

***Electromagnetic Emissions Test Report
and
Application for Grant of Equipment Authorization
pursuant to
FCC Part 15, Subpart C Specifications for an
Intentional Radiator on the
Savi Technology, Inc.
Model: SMR-640P-101***

FCC ID: KL7-600MR-V1

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

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Avenue
Sunnyvale, CA 94086

REPORT DATE: June 7, 2002

FINAL TEST DATE: May 31, 2002



AUTHORIZED SIGNATORY: _____

Mark Briggs
Director of Engineering

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SCOPE

An electromagnetic emissions test has been performed on the Savi Technology, Inc. model SMR-640P-101 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC 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 SMR-640P-101 and therefore apply only to the tested sample. The sample was selected and prepared by Gene Schlindwein of Savi Technology, Inc.

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their 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.

STATEMENT OF COMPLIANCE

The tested sample of Savi Technology, Inc. model SMR-640P-101 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product that 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.).

EMISSION TEST RESULTS

The following emissions tests were performed on the Savi Technology, Inc. model SMR-640P-101. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Frequency MHz	Level dBuV	Power Lead	FCC Limit	FCC Margin	Detector QP/Ave	Comments
0.5442	38.8	Neutral	48.0	-9.2	QP	

LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.209.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Frequency MHz	Level dBuV/m	Pol v/h	FCC Limit	FCC Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
132	-26.9	O	25.2	-52.1	QP	60	1.0	Note 1*

*Level calculated by applying an extrapolation factor calculated from measurements at 3m and 10m to the measurement recorded at 10m.

MEASUREMENT UNCERTAINTIES

ISO Guide 25 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 NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Savi Technology, Inc. model SMR-640P-101 is a transceiver, which is designed to communicate with Savi's RFID tags. The device transmits at 132kHz and at 433.92 MHz to initiate responses from tags within its vicinity. The Tag's transmit at a frequency of 433.92 MHz, so the EUT also contains a receiver operating at 433.92 MHz.

The device has a serial (RS232) interface to connect directly to a hand-held PC or similar device and operates from internal, rechargeable batteries. The device has an external DC input used to recharge the batteries via adapter. It is intended to be used as a hand-held device although it can operate while connected to the external AC-DC adapter.

The 132kHz transmitter operates under part 15.209 of the FCC's rules. The 433 MHz transceiver operates under section 15.231 of the FCC rules. The 433MHz transmissions consist of both data signals and control signals. The data signals are 10mS long and have a duty cycle of no more than 10% measured in a 100mS period. There are two types of control signal, one that has the same parameters as the data signals and another, the Wake-Up signal, which is a 2.5second transmission.

The 10mS data signals were tested against the requirements of 15.231(e). The Wake-Up control signal and pulsed control signals were tested against the requirements of 15.231(a).

The sample was received on May 29, 2002 and tested on May 29, 2002, May 31, 2002, June 3, 2002.

The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number
Savi	SMR-640P-101	Mobile reader	0386505020006

ENCLOSURE

The EUT enclosure is primarily constructed of plastic.

MODIFICATIONS

The EUT did not require modifications in order to comply with the emissions specifications

SUPPORT EQUIPMENT

The following equipment was used as local support equipment while testing the emissions from the 132kHz transmitter and 433MHz transceiver:

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	2635	Laptop	78-VA24897/11	ANO9611TBOON

No remote support equipment was used during emissions testing.

EXTERNAL I/O CABLING

The I/O cabling configuration while testing the radiated emissions from the transmitters was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RS232	Not connected	30cm integral cable		
DC	AC-DC adapter		unshielded	

The I/O cabling configuration while testing the radiated emissions from the receiver and during conducted emissions tests was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT RS232	Laptop	30cm integral cable	shielded	0.3
EUT DC	AC-DC adapter	2-wire	unshielded	1
Printer Parallel	Laptop Parallel	Multiconductor	shielded	3

EUT OPERATION**Radiated**

The EUT was transmitting at either 433 MHz or 132 KHz or was placed in receive-only mode.

Conducted

The 132kHz transmitter was operating and the laptop was running a batch file that created a scrolling 'H' pattern on the screen. The test was not repeated with the 433 MHz transmitter operating as the 132kHz mode was determined to be the worst-case mode.

TEST SITE**GENERAL INFORMATION**

Final test measurements were taken on May 31, 2002 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC 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 FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through 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. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

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.

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.

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 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 ranges 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.

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 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 FCC requires 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, 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

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.

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.

