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: FPD 1500 15" LCD Flat Panel Monitor
FCC ID: BEJLG501

July 16, 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..**	

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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 FPD 1500 15" LCD 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 ten 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 FPD1500 Flat Panel Monitor has an active matrix TFT (Thin-Film Transistor) LCD (Liquid Crystal Display). This monitor is designed for use in small working areas or for those who need more working space on the desk. It supports up to 1024 x 768, and has a wide viewing angle of $\pm$60 degrees horizontal and $\pm$45 degrees vertical.

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:

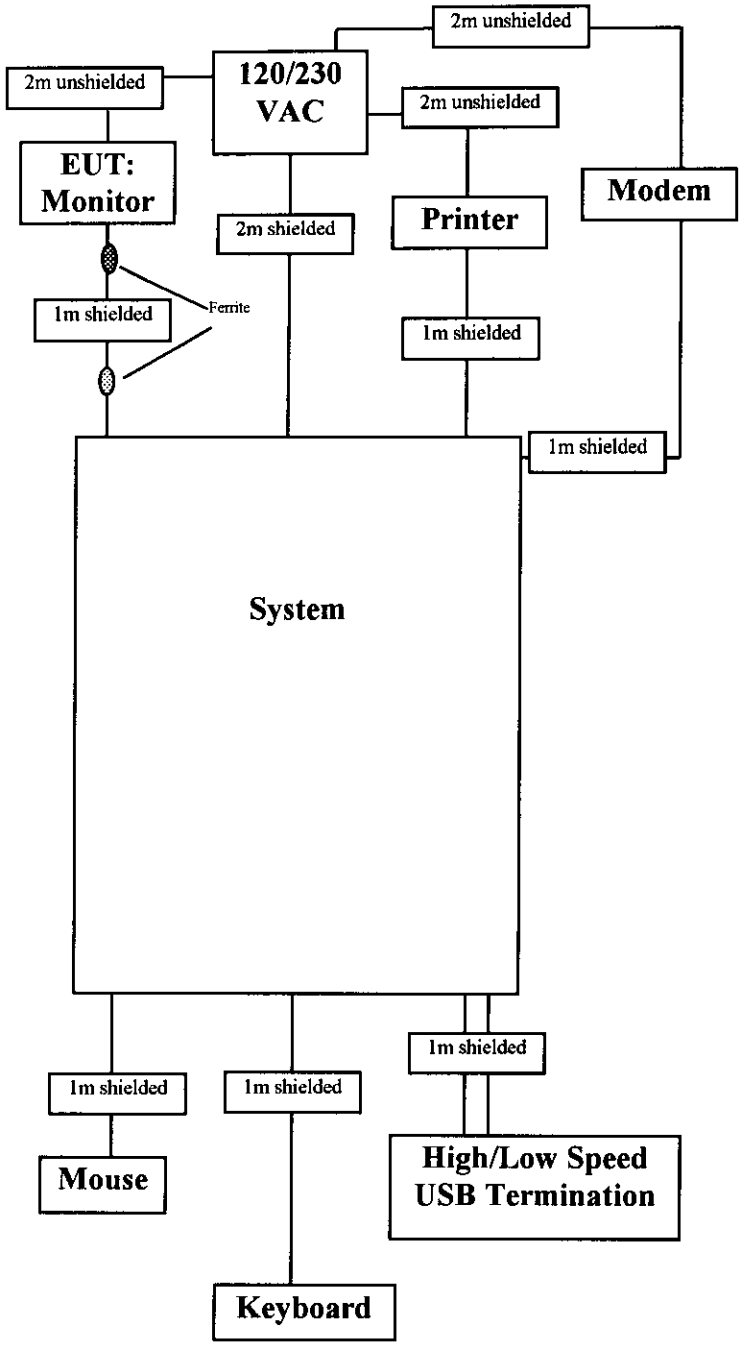
EXTERNAL PERIPHERALS

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO	FCC ID	CABLE DESCRIPTIONS	RTL BAR CODE
KEYBOARD	MAXI SWITCH	2196003-XX-XXX	07320177/G22-B	D7JL2196003-XX	SHIELDED I/O	7975
MONITOR (EUT)	**LG ELECTRONICS INC.**	**RDT151**	**804002062**	**BEJLG501**	**SHIELDED I/O, FERRITE ON BOTH ENDS, UNSHIELDED POWER**	**9333**
PRINTER	EPSON	P880A	3BR1810257	BKMP880A	SHIELDED I/O, UNSHIELDED POWER	6714
SYSTEM	GATEWAY 2000, INC.	ATX TOWER	N/A	DoC	N/A	9168
TERMINATION	GATEWAY 2000, INC.	USB HIGH/LOW SPEED	N/A	N/A	SHIELDED I/O	6834
MODEM	US ROBOTICS	0413	8390364644902	DoC	SHIELDED I/O, UNSHIELDED POWER	900423
MOUSE	PRIMAX	MOSUBJ	N/A	SAMPLE	SHIELDED I/O	8634

INTERNAL COMPONENTS

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO	FCC ID	CABLE DESCRIPTIONS	RTL BAR CODE
CD-ROM	TOSHIBA	XM-6202B	834K017835	CJ6AT97-029	INTERNAL RIBBON	9148
CPU	INTEL	PENTIUM II 400 MHZ	98140612-1160	N/A	N/A	9175
FLOPPY DRIVE	PANASONIC	JU-256A219P	00713446	N/A	INTERNAL RIBBON	7171
HARD DRIVE	QUANTUM	FIREBALL EL	341103136356	N/A	INTERNAL RIBBON	9172
MOTHERBOARD	INTEL	TABOR	ISMP81503775	N/A	INTERNAL RIBBON	9173
