



Engineering and Testing for EMC and Safety Compliance



Accredited under A2LA Certificate # 2653.01

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

<b>Test Lab:</b> Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 <a href="http://www.rheintech.com">www.rheintech.com</a> Herndon, VA 20170 Email: <a href="mailto:atcbinfo@rheintech.com">atcbinfo@rheintech.com</a>		<b>Applicant:</b> American Grid, Inc. Phone: 410-531-4848 14112 Big Branch Drive Dayton, MD 21036 Contact: C.P. Shankar		
<b>FCC ID</b>		XPZ-AGWT-01	<b>Test Report Date</b>	October 7, 2009
			<b>RTL Work Order Number</b>	2009260
<b>Model #</b>		AGWT-01	<b>RTL Quote Number</b>	QRTL09-406B
<b>FCC Classification</b>		DXX – Part 15 Low Power Communication Device Transmitter		
<b>FCC Rule Part</b>		Part 15.249 (10-01-06): Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25 GHz		
<b>Industry Canada Standard</b>		RSS-210 (Issue 7): Low Power License-Exempt Radio Communication Devices (All Frequency Bands)		
<b>Digital Interface Information</b>		Digital Interface was found to be compliant		
<b>Receiver Information</b>		Receiver 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	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 FCC Part 2, FCC Part 15, and ANSI C63.4.

Signature: 

Date: October 7, 2009

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 American Grid, Inc. The test results relate only to the item tested.

## Table of Contents

<b>1</b>	<b>General Information .....</b>	<b>5</b>
1.1	Scope .....	5
1.2	Modifications.....	5
1.3	Test Facility .....	5
1.4	Related Submittal(s)/Grant(s) .....	5
<b>2</b>	<b>Test Information .....</b>	<b>6</b>
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
<b>3</b>	<b>Conducted AC Emissions – FCC §15.207 .....</b>	<b>8</b>
3.1	Site and Test Description.....	8
3.2	Test Limits .....	8
3.3	Conducted AC Emissions Test Data.....	9
<b>4</b>	<b>Radiated Emission Limits Fundamental Emissions – FCC §15.249 .....</b>	<b>10</b>
4.1	Radiated Emission Limits Test Procedure .....	10
4.2	Radiated Emission Limits Test Data .....	11
<b>5</b>	<b>Radiated Emission Limits Radiated Harmonics – FCC §15.249.....</b>	<b>12</b>
5.1	Radiated Emission Limits Test Procedure .....	12
<b>6</b>	<b>In-Band Emission Requirement – FCC 15.215(c) .....</b>	<b>14</b>
6.1	Test Procedure .....	14
6.2	FCC 15.215(c) Requirement.....	14
6.3	Test Data .....	14
<b>7</b>	<b>Conclusion.....</b>	<b>15</b>

## Table Index

Table 2-1:	Test Result Summary with FCC Rules and Regulations .....	6
Table 2-2:	Equipment under Test (EUT) .....	6
Table 2-3:	Support Equipment .....	6
Table 3-1:	Conducted Emissions Test Equipment .....	8
Table 3-2:	Conducted AC Emissions; Neutral (Line 1); Transmit Mode .....	9
Table 3-3:	Conducted AC Emissions; Hot (Line 2); Transmit Mode .....	9
Table 4-1:	Radiated Fundamental Emissions Test Equipment .....	10
Table 4-2:	Radiated Emissions Fundamental Emissions – External Antenna .....	11
Table 4-3:	Radiated Emissions Fundamental Emissions – PCB Antenna .....	11
Table 5-1:	Radiated Spurious Emissions - External Antenna .....	12
Table 5-2:	Radiated Spurious Emissions - PCB Antenna .....	12
Table 5-3:	Radiated Spurious Emissions Test Equipment .....	13
Table 6-1:	In-band Test Equipment .....	15

## Plot Index

Plot 6-1:	20 dB Bandwidth .....	14
-----------	-----------------------	----

## Figure Index

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

## Appendix Index

Appendix A:	FCC Part 1.1307, 1.1310, 2.1091, 2.1093; RF Exposure .....	16
Appendix B:	FCC/TCB Agency Authorization Letter .....	17
Appendix C:	FCC Confidentiality Request Letter .....	18
Appendix D:	DA00-1407 Part 15 Unlicensed Modular Transmitter Approval .....	19
Appendix E:	Label and Label Location .....	20
Appendix F:	Operational Description .....	21
Appendix G:	Schematics .....	22
Appendix H:	Block Diagram .....	23
Appendix I:	Manual .....	24
Appendix J:	Test Photographs .....	25
Appendix K:	External Photographs .....	29
Appendix L:	Internal Photographs .....	35

