

*FCC PART 15, SUBPART B & SUBPART C  
TEST REPORT*

*For*  
**POWER PACK**  
Model: C0021031

Prepared for

BUDDERFLY LLC  
2 TRAP FALLS RD., SUITE 507  
SHELTON, CT 06484

Prepared by: \_\_\_\_\_

MATT HARRISON

Approved by: \_\_\_\_\_

JOSH HANSEN

COMPATIBLE ELECTRONICS INC.  
20621 PASCAL WAY  
LAKE FOREST, CALIFORNIA 92630  
(949) 587-0400

DATE: MAY 9, 2013

	REPORT BODY	APPENDICES					TOTAL
		A	B	C	D	E	
PAGES	17	2	2	2	15	21	<b>59</b>

This report shall not be reproduced, except in full, without the written approval of Compatible Electronics.

## TABLE OF CONTENTS

Section / Title	PAGE
<b>GENERAL REPORT SUMMARY</b>	<b>4</b>
<b>SUMMARY OF TEST RESULTS</b>	<b>4</b>
<b>1. PURPOSE</b>	<b>5</b>
<b>2. ADMINISTRATIVE DATA</b>	<b>6</b>
2.1 Location of Testing	6
2.2 Traceability Statement	6
2.3 Cognizant Personnel	6
2.4 Date Test Sample was Received	6
2.5 Disposition of the Test Sample	6
2.6 Abbreviations and Acronyms	6
<b>3. APPLICABLE DOCUMENTS</b>	<b>7</b>
<b>4. DESCRIPTION OF TEST CONFIGURATION</b>	<b>8</b>
4.1 Description of Test Configuration - EMI	8
4.1.1 Photograph of Test Configuration - EMI	8
4.1.2 Cable Construction and Termination	9
<b>5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT</b>	<b>10</b>
5.1 EUT and Accessory List	10
5.2 EMI Test Equipment	11
<b>6. TEST SITE DESCRIPTION</b>	<b>12</b>
6.1 Test Facility Description	12
6.2 EUT Mounting, Bonding and Grounding	12
<b>7. CHARACTERISTICS OF THE TRANSMITTER</b>	<b>13</b>
7.1 Channel Number and Frequencies	13
7.2 Antenna	13
<b>8. TEST PROCEDURES</b>	<b>14</b>
8.1 RF Emissions	14
8.1.1 Conducted Emissions Test	14
8.1.2 Radiated Emissions (Spurious and Harmonics) Test	15
8.1.3 Fundamental Field Strength	16
8.1.4 Emissions Radiated Outside of the Fundamental Frequency Band	16
8.1.5 Voltage Fluctuations	16
8.1.6 Pulsed Operation Duty Cycle Correction	16
<b>9. TEST PROCEDURE DEVIATIONS</b>	<b>17</b>
<b>10. CONCLUSIONS</b>	<b>17</b>

**LIST OF APPENDICES**

APPENDIX	TITLE
A	Laboratory Accreditations
B	Modifications to the EUT
C	Additional Models Covered Under This Report
D	Diagrams, Charts and Photos <ul style="list-style-type: none"><li>• Test Setup Diagrams</li><li>• Antenna and Amplifier Gain Factors</li><li>• Radiated and Conducted Emissions Photos</li></ul>
E	Data Sheets

**LIST OF FIGURES**

FIGURE	TITLE
1	Conducted Emissions Test Setup
2	Plot Map And Layout of Test Site below 1 GHz
3	Plot Map & layout of test site Above 1 GHz

## GENERAL REPORT SUMMARY

This electromagnetic emission report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form except in full, without the written permission of Compatible Electronics.

This report must not be used to claim product endorsement by NVLAP, NIST or any other agency of the U.S. Government.

Device Tested: Power Pack  
 Model: C0021031  
 S/N: None

Product Description: The EUT is an in-line power pack that is capable of sensing the current/voltage on the Power Line. This device also supports both power-line and RF communication using the INSTEON Protocol

Modifications: The EUT was not modified during testing.

Manufacturer: Budderfly LLC  
 2 Trap Falls Road, Suite 507  
 Shelton, CT 06484

Test Date: May 09, September 25, 2013

Test Specifications: EMI requirements  
 CFR Title 47, Part 15 Subpart B sections 15.107 and 15.109, Subpart C Sections 15.205, 15.207, 15.209 and 15.249  
 Test Procedures: ANSI C63.4 and ANSI C63.10

## SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz.	Complies with the limits of CFR Title 47 Part 15 Subpart B Section 15.107, Subpart C Section 15.207
2	Radiated RF Emissions & Harmonics, 9 kHz – 10,000 MHz.	Complies with the limits of CFR Title 47 Part 15 Subpart B Section 15.109 and Subpart C Section 15.205, 15.209
3	Fundamental Field Strength	Complies with CFR Title 47 Part 15 Subpart C Section 15.249(a)
4	Emissions Radiated Outside of the Fundamental Frequency Band	Complies with CFR Title 47 Part 15 Subpart C Section 15.249(d)
5	Voltage Variation	Complies with CFR Title 47 Part 15 Subpart C Section 15.31(e)

## 1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Power Pack Model: C0021031. The EMI measurements were performed according to the measurement procedure described in ANSI C63.10 and ANSI C63.4. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT (equipment under test) hereafter, are within the specification limits defined by the Code of Federal Regulations Title 47, Part 15 Subpart B 15.107 and 15.109, Subpart C sections 15.205, 15.207, 15.209 and 15.249. The power line carrier emissions tests were not performed by Compatible Electronics.

## 2. ADMINISTRATIVE DATA

### 2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 20621 Pascal Way, Lake Forest, California 92630.

### 2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

### 2.3 Cognizant Personnel

Budderfly LLC

Daniel Riscalla Vice President of Engineering

Compatible Electronics, Inc.

Matt Harrison	Test Technician
Joey Madlangbayan	Test Engineer
Josh Hansen	Lab Manager

### 2.4 Date Test Sample was Received

The test sample was received on May 9, 2013.

### 2.5 Disposition of the Test Sample

The test sample has not been returned to Budderfly LLC as of the date of this report.

### 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
NVLAP	National Voluntary Laboratory Accreditation Program
CFR	Code of Federal Regulations
PCB	Printed Circuit Board
TX	Transmit
RX	Receive

### 3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
CFR Title 47, Part 15	FCC Rules – Radio frequency devices (including digital devices)
ANSI C63.4 2009	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
ANSI C63.10: 2009	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz

## 4. DESCRIPTION OF TEST CONFIGURATION

### 4.1 Description of Test Configuration - EMI

The EUT was tested in a tabletop configuration. The EUT was connected to a light fixture on the load side and it was also connected to two motion sensors. The EUT was continuously Transceiving throughout the tests. All 3 axis were tested and the x axis was found to be the worst case.

The AC mains voltage was varied  $\pm 15\%$  of the nominal voltage resulting with no variation of amplitude or frequency.

The highest emissions were found when the EUT was running in the above configuration. The cables were moved to maximize the emissions. The final radiated and conducted data was taken in this mode of operation. All initial investigations were performed with the spectrum analyzer in manual mode scanning the frequency range continuously. The cables were and routed as shown in the photographs in Appendix D.

#### 4.1.1 Photograph of Test Configuration - EMI



#### 4.1.2 **Cable Construction and Termination**

##### Cable 1

This is a 1-meter, unshielded, round cable connecting the EUT to the light fixture. The cable is hardwired at the EUT end as well as the light fixture end.

##### Cables 2&3

These are 1-meter, unshielded, round cables connecting the EUT to the motion sensors. The cable is hardwired at the EUT end as well as the motion sensor end.

**5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT****5.1 EUT and Accessory List**

#	EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER
1	POWER PACK (EUT)	BUDDERFLY LLC	C0021031	NONE
2	LIGHT FIXTURE	GENERIC	NONE	NONE
3	MOTION SENSORS (x2)	HUBBELL	ATP1500C	NONE

5.2 **EMI Test Equipment**

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Computer	Compatible Electronics	NONE	NONE	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESIB40	100219	9/26/2012	9/26/2013
Antenna, Loop	Com Power	AL-130	17085	01/29/2013	01/29/2015
Antenna, CombiLog	Com Power	AC-220	25857	05/25/2012	05/25/2013
Antenna, Horn 1-18GHz	Com Power	AH-118	071250	07/03/2012	07/03/2013
Pre-Amp, 1-18GHz	Com Power	PAM-118	443013	04/08/2013	04/08/2014
Pre-Amp, 1-18GHz	Com Power	PAM-118	443014	04/08/2013	04/08/2014
High Pass Filter	AMTI Microwave Circuits	N0309153	3709-01 DC0415	05/09/2013	05/09/2014
LISN	Com Power	LI-215	12083	03/22/2013	03/22/2014
Mast, Antenna Positioner	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Antenna Mast	Sunol Science Corporation	TWR 95-4	020808-3	N/A	N/A
Turntable	Sunol Science Corporation	FM 2001	N/A	N/A	N/A
Mast and Turntable Controller	Sunol Science Corporation	SC104V	020808-1	N/A	N/A

## 6. TEST SITE DESCRIPTION

### 6.1 Test Facility Description

Please refer to section 2.1 of this report for EMI test location.

### 6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was grounded through the power cord.

## 7. CHARACTERISTICS OF THE TRANSMITTER

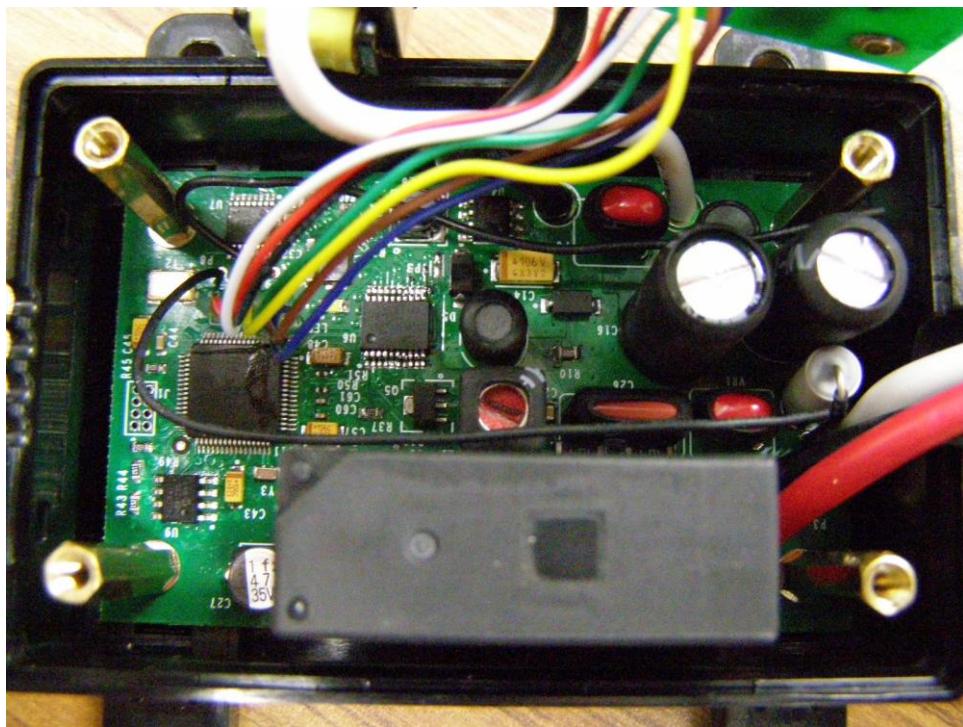
## 7.1 Channel Number and Frequencies

There is only 1 channel.

$$1 = 915 \text{ MHz}$$

## 7.2 Antenna

The antenna is made up of two 8cm wire antennas which are connected and soldered to the PCB.



