

TITLE: PLI Evaluation Report (RFI)
DRAWING: Q705102W.DWG
BY: Greg Noll

FCC ID: OTI7051X

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Issued: 15 Nov 1999

Approved: Lee Pulver

This drawing consists of pages issued or re-issued on dates shown in the following list.
Italic underlined words indicate content changes or additions on revised pages.

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Pulver Laboratories Inc. (PLI) File Number: 7051

Pulver Laboratories Inc. (PLI) Project Number: C4029

Product Names: EUT) DataFast Handheld Duplicator
(EUT = Equipment Under Test)

Model Numbers: D-101

Serial Numbers: 170B

Applicant: PubliCARD, Inc.
75 Kings Highway Cutoff
Fairfield, Connecticut 06430
Telephone: 203.368.6800
Facsimile: 203.368.1805

Location Certified: Greystone Peripherals, Inc.
130-A Knowles Drive
Los Gatos, California 95039
Telephone: 408.866.4739
Facsimile: 408.866.8328

Manufacturing Location: Greystone Peripherals, Inc.
130-A Knowles Drive
Los Gatos, California 95039
Telephone: 408.866.4739
Facsimile: 408.866.8328

Pulver Laboratories Inc. (PLI) Control Number: 7051X

Equipment Category

Information Technology Equipment including Electrical Business Equipment

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Evaluated to the Following Standards

Federal Communications Commission (FCC, USA)

Category Classification: Class B - Residential

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- American National Standards Institute C63.4-1992 entitled Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- Federal Communications Commission Rules and Regulations located in the Code of Federal Regulations, Title 47, Part 2 entitled Frequency Allocations and Radio Treaty Matters; General Rules and Regulations; and Part 15 entitled Radio Frequency Devices, March 1999 Edition.

Trademarks

All trademarks and registered trademarks shown or mentioned in this Pulver Laboratories Product Evaluation Report belong to their respective holders.

1.0 Engineering Considerations

1.1 General Engineering Considerations

1.1.1 This report deals with conformance to the:

- Code of Federal Regulations, 47 CFR, Part 2 and Part 15, revised March 1999;
- American National Standards Institute standard number C63.4-1992 entitled Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz;
- EN55022 / CISPR 22 entitled Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Second Edition 1993; and
- VFG Number 523 / 1969: "Technical Regulations of the German Federal Postal Office for High Frequency Equipment and Systems," Official Gazette of the Federal Ministers of Post and Telecommunications; Year 1969; Number 113; 28 August 1969.

1.1.2 This report also deals with conformance to Radio Frequency Interference Suppression of High Frequency Equipment for Industrial, Scientific, and Medical (ISM) and similar purposes for Canada and the countries listed in the Pulver Laboratories Certificate of Conformance associated with this report.

1.1.3 To assist the Federal Communications Commission in the continuing education of applicants and grantees, Pulver Laboratories has advised Greystone Peripherals, Inc. to purchase a copy of the Rules and Regulations located in the Code of Federal Regulations, Title 47, Part 2 entitled Frequency Allocations and Radio Treaty Matters; General Rules and Regulations; and Part 15 entitled Radio Frequency Devices, 1 October 1998 Edition.

1.1.4 The manufacturer has a contractual obligation to Pulver Laboratories to incorporate into production all modifications photographed and outlined in this report with associated documentation.

1.1.5 The Pulver Laboratories Certificate of Conformance issued with this report allows the manufacturer to ship and sell product using the Pulver Laboratories Product Certification Label. This label can only be used if the manufacturer allows Pulver Laboratories to conduct a Follow Up Service at the manufacturing facilities and conduct an Electromagnetic Interference test of the finished product every six months.

1.2 Specific Engineering Considerations

1.2.1 Interconnecting low voltage computer cables lengths:

Cable Description	Length (feet)	Length (meters)
Printer	6.0	1.83
Keyboard	6.5	1.98
Monitor	4.0	1.22
Mouse	6.0	1.83
Modem	1.0	0.30
Parallel Cable	6.0	1.83
Serial Cable	6.0	1.83
Data Ribbon Cable	0.5	0.15
External Power Cable	0.5	0.15

1.2.2 I / O Cables coiled and wrapped to maximum lengths of 30 to 40 cm, at least 40 cm from ground plane as recommended by ANSI 63.4-1992.

1.2.3 There is one possible Equipment Under Test (DataFast Handheld Duplicator, Model D-101) input power configuration:

1.2.3.1 One external wall adapter supplies the EUT with voltage.

1.2.4 There are **two** possible EUT test configurations:

1.2.4.1 **Test Configuration #1:** EUT parallel port to computer.
Data transfer between devices.

1.2.4.2 **Test Configuration #2:** Serial port to computer for
configuring EUT.

1.2.5 **Note:** RJ45 jack with 1-meter cable; no data transfer; software not available for this port yet.

1.2.6 The EUT duplicates software from a master disk to a target disk drive. The EUT operator selects these drives. For this particular test program, the master source drive was external to the EUT chassis and the target disk drive was internal to the EUT. The internal disk drive manufactured by Quantum, model Quantum Fireball, 3.5 Series.

1.3 Product Description and Intended Use

1.3.1 The Greystone Peripherals, Inc. DataFast Handheld Duplicator, **Model D-101 allows the operator to selectively copy program software and data from a master source drive to a target disk drive.** Target drives that are identical to the source drive may be "mirrored", or duplicated exactly, sector by sector. A 'Smart Copy' mode is used for faster copying, or for dissimilar drives using an FAT16, FAT32, or NTFAT file system. The D-101 is ideal for applications that require portability.

Prior to execution, copying jobs are set up according to the type (physical details) of the source and target disk, selective or complete copying, and mode of copying. Setup and execution of copy jobs is accomplished using a six button keypad and a 4-line by 20-character LCD display. A menu guides the operator easily through setup and copy jobs.

1.4 List of Photographs Contained in this Report

FIGURE 1: PLI Photograph Number 994320 illustrates the rear view of the Equipment Under Test with all peripherals attached in **Test Configuration #1**. The "open field" radiated and the "screen room" conducted Radio Frequency Interference / Electromagnetic Interference test programs utilized this equipment and cable configuration.

