



## MET Laboratories, Inc.

*Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

Rajant Corporation  
400 E. King Street  
Malvern, PA 19355

August 21, 2007

Dear Brian Hassick,

Enclosed is the EMC test report for compliance testing of the Rajant Corporation, XL and XLE, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 15 Subpart B for a Class A Digital Device.

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.

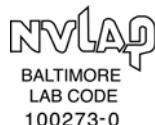
Jennifer Warnell  
Documentation Department

Reference: (\Rajant Corporation\EMC22693A-FCC)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc. While use of the National Voluntary Laboratory Accreditation Program (NVLAP) letters or the NVLAP Logo, the Standards Council of Canada Logo, A2LA, or the Nationally Recognized Testing Laboratory (NRTL) Letters in this report reflects MET Accreditation under these programs, these letters, logo, or statements do not claim product endorsement by these organizations or any Agency of the U.S. Government. This letter of transmittal is not a part of the attached report.



*The Nation's First Licensed Nationally Recognized Testing Laboratory*





**MET Laboratories, Inc.**

*Safety Certification - EMI - Telecom Environmental Simulation*  
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

---

**Electromagnetic Compatibility  
Test Report**

For the

**Rajant Corporation  
XL and XLE**

Tested under

**Title 47 of the Code of Federal Regulations (CFR),  
Part 15 Subpart B  
for a Class A Digital Device**

**MET Report: EMC22693A-FCC**

**August 21, 2007**

Prepared For:

**Rajant Corporation  
400 E. King Street  
Malvern, PA 19355**

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



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
CFR Title 47, Part 15, Subpart B

## Electromagnetic Compatibility Test Report

For the

**Rajant Corporation  
XL and XLE**

Tested under

**Title 47 of the Code of Federal Regulations (CFR),  
Part 15 Subpart B  
for a Class A Digital Device**

**MET Report: EMC22693A-FCC**

A handwritten signature in black ink, appearing to read "D. Tennakoon".

Dusmantha Tennakoon  
Project Engineer, Electromagnetic Compatibility Lab

A handwritten signature in black ink, appearing to read "Jennifer Warnell".

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 applicable limits. 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 Title 47 of the CFR, Part 15, Subpart B for a Class A Digital Device under normal use and maintenance.

A handwritten signature in black ink, appearing to read "D. Tennakoon".

Dusmantha Tennakoon,  
EMC, Wireless Coordinator



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
CFR Title 47, Part 15, Subpart B

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	August 21, 2007	Initial Issue.



## Table of Contents

<b>1.0 Testing Summary .....</b>	<b>1</b>
<b>2.0 Equipment Configuration.....</b>	<b>2</b>
<b>2.1 Overview .....</b>	<b>2</b>
<b>2.2 Test Site .....</b>	<b>3</b>
<b>2.3 Description of Test Sample .....</b>	<b>3</b>
<b>2.4 Equipment Configuration.....</b>	<b>4</b>
<b>2.5 Support Equipment .....</b>	<b>4</b>
<b>2.6 Ports and Cabling Information .....</b>	<b>5</b>
<b>2.7 Mode of Operation .....</b>	<b>8</b>
<b>2.8 Method of Monitoring EUT Operation .....</b>	<b>8</b>
<b>2.9 Modifications .....</b>	<b>8</b>
<b>2.9.1 Modifications to EUT .....</b>	<b>8</b>
<b>2.9.2 Modifications to Test Standard .....</b>	<b>8</b>
<b>2.10 Disposition of EUT .....</b>	<b>8</b>
<b>3.0 Electromagnetic Compatibility Emission Criteria.....</b>	<b>9</b>
<b>3.1 Conducted Emission Limits .....</b>	<b>9</b>
<b>3.2 Radiated Emission Limits .....</b>	<b>16</b>
<b>4.0 Test Equipment .....</b>	<b>23</b>
<b>5.0 Compliance Information.....</b>	<b>24</b>
<b>5.1 Verification Information .....</b>	<b>24</b>
<b>5.2 Label and User's Manual Information .....</b>	<b>29</b>



## List of Tables

Table 1. Summary of Test Results .....	1
Table 2. EUT Overview for the XL.....	2
Table 3. EUT Overview for the XLE .....	2
Table 4. Equipment Configuration for the XL .....	4
Table 5. Equipment Configuration for the XLE.....	4
Table 6. Support Equipment for the XL .....	4
Table 7. Support Equipment for the XLE.....	4
Table 8. Ports and Cabling Information for the XL.....	5
Table 9. Ports and Cabling Information for the XLE .....	5
Table 10. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b).....	9
Table 11. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC) .....	11
Table 12. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC).....	13
Table 13. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b) .....	16
Table 14. Radiated Emissions Limits Test Results for the XL.....	17
Table 15. Radiated Emissions Limits Test Results for the XLE .....	20
Table 16. Test Equipment .....	23

## List of Figures

Figure 1. Block Diagram, Port Identification for the XL .....	6
Figure 2. Block Diagram of Test Configuration for the XL.....	6
Figure 3. Block Diagram, Port Identification for the XLE .....	7
Figure 4. Block Diagram for the Test Configuration for the XLE .....	7

## List of Photographs

Photograph 1. Conducted Emissions Test Setup .....	15
Photograph 2. XLE, Lead Acid and PS, Front .....	22
Photograph 3. XLE, Lead Acid and PS, Rear .....	22



## List of Terms and Abbreviations

<b>AC</b>	Alternating Current
<b>ACF</b>	Antenna Correction Factor
<b>ANSI</b>	American National Standards Institute
<b>Cal</b>	Calibration
<b>d</b>	Measurement Distance
<b>dB</b>	Deci Bels
<b>dB<math>\mu</math>V</b>	Deci-Bels above one <b>micro Volt</b>
<b>dB<math>\mu</math>V/m</b>	Deci-Bels above one <b>micro Volt per meter</b>
<b>DC</b>	Direct Current
<b>DCF</b>	Distance Correction Factor
<b>E</b>	Electric Field
<b>EUT</b>	Equipment Under Test
<b>f</b>	Frequency
<b>FCC</b>	Federal Communications Commission
<b>GHz</b>	Giga Hertz
<b>Hz</b>	Hertz
<b>kHz</b>	kilohertz
<b>kPa</b>	kilopascal
<b>kV</b>	kilo Volt
<b>LISN</b>	Line Impedance Stabilization Network
<b>MHz</b>	MegaHertz
<b><math>\mu</math>H</b>	<b>micro</b> Henry
<b><math>\mu</math>F</b>	<b>micro</b> Farad
<b><math>\mu</math>s</b>	<b>micro</b> seconds
<b>RF</b>	Radio Frequency
<b>RMS</b>	Root-Mean-Square



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Testing Summary  
CFR Title 47, Part 15, Subpart B

## 1.0 Testing Summary

Title 47 of the CFR, Part 15, Subpart B, Reference and Test Description	Results	Comments
15.107 (a) Conducted Emission Limits for a Class A Digital Device	Compliant	Measured emissions were below applicable limits.
15.109 (a) Radiated Emission Limits for a Class A Digital Device	Compliant	Measured emissions were below applicable limits.

**Table 1. Summary of Test Results**



## 2.0 Equipment Configuration

### 2.1 Overview

MET Laboratories, Inc. was contracted by Rajant Corporation to perform testing on the XL and XLE, under Rajant Corporation purchase order number 2007183.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Rajant Corporation, XL and XLE.

In accordance with §2.955(a) (3), the following data is presented in support of the verification of the Rajant Corporation, XL and XLE. Rajant Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the XL and XLE has been **permanently** discontinued, as per §2.955(b).

