

Resolution Products, Inc.

**Wireless Hidden Keypad
FCC ID: U5X-RE351**

Certification Test Report

May 29, 2013

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1. Introduction

This device is a small two button keypad with a wireless transmitter. The device transmits keypresses for the purpose of controlling a security system. A PIC16LF1823 microcontroller monitors the keypad and transmits data packets when valid keypresses are detected. The device measures approximately 3" x 1.25" x 0.5" and weighs about 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-RE351". 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-RE351
 - (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.

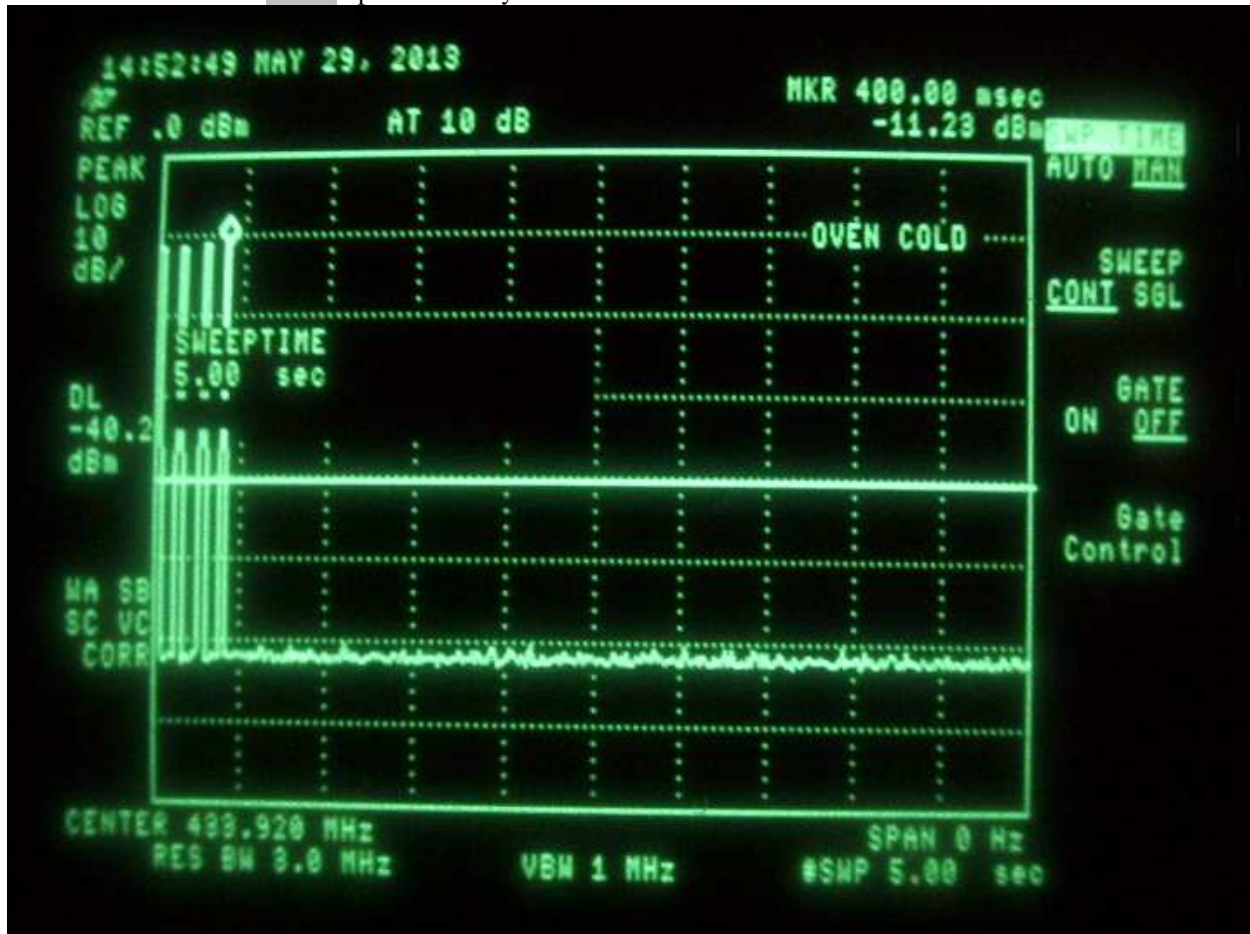
3. Discussion of Laboratory Measurements and Rules Compliance