## 8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

### 8.1 RF Emissions

#### 8.1.1 Conducted Emissions Test

The EMI receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. The LISN output was measured using the EMI receiver. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT received its power through the LISN, which was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63.4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the computer software.

#### Test Results:

The EUT complies with the limits of CFR Title 47 Part 15 Subpart B section 15.107 and Subpart C section 15.207.

### 8.1.2

### Radiated Emissions (Spurious and Harmonics) Test

The EMI receiver was used as a measuring meter. The receiver was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the receiver records the highest measured reading over all the sweeps. Preamplifiers were used to increase the sensitivity of the instrument.

For spurious emissions the quasi-peak detector was used for frequencies below 1GHz and the average detector was used for frequencies above 1 GHz.

A duty cycle average was used for the harmonic emissions.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE (MHz)	TRANSDUCER	EFFECTIVE MEASUREMENT BANDWIDTH
.009 to .150	Active Loop Antenna	200 kHz
.150 to 30	Active Loop Antenna	9 kHz
30 to 1000	Combilog Antenna	100 kHz
1000 to 10000	Horn Antenna	1 MHz

The TDK FAC-3 shielded test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.10, ANSI C63.4, EN 50147-2, and CISPR 22. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters in both vertical and horizontal polarizations (for E field radiated field strength).

#### Test Results:

The EUT complies with the limits of CFR Title 47 Part 15 Subpart B 15.109, Subpart C sections 15.205, 15.209 and 15.249.

**8.1.3****Fundamental Field Strength**

The Peak Transmit EMI was measured using the EMI Receiver at a 3-meter test distance to obtain the final test data. The final qualification data sheets are located in Appendix E.

**Test Results:**

The EUT complies with Part 15 Subpart C, Section 15.249.

**8.1.4****Emissions Radiated Outside of the Fundamental Frequency Band**

The Band Edge measurement was measured using the EMI Receiver at a 3-meter test distance to obtain the final test data. The frequency was tuned to the lowest and highest frequency if the EUT transmits more than one frequency. The final qualification data sheets are located in Appendix E.

**Test Results:**

The EUT complies with Part 15 Subpart C, Section 15.205 and 15.249.

**8.1.5****Voltage Fluctuations**

Measurements of the variation of the radiated signal level of the fundamental frequency component of the emission was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

**Test Results:**

The EUT complies with Part 15 Subpart C, Section 15.31(e).

**8.1.6****Pulsed Operation Duty Cycle Correction**

Duty Cycle Correction Factor = -11.11 dB

Number of Pulse #1 in 100ms = 36

Pulse #1 = 0.223ms \* 36 = 8.03ms

Number of Pulse #2 in 100ms = 6

Pulse #2 = 0.335ms \* 6 = 2.01ms

Number of Pulse #3 in 100ms = 79

Pulse #3 = 0.110ms \* 79 = 8.69ms

Total time at 100% Amplitude = 18.73ms

Total Time at Reduced Amplitude = 16.71ms

Amplitude Difference between 100% and Reduced Amplitude = 5.28 dB

Effective ON Time of Reduced Amplitude = 9.09ms

Total Duty Cycle = 27.62ms / 100ms = 27.82%

Correction Factor - 20 \* log 0.2763 = -11.11

**9. TEST PROCEDURE DEVIATIONS**

There were no deviations from the test procedures.

**10. CONCLUSIONS**

The Power Pack Model: C0021031 meets all of the relevant specification requirements defined in the Code of Federal Regulations Title 47, Part 15 Subpart B sections 15.107 and 15.109, Subpart C sections 15.205, 15.207, 15.209 and 15.249. The power line carrier emissions tests were not performed by Compatible Electronics.

## **APPENDIX A**

### ***LABORATORY ACCREDITATIONS***

## LABORATORY ACCREDITATIONS AND RECOGNITIONS



For US, Canada, Australia/New Zealand, Taiwan and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025 an ISO 9002 equivalent. Please follow the link to the NIST site for each of our facilities NVLAP certificate and scope of accreditation.

Silverado/Lake Forest Division: <http://ts.nist.gov/ts/htdocs/210/214/scopes/2005270.htm>

Brea Division: <http://ts.nist.gov/ts/htdocs/210/214/scopes/2005280.htm>

Agoura Division: <http://ts.nist.gov/ts/htdocs/210/214/scopes/2000630.htm>



Compatible Electronics has been accredited by ANSI and appointed by the FCC to serve as a Telecommunications Certification Body (TCB). Compatible Electronics ANSI TCB listing can be found at: [http://www.ansi.org/public/ca/ansi\\_cp.html](http://www.ansi.org/public/ca/ansi_cp.html)



Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for EMC under the US/EU Mutual Recognition Agreement (MRA). Compatible Electronics NIST US/EU CAB listing can be found at: <http://ts.nist.gov/ts/htdocs/210/gsig/emc-cabs-mar02.pdf>



Compatible Electronics has been nominated as a Conformity Assessment Body (CAB) for Taiwan/BSMI under the US/APEC (Asia-Pacific Economic Cooperation) Mutual Recognition Agreement (MRA). Compatible Electronics NIST US/APEC CAB listing can be found at: <http://ts.nist.gov/ts/htdocs/210/gsig/apec/bsmi-cabs-may02.pdf>



Compatible Electronics has been validated by NEMKO against ISO/IEC 17025 under the NEMKO EMC Laboratory Authorization (ELA) program to all EN standards required by the European Union (EU) EMC Directive 89/336/EEC. Please follow the link to the Compatible Electronics' web site for each of our facilities NEMKO ELA certificate and scope of accreditation. <http://www.celectronics.com/certs.htm>

We are also certified/listed for IT products by the following country/agency:



Compatible Electronics VCCI listing can be found at:  
[http://www.vcci.or.jp/vcci\\_e/member/tekigo/setsubi\\_index\\_id.html](http://www.vcci.or.jp/vcci_e/member/tekigo/setsubi_index_id.html)

Just type "Compatible Electronics" into the Keyword search box.



Compatible Electronics FCC listing can be found at:  
[https://gullfoss2.fcc.gov/prod/oet/index\\_ie.html](https://gullfoss2.fcc.gov/prod/oet/index_ie.html)

Just type "Compatible Electronics" into the Test Firms search box.



Compatible Electronics IC listing can be found at:  
[http://spectrum.ic.gc.ca/~cert/labs/oats\\_lab\\_c\\_e.html](http://spectrum.ic.gc.ca/~cert/labs/oats_lab_c_e.html)

## **APPENDIX B**

### ***MODIFICATIONS TO THE EUT***

## MODIFICATIONS TO THE EUT

There were no modifications made to the EUT during testing.

