

MEASUREMENT/TECHNICAL REPORT

HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.

MODEL : S450

This report concerns(check one) : Original grant **X** Class ☐ change

Equipment type : **MONITOR**

Deferred grant requested per 47 CFR 0.457(d)(1)(☐) ? yes___no **X**

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 **X**

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

Report prepared by : **BONG JAE, HUR - Manager of QA Office**

Company : HYUNDAI ELECTRONICS INDUSTRIES CO., LTD.

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1.1 Product Description

The Hyundai Electronics Industries Co., Ltd. Model S450(referred to as the EUT in this report) is a 14"COLOR Monitor HOR. Freq.48 kHz w/max. Resolution of 1024×768 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.≥ 1MHz)	8 MHz
CHIPSET BRAND AND PART NO.	HYUNDAI : 83003B SAMSUNG : KA38426 SAMSUNG : KA358 PHILIPS : TD4853 NATIONAL : LM2409T MOTOROLA : MC13281FTP MICROCHIP : 24LC04B
POWER REQUIREMENT	100 - 240 VAC 50/60Hz 1.3A
NUMBER OF LAYERS	MAIN BOARD 1 LAYER CRT SOCKET BOARD 1 LAYER
MAX. RESOLUTION	1024 X 768 NON-INTERLACED (@ 48 kHz/70 Hz)
H-SYNC FREQUENCY RANGE	30 kHz □ 50 kHz
V-SYNC FREQUENCY RANGE	50 Hz □ 130 Hz
CRT SIZE	14" (SAMSUNG / Type : M36KUM35X06)
VIDEO CONNECTOR TYPE	D-SUB 15-PIN

1.2 Related Submittal(s) / Grant(s)

ORIGINAL SUBMITTAL ONLY

1.3 Tested System Details

(including inserted cards) are:

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
COLOR MONITOR(EUT)	HYUNDAI	S450	CKLS450	HOST
PC(HOST)	H/P	HP BRIO 80XX	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	E420501****
CRT SOCKET BOARD	HYUNDAI	E420501****

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	PC 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

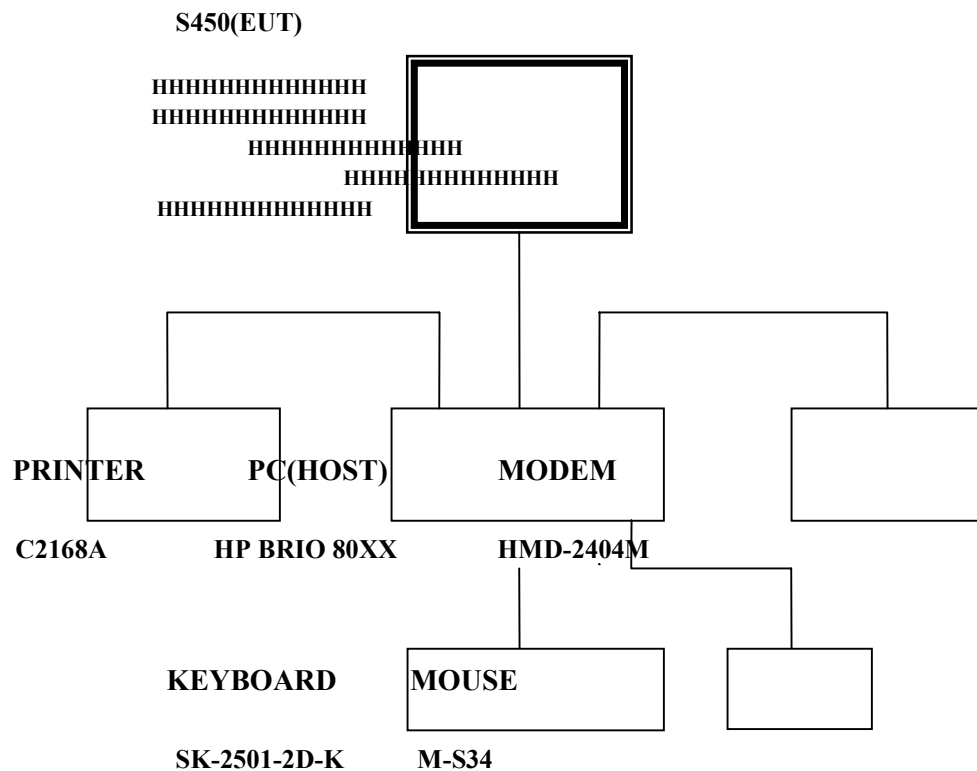
2.5 Equipment Modifications

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]



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 (48.3 kHz/60Hz)	X
Pentium 75 MHz	800 x 600 Non-Interlaced (46.8KHz/75Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (37.5KHz/75Hz)	

4.2 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 (48.3 kHz/60Hz)	X
Pentium 75 MHz	800 x 600 Non-Interlaced (46.8KHz/75Hz)	
Pentium 75 MHz	640 x 480 Non-Interlaced (37.5KHz/75Hz)	

Tested by Sang Jun, Lee

Date : NOV. 18. 1998

4.1 Conducted Emission Test

The following table shows the highest levels of conducted emissions on both polarization of hot and neutral line.