3.1. FCC Part 15 §15.231(a)(1)

The transmitter is manually activated via two push button switches. Two transmission packets are sent by the device upon keypress activations from either one of the buttons. These packets are 25.6mS in length and are sent with a spacing of 125mS. If both buttons are pressed at the same time, the device will send 4 alarm condition packets with the same length and space as above. The device will continue to send packets with the same length and spacing for the pendency of the alarm condition, as allowed, as long as the two buttons are held down at the same time by the user. After transmission is complete, the device will go into a sleep mode and not transmit again until a button is pressed.

The device does not continue transmitting beyond the packets resulting from each activation. In the absence of activations from the buttons, the transmitter does not transmit at all.

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 8591E Spectrum Analyzer.



3.2. FCC Part 15 §15.231(a)(3)

This device does not send supervision packets.

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

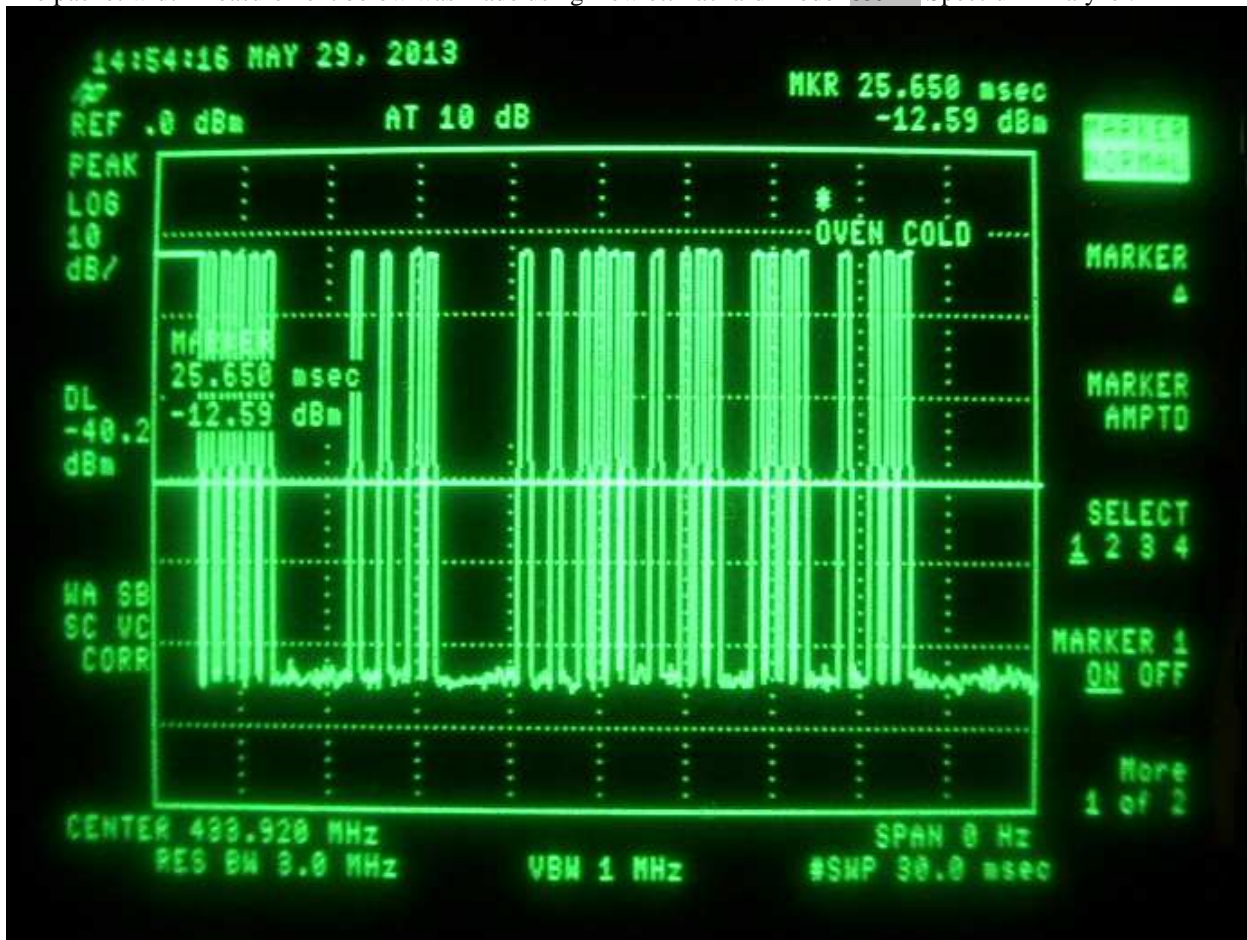
Certain harmonics of the transmitted signal fall in the restricted bands of §15.205. These harmonics are all above 960MHz and have the following limit as given in §15.209:

