LS RESEARCH, LLC
WIRELESS PRODUCT DEVELOPMENT
ACCREDITED
Testing 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:
Generac® End Station
Model VDE 0G6019A

Test Date(s):
October 25 – 30, 2008

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

Test Report Number:
308433

Project Number:
C-458

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Digital Modulation Transmitters (DTS) Operating in the
Frequency Band 2400 MHz – 2483.5 MHz

Test Project Engineer:
Ryan M. Urness, EMC Laboratory Manager

Signature:  Date: Feb. 2, 2009

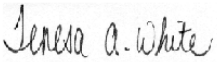
Quality Assurance:	**Reviewed by:**
Teresa A. White, Quality Manager	Khairul Aidi Zainal, Sr. EMC Engineer
Signature: 	Signature: 
Date: Feb. 2, 2009	Date: Feb. 2, 2009

TABLE OF CONTENTS *(page 1 of 2)*

TABLE OF CONTENTS *(Page 2 of 2)*

EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.247 FCC Part 2, Section 2.1043 paragraph (b)1.
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	FCC Part 15 Compliance.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – 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.
Environmental Classification:	• Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2007	Code of Federal Regulations - Telecommunications
ANSI C63.4	2003	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.
CISPR 16-1-1	2006 A1: 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.
FCC Procedures	2007	Measurement of Digital Transmission Systems operating under Section 15.247.

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

LS Research, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.lsr.com. Accreditation status can be verified at A2LA’s web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	Generac Power Systems
Address:	Hwy. 59 & Hillside Road P.O. Box 8 Waukesha, WI 53187

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	End Station
Model Number:	VDE 0G6019A
Serial Number:	0G5282PROTOF2

Note: The End station is ALWAYS powered by a 5 volt regulated power supply resident on the generator control PCB. It says this quite clearly in the technical write up. The generator control board gets its power from the engine start battery and it is charged by the charger alternator on the engine in the same way a car battery is charged. When the engine is not running, the engine start battery is charged by a 2.5 amp charger fed from the utility supply. The power ultimately fed to the End Station has been converted and buffered by several different means before it gets to the End Station and it does not require the presence of the Utility supply to function.

2.3 ASSOCIATED ANTENNA DESCRIPTION

Antenna is an integral inverted F type.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	2405 MHz – 2440 MHz
RF Power in Watts	0.07311 W
Conducted Output Power (in dBm)	18.64 dBm
Field Strength (and at what distance)	109 dBµV/m @ 3m
Occupied Bandwidth (99% BW)	2411kHz
Type of Modulation	DTS
Emission Designator	2M41F1D
EIRP (in mW)	23.82 mW
Transmitter Spurious (worst case)	76.7 dBµV/m
Frequency Tolerance %, Hz, ppm	<100 ppm
Microprocessor Model # (if applicable)	Freescale MC13213
Antenna Information	
Detachable/non-detachable	Non-Detachable
Type	Inverted F
Gain (in dBi)	1.13 dBi
EUT will be operated under FCC Rule Part(s)	15§247
Modular Filing	☐ Yes ☒ No
Fixed, Portable, or Mobile?	Fixed

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: CFR 47 Part 15 §247
- Measurement Distance: 20cm
- RF Value: 0.018868

☐ V/m ☐ A/m ☒ W/m^2
☐ Measured ☐ Computed ☒ Calculated

2.5 PRODUCT PHOTO

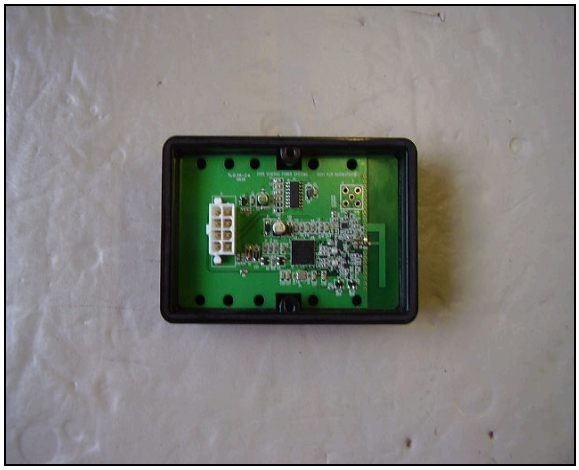


EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	26°C
Humidity:	44%
Pressure:	769.62

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Paragraph	Test Requirements	Compliance (yes/no)
15.207	Power Line Conducted Emissions Measurements	N/A
15.247(a)(2)	6 dB Bandwidth of a Digital Modulation System	Yes
15.247(b) & 1.1310	Maximum Output Power	Yes
15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d)	Transmitted Power Spectral Density of a Digital Modulation System	Yes
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers. The Receiver Test Report is available upon request		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☐ **None** ☒ **Yes (explain below)**

The Output Power during all testing was lowered to the setting “A9” to ensure compliance to PSD, Band Edge, and Spurious Harmonics.

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ **None** ☐ **Yes (explain below)**

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 7 (2007), Section Annex 8 (section 8.2) for a Digital Spread Spectrum (DTS) Transmitter.

If some emissions are seen to be within 3 dB 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.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 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 a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in continuous transmit mode, using power as provided by a laboratory grade DC switch-mode power supply. The unit has the capability to operate on 8 channels, controllable via an RS-232 Communication port on a laptop PC.

The applicable limits apply at a 3 meter distance. Measurements from 5-18 GHz were performed at a 1.0 meter separation distance, and 18-25 GHz was performed at 0.30 m. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: low (2405 MHz), middle (2420 MHz) and high (2440 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed via the PC communication port using HyperTerminal.

5.2 Test Procedure

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25000 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 a 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 18 GHz, and a standard gain Horn Antenna and pre-amplifier was used for 18 GHz to 25 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

5.3 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 a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver 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 HP 8546A EMI Receiver 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 5 GHz to 18 GHz, an HP E4407B Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the HP E4407B Spectrum Analyzer with a standard gain horn, and preamp were used.

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296
Spectrum Analyzer	Agilent	E4446A	US45300564
Log Periodic Antenna	EMCO	93146	9701-4855
Horn Antenna	EMCO	3115	6907
Bicon Antenna	EMCO	93110B	9702-2918
Pre-Amp	Adv. Microwave	WLA612	1145A04094
Horn Antenna – Std. Gain	EMCO	3160-09	9809-1120

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 for a DTS transmitter [Canada RSS-210, Issue 7 (2007), Annex 8 (section 8.2). The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in Title 47 CFR 15.247 (b)(3), is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c).

