Engineering and Testing for EMC and Safety Compliance

APPLICATION FOR FCC CERTIFICATION

CLASS B DIGITAL DEVICE

LG Electronics Inc.
184 Kongdan-Dong, Kumi-City
Kyoungsangbuk-Do, Korea

MODEL: LQ800 Flat Panel Monitor
(641 Flat Panel Monitor)
FCC ID: BEJLQ800

July 10, 1998

This report concerns (check one): **Original Grant:** X **Class II Change:** **Equipment Type: Monitor**	
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? **Yes:** **No:** X **If yes, defer until:** _____ *Date* **Company name agrees to notify the Commission by:** _____**(date) of the intended date of announcement of the product so that the grant can be issued on that date.**	
Transition Rules Request per 15.37? **Yes:** **No:** X **If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..**	

REPORT PREPARED BY:

EMI Technician: **Billy D. Young**
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Document Number: 980415

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1.0 GENERAL INFORMATION

The following Application for FCC Certification of a Class B Digital Device is prepared on behalf of LG Electronics Inc. in accordance with Part 2, and Part 15, Subparts A and B of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the LQ800 Flat Panel Monitor. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms with the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. Rhein Tech, Labs, Inc. is accepted by the FCC as a Facility available to do measurement work for others on a contract basis.

1.1 PRODUCT DESCRIPTION

The LQ800 Flat Panel Monitor has a large 18.1-inch (45.97cm) screen with an active matrix, thin-film transistor (TFT), liquid crystal display (LCD). It supports resolutions up to 1280 X 1024 and has typical wide viewing angles of 160 degrees horizontally and 100 degrees vertically.

Features:
-18.1-inch (45.97cm) viewable area display.
-On-Screen Display (OSD) adjustments in six different languages: English, Dutch, French, German, Italian, and Spanish.
-Diskette included that contains an information file (INF), Image Color Matching file (ICM), and the Compaq LCD Display Assistant utility.
-Universal Serial Bus (USB) bus-powered hub interface—plug and play connectors for use with USB peripherals (mouse, etc.).
-Plug and play capability if supported by the host system.
-Fault Management and AssetControl.
-Automatic scanning with screen expansion.
-1280 X 1024 (XGA) resolution.
-Wide viewing angle to allow viewing from a sitting or standing postition, or moving side to side.
-Removable base for flexible mounting solutions.
-Energy Saver feature.
-Programmable sleep mode timer.
-Compliant with the following regulated specifications:

- ◊ Swedish MPG II 1990
- ◊ EP ENERGY STAR
- ◊ European Union CE Directives
- ◊ Swedish TCO 1995

1.2 RELATED SUBMITTAL(S)/GRANT(S)

N/A. This is an original submission for Certification.

