EMC Test Report
Application for Grant of Equipment Authorization
pursuant to
Industry Canada RSS-Gen Issue 2 / RSS 210 Issue 7
FCC Part 15 Subpart C

Models: SMR-650-217 & SMR-650-218

IC CERTIFICATION #:	2404A-650MR4
FCC ID:	KL7-650MR-V6
APPLICANT:	Savi Technology, Inc. 351 E. Evelyn Ave. Mountain View, CA 94041
TEST SITE(S):	Elliott Laboratories 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4
REPORT DATE:	August 10, 2010
FINAL TEST DATES:	June 2, 17 and 21, 2010

AUTHORIZED SIGNATORY:

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Chief Engineer
Elliott Laboratories

REVISION HISTORY

Rev#	Date	Comments	Modified By
1	8/10/2010	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Savi Technology, Inc. model SMR-650-217 & SMR-650-218, 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.

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 SMR-650-217 & SMR-650-218 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 modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Savi Technology, Inc. models SMR-650-217 & SMR-650-218 and therefore apply only to the tested samples. The samples were selected and prepared by Eugene Schlindwein of Savi Technology, Inc..

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

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	No manually activated transmissions	< 5 seconds	Complies
15.231 (a) (2)	RSS 210 A1.1.1 (2)	Duration of automatically activated transmissions	< 5 seconds, refer to the operational description	< 5 seconds	Complies
15.231 (a) (3)	RSS 210 A1.1.1 (3)	Transmissions at predetermined / regular intervals	No transmissions at regular intervals	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 emergency conditions	-	Complies
15.231 (b)	RSS 210 Table 4	Fundamental Signal Strength	79.8dBµV/m @ 433.92MHz (Margin: -1.0dB)	Refer to table in limits section	Complies
15.231 (b) / 15.209	RSS 210 Table 2 / 4	Radiated Spurious Emissions	43.8dBµV/m @ 796.30MHz (Margin: -2.2dB)	Refer to table in limits section	Complies
15.231 (c)	-	Bandwidth (20dB)	355kHz (0.08% of 433.92 MHz)	< 0.25% of operating frequency	Complies
-	RSS 210 A1.1.3	Bandwidth (99%)	178 kHz (0.04% of 433.92 MHz)	< 0.25% of operating frequency	Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	Device 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.
Note 2 – As the device is intended for hand-held operation it was tested in all three orthogonal orientations.

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	One antenna is integral to the device and the other has a unique connector	Integral antenna or unique connector	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	43.8dBµV/m @ 796.30MHz (Margin: -2.2dB)	Refer to standard	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	45.4dBµV @ 14.852MHz (Margin: -4.6dB)	Refer to standard	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to RSS 102 declaration	Refer RSS 102	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	See user's manual	Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	See user's manual	Statement for products with detachable antenna	Complies

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	Measurement Unit	Frequency Range	Expanded Uncertainty
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Savi Technology, Inc. models SMR-650-217 & SMR-650-218 are transceivers that are designed to communicate with Savi's RFID tags. The device transmits at 123 kHz and at 433.92 MHz to initiate responses from tags within its vicinity. The tags transmit at 433.92 MHz, so the EUT also contains a receiver operating at 433.92 MHz. The device operates from an internal, rechargeable battery and is recharged through its USB cable connection. It is intended to be operated as a hand held device although it can operate while connected to a Laptop or Desktop PC. The 123 kHz transmitter operates under part 15.209 of the FCC's rules. The 433.92 MHz transceiver operates under sections 15.231 and 15.240 of the FCC rules. The 433.92 MHz transmissions consist of both data and control signals. When operating under 15.231 rules, the control/data signals are maximum 60 mS long and have a duty cycle of no more than 60% measured in a 100 mS period. There is one other type of control signals, the Wake-Up with Hello Command signal that is a 2.5 second transmission.

When operated under 15.209 rules, the 123 kHz transmissions may be continuous.

Normally the EUT would be hand held during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 5VDC, 500mA.

The sample was received on June 2, 2010 and tested on June 2, 17 and 21, 2010. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Savi Technology	SMR-650-218	RFID Tag Reader	18710493396995	KL7-650MR-V6

OTHER EUT DETAILS

The model SMR-650-217 is identical to the SMR-650-218 except the USB cable is shorter (0.5 m versus 3 m). Preliminary scans demonstrated that the emissions were highest on the SMR-650-218.

