



**HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.**

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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 16, 2004**  
  
**Test Report No.: HCT-F04-0715**  
  
**Test Site: HYUNDAI CALIBRATION & CERTIFICATION  
TECHNOLOGIES CO., LTD.**  
**HCT FRN : 0005-8664-21**

**FCC ID :**

**PJIL17C0D081**

**MODEL / TYPE :**

**Q17/L17C0D081**

**Rule Part(s):** Part 15 & 2; ET Docket 95-19  
**Equipment Class:** FCC Class B Peripheral Device (JBP)  
**Standard(s):** FCC Class B: (CISPR 22)  
**EUT Type:** 17" LCD Monitor  
**Max. Resolution(s):** Analog:1280 X 1024(@80.0KHz/75Hz), Digital: 1280 X 1024(@63.9KHz/60Hz)  
**Model(s):** Q17  
**Port/Connector(s)** 15-pin D-sub VGA, 20-pin DVI-D (Digital RGB) connector, AUDIO IN/OUT,  
USB Upload/Download.  
**LCD Panel** Samsung Electronics (LTM170EU-L11)

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.

*Ki Soo Kim*

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.

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

- **FCC ID : PJIL17COD081**
- Equipment Class: FCC Class B Peripheral Device (JBP)
- EUT Type: 17" LCD MONITOR
- Model(s): Q17
- LCD Panel: Samsung Electronics (LTM170EU-L11)
- Max. Resolution: Analog:1280 X 1024(@80.0KHz/75Hz), Digital: 1280 X 1024(@63.9KHz/60Hz)
- Frequency Range: V-Sync: 56Hz – 75Hz , H-Sync: 31KHz – 80KHz
- Cable(s): Shielded D-Sub (with ferrite on both ends), Shielded DVI-D (with ferrite on both ends)  
Shielded USB (with ferrite on both ends), Shielded AUDIO (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 21, 2004 ~ June 28, 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 (ANSI C63.4-2001) was used in determining radiated and conducted emissions emanating from **HYUNDAI IMAGEQUEST CO.,LTD. 17-inch LCD Monitor FCC ID: PJIL17C0D081**

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 : Q17 )**  
**17-inch LCD Monitor**

FCC ID: : **PJIL17COD081**

Maximum Resolution(s): Analog:1280 X 1024(@80.0KHz/75Hz),  
Digital: 1280 X 1024(@63.9KHz/60Hz)

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

Pixel Pitch: 0.264mm

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

Power Cord: *Unshielded* AC power cord

Port(s)/Input Connector(s): 15-pin D-sub VGA connector, 20-pin DVI-D connector, AUDIO IN/OUT,  
USB Upload/Download.

Cable(s): Shielded D-Sub (with ferrite on both ends), Shielded DVI-D (with ferrite on both ends)  
Shielded USB (with ferrite on both ends), Shielded AUDIO (with ferrite on both ends)

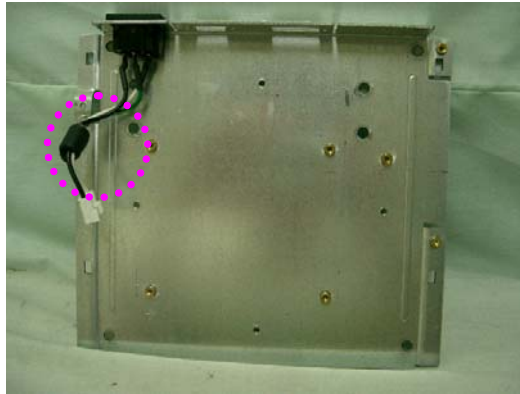
Dimensions (W×H×D): 396×414×200mm(W×H×D)

Weight (Net): 4.8Kg unpacked

### **EMI Suppression Devices:**

Please refer to next page of the photographs for Solution for EMI

**1. Apply a ferrite Core to the Power Cable**



**2. Attach a aluminum foil between Main Frame and LCD panel**



**3. Attach a gasket to stand connector**



## 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	FCC CLASS B Limits dB(uV/m)	CISPR 22 CLASS B Limits dB(uV/m)	
Freq. Range	FCC Class B Quasi-Peak	CISPR 22 Quasi-Peak	CISPR 22 Average
150kHz - 0.5MHz	48*	66-56**	56-46**
0.5MHz - 5MHz	48	56	46
5MHz - 30MHz	48	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.	Q17	PJIL17C0D081	P.C
P.C	H.P	HP Pavilion 8921	DoC	N/A
KEY BOARD	H.P	5181	DoC	P.C
MOUSE	Microsoft	IntelliMouse(PS/2)	DoC	P.C
PRINTER	H/P	C4569A	DoC	P.C
SERIAL MOUSE	LOGITECH	M-M28	DoC	P.C
USB MOUSE	Microsoft	IntelliMouse(USB)	DoC	EUT
HEADSET	T-SOUND	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), 1.8(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)
USB UPLOAD	N/A	Y	1.8(D)
USB MOUSE	N/A	Y	1.8(D)
AUDIO IN	N/A	Y	1.8(D)
HEADSET	N/A	Y	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	P.C END	Y	P.C END
PRINTER	N	N/A	Y	BOTH END
SERIAL MOUSE	N	N/A	Y	EUT END
USB UPLOAD	Y	BOTH END	Y	BOTH END
USB MOUSE	Y	EUT END	Y	EUT END
AUDIO IN	Y	BOTH END	N	N/A
HEADSET	N	N/A	N	N/A

