

## FCC IC RF Test Report

**Report No.:** FCC\_IC\_SL20061801-UTC-002\_RFID\_Rev6

**FCC ID:** R32-10106653P1

**IC:** 5058A-10106653P1

**Test Model:** 10106653P1

**Received Date:** 01/04/2021

**Test Date:** 01/14/2021 - 08/19/2022

**Issued Date:** 08/22/2022

**Applicant name:** Onity, Inc

**Address:** 4001 Fairview Industrial Dr. SE, Salem, OR 97302

**Manufacturer:** Onity, Inc

**Address:** 4001 Fairview Industrial Dr. SE, Salem, OR 97302

**Issued By:** Bureau Veritas Consumer Products Services, Inc.

**Lab Address:** 775 Montague Expressway, Milpitas, CA 95035

**FCC Registration /  
Designation Number:** 540430

**ISED# / CAB identifier:** 4842D



**Testing Cert #2742-  
01**

**US1109**

**4842D**

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### Release Control Record

| Issue No.                              | Description       | Engineer | Reviewer | Date Issued |
|----------------------------------------|-------------------|----------|----------|-------------|
| FCC_IC_RF_SL20061801-UTC-002_RFID      | Original Release  | EC       | DD       | 01/27/2021  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev1 | Errors Correction |          |          | 04/26/2022  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev2 | Errors Correction | BQ       | SK       | 08/22/2022  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev3 | Errors Correction | BQ       | SK       | 08/30/2022  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev4 | Errors Correction | BQ       | SK       | 09/20/2022  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev5 | Errors Correction | BQ       | SK       | 09/28/2022  |
| FCC_IC_RF_SL20061801-UTC-002_RFID_Rev6 | Errors Correction | BQ       | SK       | 09/28/2022  |

## 1 Certificate of Conformity

**Product:** Serene Lock

**Brand:** Onity

**Test Model:** 10106653P1

**Series Model:** N/A

**Sample Status:** Engineering sample

**Applicant:** Onity, Inc.

**Test Date:** 01/14/2021 - 08/19/2022

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.225)

RSS 210 Issue 10, December 2019

ANSI C63.10:2013

RSS Gen Issue 5, March 2019

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :**  , **Date:** 01/27/2021  
Ellen Chu / Test Engineer

**Approved by :**  , **Date:** 01/27/2021  
Deon Dai / Engineer Review

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.225 / 15.215) |                                                                                              |        |                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------|--------|--------------------------------|
| RSS 210 Issue 10, RSS Gen Issue 5                       |                                                                                              |        |                                |
| FCC IC Clause                                           | Test Item                                                                                    | Result | Remarks                        |
| 15.207<br>RSS Gen 8.8                                   | AC Power Conducted Emission                                                                  | NA     | EUT is battery powered.        |
| 15.225 (a)<br>RSS 210<br>B.6.a.i                        | The field strength of any emissions within the band 13.553-13.567 MHz                        | Pass   | Meet the requirement of limit. |
| 15.225 (b)<br>RSS 210<br>B.6.a.ii                       | The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz | Pass   | Meet the requirement of limit. |
| 15.225 (c)<br>RSS 210<br>B.6.a.iii                      | The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz | Pass   | Meet the requirement of limit. |
| 15.225 (d)<br>RSS Gen                                   | The field strength of any emissions appearing outside of the 13.110-14.010 MHz band          | Pass   | Meet the requirement of limit. |
| 15.225 (e)<br>RSS 210<br>B.6.b                          | The frequency tolerance                                                                      | Pass   | Meet the requirement of limit. |
| 15.215 (c)<br>RSS Gen 6.7                               | 20dB Bandwidth & 99% Bandwidth                                                               | Pass   | Meet the requirement of limit. |

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement                        | Frequency      | Expanded Uncertainty (k=2) (±) |
|------------------------------------|----------------|--------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 3.51dB                         |
| Radiated Emissions up to 1 GHz     | 30MHz ~ 1GHz   | 3.73dB                         |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                     |                    |
|---------------------|--------------------|
| Product             | Serene Lock        |
| Brand               | Onity              |
| Test Model          | 10106653P1         |
| Status of EUT       | Engineering sample |
| Power Supply Rating | 6Vdc               |
| Modulation Type     | ASK                |
| Operating Frequency | 13.56 MHz          |
| Antenna Type        | Loop antenna       |
| Antenna inductance  | 1uH nominal        |

Note:

1. The above EUT information is declared by the manufacturer. For more details, please refer to the manufacturer's specifications or user's manual.

### 3.2 Description of Test Modes

3.2.1 1 channel is provided to this EUT

| Channel | Freq. (MHz) |
|---------|-------------|
| 1       | 13.56       |

RFID is a PCB type antenna, Execute the command Software provided by customer and it will transmit continuously the 13.56MHz.

3.2.2 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO |     |    |    | DESCRIPTION        |
|--------------------|---------------|-----|----|----|--------------------|
|                    | RE            | PLC | FS | EB |                    |
| -                  | √             | -   | √  | √  | Power from battery |

Where **RE**: Radiated Emission  
**FS**: Frequency Stability

**PLC**: Power Line Conducted Emission  
**EB**: 20dB Bandwidth measurement

**NOTE**: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

**NOTE**: "-" means no effect.

#### Radiated Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| -                  | 1                 | 1              | ASK             |

#### Frequency Stability:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| -                  | 1                 | 1              | ASK             |

#### Test Condition:

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | INPUT POWER | TESTED BY |
|---------------|--------------------------|-------------|-----------|
| <b>RE</b>     | 25deg. C, 65%RH          | 6Vdc        | Ellen Chu |
| <b>PLC</b>    | 25deg. C, 65%RH          | -           | -         |
| <b>FS</b>     | 25deg. C, 68%RH          | 6Vdc        | Ellen Chu |
| <b>BW</b>     | 21deg. C, 60%RH          | 6Vdc        | Ellen Chu |

