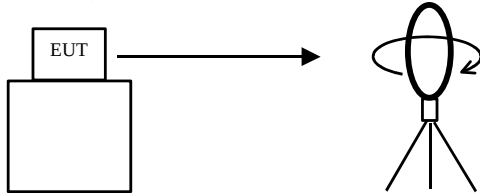
This EUT has two modes which transponder key is attached or not. The worst case was confirmed with and without transponder key attached, as a result, the test without transponder key attached was the worst case. Therefore the test without transponder key attached was performed only.

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

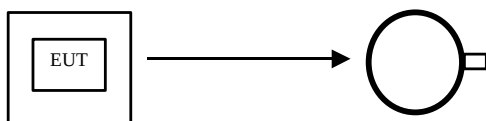
Measurement range	: 9 kHz - 1 GHz
Test data	: APPENDIX
Test result	: Pass

Figure 1: Direction of the Loop Antenna

Side View (Vertical)

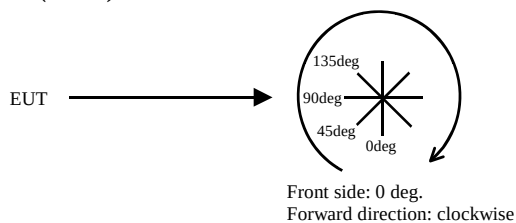


Top View (Horizontal)



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.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	75 kHz	510 Hz	1.6 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1

Test result : Pass

SECTION 7: 99% 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

*) 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

Test result : Pass

APPENDIX 1: Test data

Radiated Emission (Fundamental and Spurious Emission)

Report No. 13881505H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 9, 2021 July 10, 2021
Temperature / Humidity 24 deg. C / 68 % RH 24 deg. C / 65 % RH
Engineer Kiyoshiro Okazaki Kiyoshiro Okazaki
(Below 30 MHz) (Above 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	0.12500	PK	108.4	18.9	-73.8	32.1	-	21.4	45.6	24.2	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.4	18.9	-73.8	32.1	-	21.4	45.6	24.2	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.4	18.9	-73.8	32.1	-	21.4	45.6	24.2	Fundamental(DC 13.8 V)
0deg	0.25000	PK	75.0	18.9	-73.8	32.1	-	-12.0	39.6	51.6	
0deg	0.37500	PK	55.7	18.8	-73.8	32.1	-	-31.4	36.1	67.5	
0deg	0.50000	QP	39.3	18.8	-33.8	32.0	-	-7.7	33.6	41.3	
0deg	0.62500	QP	37.6	18.8	-33.7	32.1	-	-9.4	31.7	41.1	
0deg	0.75000	QP	33.4	18.8	-33.7	32.1	-	-13.6	30.1	43.7	
0deg	0.87500	QP	32.9	18.8	-33.7	32.1	-	-14.1	28.7	42.8	
0deg	1.00000	QP	32.8	18.8	-33.7	32.2	-	-14.3	27.6	41.9	
0deg	1.12500	QP	34.0	18.8	-33.7	32.2	-	-13.1	26.5	39.6	
0deg	1.25000	QP	33.3	18.8	-33.7	32.2	-	-13.8	25.6	39.4	
Hori.	53.621	QP	39.1	9.8	7.5	32.0	-	24.4	40.0	15.6	
Hori.	63.100	QP	36.1	7.1	7.6	32.0	-	18.8	40.0	21.2	
Hori.	116.545	QP	36.8	12.4	8.1	32.0	-	25.3	43.5	18.2	
Hori.	126.274	QP	34.7	13.3	8.2	32.0	-	24.2	43.5	19.3	
Hori.	215.023	QP	38.7	11.2	9.0	31.9	-	27.0	43.5	16.5	
Hori.	439.888	QP	37.0	16.3	10.4	32.0	-	31.7	46.0	14.3	
Vert.	58.447	QP	41.5	8.2	7.5	32.0	-	25.2	40.0	14.8	
Vert.	62.829	QP	35.8	7.1	7.6	32.0	-	18.5	40.0	21.5	
Vert.	116.604	QP	41.5	12.4	8.1	32.0	-	30.0	43.5	13.5	
Vert.	123.440	QP	39.8	13.1	8.2	32.0	-	29.1	43.5	14.4	
Vert.	216.403	QP	38.8	11.2	9.0	31.9	-	27.1	46.0	18.9	
Vert.	441.893	QP	33.4	16.3	10.4	32.0	-	28.1	46.0	17.9	

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	0.12500	PK	108.4	18.9	-73.8	32.1	0.0	21.4	25.6	4.2	DC 10.2 V
0deg	0.12500	PK	108.4	18.9	-73.8	32.1	0.0	21.4	25.6	4.2	DC 12.0 V
0deg	0.12500	PK	108.4	18.9	-73.8	32.1	0.0	21.4	25.6	4.2	DC 13.8 V
0deg	0.25000	PK	75.0	18.9	-73.8	32.1	0.0	-12.0	19.6	31.6	
0deg	0.37500	PK	55.7	18.8	-73.8	32.1	0.0	-31.4	16.1	47.5	