Humidity Level : 25% Temperature : 11 °C
Limit apply to : FCC CFR 47, PART 15, SUBPART B
Type of Tests : CLASS B
Date : NOV. 20, 1998
Result : PASSED BY 12.3 dB

EUT : 14" COLOR MONITOR
Operating Condition : 1024 X 768 Non-Interlaced (Hf : 48.3 KHz, Vf : 60Hz)
Detector : CISPR Quasi-Peak (6 dB Bandwidth : 9 KHz)

Power Line Conducted Emissions			FCC Class B	
Frequency (MHz)	Amplitude (dBuV)	Conductor	Limit (dBuV)	Margin (dB)
3.428	27.8	NEUTRAL	48	-20.2
4.057	28.5	HOT	48	-19.5
12.990	31.1	NEUTRAL	48	-16.9
19.460	35.7	NEUTRAL	48	-12.3
24.100	28.8	HOT	48	-19.2
25.940	31.7	HOT	48	-16.3
25.980	33.5	NEUTRAL	48	-14.5

Line Conducted Emission Tabulated Data

NOET:

1. All video modes and resolutions were investigated and the worst-case emissions are reported
Other video modes & resolution were tested and found to be in compliance.
2. The limit for Class B device is 250 uV from 450 kHz to 30 MHz.

Measured by : Sang Jun, Lee / Engineer

HYUNDAI

RFI Voltage Test

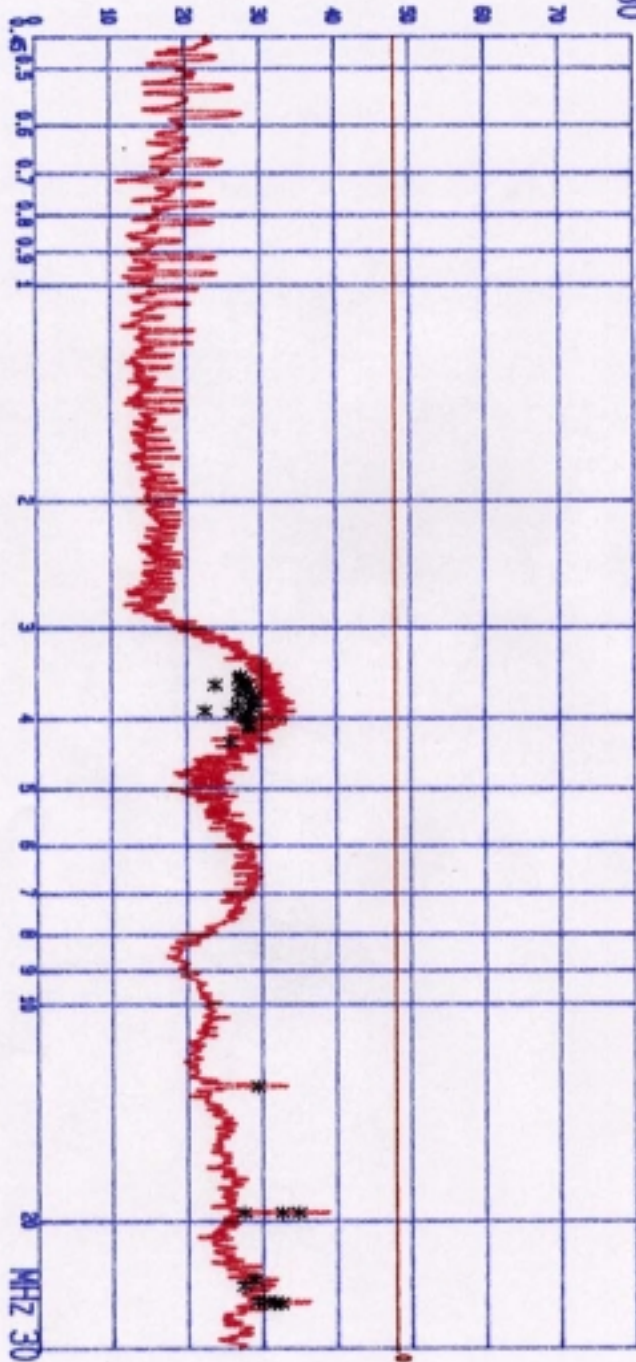
E.U.T.i: S450
Oper. Condition: 1024 * 768 (Hf=48.0MHz, Vt=60Hz)
Test Spec:
FCC PART 15 SUBPART B CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW KHz	Detec Type	Att. dB	Meas.T. #	Transd. Type
0.4500	5.0000	10	Peak	LN	0.020	
5.0000	20.0000	10	Peak	LN	0.010	

dBuV

80

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



POWER LINE POLARITY : HOT

HYUNDAI
RFI Voltage TestE.U.T.I. S450
Oper. condition: 1024 M 768 (44-48.0MHz . V1=60Hz)
Test spec:
FCC PART 15 SUBPART B CLASS B