1.3 TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

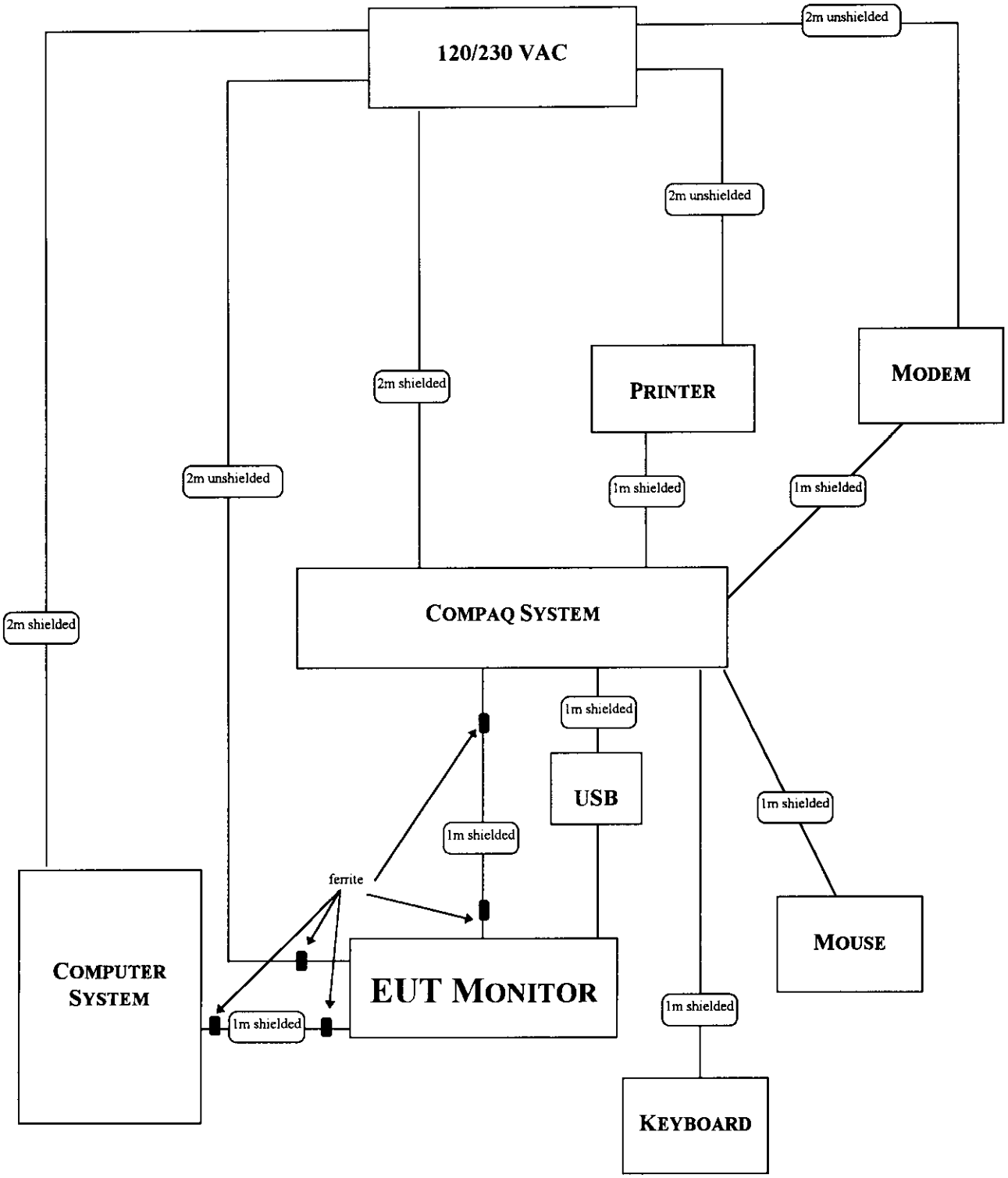
EXTERNAL PERIPHERALS

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO	FCC ID	CABLE DESCRIPTIONS	RTL BAR CODE
MODEM	US ROBOTICS	0413	839032B89P9WB	DOC	SHIELDED I/O, UNSHIELDED POWER	900409
MONITOR (EUT)	**LG ELECTRONICS INC.**	**641**	**825EA336A001**	**BEJLQ800**	**SHIELDED I/O, FERRITE ON BOTH ENDS, UNSHIELDED POWER, FERRITE ON MONITOR END**	**9515**
PRINTER	EPSON	P950A	3JU1120100	BKMFBP950A	SHIELDED I/O, UNSHIELDED POWER	7701
SYSTEM	GATEWAY 2000, INC.	BATC	N/A	N/A	SHIELDED POWER	7547
SYSTEM	COMPAQ	N/A	N/A	N/A	SHIELDED POWER	9516
KEYBOARD	COMPAQ	KOREAN 247430-ADI	B072A0A39EX03M	AQ6-72BC15	SHIELDED I/O	N/A
MOUSE	COMPAQ	MS34	1304AB0H5BFY4859	DZL211029	SHIELDED I/O	N/A

