

Dates of Tests: 12, 2023 ~ Nov 17, 2023  
Test Report S/N: LR500112311D  
Test Site : LTA CO., LTD.

## CERTIFICATION OF COMPLIANCE

FCC ID.

**2AQAV-ECU100-02W**

APPLICANT

**SMART eLOCK Co., LTD.**

|                                  |   |                                                                                   |
|----------------------------------|---|-----------------------------------------------------------------------------------|
| <b>Manufacturing Description</b> | : | <b>Energy Control Unit</b>                                                        |
| <b>Manufacturer</b>              | : | <b>SMART eLOCK Co., LTD</b>                                                       |
| <b>Model name</b>                | : | <b>ECU100-02W</b>                                                                 |
| <b>Variant Model name</b>        | : | <b>ECU100-00, ECU100-02, ECU100-00W,<br/>ECU100-00WA, ECU100-01W, ECU100-02WA</b> |
| <b>Test Device Serial No.:</b>   | : | <b>Identical prototype</b>                                                        |
| <b>Rule Part(s)</b>              | : | <b>FCC Part 15 Subpart C ; ANSI C63.10 - 2013</b>                                 |
| <b>Frequency Range</b>           | : | <b>13.56 MHz</b>                                                                  |
| <b>Data of issue</b>             | : | <b>November 17 ,2023</b>                                                          |

This test report is issued under the authority of:

The test was supervised by:



Ja-Beom Koo, Manager



Jae-Humm Yeon, Test Engineer

## **TABLE OF CONTENTS**

|                                        |       |    |
|----------------------------------------|-------|----|
| 1. GENERAL INFORMATION                 | ----- | 3  |
| 2. INFORMATION ABOUT TEST ITEM         | ----- | 4  |
| 3. TEST REPORT                         | ----- | 5  |
| 3.1 SUMMARY OF TESTS                   | ----- | 5  |
| 3.2 TECHNICAL CHARACTERISTICS TEST     | ----- | 6  |
| 3.2.1 Radiated Emission                | ----- | 6  |
| 3.2.2 Frequency Tolerance              | ----- | 11 |
| 3.2.3 20dB Bandwidth                   | ----- | 12 |
| 3.2.4 AC Conducted Emissions           | ----- | 14 |
| <br><b>APPENDIX</b>                    |       |    |
| APPENDIX TEST EQUIPMENT USED FOR TESTS | ----- | 16 |

## 1. General information

### 1-1 Test Performed

Company name : LTA Co., Ltd.  
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 17159  
 Web site : <http://www.ltalab.com>  
 E-mail : [chahn@ltalab.com](mailto:chahn@ltalab.com)  
 Telephone : +82-31-323-6008  
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

### 1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

| Agency | Country | Accreditation No. | Validity   | Reference             |
|--------|---------|-------------------|------------|-----------------------|
| RRA    | KOREA   |                   | -          | RRA accredited Lab.   |
|        | U.S.A   | KR0049            | 2025-03-29 |                       |
|        | CANADA  |                   | 2024-08-15 |                       |
| VCCI   | JAPAN   | C-14948           | 2026-09-10 | VCCI registration     |
|        |         | T-12416           | 2026-09-10 |                       |
|        |         | R-14483           | 2026-10-15 |                       |
|        |         | G-10847           | 2024-12-13 |                       |
| KOLAS  | KOREA   | KT551             | 2025-10-12 | KOLAS accredited Lab. |

## 2. Information about test item

### 2-1 Client & Manufacturer

Client Company name : SMART eLOCK Co., LTD.  
 Address : B402, Geumgang Penterium IT Tower, 215, Galmachiro, Jungwon gu,  
 Seongnam-si, Gyeonggi-do South Korea 13217  
 Tel / Fax : TEL No : +82-010-3673-7884/ FAX No : +82-031-743-7276  
 Manufacturer : SMART eLOCK Co., LTD.  
 Address : B402, Geumgang Penterium IT Tower, 215, Galmachiro, Jungwon gu,  
 Seongnam-si, Gyeonggi-do South Korea 13217  
 Tel / Fax : TEL No : +82-010-3673-7884/ FAX No : +82-031-743-7276

### 2-2 Equipment Under Test (EUT)

Model name : ECU100-02W  
 Serial number : Identical prototype  
 Date of receipt : September 12, 2023  
 EUT condition : Pre-production, not damaged  
 Antenna type : Pattern Antenna  
 Frequency Range : 13.56 MHz  
 Type of Modulation : FSK  
 Power Source : AC 120 V

### 2-3 Tested frequency

|                     | LOW | MID   | HIGH |
|---------------------|-----|-------|------|
| Frequency (MHz) BLE |     | 13.56 |      |

### 2-4 Ancillary Equipment

| Equipment | Model No. | Serial No. | Manufacturer |
|-----------|-----------|------------|--------------|
| -         | -         | -          | -            |

### 3. Test Report

#### 3.1 Summary of tests

| FCC Part<br>Section(s)       | Parameter              | Test Condition | Status<br>(note 1) |
|------------------------------|------------------------|----------------|--------------------|
| 15.209<br>15.225(a)(b)(c)(d) | Radiated Emission      | Radiated       | C                  |
| 15.225(e)                    | Frequency Tolerance    |                | C                  |
| 15.215(c)                    | 20dB Bandwidth         |                | C                  |
| 15.207                       | AC Conducted Emissions | Conducted      | N/A                |
| 15.203                       | Antenna requirement    | -              | C                  |

N/A : This product is battery-enabled and excludes the test.

