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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to

Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7 FCC Part 15 Subpart C

on the
Savi Technology, Inc.
Transmitter
Model: ST-696-001

UPN:	2404A-696T
FCC ID:	KL7-696T-V1
GRANTEE:	Savi Technology, Inc. 351 E. Evelyn Ave. Mountain View, CA 94041
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	December 5, 2007
FINAL TEST DATE:	November 12, November 16 and November 28, 2007

AUTHORIZED SIGNATORY: Mark Briggs

Mark Briggs
Principal Engineer

ACCREDITED
2016-01

REVISION HISTORY

Revision #	Date	Comments	Modified By
1	January 16, 2008	Initial Release	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the Savi Technology, Inc. model ST-696-001 pursuant to the following rules:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Savi Technology, Inc. model ST-696-001 and therefore apply only to the tested sample. The sample was selected and prepared by Eugene Schlindwein of Savi Technology, Inc.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Savi Technology, Inc. model ST-696-001 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 2
RSS 210 Issue 7 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

TEST RESULTS SUMMARY

MOMENTARILY OPERATED DEVICES – CONTROL SIGNALS

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.231 (a) (1)	RSS 210 A1.1.1 (1)	Duration of manually activated transmissions	N/A – transmissions are activated automatically via an RFID reader	< 5 seconds	Complies
15.231 (a) (2)	RSS 210 A1.1.1 (2)	Duration of automatically activated transmissions	Less than 5 seconds in duration (note 1)	< 5 seconds	Complies
15.231 (a) (3)	RSS 210 A1.1.1 (3)	Transmissions at predetermined / regular intervals	No predetermined transmissions in 15.231a mode (note 1)	Such transmissions are not permitted	Complies
15.231 (a) (4)	RSS 210 A1.1.1 (4)	Pendency of transmissions used during emergencies	Not applicable, no such transmissions		Complies
15.231 (b)	RSS 210 Table 4	Fundamental Signal Strength @ 433.9MHz	34673.7uV/m pk 8709.6µV/m avg	Refer to table in limits section	Complies
15.231 (b) / 15.209	RSS 210 Table 2 / 4	Radiated Spurious Emissions, 30 - 4400 MHz	30.1dBµV/m (32.0µV/m) @ 867.751MHz	Refer to table in limits section	Complies (-15.9dB)
15.231 (c)	RSS 210 A1.1.3	Bandwidth	507 kHz	< 0.5% of operating frequency	Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	N/A – does not operate in this band		N/A
Note 1	Refer to the operational description included with this application for detailed description and timing diagrams for transmission duration.				

MOMENTARILY OPERATED DEVICES – DATA SIGNALS OR SIGNALS AT PREDETERMINED INTERVALS

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.231 (e)	RSS 210 A1.1.5	Duration of transmissions	Less than 1 second	< 1 second	Complies
15.231 (e)	RSS 210 A1.1.5	Period between transmissions	Greater than 10 seconds and greater than 30x	> 30 times duration of signal and > 10s	Complies
15.231 (e)	RSS 210 Table 5	Fundamental Signal Strength	34673.7uV/m pk 3467.3µV/m avg	Refer to table in limits section	Complies
15.231 (e) / 15.209	RSS 210 Table 5	Radiated Spurious Emissions, 30 - 4400 MHz	30.1dBµV/m (32.0µV/m) @ 867.751MHz	Refer to table in limits section	Complies (-15.9dB)
15.231 (c)	RSS 210 A1.1.3	Bandwidth	507 kHz	< 0.5% of operating frequency	Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	N/A – does not operate in this band		N/A
Note 1	Refer to the operational description included with this application for detailed description and timing diagrams for transmission duration.				

