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# ENGINEERING TEST REPORT # 306550-TR-TCB -v2

Compliance Testing of:
**Entry Transponders**

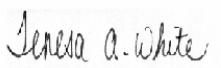
Test Date(s):
**November 21ST through 25TH, 2006**

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, EMC Engineer |
| 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<br>• 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.<br>Part 1-1: Measuring Apparatus. |
| CISPR 16-2-1 | 2003 | Specification for radio disturbance and immunity measuring apparatus and methods.<br>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:** | **Simons-Voss Technologies, Incorporated** |
| **Address:** | **10125 South 52ND Street<br>Franklin, WI 53132<br>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:** | Entry Transponders |
| **Model Number:** | TRA |
| **Serial Number:** | Engineering Units |

## 2.3 ASSOCIATED ANTENNA DESCRIPTION

These products have an on-board AM/ASK transponder.
The AM transponder portion of these products use 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 | 0.005 mW |
| Conducted Output Power (in dBm) | N/A |
| Field Strength (and at what distance) | 81.6 dBµV/m @1m ; 25.0 kHz |
| Occupied Bandwidth (99% BW) | 16.3 kHz |
| Type of Modulation | AM / ASK |
| Emission Designator | 16k3 A1D |
| Transmitter Spurious (worst case) | 68.6 dBµV/m @1m ; 27 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: 0.004 ☒ V/m ☐ A/m ☐ W/m$^2$
  ☒ Measured ☐ Computed ☐ Calculated

## 2.5 PRODUCT DESCRIPTION

### General Family of Product description:

The Simons-Voss 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.

***Simons-Voss entry keys (Left photo) and typical lock mechanism (right photo)***

***A sampling of other Simons-Voss Interface Devices***

(**Product Description continued)**

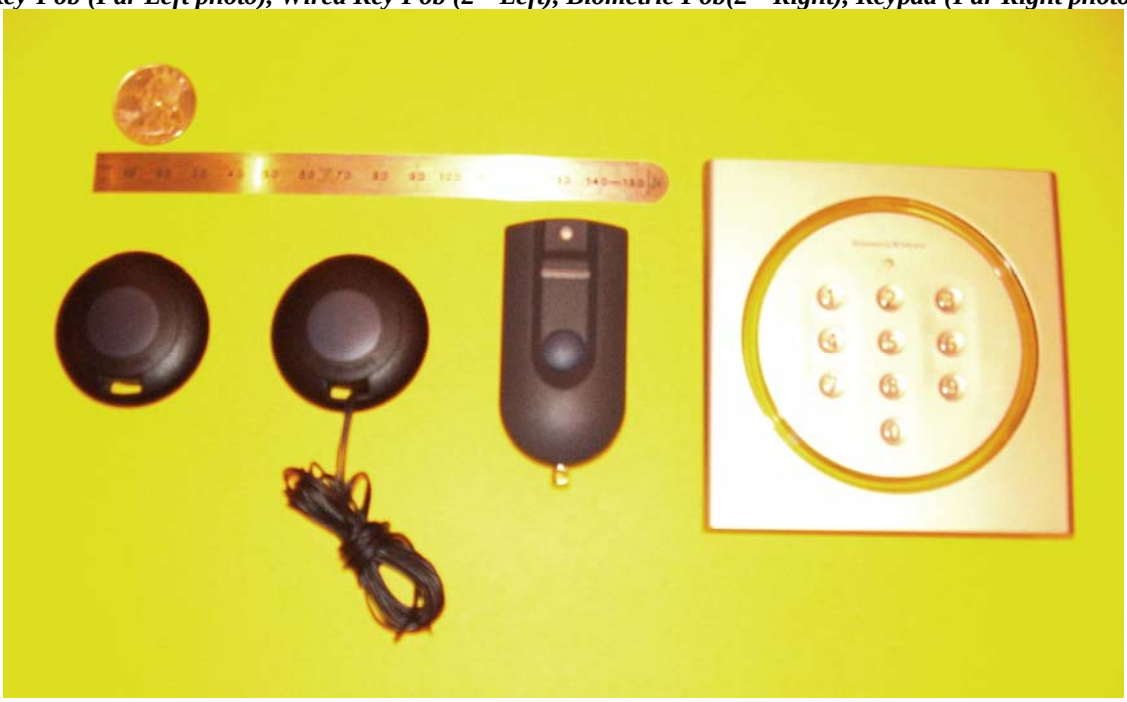
**Specific "Equipment Under Test" (EUT) description:**

This report covers the testing that was performed on the family of ***'Entry Transponders'***, in assessing conformity to the regulations as set forth by FCC and IC.