## **APPENDIX C**

### ***ADDITIONAL MODELS COVERED UNDER THIS REPORT***

## **ADDITIONAL MODELS COVERED UNDER THIS REPORT**

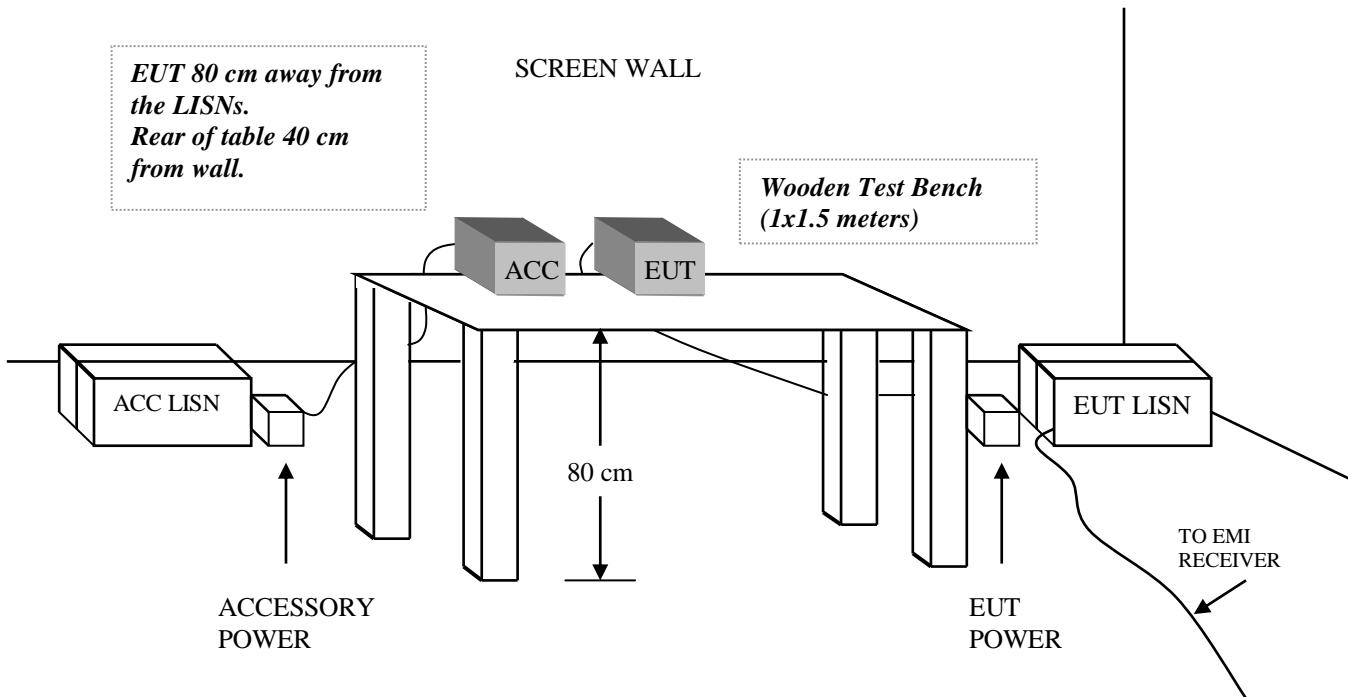
USED FOR THE PRIMARY TEST

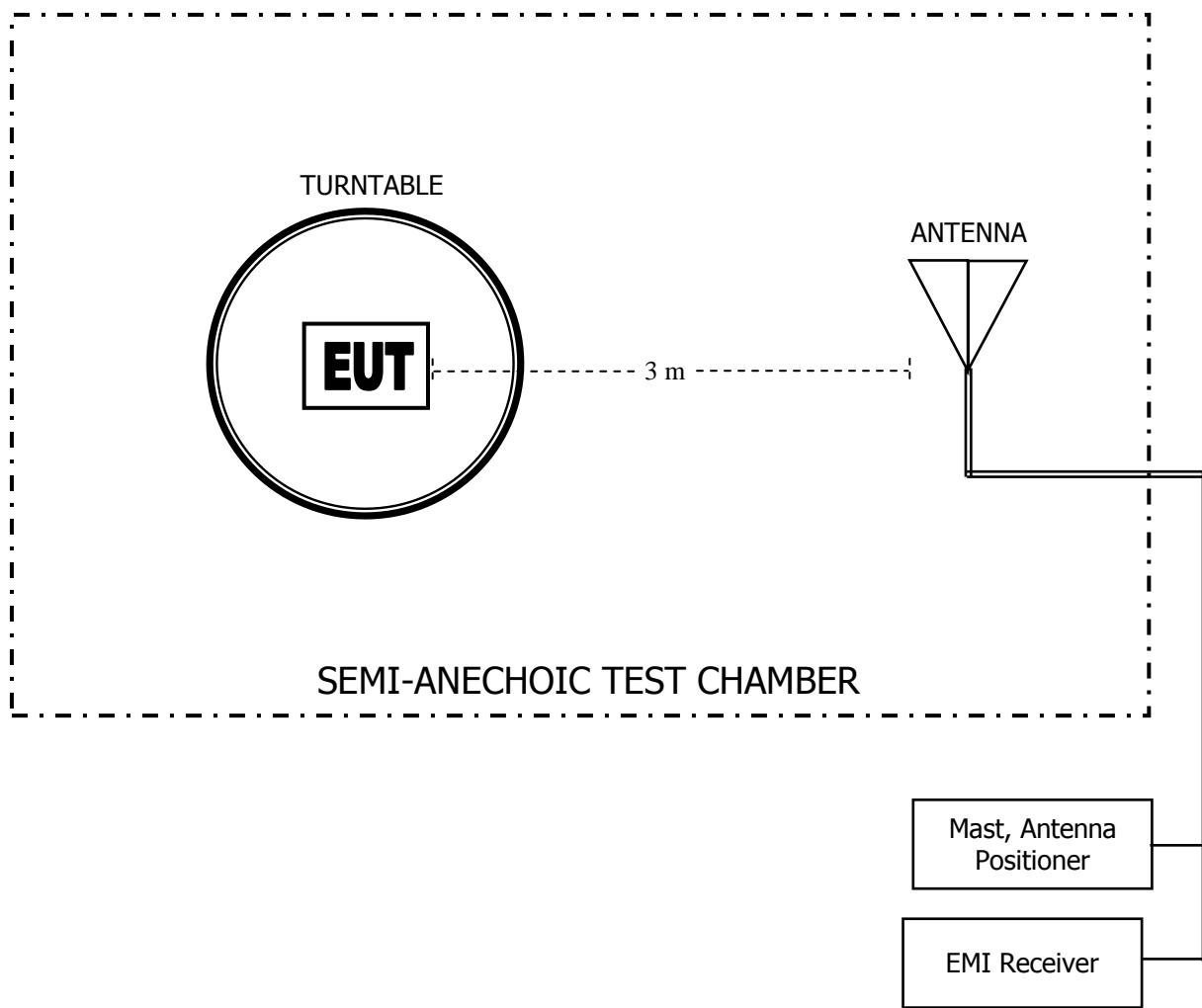
POWER PACK  
Model: C0021031  
S/N: None

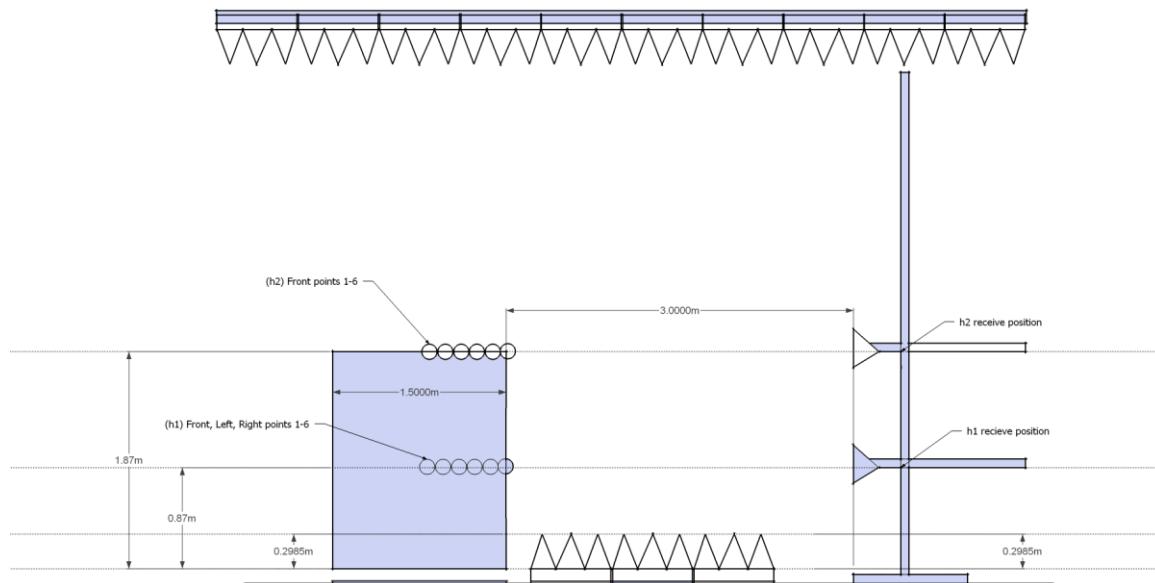
There were no additional models covered under this report.

## APPENDIX D

### *DIAGRAMS, CHARTS AND PHOTOS*

**FIGURE 1: CONDUCTED EMISSIONS TEST SETUP**


**FIGURE 2: PLOT MAP & LAYOUT OF TEST SITE  
BELOW 1GHz**

**FIGURE 3: PLOT MAP & LAYOUT OF TEST SITE  
ABOVE 1 GHz**

**COM-POWER AL-130**

**LOOP ANTENNA**

**S/N: 17085**

**CALIBRATION DUE: JANUARY 29, 2015**

<b>FREQUENCY (MHz)</b>	<b>MAGNETIC (dB/m)</b>	<b>ELECTRIC (dB/m)</b>	<b>FREQUENCY (MHz)</b>	<b>MAGNETIC (dB/m)</b>	<b>ELECTRIC (dB/m)</b>
<b>0.009</b>	-40.70	10.80	<b>0.8</b>	-40.91	10.59
<b>0.01</b>	-40.50	11.00	<b>0.9</b>	-40.80	10.70
<b>0.02</b>	-40.70	10.80	<b>1.0</b>	-40.81	10.69
<b>0.03</b>	-40.10	11.40	<b>2.0</b>	-40.51	10.99
<b>0.04</b>	-40.50	11.00	<b>3.0</b>	-40.54	10.96
<b>0.05</b>	-41.10	10.40	<b>4.0</b>	-40.44	11.06
<b>0.06</b>	-41.00	10.50	<b>5.0</b>	-40.32	11.18
<b>0.07</b>	-41.10	10.40	<b>6.0</b>	-40.69	10.81
<b>0.08</b>	-41.10	10.40	<b>7.0</b>	-40.37	11.13
<b>0.09</b>	-41.20	10.30	<b>8.0</b>	-39.99	11.51
<b>0.1</b>	-41.20	10.30	<b>9.0</b>	-40.00	11.50
<b>0.2</b>	-41.40	10.10	<b>10.0</b>	-40.08	11.42
<b>0.3</b>	-41.30	10.20	<b>15.0</b>	-42.36	9.14
<b>0.4</b>	-41.20	10.30	<b>20.0</b>	-38.75	12.75
<b>0.5</b>	-41.40	10.10	<b>25.0</b>	-40.70	10.80
<b>0.6</b>	-41.40	10.10	<b>30.0</b>	-41.09	10.41
<b>0.7</b>	-41.20	10.30			

**COM-POWER AC-220**

**LAB R - COMBILOG ANTENNA**

**S/N: 25857**

**CALIBRATION DUE: May 25, 2013**

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
<b>30</b>	17.8	<b>180</b>	9.4
<b>35</b>	18.4	<b>200</b>	9.0
<b>40</b>	19.2	<b>250</b>	12.0
<b>45</b>	17.2	<b>300</b>	13.4
<b>50</b>	17.2	<b>300</b>	13.4
<b>60</b>	13.5	<b>400</b>	15.0
<b>70</b>	8.9	<b>500</b>	17.3
<b>80</b>	6.0	<b>600</b>	17.8
<b>90</b>	7.1	<b>700</b>	20.0
<b>100</b>	8.0	<b>800</b>	20.5
<b>120</b>	9.2	<b>900</b>	20.8
<b>140</b>	7.5	<b>1000</b>	22.4
<b>160</b>	8.3		

**COM-POWER AH-118**

**HORN ANTENNA**

**S/N: 071250**

**CALIBRATION DUE: JULY 3, 2013**

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
<b>1000</b>	26.5	<b>9500</b>	40.4
<b>1500</b>	27.2	<b>10000</b>	40.3
<b>2000</b>	31.5	<b>10500</b>	41.7
<b>2500</b>	31.9	<b>11000</b>	42.1
<b>3000</b>	32.7	<b>11500</b>	42.3
<b>3500</b>	34.0	<b>12000</b>	42.6
<b>4000</b>	33.5	<b>12500</b>	41.4
<b>4500</b>	34.9	<b>13000</b>	42.7
<b>5000</b>	36.2	<b>13500</b>	43.6
<b>5500</b>	36.6	<b>14000</b>	42.4
<b>6000</b>	36.8	<b>14500</b>	42.7
<b>6500</b>	37.4	<b>15000</b>	45.4
<b>7000</b>	39.4	<b>15500</b>	45.1
<b>7500</b>	39.6	<b>16000</b>	42.9
<b>8000</b>	42.4	<b>16500</b>	44.0
<b>8500</b>	40.3	<b>17000</b>	46.8
<b>9000</b>	39.6	<b>17500</b>	47.5
		<b>18000</b>	46.6

