RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

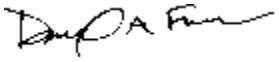
**Certification Application Report**
**FCC Part 15.249 & Industry Canada RSS-210**

| Test Lab: | Applicant: |
|---|---|
| Rhein Tech Laboratories, Inc. Phone: 703-689 0368<br>360 Herndon Parkway www.rheintech.com<br>Suite 1400 atcbinfo@rheintech.com<br>Herndon, VA 20170 | Alula<br>2340 Energy Park Drive, Suite 100<br>St. Paul, MN 55108<br>Contact: Chris Weltzien |

| | | | |
|---|---|---|---|
| **FCC ID/ IC** | U5X-RE663/ 8310A-RE663 | **Test Report Date** | April 7, 2021 |
| **Platform** | N/A | **RTL Work Order #** | 2020190 |
| **Model** | RE663 | **RTL Quote #** | QRTL20-190 |
| **American National Standard Institute** | ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices | | |
| **FCC Classification** | DXT – Part 15 Low Power Transceiver | | |
| **FCC Rule Part(s)/ Guidance** | 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz, October 1, 2019 | | |
| **Industry Canada** | RSS-210 License-Exempt Radio Apparatus: Category I Equipment Issue 10 December 2019<br>RSS-Gen Issue 5 March 2019 Amendment 1 General Requirements for Compliance of Radio Apparatus | | |

| Frequency Range (MHz) | Output Power (W) | Frequency Tolerance | Emission Designator |
|---|---|---|---|
| 2402 – 2480 | N/A | N/A | 318KFXD |

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, RSS-210, and ANSI C63.10.

Signature:  Date: April 7, 2021

Typed/Printed Name: Desmond A. Fraser Position: President

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# 1 General Information

## 1.1 Scope

This is an original certification application request.

Applicable Standards:

- FCC Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

## 1.2 Description of EUT

| | |
|---|---|
| **Equipment Under Test** | LED Keypad |
| **Model** | RE663 |
| **Power Supply** | 12V |
| **Modulation Type** | GFSK |
| **Frequency Range** | 2402 – 2480 MHz |
| **Antenna Connector Type** | Trace |

## 1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170.

ISED No.: 2956A
U.S. Identification No.: US0079

## 1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Alula LED Keypad, Model: RE663, FCC ID: U5X-RE663, IC: 8310A-RE663.

## 1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

# 2 Test Information

## 2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

**Table 2-1: Channels Tested**

| Channel | Frequency |
|---|---|
| Low | 2402 |
| Middle | 2442 |
| High | 2480 |

## 2.2 Exercising the EUT

The EUT was supplied with test firmware programmed with a high, mid, and low channel for testing, at the maximum power. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted.

## 2.3 Test Result Summary

**Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.249)**

| Test | FCC Reference | ISED Reference | Pass/Fail or N/A |
|---|---|---|---|
| AC Power Conducted Emissions | 15.207 | RSS-Gen 8.8 | Pass |
| Radiated Emissions | 15.209 | RSS-Gen 6.13/7.1 | Pass |
| Field Strength of Fundamental and Harmonics | 15.249(a) | RSS-210 Issue 10 B.10 | Pass |
| 99% Bandwidth | N/A | RSS-Gen 6.7 | Pass |

### 2.4 Test System Details

The test samples were received on December 2, 2020. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

**Table 2-3: Equipment Under Test**

| Part | Manufacturer | Model | Serial Number | FCC ID | Cable Description | RTL Bar Code |
|---|---|---|---|---|---|---|
| LED Keypad | Alula | RE663 | No | U5X-RE663 | N/A | 23683 |
| Switching Adapter | Amigo | AMS135-1201000FU | 20040551467 | N/A | Unshielded | 23684 |

### 2.5 Configuration of Tested System

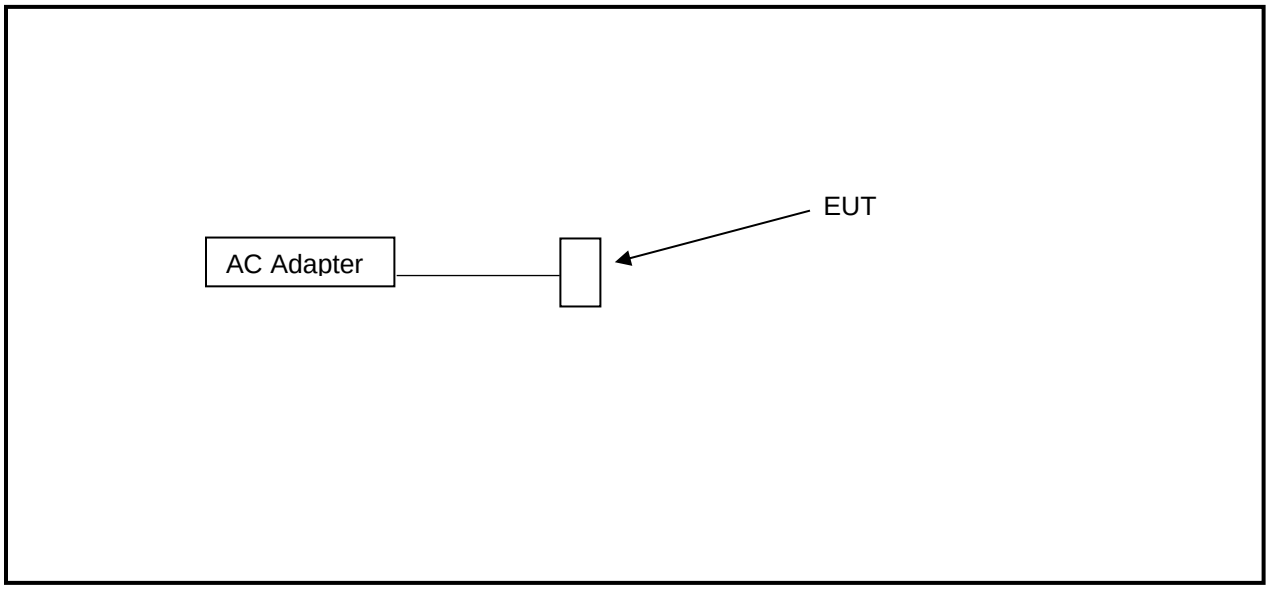



**Figure 2-1: Configuration of System Under Test**

## 3 Radiated Emissions – FCC 15.209, 15.249(a); ISED RSS-210 B.10; RSS-Gen 8.9/8.10

### 3.1 Limits of Radiated Emissions Measurement

| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009-0.490 | 2400/f (kHz) | 300 |
| 0.490-1.705 | 2400/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 |

As shown in 15.35(b), for frequencies above 1000 MHz, 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 20 dB under any circumstances of modulation.

