LS Research, LLC
ACCREDITED
Cert. # 1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012 ● USA
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

COMPLIANCE TESTING OF:
900 MHz Module with External Dipole

PREPARED FOR:

Generac Power Systems
Attn: Steve Wilcox
Hwy. 59 & Hillside Road
P.O. Box 8
Waukesha, WI 53187

TEST REPORT NUMBER: 310068

LSR Job #: C-844

TEST DATE(S): July 2, 5, 6, 8, 9, 12-15, and December 2, 2010

Table of Contents

1. LS Research, LLC In Review

LS Research, LLC - Accreditations and Listing's

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025 : 2005
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1
File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1
File Number: IC 3088

U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2)
Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002
Notified Body Identification Number: 1243

2. Signature Page

Reviewed By:		08.16.10
	Thomas T. Smith, Manager EMC Test Services	Date
Tested By:		08.16.10
	Peter Feilen, EMC Engineer	Date
Approved By:		08.16.10
	Thomas T. Smith, Manager EMC Test Services	**Date**

3. Product and General Information

Manufacturer:	Generac Power Systems					
Date(s) of Test:	July 2, 5, 6, 8, 9, 12-15, 2010					
Test Engineer(s):	X	Peter Feilen				
Model #:	0H7699					
Serial #:	N/A					
Voltage:	3.3 VDC					
Operation Mode:	Normal					

4. Introduction

On July 2, 5, 6, 8, 9, 12-15, 2010 a series of Conducted and Radiated Emission tests were performed on one sample of the 900 MHz Module, Model Number 0H7699, here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.249 (Industry Canada RSS-210, Issue 7, 2007) for a low power transmitter. These tests were performed by Peter Feilen, EMC Engineer of LS Research.

All Radiated and Conducted Emission tests were performed upon the EUT to measure the emissions in the frequency bands described in FCC Title 47 CFR Part 15, including 15.35, 15.209, 15.249 and Industry Canada RSS-210, Issue 7, 2007 to determine whether these emissions are below the limits expressed within the standards. These tests were performed in accordance with the procedures described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2003.

5. Product Description

The 900 MHz Radio with Dipole antenna is designed to be used with the 2 dBi dipole associated with testing. This antenna is detachable and the unit with antenna attached is portable for use in different applications for communicating information on generator status.

6. EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	907-923 MHz
RF Power in Watts	0.000082 W
Conducted Output Power (in dBm)	-10.84 dBm
EIRP (in mW)	0.131 mW
Field Strength (and at what distance)	89.3 dBuV/m @ 3m (907 MHz) 90.1 dBuV/m @ 3m (917 MHz) 90.4 dBuV/m @ 3m (923 MHz)
Occupied Bandwidth (99% BW)	288.84 kHz
Type of Modulation	FSK
Emission Designator	289KF1D
Transmitter Spurious (worst case)	50.5 dBuV/m @ 3m @ 1814 MHz
Receiver Spurious (worst case)	56.9 dBuV/m @ 1 m @ 8487 MHz
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Microprocessor Model # (if applicable)	Microchip PIC16F1936-I/SS
EUT will be operated under FCC Rule Part(s)	15.249
Antenna Information:	
a) Antenna Type	Nearson S467AH-915
b) Detachable/Non-Detachable	Detachable
c) Antenna Gain (in dBi)	+2 dBi
Modular Filing	☒ Yes ☐ No
Portable/Mobile	☒ Portable ☐ Mobile

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	X	RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: 100 %
- Standard used for evaluation: OET 65
- Measurement Distance: 20 cm
- RF Value: 0.00026 ☐ V/m ☐ A/m ☒ W/m^2
  ☒ Measured ☐ Computed ☐ Calculated

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-10.84	(dBm)
Maximum peak output power at antenna input terminal:	0.082	(mW)
Antenna gain(typical):	2	(dBi)
Maximum antenna gain:	1.585	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	923	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.000026	(mW/cm^2)
Maximum allowable antenna gain:	47.9	(dBi)
Margin of Compliance at 20 cm =	45.9	dB

7. Test Requirements

The above mentioned tests were performed in order to determine the compliance of the 900 MHz module with dipole antenna with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.31	15.205
15.33	15.207
15.35	15.209
15.37	15.249

8. Summary of Test Report

DECLARATION OF CONFORMITY

The 900 MHz module with external dipole was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Part 15.249, Subpart (a); and Industry Canada RSS-210, Issue 7, 2007 Section 6.2 for a *'Non-Momentarily Operated Transmitting Device'*.

Some emissions are seen to be within 3dB of their respective limits. As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

The enclosed test results pertain to the sample(s) of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

9. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15 and ANSI C63.4-2003. The EUT was placed on an 80cm high non-conductive pedestal centered on a flush mounted 2-meter diameter turntable inside the 3 Meter Semi-Anechoic, FCC listed Chamber located at LS Research, LLC Cedarburg, Wisconsin. The EUT was operated in transmit and receive modes, and final testing was performed using each mode, using power as provided by a DC bench supply. The unit has the capability to operate on 17 channels, controllable during testing purposes via dip switches. The applicable limits apply at a 3 meter distance, and are found in Section 15.209. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment. The test sample was operated on one of three (3) standard channels: low (907 MHz), medium (917 MHz) and high (923 MHz) to comply with FCC Part 15.31(m). The channels and operating modes were changed using DIP switches.

Test Procedure

Radiated RF measurements were performed on the EUT in the 3 Meter Semi-Anechoic, FCC listed Chamber, located at LS Research, LLC, in Cedarburg, Wisconsin. The frequency range from 30 MHz to 10000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on the non-conductive pedestal in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double Ridged Waveguide Horn Antenna was used from 1 GHz to 10 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height when there was a 3 meter separation distance, and between 1 and 1.8 meters in height when there was a 1 meter separation distance. Both horizontal and vertical antenna polarities were used.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and an Agilent E4445A spectrum analyzer. The resulting correction factors and the cable loss factors from these calibrations were entered into the Agilent E4445A spectrum analyzer database. As a result, the data taken from the Agilent E4445A spectrum analyzer accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The Agilent E4445A spectrum analyzer was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz). From 4 GHz to 10 GHz, an Agilent E4446A Spectrum Analyzer and an EMCO Horn Antenna were used.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.249 for a transmitter (Canada RSS-210). The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS:

Field Strength of Fundamental Frequencies:

The fundamental emissions for an intentional radiator in the 902-928 MHz band, operating under FCC part 15.249 limits, must have electric field strength of no greater than 50 mV/m, for the fundamental frequency, when measured at 3 meters, and harmonic field strength of no greater than 500 μV/m, when measured at 3 meters. Spurious emissions outside the 902-928 MHz band shall be attenuated by at least 50 dB below the level of the fundamental, or meet the limits expressed in FCC part 15.209 under general emission limits.

Field Strength of Fundamental Frequencies is Limited to 50,000 μV/m, or 94 dBμV/m.

Field Strength of Harmonic and Spurious Frequencies is Limited by FCC 15.249(c)

The harmonic limit of –50 dBc with respect to the fundamental limit would be:

94 dBμV/m – 50 dB = 44 dBμV/m,

with the exception of where FCC 15.209 allows for a higher limit to be used.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
902-928	50,000	94.0
30-88 ; 88-216	159	44.0
216-902 ; 928-960	500	46.0*
960-40,000	500	54.0*

The following table depicts the general radiated emission limits obtained from Title 47 CFR, part 15.209a, for radiated emissions measurements, including restricted band limits as expressed in 47 CFR, part 15.205.

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-40,000	500	54.0

Sample conversion from field strength μV/m to dBμV/m:

$dB\mu V/m = 20 \log_{10}$ (3m limit)

from 30 - 88 MHz for example: $dB\mu V/m = 20 \log_{10} (100)$

$40.0\ dB\mu V/m = 20 \log_{10} (100)$

For measurements made at 1 meter, a 9.5 dB correction may be been invoked.

960 MHz to 40,000 MHz

500 μV/m or 54.0 dBμV/m at 3 meters

54.0 + 9.5 = 63.5 dBμV/m at 1 meter

Note: Limits are conservatively rounded to the nearest tenth of a whole number.

