



# RADIO TEST REPORT

Test Report No.: 14653479M-F

|                     |                               |
|---------------------|-------------------------------|
| Customer            | Fujikura Ltd.                 |
| Description of EUT  | Specialty Fiber Stripper      |
| Model Number of EUT | SS110                         |
| FCC ID              | 2A9PZ-SS110                   |
| Test Regulation     | FCC Part 15 Subpart C         |
| Test Result         | Complied (Refer to SECTION 3) |
| Issue Date          | February 24, 2023             |
| Remarks             | -                             |

Representative test engineer

Hiromitsu Tanabe  
Engineer

Approved by

Kazuhiro Ando  
Engineer



CERTIFICATE 1266.01

- ☐ 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".

Report Cover Page - Form-ULID-003532 (DCS:13-EM-F0429) Issue# 21.0

---

## **ANNOUNCEMENT**

- This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
- The results in this report apply only to the sample tested. (Laboratory was not involved in sampling.)
- This sample tested is in compliance with the limits of the above regulation.
- The test results in this test report are traceable to the national or international standards.
- This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
- This test report covers Radio technical requirements.  
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
- All test items in this test report are conducted by UL Japan, Inc. Kashima EMC Lab.
- The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
- The information provided from the customer for this report is identified in Section 1.
- For test report(s) referred in this report, the latest version (including any revisions) is always referred.

## **REVISION HISTORY**

**Original Test Report No.: 14653479M-F**

| Revision        | Test Report No. | Date              | Page Revised Contents |
|-----------------|-----------------|-------------------|-----------------------|
| -<br>(Original) | 14653479M-F     | February 24, 2023 | -                     |

## 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                                        |

---

| <b>CONTENTS</b>                                                                             | <b>PAGE</b> |
|---------------------------------------------------------------------------------------------|-------------|
| <b>SECTION 1: Customer Information .....</b>                                                | <b>5</b>    |
| <b>SECTION 2: Equipment Under Test (EUT).....</b>                                           | <b>5</b>    |
| <b>SECTION 3: Test specification, procedures &amp; results .....</b>                        | <b>6</b>    |
| <b>SECTION 4: Operation of EUT during testing.....</b>                                      | <b>9</b>    |
| <b>SECTION 5: Conducted Emission.....</b>                                                   | <b>12</b>   |
| <b>SECTION 6: Radiated emission (Fundamental, Spurious Emission and Spectrum Mask).....</b> | <b>13</b>   |
| <b>SECTION 7: Other test.....</b>                                                           | <b>15</b>   |
| <b>APPENDIX 1: Test data .....</b>                                                          | <b>16</b>   |
| Conducted Emission .....                                                                    | 16          |
| Fundamental emission and Spectrum Mask.....                                                 | 18          |
| Spurious emission .....                                                                     | 20          |
| 20 dB Bandwidth and 99% Occupied Bandwidth.....                                             | 24          |
| Frequency Tolerance.....                                                                    | 25          |
| <b>APPENDIX 2: Test instruments .....</b>                                                   | <b>26</b>   |
| <b>APPENDIX 3: Photographs of test setup .....</b>                                          | <b>27</b>   |
| Conducted Emission .....                                                                    | 27          |
| Radiated Emission .....                                                                     | 28          |
| Frequency Tolerance.....                                                                    | 31          |

## **SECTION 1: Customer Information**

|                  |                                                   |
|------------------|---------------------------------------------------|
| Company Name     | Fujikura Ltd.                                     |
| Address          | 1440 Mutsuzaki, Sakura-shi, Chiba, 285-8550 Japan |
| Telephone Number | +81-43-484-3961                                   |
| Contact Person   | Masayuki Takahashi                                |

The information provided from the customer is as follows;

- Customer, Description of EUT, Model Number of EUT
  - 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
- \* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

### **2.1 Identification of EUT**

|               |                                                                                            |
|---------------|--------------------------------------------------------------------------------------------|
| Description   | Specialty Fiber Stripper                                                                   |
| Model Number  | SS110                                                                                      |
| 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  | January 23, 2023                                                                           |
| Test Date     | January 24 to February 1, 2023                                                             |

### **2.2 Product Description**

#### **General Specification**

|                       |                                      |
|-----------------------|--------------------------------------|
| Rating                | AC 100 V to 240 V, 1.5 A, 50 / 60 Hz |
| Operating Temperature | 0 deg. C to 40 deg. C                |

#### **Radio Specification**

|                        |             |
|------------------------|-------------|
| Equipment Type         | Transceiver |
| Frequency of Operation | 13.56 MHz   |
| Type of Modulation     | ASK         |

## 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 15.225 Operation within the band 13.110-14.010 MHz. |

\* The customer has declared that the EUT complies with FCC Part 15 Subpart B as SDoC.

### 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                                       | 7.5 dB<br>13.56000 MHz,<br>AV, N                        | Complied<br>a) | -        |
| Electric Field Strength<br>of Fundamental Emission | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.4, 6.12  | <FCC><br>Section 15.225(a)<br><ISED><br>RSS-210 B.6                                    | 82.2 dB,<br>13.56000 MHz,<br>QP, 0 deg.                 | Complied<br>b) | Radiated |
| Spectrum Mask                                      | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.4, 6.13  | <FCC><br>Section 15.225(b)(c)<br><ISED><br>RSS-210 B.6                                 | 44.5 dB,<br>13.11000 MHz,<br>14.01000 MHz<br>QP, 0 deg. | Complied<br>b) | Radiated |
| 20 dB Bandwidth                                    | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED> -                     | <FCC><br>Section15.215(c)<br><ISED> -                                                  | See data                                                | Complied<br>c) | Radiated |
| Electric Field Strength<br>of Spurious Emission    | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.4, 6.13  | <FCC><br>Section 15.209,<br>Section 15.225 (d)<br><ISED><br>RSS-210 B.6<br>RSS-Gen 8.9 | 11.0 dB<br>60.625 MHz,<br>Vertical, QP                  | Complied<br>d) | Radiated |
| Frequency Tolerance                                | <FCC><br>ANSI C63.10:2013<br>6 Standard test methods<br><ISED><br>RSS-Gen 6.11, 8.11 | <FCC><br>Section 15.225(e)<br><ISED><br>RSS-210 B.6                                    | See data                                                | Complied<br>e) | Radiated |

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

- a) Refer to APPENDIX 1 (data of Conducted Emission)
- b) Refer to APPENDIX 1 (data of Fundamental emission and Spectrum Mask)
- c) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99% Occupied Bandwidth)
- d) Refer to APPENDIX 1 (data of Spurious emission)
- e) Refer to APPENDIX 1 (data of Frequency Tolerance)

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

The worst case stable voltage was provided to the EUT during all tests.

And maximum and minimum voltage were provided to the EUT during the output power measurement test.

Therefore, this EUT complies with the requirement.

However, the supply voltage was varied and tested at 85 % and 115 % of the nominal rated supply voltage during frequency tolerance test according to Section 15.225(e).

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

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

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

### 3.3 Addition to standard

| Item                                                                                                                                                                                        | Test Procedure    | Specification | Worst margin | Results | Remarks  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|--------------|---------|----------|
| 99% emission bandwidth                                                                                                                                                                      | <ISED>RSS-Gen 6.7 | -             | N/A          | -<br>a) | Radiated |
| Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.<br>a) Refer to APPENDIX 1 (data of 20 dB Bandwidth and 99% Occupied Bandwidth) |                   |               |              |         |          |

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  $k = 2$ .

#### Conducted emission

| Frequency range    | Calculate Uncertainty<br>(+/-) |
|--------------------|--------------------------------|
| 0.15 MHz to 30 MHz | 3.2 dB                         |

#### Radiated emission

| Measurement distance | Frequency range     | Calculate Uncertainty<br>(+/-) |
|----------------------|---------------------|--------------------------------|
| 3 m                  | 9 kHz to 30 MHz     | 2.9 dB                         |
|                      | 30 MHz to 200 MHz   | 6.2 dB                         |
|                      | 200 MHz to 1000 MHz | 6.3 dB                         |
|                      | 1 GHz to 6 GHz      | 5.0 dB                         |
|                      | 6 GHz to 18 GHz     | 5.4 dB                         |
|                      | 18 GHz to 40 GHz    | 5.5 dB                         |
| 1 m                  | 1 GHz to 18 GHz     | 5.4 dB                         |
|                      | 18 GHz to 40 GHz    | 5.6 dB                         |
| 0.5m                 | 26.5 GHz to 40 GHz  | 5.9 dB                         |

#### Antenna Terminal test

| Test Item                                 | Calculate Uncertainty<br>(+/-) |
|-------------------------------------------|--------------------------------|
| Frequency Tolerance                       | $7.9 \times 10^{-8}$           |
| 20 dB Bandwidth / 99 % Occupied Bandwidth | 1.6 %                          |