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	0.12500	PK	108.4	18.9	6.2	32.1	-	101.4	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 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	0.12500	PK	108.1	18.9	-73.8	32.1	-	21.1	45.6	24.5	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.1	18.9	-73.8	32.1	-	21.1	45.6	24.5	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.1	18.9	-73.8	32.1	-	21.1	45.6	24.5	Fundamental(DC 13.8 V)
0deg	0.25000	PK	74.8	18.9	-73.8	32.1	-	-12.2	39.6	51.8	
0deg	0.37500	PK	55.5	18.8	-73.8	32.1	-	-31.6	36.1	67.7	
0deg	0.50000	QP	38.4	18.8	-33.8	32.0	-	-8.6	33.6	42.2	
0deg	0.62500	QP	37.5	18.8	-33.7	32.1	-	-9.5	31.7	41.2	
0deg	0.75000	QP	33.0	18.8	-33.7	32.1	-	-14.0	30.1	44.1	
0deg	0.87500	QP	32.4	18.8	-33.7	32.1	-	-14.6	28.7	43.3	
0deg	1.00000	QP	32.9	18.8	-33.7	32.2	-	-14.2	27.6	41.8	
0deg	1.12500	QP	34.6	18.8	-33.7	32.2	-	-12.5	26.5	39.0	
0deg	1.25000	QP	33.8	18.8	-33.7	32.2	-	-13.3	25.6	38.9	
Hori.	33.684	QP	22.2	17.0	7.2	32.0	-	14.4	40.0	25.6	
Hori.	53.526	QP	39.1	9.8	7.5	32.0	-	24.4	40.0	15.6	
Hori.	58.472	QP	30.0	8.2	7.5	32.0	-	13.7	40.0	26.3	
Hori.	114.717	QP	36.7	12.2	8.1	32.0	-	25.0	43.5	18.5	
Hori.	185.407	QP	27.9	16.1	8.7	31.9	-	20.8	43.5	22.7	
Hori.	215.335	QP	38.5	11.2	9.0	31.9	-	26.8	43.5	16.7	
Hori.	334.665	QP	36.9	14.7	9.8	31.9	-	29.5	46.0	16.5	
Vert.	33.809	QP	30.7	17.0	7.2	32.0	-	22.9	40.0	17.1	
Vert.	52.537	QP	38.3	10.2	7.5	32.0	-	24.0	40.0	16.0	
Vert.	58.261	QP	41.0	8.3	7.5	32.0	-	24.8	40.0	15.2	
Vert.	123.524	QP	41.5	13.1	8.2	32.0	-	30.8	43.5	12.7	
Vert.	184.817	QP	35.8	16.1	8.7	31.9	-	28.7	43.5	14.8	
Vert.	215.335	QP	38.9	11.2	9.0	31.9	-	27.2	43.5	16.3	

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	0.12500	PK	108.1	18.9	-73.8	32.1	0.0	21.1	25.6	4.5	DC 10.2 V
0deg	0.12500	PK	108.1	18.9	-73.8	32.1	0.0	21.1	25.6	4.5	DC 12.0 V
0deg	0.12500	PK	108.1	18.9	-73.8	32.1	0.0	21.1	25.6	4.5	DC 13.8 V
0deg	0.25000	PK	74.8	18.9	-73.8	32.1	0.0	-12.2	19.6	31.8	
0deg	0.37500	PK	55.5	18.8	-73.8	32.1	0.0	-31.6	16.1	47.7	

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	0.12500	PK	108.1	18.9	6.2	32.1	-	101.1	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 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	0.12500	PK	108.7	18.9	-73.8	32.1	-	21.7	45.6	23.9	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.7	18.9	-73.8	32.1	-	21.7	45.6	23.9	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.7	18.9	-73.8	32.1	-	21.7	45.6	23.9	Fundamental(DC 13.8 V)
0deg	0.25000	PK	78.6	18.9	-73.8	32.1	-	-8.4	39.6	48.0	
0deg	0.37500	PK	62.4	18.8	-73.8	32.1	-	-24.7	36.1	60.8	
0deg	0.50000	QP	38.8	18.8	-33.8	32.0	-	-8.2	33.6	41.8	
0deg	0.62500	QP	36.2	18.8	-33.7	32.1	-	-10.8	31.7	42.5	
0deg	0.75000	QP	34.3	18.8	-33.7	32.1	-	-12.7	30.1	42.8	
0deg	0.87500	QP	32.3	18.8	-33.7	32.1	-	-14.7	28.7	43.4	
0deg	1.00000	QP	32.5	18.8	-33.7	32.2	-	-14.6	27.6	42.2	
0deg	1.12500	QP	32.2	18.8	-33.7	32.2	-	-14.9	26.5	41.4	
0deg	1.25000	QP	32.0	18.8	-33.7	32.2	-	-15.1	25.6	40.7	
Hori.	53.935	QP	39.3	9.7	7.5	32.0	-	24.5	40.0	15.5	
Hori.	117.623	QP	36.8	12.5	8.1	32.0	-	25.4	43.5	18.1	
Hori.	124.037	QP	34.5	13.1	8.2	32.0	-	23.8	43.5	19.7	
Hori.	187.436	QP	27.8	16.2	8.7	31.9	-	20.8	43.5	22.7	
Hori.	214.654	QP	38.6	11.2	8.9	31.9	-	26.8	43.5	16.7	
Hori.	438.537	QP	37.2	16.3	10.4	32.0	-	31.9	46.0	14.1	
Vert.	58.409	QP	40.8	8.2	7.5	32.0	-	24.5	40.0	15.5	
Vert.	117.646	QP	40.5	12.5	8.1	32.0	-	29.1	43.5	14.4	
Vert.	124.017	QP	35.4	13.1	8.2	32.0	-	24.7	43.5	18.8	
Vert.	187.398	QP	35.6	16.2	8.7	31.9	-	28.6	43.5	14.9	
Vert.	214.668	QP	38.7	11.2	8.9	31.9	-	26.9	43.5	16.6	
Vert.	438.537	QP	33.5	16.3	10.4	32.0	-	28.2	46.0	17.8	

