

Resolution Products, Inc.

**Wireless Motion Detector
FCC ID: U5X-RE361**

Certification Test Report

March 28, 2018

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1. Introduction

There will be three models listed under FCC ID: U5X-RE361. These models include RE361, WNX-40DS, and RE661. All three of these models are identical in every respect except for slight differences in firmware. The RE361 and WNX-40DS models have identical firmware, while the RE661 model also has identical firmware except that the packet transmission format is different.

The RE361/WNX-40DS and RE661 are wireless passive infrared motion detectors. The motion detector units are powered by one CR123A battery. The transmitter for each unit is centered at 433.92MHz and is controlled by a crystal. The daughter board inside the motion detectors gives the units their wireless functionality. The daughter board measures 2.2" by 1.64" x 0.39" and weighs 0.3 oz. The entire motion detector unit measures 4.53" x 2.44" x 1.97" and weighs 3.9 oz.

The RE361/WNX-40DS and RE661 transmitter daughter board gives wireless functionality to the motion detector to send alarms to a home security system. A microcontroller on the daughter board monitors the motion detector base board connector output and transmits alarm packets when motion is detected. Alarm packets are sent by the RE361/WNX-40DS and RE661 transmitter board only upon valid alarm condition. In the absence of motion, a set of 3 supervision transmissions are sent 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.

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.

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 Resolution Products, Inc.
- 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-RE361". 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:

Resolution Products, Inc.
1402 Heggen St.
Hudson, WI 54016
 - (2) FCC Identifier is U5X-RE361
 - (3) Copy of the installation/user instructions is furnished as Exhibit E.
 - (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) Not applicable. There are no peripheral or accessory devices used with this device. It is a standalone device.
 - (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 RE361/WNX-40DS and RE661 daughter boards monitor the motion detector output connector. When an alarm signal is detected, the transmitter on the RE361/WNX-40DS and RE661 is activated. Eight transmission packets are sent by the device upon all alarm conditions. The transmitted packets are 26.5mS in length for the RE361 model, and 20mS in length for the RE661 model. The spacing between each packet is randomized from 112mS to 240mS. Under normal operation, the motion detector will only activate every 2 minutes. If the "walk test" jumper is connected on the motion detector, the device will operate in walk test mode which removes the 2-minute delay. In "walk test" mode, the device will continue to send packets with the same length and spacing for each alarm condition, as allowed. After transmission is complete, the device will go into a sleep mode and not transmit again until an alarm condition is detected or the housing is opened. 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 I.

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 RE361 and WNX-40DS models. 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 RE361 and WNX-40DS models, 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 RE661 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 RE661 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 I.

The tables that follow shows both peak and average emissions, limits, resulting margins, and pass/fail results. RE361 and WNX-40DS are shown in the first table. RE661 is shown in the second table.

Emission Frequency (MHz)	Peak Emissions (RE361/WNX-40DS)				Average Emissions (RE361/WNX-40DS)			
	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 (RE661)				Average Emissions (RE661)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	97.4	100.8	-3.4	PASS	77.4	80.8	-3.4	PASS
867.84	45.9	80.8	-34.9	PASS	25.9	60.8	-34.9	PASS
1301.76	58.8	74.0	-15.2	PASS	38.8	54.0	-15.2	PASS
1735.68	42	80.8	-38.8	PASS	22.0	60.8	-38.8	PASS
2169.60	34	80.8	-46.8	PASS	14.0	60.8	-46.8	PASS
2603.52	40.4	80.8	-40.4	PASS	20.4	60.8	-40.4	PASS
3037.44	36.6	80.8	-44.2	PASS	16.6	60.8	-44.2	PASS
3471.36	43.8	80.8	-37.0	PASS	23.8	60.8	-37.0	PASS
3905.28	29.6	74.0	-44.4	PASS	9.6	54.0	-44.4	PASS
4339.20	33	74.0	-41.0	PASS	13.0	54.0	-41.0	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 plot below shows the modulated signal for the device with the highest bandwidth. The bandwidth of the modulated signal is 41.18kHz or 0.04118MHz. These measurements show compliance with the bandwidth requirements.