Exceeding values on phase: N			
Frequency MHz	Peak dBuV	Q-Peak dBuV	OP-Margin dB
3.4815	32.9	27.2	-20.8
3.5222	32.2	27.0	-21.0
3.5290	32.0	27.7	-20.3
3.5703	32.6	27.5	-20.5
3.5772	31.7	28.3	-19.7
3.5841	32.0	23.9	-24.1
3.6261	33.0	27.8	-20.2
3.6885	32.6	28.4	-19.6
3.6756	32.1	27.1	-20.9
3.7185	33.0	29.1	-18.9
3.7594	33.7	28.4	-19.6
3.8135	34.4	29.0	-19.0
3.8209	32.5	26.9	-21.1
3.8555	33.4	28.8	-19.2
3.8881	31.7	22.4	-25.6
3.9108	34.7	29.2	-19.7
3.9184	31.7	26.0	-22.0
3.9555	31.6	27.8	-20.2
3.9842	33.3	27.8	-20.2
4.0106	33.6	28.1	-19.9
4.0575	33.4	28.5	-19.5
4.1050	32.2	28.2	-19.8
4.2006	31.6	25.9	-22.1
4.2890	33.5	29.5	-18.5
4.4600	39.0	34.9	-13.1
4.4700	32.1	27.4	-20.6
4.5100	35.5	32.7	-15.3
4.5100	32.0	29.6	-19.2
4.5789	31.6	27.4	-20.6
4.6300	35.5	30.3	-17.7
4.6400	35.4	31.7	-18.2
4.6500	32.7	29.2	-18.8
4.6700	35.1	31.4	-16.6
4.6800	35.9	32.5	-15.5
4.6899	34.6	31.5	-16.5

M Limit exceeded

POWER LINE POLARITY : HOT

HYUNDAI

RFI Voltage Test

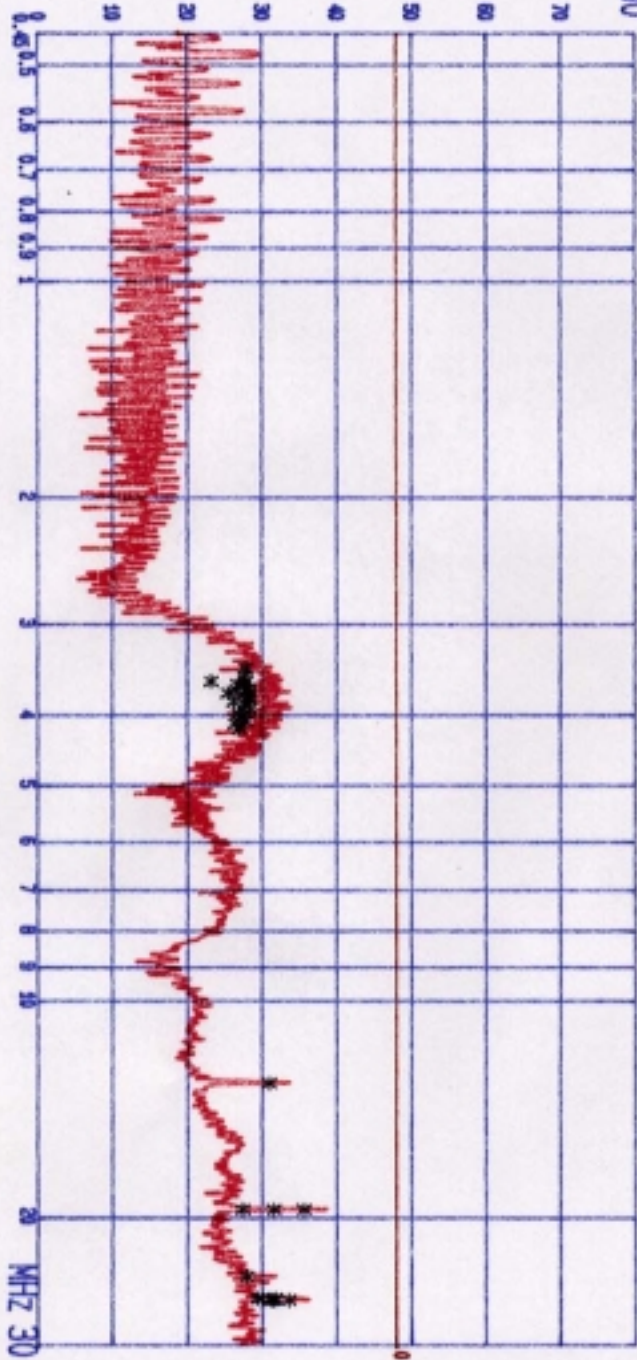
E.U.T.I. S450
Oper. Condition: 1024 x 768 (Hf=48.0KHz, Vf=60Hz)
Test spec:
FCC PART 15 SUBPART B CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW KHz	Detec Type	Att. dB	Meas.T. s	Tuned.
0.4500	5.0000	10	Peak	LN	0.020	
5.0000	30.0000	10	Peak	LN	0.010	