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antenna	Integral antenna or Unique Connector	Complies
15.109	RSS GEN 7.2.3	Receiver spurious emissions	38.6dBµV/m (85.1µV/m) @ 1302.3MHz	15.109 RSS GEN Table 1	Complies (-15.4dB)
15.207	RSS GEN Table 2	AC Conducted Emissions	Not applicable. Although the device may be connected to an AC adapter to charge the internal batteries, when the AC-DC adapter is connected the device's transceiver functions are disabled.		N/A

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± 3.0
Radiated Emissions	30 to 1000	± 3.6
Radiated Emissions	1000 to 40000	± 6.0

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Savi Technology, Inc. model ST-696-001 is an RF Tagging device which is designed to identify the container to which it is attached to the Savi System. Normally, the EUT would be mounted to a container in a specific orientation. The EUT was treated as tabletop equipment during testing to simulate the end user environment.

The tag is designed to operate from internal batteries. An external AC-DC adapter can be connected to the device to charge these internal batteries. When the external dc source is connected the transceiver functions are disabled so all testing under the scope of this test report was performed with the AC-DC adapter disconnected. A separate evaluation of the EMC emissions from the combination of AC-DC adapter and EUT will be done as a FCC Class B verification.

A response from the EUT is initiated by a 123 kHz signal from a Savi SignPost or 433.92 MHz signal from a Savi Reader. Depending on the initiation signal the EUT can respond wit a transmission of its recognition code under 15.231(a)/RSS-210 Annex A1.11. or other type of information under FCC Rule Parts 15.231(e) or 15.240 (and their RSS-210 equivalents). The type of response is determined by the SignPost or Reader initiation signal.

The sample was received on November 12, 2007 and tested on November 12, 2007. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Savi Technology	ST-696-001	RFID tag	696007	KL7-696t-v1
Balance Electronics	GPSA-0500250	AC/DC Adapter	-	-

OTHER EUT DETAILS

The product is also provided with a Siemens AG GPRS/GPS Transceiver, FCC ID: QIPTC65, and Nemerix GPS Receiver.

ANTENNA SYSTEM

The antenna is integral to the device.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic covers over all circuitry/antennas, secured to a steel bracket. EUT measures approximately 11.5cm wide by 17.5cm deep by 24.5cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with emissions specifications.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None	-	-	-	-

EUT OPERATION

The transmitter was continuously transmitting a modulated signal during radiated emissions tests. For receive mode tests the EUT was in receive mode with the LO and receiver circuit active.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on November 12, November 16 and November 28, 2007 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission.

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

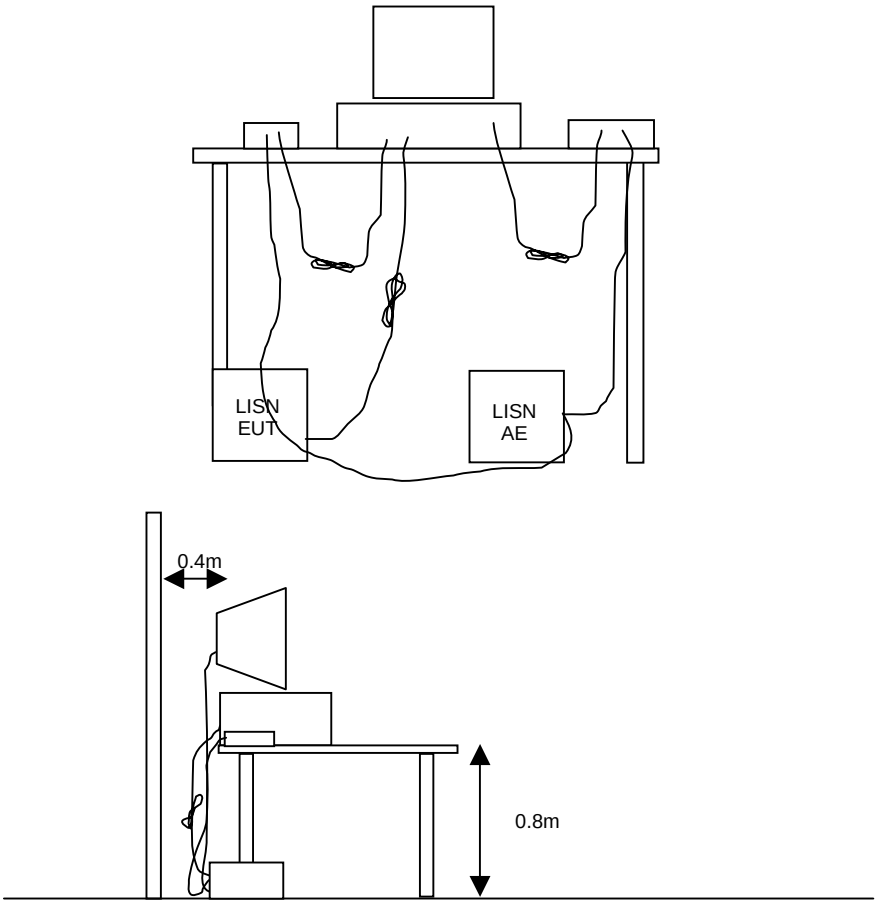
TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

