



Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.231 Certification Application Report

Test Lab: Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web: www.rheintech.com Herndon, VA 20170 Email: atcbinfo@rheintech.com		Applicant: Reconyx, Inc. Phone: 866-493-6064 3828 Creekside Lane Suite 2 Holmen WI 54636 Contact: Darrel VanderZee	
FCC ID	ZON-HF-RTI	Test Report Date	October 12, 2011
Platform	N/A	RTL Work Order Number	2011110
Model	RTI350	RTL Quote Number	QRTL11-135
FCC Classification	DSC – Part 15 Security/Remote Control Transmitter		
FCC Rule Part(s)	Part 15.231: Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz (10-01-10)		
Procedure or Other Guidance	ANSI C63.4-2003 Standard for Methods of Measurement of Radio-Noise Emissions		
Digital Interface Information	N/A		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
433.92	N/A	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. Modifications made to the equipment during testing in order to achieve compliance with these standards are listed in the report.

Furthermore, there was no deviation from, additions to, or exclusions from the applicable parts of FCC Part 2, FCC Part 15 and ANSI C63.4.

Signature: 

Date: October 12, 2011

Typed/Printed Name: Desmond A. Fraser

Position: President

This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc. and Reconyx, Inc. The test results reported relate only to the item tested.

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

1	General Information	5
1.1	Scope	5
1.2	Modifications	5
1.3	Test Facility	5
1.4	Related Submittal(s)/Grant(s)	5
2	Test Information	6
2.1	Test Justification	6
2.2	Exercising the EUT	6
2.3	Test Result Summary.....	6
2.4	Test System Details	6
2.5	Configuration of Tested System.....	7
3	Duty Cycle Calculation - FCC 15.35(c).....	8
4	Transmitter Deactivation – FCC 15.231(a)(2).....	11
5	Modulated Bandwidth – FCC 15.231(c).....	12
5.1	Modulated Bandwidth Test Procedure	12
5.2	FCC 15.231(c) Limits	12
5.3	Modulated Bandwidth Test Data	12
6	Radiated Emissions – FCC 15.209, 15.231	14
6.1	Radiated Fundamental Emissions Test Procedure.....	14
6.1.1	Radiated Fundamental Emissions Limits Test Data	14
6.2	Radiated Harmonics/Spurious Emissions – FCC 15.231	14
6.2.1	Radiated Emissions Harmonics/Spurious Test Procedure	14
7	Conducted Emissions	17
7.1	Site and Test Description	17
7.2	Test Limits	17
7.3	Conducted Emissions Test Results	17
8	Conclusion	18

Table Index

Table 2-1:	Test Result Summary with FCC Rules and Regulations	6
Table 2-2:	Equipment Under Test (EUT).....	6
Table 3-1:	Duty Cycle Test Equipment.....	10
Table 4-1:	Transmitter Deactivation Test Equipment.....	11
Table 5-1:	20 dB Modulated Bandwidths	12
Table 5-2:	Modulated Bandwidth Test Equipment	13
Table 6-1:	Radiated Fundamental Emissions	14
Table 6-2:	Radiated Spurious Harmonics	15
Table 6-3:	Radiated Digital Unintentional/RX Emissions	15
Table 6-4:	Radiated Emissions Test Equipment	16

Figure Index

Figure 2-1:	Worst Case Configuration of System under Test.....	7
-------------	--	---

Plot Index

Plot 3-1:	Six Packets in 100 ms.....	8
Plot 3-2:	Total Number of "on" Bits in a Packet = 19	9
Plot 3-3:	"On" Time of a Bit = 60 us	10
Plot 4-1:	Transmitter Deactivation	11
Plot 5-1:	Modulated Bandwidth.....	13

