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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator and FCC Part 15, Subpart B Specifications for a Receiver on the EJ Brooks Company Model: EJ-645-21

FCC ID:	R7L-645-EJB
GRANTEE:	EJ Brooks Company One Brooks Plaza Newton, NJ 07860
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	June 15, 2004
FINAL TEST DATE:	May 27, 2004
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

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SCOPE

An electromagnetic emissions test has been performed on the EJ Brooks Company model EJ-645-21 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and Subpart B of Part 15 of FCC Rules for receivers. 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 transceiver 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 EJ Brooks Company model EJ-645-21 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 Subparts B and C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators and receivers. 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 EJ Brooks Company model EJ-645-21 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators and the requirements of Subpart B of Part 15 of the FCC Rules for receivers operating between 30 MHz and 960 MHz.

Maintenance of FCC 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.).

EMISSION TEST RESULTS

The following emissions tests were performed on the EJ Brooks Company model EJ-645-21. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT does not posses AC power ports. It is powered from an internal battery.

LIMITS OF RADIATED FIELD STRENGTH - RECEIVER

The EUT tested complied with the limits detailed in FCC Rules Part 15 FCC Rules Part 15 Section 15.109(a) for a receiver.

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.

30 – 3000 MHz

Frequency	Level	Pol	15.209		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	Degrees	Meters	
867.540	38.8	v	46.0	-7.2	QP	232	1.0	Standing up

BANDWIDTH

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.231(c). The 20dB bandwidth was 193 kilohertz.

DUTY CYCLE CALCULATION

The maximum duty cycle permitted for the data signals is 10% (refer to the Theory of Operations for details) when measured over any 100mS period. This corresponds to a minimum average duty cycle correction factor of –20 dB to be applied to peak readings to calculate the average level of the signal.

PERIOD OF OPERATION

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.231(e) for data signals. Refer to the Theory of Operations for more details.

LIMITS OF RADIATED FIELD STRENGTH –INTENTIONAL RADIATOR

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.231 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

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.

Fundamental Signal at 433.92 MHz

Frequency MHz	Level dBuV/m	Pol v/h	15.231(a) Limit	15.231(a) Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
433.880	91.1	v	92.9	-1.8	Pk	192	1.1	Side

Spurious Emissions, 30 – 4340 MHz

Frequency MHz	Level dBuV/m	Pol v/h	15.231(a) Limit	15.231(a) Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
867.760	36.9	v	52.9	-16.0	Avg	250	1.1	Standing

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 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	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The EJ Brooks Company model EJ-645-21 is an RFID Tag which is designed to identify the container to which it is attached when used as part of the Savi Control System. Normally, the EUT would be mounted to a container or similar piece of equipment. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The EUT is battery operated.

The sample was received on May 27, 2004 and tested on May 27, 2004 and June 8, 2004. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number
Savi Technology/EJ-645-21/RFID Tag	-

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 5.5 cm wide by 12 cm deep by 3 cm high.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EXTERNAL I/O CABLING

No interface cabling was used during emissions testing.

EUT OPERATION

Continuously transmitting (at full power) for transmitter-related tests, in receive mode for receiver and digital device tests.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on May 27, 2004 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 is performed in conformance with ANSI C63.4-1992. 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. 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 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.

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.

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:

FUNDAMENTAL AND HARMONIC LIMITS 15.231 (b)

The table below shows the limits for both the Fundamental and Harmonic emissions for each frequency band of operation detailed in Section 15.231 (b) for control signals.

Operating Frequency (MHz)	Field strength (microvolts/m)	Harmonics (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

FUNDAMENTAL AND HARMONIC LIMITS 15.231 (e)

The table below shows the limits for both the Fundamental and Harmonic emissions (that do not fall in restricted bands) for each frequency band of operation detailed in Section 15.231 (e) for data signals.

Operating Frequency (MHz)	Field strength (microvolts/m)	Harmonics (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

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands.

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

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.109(a) (RECEIVER)

The table below shows the limits for emissions from the receiver.