The above equipment was tested by LTA Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247 The test results of this report relate only to the tested sample identified in this report.

The tests were performed according to the method of measurements prescribed in KDB No.558074.

#### → Antenna Requirement

SMART eLOCK Co., LTD. FCC ID: 2AQAV-ECU100-02W unit complies with the requirement of §15.203.  
The antenna type is Pattern Antenna

## 3.2 Technical Characteristics Test

### 3.2.1 Radiated Spurious Emissions

#### Procedure:

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.10-2013.

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10<sup>th</sup> harmonic.

RBW = 120 kHz ( 30 MHz ~ 1 GHz)

VBW  $\geq$  RBW

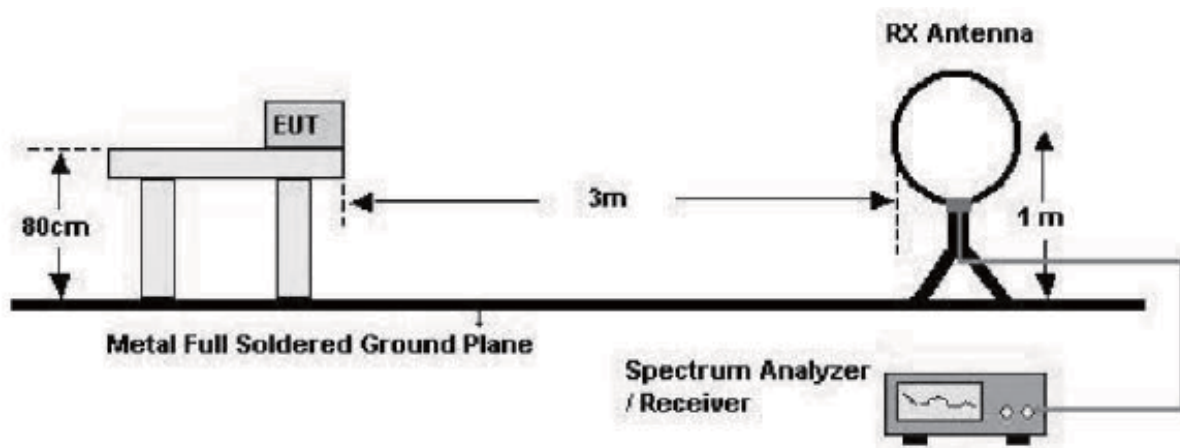
= 1 MHz (1 GHz ~ 10<sup>th</sup> harmonic )