Summary of Results and Conclusions

Based on the procedures outlined in this report, and the test results, it can be determined that the EUT does MEET the emission requirements of Title 47 CFR, FCC Part 15.249, for a frequency modulated transmitter.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed per the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

Radiated Emissions Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions

Test Standard: Title 47 CFR 15.249

Frequency Range Inspected: 30 MHz to 10000 MHz

Manufacturer:	Generac Power Systems					
Date(s) of Test:	July 2, 5, 6, 8, 9, 12, 13, 2010					
Test Engineer(s):	X	Peter Feilen				
Model #:	0H7699					
Serial #:	N/A					
Voltage:	3.3 VDC					
Operation Mode:	C.W. mode					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery	X	Other: DC Bench Supply		
EUT Placement:	X	80cm non-conductive table		10cm Spacers		
EUT Test Location:	X	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

Environmental Conditions in the Lab:
Temperature: 20 – 25 °C Actual: 21-22 °C
Relative Humidity: 30 – 60 % Actual: 45-50 %

Test Equipment Used:
EMI Measurement Instrument: Agilent E4445A and Agilent E4407B
Log Periodic Antenna: EMCO #93146
Horn Antenna: EMCO #3115
Biconical Antenna: EMCO 93110
Pre-Amp: Advanced Microwave WHA6224
Standard Gain Horn: EMCO 3160-09

The following table depicts the level of significant radiated emissions found:

Frequency (MHz)	Antenna Polarity	Eut Orientation	Channel	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
863.10	V	V	923	1.00	208	44.5	46.0	1.5
873.10	V	V	923	1.00	66	44.1	46.0	1.9
863.10	H	V	923	1.00	204	33.3	46.0	12.7
901.80	V	V	907	1.44	155	39.2	46.0	6.8
877.06	V	V	917	1.00	209	40.4	46.0	5.6
857.06	V	V	907	1.00	211	39.4	46.0	6.4
847.10	V	V	907	1.45	237	37.9	46.0	8.1
901.73	H	V	907	1.00	160	30.4	46.0	15.6
967.08	H	V	907	2.13	48	38.1	54.0	15.9
967.08	V	V	907	1.35	180	48.4	54.0	5.6
957.08	V	V	907	1.40	0	45.6	46.0	0.4
983.09	V	V	923	1.31	226	48.7	54.0	5.3
928.09	V	V	923	1.40	267	41.3	46.0	4.7
278.08	V	V	923	1.45	0	24.1	46.0	21.9
60.00	V	V	907	1.00	0	25.3	40.0	14.7

Spurious Emissions Continued: Harmonics of the Fundamentals

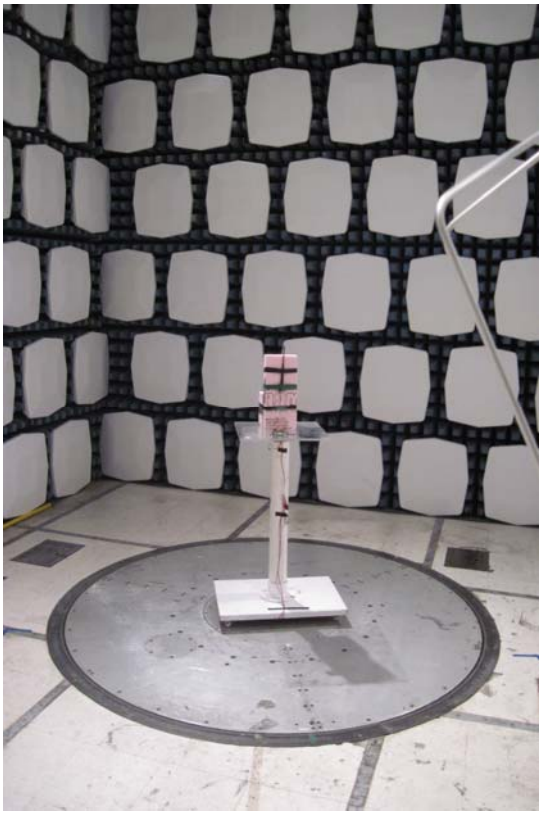
Frequency (MHz)	Antenna Polarity	Eut Orientation	Chan	Height (meters)	Azimuth (0° - 360°)	EMI Peak Reading (dBμV/m)	EMI Average Reading (dBμV/m)	15.249 Limit (dBμV/m)	Margin (dB)
1814.00	V	V	907	1.22	6	51.7	49.4	54.0	4.6
2721.00	V	V	907	1.21	110	49.1	44.8	54.0	9.2
3628.00	V	V	907				Note 2	54.0	
4535.00	V	V	907				Note 2	63.5	
5442.00	V	V	907				Note 2	63.5	
6349.00	V	V	907				Note 2	63.5	
7256.00	V	V	907				Note 2	63.5	
8163.00	V	V	907				Note 2	63.5	
9070.00	V	V	907				Note 2	63.5	
1834.00	V	V	917	1.00	0	49.3	49.5	54.0	4.5
2751.00	V	H	917	1.31	154	52.0	50.2	54.0	3.8
3668.00	V	V	917				Note 2	54.0	
4585.00	V	V	917				Note 2	54.0	
5502.00	V	V	917				Note 2	54.0	
6419.00	V	V	917				Note 2	54.0	
7336.00	V	V	917				Note 2	54.0	
8253.00	V	V	917				Note 2	54.0	
9170.00	V	V	917				Note 2	54.0	
1846.00	V	V	923	1.32	0	51.8	49.5	54.0	4.5
2769.00	V	V	923	1.22	122	50.8	47.6	54.0	6.4
3692.00	V	V	923				Note 2	54.0	
4615.00	V	V	923				Note 2	63.5	
5538.00	V	V	923				Note 2	63.5	
6461.00	V	V	923				Note 2	63.5	
7384.00	V	V	923				Note 2	63.5	
8307.00	V	V	923				Note 2	63.5	
9230.00	V	V	923				Note 2	63.5	

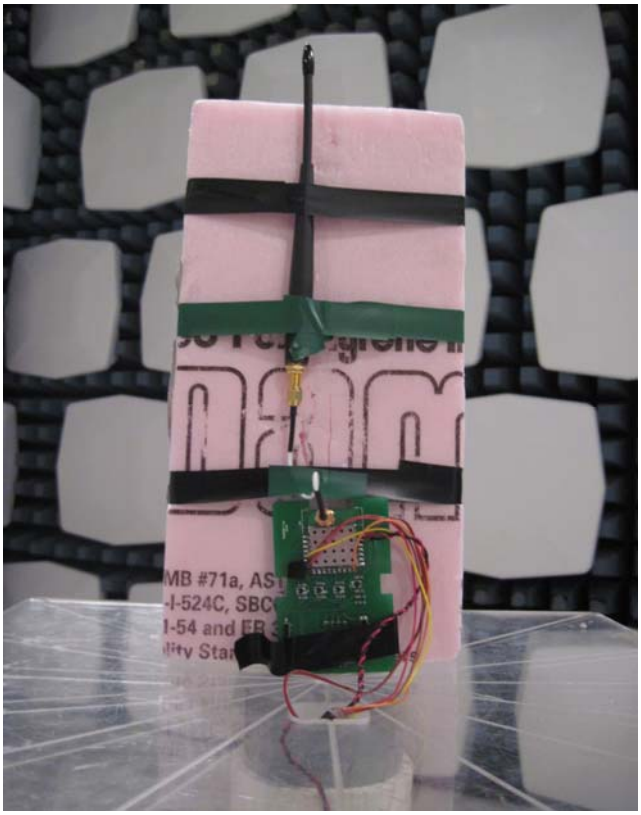
Notes: 1. A Quasi-Peak Detector was used in measurements below 1 GHz, and a 10 Hz video averaged Peak Detector was used in measurements above 1 GHz. Both the results from the Peak Detector with and without video averaging are published in the table above. A non-video averaged peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.

2. Measurement observed at system noise floor

2 Photos Taken During Radiated Emission Testing

Setup for the Radiated Emissions Test





NOTE: The photos shown demonstrate two of the board orientations, and one antenna orientation used for testing. The antenna was rotated around three axes (three orthogonal planes) in order to find the maximum signal during fundamental measurement, and the combination of board and antenna setups were rotated around three orthogonal axes to maximize emissions.