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

<b>Model(s) Tested:</b>	XL
<b>Primary Power as Tested:</b>	120 VAC
<b>Secondary Power</b>	12 VDC Lead Acid Battery
<b>Equipment Emissions Class:</b>	A
<b>Highest Clock Frequency:</b>	32 MHz
<b>Evaluated by:</b>	Dusmantha Tennakoon
<b>Report Date:</b>	August 21, 2007

Table 2. EUT Overview for the XL

<b>Model(s) Tested:</b>	XLE
<b>Primary Power as Tested:</b>	120 VAC
<b>Secondary Power</b>	12 VDC Lead Acid Battery
<b>Equipment Emissions Class:</b>	A
<b>Highest Clock Frequency:</b>	55.3 MHz
<b>Evaluated by:</b>	Dusmantha Tennakoon
<b>Report Date:</b>	August 21, 2007

Table 3. EUT Overview for the XLE



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Equipment Configuration  
CFR Title 47, Part 15, Subpart B

## 2.2 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. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

## 2.3 Description of Test Sample

The XLE, Equipment Under Test (EUT), is a portable networking device that supports wired and wireless routing, and amplified 802.11b access point/bridging/meshing functionality. It can encode an analog video stream. It can be powered from external batteries or an external AC/DC power supply. The XL is a depopulated variant of the XLE. The XL does not have the video encoder.



## 2.4 Equipment Configuration

The EUT was set up as outlined in the following diagrams. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
1	XL	XL	XL2E10-872

**Table 4. Equipment Configuration for the XL**

Ref. ID	Name / Description	Model Number	Serial Number
1	XLE	XLE	XLE2E10-1197

**Table 5. Equipment Configuration for the XLE**

## 2.5 Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
2	LAPTOP	IBM	THINKPAD 08N1180	11608K6451ZFX082091JX
3	9DBI ANTENNA, TYPE-N	PACIFIC WIRELESS	OD24M-9	N/A
4	CAT5E ETHERNET CABLE	N/A	N/A	N/A
5	LEAD ACID BATTERY	N/A	N/A	N/A

**Table 6. Support Equipment for the XL**

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
2	LAPTOP	IBM	THINKPAD	N/A
3	9DBI ANTENNA, TYPE-N	PACIFIC WIRELESS	OD24M-9	N/A
4	CAT5E ETHERNET CABLE	N/A	N/A	N/A
5	LEAD ACID BATTERY	N/A	N/A	N/A
6	75OHM TERMINATOR	N/A	N/A	N/A

**Table 7. Support Equipment for the XLE**



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Equipment Configuration  
CFR Title 47, Part 15, Subpart B

## 2.6 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
6	PRI POWER CONNECTOR	XLE AC/DC POWER SUPPLY	1	~8.0FT	N	110 AC MAINS
7	SEC POWER CONNECTOR	XL BATTERY CABLE	1	~8.0FT	N	LEAD ACID BATTERY (5)
8	AUX	N/A – PORT REMOVED AND PLUGGED.	0	N/A	N	N/A
9	RF OUT	ANTENNA, 9DBI, TYPE-N	1	27.0IN	N	9DBI OMNIDIRECTIONAL ANTENNA (3)
10	ETHERNET PORT	XL ETHERNET CABLE	1	~8.0FT	N	CAT5E CABLE (4) AND LAPTOP (2)
11	REAR AUX PORT	N/A – NOT USED IN THIS CONFIGURATION.	0	N/A	N	N/A

Table 8. Ports and Cabling Information for the XL

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
7	PRI POWER CONNECTOR	XLE AC/DC POWER SUPPLY	1	~8.0FT	N	110 AC MAINS
8	SEC POWER CONNECTOR	NONE – WOULD SWAP BETWEEN ANOTHER AC SUPPLY FOR POWERED CONTINUITY	0	N/A	N	N/A
9	RF OUT	ANTENNA, 9DBI, TYPE-N	1	27.0IN	N	9DBI OMNIDIRECTIONAL ANTENNA (3)
10	AUX	VIDEO, 75OHM, BNC CABLE	1	N/A	Y	N/A – 75OHM TERMINATOR
11	ETHERNET PORT	XL ETHERNET CABLE	1	~8.0FT	N	CAT5E CABLE (4) AND LAPTOP (2)
12	REAR AUX PORT	VEHICLE POWER CABLE	1	8.0FT	N	LEAD ACID BATTERY(5)