**COM-POWER PAM-118****1-18GHz - PREAMPLIFIER****S/N: 443013****CALIBRATION DUE: APRIL 8, 2014**

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
<b>500</b>	26.32	<b>5500</b>	25.55
<b>1000</b>	24.72	<b>6000</b>	25.54
<b>1100</b>	25.89	<b>6500</b>	24.57
<b>1200</b>	25.41	<b>7000</b>	23.51
<b>1300</b>	26.28	<b>7500</b>	23.59
<b>1400</b>	25.94	<b>8000</b>	23.32
<b>1500</b>	25.59	<b>8500</b>	22.76
<b>1600</b>	26.95	<b>9000</b>	23.15
<b>1700</b>	25.52	<b>9500</b>	24.41
<b>1800</b>	25.75	<b>10000</b>	25.71
<b>1900</b>	26.00	<b>11000</b>	26.07
<b>2000</b>	25.38	<b>12000</b>	26.17
<b>2500</b>	26.06	<b>13000</b>	24.72
<b>3000</b>	26.24	<b>14000</b>	23.19
<b>3500</b>	25.82	<b>15000</b>	25.42
<b>4000</b>	26.04	<b>16000</b>	25.07
<b>4500</b>	25.96	<b>17000</b>	24.24
<b>5000</b>	26.02	<b>18000</b>	24.92

**COM-POWER PAM-118****1-18GHz - PREAMPLIFIER****S/N: 443014****CALIBRATION DUE: APRIL 8, 2014**

<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>	<b>FREQUENCY (MHz)</b>	<b>FACTOR (dB)</b>
<b>500</b>	26.75	<b>5500</b>	26.17
<b>1000</b>	25.15	<b>6000</b>	26.28
<b>1100</b>	26.17	<b>6500</b>	25.46
<b>1200</b>	25.85	<b>7000</b>	23.93
<b>1300</b>	26.75	<b>7500</b>	23.83
<b>1400</b>	26.27	<b>8000</b>	23.86
<b>1500</b>	26.09	<b>8500</b>	23.55
<b>1600</b>	27.23	<b>9000</b>	24.39
<b>1700</b>	26.08	<b>9500</b>	25.57
<b>1800</b>	26.24	<b>10000</b>	26.24
<b>1900</b>	26.50	<b>11000</b>	26.43
<b>2000</b>	25.99	<b>12000</b>	26.79
<b>2500</b>	26.86	<b>13000</b>	25.66
<b>3000</b>	27.13	<b>14000</b>	23.50
<b>3500</b>	26.87	<b>15000</b>	25.78
<b>4000</b>	26.75	<b>16000</b>	25.45
<b>4500</b>	26.94	<b>17000</b>	26.45
<b>5000</b>	26.87	<b>18000</b>	26.70



**FRONT VIEW**

BUDDERFLY LLC  
POWER PACK  
Model: C0021031  
FCC - RADIATED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



**REAR VIEW**

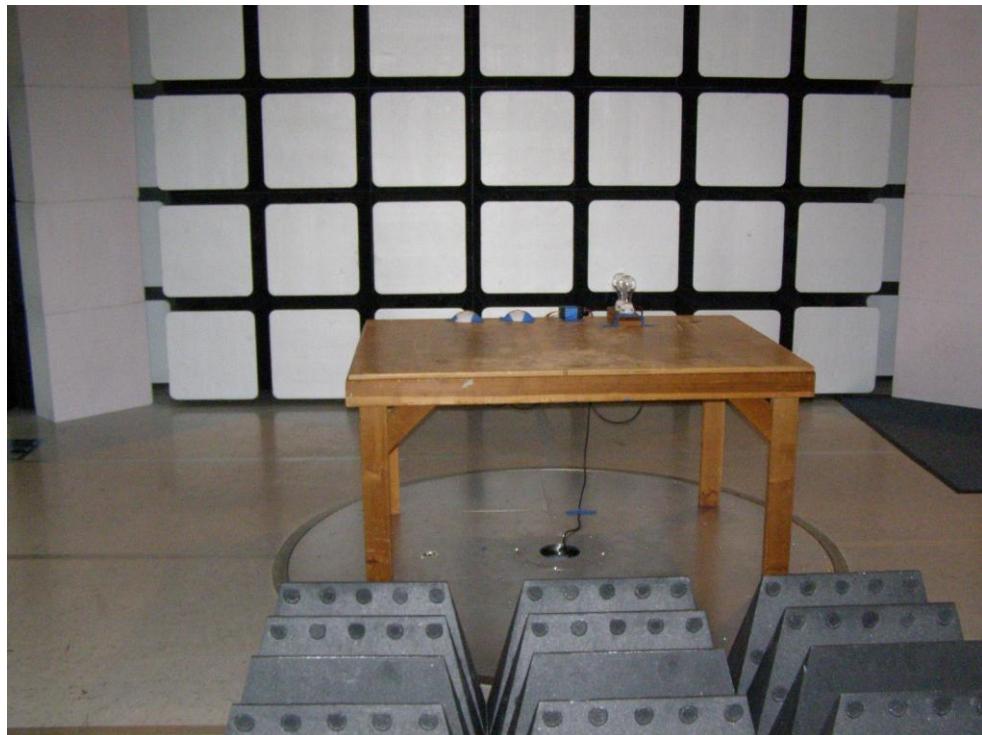
BUDDERFLY LLC

POWER PACK

Model: C0021031

FCC - RADIATED EMISSIONS - below 1GHz

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



**VIEW 1**

**BUDDERFLY LLC**

**POWER PACK**

**Model: C0021031**

**FCC - RADIATED EMISSIONS – above 1GHz**

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

**VIEW 2****BUDDERFLY LLC****POWER PACK**

Model: C0021031

FCC - RADIATED EMISSIONS – above 1GHz

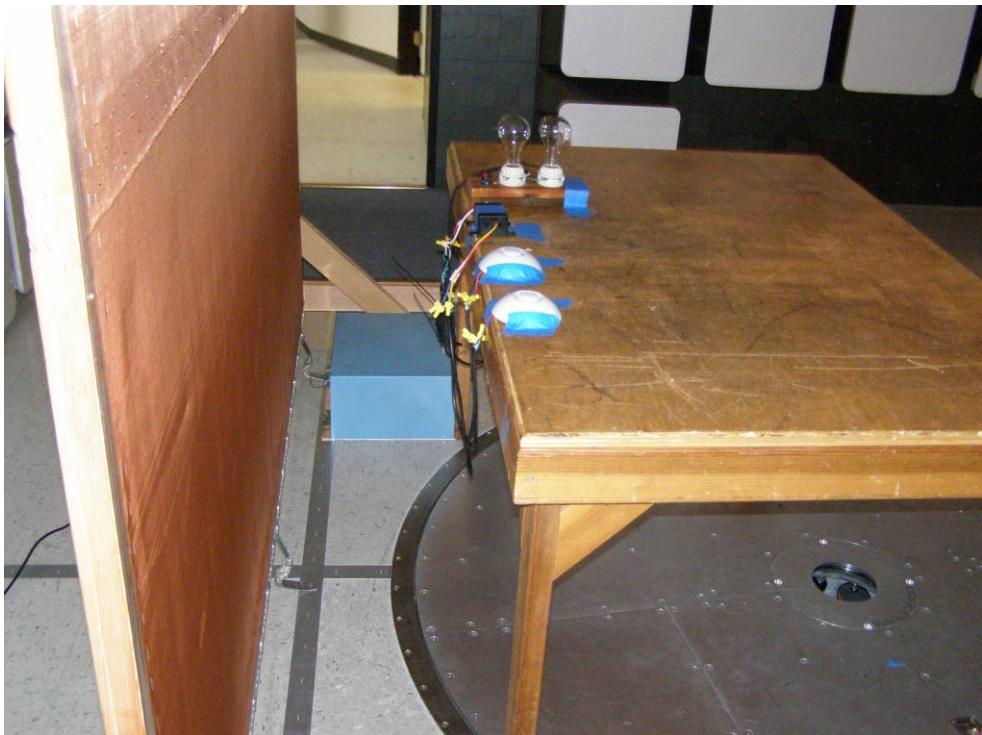
**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



**VIEW 1**

BUDDERFLY LLC  
POWER PACK  
Model: C0021031  
FCC - CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**



**VIEW 2**

BUDDERFLY LLC  
POWER PACK  
Model: C0021031  
FCC - CONDUCTED EMISSIONS

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION  
FOR MAXIMUM EMISSIONS**

## **APPENDIX E**

### ***DATA SHEETS***

## ***FUNDAMENTAL & HARMONICS***

### ***DATA SHEETS***

**FCC 15.249**

 Budderfly  
 915MHz Transceiver  
 Model: Power Pack (C0021031)

 Date: 5/9/2013  
 Lab: R  
 Tested By: Matt Harrison

**Fundamental Field Strength**

Freq (MHz)	Pol (H/V)	Peak (dB $\mu$ V/m)	QP (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	TBL (deg)	TWR (cm)	Comments
915.0	H	94.49	89.97	93.97	-4.00	185.00	100	
915.0	V	89.74	--	93.97	-4.23	220.00	120	

Test distance

3 meter

**FCC 15.249**

Budderfly  
 915MHz Transceiver  
 Model: Power Pack (C0021031)  
 Duty Cycle Correction Factor: -11.11

Date: 5/9/2013

Lab: R

Tested By: Matt Harrison

**Harmonic Emissions**

Freq. (MHz)	Level (dB $\mu$ V)	Pol (v/h)	Limit (dB $\mu$ V)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1830	54.24	V	--	--	Peak	1.10	160	
1830	43.13	V	53.98	-10.85	Avg	1.10	160	
2745	49.12	V	53.98	-4.86	Peak	1.16	195	
2745	--	V	--	--	Avg	--	--	In Restricted Band
3660	49.27	V	53.98	-4.71	Peak	1.00	190	
3660	--	V	--	--	Avg	--	--	In Restricted Band
4575		V	--	--	Peak			No Emission Found
4575		V	--	--	Avg			In Restricted Band
5490		V	--	--	Peak			No Emission Found
5490		V	--	--	Avg			No Emission Found
6405		V	--	--	Peak			No Emissions Found
6405		V	--	--	Avg			No Emissions Found
7320		V	--	--	Peak			No Emissions Found
7320		V	--	--	Avg			In Restricted Band
8235		V	--	--	Peak			No Emissions Found
8235		V	--	--	Avg			In Restricted Band
9150		V	--	--	Peak			No Emissions Found
9150		V	--	--	Avg			In Restricted Band

Test distance

3 meter

**FCC 15.249**

Budderfly  
 915MHz Transceiver  
 Model: Power Pack (C0021031)  
 Duty Cycle Correction Factor: -11.11

Date: 5/9/2013

Lab: R

Tested By: Matt Harrison

**Harmonic Emissions**

Freq. (MHz)	Level (dB $\mu$ V)	Pol (v/h)	Limit (dB $\mu$ V)	Margin (dB)	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
1830	51.83	H	53.98	-2.15	Peak	1.15	190	
1830	--	H	--	--	Avg	--	--	
2745	49.48	H	53.98	-4.50	Peak	1.00	230	
2745	--	H	--	--	Avg	--	--	In Restricted Band
3660	46.02	H	53.98	-7.96	Peak	1.00	215	
3660	--	H	--	--	Avg	--	--	In Restricted Band
4575		H	--	--	Peak			No Emission Found
4575		H	--	--	Avg			In Restricted Band
5490		H	--	--	Peak			No Emission Found
5490		H	--	--	Avg			No Emission Found
6405		H	--	--	Peak			No Emissions Found
6405		H	--	--	Avg			No Emissions Found
7320		H	--	--	Peak			No Emissions Found
7320		H	--	--	Avg			In Restricted Band
8235		H	--	--	Peak			No Emissions Found
8235		H	--	--	Avg			In Restricted Band
9150		H	--	--	Peak			No Emissions Found
9150		H	--	--	Avg			In Restricted Band

