



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 W. PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

March 9, 2009

Hillcrest Laboratories, Inc.
15245 Shady Grove Road
Rockville, MD 20850

Dear Roy Illingworth,

Enclosed is the EMC Wireless test report for compliance testing of the Hillcrest Laboratories, Inc., Loop™ Pointer as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15, Subpart B for a Class B Digital Device and Subpart C for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Hillcrest Laboratories, Inc.\EMC26122B-FCC249 Rev. 3)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc.

Electromagnetic Compatibility Criteria Test Report

for the

**Hillcrest Laboratories, Inc.
Model Loop[™] Pointer**

Verified under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15 Subpart B and Part 15.249
for Low Power License-Exempt Radio Communications Devices
Intentional Radiators

MET Report: EMC26122B-FCC249 Rev. 3

March 9, 2009

Prepared For:

**Hillcrest Laboratories, Inc.
15245 Shady Grove Road
Rockville, MD 20850**

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave.
Baltimore, MD 21230

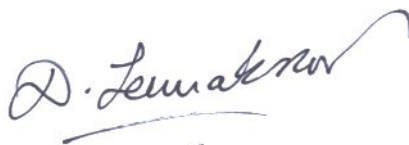
Electromagnetic Compatibility Criteria Test Report

for the

Hillcrest Laboratories, Inc.
Model Loop[™] Pointer

Tested Under

the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15 Subpart B and Part 15.249
for Low Power License-Exempt Radio Communications Devices
Intentional Radiators



Dusmantha Tennakoon
Project Engineer, Electromagnetic Compatibility Lab



Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15.249, of the FCC Rules under normal use and maintenance.



Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	February 5, 2009	Initial Issue.
1	February 11, 2009	Customer corrections.
2	February 13, 2009	Corrected block diagram.
3	March 9, 2009	Corrections per engineer.

Table of Contents

I.	Executive Summary	1
	A. Purpose of Test	2
	B. Executive Summary	2
II.	Equipment Configuration	3
	A. Overview.....	4
	B. References.....	5
	C. Test Site	5
	D. Description of Test Sample.....	5
	E. Equipment Configuration.....	7
	F. Support Equipment	7
	G. Ports and Cabling Information.....	7
	H. Mode of Operation.....	7
	I. Modifications	7
	a) Modifications to EUT.....	7
	b) Modifications to Test Standard.....	7
	J. Disposition of EUT	7
III.	Electromagnetic Compatibility Criteria for Unintentional Radiators	8
	§ 15.107(a) Conducted Emissions Limits.....	9
	§ 15.109(a) Radiated Emission Limits	10
	§ 15.09(a) Radiated Emissions Limits.....	10
IV.	Electromagnetic Compatibility Criteria for Intentional Radiators.....	14
	§ 15.207(a) Conducted Emissions Limits.....	15
	§ 15.203 Antenna Requirement	16
	§ 15.249(a) Radiated Fundamental.....	17
	§ 15.249(d) Spurious Emissions.....	19
V.	Test Equipment	25
VI.	Certification & User's Manual Information.....	27
	A. Certification Information	28
	B. Label and User's Manual Information	32

List of Tables

Table 1. Executive Summary of EMC Part 15.249 Compliance Testing	2
Table 2. EUT Specifications	4
Table 3. Equipment Configuration	7
Table 4. Support Equipment.....	7
Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)	9
Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)	10
Table 7. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz.....	11
Table 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)	15
Table 9. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)	17
Table 10. Radiated Field Strength of Fundamental, Test Results	17
Table 11. Harmonic Emissions, Test Results	18
Table 12. Restricted Bands of Operation.....	19
Table 13. Test Equipment	26

List of Figures

Figure 1. Block Diagram of Test Configuration.....	6
--	---

List of Photographs

Photograph 1. Hillcrest Laboratories, Inc. Loop [™] Pointer	6
Photograph 2. Radiated Emission Test Setup 30 MHz - 1 GHz.....	13
Photograph 3. Test Setup for Various Radiated Measurements	18

List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dBμA	Decibels above one microamp
dBμV	Decibels above one microvolt
dBμA/m	Decibels above one microamp per meter
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current μ
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	microhenry
μ	microfarad
μs	microseconds
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane



I. Executive Summary



A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Hillcrest Laboratories, Inc., Loop™ Pointer, with the requirements of Part 15, §15.249. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Loop™ Pointer. Hillcrest Laboratories, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Loop™ Pointer, has been **permanently** discontinued

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.249, in accordance with Hillcrest Laboratories, Inc., purchase order number 2008-12-160. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Description	Results
15.107	AC Power Line Conducted Emissions	Not Applicable
15.109	Radiated Spurious Emissions	Compliant
§15.207	AC Power Line Conducted Emissions	Not Applicable
§15.203	Antenna Requirement	Compliant
§15.249 (a)	Field Strength of Fundamental and Harmonics	Compliant
§15.249(d)	Spurious Emissions	Compliant

