

# RADIO TEST REPORT

## Test Report No. 15470574H-R2

|                     |                          |
|---------------------|--------------------------|
| Customer            | TOYOTA MOTOR CORPORATION |
| Description of EUT  | Smart LF oscillator      |
| Model Number of EUT | TMLF19D-A                |
| FCC ID              | NI4TMLF19D-A             |
| Test Regulation     | FCC Part 15 Subpart C    |
| Test Result         | Complied                 |
| Issue Date          | November 26, 2024        |
| Remarks             | -                        |

**Representative test engineer**Tetsuro Yoshida  
Engineer**Approved by**Shinichi Miyazono  
Leader

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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## **REVISION HISTORY**

### **Original Test Report No. 15470574H**

This report is a revised version of 15470574H-R1. 15470574H-R1 is replaced with this report.

| Revision     | Test Report No. | Date              | Page Revised Contents  |
|--------------|-----------------|-------------------|--|
| - (Original) | 15470574H       | November 7, 2024  | -  |
| 1            | 15470574H-R1    | November 25, 2024 | Correction of the Test Date in Clause 2.1 due to the additional test.<br>from October 7 to 17, 2024<br>to October 7 to November 22, 2024   |
| 1            | 15470574H-R1    | November 25, 2024 | Correction of the product configuration in Clause 2.2.   |
| 1            | 15470574H-R1    | November 25, 2024 | Correction of the FCC Part 15.31 (e) in Clause 3.2   |
| 1            | 15470574H-R1    | November 25, 2024 | Change the following in Clause 4.1.<br>- Correction of test mode<br>- Addition of "**2)" to the Remarks of Mode 3<br>- Addition of "**3)" to the Remarks of Mode 1 and note "**3)" under the table                       |
| 1            | 15470574H-R1    | November 25, 2024 | Correction of the notation of items in Clause 4.2.   |
| 1            | 15470574H-R1    | November 25, 2024 | Addition of the following to Radiated Emission data (Page 15 to 21).<br>- Test date<br>- Voltage fluctuation data  |
| 1            | 15470574H-R1    | November 25, 2024 | Deletion of the following sentence from Radiated Emission data (Mode 6);<br>* Since the peak emission result satisfied the average limit, duty factor was omitted  |
| 1            | 15470574H-R1    | November 25, 2024 | Addition of LIMS ID:146613 in the Test Equipment.  |
| 1            | 15470574H-R1    | November 25, 2024 | Correction of the antenna identification for the Worst Case Position. (page 28)  |
| 2            | 15470574H-R2    | November 26, 2024 | - Addition of the "**1)" to LIMS ID: 142152 in Test Equipment.<br>- Addition of the following sentence;<br>"The expiration*1) This test equipment was used for the tests before the expiration date of the calibration." |

## 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     | TOYOTA MOTOR CORPORATION                      |
| Address          | 1, Toyota-Cho, Toyota, Aichi, 471-8572, Japan |
| Telephone Number | +81-50-3166-4371                              |
| Contact Person   | Arinobu Kimura                                |

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   | Smart LF oscillator  |
| Model Number  | TMLF19D-A  |
| Serial Number | Refer to SECTION 4.2   |
| Condition     | Engineering 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 7 to November 22, 2024   |

### **2.2 Product Description**

#### **General Specification**

|        |         |
|--------|---------|
| Rating | DC 12 V |
|--------|---------|

#### **Radio Specification**

|                        |   |
|------------------------|---|
| Equipment Type         | Transmitter   |
| Frequency of Operation | 125 kHz   |
| Type of Modulation     | ASK   |
| Antenna type           | Outside antenna Var.C2 (*1),<br>Inside antenna Var.1 (*2), Inside antenna Var.3 (*3), Rear antenna (*4)<br>*1: Maximum number of this antenna is 4.<br>*2: Maximum number of this antenna is 2.<br>*3: Maximum number of this antenna is 1.<br>*4: Maximum number of this antenna is 6. |

Smart LF oscillator (model: TMLF19D-A) consists of the following parts:

- Smart ECU
- Outside Antenna Var.C2\*
- Inside Antenna Var.1
- Inside antenna Var.3
- Rear Antenna

\*Outside Antenna Var.C2 has a variant model: Var.C4 with a different circuit.

## 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 15.207 Conducted limits<br>Section 15.209 Radiated emission limits; general requirements. |

### 3.2 Procedures and results

| Item  | Test Procedure   | Specification   | Worst margin   | Results  | Remarks  |
|---|--|---|--|----------|----------|
| Conducted Emission                              | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 8.8            | <FCC><br>Section 15.207<br><ISED><br>RSS-Gen 8.8                | N/A  | N/A      | *1)      |
| Electric Field Strength of Fundamental Emission | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.5, 6.12      | <FCC><br>Section 15.209<br><ISED><br>RSS-210 8.2<br>RSS-Gen 8.9 | 6.9 dB<br>125 kHz, 0 deg.<br>Peak with Duty factor<br>(Mode 3) | Complied | Radiated |
| Electric Field Strength of Spurious Emission    | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.5, 6.6, 6.13 | <FCC><br>Section 15.209<br><ISED><br>RSS-210 8.3<br>RSS-Gen 8.9 | 9.8 dB<br>0.62500 MHz,<br>0 deg. QP<br>(Mode 6)                | Complied | Radiated |
| -20 dB Bandwidth                                | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>-                      | <FCC><br>Reference data<br><ISED><br>-                          | 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 is not the device that is designed to be connected to the public utility (AC) power line.

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

The battery voltage (DC 12 V) is provided to the EUT. Input voltage to RF part does not go through the regulator.

So the test was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage (DC 12 V) and the variation of the input power does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the vehicle.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

### 3.3 Addition to standard

| Item                    | Test Procedure | Specification | Worst margin | Results | Remarks  |
|-------------------------|----------------|---------------|--------------|---------|----------|
| 99 % emission bandwidth | RSS-Gen 6.7    | -             | 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                          |

#### -20 dB Bandwidth and 99% Occupied Bandwidth

| Item            | Unit | Calculated Uncertainty (+/-) |
|-----------------|------|------------------------------|
| Bandwidth (OBW) | %    | 0.96                         |

