

# RADIO TEST REPORT

## Test Report No. 15398179H-A-R3

|                     |   |
|---------------------|---|
| Customer            | MITSUBISHI ELECTRIC MOBILITY CORPORATION  |
| Description of EUT  | Remote Parking Keyless System Remocon Key |
| Model Number of EUT | SKE11D-02                                 |
| FCC ID              | UJHSKE11D02                               |
| Test Regulation     | FCC Part 15 Subpart C                     |
| Test Result         | Complied                                  |
| Issue Date          | February 25, 2025                         |
| Remarks             | -   |

Representative test engineer

Daiki Matsui  
Engineer

Approved by

Akihiko Maeda  
Leader

CERTIFICATE 5107.02

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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. 15398179H-A**

This report is a revised version of 15398179H-A-R2. 15398179H-A-R2 is replaced with this report.

| Revision     | Test Report No. | Date              | Page Revised Contents  |
|--------------|-----------------|-------------------|--|
| - (Original) | 15398179H-A     | November 27, 2024 | -  |
| 1            | 15398179H-A-R1  | February 7, 2025  | Addition of the note *1) in SECTION 1.   |
| 1            | 15398179H-A-R1  | February 7, 2025  | Addition of the following content;<br>- SECTION 4.2: Configuration and Peripherals<br>- SECTION 8: Average Output Power<br>- APPENDIX 1: Test Data<br>- APPENDIX 2: Test Instruments<br>- APPENDIX 3: Photographs of Test Setup  |
| 2            | 15398179H-A-R2  | February 21, 2025 | Change of the following items due to the additional measurement of Radiated Emission test (above 3.2 GHz).<br>- SECTION 2.1: Test Date<br>- SECTION 5: Test Setup Calculation Formula and Measurement range<br>- APPENDIX 1: Test Data (Radiated Emission)<br>- APPENDIX 2: Test Instruments |
| 2            | 15398179H-A-R2  | February 21, 2025 | Addition of the "Highest frequency used in the device" in SECTION 2.2.   |
| 2            | 15398179H-A-R2  | February 21, 2025 | Correction of the table size for 30 MHz to 1 GHz in SECTION 5:<br>from 0.5 m by 0.5 m to 1.0 m by 1.5 m.   |
| 3            | 15398179H-A-R3  | February 25, 2025 | Correction of the Test Setup Calculation Formula in SECTION 5.   |
| 3            | 15398179H-A-R3  | February 25, 2025 | Addition of the Calculation for 6 GHz to 10 GHz under the Radiated Emission test data (page 15)  |

## 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     | MITSUBISHI ELECTRIC MOBILITY CORPORATION                          |
| Address          | 840, Chiyoda-machi, Himeji, Hyogo, 670-8677, Japan <sup>*1)</sup> |
| Telephone Number | +81-79-298-8994 <sup>*1)</sup>                                    |
| Contact Person   | Masashi Nojima <sup>*1)</sup>                                     |

<sup>\*1)</sup> The Grantee address, Telephone Number and Contact Person in the FCC application are “2-3-33, Miwa, Sanda-city, Hyogo, 669-1513 Japan”, “+81-79-559-3505” and “Koichi Kuriyama”.

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   | Remote Parking Keyless System Remocon Key   |
| Model Number  | SKE11D-02   |
| 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  | October 1, 2024   |
| Test Date     | October 24, 2024 to February 20, 2025   |

### **2.2 Product Description**

#### **General Specification**

|                                      |                          |
|--------------------------------------|--------------------------|
| Rating                               | DC 3.0 V                 |
| Highest frequency used in the device | 1890 MHz (FSK modulator) |

#### **Radio Specification**

[RF part]

|                        |             |
|------------------------|-------------|
| Equipment Type         | Transmitter |
| Frequency of Operation | 315 MHz     |
| Type of Modulation     | FSK         |

[LF part] <sup>\*1)</sup>

|                        |          |
|------------------------|----------|
| Equipment Type         | Receiver |
| Frequency of Operation | 125 kHz  |

<sup>\*1)</sup> The test of receiver part was performed separately from this test report, and the conformability is confirmed.

### **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. |

\*Also the EUT complies with FCC Part 15 Subpart B.

