

# RADIO TEST REPORT

## Test Report No. 15213814H-A-R2

|                     |                                                    |
|---------------------|----------------------------------------------------|
| Customer            | Pacific Industrial Company, LTD.                   |
| Description of EUT  | TPMS (Tire Pressure Monitoring System Transmitter) |
| Model Number of EUT | PMV-H002                                           |
| FCC ID              | PAXPMVH002                                         |
| Test Regulation     | FCC Part 15 Subpart C                              |
| Test Result         | Complied                                           |
| Issue Date          | May 14, 2024                                       |
| Remarks             | -                                                  |

**Representative test engineer**Ken Fujita  
Engineer**Approved by**Shinichi Miyazono  
Engineer

CERTIFICATE 5107.02

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

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- The information provided by the customer for this report is identified in SECTION 1.
- The laboratory is not responsible for information provided by the customer which can impact the validity of the results.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

## **REVISION HISTORY**

### **Original Test Report No. 15213814H-A**

This report is a revised version of 15213814H-A-R1. 15213814H-A-R1 is replaced with this report.

| Revision     | Test Report No. | Date           | Page Revised Contents                                                                                                   |
|--------------|-----------------|----------------|-------------------------------------------------------------------------------------------------------------------------|
| - (Original) | 15213814H-A     | April 25, 2024 | -                                                                                                                       |
| 1            | 15213814H-A-R1  | May 13, 2024   | Correction of calculation for Mode 1 in Automatically deactivate test.                                                  |
| 1            | 15213814H-A-R1  | May 13, 2024   | Correction of the frequency notation for -20 dB Bandwidth / 99% emission bandwidth test; From 314.98 MHz to 314.975 MHz |
| 2            | 15213814H-A-R2  | May 14, 2024   | Re-Correction of calculation for Mode 1 in Automatically deactivate test.                                               |

## 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-H002                                                                                  |
| Serial Number | Refer to SECTION 4.2                                                                      |
| Condition     | Production prototype<br>(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 |
|--------|----------|

#### **Radio Specification**

|                        |             |
|------------------------|-------------|
| Equipment Type         | Transmitter |
| Frequency of Operation | 314.975 MHz |
| Type of Modulation     | FSK         |
| Antenna Gain           | -24.9 dBi   |

## SECTION 3: Test Specification, Procedures & Results

### 3.1 Test Specification

|                    |                                                                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Specification | FCC Part 15 Subpart C<br>The latest version on the first day of the testing period                                                                         |
| Title              | FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators<br>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<br>6 Standard test methods<br><br><b>ISED:</b> RSS-Gen 8.8  | <b>FCC:</b> Section 15.207<br><br><b>ISED:</b> RSS-Gen 8.8                                                                         | N/A                                      | N/A      | *1)      |
| Automatically Deactivate                                                                                                                                                             | <b>FCC:</b> ANSI C63.10:2013<br>6 Standard test methods<br><br><b>ISED:</b> -            | <b>FCC:</b> Section 15.231(a)(2)<br>Section 15.231(e)<br><br><b>ISED:</b> RSS-210 A1.1(b)<br>RSS-210 A1.4(b)                       | N/A                                      | Complied | Radiated |
| Electric Field Strength of Fundamental Emission                                                                                                                                      | <b>FCC:</b> ANSI C63.10:2013<br>6 Standard test methods<br><br><b>ISED:</b> RSS-Gen 6.12 | <b>FCC:</b> Section 15.231(e)<br><br><b>ISED:</b> RSS-210 A1.4                                                                     | 10.3 dB<br>314.975 MHz<br>Horizontal, PK | Complied | Radiated |
| Electric Field Strength of Spurious Emission                                                                                                                                         | <b>FCC:</b> ANSI C63.10:2013<br>6 Standard test methods<br><br><b>ISED:</b> RSS-Gen 6.13 | <b>FCC:</b> Section 15.205<br>Section 15.209<br>Section 15.231(b)<br>Section 15.231(e)<br><b>ISED:</b> RSS-210 A1.4<br>RSS-Gen 8.9 | 27.1 dB<br>2834.775 MHz<br>Vertical, PK  | Complied | Radiated |
| -20 dB Bandwidth                                                                                                                                                                     | <b>FCC:</b> ANSI C63.10:2013<br>6 Standard test methods<br><br><b>ISED:</b> -            | <b>FCC:</b> Section 15.231(c)<br><br><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.<br>*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<br>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 | dB   | 4.7                          |
|                      |                     | Vertical   | dB   | 4.7                          |
|                      | 200 MHz to 1000 MHz | Horizontal | dB   | 4.8                          |
|                      |                     | Vertical   | dB   | 6.0                          |
| 10 m                 | 30 MHz to 200 MHz   | Horizontal | dB   | 5.2                          |
|                      |                     | Vertical   | dB   | 5.1                          |
|                      | 200 MHz to 1000 MHz | Horizontal | dB   | 5.2                          |
|                      |                     | Vertical   | dB   | 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.