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 - 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:

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 4,500 MHz, 27-May-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	23-Jan-05
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	29-Oct-04
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	10-Dec-04
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	12-May-05
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1404	17-Nov-04
EMCO	Biconical Antenna, 30-300 MHz	3110B	1498	15-Jan-05

Radiated Emissions, 30 - 3,000 MHz, 08-Jun-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	23-Jan-05
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	09-Oct-04
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	20-Nov-04
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	12-May-05
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1404	17-Nov-04
EMCO	Biconical Antenna, 30-300 MHz	3110B	1498	15-Jan-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T55564 8 Pages

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EMC Test Data

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Emissions Spec:	FCC 15.231 / RSS210	Class:	B
Immunity Spec:	EN 301 489-3	Environment:	

EMC Test Data

For The

Savi Technology

Model

EJ-645-21

Date of Last Test: 6/9/2004

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Emissions Spec:	FCC 15.231 / RSS210	Class:	B
Immunity Spec:	EN 301 489-3	Environment:	

EUT INFORMATION

General Description

The EUT is an RFID Tag which is designed to identify the container to which it is attached when used as part of the Savi Control System. Normally, the EUT would be mounted to a container or similar piece of equipment. The EUT was, therefore, treated as tabletop equipment during testing to simulate the end-user environment. The EUT is battery operated.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Savi	EJ-645-21	RFID Tag		R7L-645EJB

Other EUT Details

The product will be marketed by EJ Brooks but is manufactured by Savi Technology.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. It measures approximately 5.5 cm wide by 12 cm deep by 3 cm high.

Modification History

Mod. #	Test	Date	Modification
1			

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 Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Emissions Spec:	FCC 15.231 / RSS210	Class:	B
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

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

EUT Operation During Emissions

Continuously transmitting (at full power) and receiving.

EUT Operation During Immunity

In Transmit Mode-Tag data is collect continuously by a Reader via Laptop. In Standby mode-A spectrum analzyer was used to verify that the EUT is in idle/standby mode.

Performance Criteria for Immunity

Criterion A:

No failure in communication, EUT continues to receive and transmit packets, shown by laptop diagnostic tool.

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Spec:	FCC 15.231 / RSS210	Class:	B

Radiated Emissions

Test Specifics

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

Date of Test: 5/27/2004
Test Engineer: Juan Martinez
Test Location: SVOATS #2

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

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 4500 MHz.

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: 22 °C
Rel. Humidity: 51 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, Fundamental	FCC 15.231 (e)	Pass	-1.8dB @ 433.88 MHz
2	RE, 433 - 4500MHz, Harmonic Emissions	FCC 15.231 (e)	Pass	-16.0dB @ 867.76 MHz

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 Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Spec:	FCC 15.231 / RSS210	Class:	B