## Photograph Index

---

Photograph 1:	Radiated Emissions - Front View .....	25
Photograph 2:	Radiated Emissions - Rear View .....	26
Photograph 3:	Conducted AC Emissions - Front View .....	27
Photograph 4:	Conducted AC Emissions - Rear View .....	28
Photograph 5:	Front View – Module with External Antenna.....	29
Photograph 6:	Front View – Module with External Antenna Marked.....	30
Photograph 7:	Rear View – Module with External Antenna .....	31
Photograph 8:	Front View – Module with PCB Antenna .....	32
Photograph 9:	Front View – Module with PCB Antenna Marked .....	33
Photograph 10:	Rear View – Module with PCB Antenna .....	34
Photograph 11:	Front View – Module with External Antenna.....	35
Photograph 12:	Front View – Module with External Antenna Marked.....	36
Photograph 13:	Rear View – Module with External Antenna .....	37
Photograph 14:	Front View – Module with PCB Antenna .....	38
Photograph 15:	Front View – Module with PCB Antenna Marked .....	39
Photograph 16:	Rear View – Module with PCB Antenna .....	40

## **1 General Information**

### **1.1 Scope**

FCC Rules Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz, and 24.0-24.25 GHz.

### **1.2 Modifications**

No modifications were made.

### **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 (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 **Limited Modular Approval** for American Grid, Inc. Model AGWT-01, FCC ID: XPZ-AGWT-01.

## 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. The test results relate only to the item that was tested.

### 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 2<sup>nd</sup> 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

### 2.4 Test System Details

The test samples were received on September 8, 2009. The wireless transceiver module has two antenna options. Antenna type 1 is an integral monopole PCB antenna with a gain of 0 dBi. Antenna type 2 is an SMA male reverse connector monopole antenna with a gain of 1dBi. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are in the table below.

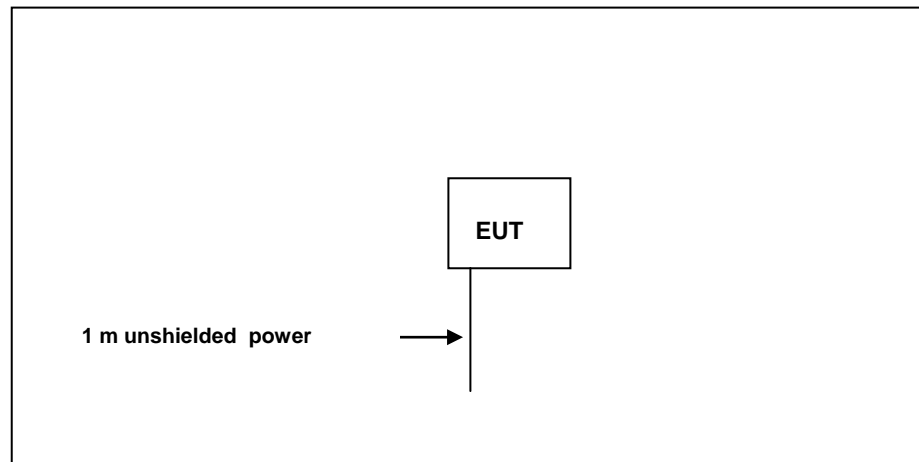
**Table 2-2: Equipment under Test (EUT)**

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Wireless Transceiver with PCB Antenna	American Grid, Inc.	AGWT-01	N/A	XPZ-AGWT-01	19201
Wireless Transceiver with External Antenna	American Grid, Inc.	AGWT-01	N/A	XPZ-AGWT-01	19200

**Table 2-3: Support Equipment**

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
AC Adapter	American Grid, Inc.	KSUFB0040DIUS	N/A	N/A	19199

## 2.5 Configuration of Tested System



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

### 3 Conducted AC Emissions – FCC §15.207

#### 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
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	6/8/10
901082	AFJ International	LS16	16A LISN	16010020081	2/23/10