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBμV/m)	1 m Limit (dBμV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

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

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

= 40 dBμV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

960 MHz to 10,000 MHz

500μV/m or 54.0 dB/μV/m at 3 meters

54.0 + 9.5 = 63.5 dB/μV/m at 1 meter

5.6 RADIATED EMISSIONS DATA CHART

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.205 and 15.247(DTS)
Frequency Range Inspected: 30 MHz to 25000 MHz

Manufacturer:	Generac Power Systems					
Date(s) of Test:	October 25, 2008					
Test Engineer(s):	Ryan Urness					
Voltage:	5 VDC					
Operation Mode:	continuous transmit					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
		Battery	X	Other: 5V DC		
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

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

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.205 Limit (dBμV/m)	Margin (dB)
299.5	Horiz	1.00	360°	24.3	46.0	21.7
299.5	Vert	1.00	360°	23.0	46.0	23.0
960.7	Horiz	1.00	360°	27.6	54.0	26.4
925.6	Vert	1.00	360°	26.5	46.0	19.5
2379	Horiz	1.00	360°	40.9	54.0	13.1
2302	Vert	1.00	360°	41.1	54.0	12.9

RADIATED EMISSIONS DATA CHART *(continued)*

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 0:

Frequency (MHz)	Ant. Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)	Measured Peak EFI (dBμV/m)
2405	Horiz	1.06	135°	108.5	125.2	16.7	114.3
4810	Vert	1.02	192°	52.8[4]	54.0	1.2	71.6
7215	Vert	1.00	57°	76.7	88.5	11.8	85.3
9620	Vert	1.10	144°	51.5	88.5	37.0	62.5
12025	Horiz	1.00	150°	44.4[4]	63.5	19.1	74.3
14430	Vert	1.00	12°	48.8	88.5	39.7	63.6
16835	Horiz	1.00	89°	48.5	88.5	40.0	62.8
19240	--	--	--	Note 3	--	--	--
21645	--	--	--	Note 3	--	--	--
24050	--	--	--	Note 3	--	--	--

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 3:

Frequency (MHz)	Ant. Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)	Measured Peak EFI (dBμV/m)
2420	Horiz	1.06	133°	109.0	125.2	16.2	115.0
4840	Vert	1.04	205°	52.3[4]	54.0	1.7	72.6
7260	Vert	1.17	57°	61.1[4]	63.5	2.4	82.7
9680	Vert	1.08	147°	54.3	89.0	34.7	65.6
12100	Horiz	1.00	150°	45.7[4]	63.5	17.8	75.9
14520	Horiz	1.00	165°	51.5	89.0	37.5	65.4
16940	Vert	1.00	0°	47.7	89.0	41.3	65.1
19360	--	--	--	Note 3	--	--	--
21780	--	--	--	Note 3	--	--	--
24200	--	--	--	Note 3	--	--	--

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 7:

Frequency (MHz)	Ant. Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.247 Limit (dBμV/m)	Margin (dB)	Measured Peak EFI (dBμV/m)
2440	Horiz	1.06	130°	107.3	125.2	17.9	113.3
4880	Vert	1.00	118°	47.9[4]	54.0	6.1	69.1
7320	Vert	1.00	85°	59.5[4]	63.5	4.1	81.3
9760	Vert	1.06	151°	54.3	87.3	33.0	67.9
12200	Horiz	1.00	153°	45.0[4]	63.5	18.5	68.3
14640	Vert	1.00	343°	51.4	87.3	35.9	64.1
17080	Horiz	1.00	15°	54.9	87.3	32.4	67.3
19520	--	--	--	Note 3	--	--	--
21960	--	--	--	Note 3	--	--	--
24400	--	--	--	Note 3	--	--	--

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak Detector was used in measurements above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits, and to record video averaged measurements.
2) Measurements above 5 GHz were made at 1 meters of separation from the EUT, and at 0.3 m separation for frequencies between 18 – 25 GHz.
3) Measurement at receiver system noise floor.
4) A relaxation of the limit is invoked based on the average duty factor of the transmitter on-air-time. Justification appears in Appendix D. The measurements have been recalculated and reduced by 20 dB as justified by the averaging factor.
5) All Peak measurements were within 20dB from average measurements

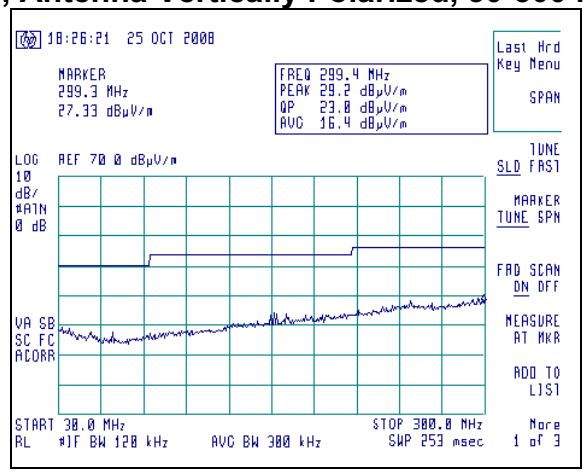
5.7 Test Setup Photo(s) – Radiated Emissions Test

5.8 Screen Captures - Radiated Emissions Testing

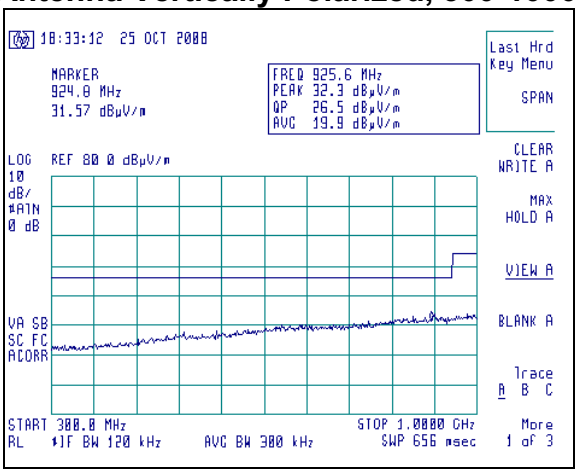
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and a Video-Averaged Peak detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 0, 3, or 7, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Channel 0, Antenna Vertically Polarized, 30-300 MHz, at 3m