Table 1. Executive Summary of EMC Part 15.249 Compliance Testing

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Hillcrest Laboratories, Inc. to perform testing on the Loop[™] Pointer, under Hillcrest Laboratories, Inc.'s purchase order number 2008-12-160.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Hillcrest Laboratories, Inc., Loop[™] Pointer.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	Loop [™] Pointer	
Model(s) Covered:	Loop [™] Pointer	
EUT Specifications:	Primary Power: 3 VDC (2xAA batteries)	
	FCC ID: WRN-3	
	Type of Modulations:	MSK
	Equipment Code:	DXT
	EUT Frequency Ranges:	2401 – 2482 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35° C)	
	Relative Humidity (30-60%)	
	Barometric Pressure (860-1060 mbar)	
Evaluated by:	Dusmantha Tennakoon	
Date(s):	February 5, 2009	

Table 2. EUT Specifications

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The Equipment Under Test (EUT), works with the Loop[™] Pointer in the model HL2201 to form a system connected by a RF link that conveys motion data of the Loop[™] Pointer to the host via the USB RF transceiver.

This test report only contains information for the Loop[™] Pointer. Please refer to EMC26122A-FCC249 for USB RF transceiver.



Photograph 1. Hillcrest Laboratories, Inc. Loop[™] Pointer

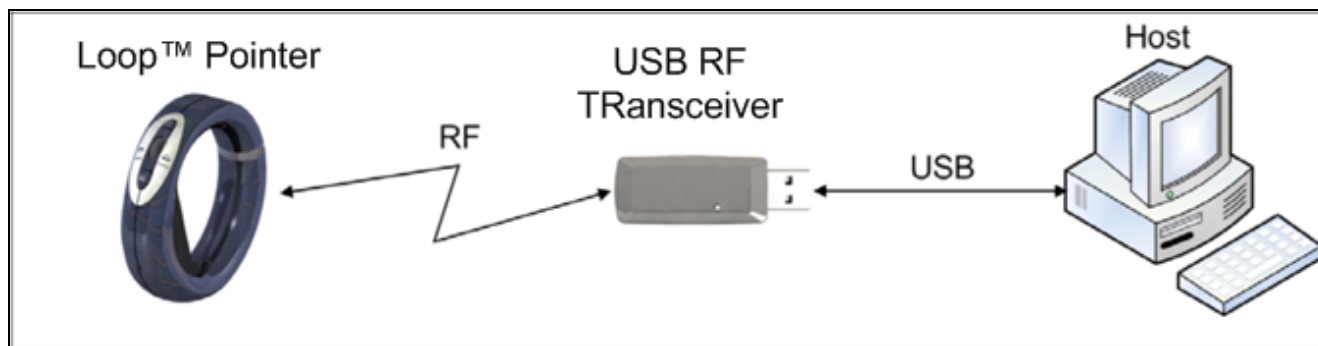


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Name / Description	Model Number	Part Number	Serial Number	Revision
LOOP [™] POINTER	HL2201	1000-1930	2000	1

Table 3. Equipment Configuration

F. Support Equipment

Hillcrest Laboratories, Inc. supplied support equipment necessary for the operation and testing of the Loop[™] Pointer. All support equipment supplied is listed in the following Support Equipment List.

Name / Description	Manufacturer	Model Number	Serial Number
LAPTOP WITH POWER SUPPLY	DELL	LATITUDE D810	2727712261
USB RF TRANSCEIVER	HILLCREST	HL2201	007

Table 4. Support Equipment

G. Ports and Cabling Information

Ports and cabling information was not required for equipment configuration.

H. Mode of Operation

The Loop[™] Pointer was made to transmit in its normal mode of operation.

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Hillcrest Laboratories, Inc. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria for Unintentional Radiators

§ 15.107 Conducted Emissions Limits

Test Requirement(s): **15.107 (a)** “Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.”

15.107 (b) “For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in Table 5. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.”

Frequency range (MHz)	15.107(b), Class A Limits (dBμV)		15.107(a), Class B Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies.				

Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)

Test Results: The EUT was not applicable with the Class B requirement(s) of this section. Device operates on two AA batteries.

Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 6.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 6.