### 3.5 Test Location

UL Japan, Inc. Kashima EMC Lab.  
1614 Mushihata, Katori-shi, Chiba-ken, 289-0341 JAPAN  
Telephone: +81 478 88 6500, Facsimile: +81 478 82 3373  
A2LA Certificate Number: 1266.01 / FCC Test Firm Registration Number: 910230  
ISED Lab Company Number: 4659A / CAB identifier: JP0006

| Test site                   | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Maximum measurement distance |
|-----------------------------|----------------------------|------------------------------------------------------------------|------------------------------|
| No.1 Open site              | 6.0 x 5.5 x 2.5            | 20 x 40                                                          | 10 m                         |
| No.5 Open site              | 8.6 x 7.1 x 2.4            | 18 x 23                                                          | 10 m                         |
| No.1 Shielded room          | 5.4 x 4.5 x 2.3            | -                                                                | -                            |
| No.5 Shielded Room          | 4.2 x 3.1 x 2.5            | -                                                                | -                            |
| No.9 Shielded Room          | 6.1 x 3.6 x 2.8            | -                                                                | -                            |
| No.6 Semi-anechoic Chamber  | 8.5 x 5.5 x 5.2            | -                                                                | 3 m                          |
| No.10 Semi-anechoic Chamber | 18.4 x 9.9 x 7.7           | -                                                                | 10 m                         |
| No.11 Semi-anechoic Chamber | 9.0 x 6.5 x 5.2            | -                                                                | 3 m                          |
| No.1 Measurement room       | 5.0 x 3.7 x 2.6            | -                                                                | -                            |
| No.2 Measurement room       | 4.3 x 4.4 x 2.7            | -                                                                | -                            |
| No.3 Measurement room       | 4.5 x 5.3 x 2.7            | -                                                                | -                            |

### 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)**

The mode is used:

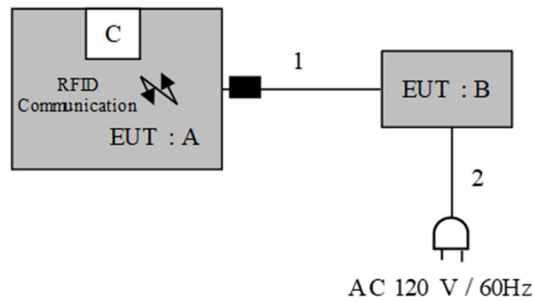
| Test mode                                                                                                                                                                                                                                                                                                                                                                                               | Remarks                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Transmitting and Receiving mode<br>- with tag<br>- without tag                                                                                                                                                                                                                                                                                                                                          | The EUT transmits and receives at the same time |
| The EUT was operated in a manner similar to typical use during the tests.                                                                                                                                                                                                                                                                                                                               |                                                 |
| *Power of the EUT was set by the software as follows;<br>Power Setting: Fixed<br>Software: EMC Test ver.SS110_0100RE0<br>(Date: January 16, 2023, Storage location: EUT memory)<br>*This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. |                                                 |
| Justification: The system was configured in typical fashion (as a user would normally use it) for testing.                                                                                                                                                                                                                                                                                              |                                                 |

| Test Item                                       | Operating mode                                          |
|-------------------------------------------------|---------------------------------------------------------|
| Conducted Emission                              | Transmitting and Receiving mode, with tag / without tag |
| Electric Field Strength of Fundamental Emission | Transmitting and Receiving mode, with tag / without tag |
| Spectrum Mask                                   | Transmitting and Receiving mode, with tag / without tag |
| 20 dB Bandwidth and 99 % Occupied Bandwidth     | Transmitting and Receiving mode, with tag / without tag |
| Electric Field Strength of Spurious Emission    | Transmitting and Receiving mode, with tag / without tag |
| Frequency Tolerance                             | Transmitting (Mod off), without tag                     |

| Frequency Tolerance: |                                                                                                                   |
|----------------------|-------------------------------------------------------------------------------------------------------------------|
| Temperature          | -20 deg. C to +50 deg. C Step 10 deg. C                                                                           |
| Voltage              | Normal Voltage AC 120 V<br>Maximum Voltage AC 138 V (AC 120 V +15 %)<br>Minimum Voltage AC 102 V (AC 120 V -15 %) |

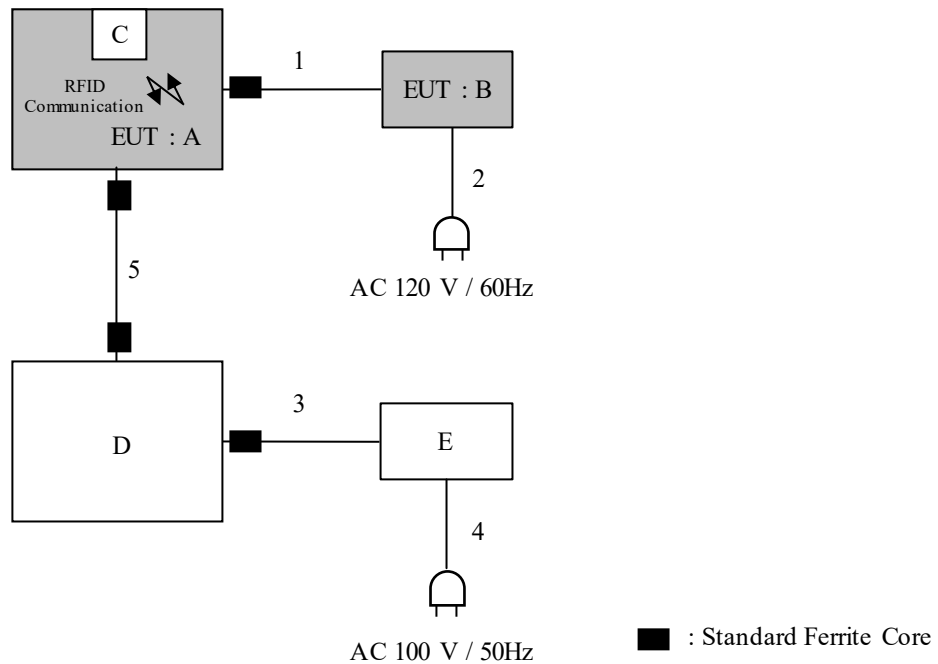
## 4.2 Configuration and peripherals

-Conducted Emission, Radiated Emission-



■ : Standard Ferrite Core

- Frequency Tolerance -



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

\*As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

#### Description of EUT and Support equipment

| No. | Item                     | Model number    | Serial number   | Manufacturer                       | Remarks |
|-----|--------------------------|-----------------|-----------------|------------------------------------|---------|
| A   | Specialty Fiber Stripper | SS110           | 500             | Fujikura Ltd.                      | EUT     |
| B   | AC Adapter               | ADC-21          | H27R1A509(A1)   | SHENZHEN HONOR ELECTRONIC CO., LTD | EUT     |
| C   | Tag (ISO 15693)          | RF37S114HTFJB   | -               | TI                                 | -       |
| D   | Laptop PC                | PR73YAJADMCQD81 | 4H026340H       | TOSHIBA                            | -       |
| E   | AC Adapter               | PA5035U-1ACA    | T14230002226A03 | TOSHIBA                            | -       |

#### List of cables used

| No. | Name      | Length (m) | Shield     |            | Remarks |
|-----|-----------|------------|------------|------------|---------|
|     |           |            | Cable      | Connector  |         |
| 1   | DC Cable  | 1.5        | Unshielded | Unshielded | -       |
| 2   | AC Cable  | 2.0        | Unshielded | Unshielded | 2wire   |
| 3   | DC Cable  | 1.8        | Unshielded | Unshielded | -       |
| 4   | AC Cable  | 1.9        | Unshielded | Unshielded | 2wire   |
| 5   | USB Cable | 1.0        | Shielded   | Shielded   | -       |

---

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

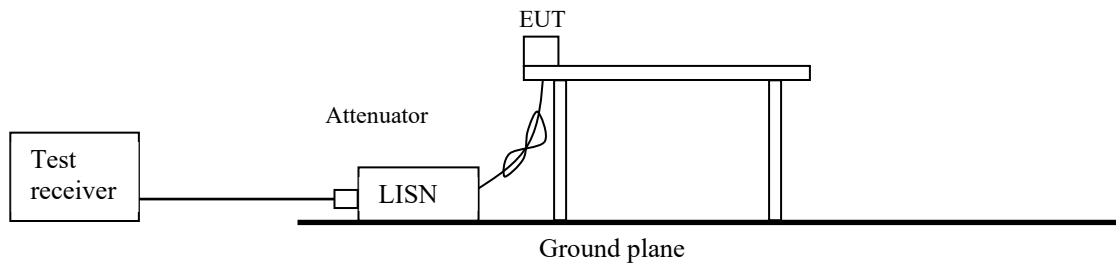
Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

**Figure 1: Test Setup**



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

|                          |                            |
|--------------------------|----------------------------|
| <b>Detector</b>          | <b>: QP and CISPR AV</b>   |
| <b>Measurement range</b> | <b>: 0.15 MHz - 30 MHz</b> |
| <b>Test data</b>         | <b>: APPENDIX</b>          |
| <b>Test result</b>       | <b>: Pass</b>              |

## **SECTION 6: Radiated emission (Fundamental, Spurious Emission and Spectrum Mask)**

### **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.) and horizontal polarization.

\*Refer to Figure 3 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 1000 MHz |
| Antenna Type | Loop         | Hybrid             |