Table 9. Ports and Cabling Information for the XLE

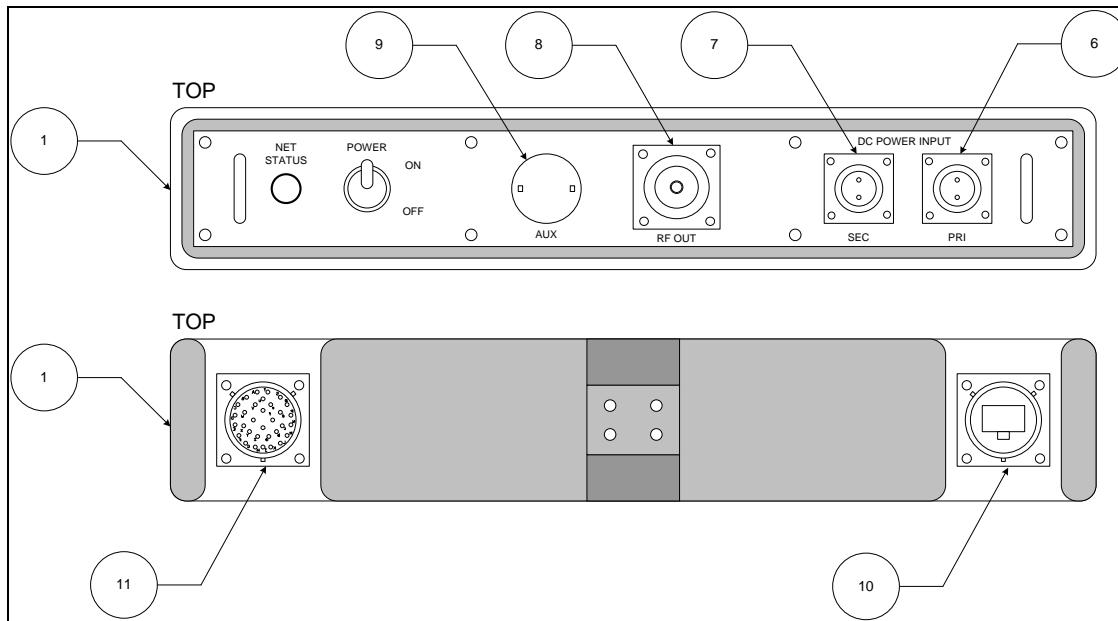


Figure 1. Block Diagram, Port Identification for the XL

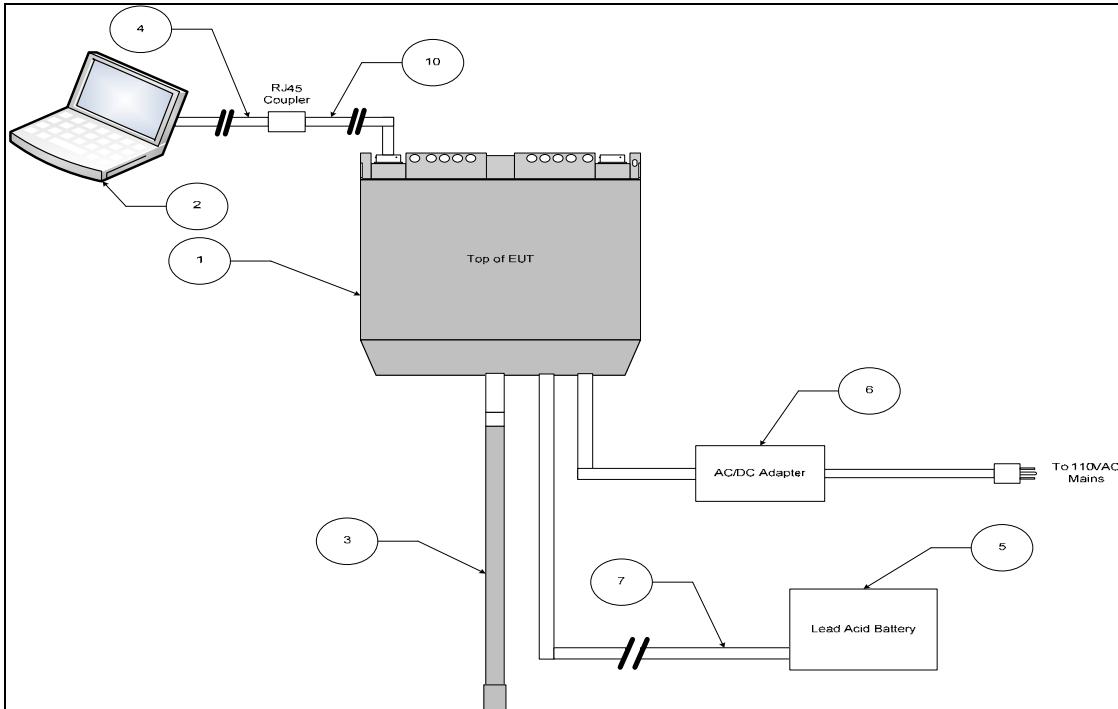
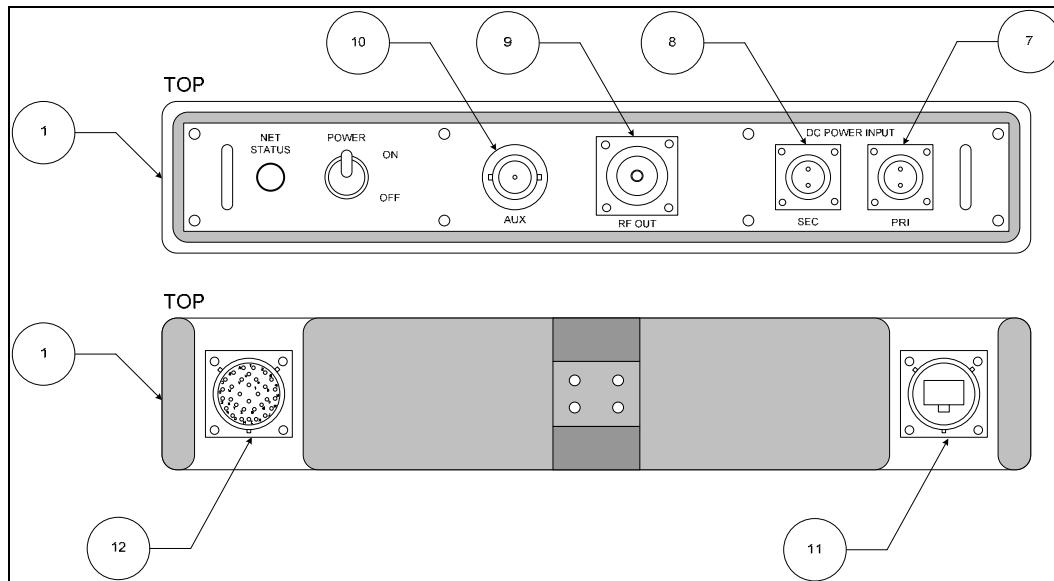
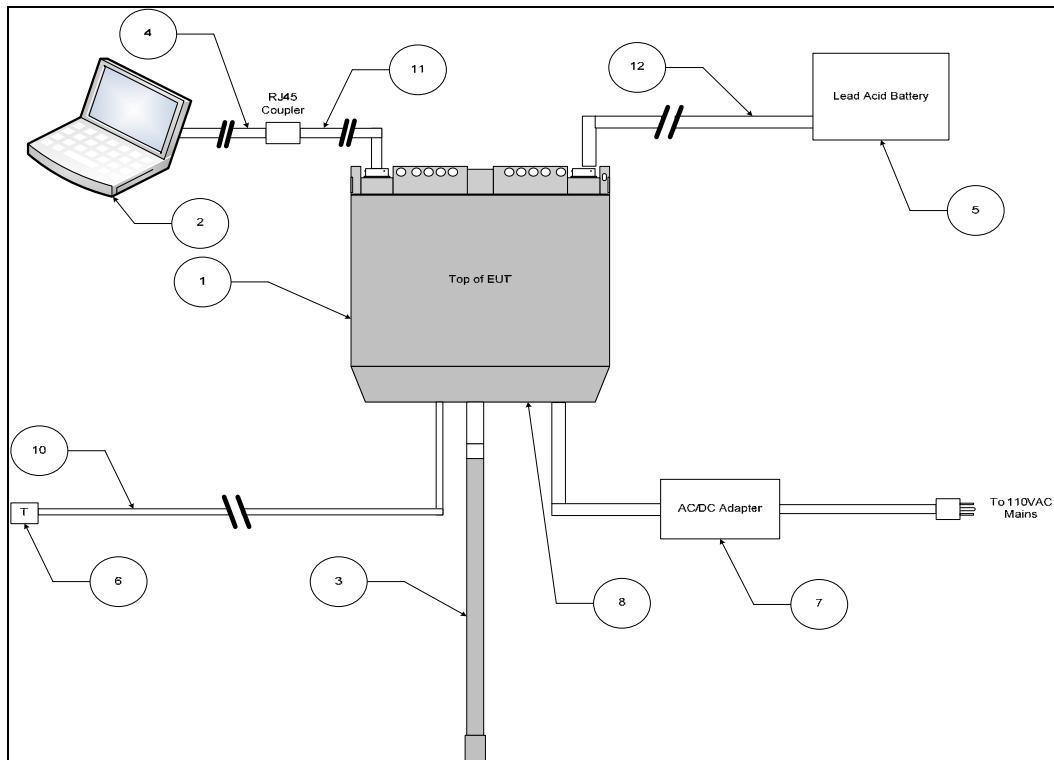


Figure 2. Block Diagram of Test Configuration for the XL


**Figure 3. Block Diagram, Port Identification for the XLE**

**Figure 4. Block Diagram for the Test Configuration for the XLE**



## 2.7 Mode of Operation

The EUT simulated a network packing routing operation internally and exercised the radio transceiver cards by forcing them into a mode where they continuously transmitted.

## 2.8 Method of Monitoring EUT Operation

The EUT “reported in” to the controlling laptop’s management application indicating that the EUT was still operating and relaying operational conditions.

## 2.9 Modifications

### 2.9.1 Modifications to the EUT

The XLE unit needed ferrites on all of its cables to pass FCC class A limits for a digital device. The ferrite model numbers and associated cables are described below.

BNC video encoder cable – Fair Rite P/N: 0461164181 (one turn)  
AC/DC power line - Fair Rite P/N: 0461164181 (one turn)  
DC line - Fair Rite P/N: 0431164181 (no turns)  
Ethernet - Fair Rite P/N: 0431176451 (one turn)

All ferrites were inserted close to the unit.

### 2.9.2 Modifications to the Test Standard

No modifications were made to the test standard.

## 2.10 Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Rajant Corporation upon completion of testing.



### 3.0 Electromagnetic Compatibility Emission Criteria

#### 3.1 Conducted Emission 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 10. 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 10. 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 (dB $\mu$ V)		15.107(a), Class B Limits (dB $\mu$ V)	
	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 10. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15  
Section 15.107(a) (b)**



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Emission Criteria  
CFR Title 47, Part 15, Subpart B

**Test Procedures:**

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a  $50\Omega/50\mu\text{H}$  LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were re-measured using a quasi-peak and/or average detector as appropriate.

The following Conducted Emissions testing was preformed on the XLE model with the Cincon power supply, M/N: TR70A12.

**Test Results:**

The EUT was compliant with the Class A requirement(s) of this section.