Frequency (MHz)	Field Strength (dBμV/m)	
	§15.109 (b), Class A Limit (dBμV) @ 10m	§15.109 (a), Class B Limit (dBμV) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures: The EUT was placed on a 0.8m-high acrylic table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 3 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Test Results: The EUT was found compliant with the Class B requirement(s) of this section. Measured emissions were below applicable limits

Test Engineer(s): Dusmantha Tennakoon

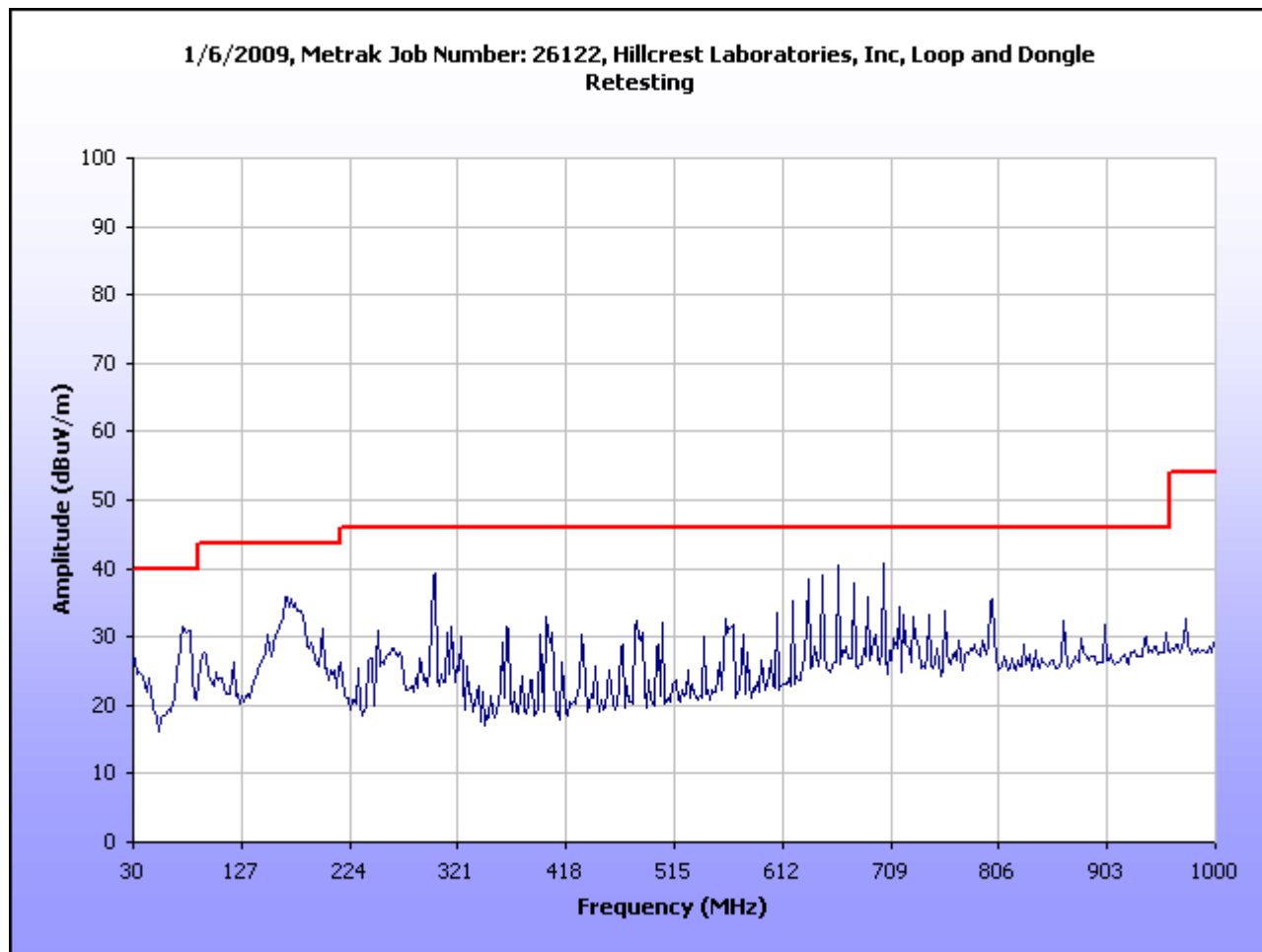
Test Date(s): 01/06/09

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
74.377	0	H	1.00	6.23	8.80	0.25	0.00	15.28	40.00	-24.72
74.377	281	V	1.00	23.06	7.70	0.25	0.00	31.01	40.00	-8.99
80.140	271	H	1.00	8.41	7.58	0.27	0.00	16.26	40.00	-23.74
80.140	189	V	1.00	21.68	6.79	0.27	0.00	28.74	40.00	-11.26
168.186	266	H	2.07	24.14	8.43	0.40	0.00	32.97	43.50	-10.53
168.186	317	V	2.25	22.36	8.76	0.40	0.00	31.52	43.50	-11.98
299.786	280	H	1.00	24.66	13.20	1.45	0.00	39.31	46.00	-6.69
299.786	17	V	1.59	22.70	12.40	1.45	0.00	36.55	46.00	-9.45
559.846	321	H	1.14	7.96	18.50	2.48	0.00	28.93	46.00	-17.07
559.846	166	V	1.00	11.97	18.50	2.48	0.00	32.95	46.00	-13.05
661.478	7	H	1.25	17.97	20.30	2.57	0.00	40.84	46.00	-5.16
661.478	280	V	1.00	12.56	20.20	2.57	0.00	35.33	46.00	-10.67
701.977	29	H	1.00	17.71	20.46	2.56	0.00	40.73	46.00	-5.27
701.977	274	V	1.00	12.25	20.50	2.56	0.00	35.31	46.00	-10.69

Table 7. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz

Note: Measurements made at 3m.



