HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

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SAN 136-1, AMI-RI , BUBAL-EUP, ICHEON-SI, KYOUNKI-DO, 467-701, KOREA
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CERTIFICATION (Permissive change class□)

Manufacture;
HYUNDAI IMAGEQUEST CO., LTD.

SAN 136-1, AMI-RI , BUBAL-EUP, ICHEON-SI, KYOUNKI-DO, 467-701,KOREA

HYUNDAI IMAGEQUEST FRN : 0005-8664-39

Date of Issue : JULY 15, 2004

Test Report No.: HCT-F04-0707

Test Site: HYUNDAI CALIBRATION & CERTIFICATION TECHNOLOGIES CO., LTD.
HCT FRN : 0005-8664-21

FCC ID : **PJIL17A0D080**

MODEL / TYPE : **L70S/L17A0D080**

Rule Part(s):	**Part 15 & 2; ET Docket 95-19**
Equipment Class:	**FCC Class B Peripheral Device (JBP)**
Standard(s):	**FCC Class B: 2003 (CISPR 22)**
EUT Type:	**17" LCD Monitor**
Max. Resolution(s):	**1280 X 1024 (@80.0KHz/ 75Hz)**
Model / Type:	**L70S / L17A0D080**
Port/Connector(s)	**15-pin D-sub VGA connector, AUDIO IN/OUT.**
LCD Panel	**Boe Hydis (HT17E13-100)**

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2001

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Report prepared by : Ki-Soo Kim
Manager of EMC Tech. Part

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MEASUREMENT REPORT

1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

Applicant Name:	**HYUNDAI IMAGEQUEST**
Address:	**SAN 136-1, AMI-RI , BUBAL-EUP, ICHEON-SI, KYOUNKI-DO, 467-701,KOREA**

- **FCC ID : PJIL17A0D080**
- Equipment Class: FCC Class B Peripheral Device (JBP)
- EUT Type: 17” LCD MONITOR
- Model(s): L70S
- LCD Panel: Boe Hydis (HT17E13-100)
- Max. Resolution: 1280 X 1024 (@80.0KHz/ 75Hz)
- Frequency Range: V-Sync: 56Hz – 75Hz , H-Sync: 31KHz – 80KHz
- Cable(s): Shielded D-Sub (with ferrite on both ends), Audio cable(with ferrite on both ends)
- Power Cord: Unshielded
- Rule Part(s): FCC Part 15 Subpart B
- Test Procedure(s): ANSI C63.4 (2001)
- Dates of Tests: June 29, 2004 ~ July 01, 2004
- Place of Tests: 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO,467-701,KOREA

2.1 INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSIC63.4-2001) was used in determining radiated and conducted emissions emanating from **HYUNDAI IMAGEQUEST CO., LTD. 17-inch LCD Monitor FCC ID: PJIL17A0D080**

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 C63.4and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 23,2003 (Confirmation Number: EA90661)

3.1 PRODUCT INFORMATION

3.2 Equipment Description

Equipment Under Test (EUT) is the **HYUNDAI IMAGEQUEST CO., Ltd. (Model : L70S) 17-inch LCD Monitor**

FCC ID**: : PJIL17A0D080**

Maximum Resolution(s): 1280 X 1024 (@80.0KHz/ 75Hz)

Frequency Range(s): H-Sync: 31KHz – 80KHz
V-Sync: 56Hz – 75 Hz
Pixel Pitch: 0.264mm

Power Supply: AC 100-240V 60/ 50Hz 1.0A

Power Cord: *Unshielded* AC power cord

Port(s)/Input Connector(s): 15-pin D-sub VGA connector, Audio In/Out

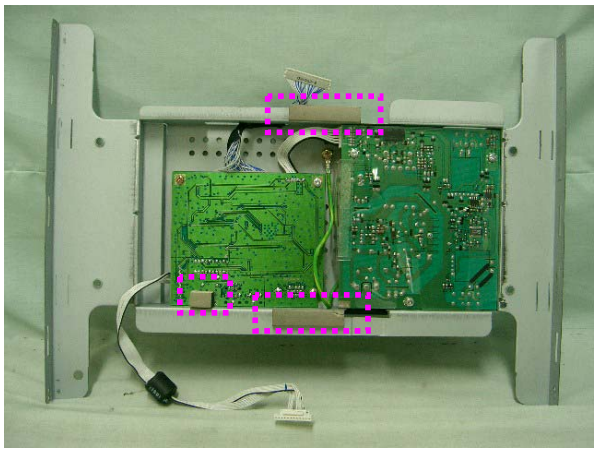
Cable(s): Shielded D-Sub (with ferrite on both ends), Audio cable(with ferrite on both ends)

