

MEASUREMENT/TECHNICAL REPORT

HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.

MODEL : HLM-1500A

This report concerns(check one) : Original grant ☒ Class ☐ ±change ☐

Equipment type : LCD MONITOR

Deferred grant requested per 47 CFR 0.457(d)(1)(☐ ☒? yes ☐ no ☒

If yes, defer until: _____

_____ agrees to notify the Commission by _____

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 ☒

If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR [10-1-91 Edition] provision.

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TABLE OF CONTENTS

	PAGE
1. GENERAL INFORMATION.....	3
1.1 Product Description.....	3
1.2 Related submittal(s)/Grant(s).....	3
1.3 Tested System Details.....	4
1.4 Test Methodology.....	4
1.5 Test Facility.....	4
2. SYSTEM TEST CONFIGURATION.....	5
2.1 Justification.....	5
2.2 EUT Exercise Software.....	5
2.3 Cable Description.....	6
2.4 Noise Suppression Parts on Cable.....	6
2.5 Equipment Modifications.....	7
2.6 Configuration of Tested System.....	8
3. PRELIMINARY TESTS.....	9
3.1 Power line Conducted Emissions Tests.....	9
3.2 Radiated Emissions Tests.....	9
4. FINAL CONDUCTED AND RADIATED EMISSION TESTS SUMMARY.....	10
4.1 Conducted Emission Tests.....	10
4.2 Radiated Emission Tests.....	11
5. FIELD STRENGTH CALCULATION.....	12

1. GENERAL INFORMATION

1.1 Product Description

The Hyundai Electronics Industries Co., Ltd. Model HLM-1500A(referred to as the EUT in this report) is a 15.1"LCD Monitor HOR. Freq. 68.7 kHz w/max. Resolution of 1024_i 768 Non-Interlaced.

Product specification information described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	PLASTIC
LIST OF EACH OSC. OR XTAL. FREQ.(FREQ. _i Å1MHz)	14.318 MHz, 11.059MHz
CHIPSET BRAND AND PART NO.	HYUNDAI : HU80C32 HYUNDAI : HY57V161610C TC-10 SGS-TOMSON : TDA9206 SONY : CXQ3026Q SONY : CXA3106Q MXIC : MX88272FC MICROCHIP : 24LC211 MICROCHIP : 24C164 TOSHIBA : TA7805F MOTOROLA : MC141544W ALPHA : AS1117M/-3.3V
POWER REQUIREMENT	100 - 240 VAC(Universal Power) 1.5A
NUMBER OF LAYERS	MAIN BOARD 1 LAYER DC/DC CONVERTER BOARD 1 LAYER AC/DC CONVERTER BOARD 1 LAYER INVERTER BOARD 1 LAYER OSD BOARD 1 LAYER
MAX. RESOLUTION	1024 X 768 NON-INTERLACED (@ 68.7kHz/85Hz)
H-SYNC FREQUENCY RANGE	31.5 kHz _i - 68.7 kHz
V-SYNC FREQUENCY RANGE	56 Hz _i - 85 Hz
CRT SIZE	15.1" (HYUNDAI/ Type : HT15X11)
VIDEO CONNECTOR TYPE	D-SUB 15-PIN

1.2 Related Submittal(s) / Grant(s)

ORIGINAL SUBMITTAL ONLY

1.3 Tested System Details

The Model names for all equipment, plus descriptions used in the tested system (including inserted cards) are:

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
LCD MONITOR(EUT)	HYUNDAI	HLM-1500A	CKLHLM-1500A	HOST
PC(HOST)	H/P	HP VECTRA	DoC	N/A
KEYBOARD	H/P	SK-2501-2D-K	DZL211029	HOST
PRINTER	H/P	C2168A	B94C2121X	HOST
MODEM	HYUNDAI	HMD-2404M	CKL8J7HMD-2404M	HOST
MOUSE	H/P	M-S34	GYUR38SK	HOST

1.4 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.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO, 467-701,KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission on May 22, 1997 and accepted dated July 25,1997(1300F2)

2.SYSTEM TEST CONFIGURATION

2.1 Justification

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following components and I/O cards inside the E.U.T were used.