INTERNAL COMPONENTS

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO	FCC ID	CABLE DESCRIPTIONS	RTL BAR CODE
CD-ROM	TOSHIBA	XM-6002B	754J012883	CJ6AT96-026	INTERNAL RIBBON	7549
CPU	INTEL	PENTIUM 166MHZ	N/A	N/A	N/A	7557
FLOPPY DRIVE	PANASONIC	JU-256A219P	F3719	N/A	INTERNAL RIBBON	7550
HARD DRIE	WESTERN DIGITAL	CAVIAR 33100	WT359 149 9668	N/A	INTERNAL RIBBON	7551
MOTHERBOARD	INTEL	TIGEREYE	N/A	N/A	INTERNAL RIBBON	7556
POWER SUPPLY	ASTEC	ATX145-3505	2265253282	N/A	SHIELDED POWER	7548
VIDEO CARD	STB SYSTEMS, INC.	LIGHTSPEED 1.1	210-0213-001	EKSUSA6000PCI	SHIELDED I/O	7553

1.4 CONFIGURATION OF TESTED SYSTEM



1.5 TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.6 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated June 24, 1996, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

3.0 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The video resolution was 1280 x 1024. CPU Speed: 166MHz.

The host computer was tested with all ports attached to external peripherals. TheLQ800 Flat Panel Monitor was investigated as powered from the wall outlet since there is no auxiliary power outlet on the host computer.

3.2 EUT EXERCISE SOFTWARE

The EUT exercise program used during radiated and conducted testing has been designed to exercise the various system components in a manner similar to a typical use. The software, contained on the hard disk drive sequentially exercises each system component: 1) an H prints on the monitor, 2) an H prints on the printer, 3) an H is sent to serial ports, 4) a file is read from the floppy diskette, 5) a file is read from the hard drive and any other hard drive present, 6) a file is read from the CD-ROM drive. In cases that implement the use of Universal Serial Bus (USB) ports, a looped batch program is initiated to render a continuous flow of data through the USB ports. The complete cycle takes less than one second and is repeated continually. Systems that utilize network cards are connected to a server and are configured to transmit and receive packets of data continuously. As the keyboard and mouse are strictly input devices, no data was transmitted to them during test. They are, however, continuously scanned for data input activity.

3.3 SPECIAL ACCESSORIES

All interface cables used for compliance testing should be the same type as those mentioned in Section 1.3 of this test report.

3.4 CONFORMANCE STATEMENT

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made during testing to the equipment in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI 63.4 test methodology.

Signature: 

Date: July 13, 1998

Typed/Printed Name: Bruno Clavier

Position: Quality Manager
(NVLAP Signatory)

NVLAP *Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.*

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

1. Video Input Ports

Thers's two input ports. Users can select the input ports with a slide switch under the cabinet. This monitor can detect the input port automatically in middle position of slide switch. The video siganal goes to the input switch. Microcontroller controls the input switch IC - BA7657F- to get the video signal.

2. Video Pre-Amplification

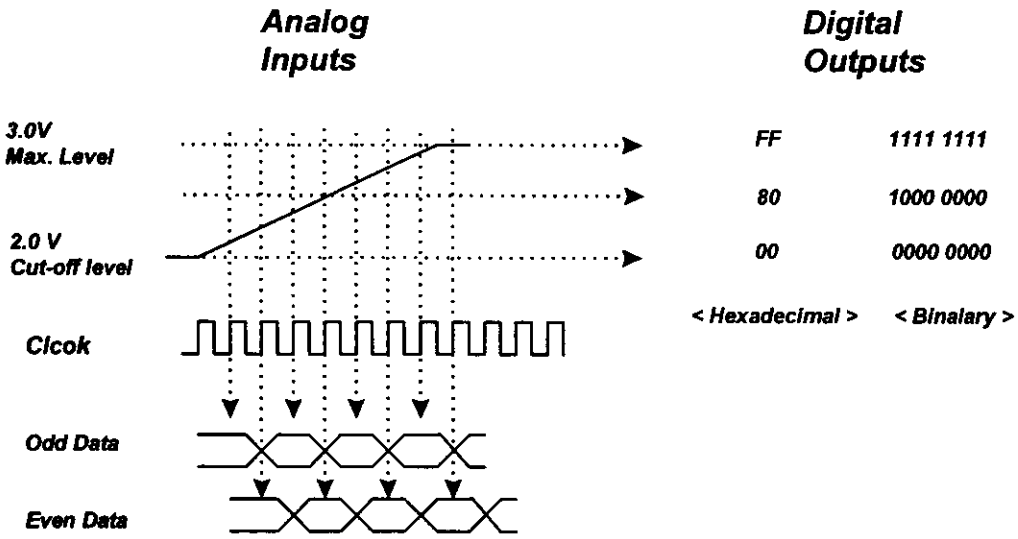
The selected video signal goes to the Pre-Amp - TDA4885- . In this chip the Contrast & Brightness level Adjustment of video siganls could be controlled. But the brightness Adjustment is fixed in this chips.

