ELECTRONIC SYSTEMS, INC.
166 South Carter, Genoa City, WI 53128

Company: Schweitzer Engineering Laboratories, Inc.
Model Tested: SEL-LG-SBR
Report Number: 16483

Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart C – Intentional Radiators
Section 15.247
Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

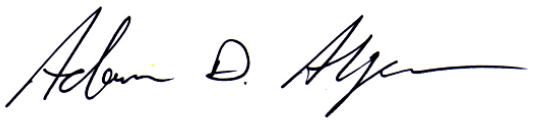
THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name:	SEL-LG-SBR
Kind of Equipment:	Module / Mobile
Frequency Range:	902.1-927.9 MHz
Test Configuration:	Battery operated transceiver module
Model Number(s):	SEL-LG-SBR
Model(s) Tested:	SEL-LG-SBR
Serial Number(s):	9151018D
Date of Tests:	September 20-23, 2010 and November 30, 2010
Test Conducted For:	Schweitzer Engineering Laboratories, Inc. 2350 NE Hopkins Court Pullman, Washington 99163-5603, USA

NOTICE: "This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Description of Test Sample" page listed inside of this report.

SIGNATURE PAGE

Report By:



Adam Alger
Test Engineer

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

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United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2010-10-01 through 2011-09-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

1.0 Summary of Test Report

It was determined that the Schweitzer Engineering Laboratories, Inc. SEL-LG-SBR, Model SEL-LG-SBR, complies with the requirements of CFR 47 Part 15 Subpart C Section 15.247.

Subpart C Section 15.247 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
15.215(c)	20 dB Emission Bandwidth	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(a)(1)	Carrier Frequency Separation	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(a)(1)(i)	Number of Hopping Channels	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(a)(1)(i)	Average Time of Occupancy	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(b)(2)	Maximum Peak Conducted Output Power	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(d)	RF Conducted Spurious	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15.247(d)	Band Edge	ANSI C63.4-2003 & ANSI C63.10-2009	1	Yes
15205(c) & 15.209(a)	Radiated Spurious Emissions in Restricted Bands	ANSI C63.4-2003 & ANSI C63.10-2009	2	Yes

Note 1: RF conducted measurement.
Note 2: Radiated emission measurement.

2.0 Introduction

In September, 2010 the SEL-LG-SBR, Model SEL-LG-SBR, as provided from Schweitzer Engineering Laboratories, Inc. was tested to the requirements of CFR 47 Part 15 Subpart C Section 15.247. To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

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3.0 Test Facilities

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at http://www.dlsemc.com/certificate. Our facilities are registered with the FCC, Industry Canada, and VCCI.

Wisconsin Test Facility:
D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

Wheeling Test Facility:
D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, IL 60090

4.0 Description of Test Sample

Description:

The test units are ISM band, 902-928 MHz, transceiver modules. The nominal transmitted RF output power is +20 dBm; the module uses binary FSK modulation at a maximum data rate of 9600 baud. The module contains microprocessor and control circuitry to drive the RF circuits, perform the data processing and manage the interface circuitry. This module is intended to be used with other circuit boards as part of an assembled final product.

Type of Equipment / Frequency Range:

Mobile / 902-928 MHz

Physical Dimensions of Equipment Under Test:

Length: 8.7 cm x Width: 4.2 cm x Height: 2.0 cm

Power Source:

5 VDC (Lab DC bench power supply used for testing)

Internal Frequencies:

14.7456 MHz

4.0 Description of Test Sample (continued)

Transmit / Receive Frequencies Used For Test Purpose:

Low channel: 902.1 MHz, Middle channel: 915 MHz, High channel: 927.9 MHz

Type of Modulation(s) / Antenna Type:

FSK / 5.25 dBi whip antenna (see additional descriptions)

Description of Circuit Board(s) / Part Number:

Cellnet UtiliNet SCADA D/A	40-1129

5.0 Test Equipment

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

D.L.S. Wisconsin - G1

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7/10	7/11
Preamplifier	Rohde & Schwarz	TS-PR10	032001/003	9 kHz – 1 GHz	1/10	1/11
Antenna	EMCO	3104C	9810-4849	20 MHz – 200 MHz	2/10	2/12
Antenna	EMCO	3146	1205	200 MHz – 1 GHz	7/09	7/11
Preamp	Ciao	CA118-4010	101	1GHz-18GHz	1/10	1/11
Horn Antenna	EMCO	3115	9502-4451	1-18GHz	4/09	4/11
Filter- High-Pass	Q-Microwave	100460	002	1-18GHz	5/10	5/11
20 dB attenuator	Aeroflex/weinschel	75A-20-12	1071	DC – 40 GHz	7/10	7/11
DC Power Supply	GW Instek	GPR1810-HD	EH925509	N/A	N/A	N/A
Multimeter	Fluke	77	43390985	N/A	7/10	7/11

6.0 Test Arrangements

Radiated Emissions Measurement Arrangement:

All radiated emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.4-2003and ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

RF Conducted Emissions Measurement Arrangement:

All RF conducted emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.4-2003and ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

7.0 Test Conditions

Normal Test Conditions:

Temperature and Humidity:

73°F at 53% RH

Supply Voltage:

5.0 VDC

8.0 Modifications Made To EUT For Compliance

None noted at time of test.

9.0 Additional Descriptions

The EUT was connected to the measuring equipment through a MCX to SMA cable for RF conducted measurements.

The EUT was connected to a MMG (Manufacturer's Marketing Group) 5.25dBi Whip Antenna P/N 16-1000-0 external antenna through a MCX to N connector for radiated emission measurements. A ground plane was also fastened to the antenna for simulation of typical use of antenna.

For measurements requiring the EUT to transmit continuously with and without modulation at a single channel, a serial interface cable was connected to a computer running a hyper terminal. The same serial cable was also equipped to provide the module with DC power from a typical lab bench supply.

For measurements requiring the EUT to transmit in its frequency hopping mode, a serial cable was connected to a computer running a proprietary software suite to control the module. The same serial cable was also equipped to provide the module with DC power from a typical lab bench supply.

10.0 Results

Measurements were performed in accordance with ANSI C63.4-2003and ANSI C63.10-2009. Graphical and tabular data can be found in Appendix B at the end of this report.

11.0 Conclusion

The SEL-LG-SBR, Model SEL-LG-SBR, as provided from Schweitzer Engineering Laboratories, Inc. tested in September & November, 2010 **meets** the requirements of CFR 47 Part Subpart C Section 15.247.

Appendix A – Test Photos

Photo Information and Test Setup:

Item0: SEL-LG-SBR, Model SEL-LG-SBR
Item1: Serial power and communications cable (power from bench supply)
Item2: MMG 5.25dBi whip antenna Model 16-1000-0 with MCX to N connectors RF cable

Radiated Emissions – Front

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Appendix A

Radiated Emissions – Back

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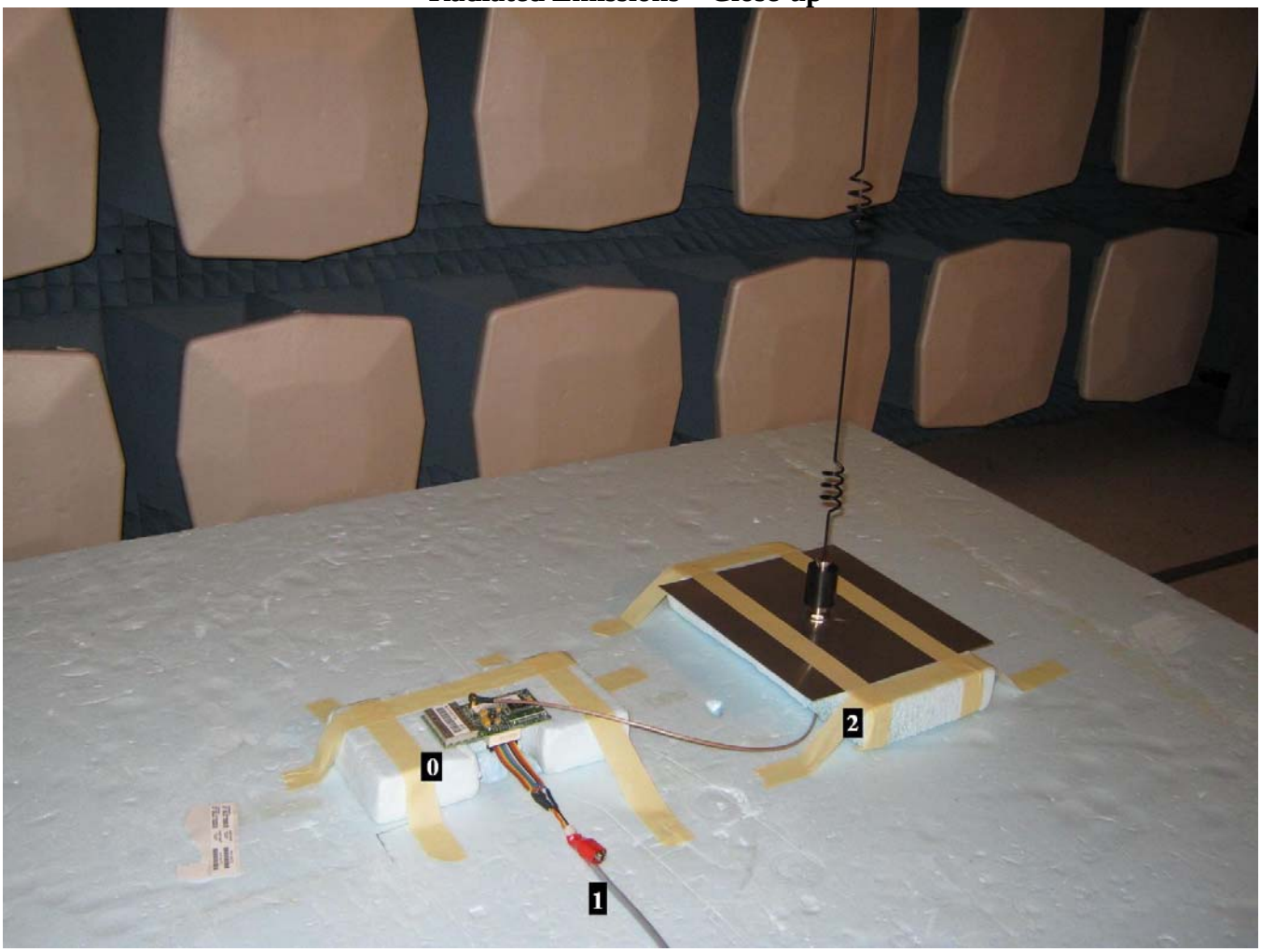
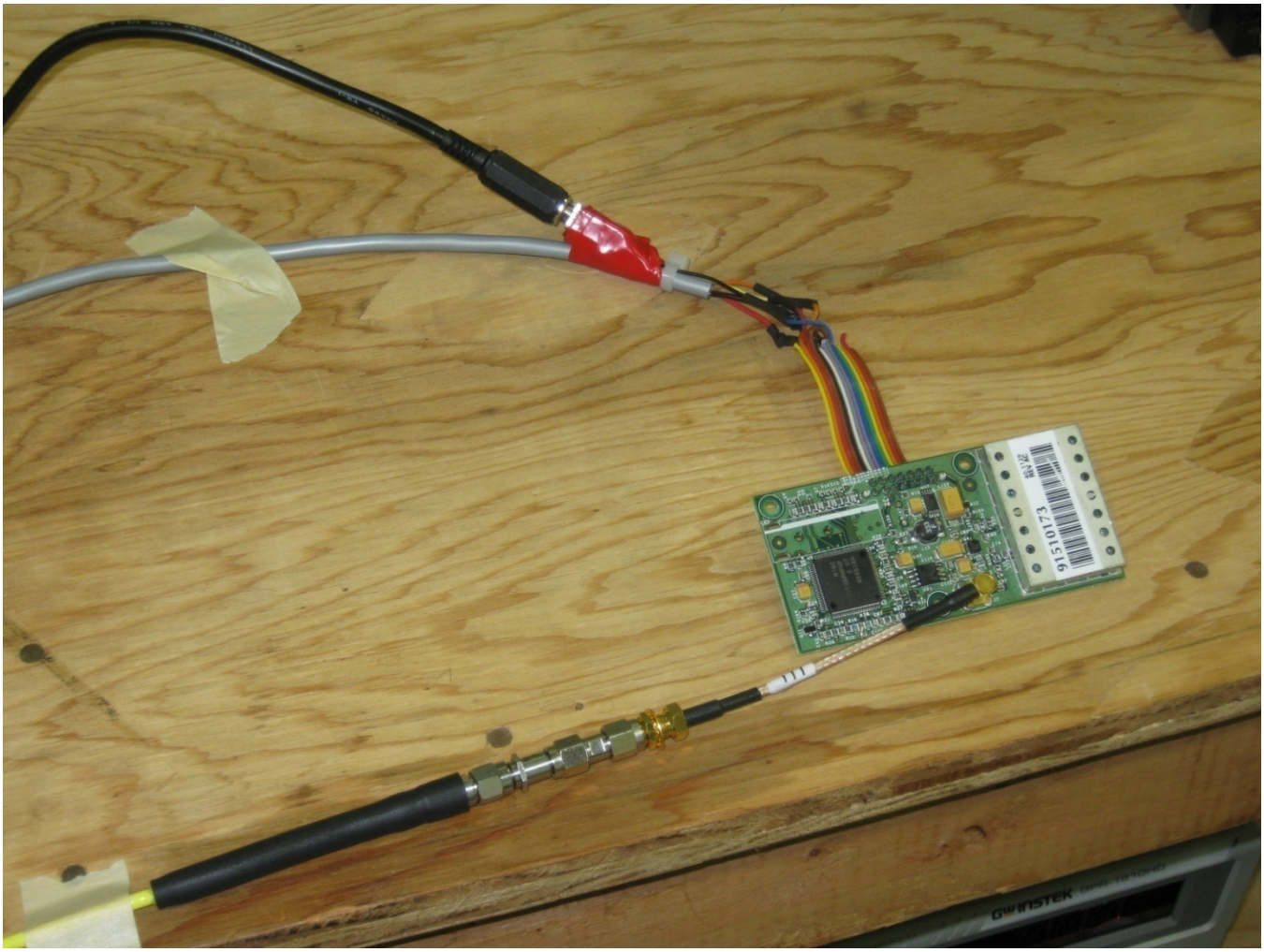
Appendix A

Radiated Emissions – Close-up



Appendix A

RF Conducted Emissions



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Appendix B – Measurement Data

1.0 Emission Bandwidth – 20 dB

Rule Part:

Section 15.215 (c)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

Section 15.247 (a) (1) (i)

Results:

Compliant
Maximum 20 dB bandwidth: **27.89 kHz**

Sample Equation(s):

