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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to Industry Canada RSS-Gen Issue 1 / RSS 210 Issue 6 FCC Part 15 Subpart C on the Savi Technology, Inc. Transmitter Model: ST-673

UPN:	2404A-673T
FCC ID:	KL7-372T-V1
GRANTEE:	Savi Technology, Inc. 615 Tasman Drive Sunnyvale, CA 94089-1707
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	April 6, 2006
FINAL TEST DATE:	February 10, February 14 and February 28, 2006

AUTHORIZED SIGNATORY:

Juan Martinez
Senior EMC Engineer

ACCREDITED
2016-01

Equipment Name and Model:

Transceiver _ST-673

Manufacturer:

Savi Technology, Inc.
615 Tasman Drive
Sunnyvale, CA 94089-1707

Tested to applicable standard:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
RSS 310 Issue 1 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment"

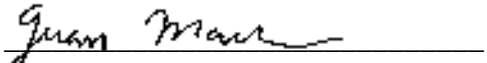
Test Report Prepared For:
Eugene Schlindwein
Savi Technology, Inc.
615 Tasman Drive
Sunnyvale, CA 94089-1707

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV2 Dated August 16, 2007

Declaration of Compliance

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4: 2003 as referenced by FCC Part 15 and by section 1.0 of RSS-212, Issue 1, "Test Facilities and Test Methods for Radio Equipment" / RSS-Gen Issue 1); and that the equipment performed in accordance with the data submitted in this report.

Signature	
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	USA
Date:	April 6, 2006

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SCOPE

An electromagnetic emissions test has been performed on the Savi Technology, Inc. model ST-673 pursuant to the following rules:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart B (Receivers)
FCC Part 15 Subpart C requirements for momentarily operated devices

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
RSS-212 Issue 1 Test Facilities and Test Methods for Radio Equipment

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-673 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. Certification of these devices is required as a prerequisite to marketing in the US and Canada.

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. Certification of these devices is required as a prerequisite to marketing in the US. Devices categorized as Class II equipment do not require certification by Industry Canada.

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-673 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 1
RSS 210 Issue 6 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart B (Receivers)
FCC Part 15 Subpart C requirements for momentarily operated devices

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 Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.231 (a) (1)	RSS 210 A1.1.1 (1)	Duration of manually activated transmissions	No manually activated transmissions	< 5 seconds	Complies
15.231 (a) (2)	RSS 210 A1.1.1 (2)	Duration of automatically activated transmissions	Response to Hello: 10ms Read response: 5s or less	< 5 seconds	Complies
15.231 (a) (3)	RSS 210 A1.1.1 (3)	Transmissions at predetermined / regular intervals	No predetermined transmissions	Such transmissions are not permitted	Complies
15.231 (a) (4)	RSS 210 A1.1.1 (4)	Pendency of transmissions used during emergencies	Not applicable	-	Complies
15.231 (b)	RSS 210 Table 4	Fundamental Signal Strength, 433.9MHz	80.5dBuV/m (Avg) 92.5dBuV/m (Pk)	80.8dBuV/m (Avg) 100.8dBuV/m (Pk)	Complies (-0.3dB)
15.231 (b) / 15.209	RSS 210 Table 2 / 4	Radiated Spurious Emissions, 30-4400 MHz	45.1dBµV/m (179.9µV/m) @ 1301.7MHz	Refer to standard	Complies (-8.9dB)
15.231 (c)	RSS 210 A1.1.3	Bandwidth	490kHz	< 1.08 MHz	Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	N/A	-	N/A

Note 1 – Refer to the operational description included with this application for detailed description and timing diagrams for transmission duration.
Note 2 – The device was tested in all three orthogonal orientations.