**Test Engineer(s):**

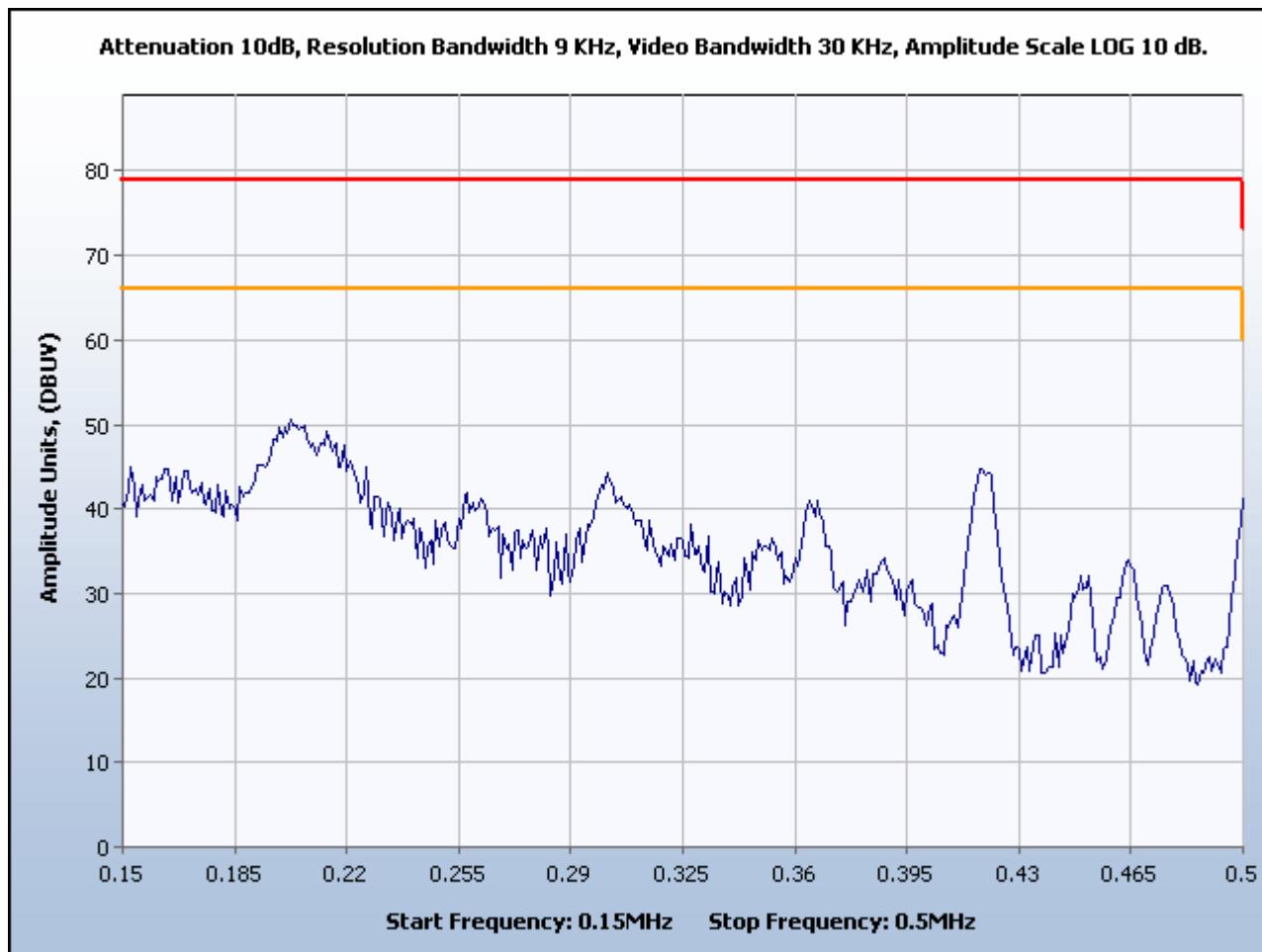
Dusmantha Tennakoon

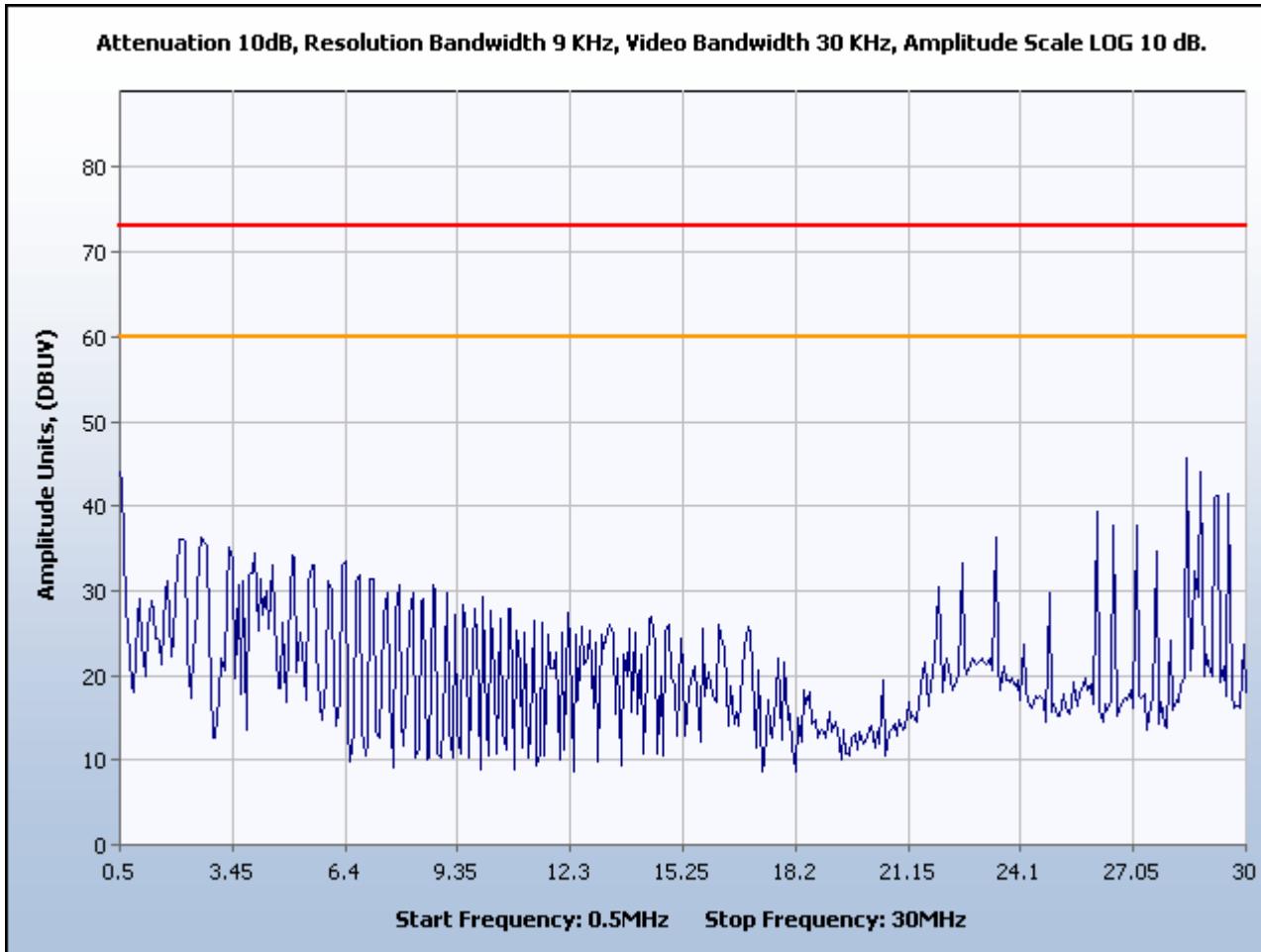
**Test Date(s):**

07/24/07

**Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC)**

Frequency (MHz)	Quasi-Peak Amplitude (dB $\mu$ V)	Quasi-Peak Limit (dB $\mu$ V)	Quasi-Peak Margin (dB $\mu$ V)	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Average Margin (dB $\mu$ V)
0.176513	44.7	79	-34.3	42.9	66	-23.1
0.180013	48.7	79	-30.3	47.2	66	-18.8
0.254431	41.792533	79	-37.3	38.492533	66	-27.5075
0.380475	44.27	79	-34.9	42.47	66	-23.53
0.67852	39.97	73	-33.2	36.07	60	-23.93
24.08544	46.29518	73	-26.9	46.19518	60	-13.8048
25.42555	44.150957	73	-29	44.250957	60	-15.749
28.098845	41.662738	73	-31.4	41.562738	60	-18.4373