Trace = max hold

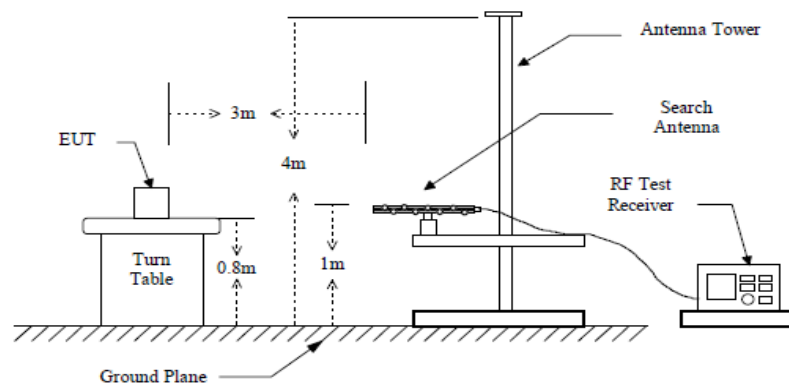
Detector function = peak

Sweep = auto

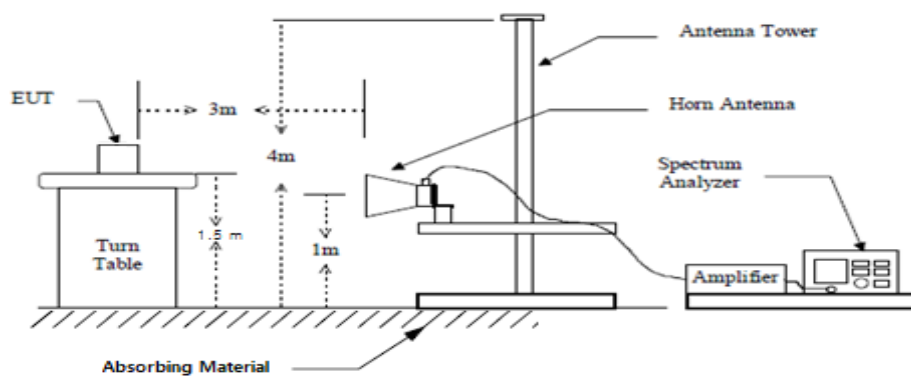
**below 30 MHz**



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



**Measurement Data: Complies**

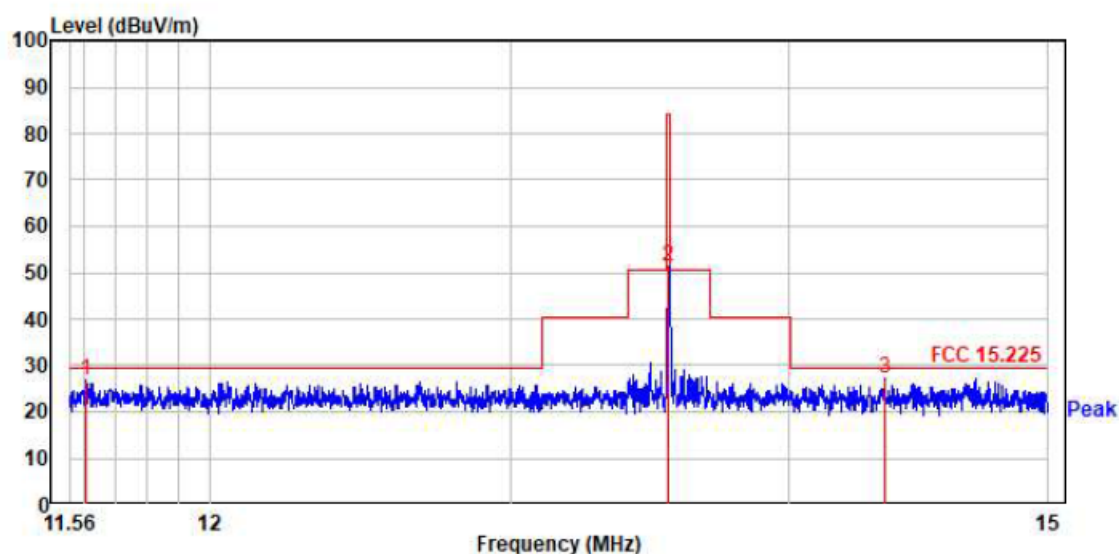
- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30MHz.
- The test results for the worst of the various operating modes are presented in accordance with 6.3.4 of ANSI C63.10.
- Checked with a red circle is the fundamental frequency.

**Minimum Standard: FCC Part 15.209(a)**

| Frequency (MHz) | Limit (uV/m) @ 3 m    |
|-----------------|-----------------------|
| 0.009 ~ 0.490   | 2400/F(kHz) (@ 300 m) |
| 0.490 ~ 1.705   | 24000/F(kHz) (@ 30 m) |
| 1.705 ~ 30      | 30(@ 30 m)            |
| 30 ~ 88         | 100 **                |
| 88 ~ 216        | 150 **                |
| 216 ~ 960       | 200 **                |
| Above 960       | 500                   |

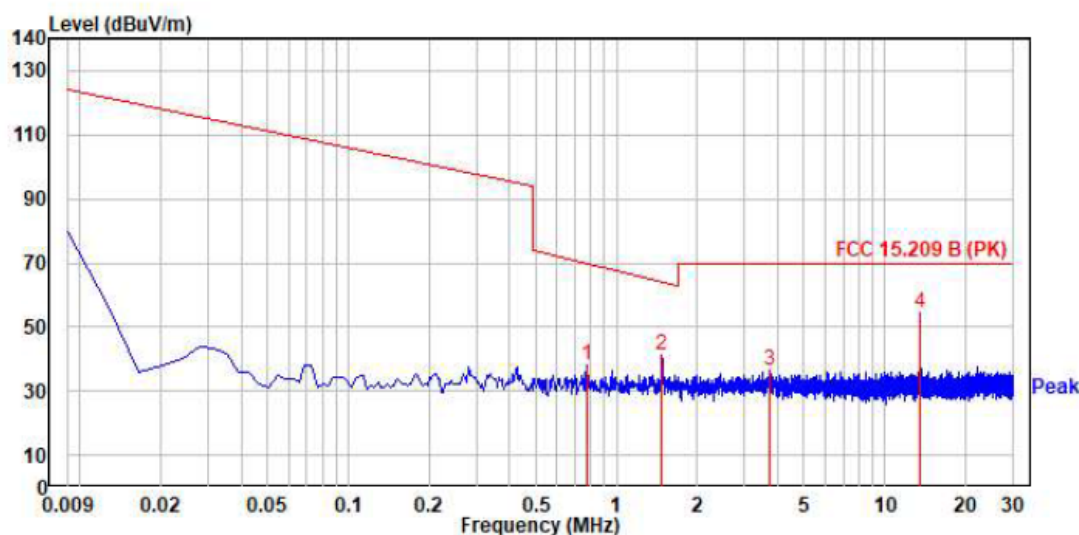
\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