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	0.12500	PK	108.7	18.9	-73.8	32.1	0.0	21.7	25.6	3.9	DC 10.2 V
0deg	0.12500	PK	108.7	18.9	-73.8	32.1	0.0	21.7	25.6	3.9	DC 12.0 V
0deg	0.12500	PK	108.7	18.9	-73.8	32.1	0.0	21.7	25.6	3.9	DC 13.8 V
0deg	0.25000	PK	78.6	18.9	-73.8	32.1	0.0	-8.4	19.6	28.0	
0deg	0.37500	PK	62.4	18.8	-73.8	32.1	0.0	-24.7	16.1	40.8	

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	0.12500	PK	108.7	18.9	6.2	32.1	-	101.7	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 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	0.12500	PK	108.5	18.9	-73.8	32.1	-	21.5	45.6	24.1	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.5	18.9	-73.8	32.1	-	21.5	45.6	24.1	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.5	18.9	-73.8	32.1	-	21.5	45.6	24.1	Fundamental(DC 13.8 V)
0deg	0.25000	PK	74.9	18.9	-73.8	32.1	-	-12.1	39.6	51.7	
0deg	0.37500	PK	56.2	18.8	-73.8	32.1	-	-30.9	36.1	67.0	
0deg	0.50000	QP	39.5	18.8	-33.8	32.0	-	-7.5	33.6	41.1	
0deg	0.62500	QP	33.1	18.8	-33.7	32.1	-	-13.9	31.7	45.6	
0deg	0.75000	QP	32.5	18.8	-33.7	32.1	-	-14.5	30.1	44.6	
0deg	0.87500	QP	32.2	18.8	-33.7	32.1	-	-14.8	28.7	43.5	
0deg	1.00000	QP	32.1	18.8	-33.7	32.2	-	-15.0	27.6	42.6	
0deg	1.12500	QP	32.2	18.8	-33.7	32.2	-	-14.9	26.5	41.4	
0deg	1.25000	QP	32.3	18.8	-33.7	32.2	-	-14.8	25.6	40.4	
Hori.	52.550	QP	38.1	10.1	7.5	32.0	-	23.7	40.0	16.3	
Hori.	64.838	QP	35.5	6.7	7.6	32.0	-	17.8	40.0	22.2	
Hori.	117.743	QP	36.9	12.6	8.1	32.0	-	25.6	43.5	17.9	
Hori.	123.976	QP	34.6	13.1	8.2	32.0	-	23.9	43.5	19.6	
Hori.	214.756	QP	33.7	11.2	9.0	31.9	-	22.0	43.5	21.5	
Hori.	440.043	QP	37.4	16.3	10.4	32.0	-	32.1	46.0	13.9	
Vert.	44.450	QP	36.2	13.2	7.3	32.0	-	24.7	40.0	15.3	
Vert.	64.849	QP	39.1	6.7	7.6	32.0	-	21.4	40.0	18.6	
Vert.	117.688	QP	40.6	12.6	8.1	32.0	-	29.3	43.5	14.2	
Vert.	123.382	QP	35.5	13.1	8.2	32.0	-	24.8	43.5	18.7	
Vert.	225.343	QP	38.5	11.2	9.0	31.9	-	26.8	46.0	19.2	
Vert.	442.310	QP	33.4	16.3	10.4	32.0	-	28.1	46.0	17.9	

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	0.12500	PK	108.5	18.9	-73.8	32.1	0.0	21.5	25.6	4.1	DC 10.2 V
0deg	0.12500	PK	108.5	18.9	-73.8	32.1	0.0	21.5	25.6	4.1	DC 12.0 V
0deg	0.12500	PK	108.5	18.9	-73.8	32.1	0.0	21.5	25.6	4.1	DC 13.8 V
0deg	0.25000	PK	74.9	18.9	-73.8	32.1	0.0	-12.1	19.6	31.7	
0deg	0.37500	PK	56.2	18.8	-73.8	32.1	0.0	-30.9	16.1	47.0	