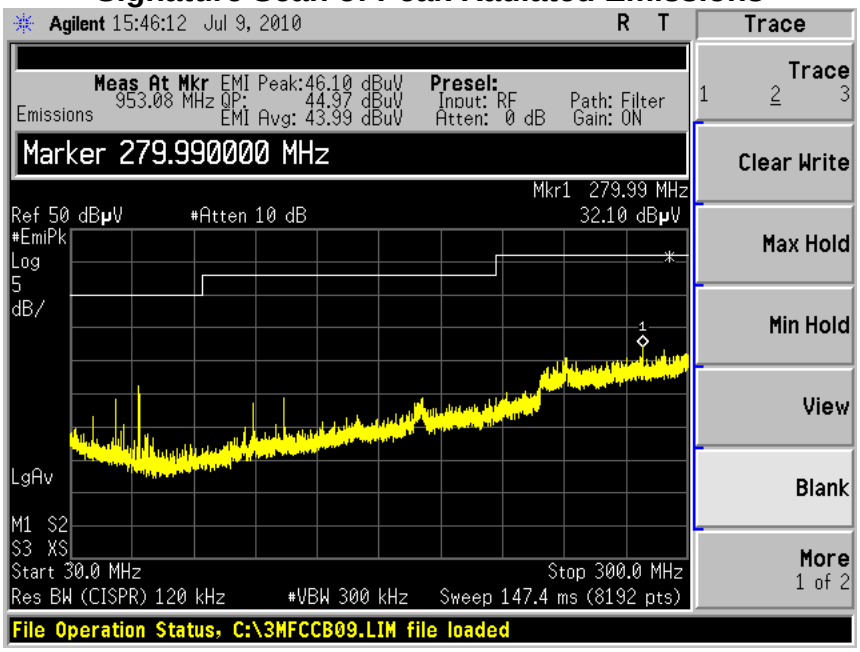
GRAPHS

Screen Captures of Radiated RF Emissions:

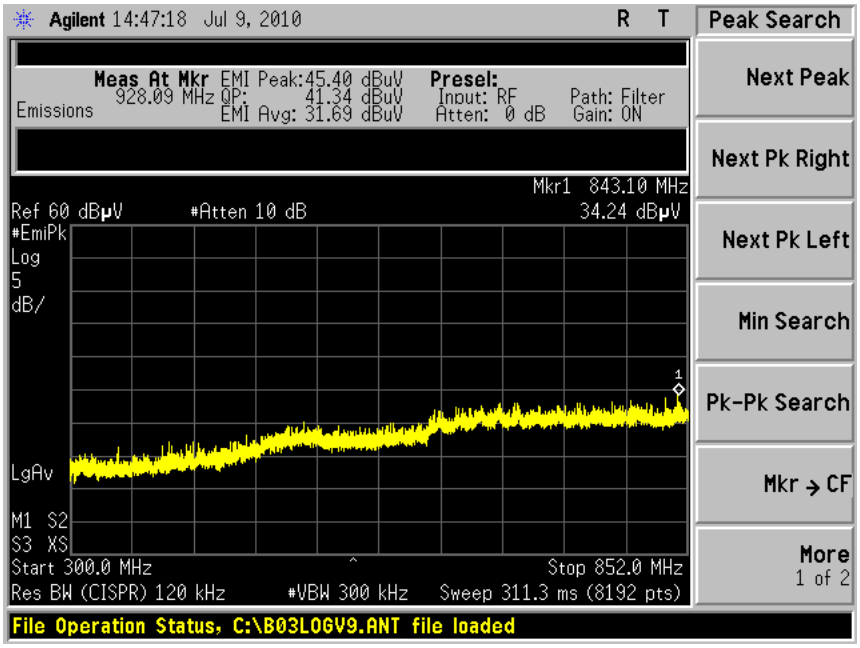
Please note these screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 907. 917 or 923 MHz with the sense and EUT antenna and sense antenna both in vertical polarity for worst case presentations.

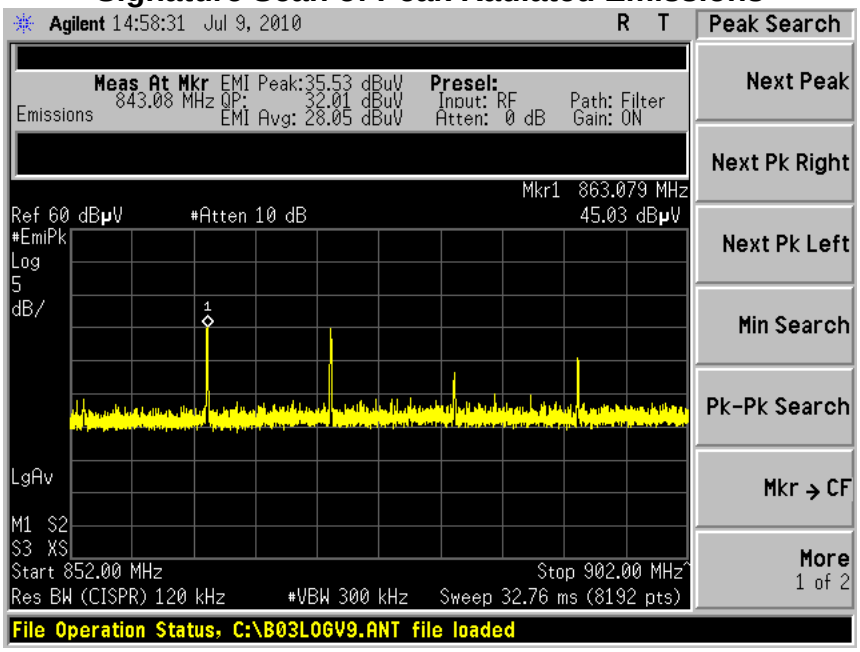
Signature Scan of Peak Radiated Emissions



Signature Scan of Peak Radiated Emissions

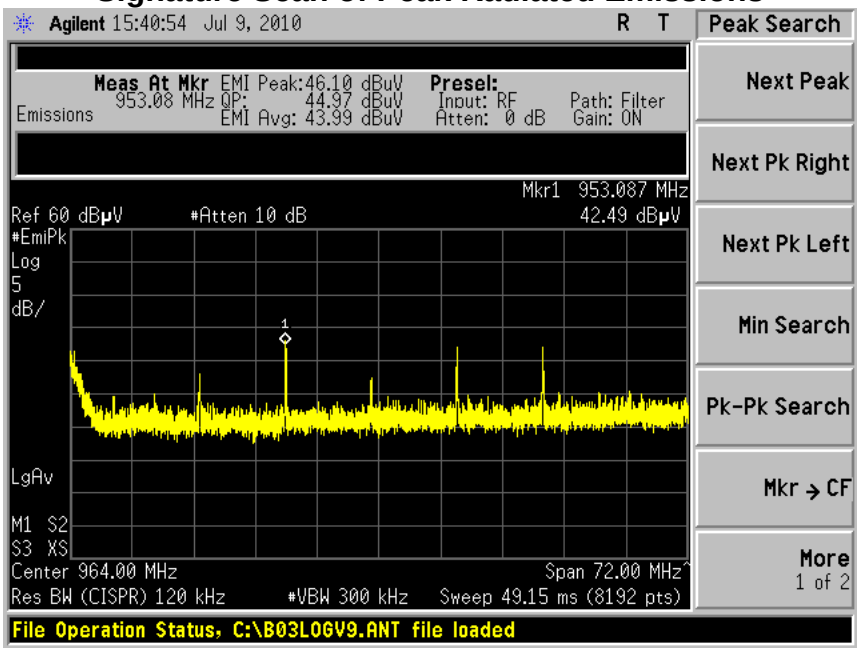


Signature Scan of Peak Radiated Emissions

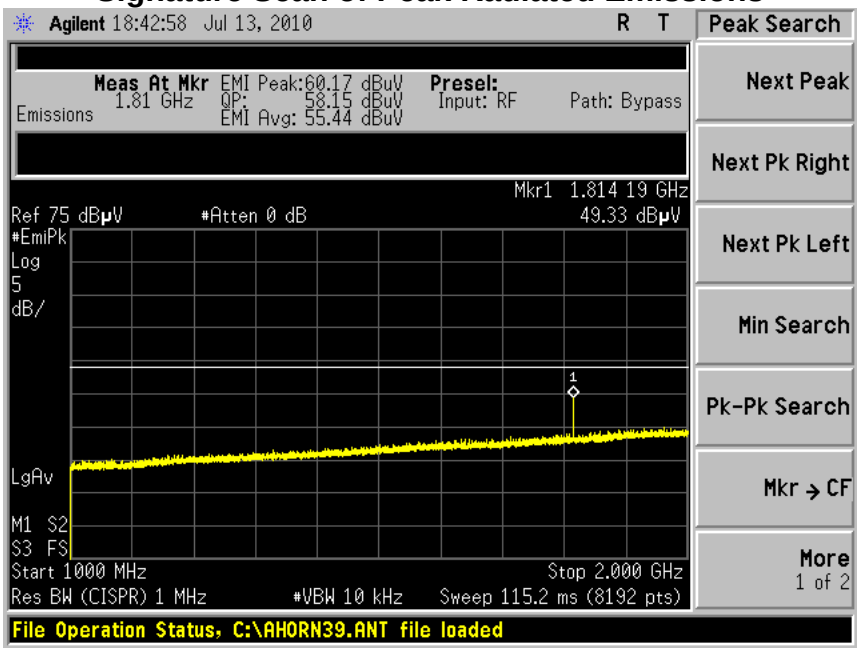


Graphs made during Radiated Emission Testing (continued)

