Resolution Products, Inc.

Wireless Smoke Detector
FCC ID: U5X-RE312

Certification Test Report

December 11, 2014

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1. Introduction

The RE312 is a wireless transmitter daughter board that plugs into a battery powered smoke detector. The transmitter gives wireless functionality to a smoke detector and sends alarms to a home security system. A PIC16LF1823 microcontroller monitors the smoke detector and transmits alarm packets when smoke is detected. The daughter board measures 1.875" by 2.125" and weights less than an ounce.

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 ASK modulation of the 433.92MHz signal. A printed 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 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-RE312". 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-RE312
   (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.

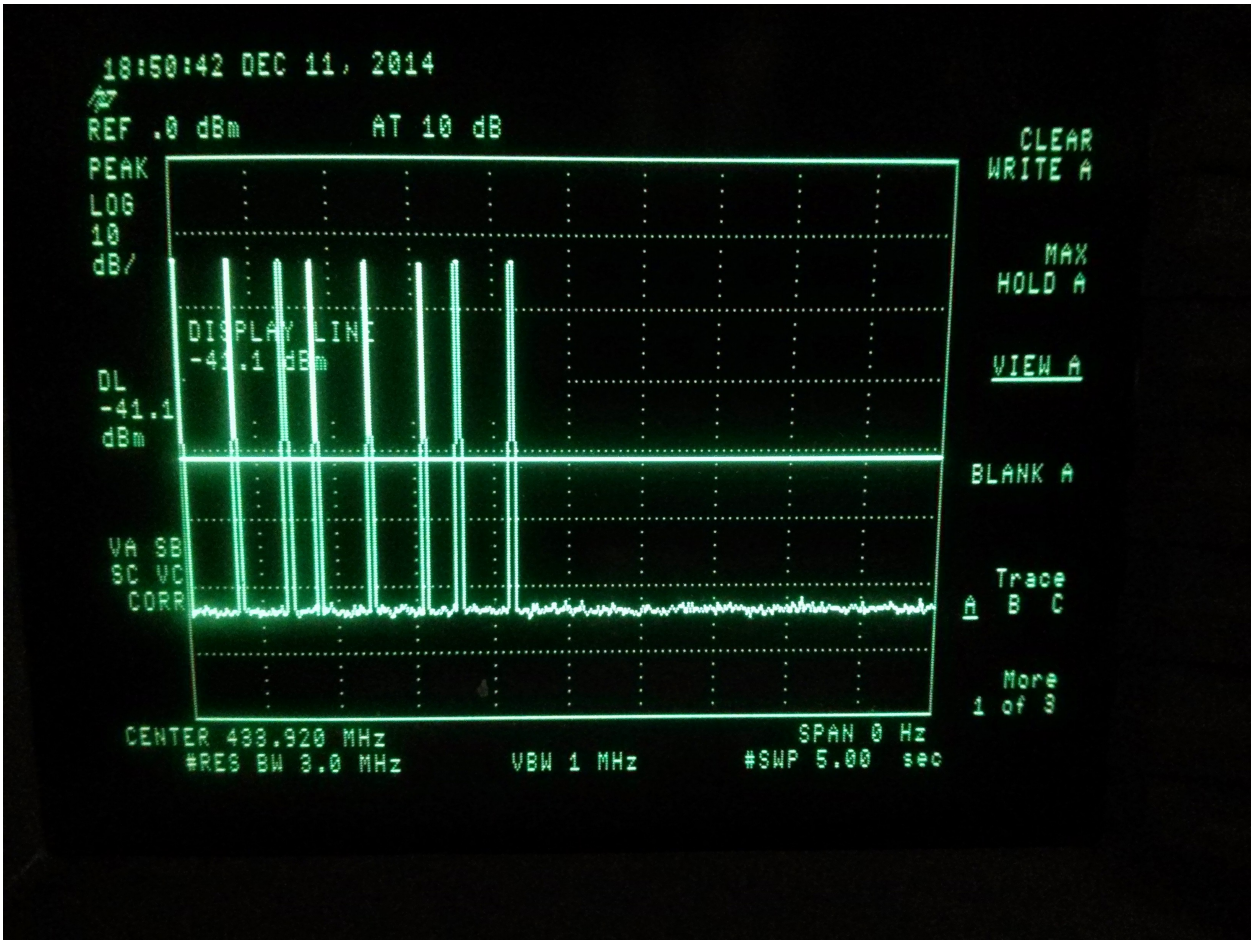
3. Discussion of Laboratory Measurements and Rules Compliance

3.1. FCC Part 15 §15.231(a)(1)

The RE312 daughter board monitors the smoke detector output connector. When an alarm signal is detected, the transmitter on the RE312 is activated. Eight transmission packets are sent by the device upon all alarm conditions. These packets are 20mS in length and are sent with a random spacing of 100-425mS. If the "test alarm" button on the smoke detector is pressed and held by a user, the device will continue to send packets with the same length and spacing for the pendency of the alarm condition, as allowed. After transmission is complete, the device will go into a sleep mode and not transmit again until smoke is detected, or "test alarm" button is pressed.

