





# RADIO TEST REPORT

## Test Report No. 15213807H-A-R2

Customer	Pacific Industrial Company, LTD.
Description of EUT	TPMS (Tire Pressure Monitoring System Transmitter)
Model Number of EUT	PMV-H102
FCC ID	PAXPMVH102
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	May 14, 2024
Remarks	-

<b>Representative test engineer</b>	<b>Approved by</b>
	
Ken Fujita Engineer	Shinichi Miyazono Engineer
 	
CERTIFICATE 5107.02	
<input type="checkbox"/> The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan, Inc.	
<input checked="" type="checkbox"/> There is no testing item of "Non-accreditation".	

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- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

## **REVISION HISTORY**

### **Original Test Report No. 15213807H-A**

This report is a revised version of 15213807H-A-R1. 15213807H-A-R1 is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15213807H-A	April 25, 2024	-
1	15213807H-A-R1	May 13, 2024	Correction of calculation for Mode 1 in Automatically deactivate test.
1	15213807H-A-R1	May 13, 2024	Correction of the 9th harmonic frequency the Horizontal side in Radiated Emission test data.
2	15213807H-A-R2	May 14, 2024	Correction of the 9th harmonic horizontal antenna factor, PK and AV margin in Radiated Emission test data.
2	15213807H-A-R2	May 14, 2024	Correction of the Plot data for Radiated Emission.

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

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

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## **SECTION 1: Customer Information**

Company Name	Pacific Industrial Company, LTD.
Address	1300-1, Yokoi, Godo-cho, Anpachi-gun, Gifu 503-2397, Japan
Telephone Number	+81-584-28-0113
Contact Person	Takashi Takeyama

The information provided by the customer is as follows;

- Customer, Description 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 and Test Date
- SECTION 4: Operation of EUT during testing

## **SECTION 2: Equipment Under Test (EUT)**

### **2.1 Identification of EUT**

Description	TPMS (Tire Pressure Monitoring System Transmitter)
Model Number	PMV-H102
Serial Number	Refer to SECTION 4.2
Condition	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	March 14, 2024
Test Date	March 22 to April 4, 2024

### **2.2 Product Description**

#### **General Specification**

Rating	DC 3.0 V
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#### **Radio Specification**

Equipment Type	Transmitter
Frequency of Operation	433.92 MHz
Type of Modulation	FSK
Antenna Gain	-23.5 dBi

## SECTION 3: Test Specification, Procedures & Results

### 3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

### 3.2 Procedures and Results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	<b>FCC:</b> ANSI C63.10:2013 6 Standard test methods  <b>ISED:</b> RSS-Gen 8.8	<b>FCC:</b> Section 15.207  <b>ISED:</b> RSS-Gen 8.8	N/A	N/A	*1)
Automatically Deactivate	<b>FCC:</b> ANSI C63.10:2013 6 Standard test methods  <b>ISED:</b> -	<b>FCC:</b> Section 15.231(a)(2) Section 15.231(e)  <b>ISED:</b> RSS-210 A1.1(b) RSS-210 A1.4(b)	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	<b>FCC:</b> ANSI C63.10:2013 6 Standard test methods  <b>ISED:</b> RSS-Gen 6.12	<b>FCC:</b> Section 15.231(e)  <b>ISED:</b> RSS-210 A1.4	7.8 dB 433.920 MHz Vertical, PK	Complied	Radiated
Electric Field Strength of Spurious Emission	<b>FCC:</b> ANSI C63.10:2013 6 Standard test methods  <b>ISED:</b> RSS-Gen 6.13	<b>FCC:</b> Section 15.205 Section 15.209 Section 15.231(b) Section 15.231(e)  <b>ISED:</b> RSS-210 A1.4 RSS-Gen 8.9	12.9 dB 4339.200 MHz Vertical, PK	Complied	Radiated
-20 dB Bandwidth	<b>FCC:</b> ANSI C63.10:2013 6 Standard test methods  <b>ISED:</b> -	<b>FCC:</b> Section 15.231(c)  <b>ISED:</b> Reference data	N/A	Complied	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.  
\*1) The test is not applicable since the EUT does not have AC Mains.

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

The test was performed with the New Battery during the tests.  
Therefore, this 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 EUT.  
Therefore, the equipment complies with the antenna requirement of Section 15.203.