### 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)

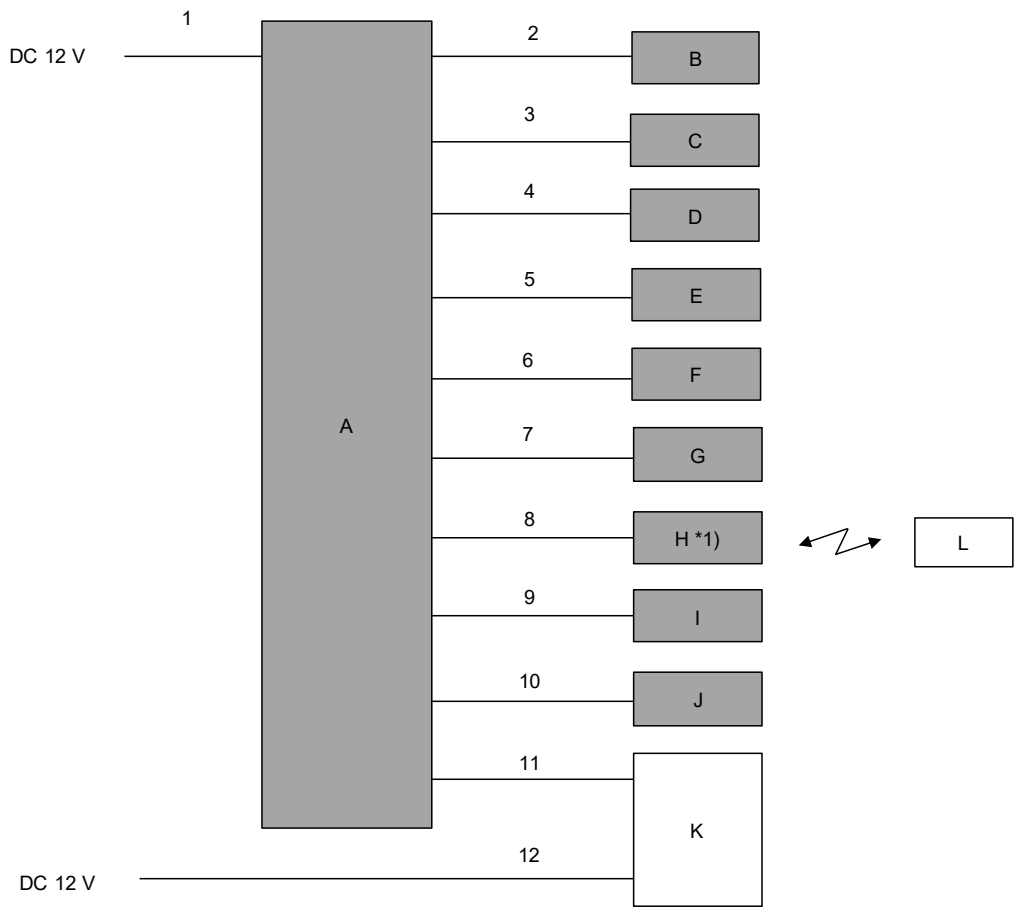
| Test mode  | Remarks  |
|--|----------|
| 1) Tx 125 kHz, Outside Antenna Var.C2  | *1), *3) |
| 2) Tx 125 kHz, Inside Antenna Var.3 (Inside Mode)  | *1)      |
| 3) Tx 125 kHz, Inside Antenna Var.3 (Immobilizer mode)   | *1), *2) |
| 4) Tx 125 kHz, Inside Antenna Var.1  | *1)      |
| 5) Tx 125 kHz, Rear Antenna  | *1)      |
| 6) Tx 125 kHz, Outside Antenna and Rear Antenna<br>(Outside Antenna 1, 2, 3, 4 and Rear Antenna 5, 6)  | *1)      |
| <p>*Power of the EUT was set by the software as follows;<br/> Software: 19CYV3_IDT_denpa_v01_cm0_240411 Version: 01<br/> (Date: 2024.04.11, Storage location: EUT memory)</p> <p>19CYV3_IDT_denpa_v01_cm4_240411 Version: 01<br/> (Date: 2024.04.11, Storage location: EUT memory)</p> <p>*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.<br/> Justification: The system was configured in typical fashion (as a user would normally use it) for testing.</p> |          |

\*1) Refer to Timing of transmission in "Operational Descrip-Transmission spec." for details.

\*2) This EUT has two modes which transponder key is attached or not. The worst case was confirmed with and without transponder key attached, as a result, the test without transponder key attached was the worst case. Therefore the test without transponder key attached was performed only.

\*3) Outside Antenna has the following two types; Var.C2 and Var.C4.  
After the worst case was confirmed with Var.C2 and Var.C4 at pre check, the test was performed with Var.C2 as representative as its result was the worst one.

4.2 Configuration and Peripherals



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.  
\*1) \*Item H has two modes: LF transmission mode and Immobilizer communication mode.

#### Description of EUT and Support Equipment

| No. | Item                   | Model number | Serial Number                             | Manufacturer | Remark |
|-----|------------------------|--------------|---|--------------|--------|
| A   | Smart ECU              | TMLF19D-A    | TE174 for Mode 1 to 5<br>TE175 for Mode 6 | -            | EUT    |
| B   | Outside Antenna Var.C2 | D19C2        | TD926                                     | -            | EUT    |
| C   | Outside Antenna Var.C2 | D19C2        | TD924                                     | -            | EUT    |
| D   | Outside Antenna Var.C2 | D19C2        | TD927                                     | -            | EUT    |
| E   | Outside Antenna Var.C2 | D19C2        | TD925                                     | -            | EUT    |
| F   | Rear Antenna           | 12TA0        | TT250                                     | -            | EUT    |
| G   | Rear Antenna           | 12TA0        | TT255                                     | -            | EUT    |
| H   | Inside Antenna Var.3   | R19A1        | TR407                                     | -            | EUT    |
| I   | Inside Antenna Var.1   | 18WA0        | TR392                                     | -            | EUT    |
| J   | Inside Antenna Var.1   | 18WA0        | TR390                                     | -            | EUT    |
| K   | Switch Box             | -            | No.7                                      | -            | *1)    |
| L   | Smart key              | 19CY_V3      | TK171                                     | -            | *2)    |

#### List of Cables Used

| No. | Name         | Length (m) | Shield     |            | Remark |
|-----|--------------|------------|------------|------------|--------|
|     |              |            | Cable      | Connector  |        |
| 1   | DC Cable     | 2.2        | Unshielded | Unshielded | -      |
| 2   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 3   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 4   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 5   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 6   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 7   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 8   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 9   | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 10  | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 11  | Signal Cable | 3.0        | Unshielded | Unshielded | -      |
| 12  | DC Cable     | 3.0        | Unshielded | Unshielded | *1)    |

\*1) Used for Mode 1 to 5 only

\*2) Used for Mode 3 only

## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **Test Procedure**

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

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

#### **[Limit conversion]**

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to  $45.5 - 51.5 = -6.0$  dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

#### **[Frequency: From 9 kHz to 30 MHz]**

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg., 180 deg. ) and horizontal polarization.

\*Refer to Figure 22 about Direction of the Loop Antenna.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore, sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

These tests were performed in semi anechoic chamber. Therefore, the measured level of emissions may be higher than if measurements were made without a ground plane. However, test results were confirmed to pass against standard limit.

#### **[Frequency: From 30 MHz to 1 GHz]**

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

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

#### **[Test instruments and test settings]**

|              |              |                   |                  |
|--------------|--------------|-------------------|------------------|
| Frequency    | Below 30 MHz | 30 MHz to 200 MHz | 200 MHz to 1 GHz |
| Antenna Type | Loop         | Biconical         | Logperiodic      |

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

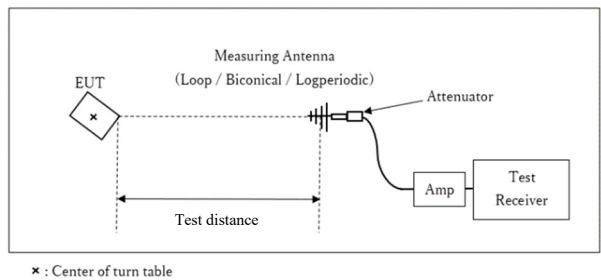
|                 |  |                        |                         |                        |                      |
|-----------------|--|------------------------|-------------------------|------------------------|----------------------|
| Frequency       | From 9 kHz to 90 kHz and From 110 kHz to 150 kHz | From 90 kHz to 110 kHz | From 150 kHz to 490 kHz | From 490 kHz to 30 MHz | From 30 MHz to 1 GHz |
| Instrument used | Test Receiver                                    |                        |                         |                        |                      |
| Detector        | PK / AV  | QP                     | PK / AV                 | QP                     | QP                   |
| IF Bandwidth    | 200 Hz   | 200 Hz                 | 9 kHz                   | 9 kHz                  | 120 kHz              |
| Test Distance   | 3 m *1)  | 3 m *1)                | 3 m *1)                 | 3 m *2)                | 3 m                  |

\*1) Distance Factor:  $40 \times \log (3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

\*2) Distance Factor:  $40 \times \log (3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Figure 1: Test Setup

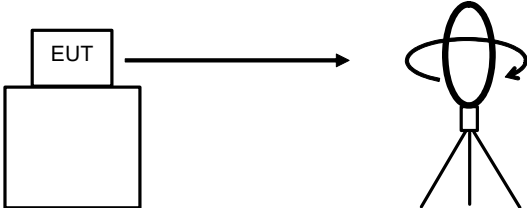
Below 1 GHz



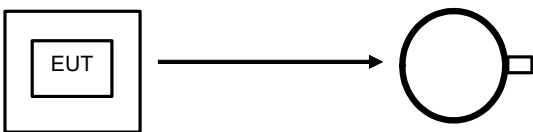
Test Distance: 3 m

Figure 2: Direction of the Loop Antenna

Side View (Vertical)

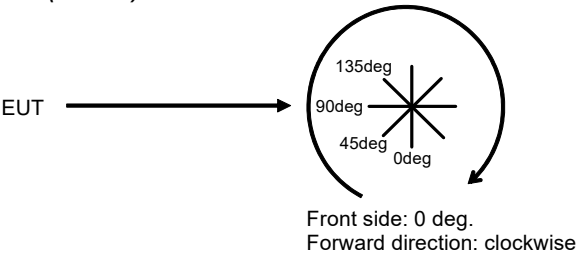


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



- 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 1 GHz  
Test data : APPENDIX  
Test result : Pass

## **SECTION 6: -20 dB Bandwidth**

### **Test Procedure**

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

| Test             | Span                                    | RBW             | VBW                | Sweep | Detector | Trace    | Instrument used   |
|------------------|---|-----------------|--------------------|-------|----------|----------|-------------------|
| -20 dB Bandwidth | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto  | Peak     | Max Hold | Spectrum Analyzer |

Test data : APPENDIX

Test result : Pass

## **SECTION 7: 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   |
|-------------------------|---|-----------------|--------------------|-------|----------|----------|-------------------|
| 99 % emission bandwidth | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto  | Peak     | Max Hold | Spectrum Analyzer |

Peak hold was applied as Worst-case measurement.