### 3.3 Description of Support Units

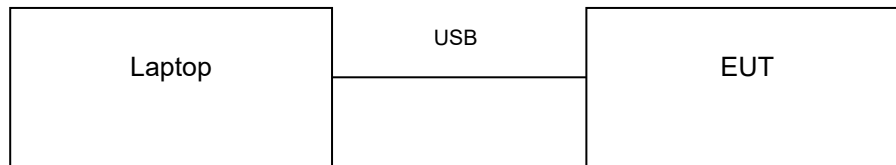
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product | Brand | Model No.     | Serial No. | FCC ID | Remarks              |
|----|---------|-------|---------------|------------|--------|----------------------|
| A. | Laptop  | Dell  | Latitude D630 | 84V6QF1    | -      | Provided by Customer |
| B. |         |       |               |            |        |                      |

| ID | Descriptions         | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks                    |
|----|----------------------|------|------------|--------------------|--------------|----------------------------|
| 1. | Blue Giga USB dongle | 1    | 0.02       | N                  | 0            | Connect from EUT to Laptop |

Note: The core(s) is(are) originally attached to the cable(s).

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**47 CFR FCC Part 15, Subpart C (Section 15.225)**  
**47 CFR FCC Part 15, Subpart C (Section 15.215)**  
**RSS 210 Issue 10, Decemeber 2019**  
**ANSI C63.10:2013**  
**RSS Gen Issue 5, March 2019**

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission Measurement

#### 4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

| Frequencies<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|----------------------|--------------------------------------|----------------------------------|
| 0.009 ~ 0.490        | 2400/F(kHz)                          | 300                              |
| 0.490 ~ 1.705        | 24000/F(kHz)                         | 30                               |
| 1.705 ~ 30.0         | 30                                   | 30                               |
| 30 ~ 88              | 100                                  | 3                                |
| 88 ~ 216             | 150                                  | 3                                |
| 216 ~ 960            | 200                                  | 3                                |
| Above 960            | 500                                  | 3                                |

#### NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$   
Limit Line (dBuV/m) =  $20 \log \text{Emission level (uV/m)} + \text{Distance extrapolation factor}$
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### 4.1.2 Test Instruments

##### Test Instruments for Testing Conducted in 2021

| DESCRIPTION & MANUFACTURER                  | MODEL NO.                | SERIAL NO.               | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|---------------------------------------------|--------------------------|--------------------------|---------------------|-------------------------|
| EMI Test Receiver<br>Keysight               | ESW 44                   | 1328.4100K-<br>101662-MH | 08/30/2020          | 08/30/2021              |
| Spectrum Analyzer<br>Keysight               | N9030B                   | 0240376                  | 06/15/2020          | 06/15/2021              |
| Hybrid Antenna<br>Sunol                     | JB1                      | A030702                  | 03/09/2020          | 03/09/2021              |
| Horn Antenna<br>ETS-Lindgren                | 3117                     | 218554                   | 11/22/2020          | 11/22/2021              |
| Preamplifier<br>RF-Lambda                   | RAMP00M50GA              | 17032300048              | 06/18/2020          | 06/18/2021              |
| Preamplifier<br>RF Bay, Inc.                | LPA-6-30                 | 11170601                 | 04/27/2020          | 04/27/2021              |
| FSB Antenna Cable, 0.5m<br>(Microwave Town) | FSB360PK-KMKM-<br>00.50M | 201906110002             | 10/1/2020           | 10/1/2021               |
| FSB Antenna Cable, 4m<br>(Microwave Town)   | FSB360PK-KMKM-<br>400M   | 202103270001             | 10/1/2020           | 10/1/2021               |
| 10m Semi-Anechoic<br>Chamber (ETS-Lindgren) | S2010BL8X8               | 1462                     | 07/21/2020          | 07/21/2021              |

**Test Instruments for Testing Conducted in 2022**

| Description & Manufacturer                      | MODEL NO.            | SERIAL NO.             | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|-------------------------------------------------|----------------------|------------------------|---------------------|-------------------------|
| Spectrum Analyzer Keysight                      | N9030B               | MY57140100             | 9/22/2021           | 9/22/2022               |
| EMI Test Receiver Rohde & Schwarz               | ESW44                | 1328.4100K44-101662-MH | 9/22/2021           | 9/22/2022               |
| Horn Antenna ETS-Lindgren                       | 3117                 | 214309                 | 4/21/2021           | 4/21/2023               |
| Horn Antenna, Sunol                             | DRH-118              | A070605                | 8/5/2020            | 08/05//2022             |
| Pre-Amplifier RF-Lambda                         | RAMP00M50GA          | 1.8E+10                | 5/7/2021            | 5/7/2022                |
| Biconilog Antenna, Sunol                        | JB1                  | A111717                | 9/4/2020            | 9/4/2022                |
| Agilent Signal Generator                        | MXG- N5182A          | MY47071065             | 9/22/2021           | 9/22/2022               |
| Tuned Dipole Antenna 30 - 1000 MHz (4pcs set)   | AD-100               | 40133                  | 1/23/2022           | 1/23/2023               |
| SMA Fixed Attenuator (50ohm, 2w, 30dB, DC-6GHz) | VAT-03W2+            | N/A                    | 7/21/2021           | 7/21/2022               |
| FSB Antenna Cable, 0.5m (Microwave Town)        | FSB360PK-KMKM-00.50M | 2.02E+11               | 10/1/2021           | 10/1/2022               |
| FSB Antenna Cable, 4m (Microwave Town)          | FSB360PK-KMKM-400M   | 2.02E+11               | 10/1/2021           | 10/1/2022               |
| 10m Semi-Anechoic Chamber (ETS-Lindgren)        | S2010BL8X8           | 1462                   | 7/21/2020           | 7/21/2022               |

