

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

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# CERTIFICATION

**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 : March 22, 2005**

**Test Report No.: HCT-F05-0306**

**Test Site: HYUNDAI CALIBRATION & CERTIFICATION  
TECHNOLOGIES CO., LTD.**

**HCT FRN : 0005-8664-21**

**FCC ID :**

**PJIL19A00000**

**MODEL /TYPE:**

**B90A/L19A00000**

|                            |                                                  |
|----------------------------|--------------------------------------------------|
| <b>Rule Part(s):</b>       | <b>Part 15 &amp; 2</b>                           |
| <b>Equipment Class:</b>    | <b>FCC Class B Peripheral Device(JBP)</b>        |
| <b>Standard(s):</b>        | <b>FCC Class B: (CISPR 22)</b>                   |
| <b>EUT Type:</b>           | <b>19" LCD Monitor</b>                           |
| <b>Max. Resolution(s):</b> | <b>1280 X 1024 (@/75Hz)</b>                      |
| <b>Model(s):</b>           | <b>B90A</b>                                      |
| <b>Port/Connector(s)</b>   | <b>15-pin D-sub VGA connector, AUDIO IN/OUT.</b> |

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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HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

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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,<br>KYOUNKI-DO, 467-701,KOREA |

- **FCC ID : PJIL19A00000**
- Equipment Class: FCC Class B Peripheral Device (JBP)
- EUT Type: 19" LCD MONITOR
- Model(s): B90A
- Max. Resolution: 1280 X 1024 (@75Hz)
- Power Cord: Unshielded
- Rule Part(s): FCC Part 15 Subpart B
- Test Procedure(s): ANSI C63.4 (2001)
- Dates of Tests: March 03, 2005 ~ March 08, 2005
- 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. 19-inch LCD Monitor FCC ID: PJIL19A00000**

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 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 : B90A ) 19-inch LCD Monitor**

FCC ID: **PJIL19A00000**

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

Dimensions: 412mm(W) x 428mm(H) x 200mm(D)

Power Supply: DC 12V -----3.3A

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)