Input siganl [Vp-p]	Output Siganl [Vp-p] Contrast : "0"	"52"	"100"
0.5	0.2	0.6	1.0
0.7	0.6	1.0	1.4
0.9	1.0	1.4	1.8

The relation of input & output siganl voltage was descrived above. Actually the input video signal level is always 0.70 ~ 0.72 Vp-p. the contrast level "52" is normal position.

3. Analog to Digital Converters

This A/D converter can convert the analog video siganl s to digital siganls. And this A/D converter has two different outputs. One is Odd Data and the other 's Even. The input & Output formats are described below.



4. Flat Panel Controller & Memory

This controller controls the input image fromats and outputs. The output resloution is SXGA 60 Hz which depends on the LCD modules. This 18.1" LCD module signal format is SXGA 60 Hz. So this controller converts the input signal format to the SXGA 60Hz.

That is, 640 x 480 60 Hz ===> 1280 x 1024 60 Hz
800 x 600 85 Hz ===> 1280 x 1024 60 Hz
1024 x 768 60 Hz ===> 1280 x 1024 60 Hz
1280 x 1024 75 Hz ===> 1280 x 1024 60 Hz , etc.

The Memory should be used to convert the input frame rates to the fixed frame rate. For example,
60 Hz, 70 Hz, 75 Hz, 85 Hz ====> 60 Hz (Fixed)

5. Display Data Transmitter

This 18.1" LCD monitor uses the LVDS (Low Voltage differential Signal) type data transmitter to transmite the 24 bits parallel data to the LCD module receivers. It also uses two LVDS transmitters. One is for Odd data and the other's for Even.

6. Power Lines

This 18.1" LCD M onitor is only for 12 V Power inputs. It's internal powers are 5 V,3.3 V and 8 V. The DC/DC converter is also used for power distributions.

7. Inverters for Backlights

This inverter power is 12 V inputs. 4 Lamps are used in this 18.1" LCD monitors. So this inverter kicks off the 4 lamps at the same times. the Power input's 12 V and the output voltage is about 650 Vrms. So the users should be careful to handle this inverter.

8. System clocks

The clock generator generates main clocks to run this 18.1" LCD monitor. These clocks are synchronized with the input H-sync. When the input video signal is the SXGA 75 Hz, this clock generator generates 135 MHz. This 135 MHz goes to the A/D Converters to convert the analog signal to digital data. And then A/D converter gives the half clock of the input clock, that is 67.5 MHz, to the Flat panel controller. Flat panel controller generates 101 MHz for Memory clocks and the LVDS output clocks - 42.5 MHz - with 14.318 MHz Crystal. And the LVDS gives same clocks - 42.5- to the LCD Module.

5.0 CONDUCTED EMISSION DATA

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the average limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 450 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.