MOMENTARILY OPERATED DEVICES – DATA SIGNALS OR SIGNALS AT PREDETERMINED INTERVALS

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.231 (e)	RSS 210 A1.1.5	Duration of transmissions	912 ms	< 1 second	Complies
15.231 (e)	RSS 210 A1.1.5	Period between transmissions	30.3 s	> 30 times duration of signal and > 10s	Complies
15.231 (e)	RSS 210 Table 5	Fundamental Signal Strength	72.5dBuV/m (Avg) 92.5dBuV/m (Pk)	72.9dBuV/m (Avg) 92.9dBuV/m (Pk)	Complies (-0.4dB)
15.231 (e) / 15.209	RSS 210 Table 5	Radiated Spurious Emissions, 433.92 – 4339.2 MHz	45.1dBµV/m (179.9µV/m) @ 1301.7MHz	Refer to standard	Complies (-8.9dB)
15.231 (c)	RSS 210 A1.1.3	Bandwidth	490 kHz	1.08 MHz	Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	N/A	N/A – Radio does no 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.
Note 2 – As the device is intended for hand-held operation it was tested in all three orthogonal orientations.

RFID DEVICES OPERATING IN THE 433.5 – 434.5MHz BANDS

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.240 (a)	RSS 210 A5	Location of operation	The tag is triggered by a reader to send transmissions under 15.240. User information and location of these Readers is applicable to the Readers and not the Tag.	Must be limited to commercial and industrial areas	
15.240 (f)	-	Information to user		Notification of geographic limitations	
15.240 (b)	RSS 210 A5 (1)	Duration of transmissions	Tag read response: 60s or less	< 60s with 10s silent period	Complies
15.240 (b)	RSS 210 A5 (2)	Fundamental Signal Strength	80.5dBuV/m (Avg) 92.5dBuV/m (Pk)	11000uV/m avg 55000uV/m pk	
15.240 (c) / 15.209	RSS 210 Table 2	Radiated Spurious Emissions, 30 MHz – 4339 MHz	45.1dBµV/m (179.9µV/m) @ 1301.7MHz	Refer to standard	Complies (-8.9dB)

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antenna	Unique rf connector or integral antenna	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	45.7dBµV/m (192.8µV/m) @ 1693.8MHz	Refer to standards	Complies (-8.3dB)
-	RSS GEN	99% bandwidth	171kHz	Reference only	N/A
15.207	RSS GEN Table 2	AC Conducted Emissions	Not applicable, device is battery powered and is not intended to be powered from another source	Refer to standard	N/A

MEASUREMENT UNCERTAINTIES

ISO Guide 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 were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

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

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Savi Technology, Inc. model ST-673 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 or similar piece of equipment. The EUT was treated as table-top 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.
The sample was received on January 26, 2006 and tested on February 10, February 14 and February 28, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Savi Technology	ST-673	RFID tag	769749	None yet

ANTENNA SYSTEM

The antenna is integral to the device.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It is provided with steel mounting bracket and measures approximately 6.5 cm wide by 3.5 cm deep by 15.5 cm 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 EUT was set to transmit continuously for tests in transmit mode and with the receiver constantly on in receive mode.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on February 10, February 14 and February 28, 2006at the Elliott Laboratories Open Area Test Site #1 & 2 located at 684 West Maude Avenue, Sunnyvale, California or 41039 Boyce Road, Fremont, 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 and RSS 212.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003 and RSS 212. 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 / RSS 212.

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.

POWER METER

Power measurements are made using either a power meter (typically with a peak power sensor) or as detailed in FCC KDB558074 using a spectrum analyzer and either the built-in channel power measurement function or software to integrate the power over the displayed spectrum.

When using the integration method the analyzer's internal function or software account for the equivalent noise bandwidth of the resolution bandwidth used when performing the integration. The bandwidths, detector (peak or sample) and trace data (max held or power averaging) are detailed in the test data. When using a power averaging function the device is either in a continuous transmit mode or the analyzer is configured to only sweep when the transmitter is active to ensure that the averaging is performed over a transmit burst and not over quiet periods.

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 biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors 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.

ANSI C63.4:2003 and RSS 212 secify 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.