Plot 1. Radiated Emissions, Pre-Scan

Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission Test Setup 30 MHz - 1 GHz

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

Test Requirement(s): § 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Results: The EUT is not applicable with this requirement. Device is battery operated.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested meets the criteria of this rule by virtue of by having an integral antenna. The EUT is therefore compliant with §15.203.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 01/09/09

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.249(a) Radiated Field Strength of Fundamental

Test Requirements: § 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 9. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The transmitter was set to the low, mid, and high channels at the highest output power and placed in a semi-anechoic chamber. Measurements were performed with the EUT rotated on all 3 orthogonal planes with the antenna height varied to find maximum emissions. Measurements were made at 1m.

Test Results Equipment complies with § 15.249.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 01/09/09

Channel	Frequency (MHz)	Measured AVG Field Strength (dBuV/m)*	Measured Peak Field Strength (dBuV/m) *	Limit Avg Field Strength (dBuV/m)
1	2401	62.05	89.23	94
40	2440	61.52	88.00	94
82	2482	59.29	87.73	94

Table 10. Radiated Field Strength of Fundamental, Test Results

The measured peak field strength was less than the average limit.

* Data has been corrected for cable loss, ACF and distance.

Channel	Frequency (GHz)	Final measurement corrected for cable loss, preamp, ACF and distance (dBuV/m)	Limit (dBuV/m)	Remark	Pass/Fail
1	4.802	68.77	74	Peak	Pass
	4.802	52.26	54	Avg	Pass
	7.203	47.78	74	Peak	Pass
	7.203	35.11	54	Avg	Pass
40	4.88	68.26	74	Peak	Pass
	4.88	52.87	54	Avg	Pass
	7.32	47.31	74	Peak	Pass
	7.32	36.02	54	Avg	Pass
82	4.964	68.41	74	Peak	Pass
	4.964	51.35	54	Avg	Pass
	7.446	51.49	74	Peak	Pass
	7.446	38.26	54	Avg	Pass

Table 11. Harmonic Emissions, Test Results

All other harmonics of the principle were below the noise floor of the measurement system.



Photograph 3. Test Setup for Various Radiated Measurements

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.249(d) Spurious Emissions Requirements

Test Requirements: §15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110-----	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505-----	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905-----	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128-----	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775-----	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775-----	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218-----	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825-----	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225-----	123–138	2200–2300	14.47–14.5
8.291–8.294-----	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366-----	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675-----	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475-----	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293-----	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025-----	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725-----	322–335.4	3600–4400	(²)

Table 12. Restricted Bands of Operation

¹ Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

² Above 38.6

Test Procedure:

The transmitter was set to the low, mid, and high channels at the highest output power in a semi-anechoic chamber. Measurements were performed with the EUT rotated on all 3 orthogonal planes varying the antenna height to determine worst case orientation for maximum emissions.

Test Results:

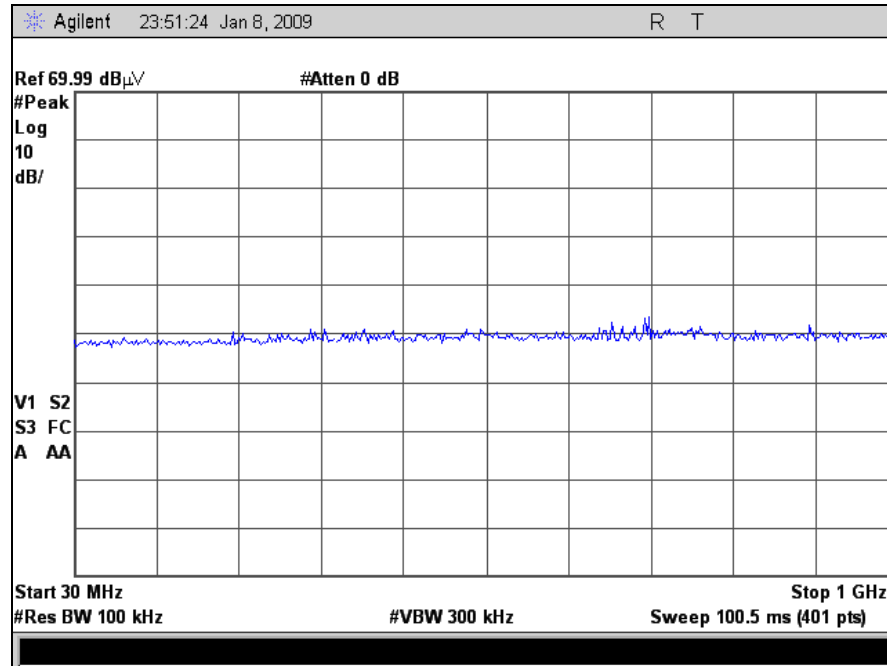
Equipment complies with the Spurious Emissions Requirements of § 15.249 (d), and band edge requirements of §15.205.

