



Simplifying · Security

**Door/Window Sensor**  
**FCC ID: U5X-RE307**

## **Certification Test Report**

**December 26, 2018**

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# 1. Introduction

There will be two models listed under FCC ID: U5X-RE307. These models are RE307 and RE607.

The RE307 and RE607 are wireless door/window sensors. The sensors send 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 two models (RE307 and RE607) are identical in every respect except that each group sends a slightly different RF transmission format. The RE307/RE607 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 RE307/RE607 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 RE307/RE607 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 RE207/RE207T 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 RE207/RE207T 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 RE307/RE607 is powered by a 3VDC CR123A battery. Open/closed packets are sent by the RE307/RE607 only upon valid alarm conditions. The transmitted packet is OOK modulated and has an on-time of 8.5ms. 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 motion, a set of four supervision transmissions are sent by the RE307/RE607 daughter board once per hour.

The RE307/RE607 transmitter circuit consists of a 13.56MHz crystal and a Micrel MICRF113YM6 PLL Chip. This chip multiplies the crystal frequency to 433.92MHz. It also includes a circuit that allows OOK modulation of the 433.92MHz signal. A coil antenna 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-RE307". 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) 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-RE307
  - (3) Copy of the installation/user instructions for each host device is furnished as 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 are 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.
- 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 RE307/RE607 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 26.5mS in length for the RE307 model, and 20mS in length for the RE607 model. The spacing between each packet is randomized from 112mS to 240mS. 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, four 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 no alarm activations have been received for a period of one hour, four supervision packets are transmitted. These supervision packets are then transmitted every hour in the absence of alarm activations. The total transmission time resulting from these supervision transmissions is well under the allowed 2 seconds per hour. 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 Emission Limit (dBuV/m)	Peak Emission Limit (dBuV/m)
Fundamental (433.92 MHz)	80.825	100.825
Spurious	60.825	80.825
Restricted Band	54.00	74.00

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

The following pertains to the RE307 model. This transmitter uses OOK modulation. The packet begins with a 2.5mS “high time.” This is followed by 48 bits of data, each of which is 500uS long. A “zero” bit is low for the entire bit. A “one” bit is high for 250uS, and then low for 250uS. Therefore, the average “high time” in a data packet is  $2.5\text{mS} + (0.250 * 24) = 8.5\text{mS}$ . The transmitter duty cycle over a 100ms period is therefore  $8.5/100 = 8.5\%$ .

Thus, the average emission level for the RE307 model, as given in §15.35(c), is calculated as follows:

$$\text{Average Emission Level} = \text{Peak Measurement} + 20\log(8.5\text{mS}/100\text{mS})$$

The following pertains to the RE607 model. This transmitter uses OOK modulation. 100 bits are transmitted in each packet, and the “on” time for each bit is 100uS. The resulting “on” time per packet is 10.0mS. The transmitted packets are limited to one packet in a 100mS period. The transmitter duty cycle over a 100ms period is therefore  $10/100 = 10\%$ .

Thus, the average emission level for the RE607 model, as given in §15.35(c), is calculated as follows:

$$\text{Average Emission Level} = \text{Peak Measurement} + 20\log(10\text{mS}/100\text{mS})$$

### 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 I1 and Exhibit I2.

The tables that follow shows both peak and average emissions, limits, resulting margins, and pass/fail results of RE307/RE607 in each enclosure.

Emission Frequency (MHz)	Peak Emissions				Average Emissions			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	93.2	100.8	-7.6	PASS	73.2	80.8	-7.6	PASS
867.84	49.3	80.8	-31.5	PASS	29.3	60.8	-31.5	PASS
1301.76	50.5	74.0	-23.5	PASS	30.5	54.0	-23.5	PASS
1735.68	50.4	80.8	-30.4	PASS	30.4	60.8	-30.4	PASS
2169.60	30.1	80.8	-50.7	PASS	10.1	60.8	-50.7	PASS
2603.52	37.1	80.8	-43.7	PASS	17.1	60.8	-43.7	PASS
3037.44	49.2	80.8	-31.6	PASS	29.2	60.8	-31.6	PASS
3471.36	52.1	80.8	-28.7	PASS	32.1	60.8	-28.7	PASS
3905.28	48.0	74.0	-26.0	PASS	28.0	54.0	-26.0	PASS
4339.20	33.9	74.0	-40.1	PASS	13.9	54.0	-40.1	PASS