DEVICE TYPE	MANUFACTURE	MODEL/PART NUMBER
MAIN BOARD	HYUNDAI	E4208615601
DC/DC CONVERTER	GLOBAL TECHNOLOGY	3610400160
AC/DC CONVERTER	ILSSAN	3610200076
INVERTER	TAI YO YUDEN	3610400178
OSD BOARD	HYUNDAI	E4208415642

2.2 EUT exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software, contained on a 3-1/2 inch disc, was inserted into drive A and is auto starting on power-up. Once loaded, the program sequentially exercises each system component in turn. The sequence used is :(1) Display test, (2) RS 232 test (3) Key board test,(4) Printer test,(5) FDD test,(6) HDD test. The complete cycle takes about 20 seconds and is repeated continuously. As the keyboard and mouse are strictly input devices, no data is transmitted to them during test. They are however, continuously scanned for data input activity. The video resolution modes setup and change program was used during the radiated and conducted emission testing.

2.3 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
PC(HOST)	N	N/A	1.5(P)
COLOR MONITOR(EUT)	N	Y	1.5(P), 1.5(D)
PARALLEL	N	Y	1.5(P), 1.5(D)
KEYBOARD	N/A	Y	1.0(D)
SERIAL	N	Y	1.5(P), 1.5(D)
MOUSE(PS/2)	N/A	Y	1.8(D)

The marked "(D)" means the Data Cable and "(P)" means the Power Cable.

2.4 Noise Suppression Parts on Cable.

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
PC(HOST)	N	N/A	N	N/A
COLOR MONITOR(EUT)	Y	BOTH END	Y	PC END
KEYBOARD	Y	PC END	Y	PC END
PARALLEL	N	N/A	Y	BOTH END
SERIAL	N	N/A	Y	BOTH END
MOUSE(PS/2)	N	N/A	Y	PC END

2.5 Equipment Modifications

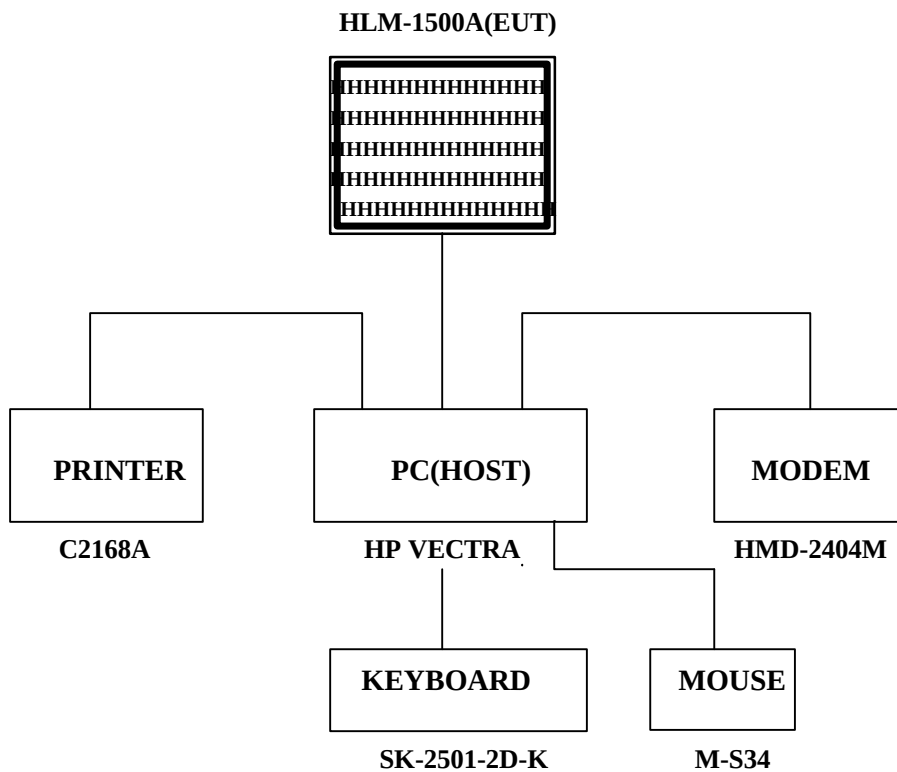
N/A

2.6 Configuration of Test system

Line Conducted Test : EUT was connected to LISN, all other supporting equipment were connected to another LISN.
Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.4/1992 7.2.3 to determine the worse operating conditions.