Appendix Index

Appendix A:	FCC/TCB Agency Authorization Letter	19
Appendix B:	FCC Confidentiality Request Letter.....	20
Appendix C:	ID Label and Label Location	21
Appendix D:	Operational Description.....	22
Appendix E:	Schematics.....	23
Appendix F:	Block Diagram	24
Appendix G:	Manual	25
Appendix H:	Test Photographs	26
Appendix I:	External Photographs.....	28
Appendix J:	Internal Photographs	34

Photograph Index

Photograph 1:	ID Label Sample and Location	21
Photograph 2:	Radiated Emissions	26
Photograph 3:	Radiated Emissions	27
Photograph 4:	Bottom	28
Photograph 5:	Front Face	29
Photograph 6:	Rear.....	30
Photograph 7:	Side with Hinge	31
Photograph 8:	Side with Latch	32
Photograph 9:	Top	33
Photograph 10:	Device Opened for User Interaction	34
Photograph 11:	Device Opened to Show Illuminator and Power Cable Connected	35
Photograph 12:	Device Opened with Illuminator Removed	36
Photograph 13:	Illuminator PCB - Side 1	37
Photograph 14:	Illuminator PCB - Side 2	38
Photograph 15:	Wireless PCB - Side 1	39
Photograph 16:	Wireless PCB - Side 2	40

1 General Information

1.1 Scope

FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

1.2 Modifications

N/A

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Rhein Tech Laboratories, Inc. (RTL), 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Reconyx, Inc. Model RTI350, Remote Wireless Trigger & Illuminator, FCC ID: ZON-HF-RTI.

2 Test Information

2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT's frequencies were tested and investigated from 9 kHz to the 10th harmonic. The test results relate only to the item that was tested.

The antenna transmits, receives, and is internal. The IF, LO, and up to the 2nd LO, were investigated and tested, and found to be compliant for unintentional emissions compliance.

2.2 Exercising the EUT

The EUT was adapted to continuously transmit for testing purposes. The carrier was also checked to verify that the information was being transmitted. The unit was reprogrammed for normal operation for the duty cycle plots and transmission requirement of 15.231(a)(2).

There were no deviations from the test standard(s) and/or methods.

2.3 Test Result Summary

Table 2-1: Test Result Summary with FCC Rules and Regulations

Standard	Test	Pass/Fail Or N/A
FCC 15.207	AC Conducted Emissions	N/A
FCC 15.231(a)(2)	Transmitter Deactivation	Pass
FCC 15.231(b)	Radiated Emissions	Pass
FCC 15.231(c)	20 dB Bandwidth	Pass

2.4 Test System Details

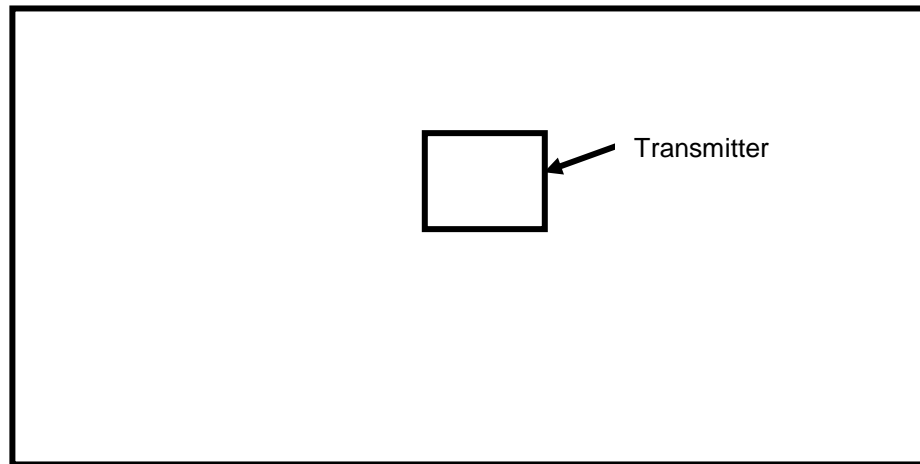
The test samples were received on July 22, 2011. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in the following table.

