
FCC Part 15 Certification Test Report

900MHz Direct Sequence Spread Spectrum Radio Device

FCC ID: Q69MIU1000

FCC Rule Part: 15.247

ACS Report Number: 03-0100-15B

Manufacturer: Screamer Technologies, Inc.
Model: Screamer MIU1000

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Prepared by: _____

R. Sam Wismer
Engineering Manager
ACS, Inc.



Reviewed by: _____

Richard Bianco
EMI/EMC Approvals Engineer
ACS, Inc.

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This report contains 12 pages

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1.0 GENERAL

1.1 Introduction

The purpose of this report is to demonstrate compliance with the relevant portions of Title 47, Part 15 of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General Description

The EUT, Screamer 1000, is a direct sequence spread spectrum radio device operating in the unlicensed 902-928 MHz designed for data transmissions.

Detailed photographs of the EUT are included separately with this filing.

1.2.2 Intended Use

The Screamer MIU1000 unit is intended for use as a device for collecting data from meters and relaying it back to its base station.

- Collects Reads from Gas Meter (Electronic Reading – very accurate)
- Collects Pulses from Water Meter (Accurate pulse counting, but readings must be adjusted at Host Computer for meters which did not start at zero gallons)
- Transmits Readings to CIU every four hours

1.2.3 Technical Specifications

Table 1.2.3-1: Specifications

Frequency Band	902-928
Channels	Single channel at 913.5 MHz
Output power	16.66dBm nominal
Antenna Type	Folded Dipole
Antenna Gain	2.3dBi
System EIRP	19dBm
Antenna Connector Type	Permanently Attached to PCB

2.0 LOCATION OF TEST FACILITY

All testing was performed by qualified ACS personnel located at the following address:

ACS, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518

2.1 DESCRIPTION OF TEST FACILITY

Both the Open Area Test Site(OATS) and Conducted Emissions site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.1.1 Open Area Test Site

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane, however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.1-1 below:

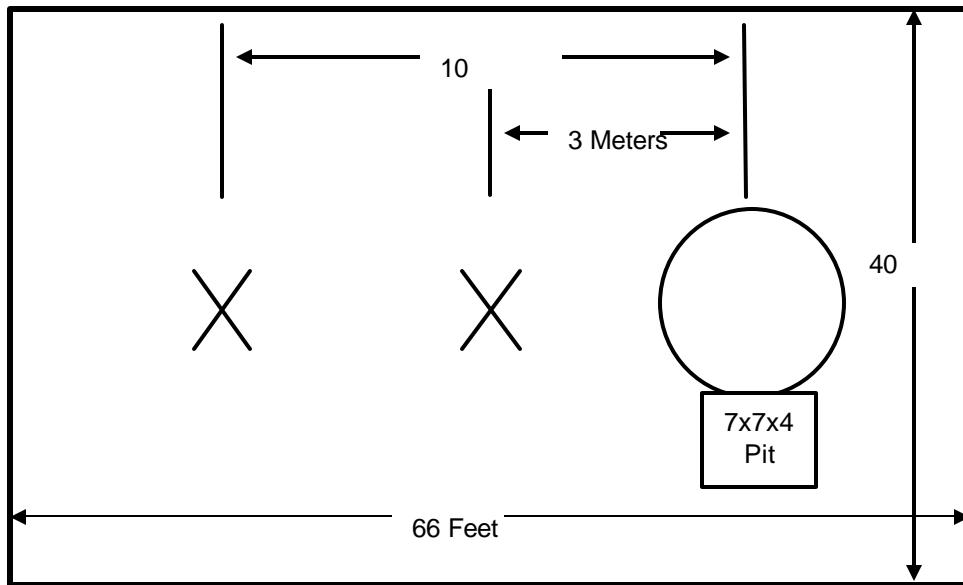


Figure 2.1-1: Open Area Test Site

2.1.2 Conducted Emissions Test Site Description

The AC mains conducted EMI site is a shielded room with the following dimensions:

- Height: 3.0 Meters
- Width: 3.6 Meters
- Length: 4.9 Meters

The room is manufactured by Rayproof Corporation and installed by Panashield, Inc. Earth ground is provided to the room via an 8' copper ground rod. Each panel of the room is connected electrically at intervals of 4".