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 2: Test Setup

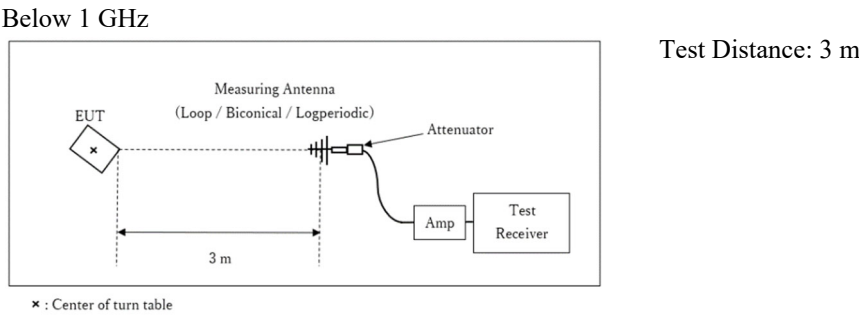
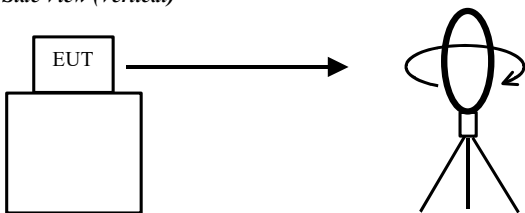
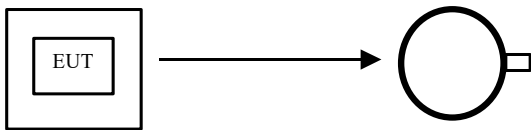


Figure 3: Direction of the Loop Antenna

Side View (Vertical)

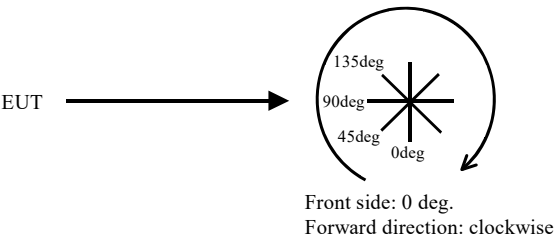


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



The test was made on EUT at the normal use position.

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 7: Other test

| Test                                                                                                                                                                                                                                                                                                                                        | Span                                    | RBW             | VBW                | Sweep | Detector | Trace        | Instrument used   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------|--------------------|-------|----------|--------------|-------------------|
| 20 dB Bandwidth                                                                                                                                                                                                                                                                                                                             | 1.5 MHz                                 | 15 kHz          | 47 kHz             | Auto  | Peak     | Max Hold     | Spectrum Analyzer |
| 99 % Occupied Bandwidth                                                                                                                                                                                                                                                                                                                     | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto  | Peak *1) | Max Hold *1) | Spectrum Analyzer |
| Frequency Tolerance *2)                                                                                                                                                                                                                                                                                                                     | -                                       | -               | -                  | -     | -        | -            | Frequency counter |
| *1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %.<br>Peak hold was applied as Worst-case measurement.<br>*2) The temperature test was started after the temperature stabilization time of 30 minutes.<br>The test was begun from 50 deg. C and the temperature was lowered each 10 deg. C. |                                         |                 |                    |       |          |              |                   |

Test data : APPENDIX  
Test result : Pass

## APPENDIX 1: Test data

### Conducted Emission

#### DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber

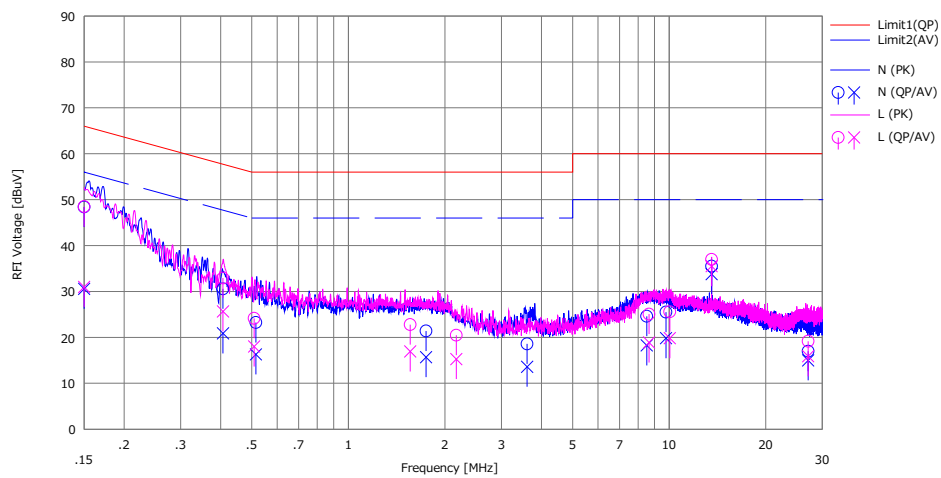
Date : 2023/01/27

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 18deg.C / 39%RH

Remarks : with Tag

Limit : FCC\_Part 15 Subpart C(15.207)

Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading |        | C.Fac | Results |        | Limit  |        | Margin |      | Phase | Comment |
|-----|----------------|---------|--------|-------|---------|--------|--------|--------|--------|------|-------|---------|
|     |                | (QP)    | (AV)   |       | (QP)    | (AV)   | (QP)   | (AV)   | (QP)   | (AV) |       |         |
|     |                | [dBuV]  | [dBuV] |       | [dBuV]  | [dBuV] | [dBuV] | [dBuV] | [dB]   | [dB] |       |         |
| 1   | 0.15000        | 38.20   | 20.37  | 10.19 | 48.39   | 30.56  | 66.00  | 56.00  | 17.6   | 25.4 | N     |         |
| 2   | 0.40675        | 20.34   | 10.62  | 10.24 | 30.58   | 20.86  | 57.71  | 47.71  | 27.1   | 26.8 | N     |         |
| 3   | 0.51503        | 12.98   | 6.04   | 10.26 | 23.24   | 16.30  | 56.00  | 46.00  | 32.7   | 29.7 | N     |         |
| 4   | 1.74607        | 10.97   | 5.27   | 10.41 | 21.38   | 15.68  | 56.00  | 46.00  | 34.6   | 30.3 | N     |         |
| 5   | 3.60806        | 7.98    | 3.00   | 10.60 | 18.58   | 13.60  | 56.00  | 46.00  | 37.4   | 32.4 | N     |         |
| 6   | 8.51356        | 13.63   | 7.29   | 10.97 | 24.60   | 18.26  | 60.00  | 50.00  | 35.4   | 31.7 | N     |         |
| 7   | 9.77615        | 14.44   | 8.76   | 11.05 | 25.49   | 19.81  | 60.00  | 50.00  | 34.5   | 30.1 | N     |         |
| 8   | 13.56000       | 24.21   | 22.50  | 11.30 | 35.51   | 33.80  | 60.00  | 50.00  | 24.4   | 16.2 | N     |         |
| 9   | 27.12000       | 5.00    | 3.00   | 11.99 | 16.99   | 14.99  | 60.00  | 50.00  | 43.0   | 35.0 | N     |         |
| 10  | 0.15000        | 38.28   | 20.79  | 10.20 | 48.48   | 30.99  | 66.00  | 56.00  | 17.5   | 25.0 | L     |         |
| 11  | 0.40664        | 22.66   | 15.39  | 10.25 | 32.91   | 25.64  | 57.72  | 47.72  | 24.8   | 22.0 | L     |         |
| 12  | 0.50838        | 13.87   | 7.75   | 10.27 | 24.14   | 18.02  | 56.00  | 46.00  | 31.8   | 27.9 | L     |         |
| 13  | 1.55854        | 12.37   | 6.52   | 10.41 | 22.78   | 16.93  | 56.00  | 46.00  | 33.2   | 29.0 | L     |         |
| 14  | 2.17026        | 10.00   | 4.79   | 10.48 | 20.48   | 15.27  | 56.00  | 46.00  | 35.5   | 30.7 | L     |         |
| 15  | 8.65075        | 14.00   | 7.81   | 11.07 | 25.07   | 18.88  | 60.00  | 50.00  | 34.9   | 31.1 | L     |         |
| 16  | 10.04439       | 14.41   | 8.65   | 11.17 | 25.58   | 19.82  | 60.00  | 50.00  | 34.4   | 30.1 | L     |         |
| 17  | 13.56000       | 25.49   | 24.00  | 11.51 | 37.00   | 35.51  | 60.00  | 50.00  | 23.0   | 14.4 | L     |         |
| 18  | 27.12000       | 6.80    | 3.50   | 12.37 | 19.17   | 15.87  | 60.00  | 50.00  | 40.8   | 34.1 | L     |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]  
LISN: CLS-02

## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

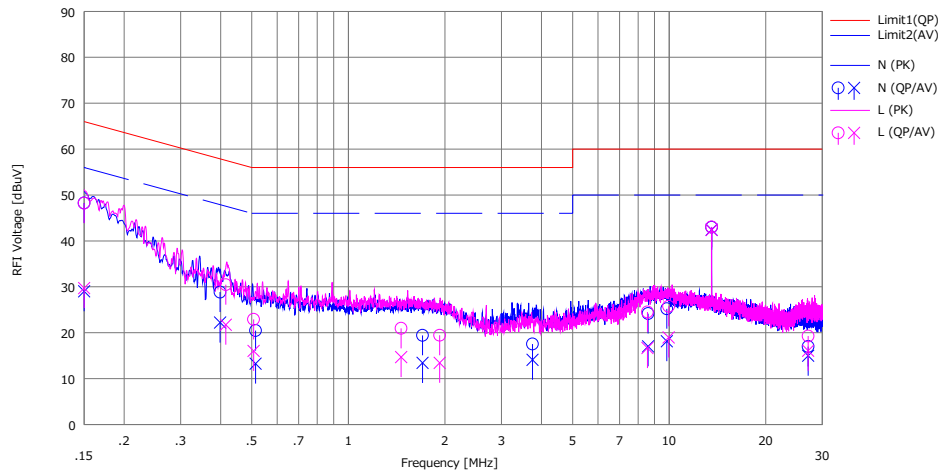
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber  
Date : 2023/01/27