## Radiated Emissions



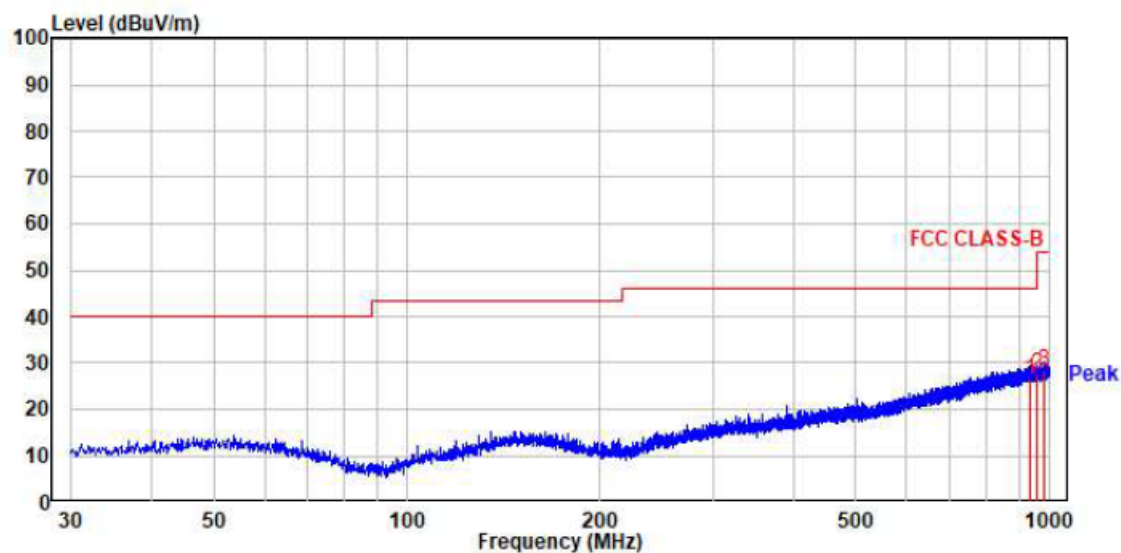
| Trace: |       |         |       |        |        |        |        |       |          |
|--------|-------|---------|-------|--------|--------|--------|--------|-------|----------|
| No.    | Freq  | Reading | C.F   | Result | Limit  | Margin | Height | Angle | Polarity |
|        | MHz   | dBμV    | dB    | QP     | dBμV/m | dB     | cm     | deg   |          |
| 1.     | 11.61 | 5.87    | 20.81 | 26.68  | 29.54  | 2.86   | -----  | ----- | vertical |
| 2.     | 13.56 | 30.49   | 20.89 | 51.38  | 84.00  | 32.62  | -----  | ----- | vertical |
| 3.     | 14.37 | 6.30    | 20.93 | 27.23  | 29.54  | 2.31   | -----  | ----- | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| Trace: |       |         |       |        |        |        |        |       |          |
|--------|-------|---------|-------|--------|--------|--------|--------|-------|----------|
| No.    | Freq  | Reading | C.F   | Result | Limit  | Margin | Height | Angle | Polarity |
|        | MHz   | dBμV    | dB    | QP     | dBμV/m | dB     | cm     | deg   |          |
| 1.     | 0.77  | 18.40   | 19.84 | 38.24  | 69.97  | 31.73  | 100    | 360   | vertical |
| 2.     | 1.47  | 21.50   | 19.95 | 41.45  | 64.30  | 22.85  | -----  | ----- | vertical |
| 3.     | 3.72  | 16.31   | 20.32 | 36.63  | 70.00  | 33.37  | -----  | ----- | vertical |
| 4.     | 13.56 | 33.37   | 20.89 | 54.26  | 70.00  | 15.74  | -----  | ----- | vertical |