Power to the room is filtered to prevent ambient noise from coupling to the EUT and measurement equipment. Filters are models 1B42-60P manufactured by Rayproof Corporation.

The room is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 2.1.2-1:

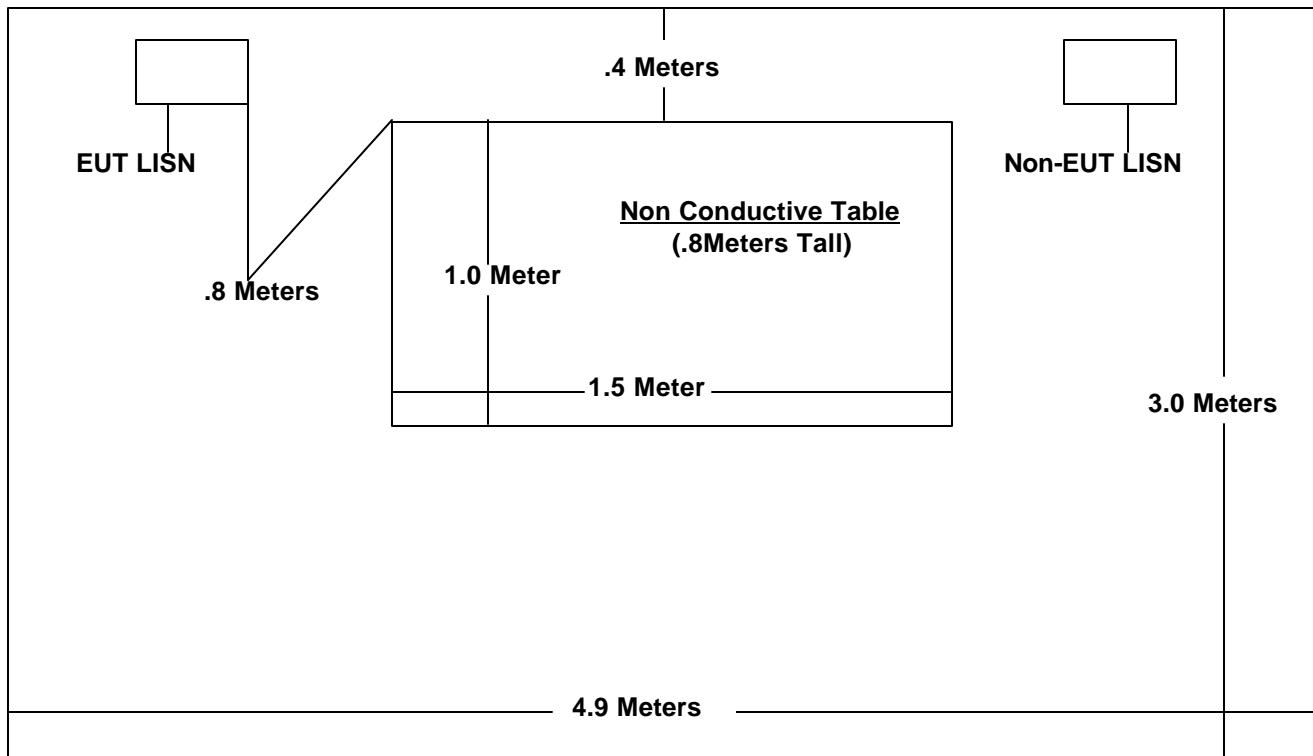


Figure 2.1.2-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures (October 2002)
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2002)
- ❖ FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
- ❖ FCC Report and Order, No. FCC 97-114, Appendix C – Laboratory Measurement Procedure, Alternative Test Procedures

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Radiated, Radiated Spurious and Conducted Emissions