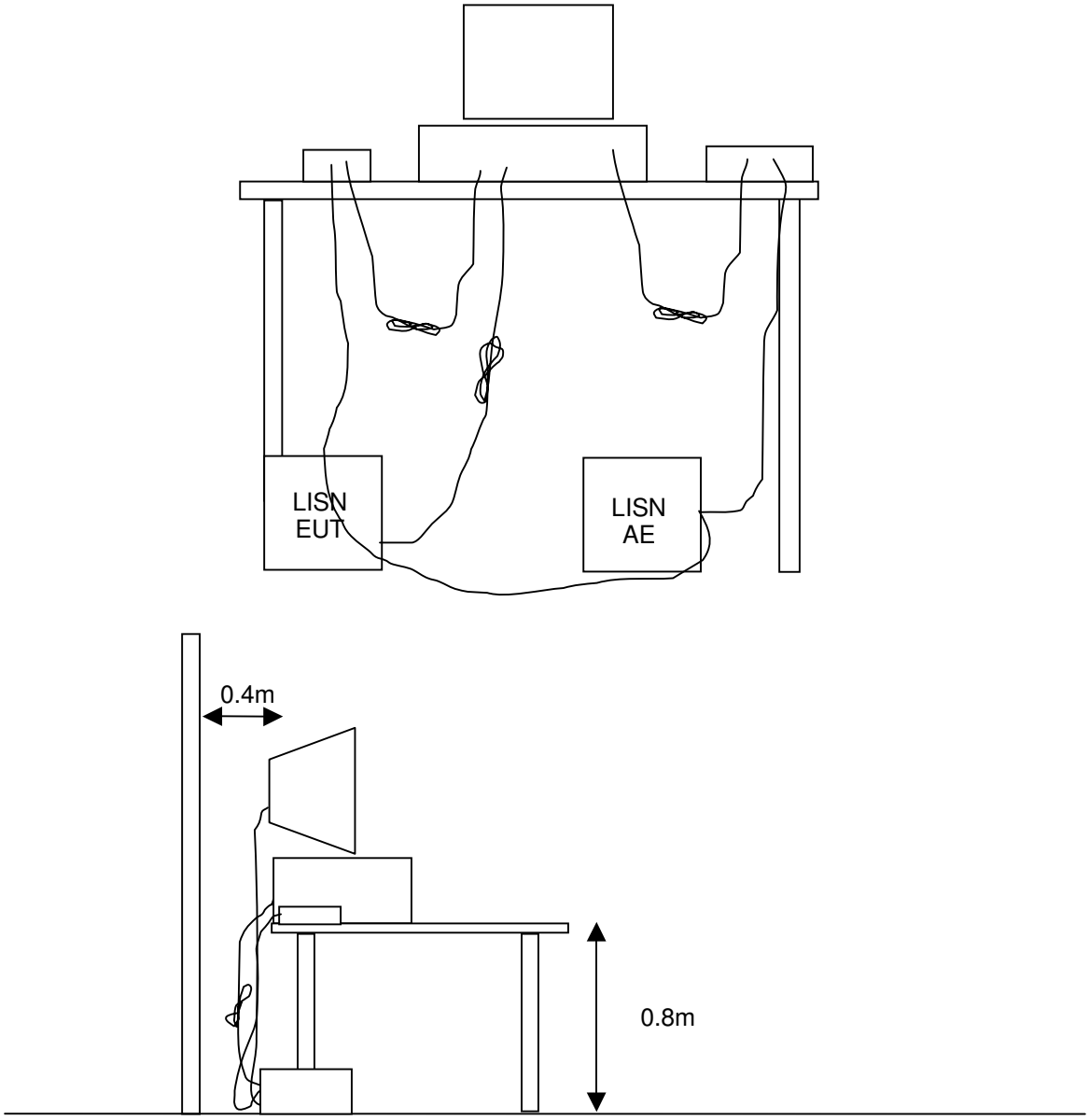
TEST PROCEDURES

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.

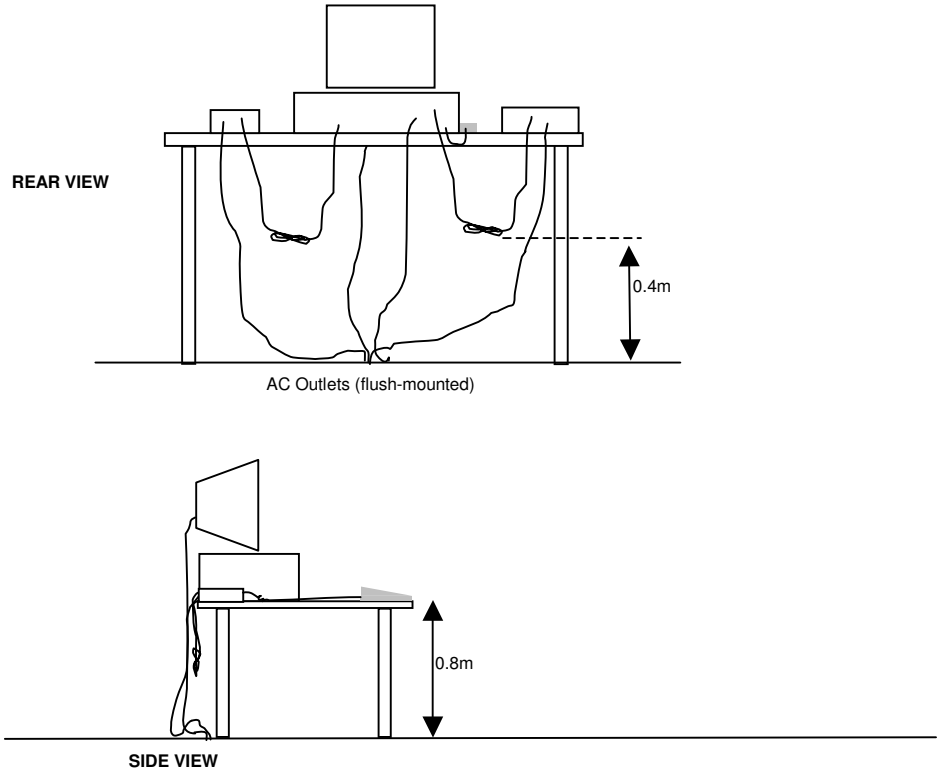

LISN
EUT
LISN
AE
0.4m
0.8m

RADIATED EMISSIONS

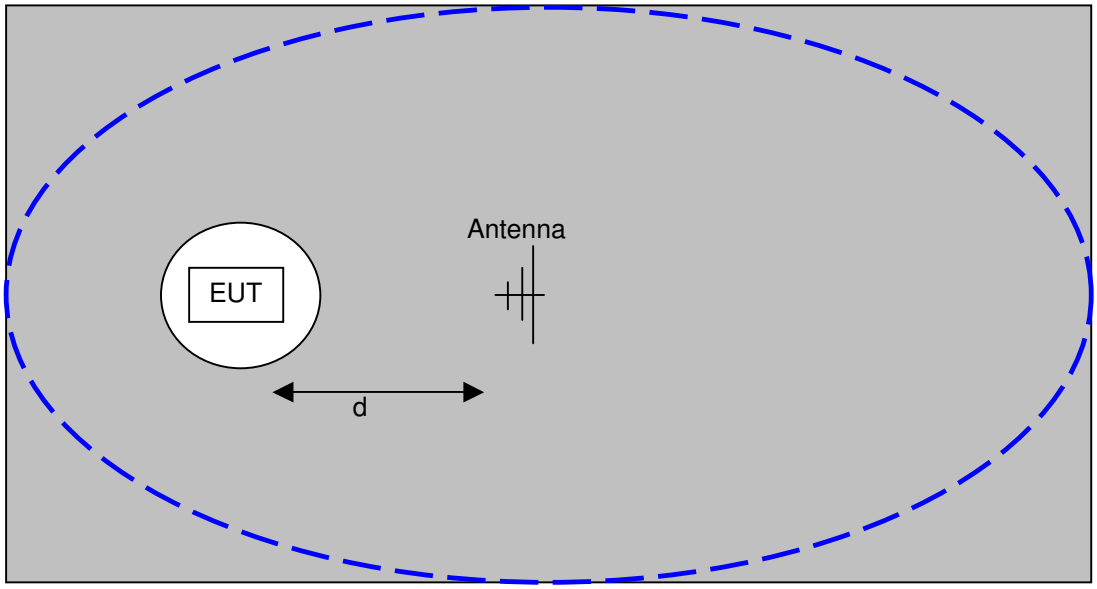
Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied 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.