FIGURE 2: PLI Photograph Number 994321 illustrates the rear view of the Equipment Under Test with all peripherals attached in **Test Configuration #2**. The "open field" radiated and the "screen room" conducted Radio Frequency Interference / Electromagnetic Interference test programs utilized this equipment and cable configuration.

FIGURE 3: PLI Photograph Number 994325 illustrates the left rear oblique view of the Equipment Under Test with all peripherals attached in the "screen room" conducted Electromagnetic Interference **Test Configuration #1**.

FIGURE 4: PLI Photograph Number 994324 illustrates the left rear oblique view of the Equipment Under Test with all peripherals attached in the "screen room" conducted Electromagnetic Interference **Test Configuration #2**.

FIGURE 5: PLI Photograph Number 994330 illustrates the top view of the EUT with the top cover removed showing the placement of internal system components.

FIGURE 6: PLI Photograph Number 994338B illustrates the component side of the D-101 Control Printed Circuit Assembly, number S-101PCB-001.

FIGURE 7: PLI Photograph Number 994339B illustrates the circuit side of the D-101 Control Printed Circuit Assembly, number S-101PCB-001.

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FIGURE 8: PLI Photograph Number 994335B illustrates the component side of the LCD Printed Circuit Assembly, number MSC-C204DYLY-1N.

FIGURE 9: PLI Photograph Number 994337B illustrates the circuit side of the LCD Printed Circuit Assembly, number MSC-C204DYLY-1N.

- 1.5 Equipment used during measurements calibrated according to internationally acceptable laboratory procedures. Calibration data along with Certificates of conformance and traceability are on file at the testing facility. Each calibrated equipment item is individually labeled with date calibrated; due date for next calibration; initials of person who calibrated the equipment; and the name of the organization that performed the calibration service.

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Equipment Type	Manufacturer	Model Number	Frequency Range
Spectrum Analyzer	Hewlett Packard	8568A	100 Hz - 1.5 GHz
Quasi-peak	Hewlett Packard	85650A	10 kHz - 1.00 GHz
Biconical Antenna	EMCO	3109	30 - 200 MHz
Log Periodic Antenna	EMCO	3146	200 - 1000 MHz
Magnetic Loop Antenna	Electro-Metrics	ALR-25M	10 kHz - 30 MHz
Oscilloscope Camera	Tektronix	C-5C	
Amplifier	Hewlett Packard	8447D Option 010	0.1 - 1300 MHz
Attenuator	Narda	757C (35797)	3 dB (DC - 12.4 GHz)
Attenuator	Narda	757C (36808)	6 dB (DC - 12.4 GHz)
Attenuator	Narda	757C (40604)	10 dB (DC - 12.4 GHz)
Attenuator	Narda	757C (40998)	20 dB (DC - 12.4 GHz)
Close Field Antenna	Electro-Metrics	EFP-25	
Oscilloscope	Tektronix	2445	up to 150 MHz

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Equipment Type	Manufacturer	Model Number	Frequency Range
Capacitor/ Inductor Z Meter	Sencore	1 picofarad to 200,000 microfarads 1 micro Henry to 10 Henries	
L.I.S.N	Solar Electronics Co.	8012-50-R-24 BNC	50 - 60 Hz
Equipment Testing Turn Table	EMCO	1061-06	
Antenna Positioning Tower	EMCO	1050	
Radio Interference Receiver	PRD Electronics Inc.	R-1040/URM-85	(two complete systems)
Antenna Coupler	PRD Electronics Inc.	Cu-893/URM-85	80 - 220 MHz
Antenna Tripod	PRD Electronics Inc.	MT-2459/URM-85	
Frequency Converter	Empire Devices Products Corp.	CV-1102/URM-85	20 - 220 MHz
Frequency Converter	PRD Electronics Inc.	CV-1104A/URM-85	400 - 1000 MHz
Frequency Converter	PRD Electronics Inc.	CV-1101A/URM-85	0.15 - 30 MHz
Frequency Converter	PRD Electronics Inc.	CV-1103/URM-85	200 - 400 MHz

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Frequency Converter	PRD Electronics Inc.	CV-1102A/URM-85	20 - 220 MHz
Antenna Coupler (two systems)	PRD Electronics Inc.	CU-890/URM-85	0.15 - 30 MHz
Loop Antenna (two systems)	PRD Electronics Inc.	AT-1026/URM-85	0.15 - 30 MHz
Frequency Comb Generator	Hewlett Packard	8406A	20 - 1200 MHz
Tunable Band Pass Filter	K & L Microwave Inc.	5BT-95/190-5/B	95 - 195 MHz
Tunable Band Pass Filter	K & L Microwave Inc.	5BT-48/95-5/B	50 - 95 MHz
High Pass Filter	Solar Electronics Co.	7801-5.0	5 kHz
Absorbing Clamp	Schaffner EMC Inc.	MDS-21	30 - 1000 MHz
Line Probe	EMCO	3701	
Antenna Set	EMCO	3121C	30 - 1000 MHz
L.I.S.N	Solar Electronics Co.	8328-50-TS-50-N	
Frequency Generator		TS-418B/U	400 - 1000 MHz
Frequency Generator		TS-510A/U	10 - 420 MHz

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Equipment Type	Manufacturer	Model Number	Frequency Range
Antenna Set	Electro-Metrics	TDA-25	30 - 200 MHz
Antenna Set	Electro-Metrics	TDS-25-1	200 - 500 MHz
Antenna Set	Electro-Metrics	TDS-25-2	500 - 1000 MHz
Antenna (two sets)	PRD Electronics Inc.	AT-1030/URM-85	400 - 1000 MHz
Coupler Antenna	PRD Electronics Inc.	CU-895/URM-85	20 - 1000 MHz
Electronic Field Probe	PRD Electronics Inc.	MX-3411/URM-85	0.15 - 1000 MHz
Fixed Attenuator	PRD Electronics Inc.	CN-721/URM-85	0.15 - 1000 MHz
Magnetic Field Probe	PRD Electronics Inc.	MX-3412/URM-85	20 - 1000 MHz
Coupler	PRD Electronics Inc.	CU-896/URM-85	20 - 1000 MHz
Coupler	PRD Electronics Inc.	CU-897/URM-85	20 - 1000 MHz
Ground Rod	PRD Electronics Inc.	GP-117/URM-85	
Coupler Antenna	PRD Electronics Inc.	CU-894/URM-85	200 - 400 MHz
Reflector Antenna	PRD Electronics Inc.	AT-1027/URM-85	0.15 - 30 MHz