None

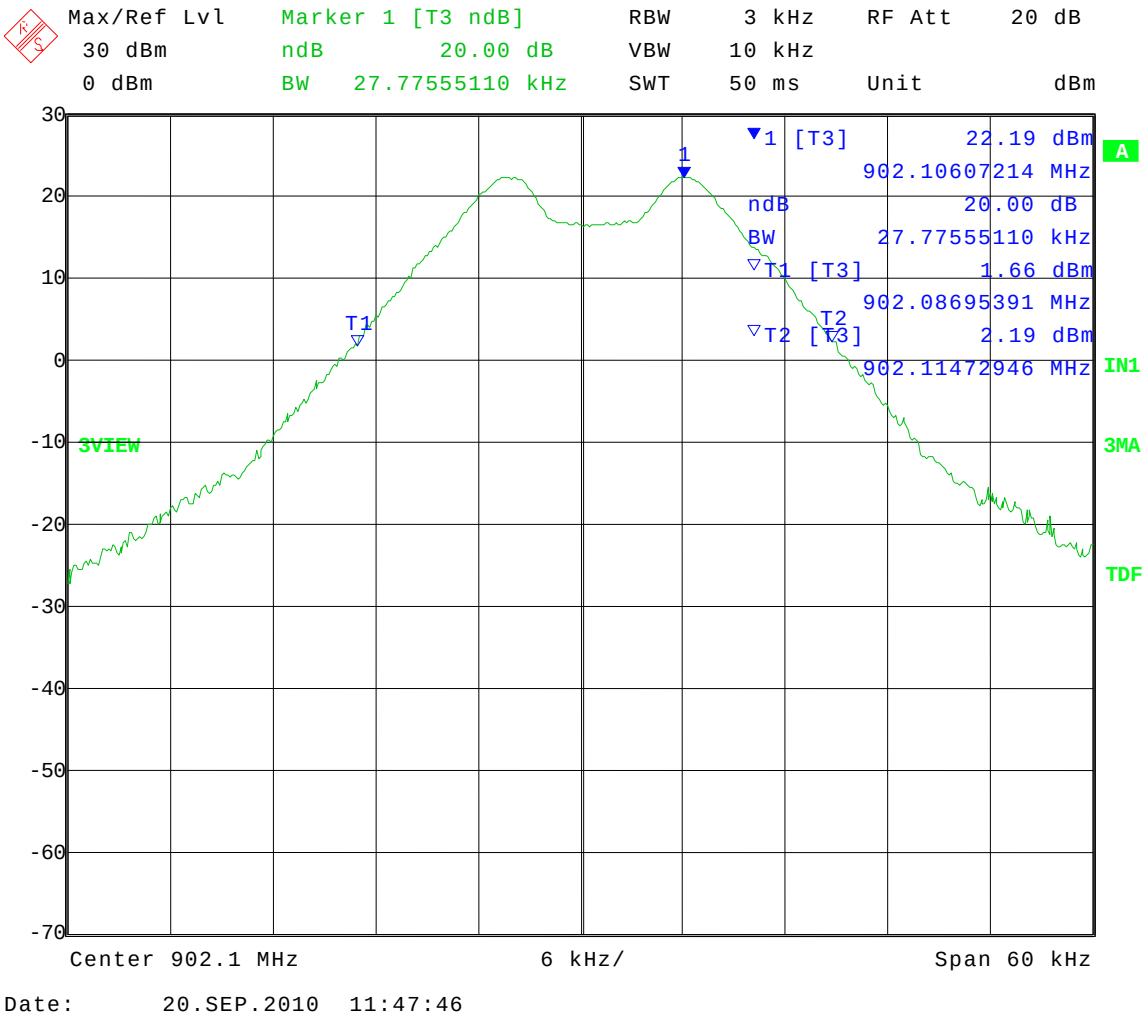
Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a hyper terminal to control the module. The EUT was set to transmit at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

166 South Carter, Genoa City, WI 53128

Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: 20 dB Bandwidth
Operator: Adam A
Comment: Low Channel: Frequency – 902.1 MHz

20dB bandwidth = 27.77 kHz



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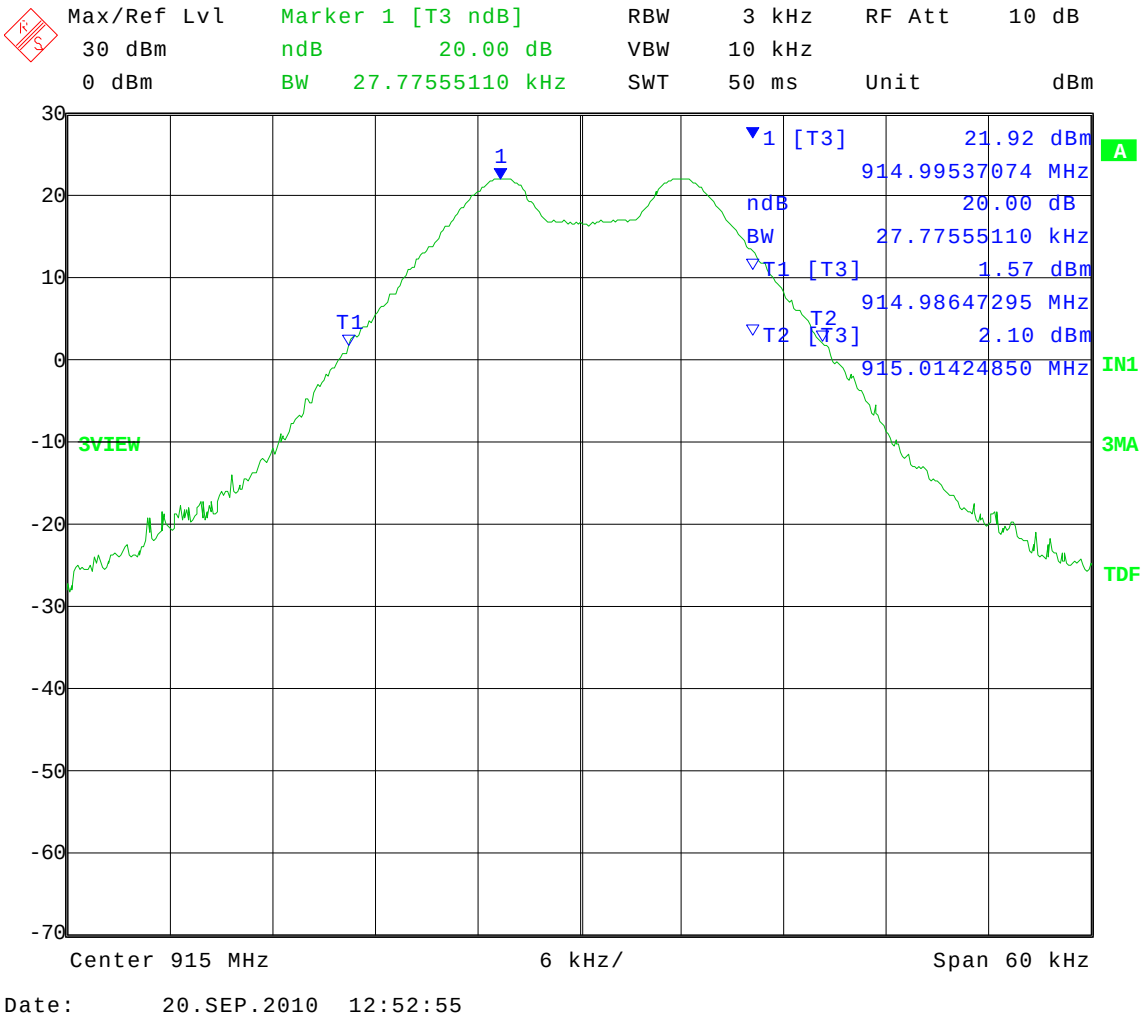
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: 20 dB Bandwidth
Operator: Adam A
Comment: Mid Channel: Frequency – 915 MHz

20dB bandwidth = 27.77



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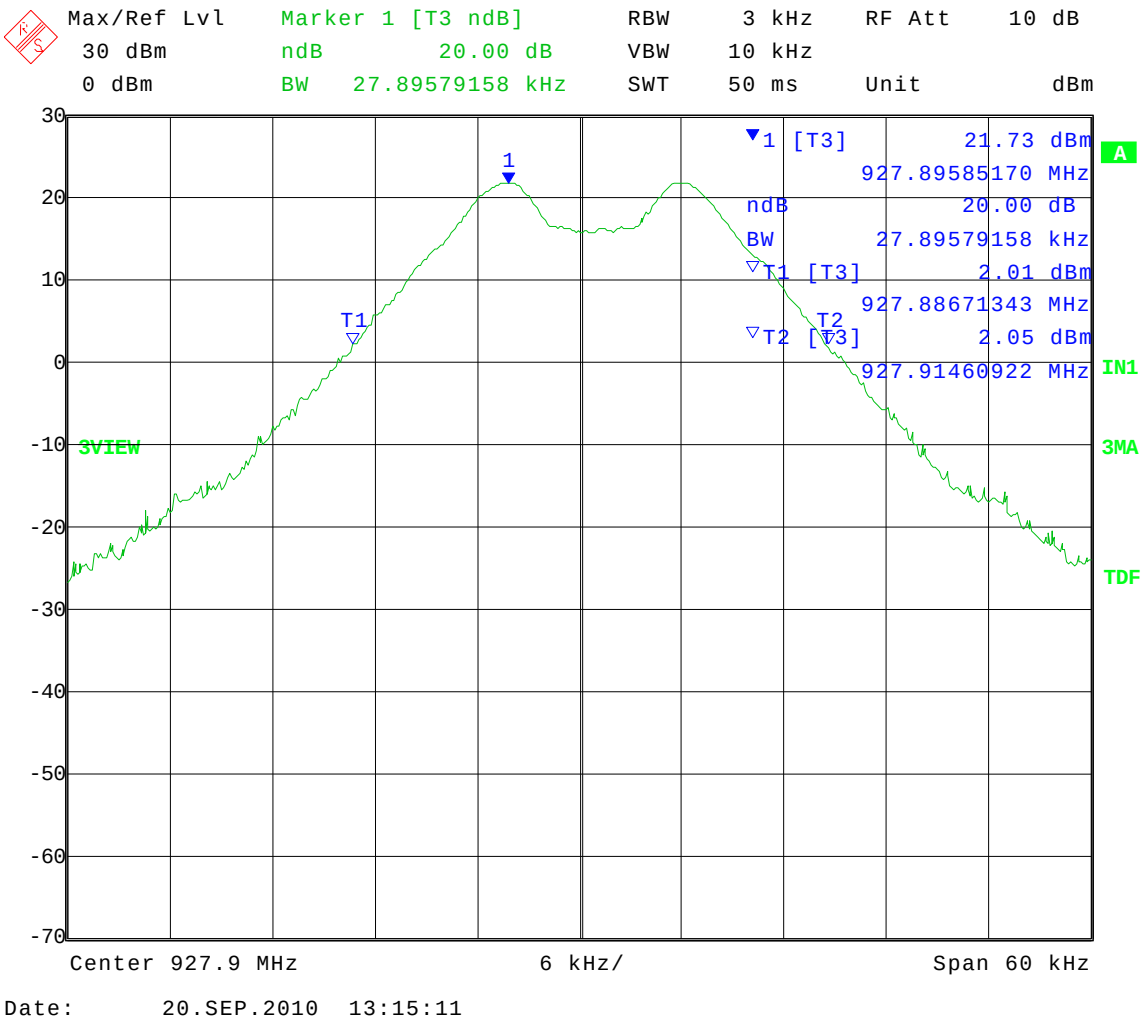
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: 20 dB Bandwidth
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz

20dB bandwidth = 27.89



Appendix B

2.0 Carrier Frequency Separation

Rule Part:

15.247 (a) (1)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Results:

Compliant
Carrier frequency separation: **100.00 kHz**

Sample Equation(s):

None

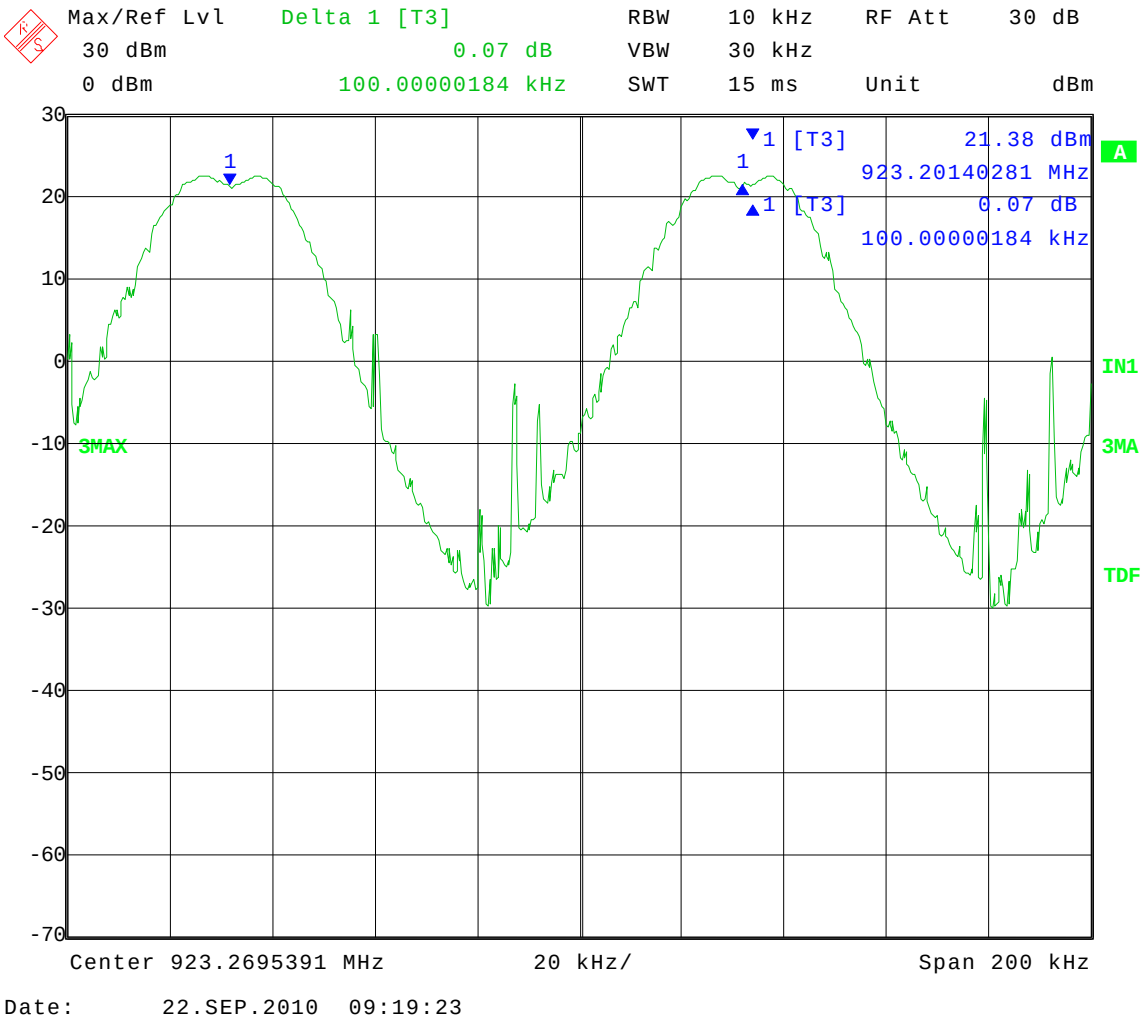
Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a proprietary software suite to control the module. The EUT was set to transmit in its normal frequency hopping mode. Computer software controlling the module was necessary to prevent the module from going into sleep mode so the appropriate measurement could be procured.

166 South Carter, Genoa City, WI 53128

Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Channel Seperation
Operator: Adam A
Comment: Frequency Hopping

Carrier Freq Separation = 100.00 kHz



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Appendix B

3.0 Number of Hopping Channels

Rule Part:

15.247 (a) (1)(i)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period

Results:

Compliant
Number of channels: 240 +1 initialization channel = 241

Sample Equation(s):

N/A

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a proprietary software suite to control the module. The EUT was set to transmit in its normal frequency hopping mode. Computer software controlling the module was necessary to prevent the module from going into sleep mode so the appropriate measurement could be procured.

