



Engineering Solutions & Electromagnetic Compatibility Services

**Certification Application Report – Modular Approval  
FCC Part 15.249**

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<b>FCC ID</b>	YL6-143460L	<b>Test Report Date</b>	March 7, 2016
		<b>RTL Work Order #</b>	2015234
<b>Model</b>	ADC-460L	<b>RTL Quote #</b>	QRTL15-234A
<b>American National Standard Institute</b>	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices		
<b>FCC Classification</b>	DXT – Part 15 Low Power Transceiver		
<b>FCC Rule Part(s)/ Guidance</b>	15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz, October 1, 2015		
<b>Digital Interface Information</b>	Digital Interface was found to be compliant		
<b>Frequency Range (MHz)</b>	<b>Output Power (W)</b>	<b>Frequency Tolerance</b>	<b>Emission Designator</b>
908.4	N/A	N/A	88K0F1D

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. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, and ANSI C63.10.

Signature: 

Date: March 7, 2016

Typed/Printed Name: Desmond A. Fraser

Position: President

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*This/these test(s) is/are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1445.*

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## 1 General Information

### 1.1 Scope

This is an original certification application request.

Applicable Standards:

- FCC Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz

### 1.2 Description of EUT

<b>Equipment Under Test</b>	Transceiver
<b>Model</b>	ADC-460L
<b>Power Supply</b>	5 - 12 VDC
<b>Modulation Type</b>	FSK
<b>Frequency Range</b>	908.4 MHz
<b>Antenna Type</b>	0 dBi whip

### 1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 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.

### 1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Modular Approval for Alarm.com Model: ADC-460L, FCC ID: YL6-143460L

Requested grant notes: This device may be collocated with the following modules:

FCC ID: 2AAGMVZ120Q and YL6-143IS205V4

### 1.5 Modifications

N/A

## 2 Test Information

### 2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

**Table 2-1: Channels Tested**

Frequency (MHz)
908.4

### 2.2 Exercising the EUT

The EUT was programmed for continuous transmission at 908.4 MHz. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The carrier was also checked to verify that information was being transmitted.

### 2.3 Test Result Summary

**Table 2-2: Test Result Summary**

FCC Reference	Test	Pass/Fail or N/A
15.207	AC Power Conducted Emissions	Pass
15.209	Radiated Emissions	Pass
15.249(a)	Field Strength of Fundamental and Harmonics	Pass
N/A	99% Bandwidth	Pass

## 2.4 Test System Details

The test samples were received on January 22, 2016. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