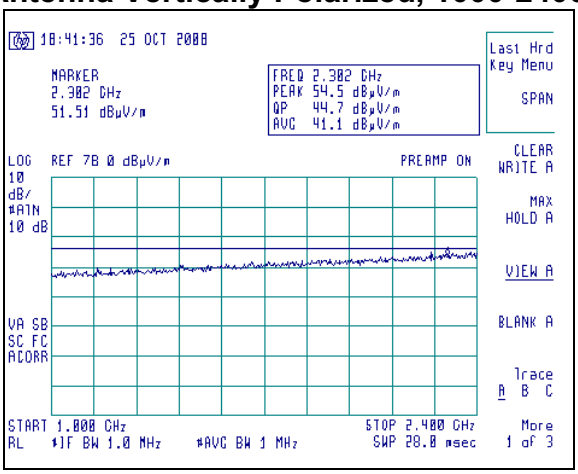


Channel 0, Antenna Vertically Polarized, 300-1000 MHz, at 3m

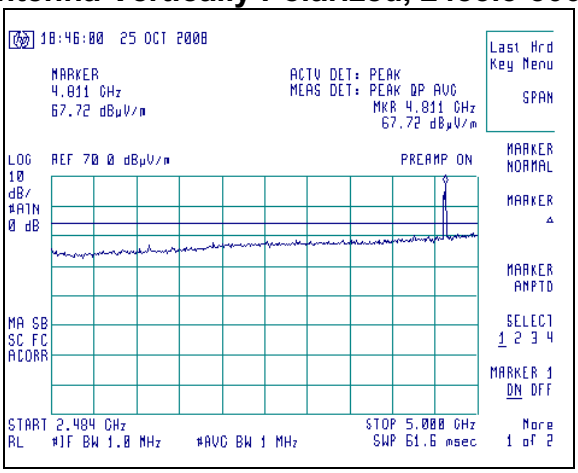


Screen Captures - Radiated Emissions Testing ***(continued)***

Channel 0, Antenna Vertically Polarized, 1000-2400 MHz, at 3m

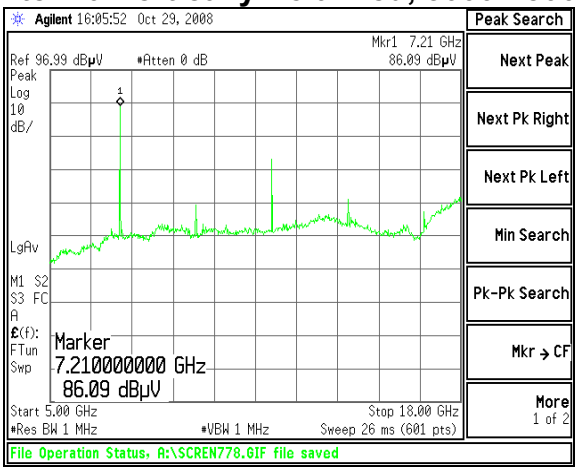


Channel 0, Antenna Vertically Polarized, 2483.5-5000 MHz, at 3m

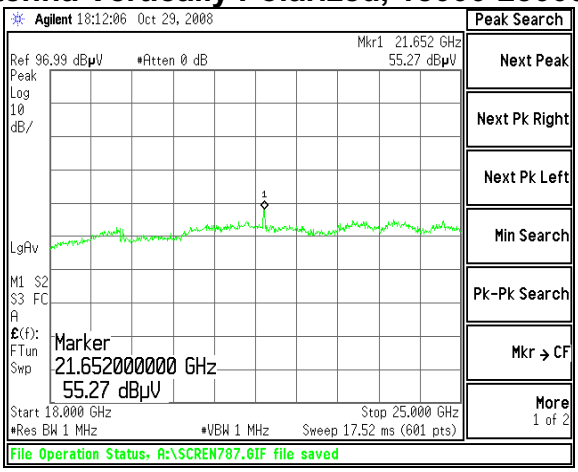


Screen Captures - Radiated Emissions Testing *(continued)*

Channel 0, Antenna Vertically Polarized, 5000-18000 MHz, at 1m

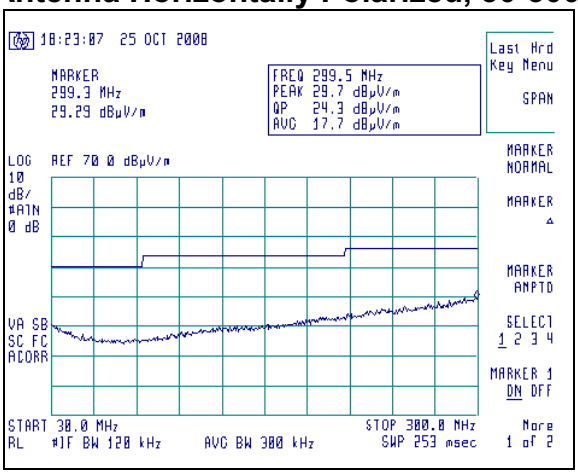


Channel 0, Antenna Vertically Polarized, 18000-25000 MHz, at 30cm

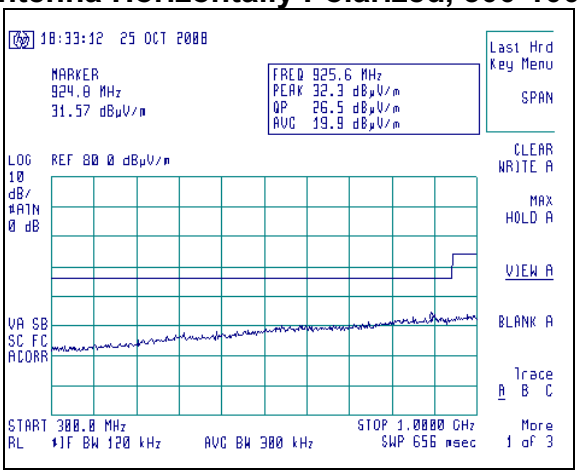


Screen Captures - Radiated Emissions Testing *(continued)*

Channel 0, Antenna Horizontally Polarized, 30-300 MHz, at 3m

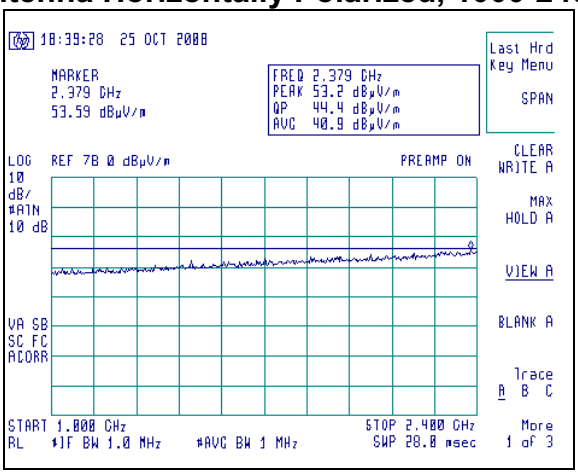


Channel 0, Antenna Horizontally Polarized, 300-1000 MHz, at 3m