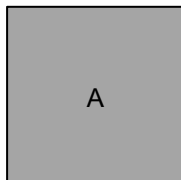
## SECTION 4: Operation of EUT during testing

### 4.1 Operating Mode(s)

| Test mode                                                                                                                                                                                                            | Remarks                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1) Stationary mode 2<br>2) Rotating mode 2<br>3) Rotating mode 3<br>4) Pressure alert 2a<br>5) Pressure alert 2b-1<br>6) Pressure alert 2b-2                                                                         | Automatically Deactivate                                                                                                                                                               |
| 7) Transmitting mode (Tx 314.975 MHz) *1)                                                                                                                                                                            | Average Output Power,<br>Electric Field Strength of Fundamental Emission,<br>Electric Field Strength of Spurious Emission,<br>Duty Cycle,<br>-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;<br>Software: PMV-H002 Version: 1.0<br>(Date: 2024.01.15, Storage location: EUT memory)                                                                         |                                                                                                                                                                                        |
| *This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>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<br>(Tire Pressure Monitoring<br>System Transmitter) | PMV-H002     | 00027EA *1)<br>00027E6 *2) | Pacific Industrial<br>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.

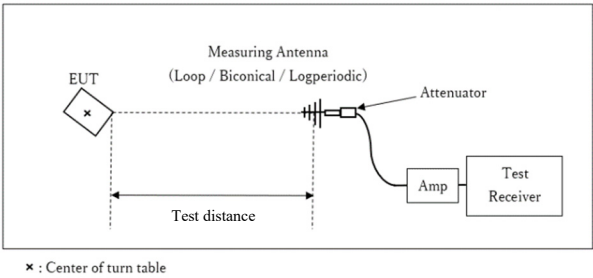
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

### **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        |

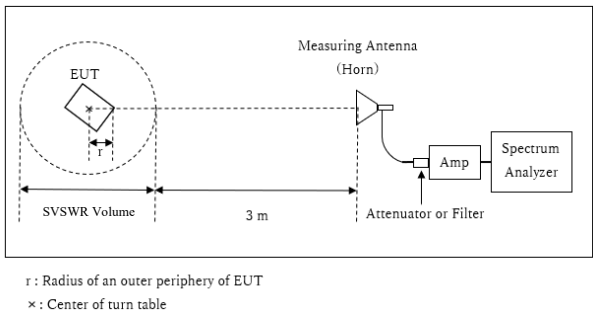
|               |                                                  |                        |                         |                        |                                |                                 |
|---------------|--------------------------------------------------|------------------------|-------------------------|------------------------|--------------------------------|---------------------------------|
| 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

1 GHz to 3.2 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.)  
 $r = 0.05 \text{ m}$

- 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 3.2 GHz  
Test data : APPENDIX  
Test result : Pass

## **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.

| Test                                                 | Span                                    | RBW             | VBW                | Sweep | Detector | Trace        | Instrument used   |
|------------------------------------------------------|-----------------------------------------|-----------------|--------------------|-------|----------|--------------|-------------------|
| -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

