




Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.249 & IC RSS-210 Certification Application Report for Full Modular Approval

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ID's	YL6-143200N25V4/ 9111A-143200N25V4	Test Report Date	June 28, 2013
Platform	N/A	RTL Work Order #	2013120
Model	ADC-200N-EVD	RTL Quote #	QRTL13-120A
American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification:	DXX – Part 15 Low Power Communication Device Transmitter		
FCC Rule Part(s)/Guidance:	Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25 GHz (10-01-12)		
Industry Canada	RSS-210 Issue 8: Low Power License-Exempt Communications Devices RSS-Gen Issue 3 2010: General Requirements and Information for the Certification of Radio Apparatus		
Digital Interface Information:	Digital Interface was found to be compliant		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
908.4	N/A	N/A	240

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, IC RSS-210 and ANSI C63.4.

Signature: 

Date: June 28, 2013

Typed/Printed Name: Desmond A. Fraser

Position: President

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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.

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1 General Information

1.1 Scope

This is an original certification application request.

Applicable Standards:

- FCC Rules Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices
- Industry Canada RSS-Gen Issue 3 2010: General Requirements and Information for the Certification of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Transceiver
Model	ADC-200N-EVD (variants 502540-900 and 502540-800)
Power Supply	12 VDC
Modulation Type	FSK
Frequency Range	908.4 MHz
Antenna Type	Permanent PCB trace antenna

Note that the EUT is available in four versions, differing only in unintentional digital circuitry: cell, cell w/audio, Ethernet, and B36 Ethernet. A fully populated version (this version is not available to customers) was tested thoroughly as a worst-case representation. Then the four versions described above were tested for worst-case spurious, harmonic, and unintentional digital emissions. Worst-case data is presented in this report.

Ethernet boards 502540-900 and 502540-800 are identical except for the configuration of the Ethernet I/O port. 502540-900 has an Ethernet connector; 502540-800 is a B36 Ethernet board which has Ethernet lines attached to a pigtail connector that can be used in a host housing.

Both boards were investigated for radiated emissions compliance as a digital interface device, specifically the Ethernet ports were investigated and found to be compliant.

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, 703-689-0368. 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 application for full modular approval certification for Alarm.com Model ADC-200N-EVD (variants 502540-900 and 502540-800), FCC ID: YL6-143200N25V4, IC: 9111A-143200N25V4.

1.5 Required Grant Notes

Testing was also performed to show collocation compliance with the Alarm.com model ADC-IS20-EVD FCC ID: YL6-143IS205V4 / IC: 9111A-143IS205V4. We would like the grant notes to reflect this.

1.6 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. 908.4 MHz was tested and investigated from 9 kHz to 9 GHz.

2.2 Exercising the EUT

The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that the information was being transmitted. There were no deviations from the test standard(s) and/or methods. The IF, LO, and up to the 2nd LO, were investigated and tested, and found to be compliant.

2.3 Test Result Summary

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

Standard	Test	Pass/Fail or N/A
FCC 15.249(a)	Radiated Emissions	Pass
FCC 15.207	AC Line Conducted Emissions	Pass
FCC 15.215	20 dB Bandwidth	Pass
RSS-Gen	99% Bandwidth	Pass
RSS-Gen ICES-003	Receiver/Digital Emissions	Pass

2.4 Test System Details

The test samples were received on June 10, 2013. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are in the table below.

Table 2-2: Equipment under Test (EUT)

Part	Manufacturer	Model	PN	FCC ID	RTL Bar Code
Transceiver	Alarm.com	ADC-200N-EVD	502540-900	YL6-143200N25V4	21072
Transceiver	Alarm.com	ADC-200N-EVD	502540-800	YL6-143200N25V4	21085

Table 2-3: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
DC Power Supply	Hewlett Packard	6291A	1928A05365	N/A	900773