Test data : APPENDIX

Test result : Pass

## APPENDIX 1: Test data

### Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | No.4                          | No.4   |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 1                            |                               |  |

#### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | -                   | 15.7               | 45.6              | 29.9           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | -                   | 15.7               | 45.6              | 29.9           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | -                   | 15.7               | 45.6              | 29.9           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 42.7              | 19.6                 | -64.0        | 32.2         | -                   | -33.9              | 39.6              | 73.5           |                        |
| 0deg                                     | 0.37500            | PK       | 60.2              | 19.7                 | -64.1        | 32.2         | -                   | -16.4              | 36.1              | 52.5           |                        |
| 0deg                                     | 0.50000            | QP       | 28.9              | 19.7                 | -24.1        | 32.2         | -                   | -7.7               | 33.6              | 41.3           |                        |
| 0deg                                     | 0.62500            | QP       | 49.5              | 19.7                 | -24.1        | 32.2         | -                   | 12.9               | 31.7              | 18.8           |                        |
| 0deg                                     | 0.75000            | QP       | 23.8              | 19.7                 | -24.1        | 32.2         | -                   | -12.8              | 30.1              | 42.9           |                        |
| 0deg                                     | 0.87500            | QP       | 43.6              | 19.7                 | -24.0        | 32.2         | -                   | 7.1                | 28.7              | 21.6           |                        |
| 0deg                                     | 1.00000            | QP       | 22.1              | 19.7                 | -24.0        | 32.2         | -                   | -14.4              | 27.6              | 42.0           |                        |
| 0deg                                     | 1.12500            | QP       | 38.9              | 19.7                 | -24.0        | 32.2         | -                   | 2.4                | 26.5              | 24.1           |                        |
| 0deg                                     | 1.25000            | QP       | 21.7              | 19.7                 | -24.0        | 32.2         | -                   | -14.8              | 25.6              | 40.4           |                        |
| Hori.                                    | 51.421             | QP       | 20.5              | 10.7                 | 7.3          | 32.1         | -                   | 6.4                | 40.0              | 33.6           | Floor Noise            |
| Hori.                                    | 59.009             | QP       | 33.9              | 8.1                  | 7.4          | 32.1         | -                   | 17.3               | 40.0              | 22.7           |                        |
| Hori.                                    | 105.307            | QP       | 20.4              | 11.1                 | 7.9          | 32.1         | -                   | 7.3                | 43.5              | 36.2           | Floor Noise            |
| Hori.                                    | 176.730            | QP       | 20.7              | 16.1                 | 8.5          | 32.0         | -                   | 13.3               | 43.5              | 30.2           | Floor Noise            |
| Hori.                                    | 244.808            | QP       | 20.3              | 11.9                 | 9.1          | 32.0         | -                   | 9.3                | 46.0              | 36.7           | Floor Noise            |
| Hori.                                    | 461.615            | QP       | 20.1              | 16.9                 | 10.5         | 32.2         | -                   | 15.3               | 46.0              | 30.7           | Floor Noise            |
| Vert.                                    | 51.421             | QP       | 20.6              | 10.7                 | 7.3          | 32.1         | -                   | 6.5                | 40.0              | 33.5           | Floor Noise            |
| Vert.                                    | 59.009             | QP       | 31.4              | 8.1                  | 7.4          | 32.1         | -                   | 14.8               | 40.0              | 25.2           |                        |
| Vert.                                    | 105.307            | QP       | 20.4              | 11.1                 | 7.9          | 32.1         | -                   | 7.3                | 43.5              | 36.2           | Floor Noise            |
| Vert.                                    | 176.730            | QP       | 20.7              | 16.1                 | 8.5          | 32.0         | -                   | 13.3               | 43.5              | 30.2           | Floor Noise            |
| Vert.                                    | 244.808            | QP       | 20.3              | 11.9                 | 9.1          | 32.0         | -                   | 9.3                | 46.0              | 36.7           | Floor Noise            |
| Vert.                                    | 461.615            | QP       | 20.2              | 16.9                 | 10.5         | 32.2         | -                   | 15.4               | 46.0              | 30.6           | Floor Noise            |

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

#### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 15.7               | 25.6              | 9.9            | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 15.7               | 25.6              | 9.9            | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 102.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 15.7               | 25.6              | 9.9            | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 42.7              | 19.6                 | -64.0        | 32.2         | 0.0                 | -33.9              | 19.6              | 53.5           |                        |
| 0deg                                     | 0.37500            | PK       | 60.2              | 19.7                 | -64.1        | 32.2         | 0.0                 | -16.4              | 16.1              | 32.5           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

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

#### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 102.2             | 19.5                 | 6.2          | 32.2         | -                   | 95.7               | -                 | -              | Fundamental |

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

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

The test result is rounded off, so some differences might be observed.

## Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | No.4                          | No.4   |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 2                            |                               |  |

### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | -                   | 16.9               | 45.6              | 28.7           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | -                   | 16.9               | 45.6              | 28.7           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | -                   | 16.9               | 45.6              | 28.7           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 37.8              | 19.6                 | -64.0        | 32.2         | -                   | -38.8              | 39.6              | 78.4           |                        |
| 0deg                                     | 0.37500            | PK       | 32.9              | 19.7                 | -64.1        | 32.2         | -                   | -43.7              | 36.1              | 79.8           |                        |
| 0deg                                     | 0.50000            | QP       | 22.8              | 19.7                 | -24.1        | 32.2         | -                   | -13.8              | 33.6              | 47.4           |                        |
| 0deg                                     | 0.62500            | QP       | 22.7              | 19.7                 | -24.1        | 32.2         | -                   | -13.9              | 31.7              | 45.6           |                        |
| 0deg                                     | 0.75000            | QP       | 21.8              | 19.7                 | -24.1        | 32.2         | -                   | -14.8              | 30.1              | 44.9           |                        |
| 0deg                                     | 0.87500            | QP       | 21.7              | 19.7                 | -24.0        | 32.2         | -                   | -14.8              | 28.7              | 43.5           |                        |
| 0deg                                     | 1.00000            | QP       | 21.4              | 19.7                 | -24.0        | 32.2         | -                   | -15.1              | 27.6              | 42.7           |                        |
| 0deg                                     | 1.12500            | QP       | 21.5              | 19.7                 | -24.0        | 32.2         | -                   | -15.0              | 26.5              | 41.5           |                        |
| 0deg                                     | 1.25000            | QP       | 21.4              | 19.7                 | -24.0        | 32.2         | -                   | -15.1              | 25.6              | 40.7           |                        |
| Hori.                                    | 50.911             | QP       | 20.5              | 10.8                 | 7.3          | 32.1         | -                   | 6.5                | 40.0              | 33.5           | Floor Noise            |
| Hori.                                    | 61.682             | QP       | 21.4              | 7.5                  | 7.5          | 32.1         | -                   | 4.3                | 40.0              | 35.7           |                        |
| Hori.                                    | 103.779            | QP       | 20.4              | 10.9                 | 7.9          | 32.1         | -                   | 7.1                | 43.5              | 36.4           | Floor Noise            |
| Hori.                                    | 176.370            | QP       | 20.9              | 16.0                 | 8.5          | 32.0         | -                   | 13.4               | 43.5              | 30.1           | Floor Noise            |
| Hori.                                    | 254.400            | QP       | 20.3              | 12.1                 | 9.2          | 32.0         | -                   | 9.6                | 46.0              | 36.4           | Floor Noise            |
| Hori.                                    | 482.402            | QP       | 20.1              | 17.6                 | 10.6         | 32.2         | -                   | 16.1               | 46.0              | 29.9           | Floor Noise            |
| Vert.                                    | 50.911             | QP       | 20.4              | 10.8                 | 7.3          | 32.1         | -                   | 6.4                | 40.0              | 33.6           | Floor Noise            |
| Vert.                                    | 61.682             | QP       | 23.5              | 7.5                  | 7.5          | 32.1         | -                   | 6.4                | 40.0              | 33.6           |                        |
| Vert.                                    | 103.779            | QP       | 20.4              | 10.9                 | 7.9          | 32.1         | -                   | 7.1                | 43.5              | 36.4           | Floor Noise            |
| Vert.                                    | 176.370            | QP       | 20.5              | 16.0                 | 8.5          | 32.0         | -                   | 13.0               | 43.5              | 30.5           | Floor Noise            |
| Vert.                                    | 254.400            | QP       | 20.3              | 12.1                 | 9.2          | 32.0         | -                   | 9.6                | 46.0              | 36.4           | Floor Noise            |
| Vert.                                    | 482.402            | QP       | 20.2              | 17.6                 | 10.6         | 32.2         | -                   | 16.2               | 46.0              | 29.8           | Floor Noise            |