#### 4.1.3 Test Procedures

##### **For Radiated emission below 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel and perpendicular orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### **NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

##### **For Radiated emission above 30MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

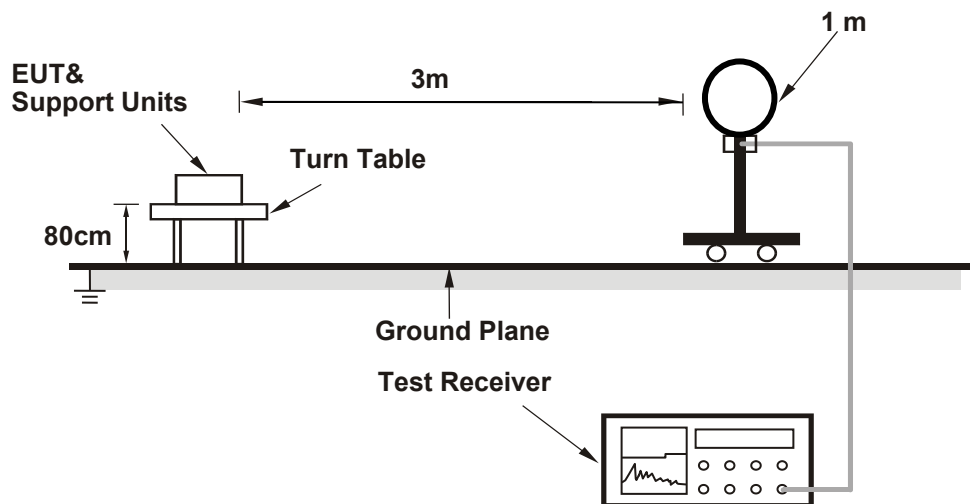
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

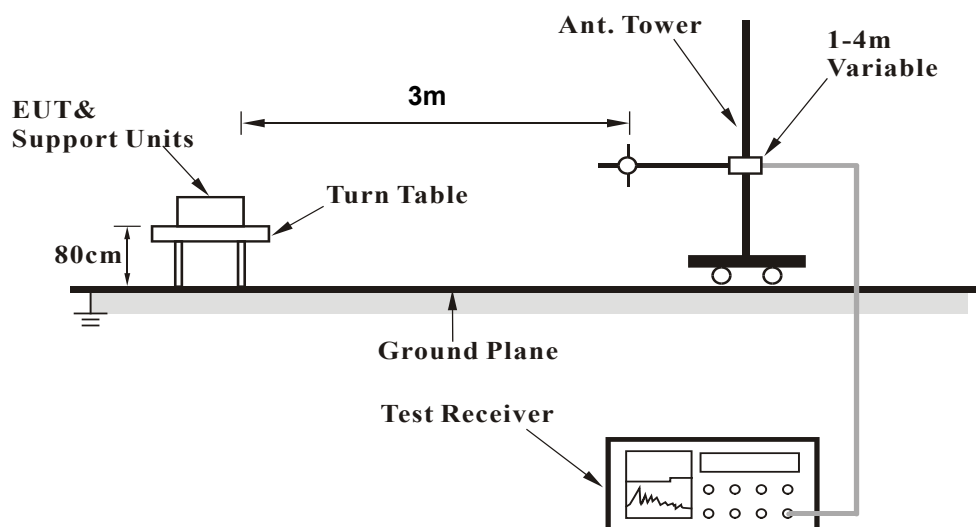
No deviation.

#### 4.1.5 Test Setup

##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



#### 4.1.6 EUT Operating Conditions

- Connected the EUT with the Notebook Computer which is placed on remote site.
- Controlling software has been activated to set the EUT on specific status.

#### 4.1.7 Test Results

### Radiated Emissions (9 kHz~30 MHz)

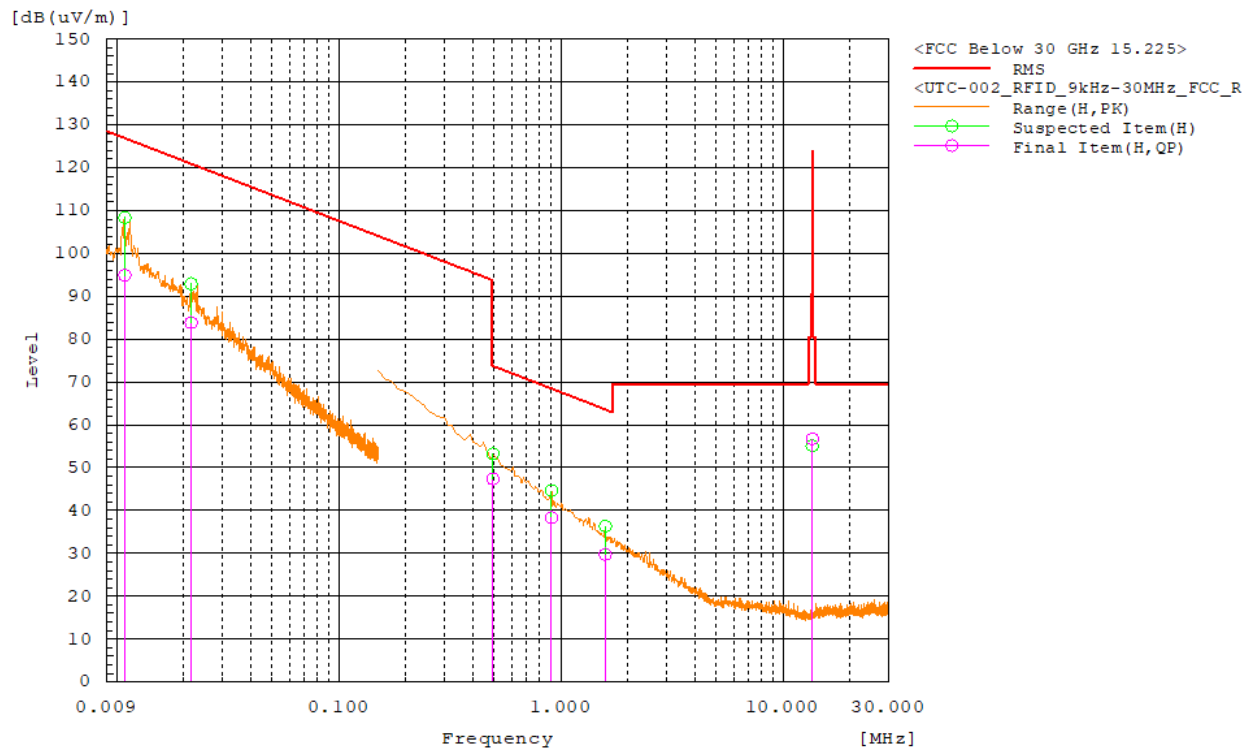
|                          |                       |                   |              |
|--------------------------|-----------------------|-------------------|--------------|
| Date Tested              | 08/15/2022            |                   |              |
| Channel                  | Channel 1             | Frequency Range   | 13.56MHz     |
| Input Power              | DC6V                  | Detector Function | Quasi-Peak   |
| Environmental Conditions | 26.8 deg. C, 36.3% RH | Tested By         | Brandon Quan |