The family of Entry Transponders are used to request access via the TN-4 electronic access control core used in the US Cylindrical and Mortise locks. The transponders contain a transceiver that operates at 25 kHz using amplitude modulation and are powered by various 3.0 VDC "coin-cell" type batteries. The Key-Fobs use a "CR-2032" type battery, the Biometric Fob uses a "CR-1/3N" type battery, and the Keypad utilizes two "CR-2032" coin-cells in parallel. The entry access control system is used to grant or deny access by engaging or disengaging the outside handle from the latch that prevents the door from opening. In order to request access a user activates an Entry Transponder, such as the units that are covered in this report. The transponder communicates to the TN-4 using the 25kHz signal, sending an encrypted, rolling-code binary information format. When communication is established through the challenge/response protocol, the TN-4 uses the transponders identification to look up the user in a table kept in its software. If the user is allowed access at this time and date, the outside handle is connected to the latch allowing the latch to be retracted and the door opened. The transponders all use identical antennas which are a wire-wound coil wrapped around a ferrite core. The Entry Transponders are completely self-contained with no other power, radio, or data connections required. The 'Wired Key-fob' is the only exception where it has an external set of wires attached to the push-button, to enable activation by an external source, such as a relay closure, or another switch, for use in legacy system installations.

All power is supplied by the coin cell batteries. All data is transmitted by the 25 kHz radio.

***Simons-Voss Entry Transponders:***
***Key-Fob (Far Left photo), Wired Key Fob (2nd Left), Biometric Fob(2nd Right), Keypad (Far Right photo)***



# 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 | N/A |
| 15.109 | Un-Intentional Radiated Emissions | Yes |
| 15.207 | Power Line Conducted Emissions Measurements | N/A |
| 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 the 'CR-2032' batteries. 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 battery voltage was checked frequently, and the batteries were replaced as necessary.

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

This process was repeated during the investigations for all four product family members. There was minimal to no noticeable difference in emission levels between the product units. The data presented is from the product, the **Key-Fob with the external wires**, with the highest measured emissions.

## 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 $\text{Log}_{10}$ (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: | Simons-Voss Technologies, Incorporated | | | | | | |
| Date(s) of Test: | November 21st through 25th, 2006 | | | | | | |
| Test Engineer(s): | Abtin Spantman | | | | | | |
| Voltage: | 3.0 VDC | | | | | | |
| Operation Mode: | Normal, and CW modes | | | | | | |
| Environmental Conditions in the Lab: | Temperature: 20 – 25° C<br>Relative Humidity: 30 – 60 % | | | | | | |
| EUT Power: | | Single Phase ___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 | |

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

| Frequency (MHz) | Ant./EUT Polarity | Tx / Rx Mode | Height (meters) | Azimuth (0° - 360°) | Measured EFI (dBµV/m) | Emission Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 0.0225 | V / V | Tx | 1.00 | 0 | 66.3 | 81.6 | 15.3 |
| 0.0270 | V / V | Tx | 1.00 | 0 | 68.6 | 81.6 | 13.0 |
| 0.1890 | V / V | Tx | 1.00 | 0 | 51.6 | 81.6 | 30.0 |