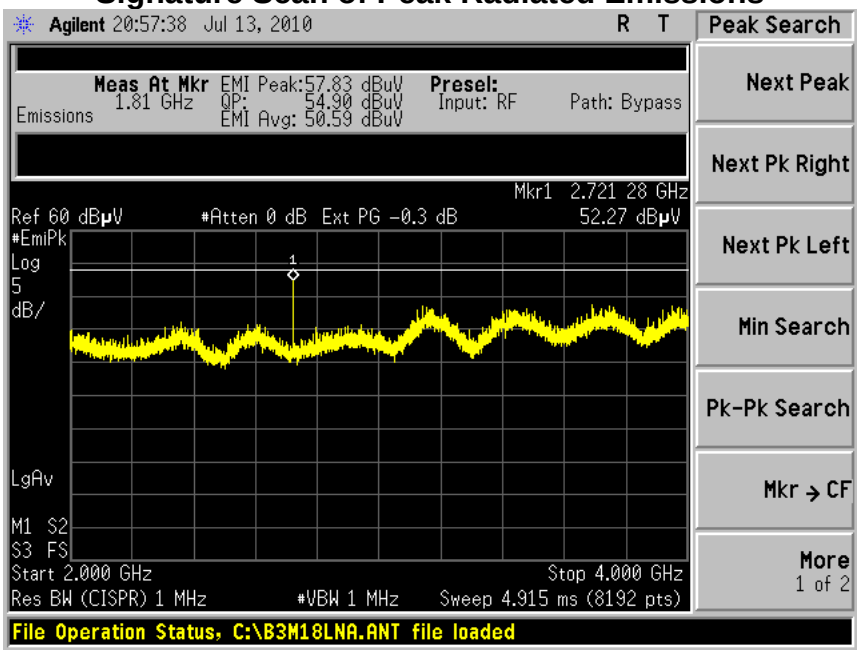
Signature Scan of Peak Radiated Emissions



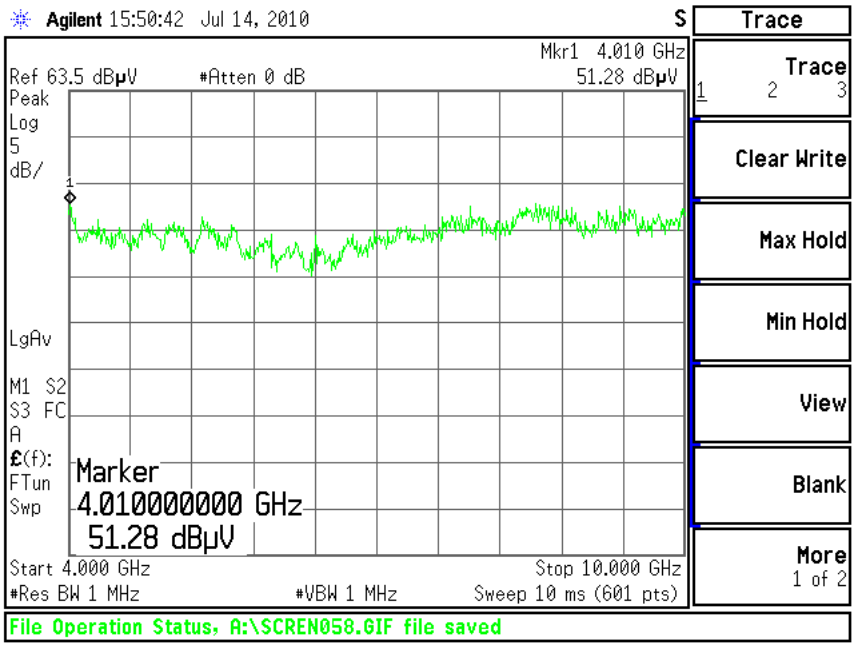
Signature Scan of Peak Radiated Emissions



Signature Scan of Peak Radiated Emissions



Signature Scan of Peak Radiated Emissions



10. RX Mode: Radiated Emissions Test

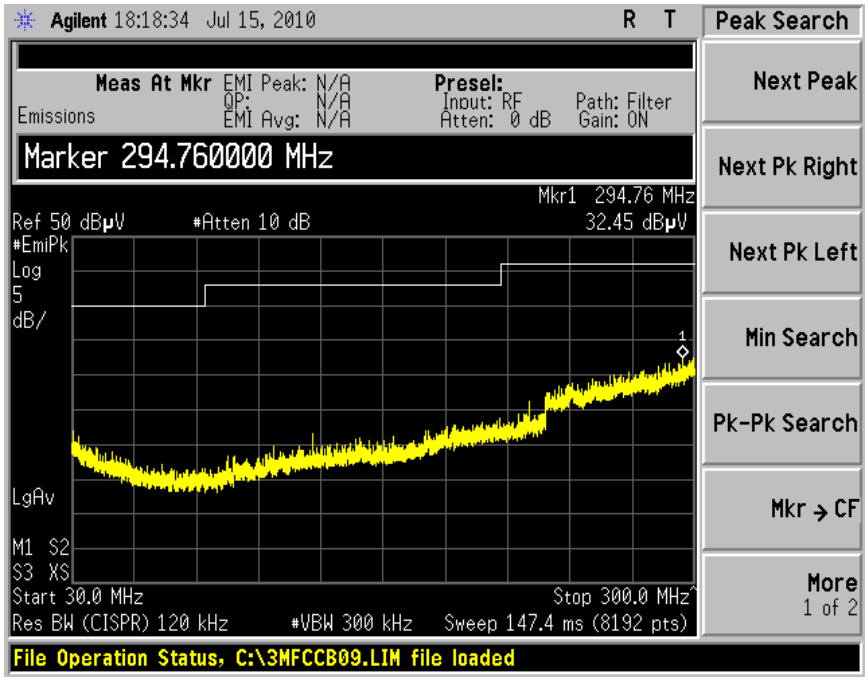
Per the requirements of RSS-210, the EUT was placed in continuous receive mode and the radiated spurious emissions were measured and compared to the limits stated in RSS-Gen Section 4.10.

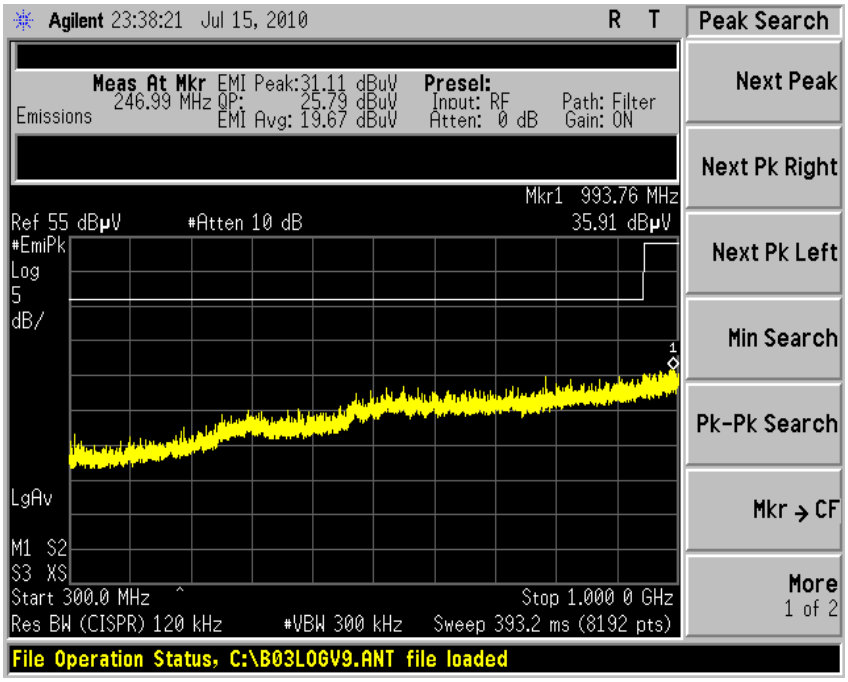
The test setup, procedure, and equipment utilized were identical to that described in sections 5.1, 5.2, and 5.3 of this document.