#### Antenna Polarity & Test Distance: Loop Antenna H-Polarity At 3m

| No. | Frequency (MHz) | Polarization | Reading QP [dB(uV)] | Factor [dB(1/m)] | Level QP [dB(uV/m)] | Limit QP dB(uV/m) | Margin QP [dB] | 30m Level [dB(uV/m)] | 30m Limit [dB(uV/m)] | 30m Margin [dB] | Height (cm) | Angle (Deg) | Pass/Fail |
|-----|-----------------|--------------|---------------------|------------------|---------------------|-------------------|----------------|----------------------|----------------------|-----------------|-------------|-------------|-----------|
| 1   | 0.011           | H            | 43.5                | 51.4             | 94.9                | 126.9             | 32             | 54.9                 | N/A                  | N/A             | 100         | 341.8       | Pass      |
| 2   | 0.022           | H            | 37.3                | 46.5             | 83.8                | 120.9             | 37.1           | 43.8                 | N/A                  | N/A             | 100         | 47.5        | Pass      |
| 3   | 0.494           | H            | 29                  | 18.4             | 47.4                | 73.7              | 26.3           | 7.4                  | N/A                  | N/A             | 100         | 42          | Pass      |
| 4   | 0.908           | H            | 24.8                | 13.5             | 38.3                | 68.4              | 30.1           | -1.7                 | N/A                  | N/A             | 100         | 85.4        | Pass      |
| 5   | 1.585           | H            | 20.2                | 9.6              | 29.8                | 63.6              | 33.8           | -10.2                | N/A                  | N/A             | 100         | 283.8       | Pass      |
| 6   | 13.56           | H            | 55.1                | 1.6              | 56.7                | 124               | 67.3           | 16.7                 | 84                   | 67.3            | 100         | 185.2       | Pass      |

#### REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. All emissions higher than the fundamental are noise floor measurements.



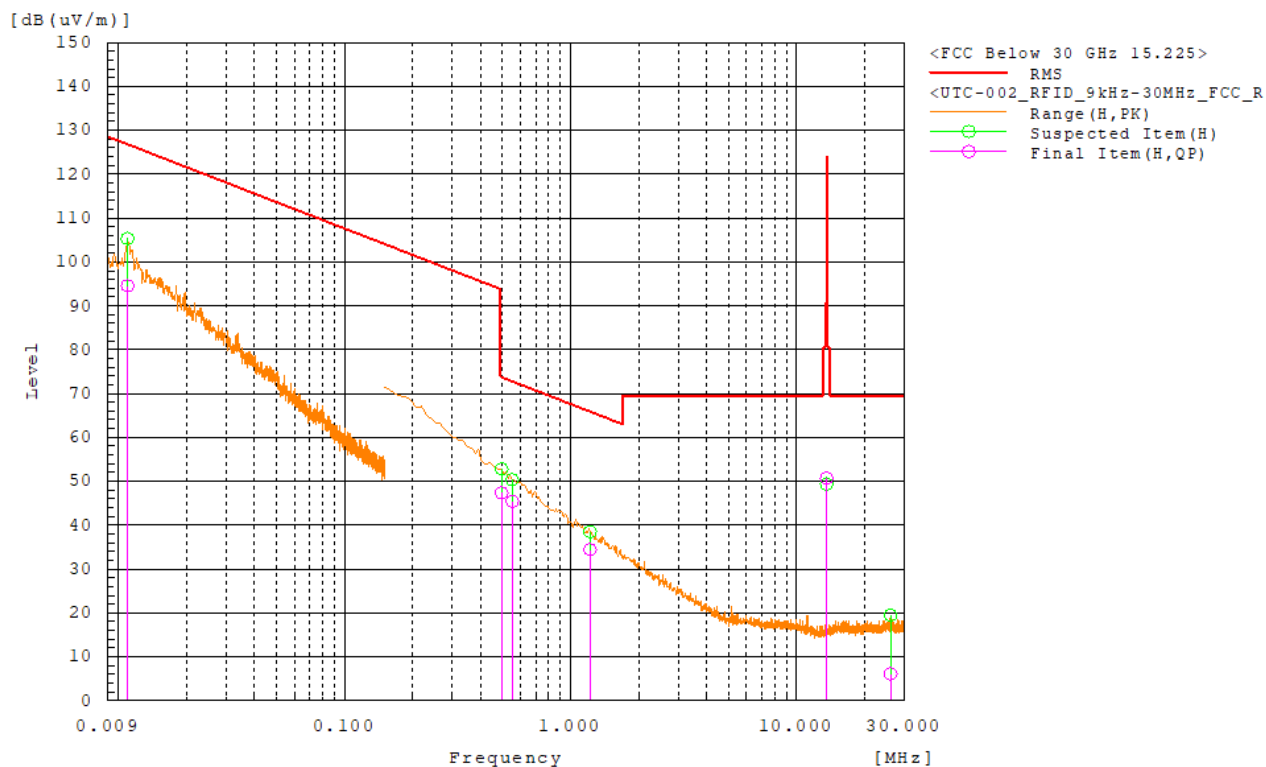
|                          |                       |                   |              |
|--------------------------|-----------------------|-------------------|--------------|
| Date Tested              | 08/15/2022            |                   |              |
| Channel                  | Channel 1             | Frequency Range   | Below 30MHz  |
| Input Power              | DC6V                  | Detector Function | Quasi-Peak   |
| Environmental Conditions | 26.8 deg. C, 36.3% RH | Tested By         | Brandon Quan |

