



**Wireless Door/Window Sensor**  
**FCC ID: U5X-RE107**

**Certification Test Report**

**December 24, 2018**

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## 1. Introduction

The RE107 is a wireless door/window sensor. The sensor sends open and closed signals to a home security system when a door or window is changed from open to closed or closed to open. The RE107 board measures 3.03" x 1.08" x 0.8" and weighs 0.6 oz. The full door/window enclosure measures 3.87" x 1.5" x 1.56" and weighs 3.3 oz. with the CR123A battery.

The RE107 uses a magnetic reed and a magnet or external contacts to determine if a door, window, or gate is open or closed. When the magnet is pulled away from the sensor or if the external contacts are shorted to the common terminal, an open signal is sent to a home security system. When a magnet is brought close to the sensor or if the external contacts are disconnected from the common terminal, a closed signal is sent to a home security system. The RE107 also sends a tamper signal if the enclosure is opened.

The external contacts can also be used for two types of PIR motion detectors. Both PIR motion detectors operate the same way but have different detection lenses for a narrow and wide-angle beam. The narrow beam PIR enclosure measures 7" x 2.63" x 2.1". The wide-angle beam PIR enclosure measures 7.16" x 2.8" x 2.54". When the RE107 is used in one of the PIR motion detectors, the external inputs are used for a motion input and a tamper input. If motion is detected, an alarm signal is sent to a home security system. The RE107 in a PIR also sends a tamper signal if the enclosure is opened. The reed in this configuration is disabled. All other functions operate the same.

A microcontroller on the RE107 is powered by a 3VDC CR123A battery. Open/closed/alarm packets are sent by the RE107 only upon valid alarm conditions. The transmitted packet is OOK modulated and has an on-time of 7.93ms. Precautions are taken in the firmware to ensure there is at least 100ms between packets, and that the transmission ends within 5 seconds. In the absence of tamper and open/close/alarm action, a set of three supervision transmissions are sent by the RE107 once per hour.

The transmitter circuit consists of a 9.984MHz crystal and a Micrel MICRF113YM6 PLL Chip. This chip multiplies the crystal frequency to 319.5MHz and allows OOK modulation of the 319.5MHz signal. A coil antenna on the PCB radiates the RF signal.

Certification is requested under FCC Rules, Part 15, Subpart C, Paragraph 15.231.

## 2. Statement of Compliance

Specific sections of FCC Rules Part 2 that require information or listing are given below.

### 2.1 FCC Part 2 §2.907

This is an application for certification of original equipment.

### 2.2 FCC Part 2 §2.911

- a) This application has been filed electronically using form 731.
- b) All required information has been supplied in this application and its attachments.
- c) This application has been electronically signed by an officer of Alula.
- d) The technical test data has been signed by the agency performing the testing.
- e) Signature supplied in appropriate block on form 731.
- f) Processing fee has been paid.
- g) Signatures have been supplied electronically.

### 2.3 FCC Part 2 §2.913

- a) This application has been filed electronically.
- b) Appropriate fees have been filed electronically.
- c) Equipment samples shall be supplied as requested.

### 2.4 FCC Part 2 §2.915

We are requesting a grant of certification. This application shows compliance with the technical standards.

## **2.5 FCC Part 2 §2.925**

A label shall be affixed to each piece of equipment, showing the FCC identifier. The label shall read “FCC ID: U5X-RE107”. See Exhibit B for a photograph showing the label and location on the device.

## **2.6 FCC Part 2 §2.943, 2.945**

Sample production equipment shall be submitted to the FCC upon request.

## **2.7 FCC Part 2 §2.947**

- a) Measurement procedure follows ANSI C63.4: 2009.
- b) A description of utilized test equipment is contained in the report.