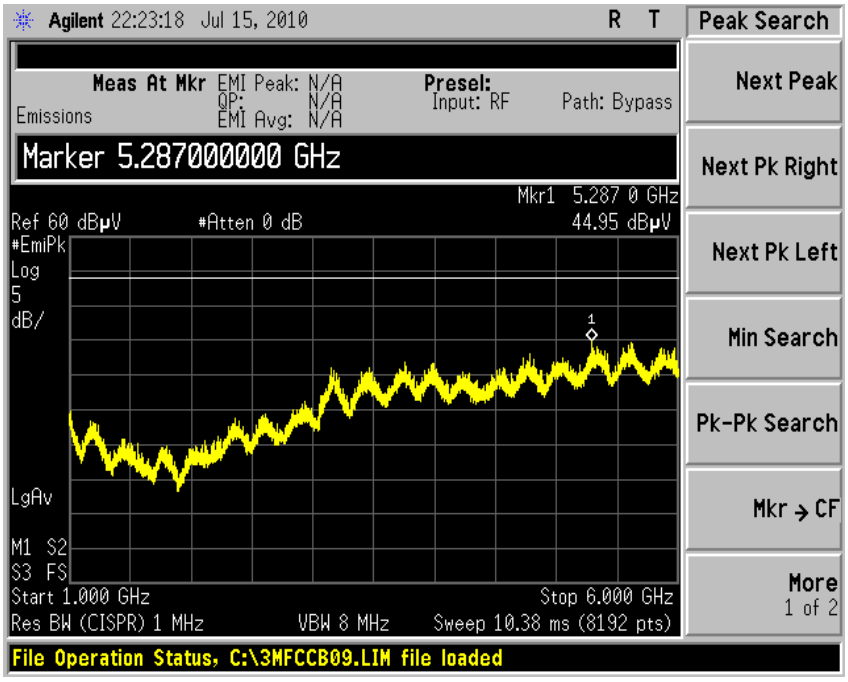
Measurement data and screen captures from the receive tests are presented below:

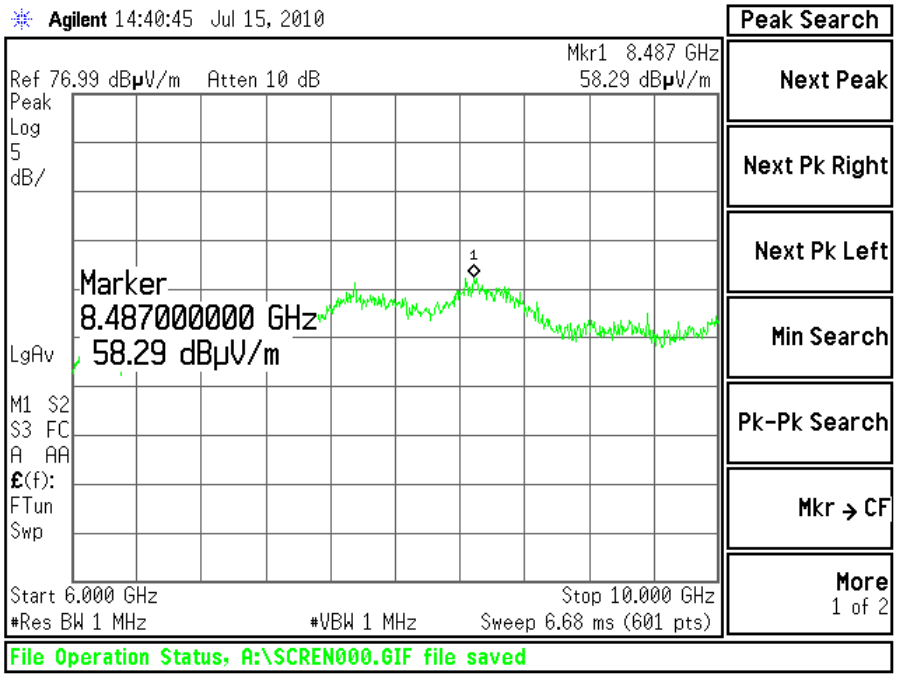
Frequency (MHz)	Height (m)	Azimuth (degree)	Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
182.74	1.00	0	15.7 [1]	43.0	27.3	V	V
247.00	1.00	0	19.7 [1]	46.0	26.3	V	V
4810.00	1.00	0	49.8 [2]	63.5	13.7	V	V

Note 1: Quasi-Peak measurement, made with a quasi-peak detector.
Note 2: Peak detector used with a 10 Hz video averaged signal reported




Agilent 23:38:21 Jul 15, 2010
R T
Peak Search
Meas At Mkr EMI Peak:31.11 dBuV
246.99 MHz QP: 25.79 dBuV
Emissions EMI Avg: 19.67 dBuV
Presel:
Input: RF
Atten: 0 dB
Path: Filter
Gain: ON
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Mkr1 993.76 MHz
Ref 55 dBµV
#Atten 10 dB
35.91 dBµV
#EmiPk
Log
5
dB/
LgAv
M1 S2
S3 XS
Start 300.0 MHz
Stop 1.000 0 GHz
Res BW (CISPR) 120 kHz
#VBW 300 kHz
Sweep 393.2 ms (8192 pts)
File Operation Status, C:\B03LOGV9.ANT file loaded

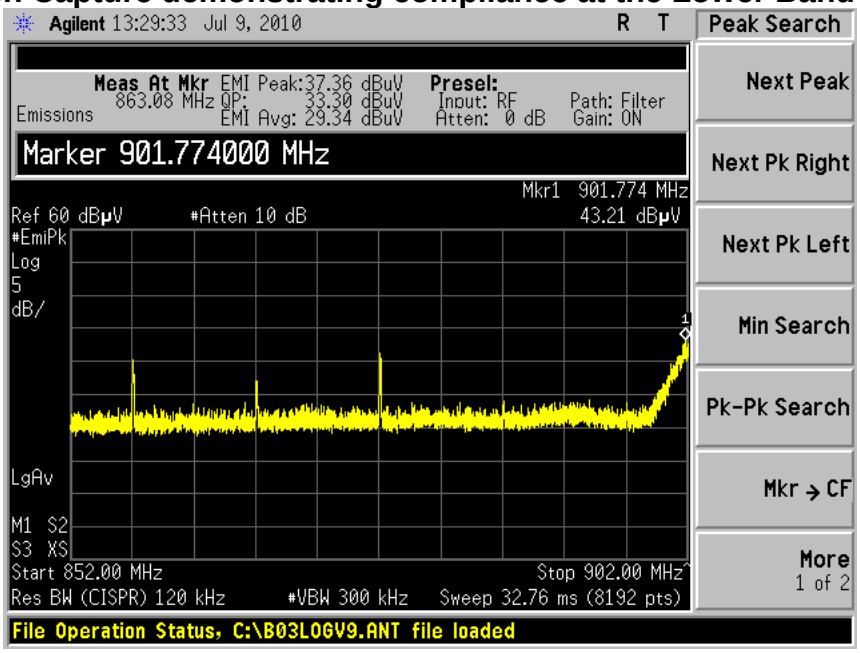

Agilent 22:23:18 Jul 15, 2010
R T
Peak Search
Meas At Mkr EMI Peak: N/A
QP: N/A
Emissions EMI Avg: N/A
Presel:
Input: RF
Path: Bypass
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Marker 5.287000000 GHz
Mkr1 5.287 0 GHz
Ref 60 dBµV
#Atten 0 dB
44.95 dBµV
#EmiPk
Log
5
dB/
LgAv
M1 S2
S3 FS
Start 1.000 GHz
Stop 6.000 GHz
Res BW (CISPR) 1 MHz
VBW 8 MHz
Sweep 10.38 ms (8192 pts)
File Operation Status, C:\3MFCCB09.LIM file loaded