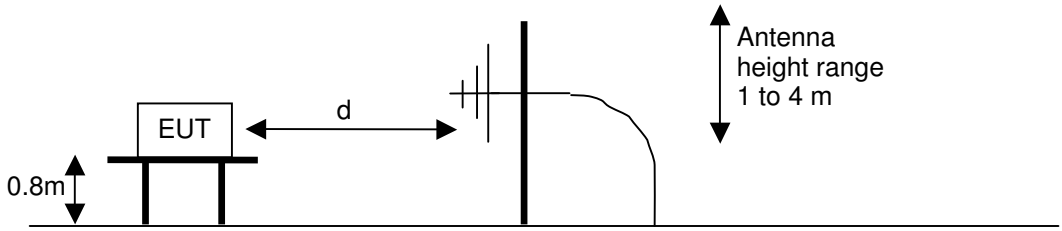
Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters. 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. Emissions, which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.



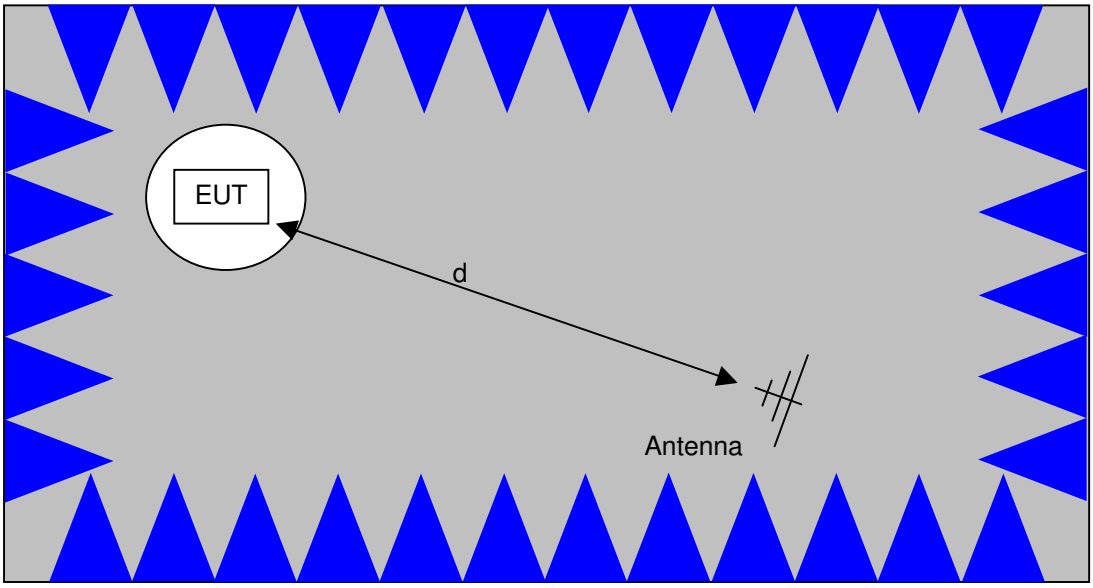
Typical Test Configuration for Radiated Field Strength Measurements



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.