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:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{\text{KHz}} @ 300\text{m}$	$67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$
0.490-1.705	$24000/F_{\text{KHz}} @ 30\text{m}$	$87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$
1.705 to 30	30 @ 30m	29.5 @ 30m
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:

$$R_T - B = C$$

and

$$C - S = M$$

where:

R_T = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

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, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

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:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions Preliminary Scans, 24-May-02**Engineer: Mark**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
EMCO	Conical Log Spiral Antenna	3101	608	12	5/15/2002	5/15/2003
EMCO	Magnetic Loop Antenna, 10k-30MHz	6502	296	12	1/16/2002	1/16/2003
Hewlett Packard	Microwave Preamplifier 0.5-26.5GHz	83017A	1257	12	10/16/2001	10/16/2002
Hewlett Packard	RF Preamplifier, 100 kHz - 1.3 GHz	8447D	999	12	4/24/2002	4/24/2003
Hewlett Packard	Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	12	4/5/2002	4/5/2003
AH Systems	Biconical Antenna	SAS-200/540H	686	12	5/8/2002	5/8/2003
Dorado	Horn Antenna 1-12GHz		1258	12	11/18/2001	11/18/2002

Radiated Emissions, 30 - 1000 MHz, 29-May-02**Engineer: Vishal**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	8/28/2001	8/28/2002
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	4/16/2002	4/16/2003

Conducted and Radiated Emissions, 31-May-02**Engineer: mfaustino**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	6/14/2001	6/14/2002
EMCO	Magnetic Loop Antenna, 10k-30MHz	6502	296	12	1/16/2002	1/16/2003
EMCO	Biconical Antenna, 30-300 MHz	3110B	801	12	5/13/2002	5/13/2003
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	8/28/2001	8/28/2002
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1398	12	2/7/2002	2/7/2003
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	12	4/16/2002	4/16/2003
Solar Electronics	Support Equipment LISN, 0.150-30.0 MHz	8012-50-R-24-BNC	305	12	7/30/2001	7/30/2002

Radiated Emissions, 1 - 4.0 GHz, 03-Jun-02**Engineer: mfaustino**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Assett #</u>	<u>Cal interval</u>	<u>Last Calibrated</u>	<u>Cal Due</u>
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	12	10/9/2001	10/9/2002
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	956	12	3/12/2002	3/12/2003
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 , 9 KHz -26.5GHz	8593EM	1141	12	3/11/2002	3/11/2003
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12	1/15/2002	1/15/2003

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T47386 13 Pages



EMC Test Data

Client:	Savi	Job Number:	J47361
Model:	SAVI SMR-640P-101	T-Log Number:	T47386
		Proj Eng:	Mark Briggs
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15 B, 15.209, 15.231	Class:	A
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Savi

Model

SAVI SMR-640P-101



EMC Test Data

Client:	Savi	Job Number:	J47361
Model:	SAVI SMR-640P-101	T-Log Number:	T47386
		Proj Eng:	Mark Briggs
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15 B, 15.209, 15.231	Class:	A
Immunity Spec:	-	Environment:	-

EUT INFORMATION

General Description

The EUT is a transceiver which is designed to communicate with Savi's RFID tags. The device transmits at 132kHz and at 433.92 MHz to initiate responses from tags within its vicinity. The Tag's transmit at a frequency of 433.92 MHz, so the EUT also contains a receiver operating at 433.92 MHz.

The device has a serial (RS232) interface to connect directly to a hand-held PC or similar device and operates from internal, rechargeable batteries. The device has an external DC input used to recharge the batteries via adapter. It is intended to be used as a hand-held device although it can operate while connected to the external AC-DC adapter.

The 132kHz transmitter operates under part 15.209 of the FCC's rules. The 433 MHz transceiver operates under section 15.231 of the FCC rules. The 433MHz transmissions consist of both data signals and control signals. The data signals are 10mS long and have a duty cycle of no more than 10% measured in a 100mS period. There are two types of control signal, one that has a 24% duty-cycle and another, the Wake-Up signal, that is a 2.5second transmission.

The data signals were tested against the requirements of 15.231(e). The control signals were tested against the requirements of 15.231(a).

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Savi	SMR-640P-101	Mobile reader	0386505020006	

EUT Enclosure

The EUT enclosure is primarily constructed of plastic.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None



EMC Test Data

Client:	Savi	Job Number:	J47361
Model:	SAVI SMR-640P-101	T-Log Number:	T47386
		Proj Eng:	Mark Briggs
Contact:	Eugene Schlindwein		
Emissions Spec:	FCC 15 B, 15.209, 15.231	Class:	A
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 Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RS232	Not connected	30cm integral cable		
DC	AC-DC adapter		unshielded	

EUT Operation During Emissions

The EUT was transmitting at either 433 MHz or 132 KHz.