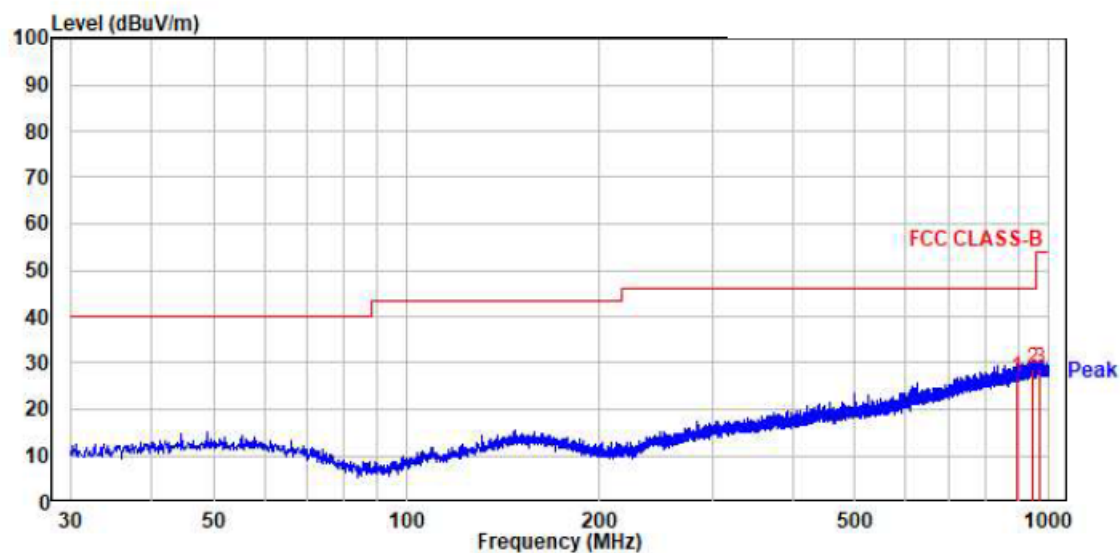
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| Trace: |        |         |      |        |        |        |        |       |          |
|--------|--------|---------|------|--------|--------|--------|--------|-------|----------|
| No.    | Freq   | Reading | C.F  | Result | Limit  | Margin | Height | Angle | Polarity |
|        | MHz    | dBμV    | dB   | QP     | dBμV/m | dB     | cm     | deg   |          |
| 1.     | 932.83 | 24.32   | 2.05 | 26.37  | 46.00  | 19.63  | -----  | ----- | vertical |
| 2.     | 957.68 | 25.14   | 2.33 | 27.47  | 46.00  | 18.53  | -----  | ----- | vertical |
| 3.     | 984.60 | 25.73   | 2.58 | 28.31  | 54.00  | 25.69  | -----  | ----- | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| Trace: |        |         |      |        |        |        |        |       |            |
|--------|--------|---------|------|--------|--------|--------|--------|-------|------------|
| No.    | Freq   | Reading | C.F  | Result | Limit  | Margin | Height | Angle | Polarity   |
|        | MHz    | dBμV    | dB   | QP     | dBμV/m | dB     | cm     | deg   |            |
| 1.     | 892.09 | 24.87   | 2.08 | 26.95  | 46.00  | 19.05  | -----  | ----- | horizontal |
| 2.     | 947.50 | 25.69   | 3.03 | 28.72  | 46.00  | 17.28  | -----  | ----- | horizontal |
| 3.     | 969.32 | 25.44   | 3.10 | 28.54  | 54.00  | 25.46  | -----  | ----- | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

### 3.2.2 Frequency Tolerance

#### Procedure:

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of

-20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Measurement Data : **Complies**

| VOLTAGE (%) | Test Conditions |                  | Fre. Dev. (Hz) | Deviation (%) | Verdict |
|-------------|-----------------|------------------|----------------|---------------|---------|
|             | Power (AC)      | Temperature (°C) |                |               |         |
| 100         | 120             | -20              | 134            | 0.0009        | PASS    |
| 100         |                 | -10              | 159            | 0.0011        |         |
| 100         |                 | 0                | 110            | 0.0008        |         |
| 100         |                 | 50               | 85             | 0.0006        |         |
| 85          | 102             | 20               | 171            | 0.0012        |         |
| 115         | 138             | 50               | 180            | 0.0013        |         |

#### Minimum Standard:

±0.01%

#### Measurement Setup

The EUT, which is powered by the AC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

### 3.2.3 20 dB Bandwidth

#### Procedure:

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1 kHz

VBW = 3 X RBW

Trace = max hold

Sweep = auto

Detector function = peak

Measurement Data : **Complies**

#### BLE Mode

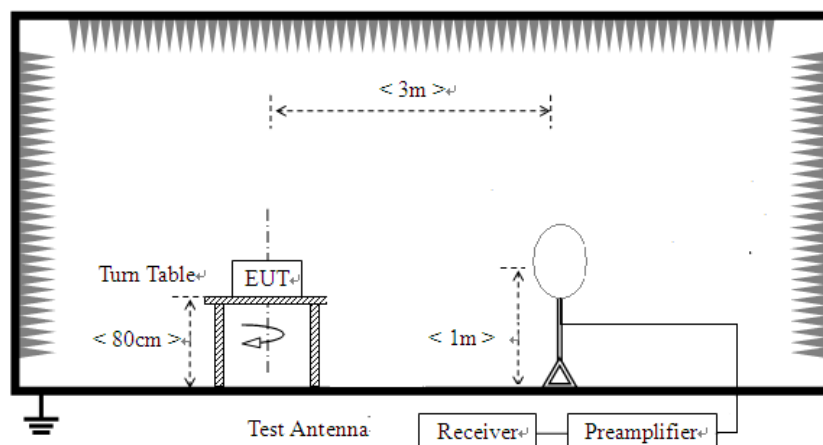
| Frequency<br>(MHz) | Test Results             |          |
|--------------------|--------------------------|----------|
|                    | Measured Bandwidth (kHz) | Result   |
| 13.56              | 2.460                    | Complies |