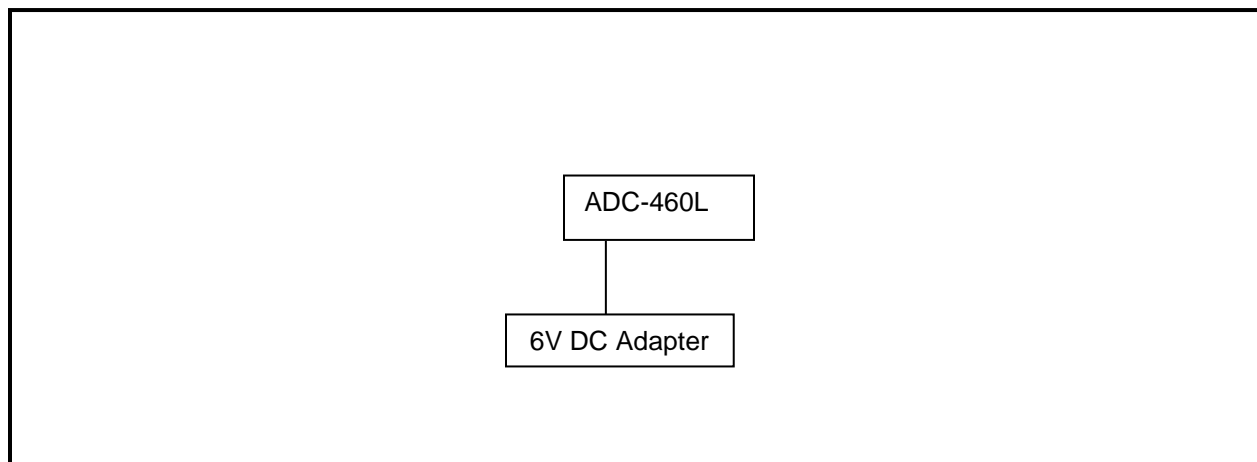
**Table 2-3: Equipment Under Test**

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
6 V DC/AC Adapter	Triad	WSU060-3000	WSU060-3000	N/A	1.8m unshielded power	21861
Transceiver	Alarm.com	ADC-460L	503412-300	YL6-143460L	N/A	21860
Ultra Wide Band Antenna 698-3000 MHz	taoglas	FXUB63	N/A	N/A	Shielded	21865
Antenna	N/A	N/A	3.5A	N/A	Shielded	21866
Daughter Module	Alarm.com	ADC-IS20-EVD	N-A-03	YL6-143IS205V4	N/A	21862

**Table 2-4: Auxiliary Equipment**

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Laptop PC	Hewlett Packard	Spectre XT Pro B0000	CND2360QBN	DoC	N/A	21759

## 2.5 Configuration of Tested System



**Figure 2-1: Configuration of System Under Test**

**3 Radiated Emissions – FCC 15.209, 15.249(a)**  
**3.1 Limits of Radiated Emissions Measurement**

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

**3.1.1 Radiated Emissions Measurement Test Procedure**

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10<sup>th</sup> harmonic of the highest fundamental transmitter frequency (9.08 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.



**Table 3-1: Radiated Emissions Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	EXA N9010A	Spectrum Analyzer (10 Hz – 26.5 GHz)	ATO-7568 SER MY51250846	4/21/17
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz - 6.5 GHz)	3325A00159	12/9/16
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	12/9/16
901683	Com-Power Corp.	PAM-118A	Preamplifier (500 MHz – 18 GHz)	551076	8/18/16
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	9/11/16
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/9/18
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/9/18
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/9/18
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	4/9/18
900325	EMCO	3160-9	Horn Antenna (18 - 26.5 GHz)	9605-1051	4/9/18
900791	Chase	CBL6112	Antenna (30 MHz – 2 GHz)	2099	6/11/17

### 3.2 Radiated Emissions Test Results

**Table 3-2: Radiated Emissions Test Data**

Emission Frequency (MHz)	Peak Detector Level (dBuV/m) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)
908.4	70.7	22.9	93.6	94.0	-0.4

\* testing performed at 3m

### 3.3 Radiated Emissions Harmonics/Spurious Test Data

**Table 3-3: Radiated Emissions Harmonics/Spurious – 908.4 MHz – Peak**

Emission Frequency (MHz)	Peak Detector (dBuV/m) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
1816.791	47.7	7.7	55.4	74.0	-18.6
2725.186	49.1	-14.7	34.4	74.0	-39.6
3633.581	47.2	-13.6	33.6	74.0	-40.4
4541.977	46.8	-7.2	39.6	74.0	-34.4
5450.372	45.5	-5.7	39.8	74.0	-34.2
6358.767	45.1	-4.4	40.7	74.0	-33.3
7267.163	46.3	-4.3	42.0	74.0	-32.0
8175.558	44.3	2.2	46.5	74.0	-27.5
9084.200	44.2	3.7	47.9	74.0	-26.1

**Table 3-4: Radiated Emissions Harmonics/Spurious – 908.4 MHz - Average**

Emission Frequency (MHz)	Average Detector (dBuV/m) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
1816.840	38.2	7.7	45.9	54.0	-8.1
2725.260	41.1	-14.7	26.4	54.0	-27.6
3633.680	38.3	-13.6	24.7	54.0	-29.3
4542.100	37.1	-7.2	29.9	54.0	-24.1
5450.520	34.3	-5.7	28.6	54.0	-25.4
6358.940	34.9	-4.4	30.5	54.0	-23.5
7267.360	38.2	-4.3	33.9	54.0	-20.1
8175.780	35.0	2.2	37.2	54.0	-16.8
9084.200	35.1	3.7	38.8	54.0	-15.2