### 3.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the $10^{th}$ harmonic of the highest fundamental transmitter frequency (24.8 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

**Table 3-1: Radiated Emissions Test Equipment**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901669 | ETS-Lindgren | 3142E | Antenna (26 - 6000 MHz) | 00166065 | 4/24/22 |
| 900772 | EMCO | 3161-02 | Horn Antenna (2 - 4 GHz) | 9804-1044 | 5/17/21 |
| 900321 | EMCO | 3161-03 | Horn Antenna (4 - 8.2 GHz) | 9528-1020 | 5/17/21 |
| 900323 | EMCO | 3160-07 | Horn Antenna (8.2 - 12.4 GHz) | 9605-1024 | 5/17/21 |
| 900356 | EMCO | 3160-08 | Horn Antenna (12.4 - 18.0 GHz) | 9607-1044 | 5/17/21 |
| 901218 | EMCO | 3160-09 | Horn Antenna (18 - 26 GHz) | 960281-003 | 5/5/21 |
| 900905 | Rhein Tech Labs | PR-1040 | Amplifier (20 - 2000 MHz) | 1006 | 8/29/21 |
| 901723 | Amplifier | 8449B | Amplifier (1 - 26.5 GHz) | 3008A00762 | 9/3/21 |
| 901583 | Agilent | N9010A | EXA Signal Analyzer | MY51250846 | 2/6/21 |

### 3.3 Radiated Emissions Test Results

#### 3.3.1 Fundamental Radiated Emissions Test Data

**Table 3-2: Fundamental Radiated Emissions**

| Emission Frequency (MHz) | Peak Analyzer Reading (dBuV/m) (1 MHz RBW/ 3 MHz VBW) | Site Correction Factor (dB/m) | Peak Corrected (dBuV/m) | Peak Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|
| 2402 | 86.7 | 25.3 | 112.0 | 114.0 | -2.0 |
| 2442 | 85.3 | 26.4 | 111.7 | 114.0 | -2.3 |
| 2480 | 87.4 | 25.6 | 113.0 | 114.0 | -1.0 |

| Emission Frequency (MHz) | Calculated Average DCCF = 20 dB (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|
| 2402 | 92.0 | 94.0 | -2.0 |
| 2442 | 91.7 | 94.0 | -2.3 |
| 2480 | 93.0 | 94.0 | -1.0 |

#### 3.3.2 Radiated Emissions Harmonics/Spurious Test Data

**Table 3-3: Radiated Emissions Harmonics/Spurious - 2402 MHz (Peak)**

| Emission Frequency (MHz) | Peak Analyzer Reading (dBuV) (1 MHz RBW/ 3 MHz VBW) | Site Correction Factor (dB/m) | Peak Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) |
|---|---|---|---|---|---|
| 4804.0 | 55.4 | -2.5 | 52.9 | 74.0 | -21.1 |
| 7206.0 | 71.5 | 0.1 | 71.6 | 74.0 | -2.4 |
| 9608.0 | 62.2 | 4.3 | 66.5 | 74.0 | -7.5 |
| 12010.0 | 52.2 | 7.2 | 59.4 | 74.0 | -14.6 |
| 14412.0 | 49.7 | 13.6 | 63.3 | 74.0 | -10.7 |
| 16814.0* | 51.0 | 4.1 | 55.1 | 74.0 | -18.9 |
| 19216.0* | 45.3 | 8.0 | 53.3 | 74.0 | -20.7 |
| 21618.0* | 46.0 | 7.0 | 53.0 | 74.0 | -21.0 |
| 24020.0* | 45.6 | 11.8 | 57.4 | 74.0 | -16.6 |

** testing performed at 1m, interpolated to 3m*

**Table 3-4: Radiated Emissions Harmonics/Spurious - 2442 MHz (Peak)**

| Emission Frequency (MHz) | Peak Analyzer Reading (dBuV) (1 MHz RBW/ 3 MHz VBW) | Site Correction Factor (dB/m) | Peak Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) |
|---|---|---|---|---|---|
| 4884.0 | 57.7 | -2.6 | 55.1 | 74.0 | -18.9 |
| 7326.0 | 71.3 | 0.1 | 71.4 | 74.0 | -2.6 |
| 9768.0 | 62.2 | 5.3 | 67.5 | 74.0 | -6.5 |
| 12210.0 | 52.9 | 7.4 | 60.3 | 74.0 | -13.7 |
| 14652.0 | 50.4 | 13.7 | 64.1 | 74.0 | -9.9 |
| 17094.0* | 49.6 | 4.2 | 53.8 | 74.0 | -20.2 |
| 19536.0* | 45.7 | 7.3 | 53.0 | 74.0 | -21.0 |
| 21978.0* | 43.1 | 13.5 | 56.6 | 74.0 | -17.4 |
| 24420.0* | 44.8 | 11.6 | 56.4 | 74.0 | -17.6 |

** testing performed at 1m, interpolated to 3m*

**Table 3-5: Radiated Emissions Harmonics/Spurious - 2480 MHz (Peak)**

| Emission Frequency (MHz) | Peak Analyzer Reading (dBuV) (1 MHz RBW/ 3 MHz VBW) | Site Correction Factor (dB/m) | Peak Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Peak Margin (dB) |
|---|---|---|---|---|---|
| 4960.0 | 60.3 | -2.6 | 57.7 | 74.0 | -16.3 |
| 7440.0 | 67.4 | 0.2 | 67.6 | 74.0 | -6.4 |
| 9920.0 | 63.2 | 5.5 | 68.7 | 74.0 | -5.3 |
| 12400.0 | 57.5 | 7.1 | 64.6 | 74.0 | -9.4 |
| 14880.0 | 49.5 | 13.3 | 62.8 | 74.0 | -11.2 |
| 17360.0* | 48.5 | 4.4 | 52.9 | 74.0 | -21.1 |
| 19840.0* | 48.6 | 7.3 | 55.9 | 74.0 | -18.1 |
| 22320.0* | 47.5 | 13.0 | 60.5 | 74.0 | -13.5 |
| 24800.0* | 43.0 | 12.3 | 55.3 | 74.0 | -18.7 |

** testing performed at 1m, interpolated to 3m*

**Table 3-6: Radiated Emissions Harmonics/Spurious - 2402 MHz (Average)**

| Emission Frequency (MHz) | Calculated Average (dBuV) | Site Correction Factor (dB/m) | Average Emission Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) |
|---|---|---|---|---|---|
| 4804.0 | 35.4 | -2.5 | 32.9 | 54.0 | -21.1 |
| 7206.0 | 51.5 | 0.1 | 51.6 | 54.0 | -2.4 |
| 9608.0 | 42.2 | 4.3 | 46.5 | 54.0 | -7.5 |
| 12010.0 | 32.2 | 7.2 | 39.4 | 54.0 | -14.6 |
| 14412.0 | 29.7 | 13.6 | 43.3 | 54.0 | -10.7 |
| 16814.0 | 31.0 | 4.1 | 35.1 | 54.0 | -18.9 |
| 19216.0 | 25.3 | 8.0 | 33.3 | 54.0 | -20.7 |
| 21618.0 | 26.0 | 7.0 | 33.0 | 54.0 | -21.0 |
| 24020.0 | 25.6 | 11.8 | 37.4 | 54.0 | -16.6 |

**Table 3-7: Radiated Emissions Harmonics/Spurious - 2442 MHz (Average)**

| Emission Frequency (MHz) | Calculated Average (dBuV) | Site Correction Factor (dB/m) | Average Emission Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) |
|---|---|---|---|---|---|
| 4884 | 37.7 | -2.6 | 35.1 | 54.0 | -18.9 |
| 7326 | 51.3 | 0.1 | 51.4 | 54.0 | -2.6 |
| 9768 | 42.2 | 5.3 | 47.5 | 54.0 | -6.5 |
| 12210 | 32.9 | 7.4 | 40.3 | 54.0 | -13.7 |
| 14652 | 30.4 | 13.7 | 44.1 | 54.0 | -9.9 |
| 17094.0 | 29.6 | 4.2 | 33.8 | 54.0 | -20.2 |
| 19536.0 | 25.7 | 7.3 | 33.0 | 54.0 | -21.0 |
| 21978.0 | 23.1 | 13.5 | 36.6 | 54.0 | -17.4 |
| 24420.0 | 24.8 | 11.6 | 36.4 | 54.0 | -17.6 |