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

### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | 0.0                 | 16.9               | 25.6              | 8.7            | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | 0.0                 | 16.9               | 25.6              | 8.7            | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 103.4             | 19.5                 | -73.8        | 32.2         | 0.0                 | 16.9               | 25.6              | 8.7            | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 37.8              | 19.6                 | -64.0        | 32.2         | 0.0                 | -38.8              | 19.6              | 58.4           |                        |
| 0deg                                     | 0.37500            | PK       | 32.9              | 19.7                 | -64.1        | 32.2         | 0.0                 | -43.7              | 16.1              | 59.8           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D Factor) - Gain(Amplifier) + Duty factor \*

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

### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 103.4             | 19.5                 | 6.2          | 32.2         | -                   | 96.9               | -                 | -              | Fundamental |

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

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

The test result is rounded off, so some differences might be observed.

## Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | No.4                          | No.4   |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 3                            |                               |  |

### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | -                   | 18.7               | 45.6              | 26.9           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | -                   | 18.7               | 45.6              | 26.9           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | -                   | 18.7               | 45.6              | 26.9           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 36.0              | 19.6                 | -64.0        | 32.2         | -                   | -40.6              | 39.6              | 80.2           |                        |
| 0deg                                     | 0.37500            | PK       | 32.8              | 19.7                 | -64.1        | 32.2         | -                   | -43.8              | 36.1              | 79.9           |                        |
| 0deg                                     | 0.50000            | QP       | 22.8              | 19.7                 | -24.1        | 32.2         | -                   | -13.8              | 33.6              | 47.4           |                        |
| 0deg                                     | 0.62500            | QP       | 22.6              | 19.7                 | -24.1        | 32.2         | -                   | -14.0              | 31.7              | 45.7           |                        |
| 0deg                                     | 0.75000            | QP       | 21.9              | 19.7                 | -24.1        | 32.2         | -                   | -14.7              | 30.1              | 44.8           |                        |
| 0deg                                     | 0.87500            | QP       | 21.8              | 19.7                 | -24.0        | 32.2         | -                   | -14.7              | 28.7              | 43.4           |                        |
| 0deg                                     | 1.00000            | QP       | 21.5              | 19.7                 | -24.0        | 32.2         | -                   | -15.0              | 27.6              | 42.6           |                        |
| 0deg                                     | 1.12500            | QP       | 21.5              | 19.7                 | -24.0        | 32.2         | -                   | -15.0              | 26.5              | 41.5           |                        |
| 0deg                                     | 1.25000            | QP       | 21.4              | 19.7                 | -24.0        | 32.2         | -                   | -15.1              | 25.6              | 40.7           |                        |
| Hori.                                    | 51.591             | QP       | 20.3              | 10.6                 | 7.3          | 32.1         | -                   | 6.1                | 40.0              | 33.9           | Floor Noise            |
| Hori.                                    | 74.880             | QP       | 24.7              | 6.5                  | 7.6          | 32.1         | -                   | 6.7                | 40.0              | 33.3           |                        |
| Hori.                                    | 104.121            | QP       | 20.2              | 10.9                 | 7.9          | 32.1         | -                   | 6.9                | 43.5              | 36.6           | Floor Noise            |
| Hori.                                    | 180.454            | QP       | 20.6              | 16.2                 | 8.6          | 32.0         | -                   | 13.4               | 43.5              | 30.1           | Floor Noise            |
| Hori.                                    | 254.424            | QP       | 20.2              | 12.1                 | 9.2          | 32.0         | -                   | 9.5                | 46.0              | 36.5           | Floor Noise            |
| Hori.                                    | 465.591            | QP       | 20.3              | 17.0                 | 10.5         | 32.2         | -                   | 15.6               | 46.0              | 30.4           | Floor Noise            |
| Vert.                                    | 51.591             | QP       | 20.3              | 10.6                 | 7.3          | 32.1         | -                   | 6.1                | 40.0              | 33.9           | Floor Noise            |
| Vert.                                    | 74.880             | QP       | 23.5              | 6.5                  | 7.6          | 32.1         | -                   | 5.5                | 40.0              | 34.5           |                        |
| Vert.                                    | 104.121            | QP       | 20.5              | 10.9                 | 7.9          | 32.1         | -                   | 7.2                | 43.5              | 36.3           | Floor Noise            |
| Vert.                                    | 180.454            | QP       | 20.4              | 16.2                 | 8.6          | 32.0         | -                   | 13.2               | 43.5              | 30.3           | Floor Noise            |
| Vert.                                    | 254.424            | QP       | 20.1              | 12.1                 | 9.2          | 32.0         | -                   | 9.4                | 46.0              | 36.6           | Floor Noise            |
| Vert.                                    | 465.591            | QP       | 20.1              | 17.0                 | 10.5         | 32.2         | -                   | 15.4               | 46.0              | 30.6           | Floor Noise            |

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

### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 18.7               | 25.6              | 6.9            | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 18.7               | 25.6              | 6.9            | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 105.2             | 19.5                 | -73.8        | 32.2         | 0.0                 | 18.7               | 25.6              | 6.9            | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 36.0              | 19.6                 | -64.0        | 32.2         | 0.0                 | -40.6              | 19.6              | 60.2           |                        |
| 0deg                                     | 0.37500            | PK       | 32.8              | 19.7                 | -64.1        | 32.2         | 0.0                 | -43.8              | 16.1              | 59.9           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D Factor) - Gain(Amplifier) + Duty factor \*

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

### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 105.2             | 19.5                 | 6.2          | 32.2         | -                   | 98.7               | -                 | -              | Fundamental |

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

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

The test result is rounded off, so some differences might be observed.

## Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | October 9, 2024               | November 22, 2024                                      |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 4                            |                               |  |

### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | -                   | 14.0               | 45.6              | 31.6           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | -                   | 14.0               | 45.6              | 31.6           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | -                   | 14.0               | 45.6              | 31.6           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 36.8              | 19.6                 | -64.0        | 32.2         | -                   | -39.8              | 39.6              | 79.4           |                        |
| 0deg                                     | 0.37500            | PK       | 34.7              | 19.7                 | -64.1        | 32.2         | -                   | -41.9              | 36.1              | 78.0           |                        |
| 0deg                                     | 0.50000            | QP       | 22.8              | 19.7                 | -24.1        | 32.2         | -                   | -13.8              | 33.6              | 47.4           |                        |
| 0deg                                     | 0.62500            | QP       | 22.3              | 19.7                 | -24.1        | 32.2         | -                   | -14.3              | 31.7              | 46.0           |                        |
| 0deg                                     | 0.75000            | QP       | 22.9              | 19.7                 | -24.1        | 32.2         | -                   | -13.7              | 30.1              | 43.8           |                        |
| 0deg                                     | 0.87500            | QP       | 23.0              | 19.7                 | -24.0        | 32.2         | -                   | -13.5              | 28.7              | 42.2           |                        |
| 0deg                                     | 1.00000            | QP       | 21.7              | 19.7                 | -24.0        | 32.2         | -                   | -14.8              | 27.6              | 42.4           |                        |
| 0deg                                     | 1.12500            | QP       | 21.6              | 19.7                 | -24.0        | 32.2         | -                   | -14.9              | 26.5              | 41.4           |                        |
| 0deg                                     | 1.25000            | QP       | 21.5              | 19.7                 | -24.0        | 32.2         | -                   | -15.0              | 25.6              | 40.6           |                        |
| Hori.                                    | 52.781             | QP       | 20.4              | 10.2                 | 7.3          | 32.1         | -                   | 5.8                | 40.0              | 34.2           | Floor Noise            |
| Hori.                                    | 63.262             | QP       | 23.9              | 7.1                  | 7.5          | 32.1         | -                   | 6.4                | 40.0              | 33.6           |                        |
| Hori.                                    | 106.842            | QP       | 20.1              | 11.3                 | 7.9          | 32.1         | -                   | 7.2                | 43.5              | 36.3           | Floor Noise            |
| Hori.                                    | 181.641            | QP       | 20.5              | 16.2                 | 8.6          | 32.0         | -                   | 13.3               | 43.5              | 30.2           | Floor Noise            |
| Hori.                                    | 254.401            | QP       | 20.3              | 12.1                 | 9.2          | 32.0         | -                   | 9.6                | 46.0              | 36.4           | Floor Noise            |
| Hori.                                    | 463.999            | QP       | 20.4              | 16.9                 | 10.5         | 32.2         | -                   | 15.6               | 46.0              | 30.4           | Floor Noise            |
| Vert.                                    | 52.781             | QP       | 20.4              | 10.2                 | 7.3          | 32.1         | -                   | 5.8                | 40.0              | 34.2           | Floor Noise            |
| Vert.                                    | 63.262             | QP       | 25.1              | 7.1                  | 7.5          | 32.1         | -                   | 7.6                | 40.0              | 32.4           |                        |
| Vert.                                    | 106.842            | QP       | 20.4              | 11.3                 | 7.9          | 32.1         | -                   | 7.5                | 43.5              | 36.0           | Floor Noise            |
| Vert.                                    | 181.641            | QP       | 20.3              | 16.2                 | 8.6          | 32.0         | -                   | 13.1               | 43.5              | 30.4           | Floor Noise            |
| Vert.                                    | 254.401            | QP       | 20.2              | 12.1                 | 9.2          | 32.0         | -                   | 9.5                | 46.0              | 36.5           | Floor Noise            |
| Vert.                                    | 463.999            | QP       | 20.1              | 16.9                 | 10.5         | 32.2         | -                   | 15.3               | 46.0              | 30.7           | Floor Noise            |

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

### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | 0.0                 | 14.0               | 25.6              | 11.6           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | 0.0                 | 14.0               | 25.6              | 11.6           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 100.5             | 19.5                 | -73.8        | 32.2         | 0.0                 | 14.0               | 25.6              | 11.6           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 36.8              | 19.6                 | -64.0        | 32.2         | 0.0                 | -39.8              | 19.6              | 59.4           |                        |
| 0deg                                     | 0.37500            | PK       | 34.7              | 19.7                 | -64.1        | 32.2         | 0.0                 | -41.9              | 16.1              | 58.0           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D Factor) - Gain(Amplifier) + Duty factor \*

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

### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 100.5             | 19.5                 | 6.2          | 32.2         | -                   | 94.0               | -                 | -              | Fundamental |

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

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

The test result is rounded off, so some differences might be observed.

## Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | No.4                          | No.4   |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 5                            |                               |  |

### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | -                   | 13.1               | 45.6              | 32.5           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | -                   | 13.1               | 45.6              | 32.5           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | -                   | 13.1               | 45.6              | 32.5           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 45.8              | 19.6                 | -64.0        | 32.2         | -                   | -30.8              | 39.6              | 70.4           |                        |
| 0deg                                     | 0.37500            | PK       | 62.1              | 19.7                 | -64.1        | 32.2         | -                   | -14.5              | 36.1              | 50.6           |                        |
| 0deg                                     | 0.50000            | QP       | 39.5              | 19.7                 | -24.1        | 32.2         | -                   | 2.9                | 33.6              | 30.7           |                        |
| 0deg                                     | 0.62500            | QP       | 50.8              | 19.7                 | -24.1        | 32.2         | -                   | 14.2               | 31.7              | 17.5           |                        |
| 0deg                                     | 0.75000            | QP       | 24.9              | 19.7                 | -24.1        | 32.2         | -                   | -11.7              | 30.1              | 41.8           |                        |
| 0deg                                     | 0.87500            | QP       | 43.8              | 19.7                 | -24.0        | 32.2         | -                   | 7.3                | 28.7              | 21.4           |                        |
| 0deg                                     | 1.00000            | QP       | 21.7              | 19.7                 | -24.0        | 32.2         | -                   | -14.8              | 27.6              | 42.4           |                        |
| 0deg                                     | 1.12500            | QP       | 38.2              | 19.7                 | -24.0        | 32.2         | -                   | 1.7                | 26.5              | 24.8           |                        |
| 0deg                                     | 1.25000            | QP       | 21.5              | 19.7                 | -24.0        | 32.2         | -                   | -15.0              | 25.6              | 40.6           |                        |
| Hori.                                    | 45.245             | QP       | 21.4              | 12.9                 | 7.2          | 32.1         | -                   | 9.4                | 40.0              | 30.6           |                        |
| Hori.                                    | 58.248             | QP       | 32.0              | 8.4                  | 7.4          | 32.1         | -                   | 15.7               | 40.0              | 24.3           |                        |
| Hori.                                    | 67.750             | QP       | 35.9              | 6.5                  | 7.5          | 32.1         | -                   | 17.8               | 40.0              | 22.2           |                        |
| Hori.                                    | 76.752             | QP       | 23.2              | 6.6                  | 7.6          | 32.1         | -                   | 5.3                | 40.0              | 34.7           |                        |
| Hori.                                    | 255.200            | QP       | 20.2              | 12.2                 | 9.2          | 32.0         | -                   | 9.6                | 46.0              | 36.4           | Floor Noise            |
| Hori.                                    | 465.601            | QP       | 20.3              | 17.0                 | 10.5         | 32.2         | -                   | 15.6               | 46.0              | 30.4           | Floor Noise            |
| Vert.                                    | 45.245             | QP       | 28.0              | 12.9                 | 7.2          | 32.1         | -                   | 16.0               | 40.0              | 24.0           |                        |
| Vert.                                    | 58.248             | QP       | 27.3              | 8.4                  | 7.4          | 32.1         | -                   | 11.0               | 40.0              | 29.0           |                        |
| Vert.                                    | 67.750             | QP       | 32.9              | 6.5                  | 7.5          | 32.1         | -                   | 14.8               | 40.0              | 25.2           |                        |
| Vert.                                    | 76.752             | QP       | 31.9              | 6.6                  | 7.6          | 32.1         | -                   | 14.0               | 40.0              | 26.0           |                        |
| Vert.                                    | 255.200            | QP       | 20.3              | 12.2                 | 9.2          | 32.0         | -                   | 9.7                | 46.0              | 36.3           | Floor Noise            |
| Vert.                                    | 465.601            | QP       | 20.2              | 17.0                 | 10.5         | 32.2         | -                   | 15.5               | 46.0              | 30.5           | Floor Noise            |

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

### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | 0.0                 | 13.1               | 25.6              | 12.5           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | 0.0                 | 13.1               | 25.6              | 12.5           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 99.6              | 19.5                 | -73.8        | 32.2         | 0.0                 | 13.1               | 25.6              | 12.5           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 45.8              | 19.6                 | -64.0        | 32.2         | 0.0                 | -30.8              | 19.6              | 50.4           |                        |
| 0deg                                     | 0.37500            | PK       | 62.1              | 19.7                 | -64.1        | 32.2         | 0.0                 | -14.5              | 16.1              | 30.6           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D Factor) - Gain(Amplifier) + Duty factor \*

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

### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 99.6              | 19.5                 | 6.2          | 32.2         | -                   | 93.1               | -                 | -              | Fundamental |

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

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

The test result is rounded off, so some differences might be observed.