Dimensions (WxHxD): 396x414x200mm (WxHxD)

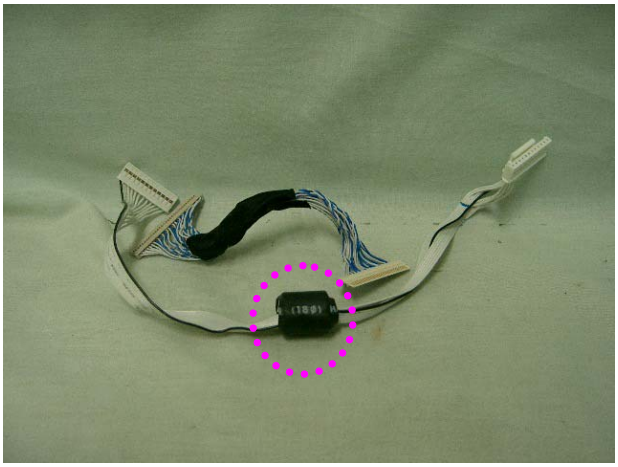
Weight (Net):3.7Kg unpacked

EMI Suppression Devices:

1. Attach a gasket on the main frame and main board to contact the LCD panel



2. Apply ferrite core to OSD signal line



4.1 Description of Tests(Conducted)

4.2 Powerline Conducted RFI (150kHz- 30MHz)

The power line conducted RFI measurements were performed according to CISPR 22.
The EUT was placed on a non-conducting 1.0 by 1.5 meter table which is 0.8 meters in height and 0.40 meters away from the vertical wall of the shielded enclosure. Power to the EUT is provided through a Rohde & Schwarz 50 Ω / 50 uH Line Impedance Stabilization Network (LISN) and the support equipment through a separate Solar 50 Ω / 50 uH Line- Conducted Test Facility LISN. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME. The spectrum was scanned from 150kHz to 30 MHz. Each maximum EME was remeasured using an EMI receiver. The detector function of the receiver was set to CISPR quasi- peak and average mode with the bandwidth set to 9 kHz. Each emission was maximized consistent with the typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum Diagram emission. Excess cable lengths were bundled at the centre with 30- 40cm. in length. The worst-case configuration is noted in the test report and the photographs are attached. Each EME reported was calibrated using the Rohde & Schwarz SMX signal generator and are listed on Table 1. RFI Conducted FCC Class B

RFI CONDUCTED	**CISPR 22 CLASS B Limits dB(uV/m)**	
Freq. Range	**CISPR 22 Quasi-Peak**	**CISPR 22 Average**
150kHz - 0.5MHz	**66-56****	**56-46****
0.5MHz - 5MHz	**56**	**46**
5MHz - 30MHz	**60**	**50**
***FCC Class B limits starts from 450kHz **Limits decreases linearly with the logarithm of frequency**		

Table 1. RFI Conducted Limits

4.3 Description of Tests(Radiated)

Radiated Emissions

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The spectrum was scanned from 30 to 300 MHz using biconical antenna, 300 to 1000 MHz using log- periodic antenna, and above 1 GHz using linearly polarized horn antennas. Final measurements were made outdoors at 10-meter test range using Dipole antennas and EMI receiver. For frequencies above 1 GHz, horn antennas were used. Sufficient time for the EUT, support equipment, and test equipment were allowed in order for them to warm up to their normal operating condition. The EMI receiver detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz. The EUT, support equipment, and interconnecting cables were arranged to the configuration that produces the maximum EME emission found during preliminary scan. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Horizontal and vertical antenna polarizations were checked. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/ or support equipment, and powering the monitor the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission.