2.5 Configuration of Tested System

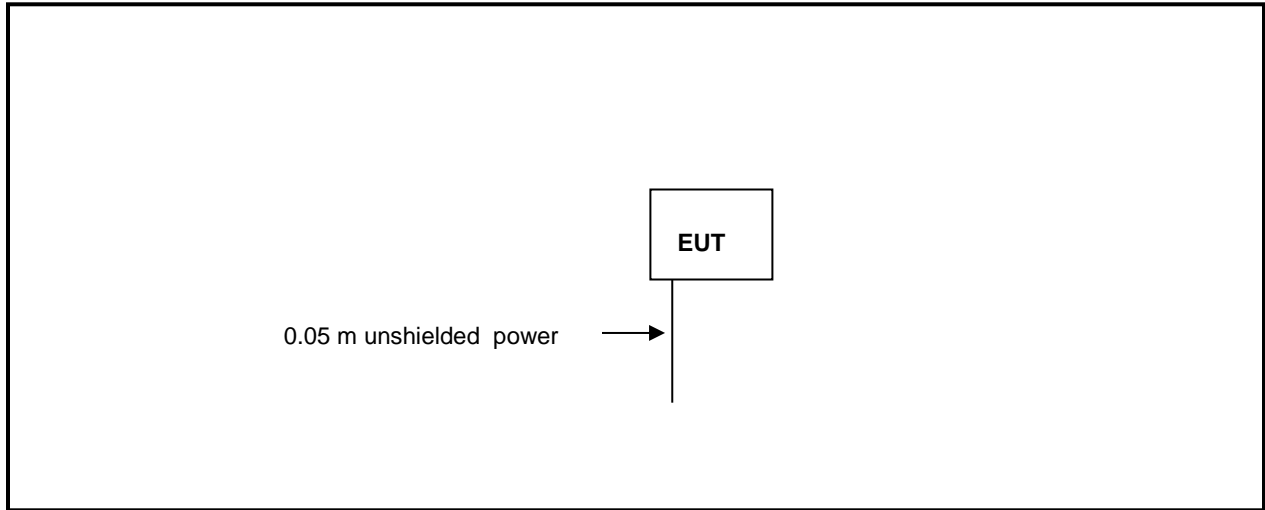


Figure 2-1: Worst Case Configuration of System under Test

3 Conducted AC Emissions – FCC 15.207: Conducted Limits; IC RSS-Gen 7.2.4: Conducted Limits

3.1 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.

3.2 Test Limits

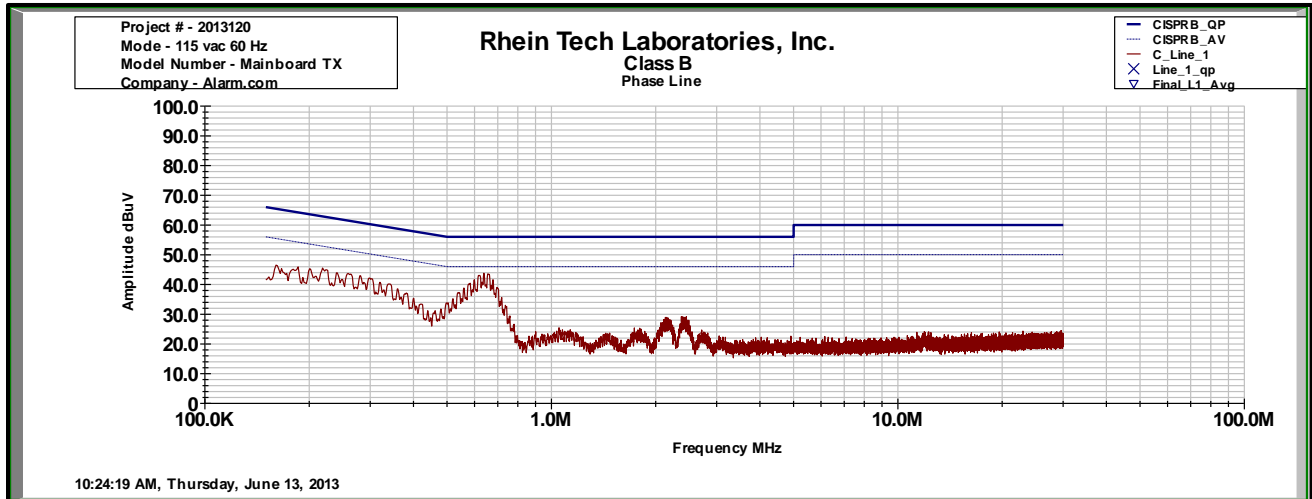
Line-Conducted Emissions		
Limit (dBµV)		
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