**Table 3-8: Radiated Emissions Harmonics/Spurious - 2480 MHz (Average)**

| Emission Frequency (MHz) | Calculated Average (dBuV) | Site Correction Factor (dB/m) | Average Emission Level (dBuV/m) | Average Limit (dBuV/m) | Average Margin (dB) |
|---|---|---|---|---|---|
| 4960.0 | 40.3 | -2.6 | 37.7 | 54.0 | -16.3 |
| 7440.0 | 47.4 | 0.2 | 47.6 | 54.0 | -6.4 |
| 9920.0 | 43.2 | 5.5 | 48.7 | 54.0 | -5.3 |
| 12400.0 | 37.5 | 7.1 | 44.6 | 54.0 | -9.4 |
| 14880.0 | 29.5 | 13.3 | 42.8 | 54.0 | -11.2 |
| 17360.0 | 28.5 | 4.4 | 32.9 | 54.0 | -21.1 |
| 19840.0 | 28.6 | 7.3 | 35.9 | 54.0 | -18.1 |
| 22320.0 | 27.5 | 13 | 40.5 | 54.0 | -13.5 |
| 24800.0 | 23.0 | 12.3 | 35.3 | 54.0 | -18.7 |

### 3.3.3 Radiated Emissions Digital Test Data

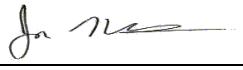
**Table 3-9: Digital Radiated Emissions Test Data (Standard)**

| Emission Frequency (MHz) | Detector | Azimuth (degrees) | Height (meters) | Antenna Polarity (H/V) | Emission Level (dBuV) | Site Factor (dB) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pass/Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| 63.768 | QP | 190 | 1.0 | V | 50.7 | -22.6 | 28.1 | 40.0 | -11.9 | Pass |
| 69.930 | QP | 330 | 1.5 | H | 45.7 | -22.2 | 23.5 | 40.0 | -16.5 | Pass |
| 82.500 | QP | 90 | 1.0 | H | 47.4 | -22.6 | 24.8 | 40.0 | -15.2 | Pass |
| 87.447 | QP | 80 | 1.2 | H | 41.2 | -22.6 | 18.5 | 40.0 | -21.5 | Pass |
| 111.376 | QP | 355 | 1.0 | V | 45.0 | -19.8 | 25.2 | 43.5 | -18.3 | Pass |
| 155.813 | QP | 290 | 1.0 | V | 40.8 | -17.5 | 23.4 | 43.5 | -20.1 | Pass |
| 181.637 | QP | 220 | 1.0 | H | 40.5 | -17.7 | 22.8 | 43.5 | -20.7 | Pass |
| 280.106 | QP | 75 | 1.2 | V | 39.0 | -13.7 | 25.3 | 46.0 | -20.7 | Pass |
| 286.388 | QP | 90 | 1.0 | V | 37.5 | -14.0 | 23.6 | 46.0 | -22.4 | Pass |

Notes:
-Tested at 3 meters unless noted otherwise. All emissions not listed were found to have amplitudes attenuated by more than 20 dB below the limit.
-Average field strength calculated from peak corrected by the Duty Cycle Correction Factor.
-Duty cycle correction = 20LOG(dwell time/pulse-train of 100 mS)
-Maximum on time in a 100 mS window is 4.47 mS (dwell time/pulse-train of 100 mS) = 4.47%
-Correction factor = 20.0 dB (max allowed)

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. ±4.6 dB

**Test Personnel:**

| Jon Wilson |  | December 3-10, 2020 |
|---|---|---|
| EMC Test Engineer | Signature | Date of Test |

## 4 AC Conducted Emissions - FCC 15.207; ISED RSS-Gen 7.2: AC Power Line Conducted Limits

### 4.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers a DC power supply which powers the EUT.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable).

The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

### 4.2 Test Limits

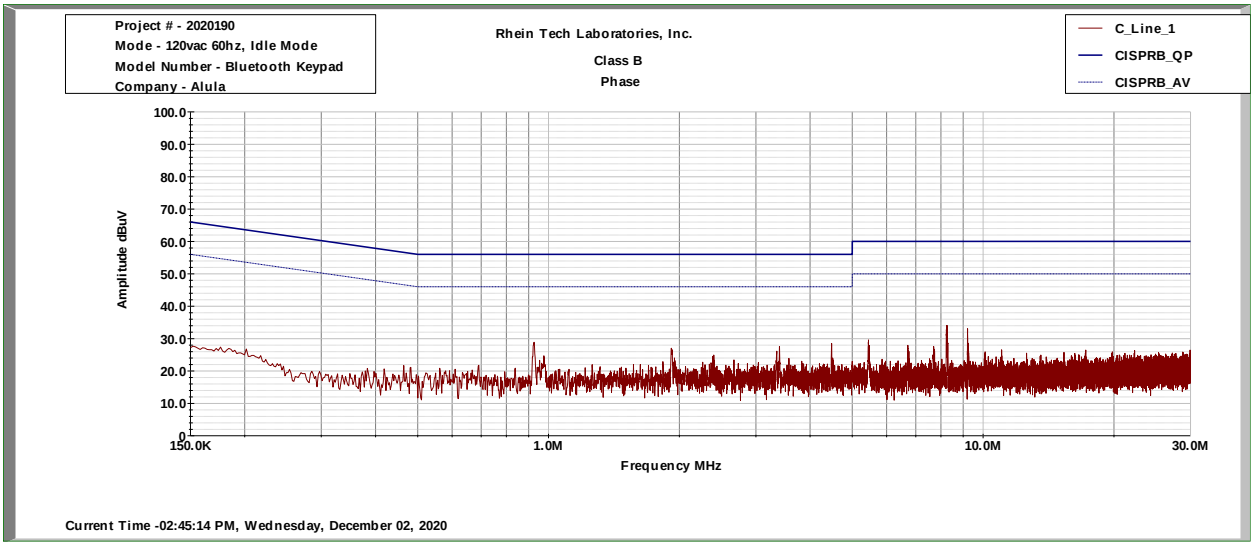
| Line-Conducted Emissions | | |
|---|---|---|
| Limit (dBµV) | | |
| **Frequency (MHz)** | **Quasi-Peak** | **Average** |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5.00 | 56 | 46 |
| 5.00 to 30.00 | 60 | 50 |