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Wireless Flash & Illuminator	Reconyx, Inc.	RTI350	A350BE07000012	ZON-HF-RTI	N/A	20106

2.5 Configuration of Tested System

Figure 2-1: Worst Case Configuration of System under Test

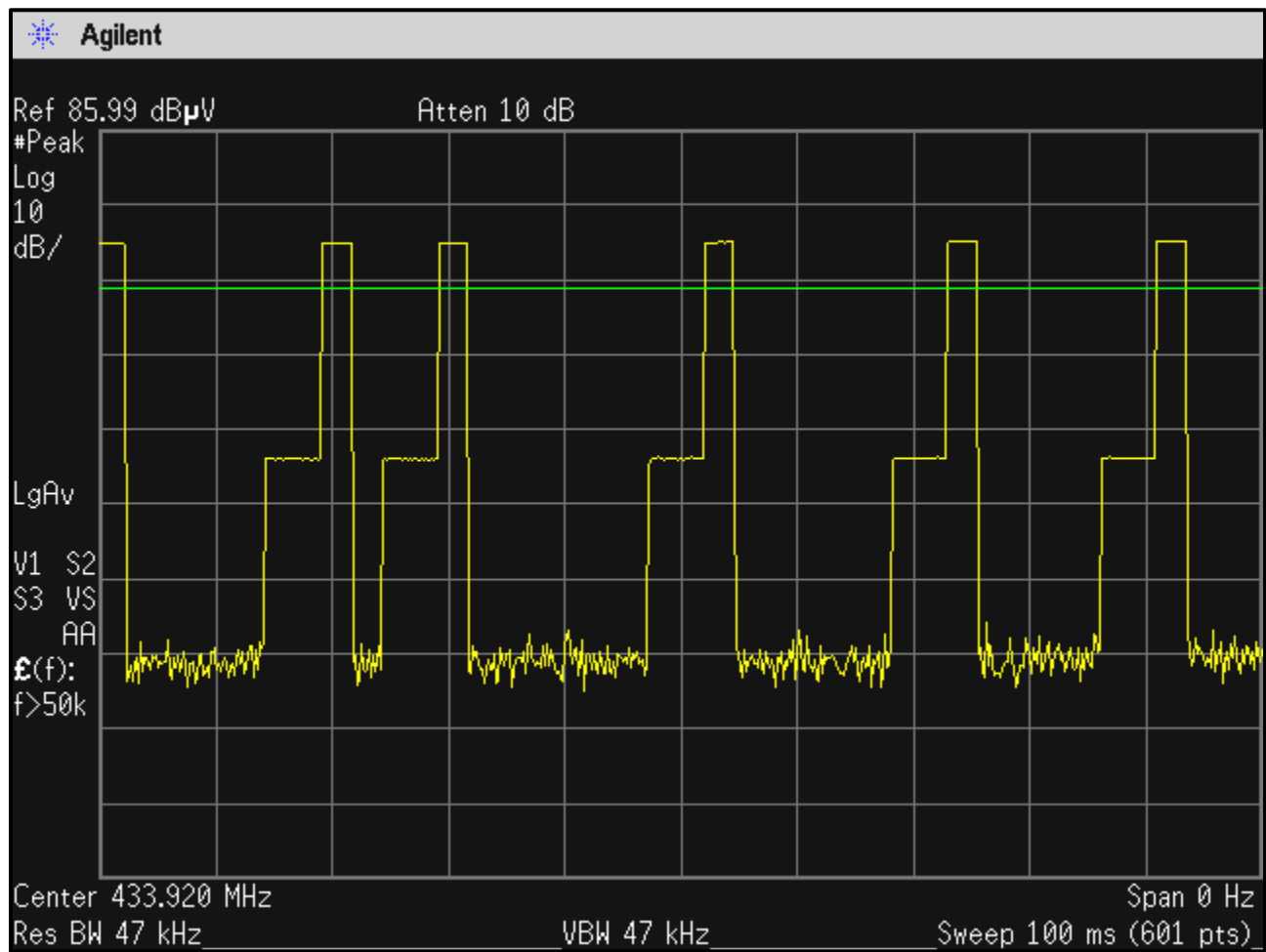


