

# MEASUREMENT / TECHNICAL REPORT

**HYUNDAI ELECTRONICS INDUSTRIES CO.,LTD.**

**MODEL : F790**

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

Equipment type : **CRT 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.

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

Company : **HYUNDAI ELECTRONICS INDUSTRIES CO., LTD.**

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## 1. GENERAL INFORMATION

## 1.1 Product Description

The Hyundai Electronics Industries Co., Ltd. Model (referred to as the EUT in this report) is a 17" COLOR CRT Monitor HOR. Freq. 93.8 KHz w/max. Resolution of 1600X1200 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)	12 MHz
CHIPSET BRAND AND PART NO.	WELTREND : 3205001362 MYSON: 3204000577 SAMSUNG: 3200001434 NATIONAL SEMICO: 3200001191 SAMSUNG: ULM324 NATIONAL SEMICO: ULM358N TOSHIBA: 3331100041 SAMSUNG: ULM7805CT SAMSUNG: ULM7812CT
POWER REQUIREMENT	100 - 240 VAC 50/60Hz 1.5A
NUMBER OF LAYERS	MAIN BOARD 1 LAYER CRT BOARD 1 LAYER BNC BOARD 1 LAYER
MAX. RESOLUTION	1600 X 1200 NON-INTERLACED (@93.8 KHz/75 Hz)
H-SYNC FREQUENCY RANGE	30KHz 95KHz
V-SYNC FREQUENCY RANGE	50 Hz 150Hz
CRT SIZE	17" ( CRT Type :LG M41QBF423X11)

## 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
MONITOR (EUT)	HYUNDAI	F790	CKLC7R06090	HOST
PC(HOST)	H/P	DTPC-17	DoC	N/A
KEY BOARD	H/P	SK-2501-2D-K	GYUR385K	HOST
PRINTER	H/P	HP895C	DoC	HOST
MODEM	3COM CORPORATION	56K FAX MODEM	DoC	HOST
VIDEO CARD	DIAMOND	3D3000	DoC	HOST
MOUSE	H/P	M-S34	DZL211029	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 10 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	304010086601
CRT BOARD	HYUNDAI	304010086701
BNC BOARD	HYUNDAI	304010085401

## 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	1.8(P)
MONITOR(EUT)	N	Y	1.8(P), 1.5(D)
PRINTER	N	Y	2.0(P),1.5(D)
KEY BOARD	N/A	Y	2.0(D)
MODEM	N	Y	2.0(P),1.5(D)
MOUSE	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. (I/O CABLE)

	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
MONITOR(EUT)	Y	BOTH END	Y	BOTH END
PRINTER	N	N/A	Y	BOTH END
KEY BOARD	Y	PC END	N	N/A
MODEM	N	N/A	Y	BOTH END
MOUSE	N	N/A	N	N/A