### 3.3 Addition to Standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% emission bandwidth	ANSI C63.10:2013 6 Standard test methods	Reference data	N/A	-	Radiated

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement. Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

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	Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz	dB	3.3
10 m		dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	4.7
		Vertical	4.7
	200 MHz to 1000 MHz	Horizontal	4.8
		Vertical	6.0
10 m	30 MHz to 200 MHz	Horizontal	5.2
		Vertical	5.1
	200 MHz to 1000 MHz	Horizontal	5.2
		Vertical	5.2
3 m	1 GHz to 6 GHz	dB	5.0
	6 GHz to 18 GHz	dB	5.2
1 m	10 GHz to 18 GHz	dB	5.3
	18 GHz to 26.5 GHz	dB	5.2
	26.5 GHz to 40 GHz	dB	4.7
0.5 m	26.5 GHz to 40 GHz	dB	4.8

#### Automatically Deactivate, -20 dB Bandwidth and 99% Occupied Bandwidth

Item	Unit	Calculated Uncertainty (+/-)
Bandwidth (OBW)	%	0.96
Time readout (time span upto 100 msec)	%	0.11
Time readout (time span upto 1000 msec)	%	0.11
Time readout (time span upto 60 sec)	%	0.02

### 3.5 Test Location

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

\*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

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

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	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

### 3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.



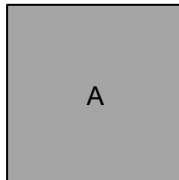
## SECTION 4: Operation of EUT during testing

### 4.1 Operating Mode(s)

Test mode	Remarks
1) Stationary mode 2 2) Rotating mode 2 3) Rotating mode 3 4) Pressure alert 2a 5) Pressure alert 2b-1 6) Pressure alert 2b-2	Automatically Deactivate
7) Transmitting mode (Tx 433.92 MHz) *1)	Average Output Power, Electric Field Strength of Fundamental Emission, Electric Field Strength of Spurious Emission, Duty Cycle, -20 dB Bandwidth / 99% emission bandwidth
* The system was configured in typical fashion (as a user would normally use it) for testing.	
*Power of the EUT was set by the software as follows; Software: PMV-H102 Version: 1.0 (Date: 2024.01.15, Storage location: EUT memory)	
*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	
Justification: The system was configured in typical fashion (as a user would normally use it) for testing.	

\*1) The software of this mode is the same as one of normal product, except that EUT continues to transmit.

### 4.2 Configuration and Peripherals



\* Setup was taken into consideration and test data was taken under worse case conditions.

#### Description of EUT

No.	Item	Model number	Serial Number	Manufacturer	Remark
A	TPMS (Tire Pressure Monitoring System Transmitter)	PMV-H102	00027F2 *1) 00027EB *2)	Pacific Industrial Company, LTD.	EUT

\*1) Used for other tests except for Radiated Emission test

\*2) Used for Radiated Emission test

## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

[For below 30 MHz]

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

[For 30 MHz to 1 GHz]

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.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

The measurements were performed for both vertical and horizontal antenna polarization.

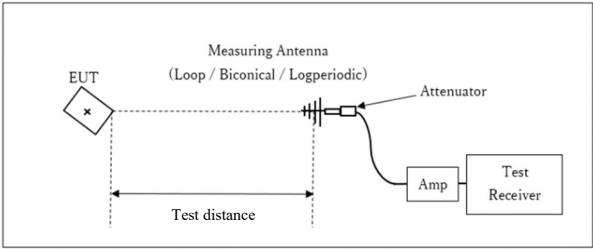
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

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

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

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	Above 1 GHz
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200 Hz	200 Hz	9.1 kHz	9.1 kHz	120 kHz	PK: S/A: RBW: 1 MHz, VBW: 3 MHz

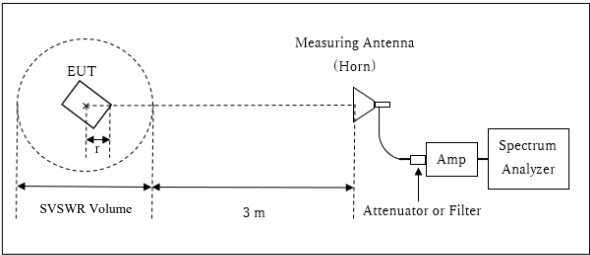
[Test Setup]  
 Below 1 GHz



Test Distance: 3 m

x : Center of turn table

1 GHz to 4.4 GHz



Distance Factor:  $20 \times \log(3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$   
 \* Test Distance:  $(3 + \text{SVSWR Volume} / 2) - r = 3.95 \text{ m}$

SVSWR Volume : 2.0 m  
 (SVSWR Volume has been calibrated based on CISPR 16-1-4.)  
 $r = 0.05 \text{ m}$

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

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

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

**Measurement range** : 9 kHz to 4.4 GHz  
**Test data** : APPENDIX  
**Test result** : Pass

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## **SECTION 6: Automatically deactivate**

### **Test Procedure**

The measurement was performed with Electric field strength using a spectrum analyzer.

**Test data** : APPENDIX  
**Test result** : Pass

## **SECTION 7: -20 dB Bandwidth and 99% emission bandwidth**

### **Test Procedure**

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

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
-20 dB Bandwidth / 99% emission bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement.							

**Test data** : APPENDIX  
**Test result** : Pass

## **SECTION 8: Average Output Power**

### **Test Procedure**

Average Output Power was measured with a Power Meter to measure Burst Average. The test data is reference data for RF Exposure.

