Resolution Products, Inc.

RE315/RE615 Carbon Monoxide Detector
FCC ID: U5X-RE315

Certification Test Report

January 29, 2018

Contents

1. Introduction

There will be two models listed under FCC ID: U5X-RE315. These two models are RE315 and RE615. The models are identical in every respect except that the firmware uses a slightly different RF transmission format. The different RF transmission formats allow communication to two different types of security systems. This report, and other supporting documentation, will detail the differences and similarities between the two models when it is relevant to the applicable requirement.

The RE315/RE615 is a wireless transmitter daughter board that plugs into a battery powered carbon monoxide detector. The carbon monoxide detector is powered by 2 AAA batteries, which also powers the transmitter daughter board. The transmitter board measures 2.3" by1.25" and weighs less than an ounce.

The transmitter daughter board gives wireless functionality to the carbon monoxide detector allowing it to communicate with a home security system. A PIC16LF18323 microcontroller is used to monitor the carbon monoxide detector for activation signals. When a valid activation is detected, the RE315 model transmits 10 packets and the RE615 model transmits 8 packets. In the absence of activity, the device transmits a set of four supervision packets every 60 to 90 minutes.

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 which allows OOK modulation of the 433.92MHz signal. The RF signal is radiated using a wire antenna.

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-RE315". 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

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:

Resolution Products, Inc.
1402 Heggen St.
Hudson, WI 54016

(2) FCC Identifier: U5X-RE315
(3) A 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.
(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 transmitter daughter board monitors the carbon monoxide detector for valid activation signals. When a valid activation is detected, the RE315 model transmits 10 packets and the RE615 model transmits 8 packets. The transmitted packets are 26.5 mS in length for the RE315 model, and 20 mS in length for the RE615 model. The spacing between each packet is randomized from 100mS to 432mS. Upon completion of these packets, the device enters sleep mode and will not transmit until another activation is detected. In the absence of activity, the device transmits a set of four supervision packets every 60 to 90 minutes.

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)

The supervision interval ranges from 60 to 90 minutes. If no activations have been detected within this supervision interval, a set of four supervision packets is transmitted. The total transmission time resulting from these supervision transmissions is well under the allowed 2 seconds per hour. Each set of four supervision packets conclude within the required 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. 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 (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 Average Emission Calculation

The following pertains to the RE315 model. This transmitter use 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 2.5mS + (0.250 * 24) = 8.5mS. The transmitter duty cycle over a 100ms time period is therefore 8.5/100 = 8.5%.

Thus the average emission level for the RE315 model, as given in §15.35(c), is calculated as follows:

Average Emission Level = Peak Measurement + 20log(8.5mS/100mS)

The following pertains to the RE615 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 time period is therefore 10/100 = 10%.

Thus the average emission level for the RE615 model, as given in §15.35(c), is calculated as follows:

Average Emission Level = Peak Measurement + 20log(10mS/100mS)

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 measured radiated data is shown in Exhibit I.

The tables that follow show both peak and average emissions, limits, resulting margins, and pass/fail results for the RE315 Model and RE615 models respectively.

Frequency (MHz)	Peak Emissions (RE315)				Average Emissions (RE315)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	95.5	100.8	-5.3	PASS	74.09	80.8	-6.7	PASS
867.84	65.6	80.8	-15.2	PASS	44.19	60.8	-16.6	PASS
1301.76	59.3	74.0	-14.7	PASS	37.89	54.0	-16.1	PASS
1735.68	51.4	80.8	-29.4	PASS	29.99	60.8	-30.8	PASS
2169.60	34	80.8	-46.8	PASS	12.59	60.8	-48.2	PASS
2603.52	35.8	80.8	-45.0	PASS	14.39	60.8	-46.4	PASS
3037.44	42.2	80.8	-38.6	PASS	20.79	60.8	-40.0	PASS
3471.36	46.1	80.8	-34.7	PASS	24.69	60.8	-36.1	PASS
3905.28	49.2	74.0	-24.8	PASS	27.79	54.0	-26.2	PASS
4339.20	50.2	74.0	-23.8	PASS	28.79	54.0	-25.2	PASS