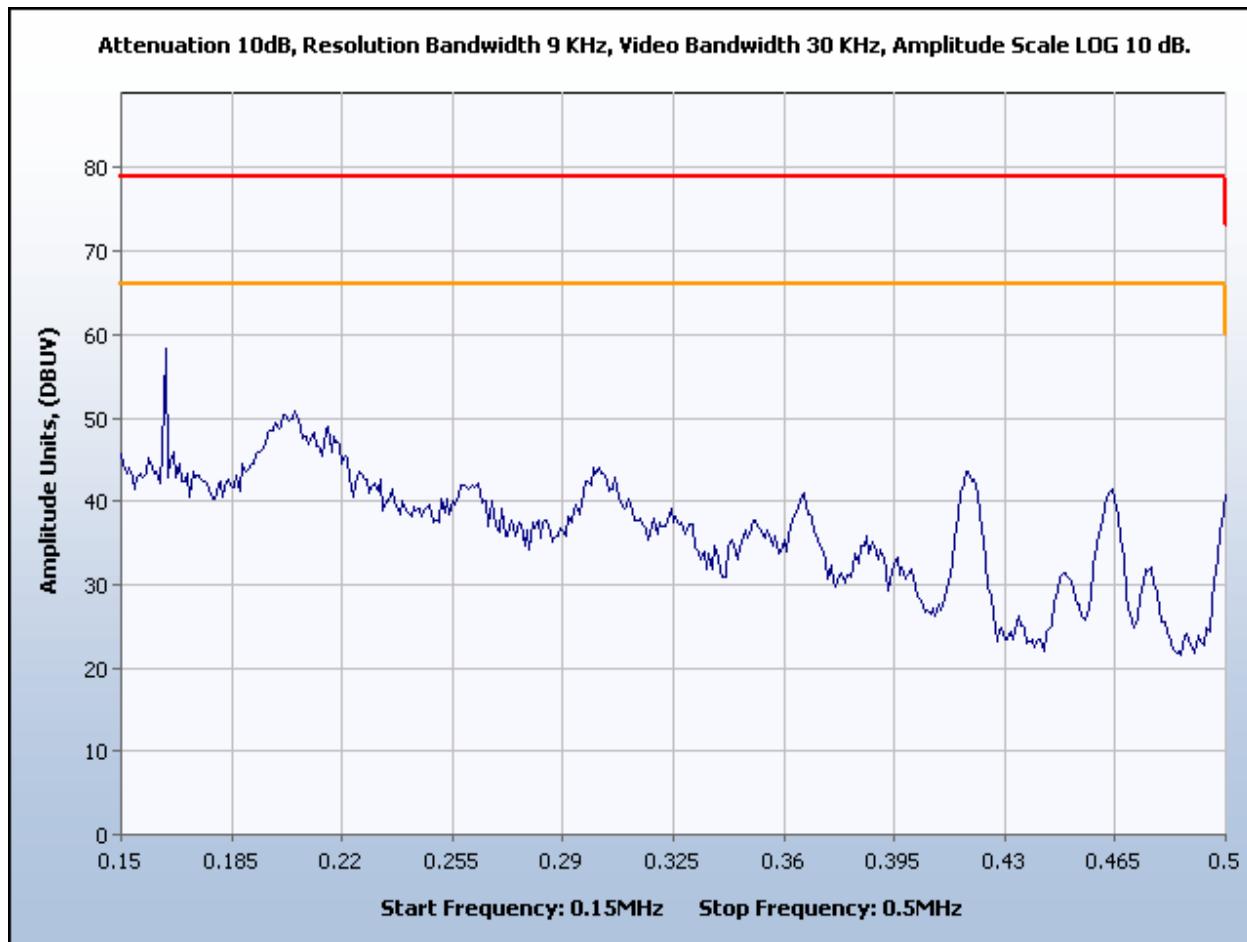
**Table 11. Conducted Emissions - Voltage, AC Power, Phase Line (120 VAC)**