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen
At 1 meter separation distance
Key-Fob with wires had the highest measured emissions as listed below:

| Frequency (MHz) | Ant./EUT Polarity | Height (meters) | Azimuth (0° - 360°) | Measured EFI (dBµV/m) | 15.209 Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 0.025 | V / V | 1.00 | 0 | 81.6 | 138.7 | 57.1 |
| 0.050 | V / V | 1.00 | 0 | 52.9 | 81.6 | 28.7 |
| 0.075 | V / V | 1.00 | 0 | 32.4 | 81.6 | 49.2 |
| 0.100 | V / V | 1.00 | 0 | 36.5 | 81.6 | 45.1 |
| 0.125 | V / V | 1.00 | 0 | 34.8 | 81.6 | 46.8 |
| 0.150 | V / V | 1.00 | 0 | 57.8 | 81.6 | 23.8 |
| 0.175 | V / V | 1.00 | 0 | 51.7 | 81.6 | 29.9 |
| 0.200 | V / V | 1.00 | 0 | 47.0 | 81.6 | 34.6 |
| 0.225 | V / V | 1.00 | 0 | 44.8 | 81.6 | 36.8 |
| 0.250 | V / V | 1.00 | 0 | 43.6 | 81.6 | 38.0 |

Notes:

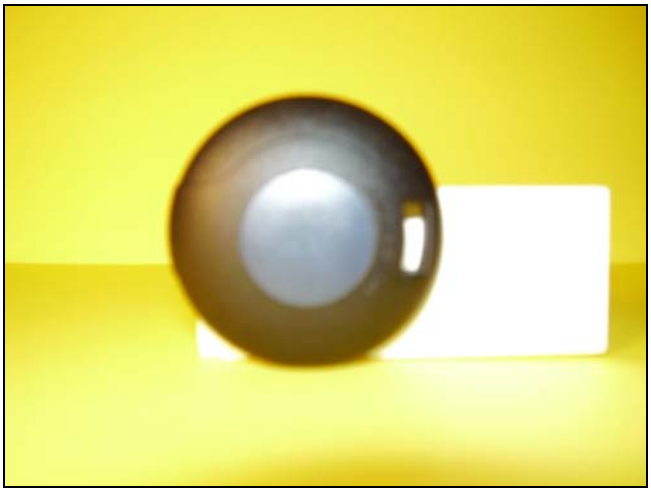
1) An Average Detector function was used in measurements below 30 MHz, a Quasi-Peak Detector was used in measurements between 30 MHz and 1 GHz, and an Average Detector was used in measurements above 1 GHz. A peak detector was used to ensure the peak emissions did not exceed 20 dB above the stated limits.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

## 5.7 Test Setup Photo(s) – Radiated Emissions Test

***Key-Fob Entry Transponder***

**Horizontal Orientation**

**Side Orientation**



**Vertical Orientation**

## *Biometric Key-Fob Entry Transponder*

**Horizontal Orientation**

**Side Orientation**

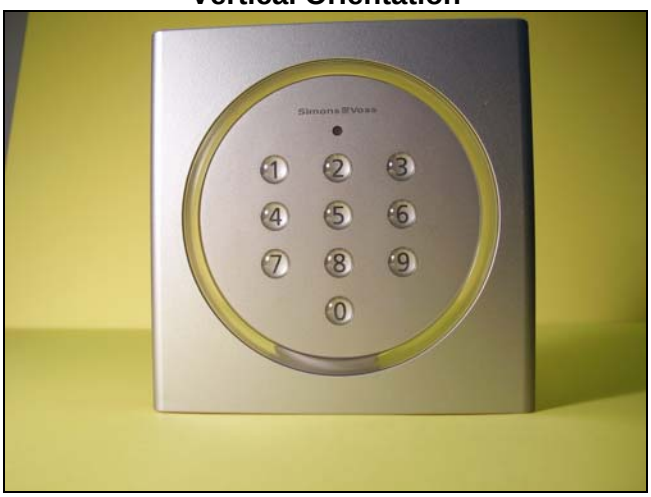
**Vertical Orientation**

## *Key-Pad Entry Transponder*

**Horizontal Orientation**

**Side Orientation**

**Vertical Orientation**



**The Entry Key-Fob with the external switch wires, as shown on Test Pedestal, had the highest measured emission levels.**