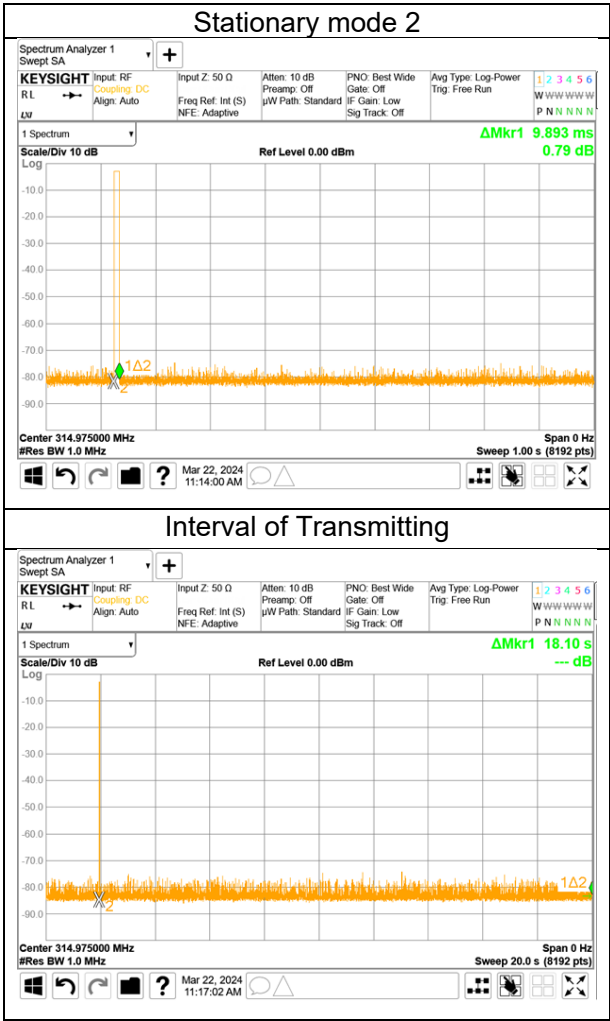
Automatically deactivate

|                        |                     |
|------------------------|---------------------|
| 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: 9.893 ms < 1 s  
Silent period between transmissions: 36000 s\* - 0.009893 s = 35999.990107 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           |

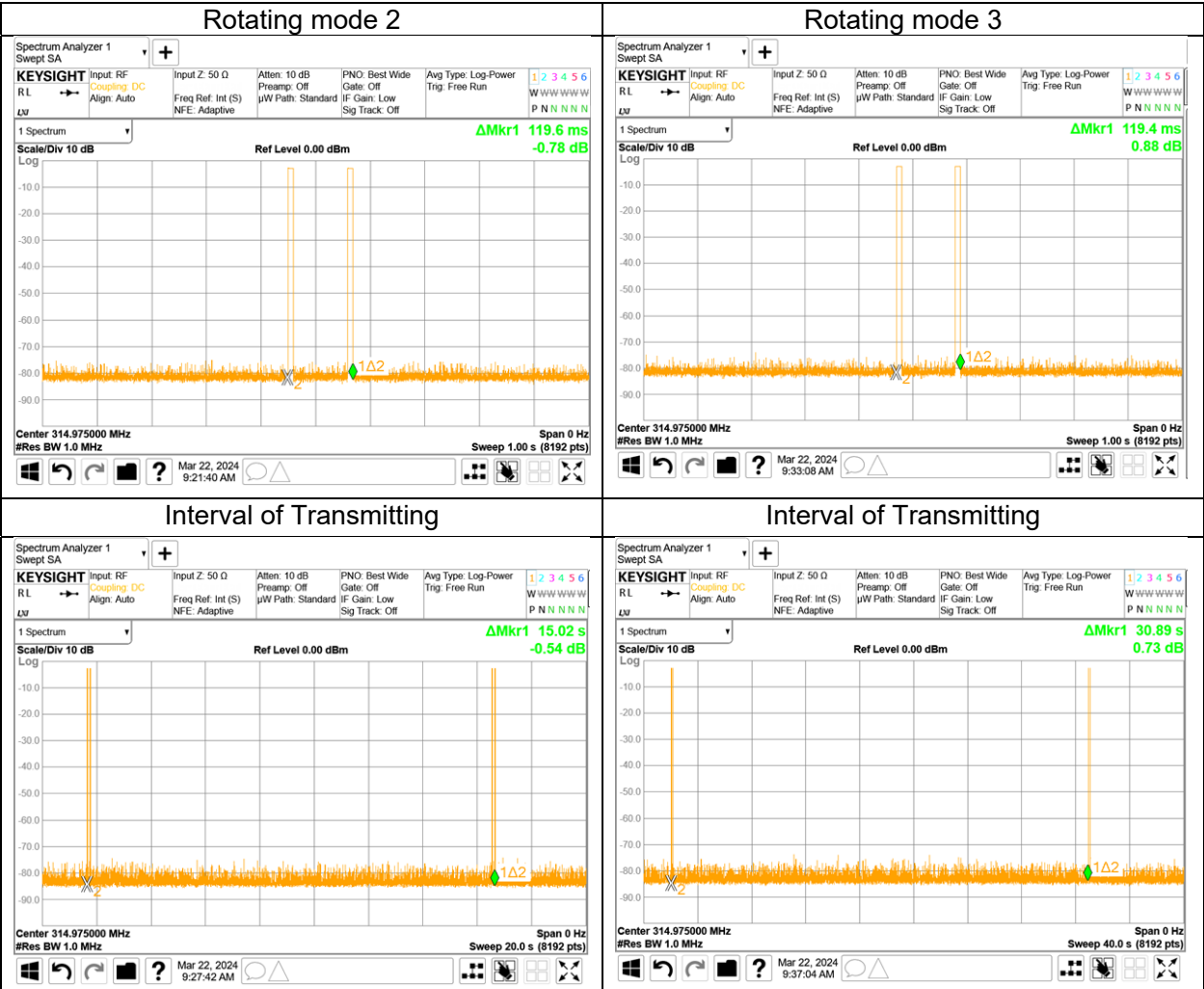
Operation in FCC 15.231(e)