Table 3-1: Conducted Emissions Test Equipment

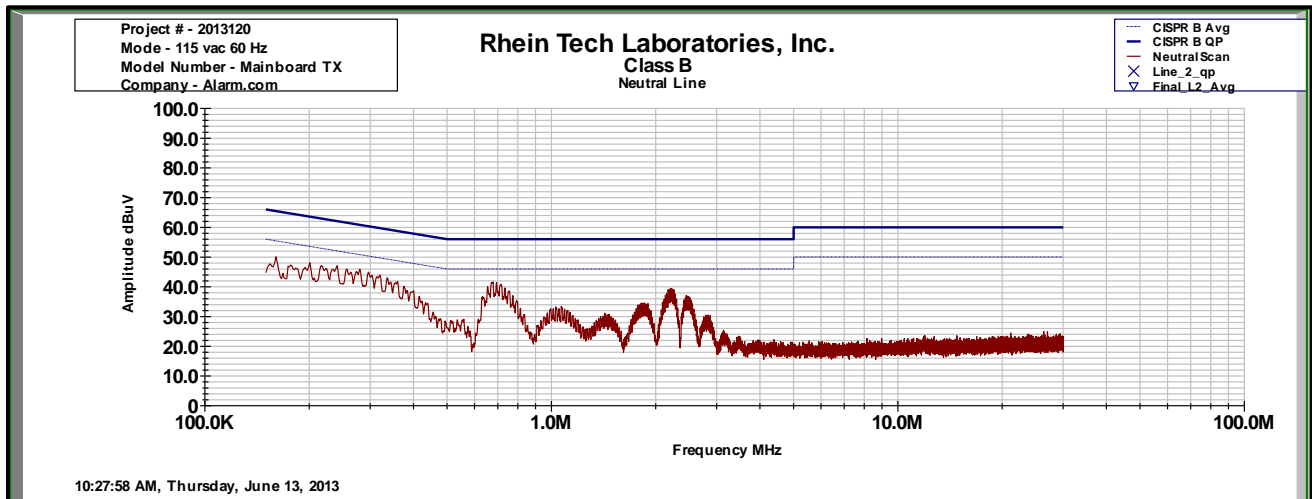
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900968	Hewlett Packard	8567A	Spectrum Analyzer (100 Hz - 1.5 GHz)	2602A00160	2/7/14
900970	Hewlett Packard	85662A	Spectrum Analyzer Display Section	2542A11239	2/7/14
900339	Hewlett Packard	85650A	Quasi-Peak Adapter	2521A00743	2/7/14
900728	Solar	8130	Filter	947306	3/1/14
901082	AFJ International	LS16/110VAC	16A LISN	16010020081	3/26/14

3.3 Conducted AC Emissions Test Data

Plot 3-1: Conducted AC Emissions; Phase, Transmit Mode



Plot 3-2: Conducted AC Emissions; Neutral; Transmit Mode



Test Personnel:

Jon Wilson
 Test Engineer

Jon Wilson
 Signature

June 13, 2013
 Date of Tests

4 Radiated Emission Limits Fundamental Emissions – FCC 15.249; RSS-210 A2.9

4.1 Radiated Emission Limits Test Procedure

Radiated Emissions of the Fundamentals were tested at three meters, and meet the quasi-peak limit of 50 mV/m. The EUT was tested in all three orthogonal planes. Peak measurements were taken and are compared to the quasi-peak limit.