Radiated Emission Test : Preliminary Radiated Emissions tests were conducted using the procedure in ANSI C63.4/1992 8.3.1.1 to determine the worse operating condition. Final Radiated Emission tests were conducted at 3 meter open area test site.

[Configuration of Tested System]



3. PRELIMINARY TESTS

3.1 AC Power line Conducted Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)	The worst operating condition
Pentium 75 MHz	1024 x 768 Non-Interlaced (68.7 kHz/ 85 Hz)	X
Pentium 75 MHz	800 x 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (43.2KHz/85Hz)	
Pentium 75 MHz	720 x 400 Non-Interlaced (37.9KHz/85Hz)	

3.2 Radiated Emission Tests

During Preliminary Tests, the following operating mode were investigated

Processor Speed (MHz)	Video Resolution (w/max)	The worst operating condition
Pentium 75 MHz	1024 x 768 Non-Interlaced (68.7 kHz/ 85 Hz)	X
Pentium 75 MHz	800 x 600 Non-Interlaced (53.6KHz/85Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (43.2KHz/85Hz)	
Pentium 75 MHz	720 x 400 Non-Interlaced (37.9KHz/85Hz)	

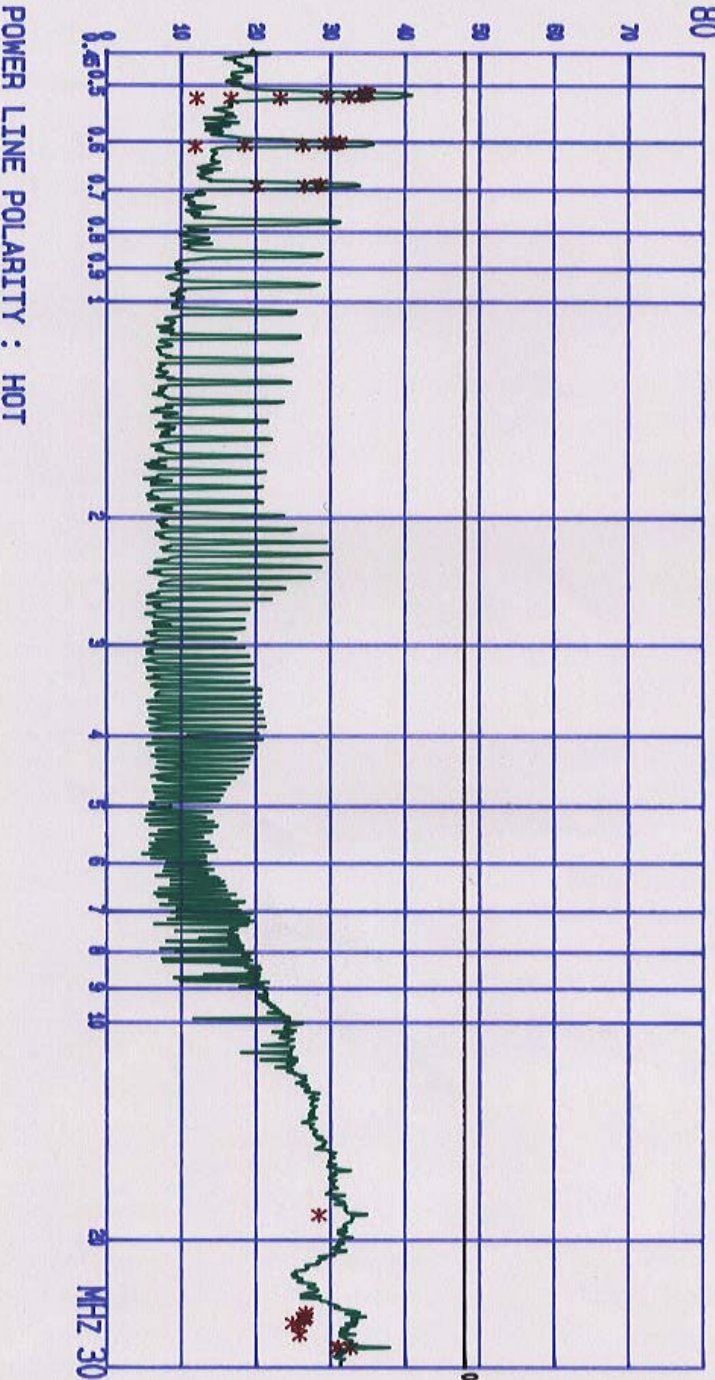
Tested by Sang Jun, Lee

Date : JAN. 21, 1999

HYUNDAI
RFI Voltage Test
E.U.T.: HLM-1500A
Oper. conditions: 1024 * 768 (4f-68.7KHz , Vf-68KHz)
