



Wireless Sensor Transmitter
FCC ID: U5X-RE328

Certification Test Report

October 24, 2018

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1. Introduction

There will be two models listed under FCC ID: U5X-RE328. These models are RE328 and RE628.

The RE328/RE628 is a transmitter daughter board that gives wireless functionality to a host device sensor. The transmitter daughter board sends alarm signals to a home security system based on inputs from a host device. The RE328/RE628 daughter board measures 2.2" x 1.64" x 0.39" and weights 0.3 oz.

The host device for this daughter board is either a motion detector or pressure sensor. These host devices have been designed to work specifically with the RE328/RE628 daughter board. These host devices operate on 3VDC battery power and supply the daughter board with the same 3VDC power as well as two inputs. The motion detector sends an alarm signal when motion has been detected and the pressure sensor sends an alarm signal when pressure has changed from compressed to decompressed or decompressed to compressed

A microcontroller on the RE328/RE628 receives 3VDC power and two inputs from the host device through the unique 10 pin connector. Alarm packets are sent by the RE328/RE628 transmitter daughter board only upon valid alarm condition from the host device. 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 any triggers, a set of three supervision transmissions are sent by the RE328/RE628 once per hour.

The 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 trace 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-RE328". 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-RE328
 - (3) Copy of the installation/user instructions for each host device is furnished as Exhibit E1 and Exhibit E2.
 - (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 RE328/RE628 daughter board monitor the host board's output connector. When an alarm signal is detected, the transmitter on the RE328/RE628 daughter board is activated. Eight transmission packets are sent by the device upon all alarm conditions. The transmitted packets are 26.5mS in length for the RE328 model, and 20mS in length for the RE628 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, 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 no alarm activations have been received for a period of one hour, three 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 RE328 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 RE328 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 RE628 model. This transmitter use 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 RE628 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 RE328/RE628 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	99.3	100.8	-1.5	PASS	77.9	80.8	-2.9	PASS
867.84	56.9	80.8	-23.9	PASS	35.5	60.8	-25.3	PASS
1301.76	46.5	74.0	-27.5	PASS	25.1	54.0	-28.9	PASS
1735.68	42.9	80.8	-37.9	PASS	21.5	60.8	-39.3	PASS
2169.60	48.9	80.8	-31.9	PASS	27.5	60.8	-33.3	PASS
2603.52	46.1	80.8	-34.7	PASS	24.7	60.8	-36.1	PASS
3037.44	48.5	80.8	-32.3	PASS	27.1	60.8	-33.7	PASS
3471.36	50.4	80.8	-30.4	PASS	29.0	60.8	-31.8	PASS
3905.28	43.7	74.0	-30.3	PASS	22.3	54.0	-31.7	PASS
4339.20	43.9	74.0	-30.1	PASS	22.5	54.0	-31.5	PASS

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
216.94	43.9	80.8	-36.9	PASS	22.5	60.8	-38.3	PASS
325.42	44.0	74.0	-30.0	PASS	22.6	54.0	-31.4	PASS
433.92	99.4	100.8	-1.4	PASS	78.0	80.8	-2.8	PASS
867.84	76.2	80.8	-4.6	PASS	54.8	60.8	-6.0	PASS
1301.76	57	74.0	-17.0	PASS	35.6	54.0	-18.4	PASS
1735.68	64.2	80.8	-16.6	PASS	42.8	60.8	-18.0	PASS

3.7. FCC Part 15 §15.231(c)

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

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

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 signal for each RE328 and RE628 in each enclosure. The highest measured 20dB bandwidth of the modulated signal is 41.18kHz or 0.04118MHz. These measurements show compliance with the bandwidth requirements.