Weight (Net):3.5Kg Unpacked

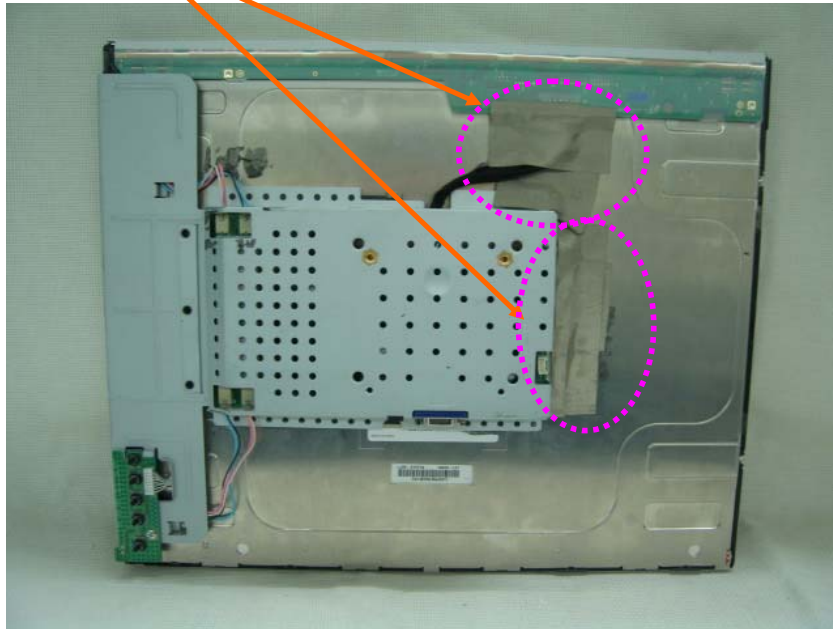
Power Consumption : 35Watts

Weight (Net): 5.2Kg Packed

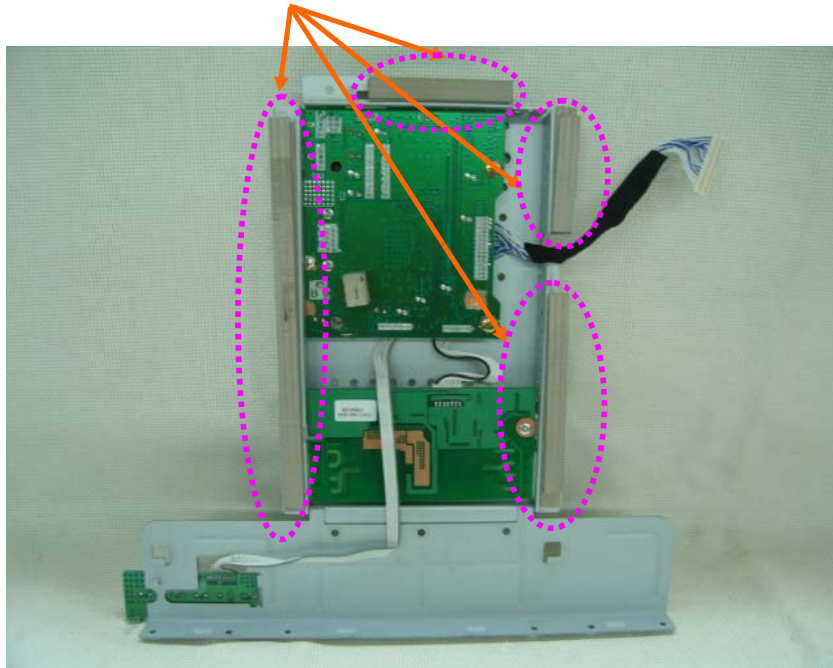
### EMI Suppression Devices:

Modifications were made to the device. Please refer to the next page.

**1. Attach fabric tape on the frame and the rear LCD panel**



**2. Attach a gasket on the main frame to contact the lcd panel**



## 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  $\Omega$  / 50 uH Line Impedance Stabilization Network (LISN) and the support equipment through a separate Solar 50  $\Omega$  / 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 center 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<br>Limits dB(uV/m) |                     |
|-------------------------------------------------------------|-------------------------------------|---------------------|
|                                                             | CISPR 22<br>Quasi-Peak              | CISPR 22<br>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<br>CO., LTD. | B90A             | PJIL19A00000 | 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       | Hyundai                         | JPC-914MW        | DoC          | EUT          |

## 5.2 Cable Description

|              | Power Cord<br>Shielded (Y/N) | I/O Cable Shielded<br>(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)         |
| AUDIO IN     | N/A                          | Y                           | 1.5(D)         |
| HEADSET      | N/A                          | N                           | 2.7(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<br>(Y/N) | Location | Metal Hood<br>(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                   | P.C END  |
| AUDIO IN     | Y                     | BOTH END | Y                   | BOTH END |
| HEADSET      | N                     | N/A      | Y                   | EUT END  |