Antenna Polarity & Test Distance: Loop Antenna V-Polarity At 3m

| No. | Frequency (MHz) | Polarization | Reading QP [dB(uV)] | Factor [dB(1/m)] | Level QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | 30m Level [dB(uV/m)] | 30m Limit [dB(uV/m)] | 30m Margin [dB] | Height (cm) | Angle (Deg) | Pass/Fail |
|-----|-----------------|--------------|---------------------|------------------|---------------------|---------------------|----------------|----------------------|----------------------|-----------------|-------------|-------------|-----------|
| 1   | 0.011           | V            | 43.1                | 51.4             | 94.5                | 126.8               | 32.3           | 54.5                 | N/A                  | N/A             | 100         | 95.6        | Pass      |
| 2   | 0.494           | V            | 28.9                | 18.4             | 47.3                | 73.7                | 26.4           | 7.3                  | N/A                  | N/A             | 100         | 358.7       | Pass      |
| 3   | 0.552           | V            | 27.9                | 17.5             | 45.4                | 72.8                | 27.4           | 5.4                  | N/A                  | N/A             | 100         | 26.1        | Pass      |
| 4   | 1.218           | V            | 23.1                | 11.4             | 34.5                | 65.9                | 31.4           | -5.5                 | N/A                  | N/A             | 100         | 268.8       | Pass      |
| 5   | 13.56           | V            | 49.1                | 1.6              | 50.7                | 124                 | 73.3           | 10.7                 | N/A                  | N/A             | 100         | 92.6        | Pass      |
| 6   | 25.993          | V            | 4.2                 | 1.9              | 6.1                 | 69.5                | 63.4           | -33.9                | 84                   | 117.9           | 100         | 0           | Pass      |

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. All emissions higher than the fundamental are noise floor measurements.



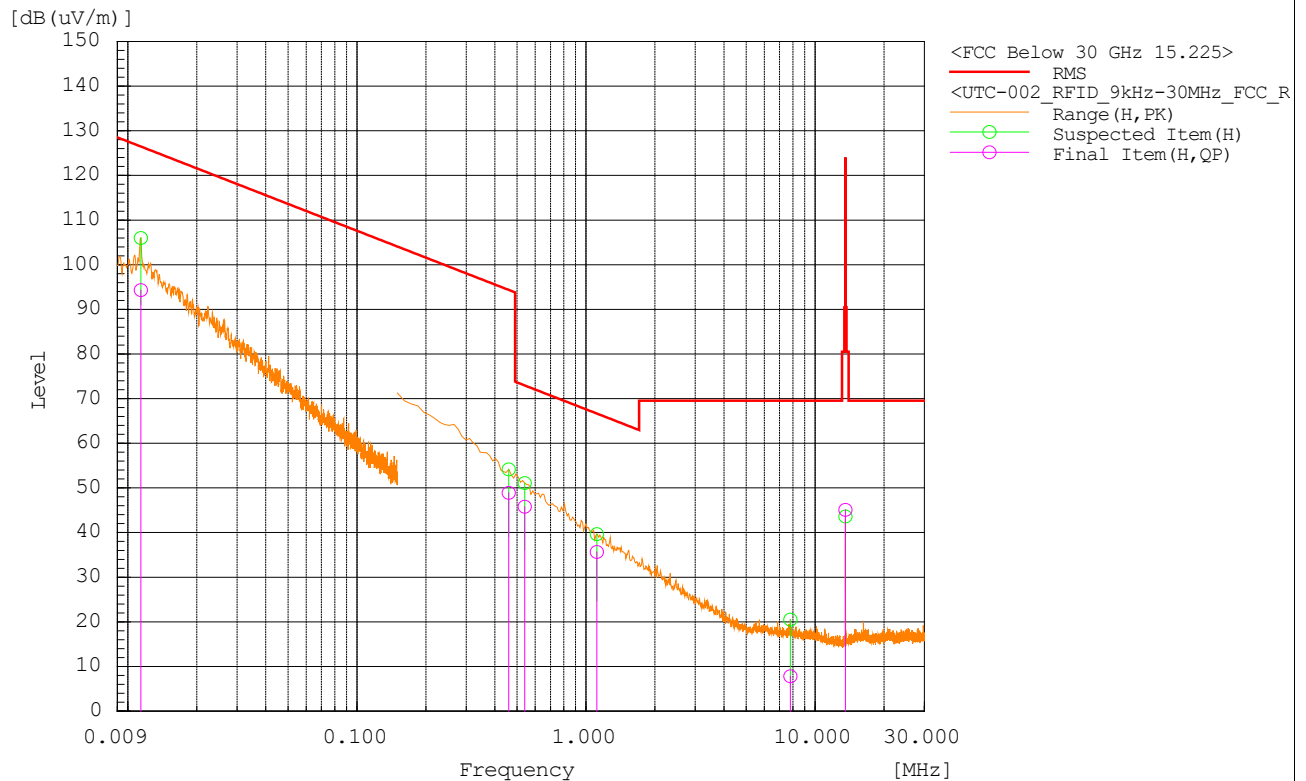
|                          |                       |                   |              |
|--------------------------|-----------------------|-------------------|--------------|
| EUT Test Condition       | 08/15/2022            |                   |              |
| Channel                  | Channel 1             | Frequency Range   | Below 30MHz  |
| Input Power              | DC6V                  | Detector Function | Quasi-Peak   |
| Environmental Conditions | 26.8 deg. C, 36.3% RH | Tested By         | Brandon Quan |