**Rotating mode 2**

Duration of transmission: 119.6 ms < 1 s  
Silent period between transmissions: 15.02 s - 0.1196 s = 14.9004 s >30 times the duration of transmission and 10 s.

**Rotating mode 3**

Duration of transmission: 119.4 ms < 1 s  
Silent period between transmissions: 30.89 s - 0.1194 s = 30.7706 s >30 times the duration of transmission and 10 s.

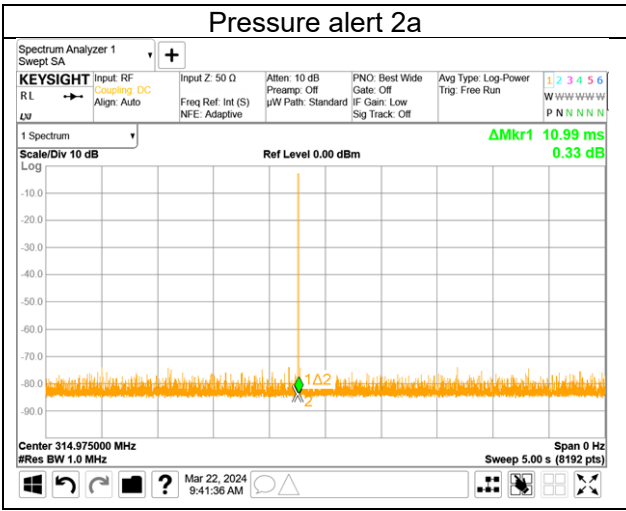


**Automatically deactivate**

|                        |                     |
|------------------------|---------------------|
| 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 | Time of Transmitting | Limit | Result |
|-------------------|--------------|----------------------|-------|--------|
|                   | [MHz]        | [s]                  | [s]   |        |
| Pressure alert 2a | 314.975      | 0.011                | 5.000 | Pass   |



## Operation in FCC 15.231(a)(2)

### Pressure alert 2b-1

**KEYSIGHT** Input: RF  
Coupling: DC  
Align: Auto  
Ref Level: 0.00 dBm  
ΔMkr1 2.092 s  
0.12 dB

Input Z: 50 Ω  
Atten: 10 dB  
Preamp: Off  
Freq Ref: Int (S)  
NFE: Adaptive  
μW Path: Standard  
Gate: Off  
IF Gain: Low  
Sig Track: Off

W W W W W W W W  
P N N N N N

1 Spectrum  
Scale/Div 10 dB  
Log  
Center 314.975000 MHz  
#Res BW 1.0 MHz  
Span 0 Hz  
Sweep 5.00 s (8192 pts)

### Pressure alert 2b-2

**KEYSIGHT** Input: RF  
Coupling: DC  
Align: Auto  
Ref Level: 0.00 dBm  
ΔMkr1 449.9 ms  
-0.04 dB

Input Z: 50 Ω  
Atten: 10 dB  
Preamp: Off  
Freq Ref: Int (S)  
NFE: Adaptive  
μW Path: Standard  
Gate: Off  
IF Gain: Low  
Sig Track: Off