3 Duty Cycle Calculation - FCC 15.35(c)

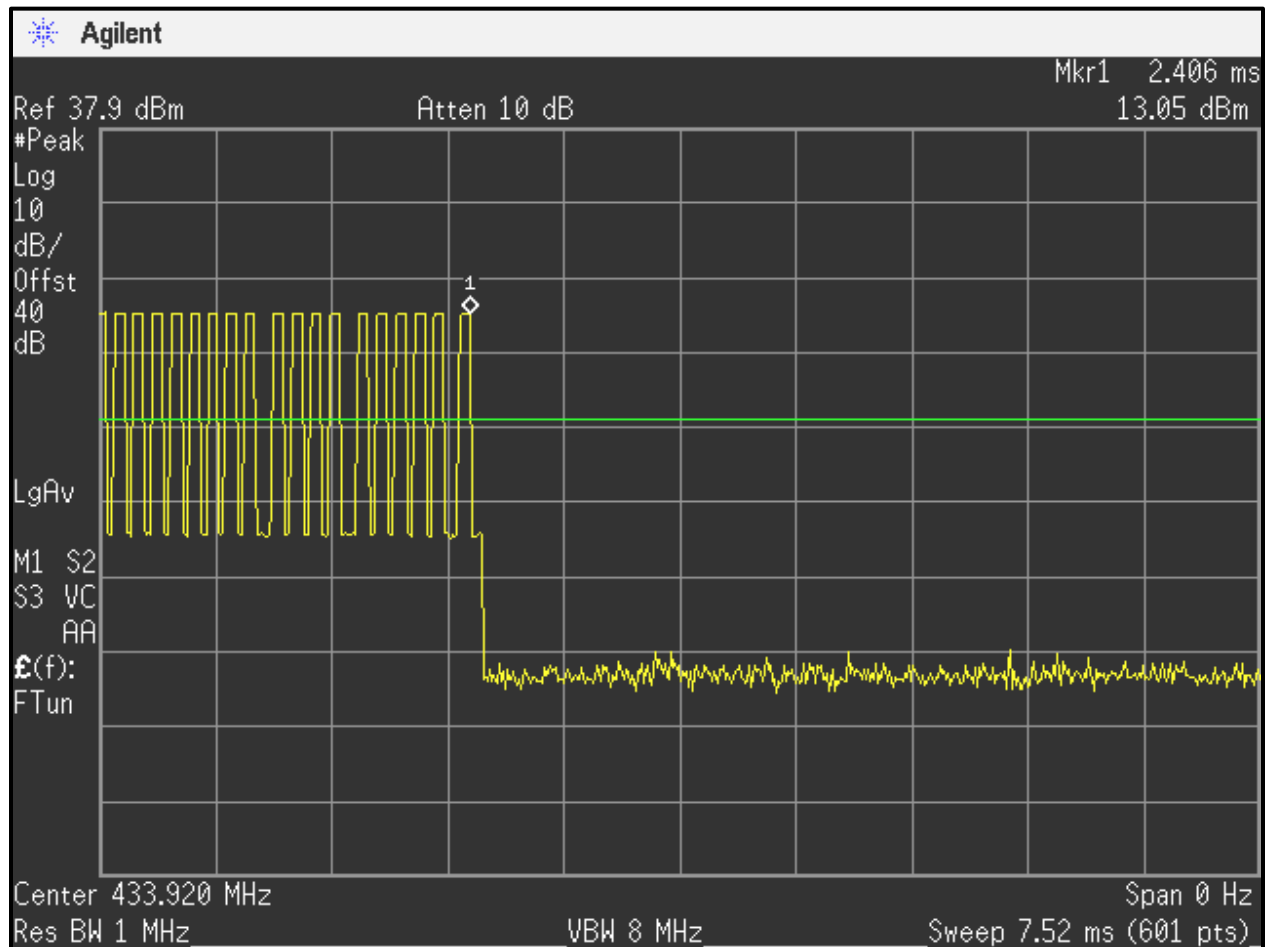
A worst-case standard transmission in 100 ms consists of 6 packets with 19 0.06 ms "on" bits. Therefore, the maximum "on" time in a 100 ms window is $6 * 19 * 0.06 \text{ ms} = 6.84 \text{ ms}$.