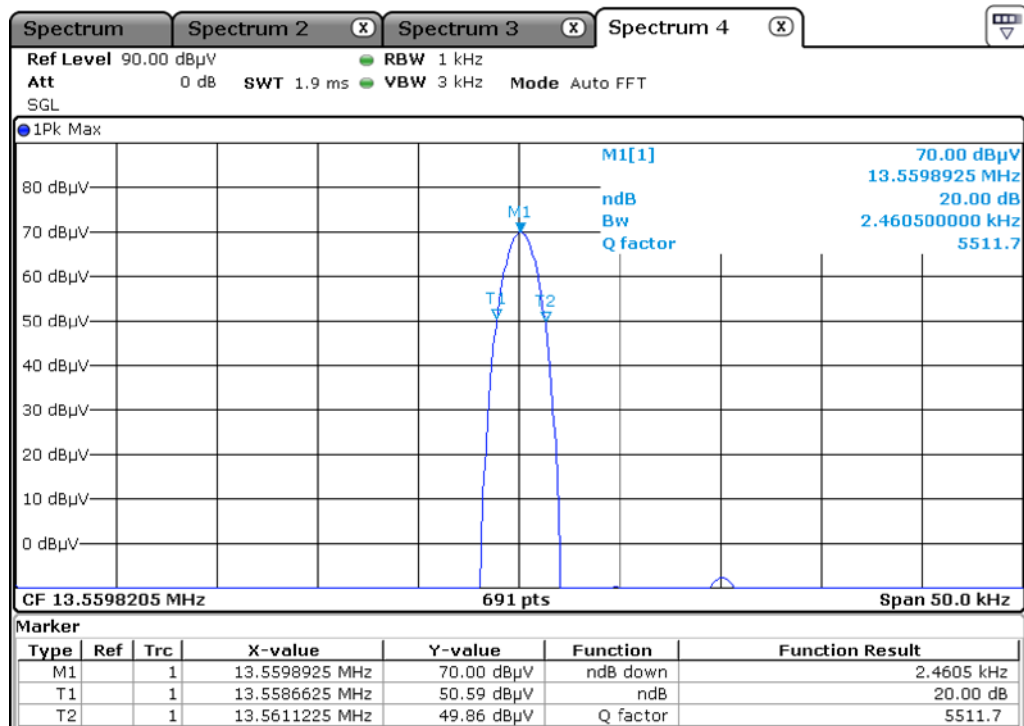
- See next pages for actual measured spectrum plots.

#### Minimum Standard:

20 dB Bandwidth  $\leq$  14 kHz

#### Measurement Setup





### 3.2.4 AC Conducted Emissions

**Procedure:**

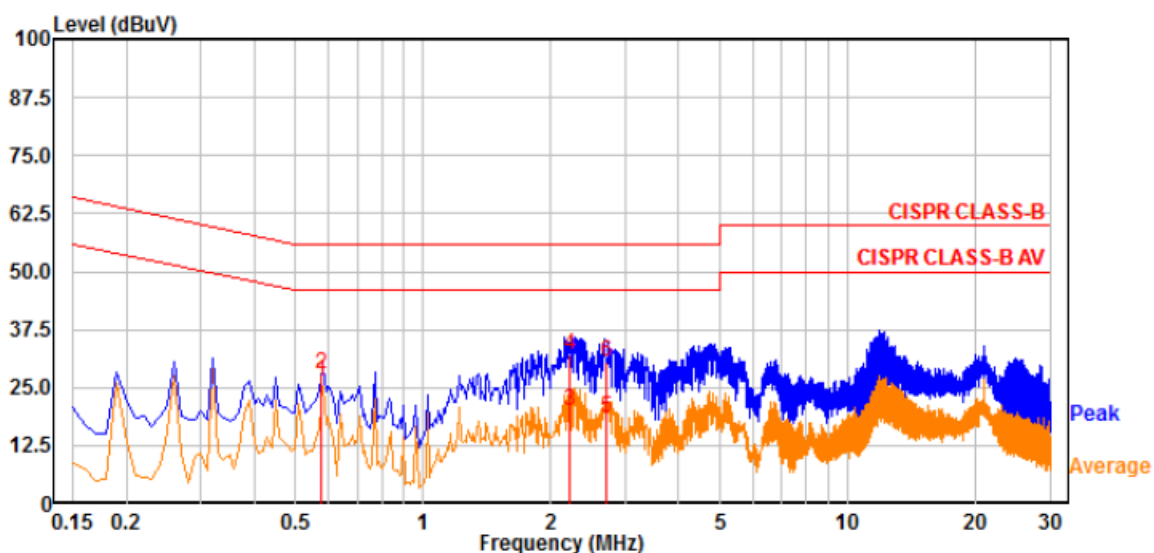
The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