**Test data** : APPENDIX

**APPENDIX 1: Test Data**

**Automatically deactivate**

Test place	Ise EMC Lab.
Measurement Room	No.5
Date	March 22, 2024
Temperature / Humidity	24 deg. C / 33 % RH
Engineer	Takafumi Noguchi
Mode	Mode 1

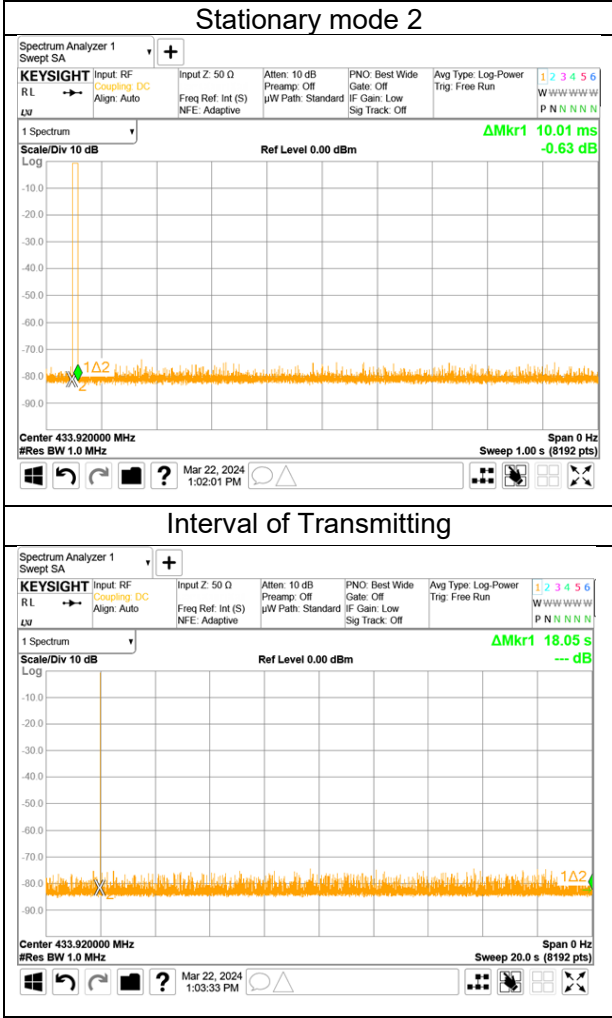
Operation in FCC 15.231(e)

Stationary mode 2

Duration of transmission: 10.01 ms < 1 s

Silent period between transmissions:  $36000 \text{ s}^* - 0.01001 \text{ s} = 35999.98999 \text{ s}$  >30 times the duration of transmission and 10 s.

\*Calculated from the technical documents



**Automatically deactivate**

Test place Ise EMC Lab.  
Measurement Room No.5  
Date March 22, 2024  
Temperature / Humidity 24 deg. C / 33 % RH  
Engineer Takafumi Noguchi  
Mode Mode 2, 3