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Equipment Type	Manufacturer	Model Number	Frequency Range
Cable Assembly Set	PRD Electronics Inc.	MX-3410/URM-85	
Cord Assembly	PRD Electronics Inc.	CX-4305/U	
Mega Cycle Tape	Disston Carlson	TM6625-351-12-8	17 - 1000 MHz
Antenna Discone	Empire Devices Products Corp.	AS-1158/URM-85	Broad Band
Headset	Empire Devices Products Corp.	H-113/U	
Mast Sections	Empire Devices Products Corp.	AB-21/GR	
Antenna Tripod			
EMI Line Filter	Stanford Applied Engineering	D30B	50 - 60 Hz 3 phase
Digital Power Meter	Fluke and Phillips	FLUKE 39	
Multimeter	Fluke and Phillips	FLUKE 87 True RMS	
Feed Through Caps	Solar Electronics Co.	6512-106 R 10 microfarad capacitors	275V RMS, 60 Hz
Multimeter	Beckman Industrial Corp.	Circuitmate DM15B	250V RMS, 400 Hz
RMS Multimeter	Beckman Industrial Corp.	Tech 310	

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Equipment Type	Manufacturer	Model Number
Multimeter	Fluke and Phillips	FLUKE 85
RMS Multimeter	Fluke and Phillips	FLUKE 87
ELF Field Monitor	Walker Magnetic Group	ELF 50D
RMS Multimeter	Fluke and Phillips	FLUKE 87

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- 1.6 List of Exhibits accompanying the FCC submission to help describe and clarify the Equipment Under Test.
 - 1.6.1 Schematics or detailed block diagrams.
 - 1.6.2 Equipment manual for operator or user showing enough detail to operate the equipment.
 - 1.6.3 Currently dated and originally signed FCC Application for Certification (Form 731) along with the FCC Certification fee.
 - 1.6.4 Proposed identification label representative of the production label to be placed on the equipment upon grant of the application. Positioned on equipment as shown in block rough in Section 2.1 of this report.

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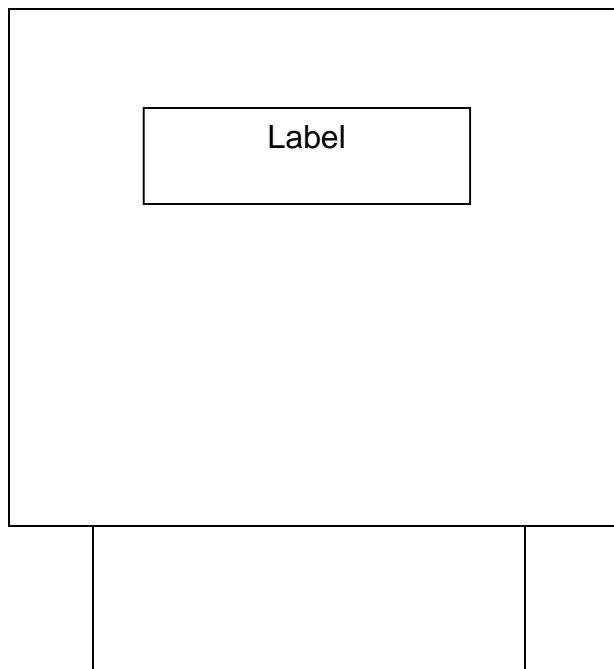
2.0 Mandatory Labeling and Operators' Manual Information and Shipping Documents

2.1 FCC Label

Illustration 1.0 on the next page illustrates the actual FCC label (three times the actual size) with the appropriate wording. Note the letters "EMI" on the label which abbreviate "Electromagnetic Interference". Organizations like the Federal Communications Commission and their respective limits are listed on the label.

Also notice the letters "NRTL", which abbreviate "Nationally Recognized Testing Laboratory" as recommended by OSHA and the National Electrical Code for the United States. For Pulver Laboratories product Certification labels used for safety Certification, the phrase "SAFETY" appears on the label. Safety Certifying organizations like Pulver Laboratories are listed on the label adjacent to the testing standards used during equipment evaluation.

A rough sketch of the label location is shown below.



Back Panel of EUT

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Illustration 1.0
{three times the size of actual FCC Label}

Label

Greystone Peripherals, Inc.
FCC ID: OTI7051X

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. This Product Certified to meet the Standards in the Categories listed on this label by



PLI Pulver Laboratories NRTL
Control Number 7051X

Information Technology Equipment
EMI: FCC Part 15 Class B

2.2 Operators' Manual Information

2.2.1 The following information is inserted directly into the equipment user instruction manual to meet the requirements of product safety and Radio Frequency Interference (RFI) rules and regulations.

CAUTION - Connections between peripherals of the computer equipment must be made with low voltage shielded computer data cables.

2.2.2 Continuation of FCC label information:

Greystone Peripherals, Inc. may decide to use a smaller FCC label. In this instance, the following phrase must be added to the Operator's Manual:

"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."

2.3 **FCC User Information** - The following statements are placed in the front of the operators' manual so that the user of the EUT is aware of its interference potential. Additional information about corrective measures may also be provided to the user at the manufacturer's option.

For a Class B Digital Device or Peripheral

**FCC NOTICE
INFORMATION FOR THE USER**

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:

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

The user may find the following publication prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems" (Stock Number 004-000-00345-4).

Available exclusively from the Superintendent of Documents, Government Printing Office, Washington, DC 20402 (telephone 202-512-1800).