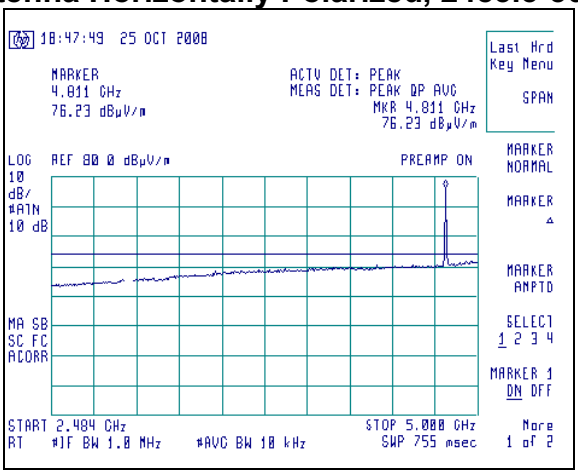


Screen Captures - Radiated Emissions Testing ***(continued)***

Channel 0, Antenna Horizontally Polarized, 1000-2400 MHz, at 3m

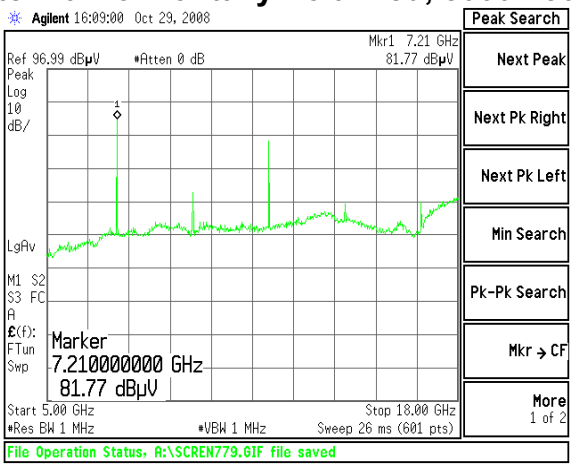


Channel 0, Antenna Horizontally Polarized, 2483.5-5000 MHz, at 3m

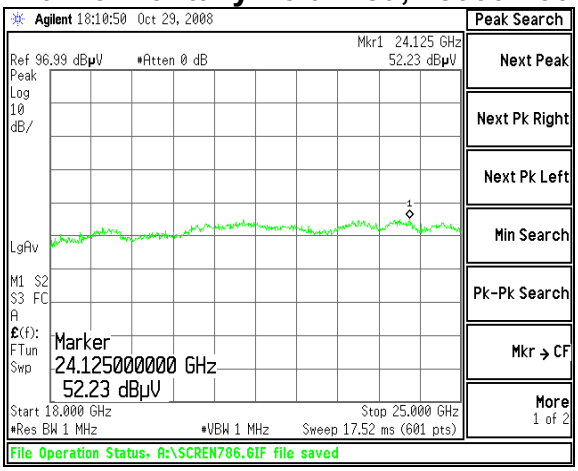


Screen Captures - Radiated Emissions Testing *(continued)*

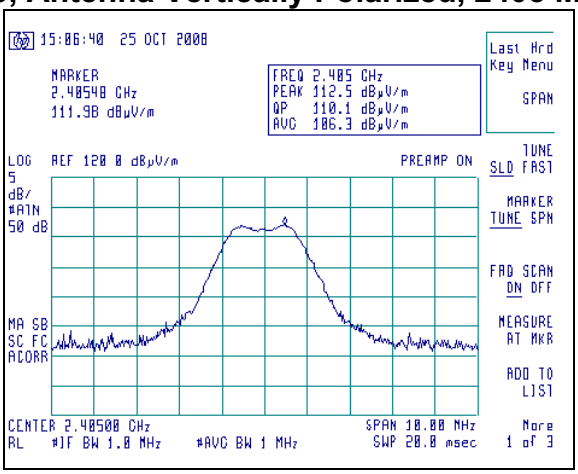
Channel 0, Antenna Horizontally Polarized, 5000-18000 MHz, at 1m



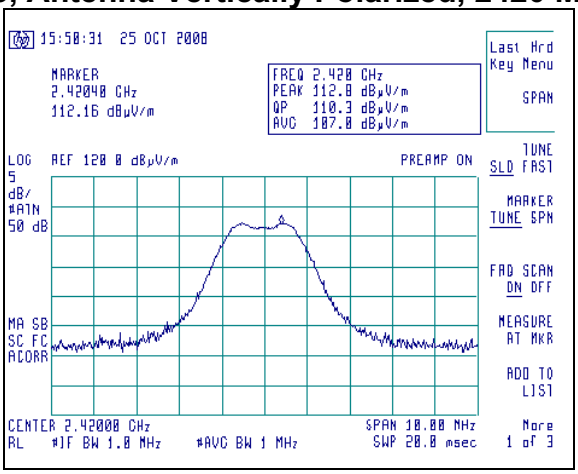
Channel 0, Antenna Horizontally Polarized, 18000-25000 MHz, at 30cm



Channel 0, Antenna Vertically Polarized, 2405 MHz, at 3m

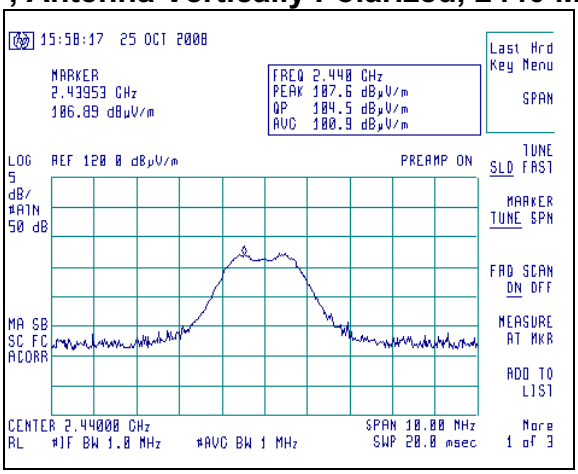


Channel 3, Antenna Vertically Polarized, 2420 MHz, at 3m

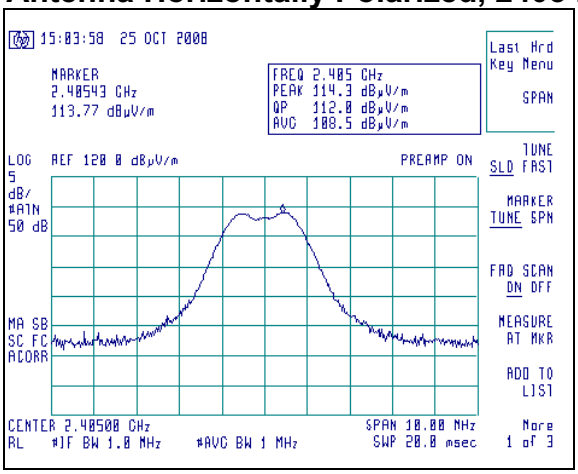


Screen Captures - Radiated Emissions Testing ***(continued)***

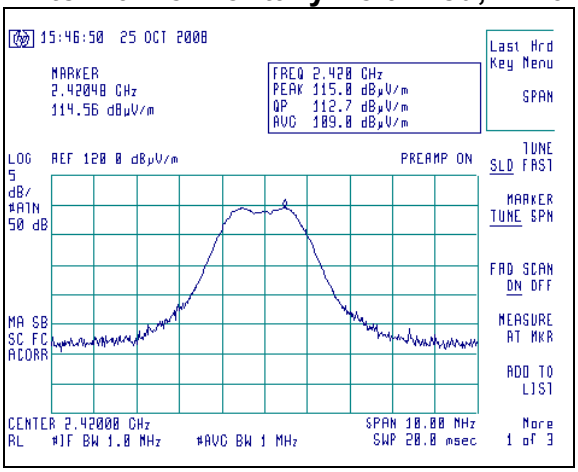
Channel 7, Antenna Vertically Polarized, 2440 MHz, at 3m