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	0.12500	PK	108.5	18.9	6.2	32.1	-	101.5	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 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	0.12500	PK	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 13.8 V)
0deg	0.25000	PK	78.8	18.9	-73.8	32.1	-	-8.2	39.6	47.8	
0deg	0.37500	PK	62.8	18.8	-73.8	32.1	-	-24.3	36.1	60.4	
0deg	0.50000	QP	39.4	18.8	-33.8	32.0	-	-7.6	33.6	41.2	
0deg	0.62500	QP	35.9	18.8	-33.7	32.1	-	-11.1	31.7	42.8	
0deg	0.75000	QP	34.4	18.8	-33.7	32.1	-	-12.6	30.1	42.7	
0deg	0.87500	QP	32.3	18.8	-33.7	32.1	-	-14.7	28.7	43.4	
0deg	1.00000	QP	32.6	18.8	-33.7	32.2	-	-14.5	27.6	42.1	
0deg	1.12500	QP	32.3	18.8	-33.7	32.2	-	-14.8	26.5	41.3	
0deg	1.25000	QP	32.1	18.8	-33.7	32.2	-	-15.0	25.6	40.6	
Hori.	52.522	QP	38.0	10.2	7.5	32.0	-	23.7	40.0	16.3	
Hori.	71.510	QP	43.1	6.3	7.7	32.0	-	25.1	40.0	14.9	
Hori.	116.683	QP	36.5	12.4	8.1	32.0	-	25.0	43.5	18.5	
Hori.	123.255	QP	34.6	13.0	8.2	32.0	-	23.8	43.5	19.7	
Hori.	224.673	QP	33.4	11.2	9.0	31.9	-	21.7	46.0	24.3	
Hori.	389.920	QP	37.2	15.5	10.1	31.9	-	30.9	46.0	15.1	
Vert.	57.550	QP	40.6	8.5	7.5	32.0	-	24.6	40.0	15.4	
Vert.	71.510	QP	46.3	6.3	7.7	32.0	-	28.3	40.0	11.7	
Vert.	118.683	QP	40.7	12.6	8.1	32.0	-	29.4	43.5	14.1	
Vert.	124.755	QP	35.0	13.2	8.2	32.0	-	24.4	43.5	19.1	
Vert.	224.673	QP	38.6	11.2	9.0	31.9	-	26.9	46.0	19.1	
Vert.	414.346	QP	33.6	16.1	10.3	31.9	-	28.1	46.0	17.9	

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	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 10.2 V
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 12.0 V
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 13.8 V
0deg	0.25000	PK	78.8	18.9	-73.8	32.1	0.0	-8.2	19.6	27.8	
0deg	0.37500	PK	62.8	18.8	-73.8	32.1	0.0	-24.3	16.1	40.4	

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	0.12500	PK	108.9	18.9	6.2	32.1	-	101.9	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 30 MHz)
Mode	Mode 6	

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	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 10.2 V)
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 12.0 V)
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	-	21.9	45.6	23.7	Fundamental(DC 13.8 V)
0deg	0.25000	PK	78.7	18.9	-73.8	32.1	-	-8.3	39.6	47.9	
0deg	0.37500	PK	62.6	18.8	-73.8	32.1	-	-24.5	36.1	60.6	
0deg	0.50000	QP	39.2	18.8	-33.8	32.0	-	-7.8	33.6	41.4	
0deg	0.62500	QP	35.4	18.8	-33.7	32.1	-	-11.6	31.7	43.3	
0deg	0.75000	QP	34.5	18.8	-33.7	32.1	-	-12.5	30.1	42.6	
0deg	0.87500	QP	32.3	18.8	-33.7	32.1	-	-14.7	28.7	43.4	
0deg	1.00000	QP	32.7	18.8	-33.7	32.2	-	-14.4	27.6	42.0	
0deg	1.12500	QP	32.3	18.8	-33.7	32.2	-	-14.8	26.5	41.3	
0deg	1.25000	QP	32.1	18.8	-33.7	32.2	-	-15.0	25.6	40.6	
Hori.	32.833	QP	35.8	17.3	7.2	32.0	-	28.3	40.0	11.7	
Hori.	65.275	QP	40.1	6.7	7.6	32.0	-	22.4	40.0	17.6	
Hori.	116.537	QP	36.7	12.4	8.1	32.0	-	25.2	43.5	18.3	
Hori.	123.632	QP	34.5	13.1	8.2	32.0	-	23.8	43.5	19.7	
Hori.	311.731	QP	35.1	13.8	9.6	31.9	-	26.6	46.0	19.4	
Hori.	437.955	QP	34.6	16.3	10.4	32.0	-	29.3	46.0	16.7	
Vert.	32.694	QP	44.9	17.3	7.2	32.0	-	37.4	40.0	2.6	
Vert.	64.983	QP	45.1	6.7	7.6	32.0	-	27.4	40.0	12.6	
Vert.	118.542	QP	40.6	12.6	8.1	32.0	-	29.3	43.5	14.2	
Vert.	124.604	QP	35.2	13.2	8.2	32.0	-	24.6	43.5	18.9	
Vert.	310.002	QP	33.3	13.8	9.6	31.9	-	24.8	46.0	21.2	
Vert.	438.901	QP	30.4	16.3	10.4	32.0	-	25.1	46.0	20.9	

