

Resolution Products, Inc.

**RE118 Trident Environmental Sensor
FCC ID: U5X-RE118**

Certification Test Report

October 27, 2016

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1. Introduction

The RE118 is an environmental sensor designed for use in a wireless home security system. The device is powered by two CR2032 lithium coin cell batteries. It measures 2.43" x 2.48" x 1.17" and weighs approximately 1.34 ounces.

The device transmits packets to a security system which indicate the status of a flood sensing input, temperature sensor, and tamper switch. A PIC12LF1572 microcontroller is used to monitor these inputs for changes. When a valid change is detected, the device transmits 8 packets. In the absence of activity, the device transmits a set of four supervision packets every 60 to 90 minutes.

The RE118 transmitter circuit consists of a 9.984MHz crystal and a Micrel MICRF113YM6 PLL chip. This chip multiplies the crystal frequency to 319.5MHz. It also includes a circuit which allows ASK modulation of the 319.5MHz signal. The RF signal is radiated using a helical wire antenna.

The transmitted packet is ASK modulated and has an on-time of 7.93mS. 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-RE118". 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-RE118
 - (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 activated via a tamper switch, temperature sensor, or water sensing circuit. When a valid activation is detected, the device transmits eight packets. The transmitted packets are 16.65mS in length. The spacing between each packet is randomized from 100mS to 330mS. 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.

The plot that follows (made using a Hewlett Packard Model 8594E 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.

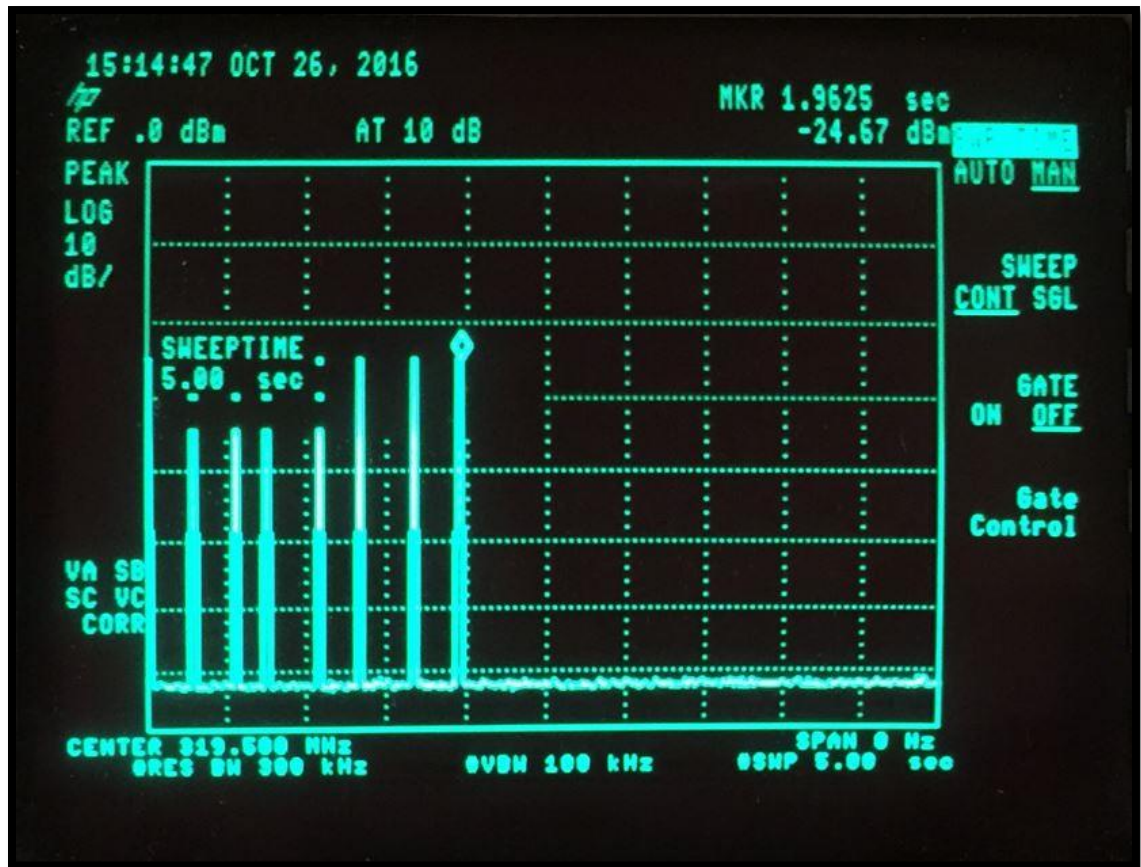


Figure 1: Packet Transmissions within a 5-Second Window

3.2. FCC Part 15 §15.231(a)(3)

The supervision interval ranges from 60 to 90 minutes. If no input 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.

3.3. 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: 75.9 dBuV/m
Spurious: 55.9 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

This transmitter uses ASK modulation. 63 bits are transmitted in each packet, and the “on” time for each bit is 122uS, except for one bit which has an “on” time of 366uS. The resulting “on” time per packet is 7.93mS. The transmitted packets are limited to one packet in a 100mS period. The transmitter duty cycle over a 100mS time period is therefore $7.93/100 = 7.93\%$.

The plot that follows (made using a Hewlett Packard Model 8594E Spectrum Analyzer) show the packet width measurement.