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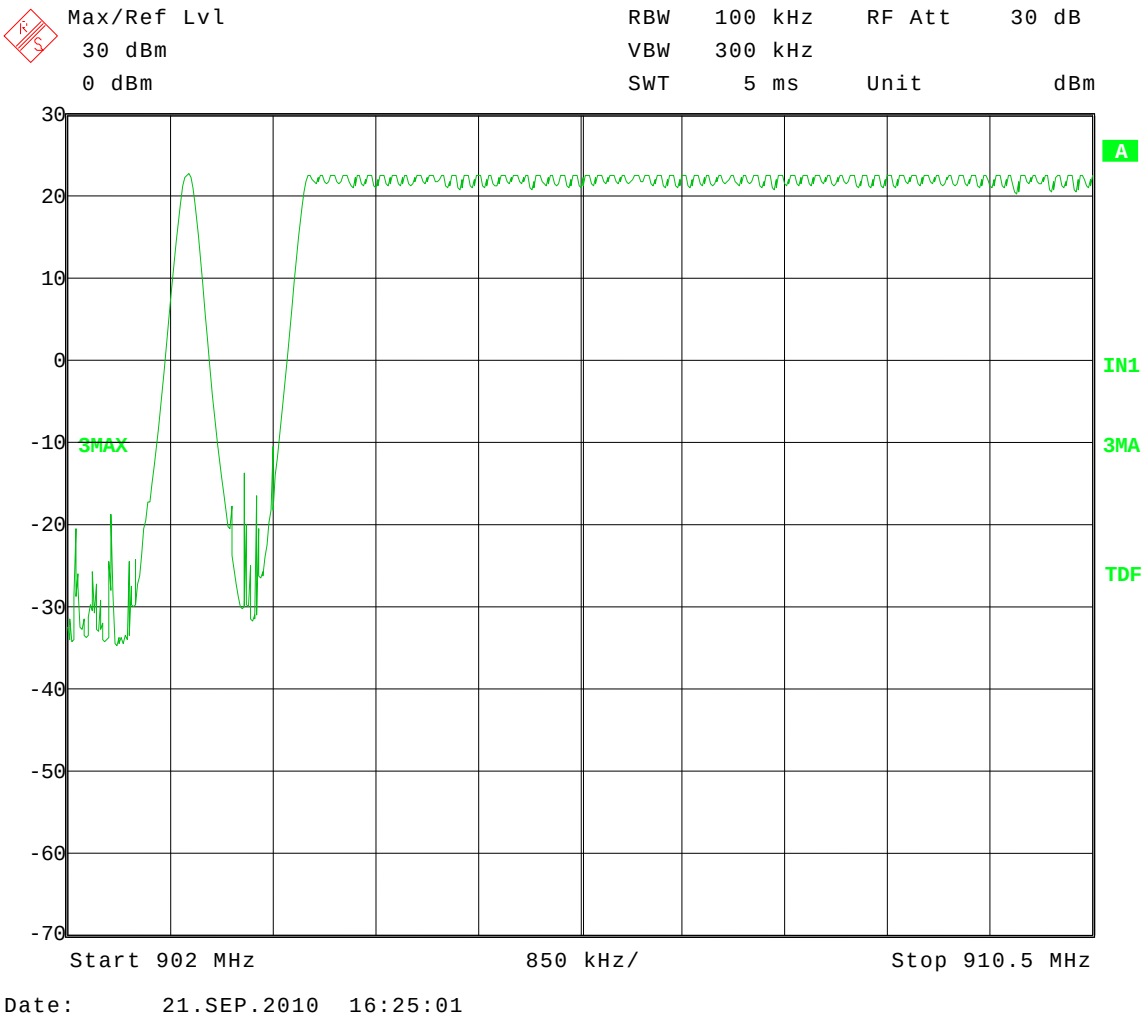
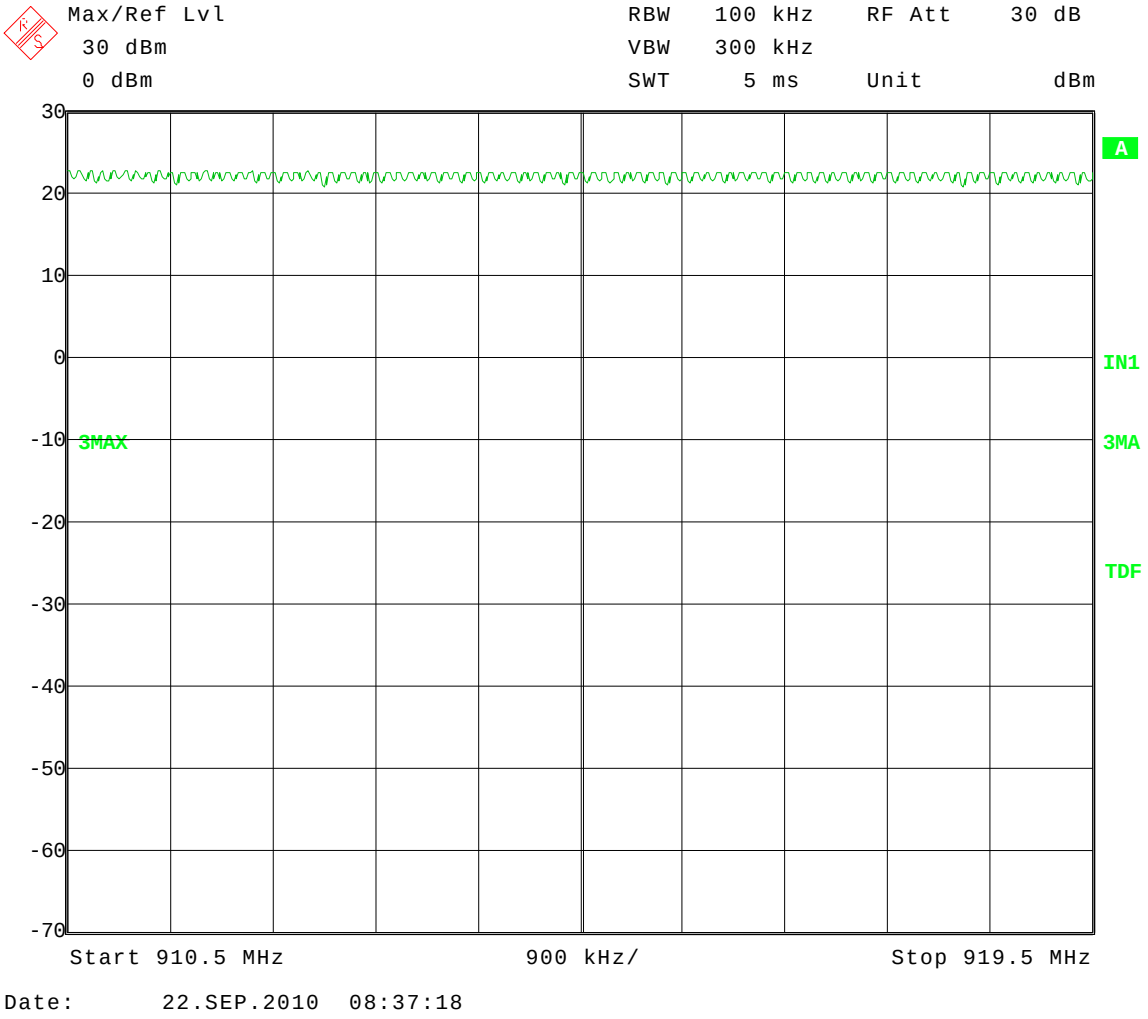
Test Date: 9-21-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Number of Hopping Channels
Operator: Adam A
Comment: Normal Transmit Operation

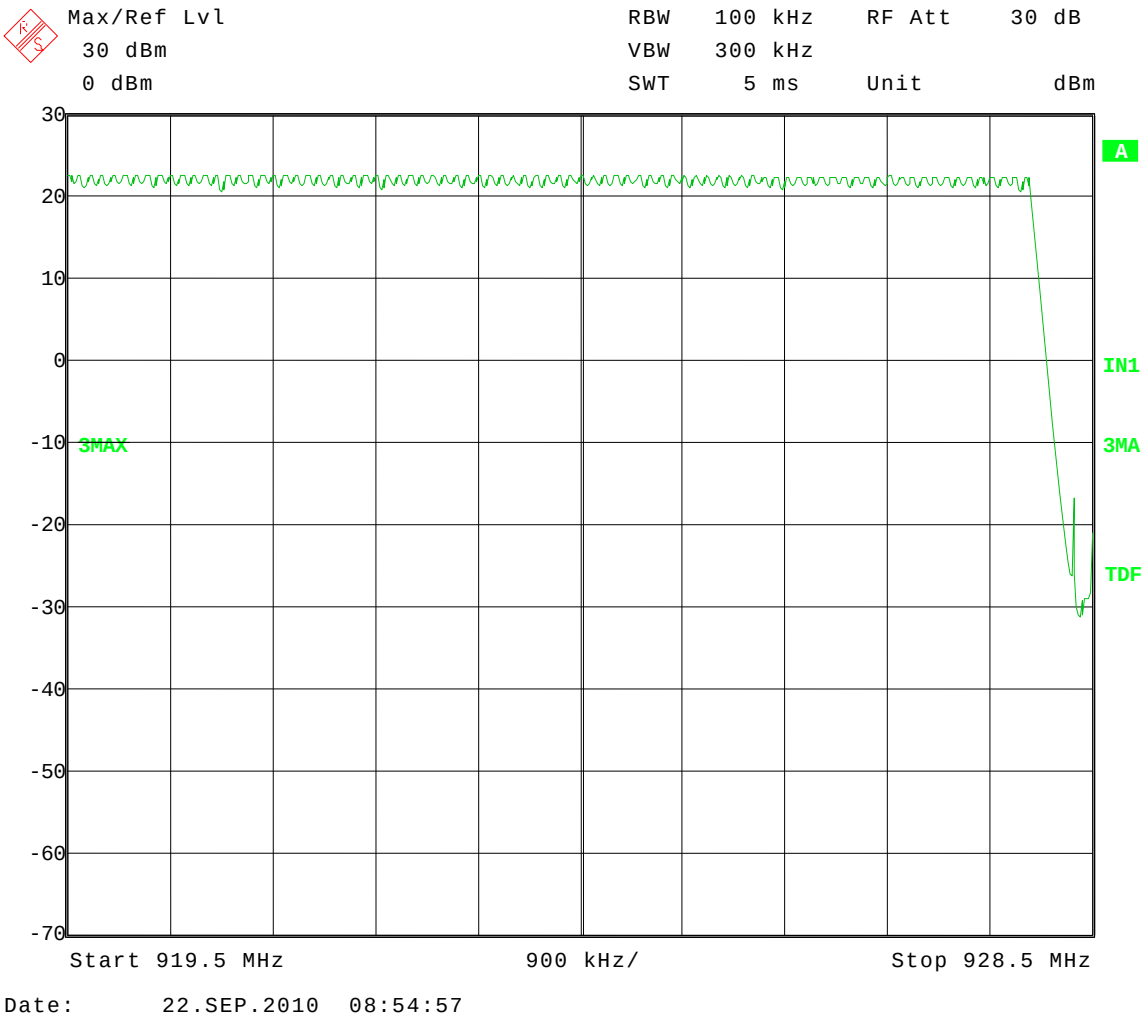


Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Number of Hopping Channels
Operator: Adam A
Comment: Normal Transmit Operation



166 South Carter, Genoa City, WI 53128

Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Number of Hopping Channels
Operator: Adam A
Comment: Normal Transmit Operation



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Appendix B

4.0 Average Time of Occupancy

Rule Part:

15.247 (a) (1)(i)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period

Results:

Compliant
One pulse in 20 second period, duration of pulse: 327.65 ms

Sample Equation(s):

N/A

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a proprietary software suite to control the module. The EUT was set to transmit in its normal frequency hopping mode. Computer software controlling the module was necessary to prevent the module from going into sleep mode so the appropriate measurement could be procured.

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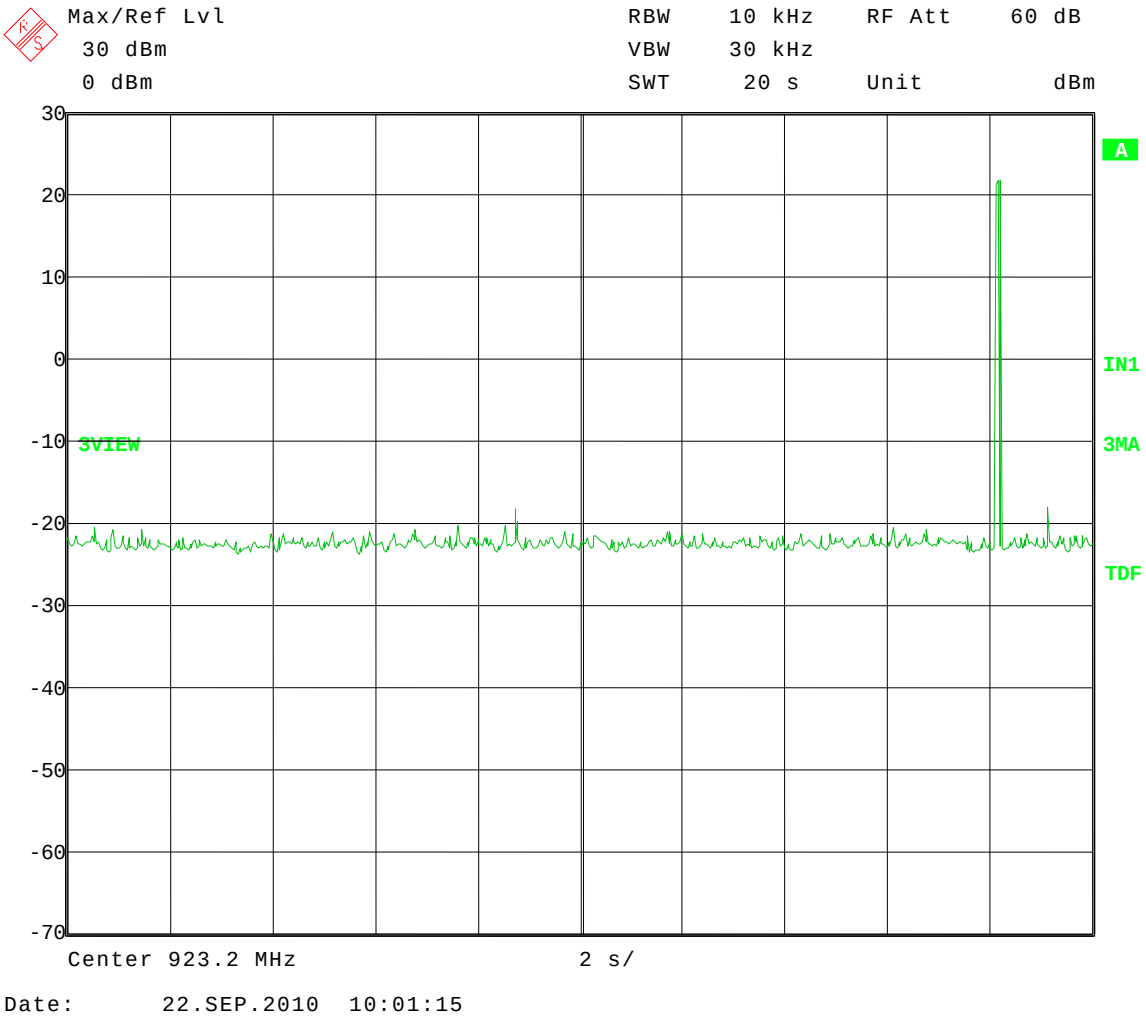
Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Average Time of Occupancy
Operator: Adam A
Comment: Normal Transmit Operation