#### **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)(1)<br><br><b>ISED:</b> RSS-210 A1.2   | 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(b)<br><br><b>ISED:</b> RSS-210 A1.3  | 4.0 dB<br>315.000 MHz,<br>Horizontal, AV | 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><b>ISED:</b> RSS-210 A1.3<br>RSS-Gen 8.9 | 10.8 dB<br>630.000 MHz,<br>Vertical, AV  | 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.

\*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   | 5.0                          |
|                      |                     | Vertical   | dB   | 5.0                          |
|                      | 200 MHz to 1000 MHz | Horizontal | dB   | 5.2                          |
|                      |                     | Vertical   | dB   | 6.2                          |
| 10 m                 | 30 MHz to 200 MHz   | Horizontal | dB   | 5.5                          |
|                      |                     | Vertical   | dB   | 5.4                          |
|                      | 200 MHz to 1000 MHz | Horizontal | dB   | 5.5                          |
|                      |                     | Vertical   | dB   | 5.5                          |
| 3 m                  | 1 GHz to 6 GHz      |            | dB   | 5.1                          |
|                      | 6 GHz to 18 GHz     |            | dB   | 5.4                          |
| 1 m                  | 10 GHz to 18 GHz    |            | dB   | 5.4                          |
|                      | 18 GHz to 26.5 GHz  |            | dB   | 5.3                          |
|                      | 26.5 GHz to 40 GHz  |            | dB   | 4.8                          |
| 0.5 m                | 26.5 GHz to 40 GHz  |            | dB   | 5.0                          |

#### 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

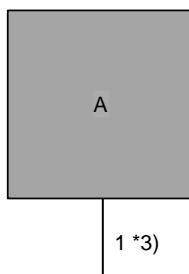
Refer to APPENDIX.

## **SECTION 4: Operation of EUT during testing**

### **4.1 Operating Mode(s)**

| Test mode  | Remarks |
|--|---------|
| 1) Normal use mode   | -       |
| 2) Transmitting mode (Tx 315 MHz)  | -       |
| * 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: IC1: DZ111712 / IC2: DZ111812<br>(Date: IC1: 2024.04.18, IC2: 2024.04.18, 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.   |         |

### **4.2 Configuration and Peripherals**



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

#### **Description of EUT**

| No. | Item  | Model number | Serial Number   | Manufacturer                                   | Remark |
|-----|---|--------------|---|--|--------|
| A   | Remote Parking<br>Keyless System<br>Remocon Key | SKE11D-02    | 20240718-R1 (No.1)<br>*1)<br>20240718-R2 (No.2)<br>*2)<br>20240718-R3 (No.3)<br>*3) | MITSUBISHI<br>ELECTRIC MOBILITY<br>CORPORATION | EUT    |

#### **List of cables used**

| No. | Name          | Length (m) | Shield   |           | Remark |
|-----|---------------|------------|----------|-----------|--------|
|     |               |            | Cable    | Connector |        |
| 1   | Antenna Cable | 0.04       | Shielded | Shielded  | *3)    |

\*1) Used for other tests

\*2) Used for Automatically Deactivate test

\*3) Used for Average Output Power 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.

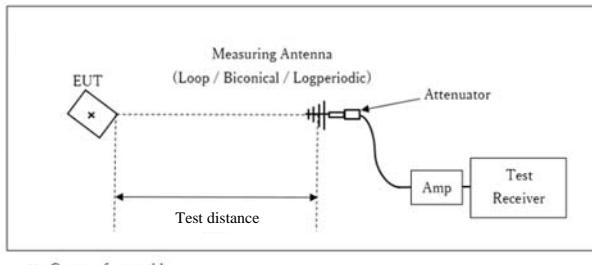
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

### **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        |

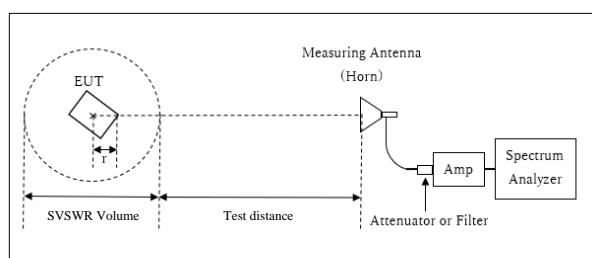
|               |  |                        |                         |                        |                                |                                 |
|---------------|--|------------------------|-------------------------|------------------------|--------------------------------|---------------------------------|
| 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 10 GHz