FCC WARNING

Changes or modifications not expressly approved by the party responsible for compliance to Part 15 of the FCC Rules could void the user's authority to operate the equipment.

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FIGURE 1: PLI Photograph Number 994320 illustrates the rear view of the Equipment Under Test with all peripherals attached in **Test Configuration #1**. The "open field" radiated and the "screen room" conducted Radio Frequency Interference / Electromagnetic Interference test programs utilized this equipment and cable configuration.

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FIGURE 2: PLI Photograph Number 994321 illustrates the rear view of the Equipment Under Test with all peripherals attached in **Test Configuration #2**. The "open field" radiated and the "screen room" conducted Radio Frequency Interference / Electromagnetic Interference test programs utilized this equipment and cable configuration.

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FIGURE 3: PLI Photograph Number 994325 illustrates the left rear oblique view of the Equipment Under Test with all peripherals attached in the "screen room" conducted Electromagnetic Interference **Test Configuration #1**.

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FIGURE 4: PLI Photograph Number 994324 illustrates the left rear oblique view of the Equipment Under Test with all peripherals attached in the "screen room" conducted Electromagnetic Interference **Test Configuration #2.**

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FIGURE 5: PLI Photograph Number 994330 illustrates the top view of the EUT with the top cover removed showing the placement of internal system components.

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FIGURE 6: PLI Photograph Number 994338B illustrates the component side of the D-101 Control Printed Circuit Assembly, number S-101PCB-001.

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FIGURE 7: PLI Photograph Number 994339B illustrates the circuit side of the D-101 Control Printed Circuit Assembly, number S-101PCB-001.

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FIGURE 8: PLI Photograph Number 994335B illustrates the component side of the LCD Printed Circuit Assembly, number MSC-C204DYLY-1N.

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FIGURE 9: PLI Photograph Number 994337B illustrates the circuit side of the LCD Printed Circuit Assembly, number MSC-C204DYLY-1N.

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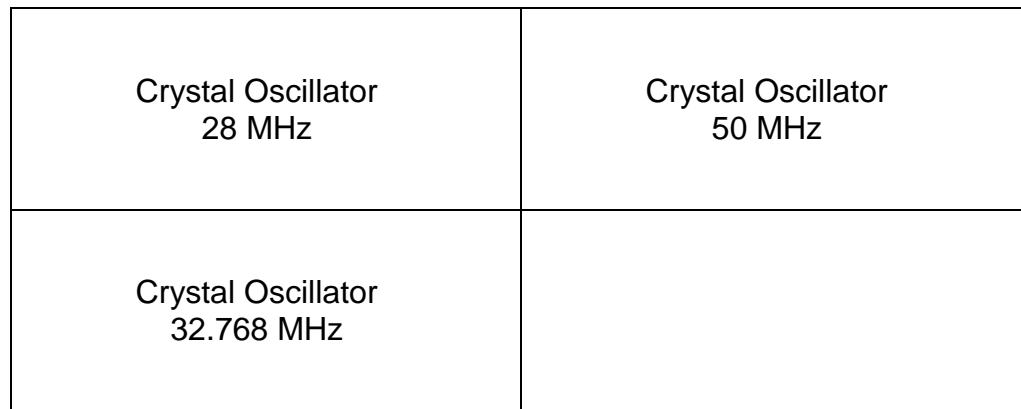
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**Block Diagram of Equipment Under Test (EUT)
Showing Clock Oscillators and Frequencies of Operation**



**Use this diagram to simplify locating the oscillators
in the accompanying schematics.**

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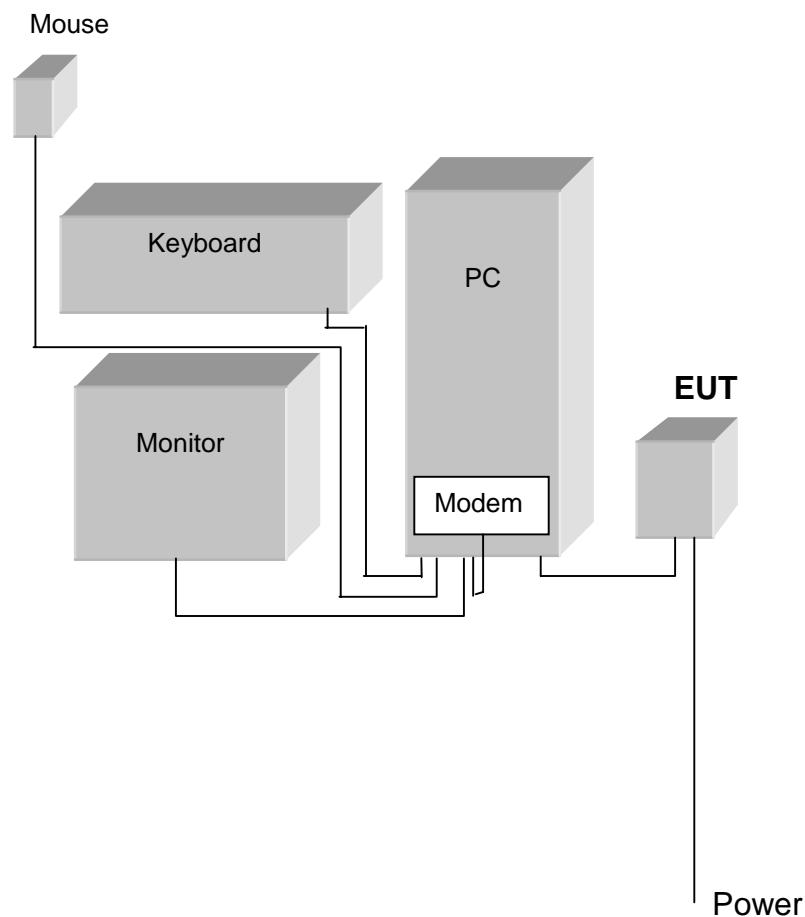
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Equipment Under Test Orientation and Configuration - Test Configuration #1