Test spec:
FCC PART 15 SUBPART B CLASS B

Start Fr.	Stop Fr.	IF-SW	Detec	Att.	Meas.T.	Transd.
MHz	MHz	KHz	top	dB	s	type
0.4500	5.0000	10	Peak	LN	0.020	
5.0000	30.0000	10	Peak	LN	0.010	

Final evaluation: Quasi Peak
* = QUASI PEAK on phase: N



HYUNDAI RFI Voltage Test

E.U.T.: HLM-1500A
 Oper. conditions: 1024 # 768 (Vf=88.7KHz, Vg=88Hz)
 Test spec:
 FCC PART 15 SUBPART B CLASS B

Exceeding value on phase N			
Frequency	Peak	G-Peak	G-Margin
MHz	dBV	dBV	dB
0.5145	39.9	34.7	-15.3
0.5155	37.6	35.0	-13.0
0.5165	39.7	35.0	-15.0
0.5175	39.9	34.8	-15.2
0.5185	39.7	34.5	-13.5
0.5195	40.8	34.0	-14.0
0.5205	39.7	32.4	-15.6
0.5215	39.4	29.4	-16.6
0.5225	38.7	29.2	-24.8
0.5235	36.9	16.6	-31.4
0.5245	34.1	12.1	-35.9
0.5255	35.2	31.2	-15.8
0.5265	35.7	30.4	-17.1
0.5275	35.7	29.3	-17.6
0.5285	35.5	29.3	-18.7
0.5295	35.7	25.3	-21.7
0.5305	34.5	18.5	-29.5
0.5315	34.3	11.8	-36.2
0.5325	33.2	28.7	-19.3
0.5335	33.9	28.2	-19.6
0.5345	33.8	25.5	-21.5
0.5355	33.6	20.1	-27.9
0.5365	34.8	28.4	-19.6
0.5375	34.6	28.7	-21.3
0.5385	33.2	25.3	-21.7
0.5395	33.5	25.7	-21.3
0.5405	33.4	24.8	-23.2
0.5415	33.2	25.6	-22.4
0.5425	33.3	25.8	-22.2
0.5435	33.4	31.0	-17.0
0.5445	37.9	30.9	-17.1
0.5455	35.7	32.6	-15.4

