Resolution Products, Inc.

RE300-5 5 Button Keyfob
FCC ID: U5X-RE300-5

Certification Test Report

January 25, 2017

Contents

1. Introduction

The RE300-5 is a small 5 button keyfob designed for controlling a wireless security system. The device is powered by a CR2032 lithium coin cell battery. It measures 2.2" x 1.5" x 0.6" and weighs approximately .66 ounces.

There will be two models listed under FCC ID: U5X-RE300-5. These two models are RE300-5 and RE600-5. 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 note the differences and similarities between the two models when it is relevant to the applicable requirement.

The device is manually activated when a user presses a valid button or button combination. A PIC16LF18323 microcontroller is used to monitor the state of these buttons. When a valid press is detected, the RE300-5 model transmits up to 12 packets. The RE600-5 model transmits up to 8 packets. Upon completion of these packets, the device goes into sleep mode and will not transmit again until a new valid press is detected.

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 ASK modulation of the 433.92MHz signal. The RF signal is radiated using a printed pcb antenna.

The transmitted packet for the RE300-5 model is ASK modulated and has an on-time of 8.5mS. The transmitted packet for the RE600-5 model is ASK modulated and has an on-time of 10mS. Precautions are taken in the firmware to ensure there is at least 100mS between packets, and that the transmissions cease within 5 seconds as required.

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-RE300-5". 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) 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-RE300-5
(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)

This transmitter is manually activated when a user presses a valid button or button combination. When a valid press is detected, the RE300-5 model transmits up to 12 packets. The RE600-5 model transmits up to 8 packets. The transmitted packets are 26.5mS in length for the RE300-5 model, and 20mS in length for the RE600-5 model. The spacing between each packet is randomized from 112mS to 240mS. Upon completion of these packets, the device goes into sleep mode and will not transmit again until a new valid press is detected.

The plots that follow (made using an Agilent Model N9340B Spectrum Analyzer) show the packet transmissions occurring in a 5 second window resulting from one activation. The packets are shown to conclude within a 5-second window as required.

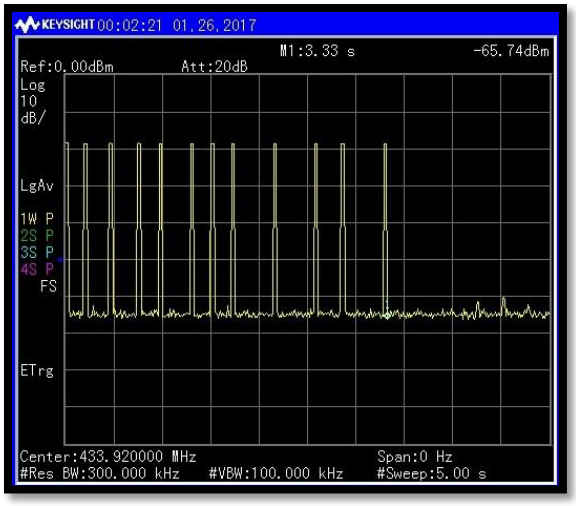

Figure 1: Packet Transmissions within a 5-Second Window (RE300-5)

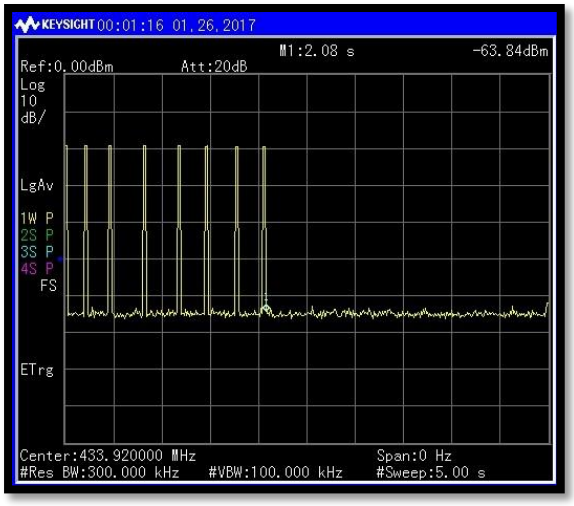

Figure 2: Packet Transmissions within a 5-Second Window (RE600-5)

3.2. FCC Part 15 §15.231(a)(3)

This device does not send periodic or automatic transmissions of any kind.