Test distance

3 meter

***EMISSIONS RADIATED OUTSIDE OF THE FUNDAMENTAL  
FREQUENCY BAND***

***DATA SHEETS***

**FCC 15.249**

 Budderfly  
 Power Pack  
 Model: C0021031

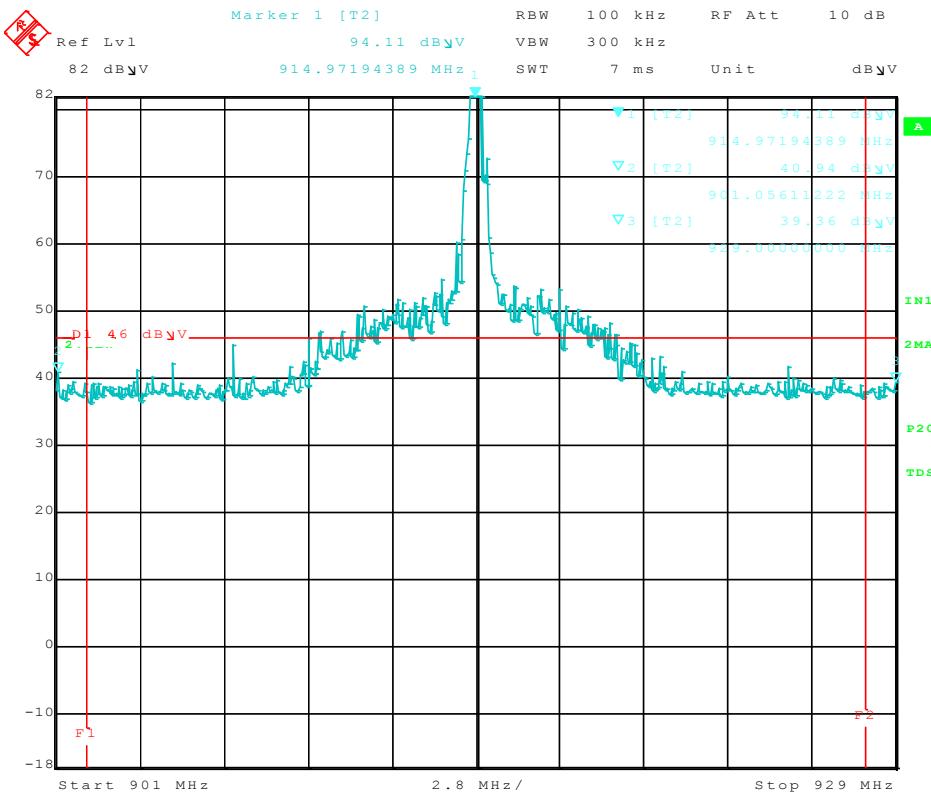
Date: 5/9/2013

Lab: R

Tested By: Matt Harrison

**Band Edge**

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margi n	Peak / QP / Avg	Ant. Heigh t (m)	Table Angle (deg)	Comments
914.97	94.11	H	--	--	Peak	1.00	185	Fundamental of Channel 915MHz @ 3 meters
901.06	40.94	H	46.00	-5.06	Peak	1.00	185	<b>No</b> Marker Delta Method
	--	H	46.00	--	QP	--	--	Method Used
914.97	94.11	H	--	--	Peak	1.00	185	Fundamental of Channel 915MHz @ 3 meters
929.00	39.36	H	46.00	-6.64	Peak	1.00	185	<b>No</b> Marker Delta Method
	--	H	46.00	--	QP	--	--	Method Used

 Test Distance  
 3 meters


Title: Power Pack, C0021031.  
 Comment A: Band Edges, Horizontal.  
 Date: 9.MAY.2013 11:26:24

**FCC 15.249**

 Budderfly  
 Power Pack  
 Model: C0021031

Date: 5/9/2013

Lab: R

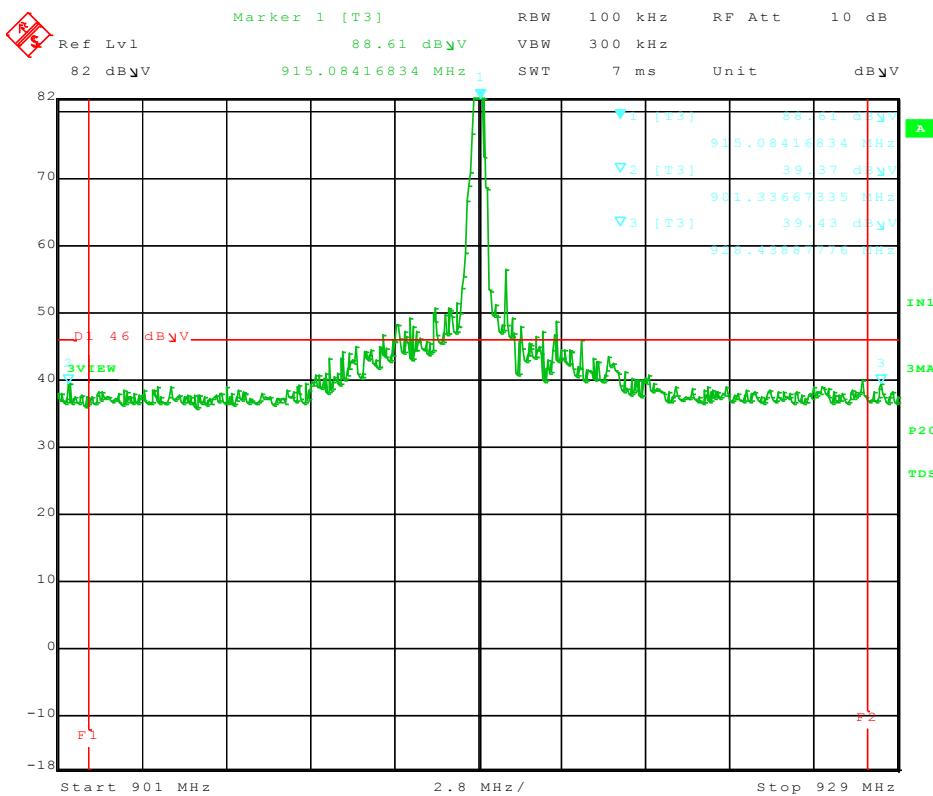
Tested By: Matt Harrison

**Band Edge**

Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
915.08	88.61	V	--	--	Peak	1.20	220	Fundamental of Channel 915MHz @ 3 meters
901.33	39.37	V	46.00	-6.63	Peak	1.20	220	No Marker Delta Method
--	--	V	46.00	--	QP	--	--	Method Used
915.08	88.61	V	--	--	Peak	1.20	220	Fundamental of Channel 915MHz @ 3 meters
928.43	39.43	V	46.00	-6.57	Peak	1.20	220	No Marker Delta Method
--	--	V	46.00	--	QP	--	--	Method Used

Test Distance

3 meters



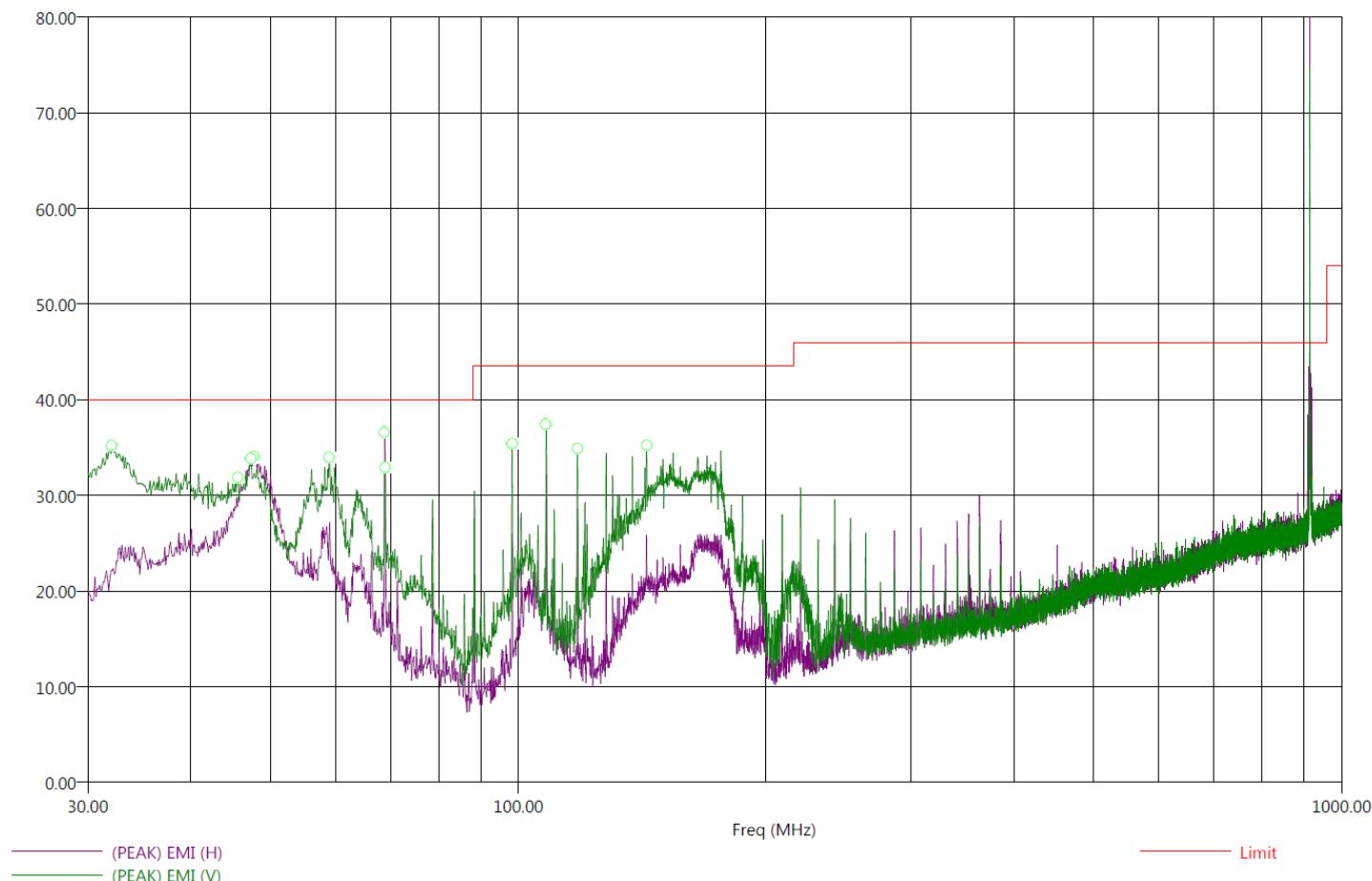
Title: Power Pack, C0021031.  
 Comment A: Band Edges, Vertical.  
 Date: 9.MAY.2013 11:22:59