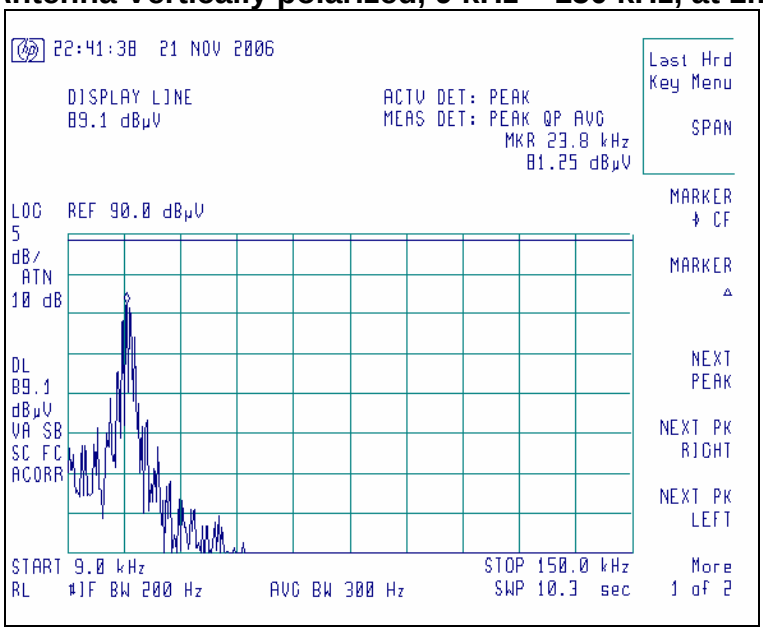
## 5.8 Screen Captures - Radiated Emissions Testing

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.

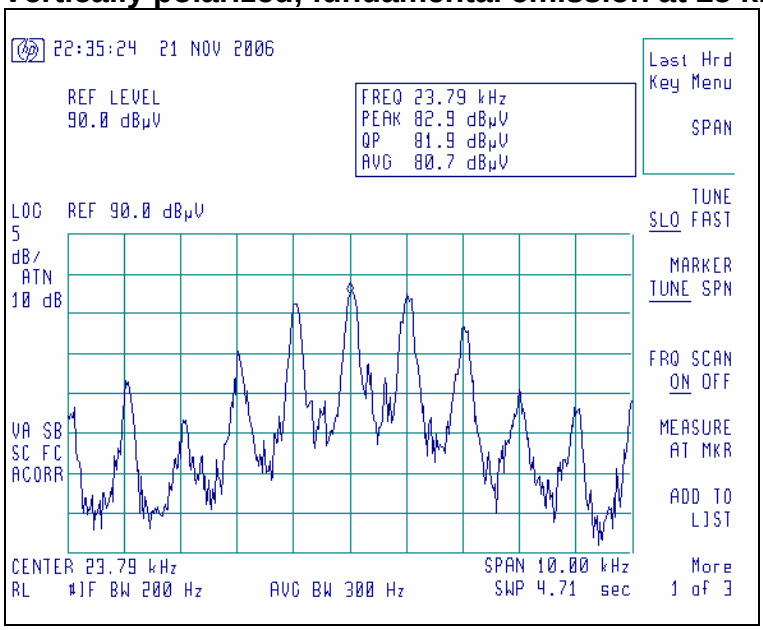
The signature scans shown here are from worst-case emissions, as measured with the sense antennas both in vertical and horizontal polarity (Active Loop antenna also tested at Bore sight) for worst case presentations.