$$20 \log (6.84/100) = -23.3 \text{ dB}$$

Plot 3-1: Six Packets in 100 ms



Plot 3-2: Total Number of “on” Bits in a Packet = 19



Agilent

Ref 85.99 dB μ V Atten 10 dB

Δ Mkr1 60 μ s 3.11 dB

#Peak Log 10 dB/

LgAv

V1 S2
S3 VC
AA

$\mathcal{E}(f)$:
FTun

Center 433.920 MHz Span 0 Hz
Res BW 1 MHz VBW 1 MHz Sweep 100 μ s (601 pts)

Marker

Select Marker 1 2 3 4

Normal

Delta

Delta Pair (Tracking Ref) Ref Δ


Span Pair Span Center

Off

More 1 of 2

Copyright 2000-2005 Agilent Technologies

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	4/8/12

Daniel Baltzell		October 6, 2011
Test Engineer	Signature	Date of Test

4 Transmitter Deactivation – FCC 15.231(a)(2)

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Plot 4-1: Transmitter Deactivation

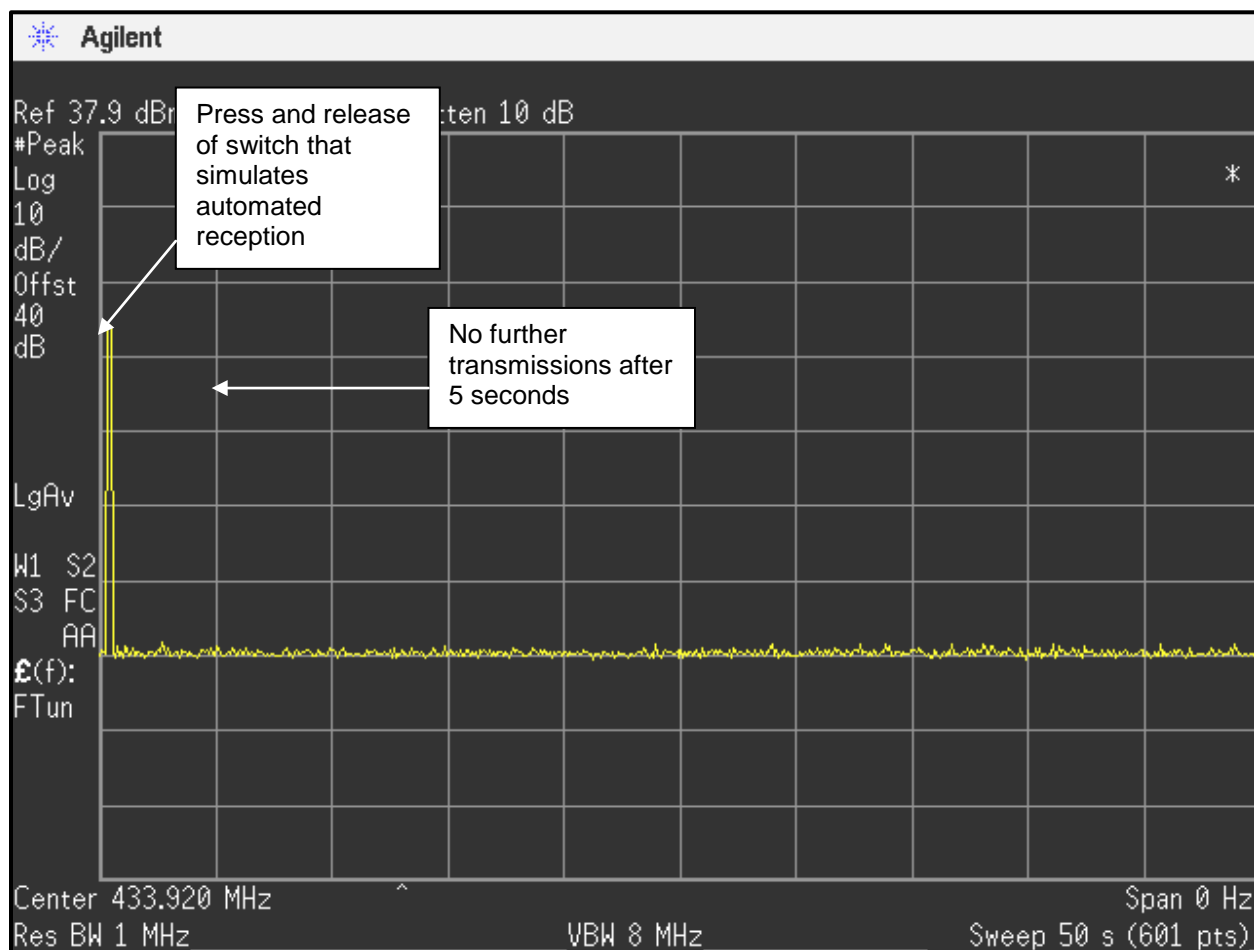


Table 4-1: Transmitter Deactivation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	4/8/12

Test Personnel:

Daniel Baltzell
 Test Engineer

Signature

October 6, 2011
 Date of Test

5 Modulated Bandwidth – FCC 15.231(c)

5.1 Modulated Bandwidth Test Procedure

The minimum 20 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 10 kHz and the video bandwidth set at 100 kHz. The spectrum analyzer's display markers were set to -20 dB using max hold until the spectrum was filled and a plot taken.

5.2 FCC 15.231(c) Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3 Modulated Bandwidth Test Data

Table 5-1: 20 dB Modulated Bandwidths

Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
433.92	57	0.25% of 433920 = 1085	-1028