Antenna Polarity & Test Distance: Loop Antenna Z-Polarity At 3m

| No. | Frequency (MHz) | Polarization | Reading QP [dB(uV)] | Factor [dB(1/m)] | Level QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | 30m Level [dB(uV/m)] | 30m Limit [dB(uV/m)] | 30m Margin [dB] | Height (cm) | Angle (Deg) | Pass/Fail |
|-----|-----------------|--------------|---------------------|------------------|---------------------|---------------------|----------------|----------------------|----------------------|-----------------|-------------|-------------|-----------|
| 1   | 0.011           | Z            | 43                  | 51.3             | 94.3                | 126.5               | 32.2           | 54.3                 | N/A                  | N/A             | 100         | 355.9       | Pass      |
| 2   | 0.46            | Z            | 29.8                | 19.1             | 48.9                | 94.3                | 45.4           | 8.9                  | N/A                  | N/A             | 100         | 28.2        | Pass      |
| 3   | 0.54            | Z            | 28.1                | 17.7             | 45.8                | 73                  | 27.2           | 5.8                  | N/A                  | N/A             | 100         | 306.7       | Pass      |
| 4   | 1.114           | Z            | 23.7                | 12               | 35.7                | 66.7                | 31             | -4.3                 | N/A                  | N/A             | 100         | 109.9       | Pass      |
| 5   | 7.796           | Z            | 5.2                 | 2.6              | 7.8                 | 69.5                | 61.7           | -32.2                | N/A                  | N/A             | 100         | 357.9       | Pass      |
| 6   | 13.56           | Z            | 43.5                | 1.6              | 45.1                | 124                 | 78.9           | 5.1                  | 84                   | 78.9            | 100         | 178.5       | Pass      |

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. All emissions higher than the fundamental are noise floor measurements.



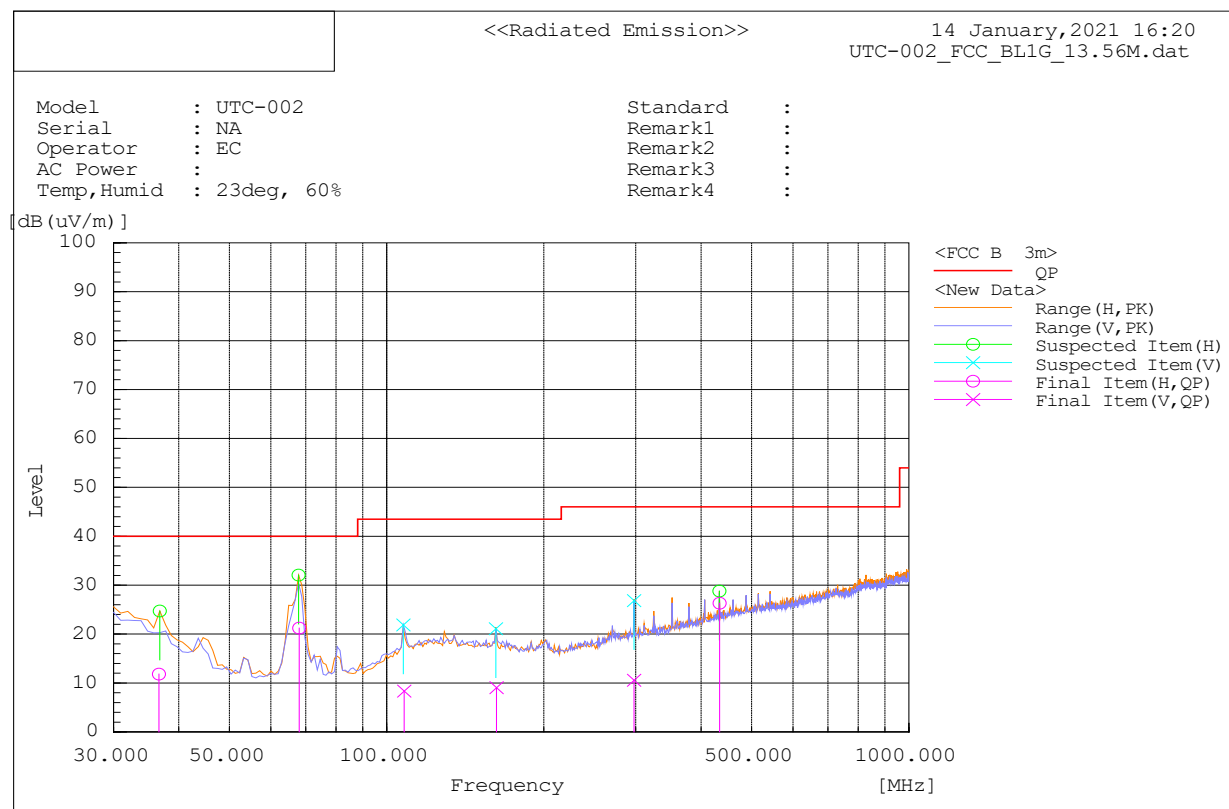
## Radiated Emissions (30 MHz~1000 MHz)