Test Engineer(s):

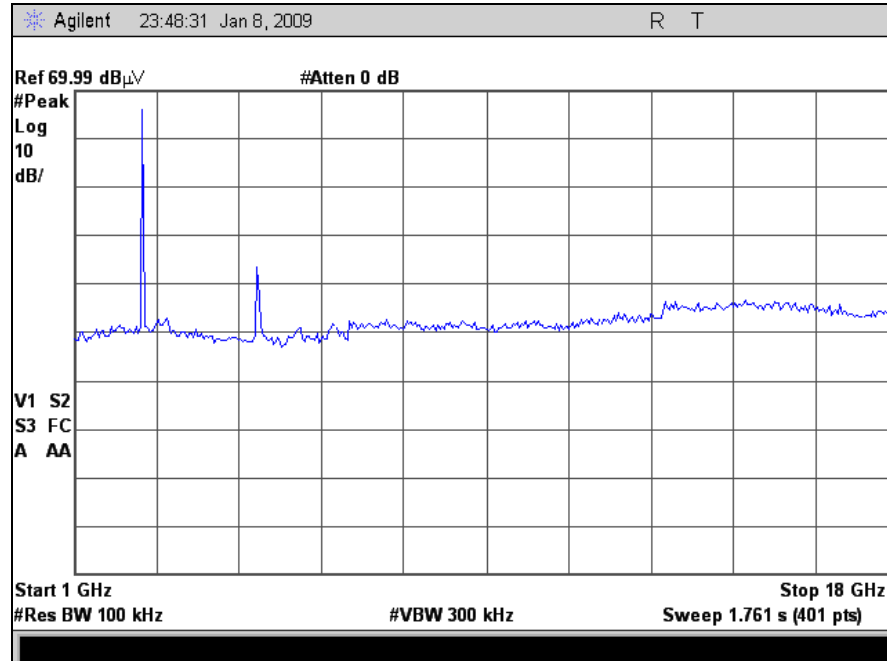
Dusmantha Tennakoon

Test Date(s):