## Radiated Emission (Fundamental and Spurious Emission)

|                        |                                   |                     |                                   |
|------------------------|-----------------------------------|---------------------|-----------------------------------|
| Test place             | Ise EMC Lab.                      | No.4                | No.4                              |
| Semi Anechoic Chamber  | No.4                              | October 9, 2024     | November 22, 2024                 |
| Date                   | October 7, 2024                   | 21 deg. C / 71 % RH | 20 deg. C / 46 % RH               |
| Temperature / Humidity | 22 deg. C / 52 % RH               | Tomoya Sone         | Shousei Hamaguchi                 |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | (Above 30 MHz)      | (Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 6                            |                     |                                   |

### PK or QP

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -                   | 18.6               | 45.6              | 27.0           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -                   | 18.6               | 45.6              | 27.0           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -                   | 18.6               | 45.6              | 27.0           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 52.2              | 19.6                 | -64.0        | 32.2         | -                   | -24.4              | 39.6              | 64.0           |                        |
| 0deg                                     | 0.37500            | PK       | 73.4              | 19.7                 | -64.1        | 32.2         | -                   | -3.2               | 36.1              | 39.3           |                        |
| 0deg                                     | 0.50000            | QP       | 43.8              | 19.7                 | -24.1        | 32.2         | -                   | 7.2                | 33.6              | 26.4           |                        |
| 0deg                                     | 0.62500            | QP       | 58.5              | 19.7                 | -24.1        | 32.2         | -                   | 21.9               | 31.7              | 9.8            |                        |
| 0deg                                     | 0.75000            | QP       | 25.5              | 19.7                 | -24.1        | 32.2         | -                   | -11.1              | 30.1              | 41.2           |                        |
| 0deg                                     | 0.87500            | QP       | 52.7              | 19.7                 | -24.0        | 32.2         | -                   | 16.2               | 28.7              | 12.5           |                        |
| 0deg                                     | 1.00000            | QP       | 23.6              | 19.7                 | -24.0        | 32.2         | -                   | -12.9              | 27.6              | 40.5           |                        |
| 0deg                                     | 1.12500            | QP       | 47.5              | 19.7                 | -24.0        | 32.2         | -                   | 11.0               | 26.5              | 15.5           |                        |
| 0deg                                     | 1.25000            | QP       | 21.7              | 19.7                 | -24.0        | 32.2         | -                   | -14.8              | 25.6              | 40.4           |                        |
| Hori.                                    | 62.004             | QP       | 30.9              | 7.4                  | 7.5          | 32.1         | -                   | 13.7               | 40.0              | 26.3           |                        |
| Hori.                                    | 71.501             | QP       | 33.9              | 6.4                  | 7.6          | 32.1         | -                   | 15.8               | 40.0              | 24.2           |                        |
| Hori.                                    | 85.377             | QP       | 28.9              | 7.7                  | 7.7          | 32.1         | -                   | 12.2               | 40.0              | 27.8           |                        |
| Hori.                                    | 100.666            | QP       | 21.3              | 10.4                 | 7.9          | 32.1         | -                   | 7.5                | 43.5              | 36.0           |                        |
| Hori.                                    | 258.402            | QP       | 20.3              | 12.3                 | 9.3          | 32.0         | -                   | 9.9                | 46.0              | 36.1           | Floor Noise            |
| Hori.                                    | 471.201            | QP       | 20.4              | 17.1                 | 10.5         | 32.2         | -                   | 15.8               | 46.0              | 30.2           | Floor Noise            |
| Vert.                                    | 62.004             | QP       | 37.4              | 7.4                  | 7.5          | 32.1         | -                   | 20.2               | 40.0              | 19.8           |                        |
| Vert.                                    | 71.501             | QP       | 32.5              | 6.4                  | 7.6          | 32.1         | -                   | 14.4               | 40.0              | 25.6           |                        |
| Vert.                                    | 85.377             | QP       | 29.5              | 7.7                  | 7.7          | 32.1         | -                   | 12.8               | 40.0              | 27.2           |                        |
| Vert.                                    | 100.666            | QP       | 28.0              | 10.4                 | 7.9          | 32.1         | -                   | 14.2               | 43.5              | 29.3           |                        |
| Vert.                                    | 258.402            | QP       | 20.2              | 12.3                 | 9.3          | 32.0         | -                   | 9.8                | 46.0              | 36.2           | Floor Noise            |
| Vert.                                    | 471.201            | QP       | 20.3              | 17.1                 | 10.5         | 32.2         | -                   | 15.7               | 46.0              | 30.3           | Floor Noise            |

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

### PK with Duty factor

| Ant Deg [deg] or<br>Polarity [Hori/Vert] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark                 |
|--|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|------------------------|
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -21.4               | -2.8               | 25.6              | 28.4           | Fundamental(DC 10.2 V) |
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -21.4               | -2.8               | 25.6              | 28.4           | Fundamental(DC 12.0 V) |
| 0deg                                     | 0.12500            | PK       | 105.1             | 19.5                 | -73.8        | 32.2         | -21.4               | -2.8               | 25.6              | 28.4           | Fundamental(DC 13.8 V) |
| 0deg                                     | 0.25000            | PK       | 52.2              | 19.6                 | -64.0        | 32.2         | -21.4               | -45.8              | 19.6              | 65.4           |                        |
| 0deg                                     | 0.37500            | PK       | 73.4              | 19.7                 | -64.1        | 32.2         | -21.4               | -24.6              | 16.1              | 40.7           |                        |

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier) + Duty factor \*

### Result of the fundamental emission at 3 m without Distance factor

| Ant Deg [deg] | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark      |
|---------------|--------------------|----------|-------------------|----------------------|--------------|--------------|---------------------|--------------------|-------------------|----------------|-------------|
| 0deg          | 0.12500            | PK       | 105.1             | 19.5                 | 6.2          | 32.2         | -                   | 98.6               | -                 | -              | Fundamental |

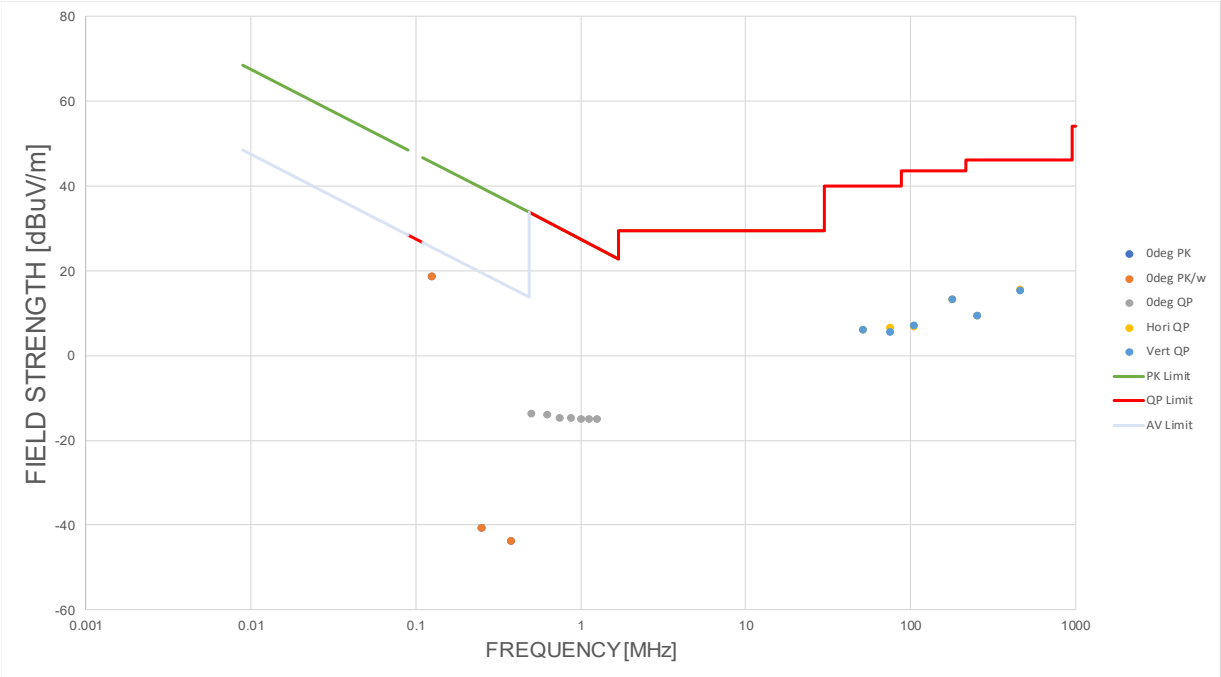
Result = Reading + Ant Factor + Loss (Cable+Attenuator) - Gain(Amplifier)

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

The test result is rounded off, so some differences might be observed.