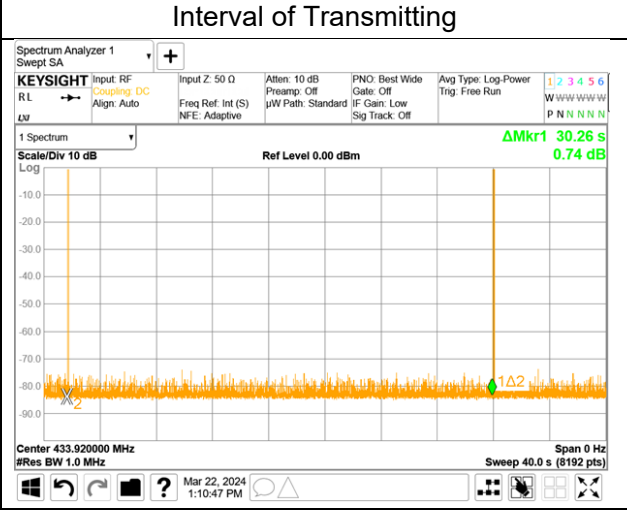
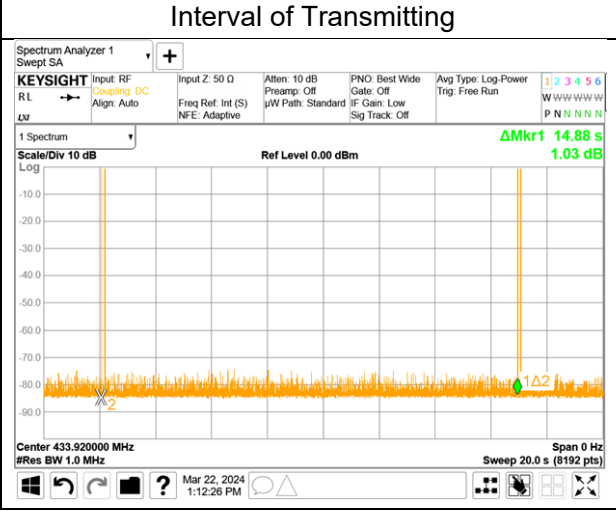
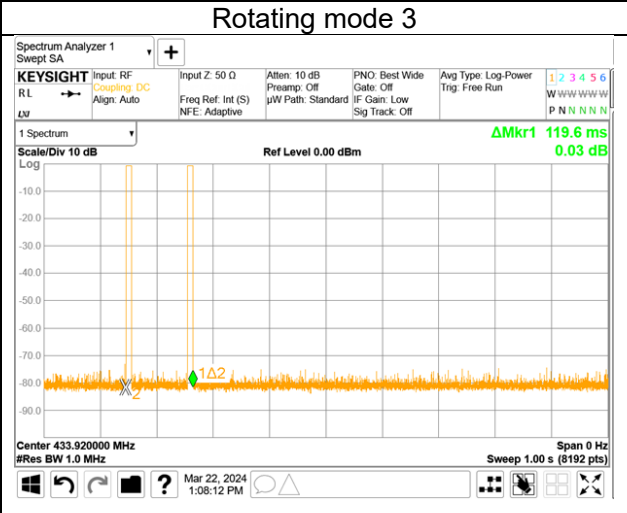
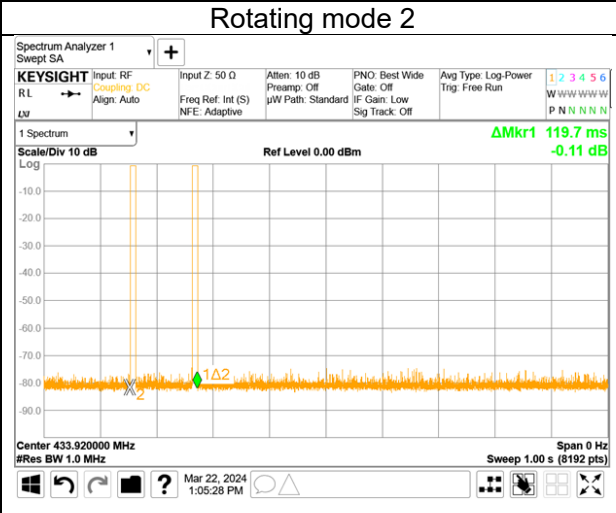
Operation in FCC 15.231(e)

**Rotating mode 2**

Duration of transmission: 119.7 ms < 1 s  
Silent period between transmissions: 14.88 s - 0.1197 s = 14.7603 s >30 times the duration of transmission and 10 s.

**Rotating mode 3**

Duration of transmission: 119.6 ms < 1 s  
Silent period between transmissions: 30.26 s - 0.1196 s = 30.1404 s >30 times the duration of transmission and 10 s.

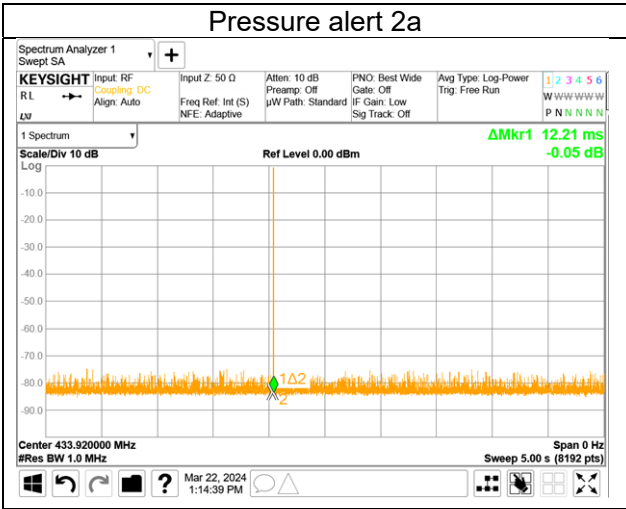


**Automatically deactivate**

Test place                                   Ise EMC Lab.  
 Measurement Room                       No.5  
 Date   March 22, 2024  
 Temperature / Humidity                 24 deg. C / 33 % RH  
 Engineer                                   Takafumi Noguchi  
 Mode                                        Mode 4

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [s]	Limit [s]	Result
Pressure alert 2a	433.92	0.012	5.000	Pass