TABLE 1: CONDUCTED EMISSIONS: 1280 X 1024 @ 75 HZ

Neutral Side (L1)

EMISSOIN FREQUENCY (MHz)	TEST DETECTOR (1)	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dBuV)	CORRECTED EMISSION LEVEL (dBuV)	FCC LIMIT (dBuV)	FCC MARGIN (dBuV)
0.497	Pk	40.3	0.3	40.6	48.0	-7.4
0.567	Pk	37.7	0.3	38.0	48.0	-10
0.714	Pk	36.3	0.4	36.7	48.0	-11.3
1.728	Pk	32.6	0.9	33.5	48.0	-14.5
2.084	Pk	41.5	1.0	42.5	48.0	-5.5
3.523	Pk	43.8	1.2	45.0	48.0	-3.0
3.523	Qp	39.4	1.2	40.6	48.0	-7.4
3.523	Av	27.1	1.2	28.3	48.0	-19.7
4.675	Pk	34.8	1.4	36.2	48.0	-11.8

Hot Side (L2)

0.501	Pk	36.0	0.3	36.3	48.0	-11.7
0.794	Pk	33.3	0.4	33.7	48.0	-14.3
2.307	Pk	42.0	1.4	43.4	48.0	-4.6
2.527	Pk	44.1	1.4	45.5	48.0	-2.5
2.527	Qp	43.2	1.4	44.6	48.0	-3.4
2.527	Av	41.8	1.4	43.2	48.0	-4.8
3.033	Pk	40.4	1.4	41.8	48.0	-6.2
4.844	Pk	35.5	1.8	37.3	48.0	-10.7

(1)Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Signature: _____ **Date:** 7/10/98

Typed/Printed Name: Billy D. Young

6.0 RADIATED EMISSION DATA

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph 6.1.

TABLE 2: RADIATED EMISSIONS: 1280 X 1024 @ 75 HZ

EMISSION FREQUENCY (MHz)	ANTENNA POLARITY (H/V)	ANALYZER READING (dBuV)*	SITE CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	FCC LIMIT (dBuV/m)	FCC MARGIN (dBuV/m)
53.208	V	58.9	-23.7	35.2	40.0	-4.8
74.472	V	60.9	-30.8	30.1	40.0	-9.9
116.972	V	53.3	-27.5	25.8	43.5	-17.7
132.918	V	62.0	-25.8	36.2	43.5	-7.3
138.216	V	61.1	-26.6	34.5	43.5	-9.0
159.474	V	64.7	-28.1	36.6	43.5	-6.9
191.364	H	61.8	-26.1	35.7	43.5	-7.8
212.624	H	61.6	-24.9	36.7	43.5	-6.8
478.296	V	47.2	-17.1	30.1	46.0	-15.9
488.928	V	52.0	-17.2	34.8	46.0	-11.2

All readings are quasi-peak, unless stated otherwise. See Appendix B for Radiated Test Methodology.

TEST PERSONNEL:

Signature: _____ Date: 7/10/98

Typed/Printed Name: Billy D. Young

6.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)$$

FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF(dB/m) = -PG(dB) + AF(dB/m) + CL(dB)$$

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(uV/m) = 10^{FI(dBuV/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3 \text{ dBuV} - 11.5 \text{ dB} = 37.8 \text{ dBuV/m}$$

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$

7.0 PHOTOS OF TESTED EUT

The following photos are attached:

Figure 3 Front of Monitor
Figure 4 Back of Monitor
Figure 5 Right Side of Monitor
Figure 6 Monitor, Bezel Removed
Figure 7 Bezel Rear
Figure 8 Monitor Rear, Cover Removed, Support Shield
Figure 9 Rear Monitor Interior, Mainboard Shield
Figure 10 Rear Monitor Interior, Mainbaord, Component Side
Figure 11 Mainboard, Solder Side, with Shield
Figure 12 Rear Monitor Interior and Frame
Figure 13 Rear LCD Module and Shield
Figure 14 Rear LCD Module and Source PCB, Component Side
Figure 15 Monitor Rear Cover Interior and Controller, Component Side
Figure 16 Inverter, Component Side
Figure 17 Inverter, Solder Side
Figure 18 Mainboard, Solder Side
Figure 19 Controller, Solder Side
Figure 20 Source PCB, Solder Side