***Signature Emissions from the Transmitter***

**Antenna Vertically polarized, 9 kHz – 150 kHz, at 1m**



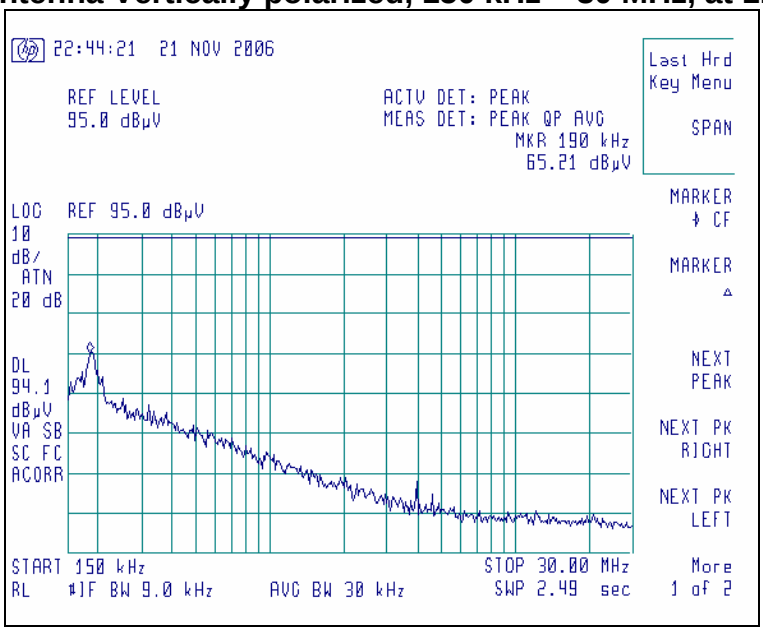

**Antenna Vertically polarized, fundamental emission at 25 kHz, at 1m**



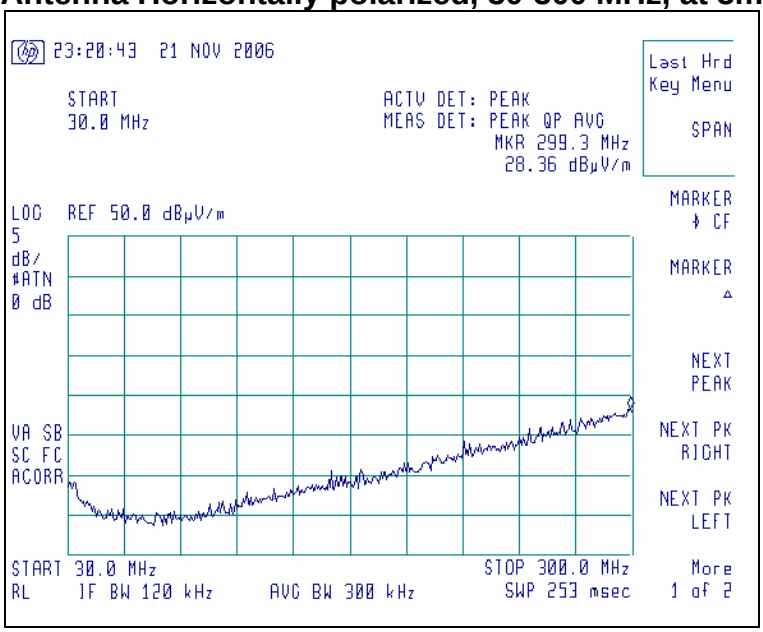
## Screen Captures - Radiated Emissions Testing *(continued)*