**Plot 1. Conducted Emission, Phase Line Plot 1**

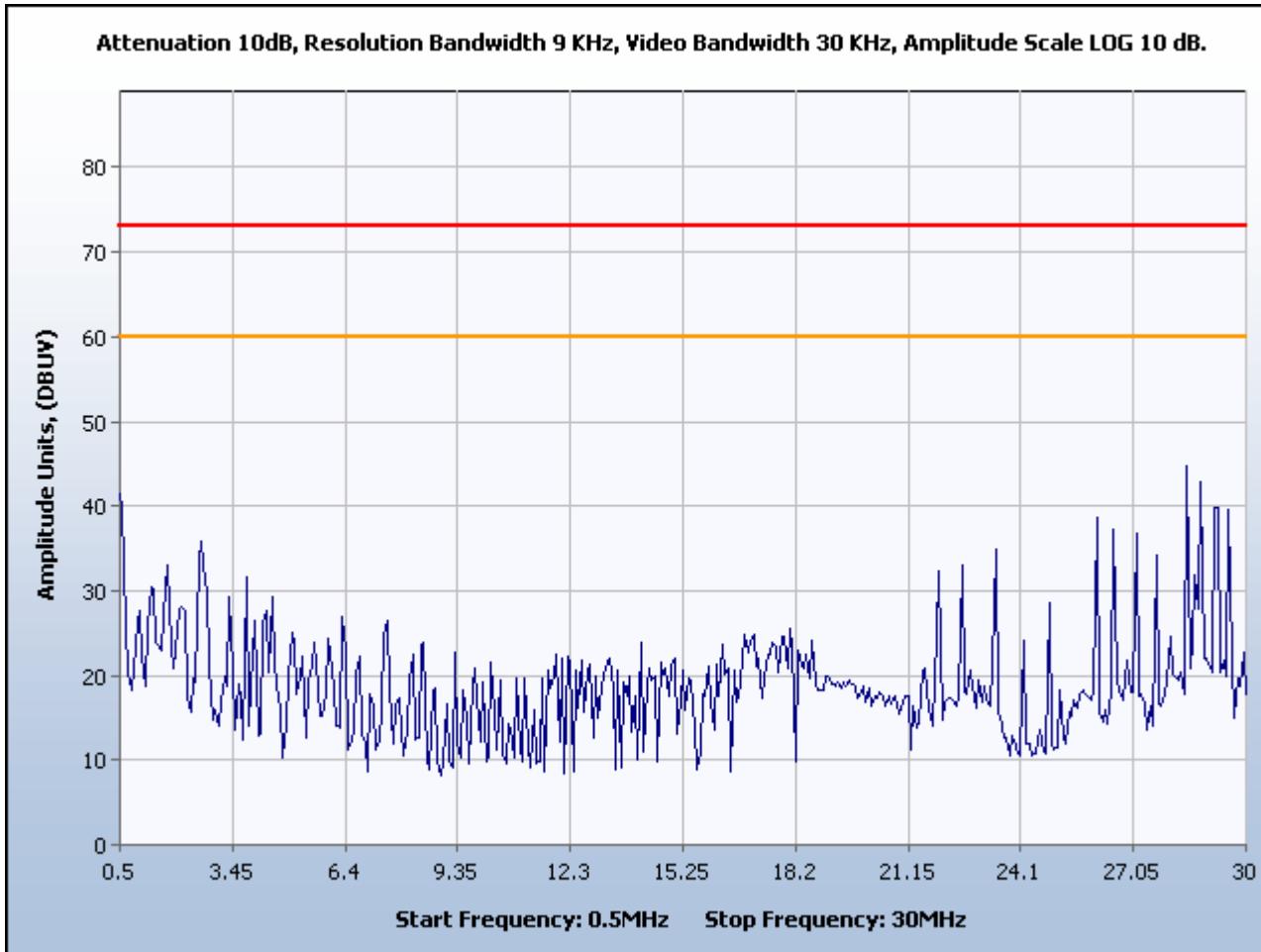


Plot 2. Conducted Emission, Phase Line Plot 2

**Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC)**

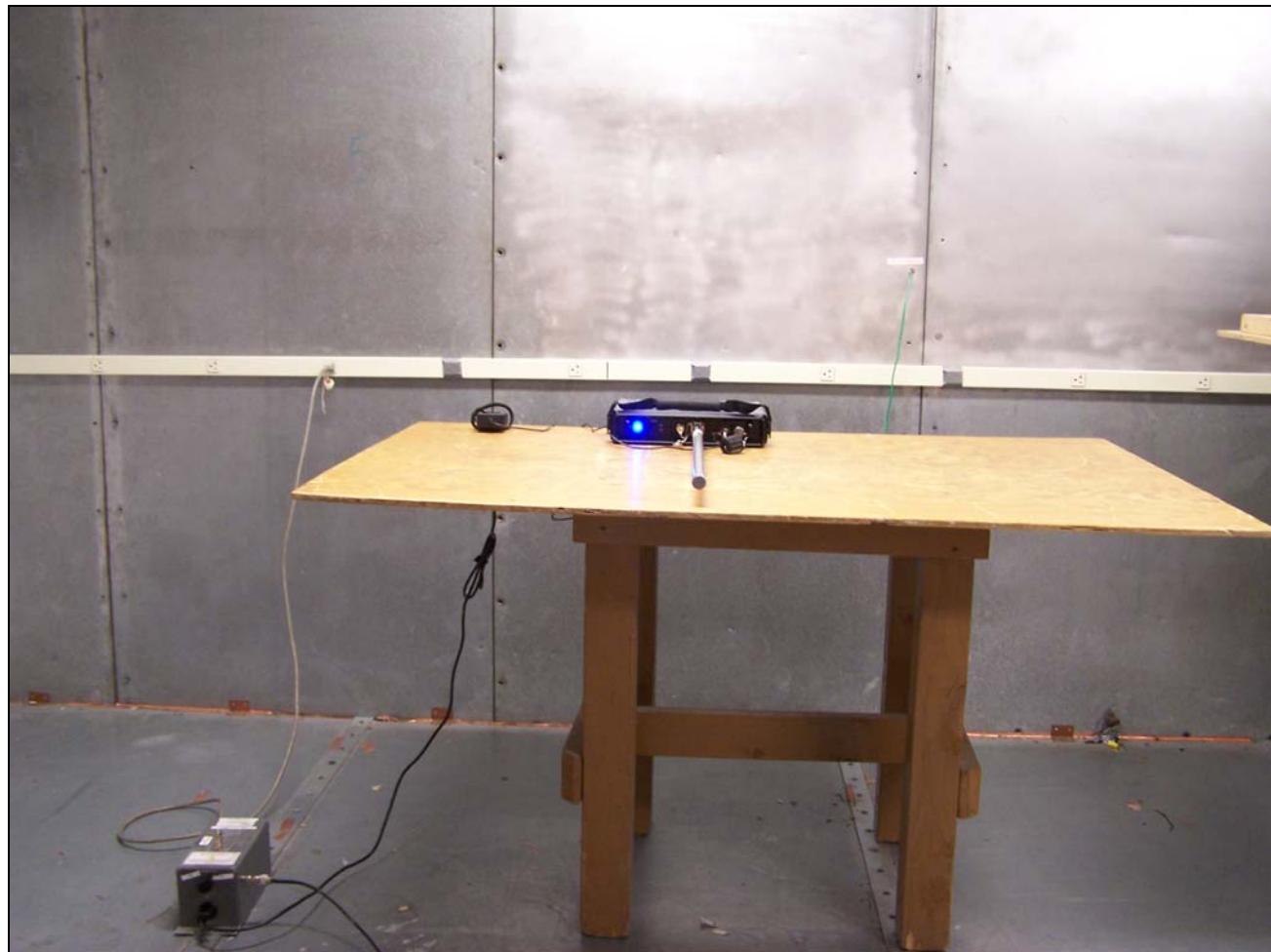
Frequency (MHz)	Quasi-Peak Amplitude (dB $\mu$ V)	Quasi-Peak Limit (dB $\mu$ V)	Quasi-Peak Margin (dB $\mu$ V)	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Average Margin (dB $\mu$ V)
0.181413	48.1	79	-30.9	46.5	66	-19.5
0.1885	44.6	79	-34.4	37.7	66	-28.3
0.189113	44.5	79	-34.5	37.4	66	-28.6
0.250931	40.986583	79	-38.1	38.686583	66	-27.3134
0.600878	32.07	73	-41.1	27.67	60	-32.33
0.678303	34.97	73	-38.2	31.77	60	-28.23
24.0812	45.19532	73	-28	45.09532	60	-14.9047
25.418985	43.551174	73	-29.6	43.251174	60	-16.7488

**Table 12. Conducted Emissions - Voltage, AC Power, Neutral Line (120 VAC)**

**Plot 3. Conducted Emission, Neutral Line Plot 1**



**Plot 4. Conducted Emission, Neutral Line Plot 2**

## Conducted Emission Limits Test Setup



Photograph 1. Conducted Emissions Test Setup



### 3.2 Radiated Emission 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 13.

**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 13.

Frequency (MHz)	Field Strength (dB $\mu$ V/m)	
	§15.109 (b), Class A Limit (dB $\mu$ V) @ 10m	§15.109 (a), Class B Limit (dB $\mu$ V) @ 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 13. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)**

**Test Procedures:**

The EUT was placed on a non-metallic table, 80 cm above the ground plane 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. Pre-scans were 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.

Emissions measured at 3m were normalized using an inverse proportionality factor of 20dB per decade for comparison to the 10 m limit.

Radiated Emissions testing was performed on both the XL and the XLE.

**Test Results:**

The EUT was compliant with the Class A requirement(s) of this section.

**Test Engineer(s):**

Dusmantha Tennakoon

**Test Date(s):**

07/21/07



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Emission Criteria  
CFR Title 47, Part 15, Subpart B

## Radiated Emissions Limits Test Results, Class A

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)
50.585	360	H	1.00	16.26	9.82	0.62	10.46	16.25	39.00	-22.75
50.585	138	V	1.00	28.62	9.75	0.62	10.46	28.53	39.00	-10.47
61.120	0	H	1.00	15.80	10.42	0.69	10.46	16.45	39.00	-22.55
61.120	191	V	1.00	25.18	10.10	0.69	10.46	25.51	39.00	-13.49
110.649	94	H	1.95	29.54	7.00	0.84	10.46	26.92	43.50	-16.58
110.649	164	V	1.00	34.06	7.60	0.84	10.46	32.04	43.50	-11.46
135.247	103	H	1.88	35.19	7.70	0.87	10.46	33.30	43.50	-10.20
135.247	358	V	1.00	35.44	7.70	0.87	10.46	33.55	43.50	-9.95
159.828	269	H	1.94	33.09	8.20	0.93	10.46	31.76	43.50	-11.74
159.828	360	V	1.00	33.56	8.39	0.93	10.46	32.42	43.50	-11.08
298.551	93	H	1.00	30.54	13.20	1.45	10.46	34.73	46.40	-11.67
298.551	359	V	1.00	26.44	12.60	1.45	10.46	30.03	46.40	-16.37