## **2.5 Equipment Modifications**

**N/A**

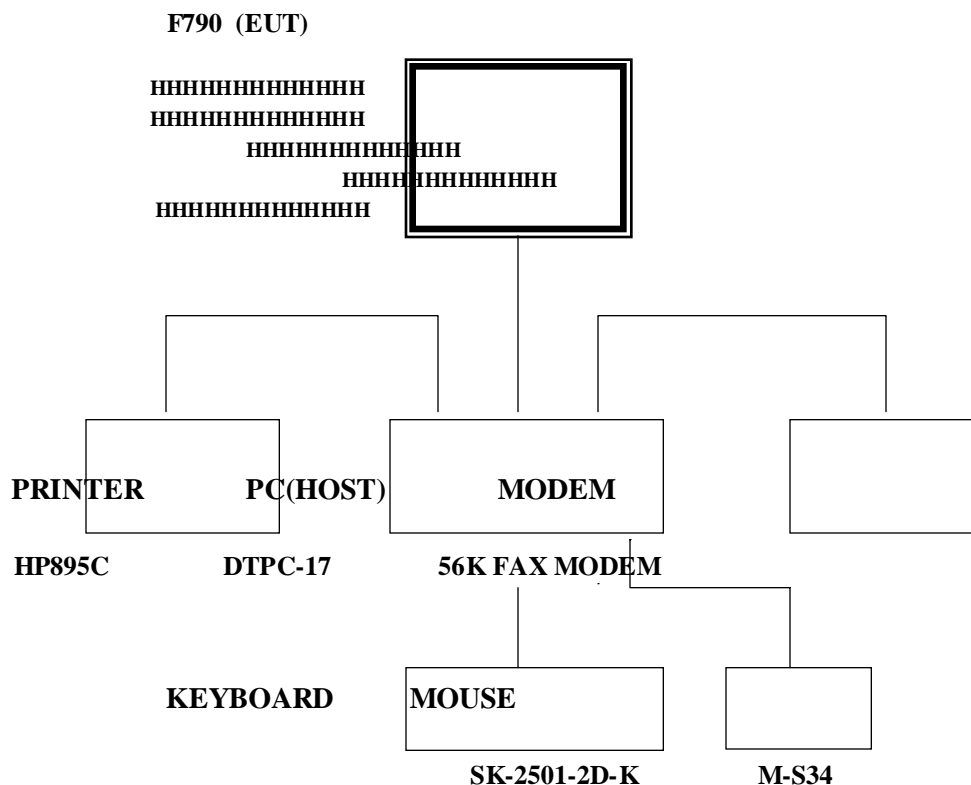
## 2.6 Configuration of Test system

**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 10 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 350 MHz	1024 x 768 Non-Interlaced (68.7KHz/85Hz)	
Pentium 350 MHz	800 x 600 Non-Interlaced (53.7 KHz/85Hz)	
Pentium 350 MHz	640 x 480 Non-Interlaced (50.6 KHz/100Hz)	
Pentium 350 MHz	1280x1024 Non-Interlaced (91.9 KHz/85Hz)	
Pentium 350 MHz	1600x1200 Non-Interlaced (93.8KHz/75Hz)	X

#### 4.2 Radiated Emission Tests

Processor Speed (MHz)	Video Resolution (w/max)	The worst operating condition
Pentium 350 MHz	1024 x 768 Non-Interlaced (68.7KHz/85Hz)	
Pentium 350 MHz	800 x 600 Non-Interlaced (53.7 KHz/85Hz)	
Pentium 350 MHz	640 x 480 Non-Interlaced (50.6 KHz/100Hz)	
Pentium 350 MHz	1280x1024 Non-Interlaced (91.9 KHz/85Hz)	
Pentium 350 MHz	1600x1200 Non-Interlaced (93.8KHz/75Hz)	X

**NOTE :**

The monitor(EUT) has two(2) video interface port(VGA 15pin D-sub, 5 BNC) to support various kinds of graphics adapters. So the test were performed with each video interface port. The final measurement was performed with VGA 15pin D-sub video interface port that produce the worst case emission.

Tested by **KEUN HO, PARK / Engineer**

Date : **JUNE 19, 2000**

## 4. FINAL CONDUCTED AND RADIATED EMISSION TESTS SUMMARY

### 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 : 45%                      Temperature : 24  
Limit apply to : CISPR 22  
Type of Tests : CLASS B  
Date : JUNE 20, 2000  
Result : PASSED BY -5.4 dB  
EUT : 17" CRT MONITOR

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Operating Condition : 1600 X1200 Non-Interlaced (Hf : 93.8 KHz, Vf : 75Hz)

Detector : CISPR Quasi-Peak (6 dB Bandwidth : 9 KHz)  
CISPR Average(6 dB Bandwidth : 9 KHz)

#### Line Conducted Emission Tabulated Data

Power Line Conducted Emissions			CISPR 22 (Average)	
Frequency (MHz)	Amplitude (dBuV)	Conductor	Limit (dBuV)	Margin (dB)
0.185	48.5	H	54.4	-5.9
0.843	40.6	H	46.0	-5.4
0.185	47.3	N	54.4	-7.1
0.843	39.4	N	46.0	-6.6