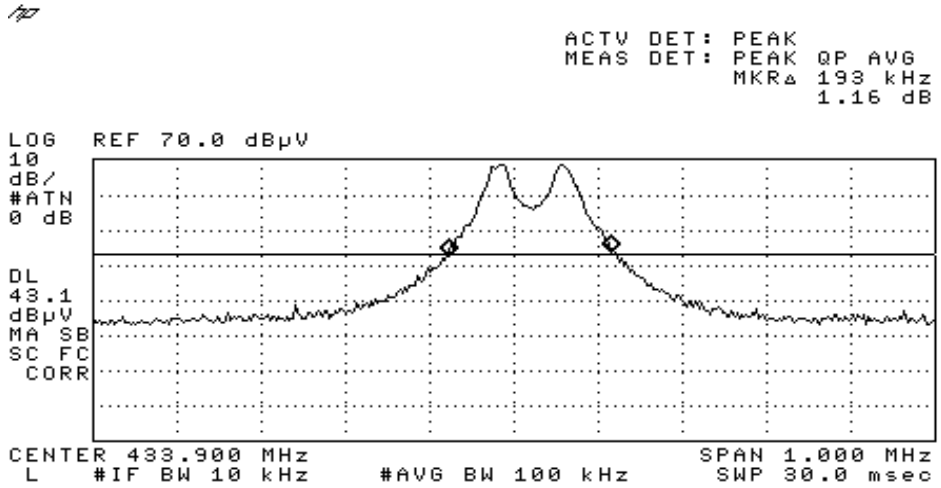
Run #1: Radiated Emissions, Fundamental

Frequency	Level	Pol	FCC 15.231 (e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Setting of 15								
433.880	91.1	v	92.9	-1.8	Pk	192	1.1	Side
433.880	71.1	v	72.9	-1.8	Avg	192	1.1	Side
433.880	86.8	h	92.9	-6.1	Pk	317	2.0	Laying Flat
433.880	66.8	h	72.9	-6.1	Avg	317	2.0	Laying Flat
433.880	86.3	h	92.9	-6.6	Pk	148	2.0	Standing
433.880	66.3	h	72.9	-6.6	Avg	148	2.0	Standing
433.880	85.6	v	92.9	-7.3	Pk	244	1.0	Standing
433.880	65.6	v	72.9	-7.3	Avg	244	1.0	Standing
433.880	85.2	h	92.9	-7.7	Pk	223	1.0	Side
433.880	65.2	h	72.9	-7.7	Avg	223	1.0	Side
433.880	79.9	v	92.9	-13.0	Pk	278	1.3	Laying Flat
433.880	59.9	v	72.9	-13.0	Avg	278	1.3	Laying Flat

Note 1:	Duty cycle is 10ms. A -20dB factor was applied to the Peak reading to get an Average reading.

Bandwidth:

The 20dB bandwidth was measured to be 193kHz using a RBW of 10kHz
Maximum permitted is 1.05 MHz.



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EMC Test Data

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Spec:	FCC 15.231 / RSS210	Class:	B

Run #2: Maximized Harmonic readings, 433 - 4500 MHz

Frequency	Level	Pol	FCC 15.231 (e)		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
867.760	36.9	v	52.9	-16.0	Avg	250	1.1	Standing
867.760	56.9	v	72.9	-16.0	Pk	250	1.1	Standing
867.760	33.8	h	52.9	-19.1	Avg	360	1.0	Side
867.760	53.8	h	72.9	-19.1	Pk	360	1.0	Side
1735.530	54.0	v	74.0	-20.0	Pk	280	1.0	Standing
1735.530	34.0	v	54.0	-20.0	Avg	280	1.0	Standing
867.760	31.8	v	52.9	-21.1	Avg	254	1.1	Side
867.760	51.8	v	72.9	-21.1	Pk	254	1.1	Side
867.760	29.4	h	52.9	-23.5	Avg	226	1.0	Laying Flat
867.760	49.4	h	72.9	-23.5	Pk	226	1.0	Laying Flat
1301.650	29.8	v	54.0	-24.2	Avg	278	1.5	Standing
1301.650	49.8	v	74.0	-24.2	Pk	278	1.5	Standing
867.760	26.2	h	52.9	-26.7	Avg	30	1.0	Standing
867.760	46.2	h	72.9	-26.7	Pk	30	1.0	Standing
1735.530	46.7	h	74.0	-27.3	Pk	220	1.8	Side
1301.650	46.7	v	74.0	-27.3	Pk	281	1.4	Laying Flat
867.760	25.6	v	52.9	-27.3	Avg	52	1.0	Laying Flat
1735.530	26.7	h	54.0	-27.3	Avg	220	1.8	Side
1301.650	26.7	v	54.0	-27.3	Avg	281	1.4	Laying Flat
867.760	45.6	v	72.9	-27.3	Pk	52	1.0	Laying Flat
1735.530	46.2	v	74.0	-27.8	Pk	267	1.6	Side
1735.530	26.2	v	54.0	-27.8	Avg	267	1.6	Side
1301.650	46.0	h	74.0	-28.0	Pk	244	1.4	Standing
1301.650	26.0	h	54.0	-28.0	Avg	244	1.4	Standing
1301.650	45.0	v	74.0	-29.0	Pk	224	1.3	Side
1301.650	25.0	v	54.0	-29.0	Avg	224	1.3	Side
1735.530	24.3	h	54.0	-29.7	Avg	159	1.9	Laying Flat
1735.530	44.3	h	74.0	-29.7	Pk	159	1.9	Laying Flat
1735.530	44.0	v	74.0	-30.0	Pk	184	1.4	Laying Flat
1735.530	24.0	v	54.0	-30.0	Avg	184	1.4	Laying Flat
1735.530	43.0	h	74.0	-31.0	Pk	99	1.4	Standing
1735.530	23.0	h	54.0	-31.0	Avg	99	1.4	Standing
1301.650	40.0	h	74.0	-34.0	Pk	57	1.0	Laying Flat
1301.650	20.0	h	54.0	-34.0	Avg	57	1.0	Laying Flat
1301.650	40.0	h	74.0	-34.0	Pk	313	1.6	Side
1301.650	20.0	h	54.0	-34.0	Avg	313	1.6	Side

Note 1:	No other harmonic emission detected after the 4th 20-dB of the limit.