POWER SUPPLY	ASTEC	ATX202-3515	2580347232	N/A	SHIELDED POWER	9169
VIDEO CARD	ATI TECHNOLOGIES, INC.	RAGE LT PRO	10646-020	DoC	N/A	9335

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 10 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 1024 x 768 @ 85Hz. CPU Speed: 400MHz.

The host computer was tested with all ports attached to external peripherals. The FPD 1500 15" LCD 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.

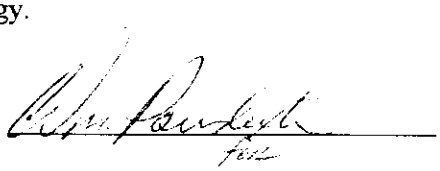
3.3 SPECIAL ACCESSORIES

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 C63.4 test methodology.

Signature:  Date: July 16, 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.

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: 1024 X 768 @ 85 HZ

NEUTRAL SIDE (Line 1)

EMISSION FREQUENCY (MHz)	TEST DETECTOR (1)	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB)	EMISSION LEVEL (dBuV)	EN55022 / CISPR22 QP LIMIT (dBuV)	EN55022 / CISPR22 QP MARGIN (dBuV)	EN55022 / CISPR22 AV LIMIT (dBuV)	EN55022 / CISPR22 AV MARGIN (dBuV)
0.205	Pk	48.2	0.3	48.5	63.4	-14.9	53.4	-4.9
0.275	Pk	43.9	0.3	44.2	61.0	-16.8	51.0	-6.8
0.343	Pk	35.1	0.2	35.3	59.1	-23.8	49.1	-13.8
0.411	Pk	35.6	0.3	35.9	57.6	-21.7	47.6	-11.7
1.775	Pk	30.4	0.9	31.3	56.0	-24.7	46.0	-14.7
4.249	Pk	33.2	1.4	34.6	56.0	-21.4	46.0	-11.4
5.960	Pk	31.2	1.8	33.0	60.0	-27.0	50.0	-17.0

HOT SIDE (Line 2)

EMISSION FREQUENCY (MHz)	TEST DETECTOR (1)	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB)	EMISSION LEVEL (dBuV)	EN55022 / CISPR22 QP LIMIT (dBuV)	EN55022 / CISPR22 QP MARGIN (dBuV)	EN55022 / CISPR22 AV LIMIT (dBuV)	EN55022 / CISPR22 AV MARGIN (dBuV)
0.205	Pk	47.4	0.3	47.7	63.4	-15.7	53.4	-5.7
0.274	Pk	31.1	0.3	31.4	61.0	-29.6	51.0	-19.6
0.411	Pk	33.3	0.3	33.6	57.6	-24.0	47.6	-14.0
0.547	Pk	29.2	0.3	29.5	56.0	-26.5	46.0	-16.5
0.616	Pk	28.5	0.4	28.9	56.0	-27.1	46.0	-17.1
1.237	Pk	29.4	1.3	30.7	56.0	-25.3	46.0	-15.3
4.240	Pk	32.2	1.6	33.8	56.0	-22.2	46.0	-12.2
6.200	Pk	32.6	2.0	34.6	60.0	-25.4	50.0	-15.4