Title: FCC 15.209  
 File: Radiated Pre-Scan 30-1000Mhz.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 9:00:03 AM  
 Sequence: Preliminary Scan

### Compatible Electronics, Inc. FAC-3 (Lab R)

Electric Field Strength (dB $\mu$ V/m)



***There were no radiated emissions found below 30 MHz***

Title: FCC 15.209  
 File: Radiated Final 30-1000Mhz.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 9:38:24 AM  
 Sequence: Final Measurements

**Compatible Electronics, Inc. FAC-3 (Lab R)**

Freq (MHz)	(QP) Margin (dB)	(QP) EMI (dB $\mu$ V/m)	(PEAK) EMI (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Pol	Ttbl Agl (deg)	Twr Ht (cm)	Transducer (dB)	Cable(dB)
32.10	-2.93	37.07	39.98	40.00	V	240.25	99.31	18.07	0.52
45.70	-13.45	26.55	31.32	40.00	V	151.50	107.97	17.20	0.60
47.30	-9.42	30.58	34.96	40.00	V	77.25	99.79	17.20	0.60
47.80	-11.70	28.30	32.80	40.00	H	12.50	338.00	17.20	0.60
59.00	-8.59	31.41	35.43	40.00	V	306.25	125.52	13.86	0.69
68.80	-3.15	36.85	37.88	40.00	H	190.00	311.91	9.41	0.70
68.90	-7.81	32.19	34.31	40.00	V	143.25	99.97	9.41	0.70
98.30	-8.45	35.07	36.50	43.52	V	270.25	115.91	7.85	0.90
108.10	-9.50	34.02	34.95	43.52	V	360.25	129.46	8.51	1.01
118.00	-5.66	37.86	38.78	43.52	V	243.50	104.86	9.09	1.12
143.20	-9.32	34.20	38.19	43.52	V	266.50	106.29	7.63	1.27

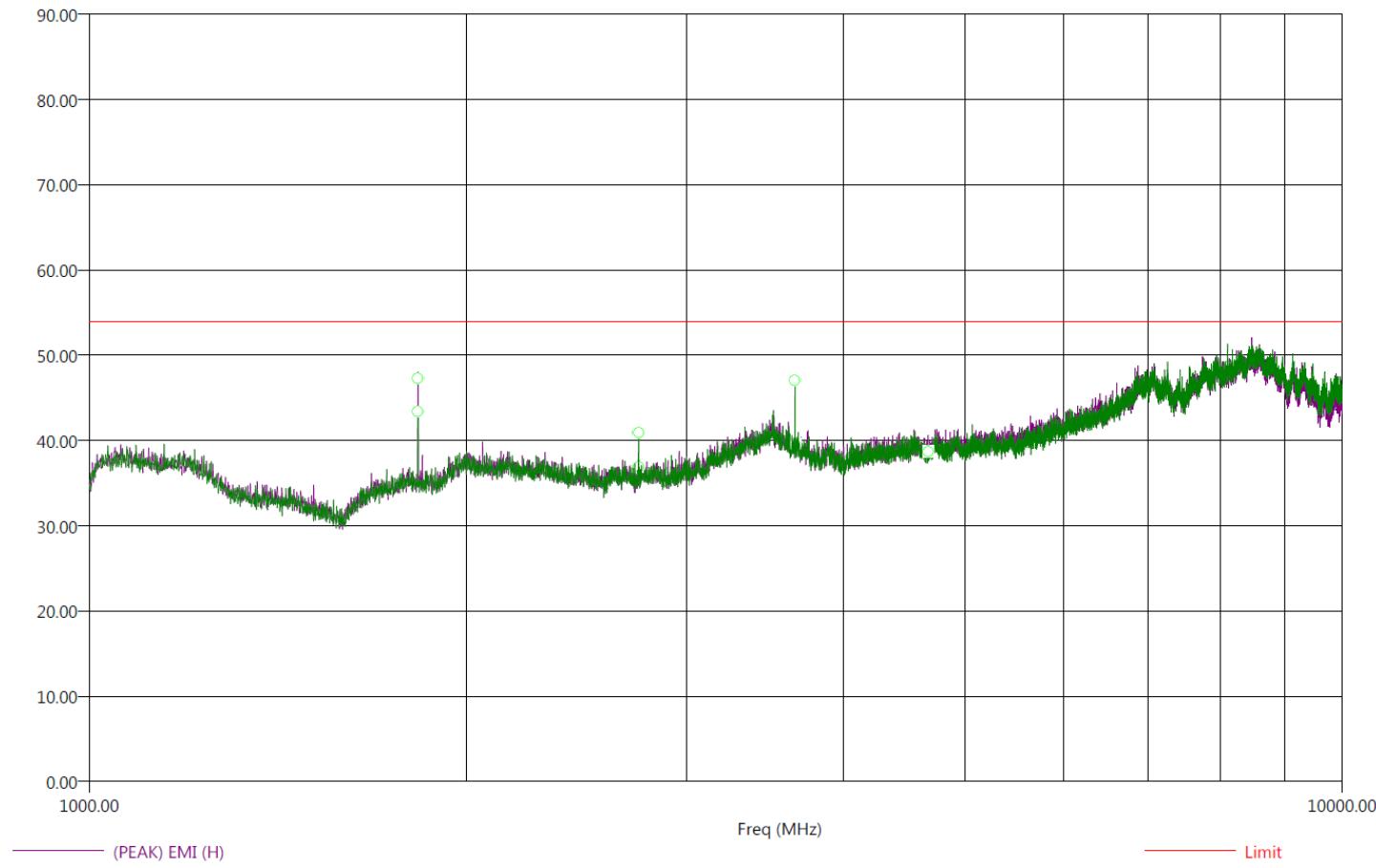
*There were no radiated emissions found below 30 MHz*

Title: FCC 15.209  
 File: Radiated Pre-scan 1-10GHz.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 3:38:12 PM  
 Sequence: Preliminary Scan

### Compatible Electronics, Inc. FAC-3 (Lab R)

Electric Field Strength (dB $\mu$ V/m)



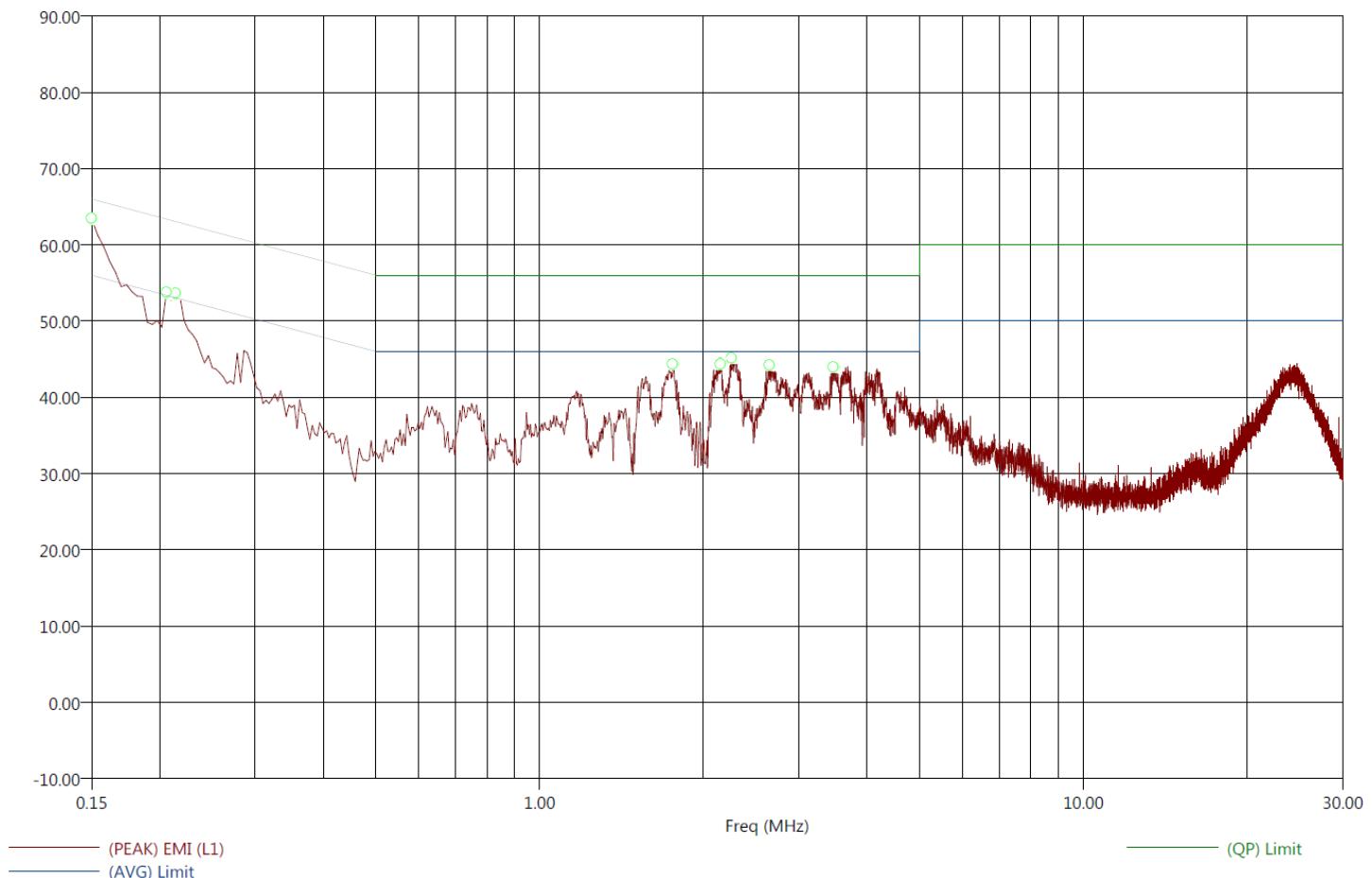
***There were no radiated emissions found Above 1GHz except Harmonics.***

Title: FCC 15.207  
 File: Conducted Pre-Line.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 10:32:33 AM  
 Sequence: Preliminary Scan

### Compatible Electronics, Inc. FAC-3 (LAB R)

Voltage (dB $\mu$ V)



Title: FCC 15.207  
 File: Conducted Final-Line.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 10:36:18 AM  
 Sequence: Final Measurements

**Compatible Electronics, Inc. FAC-3 (LAB R)**

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB $\mu$ V)	(QP) EMI (dB $\mu$ V)	(PEAK) EMI (dB $\mu$ V)	(AVG) Limit (dB $\mu$ V)	(QP) Limit (dB $\mu$ V)	Transducer (dB)	Cable (dB)
0.15	-2.61	-5.16	53.39	60.84	66.14	56.00	66.00	0.50	0.00
0.21	-11.75	-15.63	41.62	47.73	54.96	53.37	63.37	0.33	0.00
0.21	-10.09	-14.51	42.95	48.54	56.00	53.05	63.05	0.30	0.00
1.76	-8.38	-14.68	37.62	41.32	44.17	46.00	56.00	0.03	0.08
2.15	-10.85	-16.64	35.15	39.36	43.49	46.00	56.00	0.03	0.11
2.25	-9.86	-15.84	36.14	40.16	43.16	46.00	56.00	0.03	0.11
2.65	-9.90	-15.50	36.10	40.50	42.89	46.00	56.00	0.04	0.13
3.47	-10.65	-16.01	35.35	39.99	43.53	46.00	56.00	0.04	0.16

Title: FCC 15.207

5/9/2013 10:40:14 AM

File: Conducted Pre-Neutral.set

Sequence: Preliminary Scan

Operator: Matt Harrison

EUT Type: Power Pack (C0021031).

EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.

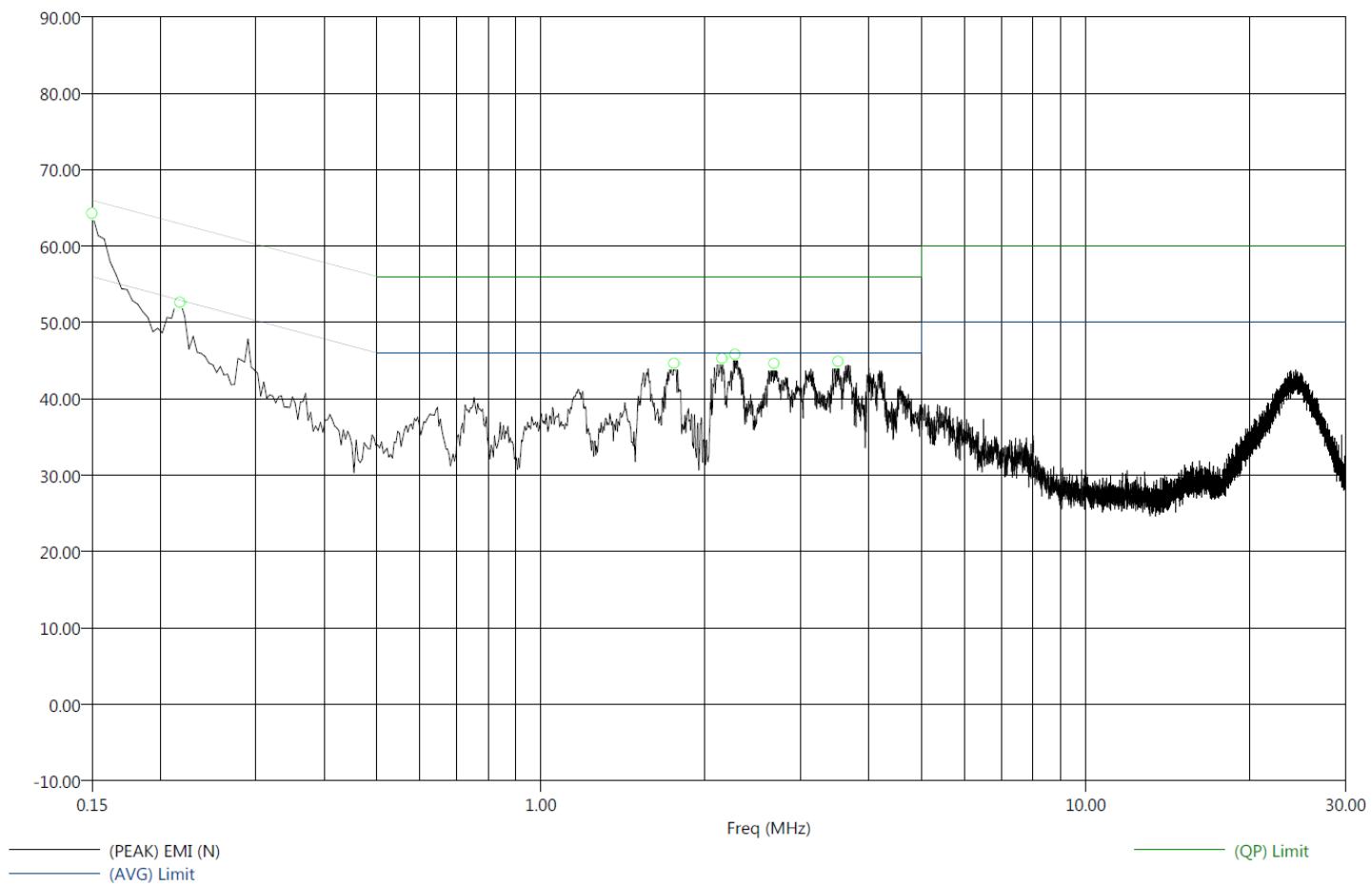
Comments: Connected to Light Bulb Load, and 2-Motion Sensors.

Temp: 68f

Hum: 50%

120V 60Hz

**Compatible Electronics, Inc. FAC-3 (LAB R)**

 Voltage (dB $\mu$ V)


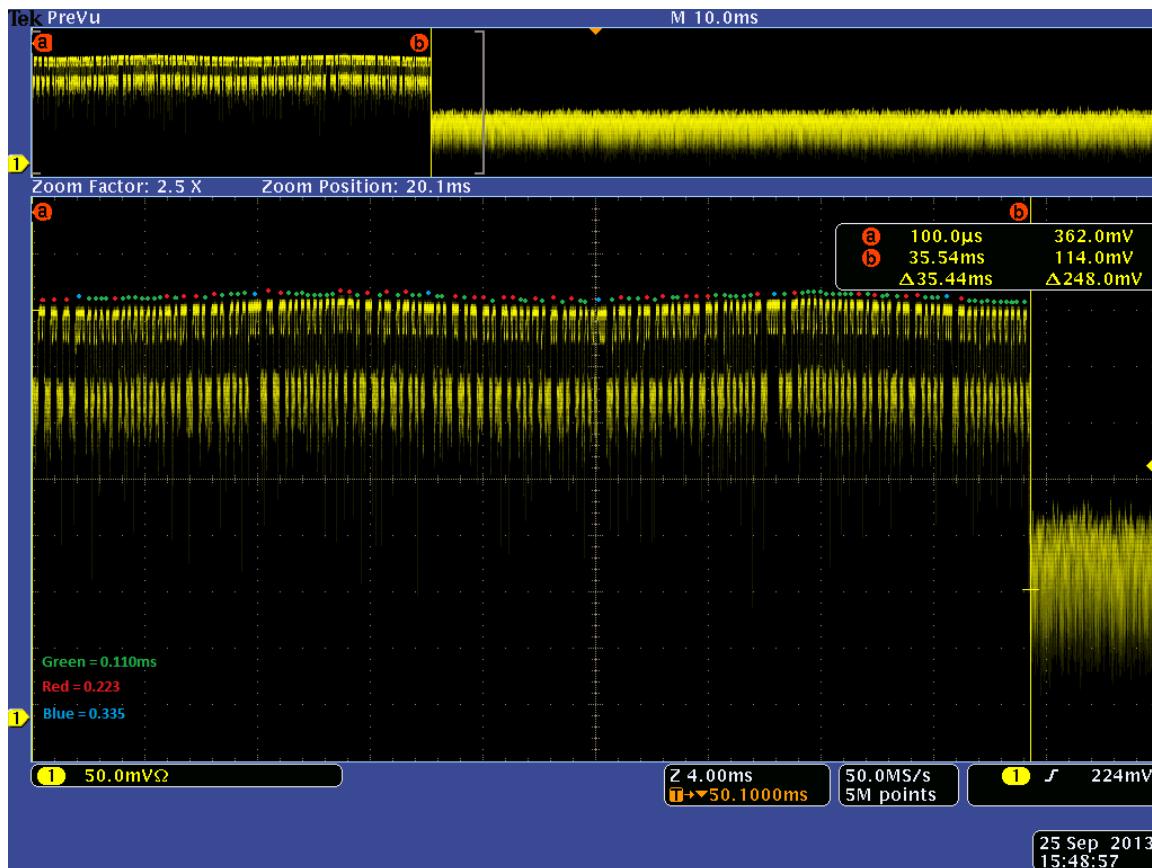
Title: FCC 15.207  
 File: Conducted Final-Neutral.set  
 Operator: Matt Harrison  
 EUT Type: Power Pack (C0021031).  
 EUT Condition: Powering Load, Constantly Transceiving @ 915MHz.  
 Comments: Connected to Light Bulb Load, and 2-Motion Sensors.  
 Temp: 68f  
 Hum: 50%  
 120V 60Hz

5/9/2013 10:43:35 AM  
 Sequence: Final Measurements

**Compatible Electronics, Inc. FAC-3 (LAB R)**

Freq (MHz)	(AVG) Margin AVL (dB)	(QP) Margin QPL (dB)	(AVG) EMI (dB $\mu$ V)	(QP) EMI (dB $\mu$ V)	(PEAK) EMI (dB $\mu$ V)	(AVG) Limit (dB $\mu$ V)	(QP) Limit (dB $\mu$ V)	Transducer (dB)	Cable (dB)
0.15	-3.12	-5.54	52.88	60.46	65.02	56.00	66.00	0.50	0.00
0.22	-11.05	-13.86	41.85	49.04	55.84	52.89	62.89	0.29	0.00
1.76	-6.65	-13.46	39.35	42.54	44.68	46.00	56.00	0.04	0.08
2.15	-9.54	-14.95	36.46	41.05	44.30	46.00	56.00	0.04	0.11
2.27	-8.88	-14.69	37.12	41.31	43.91	46.00	56.00	0.04	0.11
2.68	-8.80	-14.59	37.20	41.41	44.13	46.00	56.00	0.04	0.13
3.51	-8.81	-13.54	37.19	42.46	44.43	46.00	56.00	0.05	0.16