Channel 0, Antenna Horizontally Polarized, 2405 MHz, at 3m



Channel 3, Antenna Horizontally Polarized, 2420 MHz, at 3m



Channel 7, Antenna Horizontally Polarized, 2440 MHz, at 3m

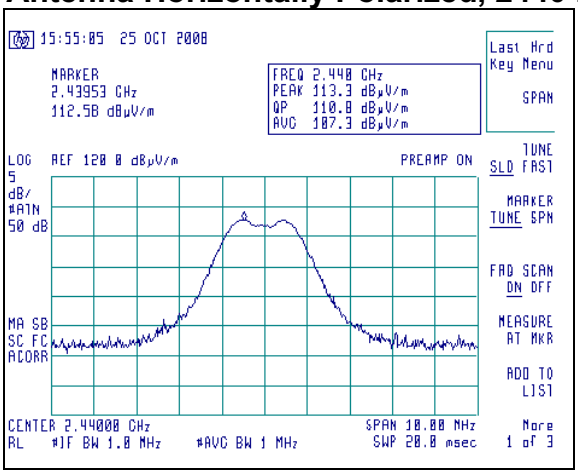


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE: 15.207

6.1 Test Results

The EUT is powered via a laboratory grade DC power supply; thus, conducted emissions test for the AC power line is not applicable.

EXHIBIT 7. OCCUPIED BANDWIDTH: 15.247(a)(2)

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

Refer to ANSI C63.4 (2003) and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=100 kHz.

The bandwidth requirement found in FCC Part 15.247(a)(2) requires a minimum -6dBc occupied bandwidth of 500 kHz. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the HP E4446A spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct measurements, without the need for any further corrections. A Hewlett Packard model E4446AB spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement when compared to the specified limit is 1589 kHz, which is above the minimum of 500 kHz.

7.3 Test Data

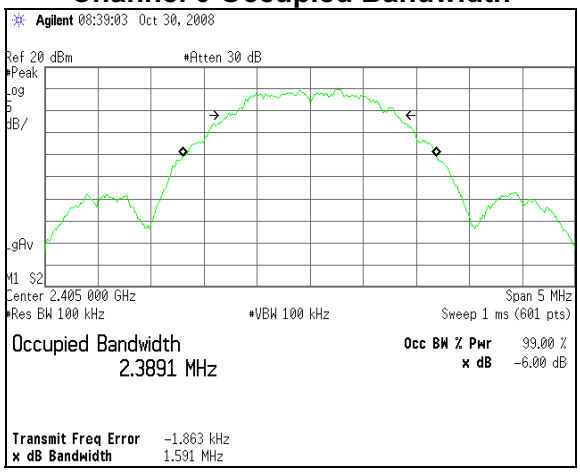
Channel	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Minimum -6 dBc Limit (kHz)	Measured -20 dBc Occ.Bw (kHz)
0	2405	1591	500	2389
3	2420	1589	500	2398
7	2440	1609	500	2411

7.4 Test Equipment List

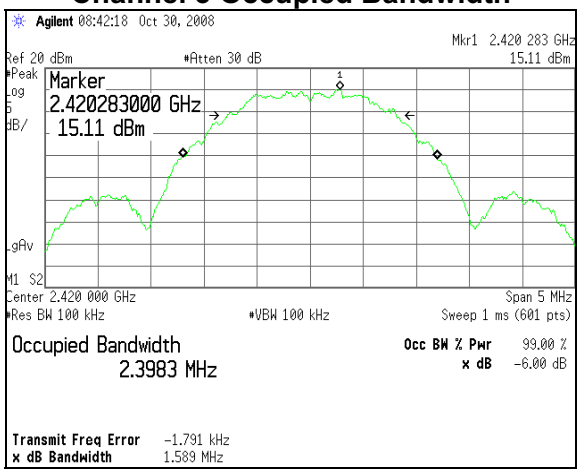
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

7.5 Screen Captures - OCCUPIED BANDWIDTH

Channel 0 Occupied Bandwidth



Channel 3 Occupied Bandwidth



Channel 7 Occupied Bandwidth

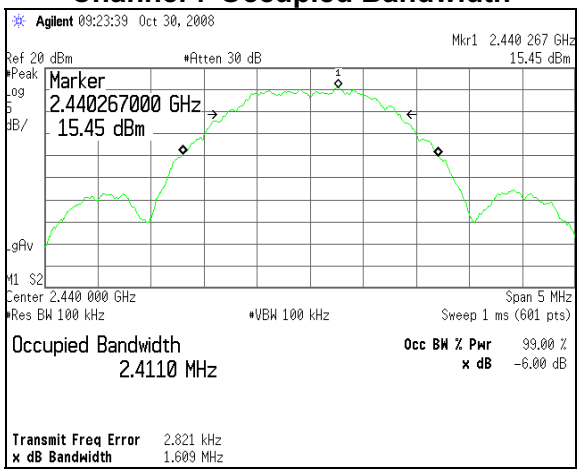


EXHIBIT 8. BAND-EDGE MEASUREMENTS

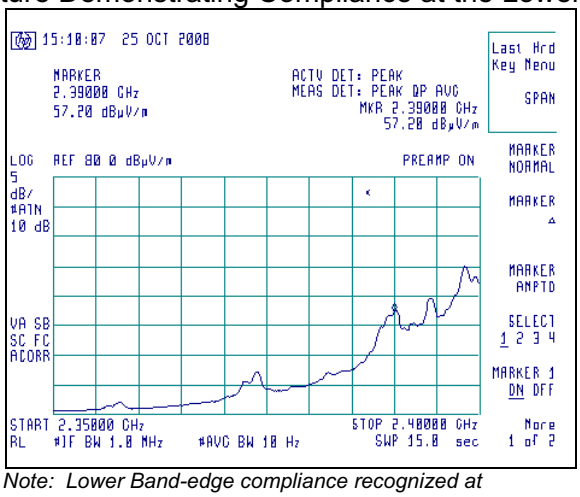
8.1 Method of Measurements

FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. The following screen captures demonstrate compliance of the intentional radiator at the 2400-2483.5 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

***Note*: Peak readings were verified to ensure measurements were less than 20dB from the average reading.**

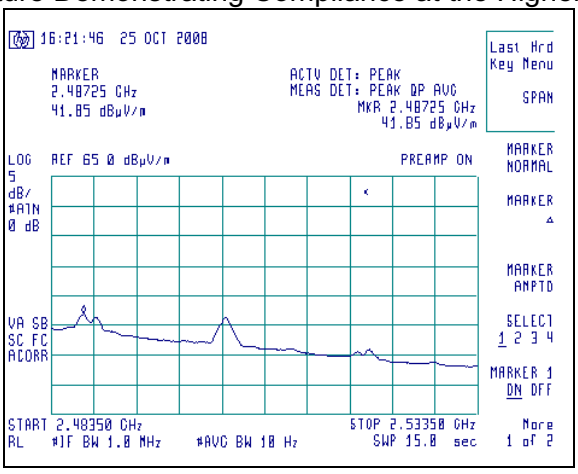
The Lower Band-Edge limit, in this case, would be -20 dBc with respect to the fundamental level.
The Upper Band-Edge limit, in this case, would be + 54 dBµV/m at 3m.