EMC Test Data

Client:	Savi	Job Number:	J47361
Model:	SAVI SMR-640P-101	T-Log Number:	T47386
		Proj Eng:	Mark Briggs
Contact:	Eugene Schindwein		
Emissions Spec:	FCC 15 B, 15.209, 15.231	Class:	A
Immunity Spec:	-	Environment:	-

Test Configuration #2 (Digital Device Testing)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
IBM	2635	Laptop	78-VA24897/11	ANO9611TBOON
Epson	P952A	Printer	ADA0013241	BKMFBP952A

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
EUT RS232	Laptop	30cm integral cable	shielded	0.3
EUT DC	AC-DC adapter	2-wire	unshielded	1
Printer Parallel	Laptop Parallel	Multiconductor	shielded	3

EUT Operation During Emissions

The EUT was placed in receive-only mode and the laptop was running a batch file that created a scrolling 'H' pattern on the screen.



EMC Test Data

Client: Savi	Job Number: J47361
Model: SAVI SMR-640P-101	T-Log Number: T47386
	Proj Eng: Mark Briggs
Contact: Eugene Schlindwein	
Spec: FCC 15 B, 15.209, 15.231	Class: A

Conducted Emissions - Power Ports

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: 5/31/2002
Test Engineer: Marissa Faustino
Test Location: SVOATS #2

Config. Used: #2
Config Change: The 132kHz Tx was on
EUT Voltage: Refer to individual run

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

Ambient Conditions: Temperature: 19°C
Rel. Humidity: 69%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 230V/50Hz	EN 301 489-3	Pass	-2.25dB @ .405MHz
2	CE, AC Power 120V/60Hz	FCC Class B / 15.207	Pass	-9.2dB @ .544MHz

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.



EMC Test Data

Client: Savi

Job Number: J47361

Model: SAVI SMR-640P-101

T-Log Number: T47386

Proj Eng: Mark Briggs

Contact: Eugene Schlindwein

Spec: FCC 15 B, 15.209, 15.231

Class: A

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz

Frequency	Level	AC	EN 301 489-3		Detector	Comments
MHz	dB μ V	Line	Limit	Margin	QP/Ave	
0.4050	45.5	Neutral	47.8	-2.3	Average	
0.5100	43.2	Line	46.0	-2.8	Average	
0.4080	44.8	Line	47.7	-2.9	Average	
0.5070	42.0	Neutral	46.0	-4.0	Average	
0.2048	42.6	Line	53.4	-10.8	Average	
0.4050	45.9	Neutral	57.8	-11.9	QP	
0.5100	43.9	Line	56.0	-12.1	QP	
0.4080	45.2	Line	57.7	-12.5	QP	
0.5070	43.4	Neutral	56.0	-12.6	QP	
0.2048	43.0	Line	63.4	-20.4	QP	
0.1530	42.7	Neutral	65.8	-23.1	QP	
0.1530	14.1	Neutral	55.8	-41.7	Average	