### *Signature Emissions from the Transmitter*

### Antenna Vertically polarized, 150 kHz – 30 MHz, at 1m



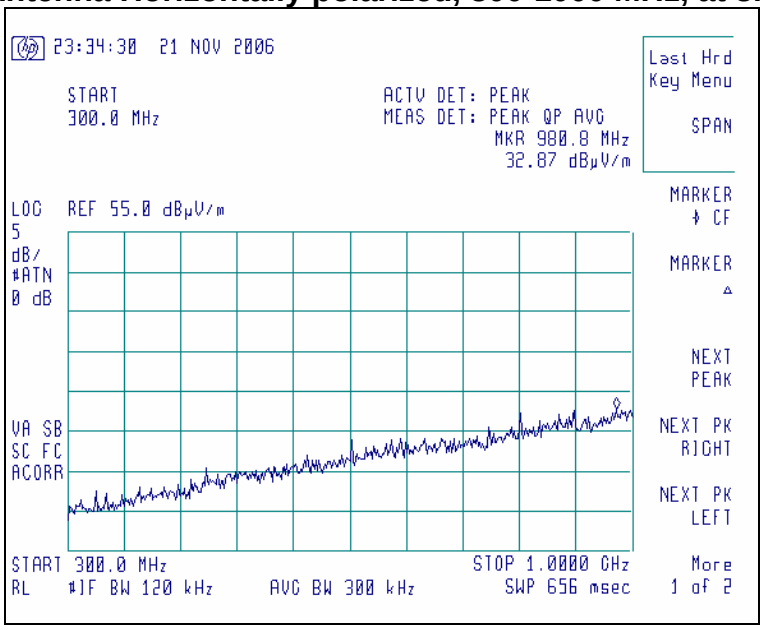

### Antenna Horizontally polarized, 30-300 MHz, at 3m



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

### *Signature Emissions from the Transmitter*

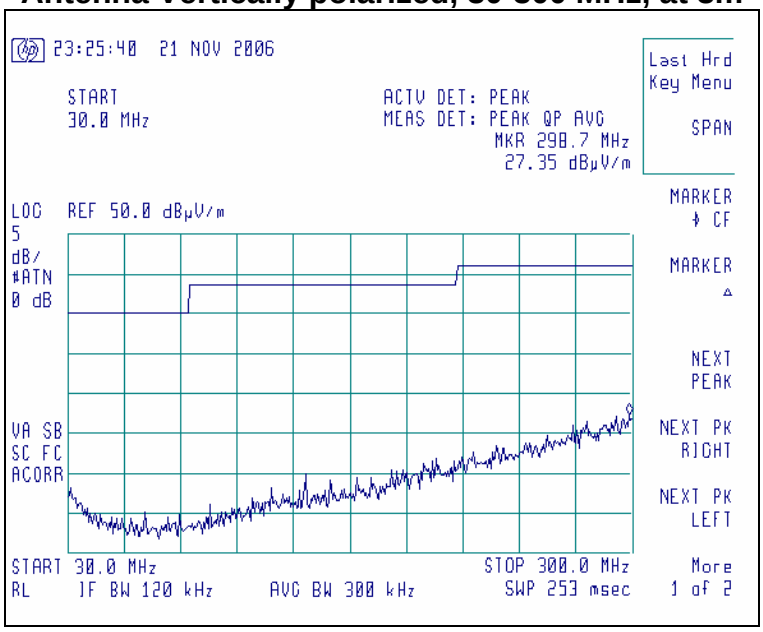
### Antenna Horizontally polarized, 300-1000 MHz, at 3m



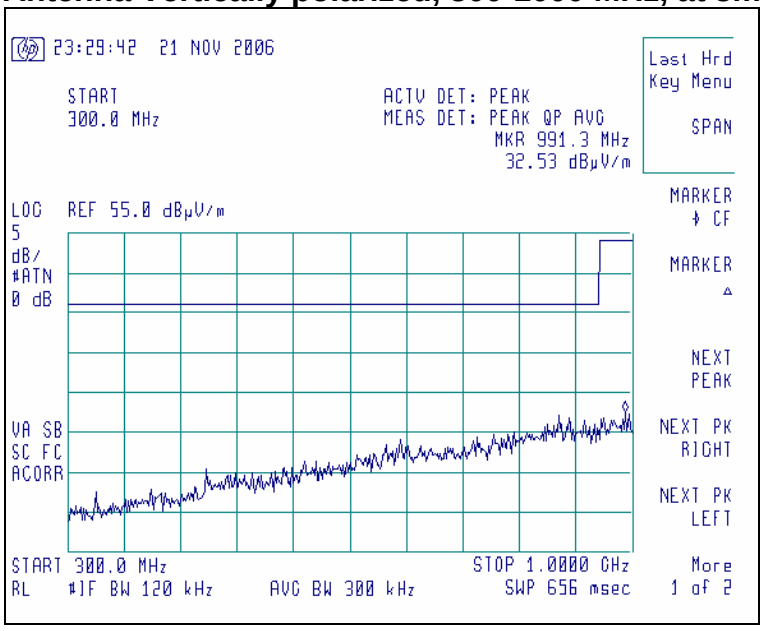
## Screen Captures - Radiated Emissions Testing *(continued)*

### *Signature Emissions from the Receiver*

### 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

This product does not have contingencies for connecting to AC mains at this time.

No testing was performed to measure conducted RF emissions on this product.