Screen Capture Demonstrating Compliance at the Lower Band-Edge



Note: Lower Band-edge compliance recognized at 2390MHz with 20dB relaxation factor

Screen Capture Demonstrating Compliance at the Higher Band-Edge



Note: Peak measurement was 48.66 dBuV/m.

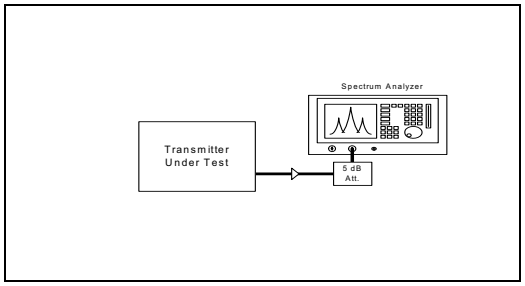
EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 5 MHz, with measurements from a peak detector presented in the chart below.

9.2 Test Data

CHANNEL	CENTER FREQ (MHz)	LIMIT (dBm)	MEASURED POWER (dBm)	MARGIN (dB)
0	2405	+30 dBm	18.41	11.59
3	2420	+30 dBm	18.55	11.45
7	2440	+30 dBm	18.64	11.36



Measured RF Power Output (in milliwatts): 73.11

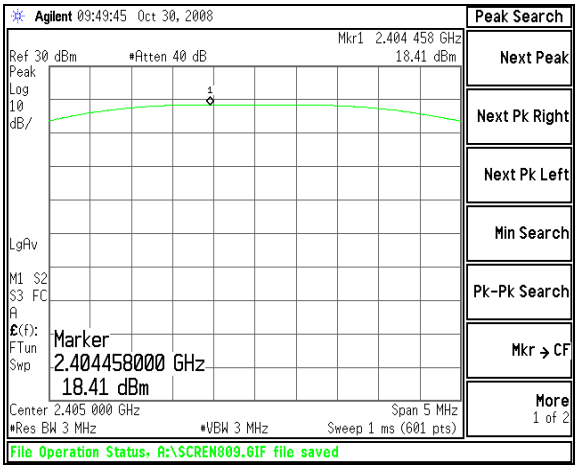
Declared RF Power Output (in milliwatts): 100

9.3 Test Equipment List

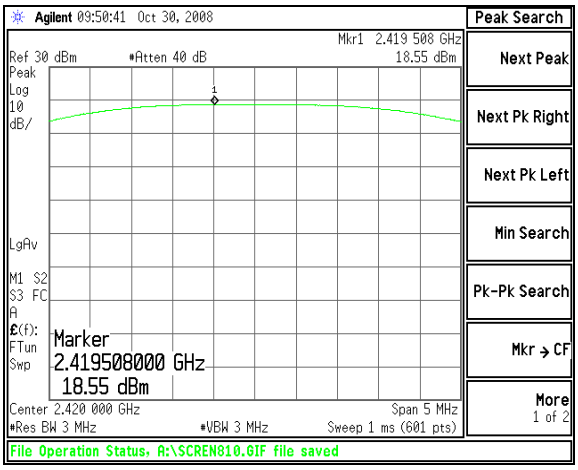
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

9.4 Screen Captures – Power Output (Conducted)

Channel 0



Channel 3



Screen Captures – Power Output (Conducted) (*continued*)

Channel 7

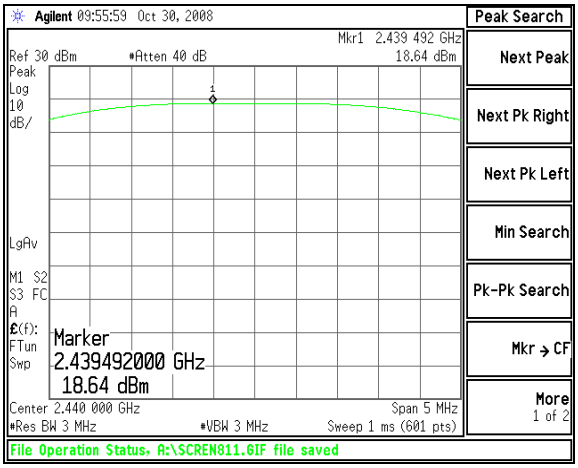


EXHIBIT 10. POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed. The highest density was found to be no greater than 3.36 dBm, which is under the allowable limit by 4.64 dB.

10.2 Test Equipment List

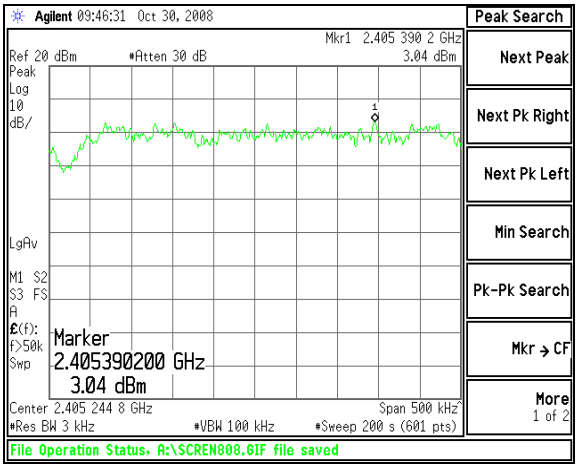
Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

10.3 Test Data

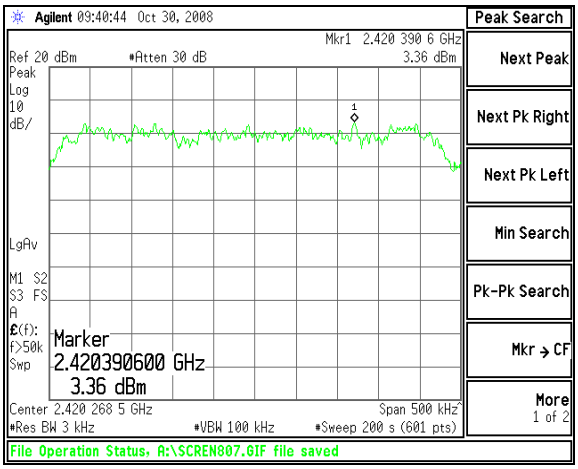
Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
Lowest	2405	3.04	8.0	4.96	Pass
Middle	2445	3.36	8.0	4.64	Pass
Highest	2480	3.29	8.0	4.71	Pass

10.4 Screen Captures – Power Spectral Density

Channel 0



Channel 3



Channel 7

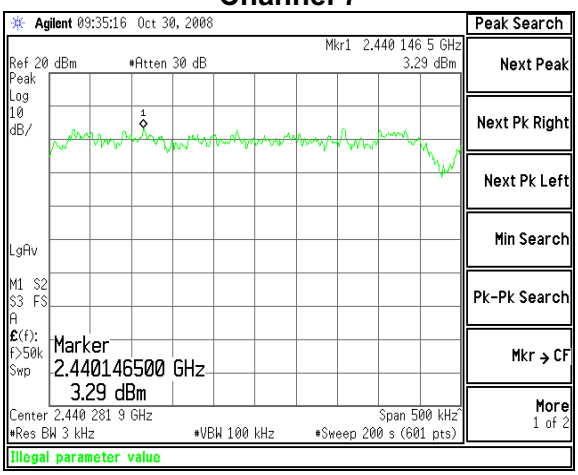


EXHIBIT 11. SPURIOUS EMISSIONS: 15.247(d)

11.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted measurement.