## **2.8 FCC Part 2 §2.948**

Radiated measurements were taken at the following FCC-approved facility:

**Rhein Tech Laboratories, Inc.**  
**360 Herndon Parkway, Suite 1400**  
**Herndon, VA 20170 USA**  
**Contact: Rick McMurray**  
**703-689-0368**

Photographs of the test site are shown in Exhibit J.

## **2.9 FCC Part 2 §2.1033**

- a) Form 731 has been filed electronically.
- b) The technical report, along with its exhibits, contains the information as follows:
  - (1) The full name and mailing address of the manufacturer of the device and the applicant for certification:

**Alula**  
**1402 Heggen St.**  
**Hudson, WI 54016**
  - (2) FCC Identifier is U5X-RE107
  - (3) Copy of the installation/user instructions for each host device are furnished in Exhibit E1, Exhibit E2, and Exhibit E3.
  - (4) A brief description of the device and operation is furnished in Exhibit F. Schematic is furnished in Exhibit G.
  - (5) Block diagram furnished in Exhibit H.
  - (6) This document constitutes a technical test report.
  - (7) Internal and external photographs have been furnished in Exhibits A and C.
  - (8) Description of Host Devices is furnished in Exhibit F.
  - (9) This application not pursuant to the transition rules of section 15.37
  - (10) Not applicable. This device does not include a scanning receiver.
  - (11) Not applicable.
  - (12) Not applicable.
  - (13) Not applicable.
  - (14) Test setup photos are furnished in Exhibit J.
- c) Not applicable. This device shall operate under Part 15 of the rules.
- d) Not applicable.
- e) Not applicable. This is not a composite system.

# **3. Discussion of Laboratory Measurements and Rules Compliance**

## **3.1. FCC Part 15 §15.231(a)(1)**

The RE107 door/window sensor monitors a magnetic reed switch and two external inputs. When any of these inputs or the tamper switch is triggered, an alarm condition is present. Eight transmission packets are sent by the device upon all valid alarm conditions. The transmitted packets are 16.65ms. After transmission is complete, the device will go into a sleep mode and not transmit again until another alarm condition is detected. If there are no activations for an hour, three supervisory packets are sent with the same spacing given above.

### **3.2. FCC Part 15 §15.231(a)(2)**

Precautions are taken in the firmware to ensure that all transmissions end within 5 seconds after activation as shown in Exhibit I1 and Exhibit I2.

### **3.3. FCC Part 15 §15.231(a)(3)**

If there is no alarm condition for an hour, three supervision packets are transmitted. These supervision packets are then transmitted every hour in the absence of an alarm condition. The total transmission time resulting from these supervision transmissions is well under the allowed 2 seconds per hour and they conclude within the 5-second window.

### **3.4. FCC Part 15 §15.231(a)(4)**

Device does not continue transmitting beyond the packets resulting from each activation.

### **3.5. FCC Part 15 §15.231(a)(5)**

There is no setup information transmitted with this device.

## **3.6. FCC Part 15 §15.231(b)**

### **3.6.1. Raw Field Strength Limits**

The table that follows shows the emission limits as determined by interpolation of the data in §15.231(b), the requirements of §15.35(b) regarding peak emission limits, and the requirements of §15.205/§15.209 regarding restricted bands and their limits.

	Average Limit (dBuV/m)	Peak Limit (dBuV/m)
Fundamental (319.5 MHz)	75.90	95.90
Spurious	55.90	75.90
Restricted Band	54.00	74.00

### **3.6.2. Duty Cycle Correction Factor and Resulting Limits**

This transmitter uses OOK modulation. 63 bits are transmitted in each packet, and the “on” time for each bit is 122usec, except for one bit which has an “on” time of 366usec. The resulting “on” time per packet is 7.93ms. The transmitted packets are limited to one packet in a 100ms period. The transmitter duty cycle over a 100ms period is therefore 7.93ms/100ms = 7.93%.