W W W W W W W W  
P N N N N N

1 Spectrum  
Scale/Div 10 dB  
Log  
Center 314.975000 MHz  
#Res BW 1.0 MHz  
Span 0 Hz  
Sweep 5.00 s (8192 pts)

**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.   | Reading<br>(P/M) | Cable<br>Loss | Atten.<br>Loss | Conducted Power |      |
|---------|------------------|---------------|----------------|-----------------|------|
|         |                  |               |                | Result          |      |
|         |                  |               |                | (Burst)         |      |
| [MHz]   | [dBm]            | [dB]          | [dB]           | [dBm]           | [mW] |
| 314.975 | -2.22            | 0.00          | 9.88           | 7.66            | 5.83 |

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<br>[Hori/Vert] | Frequency<br>[MHz] | Reading<br>(PK)<br>[dBuV] | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>(PK)<br>[dBuV/m] | Result<br>(PK with Duty<br>Factor)<br>[dBuV/m] | Limit<br>(PK)<br>[dBuV/m] | Limit<br>(AV)<br>[dBuV/m] | Margin<br>(PK)<br>[dB] | Margin<br>(AV)<br>[dB] | Inside or Outside<br>of Restricted Bands | Remarks     |
|-------------------------|--------------------|---------------------------|-------------------------|--------------|--------------|------------------------|----------------------------|------------------------------------------------|---------------------------|---------------------------|------------------------|------------------------|------------------------------------------|-------------|
| Hori.                   | 314.975            | 85.6                      | 13.9                    | 9.8          | 32.0         | -20.3                  | 77.3                       | 57.0                                           | 87.6                      | 67.6                      | 10.3                   | 10.6                   | Carrier                                  |             |
| Hori.                   | 629.950            | 39.4                      | 19.3                    | 11.6         | 32.1         | -20.3                  | 38.2                       | 17.9                                           | 67.6                      | 47.6                      | 29.4                   | 29.7                   | Outside                                  |             |
| Hori.                   | 944.925            | 26.3                      | 22.0                    | 13.2         | 30.7         | -                      | 30.8                       | 30.8                                           | 67.6                      | 47.6                      | 36.8                   | 16.8                   | Outside                                  | Floor noise |
| Hori.                   | 1259.900           | 43.5                      | 25.5                    | 4.4          | 34.1         | -                      | 39.3                       | 39.3                                           | 73.9                      | 53.9                      | 34.6                   | 14.6                   | Outside                                  | Floor noise |
| Hori.                   | 1574.875           | 42.4                      | 25.1                    | 4.6          | 33.4         | -                      | 38.7                       | 38.7                                           | 73.9                      | 53.9                      | 35.2                   | 15.2                   | Inside                                   | Floor noise |
| Hori.                   | 1889.850           | 42.0                      | 25.4                    | 4.7          | 32.6         | -                      | 39.5                       | 39.5                                           | 73.9                      | 53.9                      | 34.4                   | 14.4                   | Outside                                  | Floor noise |
| Hori.                   | 2204.825           | 41.1                      | 28.2                    | 4.8          | 32.3         | -                      | 41.8                       | 41.8                                           | 73.9                      | 53.9                      | 32.1                   | 12.1                   | Inside                                   | Floor noise |
| Hori.                   | 2519.800           | 42.3                      | 27.4                    | 4.9          | 32.2         | -                      | 42.4                       | 42.4                                           | 73.9                      | 53.9                      | 31.5                   | 11.5                   | Outside                                  | Floor noise |
| Hori.                   | 2834.775           | 42.6                      | 28.5                    | 5.1          | 32.0         | -20.3                  | 44.2                       | 23.9                                           | 73.9                      | 53.9                      | 29.7                   | 30.0                   | Inside                                   |             |
| Hori.                   | 3149.750           | 42.2                      | 28.7                    | 5.2          | 31.9         | -20.3                  | 44.2                       | 23.9                                           | 73.9                      | 53.9                      | 29.7                   | 30.0                   | Outside                                  |             |
| Vert.                   | 314.975            | 82.4                      | 13.9                    | 9.8          | 32.0         | -20.3                  | 74.1                       | 53.8                                           | 87.6                      | 67.6                      | 13.5                   | 13.8                   | Carrier                                  |             |
| Vert.                   | 629.950            | 39.7                      | 19.3                    | 11.6         | 32.1         | -20.3                  | 38.5                       | 18.2                                           | 67.6                      | 47.6                      | 29.1                   | 29.4                   | Outside                                  |             |
| Vert.                   | 944.925            | 26.4                      | 22.0                    | 13.2         | 30.7         | -                      | 30.9                       | 30.9                                           | 67.6                      | 47.6                      | 36.7                   | 16.7                   | Outside                                  | Floor noise |
| Vert.                   | 1259.900           | 43.3                      | 25.5                    | 4.4          | 34.1         | -                      | 39.1                       | 39.1                                           | 73.9                      | 53.9                      | 34.8                   | 14.8                   | Outside                                  | Floor noise |
| Vert.                   | 1574.875           | 42.1                      | 25.1                    | 4.6          | 33.4         | -                      | 38.4                       | 38.4                                           | 73.9                      | 53.9                      | 35.5                   | 15.5                   | Inside                                   | Floor noise |
| Vert.                   | 1889.850           | 43.1                      | 25.4                    | 4.7          | 32.6         | -                      | 40.6                       | 40.6                                           | 73.9                      | 53.9                      | 33.3                   | 13.3                   | Outside                                  | Floor noise |
| Vert.                   | 2204.825           | 42.7                      | 28.2                    | 4.8          | 32.3         | -                      | 43.4                       | 43.4                                           | 73.9                      | 53.9                      | 30.5                   | 10.5                   | Inside                                   | Floor noise |
| Vert.                   | 2519.800           | 41.8                      | 27.4                    | 4.9          | 32.2         | -                      | 41.9                       | 41.9                                           | 73.9                      | 53.9                      | 32.0                   | 12.0                   | Outside                                  | Floor noise |
| Vert.                   | 2834.775           | 45.2                      | 28.5                    | 5.1          | 32.0         | -20.3                  | 46.8                       | 26.5                                           | 73.9                      | 53.9                      | 27.1                   | 27.4                   | Inside                                   |             |
| Vert.                   | 3149.750           | 42.4                      | 28.7                    | 5.2          | 31.9         | -20.3                  | 44.4                       | 24.1                                           | 73.9                      | 53.9                      | 29.5                   | 29.8                   | Outside                                  |             |