Table 4-1: Radiated Fundamental 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	8/20/13
900791	Schaffner Chase	CBL6112	Bilog Periodic Antenna (25 MHz - 2 GHz)	2099	2/2/14
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz - 6.5 GHz)	3325A00159	9/20/13
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	9/20/13
N/A	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Emissions Testing Software	Rev. 14.0.2	N/A

4.2 Radiated Emission Test Data

Table 4-2: Radiated Emissions Fundamental Emission

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
908.400	Peak	V	40.2	36.0	76.2	94.0	-17.8	Pass

Test Personnel:

Jon Wilson Test Engineer	 Signature	June 13, 2013 Date of Tests
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5 Radiated Emission Limits Radiated Harmonics – FCC 15.249; RSS-210 A2.9

5.1 Radiated Emission Limits Test Procedure

Radiated emissions of the harmonics were tested at three meters. The EUT was tested by rotating through three orthogonal planes, each at 360° rotation with the receive antenna in both vertical and horizontal polarity.

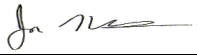
Table 5-1: Radiated Spurious Emissions - Peak

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
1816.800	Peak	H	36.2	4.3	40.5	74.0	-33.5	Pass
2725.300	Peak	V	41.8	-18.8	23.0	74.0	-51.0	Pass
3633.700	Peak	V	36.3	-16.8	19.5	74.0	-54.5	Pass
4542.100	Peak	H	35.5	-11.6	23.9	74.0	-50.1	Pass
5450.500	Peak	H	34.7	-9.2	25.5	74.0	-48.5	Pass
6358.900	Peak	V	35.7	-9.5	26.2	74.0	-47.8	Pass
7267.400	Peak	V	38.9	-8.6	30.3	74.0	-43.7	Pass
8175.800	Peak	H	39.4	0.7	40.1	74.0	-33.9	Pass
9084.200	Peak	V	40.2	-1.1	39.1	74.0	-34.9	Pass

Table 5-2: Radiated Spurious 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	8/20/13
900791	Schaffner Chase	CBL6112	Bilog Periodic Antenna (25 MHz - 2 GHz)	2099	2/2/14
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz - 6.5 GHz)	3325A00159	9/20/13
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	9/20/13
901215	Hewlett Packard	8596EM	Spectrum Analyzer	3826A00144	3/15/14
901364	Rhein Tech Laboratories, Inc.	PR-1042	Amplifier (1 GHz - 26.4 GHz)	1003	7/14/13
900772	EMCO	3161-02	Horn Antenna (2.0 - 4.0 GHz)	9804-1044	4/20/15
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	4/20/15
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	4/20/15
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	June 13, 2013 Date of Tests
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6 In-Band Emissions Requirement – FCC 15.215(c)

6.1 Test Procedure 20 dB Bandwidth

The 20 dB bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz (1% of span), and the video bandwidth set at 1 MHz. The spectrum analyzer's automated display markers adjusted to -20 dBc using max hold until the spectrum was filled and a plot taken.

6.2 FCC 15.215(c) Requirement

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in FCC 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