**Table 4-1: Conducted Emissions Test Equipment**

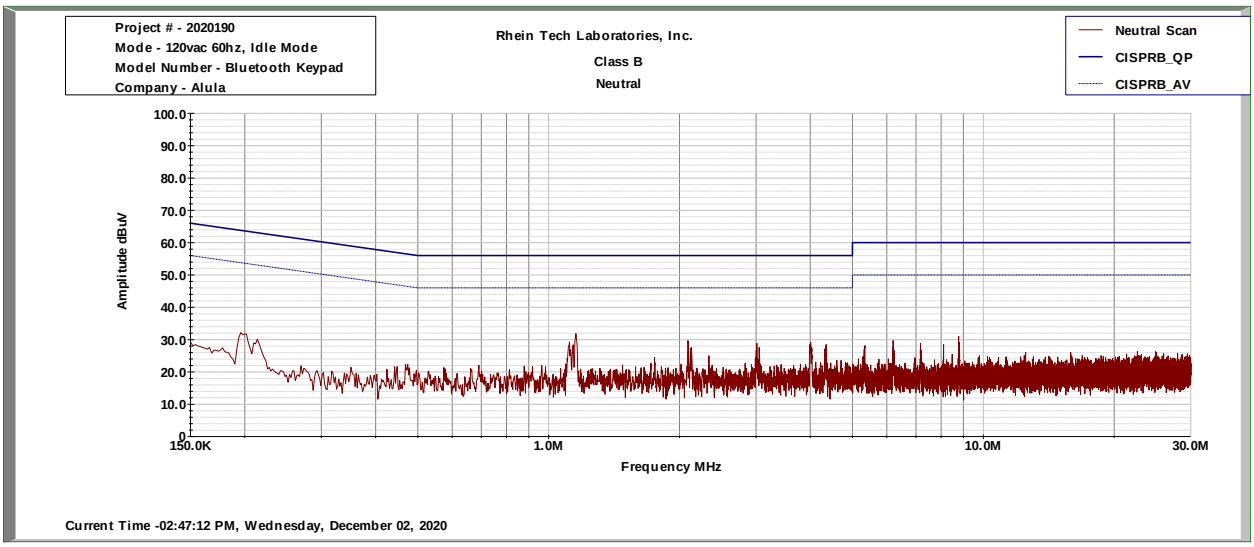
| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 900339 | Hewlett Packard | 85650A | Quasi-Peak Adapter | 2521A00743 | 4/24/21 |
| 900728 | SOLAR | 8130 | Filter | 947305 | 4/24/21 |
| 900970 | Hewlett Packard | 85662A | Spectrum Analyzer Display Section | 2542A11239 | 4/30/21 |
| 900968 | Hewlett Packard | 8567A | Spectrum Analyzer (10 kHz-1.5 GHz) | 2602A00160 | 4/30/21 |
| 901083 | AFJ International | LS16/110VAC | 16A LISN | 16010020080 | 2/13/21 |
| N/A | Quantum Change | Tile! | Test Software | 4.0.A.8 | N/A |

## 4.3 Conducted Emissions Test Data

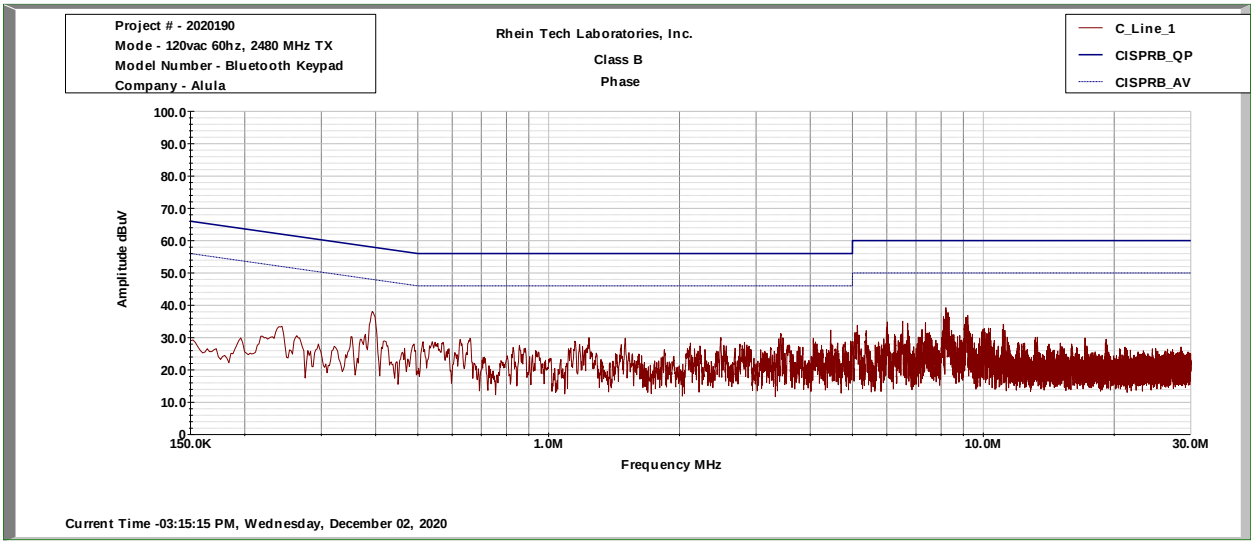
### Plot 4-1: Conducted Emissions – Phase – Idle Mode



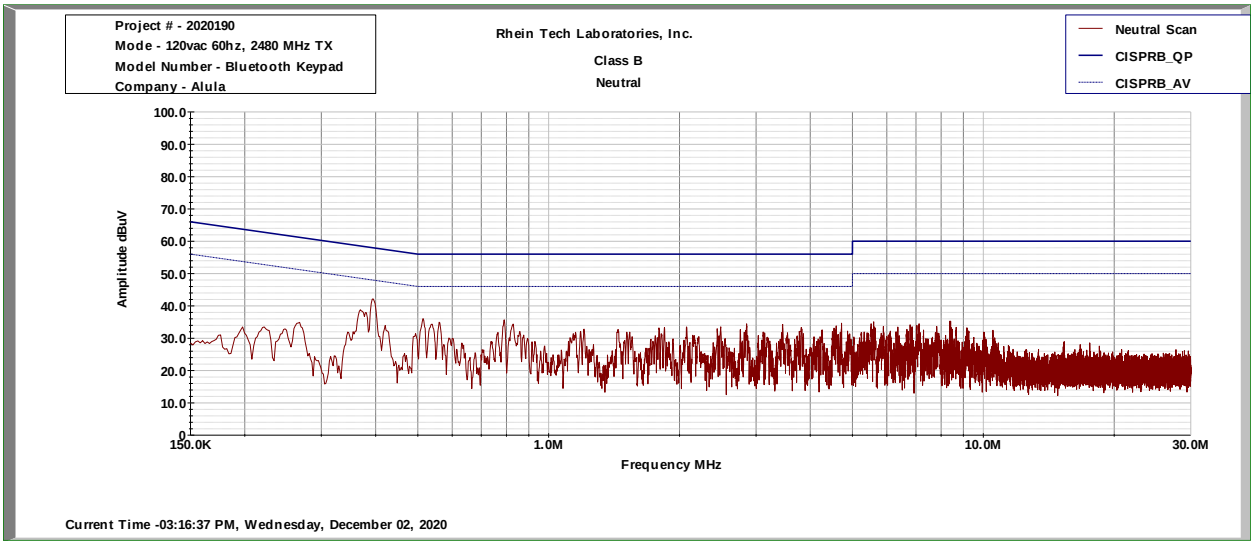

### Plot 4-2: Conducted Emissions – Neutral – Idle Mode



**Plot 4-3: Conducted Emissions – Phase – TX Mode**




**Plot 4-4: Conducted Emissions – Neutral – TX Mode**




Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. ±3.6 dB

**Test Personnel:**

| Jon Wilson | | December 2, 2020 |
|---|---|---|
| EMC Test Engineer | Signature | Date of Test |

# 5 99% Bandwidth – ISED RSS-Gen 6.7

## 5.1 99% Bandwidth Test Procedure

The 99% bandwidth per RSS-Gen was measured using a 50-ohm spectrum analyzer, per C63.10 6.9.2. The modulated carrier was adjusted on the analyzer with the RBW 1-5% of the occupied bandwidth and the span 1-5 times the occupied bandwidth. The sweep time was auto and allowed through several sweeps with the max hold function used in peak detector mode. The table below contains the bandwidth measurement results.