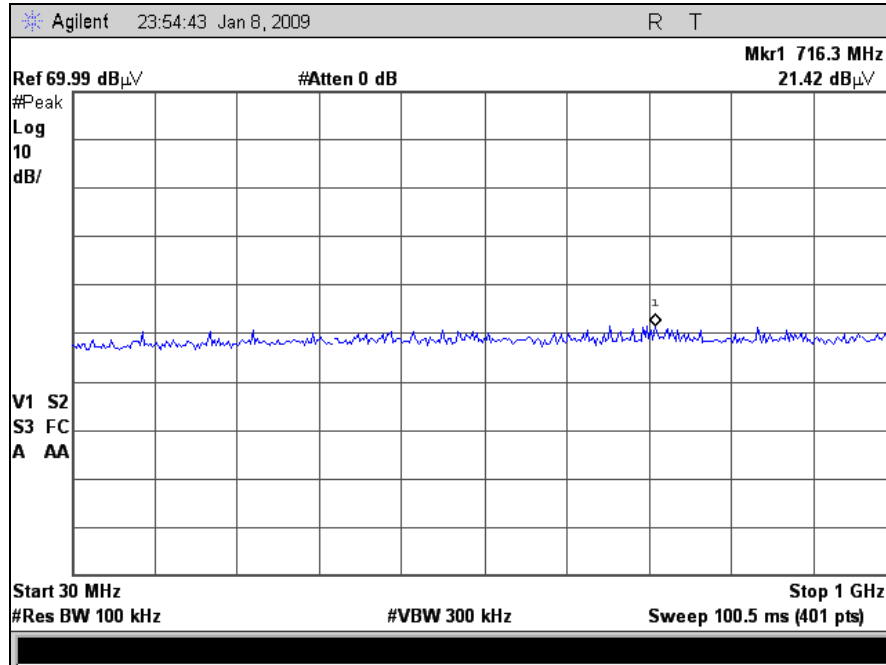
01/23/09



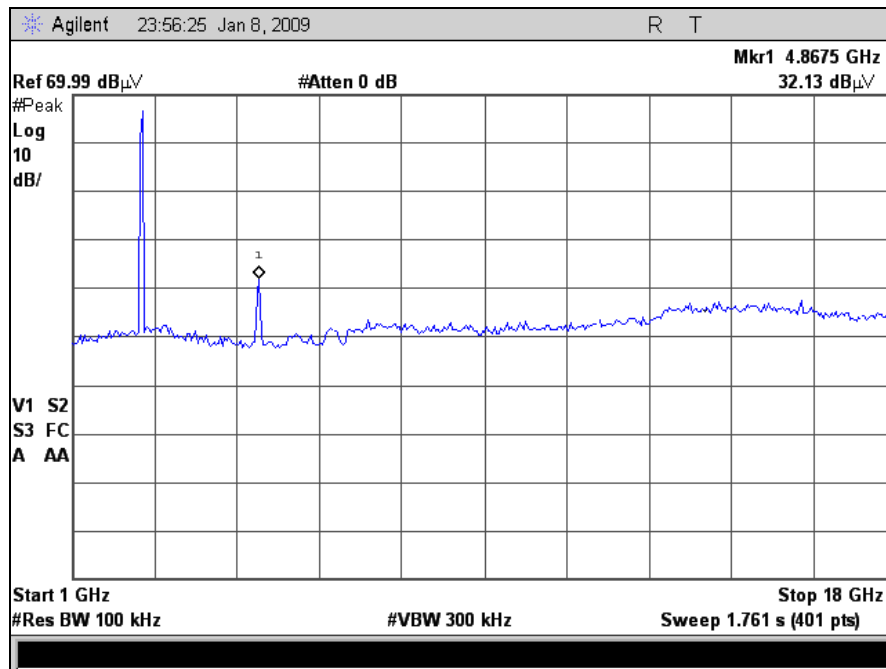
Plot 2. Harmonic Emissions, Channel 1, 30 MHz – 1 GHz



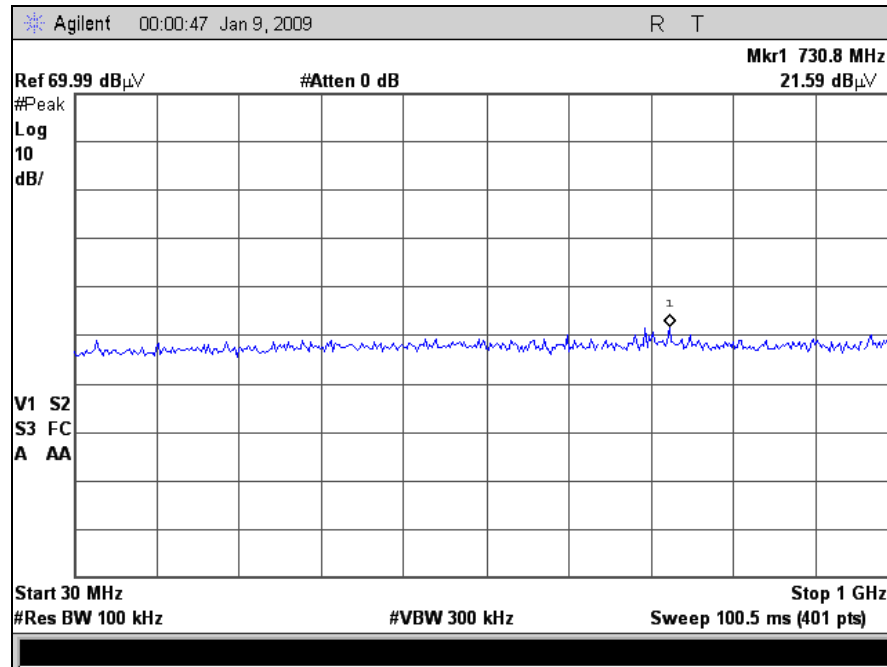
Plot 3. Harmonic Emissions, Channel 1, 1 GHz – 18 GHz



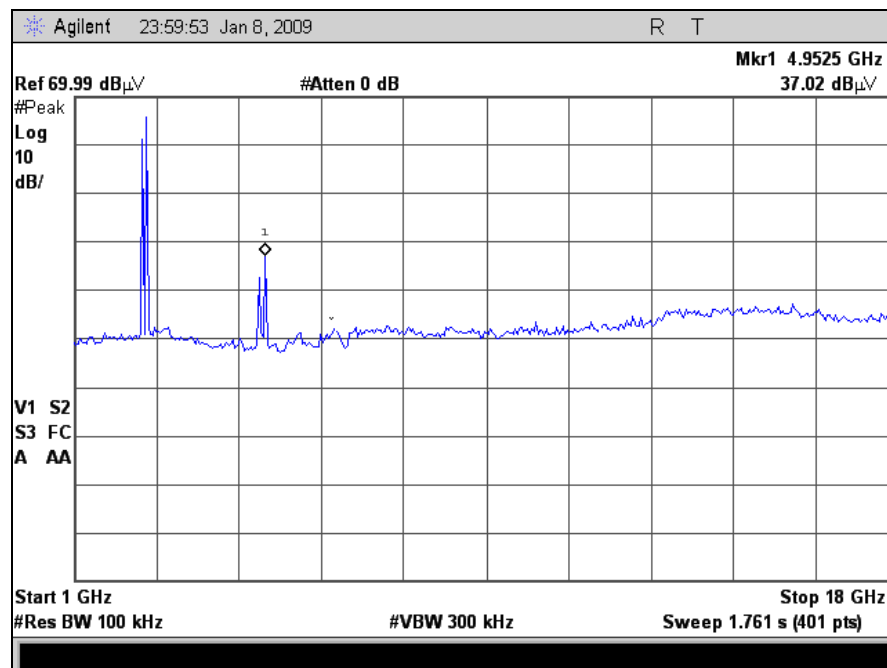
Plot 4. Harmonic Emissions, Channel 40, 30 MHz – 1 GHz