6.3 Test Data

Plot 6-1: 20 dB Bandwidth

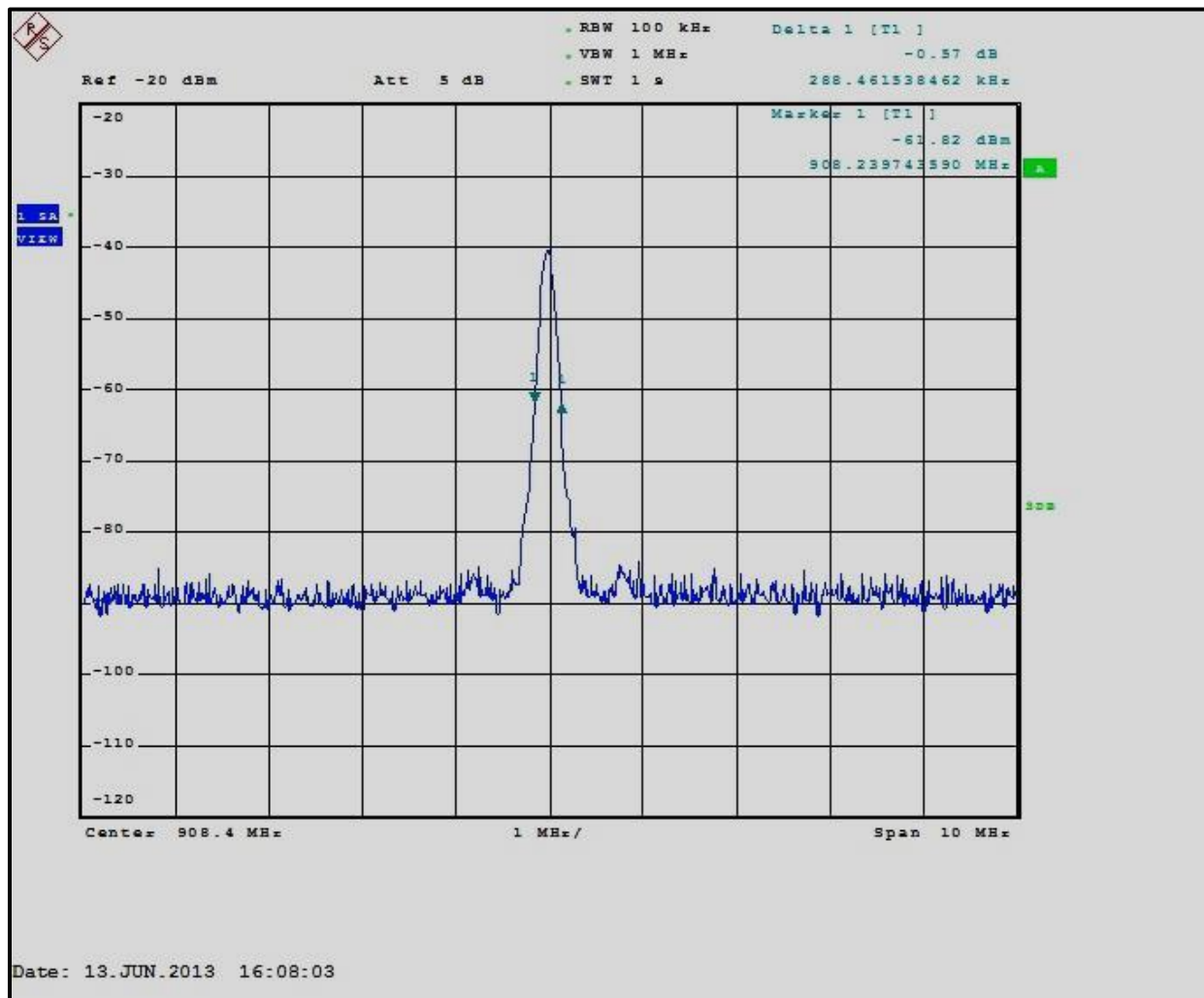


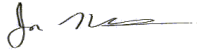
Table 6-1: 20 dB Modulated Bandwidth

Frequency (MHz)	20 dB Bandwidth (kHz)
908.4	288.5

Table 6-2: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	1166.1660.50	FSU Spectrum Analyzer (20 Hz – 50 GHz)	200106	01/19/14

Test Personnel:

Jon Wilson Test Engineer	 Signature	June 13, 2013 Date of Tests
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7 Occupied Bandwidth - RSS-Gen 4.6.1

7.1 Modulated Bandwidth Test Procedure

The 99% bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz (1% of span), and the video bandwidth set at 1 MHz.