**Table 5-1: 99% Bandwidth Test Equipment**

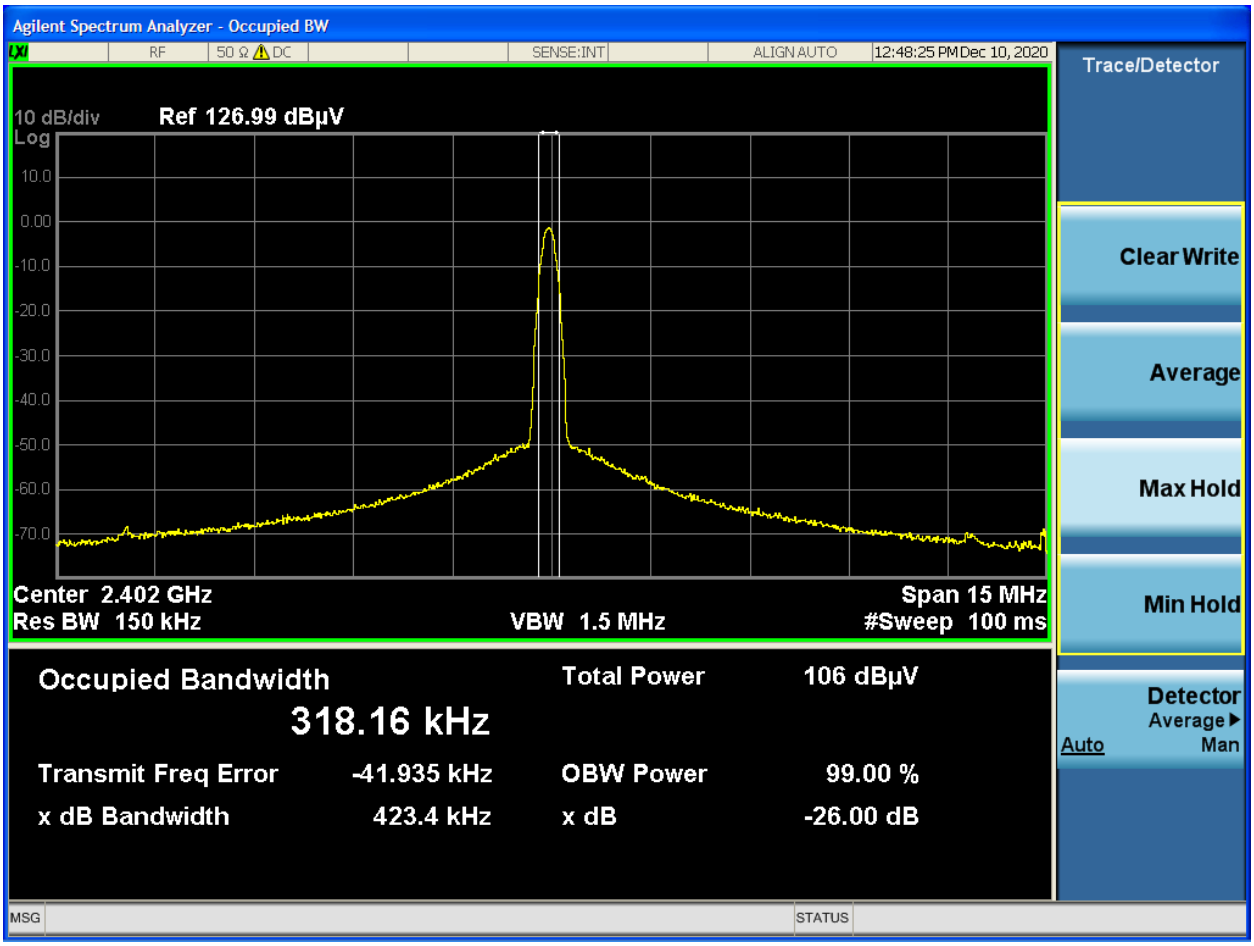
| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901583 | Agilent | N9010A | EXA Signal Analyzer | MY51250846 | 2/6/21 |

## 5.2 Bandwidth Test Data

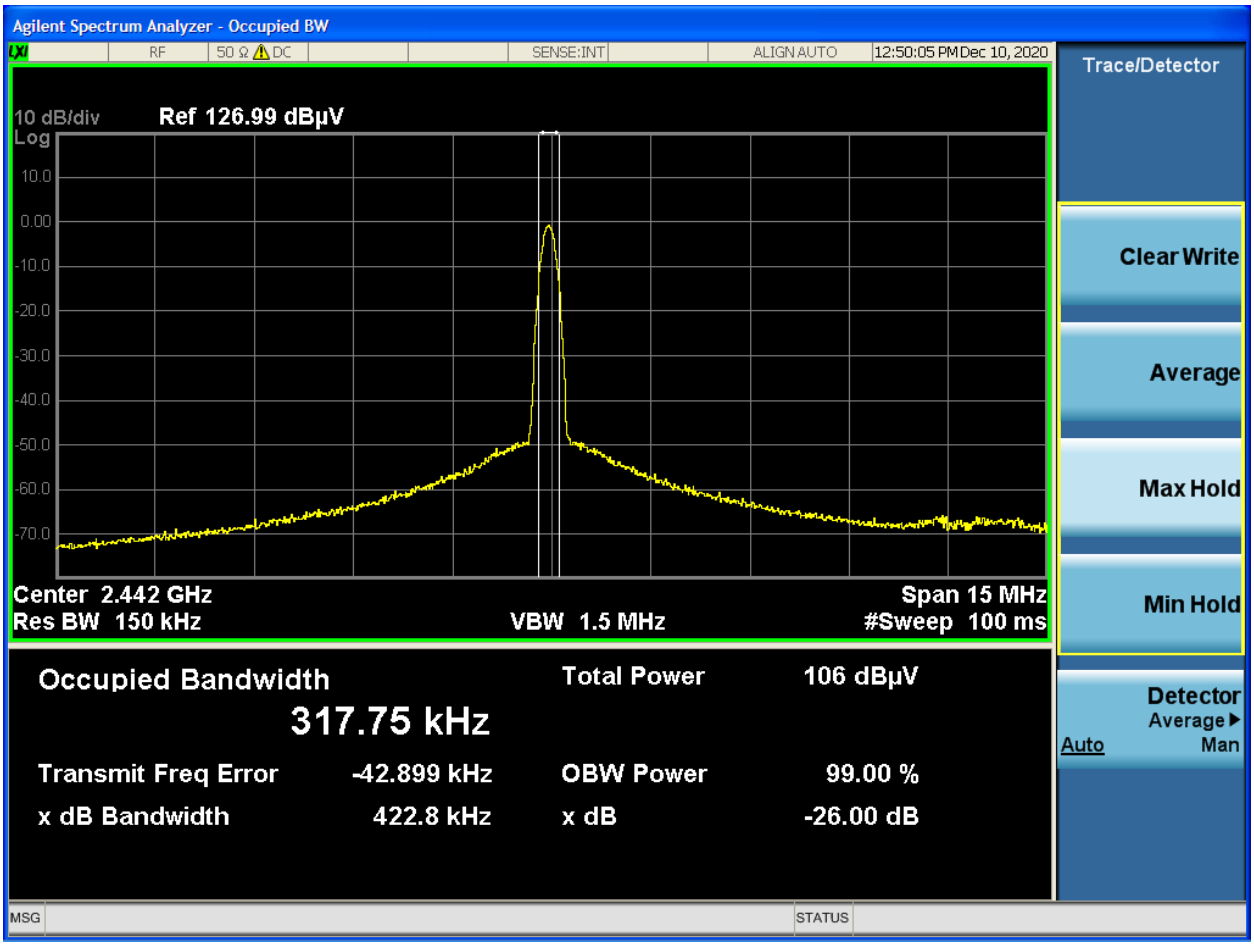
**Table 5-2: 99% Bandwidth Test Data**

| 99% bandwidths | |
|---|---|
| **Frequency (MHz)** | **Bandwidth (kHz)** |
| 2402 | 318.16 |
| 2442 | 317.75 |
| 2480 | 317.30 |