|                          |                   |                   |            |
|--------------------------|-------------------|-------------------|------------|
| EUT Test Condition       | 01/14/2021        |                   |            |
| Channel                  | Channel 1         | Frequency Range   | 13.56MHz   |
| Input Power              | DC 6V             | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 30% RH | Tested By         | Ellen Chu  |

| No. | Frequency (MHz) | Polarization | Reading QP [dB(uV)] | Factor [dB(1/m)] | Level QP [dB(uV/m)] | Limit\QP dB(uV/m) | Margin QP [dB] | Height (cm) | Angle (Deg) | Pass/Fail |
|-----|-----------------|--------------|---------------------|------------------|---------------------|-------------------|----------------|-------------|-------------|-----------|
| 1   | 36.643          | H            | -10.3               | 22.1             | 11.8                | 40                | -28.2          | 153         | 188.1       | Pass      |
| 2   | 68.051          | H            | 7.8                 | 13.4             | 21.2                | 40                | -18.8          | 100         | 284.9       | Pass      |
| 3   | 108.044         | V            | -9.9                | 18.2             | 8.3                 | 43.5              | -35.2          | 331         | 0           | Pass      |
| 4   | 162.317         | V            | -9.8                | 18.9             | 9.1                 | 43.5              | -34.4          | 294         | 76.2        | Pass      |
| 5   | 297.558         | V            | -9.6                | 20.2             | 10.6                | 46                | -35.4          | 256         | 37.1        | Pass      |
| 6   | 433.926         | H            | 2.6                 | 23.7             | 26.3                | 46                | -19.7          | 143         | 12.1        | Pass      |

### REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.



## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) |         |
|-----------------|------------------------|---------|
|                 | Quasi-peak             | Average |
| 0.15 - 0.5      | 66 - 56                | 56 - 46 |
| 0.50 - 5.0      | 56                     | 46      |
| 5.0 - 30.0      | 60                     | 50      |

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 4.2.2 Test Procedures

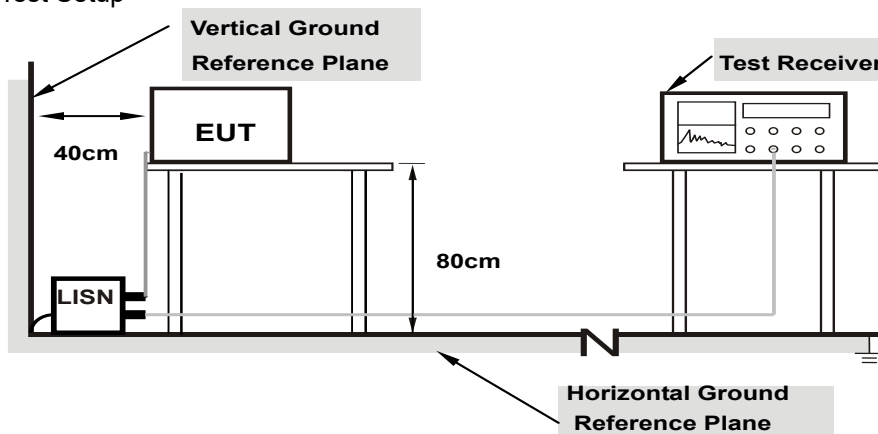
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

### 4.2.3 Deviation from Test Standard

No deviation.

### 4.2.4 Test Setup



**Note:** 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 4.2.5 EUT Operating Conditions

Same as 4.1.6.

### 4.2.6 Test Results

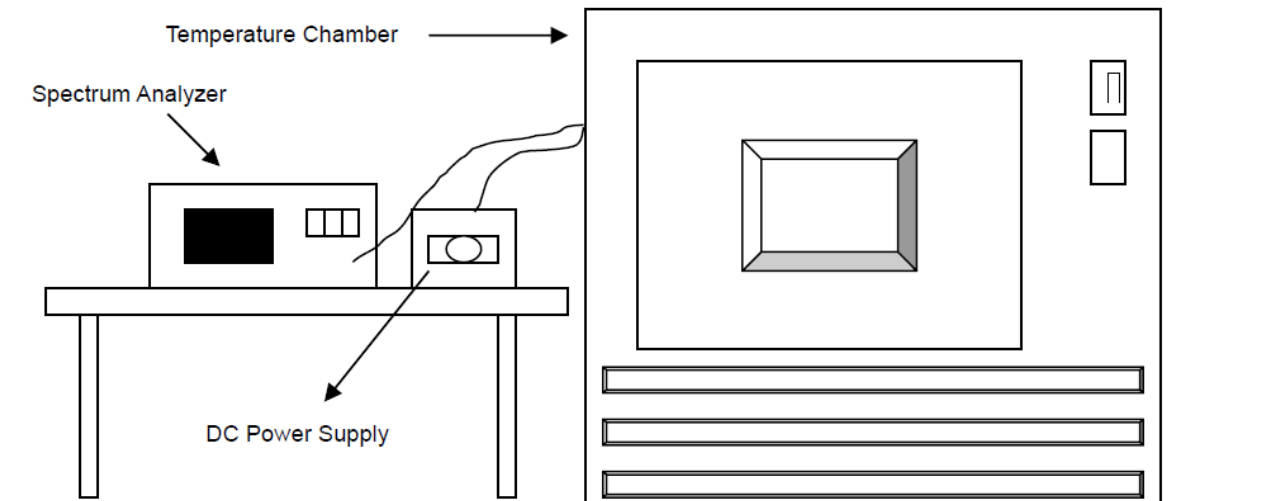
**N/A (Work with battery).**

### 4.3 Frequency Stability

#### 4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from  $85\%$  to  $115\%$  of the rated supply voltage at a temperature of  $20$  degrees C.