7.2 Modulated Bandwidth Test Data

Plot 7-1: 99% Bandwidth

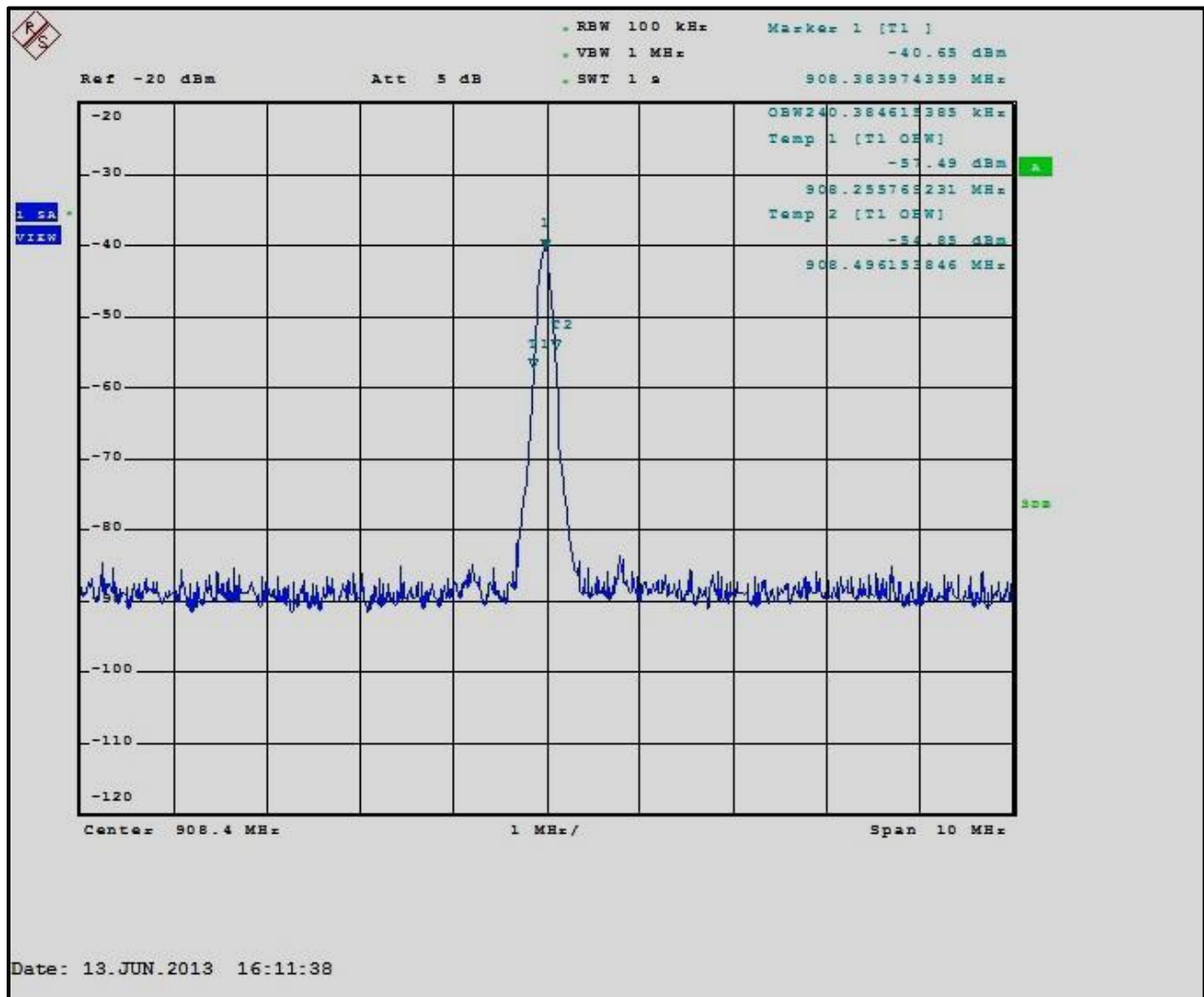


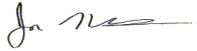
Table 7-1: 99% Modulated Bandwidth

Frequency (MHz)	99% Bandwidth (kHz)
908.4	240.4

Table 7-2: 99% Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	1166.1660.50	FSU Spectrum Analyzer (20 Hz – 50 GHz)	200106	01/19/14

Test Personnel:

Jon Wilson Test Engineer	 Signature	June 14, 2013 Date of Tests
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8 Conclusion

The data in this measurement report shows that the EUT as tested, Alarm.com Model ADC-200N-EVD (variants 502540-900 and 502540-800), FCC ID: YL6-143200N25V4, IC: 9111A-143200N25V4, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules, and Industry Canada RSS-210 and RSS-Gen, for Modular Approval.