3.3. FCC Part 15 §15.231(a)(4)

This 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: **80.825 dBuV/m**
Spurious: **60.825 dBuV/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

The following pertains to the RE300-5 Model. 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 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%.

The following pertains to the RE600-5 Model. This transmitter uses ASK 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%.

The plots that follow (made using an Agilent Model N9340B Spectrum Analyzer) show the packet width measurements.

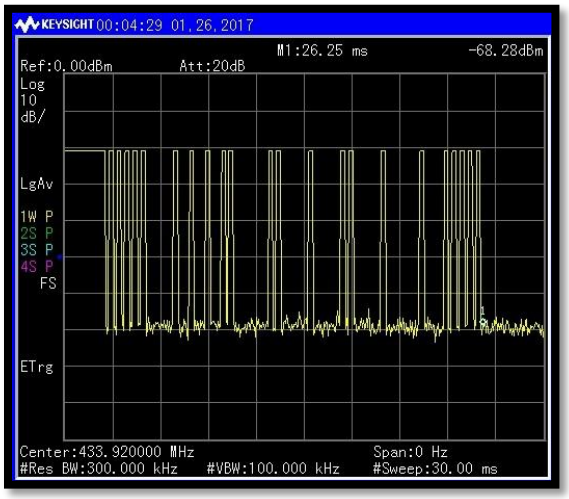

Figure 3: Packet Width (RE300-5)

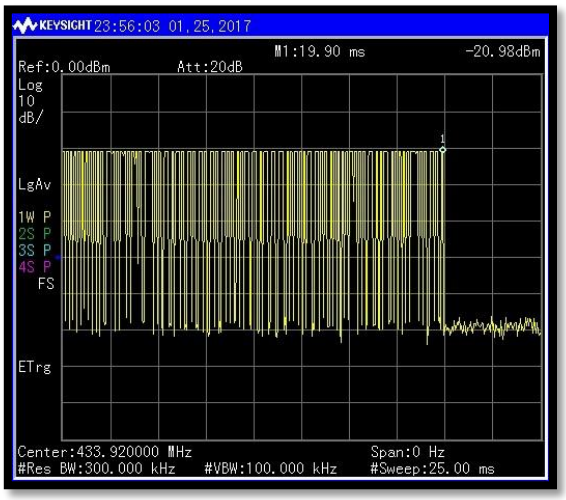

Figure 4: Packet Width (RE600-5)

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

20log(8.5/100) = -21.41 dB (RE300-5 Model)
20log(10/100) = -20.00 dB (RE600-5 Model)

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 calculated as follows:

Fundamental:	80.825 dBuV/m + 20 dBuV/m	**= 100.825 dBuV/m**
Spurious:	60.825 dBuV/m + 20 dBuV/m	**= 80.825 dBuV/m**
Restricted Band:	54.000 dBuV/m + 20 dBuV/m	**= 74.00 dBuV/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 88.6dBuV/m, passed by 12.2dB.
The highest spurious signal was the second harmonic, which passed by 30.3dB.

Further measured radiated field strength data is shown in Exhibit I.

3.6. FCC Part 15 §15.231(c)

3.6.1. 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
BW Limit = 1.0848 MHz

The plots that follow (made using an Agilent Model N9340B Spectrum Analyzer) show the bandwidth of the modulated signal to be 125 kHz or 0.125 MHz for the RE300-5 model, and 127 kHz or .127 MHz for the RE600-5 model. These measurements show compliance with the bandwidth requirements by a margin of 959.8 kHz and 957.8 kHz respectively.

Figure 5: Measured Bandwidth (RE300-5)

Figure 6: Measured Bandwidth (RE600-5)