[1 GHz to 6 GHz]

Distance Factor:  $20 \times \log (4.00 \text{ m} / 3.00 \text{ m}) = 2.50 \text{ dB}$   
\*(Test Distance + SVSWR Volume / 2) - r = 4.00 m

Test Distance: 3 m

SVSWR Volume : 2.00 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)

r = 0.0 m

[6 GHz to 10 GHz]

Distance Factor:  $20 \times \log (5.00 \text{ m} / 3.00 \text{ m}) = 4.44 \text{ dB}$   
\*(Test Distance + SVSWR Volume / 2) - r = 5.00 m

Test Distance: 4.30 m

SVSWR Volume : 1.40 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)

r = 0.0 m

\* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

- 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.

|                          |                          |
|--------------------------|--------------------------|
| <b>Measurement range</b> | <b>: 9 kHz to 10 GHz</b> |
| <b>Test data</b>         | <b>: APPENDIX</b>        |
| <b>Test result</b>       | <b>: Pass</b>            |

## **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.

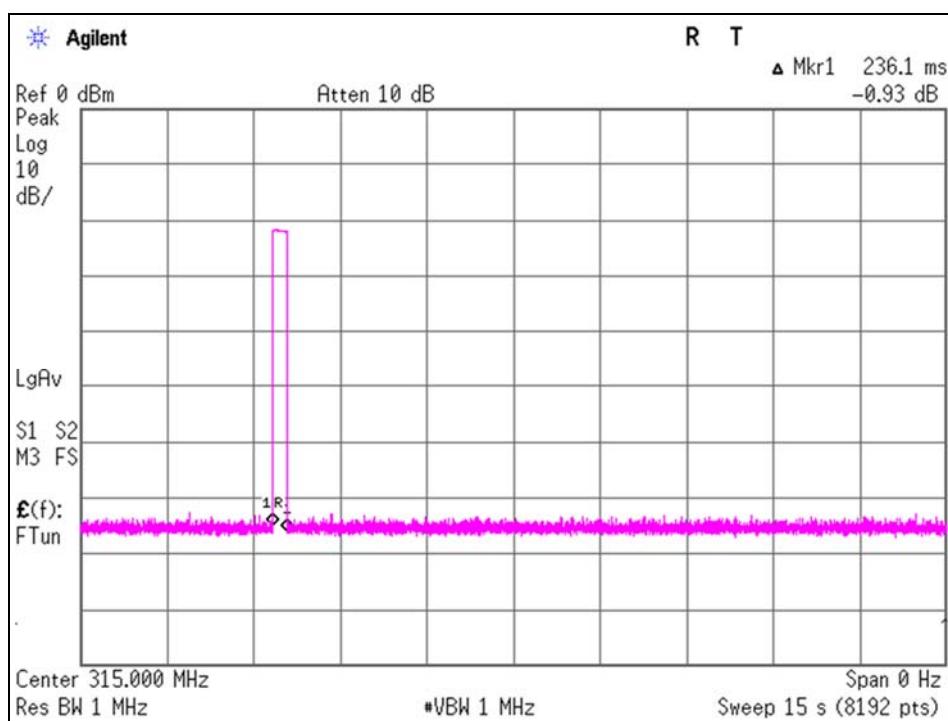
**Test data** : APPENDIX

## APPENDIX 1: Test Data

### Automatically deactivate

Test place Ise EMC Lab.  
Semi Anechoic Chamber No.4  
Date October 24, 2024  
Temperature / Humidity 22 deg. C / 60 % RH  
Engineer Daiki Matsui  
Mode Mode 1

| Time of<br>Transmitting<br>[s] | Limit<br>[s] | Result |
|--------------------------------|--------------|--------|
| 0.2361                         | 5.00         | Pass   |