ITE Radiated Limits			
Frequency (MHz)	**FCC Limit @ 3m. Quasi-Peak dB[μV/m]**	**FCC Limit @ 10m.* Quasi – Peak dB [μV/m]**	**CISPR Limit @ 10m. Quasi-Peak dB [μV/m]**
30-88	**40.0**	**29.5**	**30.0**
88-216	**43.5**	**33.0**	**30.0**
216-230	**46.0**	**35.6**	**30.0**
230-960	**46.0**	**35.6**	**37.0**
960-1000	**54.0**	**43.5**	**37.0**
> 1000	**54.0**	**43.5**	**No Specified Limit**
*** Limit extrapolated 20 dB/decade**			

Table 2. Radiated Class B limits @ 10-meters

5.1 Support Equipment Used

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
MONITOR (EUT)	HYUNDAI IMAGEQUEST CO., LTD.	L70S	PJIL17A0D080	P.C
P.C	H.P	HP Pavilion 8921	DoC	N/A
KEY BOARD	H.P	5181	DoC	P.C
MOUSE	Microsoft	IntelliMouse	DoC	P.C
PRINTER	H/P	C4569A	DoC	P.C
SERIAL MOUSE	Logitech	M-M28	DoC	P.C
HEADSET	Tsound	CAS08	DoC	EUT

5.2 Cable Description

	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
MONITOR(EUT)	N	Y	1.8(P), 1.5(D)
PC(HOST)	N	N/A	1.8(P)
KEY BOARD	N/A	Y	1.8(D)
MOUSE	N/A	Y	1.8(D)
PRINTER	N	Y	1.8(P),1.8(D)
SERIAL MOUSE	N/A	Y	1.8(D)
AUDIO IN	N/A	Y	1.5(D)
HEADSET	N/A	N	1.8(D)

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

5.3 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
KEY BOARD	N	N/A	Y	P.C END
MOUSE	Y	N/A	Y	P.C END
PRINTER	N	N/A	Y	BOTH END
SERIAL MOUSE	N	N/A	Y	EUT END
AUDIO IN	Y	BOTH END	N	N/A
HEADSET	Y	P.C END	N	N/A

6.1 LINE-CONDUCTED TEST DATA

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EMC TESTING Laboratory

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EUT:                    L70S
Manufacturer:           HYUNDAI IMAGEQUEST CO., LTD.
Operating Condition:    1280 X1024 75Hz
Test Site:              Shield Room
Operator:               KS, KIM
Test Specification:     CISPR 22 CLASS B
Comment:                N
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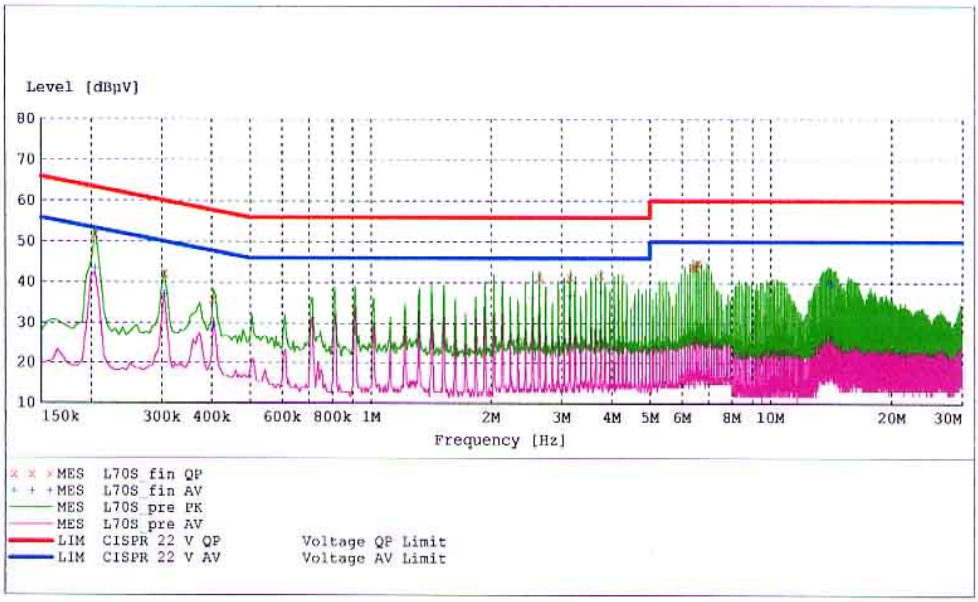
SCAN TABLE: "CISPR 22 Voltage"

Short Description: CISPR 22 Voltage

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
5.0 MHz	30.0 MHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None