## DUTY CYCLE Pulse Train



Time of Pulse with Blanking Interval = >100ms

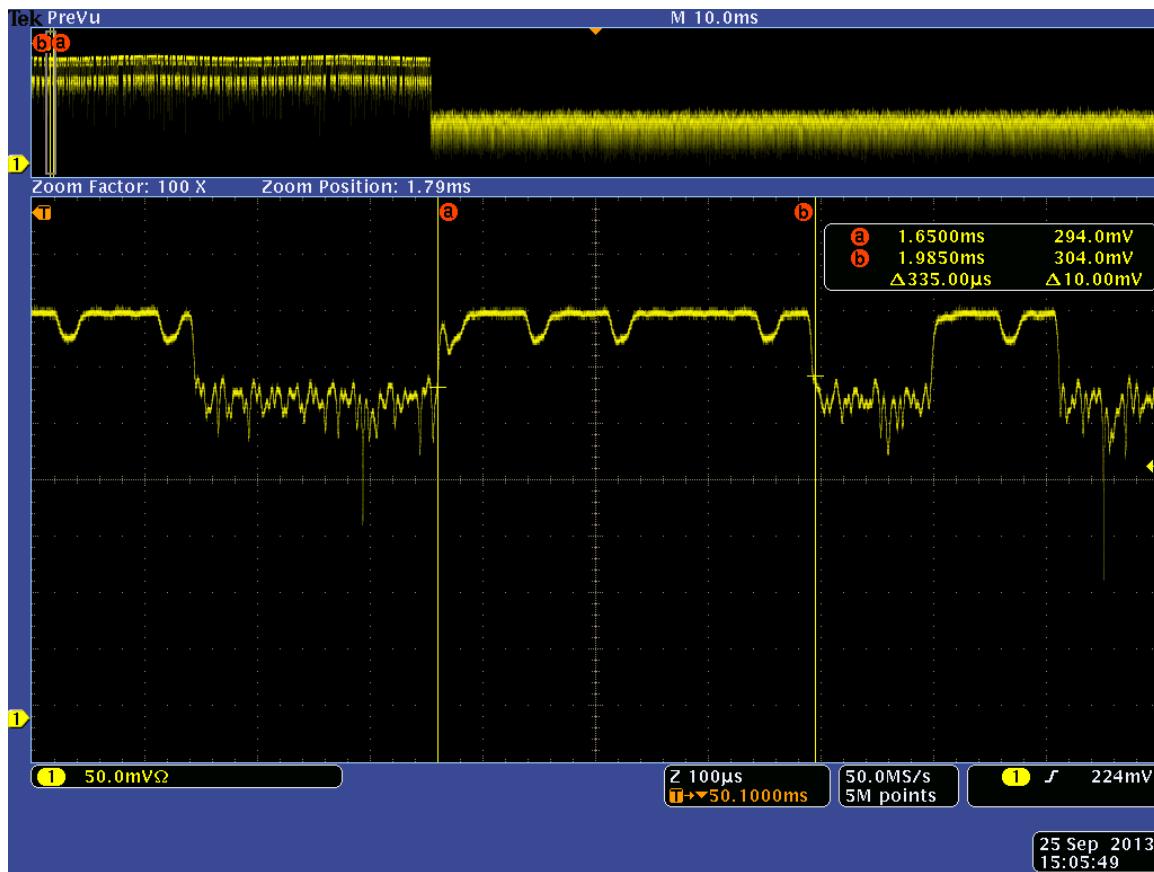
Time of One Pulse Train = 35.44ms

## DUTY CYCLE PULSE #1 WIDTH



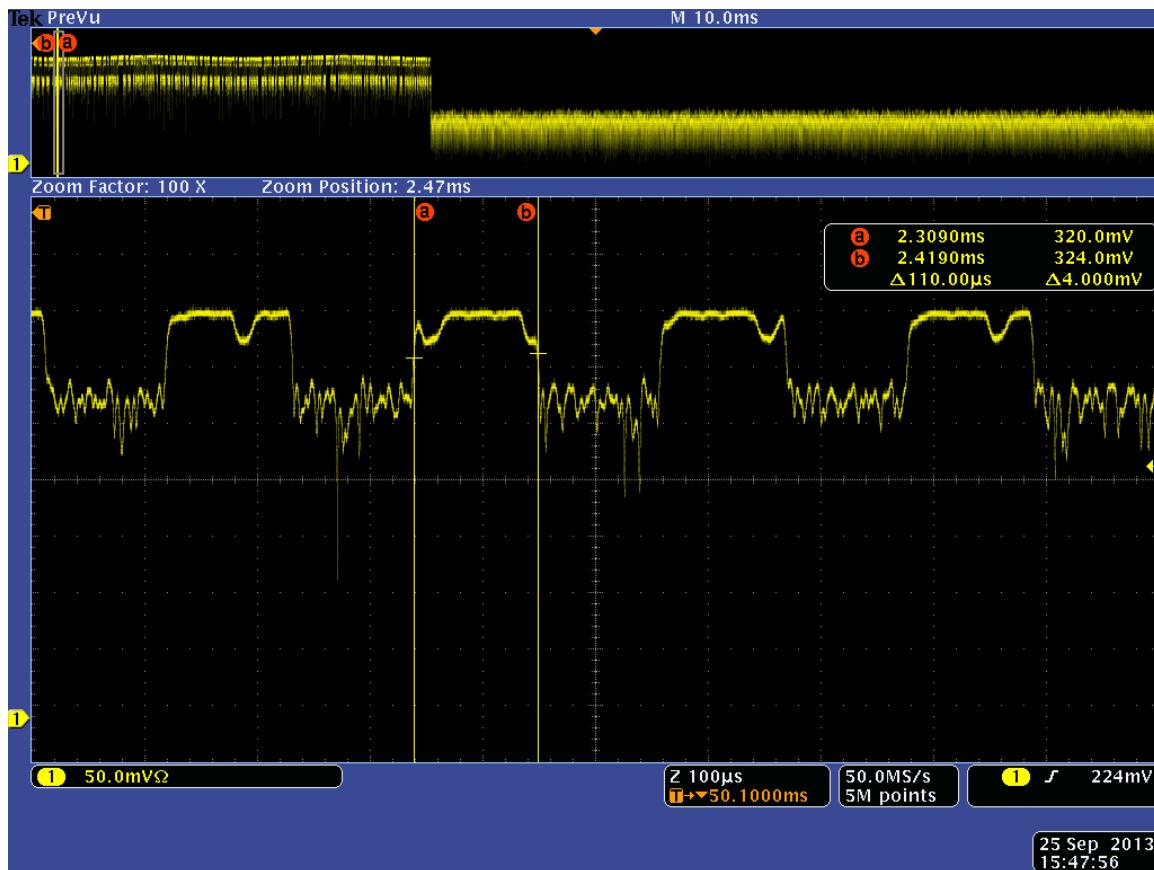
Pulse #1 width = 0.223ms

## DUTY CYCLE PULSE #2 WIDTH



Pulse #2 width = 0.335ms

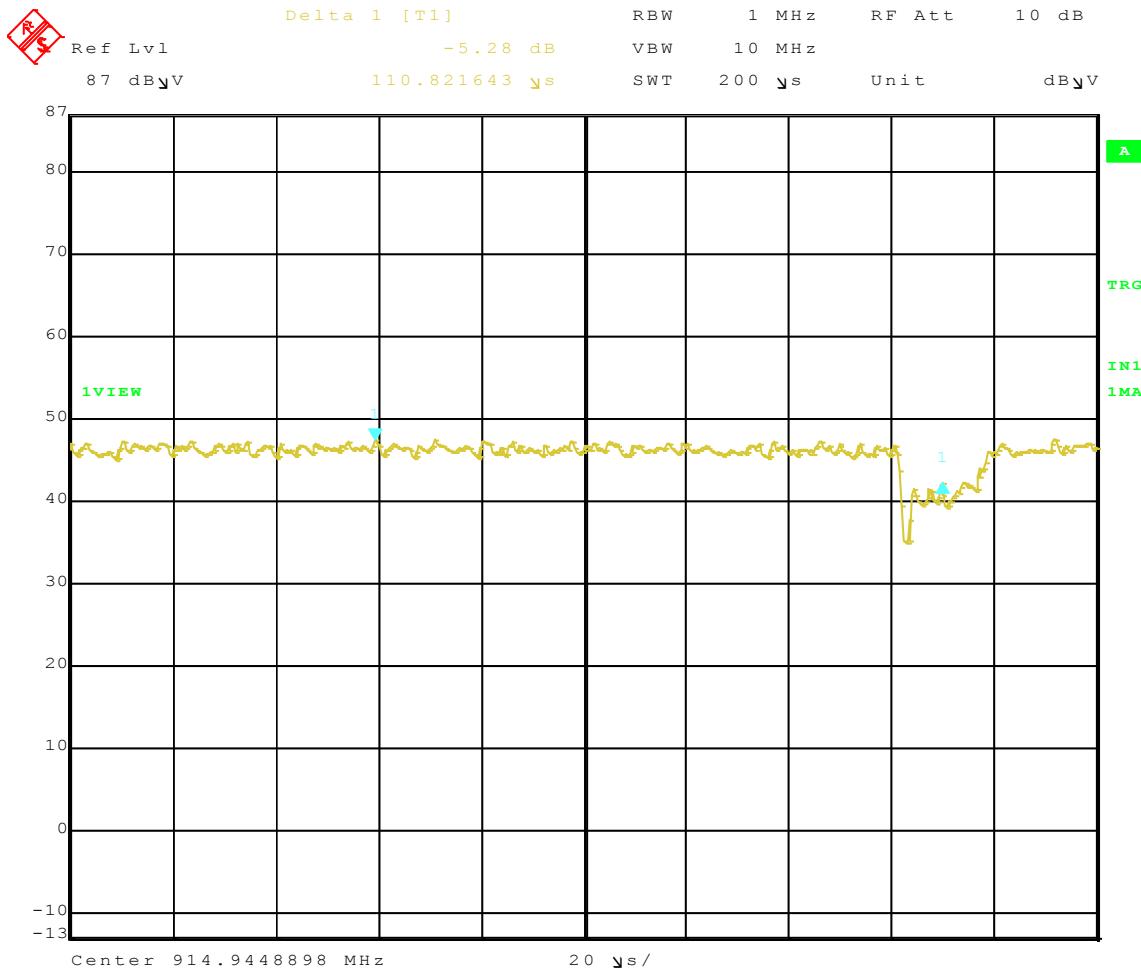
## DUTY CYCLE PULSE #3 WIDTH



*Pulse width = 0.110ms*

## DUTY CYCLE

### Amplitude Difference



*Minimum Level for 100% Amplitude and Maximum Level for Reduced Amplitude Delta = -5.28dB*

## DUTY CYCLE Calculation

*Number of Pulse #1 in 100ms = 36  
Pulse #1 = 0.223ms \* 36 = 8.03ms  
Number of Pulse #2 in 100ms = 6  
Pulse #2 = 0.335ms \* 6 = 2.01ms  
Number of Pulse #3 in 100ms = 79  
Pulse #3 = 0.110ms \* 79 = 8.69ms*

*Total time at 100% Amplitude = 18.73ms  
Total Time at Reduced Amplitude = 16.71ms  
Amplitude Difference between 100% and Reduced Amplitude = 5.28 dB  
Effective ON Time of Reduced Amplitude = 9.09ms  
Total Duty Cycle = 27.62ms / 100ms = 27.82%*

*Correction Factor - 20 \* log 0.2763 = -11.11*