Plot 5-1: Modulated Bandwidth

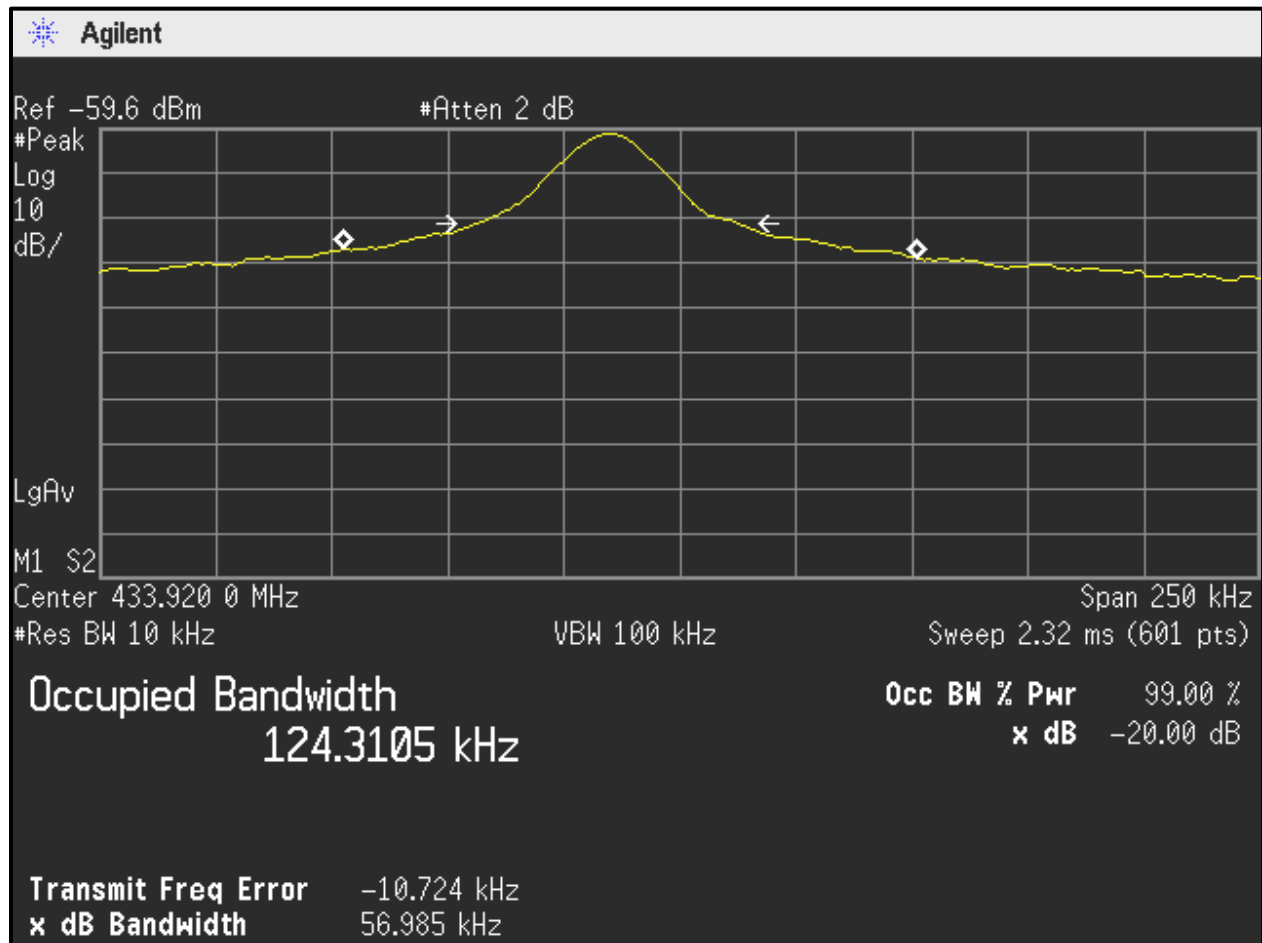


Table 5-2: Modulated Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	4/08/12

Test Personnel:

Richard B. McMurray, P.E.
 Test Engineer

Richard B. McMurray
 Signature

August 3, 2011
 Date of Test

6 Radiated Emissions – FCC 15.209, 15.231

6.1 Radiated Fundamental Emissions Test Procedure

Radiated emissions of the fundamentals were tested at three meters, and meet the requirements of average mode, and 20 dB higher in peak mode. The limit is calculated from a linear interpolation between 3,750 and 12,500 uV/m, and from 260-470 MHz, or 10,997 uV/m at 433.92 MHz. The EUT was tested in all three orthogonal planes. Measurement was based on a peak detector and an average level was calculated. The average level was compared to the average limit as per 15.231(b) and the peak level was compared to the average limit +20 dB per 15.35(b).

6.1.1 Radiated Fundamental Emissions Limits Test Data

Table 6-1: Radiated Fundamental Emissions

Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
433.92	64.7	30.5	95.2	100.8	-5.6	-23.3	71.9	80.8	-8.9

6.2 Radiated Harmonics/Spurious Emissions – FCC 15.231

6.2.1 Radiated Emissions Harmonics/Spurious Test Procedure

Radiated emissions of the harmonics 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 4 m, and the EUT was rotated through 360° on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 100 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz.