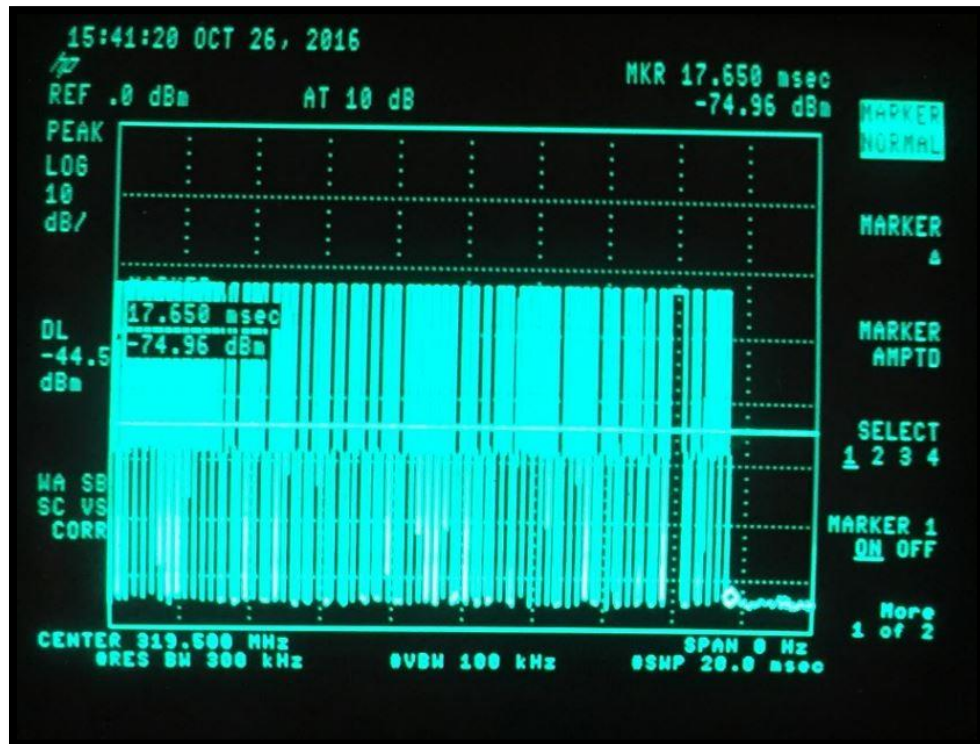


Figure 2: Packet Width

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

$$20\log(7.93/100) = -22.01\text{dB}$$

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 calculated as follows:

Fundamental: 75.9 dBuV/m + 20 dBuV/m = **95.9 dBuV/m**
Spurious: 55.9 dBuV/m + 20 dBuV/m = **75.9 dBuV/m**
Restricted Band: 54.0 dBuV/m + 20 dBuV/m = **74.0 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 91.4dBuV/m, passed by 4.5dB

The highest spurious signal was the sixth harmonic, which passed by 15.3dB.

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.

$$\text{BW Limit} = 0.0025 * 319.5 \text{ MHz}$$

$$\text{BW Limit} = 0.799 \text{ MHz}$$

The plot that follows (made using a Hewlett Packard Model 8594E Spectrum Analyzer) shows the bandwidth of the modulated signal is 145.5 kHz or 0.1455 MHz. These measurements show compliance with the bandwidth requirements by a margin of 653.5 kHz or .6535 MHz.

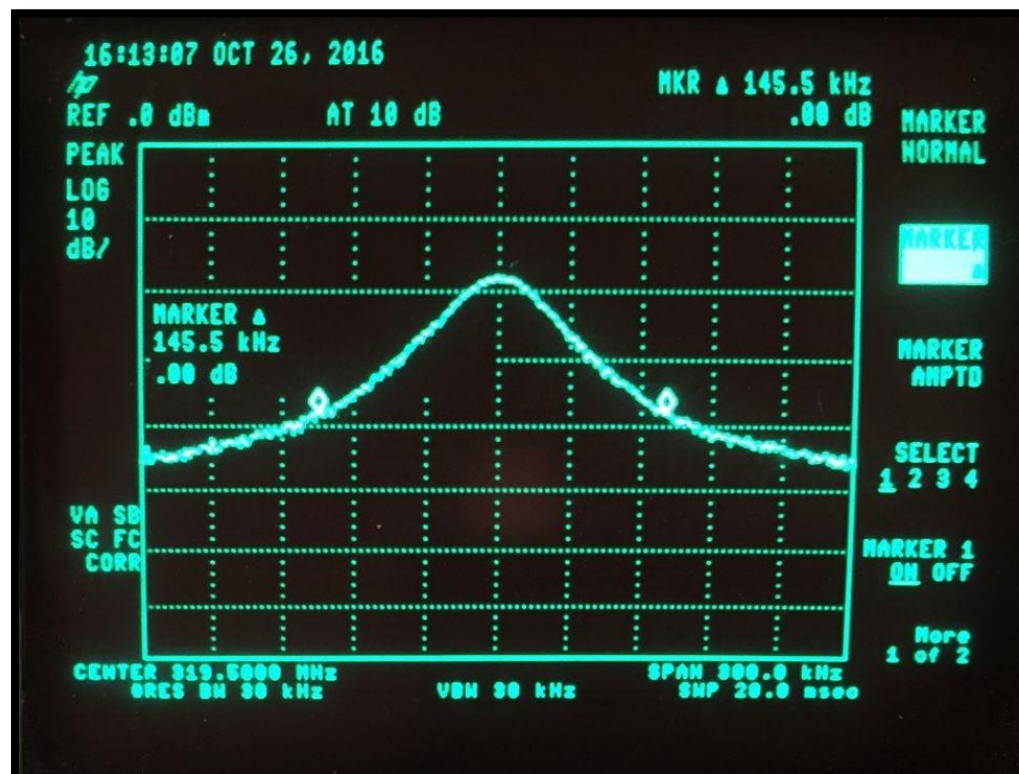


Figure 3: Measured Bandwidth