**Table 3-5: Radiated Emissions Test Data, Digital Unintentional 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
87.000	Qp	46.7	-23.0	23.7	40.0	-16.3	Pass
130.850	Qp	41.3	-20.3	21.0	43.5	-22.5	Pass
163.000	Qp	42.0	-21.2	20.8	43.5	-22.7	Pass
213.500	Qp	37.6	-21.6	16.0	43.5	-27.5	Pass
327.170	Qp	36.3	-16.5	19.8	46.0	-26.2	Pass
457.800	Qp	34.7	-12.6	22.1	46.0	-23.9	Pass
587.600	Qp	42.8	-10.1	32.7	46.0	-13.3	Pass

\* testing performed at 3m

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor  $k = 2$ . +4.0 dB / -2.65 dB

**Test Personnel:**

Jon Wilson		February 12 and 17, March 2, 2016
Test Engineer	Signature	Dates of Test

**Note:** Radiated emissions were investigated with the module collocated and transmitting simultaneously with the following modularly approved devices. No non-compliant emissions were found; per FCC guidance, no data is being reported.

FCC ID: 2AAGMVZ120Q and YL6-143IS205V4

**Test Personnel:**

Daniel W. Baltzell		February 11 – 13, 2016
Test Engineer	Signature	Dates of Test

#### 4 AC Conducted Emissions - FCC 15.207

##### 4.1 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 AC 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).

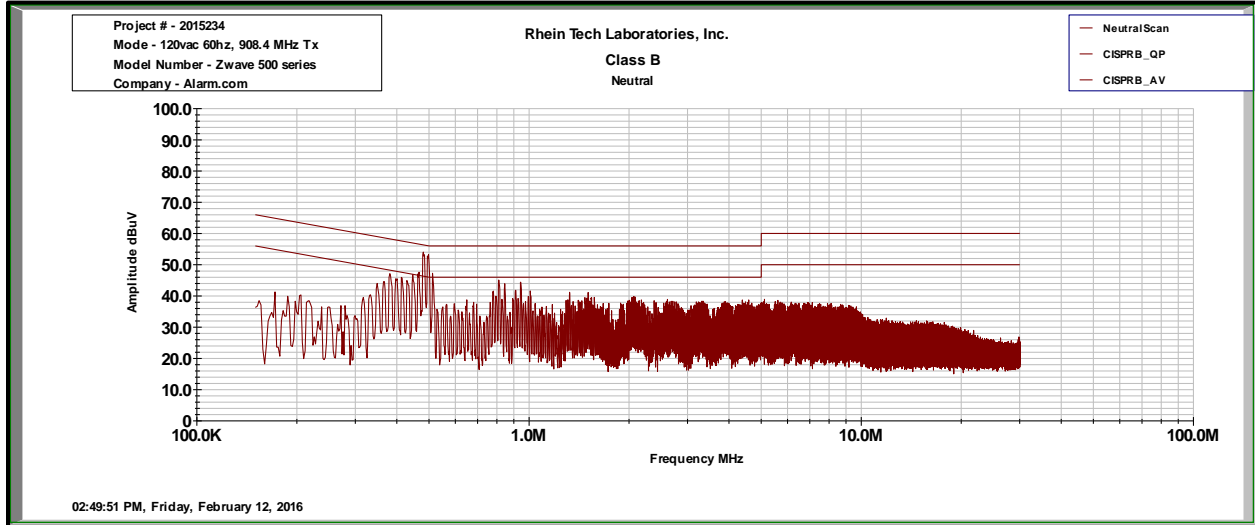
The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. 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.