#### 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.

Measured by : KEUN HO, PARK / Engineer

Date : JUNE 20, 2000

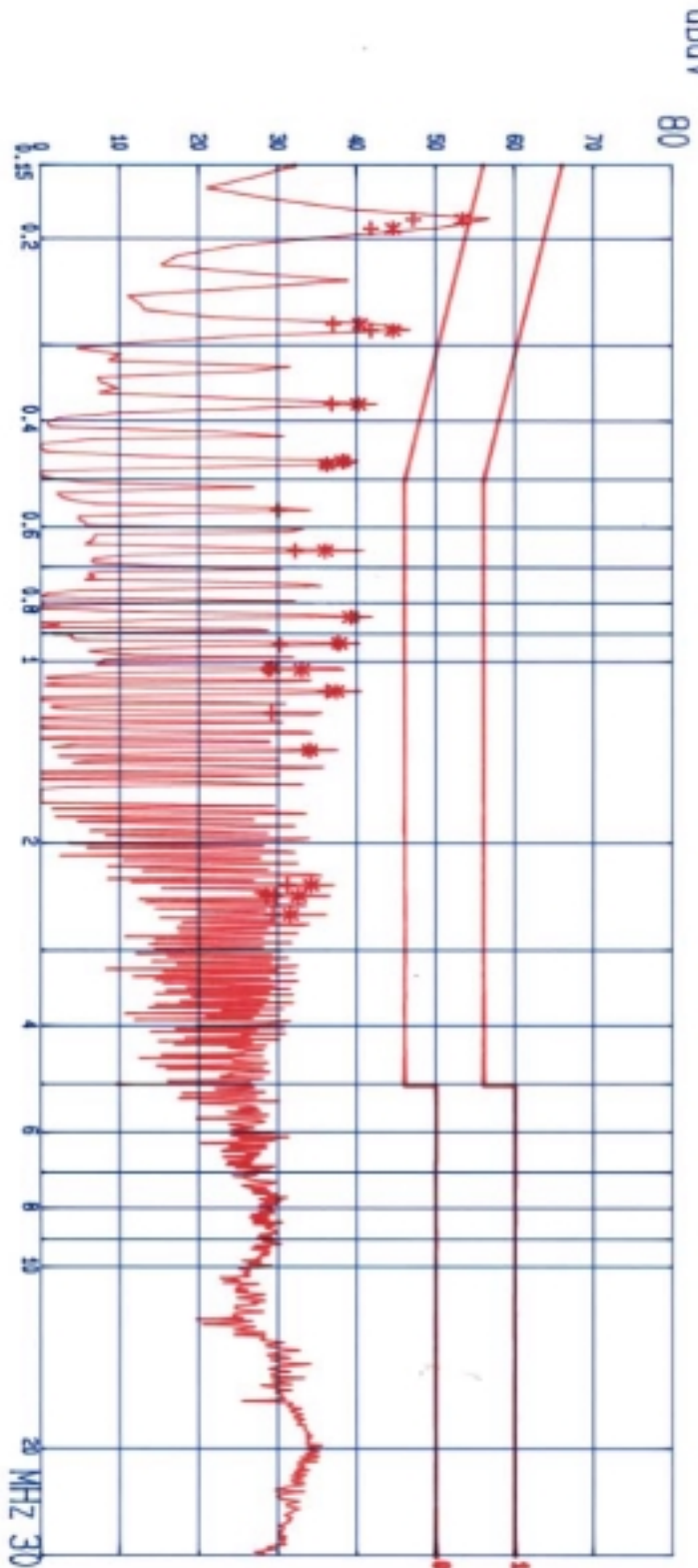


## RFI Voltage Test

E.U.T.: F790  
 Oper. Condition: 1600X1200 MHz; 83.8KHz VFI; 75MHz  
 Operator: Keun Ho, Park  
 Test Spec: CISPR 22 CLASS B

Start Fr. MHz	Stop Fr. MHz	IF-BW KHz	Detec type	Att. dB	Meas. T. #	Trended.
0.1500	5.0000	10	Peak	LD	0.010	
5.0000	30.0000	10	Peak	LN	0.010	

Final evaluation: Quasi Peak/average  
 \* = QUASI PEAK + = AVERAGE



POWER LINE POLARITY: NEUTRAL

## RFI Voltage Test

E.U.T.: F790  
 Oper. Conditions: 1500X1200 Hz; 93.8KHz V#: 75Hz  
 Operator: Keun Ho, Park  
 Test Spec:  
 CISPR 22 CLASS B

Start Freq. Stop Freq. IF-BW Detect Att. Meas. T. Transd.  
 MHz MHz KHz for dB s type  
 0.1500 5.0000 10 Peak LD 0.010  
 5.0000 30.0000 10 Peak LN 0.010

POWER LINE POLARITY: NEUTRAL

Guest Peak values		Q-Peak		QP-Margin	
Frequency MHz	Peak dBuV	Q-Peak dBuV	QP-Margin dB		
0.1850	55.8	53.4	-11.0		
0.1920	50.5	44.5	-19.4		
0.2760	42.5	40.5	-20.5		
0.2829	45.9	44.5	-16.2		
0.3740	42.7	40.3	-18.3		
0.4650	40.3	38.3	-18.3		
0.4720	39.1	36.2	-20.4		
0.6540	41.1	36.1	-19.9		
0.8430	42.0	39.3	-16.7		
0.9340	40.5	37.9	-18.1		
1.0250	37.7	29.3	-26.7		
1.0320	38.4	33.0	-23.0		
1.1230	40.7	37.4	-18.6		
1.4030	37.7	34.1	-21.9		
2.3410	37.3	34.3	-21.7		
2.4320	36.6	32.6	-23.4		
2.6210	35.2	31.7	-24.3		
Average values					
Frequency MHz	Peak dBuV	Average dBuV	Average-Margin dB		
0.1850	55.8	47.3	-7.1		
0.1920	50.5	41.9	-12.1		
0.2760	42.5	37.1	-13.9		
0.2829	45.9	41.9	-8.9		
0.3740	42.7	36.8	-11.8		
0.4650	40.3	38.4	-8.2		
0.4720	39.1	36.3	-10.3		
0.6540	41.1	30.1	-15.9		
0.8430	42.0	32.2	-15.8		
0.9340	40.5	39.4	-8.6		
1.0250	37.7	37.7	-8.3		
1.0320	38.4	30.3	-15.7		
1.1230	40.7	28.9	-17.1		
1.2140	35.7	26.3	-9.7		
1.4030	37.7	34.0	-12.0		
2.3410	37.3	31.2	-14.8		
2.4320	36.6	29.7	-16.3		
2.6210	35.2	28.7	-17.3		
* Limit exceeded		29.5	-15.5		