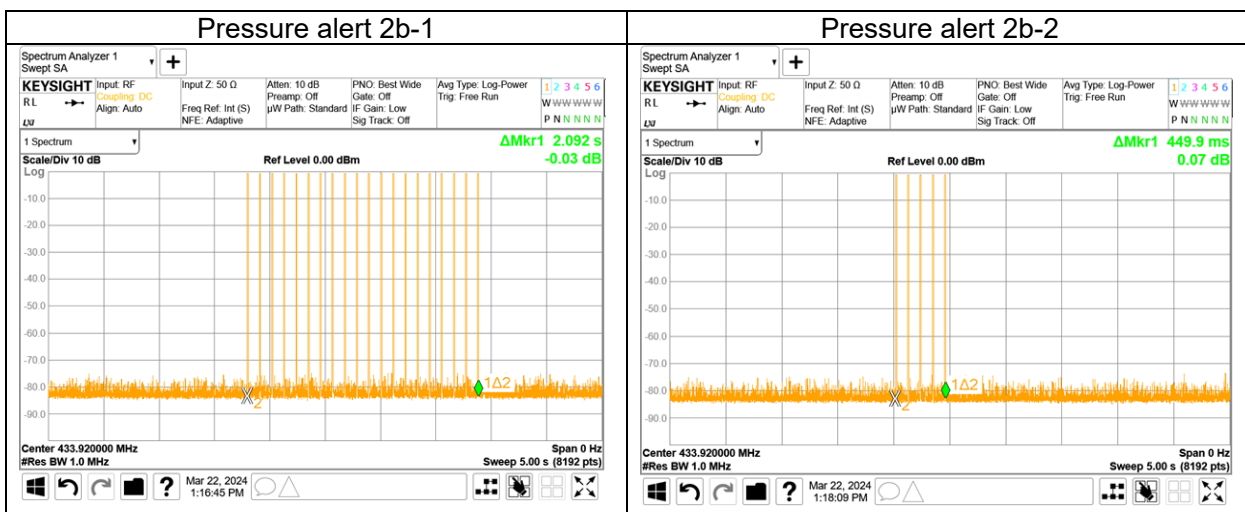


**Automatically deactivate**

Test place                                   Ise EMC Lab.  
Measurement Room                        No.5  
Date    March 22, 2024  
Temperature / Humidity                    24 deg. C / 33 % RH  
Engineer                                     Takafumi Noguchi  
Mode    Mode 5, 6

Operation in FCC 15.231(a)(2)

Mode	Tx Frequency [MHz]	Time of Transmitting [s]	Limit [s]	Result
Pressure alert 2b-1	433.92	2.092	5.000	Pass
Pressure alert 2b-2	433.92	0.450	5.000	Pass





**Average Output Power**  
**(Reference data for RF Exposure)**

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.8
Date	March 29, 2024
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Ken Fujita
Mode	Mode 7

Freq. [MHz]	Reading (P/M) [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power	
				Result (Burst)	
				[dBm]	[mW]
433.92	-0.22	0.00	9.89	9.67	9.27

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss

\*The equipment and cables were not used for factor 0 dB of the data sheets.

\*Since Burst Power is higher than Time Average Power, the test was performed at Burst Power to be more conservative.

The measurement of Burst Power used Gate function.

## Radiated Emission (Fundamental and Spurious Emission)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 27, 2024
Temperature / Humidity	18 deg. C / 50 % RH
Engineer	Ken Fujita
Mode	Mode 7

Polarity [Hori/Vert]	Frequency [MHz]	Reading (PK) [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result		Limit (PK) [dBuV/m]	Limit (AV) [dBuV/m]	Margin (PK) [dB]	Margin (AV) [dB]	Inside or Outside of Restricted Bands	Remarks
							Result (PK) [dBuV/m]	Result (PK with Duty Factor) [dBuV/m]						
Hori.	433.920	87.0	16.2	12.9	32.0	-20.3	84.1	63.8	92.8	72.8	8.7	9.0	Carrier	
Hori.	867.840	42.9	21.8	15.2	31.2	-20.3	48.7	28.4	72.8	52.8	24.1	24.4	Outside	
Hori.	1301.760	43.8	25.6	6.9	34.0	-	42.3	42.3	73.9	53.9	31.6	11.6	Inside	Floor noise
Hori.	1735.680	42.0	24.9	7.0	33.0	-	40.9	40.9	73.9	53.9	33.0	13.0	Outside	Floor noise
Hori.	2169.600	42.2	28.0	7.1	32.3	-	45.0	45.0	73.9	53.9	28.9	8.9	Outside	Floor noise
Hori.	2603.520	43.1	27.6	7.4	32.1	-20.3	46.0	25.7	73.9	53.9	27.9	28.2	Outside	
Hori.	3037.440	43.3	28.6	7.6	32.0	-20.3	47.5	27.2	73.9	53.9	26.4	26.7	Outside	
Hori.	3471.360	42.2	28.6	7.8	31.7	-20.3	46.9	26.6	73.9	53.9	27.0	27.3	Outside	
Hori.	3905.280	41.3	29.7	7.9	31.5	-	47.4	47.4	73.9	53.9	26.5	6.5	Inside	Floor noise
Hori.	4339.200	53.6	30.5	8.1	31.4	-20.3	60.8	40.5	73.9	53.9	13.1	13.4	Inside	
Vert.	433.920	87.9	16.2	12.9	32.0	-20.3	85.0	64.7	92.8	72.8	<b>7.8</b>	8.1	Carrier	
Vert.	867.840	43.3	21.8	15.2	31.2	-20.3	49.1	28.8	72.8	52.8	23.7	24.0	Outside	
Vert.	1301.760	43.7	25.6	6.9	34.0	-	42.2	42.2	73.9	53.9	31.7	11.7	Inside	Floor noise
Vert.	1735.680	43.7	24.9	7.0	33.0	-	42.6	42.6	73.9	53.9	31.3	11.3	Outside	Floor noise
Vert.	2169.600	42.3	28.0	7.1	32.3	-	45.1	45.1	73.9	53.9	28.8	8.8	Outside	Floor noise
Vert.	2603.520	42.4	27.6	7.4	32.1	-	45.3	45.3	73.9	53.9	28.6	8.6	Outside	Floor noise
Vert.	3037.440	43.5	28.6	7.6	32.0	-	47.7	47.7	73.9	53.9	26.2	<b>6.2</b>	Outside	Floor noise
Vert.	3471.360	41.9	28.6	7.8	31.7	-	46.6	46.6	73.9	53.9	27.3	7.3	Outside	Floor noise
Vert.	3905.280	44.7	29.7	7.9	31.5	-20.3	50.8	30.5	73.9	53.9	23.1	23.4	Inside	
Vert.	4339.200	53.8	30.5	8.1	31.4	-20.3	61.0	40.7	73.9	53.9	12.9	13.2	Inside	