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

Test place Ise EMC Lab.  
Semi Anechoic Chamber No.4  
Date October 25, 2024  
Temperature / Humidity 22 deg. C / 60 % RH  
Engineer Daiki Matsui  
Mode Mode 2

| Freq.<br>[MHz] | Reading<br>(P/M)<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Conducted Power   |      |
|----------------|---------------------------|-----------------------|------------------------|-------------------|------|
|                |                           |                       |                        | Result<br>(Burst) |      |
|                |                           |                       |                        | [dBm]             | [mW] |
| 315.00         | -9.56                     | 0.53                  | 9.88                   | 0.85              | 1.22 |

Sample Calculation:

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

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

## Radiated Emission (Fundamental and Spurious Emission)

|                                     |                               |                                    |                                 |
|-------------------------------------|-------------------------------|------------------------------------|---------------------------------|
| Test place<br>Semi Anechoic Chamber | Ise EMC Lab.                  | No.4                               | No.4                            |
| Date                                | October 24, 2024              | October 25, 2024                   | February 20, 2025               |
| Temperature / Humidity              | 22 deg. C / 60 % RH           | 22 deg. C / 58 % RH                | 20 deg. C / 36 % RH             |
| Engineer                            | Daiki Matsui<br>(Below 1 GHz) | Daiki Matsui<br>(1 GHz to 3.2 GHz) | Daiki Matsui<br>(Above 3.2 GHz) |
| Mode                                | Mode 2                        |                                    |                                 |

| Polarity<br>[Hori/Vert] | Frequency<br>[MHz] | Reading<br>(PK)<br>[dBuV] | Ant<br>Factor<br>[dBu/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.                   | 315.000            | 79.8                      | 14.1                     | 9.7          | 32.0         | 0.0                    | 71.6                       | 71.6   | 95.6                      | 75.6                      | 24.0                   | <b>4.0</b>             | Carrier                                  |             |
| Hori.                   | 630.000            | 45.0                      | 19.6                     | 11.4         | 32.3         | 0.0                    | 43.7                       | 43.7   | 75.6                      | 55.6                      | 31.9                   | 11.9                   | Outside                                  |             |
| Hori.                   | 945.000            | 28.8                      | 22.1                     | 12.5         | 30.9         | -                      | 32.5                       | 32.5   | 75.6                      | 55.6                      | 43.1                   | 23.1                   | Outside                                  | Floor noise |
| Hori.                   | 1260.000           | 42.9                      | 25.9                     | 4.7          | 34.0         | -                      | 39.5                       | 39.5   | 75.6                      | 55.6                      | 36.1                   | 16.1                   | Outside                                  | Floor noise |
| Hori.                   | 1575.000           | 42.4                      | 25.3                     | 5.0          | 33.1         | -                      | 39.6                       | 39.6   | 73.9                      | 53.9                      | 34.3                   | 14.3                   | Inside                                   | Floor noise |
| Hori.                   | 1890.000           | 44.5                      | 25.7                     | 5.0          | 32.3         | 0.0                    | 42.9                       | 42.9   | 75.6                      | 55.6                      | 32.7                   | 12.7                   | Outside                                  |             |
| Hori.                   | 2205.000           | 41.9                      | 28.4                     | 5.1          | 31.9         | -                      | 43.5                       | 43.5   | 73.9                      | 53.9                      | 30.4                   | <b>10.4</b>            | Inside                                   | Floor noise |