Equipment Calibration Information					
ACS #	Mfg.	Eq. type	Model	S/N	Cal. Due
4	Rohde & Schwarz	Spectrum Analyzer	ESMI	833827/003	8/16/03
3	Rohde & Schwarz	Display Unit	ESDI	839379/011	8/16/03
2	Rohde & Schwarz	Spectrum Analyzer	ESMI	839587/003	12/23/03
1	Rohde & Schwarz	Display Unit	ESDI	839379/011	12/26/03
26	Chase	Bi-Log Antenna	CBL6111	1044	8/26/03
25	Chase	Bi-Log Antenna	CBL6111	1043	9/19/03
71	Chase	LISN	ALN2070A	1028	8/23/03
152	EMCO	LISN	3825/2	9111-1905	12/11/03
153	EMCO	LISN	3825/2	9411-2268	12/11/03
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
16	ACS	Cable	RG8	16	9/17/03
23	ACS	Cable	RG8	23	1/3/04
24	ACS	Cable	Heliax	24	04/07/04
5	ACS	Cable	LL-335	None	7/31/03
6	ACS	Cable	LL-335	None	7/31/03
22	Agilent	Pre-Amplifier	8449B	3008A00526	9/21/03
73	Agilent	Pre-Amplifier	8447D	272A05624	04/15/04
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	9/17/03
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	6/17/04

5.0 EUT Setup Block Diagram

Table 5.0: System Block Diagram

Diagram Number	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	EUT	Radio Module	Screamer MIU1000	None	Q69MIU1000
2	HP	DC Power Supply	6286A	2109A-06095	None

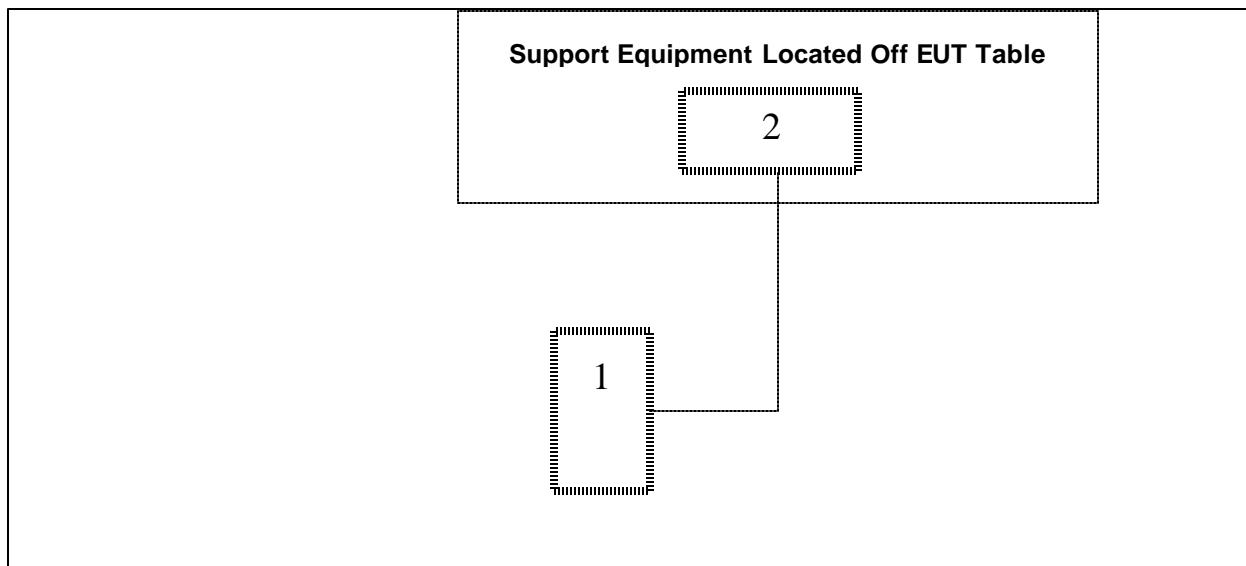


Figure 5.0-1: EUT Test Setup

6.0 SUMMARY OF TESTS

6.1 Antenna Requirement – FCC Section 15.203

The antenna used with this device is a permanently affixed, folded dipole antenna. Because it is permanently affixed to the device, it meets the antenna requirement of 15.203.