**Table 14. Radiated Emissions Limits Test Results for the XL**

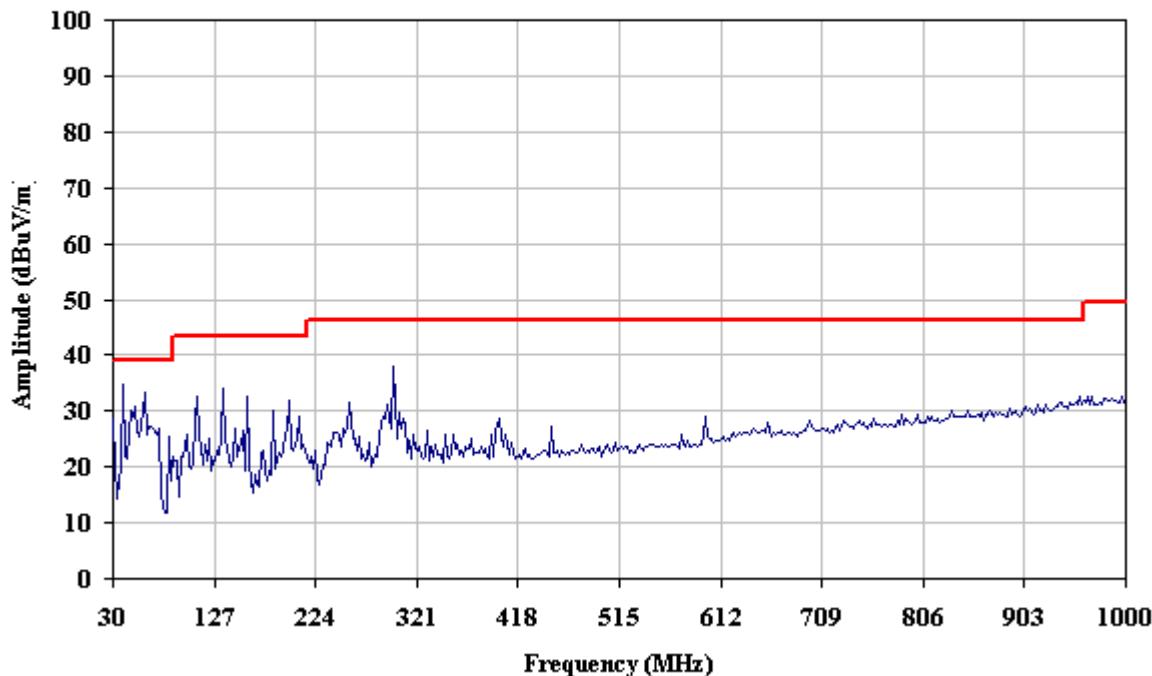
Note: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Emission Criteria  
CFR Title 47, Part 15, Subpart B

7/21/2007, Metrak Job Number: 22693, Rajant Corporation, Breadcrumb (Models ME and XL)



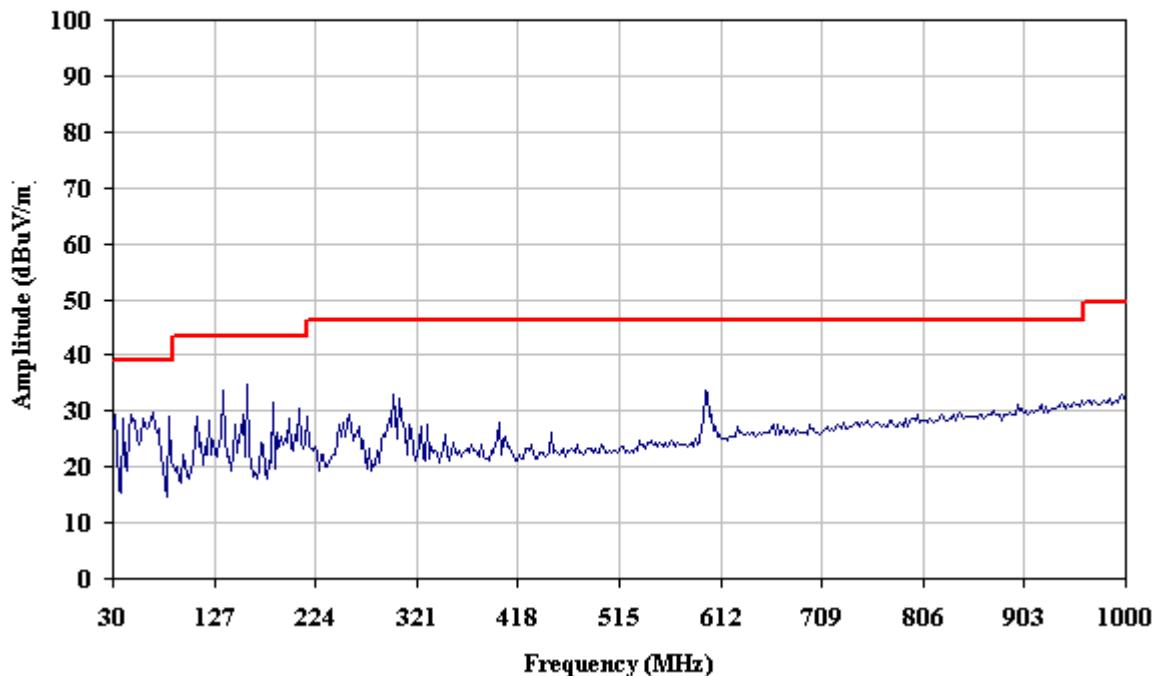
Plot 5. Radiated Emissions, Pre-Scan for the XL, Lead Acid Battery and PS (NSP)



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Emission Criteria  
CFR Title 47, Part 15, Subpart B

7/21/2007, Metrak Job Number: 22693, Rajant Corporation, Breadcrumb (Models ME and XL)



Plot 6. Radiated Emissions, Pre-Scan for the XL, Lead Acid Battery and PS (Cincon)



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Emission Criteria  
CFR Title 47, Part 15, Subpart B

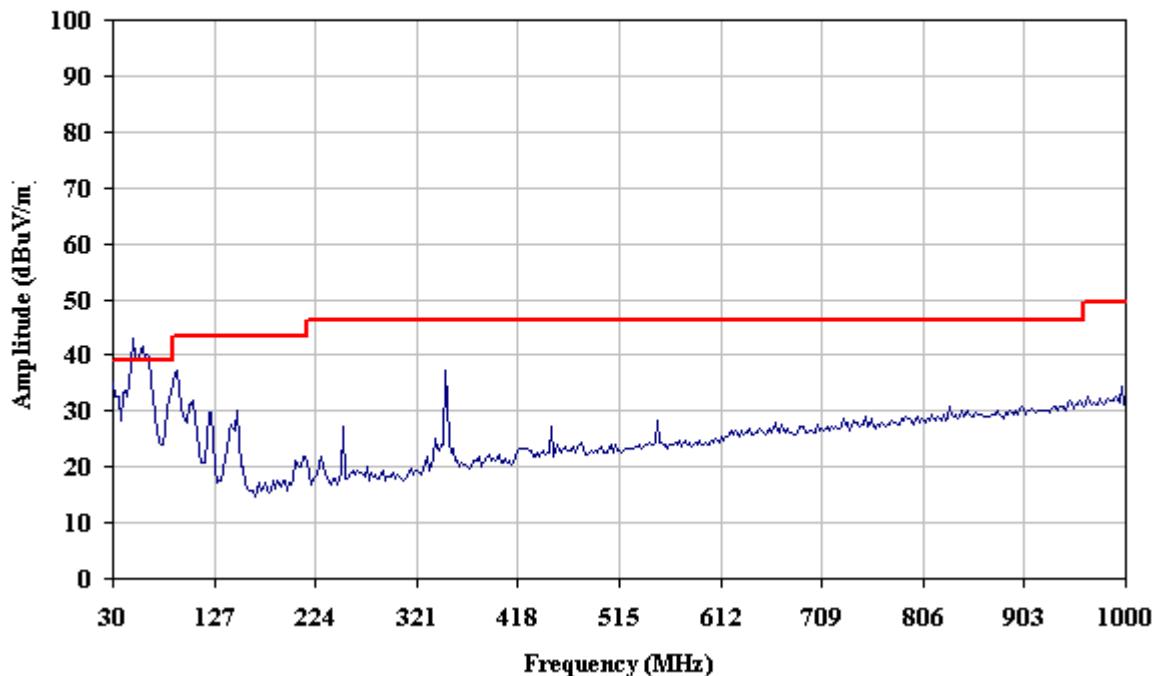
Frequency (GHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected Amplitude (dBuV)	Antenna Correction Factor (dB) (+)	System Gain (dB) (-)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.455	-1	H	4.00	21.08	5.72	0.34	10.46	16.68	39.00	-22.32
*30.455	359	V	1.00	42.21	4.32	0.34	10.46	36.41	39.00	-2.59
53.000	0	H	4.00	26.85	9.92	0.64	10.46	26.95	39.00	-12.05
*53.000	359	V	1.00	37.75	9.94	0.64	10.46	37.87	39.00	-1.13
92.347	99	H	1.78	25.50	7.33	0.76	10.46	23.13	43.50	-20.37
92.347	81	V	1.00	38.17	6.74	0.76	10.46	35.21	43.50	-8.29
104.275	59	H	1.81	30.37	7.46	0.82	10.46	28.18	43.50	-15.32
104.275	221	V	1.00	34.01	7.64	0.82	10.46	32.01	43.50	-11.49
149.453	237	H	2.16	27.54	8.09	0.84	10.46	26.01	43.50	-17.49
149.453	90	V	1.00	26.44	7.99	0.84	10.46	24.81	43.50	-18.69
350.010	86	H	1.00	27.60	14.70	1.61	10.46	33.45	46.40	-12.95
350.010	141	V	1.45	25.50	15.20	1.61	10.46	31.85	46.40	-14.55