| Hori.                   | 2520.000           | 41.2                      | 27.5                     | 5.3          | 31.7         | -                      | 42.3                       | 42.3   | 75.6                      | 55.6                      | 33.3                   | 13.3                   | Outside                                  | Floor noise |
| Hori.                   | 2835.000           | 40.9                      | 28.5                     | 5.5          | 31.5         | -                      | 43.4                       | 43.4   | 73.9                      | 53.9                      | 30.5                   | 10.5                   | Inside                                   | Floor noise |
| Hori.                   | 3150.000           | 40.5                      | 28.8                     | 5.6          | 31.4         | -                      | 43.5                       | 43.5   | 75.6                      | 55.6                      | 32.1                   | 12.1                   | Outside                                  | Floor noise |
| Vert.                   | 315.000            | 76.7                      | 14.1                     | 9.7          | 32.0         | 0.0                    | 68.5                       | 68.5   | 95.6                      | 75.6                      | 27.1                   | 7.1                    | Carrier                                  |             |
| Vert.                   | 630.000            | 46.1                      | 19.6                     | 11.4         | 32.3         | 0.0                    | 44.8                       | 44.8   | 75.6                      | 55.6                      | 30.8                   | 10.8                   | Outside                                  |             |
| Vert.                   | 945.000            | 29.0                      | 22.1                     | 12.5         | 30.9         | -                      | 32.7                       | 32.7   | 75.6                      | 55.6                      | 42.9                   | 22.9                   | Outside                                  | Floor noise |
| Vert.                   | 1260.000           | 42.8                      | 25.9                     | 4.7          | 34.0         | -                      | 39.4                       | 39.4   | 75.6                      | 55.6                      | 36.2                   | 16.2                   | Outside                                  | Floor noise |
| Vert.                   | 1575.000           | 42.6                      | 25.3                     | 5.0          | 33.1         | -                      | 39.8                       | 39.8   | 73.9                      | 53.9                      | 34.1                   | 14.1                   | Inside                                   | Floor noise |
| Vert.                   | 1890.000           | 44.9                      | 25.7                     | 5.0          | 32.3         | 0.0                    | 43.3                       | 43.3   | 75.6                      | 55.6                      | 32.3                   | 12.3                   | Outside                                  |             |
| Vert.                   | 2205.000           | 41.8                      | 28.4                     | 5.1          | 31.9         | -                      | 43.4                       | 43.4   | 73.9                      | 53.9                      | 30.5                   | 10.5                   | Inside                                   | Floor noise |
| Vert.                   | 2520.000           | 41.6                      | 27.5                     | 5.3          | 31.7         | -                      | 42.7                       | 42.7   | 75.6                      | 55.6                      | 32.9                   | 12.9                   | Outside                                  | Floor noise |
| Vert.                   | 2835.000           | 40.7                      | 28.5                     | 5.5          | 31.5         | -                      | 43.2                       | 43.2   | 73.9                      | 53.9                      | 30.7                   | 10.7                   | Inside                                   | Floor noise |
| Vert.                   | 3150.000           | 40.3                      | 28.8                     | 5.6          | 31.4         | -                      | 43.3                       | 43.3   | 75.6                      | 55.6                      | 32.3                   | 12.3                   | Outside                                  | Floor noise |