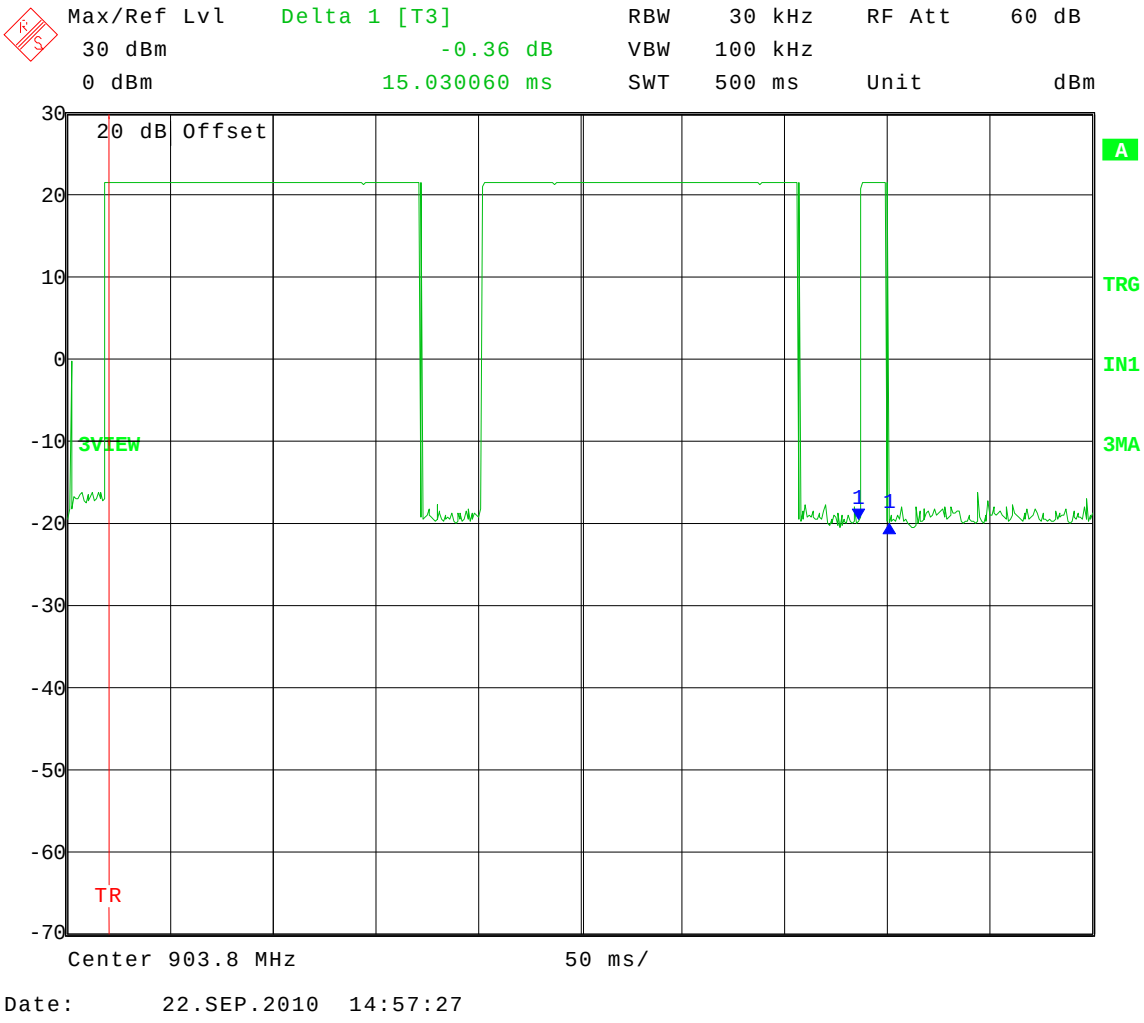
One pulse in 20 second period
Total Duration of pulse: 327.65 ms



166 South Carter, Genoa City, WI 53128

Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Average Time of Occupancy
Operator: Adam A
Comment: Normal Transmit Operation

Duration of pulse: 15.03 ms



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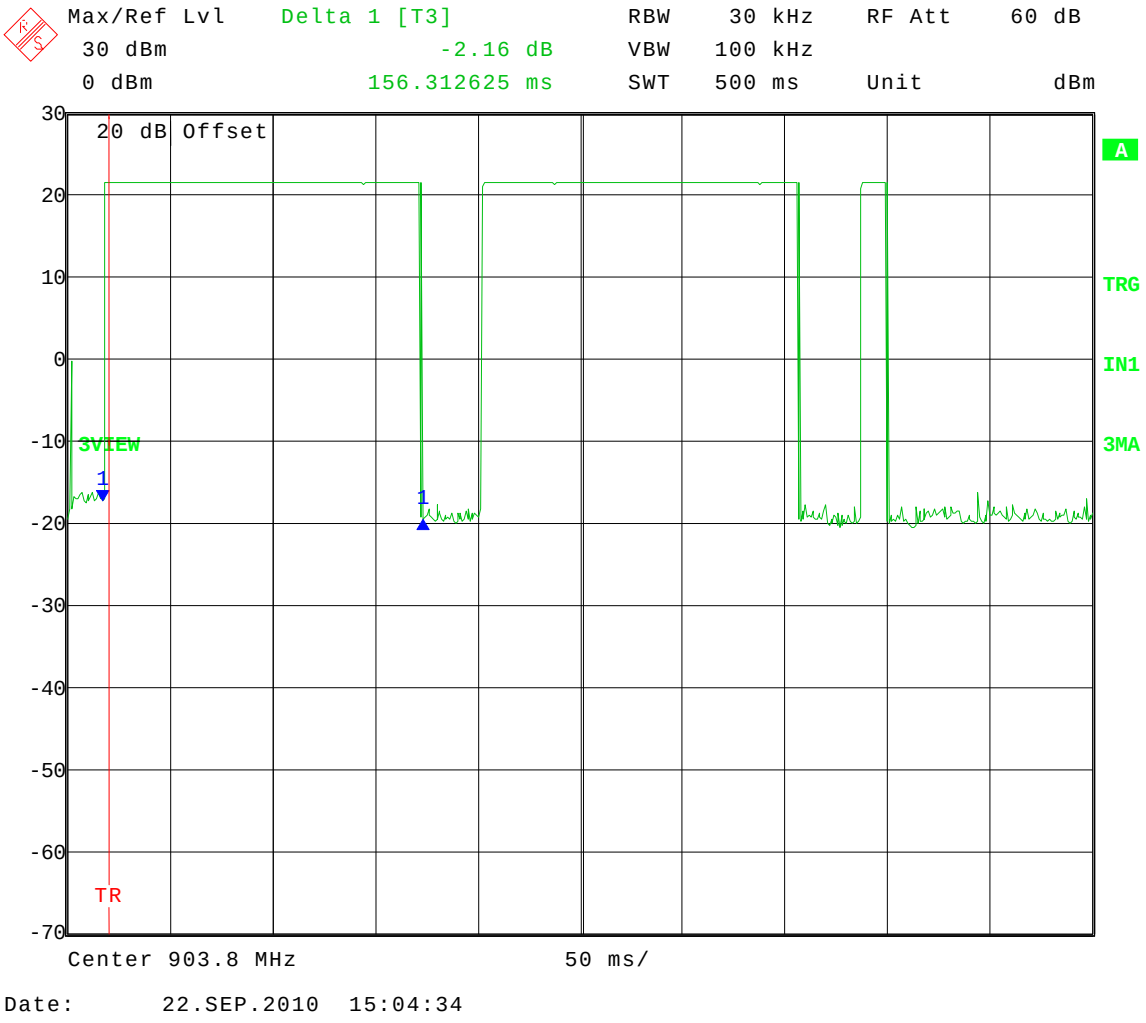
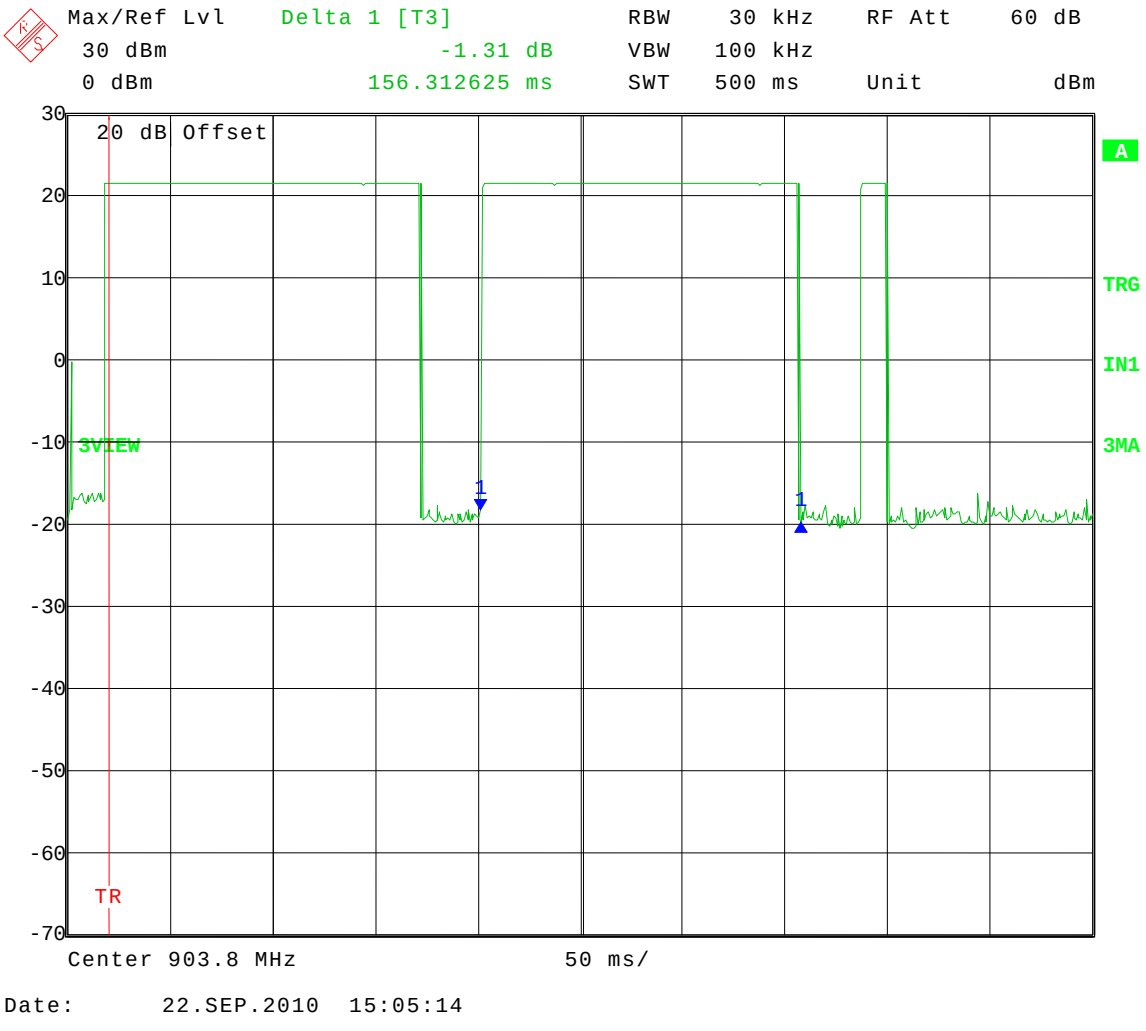
Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Average Time of Occupancy
Operator: Adam A
Comment: Normal Transmit Operation

Duration of pulse: 156.312 ms



Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Average Time of Occupancy
Operator: Adam A
Comment: Normal Transmit Operation

Duration of pulse: 156.312 ms



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Appendix B

5.0 Maximum Peak Conducted Output Power

Rule Part:

15.247(b) (2)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

1 Watt (30 dBm)

Results:

Compliant
Maximum Peak Conducted Output Power: 22.04 dBm = 159.9558 mW

Sample Equation(s):

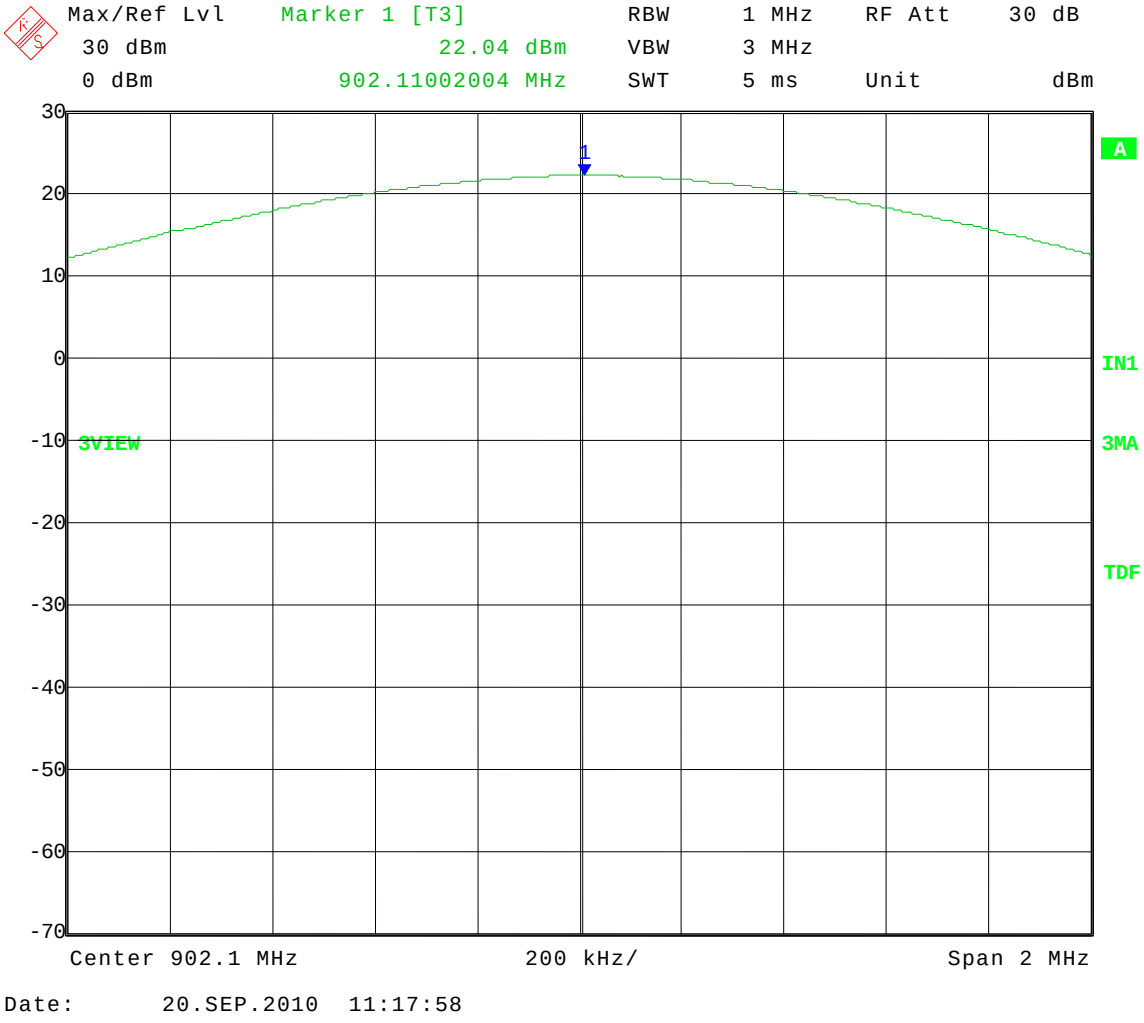
N/A

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a hyper terminal to control the module. The EUT was set to transmit at its maximum power and verified to be the maximum power under worst case modulation, data rate and un-modulated carriers at the low, middle and high channels of the operating band.

Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Peak Power Output - Conducted
Operator: Adam A
Comment: Low Channel: Frequency – 902.1 MHz

Peak Output Power = 22.04 dBm = 159.9558 **mW**



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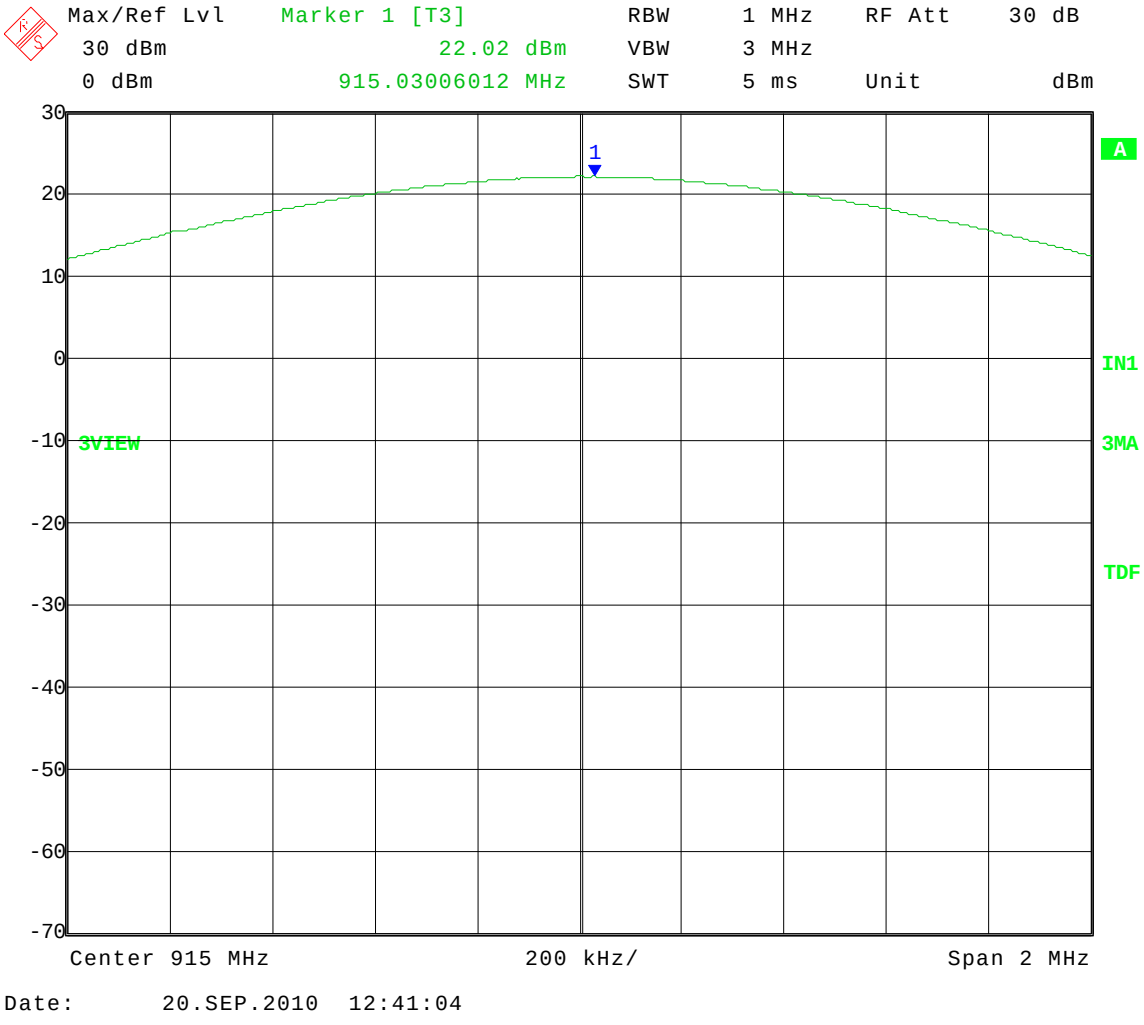
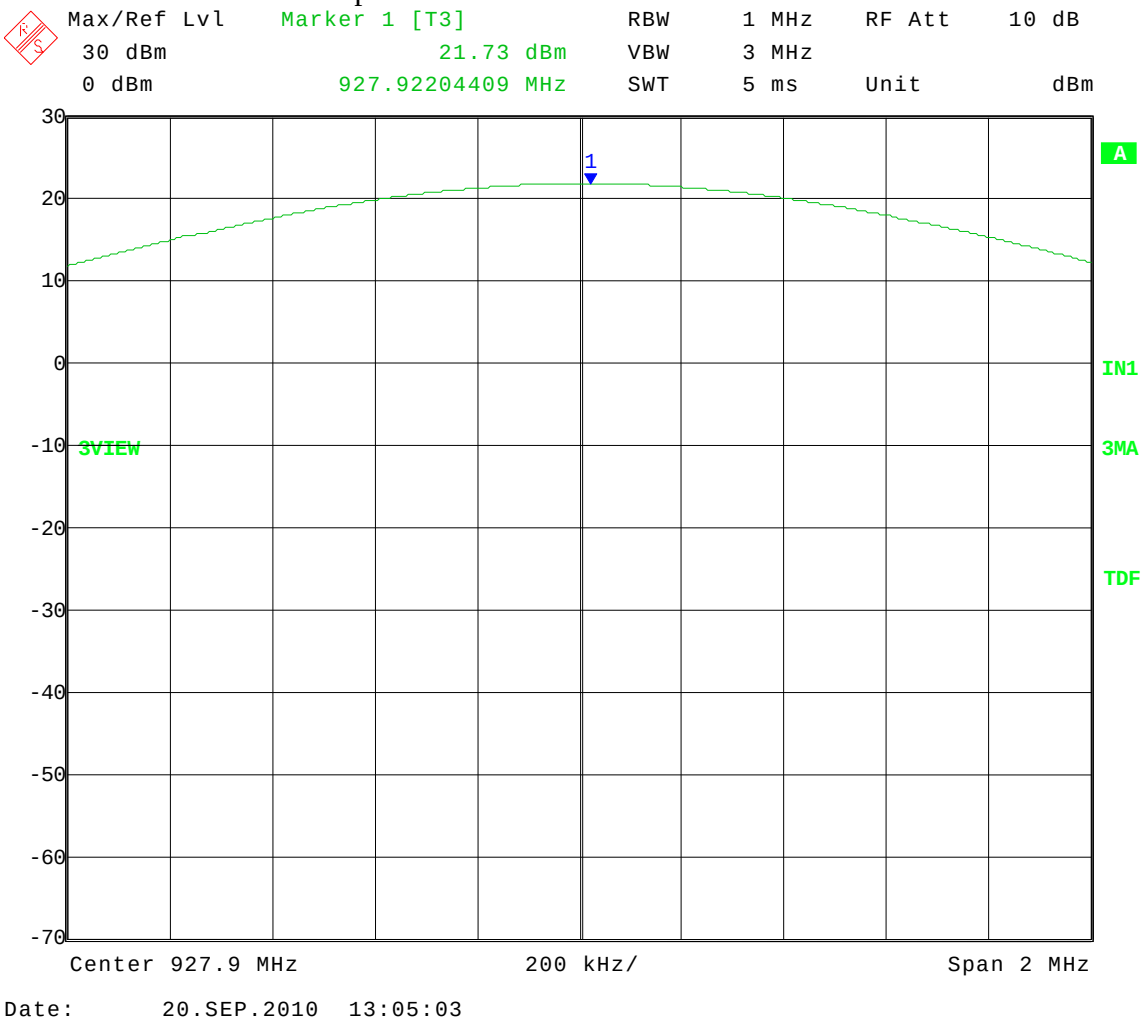
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Peak Power Output - Conducted
Operator: Adam A
Comment: Mid Channel: Frequency – 915 MHz

Peak Output Power = 22.02 dBm = **159.2209 mW**



Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Peak Power Output - Conducted
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz

Peak Output Power = 21.73 dBm = **148.93641 mW**



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Appendix B

6.0 RF Conducted Spurious Emissions

Rule Part:

15.247(d)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

20 dB below the highest level of the desired power in a 100 kHz bandwidth

Results:

Compliant

Sample Equation(s):

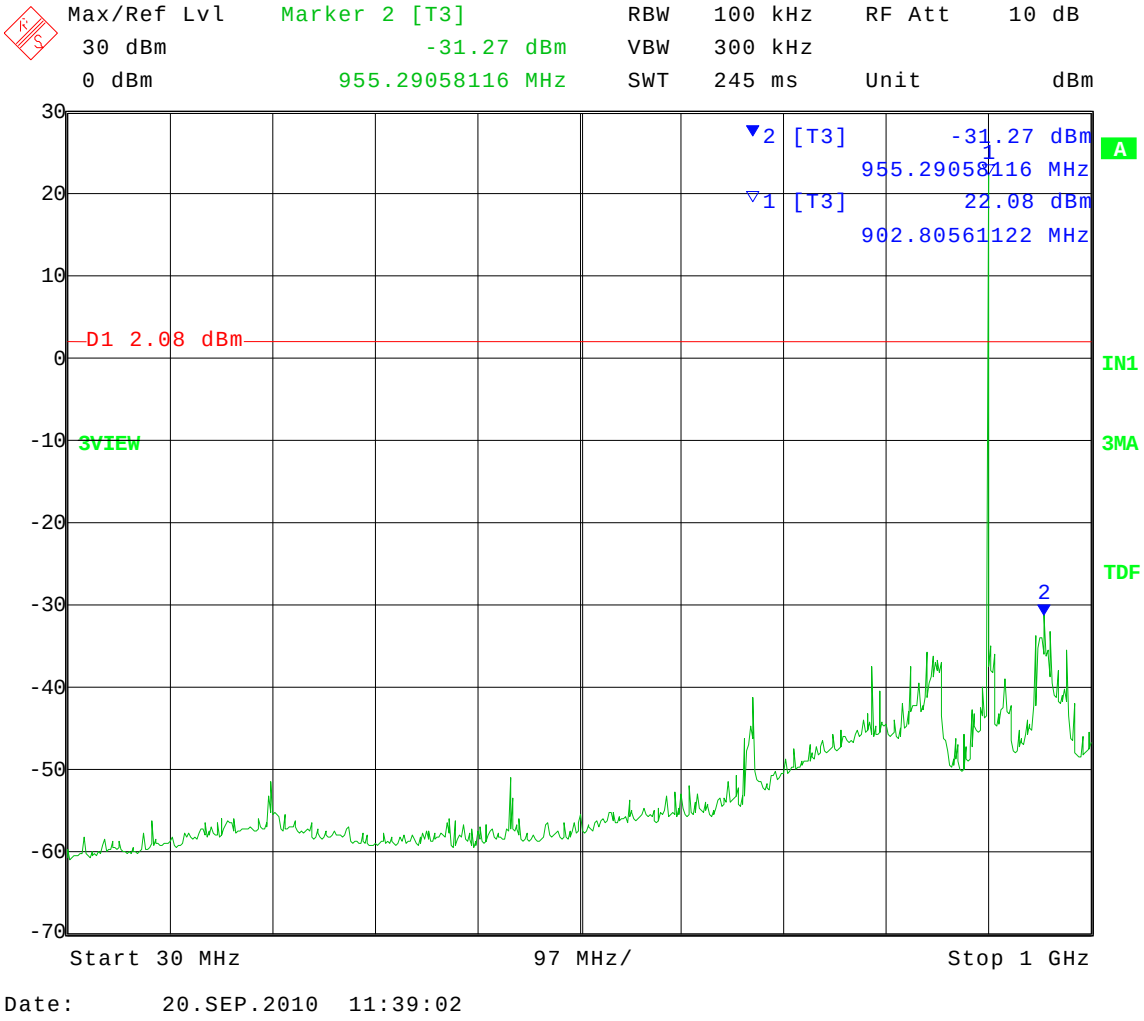
N/A

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a hyper terminal to control the module. The EUT was set to transmit at its maximum power, with operation on the low, middle, and high channels of the operating band.

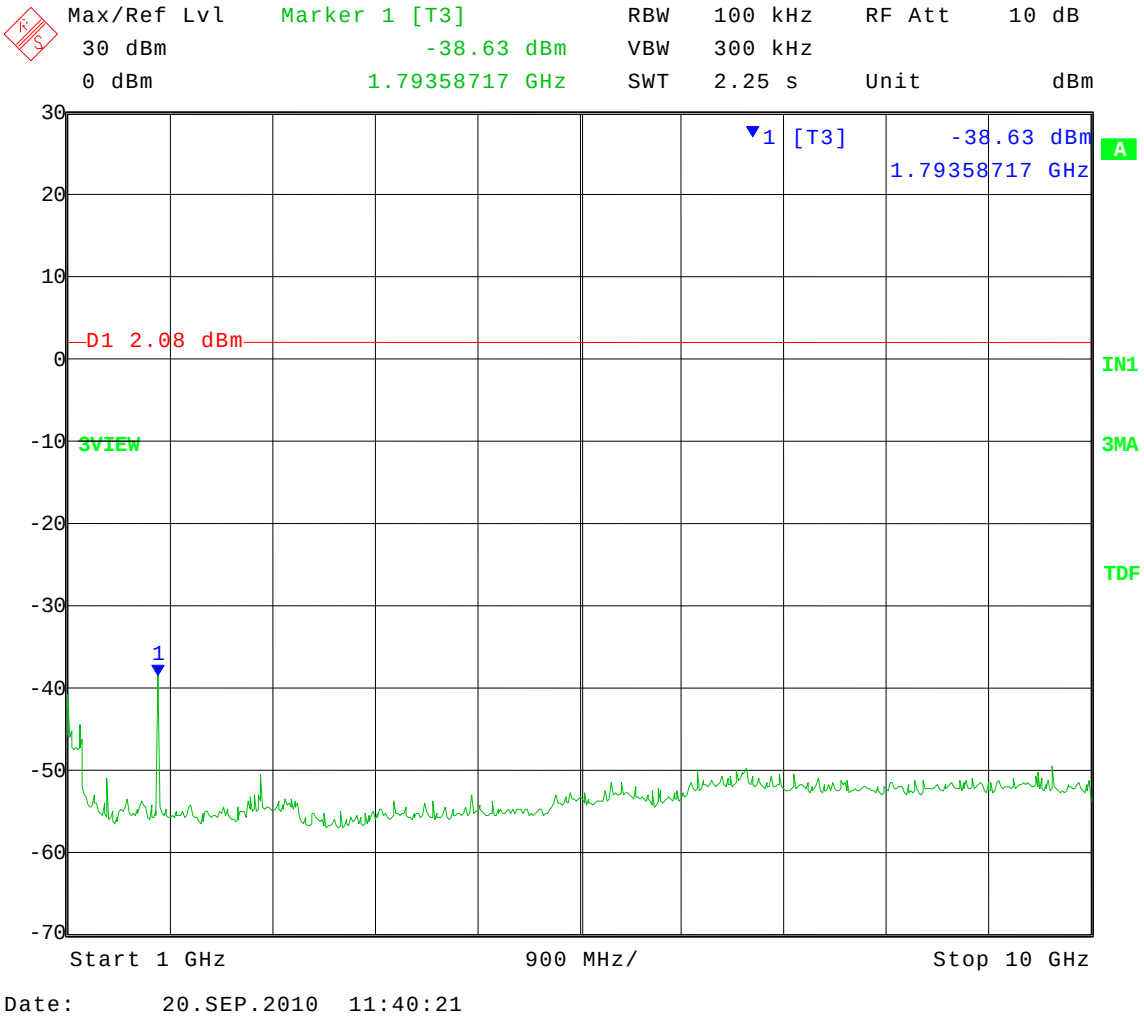
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: Low Channel: Frequency – 902.1 MHz

Frequency Range: 30 to 1000 MHz
Limit = 2.08 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



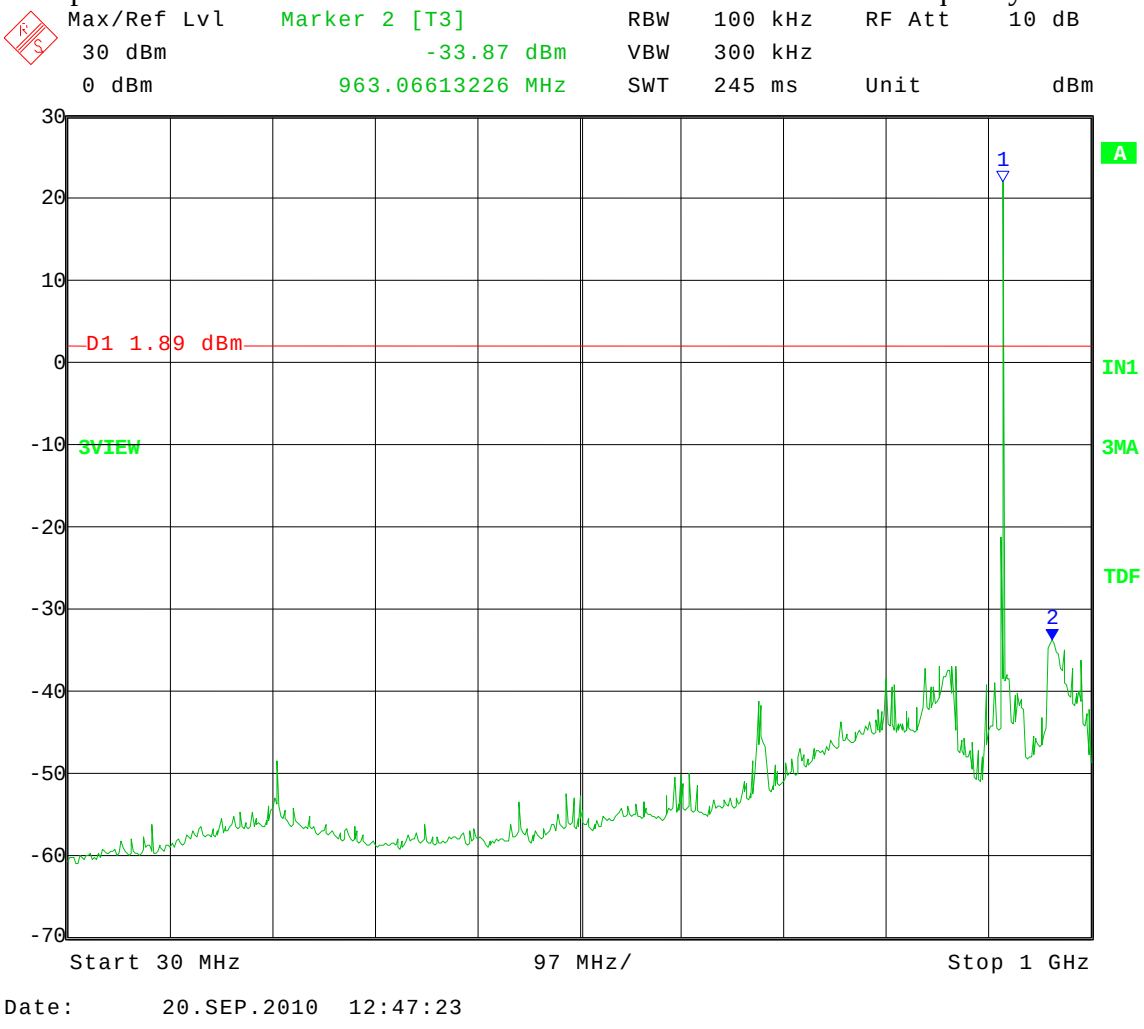
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: Low Channel: Frequency – 902.1 MHz