Agilent 14:40:45 Jul 15, 2010
Peak Search
Mkr1 8.487 GHz
Ref 76.99 dBµV/m Atten 10 dB
58.29 dBµV/m
Next Peak
Peak
Log
5
dB/
Next Pk Right
Next Pk Left
Marker
8.487000000 GHz
58.29 dBµV/m
LgAv
Min Search
M1 S2
S3 FC
A AA
£(f):
FTun
Swp
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 6.000 GHz
Stop 10.000 GHz
#Res BW 1 MHz
#VBW 1 MHz
Sweep 6.68 ms (601 pts)
File Operation Status, A:\SCREN000.GIF file saved

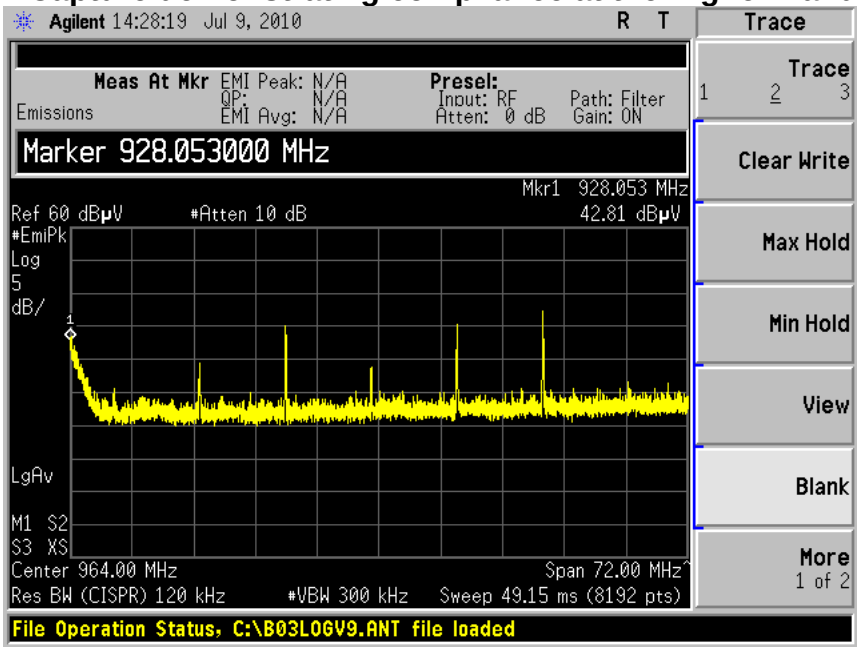
11. Band-Edge Measurements

FCC 15.209(b) and 15.249(d) require a measurement of spurious emission levels, in particular at the band-edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 902-928 MHz band-edges. An investigation of the lower band-edge and at the highest channel for the investigation of the higher band-edge is represented showing compliance is met.

Screen Capture demonstrating compliance at the Lower Band-Edge



Screen Capture demonstrating compliance at the Higher Band-Edge



12. Frequency and Power Stability across input voltage

The fundamental emission of the transmitter needs to be stable with varying voltage. According to the FCC Part 15.31 (e) the supply voltage should be varied between 85 % and 115 % from the nominal specified voltage. The EUT was tested in the semi-anechoic chamber, with the transmitter portion of the EUT placed in continuous C.W. transmit mode. The fundamental frequency was measured with a receiver bandwidth of 1 kHz, and video bandwidth of 1 kHz. The fundamental voltage was measured with a receiver bandwidth of 3 MHz, and video bandwidth of 3 MHz.

	Voltage (VDC)	Channel Low Center Freq (MHz)	Channel Mid Center Freq (MHz)	Channel High Center Freq (MHz)
115 % of Nominal	3.8	907.080000	917.080000	923.080000
100 % of Nominal	3.3	907.080000	917.080000	923.080000
85 % of Nominal	2.8	907.080000	917.080000	923.080000

No anomalies were noted, in the frequency of operation, during the voltage variation tests.

	Voltage	Channel Low ERP (dBm)	Channel Mid ERP (dBm)	Channel High ERP (dBm)
115 % of Nominal	3.8	-14.05	-11.86	-10.84
100 % of Nominal	3.3	-14.06	-11.96	-10.99
85 % of Nominal	2.8	-14.21	-12.15	-11.22

No anomalies were noted, in fundamental power, during the voltage variation tests.

13. Conducted AC Line Emissions

13.1 Test Setup

The test area and setup are in accordance with ANSI C63.4 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to EMI receiver System. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

13.2 Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded. An Agilent E4446A spectrum analyzer was used to observe the fundamental signal that the EUT was generating while being tested to ensure the device was functioning properly.

13.3 Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. All cables are calibrated and checked periodically for conformance. The emissions are measured on the EMI System, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

13.4 Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC Part 15.207 and RSS GEN 7.2.2 for Conducted Emissions for an Intentional Radiator. See the Data Charts and Graphs for more details of the test results.

13.5 FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBµV)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average
0.5 – 5.0	56	46	
5.0 – 30	60	50	
* The limit decreases linearly with the logarithm of the frequency in this range.			

13.6 CONDUCTED EMISSIONS TEST DATA CHART

Frequency Range inspected: 150 KHz to 30 MHz

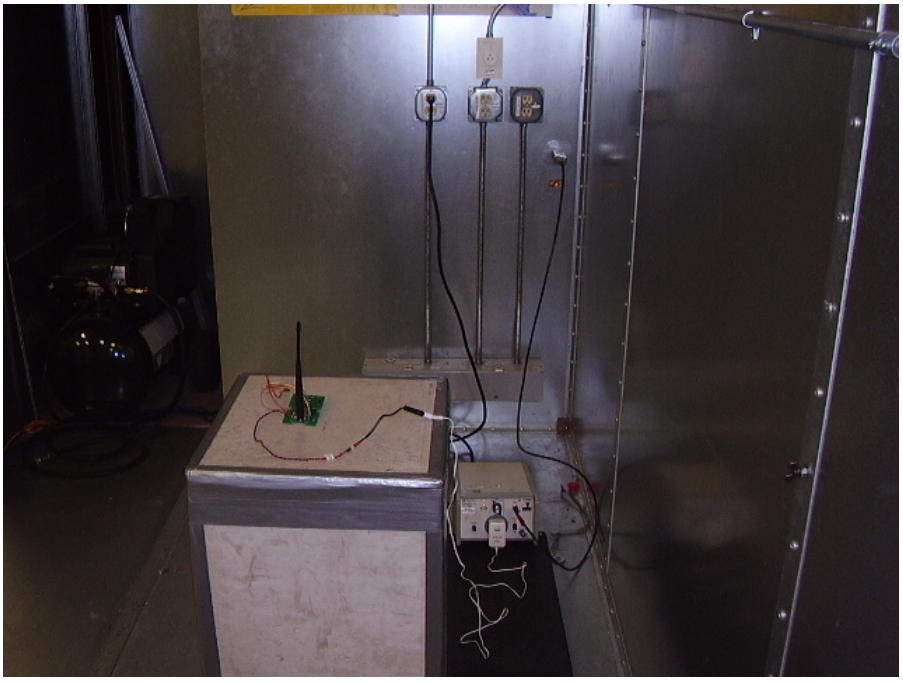
Manufacturer:	Generac Power Systems					
Date(s) of Test:	November 17, 2010					
Project Engineer:	Peter Feilen					
Test Engineer:	Peter Feilen					
Voltage:	3.3 VDC					
Operation Mode:	Normal					
Environmental Conditions in the Lab:	Temperature: 22˚C Relative Humidity: 48 %					
Test Location:	X	AC Mains Test area				Chamber
EUT Placed On:	X	40cm from Vertical Ground Plane				10cm Spacers
	X	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	X	Final
Detectors Used:	X	Peak	X	Quasi-Peak	X	Average

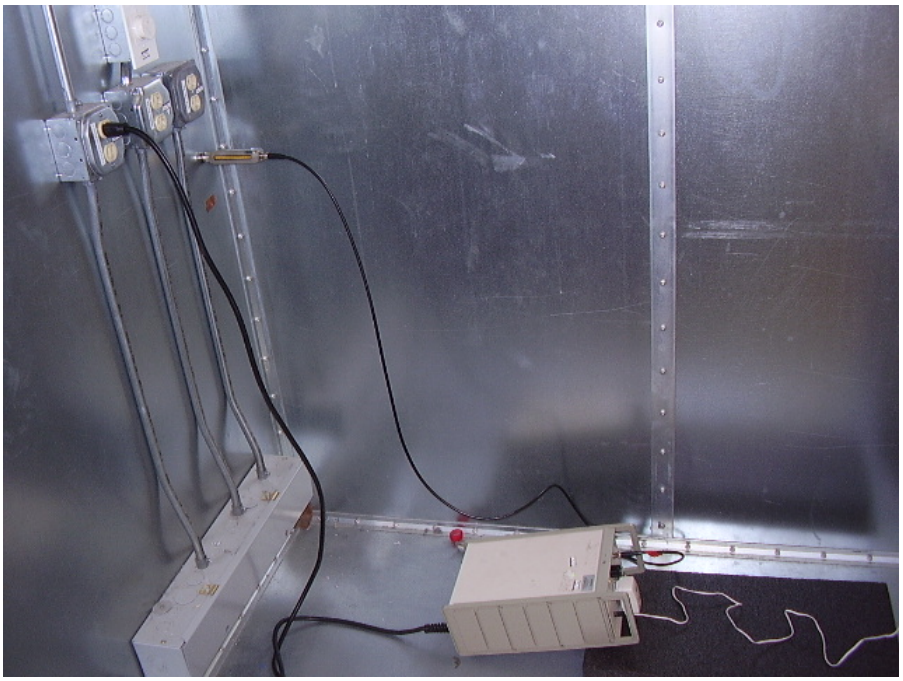
		Quasi-Peak			Average		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.158	L1	37.200	65.572	28.372	19.270	55.572	36.302
0.602	L1	30.180	56.000	25.820	25.130	46.000	20.870
1.588	L1	18.990	56.000	37.010	12.140	46.000	33.860
0.606	L2	29.440	56.000	26.560	24.650	46.000	21.350
11.781	L2	20.150	60.000	39.850	13.310	50.000	36.690

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the EUT.
2) All other emissions were better than 20 dB below the limits.
3) The EUT exhibited similar emissions across the Low, Middle and High channels tested.

13.7 Test Setup Photo(s) – Conducted Emissions Test



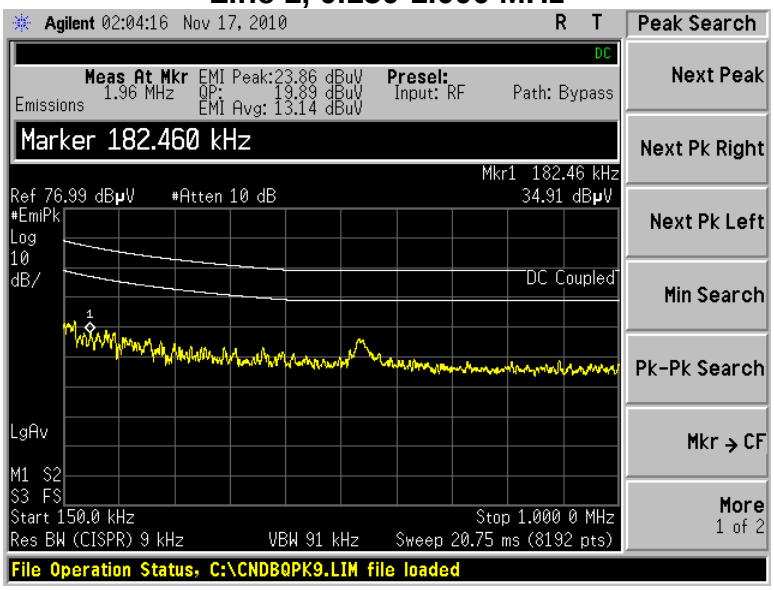


13.8 Screen Captures – Conducted Emissions Test

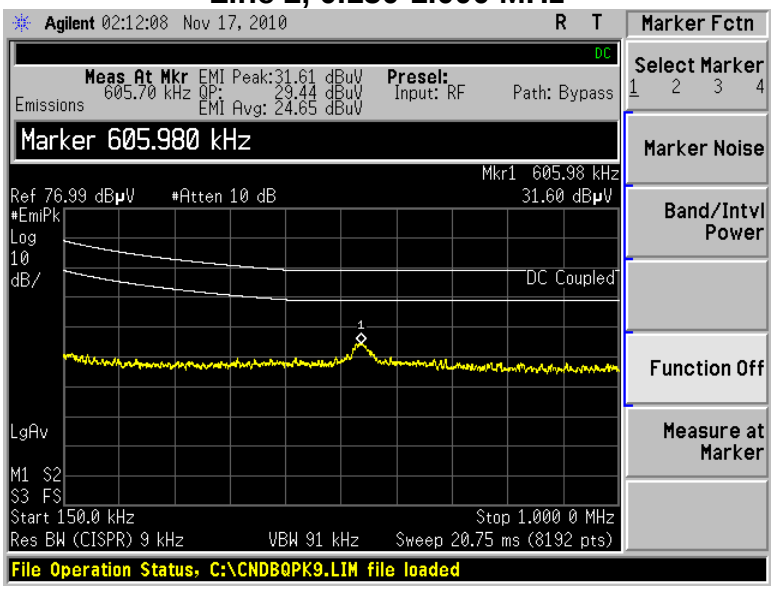
These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector function and an Average detector function are utilized. The emissions must meet both the Quasi-peak limit and the Average limit as described in 47 CFR 15.207 and RSS GEN 7.2.2 (Table 2).

The signature scans shown here are from channel 907 MHz, chosen as being a good representative of channels. The signature scans were similar in TX and RX mode