### 3.3 Conducted AC Emissions Test Data

**Table 3-2: Conducted AC Emissions; Neutral (Line 1); Transmit Mode**

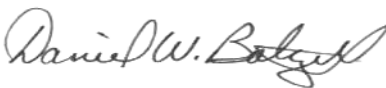
Temperature: 72.3°F Humidity: 63%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/Fail
0.150	Qp	43.2	0.2	43.4	66.0	-22.6			Pass
0.175	Qp	42.6	0.2	42.8	64.7	-21.9			Pass
0.380	Qp	41.1	0.3	41.4	58.3	-16.9			Pass
1.648	Qp	40.2	0.8	41.0	56.0	-15.0			Pass
3.507	Qp	40.7	1.3	42.0	56.0	-14.0			Pass
16.001	Qp	19.9	2.8	22.7	60.0	-37.3			Pass
25.015	Av	14.5	3.3	17.8			50.0	-32.2	Pass
25.015	Qp	52.6	3.3	55.9	60.0	-4.1			Pass

**Table 3-3: Conducted AC Emissions; Hot (Line 2); Transmit Mode**

Temperature: 72.3°F Humidity: 63%							
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	Pass/Fail
0.172	Qp	40.9	0.2	41.1	64.9	-23.8	Pass
0.230	Qp	31.7	0.2	31.9	62.4	-30.5	Pass
0.437	Qp	23.8	0.3	24.1	57.1	-33.0	Pass
1.450	Qp	30.5	0.8	31.3	56.0	-24.7	Pass
3.600	Qp	39.8	1.3	41.1	56.0	-14.9	Pass
6.730	Qp	24.4	1.8	26.2	60.0	-33.8	Pass
25.160	Qp	12.9	3.3	16.2	60.0	-43.8	Pass

**Test Personnel:**

Daniel W. Baltzell  
Test Engineer



Signature

September 8 and 11, 2009  
Dates of Tests

#### 4 Radiated Emission Limits Fundamental Emissions – FCC §15.249

##### 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 for the low, mid, and high channels; the worst case emissions are shown. 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
900791	Chase	CBL6111B	Bilog antenna (30 MHz – 2000 MHz)	N/A	12/12/10
901365	MITEQ	JS4- 00102600-41- 5P	Amplifier, 0.1-26 GHz, 30dB gain	N/A	3/4/10
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/09
901516	Insulated Wire, Inc.	KPS-1503- 2400-KPS- 09302008	RF cable, 20'	NA	10/17/09
901517	Insulated Wire Inc.	KPS-1503- 360-KPS- 09302008	RF cable 36"	NA	10/17/09
900878	Rhein Tech Laboratories	AM3-1197- 0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000- 0003	Wood rotating table	N/A	Not Required

## 4.2 Radiated Emission Limits Test Data


**Table 4-2: Radiated Emissions Fundamental Emissions – External Antenna**

Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.4	Pk	99.1	-9.2	89.9	94.0	-4.1

**Table 4-3: Radiated Emissions Fundamental Emissions – PCB Antenna**

Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
908.4	Pk	89.2	-9.2	80.0	94.0	-14.0

### Test Personnel:

Daniel Baltzell Test Engineer	 Signature	September 11 and 16, 2009 Dates of Tests
----------------------------------	---	---

## 5 Radiated Emission Limits Radiated Harmonics – FCC §15.249

### 5.1 Radiated Emission Limits Test Procedure

Radiated emissions of the harmonics were tested at three meters, and meet the requirements of 500 microvolts/meter in average mode, and 20 dB higher in peak mode, per 15.249(e). The EUT was tested in the X-Y, X-Z, and Y-Z orthogonal planes.

**Table 5-1: Radiated Spurious Emissions - External Antenna**

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1816.795	54.5	-3.5	51.0	54.0	-3.0
2725.195	48.7	-0.5	48.2	54.0	-5.8
3633.595	42.5	-2.5	40.0	54.0	-14.0
4541.995	27.0	3.3	30.3	54.0	-23.7
5450.395	28.8	8.3	37.1	54.0	-16.9
6358.795	25.8	6.0	31.8	54.0	-22.2
7267.195	29.3	5.7	35.0	54.0	-19.0
8175.595	29.0	7.3	36.3	54.0	-17.7
9083.950	28.6	12.7	41.3	54.0	-12.7

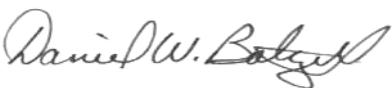
**Table 5-2: Radiated Spurious Emissions - PCB Antenna**