Emission Frequency (MHz)	Peak Emissions (RE353/RE653)				Average Emissions (RE353/RE653)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	94.2	100.8	-6.6	PASS	74.2	80.8	-6.6	PASS
867.84	60.3	80.8	-20.5	PASS	40.3	60.8	-20.5	PASS
1301.76	54.0	74.0	-20.0	PASS	34.0	54.0	-20.0	PASS
1735.68	54.2	80.8	-26.6	PASS	34.2	60.8	-26.6	PASS
2169.60	45.8	80.8	-35.0	PASS	25.8	60.8	-35.0	PASS
2603.52	51.8	80.8	-29.0	PASS	31.8	60.8	-29.0	PASS
3037.44	47.6	80.8	-33.2	PASS	27.6	60.8	-33.2	PASS
3471.36	53.7	80.8	-27.1	PASS	33.7	60.8	-27.1	PASS
3905.28	48.3	74.0	-25.7	PASS	28.3	54.0	-25.7	PASS
4339.20	38.9	74.0	-35.1	PASS	18.9	54.0	-35.1	PASS

Emission Frequency (MHz)	Peak Emissions (RE360/RE660)				Average Emissions (RE360/RE660)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	86.7	100.8	-14.1	PASS	66.7	80.8	-14.1	PASS
867.84	72.7	80.8	-8.1	PASS	52.7	60.8	-8.1	PASS
1301.76	45.4	74.0	-28.6	PASS	25.4	54.0	-28.6	PASS
1735.68	48	80.8	-32.8	PASS	28.0	60.8	-32.8	PASS
2169.60	53.5	80.8	-27.3	PASS	33.5	60.8	-27.3	PASS
2603.52	49.8	80.8	-31.0	PASS	29.8	60.8	-31.0	PASS
3037.44	47.6	80.8	-33.2	PASS	27.6	60.8	-33.2	PASS
3471.36	53.5	80.8	-27.3	PASS	33.5	60.8	-27.3	PASS
3905.28	44.7	74.0	-29.3	PASS	24.7	54.0	-29.3	PASS
4339.20	42.1	74.0	-31.9	PASS	22.1	54.0	-31.9	PASS

### 3.7. FCC Part 15 §15.231(c)

The allowed 20dB bandwidth of the transmitted signal is 0.25% of the carrier frequency:

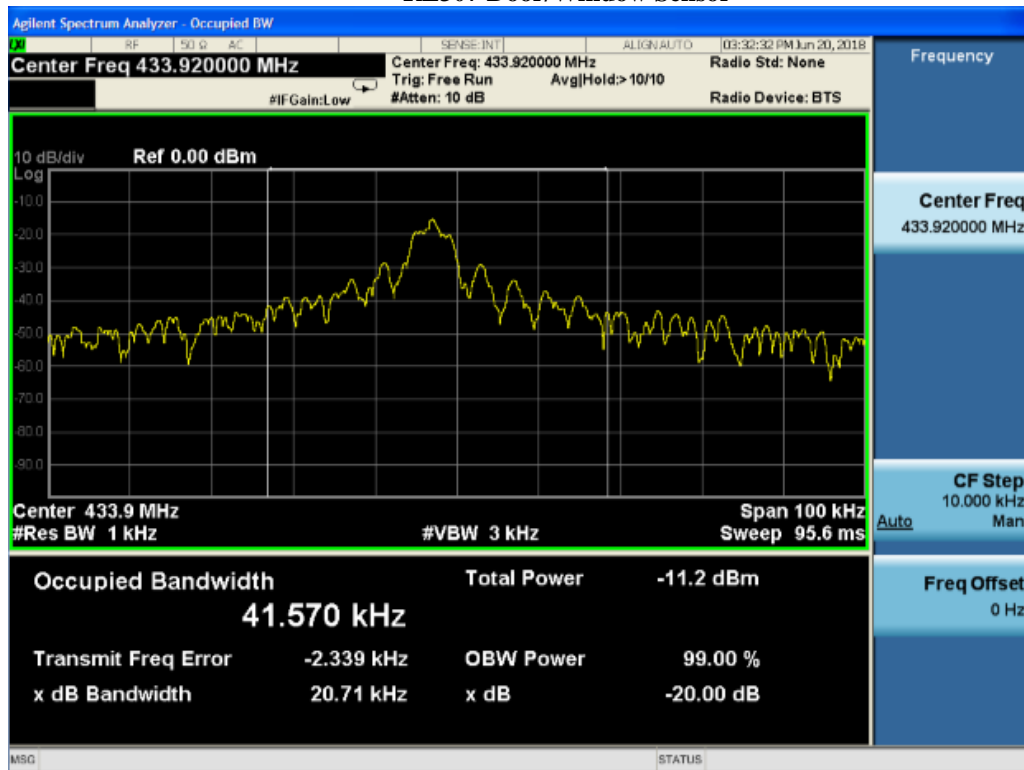
$$\text{BW Limit} = 0.0025 \times 433.92 \text{ MHz} = 1.0848 \text{ MHz}$$

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 show the modulated signals. The highest measured 20dB bandwidth of the modulated signal is 28.4kHz or 0.0284MHz. These measurements show compliance with the bandwidth requirements.

**RE307 Door/Window Sensor**



Agilent Spectrum Analyzer - Occupied BW

Center Freq 433.920000 MHz

Trig: Free Run Avg/Hold: > 10/10

#IF Gain: Low #Atten: 0 dB

Radio Std: None Radio Device: BTS

Frequency

Center Freq 433.920000 MHz

CF Step 18.000 kHz

Auto Man

Freq Offset 0 Hz

10 dB/div

Ref 0.00 dBm

Center 433.9 MHz

#Res BW 2 kHz

#VBW 6.2 kHz

Span 180 kHz

Sweep 42.93 ms

Occupied Bandwidth	Total Power	-20.0 dBm
86.852 kHz		
Transmit Freq Error	-1.594 kHz	OBW Power
x dB Bandwidth	41.44 kHz	x dB
		99.00 %
		-20.00 dB

MSG STATUS

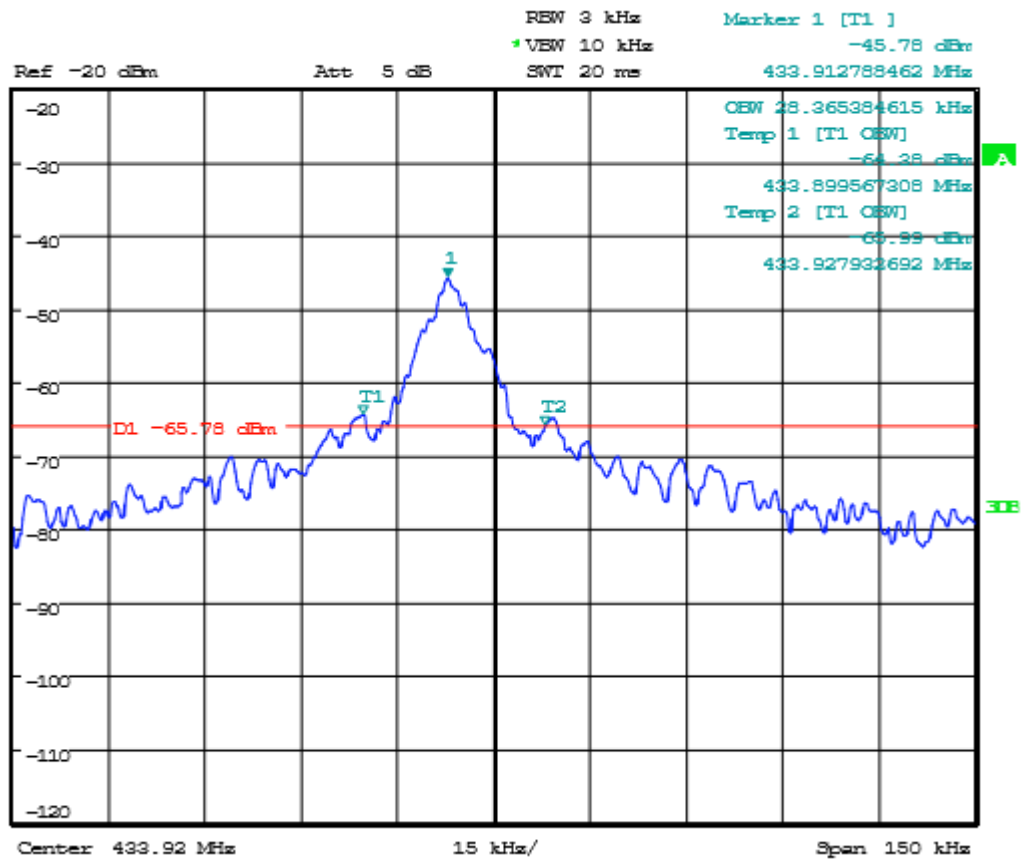
Ref 10 dBm Att 15 dB SWT 40 ms 433.922644231 MHz  
 Center 433.92 MHz Span 150 kHz  
 15 kHz/  
 Marker 1 [T1] 433.922644231 MHz -29.29 dBm  
 Temp 1 [T1] 433.922644231 MHz -49.62 dBm  
 Temp 2 [T1] 433.922644231 MHz -49.29 dBm  
 D1 -49.29 dBm  
 T1 T2



# RE660



1.8  
MAX



*Paul J. Hill*