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)

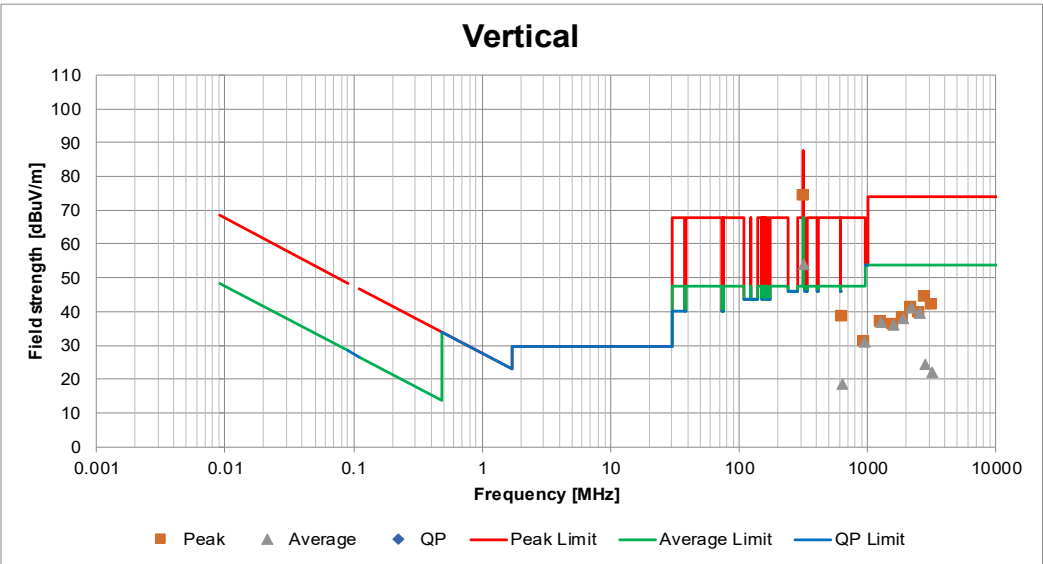
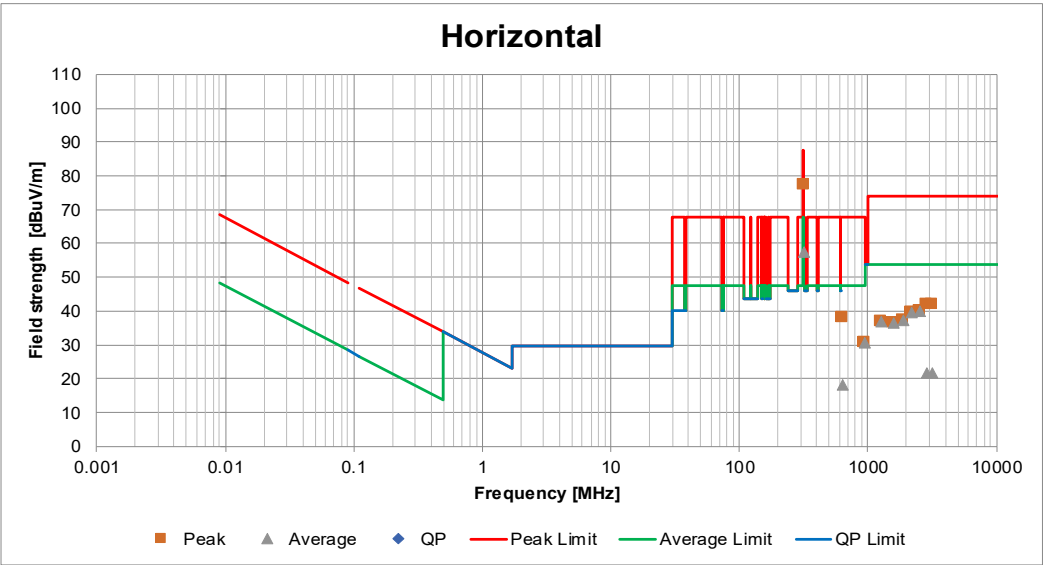
For above 1 GHz: Distance Factor:  $20 \times \log (3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

\*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)<br>[ms] | ON time(in 100 ms)<br>[ms] |
|------|-------|----------------------------|----------------------------|