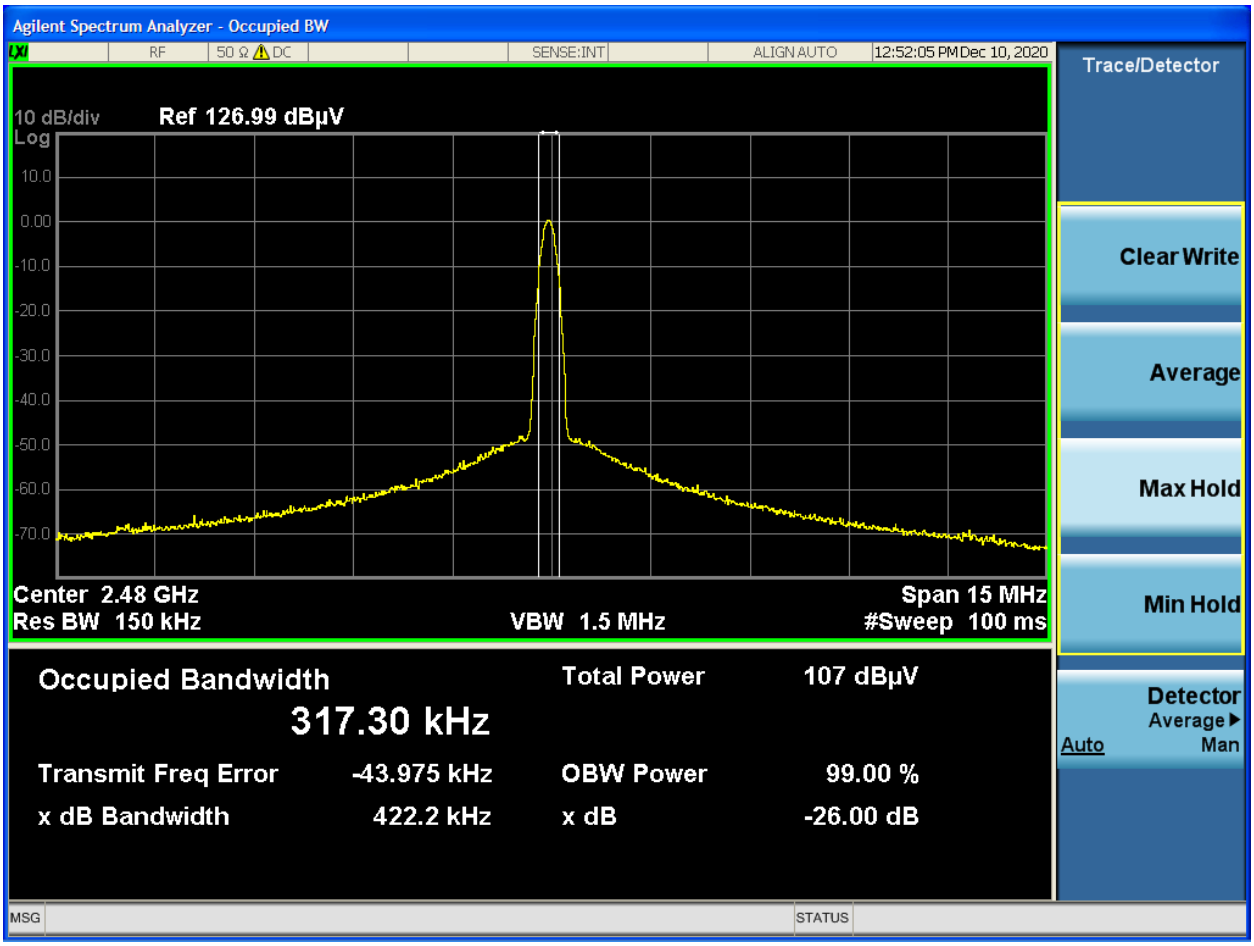
**Plot 5-1: 99% Bandwidth – 2402 MHz**



**Plot 5-2: 99% Bandwidth - 2442 MHz**



**Plot 5-3: 99% Bandwidth - 2480 MHz**




Measurement uncertainties shown for these tests are expanded uncertainty expressed at 95% confidence level using a coverage factor k=2. Measurement uncertainty ±1.0 * $10^{-6}$ Hz

**Test Personnel:**

| Jon Wilson | | December 10, 2020 |
|---|---|---|
| EMC Test Engineer | Signature | Date of Test |