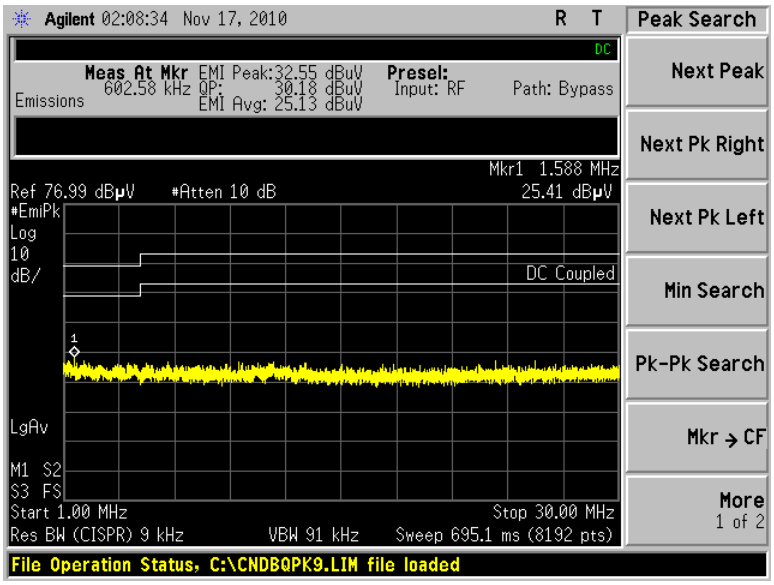
Line 1, 0.150-1.000 MHz



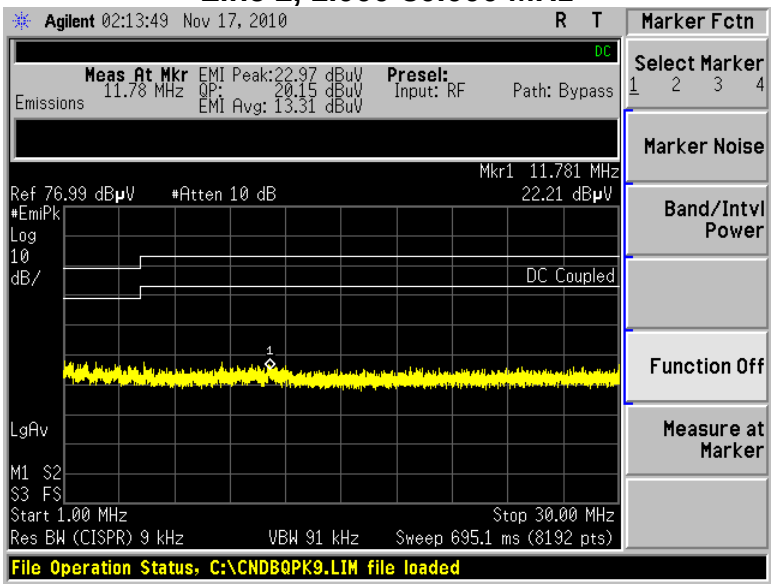
Line 2, 0.150-1.000 MHz



Line 1, 1.000-30.000 MHz



Line 2, 1.000-30.000 MHz



14. Screen Captures – Conducted Emissions Test

14.1 TEST PROCEDURE

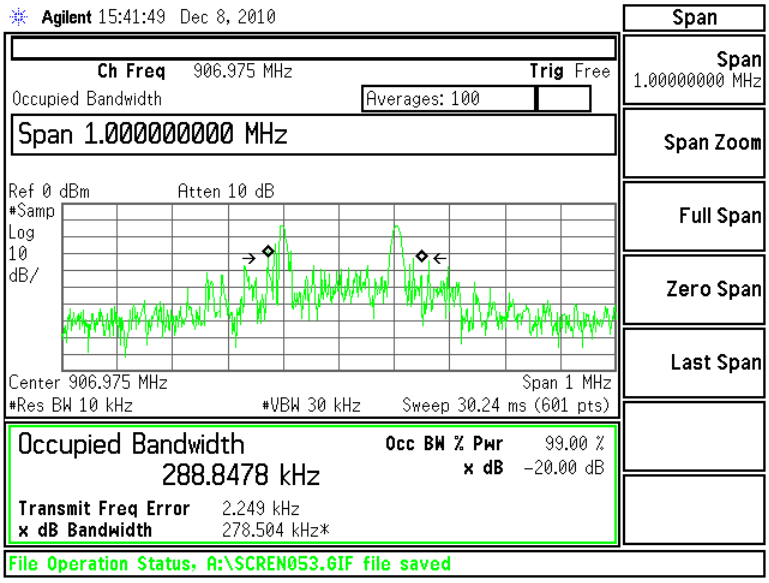
The 99% occupied BW was measured using an Agilent E4446A Spectrum Analyzer. A direct connection was made by way of an SMA 3m Gore cable and using a calibration saved on the hard drive of the analyzer correction was made automatically to measurements taken. Measurements were made on three unique channels, 907 MHz, 917 MHz and 923 MHz. Numbers are recorded in section 14.2 and screen captures are available in section 14.3.

14.2 TEST DATA

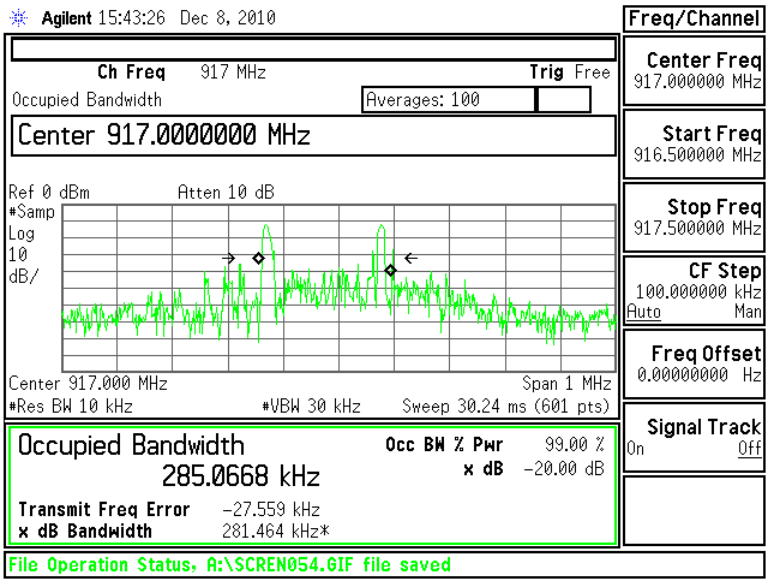
Frequency (MHz)	99% Occupied BW (kHz)
907	**288.84**
917	**285.06**
923	**288.44**

14.3 SCREEN CAPTURES

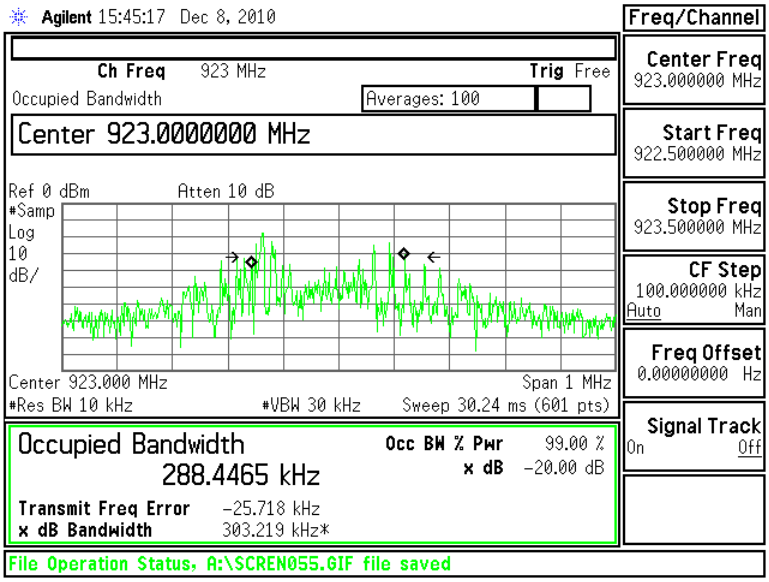
LOW CHANNEL (907 MHz)



MIDDLE CHANNEL (917 MHz)



UPPER CHANNEL (923 MHz)



APPENDIX A

Test Equipment List

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 21-Jul-2010 Type Test : Radiated Emissions Job # : C-844

Prepared By: Peter Customer : Generac Power Systems Quote #: 310068

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/7/2010	6/7/2011	Active Calibration
2	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/7/2010	6/7/2011	Active Calibration
3	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/3/2009	11/3/2010	Active Calibration
4	EE 960004	Mast/Table Controller	EMCO	2090	n/a	System	System	Cal Not Required
5	EE 960130	Multi-Device Controller	ETS	2090	45968	XXX	XXX	Cal Not Required
6	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/16/2009	10/16/2010	Active Calibration
7	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	11/10/2009	11/10/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 21-Jul-2010 Type Test : Band-Edge Job # : C-844

Prepared By: Peter Customer : Generac Power Systems Quote #: 310068

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/7/2010	6/7/2011	Active Calibration
2	EE 960004	Mast/Table Controller	EMCO	2090	n/a	System	System	Cal Not Required
3	EE 960130	Multi-Device Controller	ETS	2090	45968	XXX	XXX	Cal Not Required
4	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/16/2009	10/16/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 21-Jul-2010 Type Test : Spurious Emissions Job # : C-844

Prepared By: Peter Customer : Generac Power Systems Quote #: 310068

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960130	Multi-Device Controller	ETS	2090	45968	XXX	XXX	Cal Not Required
2	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	12/22/2009	12/22/2010	Active Calibration
3	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	12/28/2009	12/28/2010	Active Calibration
4	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	6/4/2010	6/4/2011	Active Calibration
5	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/17/2009	9/17/2010	Active Calibration

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 17-Nov-2010 Type Test : Conducted AC Line Emissions Job # : C-844

Prepared By: Peter Customer : Generac Power Systems Quote #: 310068

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960072	Transient Limiter	HP	11947A	3107A01708	10/8/2010	10/8/2011	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	6/7/2010	6/7/2011	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	6/7/2010	6/7/2011	Active Calibration
4	AA 960008	LISN	EMCO	3816/2NM	9701-1057	12/15/2009	12/15/2010	Active Calibration

Appendix B
Test Standards List

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2009		
ANSI C63.10	2009		
CISPR 11	2009-05	2009-12 P	
CISPR 12	2007-05		
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2010-01		
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008-09		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2007-05		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006	2007	
EN 60601-1-2	2007-03		
EN 61000-3-2	2006-05		
EN 61000-3-3	2008-12		
EN 61000-4-2	2009-05		
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2009-05		
EN 61000-4-8	1994	2001	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15, 18, 90, 95	2008		
FCC Public Notice DA 00-1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2009-08		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	2009-02
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		
IEC 61000-4-3	2008-04	incl in 2008-04	2009-12 FD

STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-4	2004-07	2010-10	
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-10		
IEC 61000-4-8	2009-09		
IEC 61000-4-11	2004-03		
IEC 61000-6-1	2005-03		
IEC 61326-1	2006-06		
ISO 14982	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	2009-02		
RSS 210	2007-06		
RSS 213	2005-12		
RSS 243	2005-11		
RSS 310	2007-06		

Note 1: Test not on LSR Scope of Accreditation.

APPENDIX C
Uncertainty Statement

This uncertainty represents an expanded uncertainty
expressed at approximately the 95% confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V