**Measurement Data: Complies**

Class B

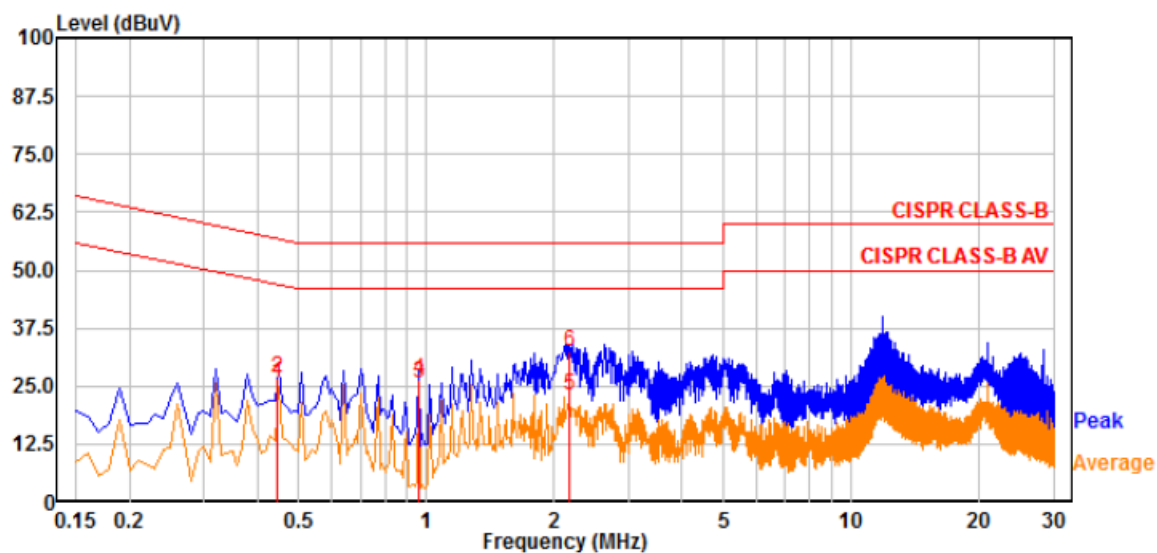
| Frequency Range | quasi-peak | Average    |
|-----------------|------------|------------|
| 0.15 ~ 0.5      | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5         | 56         | 46         |
| 5 ~ 30          | 60         | 50         |

\* Decreases with the logarithm of the frequency



| No. | Freq<br>MHz | RD<br>QP<br>dBμV | RD<br>AV<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV | Result<br>AV<br>dBμV | Limit<br>QP<br>dBμV | Limit<br>AV<br>dBμV | Margin<br>QP<br>dB | Margin<br>AV<br>dB | Phase |
|-----|-------------|------------------|------------------|-----------|----------------------|----------------------|---------------------|---------------------|--------------------|--------------------|-------|
| 2.  | 0.575       | 8.55             | 6.77             | 19.47     | 28.02                | 26.24                | 56.00               | 46.00               | 27.98              | 19.76              | Line  |
| 4.  | 2.222       | 12.55            | 0.30             | 19.56     | 32.11                | 19.86                | 56.00               | 46.00               | 23.89              | 26.14              | Line  |
| 6.  | 2.700       | 11.15            | -1.11            | 19.57     | 30.72                | 18.46                | 56.00               | 46.00               | 25.28              | 27.54              | Line  |

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter



| No. | Freq<br>MHz | RD<br>QP<br>dBμV | RD<br>AV<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV | Result<br>AV<br>dBμV | Limit<br>QP<br>dBμV | Limit<br>AV<br>dBμV | Margin<br>QP<br>dB | Margin<br>AV<br>dB | Phase   |
|-----|-------------|------------------|------------------|-----------|----------------------|----------------------|---------------------|---------------------|--------------------|--------------------|---------|
| 2.  | 0.448       | 7.51             | 6.08             | 19.42     | 26.93                | 25.50                | 56.92               | 46.92               | 29.99              | 21.42              | neutral |
| 4.  | 0.961       | 6.79             | 6.16             | 19.47     | 26.26                | 25.63                | 56.00               | 46.00               | 29.74              | 20.37              | neutral |
| 6.  | 2.181       | 13.01            | 3.44             | 19.52     | 32.53                | 22.96                | 56.00               | 46.00               | 23.47              | 23.04              | neutral |