Frequency (MHz)	Peak Emissions (RE615)				Average Emissions (RE615)			
	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Test Result
433.92	95.5	100.8	-5.3	PASS	75.50	80.8	-5.3	PASS
867.84	65.6	80.8	-15.2	PASS	45.60	60.8	-15.2	PASS
1301.76	59.3	74.0	-14.7	PASS	39.30	54.0	-14.7	PASS
1735.68	51.4	80.8	-29.4	PASS	31.40	60.8	-29.4	PASS
2169.60	34	80.8	-46.8	PASS	14.00	60.8	-46.8	PASS
2603.52	35.8	80.8	-45.0	PASS	15.80	60.8	-45.0	PASS
3037.44	42.2	80.8	-38.6	PASS	22.20	60.8	-38.6	PASS
3471.36	46.1	80.8	-34.7	PASS	26.10	60.8	-34.7	PASS
3905.28	49.2	74.0	-24.8	PASS	29.20	54.0	-24.8	PASS
4339.20	50.2	74.0	-23.8	PASS	30.20	54.0	-23.8	PASS

3.7. FCC Part 15 §15.231(c)

3.7.1. Bandwidth Requirements - Limits and Measured Data

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

BW Limit = 0.0025 * 433.92 MHz = 1.0848 MHz

The plots that follow show the 20dB bandwidth of the modulated signal to be 15.4 kHz or 0.0154 MHz for the RE315 model, and 34.6 kHz or 0.0346 MHz for the RE615 model. These measurements show compliance with the bandwidth requirements by a margin of 1069.4 kHz and 1050.2 kHz respectively. Further bandwidth data is shown in Exhibit I.

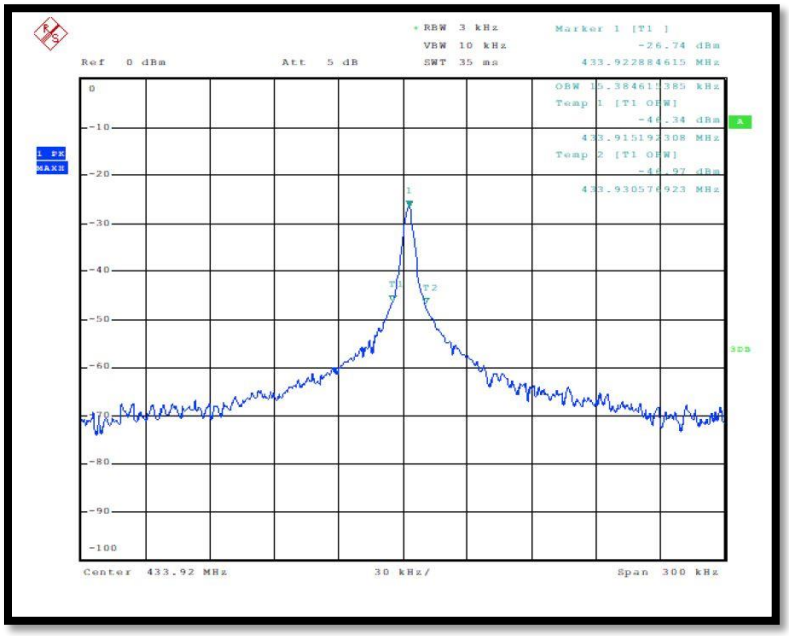

Figure 1: Measured 20dB Bandwidth (RE315)

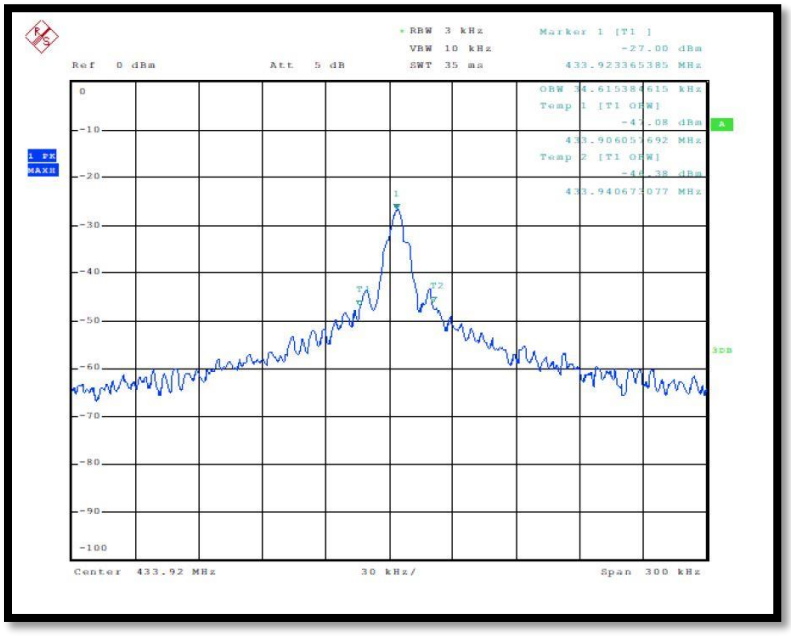

Figure 2: Measured 20dB Bandwidth (RE615)