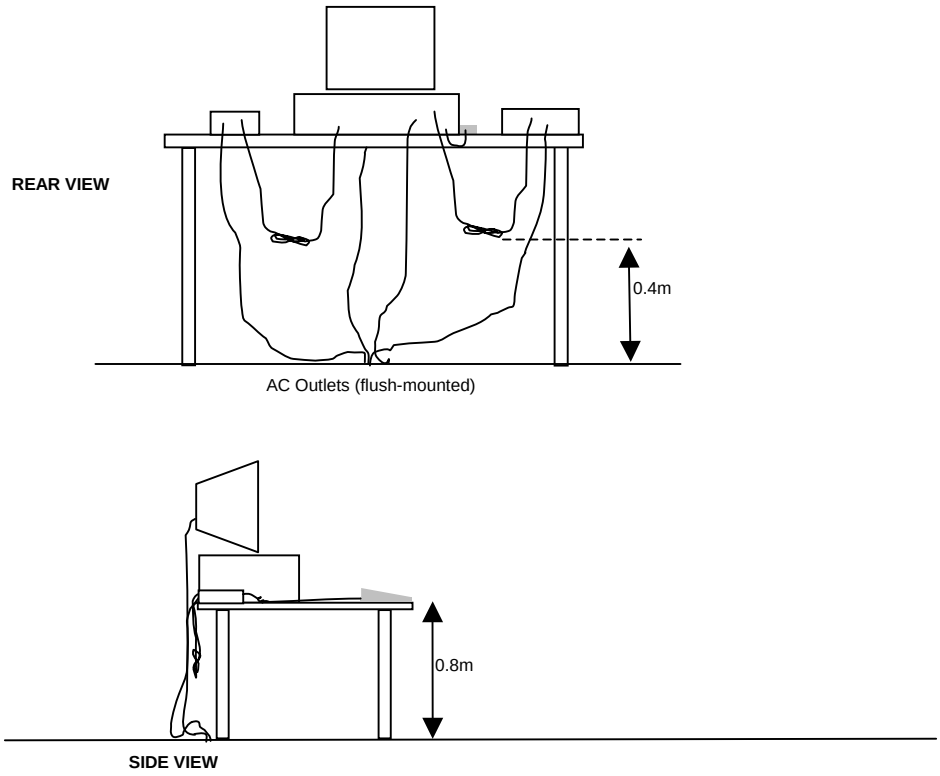


A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

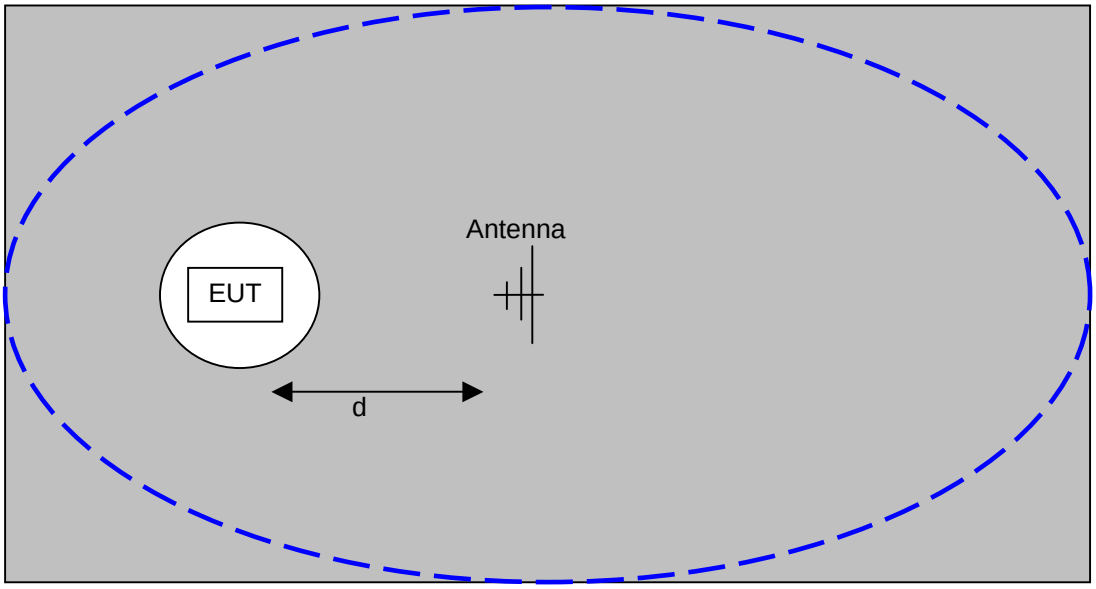
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

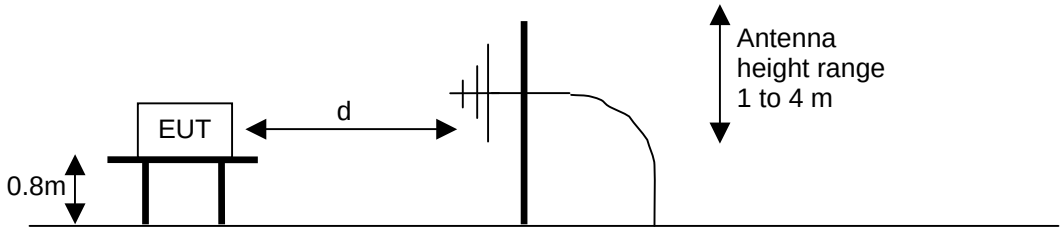
When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.



Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

The table below shows the limits for both the fundamental and spurious emissions for control signals. The limits for data signals, or signals with predetermined transmissions, are given in the second table

Operating Frequency (MHz)	Fundamental Field Strength (microvolts/m)	Spurious Emissions (microvolts/m)
70 - 130	1250	125
130 - 174	1250 - 3750	125 - 375
174 – 260	3750	375
260 – 470	3750 – 12,500	375 - 1250
Above 470	12,500	1250

Spurious Emissions Limits – Control Signals

Operating Frequency (MHz)	Fundamental Field Strength (microvolts/m)	Spurious Emissions (microvolts/m)
70 - 130	500	50
130 - 174	500 - 1500	50 - 150
174 – 260	1500	150
260 – 470	1500 – 5000	150 - 500
Above 470	5000	500

Spurious Emissions Limits – Data Signals

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{3} \text{ microvolts per meter}$$

where P is the eirp (Watts)

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 4,400 MHz, 12-Nov-07

Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	24-May-08
Filtek	Filter, 1 GHz High Pass	HP12/1000-5BA	957	29-May-08
Hewlett Packard	EMC Spectrum Analyzer, 9 KHz - 22 GHz	8593EM	1319	18-May-08
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	21-Nov-07
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1404	30-Mar-08
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	15-Nov-07

Conducted Emissions - AC Power Ports, 16-Nov-07

Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	LISN, FCC / CISPR	LISN-3, OATS	304	18-Jul-08
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	21-Nov-07
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FMT (SA40) Blue	8564E (84125C)	1393	17-Jan-08
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	05-Feb-08