Sample calculation:

Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier)

Result of PK with Duty factor (PK / W) = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor (Refer to Duty cycle data sheet)

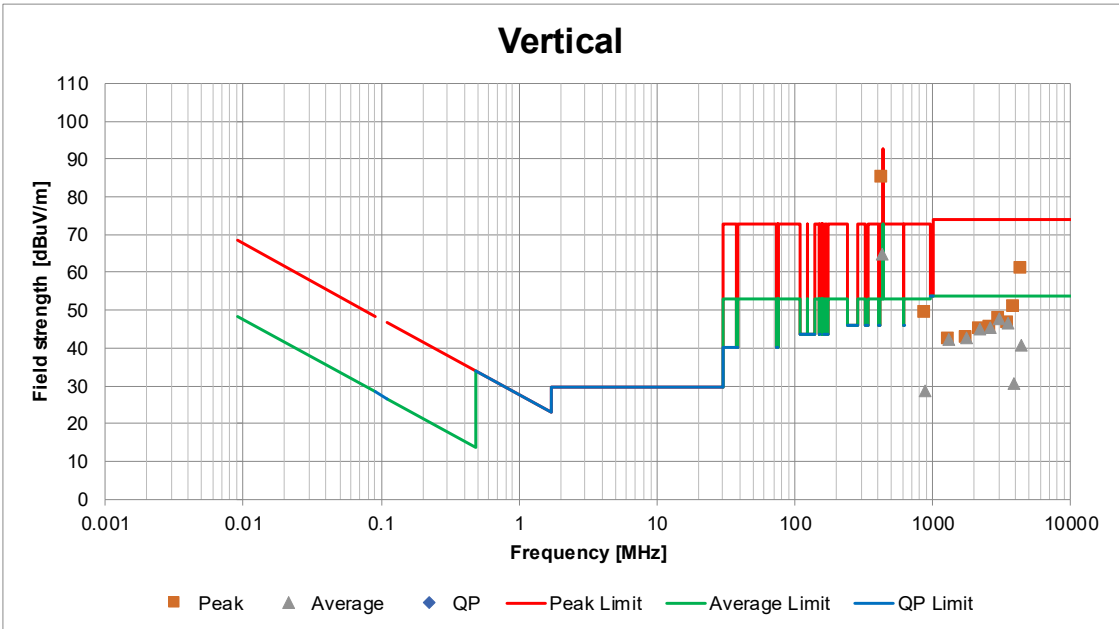
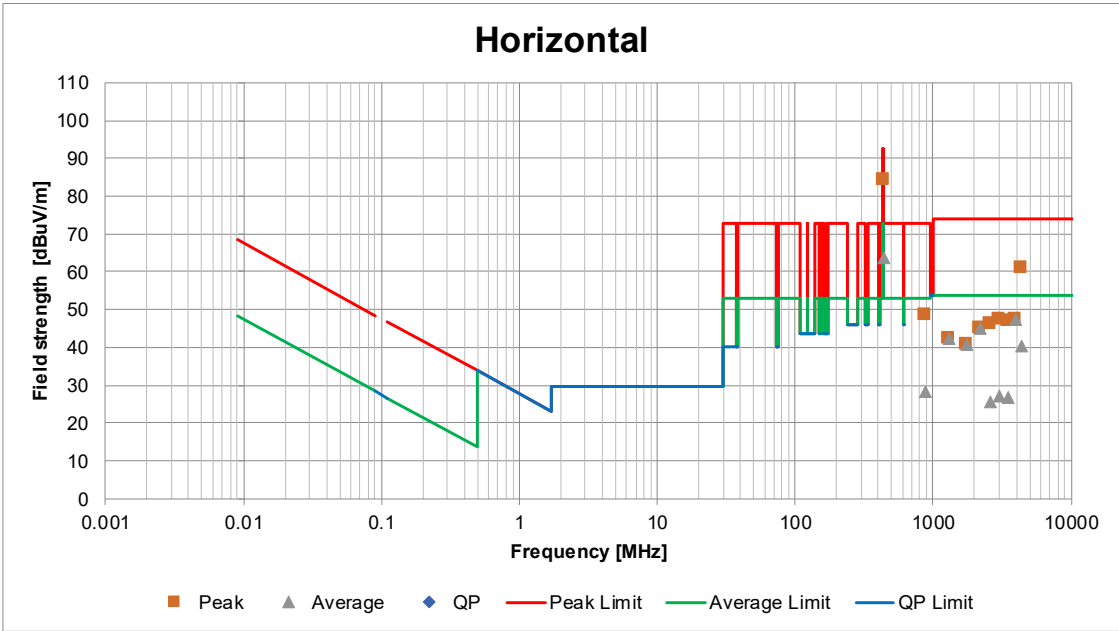
For above 1 GHz: Distance Factor:  $20 \times \log(3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