Run #2: AC Power Port Conducted Emissions, 0.45 - 30MHz, 120V/60Hz

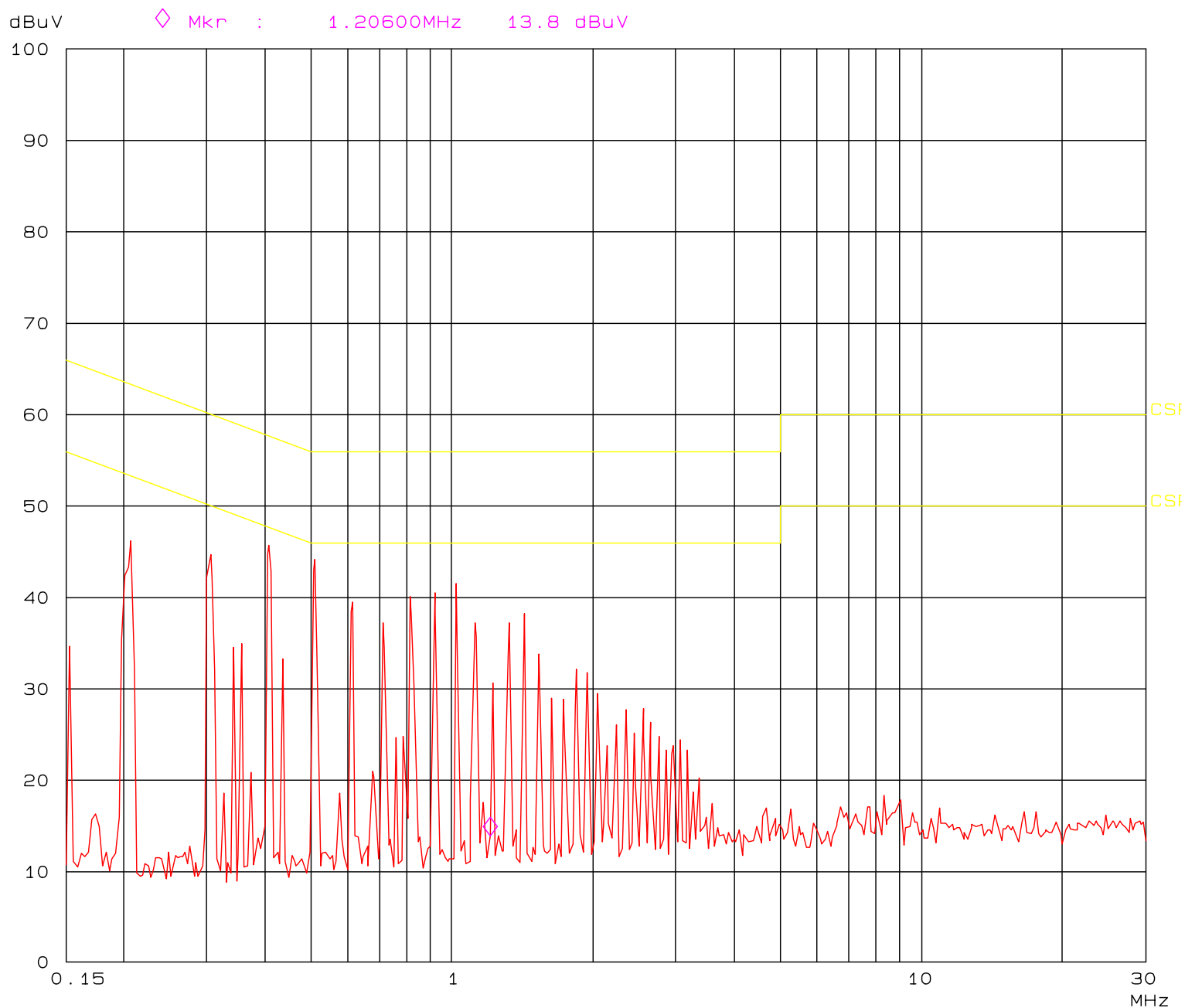
Frequency	Level	AC	FCC 15.109B, 15.209		Detector	Comments
MHz	dB μ V	Line	Limit	Margin	QP/Ave	
0.5442	38.8	Neutral	48.0	-9.2	QP	
0.6330	38.7	Neutral	48.0	-9.3	QP	
0.6355	38.4	Line	48.0	-9.6	QP	
0.5449	37.9	Line	48.0	-10.1	QP	
1.2719	37.4	Line	48.0	-10.6	QP	
1.2703	37.3	Neutral	48.0	-10.7	QP	

Elliott Laboratories Inc.

Conducted Emissions

31. May 02 14:39

Operator: Marissa Fausitno
Comment: Savi Technology
SMR-600P-102
EN 301 489-3
Run 1
230V/50Hz
Line