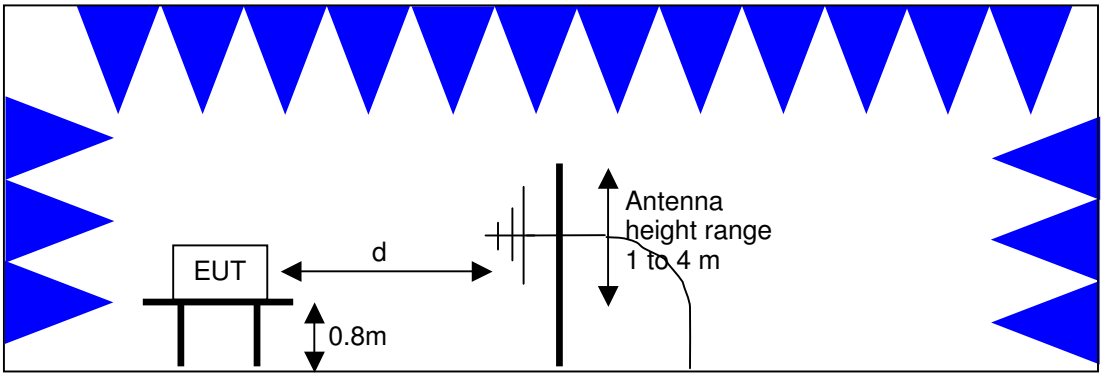


Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

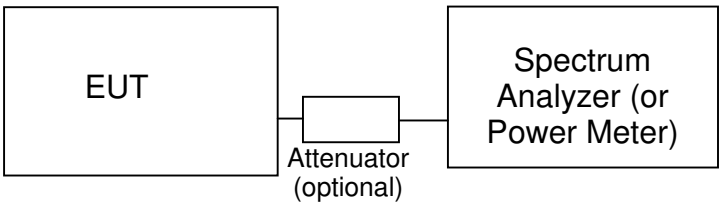
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and Elliott's test procedures for the type of radio being tested.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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 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 the limits for all emissions for a low power device operating under the general rules of RSS 210, FCC Part 15 Subpart C.

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

RADIATED SPURIOUS EMISSIONS – MOMENTARILY OPERATED DEVICES

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

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

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

RECEIVER SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for emissions from the receiver as detailed in FCC Part 15.109, RSS 210 table 2, RSS GEN table 1.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

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

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, 400 - 6,500 MHz, 10-Feb-06 & 28-Feb-06
Engineer: David Bare & Mehran Bergani

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	24-Apr-07
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	17-Apr-07
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	30-Mar-07
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06
ETS-Lindgren	Horn Antenna, D. Ridge 1-18GHz	3117	1662	07-Apr-07

EXHIBIT 2: Test Measurement Data

8 Pages

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EMC Test Data

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-
Immunity Spec:	EN 301 489-3	Environment:	-

EMC Test Data

For The

Savi

Model

ST-673 & ST-674

Date of Last Test: 5/11/2006

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-
Immunity Spec:	EN 301 489-3	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 or similar piece of equipment. The EUT was treated as table-top 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-673	RFID tag	769749	None yet
Savi Technology	ST-674	RFID tag	769733	None yet

EUT Antenna

The antenna is integral to the device.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. Model ST-673 is provided with steel mounting bracket and measures approximately 6.5 cm wide by 3.5 cm deep by 15.5 cm high. Model ST-674 measures approximately 5.5 cm wide by 3 cm deep by 15 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

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EMC Test Data

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-
Immunity Spec:	EN 301 489-3	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 EUT enclosure is primarily constructed of plastic. Model ST-673 is provided with steel mounting bracket and measures

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-

Radiated Emissions (ST-673)

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: 2/28/2006
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: 13 °C
Rel. Humidity: 59 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 433.92MHz, Fundamental	15.231(e), 15.240 and 15.231(a); RSS-210	Pass	80.5dBµV/m (10592.5µV/m) @ 433.878MHz (-0.3dB)
1b	RE, Tx Spurious Emissions	FCC 15.209	Pass	45.1dBµV/m (179.9µV/m) @ 1301.7MHz (-8.9dB)
2	RE, RxSpurious Emissions	15.109 & RSS-GEN	Pass	45.7dBµV/m (192.8µV/m) @ 1693.8MHz (-8.3dB)
3	Bandwidth (20dB)	15.109 & RSS-GEN	Pass	490kHz
3	Bandwidth (99%)	15.109 & RSS-GEN	N/A	171 kHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-