If there are no alarm activations received for one hour, three supervisory packets are sent with the same spacing given above.

A plot of the transmissions is shown below. This plot shows the transmissions occurring in a 5 second window as a result of one activation. The packets are shown to conclude within the 5-second window. This plot made using Hewlett Packard Model 8594E Spectrum Analyzer.



3.2. 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.

3.3. FCC Part 15 §15.231(a)(4)

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

3.4. FCC Part 15 §15.231(a)(5)

There is no setup information transmitted with this device.

3.5. FCC Part 15 §15.231(b)

3.5.1. Raw Field Strength Limits

Interpolation performed on the data in the §15.231(b) table yields raw field strength limits as follows:
Fundamental: 80.825dBuV/m
Spurious: 60.825dBuV/m

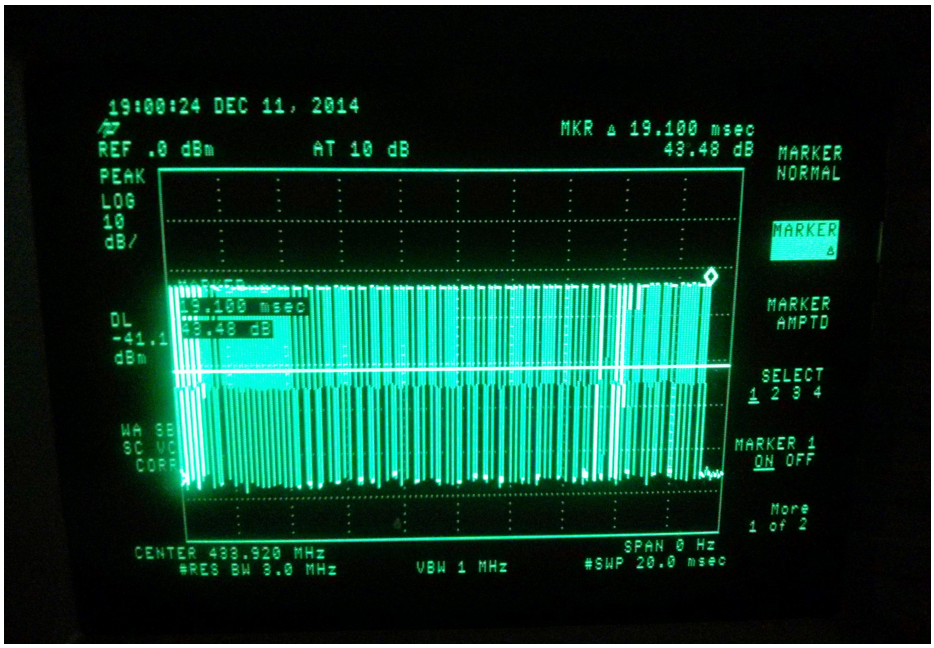
Certain harmonics of the transmitted signal fall in the restricted bands of §15.205. These harmonics are all above 960MHz and have the following limit as given in §15.209:
Restricted band limit = 500uV/m = 54dBuV/m.

3.5.2. Duty Cycle Correction Factor and Resulting Limits

This transmitter uses ASK modulation. Each transmitted packet has a length of 20mS with a minimum of 100ms gap between each packet.

Each transmitted packet contains 100 bits, each 200us long. The bits use Manchester encoding, so every 200us bit has an on time of 100us. Total packet on time is then 10ms. The maximum transmitter duty cycle in a 100ms period thus is 10/100 = 10%.

The packet width measurement below was made using Hewlett Packard Model 8594E Spectrum Analyzer.



Calculating the allowed duty cycle correction factor as given in §15.35(c):

20log(10/100) = -20dB

This transmitter therefore qualifies for the maximum duty cycle correction factor allowed in §15.35(c). The maximum duty cycle correction factor allowed is 20dB. Resulting radiated field strength limits are as follows:

Fundamental:	**100.825dBuV/m**
Spurious:	**80.825dBuV/m**
Restricted Band:	**74dBuV/m**

3.5.3. 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 100kHz 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.

The fundamental signal, at 95.2dBuV/m, passed by 5.6dB
The highest spurious signal was the 2nd harmonic at 67.4dBuV/m, which passed by 13.4dB.

All non-harmonic spurious emissions in the applicable frequency range were investigated.
The highest spurious emission is at 542.4MHz, at 42.3dBuV/m, passed by 3.7dB.
Next highest spurious emission is at 325.44MHz, at 30.9dBuV/m, passed by 15.1dB.