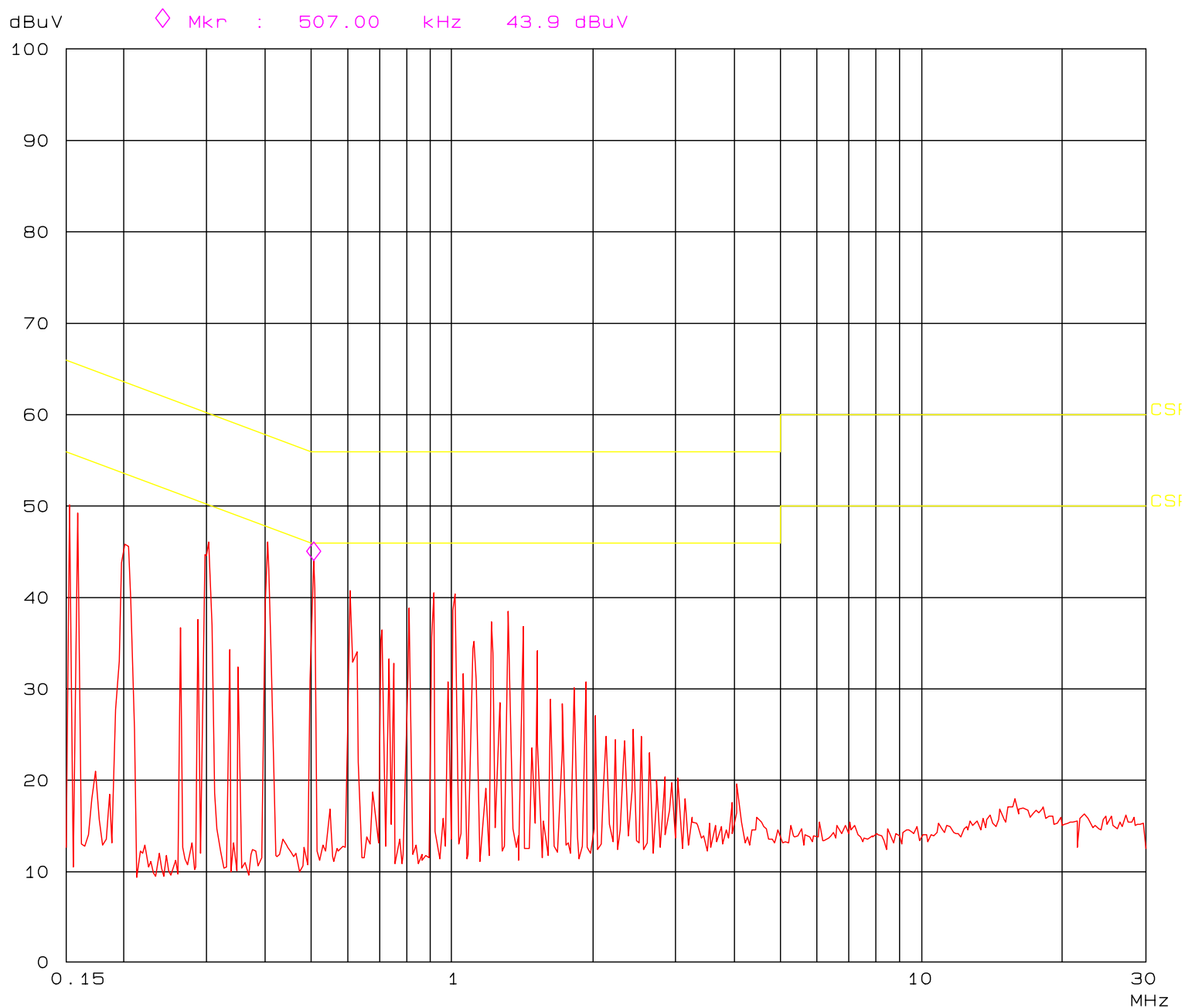


Elliott Laboratories Inc.

Conducted Emissions

31. May 02 14:46

Operator: Marissa Fausitno
Comment: Savi Technology
SMR-600P-102
EN 301 489-3
Run 1
230V/50Hz
Neutral