MEASUREMENT RESULT: "L70S_fin QP"
6/29/04 11:20AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	51.90	10.1	63	11.5	1	---
0.305000	42.20	10.1	60	17.9	1	---
0.405000	35.90	10.1	58	21.8	1	---
2.645000	41.40	10.3	56	14.6	1	---
3.155000	41.40	10.2	56	14.6	1	---
3.765000	41.90	10.3	56	14.1	1	---
6.410000	44.00	10.3	60	16.0	1	---
6.515000	43.60	10.3	60	16.4	1	---
6.615000	44.80	10.3	60	15.2	1	---

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MEASUREMENT RESULT: "L70S_fin AV"

6/29/04 11:20AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	43.50	10.1	53	9.9	1	---
0.305000	37.10	10.1	50	13.0	1	---
0.405000	29.50	10.1	48	18.2	1	---
2.545000	36.20	10.3	46	9.8	1	---
3.155000	36.70	10.2	46	9.3	1	---
3.765000	37.70	10.3	46	8.3	1	---
13.940000	40.20	10.5	50	9.8	1	---
14.145000	39.90	10.5	50	10.1	1	---
14.245000	39.30	10.5	50	10.7	1	---

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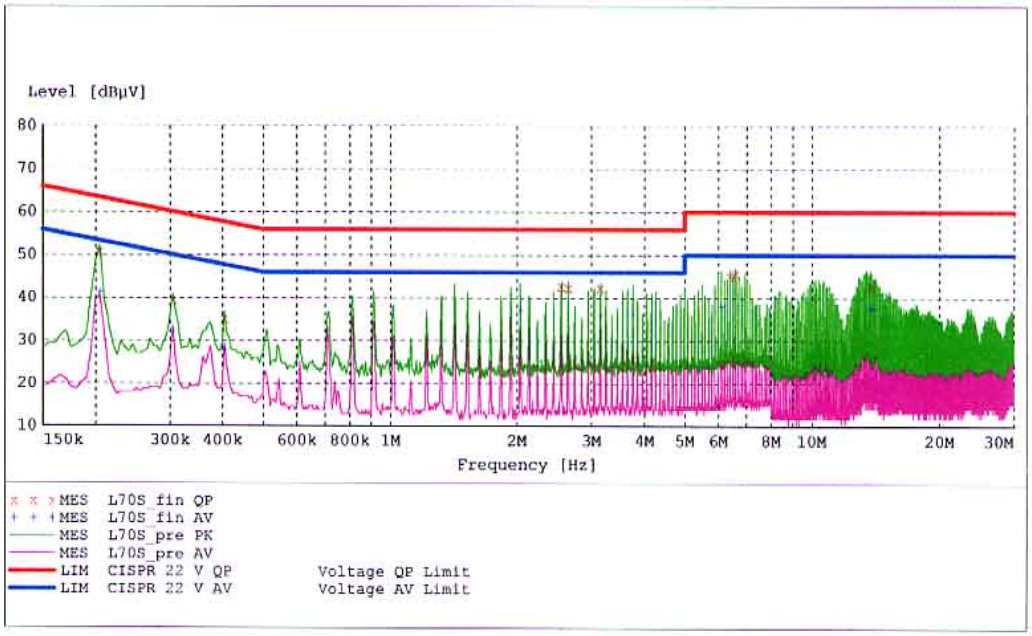
EUT: L70S
Manufacturer: HYUNDAI IMAGEQUEST CO., LTD.
Operating Condition: 1280 X1024 75Hz
Test Site: Shield Room
Operator: KS, KIM
Test Specification: CISPR 22 CLASS B
Comment: H

SCAN TABLE: "CISPR 22 Voltage"

Short Description: CISPR 22 Voltage

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 kHz	500.0 kHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None
5.0 MHz	30.0 MHz	5.0 kHz	MaxPeak Average	10.0 ms	9 kHz	None



MEASUREMENT RESULT: "L70S_fin QP"

6/29/04 11:24AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	50.70	10.1	63	12.7	1	---
0.305000	39.50	10.1	60	20.6	1	---
0.405000	35.00	10.1	58	22.8	1	---
2.545000	42.80	10.3	56	13.2	1	---
2.645000	42.20	10.3	56	13.8	1	---
3.155000	42.20	10.2	56	13.8	1	---
6.410000	45.30	10.3	60	14.7	1	---
6.615000	45.70	10.3	60	14.3	1	---
13.740000	42.80	10.5	60	17.2	1	---

MEASUREMENT RESULT: "L70S_fin AV"