## 6 Band Edge – FCC 15.249(d); ISED RSS-210 B.10(b)

### 6.1 Band Edge Test Procedure

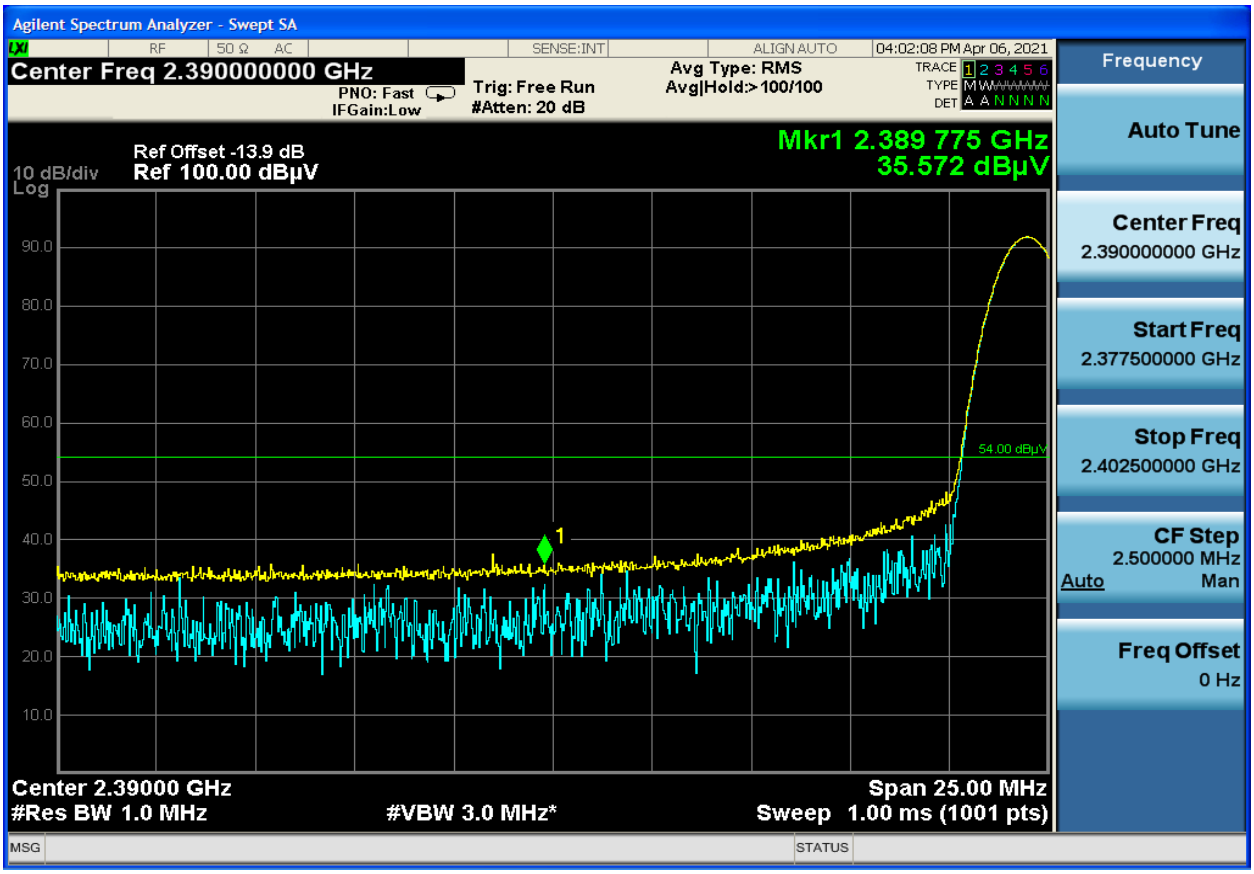
The band edge was measured using a 50-ohm spectrum analyzer, per C63.10 6.10.5. Test was performed radiated at 3 meters. The EUT was set to transmit at 100% duty cycle. The span was wide enough to capture the lowest/ highest channel produced by the EUT. The RBW and VBW were set to 1 MHz and 3 MHz respectively. Both Average and Peak detectors were implemented.

**Table 6-1: Band Edge Test Equipment**

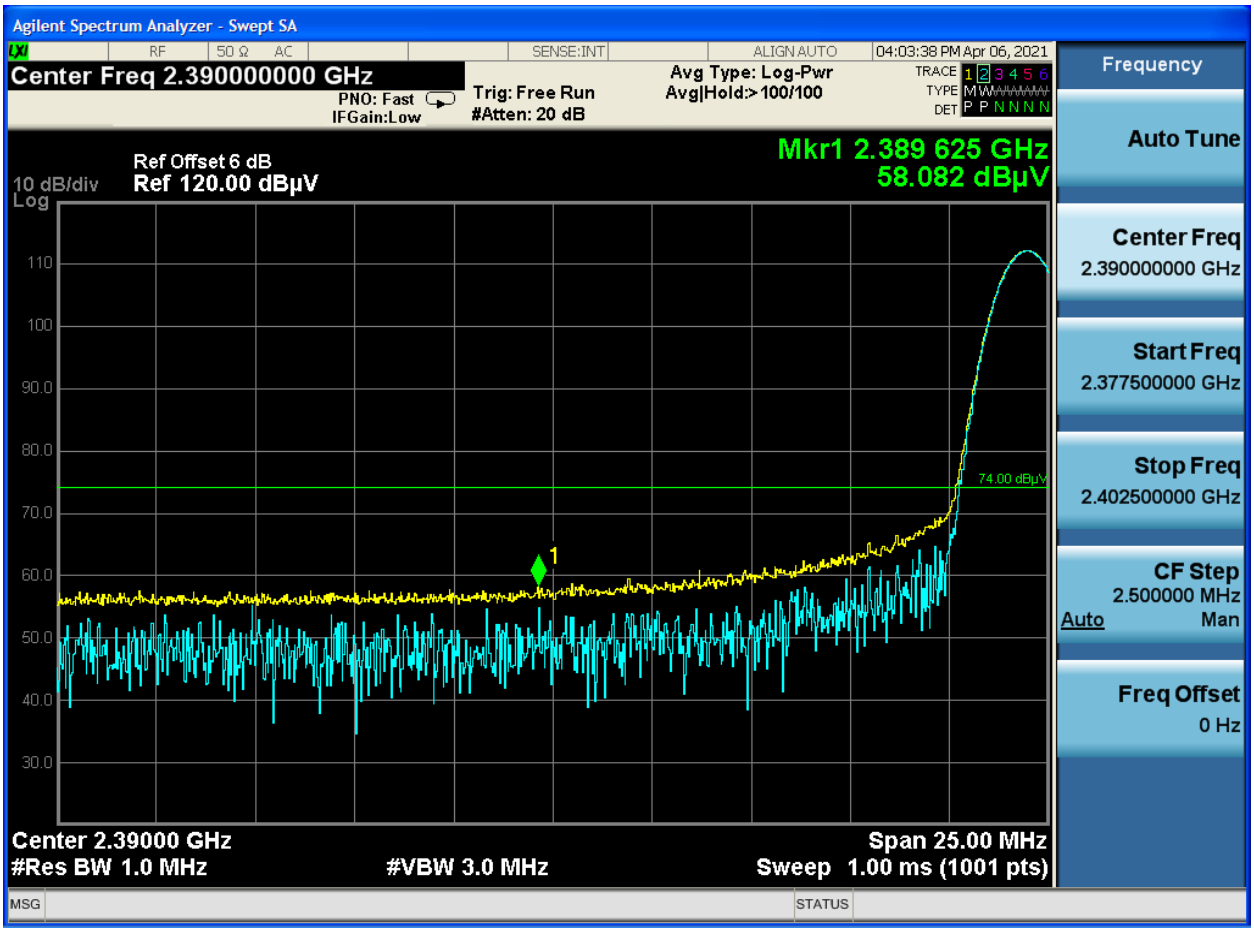
| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901669 | ETS-Lindgren | 3142E | Antenna (26 - 6000 MHz) | 00166065 | 4/24/22 |
| 900772 | EMCO | 3161-02 | Horn Antenna (2 - 4 GHz) | 9804-1044 | 5/17/21 |
| 901723 | Amplifier | 8449B | Amplifier (1 - 26.5 GHz) | 3008A00762 | 9/3/21 |
| 901583 | Agilent | N9010A | EXA Signal Analyzer | MY51250846 | 2/6/21 |