No signal was detected above 3.2 GHz.

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

For 1 GHz to 6 GHz: Distance Factor:  $20 \times \log (4.00 \text{ m} / 3.00 \text{ m}) = 2.50 \text{ dB}$

For 6 GHz to 10 GHz: Distance Factor:  $20 \times \log (5.00 \text{ m} / 3.00 \text{ m}) = 4.44 \text{ dB}$

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

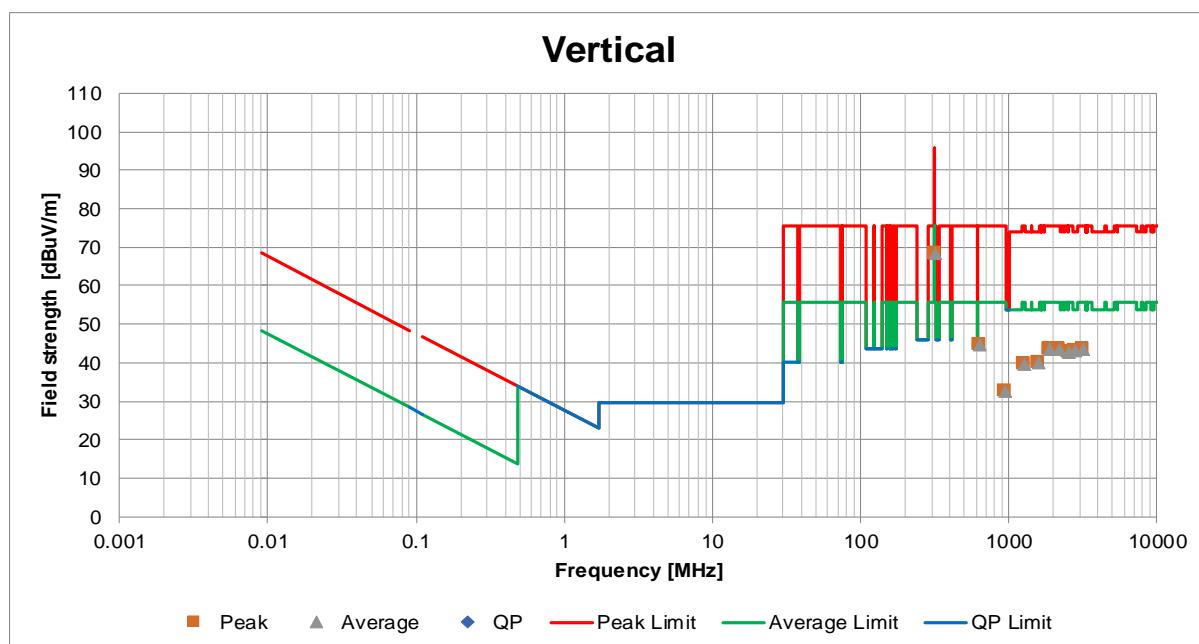
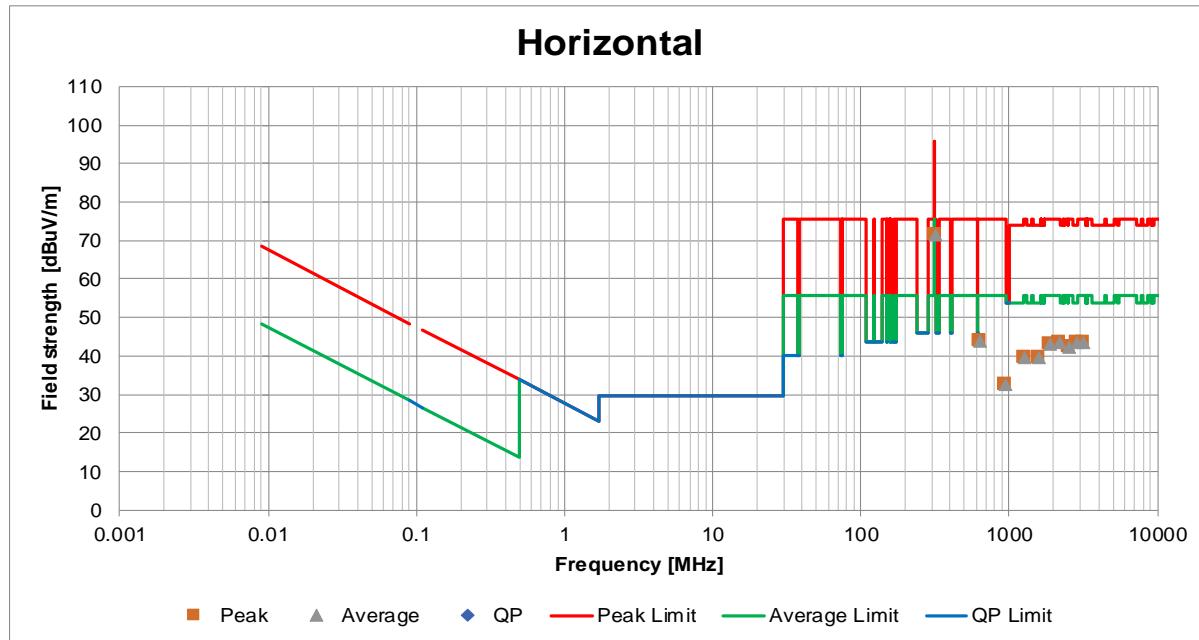
Harmonic test (Above 1 GHz) was applied to worst 100% (Duty factor = 0) although Duty Factor was applied in harmonic test which peak to peak frequency bandwidth of FSK modulation is equal to or more than measurement bandwidth (1 MHz).

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

Although Duty of this product was 100% or less, the result (Below 1 GHz) of AV (PK with Duty factor) was calculated by applying Duty 100 % as worst.