## 6.1 LINE-CONDUCTED TEST DATA

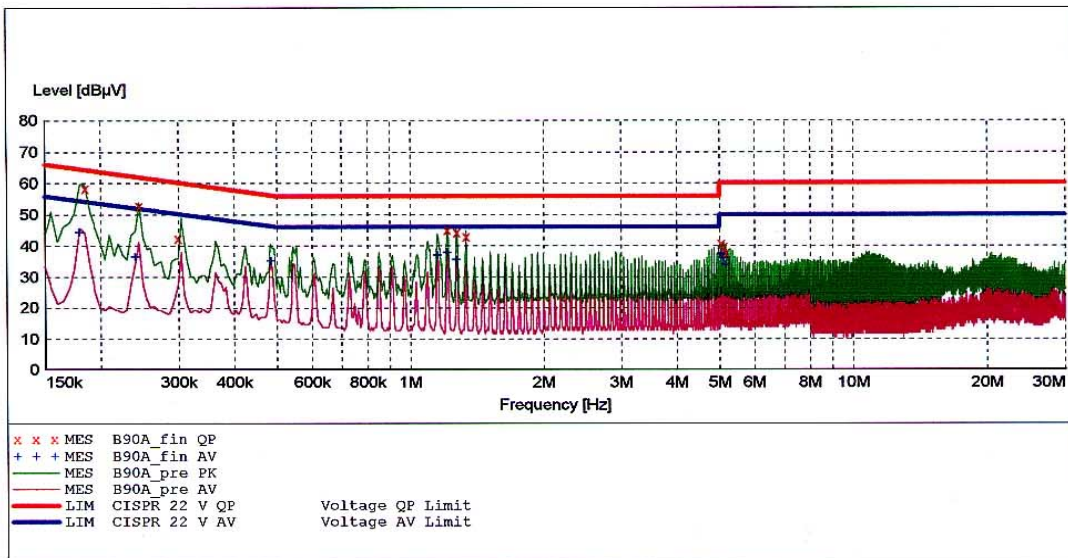
**HCT**

### EMC TESTING Laboratory

EUT: B90A  
Manufacturer: HYUNDAI IMAGEQUEST  
Operating Condition: 1280 X 1024 75Hz  
Test Site: SHIELD ROOM  
Operator: GS, KIM  
Test Specification: CISPR 22 CLASS B  
Comment: N

#### SCAN TABLE: "CISPR 22 Voltage"

| Short Description: |           |         | CISPR 22 Voltage |            |           |            |
|--------------------|-----------|---------|------------------|------------|-----------|------------|
| Start              | Stop      | Step    | 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          |            |           |            |



#### MEASUREMENT RESULT: "B90A\_fin QP"

3/3/05 5:00PM

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Line | PE  |
|---------------|------------|-----------|------------|-----------|------|-----|
| 0.185000      | 58.30      | 10.1      | 64         | 5.9       | 1    | --- |
| 0.245000      | 52.90      | 10.1      | 62         | 9.0       | 1    | --- |
| 0.300000      | 42.40      | 10.1      | 60         | 17.8      | 1    | --- |
| 1.215000      | 45.20      | 10.2      | 56         | 10.8      | 1    | --- |
| 1.275000      | 44.50      | 10.2      | 56         | 11.5      | 1    | --- |
| 1.340000      | 43.10      | 10.2      | 56         | 12.9      | 1    | --- |
| 5.050000      | 40.80      | 10.3      | 60         | 19.2      | 1    | --- |
| 5.110000      | 39.90      | 10.3      | 60         | 20.1      | 1    | --- |
| 5.175000      | 37.90      | 10.3      | 60         | 22.1      | 1    | --- |

**MEASUREMENT RESULT: "B90A\_fin AV"**

3/3/05 5:00PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|------|-----|
| 0.180000         | 44.40         | 10.1         | 55            | 10.1         | 1    | --- |
| 0.240000         | 36.60         | 10.1         | 52            | 15.5         | 1    | --- |
| 0.485000         | 35.20         | 10.1         | 46            | 11.1         | 1    | --- |
| 1.155000         | 37.00         | 10.1         | 46            | 9.0          | 1    | --- |
| 1.215000         | 37.80         | 10.2         | 46            | 8.2          | 1    | --- |
| 1.275000         | 35.50         | 10.2         | 46            | 10.5         | 1    | --- |
| 5.050000         | 37.50         | 10.3         | 50            | 12.5         | 1    | --- |
| 5.110000         | 36.10         | 10.3         | 50            | 13.9         | 1    | --- |
| 5.175000         | 33.80         | 10.3         | 50            | 16.2         | 1    | --- |