| A    | 1     | 9.5769                     | 9.5769                     |

$$\text{ON time(in 100 ms)} = \text{Times} * \text{ON time(One pulse)}$$

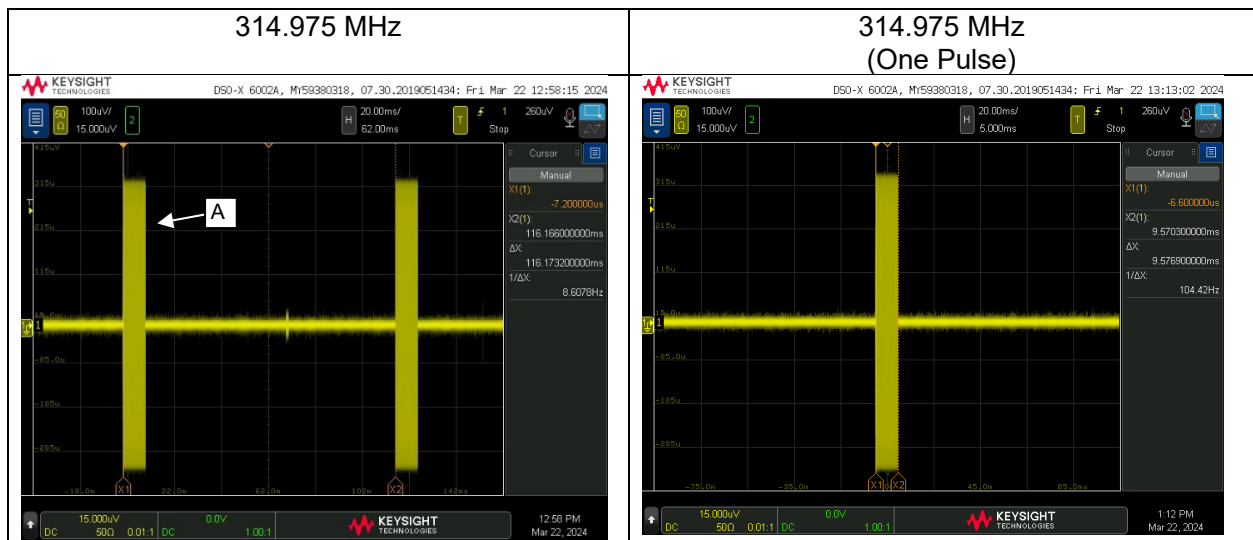
**(Total)**

| ON time<br>[ms] | Cycle<br>[ms] | Duty<br>(On time/Cycle) | Duty<br>[dB] |
|-----------------|---------------|-------------------------|--------------|
| 9.5769          | 100           | 0.0958                  | -20.3        |