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

If Gain 0.0 dB shown in the above table, pre-amplifier was not used to avoid the influence of carrier power. The pre-amplifier used for carrier frequency measurement was not saturated.

**Radiated Spurious Emission**  
**(Plot data, Worst case for Fundamental Emission)**

Test place                    Ise EMC Lab.  
Semi Anechoic Chamber    No.3  
Date                            March 27, 2024  
Temperature / Humidity    18 deg. C / 50 % RH  
Engineer                      Ken Fujita  
Mode                            Mode 7



**Duty Cycle**

Test place Ise EMC Lab.  
 Measurement Room No.5  
 Date March 22, 2024  
 Temperature / Humidity 24 deg. C / 33 % RH  
 Engineer Takafumi Noguchi  
 Mode Mode 7

**(Pulse length)**

Type	Times	ON time(One pulse) [ms]	ON time(in 100 ms) [ms]
A	1	9.57664	9.57664

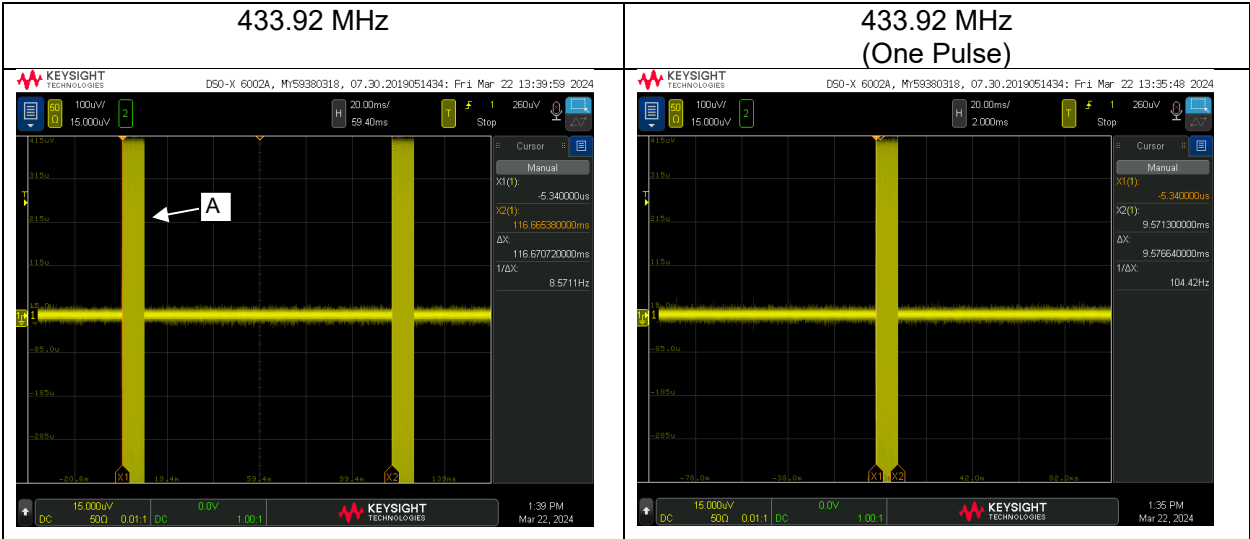
ON time(in 100 ms) = Times \* ON time(One pulse)

**(Total)**

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
9.57664	100	0.0958	-20.3

ON time[ms] = Type A's On Time(in 100 ms)  
 Duty = 20 \* log<sub>10</sub>(ON time/Cycle)

\* "Timing of transmission" of the application documents was referred, since Intentional off time was unrealizable in measurement circumstance.