Thus, the average emission level, as given in §15.35(c), is calculated as follows:

$$\text{Average Emission Level} = \text{Peak Measurement} + 20\log(7.93\text{mS}/100\text{mS})$$

### **3.6.3. Measured Radiated Field Strength Data**

Radiated fundamental and spurious emissions were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized per ANSI C63.4:2003 8.3.1.2; that is, the measurement antenna height was varied between 1 and 4m, and the EUT was rotated through 360 degrees on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 120kHz was used for frequencies less than 1000MHz, and a resolution bandwidth of 1MHz was used for frequencies greater than or equal to 1000MHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth. All spurious emissions in the applicable frequency range were investigated. The EUT was adapted to continuously transmit for testing purposes. Further details of measured radiated field strength are shown in Exhibit I.

The table below shows peak and average emissions, limits, resulting margins, and pass/fail results for the RE107 in each host device.

Frequency (MHz)	Peak Emissions (RE107)				Average Emissions (RE107)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
319.5	88.0	95.9	-7.9	PASS	66.0	75.9	-9.9	PASS
639.0	48.2	75.9	-27.7	PASS	26.2	55.9	-29.7	PASS
958.5	44.7	75.9	-31.2	PASS	22.7	55.9	-33.2	PASS
1278.0	49.7	75.9	-26.2	PASS	27.7	55.9	-28.2	PASS
1597.5	46.2	74.0	-27.8	PASS	24.2	54.0	-29.8	PASS
1917.0	48.5	75.9	-27.4	PASS	26.5	55.9	-29.4	PASS
2236.5	35.7	74.0	-38.3	PASS	13.7	54.0	-40.3	PASS
2556.0	46.0	75.9	-29.9	PASS	24.0	55.9	-31.9	PASS
2875.5	49.3	74.0	-24.7	PASS	27.3	54.0	-26.7	PASS
3195.0	35.4	75.9	-40.5	PASS	13.4	55.9	-42.5	PASS

Frequency (MHz)	Peak Emissions (RE153)				Average Emissions (RE153)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
319.5	88.1	95.9	-7.8	PASS	66.7	75.9	-9.2	PASS
639.0	62.3	75.9	-13.6	PASS	40.9	55.9	-15.0	PASS
958.5	51.8	75.9	-24.1	PASS	30.4	55.9	-25.5	PASS
1278.0	54.0	75.9	-21.9	PASS	32.6	55.9	-23.3	PASS
1597.5	49.6	74.0	-24.4	PASS	28.2	54.0	-25.8	PASS
1917.0	46.1	75.9	-29.8	PASS	24.7	55.9	-31.2	PASS
2236.5	46.3	74.0	-27.7	PASS	24.3	54.0	-29.7	PASS
2556.0	44.2	75.9	-31.7	PASS	22.2	55.9	-33.7	PASS
2875.5	45.0	74.0	-29.0	PASS	23.0	54.0	-31.0	PASS
3195.0	42.9	75.9	-33.0	PASS	20.9	55.9	-35.0	PASS

Frequency (MHz)	Peak Emissions (RE160)				Average Emissions (RE160)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
319.5	89.8	95.9	-6.1	PASS	68.4	75.9	-7.5	PASS
399.4	37.8	46.0	-8.2	PASS	16.4	55.9	-39.5	PASS
639.0	56.1	75.9	-19.8	PASS	34.7	55.9	-21.2	PASS
958.5	55.2	75.9	-20.7	PASS	33.8	55.9	-22.1	PASS
1278.0	47.3	75.9	-28.6	PASS	25.9	55.9	-30.0	PASS
1597.5	48.1	74.0	-25.9	PASS	26.7	54.0	-27.3	PASS
1917.0	47.9	75.9	-28.0	PASS	26.5	55.9	-29.4	PASS
2236.5	44.7	74.0	-29.3	PASS	22.7	54.0	-31.3	PASS
2556.0	49.3	75.9	-26.6	PASS	27.3	55.9	-28.6	PASS
2875.5	53.4	74.0	-20.6	PASS	31.4	54.0	-22.6	PASS
3195.0	53.5	75.9	-22.4	PASS	31.5	55.9	-24.4	PASS