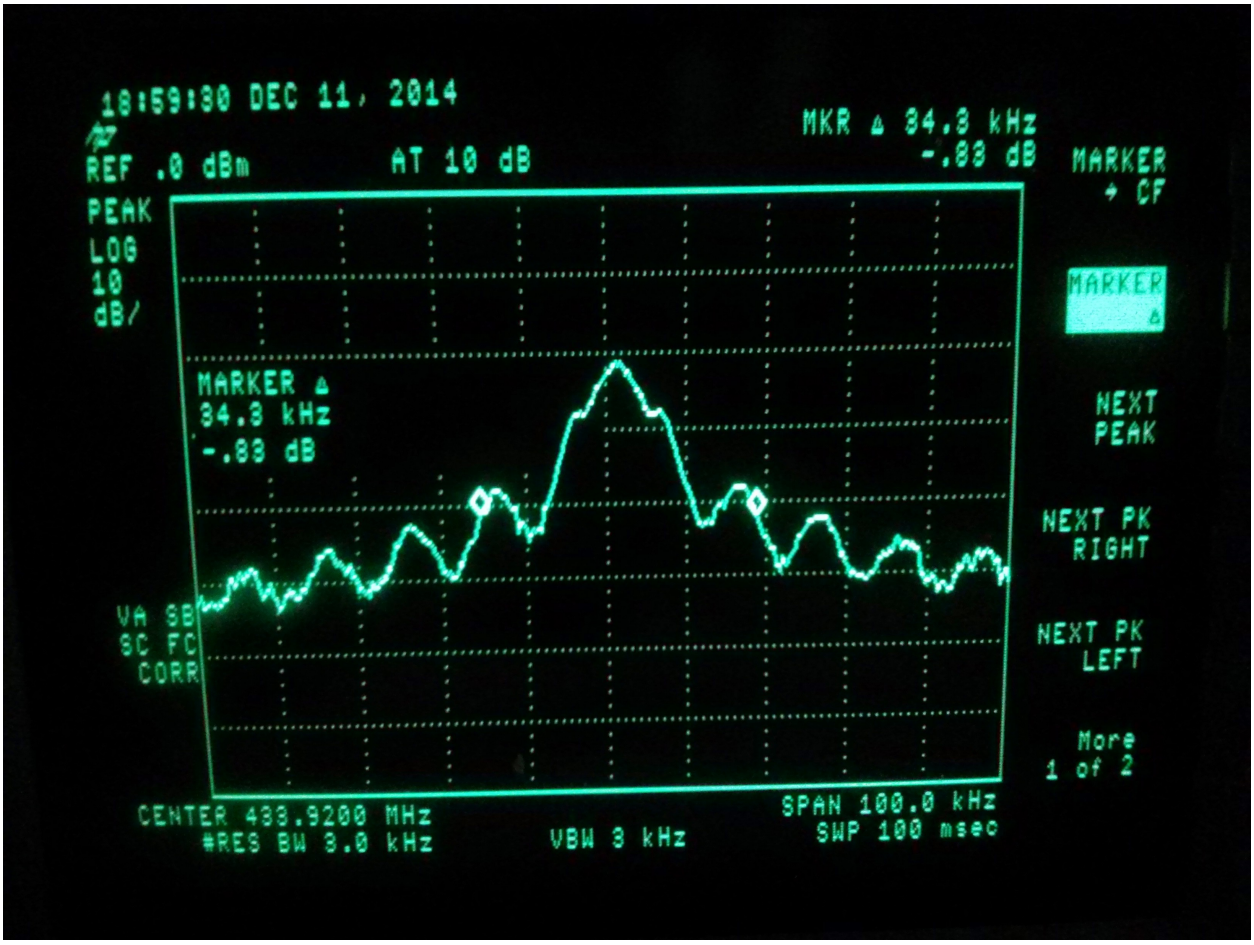
Measured radiated field strength data is shown in Exhibit I.

3.6. FCC Part 15 §15.231(c)

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

BW Limit = 0.0025*433.92MHz
BW Limit = 1.0848MHz

The plot below shows the modulated signal. Bandwidth of the modulated signal is 34.3kHz or 0.0343MHz. These measurements show compliance with the bandwidth requirements.


18:59:30 DEC 11, 2014
MKR Δ 34.3 kHz
-.83 dB
REF .0 dBm
AT 10 dB
PEAK
LOG
10
dB/
MARKER Δ
34.3 kHz
-.83 dB
VA SB
SC FC
CORR
CENTER 433.9200 MHz
#RES BW 3.0 kHz
VBW 3 kHz
SPAN 100.0 kHz
SWP 100 msec
MARKER
→ CF
MARKER
Δ
NEXT
PEAK
NEXT PK
RIGHT
NEXT PK
LEFT
More
1 of 2