ON time[ms] = Type A's On Time(in 100 ms)

$$\text{Duty} = 20 * \log_{10}(\text{ON time/Cycle})$$

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



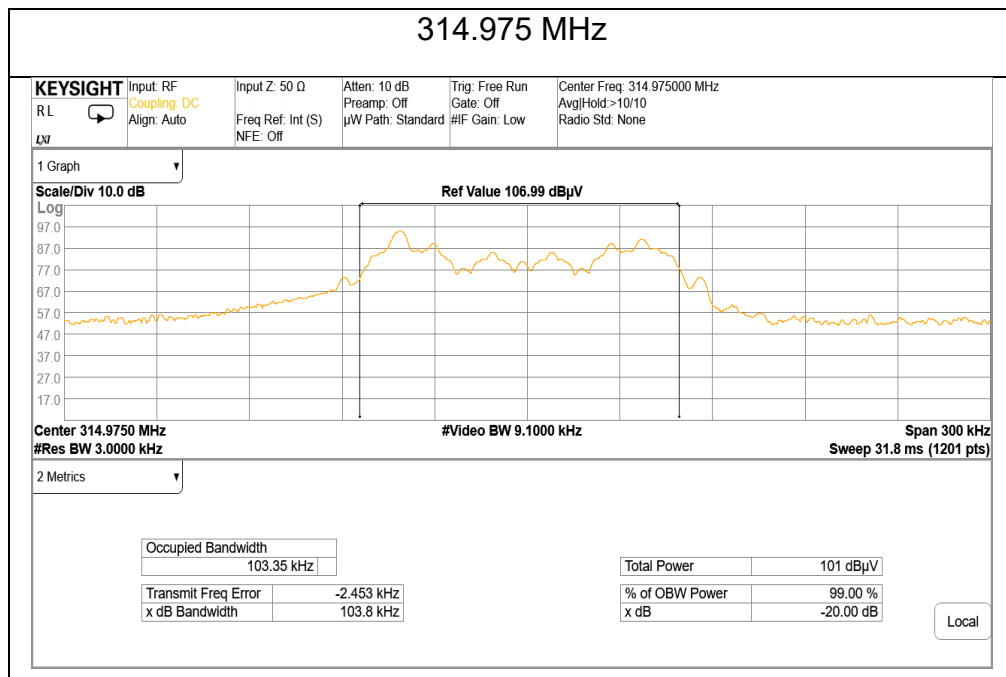
### -20 dB Bandwidth / 99% emission bandwidth

|                        |                     |
|------------------------|---------------------|
| 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**       $314.975 \text{ MHz} \times 0.25 \% = 787.438 \text{ kHz}$

|                           |                          |        |
|---------------------------|--------------------------|--------|
| -20 dB Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
| 103.8000                  | 787.438                  | Pass   |

| 99% emission bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
|---------------------------------|--------------------------|--------|
| 103.3500                        | 787.438                  | Pass   |



## APPENDIX 2: Test Instruments

### Test Equipment

| Test Item | LIMS ID | Description                       | Manufacturer                    | Model                                      | Serial                  | Last Calibration Date | Cal Int |
|-----------|---------|-----------------------------------|---------------------------------|--------------------------------------------|-------------------------|-----------------------|---------|
| 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               | 08/10/2023            | 12      |
| AT        | 141156  | Attenuator(10dB)                  | Weinschel Corp                  | 2                                          | BL1173                  | 11/17/2023            | 12      |
| AT        | 141327  | Coaxial Cable                     | UL Japan                        | -                                          | -                       | 02/09/2024            | 12      |
| AT        | 141532  | DIGITAL HiTESTER                  | HIOKI E.E. CORPORATION          | 3805                                       | 051201197               | 01/31/2024            | 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        | 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