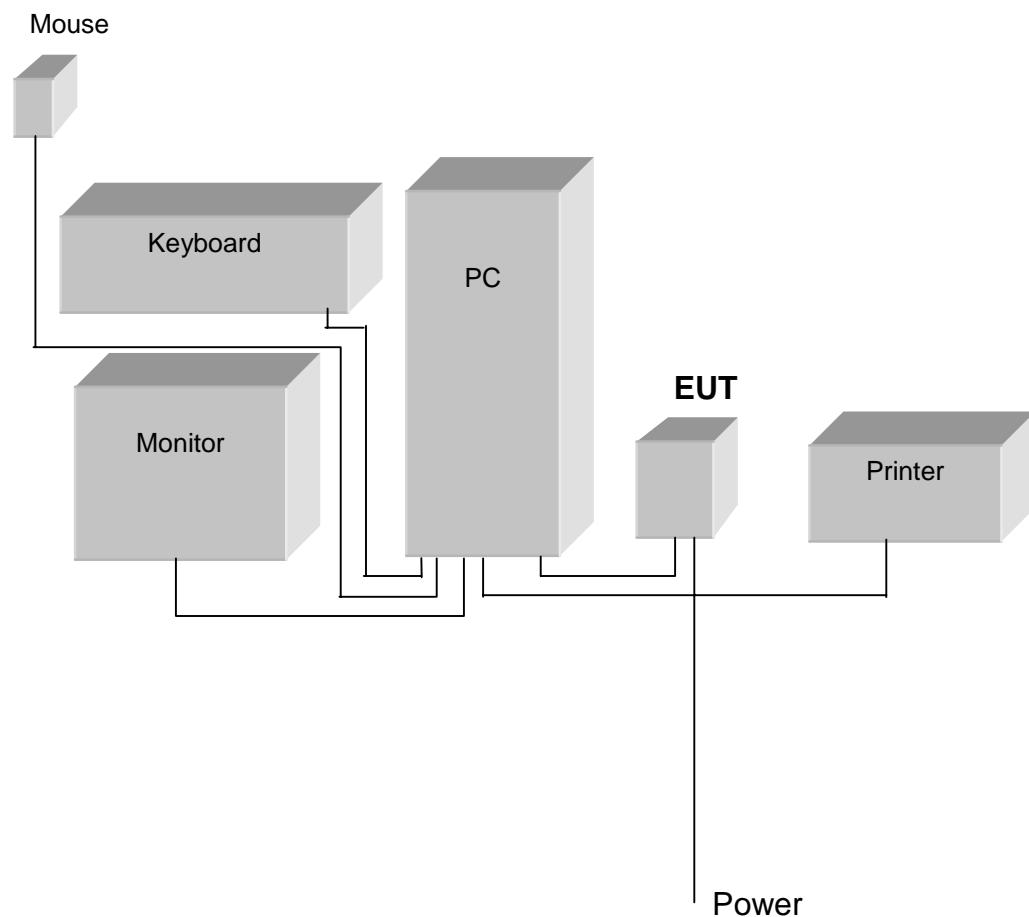
Zero Degrees



180 Degrees

Equipment Under Test Orientation and Configuration - Test Configuration #2

Zero Degrees



180 Degrees

3.0 Radiated Electromagnetic Interference (EMI) - Test Configuration

- 3.1 PLI placed the Equipment Under Test (EUT) on an 80 centimeter high table located on a 12.70 millimeter (0.5 inch) thick, 1.83 meter (6.00 foot) diameter, remote controlled steel turntable positioned 3.00 meters away from a receiving antenna assembly. This steel gear driven turntable has a 2400 pound capacity. The grounded turntable top surface is flush with a grounded screen consisting of 6.35 millimeter (0.25 inch) squares forming a wire mesh. The automated 4.00 meter mast and antenna assembly connects to an RF amplifier attached to a spectrum analyzer with quasi-peak adapter.
- 3.2 The Equipment Under Test (EUT) was operated at its specified load condition for which it was designed. After 30 minutes of continuous operation the EUT reached normal operating temperature. Recorded EMI data in this report was accumulated during the normal load and operating temperature of the EUT.
- 3.3 The EUT and system configuration follows:

Test Configuration #1: The EUT was connected to a computer system via a parallel cable. Connected to the computer system were monitor, mouse, keyboard, and modem. A bootable D-101 software diskette was inserted into the floppy drive. The computer system and the EUT were powered on. The computer system booted into DOS and then automatically loaded the D-101 software. The software was accessed to allow continuous communication between the EUT and computer system.

Test Configuration #2: The EUT was connected to a computer system via a serial cable. Connected to the computer system were monitor, mouse, keyboard, and printer. A bootable D-101 software diskette was inserted into the floppy drive. The computer system and the EUT were powered on. The computer system booted into DOS and then automatically loaded the D-101 software. The software was not programmed to allow communication between the EUT and the computer via the serial cable so both remained in a powered on, but dormant state.

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The following equipment list defines the system configurations:

Test Configuration #1:

EUT	:DataFast Handheld Duplicator
Model Number	:D-101
Serial Number	:170B
FCC ID Number	:OTI7051X
Manufacturer	:Greystone Peripherals, Inc.
Product	:Compaq Presario Computer System
Model Number	:3441
Serial Number	:6735BN29T938
FCC ID Number	:EJH3441
Manufacturer	:Compaq Computer Corporation
Product	:Color Monitor
Model Number	:M1448L
Serial Number	:4LCB56M003802
FCC ID Number	:DK4M1448
Manufacturer	:GVC Technologies Inc.
Product	:Mouse
Model Number	:PS/2 - Mouse
Serial Number	:20319879
FCC ID Number	:EMJMU501
Manufacturer	:Packard Bell
Product	:Keyboard
Model Number	:WB Series
Serial Number	:50S1010411
FCC ID Number	:CWTKFRC
Manufacturer	:Alp Electric (USA), Inc.
Product Name	:Smart Modem 2400
Model Number	:231AA
Serial Number	:AO3031003936
FCC ID Number	:BFJ9D9231AA
Manufacturer	:Hayes MicroComputer Products Inc.