Frequency Range: 1 to 10 GHz
Limit = 2.08 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: Mid Channel: Frequency – 915 MHz

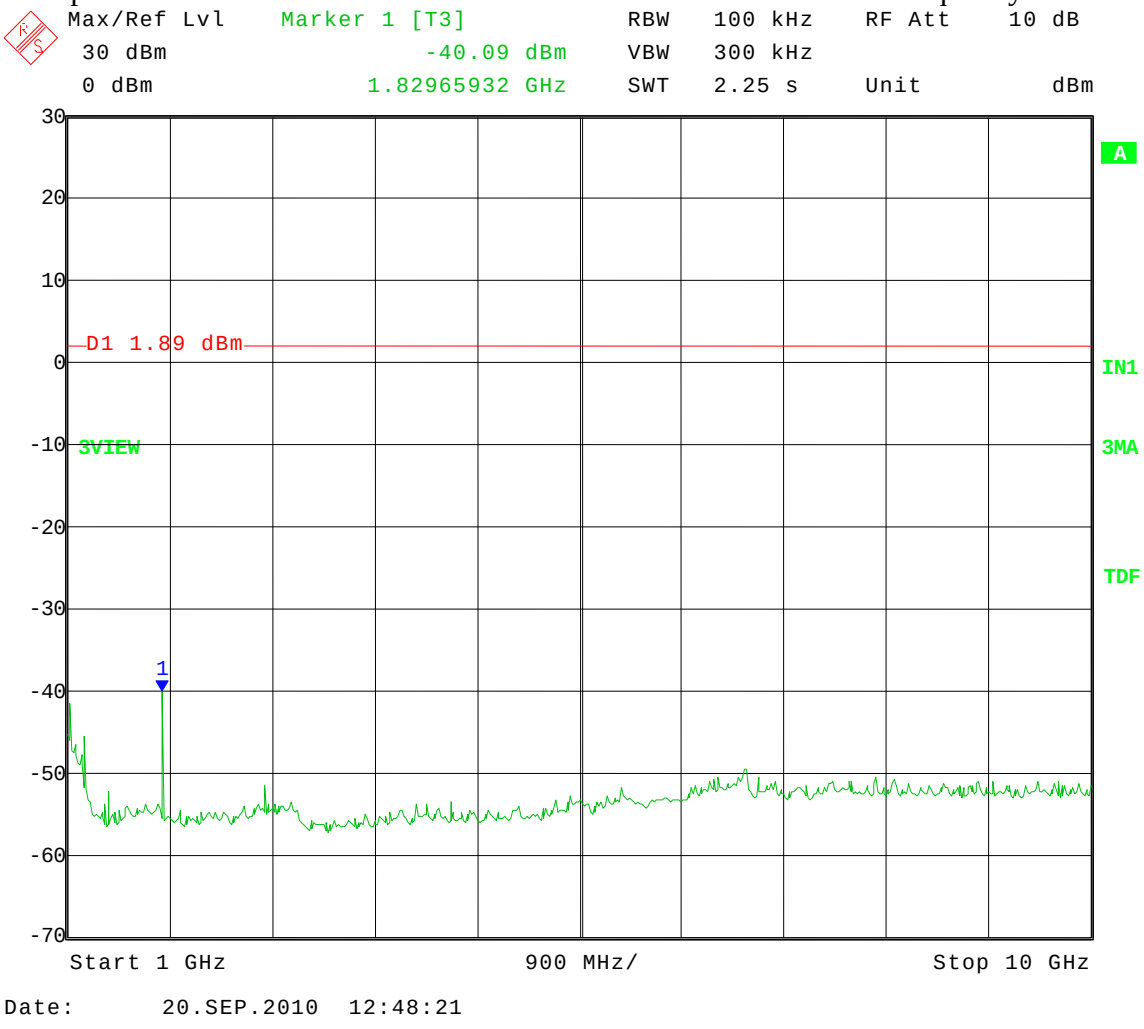
Frequency Range: 30 to 1000 MHz
Limit = 1.89 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



166 South Carter, Genoa City, WI 53128

Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: Mid Channel: Frequency – 915 MHz

Frequency Range: 1 to 10 GHz
Limit = 1.89 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



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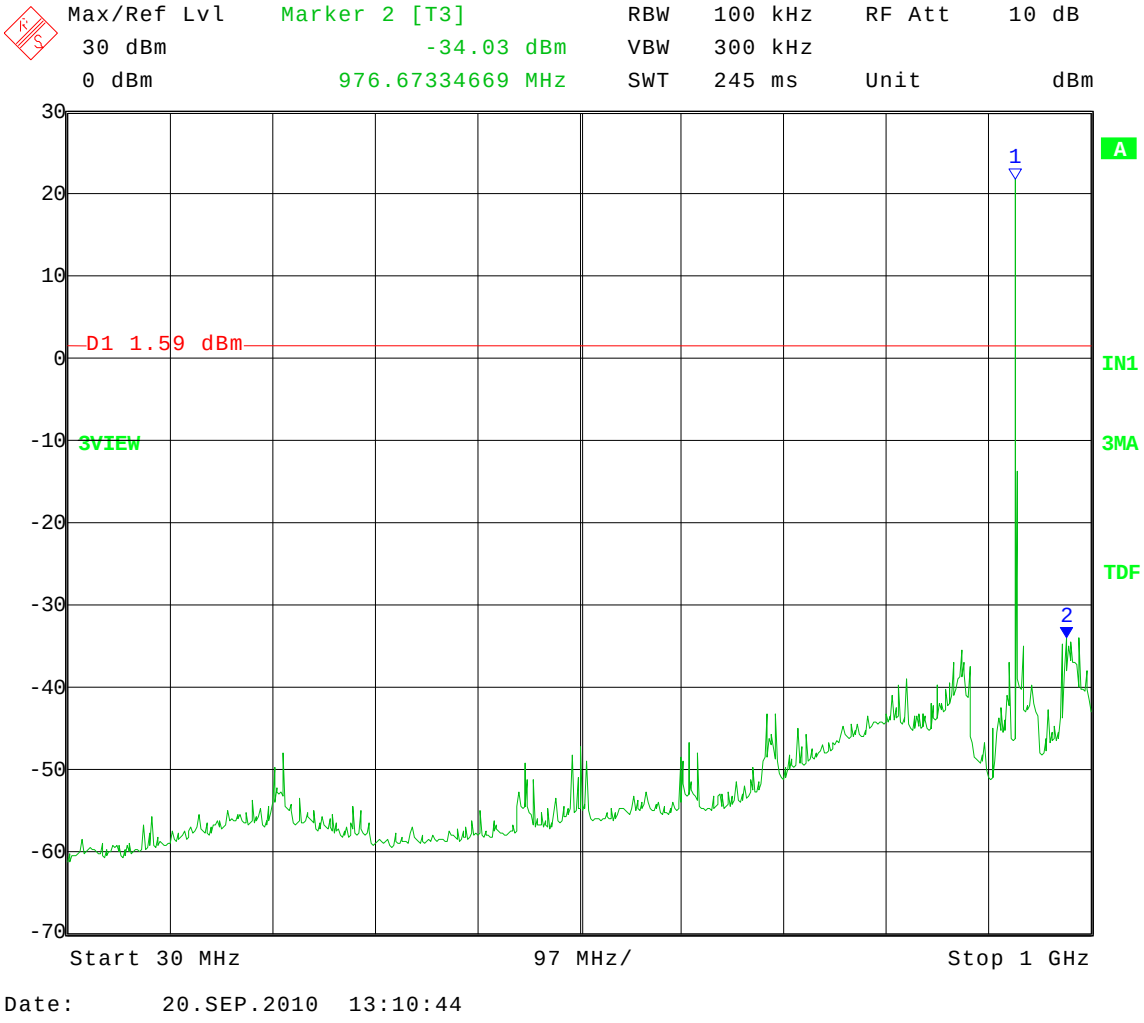
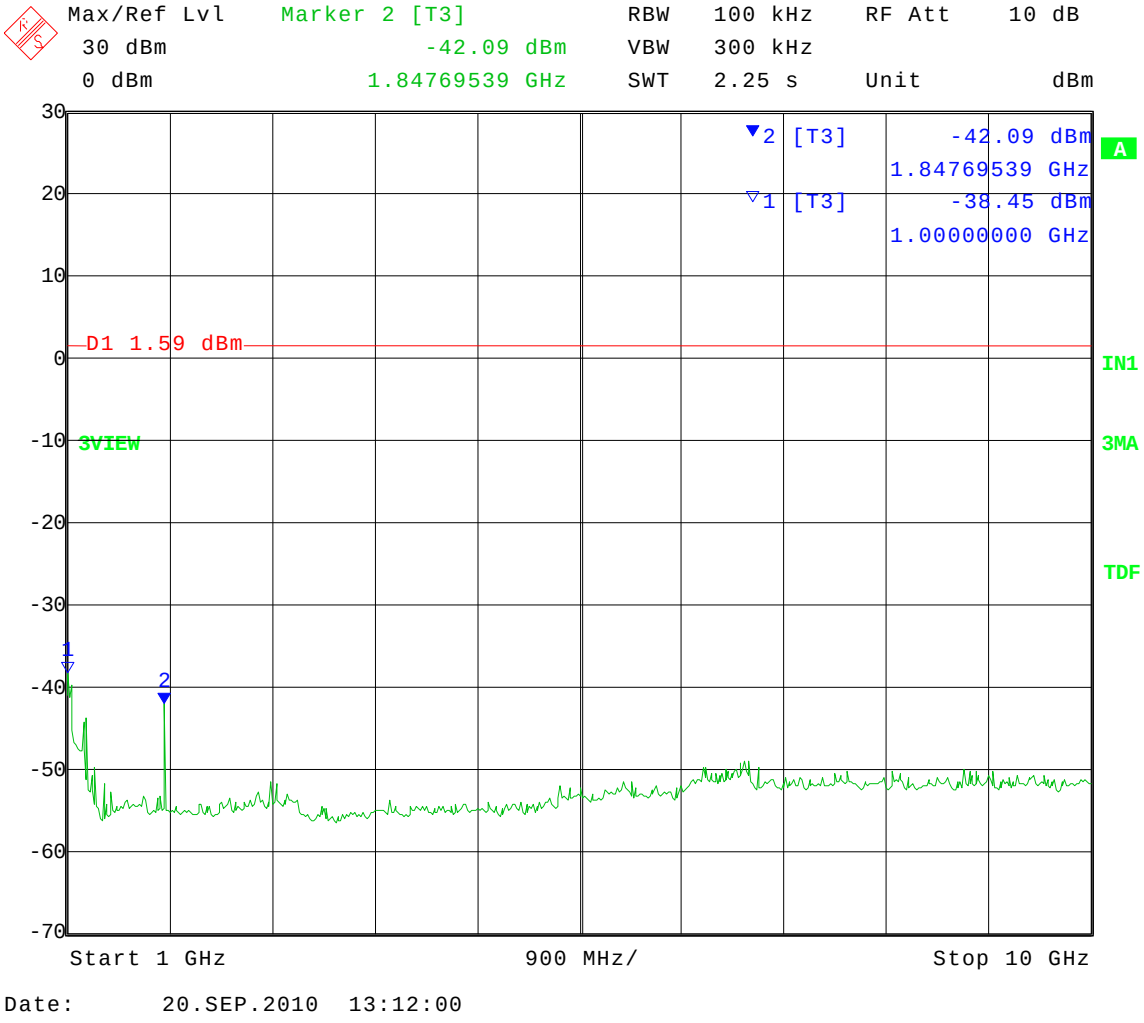
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz

Frequency Range: 30 to 1000 MHz
Limit = 1.59 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Conducted Spurious Emissions
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz

Frequency Range: 1 to 10 GHz
Limit = 1.59 dBm
All Spurious Emissions at Least 20 dB below Peak Level of In Band Frequency



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Appendix B

7.0 Band Edge Measurements

Rule Part:

15.247(d)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

20 dB below the highest level of the desired power in a 100 kHz bandwidth

Results:

Compliant
The highest frequency of operation of the EUT is greater than 30 MHz from the nearest restricted band as defined in section 15.205.

Sample Equation(s):

N/A

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through a MCX to SMA connector. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a hyper terminal to control the module. The EUT was set to transmit at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low and high channels of the operating band. The EUT was also set in its normal frequency hopping mode of operation and verified to be compliant with the band edge requirements.

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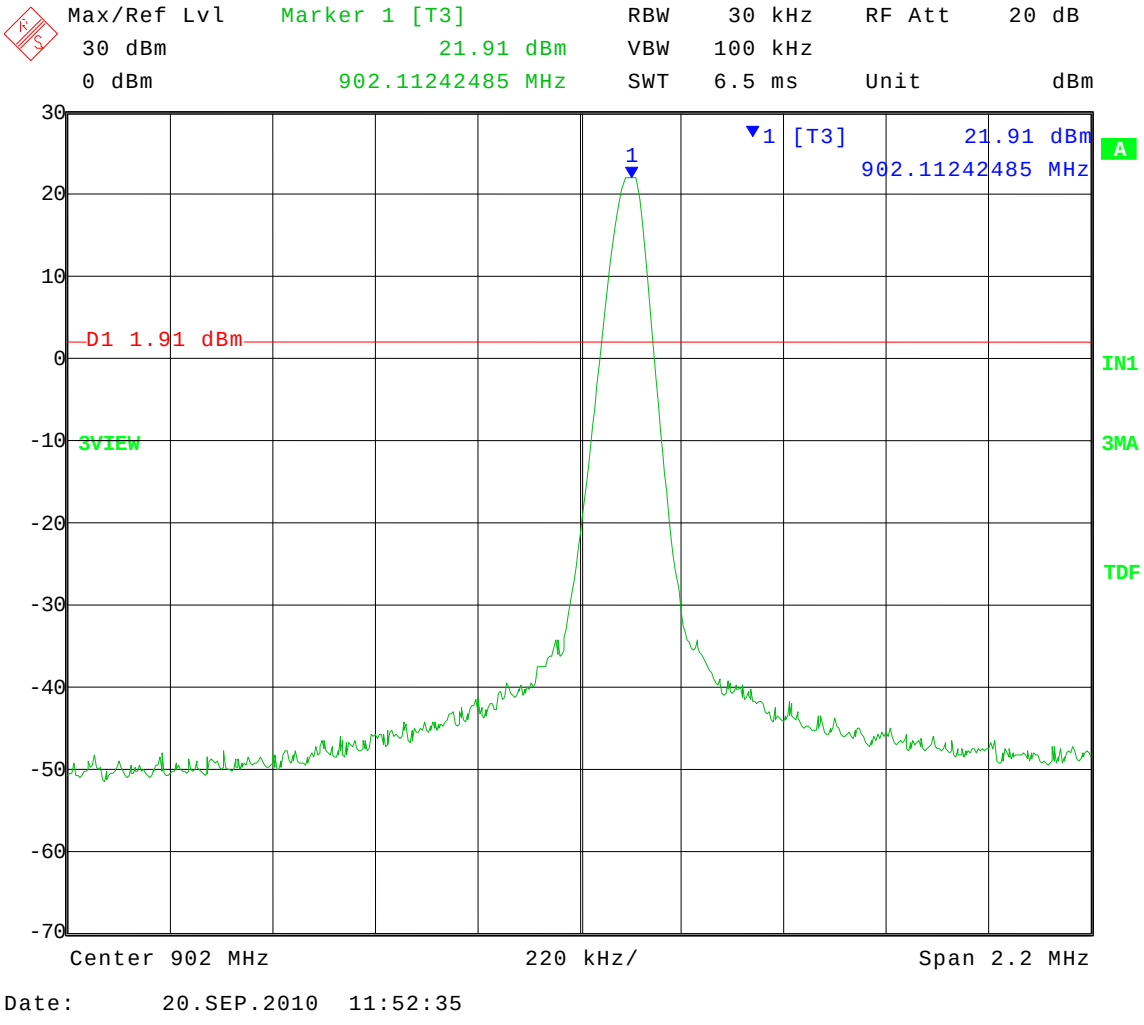
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Band-Edge
Operator: Adam A
Comment: Low Channel: Frequency – 902.1 MHz