ENCLOSURE

The SMR-650-217 & SMR-650-218 enclosure is primarily constructed of plastic. It measures approximately 7cm wide by 2.5cm deep by 7cm high.

ANTENNA SYSTEM

The antenna systems used in the Savi Technology, Inc. models SMR-650-217 & SMR-650-218 consist of an integral antenna for the 123 kHz transmitter and a monopole antenna with a custom connector for the 433.92 MHz transmitter.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at Elliott.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
HP	Pavilion dv6000	Laptop Computer	CNF73411TQ	DoC

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

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

Port		Cable(s)		
From	To	Description	Shielded/Unshielded	Length(m)
Interface (Model 218)	Laptop	USB	Shielded	3.0
Interface (Model 217)	Laptop	USB	Shielded	0.5

EUT OPERATION

The EUT was continuously transmitting CW for transmitter mode tests. For receiver/digital device tests the EUT was pinged from the laptop and operated in receive mode.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. 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 and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435

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. The test site(s) contain 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 16-1-1 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.

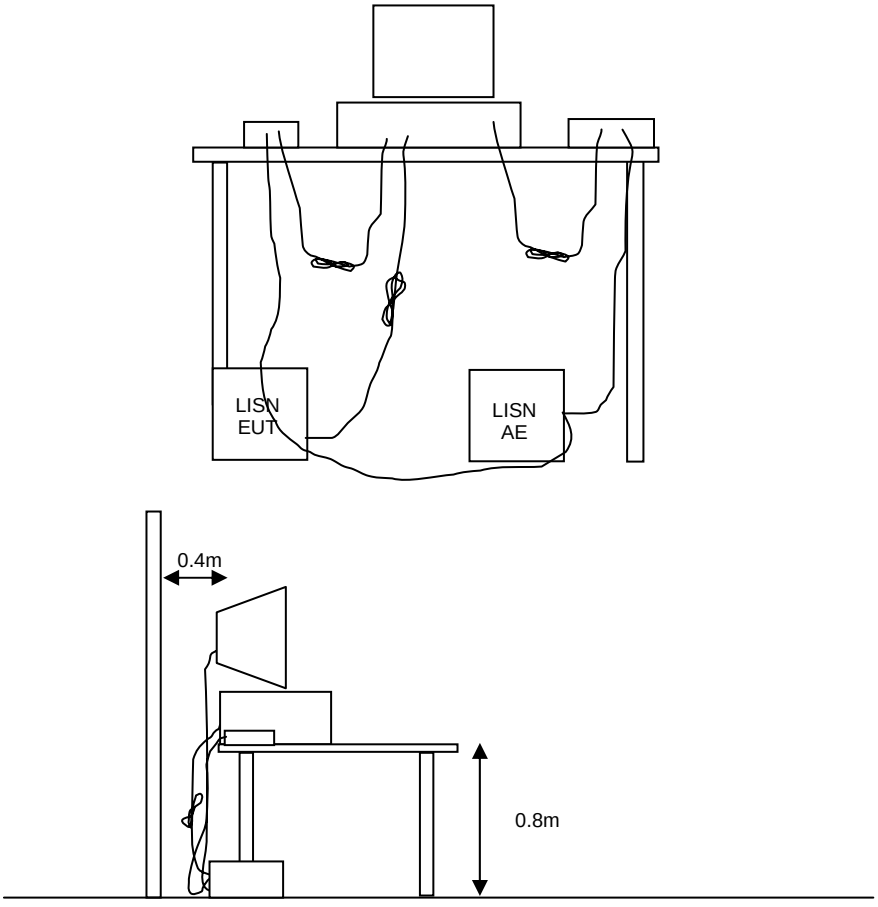
TEST PROCEDURES

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.



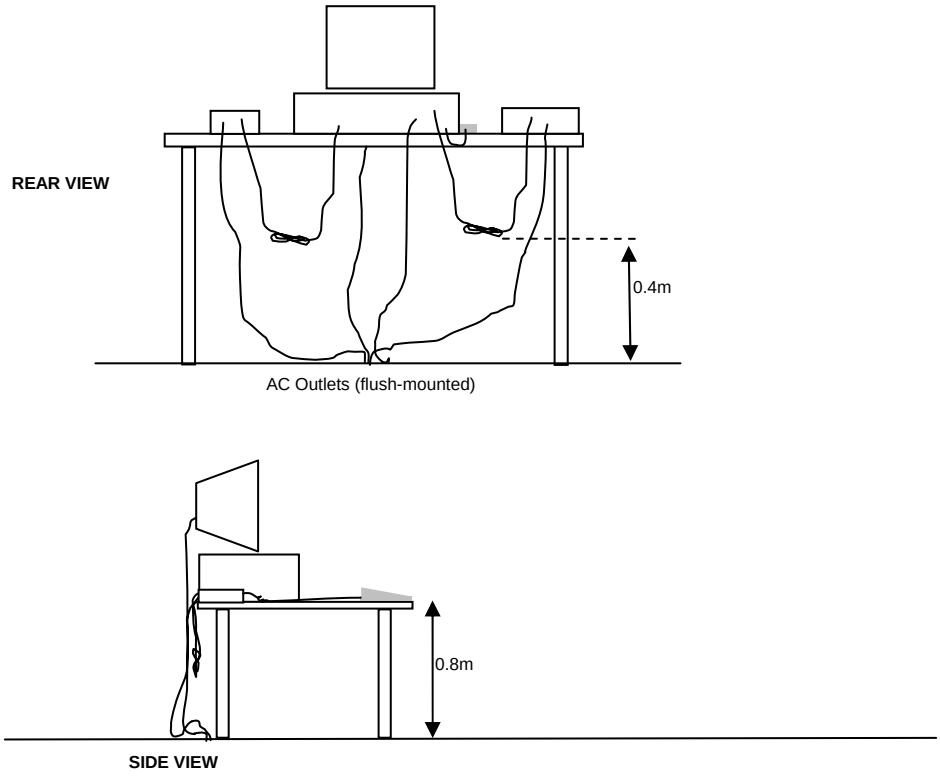
RADIATED EMISSIONS

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.

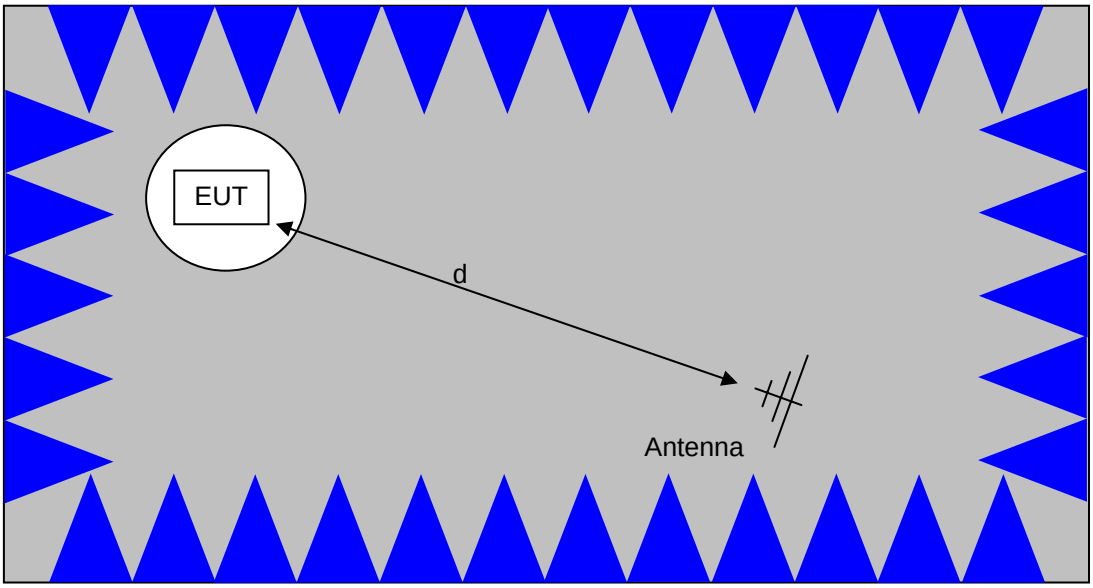
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

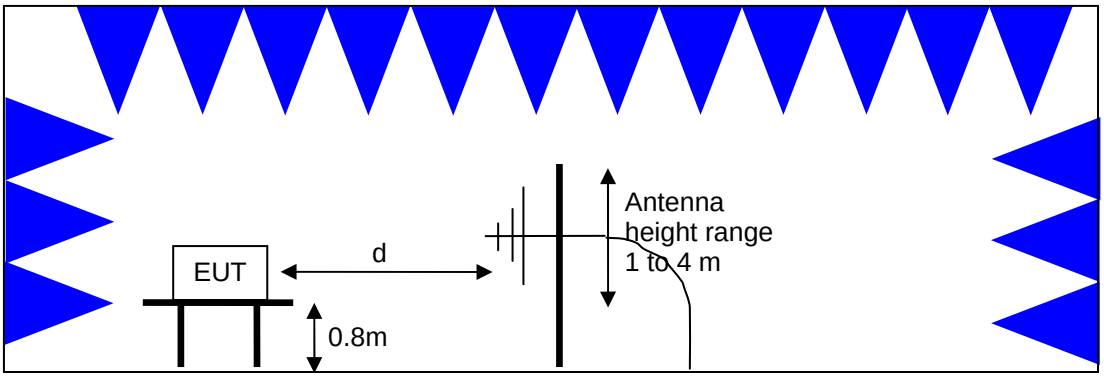


Typical Test Configuration for Radiated Field Strength Measurements



The 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

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.

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 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

RADIATED FUNDAMENTAL AND 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

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 d (meters) from the equipment under test:

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

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 30 - 4,400 MHz, 02-Jun-10

Manufacturer	Description	Model	Asset #	Cal Due
Filtek	Filter, 1 GHz High Pass	HP12/1000-5BA	957	6/17/2011
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	10/15/2010
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	6/4/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	8/10/2010
Hewlett Packard	Preamplifier, 100 kHz - 1.3 GHz	8447E	1606	4/29/2011
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	9/17/2010

Radiated Emissions, 10kHz - 5,000 MHz, 17-Jun-10

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/15/2010
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	5/26/2011
EMCO	Magnetic Loop Antenna, 10 kHz-30 MHz	6502	1299	1/23/2011
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	4/14/2011
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	6/18/2010
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103	1632	4/23/2011
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	3/16/2011

Conducted Emissions - AC Power Ports, 21-Jun-10

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1401	4/20/2011
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	10/15/2010
Fischer Custom Comm	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	2001	10/21/2010

Radiated Emissions, 30 - 5,000 MHz, 13-Jul-10

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	5/26/2011
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	7/15/2010
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	10/15/2010
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	6/4/2011
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	8/10/2010
Hewlett Packard	Preamplifier, 100 kHz - 1.3 GHz	8447E	1606	4/29/2011

Appendix B Test Data

T79517 7 Pages

Client:	Savi Technologies	Job Number:	J79402
Model:	SMR-650-217 & SMR-650-218	T-Log Number:	T79517
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein	Project Engineer:	David Bare
Emissions Spec:	FCC 15.240, 15.231a	Class:	A
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Savi Technologies

Model

SMR-650-217 & SMR-650-218

Date of Last Test: 7/19/2010

Client:	Savi Technologies	Job Number:	J79402
Model:	SMR-650-217 & SMR-650-218	T-Log Number:	T79517
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A

Radiated Emissions

Test Specific Details

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

Date of Test: 6/2 & 17/2010
Test Engineer: Mehran Birgani
Test Location: FT Chamber #4

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. Remote support equipment was located approximately 30 meters from the test area with all I/O connections routed overhead.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

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.

Ambient Conditions:

Temperature: 15-20 °C
Rel. Humidity: 30-40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1a	RE, 30 -4400 MHz Control/Data Transmissions	FCC 15.231(a), 15.240, RSS 210	PASS	78.3dBµV/m @ 433.92MHz (Margin: -2.5dB)
1b	RE, 30 -4400 MHz Wake-Up Transmissions	FCC 15.231(a), 15.240, RSS 210	PASS	79.8dBµV/m @ 433.92MHz (Margin: -1.0dB)
2	RE, RxSpurious Emissions	15.109 RSS 210	PASS	43.8dBµV/m @ 796.30MHz (Margin: -2.2dB)
3	Harmonics	IEC 60601-1-2	PASS	33.3dBµV/m @ 796.30MHz (Margin: -13.7dB)
4	20dB Bandwidth	FCC 15.231	PASS	355 kHz
4	99% Bandwidth	RSS 210	-	178 kHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Savi Technologies	Job Number:	J79402
Model:	SMR-650-217 & SMR-650-218	T-Log Number:	T79517
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A

Run #1a: Radiated Emissions, 30-4400 MHz
Measurements made with 120kHz BW and Peak detector. See note 1 for average values.

Fundamental - TX with Unit serial number: 18710493396995 (Control/Data)

Frequency	Level	Pol	FCC 15.231(a)		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	Setting	Position
433.920	78.3	V	80.8	-2.5	AVG	46	1.1	13	Upright
433.920	77.9	H	80.8	-2.9	AVG	260	2.1	13	Flat
433.920	77.5	H	80.8	-3.3	AVG	267	2.0	13	Side
433.920	69.1	V	80.8	-11.7	AVG	314	2.4	13	Flat
433.920	68.7	V	80.8	-12.1	AVG	149	1.0	13	Side
433.920	68.1	H	80.8	-12.7	AVG	267	1.0	13	Upright
433.920	82.7	V	100.8	-18.1	PK	46	1.1	13	Upright
433.920	82.3	H	100.8	-18.5	PK	260	2.1	13	Flat
433.920	81.9	H	100.8	-18.9	PK	267	2.0	13	Side
433.920	73.5	V	100.8	-27.3	PK	314	2.4	13	Flat
433.920	73.1	V	100.8	-27.7	PK	149	1.0	13	Side
433.920	72.5	H	100.8	-28.3	PK	267	1.0	13	Upright

Note 1:	Average readings for control/data mode were calculated from the peak readings by applying a duty cycle correction factor based on the highest duty cycle of all pulsed transmissions (60% in any 100mS period equals a duty cycle correction of -4.4dB).

Run #1b: Radiated Emissions, 30-4400 MHz
Measurements made with 120kHz BW and Peak detector. See note 1 for average values.

Fundamental - TX with Unit serial number: 18710493396995 (Wakeup)

Frequency	Level	Pol	FCC 15.231(a)		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	Setting	Position
433.920	79.6	H	80.8	-1.2	AVG	260	2.1	21	Flat
433.920	70.7	V	80.8	-10.1	AVG	314	2.4	21	Flat
433.920	79.6	H	100.8	-21.2	PK	260	2.1	21	Flat
433.920	70.7	V	100.8	-30.1	PK	314	2.4	21	Flat
433.920	79.1	H	80.8	-1.7	AVG	267	2.0	21	Side
433.920	70.4	V	80.8	-10.4	AVG	149	1.0	21	Side
433.920	79.1	H	100.8	-21.7	PK	267	2.0	21	Side
433.920	70.4	V	100.8	-30.4	PK	149	1.0	21	Side
433.920	79.8	V	80.8	-1.0	AVG	46	1.1	21	Upright
433.920	69.5	H	80.8	-11.3	AVG	267	1.0	21	Upright
433.920	79.8	V	100.8	-21.0	PK	46	1.1	21	Upright
433.920	69.5	H	100.8	-31.3	PK	267	1.0	21	Upright

Note 1:	Average readings for the wakeup are identical to the peak values as the EUT transmits continuous CW.

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		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A

Spurious Emissions with power setting of 13

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	Orientation	
867.846	28.9	V	46.0	-17.1	QP	67	1.0	Flat	
867.846	39.6	H	46.0	-6.4	QP	20	1.0	Flat	
867.846	34.0	V	46.0	-12.0	QP	306	1.2	Side	
867.846	35.7	H	46.0	-10.3	QP	116	1.0	Side	
867.846	33.8	V	46.0	-12.2	QP	281	1.1	Upright	
867.846	36.8	H	46.0	-9.2	QP	277	1.0	Upright	
1200.370	38.5	V	54.0	-15.5	Peak	154	1.0	Upright	Note 2
1301.800	33.9	H	54.0	-20.1	Peak	238	1.0	Upright	Note 2
1301.800	34.1	V	54.0	-19.9	Peak	288	1.3	Side	Note 2
1200.370	38.0	V	54.0	-16.0	Peak	318	1.0	Side	Note 2
2598.340	36.8	H	54.0	-17.2	Peak	235	1.6	Side	Note 2
1198.330	39.6	V	54.0	-14.4	Peak	151	1.0	Flat	Note 2
1062.330	35.1	V	54.0	-18.9	Peak	33	1.3	Flat	Note 2
1301.830	33.6	H	54.0	-20.4	Peak	47	1.0	Flat	Note 2

Note:	Peak and average measurements below 1GHz made using the test receiver's detectors and a 120kHz bandwidth. Peak measurements above 1GHz were made using RBW=VBW=1MHz and compared to the average limit.
Note 1:	Spurious emission were tested at highest power setting (13).
Note 2:	Peak reading vs. average limit

Client:	Savi Technologies	Job Number:	J79402
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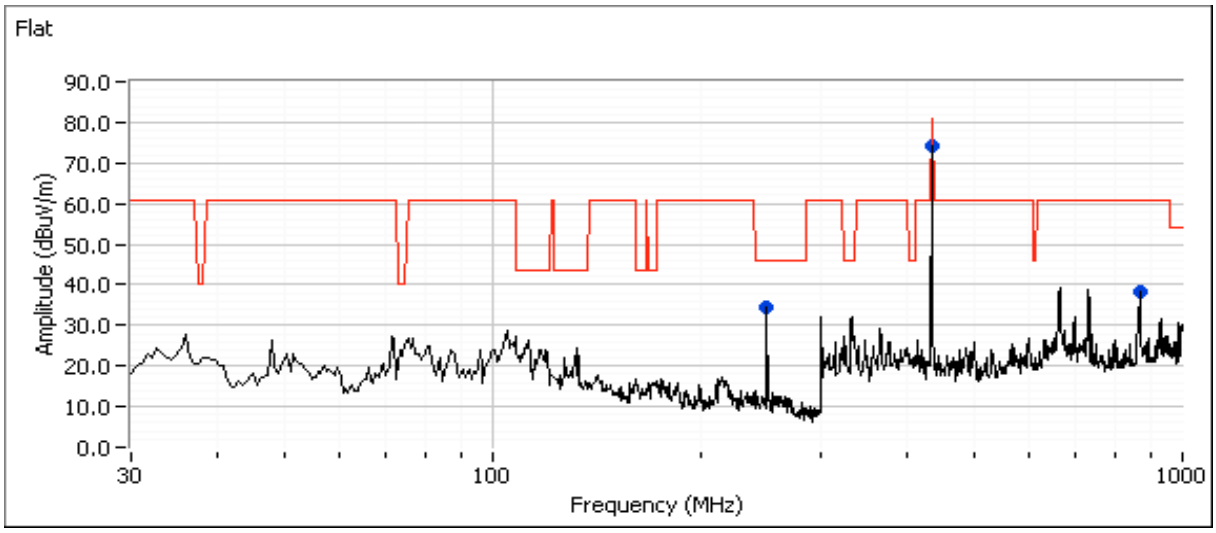
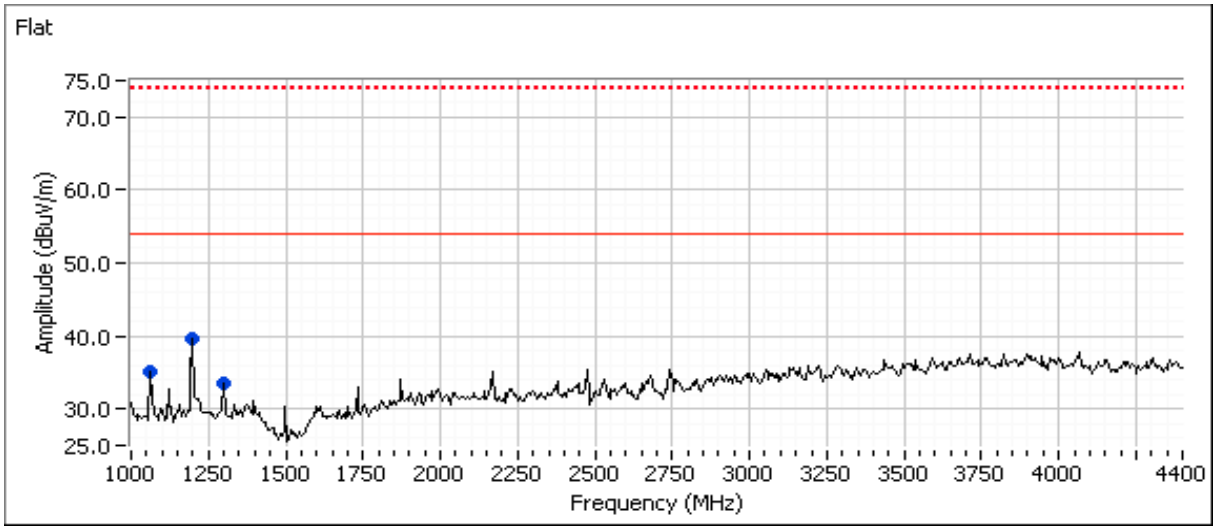
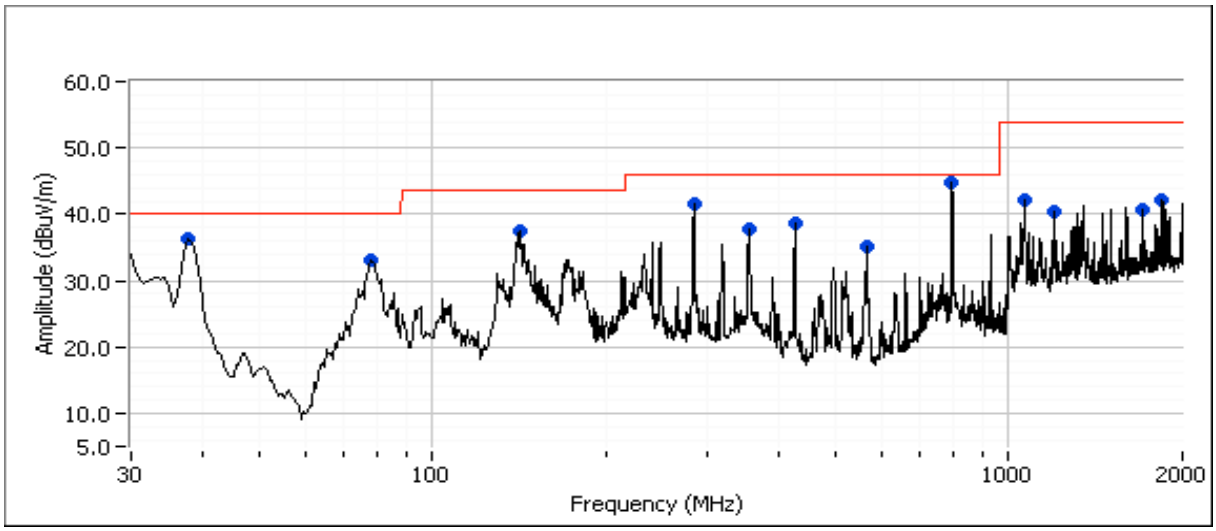
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A