**Table 15. Radiated Emissions Limits Test Results for the XLE**

Note 1: \* - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.

Note 2: The EUT was tested at 3 m. The data has been corrected for comparison with the 10 m limit using the formula:  $20\log(3\text{ m}/10\text{ m})$  as expressed in the 'Distance Correction' column.

7/21/2007, Metrak Job Number: 22693, Rajant Corporation, Breadcrumb (Models ME and XL)



Plot 7. Radiated Emissions, Pre-Scan for the XLE, Lead Battery Acid and PS

## Radiated Emission Limits Test Setup



Photograph 2. XLE, Lead Acid and PS, Front



Photograph 3. XLE, Lead Acid and PS, Rear



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Test Equipment  
CFR Title 47, Part 15, Subpart B

## 4.0 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 17025:1999.

Test Name: <b>Conducted Emissions</b>						Test Date(s): <b>07/24/07</b>
<b>MET Asset #</b>	<b>Nomenclature</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Last Cal Date</b>	<b>Cal Due Date</b>	
1T4302	EMI RECEIVER	HEWLETT PACKARD	85462A	11/20/2006	11/20/2007	
1T4146	TRANSIENT LIMITER	HEWLETT PACKARD	11947A		SEE NOTE	
1T4079	LISN; SWITCH	SOLAR	8012-50-R-24-BNC	04/02/2007	04/02/2008	
1T4502	COMB GENERATOR	COM-POWER	CGC-255	08/22/2006	08/22/2007	
1T4405	EMC TEST ROOM 2	MET	N/A		SEE NOTE	
1T4558	THERMOMETER/HY GROMETER	FISCHER SCIENTIFIC	S6-627-9	03/03/2006	03/03/2008	

Test Name: <b>Radiated Emissions</b>						Test Date(s): <b>07/21/07</b>
<b>MET Asset #</b>	<b>Nomenclature</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Last Cal Date</b>	<b>Cal Due Date</b>	
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	06/29/2007	06/29/2008	
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	02/17/2006	01/17/2009	
1T4578	THERMO/HYGROMETER	CONTROL COMPANY	S6-627-9	09/24/2006	09/24/2008	
1T4409	EMI RECEIVER	ROHDE & SCHWARTZ	ESIB7	04/24/2007	04/24/2008	

**Table 16. Test Equipment**

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



## 5.0 Compliance Information

### 5.1 Verification 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 stages; 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 provision that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.



Rajant Corporation  
XL and XLE

Electromagnetic Compatibility  
Compliance Information  
CFR Title 47, Part 15, Subpart B

**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.<sup>1</sup> *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.

**§ 2.902 Verification.**

- (a) *Verification is a procedure where the manufacturer*<sup>2</sup> *makes measurements or takes the necessary steps to insure that the equipment complies with the appropriate technical standards.* Submission of a sample unit or representative data to the Commission demonstrating compliance is not required unless specifically requested by the Commission pursuant to § 2.957, of this part.
- (b) Verification attaches to all items subsequently marketed by the manufacturer or importer which are identical as defined in § 2.908 to the sample tested and found acceptable by the manufacturer.

<sup>1</sup> 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.

<sup>2</sup> In this case, MET Laboratories, Inc. is acting as an agent of the manufacturer.



#### § 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.

#### § 2.952 Limitation on verification.

- (a) Verification signifies that the manufacturer or importer has determined that the equipment has been shown to be capable of compliance with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. Compliance with these standards shall not be construed to be a finding by the manufacturer or importer with respect to matters not encompassed by the Commission's rules.
- (b) Verification of the equipment by the manufacturer or importer is effective until a termination date is otherwise established by the Commission.
- (c) No person shall, in any advertising matter, brochure, etc., use or make reference to a verification in a deceptive or misleading manner or convey the impression that such verification reflects more than a determination by the manufacturer or importer that the device or product has been shown to be capable of compliance with the applicable technical standards of the Commission's rules.



#### **§ 2.953 Responsibility for compliance.**

- (a) In verifying compliance, the responsible party, as defined in §2.909 warrants that each unit of equipment marketed under the verification procedure will be identical to the unit tested and found acceptable with the standards and that the records maintained by the responsible party continue to reflect the equipment being produced under such verification within the variation that can be expected due to quantity production and testing on a statistical basis.
- (b) The importer of equipment subject to verification may upon receiving a written statement from the manufacturer that the equipment complies with the appropriate technical standards rely on the manufacturer or independent testing agency to verify compliance. The test records required by §2.955 however should be in the English language and made available to the Commission upon a reasonable request, in accordance with §2.956.
- (c) In the case of transfer of control of equipment, as in the case of sale or merger of the grantee, the new manufacturer or importer shall bear the responsibility of continued compliance of the equipment.
- (d) Verified equipment shall be re-verified if any modification or change adversely affects the emanation characteristics of the modified equipment. The party designated in §2.909 bears responsibility for continued compliance of subsequently produced equipment.

#### **§ 2.954 Identification.**

Devices subject only to verification shall be uniquely identified by the person responsible for marketing or importing the equipment within the United States. However, the identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified or type accepted equipment. The importer or manufacturer shall maintain adequate identification records to facilitate positive identification for each verified device.

#### **§ 2.955 Retention of records.**

- (a) For each equipment subject to verification, the responsible party, as shown in §2.909 shall maintain the records listed as follows:
  - (1) A record of the original design drawings and specifications and all changes that have been made that may affect compliance with the requirements of §2.953.
  - (2) A record of the procedures used for production inspection and testing (if tests were performed) to insure the conformance required by §2.953. (Statistical production line Emission testing is not required.)
- (b) The records listed in paragraph (a) of this section shall be retained for two years after the manufacture of said equipment item has been permanently discontinued, or until the conclusion of an investigation or a proceeding if the manufacturer or importer is officially notified that an investigation or any other administrative proceeding involving his equipment has been instituted.



### **§ 2.956 FCC inspection and submission of equipment for testing.**

(a) Each responsible party shall upon receipt of reasonable request:

- (1) Submit to the Commission the records required by §2.955.
- (2) Submit one or more sample units for measurements at the Commission's Laboratory.
  - (i) Shipping costs to the Commission's Laboratory and return shall be borne by the responsible party.
  - (ii) In the event the responsible party believes that shipment of the sample to the Commission's Laboratory is impractical because of the size or weight of the equipment, or the power requirement or for any other reason, the responsible party may submit a written explanation why such shipment is impractical and should not be required.

### **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 users 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.

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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, 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.