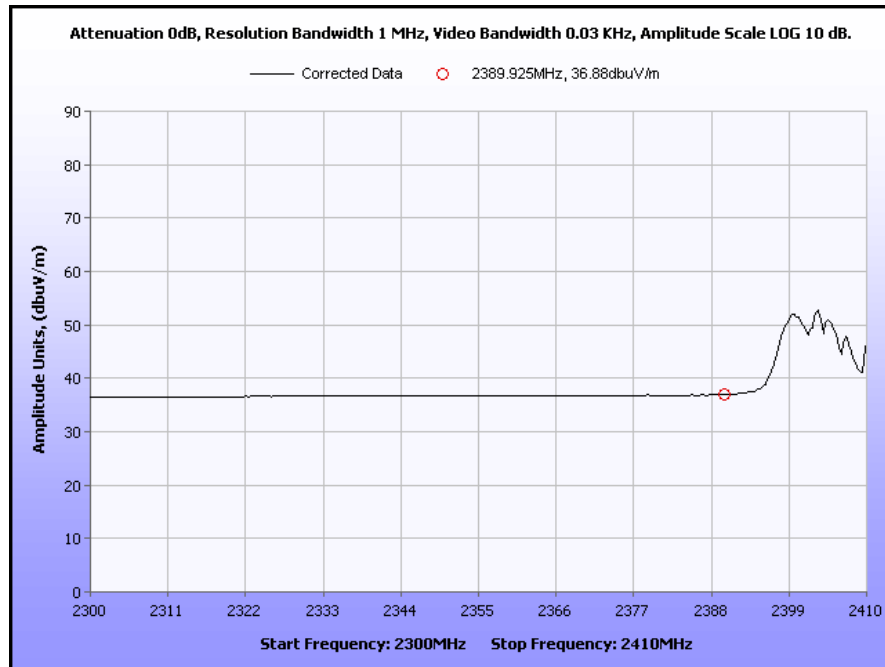
Plot 5. Harmonic Emissions, Channel 40, 1 GHz – 18 GHz



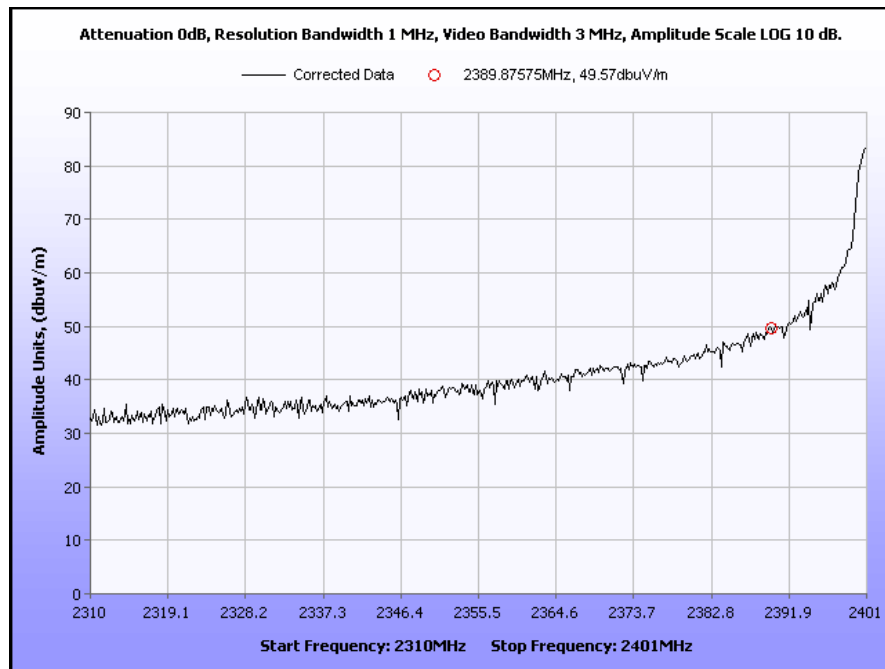
Plot 6. Harmonic Emissions, Channel 82, 30 MHz – 1 GHz