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Spec:	FCC 15.231 / RSS210	Class:	B

Receiver Radiated Emissions

Test Specifics

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

Date of Test: 6/8/2004
Test Engineer: Juan Martinez
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: Battery Operated

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

Unless otherwise specified, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 3000 MHz

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: 18 °C
Rel. Humidity: 50 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 3000MHz, Maximized Emissions	FCC B	Pass	-7.2dB @ 867.540MHz

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.

Elliott

EMC Test Data

Client:	Savi Technology	Job Number:	J55530
Model:	EJ-645-21	T-Log Number:	T55564
		Account Manager:	Rob Holt
Contact:	Gene Schlindwein		
Spec:	FCC 15.231 / RSS210	Class:	B

Run #1: Maximized Radiated Emissions, 30-3000 MHz

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
867.540	38.8	v	46.0	-7.2	QP	232	1.0	Standing up
1732.930	46.2	v	54.0	-7.8	QP	100	1.1	Sideways
1732.930	46.1	h	54.0	-7.9	QP	313	1.1	Standing up
1732.930	46.1	v	54.0	-8.0	QP	227	1.0	Laying flat
1732.930	46.1	h	54.0	-8.0	QP	0	1.2	Laying flat
1732.930	45.6	h	54.0	-8.4	QP	361	1.0	Sideways
1031.000	44.6	v	54.0	-9.4	QP	360	1.0	Laying flat
1031.000	44.1	h	54.0	-9.9	QP	0	1.0	Sideways
867.540	36.0	h	46.0	-10.0	QP	195	1.0	Laying flat
1732.930	43.8	v	54.0	-10.2	QP	56	1.0	Standing up
1031.000	43.6	h	54.0	-10.4	QP	101	1.1	Standing up
867.540	35.0	v	46.0	-11.0	QP	262	1.0	Sideways
1031.000	42.2	v	54.0	-11.8	QP	242	1.1	Sideways
1031.000	41.8	v	54.0	-12.2	QP	202	1.0	Standing up
433.770	33.7	v	46.0	-12.3	QP	225	1.3	Sideways
433.770	32.7	v	46.0	-13.3	QP	305	1.2	Standing up
1031.000	40.4	h	54.0	-13.6	QP	353	1.2	Laying flat
433.770	32.3	h	46.0	-13.7	QP	303	2.0	Laying flat
867.540	31.5	v	46.0	-14.5	QP	38	1.0	Laying flat
867.540	31.4	h	46.0	-14.6	QP	340	2.3	Sideways
867.540	29.5	h	46.0	-16.5	QP	101	1.0	Standing up
433.770	28.6	h	46.0	-17.4	QP	361	1.0	Standing up
433.770	28.5	h	46.0	-17.5	QP	0	2.0	Sideways
433.770	24.0	v	46.0	-22.0	QP	230	2.0	Laying flat

Run #1: Maximized Radiated Emissions, 30-3000 MHz

Frequency	Level	Pol	EN 55022 B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
433.770	23.2	v	37.0	-13.8	QP	225	1.3	Sideways
867.540	28.3	v	37.0	-8.7	QP	232	1.0	Standing up

EXHIBIT 3: Test Configuration Photographs

Uploaded as A Separate Attachment

EXHIBIT 4: Theory of Operation EJ Brooks Company Model EJ-645-21

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EXHIBIT 5: Proposed FCC ID Label & Label Location

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EXHIBIT 6: Detailed Photographs EJ Brooks Company Model EJ-645-21

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EXHIBIT 7: Installation Guide EJ Brooks Company Model EJ-645-21

Uploaded as A Separate Attachment

EXHIBIT 8: Block Diagram EJ Brooks Company Model EJ-645-21

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EXHIBIT 9: Schematic Diagrams EJ Brooks Company Model EJ-645-21

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