Table 6-2: Radiated Spurious Harmonics

Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
867.823	63.0	-3.2	59.8	80.8	-21.0	-23.3	36.5	60.8	-24.3
1301.742	44.5	3.4	47.9	80.8	-32.9	-23.3	24.6	60.8	-36.2
1735.652	45.6	7.8	53.4	80.8	-27.4	-23.3	30.1	60.8	-30.7
2,169.572	44.2	7.8	52.0	80.8	-28.8	-23.3	28.7	60.8	-32.1
2,603.492	39.1	9.0	48.1	80.8	-32.7	-23.3	24.8	60.8	-36.0
3,037.412	41.7	7.3	49.0	80.8	-31.8	-23.3	25.7	60.8	-35.1
3,471.332	38.4	8.0	46.4	80.8	-34.4	-23.3	23.1	60.8	-37.7
3,905.252	40.5	8.8	49.3	80.8	-31.5	-23.3	26.0	60.8	-34.8
4,339.172	39.7	13.0	52.7	80.8	-28.1	-23.3	29.4	60.8	-31.4

Table 6-3: Radiated Digital Unintentional/RX Emissions

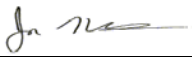
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
64.000	Qp	42.0	-23.3	18.7	40.0	-21.3	Pass
80.000	Qp	46.2	-21.7	24.5	40.0	-15.5	Pass
109.380	Qp	39.4	-16.7	22.7	43.5	-20.8	Pass
135.780	Qp	49.7	-17.7	32.0	43.5	-11.5	Pass
167.480	Qp	46.2	-18.8	27.4	43.5	-16.1	Pass
214.530	Qp	52.9	-19.0	33.9	43.5	-9.6	Pass
274.439	Qp	48.0	-14.2	33.8	46.0	-12.2	Pass
386.915	Qp	44.6	-11.6	33.0	46.0	-13.0	Pass
692.100	Qp	35.4	-5.7	29.7	46.0	-16.3	Pass

Table 6-4: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900905	Rhein Tech Laboratories, Inc.	PR-1040	Amplifier (20 MHz - 2 GHz)	900905	4/10/12
900791	Schaffner Chase	CBL6112	Bilog Periodic Antenna (25 MHz - 2 GHz)	2099	12/12/12
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz - 6.5 GHz)	3325A00159	8/2/11
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	8/2/11
901215	Hewlett Packard	8596EM	Spectrum Analyzer	3826A00144	11/23/11
900932	Hewlett Packard	8449B OPT H02	Amplifier (1 GHz - 26.4 GHz)	3008A00505	7/14/12
900772	EMCO	3161-02	Horn Antenna, (2.0 - 4.0 GHz)	9804-1044	6/13/12
900321	EMCO	3161-03	Horn Antenna, (4.0 - 8.2 GHz)	9508-1020	6/13/12
N/A	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Emissions Testing Software	Rev. 14.0.2	N/A

Test Personnel:

Jon Wilson
 Test Engineer


 Signature

July 25, 2011
 Date of Tests

7 Conducted Emissions

7.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50 ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded. The limits for Class A and Class B are contained therein.

7.2 Test Limits

Class A Line-Conducted Emissions		
Limit (dB μ V)		
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	79	66
0.50 to 30.0	73	60

Class B Line-Conducted Emissions		
Limit (dB μ V)		
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

7.3 Conducted Emissions Test Results

Testing is N/A – the EUT is battery powered.

Rhein Tech Laboratories, Inc.
360 Herndon Parkway
Suite 1400
Herndon, VA 20170
<http://www.rheintech.com>

Client: Reconyx, Inc.
Model: RTI350
Standard: FCC 15.231
FCC ID: ZON-HF-RTI
Report #: 2011110

8 Conclusion

The data in this measurement report shows that Reconyx, Inc. Model RTI350, Remote Wireless Trigger & Illuminator, FCC ID: ZON-HF-RTI, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules.