LS Research, LLC
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ENGINEERING TEST REPORT # 306551-TR-TCB-v2

Compliance Testing of:
SmartRelay Module

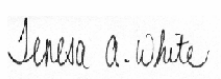
Test Date(s):
December 5TH and 6TH, 2006

Prepared For:
SimonsVoss Technologies, Incorporated
10125 South 52ND Street
Franklin, WI 53132
U.S.A.

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.209, and 15.109
General Operating Requirements for Low-Power License-Exempt Transceivers

This Test Report is issued under the Authority of:
Brian E. Petted, VP of Engineering

Signature:  Date: December 7, 2006

Test Report Prepared by:	**Tested by:**
Teresa A. White, Document Coordinator	Abtin Spantman
Signature: 	Signature: 
Date: December 7, 2006	Date: December 7, 2006

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LSC Revision Control

Date	Revision #	Revised By
2006-11-27	0.0	TW/AS

EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.209
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Low-Power License-Exempt Transmitters.

References:	FCC Part 15, Subpart B, Section 15.109
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for a Digital Device or a Non-Intentional Radiator.

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)	2005	Code of Federal Regulations - Telecommunications
ANSI C63.4	2004	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	2003	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.

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:	**SimonsVoss Technologies, Incorporated**
Address:	**10125 South 52ND Street Franklin, WI 53132 U.S.A**
Contact Person:	**Mr. Warren Simonsen**
Contact Phone:	**1-414-421-2496**
Contact Email:	**WARREN.SIMONSEN@SIMONS-VOSS.US**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	SmartRelay Module
Model Number:	SREL.ADV
Serial Number:	Engineering Unit

2.3 ASSOCIATED ANTENNA DESCRIPTION

The AM transponder function is tested and covered in this report.
The AM transponder portion of the product uses a proprietary custom internal AM-Loop type antenna.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	25 kHz
RF Power in Watts	0.897 mW
Conducted Output Power (in dBm)	N/A
Field Strength (and at what distance)	104.3 dBµV/m @1m ; 25.0 kHz
Occupied Bandwidth (99% BW)	8.25 kHz
Type of Modulation	AM / ASK
Emission Designator	8k25 A1D
Transmitter Spurious (worst case)	57.2 dBµV/m @1m ; 32.7 kHz
Frequency Tolerance %, Hz, ppm	10 %
Microprocessor Model # (if applicable)	Microchip PIC 16 family
EUT will be operated under FCC Rule Part(s)	47 CFR 15.209
Antenna Information:	
a) Antenna Type	Custom, internal permanent.
b) Detachable/Non-Detachable	Non-detachable
c) Antenna Gain (in dBi)	Not declared
Modular Filing	☐ Yes ☒ No

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	√	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: 47 CFR 2.1093
- Measurement Distance: 3 m
- RF Value: 0.0547 ☒ V/m ☐ A/m ☐ W/m^2
  ☒ Measured ☐ Computed ☐ Calculated

2.5 PRODUCT DESCRIPTION

General Family of Product description:
The SimonsVoss entry access control system is designed to control entry access points by means of an RF encrypted key and lock combinations, along with interface modules for incorporation into legacy systems. The system is designed to provide complete wireless access control requiring no additional holes, no wires, and all the features of electronic access control. Each lockset can support up to 64,000 users, while keeping track of the last 5,000 transactions. User access can be limited by time and day or the lock can be automatically programmed to unlock and relock at predetermined times. Access is granted with the use of a pebble-shaped transponder, a finger-print biometric transponder, or a wireless keypad each of which has won awards for their design and appearance.

In addition to the locksets for the door, the same transponders can be used to activate a SmartRelayTM which contains all the same access control features as the lockset, but activates a relay in place of the mechanical interface for overhead doors, parking gates, and other motor-driven portals. The SmartRelay can be expanded with up to 16 8-output SmartOutputTM modules so that each transponder can activate a unique combination of up to 128 relay outputs for elevator and tool-crib control. The entire system can be programmed and monitored through a network or individually with the use of a proprietary configuration tool.

SimonsVoss entry keys (Left photo) and typical lock mechanism (right photo)

A sampling of other SimonsVoss Interface Devices

(**Product Description continued)**

Specific "Equipment Under Test" (EUT) description:
This report covers the testing that was performed on the *"Smart Relay"*, in assessing conformity to the regulations as set forth by FCC and IC.

The *"Smart Relay"* is used to gain access into a secured entry system lock mechanism, such as a garage door, locked gates, or lighting and HVAC systems. The "Smart Relay" extract status from the lock mechanism, and perform certain control functions (i.e. command the lock to open or close) on the secured entry point. The Smart Relay communicates with a transceiver that uses a 25kHz AM, encrypted, rolling-code signal. The Smart Relay is powered by an external AC/DC power source, and is regulated on board. The Smart Relay also has the ability to communicate to a "Smart Output" device through an RS 485. The Smart Relay can also activate the relay automatically, without a transponder, based on the time and date if that is required

Operating power during the test was provided by a generic 9 VDC, 200 mA wall transformer.

SimonsVoss "Smart Relay"

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	22 ^{0}C
Humidity:	44%
Pressure:	98 kPa

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Paragraph	Test Requirements	Compliance (yes/no)
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.107	Power Line Conducted Emissions Measurements	Yes
15.109	Un-Intentional Radiated Emissions	Yes
15.207	Power Line Conducted Emissions Measurements	Yes
15.209 (a)	Maximum RF Output Power	Yes
15.209 (c)	Maximum RF Spurious Emissions	Yes
15.109 & 15.205	Transmitter General 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)**

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 15.209, and Industry Canada RSS-210 (2005), Section 2.6 for a Low-Power License-Exempt Transmitters, as well as the specification of FCC Title 47, CFR Part 15.109, and Industry Canada RSS-210 (2005), Section 7 for non-intentional radiators.

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 CW mode during the transmitter testing, and continuous receive mode during the receiver testing, using power as provided by a generic 9 VDC, 200 mA wall transformer. The unit was also tested in normal operating mode, with the RS-485 connection to a "Smart Output" device. The unit is capable of operating on only one channel, and was placed in CW mode by modifying the firmware code on the transceiver.

The applicable limits apply at a 300 meter distance. The measurement distance was reduced to 30m, 20m, 10m and 3m in succession, while measurements for the RF emissions were carried out in order to calculate a more accurate field attenuation rate. The RF power and emissions were finally measured at 1 meter separation in a semi-anechoic chamber. This device would qualify for the 40 dB per decade linear distance extrapolation factor as allowed under 47CFR 15.31(f)(2).

The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment.

5.2 Test Procedure

Final Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 9 kHz to 1000 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. An active Loop antenna was used to measure emissions from 9 kHz to 30MHz.
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. 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

The EUT was rotated along three orthogonal axis during the investigations to find the highest emission levels.

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 resolution bandwidths as prescribed in ANSI C63.4 (2003).

Test Equipment List

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 as described within the specification of FCC Title 47, CFR Part 15.209, and Industry Canada RSS-210 (2005), Section 2.6 for a Low-Power License-Exempt Transmitters, as well as the specification of FCC Title 47, CFR Part 15.109, and Industry Canada RSS-210 (2005), Section 7 for non-intentional radiators. 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

Transmitter Limits

The maximum peak output power of an intentional radiator in the 9-490 kHz band, as specified in Title 47 CFR 15.209, is calculated in a formula as described below. The harmonic and spurious RF emissions, with appropriate receiver bandwidths, as specified in 15.209 (c), shall be below the measured power of the desired signal, and must also meet the requirements described in 15.205(c) where applicable.

The following table depicts the general radiated emission limits. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to the fundamental emission of the intentional radiator as well as all other significant spurious signals.

Frequency (MHz)	Limit μV/m	Limit (dBμV/m)	Measurement Distance (m)
0.009-0.490	2400/F (kHz)	Note 1	300
0.490-1.705	24000/F (kHz)		30
1.705-30.0	30		30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
960-24,000	500	54.0	3

Note 1: Sample calculation for the Fundamental Emission of the transmitter:
Given the transmitter operates at a fundamental frequency of 25 kHz, the emission limit may be calculated:
2400/F = 2400/25 = 96.0 μV/m if measured at 300 meters separation.
Expressed in decibels: 20 $\log_{10}$ (96.0) = 39.64 dBμV/m at 300 m separation.
At 3 meters separation, the limit may be extrapolated by the addition of 40 dB/decade per 47CFR 15.31(f)(2)
If measured at 1.0 meter separation, the extrapolation is calculated at 40 Log_{10} (300/1) = 99.08dB

Limit for the fundamental emission = 39.64 dBμV/m + 99.08 dB = 138.72 dB/μV/m at 1 meter.

Receiver Limits

The following table depicts the Class B limits for an unintentional radiator. These limits are obtained from Title 47 CFR, Part 15.109(a), for radiated emissions measurements.

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
960-10,000	500	54.0

5.6 RADIATED EMISSIONS DATA CHART

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.209
Frequency Range Inspected: 9 kHz to 1000 MHz

Manufacturer:	SimonsVoss Technologies, Incorporated						
Date(s) of Test:	December 5TH and 6TH, 2006						
Test Engineer(s):	Abtin Spantman						
Voltage:	9.0 VDC from generic wall transformer, connected to AC Mains						
Operation Mode:	Normal, and CW modes						
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %						
EUT Power:	√	Single Phase 120 VAC		3 Phase ___VAC			
		Battery		Other:			
EUT Placement:	√	80cm non-conductive table		10cm Spacers			
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS			
Measurements:		Pre-Compliance		Preliminary	√	Final	
Detectors Used:	√	Peak	√	Quasi-Peak	√	Average	

Frequency (MHz)	Ant./EUT Polarity	Tx / Rx Mode	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	Emission Limit (dBμV/m)	Margin (dB)
0.0016	B / H	Tx	1.00	265	54.4	104.3	49.9
0.0261	B / H	Tx	1.00	265	47.4	104.3	56.9
0.0327	B / H	Tx	1.00	265	57.2	104.3	47.1
0.0495	B / H	Tx	1.00	265	50.2	104.3	54.1
57.52	H /H	Tx & Rx	1.00	120	22.4	40.0	17.6
60.01	H /H	Tx & Rx	1.00	120	25.6	40.0	14.4
67.52	H /H	Tx & Rx	1.00	120	19.7	40.0	20.3
70.03	H /H	Tx & Rx	1.00	120	17.5	40.0	22.5

Note: The reported emissions measurements were made at 1 meter separation distance for emissions below 30 MHz, and at 3 meter separation for emissions above 30MHz:

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen At 1 meter separation distance:

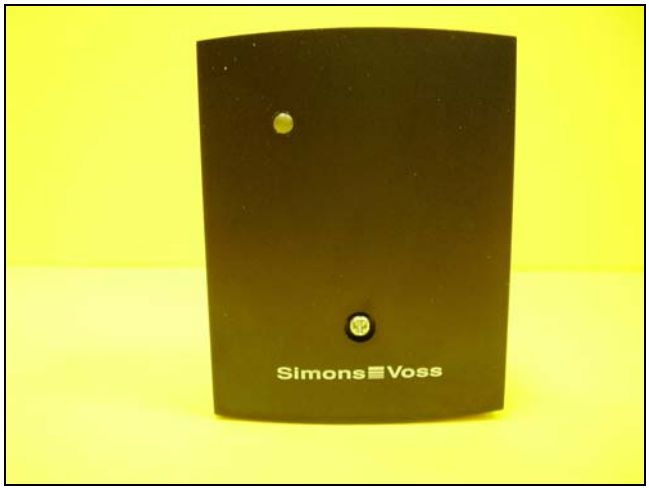
Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	15.209 Limit (dBμV/m)	Margin (dB)
0.025	B / H	1.00	265	104.3	138.7	34.4
0.050	B / H	1.00	265	66.3	104.3	38.0
0.075	B / H	1.00	265	62.9	104.3	41.4
0.100	B / H	1.00	265	55.9	104.3	48.4
0.125	B / H	1.00	265	56.7	104.3	47.6
0.150	B / H	1.00	265	52.4	104.3	51.9
0.175	B / H	1.00	265	54.0	104.3	50.3
0.200	B / H	1.00	265	51.0	104.3	53.3
0.225	B / H	1.00	265	50.8	104.3	53.5
0.250	B / H	1.00	265	48.8	104.3	55.5

Notes:

1) An Average Detector function was used in measurements below 30 MHz, a Quasi-Peak Detector was used in measurements between 30 MHz and 1 GHz, and an Average Detector was used in measurements above 1 GHz. A peak detector was used to ensure the peak emissions did not exceed 20 dB above the stated limits.
2) No significant emissions noted - measurement at receiver system noise floor.