Band-Edge Frequency = 902 MHz
Band-Edge > 20 dB Below Peak In-Band Emission



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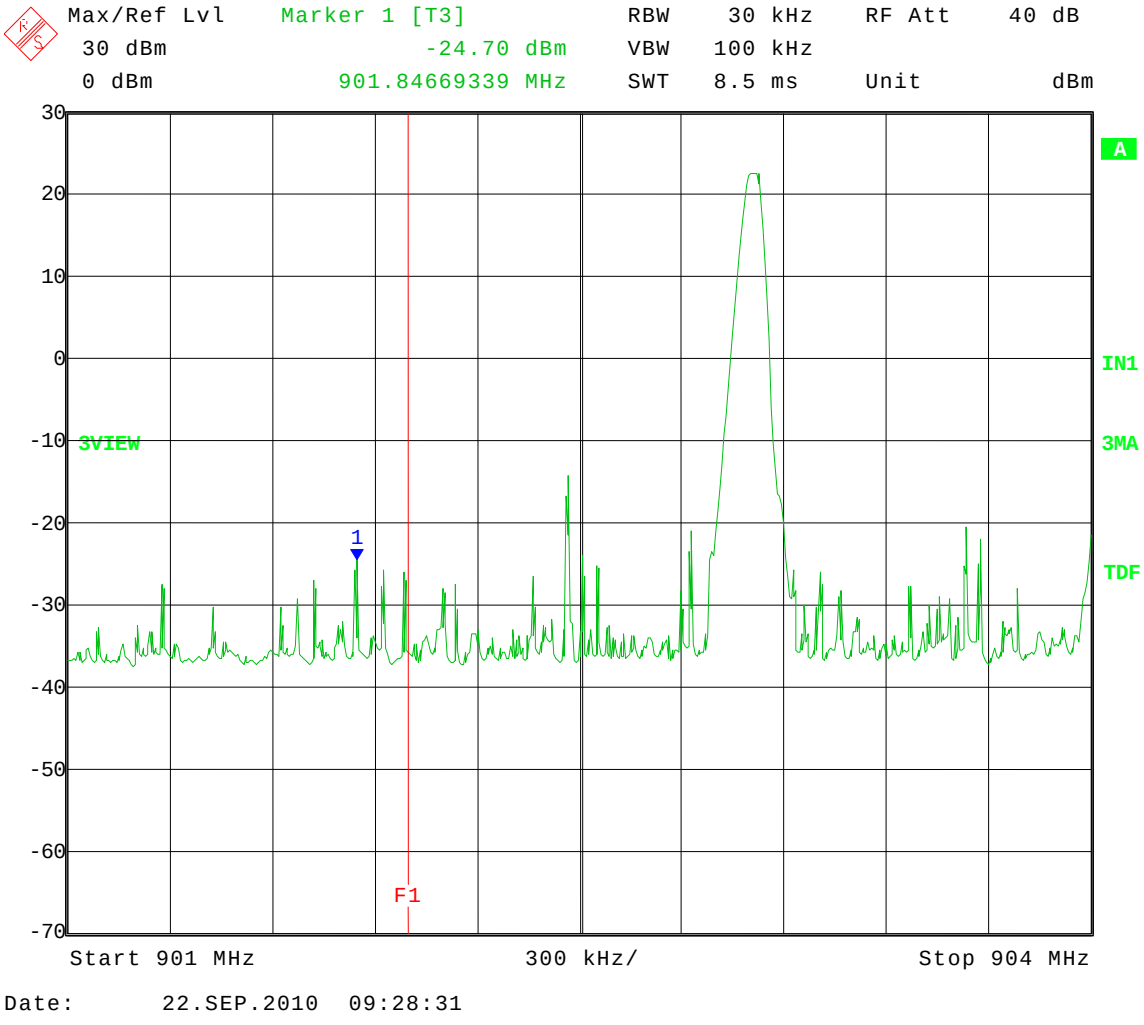
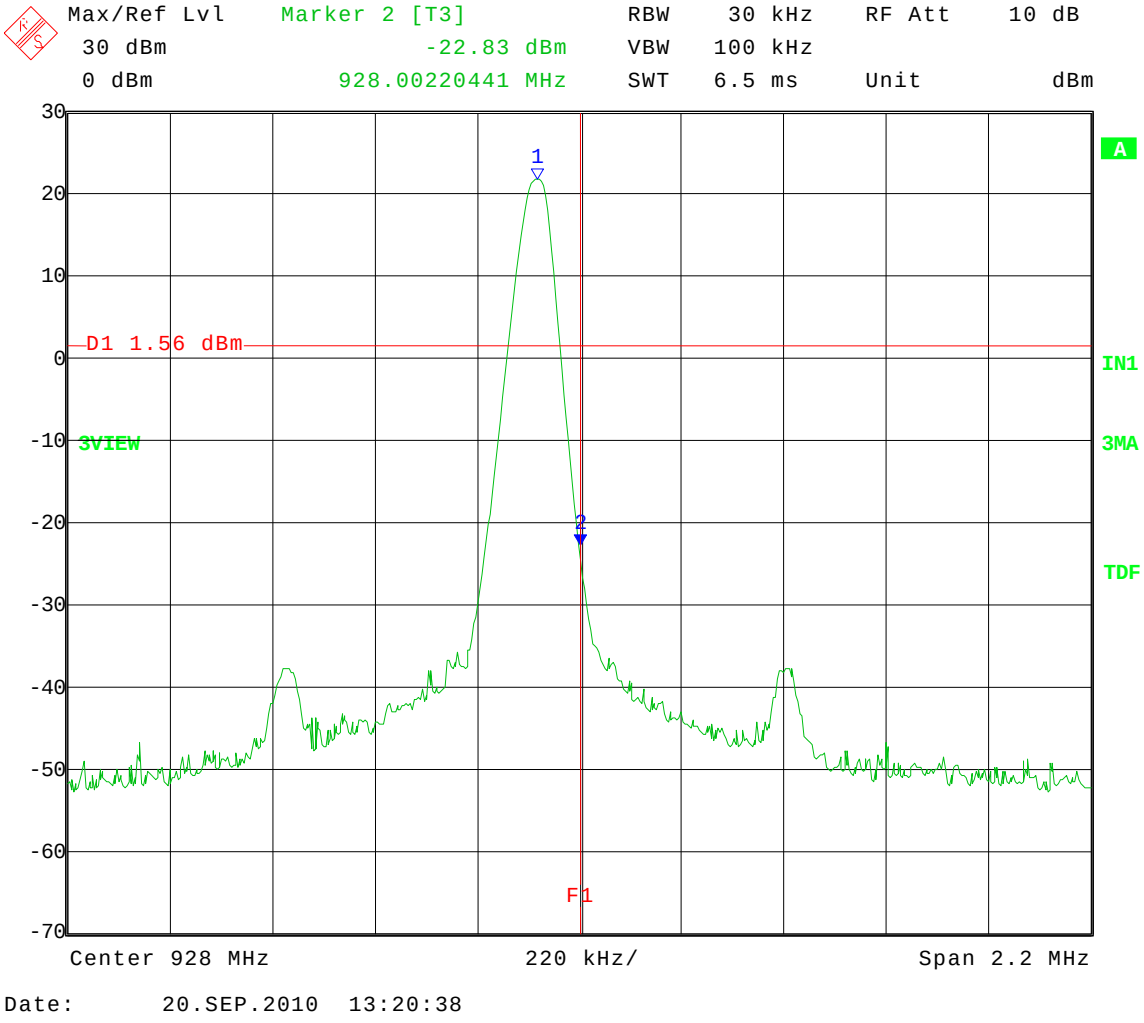
Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Band-Edge
Operator: Adam A
Comment: Hopping ON – Lowest channel: 903 MHz

Band-Edge Frequency = 902 MHz
Band-Edge > 20 dB Below Peak In-Band Emission



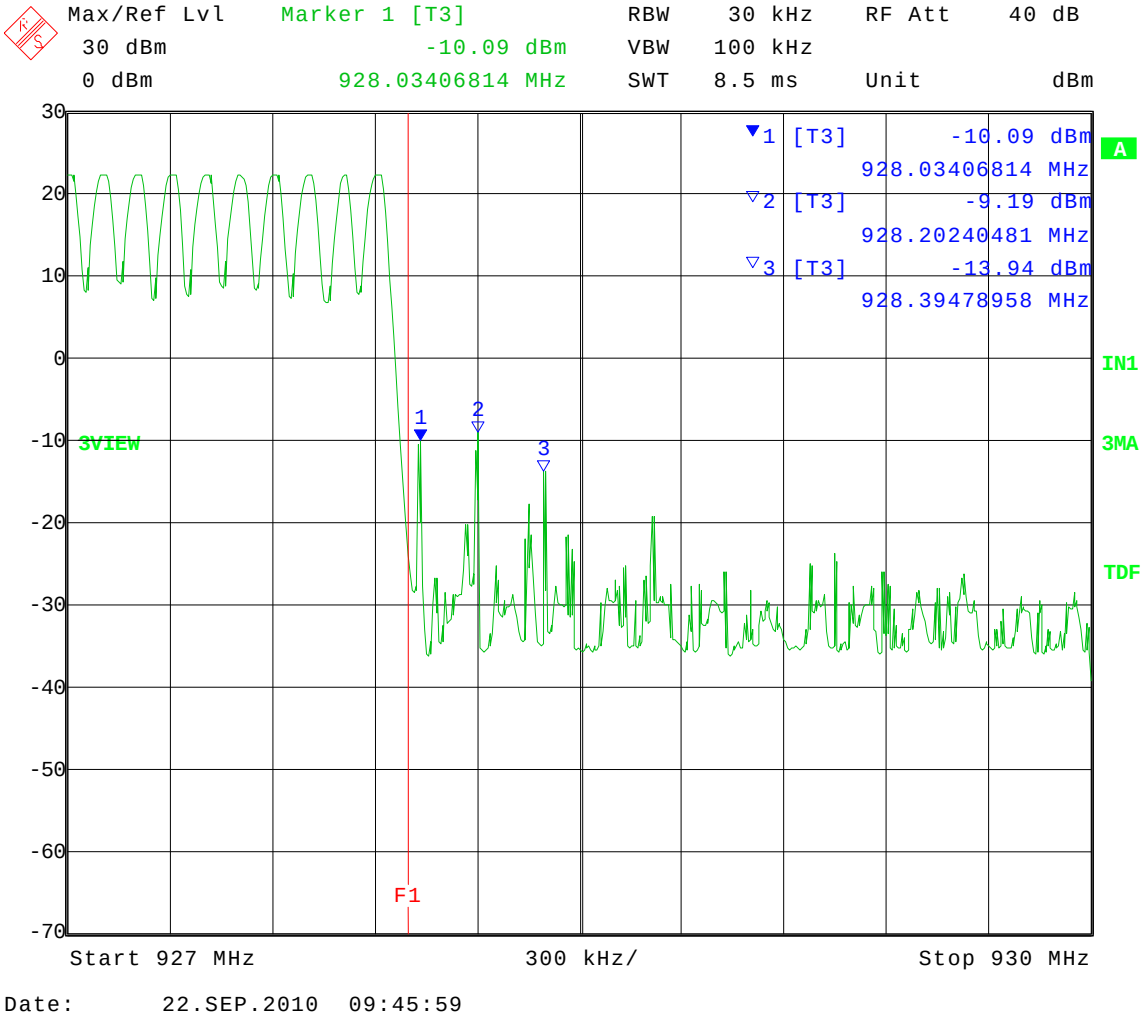
Test Date: 9-20-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Band-Edge
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz

Band-Edge Frequency = 928 MHz
Band-Edge > 20 dB Below Peak In-Band Emission



Test Date: 9-22-2010
Company: Schweitzer Engineering
EUT: SEL-LG-SBR
Test: Band-Edge
Operator: Adam A
Comment: High Channel: Frequency – 927.9 MHz – Hopping Mode

Band-Edge Frequency = 928 MHz
Band-Edge > 20 dB Below Peak In-Band Emission



Appendix B

8.0 Radiated Spurious Emissions in Restricted Bands

Rule Part:

15.209(a) and 15.205(c)

Test Procedure:

ANSI C63.4-2003and ANSI C63.10-2009

Limit:

15.209(a)

Results:

Compliant

Sample Equation(s):

Final Corrected = Total Level - Duty Cycle Correction
Margin = Limit - Final Corrected
Level = Total Level - System Loss - Antenna Factor

Notes:

This was a radiated emissions measurement. The EUT was connected to a 5.25dBi gain whip antenna through a MCX to N cable.
The EUT was powered through a serial interface cable that was connected to the bench supply set to 5 VDC. The serial cable was also connected to a computer running a hyper terminal to set the module in the mode desired and then removed for testing.
The EUT was set to transmit at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.
The normal operation of the device has a pulse time greater than 100 ms therefore no duty cycle correction factor was applied. Average measurements were performed with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

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Appendix B

High Channel Spurious Emissions

Radiated Spurious Emissions – 30 MHz to 10 GHz

Tested at a 3 Meter Distance 30 MHz - 5 GHz

Tested at a 1 Meter Distance 5 - 10 GHz

EUT: SEL-LG-SBR
Manufacturer: Schweitzer Engineering Laboratories
Operating Condition: 73deg F; 53% R.H.
Test Site: Chamber G1
Operator: Adam A
Test Specification: FCC Part 15.247
Comment: Battery Operated (5 VDC from Bench Supply)
Date: 9-22-2010
Notes: All other emissions at least 20 dB under the limit.
Average measurements made with 1 MHz resolution bandwidth and 10 Hz video bandwidth

Frequency (MHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
2783.700	Max Peak	Vertical	62.98	29.48	-36.8	55.66	0	55.66	74.00	18.3	1.17	188	H / RB
	Average		60.22			52.90	0	52.90	54.00	1.1			
	Max Peak	Horizontal	51.92			44.60	0	44.60	74.00	29.4	1.20	275	
	Average		44.55			37.23	0	37.23	54.00	16.8			
7423.200	Max Peak	Vertical	52.07	36.35	-27.7	60.72	0	60.72	83.54	22.8	1.15	80	H / RB
	Average		48.97			57.62	0	57.62	63.54	5.9			
	Max Peak	Horizontal	50.42			59.07	0	59.07	83.54	24.5	1.15	163	
	Average		46.38			55.03	0	55.03	63.54	8.5			

Legend: H=Harmonic ; RB=Restricted Band ; F=Fundamental
Level = Total Level - System Loss - Antenna Factor
Final Corrected = Total Level - Duty Cycle Correction
Margin = Limit - Final Corrected

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Appendix B

Middle Channel Spurious Emissions

Radiated Spurious Emissions – 30 MHz to 10 GHz

Tested at a 3 Meter Distance 30 MHz - 5 GHz

Tested at a 1 Meter Distance 5 - 10 GHz

EUT: SEL-LG-SBR
Manufacturer: Schweitzer Engineering Laboratories
Operating Condition: 73deg F; 53% R.H.
Test Site: Chamber G1
Operator: Adam A
Test Specification: FCC Part 15.247
Comment: Battery Operated (5 VDC from Bench Supply)
Date: 9-22-2010
Notes: All other emissions at least 20 dB under the limit.
Average measurements made with 1 MHz resolution bandwidth and 10 Hz video bandwidth