Test Configuration #2:

Identical to Test Configuration #1, except instead of modem, a printer was connected to the computer system:

Product Name	:Printer
Model Number	:GE5251B
Serial Number	:510A0112915
FCC ID Number	:BDB9F2192
Manufacturer	:Okidata

3.4 The Equipment Under Test was evaluated per the American National Standards Institute standard number C63.4-1992 entitled Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. To maximize Electromagnetic Interference signal strength, PLI rotated the System Under Test 360 degrees and then adjusted the receiving antenna height until the maximum signal appeared on the spectrum analyzer. The input/output interface cables between units of the system were always positioned to yield maximum field strength.

4.0 Radiated EMI – Results

- 4.1 The investigated frequency spectrum revealed radiated EMI signals. The highest interference in the horizontal polarization occurred when the front of the unit was facing 180 degrees clockwise with respect to the antenna. The highest interference in the vertical polarization occurred when the front of the unit was facing 180 degrees clockwise with respect to the antenna.
- 4.2 The "ACF" (Antenna Correction Factor) shown in the test data in this report includes compensation for the antenna factor; cable attenuation; the series RF attenuator; the RF amplifier; and pre-selector system losses. The spectrum analyzer data is shown as quasi-peak amplitudes.
- 4.3 The test facility is FCC registered; the procedures are CISPR registered, ICAN registered, VCCI registered, VDE approved, and BZT approved.

Type of Test	Radiated Electromagnetic Interference
Specification	FCC Class B
Date Data Collected	29 October 1999
Detection Technique	Spectrum Analyzer with Quasi-peak Adapter
Resolution Bandwidth	100 kHz
Video Bandwidth	100 kHz
Antennas	30 to 200 MHz High Field Biconical 200 to 1000 MHz Log-Periodic

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Test Configuration #1

Frequency MHz	EMI Data dB μ V/M	ACF	Field Strength dB μ V/M	FCC Limit dB μ V/M	Margin to Limit dB μ V/M
Horizontal					
36.08	29.70	-8.66	21.04	40.00	-18.96
42.50	30.90	-9.23	21.67	40.00	-18.33
58.85	30.20	-10.70	19.50	40.00	-20.50
66.40	42.50	-11.69	30.81	40.00	-9.19
79.28	36.00	-13.85	22.15	40.00	-17.85
86.15	32.90	-14.28	18.62	40.00	-21.38
110.00	25.80	-10.96	14.84	43.50	-28.66
132.95	37.40	-9.82	27.58	43.50	-15.92
148.58	31.00	-9.44	21.56	43.50	-21.94
166.75	26.70	-9.18	17.52	43.50	-25.98
170.00	28.40	-10.17	18.23	43.50	-25.27
189.73	25.20	-9.07	16.13	43.50	-27.37
250.03	42.10	-8.08	34.02	46.00	-11.98
276.80	34.60	-6.05	28.55	46.00	-17.45
332.15	31.60	-6.04	25.56	46.00	-20.44
350.05	30.90	-6.29	24.61	46.00	-21.39
431.83	25.40	-2.27	23.13	46.00	-22.87
450.00	44.30	-1.80	42.50	46.00	-3.50
524.60	31.40	-1.11	30.29	46.00	-15.71
550.00	43.00	-1.01	41.99	46.00	-4.01
600.03	34.10	-0.58	33.52	46.00	-12.48
771.25	38.20	1.61	39.81	46.00	-6.19
857.38	22.10	4.03	26.13	46.00	-19.87
933.35	29.30	5.54	34.84	46.00	-11.16

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Test Configuration #1

Frequency MHz	EMI Data dB μ V/M	ACF	Field Strength dB μ V/M	FCC Limit dB μ V/M	Margin to Limit dB μ V/M
Vertical					
31.53	35.10	-8.35	26.75	40.00	-13.25
45.43	41.20	-9.58	31.62	40.00	-8.38
52.08	34.40	-10.26	24.14	40.00	-15.86
* 66.38	51.00	-11.69	39.31	40.00	-0.69
71.60	43.50	-12.49	31.01	40.00	-8.99
84.35	33.40	-14.19	19.21	40.00	-20.79
113.68	40.50	-10.36	30.14	43.50	-13.36
124.33	31.50	-9.50	22.00	43.50	-21.50
132.90	41.50	-9.82	31.68	43.50	-11.82
159.30	29.60	-7.28	22.32	43.50	-21.18
166.68	29.40	-9.16	20.24	43.50	-23.26
197.40	23.80	-10.74	13.06	43.50	-30.44
217.60	32.50	-10.18	22.32	46.00	-23.68
265.70	28.90	-6.89	22.01	46.00	-23.99
332.25	27.50	-6.04	21.46	46.00	-24.54
350.00	45.20	-6.29	38.91	46.00	-7.09
450.03	35.90	-1.80	34.10	46.00	-11.90
493.75	32.40	-1.29	31.11	46.00	-14.89
550.03	38.50	-1.01	37.49	46.00	-8.51
585.25	36.10	-0.70	35.40	46.00	-10.60
639.25	30.10	-0.66	29.44	46.00	-16.56
741.53	24.70	1.24	25.94	46.00	-20.06
799.63	27.90	2.31	30.21	46.00	-15.79
950.00	30.30	5.87	36.17	46.00	-9.83

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Test Configuration #2

Frequency MHz	EMI Data dB μ V/M	ACF	Field Strength dB μ V/M	FCC Limit dB μ V/M	Margin to Limit dB μ V/M
Horizontal					
34.88	26.30	-8.58	17.72	40.00	-22.28
48.08	28.70	-9.89	18.81	40.00	-21.19
66.40	43.50	-11.69	31.81	40.00	-8.19
75.58	37.90	-13.20	24.70	40.00	-15.30
80.33	37.00	-13.99	23.01	40.00	-16.99
114.60	31.50	-10.21	21.29	43.50	-22.21
124.88	27.20	-9.53	17.67	43.50	-25.83
132.95	35.20	-9.82	25.38	43.50	-18.12
146.98	28.90	-9.55	19.35	43.50	-24.15
166.65	29.80	-9.15	20.65	43.50	-22.85
177.65	37.70	-7.71	29.99	43.50	-13.51
195.53	32.90	-10.33	22.57	43.50	-20.93
217.58	37.90	-10.18	27.72	46.00	-18.28
252.73	38.30	-7.87	30.43	46.00	-15.57
315.00	34.20	-5.80	28.40	46.00	-17.60
366.53	26.20	-5.24	20.96	46.00	-25.04
400.03	30.50	-3.09	27.41	46.00	-18.59
450.03	41.40	-1.80	39.60	46.00	-6.40
523.78	38.70	-1.12	37.58	46.00	-8.42
577.73	29.60	-0.77	28.83	46.00	-17.17
650.03	28.40	-0.68	27.72	46.00	-18.28
733.35	34.00	1.37	35.37	46.00	-10.63
842.50	22.00	3.65	25.65	46.00	-20.35
946.45	28.70	5.80	34.50	46.00	-11.50