5.7 Test Setup Photo(s) – Radiated Emissions Test

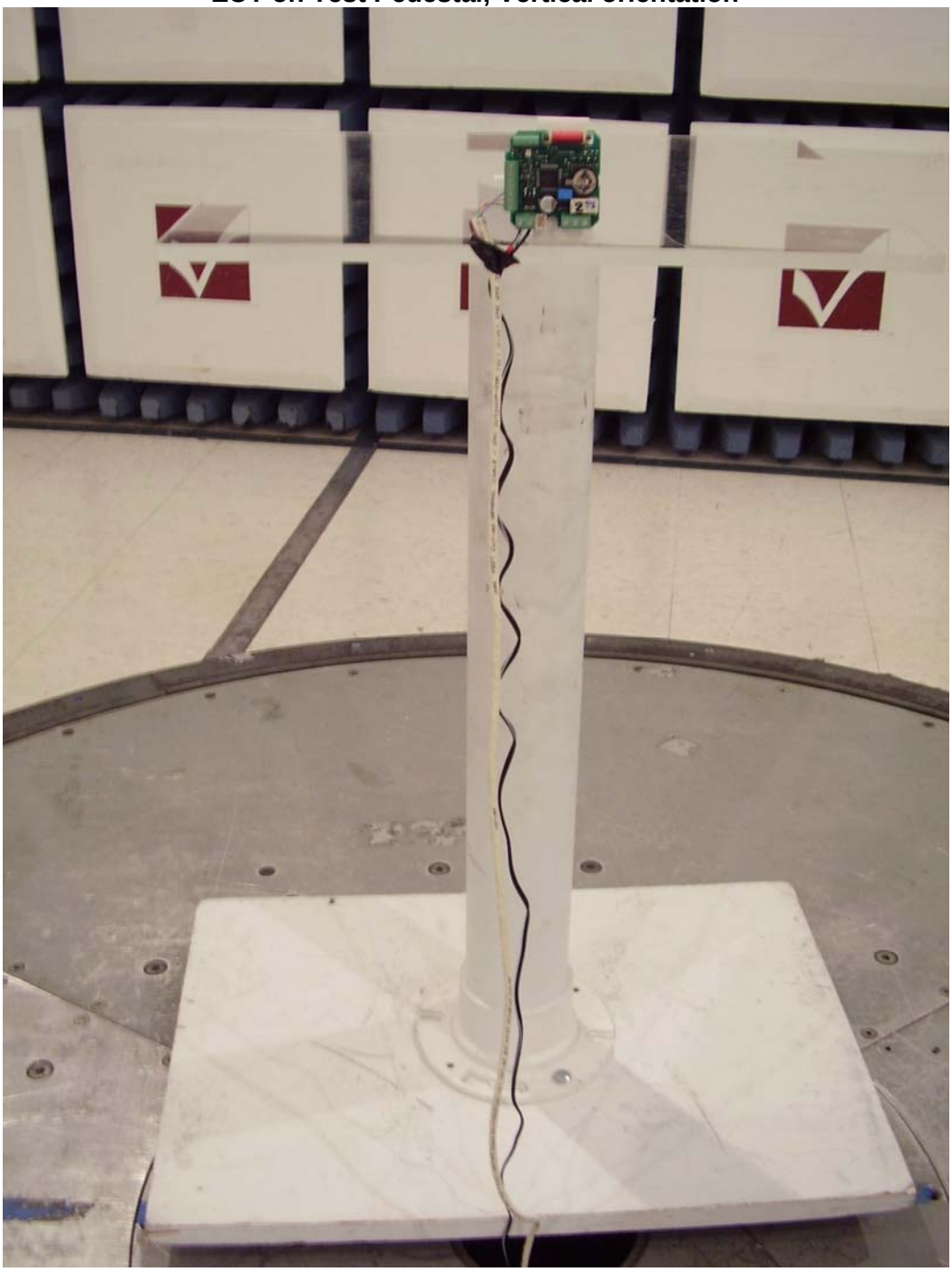
Vertical Orientation



Side **Orientation**

Horizontal Orientation

EUT on Test Pedestal, Vertical orientation



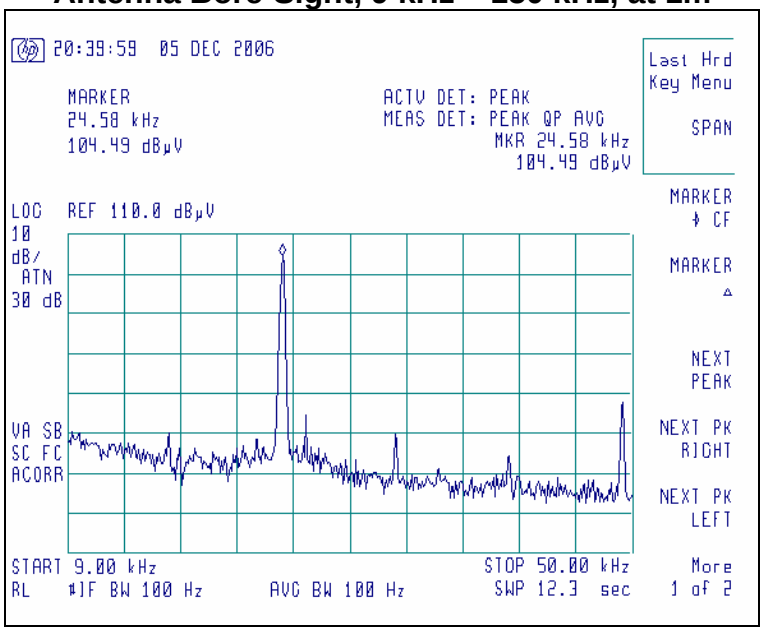
5.8 Screen Captures - Radiated Emissions Testing

These screen captures represent Peak Emissions. An Average Detector was used for radiated emission measurements below 30 MHz, a Quasi-Peak Detector was used for measurements between 30 MHz and 1000 MHz.

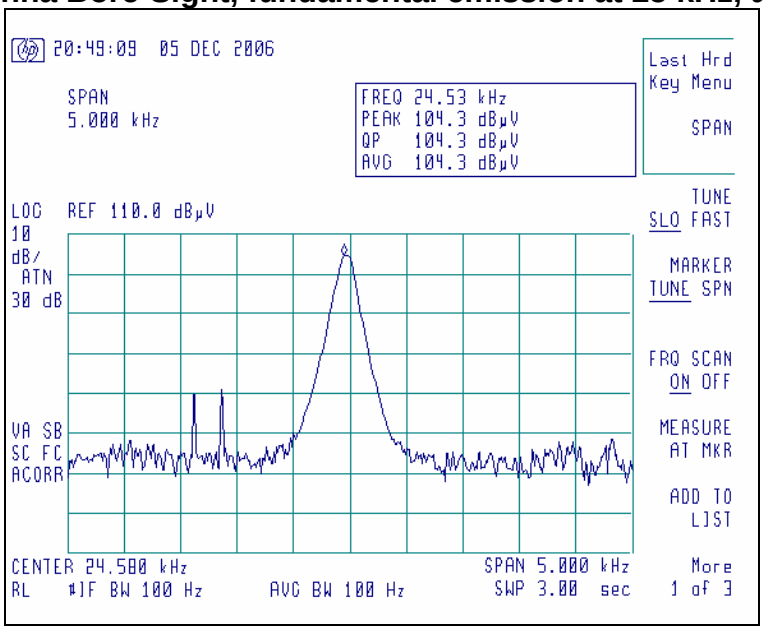
The signature scans shown here are from worst-case emissions, as measured with the sense antennas both in vertical and horizontal polarity (Active Loop antenna also tested at Bore sight) for worst case presentations.

Signature Emissions from the Transmitter

Antenna Bore-Sight, 9 kHz – 150 kHz, at 1m



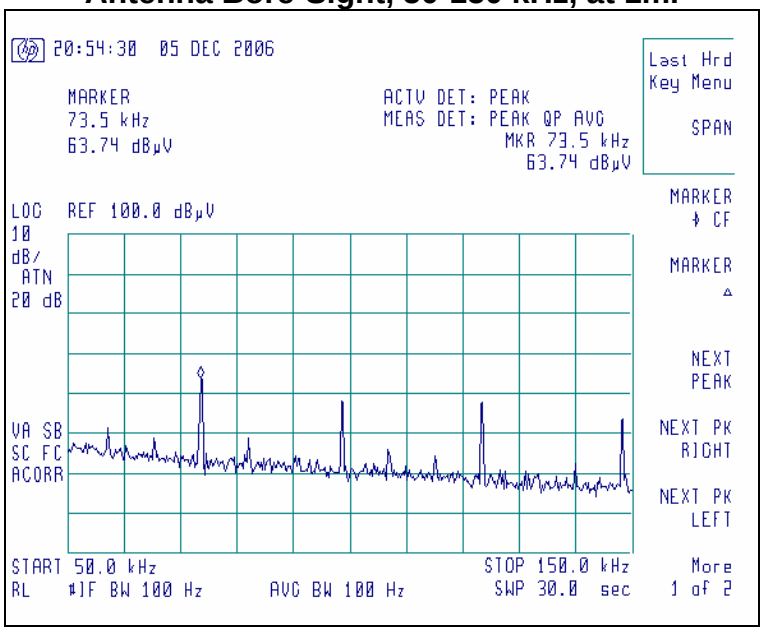
Antenna Bore-Sight, fundamental emission at 25 kHz, at 1m



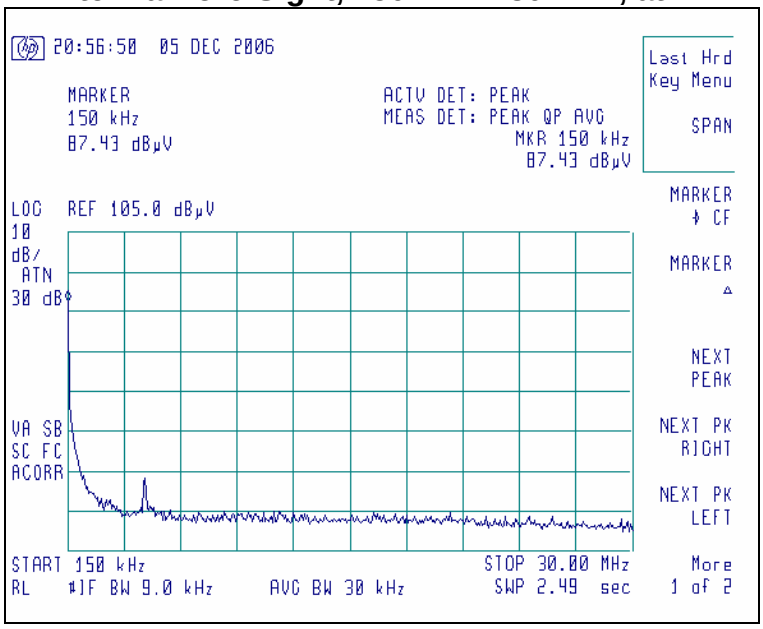
Screen Captures - Radiated Emissions Testing *(continued)*

Signature Emissions from the Transmitter

Antenna Bore-Sight, 50-150 kHz, at 1m.



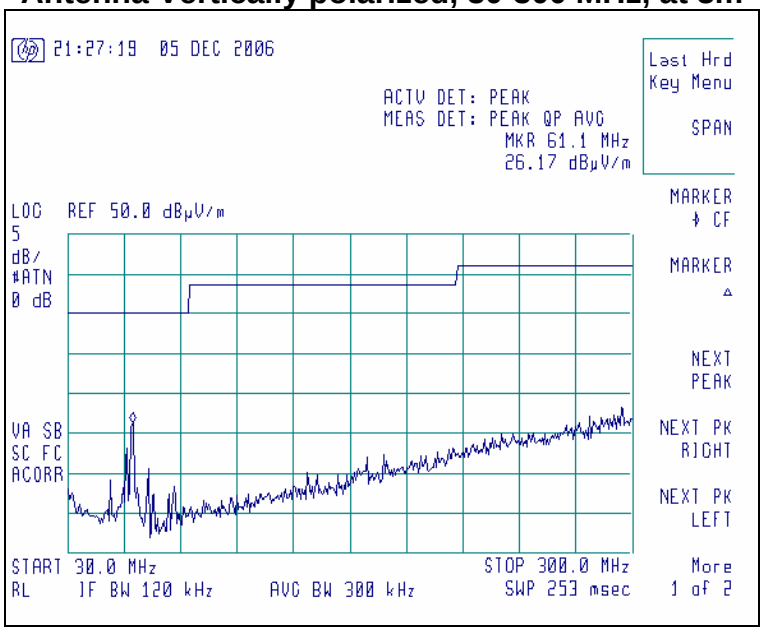
Antenna Bore-Sight, 150 kHz – 30 MHz, at 1m.



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

Signature Emissions from the Transmitter and Receiver modes,

Antenna Vertically polarized, 30-300 MHz, at 3m



Antenna Vertically polarized, 300-1000 MHz, at 3m

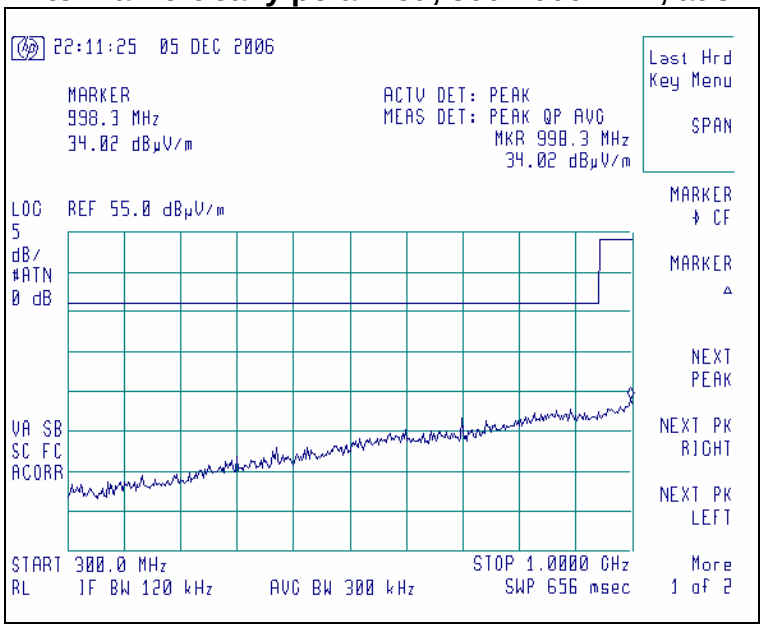


EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE: 15.207

6.1 Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15 (Industry Canada RSS-210, Issue 6). 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 is derived from the external generic 9 VDC, 200 mA wall-transformer. The wall transformer 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. 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 the HP 8546A EMI Receiver. 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).

6.2 Test Procedure

The EUT was operated in continuous transmit CW mode during the transmitter testing, and continuous receive mode during the receiver testing, using power as provided by a generic 9 VDC, 200 mA wall-transformer. The unit was also tested in normal operating mode, with the RS-485 connection to a "Smart Output" device. The unit is capable of operating on only one channel, and was placed in CW mode by modifying the firmware code on the transceiver.

The EUT was investigated in the above modes 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 (2003), Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30MHz. Final readings were then taken and recorded.

6.3 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 are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
Spectrum Analyzer	Agilent	E4446A	US45300564
LISN	EMCO	3816/2NM	9701-1057
Transient Limiter	HP	119474A	3107A01708

6.4 Test Results

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

6.5 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.			

6.6 TEST DATA CHART CONDUCTED EMISSION

Frequency Range inspected: 150 KHz to 30 MHz

Test Standard: FCC 15.207 Class B

Manufacturer:	SimonsVoss Technologies, Incorporated					
Date(s) of Test:	December 5TH and 6TH, 2006					
Test Engineer:	Abtin Spantman					
Model #:	Smart CD Configuration Tool					
Serial #:	Pre-Production Sample					
Voltage:	9.0 VDC from generic wall-transformer, connected to AC Mains					
Operation Mode:	Normal with RS-485 connection, and continuous transmit, C.W. mode					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
Test Location:						Chamber
EUT Placed On:	√	40cm from Vertical Ground Plane				10cm Spacers
	√	80cm above Ground Plane				Other:
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:		Peak	√	Quasi-Peak	√	Average

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	Q-Peak Reading (dBµV)	Q-Peak Limit (dBµ V)	Quasi-Peak Margin (dB)	Average Reading (dBµV)	Average Limit (dBµ V)	Average Margin (dB)
0.155	L1	26.5	65.7	39.2	9.6	55.7	46.1
0.155	L2	29.2	65.7	36.5	4.0	55.7	51.7
Note (2)							

Notes:

1) The emissions listed are characteristic of the power supply used, and did not change by the introduction of the EUT.

2) All other emissions were better than 20 dB below the limits. The sampling of measurements provided above is provided for completeness.

3) The EUT exhibited similar emissions in transmit and receive modes.

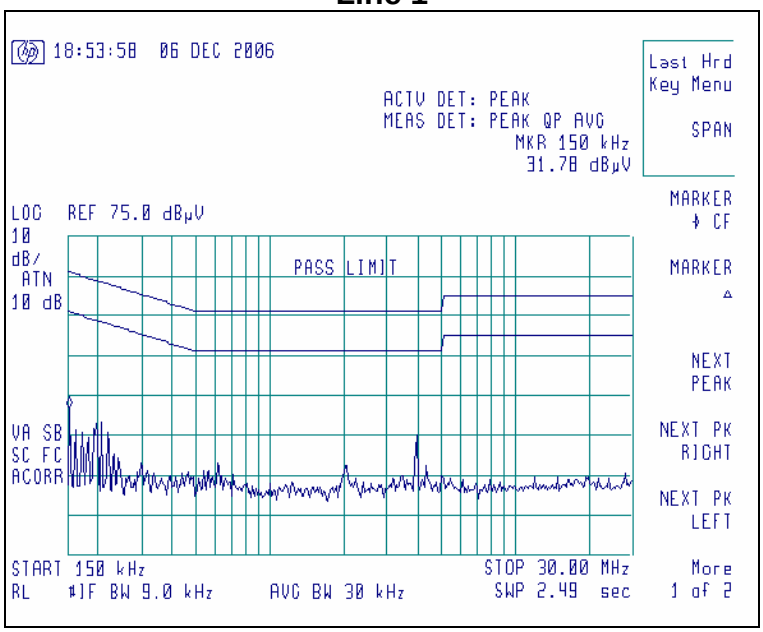
6.7 Test Setup Photo(s) – Conducted Emissions Test

6.8 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.

The signature scans shown here represent both transmit and receive modes, while the EUT is connected to a 'Smart Output' device.

Line 1



Line 2

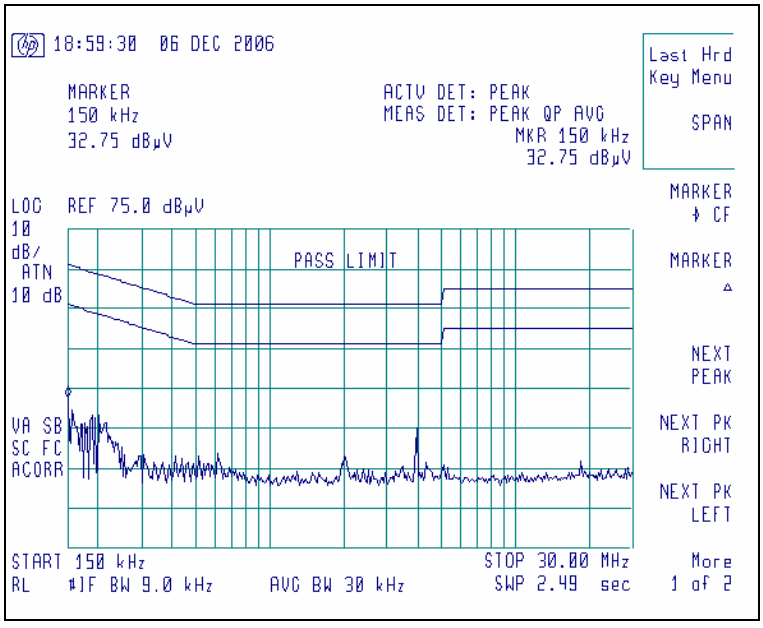


EXHIBIT 7. OCCUPIED BANDWIDTH

7.1 Limits

There are no stated limits for the occupied bandwidth for devices operating under 47CFR Part 15.209. The data presented here is for completeness only.

7.2 Method of Measurements

ANSI C63.4 and FCC standard procedures were adhered to in these measurements.

The transmitter output was placed in continuous transmit mode, with modulation from typical data as generated by the device. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using RBW=100 Hz and VBW=100 Hz.