dBuV

80

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



POWER LINE POLARITY : NEUTRAL

HYUNDAI RFI Voltage Test

E.U.T.: S450
Oper. Condition: 1024 W 768 (Hf=48.0KHz, Vf=60Hz)
Test Spec:
FCC PART 15 SUBPART B CLASS B

Frequency MHz	Exceeding values on phase N		
	Peak dBV	Q-Peak dBV	Q-Margin dB
3.4280	31.5	27.8	-20.3
3.5290	32.5	27.7	-20.4
3.5772	32.8	27.9	-20.2
3.5841	31.5	23.2	-24.9
3.6181	32.1	26.8	-21.3
3.6264	32.3	27.5	-20.8
3.6585	32.5	28.3	-19.8
3.6756	32.2	28.6	-21.5
3.7186	33.8	28.2	-19.9
3.7258	31.4	25.4	-22.7
3.7694	32.3	28.2	-19.9
3.8135	31.8	28.3	-19.8
3.8209	31.5	26.2	-21.9
3.8656	33.6	27.9	-20.2
3.8108	34.1	28.5	-19.5
3.8842	32.7	25.8	-21.3
4.0106	32.8	27.3	-20.8
4.0575	32.9	27.8	-20.3
4.1030	32.3	25.5	-21.6
4.1828	32.4	27.0	-21.1
4.2980	33.9	31.1	-17.0
4.4800	38.9	35.7	-12.4
4.4700	31.4	27.4	-20.7
4.8100	38.2	31.7	-16.4
4.8100	32.1	28.1	-20.0
4.9300	34.6	30.0	-18.1
4.9400	35.3	31.8	-18.3
4.9500	32.4	29.4	-18.7
4.9700	36.1	31.6	-15.5
4.9800	36.5	33.6	-14.5
4.9899	34.5	31.3	-18.8

* Limit exceeded

POWER LINE POLARITY : NEUTRAL

4.2 Radiated Emissions Tests

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 20 % Temperature : 6 °C
 Limit apply to : FCC CFR 47, PART 15, SUBPART B
 Type of Tests : CLASS B
 Date : NOV. 20, 1998
 Result : PASSED BY 5.0 dB

EUT : 14" COLOR MONITOR

Operating Condition : 1024 X 768 Non-Interlaced (Hf : 48.3 kHz, Vf : 60 Hz)

Detector : CISPR Quasi-Peak (6 dB Bandwidth : 120 KHz)

Radiated Emissions		Ant.	Correction Factors	Total	FCC Class B	
Freq. (MHz)	Ampl. (dBuV)	Pol.	Antenna & Cable Loss (dB/m)	Ampl. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.4	17.0	V	18.0	35.0	40.0	-5.0
38.9	14.9	V	15.3	30.2	40.0	-9.8
45.4	16.4	V	13.8	30.2	40.0	-9.8
64.9	22.1	V	8.1	30.2	40.0	-9.8
77.9	23.4	V	7.6	31.0	40.0	-9.0
84.4	21.4	V	8.8	30.2	40.0	-9.8
97.4	23.1	H	10.9	34.0	43.5	-9.5
129.9	18.6	V	15.4	34.0	43.5	-9.5
155.8	15.7	H	17.5	33.2	43.5	-10.3
175.3	15.5	H	18.7	34.2	43.5	-9.3
201.3	12.4	V	20.1	32.5	43.5	-11.0
259.8	15.0	H	21.0	36.0	46.0	-10.0
279.2	13.9	V	21.9	35.8	46.0	-10.2
285.7	14.8	V	22.2	37.0	46.0	-9.2
292.2	15.7	V	22.3	38.0	46.0	-8.0
298.7	16.5	V	22.5	39.0	46.0	-7.0

NOTE:

- 1.All video modes and resolutions were investigated and the worst-case emissions are reported.
- 2.Other video modes & resolution were tested and found to be in compliance.

Measured by : Sang Jun, Lee / Engineer

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.

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

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