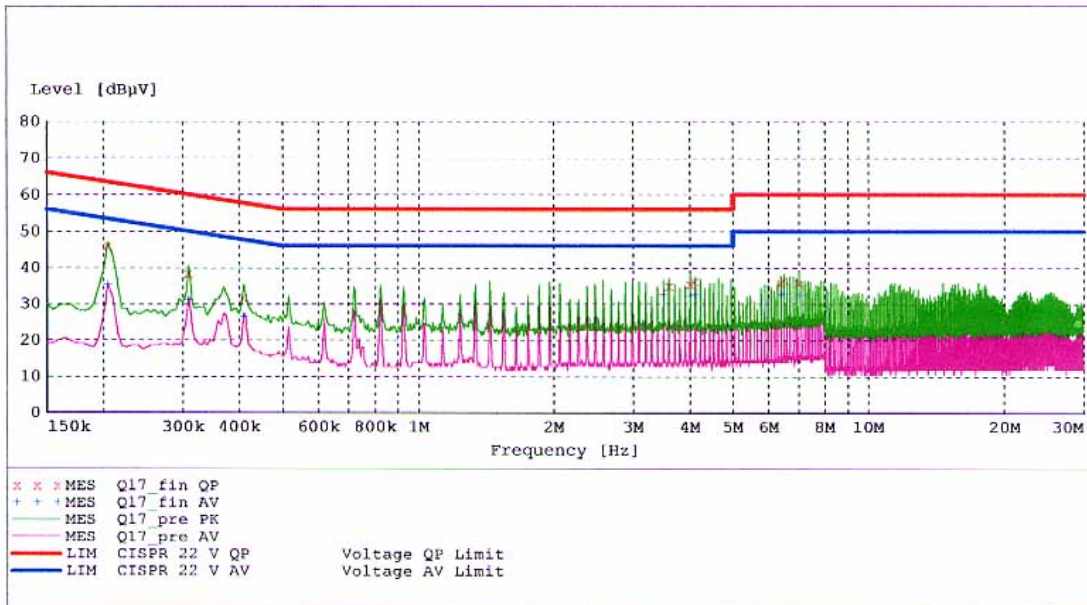
## 6.1 LINE-CONDUCTED TEST DATA

**HCT**  
**EMC TESTING Laboratory**

EUT: Q17  
 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"**

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



**MEASUREMENT RESULT: "Q17\_fin QP"**

6/24/04 11:03AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	46.00	10.1	63	17.4	1	---
0.310000	38.50	10.1	60	21.5	1	---
0.410000	31.70	10.1	58	26.0	1	---
3.615000	34.90	10.2	56	21.1	1	---
4.025000	35.40	10.3	56	20.6	1	---
4.130000	36.20	10.3	56	19.8	1	---
6.400000	35.70	10.3	60	24.3	1	---
6.505000	36.60	10.3	60	23.4	1	---
7.020000	35.70	10.3	60	24.3	1	---

**MEASUREMENT RESULT: "Q17\_fin AV"**

6/24/04 11:03AM

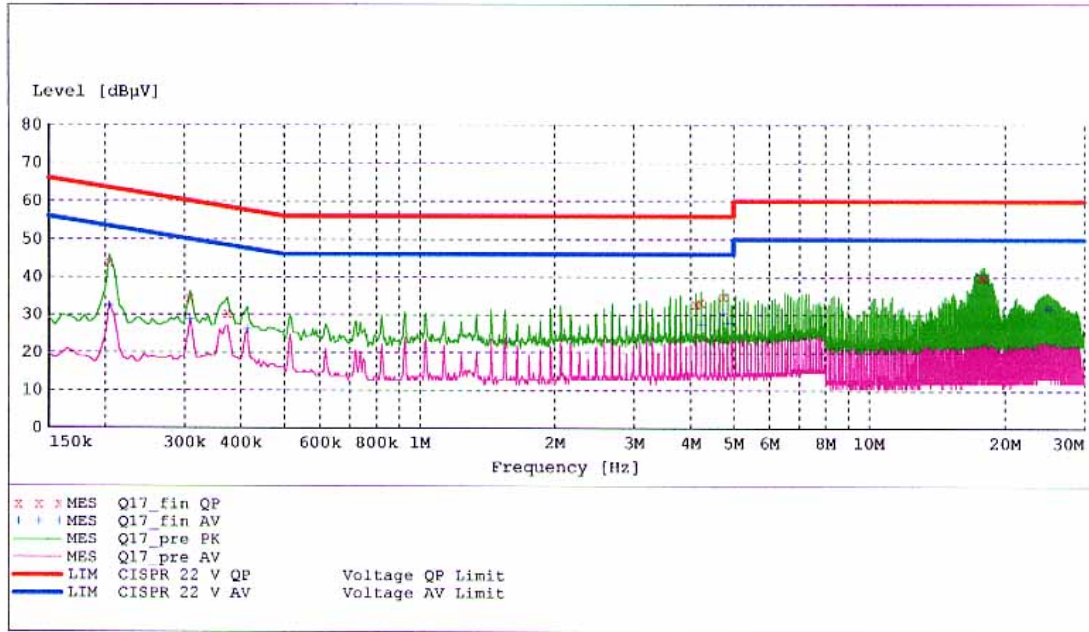
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.205000	35.50	10.1	53	17.9	1	---
0.310000	31.20	10.1	50	18.7	1	---
0.410000	26.50	10.1	48	21.2	1	---
3.510000	32.70	10.2	46	13.3	1	---
4.025000	32.30	10.3	46	13.7	1	---
4.130000	32.70	10.3	46	13.3	1	---
6.400000	32.90	10.3	50	17.1	1	---
6.505000	33.00	10.3	50	17.0	1	---
7.020000	32.50	10.3	50	17.5	1	---