Restricted band limit = 500uV/m = 54dBuV/m.

3.5.2. Duty Cycle Correction Factor and Resulting Limits

This transmitter uses ASK modulation. 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 the first half of the bit. Therefore, the average "high time" in a data packet is $2.5\text{ms} + (0.250)(24) = 8.5\text{ms}$. The maximum transmitter duty cycle in a 100ms period thus is $8.5/100 = 8.5\%$.

The packet width measurement below was made using Hewlett Packard Model 8591E Spectrum Analyzer.



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

$$20\log(8.5/100) = -21.411\text{dB}$$

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, only harmonic emissions were present as noted in the test report.

The EUT was adapted to continuously transmit for testing purposes.

The fundamental signal, at 95.5dBuV/m, passed by 5.3dB
The highest spurious signal was the 8th harmonic, which passed by 22.8dB.

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

Bandwidth measurements were made using Hewlett Packard Model 8591E Spectrum Analyzer. The plot below shows the modulated signal. Bandwidth of the modulated signal is 146.3kHz or 0.1463MHz. These measurements show compliance with the bandwidth requirements.

14:58:02 MAY 29, 2013

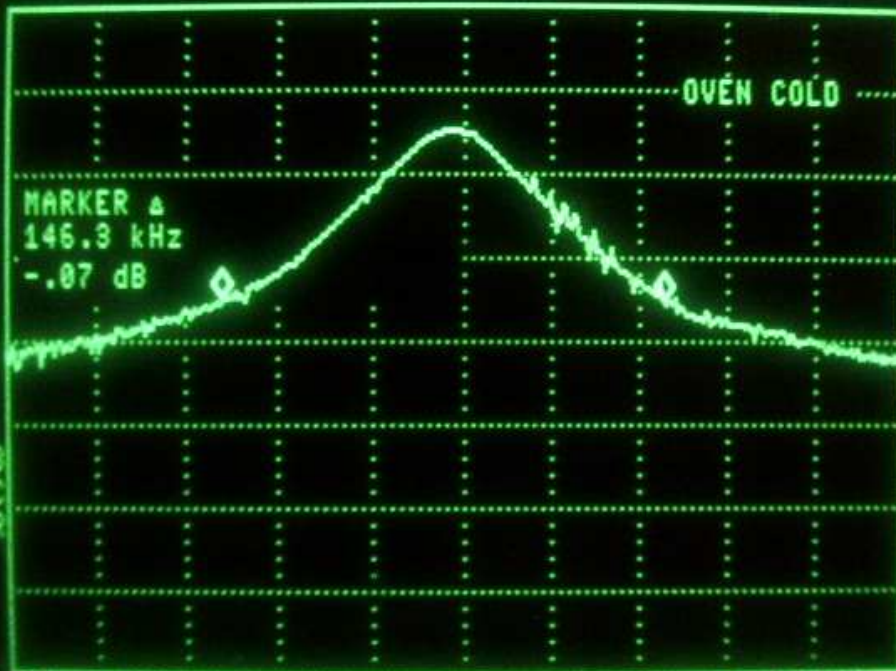
REF .0 dBm

AT 10 dB

MKR Δ 146.3 kHz
-.07 dB

PEAK
LOG
10
dB/

MARKER
→ CF



MARKER

NEXT
PEAK

NEXT PK
RIGHT

NEXT PK
LEFT

More
1 of 2

MA SB
SC FC
CORR

CENTER 433.9200 MHz
#RES BW 30 kHz

#VBM 30 kHz

SPAN 300.0 kHz
SMP 20.0 msec