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 18deg.C / 39%RH

Remarks : without Tag

Limit : FCC\_Part 15 Subpart C(15.207)

Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading |        | C.Fac | Results |        | Limit  |        | Margin |      | Phase | Comment |
|-----|----------------|---------|--------|-------|---------|--------|--------|--------|--------|------|-------|---------|
|     |                | <QP>    | <AV>   |       | <QP>    | <AV>   | <QP>   | <AV>   | <QP>   | <AV> |       |         |
|     |                | [dBuV]  | [dBuV] |       | [dBuV]  | [dBuV] | [dBuV] | [dBuV] | [dB]   | [dB] |       |         |
| 1   | 0.15000        | 38.07   | 18.83  | 10.19 | 48.26   | 29.02  | 66.00  | 56.00  | 17.7   | 26.9 | N     |         |
| 2   | 0.39819        | 18.60   | 11.98  | 10.24 | 28.84   | 22.22  | 57.89  | 47.89  | 29.0   | 25.6 | N     |         |
| 3   | 0.51375        | 10.20   | 3.00   | 10.26 | 20.46   | 13.26  | 56.00  | 46.00  | 35.5   | 32.7 | N     |         |
| 4   | 1.70275        | 9.02    | 3.00   | 10.41 | 19.43   | 13.41  | 56.00  | 46.00  | 36.5   | 32.5 | N     |         |
| 5   | 3.74976        | 6.93    | 3.50   | 10.60 | 17.53   | 14.10  | 56.00  | 46.00  | 38.4   | 31.9 | N     |         |
| 6   | 8.59525        | 13.20   | 6.07   | 10.97 | 24.17   | 17.04  | 60.00  | 50.00  | 35.8   | 32.9 | N     |         |
| 7   | 9.83064        | 14.17   | 7.10   | 11.05 | 25.22   | 18.15  | 60.00  | 50.00  | 34.7   | 31.8 | N     |         |
| 8   | 13.56000       | 31.67   | 31.15  | 11.30 | 42.97   | 42.45  | 60.00  | 50.00  | 17.0   | 7.5  | N     |         |
| 9   | 27.12000       | 5.00    | 3.00   | 11.99 | 16.99   | 14.99  | 60.00  | 50.00  | 43.0   | 35.0 | N     |         |
| 10  | 0.15000        | 38.03   | 19.51  | 10.20 | 48.23   | 29.71  | 66.00  | 56.00  | 17.7   | 26.2 | L     |         |
| 11  | 0.41478        | 20.22   | 11.48  | 10.25 | 30.47   | 21.73  | 57.55  | 47.55  | 27.0   | 25.8 | L     |         |
| 12  | 0.50650        | 12.64   | 5.76   | 10.27 | 22.91   | 16.03  | 56.00  | 46.00  | 33.0   | 29.9 | L     |         |
| 13  | 1.46038        | 10.55   | 4.31   | 10.40 | 20.95   | 14.71  | 56.00  | 46.00  | 35.0   | 31.2 | L     |         |
| 14  | 1.92546        | 9.00    | 3.00   | 10.45 | 19.45   | 13.45  | 56.00  | 46.00  | 36.5   | 32.5 | L     |         |
| 15  | 8.55203        | 13.46   | 5.62   | 11.05 | 24.51   | 16.67  | 60.00  | 50.00  | 35.4   | 33.3 | L     |         |
| 16  | 9.96528        | 14.60   | 7.80   | 11.17 | 25.77   | 18.97  | 60.00  | 50.00  | 34.2   | 31.0 | L     |         |
| 17  | 13.56000       | 31.53   | 30.88  | 11.51 | 43.04   | 42.39  | 60.00  | 50.00  | 16.9   | 7.6  | L     |         |
| 18  | 27.12000       | 6.90    | 3.70   | 12.37 | 19.27   | 16.07  | 60.00  | 50.00  | 40.7   | 33.9 | L     |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN+Cable+ATT)[dB]  
LISN: CLS-02

## Fundamental emission and Spectrum Mask

### DATA OF RADIATED EMISSION(below 30MHz) TEST

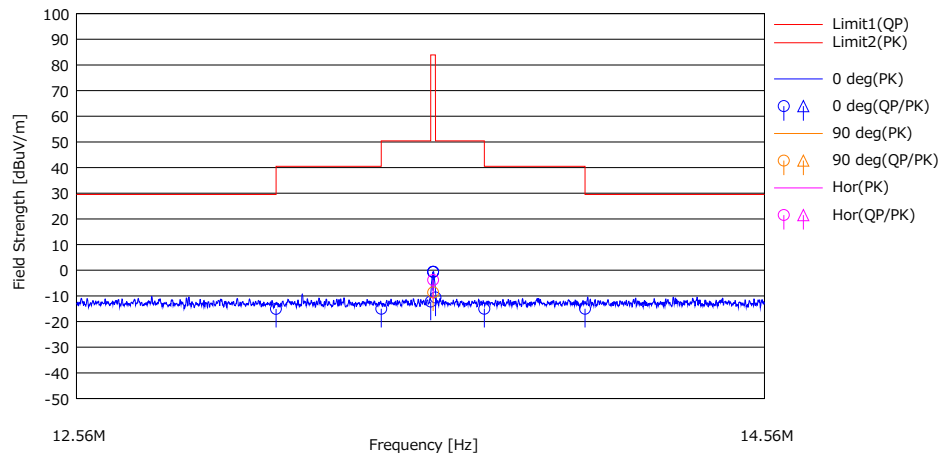
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber

Date : 2023/01/24

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : with Tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)  
Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading |        | Ant.Fac<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result   |          | Limit    |          | Margin |      | Antenna<br>[deg] | Table<br>[deg] | Comment |
|-----|----------------|---------|--------|-------------------|--------------|--------------|----------|----------|----------|----------|--------|------|------------------|----------------|---------|
|     |                | [dBuV]  | [dBuV] |                   |              |              | [dBuV/m] | [dBuV/m] | [dBuV/m] | [dBuV/m] | [dB]   | [dB] |                  |                |         |
| 1   | 13.11000       | 22.90   | ---    | 19.28             | -33.04       | 24.21        | -15.07   | ---      | 29.50    | ---      | 44.5   | ---  | 0 deg            | 118            |         |
| 2   | 13.41000       | 22.90   | ---    | 19.29             | -33.02       | 24.22        | -15.05   | ---      | 40.50    | ---      | 55.5   | ---  | 0 deg            | 118            |         |
| 3   | 13.55300       | 25.70   | ---    | 19.29             | -33.01       | 24.23        | -12.25   | ---      | 50.40    | ---      | 62.6   | ---  | 0 deg            | 118            |         |
| 4   | 13.56000       | 37.30   | ---    | 19.29             | -33.01       | 24.23        | -0.65    | ---      | 83.90    | ---      | 84.5   | ---  | 0 deg            | 118            | AC 102V |
| 5   | 13.56000       | 37.30   | ---    | 19.29             | -33.01       | 24.23        | -0.65    | ---      | 83.90    | ---      | 84.5   | ---  | 0 deg            | 118            | AC 120V |
| 6   | 13.56000       | 37.30   | ---    | 19.29             | -33.01       | 24.23        | -0.65    | ---      | 83.90    | ---      | 84.5   | ---  | 0 deg            | 118            | AC 138V |
| 7   | 13.56700       | 27.30   | ---    | 19.29             | -33.01       | 24.23        | -10.65   | ---      | 50.40    | ---      | 61.0   | ---  | 0 deg            | 118            |         |
| 8   | 13.71000       | 22.90   | ---    | 19.30             | -33.01       | 24.23        | -15.04   | ---      | 40.50    | ---      | 55.5   | ---  | 0 deg            | 118            |         |
| 9   | 14.01000       | 22.90   | ---    | 19.30             | -33.00       | 24.25        | -15.05   | ---      | 29.50    | ---      | 44.5   | ---  | 0 deg            | 118            |         |
| 10  | 13.56000       | 29.30   | ---    | 19.29             | -33.01       | 24.23        | -8.65    | ---      | 83.90    | ---      | 92.5   | ---  | 90 deg           | 31             |         |
| 11  | 13.56000       | 34.10   | ---    | 19.29             | -33.01       | 24.23        | -3.85    | ---      | 83.90    | ---      | 87.7   | ---  | Hor              | 123            |         |

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=LOOP: Loop antenna

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

QP

| Ant Deg [deg] | Frequency | Detector | Reading | Ant Factor | Loss | Gain  | Duty Factor | Result   | Limit    | Margin | Remark      |
|---------------|-----------|----------|---------|------------|------|-------|-------------|----------|----------|--------|-------------|
|               | [MHz]     |          | [dBuV]  | [dB/m]     | [dB] | [dB]  | [dB]        | [dBuV/m] | [dBuV/m] | [dB]   |             |
| 0             | 13.56000  | QP       | 37.30   | 19.29      | 6.99 | 24.23 | -           | 39.35    | -        | -      | Fundamental |