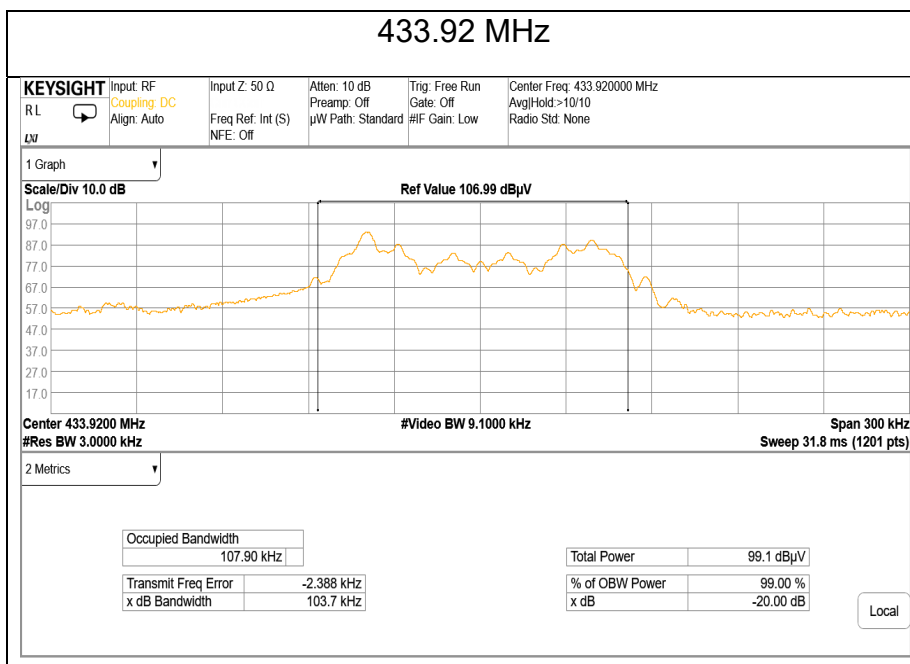
**-20 dB Bandwidth / 99% emission bandwidth**

Test place Ise EMC Lab.  
 Measurement Room No.7 Shielded Room  
 Date April 4, 2024  
 Temperature / Humidity 23 deg. C / 36 % RH  
 Engineer Hiroyuki Furutaka  
 Mode Mode 7

Bandwidth Limit : Fundamental Frequency 433.92 MHz x 0.25 % = 1084.800 kHz

-20 dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
103.7000	1084.800	Pass

99% emission bandwidth [kHz]	Bandwidth Limit [kHz]	Result
107.9000	1084.800	Pass



## APPENDIX 2: Test Instruments

### Test Equipment

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/10/2023	12
RE	141323	Coaxial cable	UL Japan	-	-	09/10/2023	12
RE	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	11/20/2023	12
RE	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	051201197	01/31/2024	12
RE	141572	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	3401	01/10/2024	12
RE	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	03/08/2024	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/17/2024	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	05/17/2023	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/11/2023	24
RE	142013	AC3_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	10/18/2023	12
RE	142183	Measure	KOMELON	KMC-36	-	10/20/2023	12
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/23/2023	12
RE	142645	Loop Antenna	UL Japan	-	-	-	-
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	182484	Signal Analyzer	Keysight Technologies Inc	N9030B	MY57143159	04/14/2023	12
RE	197990	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHBB 9124 + BBA 9106	01365	11/29/2023	12
RE	244709	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202103	01/25/2024	12
RE	246001	Microwave Cable	Huber+Suhner	SF103/11PC35/11PC35/1000mm / SF126E/5000mm	800673(1m) / 610204(5m)	03/06/2024	12
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	2023/08/10	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/17/2023	12
AT	141327	Coaxial Cable	UL Japan	-	-	02/09/2024	12
AT	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	04/08/2024	12
AT	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/12/2023	12
AT	141343	Barometer	Sanoh Co., Ltd	SBR121	596	02/27/2024	36
AT	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	051201197	01/31/2024	12
AT	141563	Thermo-Hygrometer	CUSTOM. Inc	CTH-180	1005	01/10/2024	12
AT	141809	Power Meter	Anritsu Corporation	ML2495A	825002	05/26/2023	12
AT	141830	Power sensor	Anritsu Corporation	MA2411B	738285	05/26/2023	12
AT	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	05/23/2023	12
AT	211944	Digital Storage Oscilloscope	Keysight Technologies Inc	DSOX6002A	MY59380318	12/16/2023	12
AT	212970	Signal Analyzer	Keysight Technologies Inc	N9030B	MY61330357	12/26/2023	12
AT	244709	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202103	01/25/2024	12

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

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

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

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

Test item:

RE: Radiated Emission

AT: Antenna Terminal Conducted