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Test Configuration #2

Frequency MHz	EMI Data dB μ V/M	ACF	Field Strength dB μ V/M	FCC Limit dB μ V/M	Margin to Limit dB μ V/M
Vertical					
34.38	33.60	-8.55	25.05	40.00	-14.95
40.65	35.70	-9.02	26.68	40.00	-13.32
50.03	42.60	-10.12	32.48	40.00	-7.52
67.23	47.60	-11.81	35.79	40.00	-4.21
71.73	41.80	-12.51	29.29	40.00	-10.71
80.78	37.20	-14.02	23.18	40.00	-16.82
117.25	35.80	-9.77	26.03	43.50	-17.47
132.93	38.50	-9.82	28.68	43.50	-14.82
150.03	39.50	-9.34	30.16	43.50	-13.34
171.58	28.60	-9.66	18.94	43.50	-24.56
189.20	23.20	-8.95	14.25	43.50	-29.25
196.95	30.20	-10.64	19.56	43.50	-23.94
212.18	39.50	-10.52	28.98	43.50	-14.52
250.03	42.10	-8.08	34.02	46.00	-11.98
315.00	41.10	-5.80	35.30	46.00	-10.70
350.03	39.40	-6.29	33.11	46.00	-12.89
450.00	42.10	-1.80	40.30	46.00	-5.70
500.03	34.20	-1.22	32.98	46.00	-13.02
550.00	38.50	-1.01	37.49	46.00	-8.51
639.28	32.50	-0.66	31.84	46.00	-14.16
695.53	30.10	1.71	31.81	46.00	-14.19
733.33	35.00	1.37	36.37	46.00	-9.63
815.43	31.80	2.80	34.60	46.00	-11.40
950.03	23.90	5.87	29.77	46.00	-16.23

4.4 Calculations and Notes Concerning Data Presentation

- 4.4.1 "ACF" means the Antenna Correction Factor for either Horizontal or Vertical antenna orientation.
- 4.4.2 "H" means Horizontal antenna orientation.
- 4.4.3 "V" means Vertical antenna orientation.
- 4.4.4 "*" means the "Margin to Limit" Exceeds the "EN Limit" and/or Exceeds the "FCC Limit" or is within a -2 dB μ V margin.
- 4.4.5 "A" designates an ambient signal.
- 4.4.6 "(-. -)" means the signal level as lower than the adjacent data or within the background ambients.
- 4.4.7 "EMI DATA" plus "ACF" equals "Field Strength".
- 4.4.8 "Field Strength" minus "EN Limit" and/or minus "FCC Limit" equals "Margin to Limit".
- 4.4.9 "Margin to Limit" negative numbers show Equipment Under Test "Field Strength" below the "EN Limit" and/or below the "FCC Limit". "Margin to Limit" positive numbers show Equipment Under Test "Field Strength" above the "EN Limit" and/or above the "FCC Limit".

- 4.5 The field strengths in this section were measured at 3.0 meters. None of the Electromagnetic Interference quasi-peaks are in excess of the FCC (Federal Communications Commission) Class B maximums, even when the field strength readings in the above table are reduced by 20 dB μ V (to represent 30 meter test site measurements, since an antenna positioned at 30.0 meters receives one tenth of the field strength recorded at 3.0 meters).
- 4.6 **Conclusion** - The radiated Electromagnetic Interference of the Equipment Under Test meets the requirements for Federal Communications Commission (FCC) Class B devices.

5.0 Conducted EMI - Test Configuration

- 5.1 Current input power leads of the Equipment Under Test were connected to a Line Impedance Stabilization Network (LISN), which isolate and couple the conducted interference from the power lines to a spectrum analyzer. The LISN and the Equipment Under Test were connected and positioned according to the Industry Canada and the Federal Communications Commission test recommendations. The Equipment Under Test was configured exactly as outlined in the Radiated Electromagnetic Interference Section of this report. The spectrum analyzer data is shown in the following table as quasi-peak amplitudes.
- 5.2 To increase data integrity and also meet the recommendations of the American National Standards Institute standard number C63.4-1992, all electrical devices comprising the system being tested with the Equipment Under Test were connected to the VAC mains using a second Line Impedance Stabilization Network.

6.0 Conducted EMI – Results

- 6.1 Investigation of the EUT revealed conducted interference levels as shown in the table below.

Type of Test	Conducted Electromagnetic Interference
Specification	FCC Class B
Date Data Collected	29 Oct 1999
Detection Technique	Spectrum Analyzer with Quasi-peak Adapter
Frequency Range	0.150 to 30.0 MHz
Resolution Bandwidth	10 kHz
Video Bandwidth	10 kHz
Line Impedance Stabilization Network	50 micro Henry; 50 ohm