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

TEST PERSONNEL:

Signature: _____ **Date:** 7/9/98

Typed/Printed Name: Christopher Shackleton

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: 1024 X 768 @ 85 HZ

EMISSION FREQUENCY (MHz)	ANTENNA POLARITY (H/V)	ANALYZER READING (dBuV)	SITE CORRECTION FACTOR (dB/m)	EMISSION LEVEL (dBuV/m)	EN55022 / CISPR22 LIMIT (dBuV/m)	EN55022 / CISPR22 MARGIN (dBuV/m)
120.330	V	49.7	-24.0	25.7	30.0	-4.3
147.670	V	47.3	-26.6	20.7	30.0	-9.3
153.085	H	46.8	-26.3	20.5	30.0	-9.5
164.067	H	46.3	-25.9	20.4	30.0	-9.6
180.460	H	42.8	-24.5	18.3	30.0	-11.7
185.940	H	47.3	-19.7	27.6	30.0	-2.4
191.400	H	47.9	-23.8	24.1	30.0	-5.9
196.865	H	45.3	-19.0	26.3	30.0	-3.7
202.340	H	44.5	-23.9	20.6	30.0	-9.4
213.280	H	44.3	-22.6	21.7	30.0	-8.3
218.750	H	48.1	-22.2	25.9	30.0	-4.1
224.220	H	44.9	-22.0	22.9	30.0	-7.1
229.667	H	43.2	-21.3	21.9	30.0	-8.1
240.610	V	45.0	-20.5	24.5	37.0	-12.5
246.080	V	49.3	-20.3	29.0	37.0	-8.0
251.550	V	48.7	-20.3	28.4	37.0	-8.6
257.015	V	47.5	-20.4	27.1	37.0	-9.9
262.470	V	47.6	-20.2	27.4	37.0	-9.6
284.350	V	48.5	-20.3	28.2	37.0	-8.8
295.285	V	44.0	-19.5	24.5	37.0	-12.5
328.085	V	52.8	-17.7	35.1	37.0	-1.9
393.692	V	43.0	-14.8	28.2	37.0	-8.8
422.852	V	39.4	-13.6	25.8	37.0	-11.2
426.490	H	41.3	-13.7	27.6	37.0	-9.4
459.310	V	43.3	-12.9	30.4	37.0	-6.6
492.115	V	42.8	-11.9	30.9	37.0	-6.1
524.910	V	39.6	-11.6	28.0	37.0	-9.0
557.712	H	38.8	-11.1	27.7	37.0	-9.3
656.132	H	41.6	-8.6	33.0	37.0	-4.0
721.672	H	39.4	-7.6	31.8	37.0	-5.2
754.472	H	35.5	-5.9	29.6	37.0	-7.4
885.672	H	34.7	-3.7	31.0	37.0	-6.0

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

TEST PERSONNEL:

Signature: _____ **Date:** 7/9/98

Typed/Printed Name: Christopher Shackleton

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 with Stand
Figure 5 Back of Monitor, Stand Removed
Figure 6 Monitor Stand, Front
Figure 7 Monitor Bottom
Figure 8 Rear Case, Interior
Figure 9 Monitor Rear, Shield, Bezel attached to Front
Figure 10 Monitor Rear, Interior, Component Side, Supports Shield for Module and Mainboard
Figure 11 Bezel Rear with Controller, Solder Side
Figure 12 LCD Module, Front
Figure 13 Monitor Interior, Rear Shield
Figure 14 LCD Module, Rear Shield
Figure 15 LCD Module, Rear Support Shield
Figure 16 Inverter, Component Side
Figure 17 Inverter, Solder Side
Figure 18 Mainboard, Component Side, Support Shield
Figure 19 Mainboard, Component Side
Figure 20 Mainbaord, Solder Side with Support Shield
Figure 21 Button Control Panel, Component Side
Figure 22 Button Control Panel, 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.

APPENDIX D:

USER'S MANUAL