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	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 10.2 V
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 12.0 V
0deg	0.12500	PK	108.9	18.9	-73.8	32.1	0.0	21.9	25.6	3.7	DC 13.8 V
0deg	0.25000	PK	78.7	18.9	-73.8	32.1	0.0	-8.3	19.6	27.9	
0deg	0.37500	PK	62.6	18.8	-73.8	32.1	0.0	-24.5	16.1	40.6	

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	0.12500	PK	108.9	18.9	6.2	32.1	-	101.9	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 30 MHz)
Mode	Mode 7	

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	91.8	18.9	-73.8	32.1	-	4.8	45.6	40.8	Fundamental(DC 10.2 V)
0deg	0.12500	PK	91.8	18.9	-73.8	32.1	-	4.8	45.6	40.8	Fundamental(DC 12.0 V)
0deg	0.12500	PK	91.8	18.9	-73.8	32.1	-	4.8	45.6	40.8	Fundamental(DC 13.8 V)
0deg	0.25000	PK	53.4	18.9	-73.8	32.1	-	-33.6	39.6	73.2	
0deg	0.37500	PK	55.0	18.8	-73.8	32.1	-	-32.1	36.1	68.2	
0deg	0.50000	QP	33.2	18.8	-33.8	32.0	-	-13.8	33.6	47.4	
0deg	0.62500	QP	43.8	18.8	-33.7	32.1	-	-3.2	31.7	34.9	
0deg	0.75000	QP	32.0	18.8	-33.7	32.1	-	-15.0	30.1	45.1	
0deg	0.87500	QP	38.8	18.8	-33.7	32.1	-	-8.2	28.7	36.9	
0deg	1.00000	QP	31.7	18.8	-33.7	32.2	-	-15.4	27.6	43.0	
0deg	1.12500	QP	35.7	18.8	-33.7	32.2	-	-11.4	26.5	37.9	
0deg	1.25000	QP	31.5	18.8	-33.7	32.2	-	-15.6	25.6	41.2	
Hori.	125.000	QP	22.3	13.3	8.2	32.0	-	11.8	43.5	31.7	
Hori.	183.870	QP	22.4	16.1	8.7	31.9	-	15.3	43.5	28.2	
Hori.	260.239	QP	35.2	12.2	9.3	31.9	-	24.8	46.0	21.2	
Hori.	292.270	QP	34.0	13.5	9.5	31.9	-	25.1	46.0	20.9	
Hori.	300.266	QP	33.7	13.6	9.6	31.9	-	25.0	46.0	21.0	
Hori.	344.017	QP	31.0	15.0	9.8	31.9	-	23.9	46.0	22.1	
Vert.	125.000	QP	29.9	13.3	8.2	32.0	-	19.4	43.5	24.1	
Vert.	182.908	QP	25.9	16.1	8.7	31.9	-	18.8	43.5	24.7	
Vert.	260.023	QP	35.3	12.2	9.3	31.9	-	24.9	46.0	21.1	
Vert.	292.271	QP	33.7	13.5	9.5	31.9	-	24.8	46.0	21.2	
Vert.	299.799	QP	27.9	13.6	9.6	31.9	-	19.2	46.0	26.8	
Vert.	344.285	QP	24.5	15.0	9.8	31.9	-	17.4	46.0	28.6	

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	0.12500	PK	91.8	18.9	-73.8	32.1	0.0	4.8	25.6	20.8	DC 10.2 V
0deg	0.12500	PK	91.8	18.9	-73.8	32.1	0.0	4.8	25.6	20.8	DC 12.0 V
0deg	0.12500	PK	91.8	18.9	-73.8	32.1	0.0	4.8	25.6	20.8	DC 13.8 V
0deg	0.25000	PK	53.4	18.9	-73.8	32.1	0.0	-33.6	19.6	53.2	
0deg	0.37500	PK	55.0	18.8	-73.8	32.1	0.0	-32.1	16.1	48.2	

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	0.12500	PK	91.8	18.9	6.2	32.1	-	84.8	-	-	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).

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Radiated Emission (Fundamental and Spurious Emission)

Report No.	13881505H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	July 9, 2021	July 10, 2021
Temperature / Humidity	24 deg. C / 68 % RH	24 deg. C / 65 % RH
Engineer	Kiyoshiro Okazaki (Below 30 MHz)	Kiyoshiro Okazaki (Above 30 MHz)
Mode	Mode 8	