### 3.7. FCC Part 15 §15.231(c)

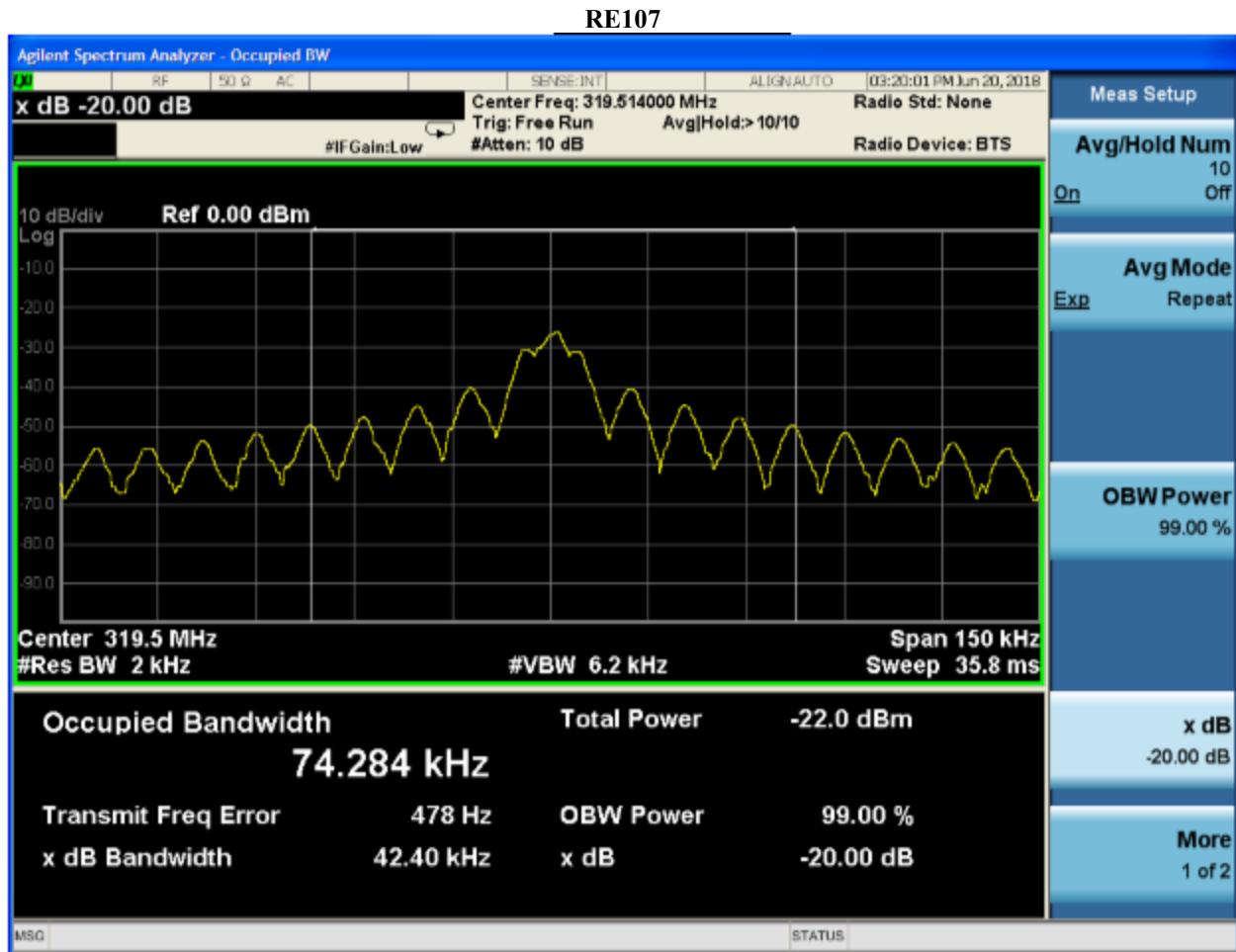
Allowed 20dB bandwidth of the transmitted signal is 0.25% of the carrier frequency.