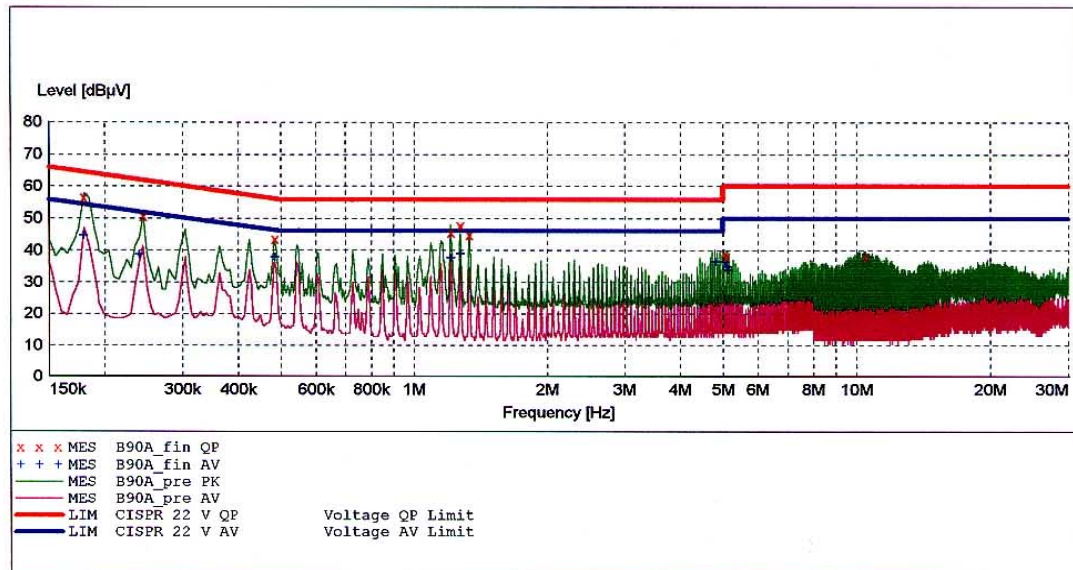
**HCT**

**EMC TESTING Laboratory**

EUT: B90A  
Manufacturer: HYUNDAI IMAGEQUEST  
Operating Condition: 1280 X 1024 75Hz  
Test Site: SHIELD ROOM  
Operator: GS, KIM  
Test Specification: CISPR 22 CLASS B  
Comment: H

**SCAN TABLE: "CISPR 22 Voltage"**

| Short Description: |           |         | CISPR 22 Voltage |            |           |            |
|--------------------|-----------|---------|------------------|------------|-----------|------------|
| Start              | Stop      | Step    | Detector         | Meas. Time | IF Bandw. | Transducer |
| Frequency          | Frequency | Width   |                  |            |           |            |
| 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          |            |           |            |



**MEASUREMENT RESULT: "B90A\_fin QP"**

3/3/05 5:30PM

| Frequency MHz | Level dBμV | Transd dB | Limit dBμV | Margin dB | Line | PE  |
|---------------|------------|-----------|------------|-----------|------|-----|
| 0.180000      | 56.60      | 10.1      | 65         | 7.9       | 1    | --- |
| 0.245000      | 50.70      | 10.1      | 62         | 11.2      | 1    | --- |
| 0.485000      | 43.70      | 10.1      | 56         | 12.5      | 1    | --- |
| 1.215000      | 45.70      | 10.2      | 56         | 10.3      | 1    | --- |
| 1.275000      | 47.80      | 10.2      | 56         | 8.2       | 1    | --- |
| 1.335000      | 44.90      | 10.2      | 56         | 11.1      | 1    | --- |
| 5.040000      | 38.90      | 10.3      | 60         | 21.1      | 1    | --- |
| 5.105000      | 38.10      | 10.3      | 60         | 21.9      | 1    | --- |
| 10.510000     | 38.10      | 10.4      | 60         | 21.9      | 1    | --- |

**MEASUREMENT RESULT: "B90A\_fin AV"**

3/3/05 5:30PM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|------|-----|
| 0.180000         | 44.70         | 10.1         | 55            | 9.8          | 1    | --- |
| 0.240000         | 38.80         | 10.1         | 52            | 13.3         | 1    | --- |
| 0.485000         | 37.80         | 10.1         | 46            | 8.5          | 1    | --- |
| 1.215000         | 37.70         | 10.2         | 46            | 8.3          | 1    | --- |
| 1.275000         | 39.00         | 10.2         | 46            | 7.0          | 1    | --- |
| 4.800000         | 36.40         | 10.3         | 46            | 9.6          | 1    | --- |
| 5.040000         | 36.40         | 10.3         | 50            | 13.6         | 1    | --- |
| 5.105000         | 35.00         | 10.3         | 50            | 15.0         | 1    | --- |
| 5.165000         | 33.80         | 10.3         | 50            | 16.2         | 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 (Page 7).
3. Line H = Phase Line N = Neutral Line

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\*\* Measurements using CISPR quasi-peak mode.