Client:	Savi Technologies	Job Number:	J79402
Model:	SMR-650-217 & SMR-650-218	T-Log Number:	T79517
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A

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	
38.608	29.9	V	40.0	-10.1	QP	101	1.0	
78.289	27.2	H	40.0	-12.8	QP	143	2.2	
140.025	31.6	H	43.5	-11.9	QP	143	2.2	
283.176	35.9	H	46.0	-10.1	QP	102	1.0	
353.299	35.9	V	46.0	-10.1	QP	180	1.3	
423.998	33.7	V	46.0	-12.3	QP	182	1.0	
565.239	34.1	V	46.0	-11.9	QP	146	1.6	
796.298	43.8	H	46.0	-2.2	QP	179	1.0	
1066.670	42.2	V	54.0	-11.8	Peak	144	1.0	Peak reading with average limit
1193.330	40.3	V	54.0	-13.7	Peak	302	1.3	Peak reading with average limit
1700.000	40.8	H	54.0	-13.2	Peak	108	1.1	Peak reading with average limit
1838.330	42.2	H	54.0	-11.8	Peak	155	1.0	Peak reading with average limit

Note 1:	All three orientations evaluated and harmonics below noise floor were not recorded.

Run #3: Radiated Emissions, 30-1000 MHz - Harmonics versus IEC 60601-1-2 limit.

The highest signal level at the second harmonic from the previous runs was measured at 10m:

Frequency	Level	Pol	EN 55011 Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
796.298	33.3	H	47.0	-13.7	QP	179	1.0	Flat

Client:	Savi Technologies	Job Number:	J79402
Model:	SMR-650-217 & SMR-650-218	T-Log Number:	T79517
		Account Manager:	Shreean Washington
Contact:	Eugene Schlindwein		
Standard:	FCC 15.240, 15.231a	Class:	A

Run #4: 20dB Bandwidth

20dB BW Limit = 1.08 MHz