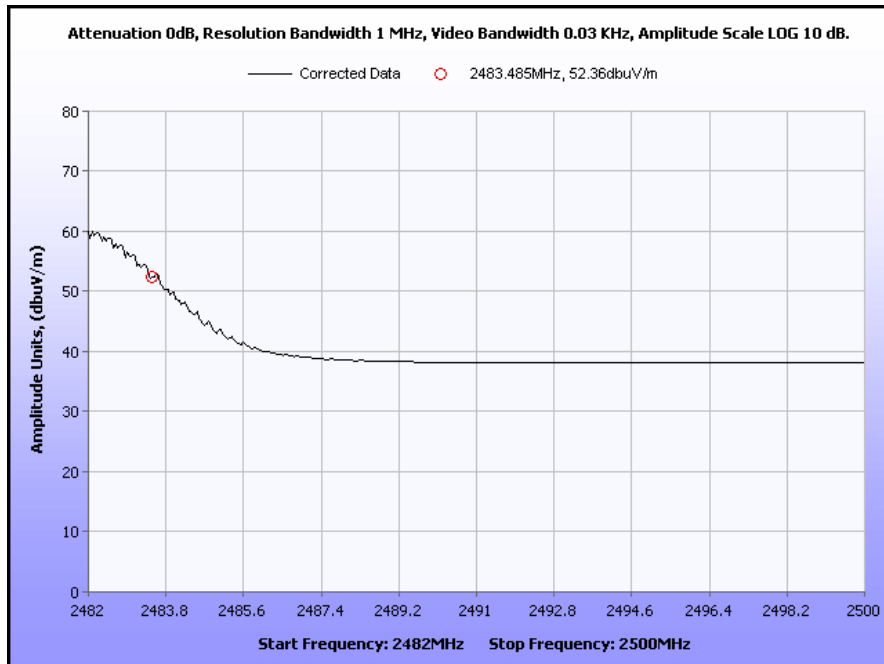
Plot 7. Harmonic Emissions, Channel 82, 1 GHz – 18 GHz



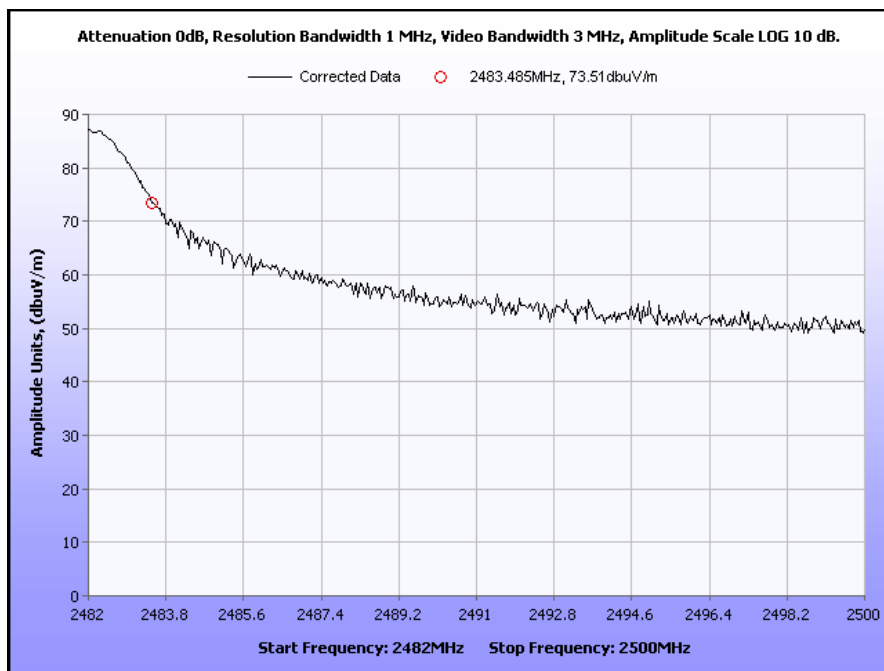
Plot 8. Band Edge, Channel 1, Average



Plot 9. Band Edge, Channel 1, Peak



Plot 10. Band Edge, Channel 82, Average



Plot 11. Band Edge, Channel 82, Peak



IV. Test Equipment



Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	05/17/2009
1T2665	HORN ANTENNA	EMCO	3115	05/07/2008	05/07/2009
1T4612	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4407B	01/04/2008	01/22/2009
1T4303	ANTENNA; BILOG	SCHAFNER-CHASE EMC	CBL6140A	07/07/2008	07/07/2009
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	SEE NOTE	

Table 13. Test Equipment

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing*;
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
 - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.¹ *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.*
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

¹ In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
 - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
 - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
 - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
 - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

- (a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

- (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



Hillcrest Laboratories, Inc.
Loop™ Pointer

Electromagnetic Compatibility
End of Report
CFR Title 47, Part 15, Subpart C

End of Report