# 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

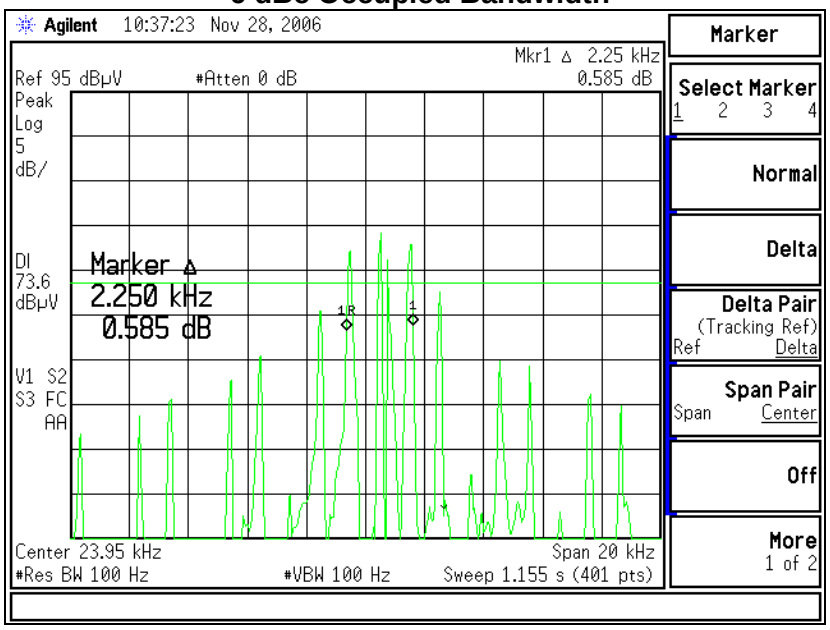
| Center Frequency (kHz) | Measured -6 dBc Occ. BW (kHz) | Measured -20 dBc Occ. BW (kHz) |
|---|---|---|
| 24.5 | 2.25 | 16.30 |

## 7.3 Test Equipment List

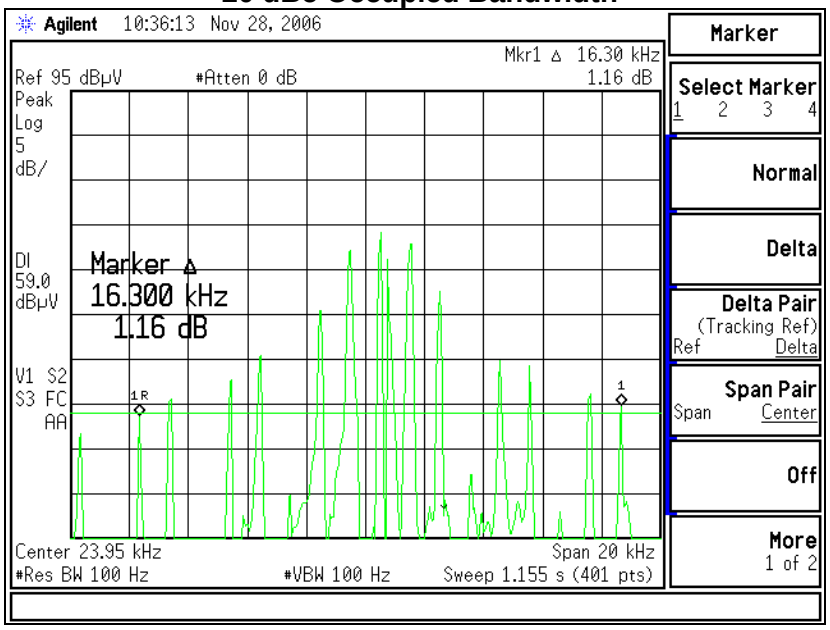
| Test Equipment | Manufacturer | Model No. | Serial No. |
|---|---|---|---|
| EMI Receiver | HP | 8546A | 3617A00320 |
| EMI Receiver Pre-Select. | HP | 85460A | 3448A00296 |

## 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 uses a type "CR-2032" battery, with a nominal voltage of 3.0 VDC. The working range of this battery is 3.4 VDC to 2.5 VDC (50% life), but the defined operation range of the EUT is limited to 2.80 VDC on the low end.

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 | | |
|---|---|---|
| 2.5 VDC | 3.0 VDC | 3.4 VDC |
| 24.56 (kHz) | 24.58 (kHz) | 24.58 (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 | | |
|---|---|---|
| 2.5 VDC | 3.0 VAC | 3.4 VDC |
| 65.5 (dBµV/m) | 80.8 (dBµV/m) | 82.0 (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)

This product has an on-board AM/ASK transponder.
The AM transponder portion of the product uses a proprietary custom internal AM-Loop type antenna.