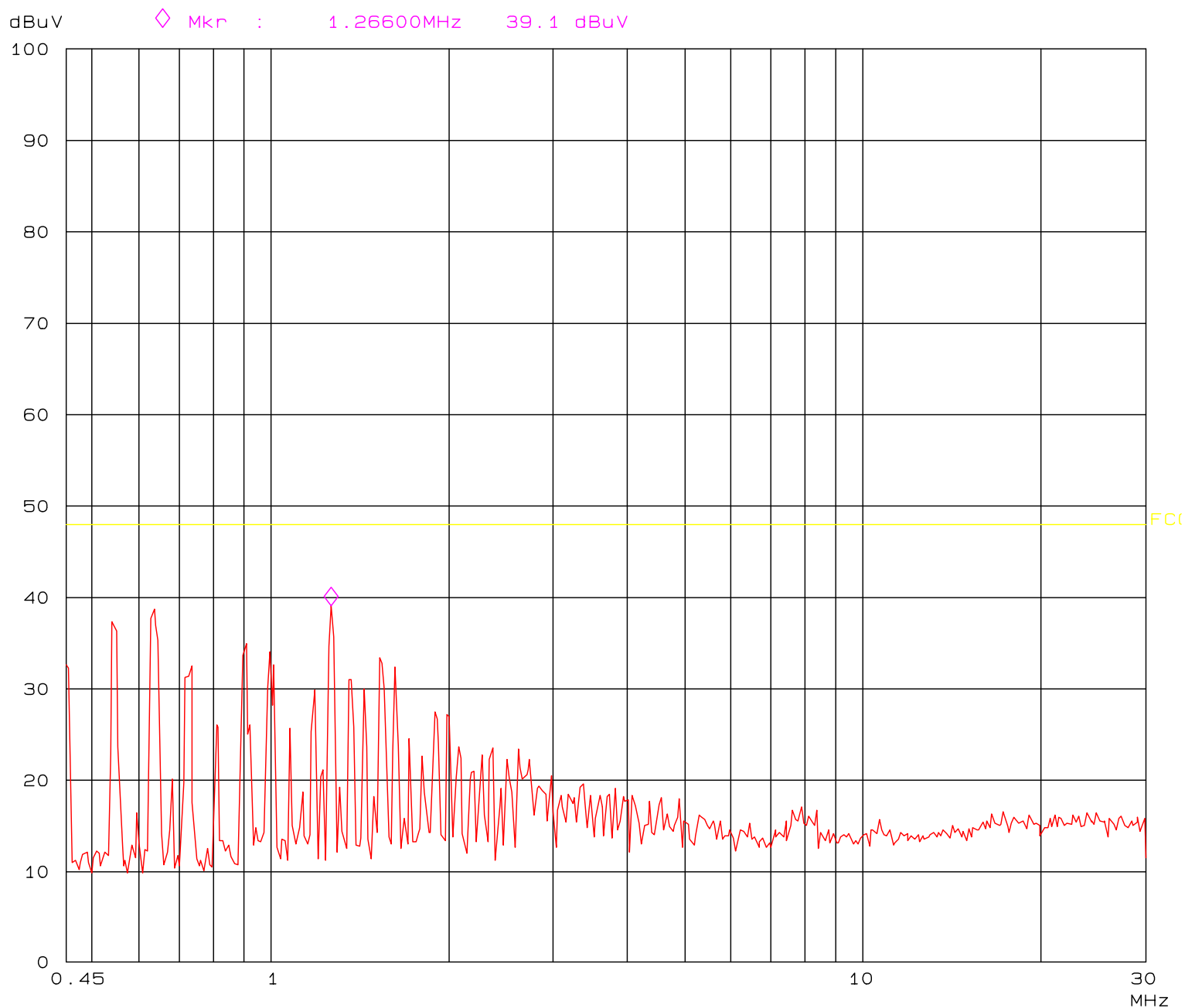


Elliott Laboratories Inc.

Conducted Emissions

31. May 02 15:03

Operator: Marissa Fausitno
Comment: Savi Technology
SMR-600P-102
FCC Class B
Run 2
120V/60Hz
Line