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

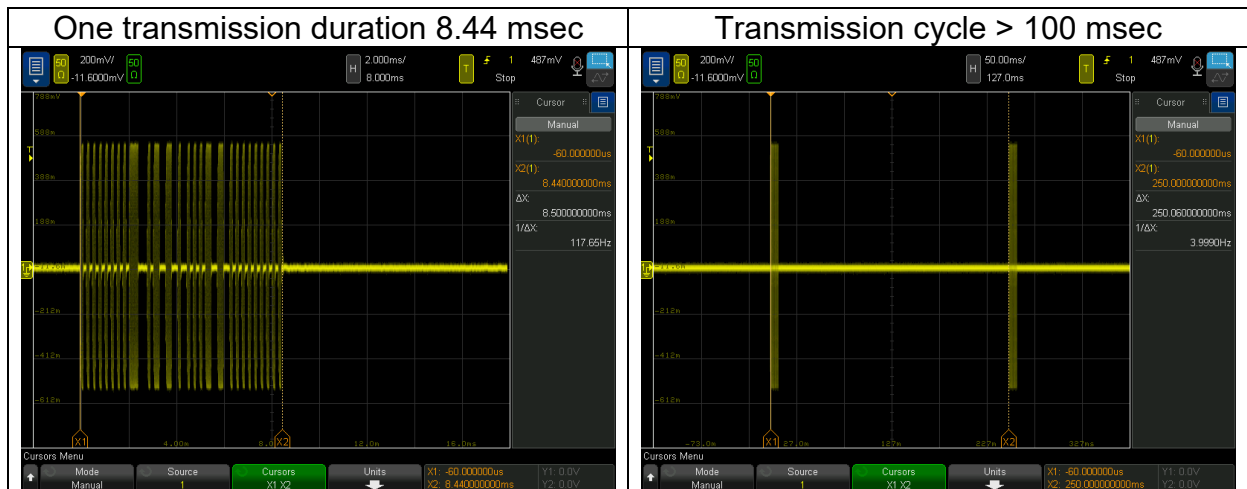
|                        |                                   |                               |  |
|------------------------|-----------------------------------|-------------------------------|--|
| Test place             | Ise EMC Lab.                      | No.4                          | No.4   |
| Semi Anechoic Chamber  | No.4                              | No.4                          | No.4   |
| Date                   | October 7, 2024                   | October 9, 2024               | November 22, 2024                                      |
| Temperature / Humidity | 22 deg. C / 52 % RH               | 21 deg. C / 71 % RH           | 20 deg. C / 46 % RH                                    |
| Engineer               | Tetsuro Yoshida<br>(Below 30 MHz) | Tomoya Sone<br>(Above 30 MHz) | Shousei Hamaguchi<br>(Below 30 MHz),<br>(Above 30 MHz) |
| Mode                   | Mode 3                            |                               |  |



### Duty Cycle

|                        |                     |
|------------------------|---------------------|
| Test place             | Ise EMC Lab.        |
| Semi Anechoic Chamber  | No.4                |
| Date                   | October 8, 2024     |
| Temperature / Humidity | 22 deg. C / 70 % RH |
| Engineer               | Tetsuro Yoshida     |
| Mode                   | Mode 6              |

| ON time<br>[ms] | Cycle<br>[ms] | Duty<br>(On time/Cycle) | Duty factor<br>[dB] |
|-----------------|---------------|-------------------------|---------------------|
| 8.44            | 100           | 0.0844                  | -21.4               |

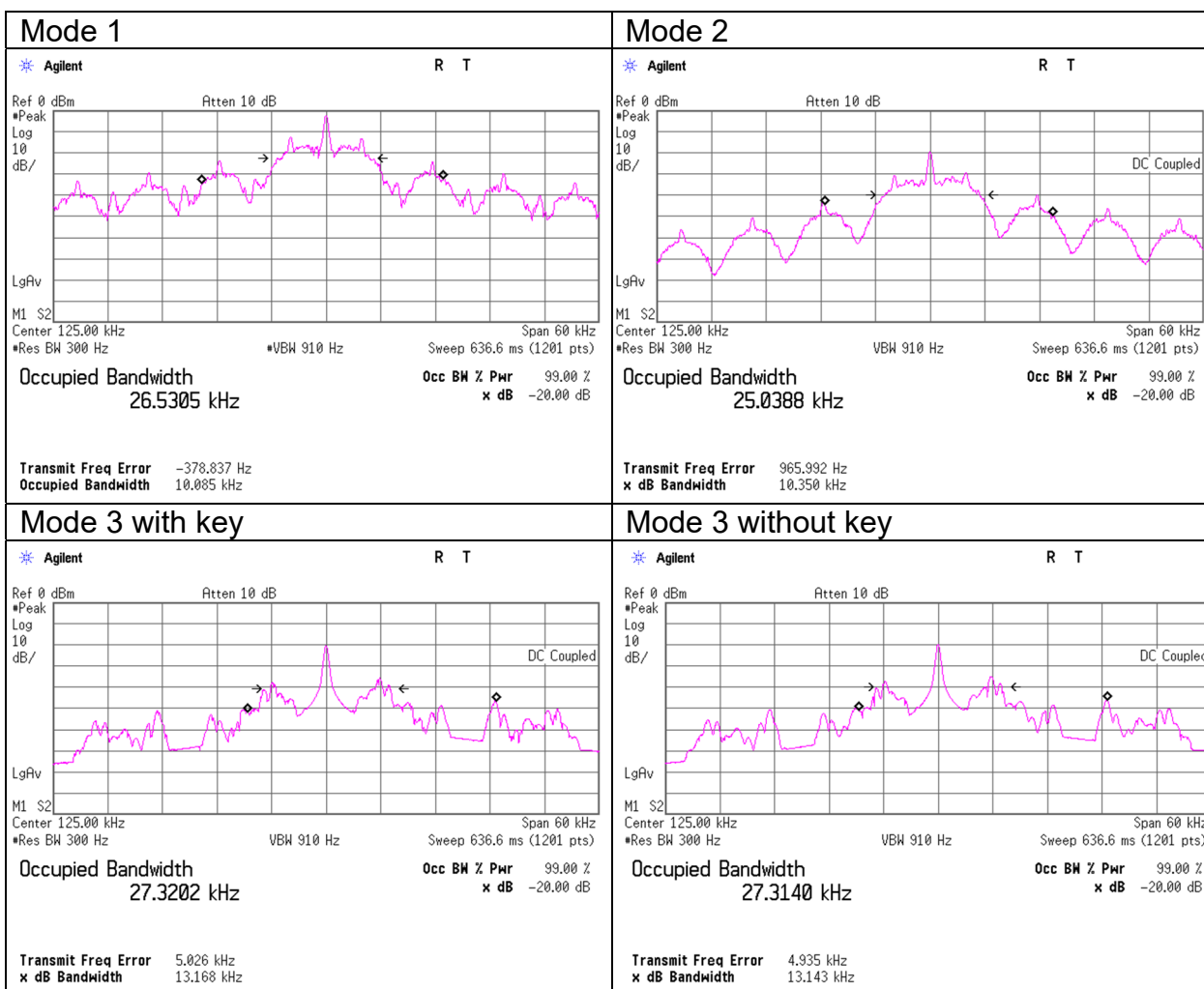
$$\text{Duty} = 20 * \log_{10}(\text{ON time/Cycle})$$