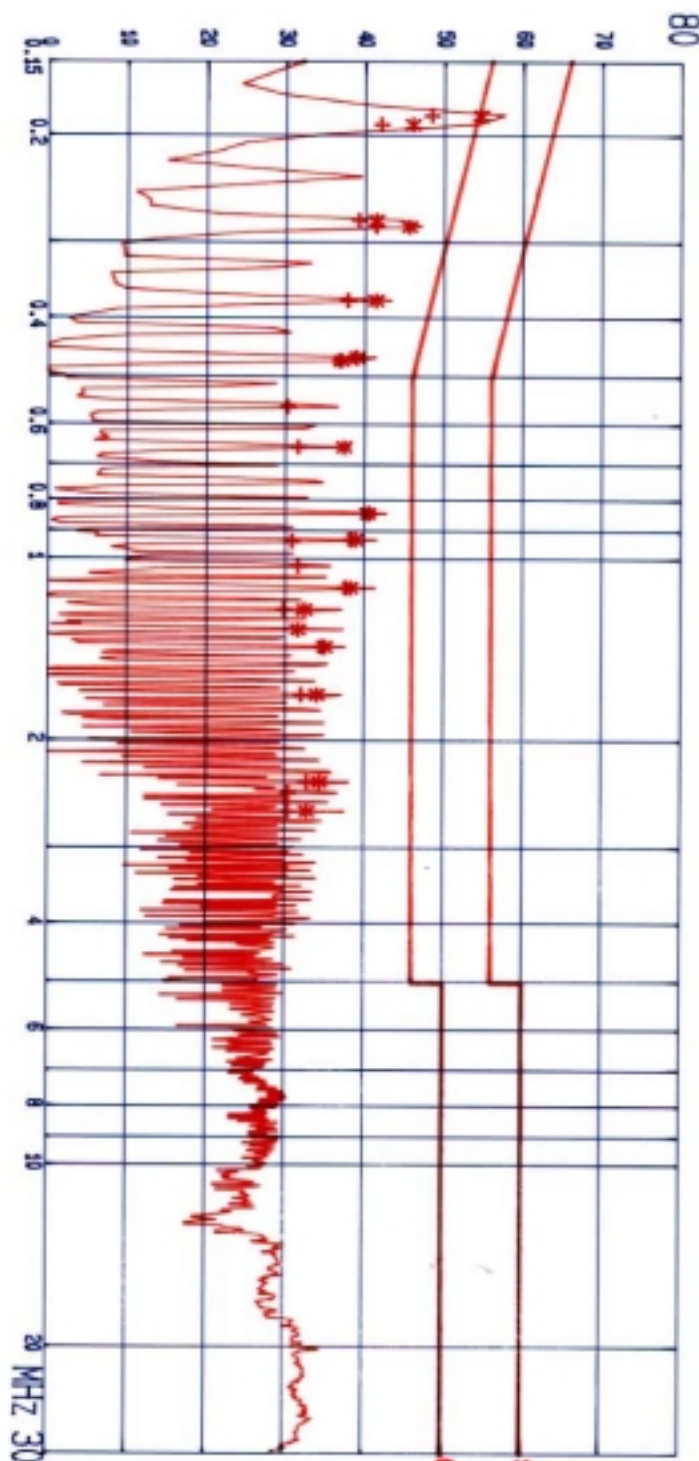
## RFI Voltage Test

E.U.T. :  
 Oper. Condition: F790  
 Operator: 1600X1200 Hf: 93.8KHz Vf: 75Hz  
 Test Spec: Keun Ho. Park  
 CIRPA 22 CLASS B