**BW Limit = 0.0025\*319.5MHz = 0.799MHz**

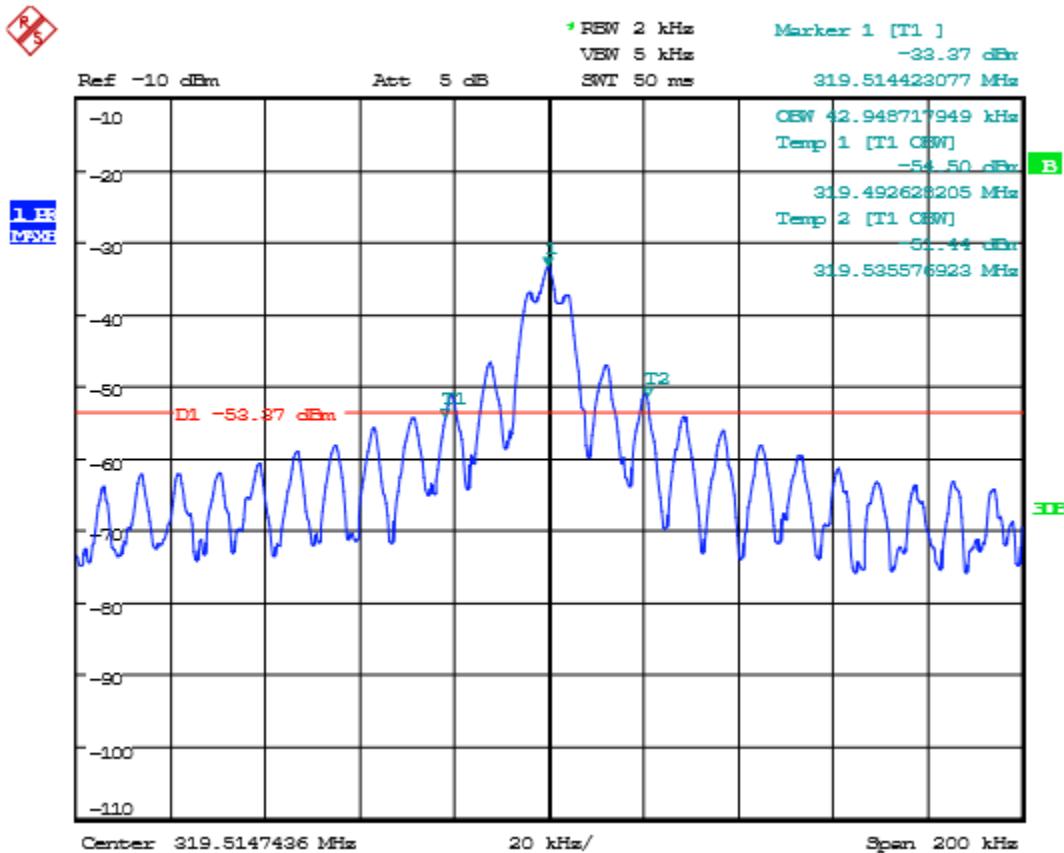
Bandwidth measurements were taken at the following FCC-approved facility:

**Rhein Tech Laboratories, Inc.**  
**360 Herndon Parkway, Suite 1400**  
**Herndon, VA 20170 USA**  
**Contact: Rick McMurray**  
**703-689-0368**

The plots below shows the modulated signal for the RE107. The peak 20dB bandwidth of the modulated signal is 43kHz or 0.043MHz amongst all three devices. These measurements show compliance with the bandwidth requirements.



### RE153 and RE160



*Paul Hall*