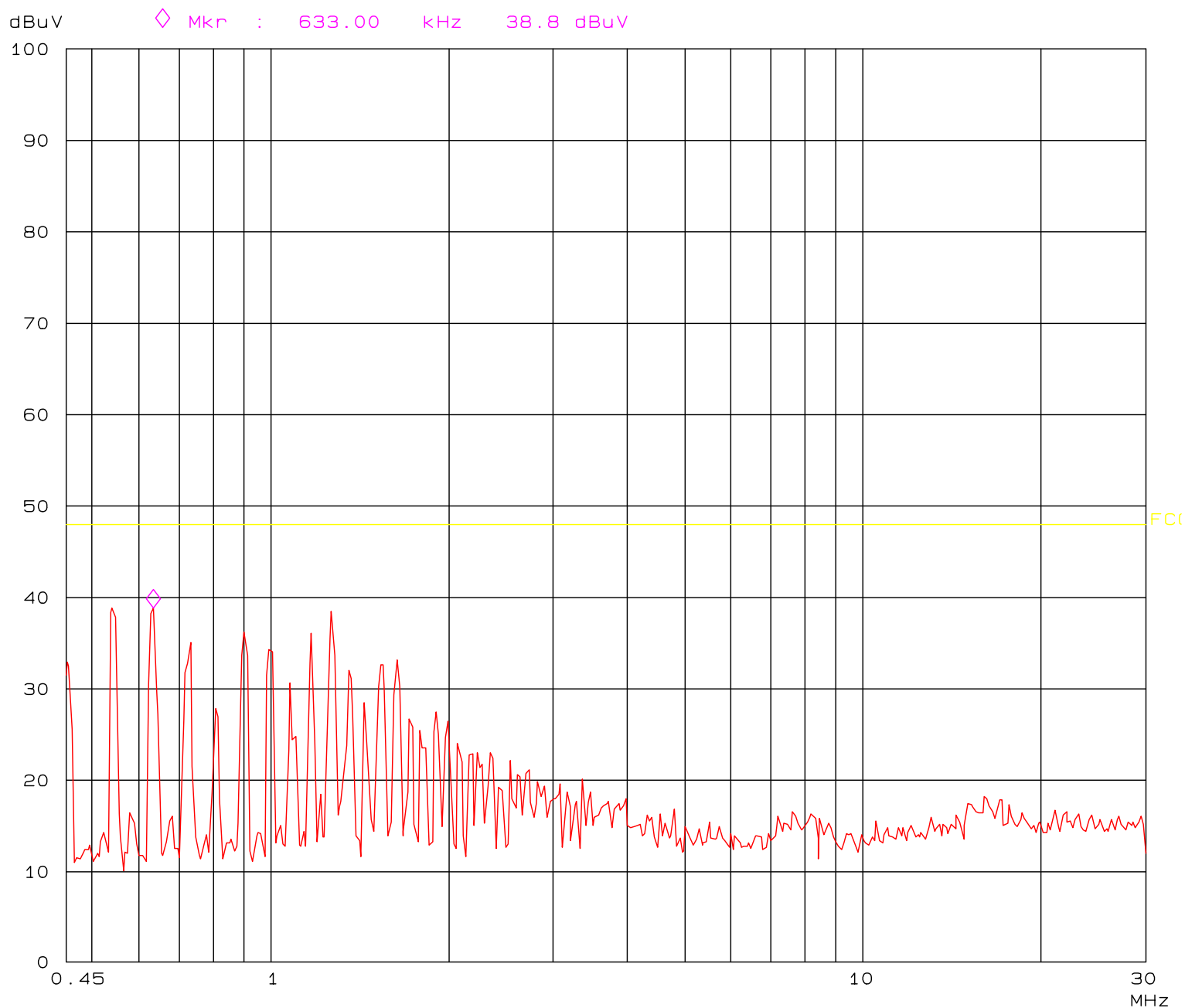


Elliott Laboratories Inc.

Conducted Emissions

31. May 02 14:58

Operator: Marissa Fausitno
Comment: Savi Technology
SMR-600P-102
FCC Class B
Run 2
120V/60Hz
Neutral





EMC Test Data

Client: Savi	Job Number: J47361
Model: SAVI SMR-640P-101	T-Log Number: T47386
	Proj Eng: Mark Briggs
Contact: Eugene Schlindwein	
Spec: FCC 15 B, 15.209, 15.231	Class: A

Radiated Emissions - 132kHz Transmitter (FCC 15.209)

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: 5/31/2002

Test Engineer: Marissa Faustino

Test Location: SVOATS #2

Config. Used: #1

Config Change: N/A

EUT Voltage 120V/60Hz

General Test Configuration

The 132kHz MHz transmitter was set to maximum output level during the test.

The measurement antenna was located 3m and/or 10m from the EUT. The measurement data has been extrapolated to the appropriate distance.

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: 19°C

Rel. Humidity: 69%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 0.132 - 1.32 MHz	FCC 15.209	Pass	-52.08dB @ 132KHz

Modifications Made During Testing:

Modifications are detailed under each run description.

Deviations From The Standard

No deviations were made from the requirements of the standard.



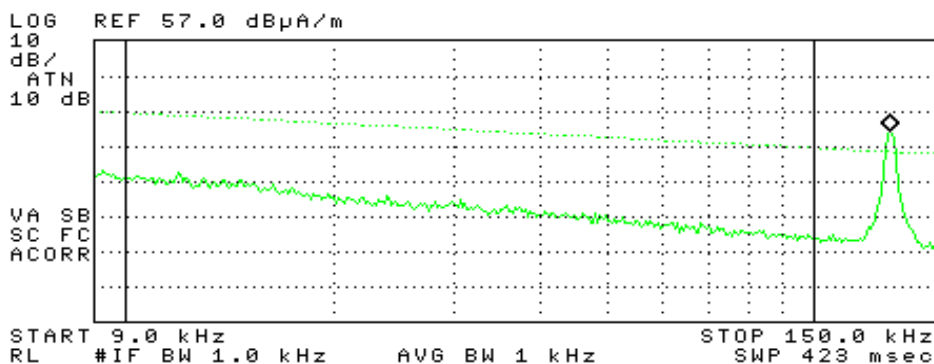
EMC Test Data

Client: Savi	Job Number: J47361
Model: SAVI SMR-640P-101	T-Log Number: T47386
Contact: Eugene Schlindwein	Proj Eng: Mark Briggs
Spec: FCC 15 B, 15.209, 15.231	Class: A

Run #1: Radiated Emissions, 0.009 - 1000 MHz: Transmit Mode (132kHz)