6.2 Power Line Conducted Emissions - FCC Section 15.207

6.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz.

6.2.2 Test Results

The EUT is battery powered, with no connection to the AC mains; therefore this requirement is not applicable to the EUT.

6.3 Radiated Emissions - FCC Section 15.209(Unintentional Radiation)

6.3.1 Test Methodology

ANSI C63.4 Sections 6 and 8 were the guiding documents for this evaluation. Radiated emissions tests were performed over the frequency range of 30MHz to 1000. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz.

The EUT was set for an idle state where no transmissions were occurring.

6.3.2 Test Results

Results of the test are given in Table 6.2.2-1 below:

Table 6.3.2-1: Radiated Emissions Tabulated Data (Unintentional Radiators)

Frequency (MHz)	Uncorrected Reading (dB μ V)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (°)	Total Correction Factor (dB)	Corrected Reading (dB μ V)	Limit (dB μ V)	Margin (dB)	Results
34.31	12.26	V	100	0	17.17	29.43	40	10.6	Pass
44	12.43	V	100	0	12.38	24.81	40	15.2	Pass
114.06	14.16	V	100	270	12.29	26.45	43.5	17.1	Pass
209.98	13.2	V	100	99	11.50	24.70	43.5	18.8	Pass
333.93	25.16	V	100	0	-11.29	13.87	46	32.1	Pass
474.05	29.3	V	150	0	-6.77	22.53	46	23.5	Pass
703.61	25.36	V	100	0	-2.35	23.01	46	23.0	Pass
907.31	39.61	V	100	0	0.18	39.79	46	6.2	Pass
34.31	11.19	H	100	0	17.17	28.36	40	11.6	Pass
44.04	13.42	H	100	0	12.36	25.78	40	14.2	Pass
114.06	13.17	H	200	0	12.29	25.46	43.5	18.0	Pass
209.98	13.17	H	150	335	11.50	24.67	43.5	18.8	Pass
333.93	30.24	H	150	275	-11.29	18.95	46	27.1	Pass
474.05	23.45	H	150	0	-6.77	16.68	46	29.3	Pass
703.61	25.05	H	150	0	-2.35	22.70	46	23.3	Pass
907.31	35.47	H	150	0	0.18	35.65	46	10.3	Pass

6.4 Peak Output Power – FCC Section 15.247(b)(3)

6.4.1 Test Methodology

A radiated output power measurement procedure was used to determine the output power level, according to FCC 97-114 Appendix C, Alternative Test Procedure. The EUT was caused to generate a continuous DSSS signal during the test.

6.4.2 Test Results

Results are shown below in figure 6.3.2-1:

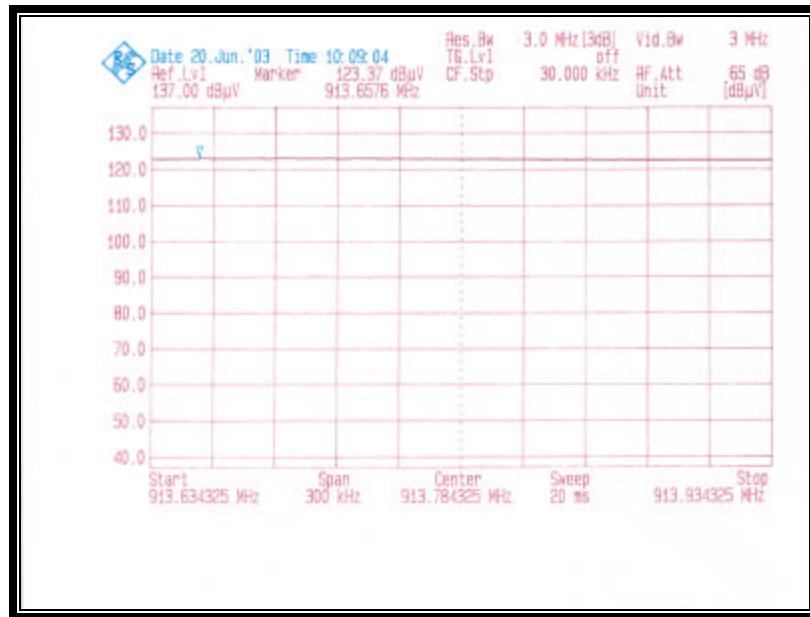


Figure 6.4.2-1: RF Output Power

The corrected field strength, accounting for measurement system gain and loss, was 123.66 dBuV. The measured field strength was first converted to V/m: 123.66dBuV = 1.52 V/m.

Next, the output power in watts was determined using the formula:

$$P = \frac{(Ed)^2}{30G} = 627 \text{mW}$$

Result: PASS

6.5 6dB Bandwidth – FCC Section 15.247(a)(2)

6.5.1 Test Methodology

A radiated measurement procedure was used to view the 6dB bandwidth, according to FCC 97-114 Appendix C, Alternative Test Procedure. The EUT was caused to generate a continuous DSSS signal during the test.

6.5.2 Test Results

Results are shown below in figures 6.5.2-1:

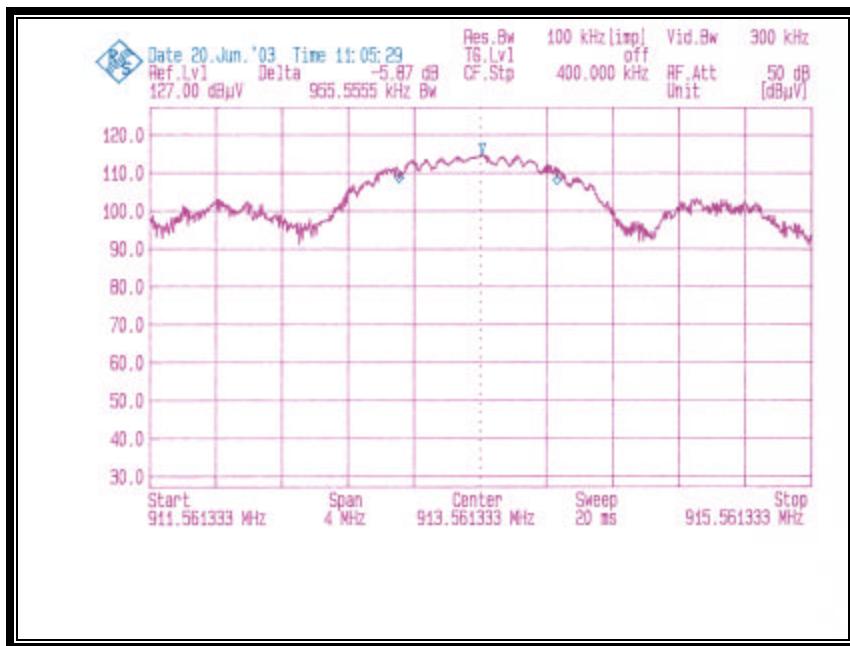


Figure 6.5.2-1: 6dB Bandwidth

Result: 955.5555 MHz - PASS

6.6 Spurious Emissions – FCC Section 15.247(c)

6.6.1 Conducted Spurious Emissions

Because radiated measurements were taken, conducted spurious emissions were not measured.

6.6.2 Radiated Spurious Emissions

6.6.2.1 Test Methodology

TIA 603-A section 2.2.12 was the guiding document for this test.

6.6.2.2 Test Results

The limit for this test is determined by the formula $43 + \log(P_{\text{watts}})$.

Radiated spurious emissions found in the band of 30MHz to 20GHz are reported in Table 6.5.2.2-1. Plots of these emissions are also presented separately in Appendix D of this filing.

Table 6.6.2.2-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)	Detector (P/A)	Antenna Polarity (H/V)	Turntable Position (o)	Correction Factors (dB)	Corrected Level (dBuV)	Limit (dBuV)	Margin (dB)	Final Result (Pass/Fail)
2740	60.97	p	v	525	-2.43	58.54	74.00	15.46	PASS
2740	56.6	a	v	525	-14.43	42.17	54.00	11.83	PASS
3653	58.1	p	v	541	4.26	62.36	74.00	11.64	PASS
3630	56.53	a	v	541	-7.83	48.70	54.00	5.30	PASS
4567	59.07	p	v	511	6.54	65.61	74.00	8.39	PASS
4567	56.68	a	v	511	-5.46	51.22	54.00	2.78	PASS
5480	55.3	p	v	69	9.29	64.59	74.00	9.41	PASS
5480	53.3	a	v	69	-2.71	50.59	54.00	3.41	PASS
6394	51.6	p	v	520	10.73	62.33	74.00	11.67	PASS
6391	49.16	a	v	520	-1.28	47.88	54.00	6.12	PASS
7307	50.92	p	v	211	13.23	64.15	74.00	9.85	PASS
7307	46.62	a	v	211	1.23	47.85	54.00	6.15	PASS
8221	48.1	p	v	526	13.93	62.03	74.00	11.97	PASS
8221	42.97	a	v	526	1.93	44.90	54.00	9.10	PASS
9134	46.19	p	v	72	14.16	60.35	74.00	13.65	PASS
9134	36.77	a	v	72	2.16	38.93	54.00	15.07	PASS

Results: Pass

6.7 Peak Power Spectral Density- FCC Section 15.247(d)

6.7.1 Test Methodology

A radiated measurement procedure was used to view the peak power spectral density in any 3 kHz band, according to FCC 97-114 Appendix C, Alternative Test Procedure. The EUT was caused to generate a continuous DSSS signal during the test.

6.7.2 Test Results

Results are shown below in figures 6.6.2-1.

The corrected field strength, accounting for measurement system gain and loss was 103.63 dBuV.

The measured field strength was converted to dBm; $103.63 \text{ dBuV} - 107 = -3.37 \text{ dBm}$.

Result: PASS

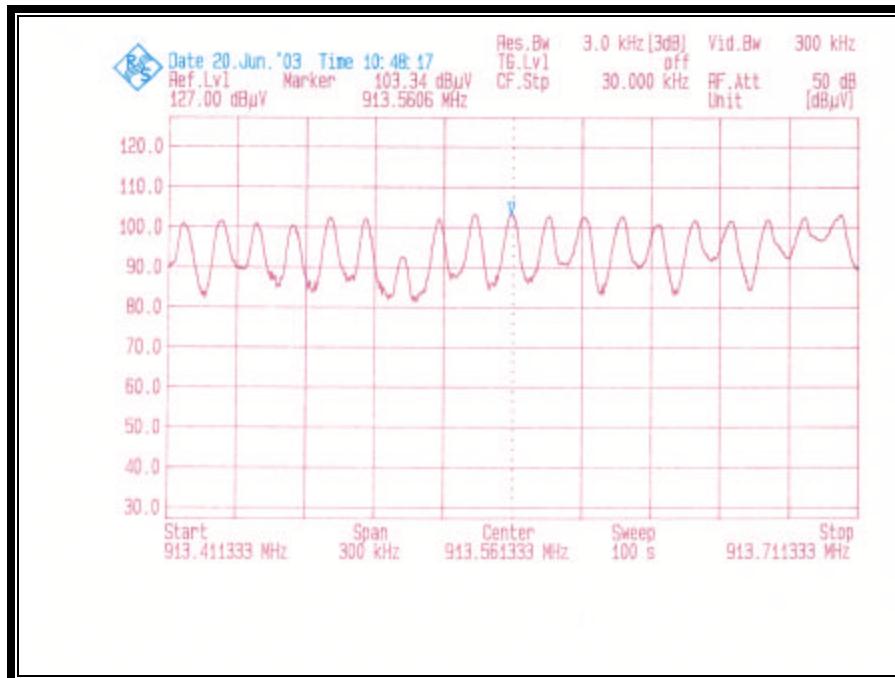


Figure 6.7.2-1: Power Spectral Density

7.0 CONCLUSION

In the opinion of ACS, Inc. the Screamer 1000, manufactured by Screamer Technologies, Inc. meets the relevant requirements of FCC Parts 2 and 15, as required.