Deviations From The Standard

No deviations were made from the requirements of the standard.
Model ST-673, R21 = 13k ohms

Run #1a: Fundamental Mesaurement of 433.923

Operation under 15.231(e)

Frequency	Level	Pol	FCC 15.231(e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.923	92.5	H	92.9	-0.4	Pk	195	1.0	Side
433.923	72.5	H	72.9	-0.4	Avg	195	1.0	Side
433.923	91.3	V	92.9	-1.6	Pk	172	1.2	Upright
433.923	71.3	V	72.9	-1.6	Avg	172	1.2	Upright
433.923	88.3	V	92.9	-4.6	Pk	259	1.1	Flat
433.923	68.3	V	72.9	-4.6	Avg	259	1.1	Flat
433.923	88.2	H	92.9	-4.7	Pk	16	1.0	Flat
433.923	68.2	H	72.9	-4.7	Avg	16	1.0	Flat
433.923	84.7	H	92.9	-8.2	Pk	274	1.0	Upright
433.923	64.7	H	72.9	-8.2	Avg	274	1.0	Upright
433.923	72.0	V	92.9	-20.9	Pk	176	1.1	Side
433.923	52.0	V	72.9	-20.9	Avg	176	1.1	Side

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

Operation under 15.231(a)

Frequency	Level	Pol	FCC 15.231(a)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.878	80.5	V	80.8	-0.3	Avg	186	1.2	Side
433.878	92.5	V	100.8	-8.3	Pk	186	1.2	Side

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.

Operation under 15.240

Frequency	Level	Pol	FCC 15.240		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.878	80.5	V	80.8	-0.3	Pk	186	1.2	Side
433.878	92.5	V	94.8	-2.3	Pk	186	1.2	Side

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.

Elliott

EMC Test Data

Client:	Savi	Job Number:	J62592
Model:	ST-673 & ST-674	T-Log Number:	T62626
		Account Manager:	Esther
Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-

Run #1b: Other 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	
1301.732	45.1	V	54.0	-8.9	Avg	28	1.0	Upright
867.847	34.7	H	46.0	-11.3	PK	196	1.0	Side, peak reading QP limit
1301.724	42.4	H	54.0	-11.6	Avg	20	2.8	Flat
1301.769	41.2	H	54.0	-12.8	Avg	142	3.2	Side
1301.784	39.5	V	54.0	-14.5	Avg	110	1.0	Flat
867.847	31.5	V	46.0	-14.5	PK	228	1.0	Upright, peak reading QP limit
867.847	30.2	V	46.0	-15.8	PK	265	1.1	Flat, peak reading QP limit
1301.739	38.0	V	54.0	-16.0	Avg	140	1.0	Side
867.847	29.7	H	46.0	-16.3	PK	360	1.2	Flat, peak reading QP limit
1301.746	37.5	H	54.0	-16.5	Avg	145	1.5	Upright
867.847	29.4	H	46.0	-16.6	PK	244	1.0	Upright, peak reading QP limit
1301.732	57.1	V	74.0	-16.9	PK	28	1.0	Upright
867.847	28.9	V	46.0	-17.1	PK	84	1.0	Side, peak reading QP limit
2170.041	34.7	V	54.0	-19.3	Avg	260	1.0	Upright
1301.724	54.4	H	74.0	-19.6	PK	20	2.8	Flat
1301.769	53.2	H	74.0	-20.8	PK	142	3.2	Side
1735.715	32.1	H	54.0	-21.9	Avg	140	1.5	Side
1735.685	32.1	H	54.0	-22.0	Avg	50	1.5	Flat
1301.784	51.5	V	74.0	-22.5	PK	110	1.0	Flat
1735.610	31.5	H	54.0	-22.5	Avg	250	1.0	Upright
1735.693	31.0	V	54.0	-23.0	Avg	230	2.0	Flat
1735.708	31.0	V	54.0	-23.0	Avg	360	1.5	Upright
1735.820	30.9	V	54.0	-23.1	Avg	60	1.1	Side
1301.739	50.0	V	74.0	-24.0	PK	140	1.0	Side
1301.746	49.5	H	74.0	-24.5	PK	145	1.5	Upright
2170.041	46.7	V	74.0	-27.3	PK	260	1.0	Upright
1735.715	44.1	H	74.0	-29.9	PK	140	1.5	Side
1735.685	44.1	H	74.0	-30.0	PK	50	1.5	Flat
1735.610	43.5	H	74.0	-30.5	PK	250	1.0	Upright
1735.693	43.0	V	74.0	-31.0	PK	230	2.0	Flat
1735.708	43.0	V	74.0	-31.0	PK	360	1.5	Upright
1735.820	42.9	V	74.0	-31.1	PK	60	1.1	Side