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turned the EUT on and coupled its output to a spectrum analyzer.
- Turned the EUT off and set the chamber to the highest temperature specified.
- Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- Repeated step 2 and 3 with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at  $+20$  degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from  $85\%$  to  $115\%$  and the frequency record.

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.3.7 Test Result

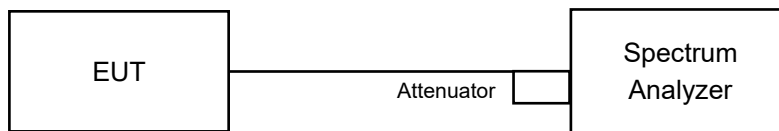
| Frequency Stability Versus Temp. |                       |                                |                        |               |
|----------------------------------|-----------------------|--------------------------------|------------------------|---------------|
| TEMP.<br>(°C)                    | Power<br>Supply (Vdc) | Measured<br>Frequency<br>(MHz) | Frequency Dev.<br>(Hz) | Deviation (%) |
| 50                               | 6                     | 13.56002                       | 20                     | 0.000147      |
| 40                               |                       | 13.55997                       | -30                    | -0.000221     |
| 30                               |                       | 13.55997                       | -30                    | -0.000221     |
| 20                               |                       | 13.56006                       | 60                     | 0.000442      |
| 10                               |                       | 13.55994                       | -60                    | -0.000442     |
| 0                                |                       | 13.56003                       | 30                     | 0.000221      |
| -10                              |                       | 13.55994                       | -60                    | -0.000442     |
| -20                              |                       | 13.56005                       | 50                     | 0.000369      |
| 20                               | 5.10                  | 13.55992                       | -80                    | -0.000590     |
|                                  | 6.90                  | 13.55994                       | -60                    | -0.000442     |

## 4.4 20dB Bandwidth

### 4.4.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

### 4.4.2 Test Setup



### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.4 Test Procedures

The following procedure shall be used for measuring 99% power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10KHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

### 4.4.5 Deviation from Test Standard

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.

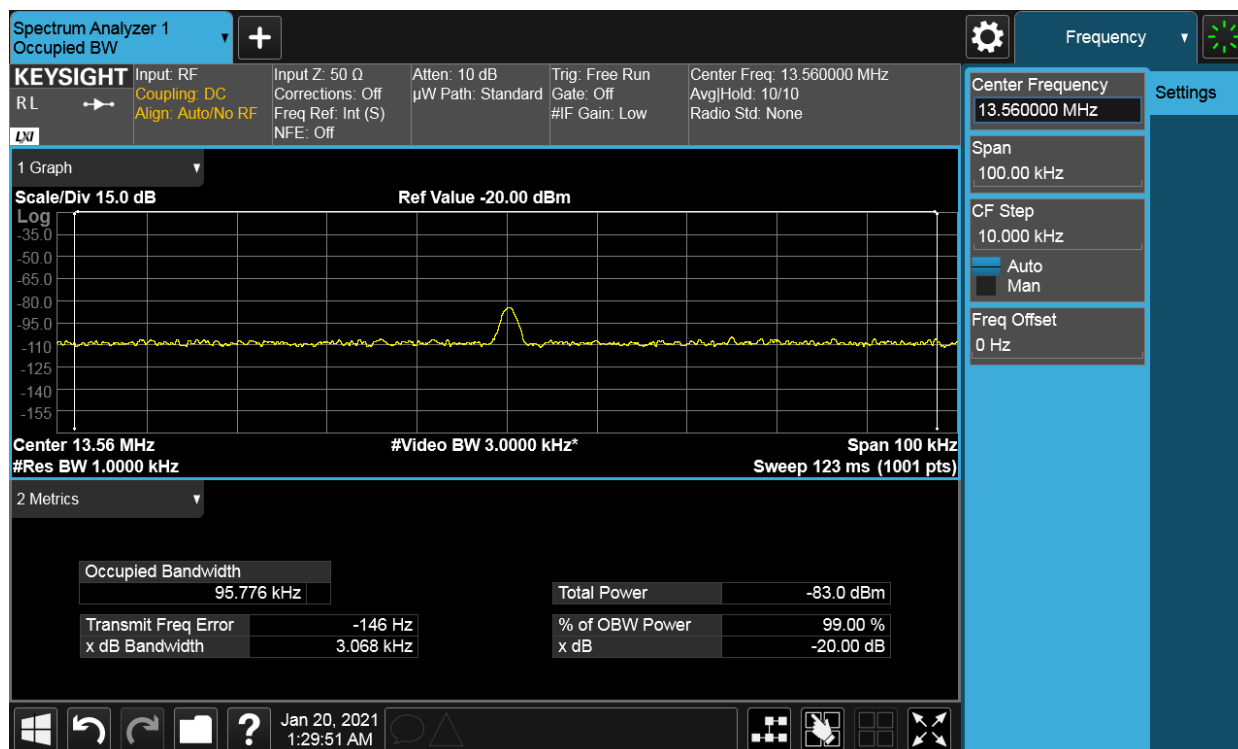
### 4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

#### 4.4.7 Test Results

| Frequency<br>(MHz) | 20dB Bandwidth<br>(kHz) | 99% Bandwidth<br>(kHz) |
|--------------------|-------------------------|------------------------|
| 13.56              | 3.068                   | 95.776                 |

#### Test Plots:



## 5 Pictures of Test Arrangements

Please see setup photo file.

## Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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**Web Site:** [www.cpsusa-bureauveritas.com](http://www.cpsusa-bureauveritas.com)

The address and road map of all our labs can be found in our web site also.

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