Frequency (MHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
2745.000	Max Peak	Vertical	54.51	29.36	-36.3	47.57	0	47.57	74.00	26.4	1.18	308	H / RB
	Average		50.12			43.18	0	43.18	54.00	10.8			
	Max Peak	Horizontal	52.16			45.22	0	45.22	74.00	28.8	1.15	45	
	Average		45.17			38.23	0	38.23	54.00	15.8			
7320.000	Max Peak	Vertical	53.63	36.08	-28.5	61.21	0	61.21	83.54	22.3	1.27	340	H / RB
	Average		49.87			57.45	0	57.45	63.54	6.1			
	Max Peak	Horizontal	52.65			60.23	0	60.23	83.54	23.3	1.10	318	
	Average		49.61			57.19	0	57.19	63.54	6.4			

Legend: H=Harmonic ; RB=Restricted Band ; F=Fundamental
Level = Total Level - System Loss - Antenna Factor
Final Corrected = Total Level - Duty Cycle Correction
Margin = Limit - Final Corrected

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Appendix B

Low Channel Spurious Emissions

Radiated Spurious Emissions – 30 MHz to 10 GHz

Tested at a 3 Meter Distance 30 MHz - 5 GHz

Tested at a 1 Meter Distance 5 - 10 GHz

EUT: SEL-LG-SBR
Manufacturer: Schweitzer Engineering Laboratories
Operating Condition: 73deg F; 53% R.H.
Test Site: Chamber G1
Operator: Adam A
Test Specification: FCC Part 15.247
Comment: Battery Operated (5 VDC from Bench Supply)
Date: 9-22-2010
Notes: All other emissions at least 20 dB under the limit.
Average measurements made with 1 MHz resolution bandwidth and 10 Hz video bandwidth

Frequency (MHz)	Measurement Type	Antenna Polarization	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	EUT Angle (deg)	Comment
2706.300	Max Peak	Vertical	50.89	29.25	-36.3	43.84	0	43.84	74.00	30.2	1.10	10	H / RB
	Average		44.25			37.20	0	37.20	54.00	16.8			
	Max Peak	Horizontal	50.07			43.02	0	43.02	74.00	31.0	1.10	256	
	Average		39.71			32.66	0	32.66	54.00	21.3			
7216.800	Max Peak	Vertical	54.32	35.8	-28.9	61.22	0	61.22	83.54	22.3	1.30	295	H / RB
	Average		51.26			58.16	0	58.16	63.54	5.4			
	Max Peak	Horizontal	50.96			57.86	0	57.86	83.54	25.7	1.20	163	
	Average		45.52			52.42	0	52.42	63.54	11.1			

Legend: H=Harmonic ; RB=Restricted Band ; F=Fundamental
Level = Total Level - System Loss - Antenna Factor
Final Corrected = Total Level - Duty Cycle Correction
Margin = Limit - Final Corrected

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Appendix C

1.0 Test Photos - AC Line Conducted Emissions

Item0: SEL-LG-SBR, Model SEL-LG-SBR
Item1: MMG (Manufacturer's Marketing Group) 5.25dBi Whip Antenna P/N 16-1000-0
Item2: AC Adapter, Model CSD0450500U-31

AC Line Conducted Emissions – Front

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Appendix C

AC Line Conducted Emissions – Back

Appendix C

2.0 Test Equipment - AC Line Conducted Emissions

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

D.L.S. Wisconsin – Site 1 (Screen room)

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7/10	7/11
LISN	Solar	9252-50-R-24-BNC	961019	9 kHz – 30 MHz	7/10	7/11
Filter- High-Pass	SOLAR	7930-120	090702	120 kHz – 30 MHz	1/10	1/11
Limiter	Electro-Metrics	EM-7600	706	9 kHz – 30 MHz	1/10	1/11

Appendix C

3.0 Measurement Data - AC Line Conducted Emissions

Rule Part:

15.207

Test Procedure:

ANSI C63.4-2009 and ANSI C63.10-2009

Limit:

15.207(a)

Results:

Compliant

Sample Equation(s):

None

Notes:

This was an AC Conducted emissions measurement. The EUT was connected to a 5.25dBi gain whip antenna through a MCX to N cable.
The EUT was powered through a serial interface cable that was connected to an off the shelf AC Adapter model CSD0450500U-31 operating at 4.5 VDC 500 mA with an input of 120 VAC 60Hz.

FCC Part 15.207 Class B

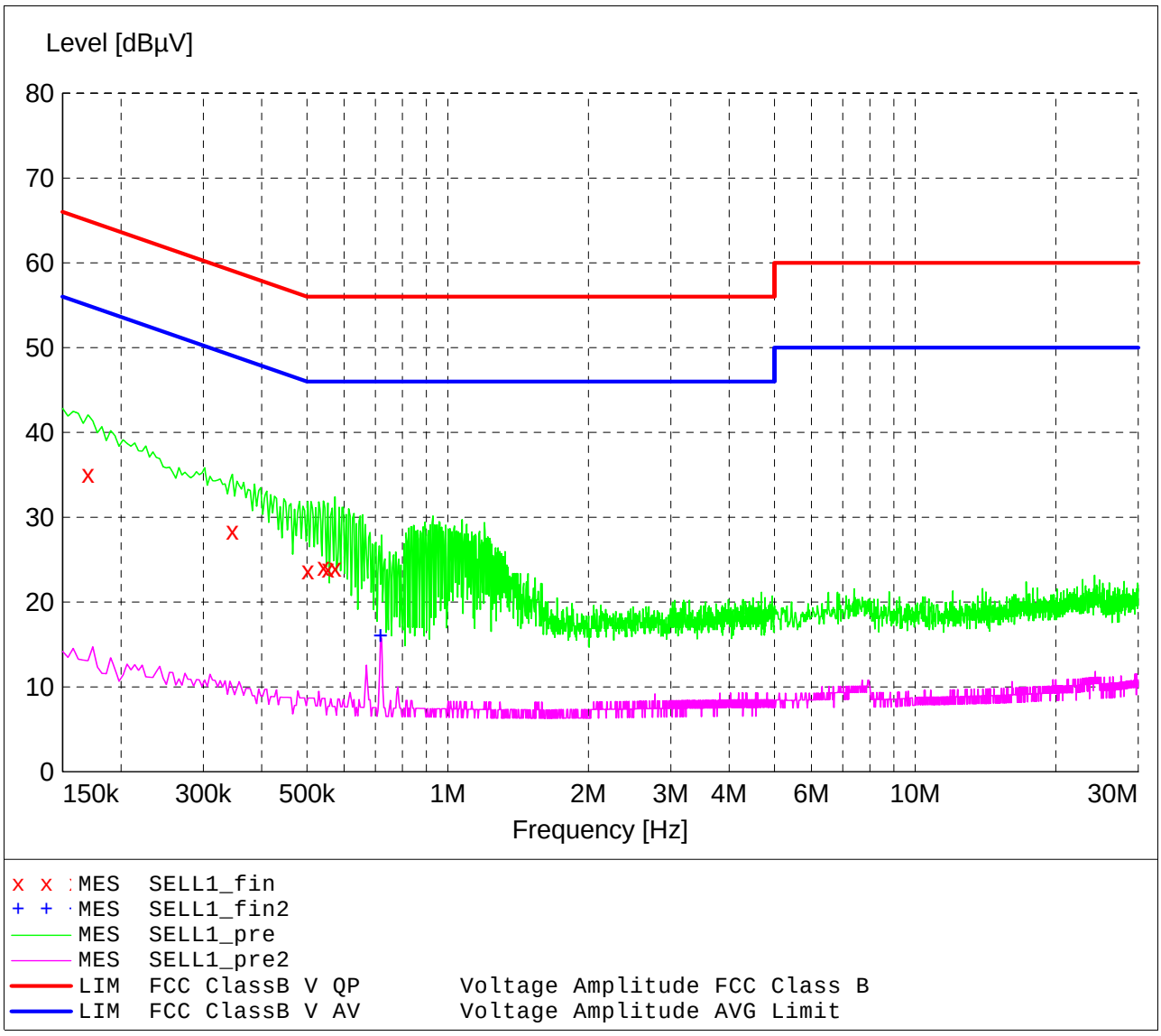
Voltage Mains Test

EUT: SEL-LG-SBR
Manufacturer: Schweitzer Engineering Laboratories, Inc.
Operating Condition: 68 deg. F, 33% R.H.
Test Site: DLS O.F. Screenroom
Operator: Adam A
Test Specification: Line 1
Comment: 120 VAC 60 Hz
Date: 11-30-2010

SCAN TABLE: "Line Cond Scrn RmFin"

Short Description: Line Conducted Emissions

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
9.0 kHz	150.0 kHz	4.0 kHz	QuasiPeak	2.0 s	200 Hz	LISN DLS#128
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak CISPR AV	2.0 s	9 kHz	LISN DLS#612



MEASUREMENT RESULT: "SELL1_fin"

11/30/2010 11:47AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.170000	35.10	15.7	65	29.9	QP
0.346000	28.40	14.7	59	30.7	QP
0.502000	23.70	14.3	56	32.3	QP
0.542000	24.20	14.2	56	31.8	QP
0.554000	23.90	14.2	56	32.1	QP
0.574000	24.00	14.2	56	32.0	QP

MEASUREMENT RESULT: "SELL1_fin2"

11/30/2010 11:47AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.718000	16.10	14.0	46	29.9	CAV

FCC Part 15.207 Class B

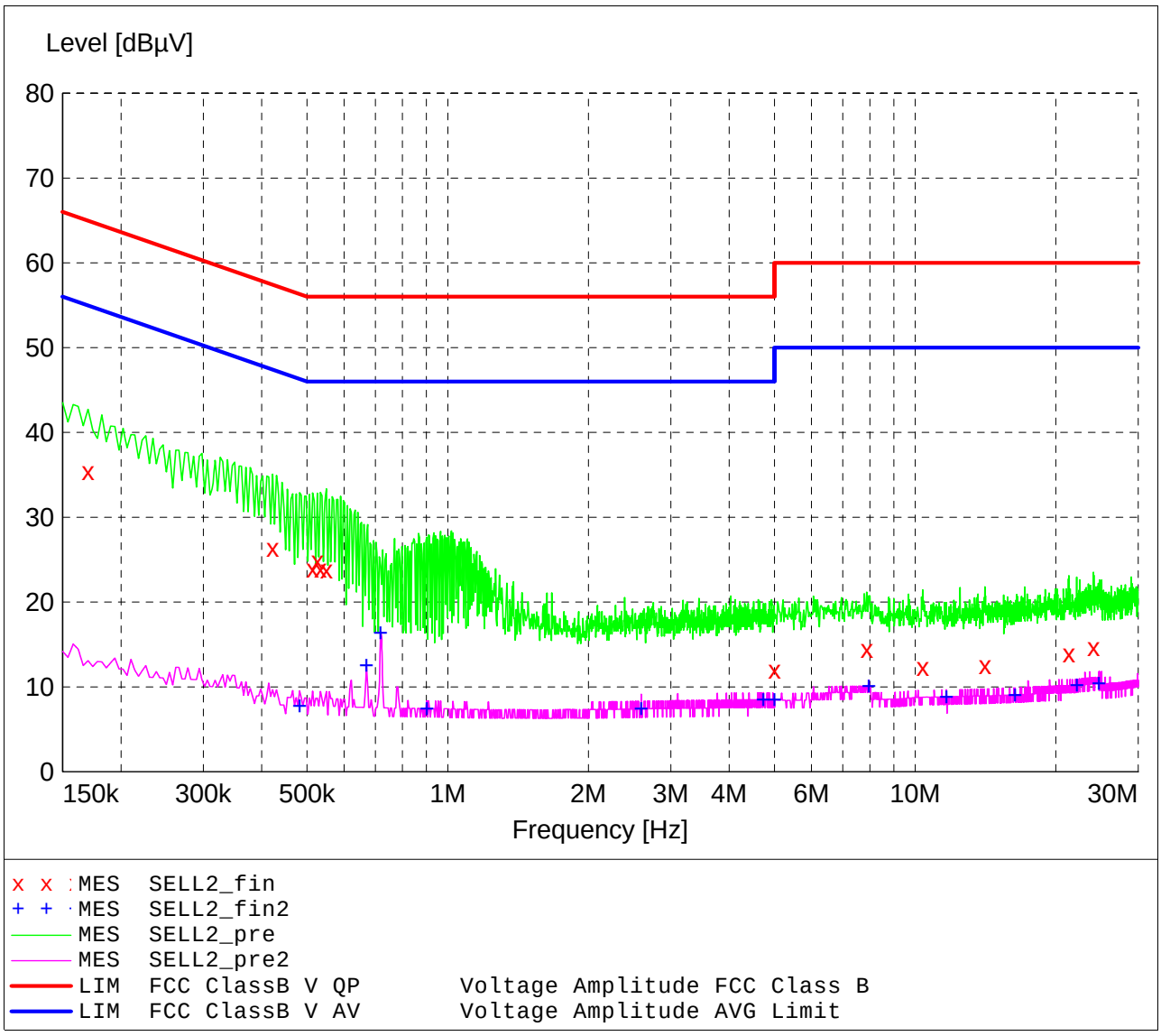
Voltage Mains Test

EUT: SEL-LG-SBR
Manufacturer: Schweitzer Engineering Laboratories, Inc.
Operating Condition: 68 deg. F, 33% R.H.
Test Site: DLS O.F. Screenroom
Operator: Adam A
Test Specification: Line 2
Comment: 120 VAC 60 Hz
Date: 11-30-2010

SCAN TABLE: "Line Cond Scrn RmFin"

Short Description: Line Conducted Emissions

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
9.0 kHz	150.0 kHz	4.0 kHz	QuasiPeak	2.0 s	200 Hz	LISN DLS#128
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak CISPR AV	2.0 s	9 kHz	LISN DLS#612



MEASUREMENT RESULT: "SELL2_fin"

11/30/2010 11:51AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.170000	35.40	15.7	65	29.6	QP
0.422000	26.40	14.4	57	31.0	QP
0.514000	23.90	14.2	56	32.1	QP
0.526000	24.90	14.2	56	31.1	QP
0.534000	23.90	14.2	56	32.1	QP
0.550000	23.80	14.2	56	32.2	QP
5.000000	12.00	14.0	56	44.0	QP
7.880000	14.50	14.1	60	45.5	QP
10.380000	12.30	14.4	60	47.7	QP
14.100000	12.50	14.5	60	47.5	QP
21.320000	13.90	14.9	60	46.1	QP
24.080000	14.70	15.1	60	45.3	QP

MEASUREMENT RESULT: "SELL2_fin2"

11/30/2010 11:51AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.482000	7.80	14.3	46	38.5	CAV
0.670000	12.60	14.1	46	33.4	CAV
0.718000	16.40	14.0	46	29.6	CAV
0.902000	7.50	13.9	46	38.5	CAV
2.594000	7.40	13.9	46	38.6	CAV
4.734000	8.50	14.1	46	37.5	CAV
5.000000	8.50	14.0	46	37.5	CAV
7.960000	10.10	14.1	50	39.9	CAV
11.660000	8.80	14.4	50	41.2	CAV
16.360000	9.10	14.6	50	40.9	CAV
22.180000	10.20	14.9	50	39.8	CAV
24.740000	10.40	15.1	50	39.6	CAV

END OF REPORT

Revision #	Date	Comments	By
1.0	09-24-2010	Preliminary Release	AA
1.1	10-01-2010	Edit Pg 5, added footer of page #'s, update pg #'s, model name change	JS
1.2	10-04-2010	Additional Descriptions , Notes, updated NVLAP certificate	AA
1.3	10-05-2010	Specify Freq range & adjust bookmarks	JS
1.4	11-19-2010	Correction - Antenna is 5.25dBi, not 5dBi	JS
1.5	12-01-2010	Added AC Line Conducted section	AA