## -20 dB Bandwidth / 99 % emission bandwidth

|                        |                     |                            |                       |
|------------------------|---------------------|----------------------------|-----------------------|
| Test place             | Ise EMC Lab.        | No.4 Semi Anechoic Chamber | No.8 Measurement Room |
| Date                   | October 7, 2024     | October 8, 2024            | October 17, 2024      |
| Temperature / Humidity | 22 deg. C / 52 % RH | 22 deg. C / 70 % RH        | 21 deg. C / 63 % RH   |
| Engineer               | Tetsuro Yoshida     | Tetsuro Yoshida            | Ken Fujita            |

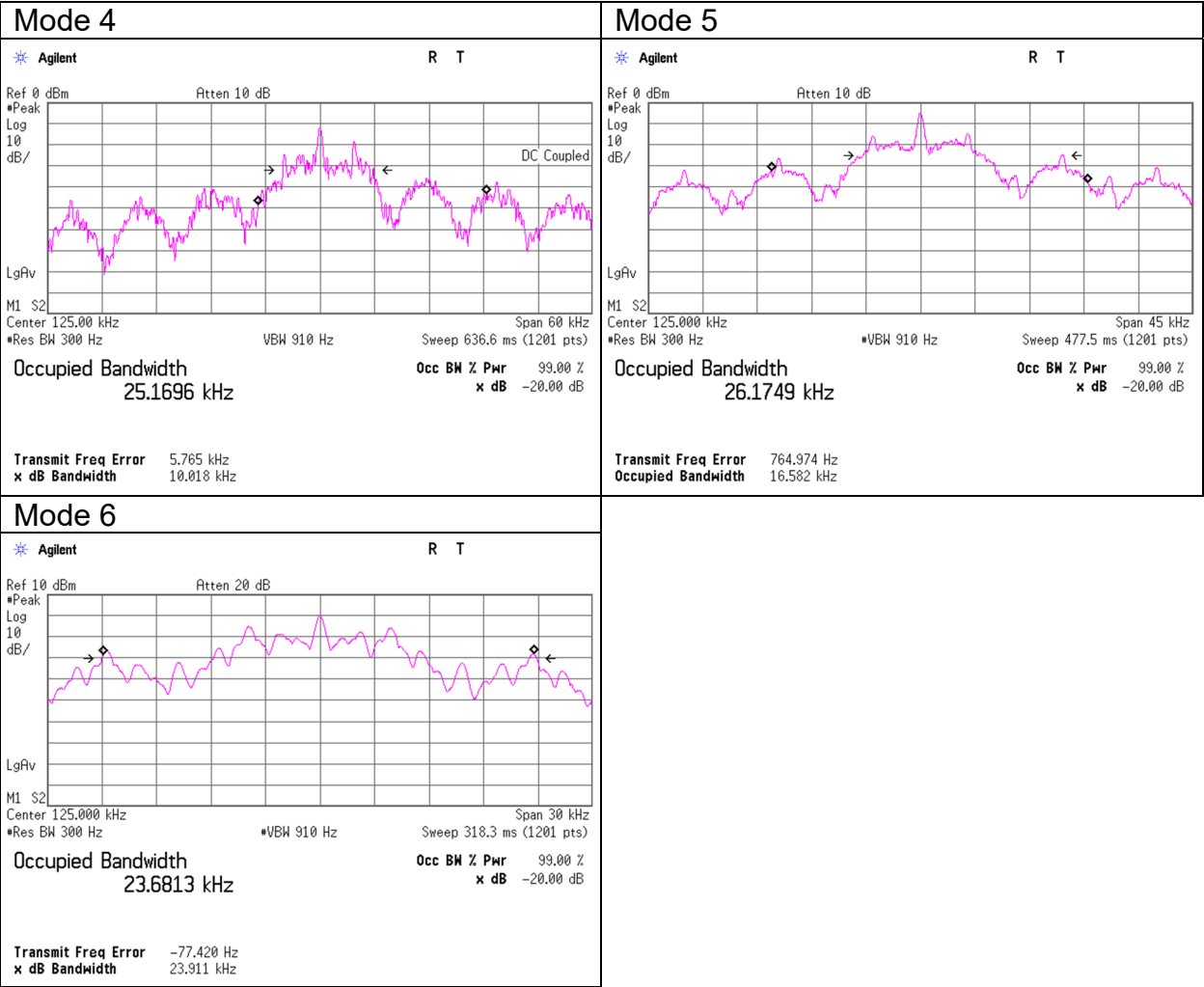
| Mode          | 99 % emission bandwidth [kHz] | -20 dB Bandwidth [kHz] |
|---------------|-------------------------------|------------------------|
| 1             | 26.5305                       | 10.085                 |
| 2             | 25.0388                       | 10.350                 |
| 3 with key    | 27.3202                       | 13.168                 |
| 3 without key | 27.3140                       | 13.143                 |
| 4             | 25.1696                       | 10.018                 |
| 5             | 26.1749                       | 16.582                 |
| 6             | 23.6813                       | 23.911                 |

\*It was confirmed that there were no differences in the bandwidth due to the input voltage.



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

|                        |  |                       |
|------------------------|--|-----------------------|
| Test place             | Ise EMC Lab.<br>No.4 Semi Anechoic Chamber | No.8 Measurement Room |
| Date                   | October 7, 2024                            | October 17, 2024      |
| Temperature / Humidity | 22 deg. C / 52 % RH                        | 21 deg. C / 63 % RH   |
| Engineer               | Tetsuro Yoshida                            | Ken Fujita            |



## APPENDIX 2: Test instruments

### Test Equipment

| Test Item | LIMS ID | Description                       | Manufacturer                    | Model  | Serial       | Last Calibration Date | Cal Int |
|-----------|---------|-----------------------------------|---------------------------------|--|--------------|-----------------------|---------|
| RE        | 141217  | Coaxial cable                     | Fujikura/Suhner/TSJ             | 5D-2W/SFM141/421-010/sucoform141-PE/RFM-E121(SW) | -/04178      | 06/14/2024            | 12      |
| RE        | 141267  | Logperiodic Antenna (200-1000MHz) | Schwarzbeck Mess-Elektronik OHG | VUSLP9111B                                       | 9111B-192    | 09/18/2024            | 12      |
| RE        | 141295  | High Pass Filter 0.15-30MHz       | Rohde & Schwarz                 | EZ-25/3  | 100041       | 02/14/2024            | 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        | 141545  | DIGITAL HiTESTER                  | HIOKI E.E. CORPORATION          | 3805   | 51201148     | 02/01/2024            | 12      |
| RE        | 141583  | Pre Amplifier                     | SONOMA INSTRUMENT               | 310  | 260833       | 04/04/2024            | 12      |
| RE        | 141885  | Spectrum Analyzer                 | Keysight Technologies Inc       | E4448A   | US44300523   | 11/29/2023            | 12      |
| RE        | 141951  | EMI Test Receiver                 | Rohde & Schwarz                 | ESR26  | 101408       | 05/17/2024            | 12      |
| RE        | 142011  | AC4_Semi Anechoic Chamber (NSA)   | TDK                             | Semi Anechoic Chamber 3m                         | DA-10005     | 12/13/2023            | 24      |
| RE        | 142152  | Loop Antenna                      | Rohde & Schwarz                 | HFH2-Z2  | 836553/009   | 10/17/2023<br>*1)     | 12      |
| RE        | 142230  | Measure, Tape, Steel              | KOMELON                         | KMC-36   | -            | -                     | -       |
| RE        | 159670  | Coaxial Cable                     | UL Japan                        | -  | -            | 11/21/2023            | 12      |
| RE        | 178648  | EMI measurement program           | TSJ (Techno Science Japan)      | TEPTO-DV   | -            | -                     | -       |
| RE        | 244710  | Thermo-Hygrometer                 | HIOKI E.E. CORPORATION          | LR5001   | 231202104    | 01/25/2024            | 12      |
| RE        | 146613  | Loop Antenna                      | Rohde & Schwarz                 | HFH2-Z2  | 842906/011   | 09/02/2024            | 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.

The expiration\*1) This test equipment was used for the tests before the expiration date of the calibration.

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

Test item:

RE: Radiated Emission