## 7.1 RADIATED TEST DATA

| Frequency<br>MHz | Reading<br>dBuV | Ant. Factor<br>dB/m | Cable Loss<br>Db | ANT POL<br>(H/V) | Total<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|------------------|-----------------|---------------------|------------------|------------------|-----------------|-----------------|--------------|
| 35.5             | 9.5             | 11.3                | 1.3              | V                | 22.1            | 30              | 7.9          |
| 48.0             | 6.9             | 12.3                | 1.5              | H                | 20.7            | 30              | 9.3          |
| 63.0             | 9.0             | 10.7                | 1.8              | V                | 21.5            | 30              | 8.5          |
| 106.5            | 10.2            | 9.9                 | 2.3              | V                | 22.4            | 30              | 7.6          |
| 108.0            | 11.3            | 10.1                | 2.3              | H                | 23.7            | 30              | 6.3          |
| 140.5            | 8.6             | 12.8                | 2.6              | H                | 24.0            | 30              | 6.0          |
| 312.0            | 12.8            | 13.2                | 4.1              | V                | 30.1            | 37              | 6.9          |
| 336.0            | 14.2            | 13.7                | 4.2              | V                | 32.1            | 37              | 4.9          |
| 537.3            | 8.5             | 17.9                | 5.3              | H                | 31.7            | 37              | 5.3          |
| 782.4            | 5.0             | 22.2                | 6.3              | V                | 33.5            | 37              | 3.5          |

Radiated Measurements at 10-meters.

**1280 X 1024 (@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:

**@ 185.0 KHz**

Class B limit = 64.2 dB  $\square$   
Reading = 58.3 dB  $\square$  (calibrated level)

**Margin** = 58.3 – 64.2 = - 5.9 dB  $\square$   
= **5.9 dB below limit**

### 8.3 Example 2:

**@ 782.4 MHz**

Class B limit = 37 dB $\mu$ V/m  
Reading = 5.0 dB $\mu$ V/m (calibrated level)  
Antenna Factor + Cable Loss = 28.5 dB  
Total = 33.5 dB $\mu$ V/m

**Margin** = 33.5 - 37.0 = - 3.5  
= **3.5 dB**  
**below limit**

## 9.1 Test Equipment

| <u>Type</u>                 | <u>Manufacture</u> | <u>Model Number</u> | <u>CAL Due Date</u> |
|-----------------------------|--------------------|---------------------|---------------------|
| EMI Test Receiver           | Rohde & Schwarz    | ESCI40              | 2005.11.16          |
| EMI Test Receiver           | Rohde & Schwarz    | ESVS30              | 2005.07.15          |
| EMI Test Receiver           | Rohde & Schwarz    | ESCI                | 2005.09.13          |
| LISN                        | Rohde & Schwarz    | ESH2-Z5             | 2005.07.28          |
| LISN                        | Rohde & Schwarz    | ESH3-Z2             | 2005.08.10          |
| TRILOG Antenna              | Schwarzbeck        | 9160                | 2005.04.06          |
| Antenna Position Tower      | HD                 | MA240               | N/A                 |
| Turn Table                  | EMCO               | 1050                | N/A                 |
| Power Analyzer              | Voltech            | PM 3300             | 2006.03.22          |
| Reference Network Impedance | Voltech            | IEC 555             | N/A                 |
| AC Power Source             | PACIFIC            | Magnetic Module     | N/A                 |
| AC Power Source             | PACIFIC            | 360-AMX             | 2005.11.25          |
| Controller                  | HD GmbH            | HD 100              | N/A                 |
| SlideBar                    | HD GmbH            | KMS 560             | N/A                 |
| PULSE LIMITER               | Rohde & Schwarz    | ESH3-Z2             | 2005.11.16          |

## 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 ( 720x400, 640x480, 800x600, 832x624, 1024x768, 1152x864, 1280x1024) were investigated and tested

## 11.1 Conclusion

The data collected shows that the HYUNDAI IMAGEQUEST CO., LTD. 19-inch LCD Monitor  
**FCC ID: PJIL19A00000**

complies with §15.107 and §15.109 of the FCC Rules.