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	101.3	18.9	-73.8	32.1	-	14.3	45.6	31.3	Fundamental(DC 10.2 V)
0deg	0.12500	PK	101.3	18.9	-73.8	32.1	-	14.3	45.6	31.3	Fundamental(DC 12.0 V)
0deg	0.12500	PK	101.3	18.9	-73.8	32.1	-	14.3	45.6	31.3	Fundamental(DC 13.8 V)
0deg	0.25000	PK	72.1	18.9	-73.8	32.1	-	-14.9	39.6	54.5	
0deg	0.37500	PK	71.5	18.8	-73.8	32.1	-	-15.6	36.1	51.7	
0deg	0.50000	QP	37.2	18.8	-33.8	32.0	-	-9.8	33.6	43.4	
0deg	0.62500	QP	55.1	18.8	-33.7	32.1	-	8.1	31.7	23.6	
0deg	0.75000	QP	33.8	18.8	-33.7	32.1	-	-13.2	30.1	43.3	
0deg	0.87500	QP	49.3	18.8	-33.7	32.1	-	2.3	28.7	26.4	
0deg	1.00000	QP	32.7	18.8	-33.7	32.2	-	-14.4	27.6	42.0	
0deg	1.12500	QP	45.4	18.8	-33.7	32.2	-	-1.7	26.5	28.2	
0deg	1.25000	QP	32.1	18.8	-33.7	32.2	-	-15.0	25.6	40.6	
Hori.	53.558	QP	35.7	9.8	7.5	32.0	-	21.0	40.0	19.0	
Hori.	66.158	QP	25.5	6.6	7.6	32.0	-	7.7	40.0	32.3	
Hori.	96.577	QP	32.3	9.5	7.9	32.0	-	17.7	43.5	25.8	
Hori.	115.615	QP	32.8	12.3	8.1	32.0	-	21.2	43.5	22.3	
Hori.	260.228	QP	35.1	12.2	9.3	31.9	-	24.7	46.0	21.3	
Hori.	397.851	QP	32.4	15.7	10.2	31.9	-	26.4	46.0	19.6	
Vert.	58.559	QP	34.5	8.2	7.5	32.0	-	18.2	40.0	21.8	
Vert.	69.455	QP	37.0	6.3	7.7	32.0	-	19.0	40.0	21.0	
Vert.	95.587	QP	34.3	9.3	7.9	32.0	-	19.5	43.5	24.0	
Vert.	115.606	QP	32.8	12.3	8.1	32.0	-	21.2	43.5	22.3	
Vert.	259.995	QP	36.7	12.2	9.3	31.9	-	26.3	46.0	19.7	
Vert.	388.824	QP	27.5	15.5	10.1	31.9	-	21.2	46.0	24.8	

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	0.12500	PK	101.3	18.9	-73.8	32.1	0.0	14.3	25.6	11.3	DC 10.2 V
0deg	0.12500	PK	101.3	18.9	-73.8	32.1	0.0	14.3	25.6	11.3	DC 12.0 V
0deg	0.12500	PK	101.3	18.9	-73.8	32.1	0.0	14.3	25.6	11.3	DC 13.8 V
0deg	0.25000	PK	72.1	18.9	-73.8	32.1	0.0	-14.9	19.6	34.5	
0deg	0.37500	PK	71.5	18.8	-73.8	32.1	0.0	-15.6	16.1	31.7	

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	0.12500	PK	101.3	18.9	6.2	32.1	-	94.3	-	-	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).

UL Japan, Inc.

Ise EMC Lab.

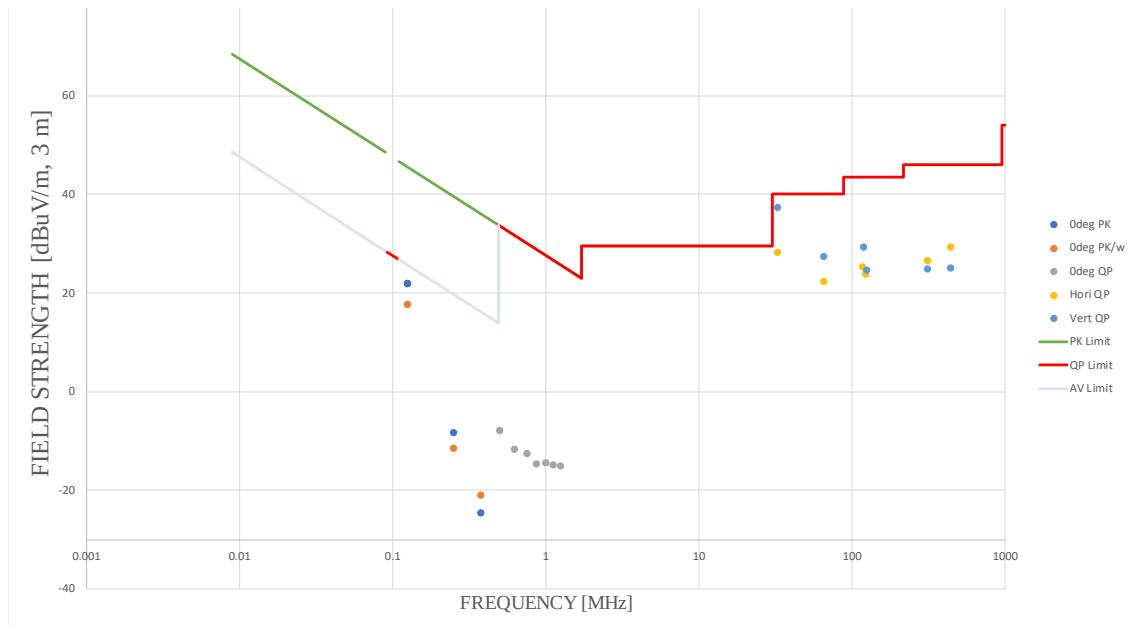
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Radiated Spurious Emission (Plot data, Worst case)