**HCT  
EMC TESTING Laboratory**

EUT: Q17  
 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

**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	10.0 ms	9 kHz	None
			Average			
500.0 kHz	5.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			
5.0 MHz	30.0 MHz	5.0 kHz	MaxPeak	10.0 ms	9 kHz	None
			Average			



**MEASUREMENT RESULT: "Q17\_fin QP"**

6/24/04 11:13AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.205000	44.00	10.1	63	19.4	1	---
0.310000	34.40	10.1	60	25.5	1	---
0.375000	30.20	10.1	58	28.1	1	---
4.130000	32.90	10.3	56	23.1	1	---
4.235000	33.40	10.3	56	22.6	1	---
4.750000	34.80	10.3	56	21.2	1	---
17.655000	40.30	10.5	60	19.7	1	---
17.865000	39.90	10.5	60	20.1	1	---
18.070000	39.80	10.5	60	20.2	1	---

**MEASUREMENT RESULT: "Q17\_fin AV"**

6/24/04 11:13AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.205000	32.60	10.1	53	20.8	1	---
0.310000	28.70	10.1	50	21.3	1	---
0.415000	26.10	10.1	48	21.5	1	---
4.235000	27.50	10.3	46	18.5	1	---
4.750000	30.50	10.3	46	15.5	1	---
4.855000	28.00	10.3	46	18.0	1	---
24.680000	31.30	10.6	50	18.7	1	---
24.885000	32.10	10.6	50	17.9	1	---
25.195000	31.50	10.6	50	18.5	1	---

**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 (Page7).**
- 3. Line H = Hot, Line N = Neutral**

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\*\* 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	6.1	15.0	1.3	V	22.4	30	-7.6
94.6	11.6	9.3	2.2	H	23.1	30	-6.9
114.5	8.9	12.2	2.4	H	23.5	30	-6.5
152.9	6.8	15.1	2.7	V	24.6	30	-5.4
162.2	5.7	15.5	2.9	V	24.1	30	-5.9
199.7	4.9	16.2	3.2	V	24.3	30	-5.7
270.4	11.4	18.0	3.8	V	33.2	37	-3.8
298.1	8.8	19.6	4.0	V	32.4	37	-4.6
363.6	11.2	16.6	4.4	V	32.2	37	-4.8
397.6	11.9	16.9	4.6	H	33.4	37	-3.6
457.9	10.2	18.5	4.9	H	33.6	37	-3.4

Radiated Measurements at 10-meters.

**Analog mode: 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

$$\text{dB } \square = 20 \log_{10} (\text{mV/m})$$

### 8.2 Example 1:

@ 0.205 MHz

Class B limit = 63.4 dB $\mu$ V  
Reading = 46.0 dB $\mu$ V (calibrated level)

**Margin** = 46.0 – 63.4 = - 17.4  
**= 17.4 dB below limit**

### 8.3 Example 2:

@ 457.9 MHz

Class B limit = 37.0 dB $\mu$ V/m  
Reading = 10.2 dB $\mu$ V/m (calibrated level)  
Antenna Factor + Cable Loss = 23.4 dB  
Total = 33.6dB $\mu$ V/m

**Margin** = 33.6- 37.0 = - 3.4  
**= 3.4 dB below limit**

## 9.1 Test Equipment

<u>Type</u>	<u>Manufacture</u>	<u>Model Number</u>	<u>CAL Date</u>
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	EMCO	ESH3-Z5	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 (1280×1024, 1152×870, 1024×768, 832×624, 800×600, 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: PJIL17C0D081** complies with §15.107 and §15.109 of the FCC Rules.