* Limit exceeded

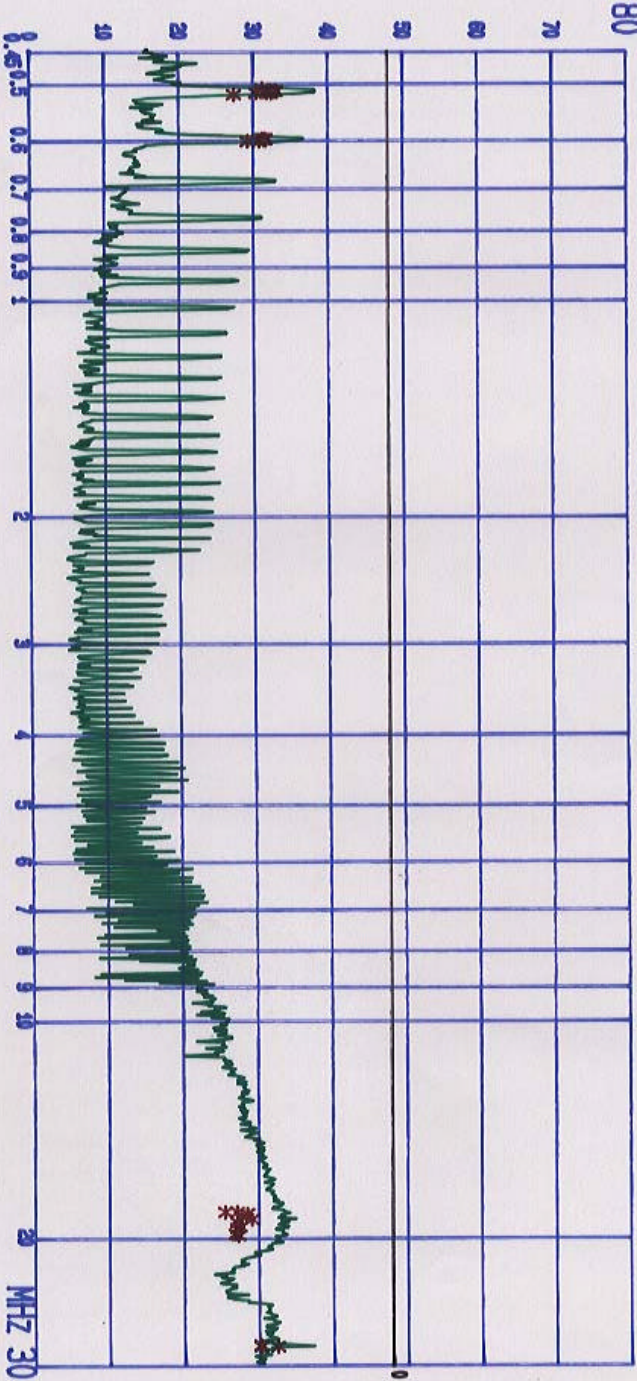
POWER LINE POLARITY : HOT

HYUNDAI
RFI Voltage Test

E.U.T.: HLM-1500A
Oper. condition: 1024 W 768 (Hf=68.7KHz . Vt=65KHz)
Test spec:
FCC PART 15 SUBPART B CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-SW KHz	Detec tor	Att. dB	Meas.T. s	Transd. type
0.4500	5.0000	10	Peak	LN	0.020	
5.0000	30.0000	10	Peak	LN	0.010	

dBuV
Final evaluation: Quasi Peak
* = QUASI PEAK on phase: L1



HYUNDAI RFI Voltage Test

E.U.T.: HLM-1500A
 Oper. conditions: 1024 # 768 (4f-68.7KHz . Vt-65KHz)
 Test spec:
 FCC PART 15 SUBPART B CLASS B

Frequency MHz	Exceeding values on phase: L1		
	Peak dBuV	G-Peak dBuV	G-Margin dB
0.5098	34.9	31.3	-16.7
0.5107	36.6	32.5	-15.6
0.5116	37.1	33.0	-15.0
0.5125	37.3	33.1	-14.9
0.5135	37.6	33.1	-14.9
0.5145	37.5	32.9	-15.1
0.5155	37.0	32.5	-15.5
0.5165	36.3	31.9	-16.1
0.5175	34.7	30.5	-17.5
0.5185	30.6	27.4	-20.6
0.5195	36.0	31.2	-16.8
0.5205	36.1	31.6	-16.4
0.5215	36.7	31.7	-15.3
0.5225	36.4	31.7	-15.3
0.5235	35.8	31.4	-16.6
0.5245	35.3	30.8	-17.2
0.5255	32.2	29.2	-18.6
0.5265	32.4	27.0	-21.0
0.5275	29.2	25.4	-22.6
0.5285	35.3	28.4	-19.6
0.5295	31.5	27.6	-20.4
0.5305	34.8	29.0	-19.0
0.5315	32.3	27.1	-20.9
0.5325	32.2	27.4	-20.6
0.5335	28.3	27.1	-20.9
0.5345	31.8	26.9	-21.1
0.5355	30.6	27.2	-20.8
0.5365	30.6	30.3	-17.7
0.5375	30.0	30.3	-17.7
0.5385	35.2	32.5	-15.5

* Limit exceeded

POWER LINE POLARITY : NEUTRAL

5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The 30 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 21.5 + 7.4 + 1.1 = 30 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(30 \text{ dBuV/m})/20] = 31.6 \text{ uV/m}$$