Radiated Emissions, 25 - 16,000 MHz, 27-Dec-07

Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	SpecAn 9 KHz-26.5 GHz, Non-Program	8563E	284	21-Jun-08
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	29-May-08
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	12-Apr-08
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	10-May-08
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	11-Jan-08
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103	1632	25-May-08

EXHIBIT 2: Test Measurement Data

9 Pages

Elliott

EMC Test Data

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Savi

Model

ST-696-001

Date of Last Test: 12/27/2007

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240; RS	Class:	-
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is an RF Tagging device which is designed to identify the container to which it is attached to the Savi System. Normally, the EUT would be mounted to a container in a specific orientation. The EUT was treated as tabletop equipment during testing to simulate the end user environment.

A response from the EUT is initiated by a 123 kHz signal from a Savi SignPost or 433.92 MHz signal from a Savi Reader. Upon receiving the initiation signal the EUT transmits a signal at 433.92 MHz. This signal is comprised of SignPost ID and Tag ID.

A response from the EUT is initiated by a 433.92 MHz Savi Reader signal. Upon receiving the initiation signal the EUT transmits a signal at 433.92 MHz. This signal is comprised of Tag ID.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Savi Technology	ST-696-001	RFID tag	696007	KL7-696t-v1
Balance Electronics	GPSA-0500250	AC/DC Adapter	-	-

Other EUT Details

The product is also provided with a Siemens AG GPRS/GPS Transceiver, FCC ID: QIPTC65, and Nemerix GPS Receiver.

EUT Antenna

The antenna is integral to the device.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic covers over all circuitry/antennas, secured to a steel bracket. EUT measures approximately 11.5cm wide by 17.5cm deep by 24.5cm high.

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240; RS	Class:	-
Immunity Spec:	-	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None	-	-	-	-

EUT Operation During Emissions Tests

The transmitter was continuously transmitting a modulated signal during radiated emissions tests. For receive mode tests the EUT's GPS receiver or UHF transceiver was in receive mode with the LO and receiver circuit active.

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 11/12/2007
Test Engineer: Mehran Birgani
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: Battery

General Test Configuration

The EUT was located on the turntable for radiated emissions testing.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 15 °C
Rel. Humidity: 64 %

Modifications Made During Testing:

The output power of the EUT was set to 101

Deviations From The Standard

No deviations were made from the requirements of the standard.
The EUT is designed to be mounted only in one orientation; therefore, it was evaluated in single orientation as typically installed.

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		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 433.92MHz, Fundamental	15.231(a) / RSS 210	Pass	78.8dBµV/m (8709.6µV/m) @ 433.924MHz (-2.0dB)
1b	RE, Tx Spurious Emissions	15.231(a) / RSS 210	Pass	30.1dBµV/m (32.0µV/m) @ 867.751MHz (-15.9dB)
2a	RE, 433.92MHz, Fundamental	15.231(e) / RSS 210	Pass	70.8dBµV/m (3467.4µV/m) @ 433.924MHz (-2.1dB)
2b	RE, Tx Spurious Emissions	15.231(e) / RSS 210	Pass	30.1dBµV/m (32.0µV/m) @ 867.751MHz (-15.9dB)
3	RE, RxSpurious Emissions	15.109 & RSS-GEN	Pass	38.6dBµV/m (85.1µV/m) @ 1302.3MHz (-15.4dB)
4	Bandwidth (20dB)	15.231 / RSS 210	Pass	507kHz
4	Bandwidth (99%)	RSS-GEN	N/A	269kHz

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Run #1: Radiated Emissions, 30 MHz - 4400 GHz
Operation under 15.231(a)

Run #1a: Fundamental Mesaurement of 433.976

Frequency	Level	Pol	FCC 15.231(a)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.924	78.8	V	80.8	-2.0	Avg	354	1.0	
433.924	90.8	V	100.8	-10.0	Pk	354	1.0	
433.924	69.7	H	80.8	-11.1	Avg	73	3.2	
433.924	81.7	H	100.8	-19.1	Pk	73	3.2	

Note 1:	Duty cycle is 25% . A -12dB correction was used to determine the average level from the peak reading
Note 2:	Peak readings made using a receiver and measurement bandwidth set to 120kHz.