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

## Fundamental emission and Spectrum Mask

### DATA OF RADIATED EMISSION(below 30MHz) TEST

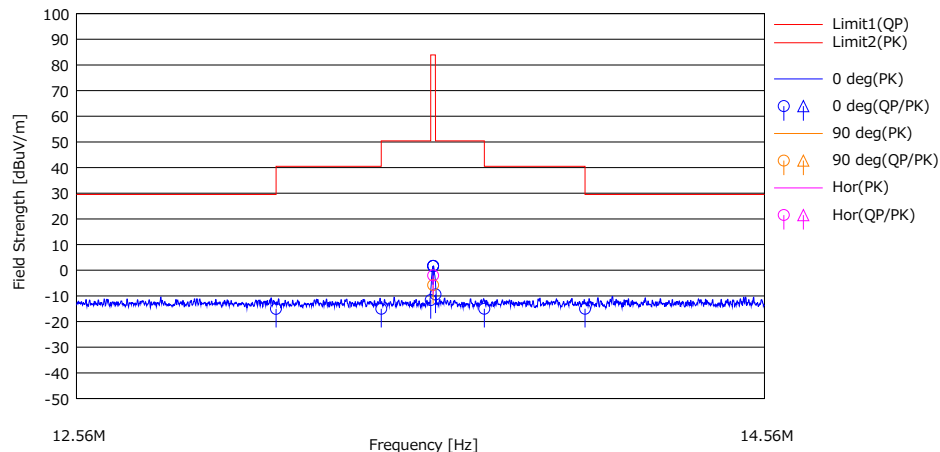
UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber

Date : 2023/01/24

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : without Tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)  
Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading        |                | Ant.Fac<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result           |                  | Limit            |                  | Margin       |              | Antenna<br>[deg] | Table | Comment |
|-----|----------------|----------------|----------------|-------------------|--------------|--------------|------------------|------------------|------------------|------------------|--------------|--------------|------------------|-------|---------|
|     |                | <QP><br>[dBuV] | <PK><br>[dBuV] |                   |              |              | <QP><br>[dBuV/m] | <PK><br>[dBuV/m] | <QP><br>[dBuV/m] | <PK><br>[dBuV/m] | <QP><br>[dB] | <PK><br>[dB] |                  |       |         |
| 1   | 13.11000       | 22.90          | ---            | 19.28             | -33.04       | 24.21        | -15.07           | ---              | 29.50            | ---              | 44.5         | ---          | 0 deg            | 115   |         |
| 2   | 13.41000       | 22.90          | ---            | 19.29             | -33.02       | 24.22        | -15.05           | ---              | 40.50            | ---              | 55.5         | ---          | 0 deg            | 115   |         |
| 3   | 13.55300       | 26.30          | ---            | 19.29             | -33.01       | 24.23        | -11.65           | ---              | 50.40            | ---              | 62.0         | ---          | 0 deg            | 115   |         |
| 4   | 13.56000       | 39.60          | ---            | 19.29             | -33.01       | 24.23        | 1.65             | ---              | 83.90            | ---              | 82.2         | ---          | 0 deg            | 115   | AC 102V |
| 5   | 13.56000       | 39.60          | ---            | 19.29             | -33.01       | 24.23        | 1.65             | ---              | 83.90            | ---              | 82.2         | ---          | 0 deg            | 115   | AC 120V |
| 6   | 13.56000       | 39.60          | ---            | 19.29             | -33.01       | 24.23        | 1.65             | ---              | 83.90            | ---              | 82.2         | ---          | 0 deg            | 115   | AC 138V |
| 7   | 13.56700       | 28.50          | ---            | 19.29             | -33.01       | 24.23        | -9.45            | ---              | 50.40            | ---              | 59.8         | ---          | 0 deg            | 115   |         |
| 8   | 13.71000       | 22.90          | ---            | 19.30             | -33.01       | 24.23        | -15.04           | ---              | 40.50            | ---              | 55.5         | ---          | 0 deg            | 115   |         |
| 9   | 14.01000       | 22.90          | ---            | 19.30             | -33.00       | 24.25        | -15.05           | ---              | 29.50            | ---              | 44.5         | ---          | 0 deg            | 115   |         |
| 10  | 13.56000       | 32.10          | ---            | 19.29             | -33.01       | 24.23        | -5.85            | ---              | 83.90            | ---              | 89.7         | ---          | 90 deg           | 208   |         |
| 11  | 13.56000       | 35.90          | ---            | 19.29             | -33.01       | 24.23        | -2.05            | ---              | 83.90            | ---              | 85.9         | ---          | Hor              | 114   |         |

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=LOOP: Loop antenna

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

| QP            |           |          |         |            |      |       |             |          |          |        |             |
|---------------|-----------|----------|---------|------------|------|-------|-------------|----------|----------|--------|-------------|
| Ant Deg [deg] | Frequency | Detector | Reading | Ant Factor | Loss | Gain  | Duty Factor | Result   | Limit    | Margin | Remark      |
|               | [MHz]     |          | [dBuV]  | [dB/m]     | [dB] | [dB]  | [dB]        | [dBuV/m] | [dBuV/m] | [dB]   |             |
| 0             | 13.56000  | QP       | 39.60   | 19.29      | 6.99 | 24.23 | -           | 41.65    | -        | -      | Fundamental |

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

## Spurious emission

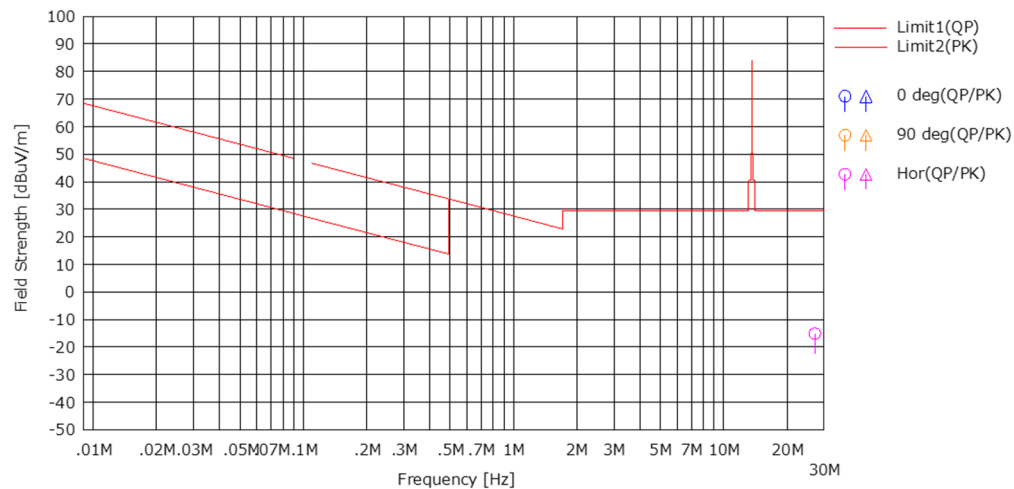
### DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber  
Date : 2023/01/24

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : with Tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)  
Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading |        | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result   |          | Limit    |          | Margin |      | Antenna | Table | Comment |
|-----|----------------|---------|--------|--------------------|--------------|--------------|----------|----------|----------|----------|--------|------|---------|-------|---------|
|     |                | [dBuV]  | [dBuV] |                    |              |              | [dBuV/m] | [dBuV/m] | [dBuV/m] | [dBuV/m] | [dB]   | [dB] |         |       |         |
| 1   | 27.12000       | 21.90   | ---    | 19.88              | -32.52       | 24.42        | -15.16   | ---      | 29.50    | ---      | 44.6   | ---  | 0 deg   | 0     |         |
| 2   | 27.12000       | 21.90   | ---    | 19.88              | -32.52       | 24.42        | -15.16   | ---      | 29.50    | ---      | 44.6   | ---  | 90 deg  | 0     |         |
| 3   | 27.12000       | 21.90   | ---    | 19.88              | -32.52       | 24.42        | -15.16   | ---      | 29.50    | ---      | 44.6   | ---  | Hor     | 0     |         |

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=LOOP: Loop antenna

## Spurious emission

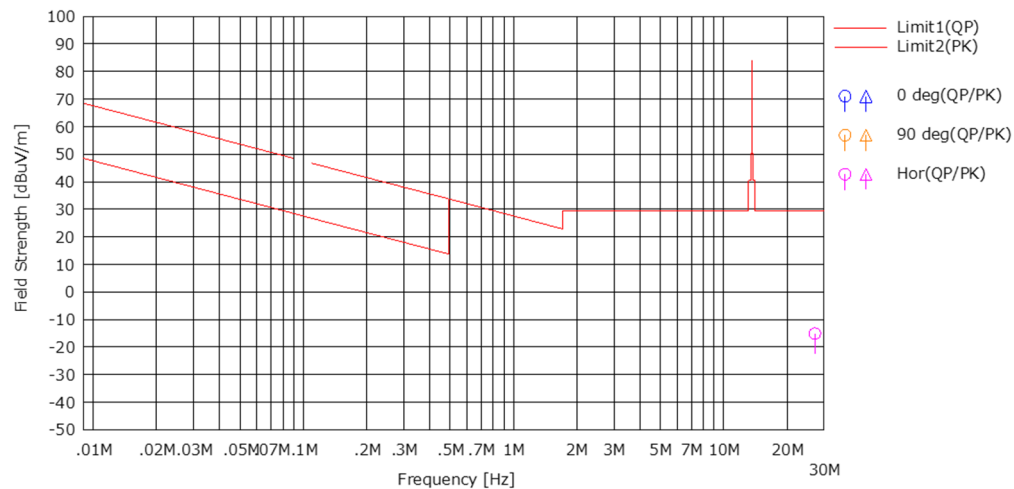
### DATA OF RADIATED EMISSION(below 30MHz) TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber  
Date : 2023/01/24