### 6.2 Band Edge Test Data

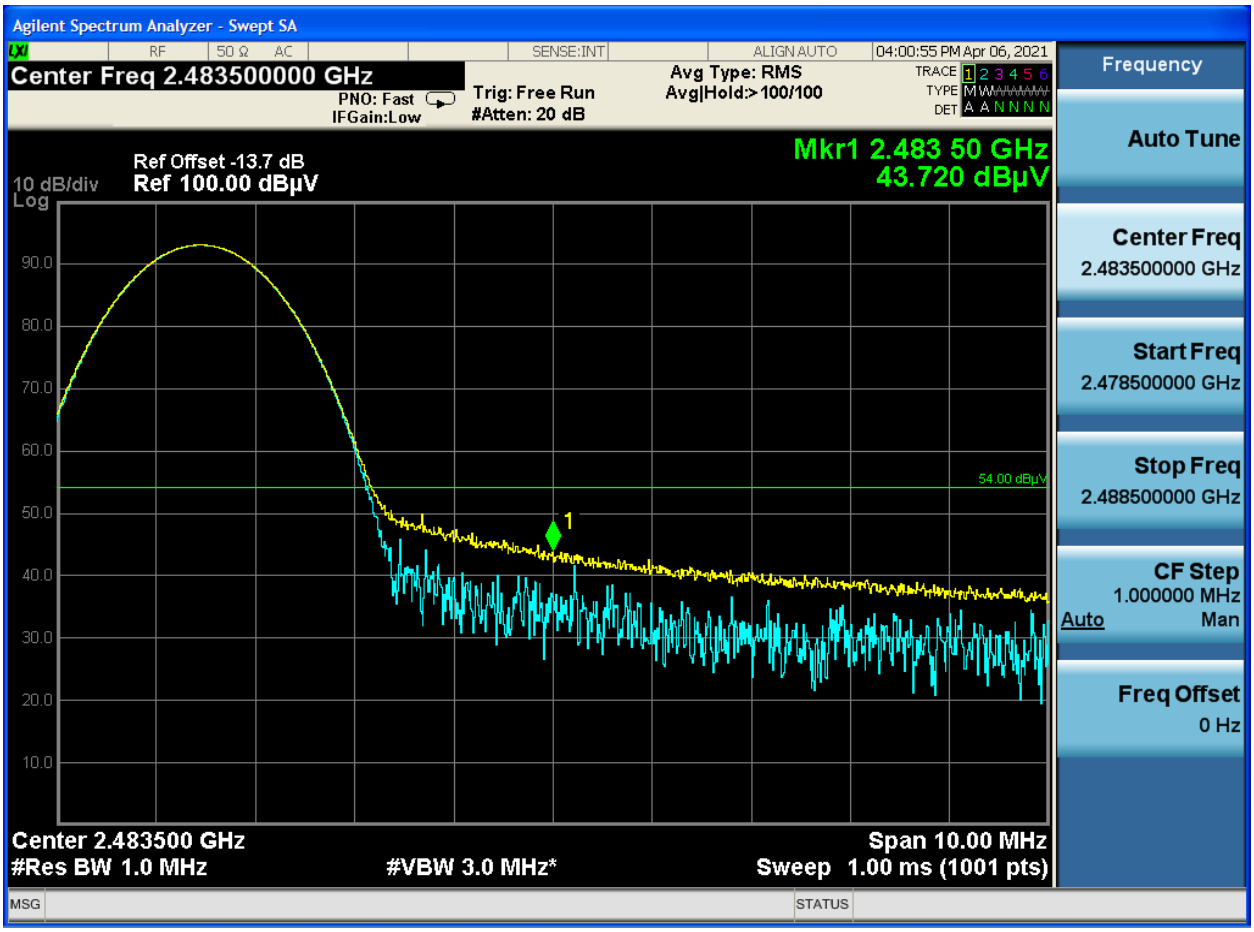
**Plot 6-1: Lower Band Edge, Average**



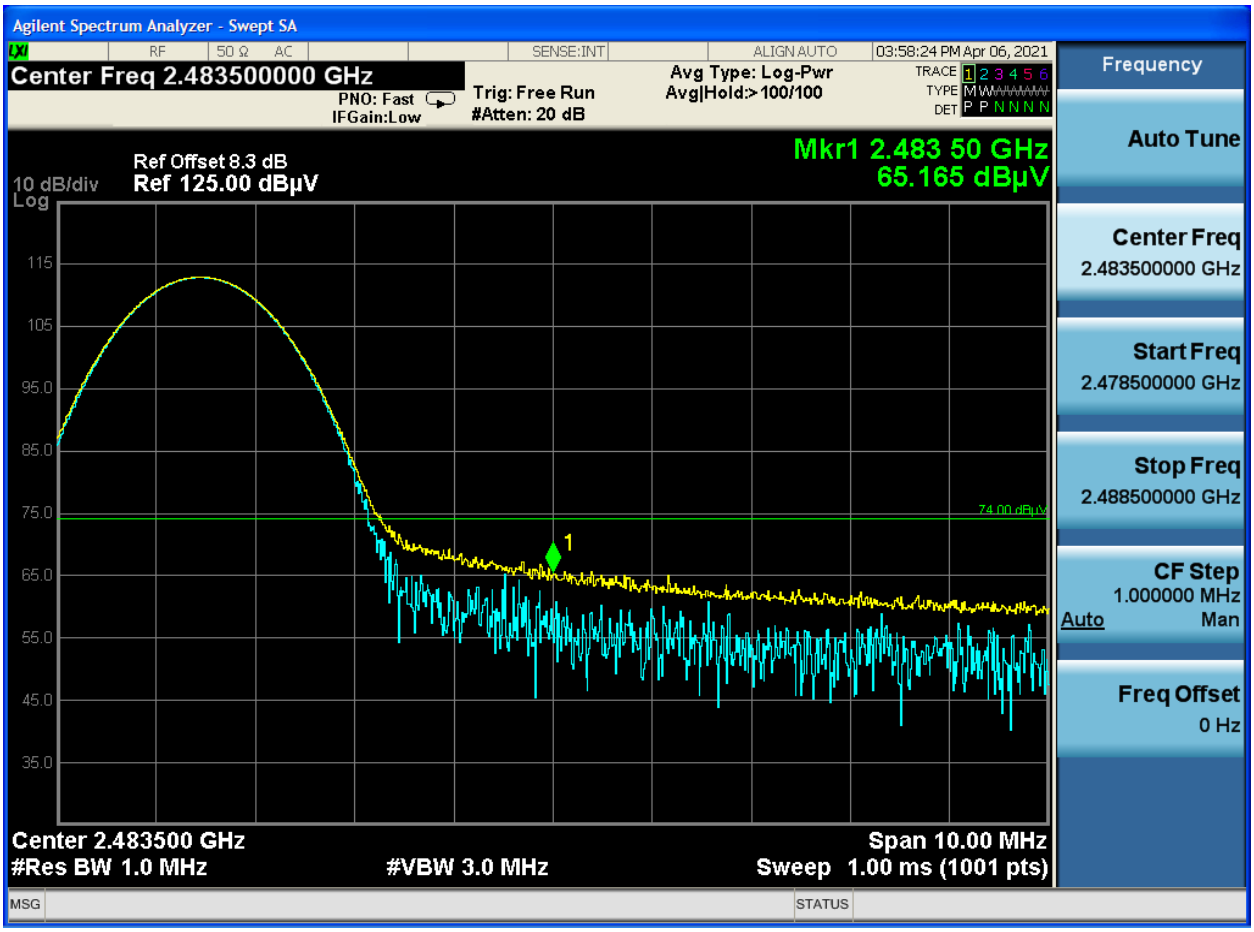
**Plot 5-2: Lower Band Edge, Peak**



**Plot 6-3: Upper Band Edge, Average**

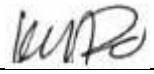


**Plot 5-4: Upper Band Edge, Peak**




Measurement uncertainties shown for these tests are expanded uncertainty expressed at 95% confidence level using a coverage factor k=2. Measurement uncertainty ±4.6 dB

**Test Personnel:**

| Khue Do |  | April 6, 2020 |
|---|---|---|
| EMC Test Engineer | Signature | Date of Test |

## 7 Conclusion

The data in this measurement report shows that the EUT as tested, Allula LED Keypad, Model: RE663, FCC ID: U5X-RE663, IC: 8310A-RE663, complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and IC RSS-210 and RSS-Gen.