Emission Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1816.795	48.4	-3.4	45.0	54.0	-9.0
2725.195	46.2	-0.5	45.7	54.0	-8.3
3633.595	40.5	-2.5	38.0	54.0	-16.0
4541.995	34.1	3.3	37.4	54.0	-16.6
5450.395	31.9	8.3	40.2	54.0	-13.8
6358.795	32.4	6.0	38.4	54.0	-15.6
7267.195	33.4	5.7	39.1	54.0	-14.9
8175.595	34.5	7.3	41.8	54.0	-12.2
9083.950	28.6	12.7	41.3	54.0	-12.7

**Table 5-3: Radiated Spurious Emissions Test Equipment**

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog antenna (30 MHz – 2000 MHz)	N/A	12/12/10
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 30dB gain	N/A	3/4/10
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	6/14/10
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	6/14/10
900323	EMCO	3160-07	Horn Antennas (8.2 – 12 GHz)	9605-1054	6/14/10
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/09
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS-09302008	RF cable, 20'	NA	10/17/09
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/17/09
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required

**Test Personnel:**

Daniel Baltzell		September 11 and 16, 2009
Test Engineer	Signature	Dates of Tests

## 6 In-Band Emission Requirement – FCC 15.215(c)

### 6.1 Test Procedure

The 20 dB bandwidth was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 10 kHz (1% of span), and the video bandwidth set at 30 kHz. The spectrum analyzer's display markers were set to -20 dB 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 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

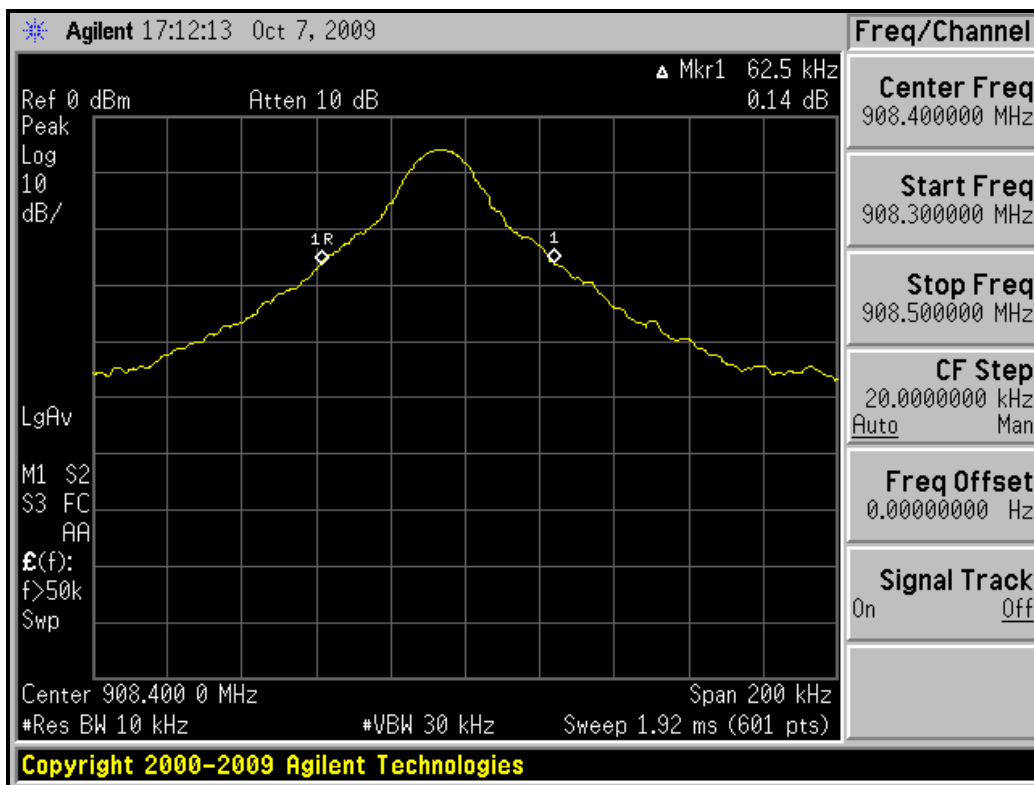
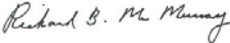


Table 6-1: In-band Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	7/31/10

**Test Personnel:**

Richard B. McMurray, P.E.		October 7, 2009
Test Engineer	Signature	Date Of Test

**7 Conclusion**

The data in this measurement report shows that American Grid, Inc. Model: AGWT-01, FCC ID: XPZ-AGWT-01, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules.