L.S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, WI 53012
262-375-4400 Fax: 262-375-4248

Assigned Engineer: Abtin Spantman

COMPLIANCE TESTING OF:
Outdoor Virtual Fence Transmitter

PREPARED FOR:
Multivet International, Inc.
B.P. 651
St-Hyacinthe, QC, Canada

TEST REPORT NUMBER:
303192

TEST DATES:
July 15th, 2003

All results of this report relate only to the items that were tested. This report is not to be reproduced, except in full, without written approval of L. S. Compliance, Inc.

Table of Contents

1. L. S. Compliance In Review

L. S. Compliance, Inc. is located in Cedarburg, Wisconsin – United States.

We may be contacted by:

Mail: L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53012

Phone: 262-375-4400
Fax: 262-375-4248
E-mail: eng@lsr.com

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

A2LA – American Association for Laboratory Accreditation
Accreditation based on ISO/IEC 17025 : 2005
with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: **1255.01**

U. S. Conformity Assessment Body (CAB) Validation
Validated by the European Commission as a U. S. Conformity Assessment Body operating under the U. S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union EMC Directive 89/336/EEC, Article 10.2.
Date of Validation: **January 16, 2001**

Federal Communications Commission (FCC) – USA
Listing of 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
FCC Registration Number: **90756**

Listing of 3 and 10 meter OATS based on 47CFR 2.948
FCC Registration Number: **90757**

Industry Canada
On-file, 3 Meter Semi-Anechoic Chamber based on 47CFR 2.948
File Number: **IC 3088**

On-file 3 and 10 Meter OATS based on RSS-210
File Number: **IC 3088-A**

2. A2LA Certificate of Accreditation

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002 (1994).

Presented this 26th day of March 2003.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2005

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

3. A2LA Scope of Accreditation

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

L.S. COMPLIANCE, INC.
W66 N220 Commerce Court
Cedarburg, WI 53012
James Blaha Phone: 262 375 4400

ELECTRICAL (EMC)

Valid to: January 31, 2005 Certificate Number: 1255-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test	Test Method(s)
Emissions	
Conducted	
Continuous/Discontinuous	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4; EN: 55011, 55022, 50081-1, 50081-2; CISPR: 11, 12, 14-1, 22; CNS 13438
Radiated	Code of Federal Regulations (CFR) 47, FCC Method Parts 15, 18 using ANSI C63.4; EN: 55011, 55022, 50081-1, 50081-2; CISPR: 11, 12, 14-1, 22; CNS 13438
Current Harmonics	IEC 61000-3-2; EN 61000-3-2
Voltage Fluctuations & Flicker	IEC 61000-3-3; EN 61000-3-3
Immunity	EN: 50082-1, 50082-2 EN 61000-6-2 CISPR: 14-2, 24
Conducted Immunity	
Fast Transients/Burst	IEC 61000-4-4; EN 61000-4-4
Surge	IEC: 61000-4-5; ENV 50142; EN 61000-4-5
RF Fields	IEC: 61000-4-6; ENV 50141; EN 61000-4-6
Voltage Dips/Interruptions	IEC 61000-4-11; EN 61000-4-11

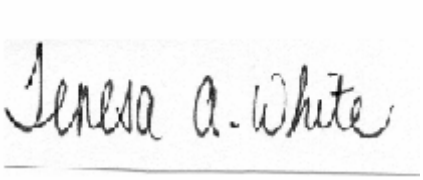
Roxanne M. Robinson

(A2LA Cert. No. 1255-01) 05/13/03 Page 1 of 2

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

4. Signatures:

Manufacturer:	Multivet International, Inc.
Model No.:	Virtual Fence Transmitter
Serial No.:	Engineering Unit
Description:	Perimeter Detection Transmitter



Prepared By: October 27, 2003

Teresa A. White, Document Coordinator Date

Tested By: October 27, 2003

Abtin Spantman, EMC Engineer Date

Approved By: October 27, 2003

Kenneth L. Boston, EMC Lab Manager Date
PE # 31926 Licensed Professional Engineer
Registered in the State of Wisconsin, United States

5. Product and General Information

Manufacturer:	Multivet International, Inc.
Model No.:	Virtual Fence Transmitter
Serial No.:	Engineering Unit
Description:	Perimeter Detection Transmitter
Operating Voltage:	15 VAC

6. Product Description

The Multivet International *Virtual Fence* is an outdoor RF based training system for pets. This product combines electronics with a citronella spray system to alert the pet when it has approached the pre-defined perimeter.

The *Virtual Fence* training system has 3 components: an emitter (Transmitter), a spray receiver collar, and an antenna (buried wire around established perimeter). The emitter is plugged into the regular household 120 VAC power mains. It generates a low frequency 10.5 kHz radio signal that is transmitted through the buried wire. As the pet approaches the buried wire, the spray receiver collar will pick up the low frequency signal. The collar will at first emit a warning beeping sound to let your animal know it has reached the limit. Should he continue on, he will then receive a brisk spray of citronella. The Multivet *Virtual Fence* must be used in conjunction with Multivet International spray receiver collars and citronella refills. The Virtual Fence training system is not a solid barrier. The system is designed as a training aid to remind the pet to stay within set boundaries.

7. Test Requirements

The Multivet *Virtual Fence* was tested for Radiated Emissions to establish compliance with the limits set forth by Title 47 CFR, Parts 15.205, 15.207, and 15.209 as an intentional radiator.

8. Summary of Test Report

DECLARATION OF CONFORMITY

The Multivet *Virtual Fence* was found to **MEET** the requirements as described within the specification of Title 47 CFR FCC, Parts 15.205, 15.207, 15.209 and Industry Canada I.C. RSS-210, Section 6 for an intentional radiator.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed per the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report.

9. Introduction

On July 15th, 2003 a series of Radiated Emission tests were performed on one sample of the Multivet International model: "Outdoor Virtual Fence", Serial Number: "Engineering Unit", here forth referred to as the "*Equipment Under Test*" or "*EUT*". These tests were performed using the procedures outlined in ANSI C63.4-2001 for intentional radiators, and in accordance with the limits set forth in FCC Parts 15.207, 15.205 and 15.209 (Industry Canada RSS-210) for a transmitter or digital device. These tests were performed by Abtin Spantman, EMC Engineer of L.S. Compliance, Inc.

10. Purpose

The above-mentioned tests were performed in order to determine the compliance of the equipment under test (EUT) with limits contained in various provisions of Title 47 CFR, FCC Part 15, including: 15.205, 15.207 and 15.209. All Radiated Emission tests were performed to measure the emissions in the frequency bands described in this report, and to determine whether said emissions are below the limits established by the above sections.

These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2001). Another document used as a reference for the EMI Receiver specification was the Comite International Special Des Perturbations Radioelelectriques (CISPR) Number 16-1, 2002.

11. Radiated Emissions Test

Test Setup

The test setup was assembled in accordance with Title 47, CRF FCC Part 15 and ANSI C63.4-2001. The EUT was placed on an 80cm high non-conductive table centered on a flush mounted 2-meter diameter turntable inside the 3 Meter Semi-Anechoic, FCC listed Chamber located at L. S. Compliance, Inc., Cedarburg, Wisconsin. The EUT was operated in continuous transmit normal operating mode, using 15 VAC power, derived from an AC wall type power transformer. The emissions were investigated with varying wire lengths. A length of 10 meters was considered for the final testing, as additional length did not appear to increase the results significantly. The applicable limits for the fundamental frequency apply at a 300 meter distance, and are found in the Calculation of Radiated Emissions Limits page of this report. The applicable limits are adjusted for a 10 meter separation distance, as described in Title 47 CFR 15.31(.f.2) by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a list of the test equipment. The test sample was operated in a normal operating mode during all of the tests.

Test Procedure

Preliminary radiation measurements were performed on the EUT in the 3 Meter FCC listed Semi-Anechoic, Chamber, located at L. S. Compliance, Inc. in Cedarburg, Wisconsin. The frequency range from 9 kHz to 1000 MHz was pre-scanned, and levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 Meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the test object. A Loop antenna was used to measure emissions from 9 kHz to 30 MHz. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. The maximum radiated emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities.

The EUT was operated in the normal operating mode during the test. For those frequencies that have significant emissions, measurements were repeated on an FCC listed, 10 meter Open Area Test Site (OATS). The radiated emissions were measured at 30 meters, 10 meters, and 3 meters separation from the EUT, but only the 10 meter results are presented in this report. The EUT was scanned for emissions at those particular frequencies from 9 kHz to 1000 MHz to establish compliance in accordance with FCC Parts 15.35 and 15.209 (RSS-210). The Loop, Biconical, and Log Periodic antennas were used as the sensing elements. The EUT was positioned on an 80 cm high pedestal in the center of a flush-mounted turntable. The EUT was rotated, and the antenna mast was scanned to obtain a maximum signal level.

Final emission measurements were performed on the 10 meter OATS and the results of the highest emissions seen, along with azimuth and height, are recorded in the Radiated Emissions Data Chart in this report.

Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The HP 8546A EMI Receiver was operated with a bandwidth of 9 kHz for frequencies between 9 kHz and 30 MHz, a bandwidth of 120 kHz for measurements between 30 MHz and 1000 MHz, and a bandwidth of 1 MHz when measuring frequencies above 1000 MHz. The Peak, Quasi-Peak and Average Detector functions were utilized.

Test Results

The EUT was found to MEET the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.209 for an intentional radiator (Canada RSS-210). The frequencies with significant signals were recorded and plotted as shown in the Data Charts and Graphs.

CALCULATION OF RADIATED EMISSIONS LIMITS

The following table depicts the general emission limits for an intentional radiator. These limits are obtained from Title 47 CFR, Part 15.209(a), for radiated emissions measurements.

Frequency (MHz)	Measurement Distance (m)	Limit (μV/m)	10 m Limit (dBμV/m)
0.009-0.490	300	2400/F (kHz)	20Log(2400/F (kHz)) + 59
0.490-1.705	30	24000/F (kHz)	20Log(24000/F (kHz)) +19
1.705-30.0	30	30	48.0
30-88	3	100	30.0
88-216	3	150	33.0
216-960	3	200	36.0
960-10,000	3	500	43.5

Sample conversion from field strength μV/m to dBμV/m:

dBμV/m = 20 $\log_{10}$ (3m limit)

from 30-88 MHz for example: dBμV/m = 20 $\log_{10}$ (100)

40.0 dBμV/m = 20 $\log_{10}$ (100)

Sample conversion of limits between 3 meters to 10 meters for frequencies above 30 MHz:

Reference 47 CFR 15.31.f.1

10m limit (dBμV/m) = 3m limit (dBμV/m) + 20 $\log_{10}$ (3m/10m)

from 30-88 MHz for example: 10m limit (dBμV/m) = 40.0 dBμV/m - 10.4 (dB)

30.0 (dBμV/m) = 40.0 dBμV/m - 10.4 (dB)

Sample conversion of limits between 300 meters to 10 meters for frequencies below 30 MHz:

Reference 47 CFR 15.31.f.2

10m limit (dBμV/m) = 300m limit (dBμV/m) + 40 $\log_{10}$ (300m/10m)

from 0.009 - 0.490 MHz for example: 10m limit (dBμV/m) = 20 Log [2400/F (kHz)] (dBμV/m) + 59.0 (dB)
or more specifically, at 10.1 kHz:

$$10meter.Limit\big|_{F=10.1kHz}(dB\mu V/m) = 300\text{m limit (dBμV/m)} + 40\log_{10}(300\text{m}/10\text{m})$$

$$10meter.Limit\big|_{F=10.1kHz}(dB\mu V/m) = \left[20Log_{10}\left(\frac{2400}{10.1}\right)\right](dB\mu V/m) + \left[40Log_{10}\left(\frac{300}{10}\right)\right](dB)$$

$$10meter.Limit\big|_{F=10.1kHz}(dB\mu V/m) = 47.0\text{ (dBμV/m)} + 59.0\text{ (dBμV/m)} = 106.0\text{ (dBμV/m)}$$

Note: Limits are conservatively rounded to the nearest tenth of a whole number.

Measurement of Electromagnetic Radiated Emissions Upon a 10 Meter FCC Listed OATS

Frequency Range Inspected: 19 kHz - 1000 MHz
Test Requirements: Title 47CFR 15.209

Manufacturer:	Multivet International, Inc.						
Date(s) of Test:	July 15th , 2003						
Test Engineer:	Abtin Spantman						
Model #:	Virtual Fence						
Serial #:	Engineering Unit						
Voltage:	15 VAC power, derived from a 120 VAC wall transformer						
Distance:	10 Meters						
Detectors Used:			Peak	√	Quasi-Peak	√	Average

Test Equipment Utilized:
EMI Measurement Instrument: HP 8546A
Biconical Antenna: EMCO 3110
Log Periodic Antenna: EMCO 43146A
Double Ridged Wave Guide Horn Antenna: EMCO 3115

The following table depicts the level of significant radiated emissions found:

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dBμV/m)	15.209 Limit (dBμV/m)	Margin (dB)
0.0101	H	1.00	0	59.3	106.5	47.2
0.0300	H	1.00	0	77.2	97.1	19.9
0.0500	H	1.00	0	71.3	92.6	21.3
0.0700	H	1.00	0	66.9	89.7	22.8
0.0900	H	1.00	0	62.7	87.5	24.8
0.1100	H	1.00	0	71.3	85.8	14.5
51.8	H	1.00	0	18.2	30.0	11.8
76.0	V	1.20	0	16.9	30.0	13.1

Note: A Quasi-Peak Detector was used in measurements below 1 GHz, and an Average Detector was used in measurements above 1 GHz, and below 90 kHz.

All other emissions seen, other than the noise floor, were greater than 20 dB below the limits.

Photo(s) Taken During Radiated Emission Testing

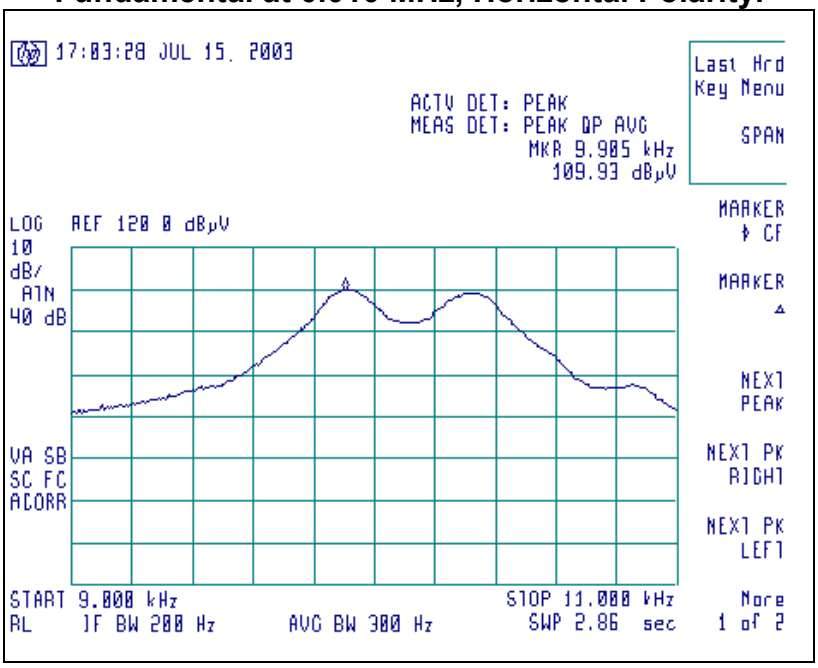
Setup for the Radiated Emissions Test

View of the EUT during Radiated Emission Testing on the 10 Meter OATS

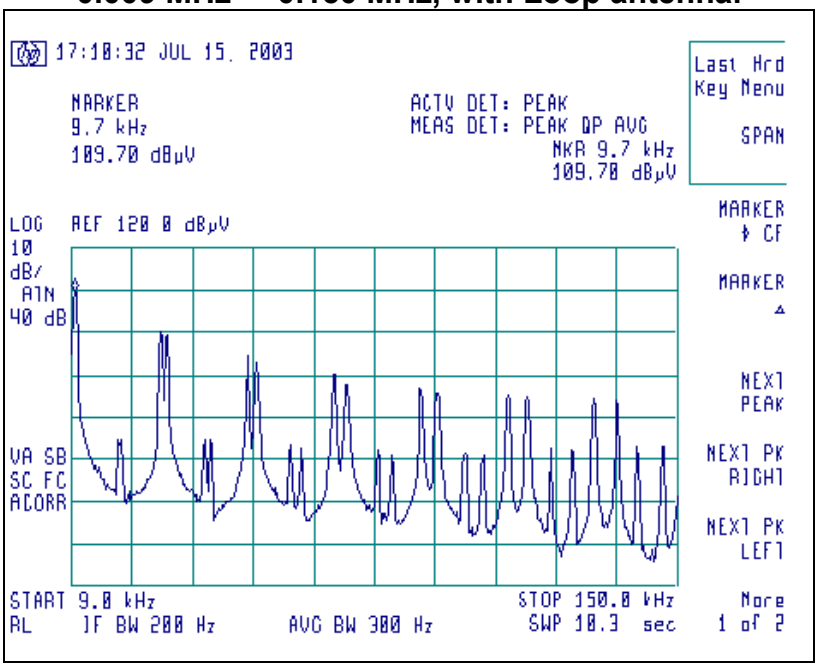
View of the EUT during Radiated Emission Investigative Testing In the 3 Meter Chamber

Graphs made during Radiated Emission Testing

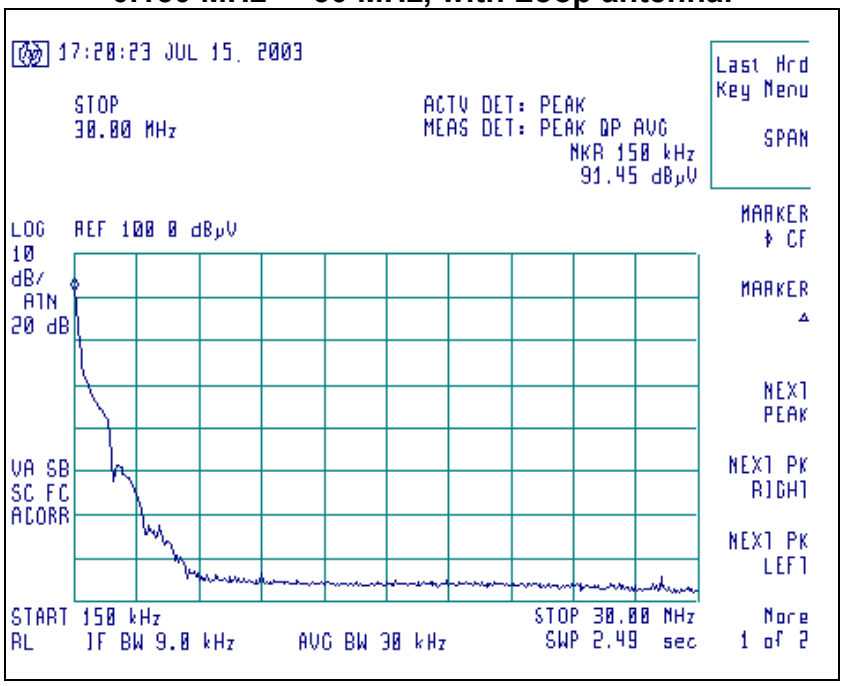
Signature Scan of Radiated Emissions at 3.0 meters
Fundamental at 0.010 MHz, Horizontal Polarity.



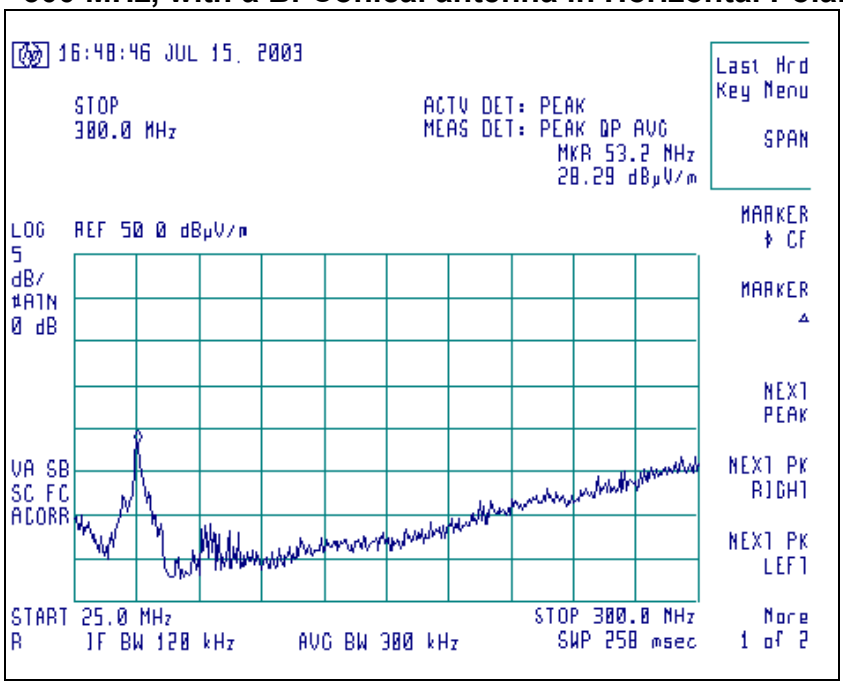
Signature Scan of Radiated Emissions at 3.0 meters
0.009 MHz - 0.150 MHz, with Loop antenna.



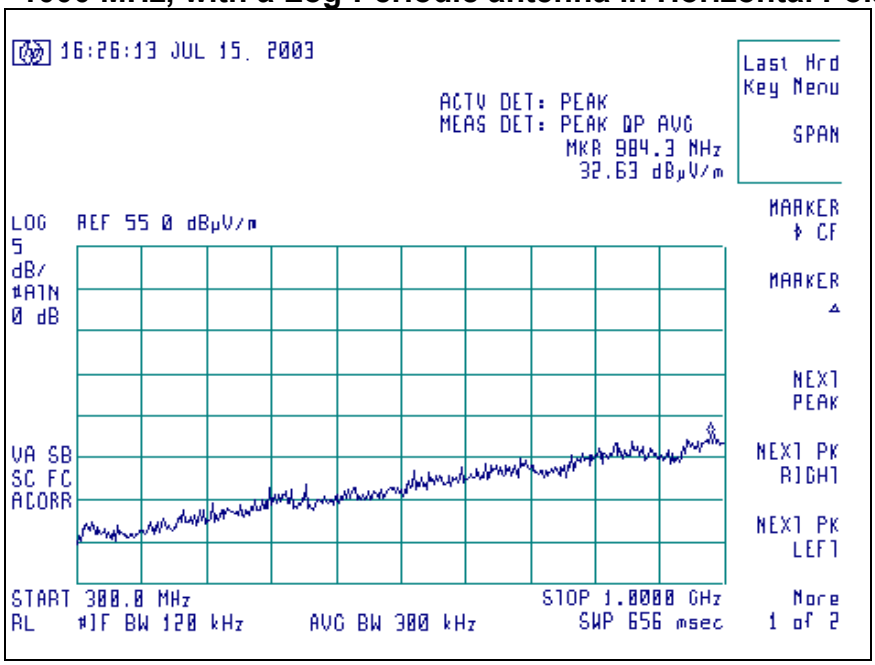
Signature Scan of Radiated Emissions at 3.0 meters
0.150 MHz - 30 MHz, with Loop antenna.



Signature Scan of Radiated Emissions at 3.0 meters
30 MHz - 300 MHz, with a Bi-Conical antenna in Horizontal Polarization.



Signature Scan of Radiated Emissions at 3.0 meters
300 MHz - 1000 MHz, with a Log-Periodic antenna in Horizontal Polarization.



12. Conducted Emissions at AC Mains

Test Setup

The Conducted Emissions tests were performed within the Shielded Room, located at L.S. Compliance, Inc. in Cedarburg, Wisconsin. The EUT was placed on a non-conductive pedestal, with a height of 80 cm above the reference ground plane. The EUT's power supply was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The test area and setup are in accordance with ANSI C63.4-2001 and with IEC CISPR 22 (EN 55022). The AC power source to the LISN was connected to inside the Shielded Room via an appropriate broadband EMI Filter. Final readings were then taken and recorded.

Test Procedure

After the EUT was setup in the Shielded Room and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the HP 8546A EMI Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral). The appropriate frequency range and bandwidths were entered into the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1 (2001), Section 1, Table 1, for Quasi-Peak and Average Detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded. The limits for Conducted Emissions can be found in Title 47CFR 15.207, and are presented later in this report.

Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to a N.I.S.T. site. All cables are calibrated and checked periodically for conformance. The emissions are measured on the HP 8546A EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

Test Results

The EUT was found to MEET the Conducted AC Mains Emissions requirements of FCC Part 15.207 for an intentional radiator. See the Data Charts and Graphs for more details of the test results.

CALCULATION OF CONDUCTED EMISSIONS LIMITS

The following table depicts the general emission limits for an intentional radiator. These limits are obtained from Title 47 CFR, Part 15.207, for radiated emissions measurements.

Frequency (MHz)	Quasi-Peak Limit (dBμV)	Average Limit (dBμV)
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5.0	56	46
5.0 - 30	60	50

* Decreases with logarithm of the frequency.

Sample conversion in the 0.15 MHz to 0.5 MHz range:

$$Limit\big|_F = \left[-19.12\left(\frac{dB}{Hz}\right)x\left(\log\frac{freq(MHz)}{0.15}\right)\right] + 66$$

For 200 kHz for example (F=0.20 MHz):

$$Limit\big|_{F=200kHz} = \left[-19.12\left(\frac{dB}{Hz}\right)x\left(\log\frac{0.20}{0.15}\right)\right] + 66$$

$$Limit\big|_{F=200kHz} = 63.61\left(dB\mu V\right)$$

Note: Limits are rounded to the nearest whole number.

Photo(s) Taken During Conducted AC Mains Emission Testing

Setup for the Conducted Emissions Test

View of the EUT during Conducted Emission Testing in the 3 Meter FCC Listed Chamber

Conducted AC Mains Emissions Data Chart

Manufacturer:	Multivet International, Inc.						
Date(s) of Test:	July 15th , 2003						
Test Engineer:	Abtin Spantman						
Model #:	Virtual Fence						
Serial #:	Engineering Unit						
Voltage:	15 VAC power, derived from a 120 VAC wall transformer						
Detectors Used:			Peak	√	Quasi-Peak	√	Average

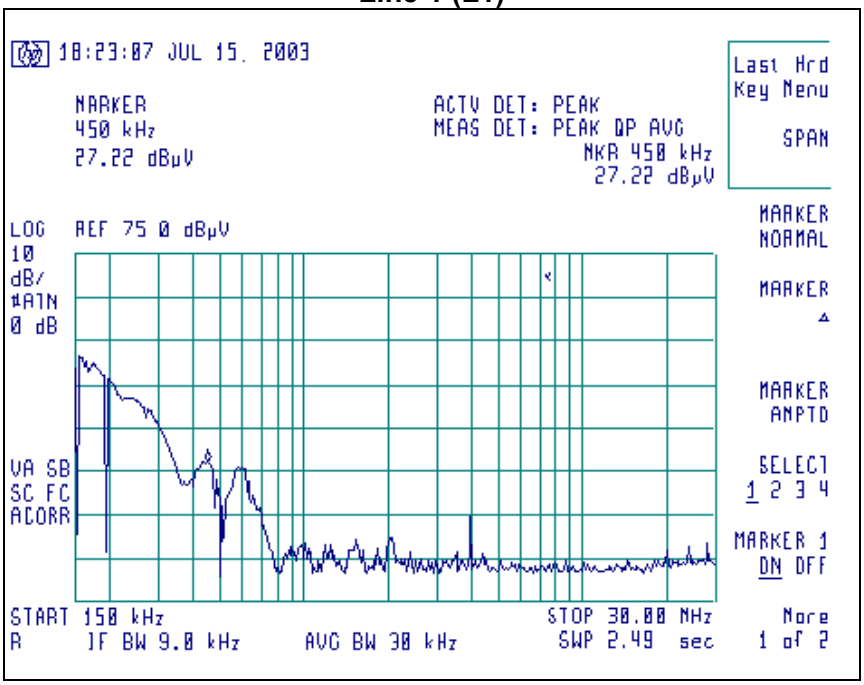
Test Equipment Used:	Hewlett Packard (HP) 8546A
Specifications:	47 CFR 15.207
Detector(s) Used:	Peak, Quasi-Peak and AVG
Configuration:	0.8m height

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	**Line**	**Q-Peak Reading (dBµV/m)**	**Q-Peak Limit (dBµ V/m)**	**Q-Peak Margin (dB)**	**Average Reading (dBµV/m)**	**Average Limit (dBµ V/m)**	**Average Margin (dB)**

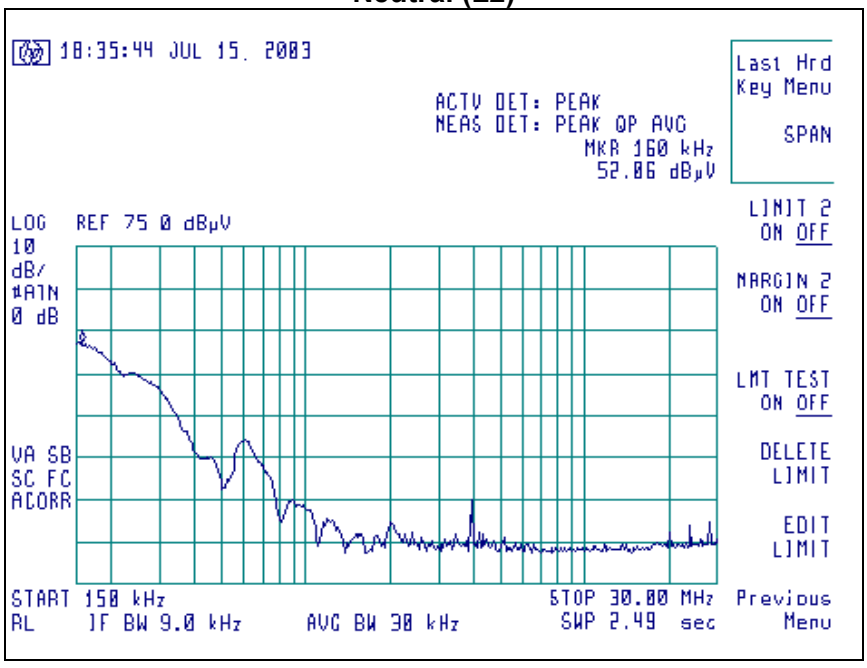
Note: No signals that were seen were within 20 dB of the limits.

Graphs made during Conducted AC Mains Emission Testing

Signature Scan of Conducted AC Mains Emissions
Line 1 (L1)



Signature Scan of Conducted AC Mains Emissions
Neutral (L2)



APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/19/02	9/19/03
AA960031	HP	119474A	3107A01708	Transient Limiter	6/19/03	6/19/04
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/19/02	9/19/03
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/19/02	9/19/03
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	11/12/02	11/12/03
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	10/28/02	10/28/03
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/20/02	9/20/03
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/20/02	9/20/03
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	6/19/03	6/19/04
N/A	LSC	Cable	0038	1 Meter RG 214 Cable	6/19/03	6/19/04
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	6/19/03	6/19/04
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	6/19/03	6/19/04

Note 1 - Equipment calibrated within a traceable system.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V