Remarks:

- The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

FCC Part 15.247(d) requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. A Hewlett Packard model E4446A spectrum analyzer was used with the resolution bandwidth set to 100 kHz for this portion of the tests. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

11.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

11.3 Test Data

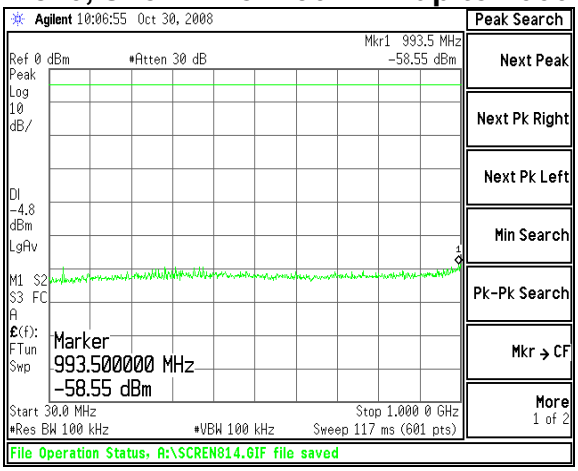
Fundamental Frequency: 2400MHz, 2420MHz, 2440 MHz
Modulation: DTS
Frequency Test Range: 2400-2483.5 MHz

	Channel 0	Channel 3	Channel 7
Fundamental	13.64 (dBm)	13.37 (dBm)	13.56 (dBm)
2nd Harmonic	-13.61 (dBm)	-14.14 (dBm)	-12.22 (dBm)
3rd Harmonic	-29.10 (dBm)	-27.84 (dBm)	-28.13 (dBm)
4th Harmonic	Note (1)	Note (1)	Note (1)
5th Harmonic	Note (1)	Note (1)	Note (1)
6th Harmonic	Note (1)	Note (1)	Note (1)
7th Harmonic	Note (1)	Note (1)	Note (1)
8th Harmonic	Note (1)	Note (1)	Note (1)
9th Harmonic	Note (1)	Note (1)	Note (1)
10th Harmonic	Note (1)	Note (1)	Note (1)

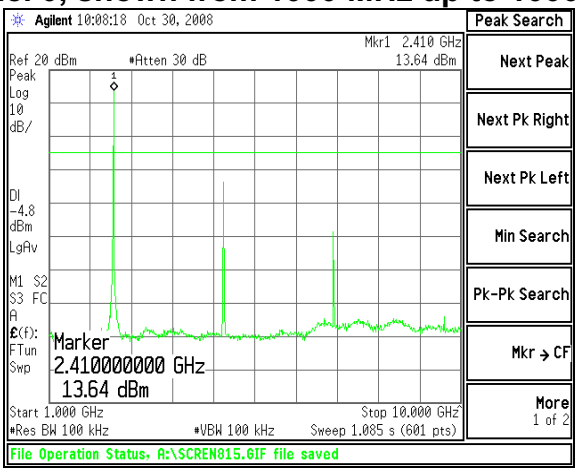
Notes:
(1) Measurement at system noise floor.

11.4 Screen Captures – Spurious Radiated Emissions

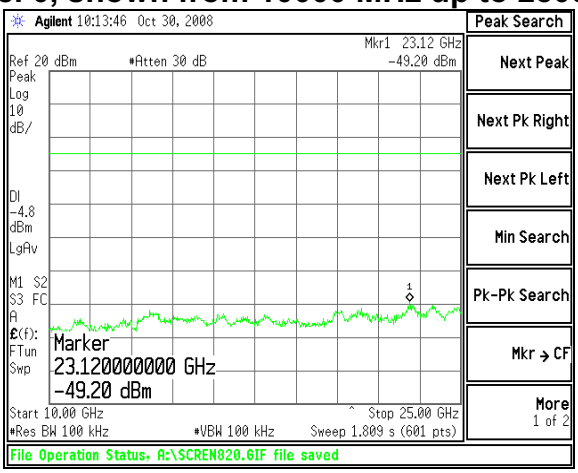
Channel 0, shown from 30 MHz up to 1000 MHz



Channel 0, shown from 1000 MHz up to 10000 MHz

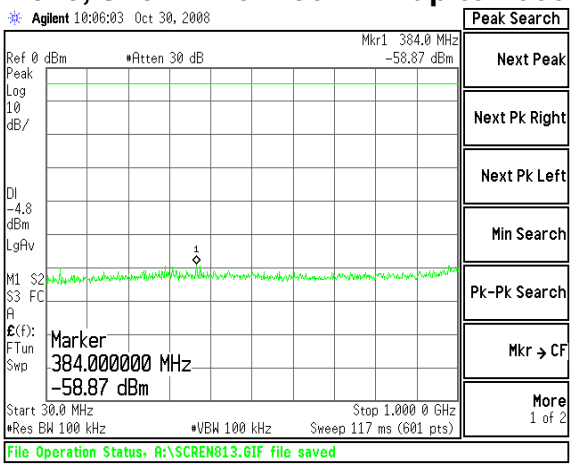


Channel 0, shown from 10000 MHz up to 25000 MHz

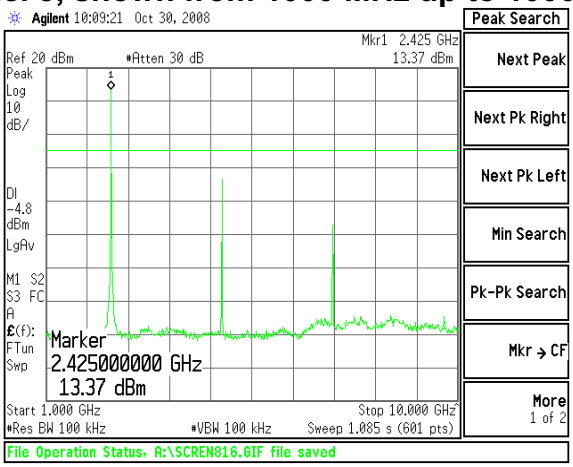


Screen Captures – Spurious Radiated Emissions (*continued*)