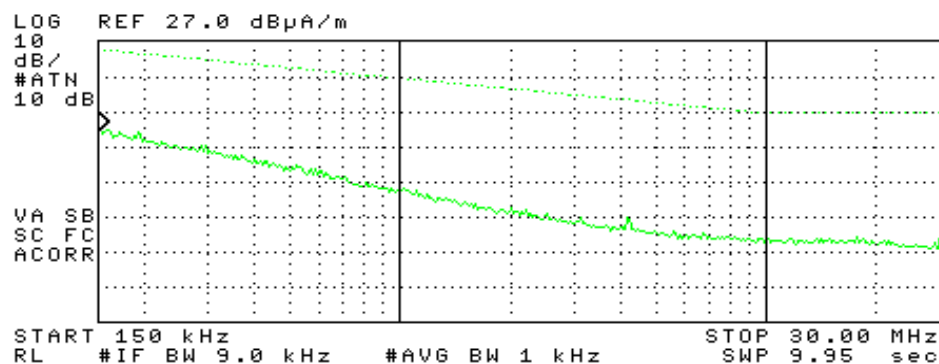
Preliminary measurements were made on 5/24/2002 in an anechoic chamber. The plots below show the emissions from the device compared against the EN 300 330 limits.

15:20:15 MAY 24, 2002
Run #1: 0.009-0.15 MHz (132kHz Tx ON)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 132.1 kHz
31.13 dBµA/m



Note: Used RBW = 1kHz rather than 200Hz to obtain a quicker sweep time

15:51:57 MAY 24, 2002
Run #1: 0.15-30MHz (132kHz Tx ON)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 150 kHz
1.85 dBµA/m





EMC Test Data

Client: Savi	Job Number: J47361
Model: SAVI SMR-640P-101	T-Log Number: T47386
Contact: Eugene Schlindwein	Proj Eng: Mark Briggs
Spec: FCC 15 B, 15.209, 15.231	Class: A

Measurements of the fundamental signal were made on the OATS at test distances of 3m and 10m and are recorded in the table below.

Frequency	Level	AF	Level	Pol	Detector	Azimuth	Height	Comments
kHz	dB μ V	dBm ⁻¹	dB μ V/m	(O / I)	Pk/QP/Avg	degrees	meters	
132.000	74.4	10.4	84.8	O	Pk	59	1.0	Tested at 3m - Note 1
132.000	45.2	10.4	55.6	O	Pk	60	1.0	Tested at 10m - Note 2

Note 1:	The maximum signal level was with the device oriented upright .
Note 2:	The maximum signal level was with the device oriented upright .
Note 3:	Polarization of O indicates the loop was facing the EUT, I indicates that the loop was perpendicular to the EUT.

Extrapolation Factor Calculation:

Level at 3m:	84.8	dB μ V/m
Level at 10m:	55.6	dB μ V/m
Extrapolation from 3m to 10m:	55.8	dB
Extrapolation from 10m to 300m:	82.5	(This factor used to calculate the level in the table below)

Frequency	Level	FCC 15.209		Detector	Azimuth	Height	Comments
KHz	dB μ V/m	Limit	Margin	Pk/QP/Avg	degrees	meters	
132	-26.9	25.2	-52.1	QP	60	1.0	Note 1
264	-	19.2	>20dB	QP	-	-	Note 2
396	-	15.7	>20dB	QP	-	-	Note 2
528	-	33.2	>20dB	QP	-	-	Note 3
660	-	31.2	>20dB	QP	-	-	Note 3
792	-	29.6	>20dB	QP	-	-	Note 3
924	-	28.3	>20dB	QP	-	-	Note 3
1056	-	27.1	>20dB	QP	-	-	Note 3
1188	-	26.1	>20dB	QP	-	-	Note 3
1320	-	25.2	>20dB	QP	-	-	Note 3

Note 1:	Level calculated by applying the extrapolation factor calculated from the measurements at 3m and 10m to the measurement recorded at 10m.
Note 2:	Preliminary measurements showed there to be no significant signals at a distance of 3m from the EUT other than the fundamental signal. Apart from the fundamental transmission, all signals below 490kHz were less than 52dB μ V/m (1.85dB μ A/m) at a distance of 3m, which is equivalent to a level of -28dB μ V/m at the specification distance of 300m if using the suggested extrapolation factor of $40\log(\text{measurement distance/specification distance})$.
Note 3:	Preliminary measurements showed there to be no significant signals at a distance of 3m from the EUT other than the fundamental signal. All signals above 490kHz were less than 43.4dB μ V/m (-8.2dB μ A/m) at a distance of 3m, which is equivalent to a level of 3.4dB μ V/m at the specification distance of 30m if using the suggested extrapolation factor of $40\log(\text{measurement distance/specification distance})$.