Start Freq.	Stop Freq.	IF-BW	Detector	Att.	Meas. T.	Transd.
MHz	MHz	KHz	type	dB	s	type
0.1500	5.0000	10	Peak	LD	0.010	
5.0000	30.0000	10	Peak	LN	0.010	

dBuV

Final evaluation: Quasi Peak/average  
 \* = QUASI PEAK + = AVERAGE



POWER LINE POLARITY: HOT

## RFI Voltage Test

E.U.T.: F790  
 Oper. Conditions: 1800X1200 Hz, 93.8KHz Vfr: 75Hz  
 Operator: Keun Ho, Park  
 Test Spec: CISPR 22 CLASS B

Start Fr. Stop Fr. IF-BW Detect Att. Meas. T. Transd.  
 MHz MHz KHz for dB s type  
 0.1850 5.0000 10 Peak LD 0.010  
 5.0000 30.0000 10 Peak LN 0.010

POWER LINE POLARITY: HOT

Quasi Peak values			
Frequency MHz	Peak dBuV	0-Peak dBuV	GP-Margin dB
0.1850	57.7	54.6	-3.7
0.1920	54.2	46.0	-18.0
0.2760	44.4	41.5	-19.4
0.2829	47.2	45.6	-15.1
0.3740	43.4	41.4	-17.1
0.4650	41.4	39.1	-17.4
0.4720	39.0	37.1	-19.4
0.6340	38.2	37.4	-18.6
0.8430	42.8	40.4	-15.5
0.9340	41.7	38.9	-17.1
1.1230	41.5	38.2	-17.7
1.2140	37.2	32.5	-23.5
1.3120	37.4	31.7	-24.2
1.4030	37.7	35.1	-20.9
1.6830	37.3	34.1	-21.8
2.3410	38.3	34.4	-21.5
2.6210	37.6	32.9	-23.1
Average values			
Frequency MHz	Peak dBuV	Average dBuV	Average-Margin dB
0.1850	57.7	48.5	-5.8
0.1920	54.2	42.1	-11.9
0.2760	44.4	39.2	-11.8
0.2829	47.2	41.5	-9.5
0.3740	43.4	37.8	-10.8
0.4650	41.4	38.9	-7.7
0.4720	39.0	36.9	-9.7
0.5629	36.6	30.3	-15.7
0.6340	38.2	31.7	-14.5
0.8430	42.8	40.6	-5.4
0.9340	41.7	38.3	-7.7
0.9410	35.2	30.9	-15.1
1.0320	35.8	31.7	-14.3
1.1230	41.5	37.7	-8.3
1.2140	37.2	29.9	-16.1
1.4030	37.7	34.6	-11.4
1.6830	37.3	32.0	-14.0
2.3410	38.3	32.8	-13.2
2.4320	38.9	30.5	-15.5
2.6210	37.6	30.5	-15.5
M Limit exceeded			

## 4.2 Radiated Emissions Tests

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

Humidity Level : 30 %                      Temperature : 20

Limit apply to : CISPR 22

Type of Tests : CLASS B

Date : JUNE 21, 2000

Result : PASSED BY -3.7 dB

EUT : 17" COLOR MONITOR

Operating Condition : 1600 X 1200 Non-Interlaced (Hf :93.8 kHz, Vf : 75 Hz)

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

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dB	Margin dB
40.4	9.74	15.26	1.30	V	26.3	30.0	-3.7
60.6	17.02	7.18	1.70	V	25.9	30.0	-4.1
101.1	12.52	10.78	2.10	V	25.4	30.0	-4.6
101.1	12.32	10.78	2.10	H	25.2	30.0	-4.8
141.6	8.11	14.59	2.50	V	25.2	30.0	-4.8
161.8	8.70	14.80	2.70	V	26.2	30.0	-3.8
161.8	7.30	14.80	2.70	H	24.8	30.0	-5.2
222.5	4.75	17.05	3.30	V	25.1	30.0	-4.9
225.5	5.28	17.12	3.30	V	25.7	30.0	-4.3
242.7	7.34	17.56	3.50	V	28.4	37.0	-8.6
424.8	8.95	16.95	4.30	V	30.2	37.0	-6.8
445.0	7.59	17.21	4.60	V	29.4	37.0	-7.6
465.3	7.79	17.91	4.80	V	30.5	37.0	-6.5
485.5	5.87	18.13	4.80	V	28.8	37.0	-8.2
606.8	4.86	20.84	5.80	V	31.5	37.0	-5.5

**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.
3. The EUT was test up to 2GHz and no significant emission was found.

Measured by : KEUN HO, PARK / Engineer

Date : JUNE 21, 2000



## 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.

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

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