Note 1:	Highest duty cycle for all modes of operation is 25%. A -12dB correction was used to determine the average level from the peak reading
Note 2:	Peak readings below 1GHz made using a receiver and measurement bandwidth set to 120kHz. Above 1GHz peak readings made with RB=VB=1MHz
Note 2:	All measurements compared to the 15.209 limits as these are the most stringent limits for all three modes of operation (15.231(a), 15.231(e) and 15.240).

Client:	Savi	Job Number:	J62592
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Contact:	Eugene Schlindwein		
Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-

Run #2: 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		
1693.843	45.7	V	54.0	-8.3	PK	360	1.0	Upright, Noise Floor	Note 1
1692.448	44.5	H	54.0	-9.5	PK	360	1.0	Upright, Noise Floor	Note 1
1269.982	41.3	H	54.0	-12.7	PK	63	1.7	Side	Note 1
1269.712	41.0	V	54.0	-13.0	PK	129	1.0	Side	Note 1
1269.787	40.9	H	54.0	-13.1	PK	64	1.0	Upright	Note 1
1270.305	40.9	V	54.0	-13.1	PK	0	1.0	Upright	Note 1
1270.140	40.8	H	54.0	-13.2	PK	133	1.0	Flat	Note 1
1270.357	40.8	V	54.0	-13.2	PK	360	1.8	Flat	Note 1
423.232	31.9	V	46.0	-14.1	QP	255	1.4	Upright	
423.232	28.1	H	46.0	-17.9	QP	90	1.0	Side	
846.464	26.8	V	46.0	-19.2	QP	360	1.0	Upright	
846.464	26.8	H	46.0	-19.2	QP	0	1.0	Upright	
846.464	26.8	V	46.0	-19.2	QP	360	1.0	Side	
846.464	26.8	H	46.0	-19.2	QP	0	1.0	Side	
846.464	26.8	V	46.0	-19.2	QP	360	1.0	Flat	
846.464	26.8	H	46.0	-19.2	QP	0	1.0	Flat	
423.232	25.9	H	46.0	-20.1	QP	60	1.0	Flat	
423.232	25.3	V	46.0	-20.7	QP	360	1.3	Flat	
423.232	23.2	H	46.0	-22.8	QP	175	1.9	Upright	
423.232	21.2	V	46.0	-24.8	QP	193	1.3	Side	
610.000	16.8	H	46.0	-29.2	QP	0	1.0	Side, Noise Floor	
330.000	16.6	H	46.0	-29.4	QP	0	1.0	Side, Noise Floor	
400.000	16.2	H	46.0	-29.8	QP	360	1.0	Side, Noise Floor	

Note 1	Peak reading (RB=VB=1MHz), average limit

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Spec:	FCC 15.231(a/e); FCC 15.240	Class:	-

Run #3: Transmit Mode (433.92 MHz) - Bandwidth

Signal bandwidth was measured to be 490 kHz (see graph below - RB=VB=100kHz).
The maximum permitted bandwidth is 0.25% of the fundamental signal level = 1.08MHz