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : without Tag

Limit : FCC15.225,PK/AV/QP,9-90 kHz:PK/AV,110-490 kHz:PK/AV,other:QP(<490 kHz:300 m,>490 kHz:30 m)  
Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading        |                | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result           |                  | Limit            |                  | Margin       |              | Antenna | Table | Comment |
|-----|----------------|----------------|----------------|--------------------|--------------|--------------|------------------|------------------|------------------|------------------|--------------|--------------|---------|-------|---------|
|     |                | [QP]<br>[dBuV] | [PK]<br>[dBuV] |                    |              |              | [QP]<br>[dBuV/m] | [PK]<br>[dBuV/m] | [QP]<br>[dBuV/m] | [PK]<br>[dBuV/m] | [QP]<br>[dB] | [PK]<br>[dB] |         |       |         |
| 1   | 27.12000       | 21.90          | ---            | 19.88              | -32.52       | 24.42        | -15.16           | ---              | 29.50            | ---              | 44.6         | ---          | 0 deg   | 0     |         |
| 2   | 27.12000       | 21.90          | ---            | 19.88              | -32.52       | 24.42        | -15.16           | ---              | 29.50            | ---              | 44.6         | ---          | 90 deg  | 0     |         |
| 3   | 27.12000       | 21.90          | ---            | 19.88              | -32.52       | 24.42        | -15.16           | ---              | 29.50            | ---              | 44.6         | ---          | Hor     | 0     |         |

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=LOOP: Loop antenna

## Spurious emission

### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber

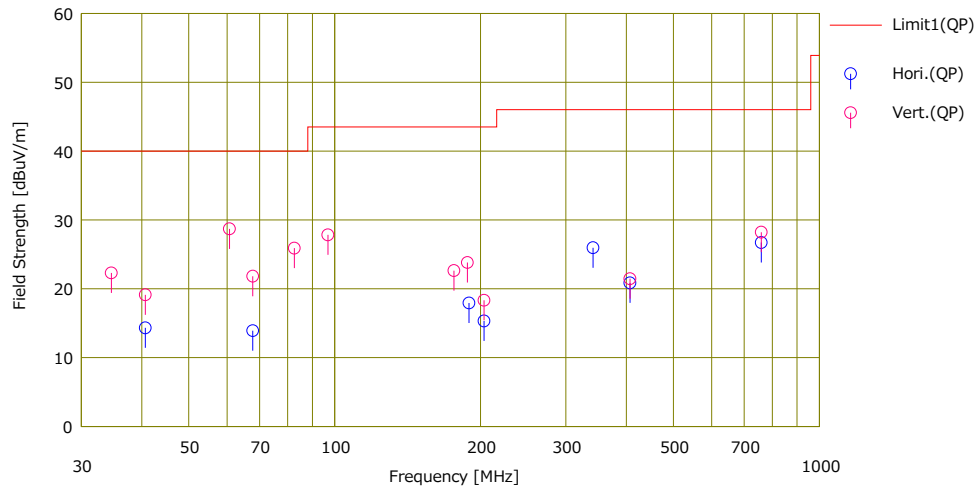
Date : 2023/01/25

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : with Tag

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK

Tested by : Hiromitsu Tanabe



| No. | Freq.<br>[MHz] | Reading<br>(QP) | Ant.Fac<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>(QP) | Limit<br>(QP) | Margin<br>(QP) | Pola.<br>[H/V] | Height<br>[cm] | Angle<br>[deg] | Ant.<br>Type | Comment |
|-----|----------------|-----------------|-------------------|--------------|--------------|----------------|---------------|----------------|----------------|----------------|----------------|--------------|---------|
|     |                | [dBuV]          |                   |              |              | [dBuV/m]       | [dBuV/m]      | [dB]           |                |                |                |              |         |
| 1   | 40.680         | 26.50           | 13.34             | 6.08         | 31.60        | 14.32          | 40.00         | 25.6           | Hori.          | 207            | 88             | HB           |         |
| 2   | 67.800         | 27.00           | 11.97             | 6.50         | 31.56        | 13.91          | 40.00         | 26.0           | Hori.          | 220            | 241            | HB           |         |
| 3   | 189.392        | 30.80           | 10.65             | 7.84         | 31.36        | 17.93          | 43.50         | 25.5           | Hori.          | 184            | 122            | HB           |         |
| 4   | 203.400        | 28.90           | 9.78              | 7.97         | 31.33        | 15.32          | 43.50         | 28.1           | Hori.          | 157            | 285            | HB           |         |
| 5   | 341.399        | 33.50           | 14.24             | 9.48         | 31.27        | 25.95          | 46.00         | 20.0           | Hori.          | 100            | 271            | HB           |         |
| 6   | 406.800        | 26.30           | 15.65             | 10.12        | 31.22        | 20.85          | 46.00         | 25.1           | Hori.          | 200            | 14             | HB           |         |
| 7   | 759.360        | 24.20           | 21.99             | 11.50        | 30.98        | 26.71          | 46.00         | 19.2           | Hori.          | 100            | 142            | HB           |         |
| 8   | 34.622         | 35.30           | 12.65             | 5.97         | 31.62        | 22.30          | 40.00         | 17.7           | Vert.          | 100            | 23             | HB           |         |
| 9   | 40.680         | 31.30           | 13.34             | 6.08         | 31.60        | 19.12          | 40.00         | 20.8           | Vert.          | 100            | 180            | HB           |         |
| 10  | 60.687         | 40.90           | 12.98             | 6.40         | 31.58        | 28.70          | 40.00         | 11.3           | Vert.          | 100            | 189            | HB           |         |
| 11  | 67.800         | 34.90           | 11.97             | 6.50         | 31.56        | 21.81          | 40.00         | 18.1           | Vert.          | 100            | 24             | HB           |         |
| 12  | 82.585         | 42.20           | 8.52              | 6.70         | 31.53        | 25.89          | 40.00         | 14.1           | Vert.          | 100            | 225            | HB           |         |
| 13  | 96.881         | 43.90           | 8.54              | 6.88         | 31.50        | 27.82          | 43.50         | 15.6           | Vert.          | 105            | 322            | HB           |         |
| 14  | 176.280        | 33.90           | 12.41             | 7.71         | 31.39        | 22.63          | 43.50         | 20.8           | Vert.          | 100            | 277            | HB           |         |
| 15  | 187.989        | 36.50           | 10.84             | 7.82         | 31.36        | 23.80          | 43.50         | 19.7           | Vert.          | 100            | 262            | HB           |         |
| 16  | 203.400        | 31.90           | 9.78              | 7.97         | 31.33        | 18.32          | 43.50         | 25.1           | Vert.          | 100            | 260            | HB           |         |
| 17  | 406.800        | 26.90           | 15.65             | 10.12        | 31.22        | 21.45          | 46.00         | 24.5           | Vert.          | 145            | 272            | HB           |         |
| 18  | 759.360        | 25.70           | 21.99             | 11.50        | 30.98        | 28.21          | 46.00         | 17.7           | Vert.          | 138            | 220            | HB           |         |

Calculation:Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=HB:Hybrid Antenna

## Spurious emission

### DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Kashima EMC Lab. No.10 Semi-Anechoic Chamber

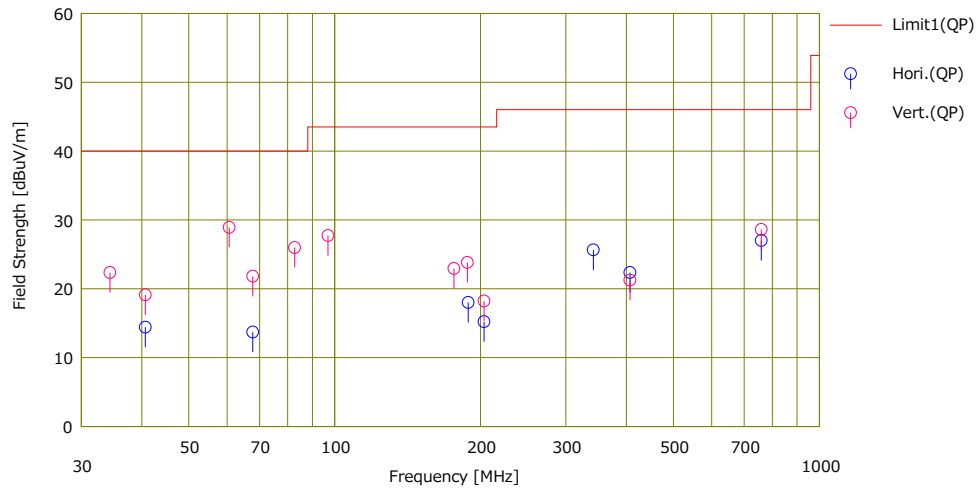
Date : 2023/01/25

Mode : Transmitting and Receiving mode  
Order No. : 14653479  
Power : AC 120V / 60Hz  
Temp./Humi. : 20deg.C / 43%RH