Run #1b: Spurious Emissions, 30-4400 MHz (Tx Mode)

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
867.751	30.1	V	46.0	-15.9	QP	237	1.0	
2170.110	34.5	H	54.0	-19.5	AVG	0	1.7	Unrestricted with restricted limit
867.751	25.8	H	46.0	-20.2	QP	120	2.5	
2169.340	32.0	V	54.0	-22.0	AVG	2	1.0	Unrestricted with restricted limit
1301.640	30.6	H	54.0	-23.4	AVG	33	1.7	Unrestricted with restricted limit
1736.270	29.4	H	54.0	-24.6	AVG	360	1.0	Unrestricted with restricted limit
1734.160	28.8	V	54.0	-25.2	AVG	360	1.0	Unrestricted with restricted limit
1301.670	27.7	V	54.0	-26.3	AVG	330	1.0	
2170.110	46.5	H	74.0	-27.5	PK	0	1.7	Unrestricted with restricted limit
2169.340	44.0	V	74.0	-30.0	PK	2	1.0	Unrestricted with restricted limit
1301.640	42.6	H	74.0	-31.4	PK	33	1.7	Unrestricted with restricted limit
1736.270	41.4	H	74.0	-32.6	PK	360	1.0	Unrestricted with restricted limit
1734.160	40.8	V	74.0	-33.2	PK	360	1.0	Unrestricted with restricted limit
1301.670	39.7	V	74.0	-34.3	PK	330	1.0	

Note 1:	Duty cycle is 25% . A -12dB correction was used to determine the average level from the peak reading. All readings within 25dB of the limit were recorded.

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-

Run #2: Radiated Emissions, 30 MHz - 4400 GHz
Operation under 15.231(e)

Run #2a: Fundamental Mesaurement of 433.976

Frequency	Level	Pol	FCC 15.231(e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.924	70.8	V	72.9	-2.1	Avg	354	1.0	
433.924	90.8	V	92.9	-2.1	Pk	354	1.0	
433.924	61.7	H	72.9	-11.2	Avg	73	3.2	
433.924	81.7	H	92.9	-11.2	Pk	73	3.2	

Note 1:	Duty cycle is 10% . A -20dB correction was used to determine the average level from the peak reading

Run #2b: Spurious Emissions, 30-4400 MHz (Tx Mode)

Frequency	Level	Pol	FCC 15.231(e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
867.751	30.1	V	46.0	-15.9	QP	237	1.0	
867.751	25.8	H	46.0	-20.2	QP	120	2.5	
2170.110	26.5	H	54.0	-27.5	AVG	0	1.7	Unrestricted with restricted limit
2170.110	46.5	H	74.0	-27.5	PK	0	1.7	Unrestricted with restricted limit
2169.340	24.0	V	54.0	-30.0	AVG	2	1.0	Unrestricted with restricted limit
2169.340	44.0	V	74.0	-30.0	PK	2	1.0	Unrestricted with restricted limit
1301.640	22.6	H	54.0	-31.4	AVG	33	1.7	Unrestricted with restricted limit
1301.640	42.6	H	74.0	-31.4	PK	33	1.7	Unrestricted with restricted limit
1736.270	21.4	H	54.0	-32.6	AVG	360	1.0	Unrestricted with restricted limit
1736.270	41.4	H	74.0	-32.6	PK	360	1.0	Unrestricted with restricted limit
1734.160	20.8	V	54.0	-33.2	AVG	360	1.0	Unrestricted with restricted limit
1734.160	40.8	V	74.0	-33.2	PK	360	1.0	Unrestricted with restricted limit
1301.670	19.7	V	54.0	-34.3	AVG	330	1.0	
1301.670	39.7	V	74.0	-34.3	PK	330	1.0	

Note 1:	Duty cycle is 10% . A -20dB correction was used to determine the average level from the peak reading. All three orientations evaluated and all readings within 20dB of the limit were recorded.

Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-

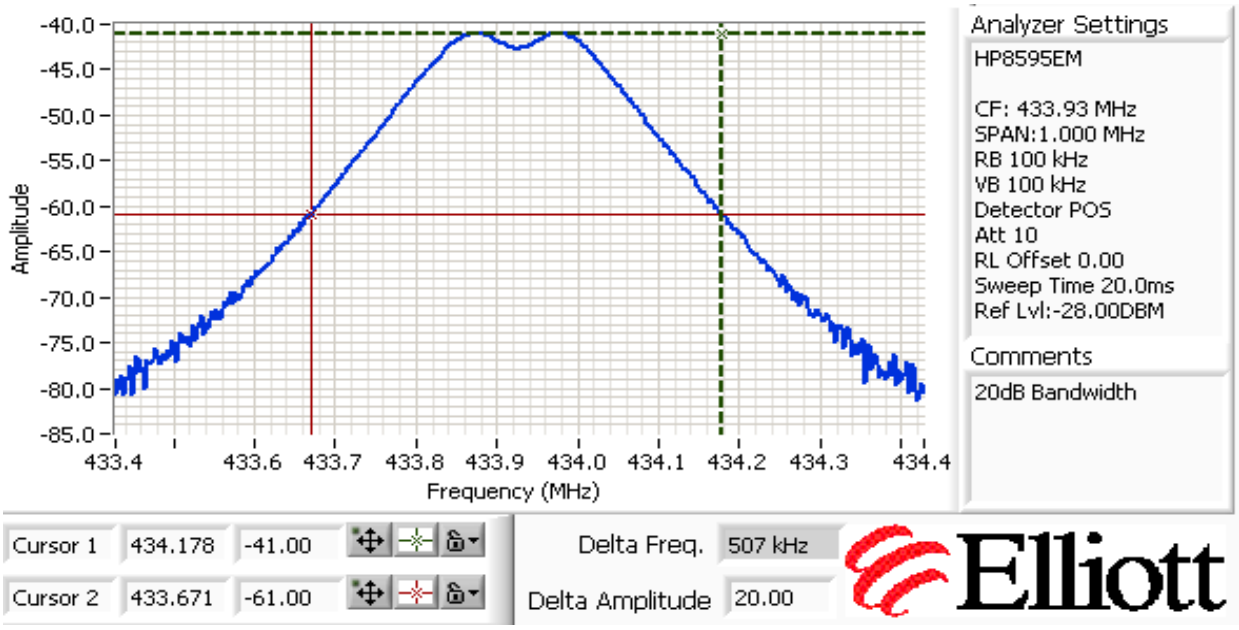
Run #3: Spurious Emissions, Receive Mode, 30MHz - 2000 MHz

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
1302.330	38.6	V	54.0	-15.4	QP	263	1.0	
1302.380	38.3	H	54.0	-15.7	PK	0	1.0	
867.451	28.6	V	46.0	-17.4	QP	200	1.0	
867.451	28.6	H	46.0	-17.4	QP	360	1.0	
1302.330	27.6	V	54.0	-26.4	QP	263	1.0	
433.726	18.4	H	46.0	-27.6	QP	256	1.5	
433.726	18.2	V	46.0	-27.8	QP	0	1.0	
1301.176	26.1	H	54.0	-27.9	QP	0	1.0	
1301.176	38.3	H	74.0	-35.7	QP	0	1.0	

Note 1:	Fundmental and harmonics were within noise floor.

Run #4: Transmit Mode (433.92 MHz) - Bandwidth

Signal bandwidth was measured to be 507 kHz (see graph below - RB=VB=100kHz). The maximum permitted bandwidth is 0.25% of the fundamental signal frequency = 1.08MHz



Client:	Savi	Job Number:	J69830
Model:	ST-696-001	T-Log Number:	T69904
		Account Manager:	Dean Eriksen
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Spec:	FCC 15.231(a/e); FCC 15.240; RSS 210	Class:	-