APPENDIX B: Emissions Equipment List

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. LAB
AMPLIFIER	HEWLETT PACKARD	11975A	2304A00348	TEST EQUITY
AMPLIFIER (S/A 1)	RHEIN TECH	PR-1040	N/A	RTL
AMPLIFIER (S/A 2)	RHEIN TECH	RTL2	N/A	RTL
AMPLIFIER (S/A 3)	RHEIN TECH	8447F	2944A03783	RTL
AMPLIFIER (S/A 4)	RHEIN TECH	8447D	2727A05397	RTL
BICONICAL/LOG ANTENNA 1	ANTENNA RESEARCH	LPB-2520	1037	LIBERTY LABS
BICONICAL/LOG ANTENNA 2	ANTENNA RESEARCH	LPB-2520	1036	LIBERTY LABS
FIELD SITE SOURCE	EMCO	4610	9604-1313	RTL
FILTER (ROOM 1)	SOLAR	8130	947305	RTL
FILTER (ROOM 2)	SOLAR	8130	947306	RTL
HARMONIC MIXER 1	HEWLETT PACKARD	11970K	2332A00563	TELOGY
HARMONIC MIXER 2	HEWLETT PACKARD	11970A	2332A01199	TELOGY
HORN ANTENNA 1	EMCO	3160-10	9606-1033	EMCO
HORN ANTENNA 2	EMCO	3160-9	9605-1051	EMCO
HORN ANTENNA 3	EMCO	3160-7	9605-1054	EMCO
HORN ANTENNA 4	EMCO	3160-8	9605-1044	EMCO
HORN ANTENNA 5	EMCO	3160-03	9508-1024	EMCO
LISN (ROOM 1/L1)	SOLAR	7225-1		ACUCAL
LISN (ROOM 1/L2)	SOLAR	7225-1		ACUCAL
LISN (ROOM 2/L1)	SOLAR	7225-1	900078	ACUCAL
LISN (ROOM 2/L2)	SOLAR	7225-1	900077	ACUCAL
PRE-AMPLIFIER	HEWLETT PACKARD	8449B OPT	3008A00505	TELOGY
QUASI-PEAK ADAPTER (S/A 1)	HEWLETT PACKARD	85650A	3145A01599	ACUCAL
QUASI-PEAK ADAPTER (S/A 2)	HEWLETT PACKARD	85650A	2811A01276	ACUCAL
QUASI-PEAK ADAPTER (S/A 3)	HEWLETT PACKARD	85650A	2521A00473	ACUCAL
QUASI-PEAK ADAPTER (S/A 4)	HEWLETT PACKARD	85650A	2521A01032	ACUCAL
RF PRESELECTOR (S/A 1)	HEWLETT PACKARD	85685A	3146A01309	ACUCAL
SIGNAL GENERATOR (HP)	HEWLETT PACKARD	8660C	1947A02956	ACUCAL
SIGNAL GENERATOR (WAVETEK)	WAVETEK	3510B	4952044	ACUCAL
SPECTRUM ANALYZER 1	HEWLETT PACKARD	8566B	3138A07771	ACUCAL
SPECTRUM ANALYZER 2	HEWLETT PACKARD	8567A	2841A00614	ACUCAL
SPECTRUM ANALYZER 4	HEWLETT PACKARD	8567A	2727A00535	ACUCAL
TUNABLE DIPOLE	EMCO	3121	274	LIBERTY LABS

APPENDIX C: Conducted and Radiated Test Methodology

CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from (150/450) kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one meter and three meter distances if necessary in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The spectrum was examined from 30 MHz to 1000 MHz using a Hewlett Packard 8566B spectrum analyzer, a Hewlett Packard 85650A quasi-peak adapter, and an Antenna Research bilog antenna. In order to gain sensitivity, an RTL PR-1040 preamplifier was connected in series between the antenna and the input of the spectrum analyzer.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. When the dot clock or CPU clock exceeds 108 MHz, the EUT was tested between 1 to 2 Gigahertz in peak mode with the resolution bandwidth set at 1 MHz as stated in ANSI C63.4. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as daily calibration methods, technician training, and emphasis to employees on avoiding error.