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

|                        |                               |                                    |                                 |
|------------------------|-------------------------------|------------------------------------|---------------------------------|
| Test place             | Ise EMC Lab.                  | No.4                               | No.4                            |
| Semi Anechoic Chamber  |                               |                                    |                                 |
| Date                   | October 24, 2024              | October 25, 2024                   | February 20, 2025               |
| Temperature / Humidity | 22 deg. C / 60 % RH           | 22 deg. C / 58 % RH                | 20 deg. C / 36 % RH             |
| Engineer               | Daiki Matsui<br>(Below 1 GHz) | Daiki Matsui<br>(1 GHz to 3.2 GHz) | Daiki Matsui<br>(Above 3.2 GHz) |
| Mode                   | Mode 2                        |                                    |                                 |



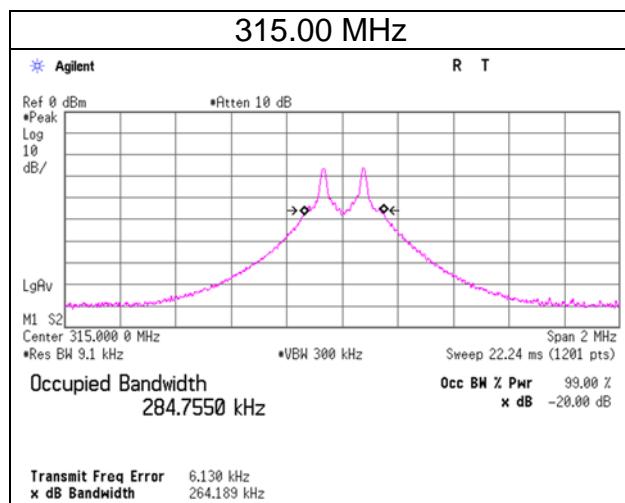
## -20 dB Bandwidth / 99% emission bandwidth

Test place Ise EMC Lab.  
Semi Anechoic Chamber No.4  
Date October 24, 2024  
Temperature / Humidity 22 deg. C / 60 % RH  
Engineer Daiki Matsui  
Mode Mode 2

Bandwidth Limit : Fundamental Frequency  $315.00 \text{ MHz} \times 0.25 \% = 787.500 \text{ kHz}$

| -20 dB Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
|---------------------------|--------------------------|--------|
| 264.189                   | 787.500                  | Pass   |

| 99% emission bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
|---------------------------------|--------------------------|--------|
| 284.7550                        | 787.500                  | Pass   |