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Test Configuration #1

Frequency MHz	Line Data dB μ V	Neutral Data dB μ V	FCC Limit dB μ V	Margin to Limit (Line) dB μ V	Margin to Limit (Neutral) dB μ V
0.50	26.80	27.10	48.00	-21.20	-20.90
1.50	-.-	26.80	48.00	-.-	-21.20
2.41	-.-	25.70	48.00	-.-	-22.30
3.66	18.60	-.-	48.00	-29.40	-.-
5.73	-.-	24.70	48.00	-.-	-23.30
5.99	29.30	-.-	48.00	-18.70	-.-
6.65	31.60	30.00	48.00	-16.40	-18.00
7.57	-.-	29.30	48.00	-.-	-18.70
7.90	29.90	-.-	48.00	-18.10	-.-
8.06	30.50	-.-	48.00	-17.50	-.-
10.39	22.10	-.-	48.00	-25.90	-.-
13.81	-.-	21.10	48.00	-.-	-26.90
13.96	18.70	-.-	48.00	-29.30	-.-
16.05	28.30	28.40	48.00	-19.70	-19.60
19.11	-.-	19.70	48.00	-.-	-28.30
19.30	22.50	-.-	48.00	-25.50	-.-
20.06	29.80	30.10	48.00	-18.20	-17.90
22.51	18.70	-.-	48.00	-29.30	-.-
24.07	29.90	30.30	48.00	-18.10	-17.70
26.66	-.-	22.30	48.00	-.-	-25.70
27.22	27.10	25.50	48.00	-20.90	-22.50
28.64	37.50	38.10	48.00	-10.50	-9.90
29.79	23.90	-.-	48.00	-24.10	-.-
29.90	-.-	19.60	48.00	-.-	-28.40

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Test Configuration #2

Frequency MHz	Line Data dB μ V	Neutral Data dB μ V	FCC Limit dB μ V	Margin to Limit (Line) dB μ V	Margin to Limit (Neutral) dB μ V
0.50	28.30	28.90	48.00	-19.70	-19.10
0.91	-.-	26.50	48.00	-.-	-21.50
1.25	24.60	-.-	48.00	-23.40	---
1.66	-.-	31.40	48.00	-.-	-16.60
2.08	22.50	-.-	48.00	-25.50	---
2.16	-.-	20.00	48.00	-.-	-28.00
4.24	-.-	24.70	48.00	-.-	-23.30
4.66	23.80	-.-	48.00	-24.20	---
5.65	-.-	27.70	48.00	-.-	-20.30
6.73	29.60	-.-	48.00	-18.40	---
6.90	-.-	29.10	48.00	-.-	-18.90
8.31	-.-	26.30	48.00	-.-	-21.70
9.15	18.90	-.-	48.00	-29.10	---
10.14	-.-	24.90	48.00	-.-	-23.10
12.58	18.60	-.-	48.00	-29.40	---
13.39	-.-	19.40	48.00	-.-	-28.60
15.68	18.60	-.-	48.00	-29.40	---
16.05	26.70	26.60	48.00	-21.30	-21.40
19.39	19.50	-.-	48.00	-28.50	---
20.06	32.60	31.80	48.00	-15.40	-16.20
23.53	-.-	19.00	48.00	-.-	-29.00
24.07	27.90	28.10	48.00	-20.10	-19.90
27.35	-.-	21.60	48.00	-.-	-26.40
29.78	-.-	19.60	48.00	-.-	-28.40

6.2 Calculations and Notes Concerning Data Presentation

6.2.1 "*" means the "Margin to Limit" Exceeds the "FCC Limit" and/or Exceeds the "EN Limit" or is within a -2 dB μ V margin.

6.2.2 "(--)" means the signal level as lower than the adjacent data or within the background ambients.

6.2.3 "Line Data" minus "FCC Limit" and/or minus "EN Limit" equals "Margin to Limit" for the Line side of the input power cord.

6.2.4 "Neutral Data" minus "FCC Limit" and/or minus "EN Limit" equals "Margin to Limit" for the Neutral side of the input power cord.

6.2.5 "Margin to Limit" negative numbers show Equipment Under Test "Field Strength" **below** the "FCC Limit" and/or **below** the "EN Limit". "Margin to Limit" positive numbers show Equipment Under Test "Field Strength" **above** the "FCC Limit" and/or **above** the "EN Limit".

6.2.6 "A" means an Ambient signal.

6.2.7 The symbol " Σ " adjacent to a line of conducted Electromagnetic Interference data means that the "Field Strength" was recorded directly as a quasi-peak measurement, and then reduced by 13 dB μ V. The data obtained in quasi-peak mode was 6 dB μ V or higher than the level of the same emission measured with the spectrum analyzer detector function set to the average mode. The emission was considered broadband, since the quasi-peak mode bandwidth setting was identical to the average mode bandwidth setting. 100 samples were recorded represented by the following equation:

$$(1 / n) \sum_{i=1}^n x_i$$

6.3 **Conclusion** - The conducted Electromagnetic Interference of the Equipment Under Test meets the requirements for Federal Communications Commission (FCC) Class B devices.

6.4 Graphs of PEAK conducted Electromagnetic Interference for frequency ranges on Line and Neutral are shown on the following pages.

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- 6.5 The recorded conducted data utilized a quasi-peak measurement procedure. Hence, any differences between the graphs and the data are merely the differences between peak and quasi-peak measurements.
- 6.6 There are 33 AM and 56 FM radio stations in the immediate San Jose, California, area which create large ambient signals. Typical radio stations are:
 - 0.810 MHz KGO
 - 1.170 MHz KLOK
 - 1.370 MHz KEEN
 - 1.500 MHz KHTT
 - 1.590 MHz KLIV
- 6.7 The conducted Electromagnetic Interference graphs in this report show some of the large ambient signals for several of these radio stations.
- 6.8 The final Electromagnetic Interference conducted test and measurement equipment configuration was evaluated to assure that Data Compression or Intermodulation Distortion did not occur due to these large ambient signals.

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FCC Conducted Photographs – Test Configuration #1

**Line Lead
0.15 to 30.00 MHz**

**Neutral Lead
0.15 to 30.00 MHz**

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FCC Conducted Photographs – Test Configuration #2

**Line Lead
0.15 to 30.00 MHz**

**Neutral Lead
0.15 to 30.00 MHz**

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Signature Page - Last Page of Report

Project Coordinated by

Signed _____
Laura A. Bramschreiber

Data and Technical Details by

Signed _____
Greg Noll

Quality Assurance by

Signed _____
Kate Wolf

Report Approved by

Signed _____
Lee J. Pulver