6/29/04 11:24AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	41.30	10.1	53	12.1	1	---
0.305000	32.00	10.1	50	18.2	1	---
0.405000	27.70	10.1	48	20.1	1	---
2.035000	37.10	10.3	46	8.9	1	---
3.155000	36.00	10.2	46	10.0	1	---
3.765000	36.30	10.3	46	9.7	1	---
6.105000	38.20	10.3	50	11.8	1	---
13.840000	37.50	10.5	50	12.5	1	---
13.940000	37.90	10.5	50	12.1	1	---

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NOTES:

1. **All modes of operation were investigated and the worst-case emissions are reported.**
2. **The CISPR RFI conducted limits are listed on Table 1 (Page 7).**
3. **Line H = Hot Line N = Neutral**

** Measurements using CISPR quasi-peak mode.

7.1 RADIATED TEST DATA

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
40.5	7.1	15.0	1.3	V	**23.4**	30	-6.6
67.1	16.0	6.6	1.8	H	**24.4**	30	-5.6
72.1	15.0	6.3	1.8	V	**23.1**	30	-6.9
108.9	10.8	11.4	2.3	V	**24.5**	30	-5.5
144.0	5.8	14.7	2.6	V	**23.1**	30	-6.9
235.0	5.1	17.2	3.5	V	**25.8**	30	-4.2
298.2	9.0	19.6	4.0	V	**32.6**	37	-4.4
585.7	6.3	20.8	5.5	H	**32.6**	37	-4.2
612.0	5.9	21.5	5.7	H	**33.1**	37	-3.9
669.2	4.0	22.6	5.9	H	**32.5**	37	-4.5
689.1	4.4	22.5	6.0	V	**32.9**	37	-4.1
637.7	5.0	22.3	5.8	V	**33.1**	37	-3.9

Radiated Measurements at 10-meters.

1280 X 1024 (@80.0KHz/ 75Hz)

NOTES:

1. All modes of operation were investigated, and the worst-case emissions are reported.
2. The radiated limits are listed on Table 2 (Page 8).

** AFCL = Antenna Factor (Roberts dipole) and Cable Loss .

*** Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

8.1 Sample Calculations

dB □ = 20 log $_{10}$ (□/m)

8.2 Example 1:

@ 0.205MHz

Class B limit = 63.4 dBμV
Reading = 51.9 dBμV (calibrated level)

Margin = 51.9 – 63.4 = - 11.5
= 11.5 dB below limit

8.3 Example 2:

@ 612.0 MHz

Class B limit = 37 dBμV/m
Reading = 5.9 dBμV/m (calibrated level)
Antenna Factor + Cable Loss = 27.2 dB
Total = 33.1dBμV/m

Margin = 33.1 - 37 = - 3.9
= 3.9 dB below limit

9.1 Test Equipment

Type	Manufacture	Model Number	CAL Date
EMI Test Receiver	Rohde & Schwarz	ESI40	2003.11.16
EMI Test Receiver	Rohde & Schwarz	ESVS30	2003.07.15
LISN	Rohde & Schwarz	ESH2-Z5	2003.08.21
LISN	Rohde & Schwarz	ESH3-Z2	2003.11.12
Amplifier	Hewlett-Packard	8447E	2004.04.26
Dipole Antennas	Schwarzbeck	VHAP	2004.04.08
Dipole Antennas	Schwarzbeck	UHAP	2004.04.08
TRILOG Antenna	Schwarzbeck	9160	2004.04.06
Antenna Position Tower	HD	MA240	N/A
Turn Table	EMCO	1050	N/A
Power Analyzer	Voltech	PM 3300	2004.04.02
Reference Network Impedance	Voltech	IEC 555	N/A
AC Power Source	PACIFIC	Magnetic Module	N/A
AC Power Source	PACIFIC	360-AMX	2003.12.10
Controller	HD GmbH	HD 100	N/A
SlideBar	HD GmbH	KMS 560	N/A

10.1 Test Software Used

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.

NOTE: This is a sample of the basic program used during the test. However, during testing, a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

Actual program used is the “H” pattern in Notepad under Windows environment. All resolution modes (1280x1024, 1024x768, 800x600, 640x480, 720x400) were investigated and tested

11.1 Conclusion

The data collected shows that the HYUNDAI IMAGEQUEST CO., LTD. 17-inch LCD Monitor **FCC ID: PJIL17A0D080** complies with §15.107 and §15.109 of the FCC Rules.