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

## APPENDIX

### TEST EQUIPMENT USED FOR TESTS

|    | Use | Description                          | Model No.        | Serial No.  | Manufacturer           | Interval | Next Cal. Date |
|----|-----|--------------------------------------|------------------|-------------|------------------------|----------|----------------|
| 1  | ■   | Signal Analyzer (9 kHz ~ 30 GHz)     | FSV30            | 100757      | R&S                    | 1 year   | 2024-08-22     |
| 2  | ■   | Signal Generator (~3.2 GHz)          | 8648C            | 3623A02597  | HP                     | 1 year   | 2024-03-14     |
| 3  |     | SYNTHESIZED CW GENERATOR             | 83711B           | US34490456  | HP                     | 1 year   | 2024-03-14     |
| 4  |     | Attenuator (3 dB)                    | 8491A            | 37822       | HP                     | 1 year   | 2024-04-03     |
| 5  |     | Attenuator (10 dB)                   | 8491A            | 63196       | HP                     | 1 year   | 2024-03-15     |
| 6  | ■   | EMI Test Receiver (~7 GHz)           | ESCI7            | 100722      | R&S                    | 1 year   | 2024-08-22     |
| 7  |     | RF Amplifier (~1.3 GHz)              | 8447D OPT 010    | 2944A07684  | HP                     | 1 year   | 2024-08-22     |
| 8  |     | RF Amplifier (1~26.5 GHz)            | 8449B            | 3008A02126  | HP                     | 1 year   | 2024-03-14     |
| 9  | ■   | Horn Antenna (1~18 GHz)              | 3115             | 00114105    | ETS                    | 2 year   | 2024-08-22     |
| 10 |     | DRG Horn (Small)                     | 3116B            | 81109       | ETS-Lindgren           | 2 year   | 2024-03-18     |
| 11 |     | DRG Horn (Small)                     | 3116B            | 133350      | ETS-Lindgren           | 2 year   | 2024-03-18     |
| 12 | ■   | TRILOG Antenna                       | VULB 9160        | 9160-3237   | SCHWARZBECK            | 2 year   | 2024-03-14     |
| 13 |     | Temp.Humidity Data Logger            | SK-L200TH II A   | 00801       | SATO                   | 1 year   | 2024-03-14     |
| 14 |     | Splitter (SMA)                       | ZFSC-2-2500      | SF617800326 | Mini-Circuits          | -        | -              |
| 15 | ■   | DC Power Supply                      | 6674A            | 3637A01657  | Agilent                | -        | -              |
| 17 | ■   | Power Meter                          | EPM-441A         | GB32481702  | HP                     | 1 year   | 2024-03-14     |
| 18 | ■   | Power Sensor                         | 8481A            | 3318A94972  | HP                     | 1 year   | 2024-08-22     |
| 19 |     | Audio Analyzer                       | 8903B            | 3729A18901  | HP                     | 1 year   | 2024-08-22     |
| 20 |     | Modulation Analyzer                  | 8901B            | 3749A05878  | HP                     | 1 year   | 2024-08-22     |
| 21 |     | TEMP & HUMIDITY Chamber              | YJ-500           | LTAS06041   | JinYoung Tech          | 1 year   | 2024-08-22     |
| 22 |     | Stop Watch                           | HS-3             | 812Q08R     | CASIO                  | 2 year   | 2026-03-14     |
| 23 |     | LISN                                 | KNW-407          | 8-1430-1    | Kyoritsu               | 1 year   | 2024-03-14     |
| 24 |     | Two-Lime V-Network                   | ESH3-Z5          | 893045/017  | R&S                    | 1 year   | 2024-03-14     |
| 25 |     | UNIVERSAL RADIO COMMUNICATION TESTER | CMU200           | 106243      | R&S                    | 1 year   | 2024-03-14     |
| 26 |     | Highpass Filter                      | WHKX1.5/15G-10SS | 74          | Wainwright Instruments | 1 year   | 2024-03-14     |
| 27 |     | Highpass Filter                      | WHKX3.0/18G-10SS | 118         | Wainwright Instruments | 1 year   | 2024-03-14     |
| 28 |     | OSP120 BASE UNIT                     | OSP120           | 101230      | R&S                    | 1 year   | 2024-03-14     |
| 29 |     | Signal Generator(100 kHz ~ 40 GHz)   | SMB100A03        | 177621      | R&S                    | 1 year   | 2024-03-14     |
| 30 |     | Signal Analyzer (10 Hz ~ 40 GHz)     | FSV40            | 101367      | R&S                    | 1 year   | 2024-03-14     |
| 31 | ■   | Active Loop Antenna                  | FMZB 1519        | 1519-031    | SCHWARZBECK            | 2 year   | 2024-03-16     |