Remarks : without Tag

Limit : FCC15.209 3 m, below 1 GHz:QP, above 1 GHz:AV/PK

Tested by : Hiromitsu Tanabe



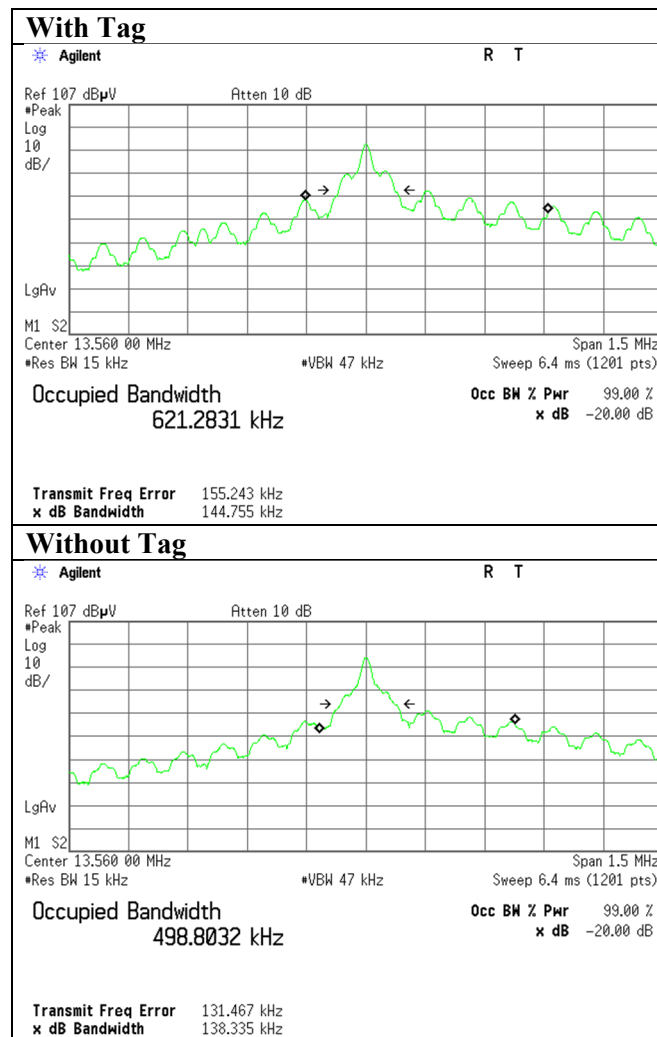
| No. | Freq.<br>[MHz] | Reading<br>(QP) | Ant.Fac<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Result<br>(QP) | Limit<br>(QP) | Margin<br>(QP) | Pola.<br>[H/V] | Height<br>[cm] | Angle<br>[deg] | Ant.<br>Type | Comment |
|-----|----------------|-----------------|-------------------|--------------|--------------|----------------|---------------|----------------|----------------|----------------|----------------|--------------|---------|
|     |                | [dBuV]          |                   |              |              | [dBuV/m]       | [dBuV/m]      | [dB]           |                |                |                |              |         |
| 1   | 40.680         | 26.60           | 13.34             | 6.08         | 31.60        | 14.42          | 40.00         | 25.5           | Hori.          | 240            | 64             | HB           |         |
| 2   | 67.800         | 26.80           | 11.97             | 6.50         | 31.56        | 13.71          | 40.00         | 26.2           | Hori.          | 220            | 218            | HB           |         |
| 3   | 188.720        | 30.80           | 10.73             | 7.83         | 31.36        | 18.00          | 43.50         | 25.5           | Hori.          | 168            | 113            | HB           |         |
| 4   | 203.400        | 28.80           | 9.78              | 7.97         | 31.33        | 15.22          | 43.50         | 28.2           | Hori.          | 162            | 292            | HB           |         |
| 5   | 341.873        | 33.20           | 14.24             | 9.48         | 31.27        | 25.65          | 46.00         | 20.3           | Hori.          | 100            | 276            | HB           |         |
| 6   | 406.800        | 27.80           | 15.65             | 10.12        | 31.22        | 22.35          | 46.00         | 23.6           | Hori.          | 100            | 189            | HB           |         |
| 7   | 759.360        | 24.50           | 21.99             | 11.50        | 30.98        | 27.01          | 46.00         | 18.9           | Hori.          | 100            | 160            | HB           |         |
| 8   | 34.389         | 35.40           | 12.61             | 5.97         | 31.62        | 22.36          | 40.00         | 17.6           | Vert.          | 100            | 24             | HB           |         |
| 9   | 40.680         | 31.30           | 13.34             | 6.08         | 31.60        | 19.12          | 40.00         | 20.8           | Vert.          | 100            | 145            | HB           |         |
| 10  | 60.625         | 41.10           | 12.99             | 6.40         | 31.58        | 28.91          | 40.00         | 11.0           | Vert.          | 100            | 183            | HB           |         |
| 11  | 67.800         | 34.90           | 11.97             | 6.50         | 31.56        | 21.81          | 40.00         | 18.1           | Vert.          | 100            | 5              | HB           |         |
| 12  | 82.694         | 42.30           | 8.50              | 6.71         | 31.53        | 25.98          | 40.00         | 14.0           | Vert.          | 100            | 191            | HB           |         |
| 13  | 96.903         | 43.80           | 8.54              | 6.88         | 31.50        | 27.72          | 43.50         | 15.7           | Vert.          | 105            | 321            | HB           |         |
| 14  | 176.280        | 34.20           | 12.41             | 7.71         | 31.39        | 22.93          | 43.50         | 20.5           | Vert.          | 100            | 265            | HB           |         |
| 15  | 187.880        | 36.50           | 10.86             | 7.82         | 31.36        | 23.82          | 43.50         | 19.6           | Vert.          | 100            | 274            | HB           |         |
| 16  | 203.400        | 31.80           | 9.78              | 7.97         | 31.33        | 18.22          | 43.50         | 25.2           | Vert.          | 100            | 267            | HB           |         |
| 17  | 406.800        | 26.70           | 15.65             | 10.12        | 31.22        | 21.25          | 46.00         | 24.7           | Vert.          | 140            | 264            | HB           |         |
| 18  | 759.360        | 26.10           | 21.99             | 11.50        | 30.98        | 28.61          | 46.00         | 17.3           | Vert.          | 149            | 211            | HB           |         |

Calculation: Result[dBuV/m]=Reading[dBuV]+Ant.Fac[dB/m]+Loss(Cable+ATT)[dB]-Gain(AMP)[dB]  
Ant.Type=HB:Hybrid Antenna

## 20 dB Bandwidth and 99% Occupied Bandwidth

Test place Kashima EMC Lab. No.2 Measurement room  
Date February 1, 2023  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Hiromitsu Tanabe  
Mode Tx and Rx, Mod on

| FREQ<br>[MHz] | Mode        | 20dB Bandwidth<br>[kHz] | 99% Occupied Bandwidth<br>[kHz] |
|---------------|-------------|-------------------------|---------------------------------|
| 13.56         | With Tag    | 144.76                  | 621.28                          |
|               | Without Tag | 138.34                  | 498.80                          |



\* Since the transmitter signal is CW-like it is impractical to use a RBW setting of 1 - 5% of the emission bandwidth since the emission bandwidth will be proportional to the RBW.

## Frequency Tolerance

|                        |                                        |
|------------------------|----------------------------------------|
| Test place             | Kashima EMC Lab. No.2 Measurement room |
| Date                   | February 1, 2023                       |
| Temperature / Humidity | 23 deg. C / 41 % RH                    |
| Engineer               | Hiromitsu Tanabe                       |
| Mode                   | Tx Mod off                             |