##### 4.2 Test Limits

Line-Conducted Emissions		
Limit (dB $\mu$ 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

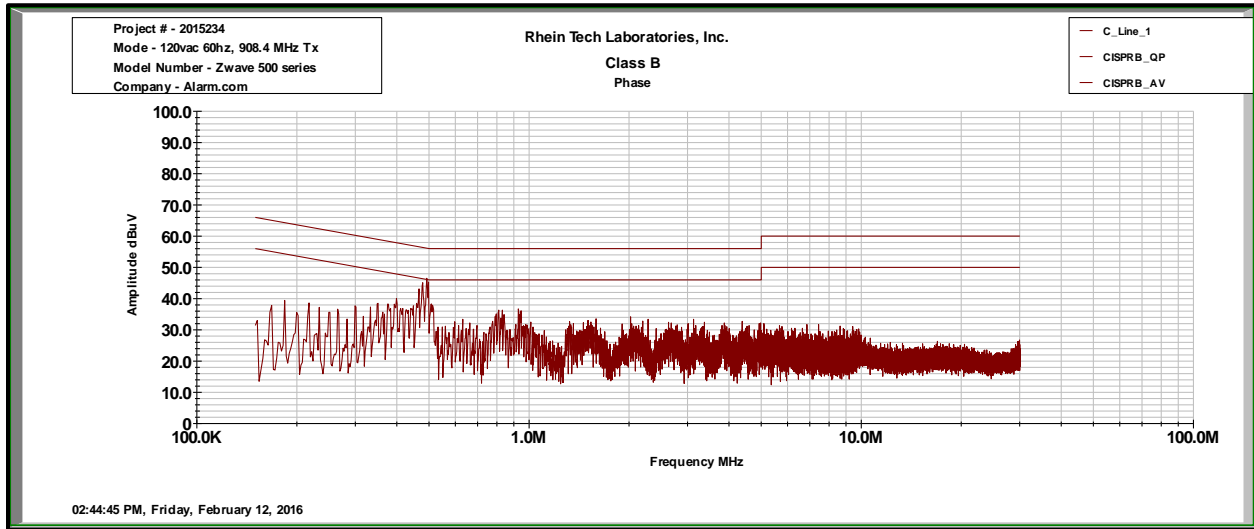
### 4.3 Conducted Emissions Test Data

Plot 4-1: Conducted Emissions Transmit - Neutral Side



Frequency (MHz)	Detector	Level (dBµV)	Site Correction Factor (dB)	Corrected Level (dBµV)	Limit (dBµV)	Margin (dB)	Pass/Fail
0.491	QP	51.5	0.9	52.4	56.2	-3.8	Pass
0.491	Av	41.6	0.9	42.5	46.2	-3.7	Pass

**Plot 4-2: Conducted Emissions Transmit - Phase Side – Z-Wave Module**



Frequency (MHz)	Detector	Level (dBµV)	Site Correction Factor (dB)	Corrected Level (dBµV)	Limit (dBµV)	Margin (dB)	Pass/Fail
0.491	QP	47.0	0.9	47.9	56.2	-8.3	Pass
0.491	Av	36.9	0.9	37.8	46.2	-8.4	Pass

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor  $k = 2$ .  $\pm 3.6$  dB

**Table 4-1: Conducted Emissions Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900339	Hewlett Packard	85650A	Quasi-Peak Adapter	2521A00743	2/17/16
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	4/21/16
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz – 22 GHz)	3138A07771	4/21/16
901084	AFJ International	LS16	16A LISN	16010020082	4/1/16
900728	Solar	Type 8130-7.0	Filter	N/A	4/9/17

**Test Personnel:**

Jon Wilson Test Engineer	 Signature	February 12, 2016 Date of Test
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Suite 1400  
Herndon, VA 20170  
<http://www.rheintech.com>

Client: Alarm.com  
Model: ADC-460L  
Standards: FCC 15.249  
IDs: YL6-143460L  
Report #: 2015234

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Herndon, VA 20170  
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Client: Alarm.com  
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Standards: FCC 15.249  
IDs: YL6-143460L  
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## **6 Conclusion**

The data in this measurement report shows that the EUT as tested, Alarm.com Model: ADC-460L, FCC ID: YL6-143460L complies with the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations and qualifies for Modular Approval.