Report No. 13881505H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 9, 2021
Temperature / Humidity 24 deg. C / 68 % RH
Engineer Kiyoshiro Okazaki
Mode Mode 6



-26 dB Bandwidth / 99 % Occupied Bandwidth

Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date July 9, 2021
Temperature / Humidity 24 deg. C / 68 % RH
Engineer Kiyoshiro Okazaki
Mode Tx 125 kHz

Mode	-26 dB Bandwidth [kHz]	99 % Occupied Bandwidth [kHz]
1) Outside Antenna D	24.385	23.3876
2) Outside Antenna P	24.220	22.5974
3) Outside Antenna B	17.831	16.5261
4) Inside Antenna Fr	24.420	19.8340
5) Inside Antenna Rr	17.763	16.3386
6) Inside Antenna Mi	17.868	16.6151
7) Immobilizer Antenna (With Key)	25.909	33.6543
Immobilizer Antenna (Without Key)	18.270	21.7901
8) Outside Antenna D+P	39.896	32.6164

UL Japan, Inc.

Ise EMC Lab.

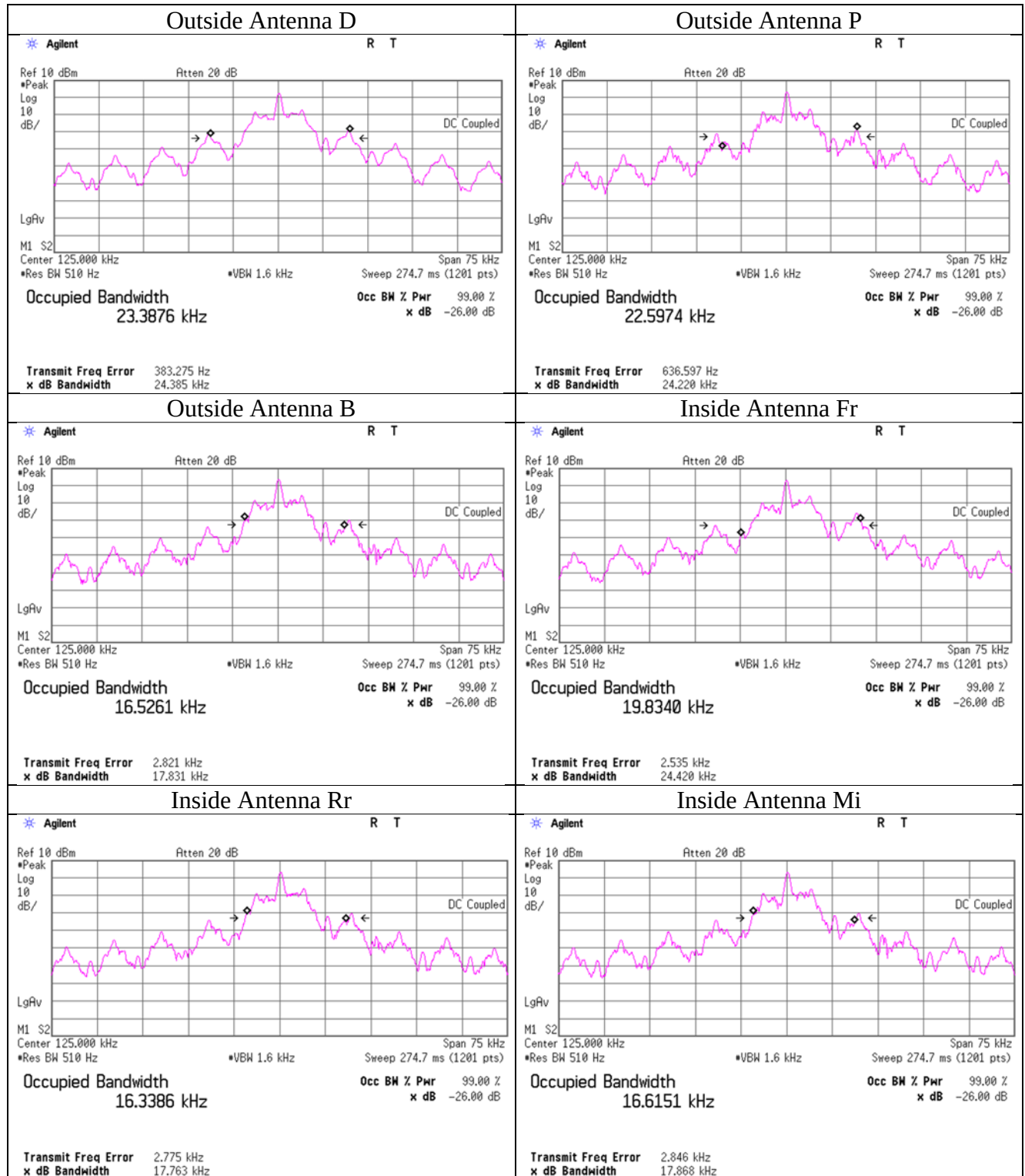
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

-26 dB Bandwidth / 99 % Occupied Bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	July 9, 2021
Temperature / Humidity	24 deg. C / 68 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 1 to 6



UL Japan, Inc.