| Test condition    |                    | Tested timing | Measured frequency<br>[MHz] | Frequency error<br>[MHz] | Result  |       | Limit<br>[+/- %] |
|-------------------|--------------------|---------------|-----------------------------|--------------------------|---------|-------|------------------|
| Temp.<br>[deg. C] | Voltage<br>[V]     |               |                             |                          | [%]     | [ppm] |                  |
| 50                | 120                | Power on      | 13.560445                   | 0.000445                 | 0.00328 | 32.8  | 0.01             |
|                   |                    | + 2 min.      | 13.560443                   | 0.000443                 | 0.00327 | 32.7  | 0.01             |
|                   |                    | + 5 min.      | 13.560447                   | 0.000447                 | 0.00330 | 33.0  | 0.01             |
|                   |                    | + 10 min.     | 13.560450                   | 0.000450                 | 0.00332 | 33.2  | 0.01             |
| 40                | 120                | Power on      | 13.560471                   | 0.000471                 | 0.00347 | 34.7  | 0.01             |
|                   |                    | + 2 min.      | 13.560455                   | 0.000455                 | 0.00336 | 33.6  | 0.01             |
|                   |                    | + 5 min.      | 13.560452                   | 0.000452                 | 0.00333 | 33.3  | 0.01             |
|                   |                    | + 10 min.     | 13.560451                   | 0.000451                 | 0.00333 | 33.3  | 0.01             |
| 30                | 120                | Power on      | 13.560505                   | 0.000505                 | 0.00372 | 37.2  | 0.01             |
|                   |                    | + 2 min.      | 13.560481                   | 0.000481                 | 0.00355 | 35.5  | 0.01             |
|                   |                    | + 5 min.      | 13.560472                   | 0.000472                 | 0.00348 | 34.8  | 0.01             |
|                   |                    | + 10 min.     | 13.560469                   | 0.000469                 | 0.00346 | 34.6  | 0.01             |
| 20                | 120                | Power on      | 13.560515                   | 0.000515                 | 0.00380 | 38.0  | 0.01             |
|                   |                    | + 2 min.      | 13.560498                   | 0.000498                 | 0.00367 | 36.7  | 0.01             |
|                   |                    | + 5 min.      | 13.560486                   | 0.000486                 | 0.00358 | 35.8  | 0.01             |
|                   |                    | + 10 min.     | 13.560483                   | 0.000483                 | 0.00356 | 35.6  | 0.01             |
| 20                | 102<br>(120V -15%) | Power on      | 13.560525                   | 0.000525                 | 0.00387 | 38.7  | 0.01             |
|                   |                    | + 2 min.      | 13.560500                   | 0.000500                 | 0.00369 | 36.9  | 0.01             |
|                   |                    | + 5 min.      | 13.560489                   | 0.000489                 | 0.00361 | 36.1  | 0.01             |
|                   |                    | + 10 min.     | 13.560483                   | 0.000483                 | 0.00356 | 35.6  | 0.01             |
| 20                | 138<br>(120V +15%) | Power on      | 13.560527                   | 0.000527                 | 0.00389 | 38.9  | 0.01             |
|                   |                    | + 2 min.      | 13.560500                   | 0.000500                 | 0.00369 | 36.9  | 0.01             |
|                   |                    | + 5 min.      | 13.560487                   | 0.000487                 | 0.00359 | 35.9  | 0.01             |
|                   |                    | + 10 min.     | 13.560483                   | 0.000483                 | 0.00356 | 35.6  | 0.01             |
| 10                | 120                | Power on      | 13.560583                   | 0.000583                 | 0.00430 | 43.0  | 0.01             |
|                   |                    | + 2 min.      | 13.560564                   | 0.000564                 | 0.00416 | 41.6  | 0.01             |
|                   |                    | + 5 min.      | 13.560554                   | 0.000554                 | 0.00409 | 40.9  | 0.01             |
|                   |                    | + 10 min.     | 13.560547                   | 0.000547                 | 0.00403 | 40.3  | 0.01             |
| 0                 | 120                | Power on      | 13.560594                   | 0.000594                 | 0.00438 | 43.8  | 0.01             |
|                   |                    | + 2 min.      | 13.560589                   | 0.000589                 | 0.00434 | 43.4  | 0.01             |
|                   |                    | + 5 min.      | 13.560583                   | 0.000583                 | 0.00430 | 43.0  | 0.01             |
|                   |                    | + 10 min.     | 13.560579                   | 0.000579                 | 0.00427 | 42.7  | 0.01             |
| -10               | 120                | Power on      | 13.560580                   | 0.000580                 | 0.00428 | 42.8  | 0.01             |
|                   |                    | + 2 min.      | 13.560593                   | 0.000593                 | 0.00437 | 43.7  | 0.01             |
|                   |                    | + 5 min.      | 13.560594                   | 0.000594                 | 0.00438 | 43.8  | 0.01             |
|                   |                    | + 10 min.     | 13.560595                   | 0.000595                 | 0.00439 | 43.9  | 0.01             |
| -20               | 120                | Power on      | 13.560529                   | 0.000529                 | 0.00390 | 39.0  | 0.01             |
|                   |                    | + 2 min.      | 13.560567                   | 0.000567                 | 0.00418 | 41.8  | 0.01             |
|                   |                    | + 5 min.      | 13.560577                   | 0.000577                 | 0.00426 | 42.6  | 0.01             |
|                   |                    | + 10 min.     | 13.560582                   | 0.000582                 | 0.00429 | 42.9  | 0.01             |

Calculation formula:

Frequency error = Measured frequency - Tested frequency

Result [%] = Frequency error / Tested frequency \* 100

Tested frequency:

13.56 MHz

Limit (+/-):

0.01 %

(± 100ppm)

## APPENDIX 2: Test instruments

### Test equipment

| Test Item | Local ID     | LIMS ID | Description                      | Manufacturer                       | Model                   | Serial              | Last Calibration Date | Cal Int |
|-----------|--------------|---------|----------------------------------|------------------------------------|-------------------------|---------------------|-----------------------|---------|
| CE        | CLS-02       | 143498  | A.M.N.                           | Rohde & Schwarz                    | ESH3-Z5                 | 828874/019          | 2022/07/20            | 12      |
| CE        | CCC-S10-C    | 143157  | 10 Site CE System                | UL Japan                           | none                    | none                | 2022/08/27            | 12      |
| CE        | CTR-09       | 144199  | Test Receiver                    | Keysight Technologies Inc          | N9038A                  | MY53290016          | 2022/07/21            | 12      |
| RE        | KLP-01       | 143833  | Loop Antenna                     | Rohde & Schwarz                    | HFH2-Z2                 | 827779/008          | 2022/10/05            | 12      |
| RE        | CCC-M01      | 143161  | Coaxial Cable                    | Fujikura,HP,Mini-Circuits,Fujikura | 3D2W                    | none                | 2022/05/16            | 12      |
| RE        | CAT6-17      | 144245  | 6dB Fixed Atten.                 | Suhner                             | 6906.01.A               | none                | 2022/07/20            | 12      |
| RE        | CAF-24       | 171927  | Pre Amplifier                    | Mini-Circuits                      | GALI-84+                | 001                 | 2022/07/06            | 12      |
| RE        | CCC-S10-C    | 143157  | 10 Site CE System                | UL Japan                           | none                    | none                | 2022/08/27            | 12      |
| RE        | CTR-09       | 144199  | Test Receiver                    | Keysight Technologies Inc          | N9038A                  | MY53290016          | 2022/07/21            | 12      |
| RE        | CBL-08       | 143121  | LOGBICON                         | Schwarzbeck Mess-Elektronik OHG    | VULB 9168               | 343                 | 2022/04/18            | 12      |
| RE        | CAT5-03      | 178806  | 5dB Fixed Atten.                 | Pasternack Enterprises             | PE7047-5                | none                | 2022/04/01            | 12      |
| RE        | CCC-S10-R3   | 143165  | 10 Site RE 3m System             | UL Japan                           | none                    | none                | 2022/08/27            | 12      |
| RE        | CAF-28       | 183880  | Pre-Amplifier                    | Mini-Circuits                      | ZKL-2                   | 001                 | 2022/04/06            | 12      |
| RE        | CAEC-10(NSA) | 144632  | Semi Anechoic Chamber            | TDK                                | NSA (No.10)             | 10                  | 2022/05/15            | 12      |
| CE, RE    | CSCL-26      | 222745  | Measure                          | SHINWA RULES CO., LTD.             | 80862                   | none                | -                     | -       |
| CE, RE    | COS-10       | 143542  | Temperature & Humidity Indicator | HIOKI E.E. CORPORATION             | 3641/9680-50            | 090999895/090905406 | 2022/06/20            | 12      |
| CE, RE    | CBM-10       | 143133  | Barometer                        | Sanoh Co., Ltd                     | SBR-151                 | 001439              | 2021/11/24            | 36      |
| CE, RE    | CTS-14       | 144216  | Digital Multimeter               | Fluke Corporation                  | 115                     | 994460954           | 2022/10/19            | 12      |
| CE, RE    | COTS-CEMI-03 | 178804  | EMI Software                     | TSJ (Techno Science Japan)         | TEPTO-DV3 (RE,CE,ME,PE) | -                   | -                     | -       |
| FT        | CSA-07       | 143643  | Spectrum Analyzer                | Keysight Technologies Inc          | E4448A                  | MY52490024          | 2022/06/23            | 12      |
| FT        | CCH-04       | 143181  | Temperature and Humidity Chamber | Espec                              | PL-1J                   | 15004059            | 2022/10/05            | 12      |
| FT        | CFC-02       | 143423  | Frequency Counter                | Keysight Technologies Inc          | 53151A                  | US40511823          | 2022/04/13            | 12      |
| FT        | CMS-07       | 143942  | Near Field Probe                 | Langer                             | LF-R400                 | 02-0815             | -                     | -       |
| FT        | CTS-08       | 144210  | Digital Multimeter               | Fluke Corporation                  | 112                     | 89790193            | 2022/10/12            | 12      |
| FT        | COS-27       | 200034  | Temperature & Humidity Logger    | HIOKI E.E. CORPORATION             | LR5001/LR9504           | 200636456/200699552 | 2022/07/22            | 12      |
| FT        | CBM-05       | 143128  | Barometer                        | OTA                                | No.11                   | 15404               | 2021/11/24            | 36      |

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

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

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

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

Test item:

CE: Conducted Emission

RE: Radiated Emission

FT: Frequency Tolerance

UL Japan, Inc. Kashima EMC Lab.

1614, Mushiata, Katori-shi, Chiba-ken, 289-0341 Japan / +81-478-88-6500