Test Data

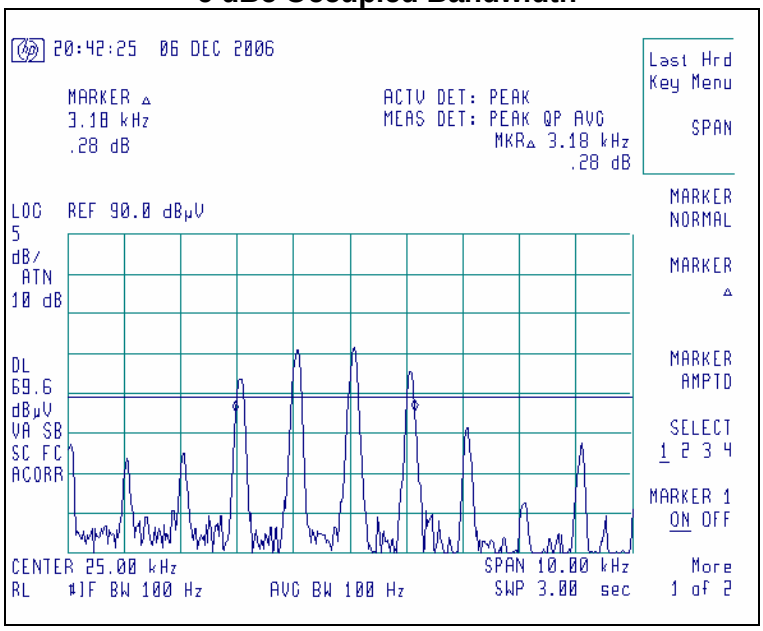
Center Frequency (kHz)	Measured -6 dBc Occ. BW (kHz)	Measured -20 dBc Occ. BW (kHz)
25.498	3.18	8.25

7.3 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296

7.4 Screen Captures - OCCUPIED BANDWIDTH

-6 dBc Occupied Bandwidth



-20 dBc Occupied Bandwidth

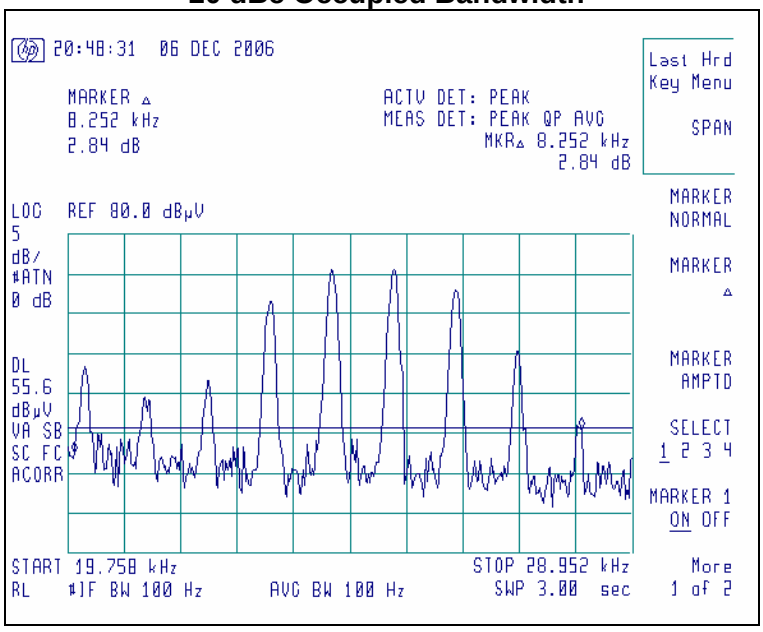


EXHIBIT 8. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT

In this case, the EUT is equipped with an on-board voltage rectifier and 5VDC regulator, and is rated for input voltage range from 9-24 Volts. The EUT was tested with a variable DC bench power supply from 4.25 VDC (V_{min} – 15%).to 27.6 VDC (V_{max} + 15%).

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=30Hz settings while the voltage was varied.

RF Fundamental Frequency Variance

DC Voltage Source		
4.25 VDC	9.00 VDC	27.60 VDC
24.543 (kHz)	24.543 (kHz)	24.541 (kHz)

The RF Power Output of the EUT was also monitored in a separate test, also using a Spectrum Analyzer with RBW=VBW=100 Hz setting while the voltage was varied.

RF Output Power Variance

DC Voltage Source		
4.25 VDC	9.00 VDC	27.60 VDC
102.1 (dBµV/m)	104.3 (dBµV/m)	105.7 (dBµV/m)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characterizes were well behaved, and the system returned to the same state of operation as before the power cycle.

A wide frequency sweep was also investigated, with minimum and maximum input voltages, to ensure that no unexpected anomalies have occurred.

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

APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/27/05	9/27/06
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	7/26/06	7/26/07
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	7/20/06	7/20/07
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/07/05	12/07/06
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/29/05	12/29/06
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/29/05	9/29/06
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/29/05	9/29/06
EE960073	Agilent	E4446A	US45300564	Spectrum Analyzer	2/01/06	2/01/07
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	Note 1	Note 1
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	Note 1	Note 1

Note 1 - Equipment calibrated within a traceable system.

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 B

Antenna Specification(s)

The AM transponder function is tested and covered in this report.
The AM transponder portion of the product uses a proprietary custom internal AM-Loop type antenna.