Ise EMC Lab.

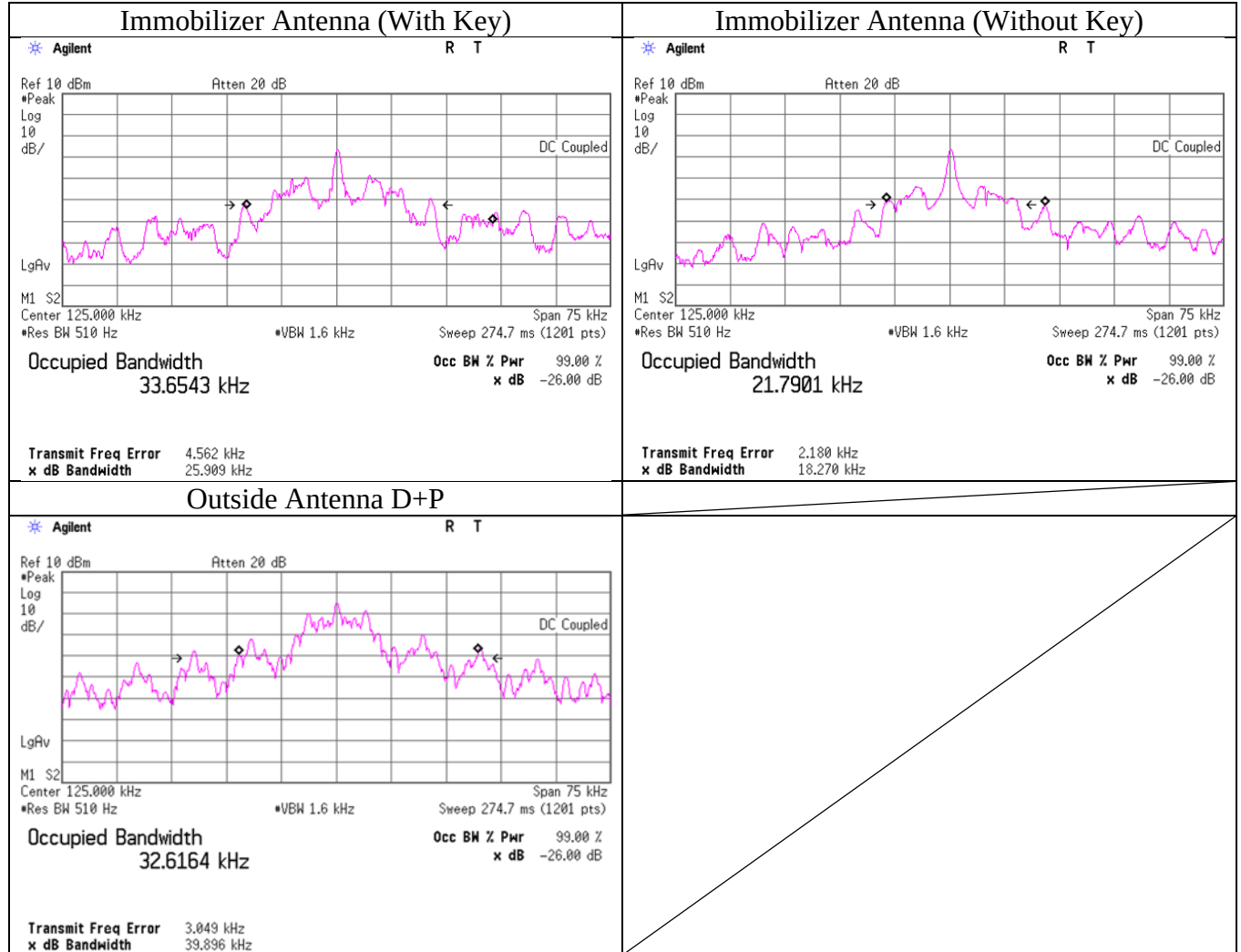
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Telephone : +81 596 24 8999

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-26 dB Bandwidth / 99 % Occupied Bandwidth

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	July 9, 2021
Temperature / Humidity	24 deg. C / 68 % RH
Engineer	Kiyoshiro Okazaki
Mode	Mode 7, 8



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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	MLPA-01	141254	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	04/17/2021	12
RE	MCC-113	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/ 421-010/sucoform141- PE/RFM-E121(SW)	-/04178	06/02/2021	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/02/2021	12
RE	MCC-255	207745	Coaxial Cable	UL Japan Inc.	-	-	05/17/2021	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	03/09/2021	12
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/18/2020	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2021	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	01/15/2021	12
RE	MMM-10	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	01/07/2021	12
RE	MJM-29	142230	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	VHA 91031302	08/31/2020	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	11/06/2020	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-192	09/02/2020	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: Radiated Emission test

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