## **APPENDIX 2: Test Instruments**

### **Test Equipment (Tested on October 1, 2024)**

| Test Item | LIMS ID | Description                       | Manufacturer                    | Model                            | Serial                    | Last Calibration Date | Cal Int |
|-----------|---------|-----------------------------------|---------------------------------|----------------------------------|---------------------------|-----------------------|---------|
| RE        | 141267  | Logperiodic Antenna (200-1000MHz) | Schwarzbeck Mess-Elektronik OHG | VUSLP9111B                       | 9111B-192                 | 09/18/2024            | 12      |
| RE        | 141331  | Attenuator(6dB)                   | TME                             | UFA-01                           | -                         | 02/17/2024            | 12      |
| RE        | 141397  | Coaxial Cable                     | UL Japan                        | -                                | -                         | 11/22/2023            | 12      |
| RE        | 141425  | Biconical Antenna                 | Schwarzbeck Mess-Elektronik OHG | VHA9103+BBA9106                  | VHA 91031302              | 08/23/2024            | 12      |
| RE        | 141512  | Horn Antenna 1-18GHz              | Schwarzbeck Mess-Elektronik OHG | BBHA9120D                        | 254                       | 10/17/2023            | 12      |
| RE        | 141545  | DIGITAL HiTESTER                  | HIOKI E.E. CORPORATION          | 3805                             | 51201148                  | 02/01/2024            | 12      |
| RE        | 141581  | MicroWave System Amplifier        | Keysight Technologies Inc       | 83017A                           | 00650                     | 10/30/2024            | 12      |
| RE        | 141583  | Pre Amplifier                     | SONOMA INSTRUMENT               | 310                              | 260833                    | 04/04/2024            | 12      |
| RE        | 141903  | Spectrum Analyzer                 | Keysight Technologies Inc       | E4440A                           | MY46186390                | 01/26/2024            | 12      |
| RE        | 141950  | EMI Test Receiver                 | Rohde & Schwarz                 | ESU26                            | 100412                    | 11/20/2023            | 12      |
| RE        | 142011  | AC4_Semi Anechoic Chamber(NSA)    | TDK                             | Semi Anechoic Chamber 3m         | DA-10005                  | 12/13/2023            | 24      |
| RE        | 142017  | AC4_Semi Anechoic Chamber(SVSWR)  | TDK                             | Semi Anechoic Chamber 3m         | DA-10005                  | 04/14/2023            | 24      |
| RE        | 142230  | Measure, Tape, Steel              | KOMELON                         | KMC-36                           | -                         | -                     | -       |
| RE        | 178648  | EMI measurement program           | TSJ (Techno Science Japan)      | TEPTO-DV                         | -                         | -                     | -       |
| RE        | 234602  | Microwave Cable                   | Huber+Suhner                    | SF126E/11PC35/11PC35/1000M,5000M | 537063/126E / 537074/126E | 03/08/2024            | 12      |
| RE        | 242978  | High Pass Filter 1-13 GHz         | Pasternak                       | PE87FL1018                       | D.C. 2215                 | 02/02/2024            | 12      |
| RE        | 244710  | Thermo-Hygrometer                 | HIOKI E.E. CORPORATION          | LR5001                           | 231202104                 | 01/25/2024            | 12      |
| RE        | 142645  | Loop Antenna                      | UL Japan                        | -                                | -                         | -                     | -       |
| AT        | 141156  | Attenuator(10dB)                  | Weinschel Corp                  | 2                                | BL1173                    | 11/17/2023            | 12      |
| AT        | 141327  | Coaxial Cable                     | UL-ISE                          | -                                | -                         | 02/09/2024            | 12      |
| AT        | 141545  | DIGITAL HiTESTER                  | HIOKI E.E. CORPORATION          | 3805                             | 51201148                  | 02/01/2024            | 12      |
| AT        | 141809  | Power Meter                       | Anritsu Corporation             | ML2495A                          | 825002                    | 05/22/2024            | 12      |
| AT        | 141830  | Power sensor                      | Anritsu Corporation             | MA2411B                          | 738285                    | 05/22/2024            | 12      |
| AT        | 244710  | Thermo-Hygrometer                 | HIOKI E.E. CORPORATION          | LR5001                           | 231202104                 | 01/25/2024            | 12      |

**Test Equipment (Tested on February 20, 2025)**

| Test Item | LIMS ID | Description                      | Manufacturer                    | Model                            | Serial                    | Last Calibration Date | Cal Int |
|-----------|---------|----------------------------------|---------------------------------|----------------------------------|---------------------------|-----------------------|---------|
| RE        | 141508  | Horn Antenna 1-18GHz             | Schwarzbeck Mess-Elektronik OHG | BBHA9120D                        | 557                       | 05/17/2024            | 12      |
| RE        | 141581  | MicroWave System Amplifier       | Keysight Technologies Inc       | 83017A                           | 00650                     | 10/30/2024            | 12      |
| RE        | 141903  | Spectrum Analyzer                | Keysight Technologies Inc       | E4440A                           | MY46186390                | 01/30/2025            | 12      |
| RE        | 142017  | AC4_Semi Anechoic Chamber(SVSWR) | TDK                             | Semi Anechoic Chamber 3m         | DA-10005                  | 04/14/2023            | 24      |
| RE        | 178648  | EMI measurement program          | TSJ (Techno Science Japan)      | TEPTO-DV                         | -                         | -                     | -       |
| RE        | 234602  | Microwave Cable                  | Huber+Suhner                    | SF126E/11PC35/11PC35/1000M,5000M | 537063/126E / 537074/126E | 03/08/2024            | 12      |
| RE        | 238713  | Double Ridge Horn Antenna        | Schwarzbeck Mess-Elektronik OHG | BBHA 9120 C                      | 688                       | 09/02/2024            | 12      |
| RE        | 242978  | High Pass Filter 1-13 GHz        | Pasternak                       | PE87FL1018                       | D.C. 2215                 | 02/14/2025            | 12      |
| RE        | 244710  | Thermo-Hygrometer                | HIOKI E. E. CORPORATION         | LR5001                           | 231202104                 | 01/19/2025            | 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**