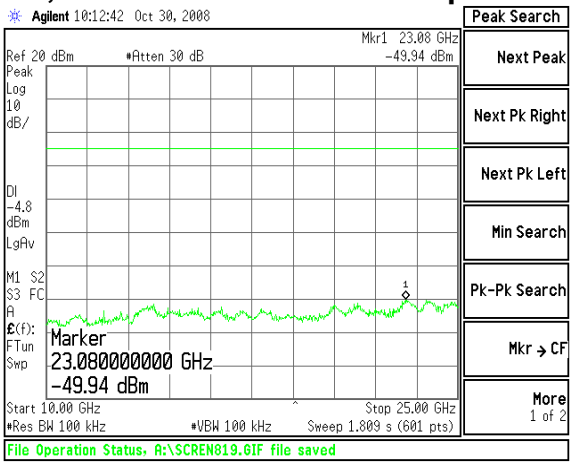
Channel 3, shown from 30 MHz up to 1000 MHz



Channel 3, shown from 1000 MHz up to 10000 MHz

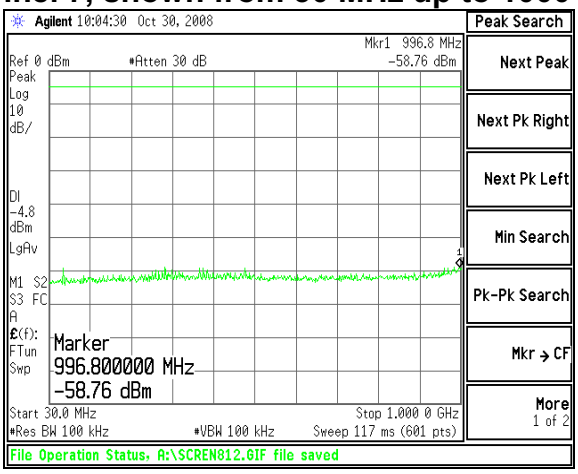


Channel 3, shown from 10000 MHz up to 25000 MHz

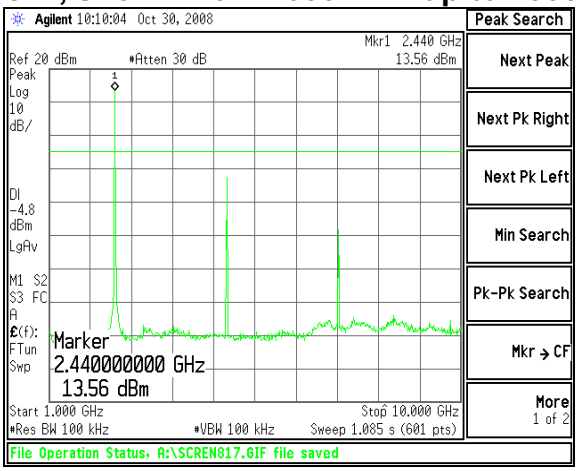


Screen Captures – Spurious Radiated Emissions (*continued*)

Channel 7, shown from 30 MHz up to 1000 MHz



Channel 7, shown from 1000 MHz up to 10000 MHz



Channel 7, shown from 10000 MHz up to 25000 MHz

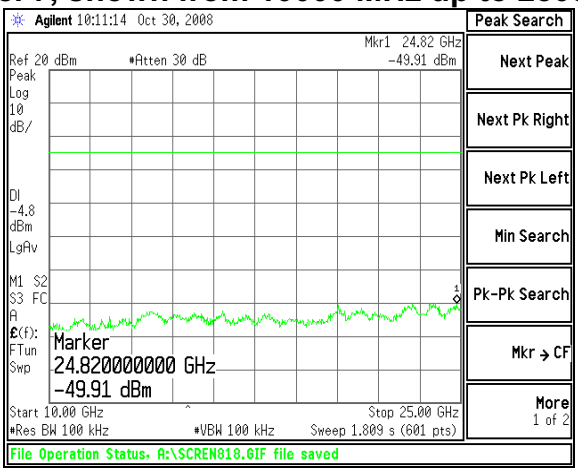


EXHIBIT 12. MPE CALCULATIONS

The following MPE calculations are based on a 1.8 centimeter inverted-F printed circuit board trace antenna, with a measured ERP of 115 dBµV/m, at 3 meters, and conducted RF power of +18.64 dBm as presented to the antenna. The calculated gain of this antenna, based on the ERP measurements is 1.13 dB.

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:	18.64	(dBm)
Maximum peak output power at antenna input terminal:	73.114	(mW)
Antenna gain(typical):	1.13	(dBi)
Maximum antenna gain:	1.297	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.018868	(mW/cm^2)
Maximum allowable antenna gain:	18.4	(dBi)
Margin of Compliance at 20 cm =	17.2	dB

Appendix A

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Radiated Emissions Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/20/2008	10/20/2009	Active Calibration
4	AA 960077	Bicon Antenna	EMCO	93110B	9702-2918	11/24/2008	11/24/2009	Active Calibration
5	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	9/26/2008	9/26/2009	Active Calibration
6	AA 960063	Pyramidal Horn Antenna	EMCO	3160-09	9809-1120	6/17/2008	6/17/2009	Active Calibration

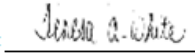
Project Engineer: Quality Manager: Teresa A. White

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Band-Edge Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	9/23/2008	9/23/2009	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	9/23/2008	9/23/2009	Active Calibration
3	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	10/20/2008	10/20/2009	Active Calibration
4	AA 960077	Bicon Antenna	EMCO	93110B	9702-2918	11/24/2008	11/24/2009	Active Calibration
5	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	9/26/2008	9/26/2009	Active Calibration
6	AA 960063	Pyramidal Horn Antenna	EMCO	3160-09	9809-1120	6/17/2008	6/17/2009	Active Calibration

Project Engineer:  Quality Manager: 

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Conducted Emissions Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

Project Engineer: _____ Quality Manager: _____

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

Project Engineer: Quality Manager: Teresa A. White

LS RESEARCH LLC
Wireless Product Development

Equipment Calibration

Date : 9-Dec-2008 Type Test : Conducted Power Output Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

Project Engineer: _____ Quality Manager: _____

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Power Spectral Density Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

Project Engineer: _____ Quality Manager: _____

LS RESEARCH LLC
Wireless Product Development
Equipment Calibration

Date : 9-Dec-2008 Type Test : Spurious Emissions Job # : C-458

Prepared By: Ryan Urness Customer : Generac Power Systems Quote #: 308433

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	9/26/2008	9/26/2009	Active Calibration

Project Engineer: Quality Manager: Teresa A. White

Appendix B

Current Test Standards

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2003		
CISPR 11	2003-03	2004-05	2006-06
CISPR 14-1	2005-11		
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2006-03	2006-09	2007-07
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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

Appendix D

Justifications of Average Duty Factor Calculations

Average (Relaxation) Factor

Average Factor = 20* Log_{10} (Worst Case EUT On-time over 100 ms time window)

The transmit packet occupies 0.775 ms of time, within any 100 ms window. Therefore, the relaxation factor allowance is calculated as:

Average Factor = 20* Log_{10} (0.775 / 100 ms) = -42.21

A relaxation factor of 20 dB would be allowable for this product.