

HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

Product Compliance Division, EMC Team
SAN 136-1, AMI-RI, BUBAL-EUP, ICHEON-SI, KYOUNKI-DO, 467-701, KOREA
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TEST REPORT

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 : May 12, 2005

Test Report No.: HCT-F05-0502

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

HCT FRN : 0005-8664-21

FCC ID :

PJILT32AW000

MODEL /TYPE:

HQL320WR/LT32AW000

Rule Part(s) : Part 15 & 2
Equipment Class : FCC Class B Peripheral Device (JBP)
Standard(s) : FCC Class B: (CISPR 22)
EUT Type : 32" LCD TV Monitor
Max. Resolution(s): 1024x768(@60.0KHz/75Hz)
Digital : 1280x1024(@63.9KHz/60Hz)
Model(s) : HQL320WR
Port/Connector(s) : 15-pin D-sub VGA, 20-pin DVI-D(Digital RGB) Connector, Audio IN/OUT
LCD Panel Samsung Electronics(LTA320AW- L03)

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 C63.4-2003

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 : PJILT32AW000**
- Equipment Class: FCC Class B Peripheral Device (JBP)
- EUT Type: 32 " LCD TV MONITOR
- Model/Type: HQL320WR/LT32AW000
- LCD Panel: Samsung Electronics(LTA320AW-L03)
- Maximum Resolution(s) : 1024x768(@60.0KHz/75Hz)
- Frequency Range : V-Sync :60Hz-75Hz
H-Sync :31KHz-60Hz
- Cable(S) : Shielded D-Sub, Shielded S-Video(with ferrite on bothends), Shielded A/V Input(with ferrite on bothends), Shielded A/V Output, Shielded Antenna(with ferrite on bothends)
- Power Cord: Unshielded
- Rule Part(s): FCC Part 15 Subpart B
- Test Procedure(s): ANSI C63.4 (2003)
- Dates of Tests: April 27, 2005 ~ April 29, 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. 32-inch LCD TV Monitor FCC ID: PJILT32W000**

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 : HQL320WR)**
32-inch LCD TV Monitor

FCC ID: PJILT32W000

Maximum Resolution(s) : 1024x768(@60.0KHz/75Hz)

Frequency Range : H-Sync :31.5-Hz-60Hz
V-Sync :31KHz-80KHz

Pixel Pitch : 0.51075mm

Power Supply: AC 100-240V, 50/60Hz 2.0A

Power Cord : Unshielded AC power cord

Port(s)/Input Connector(s): D-sub, S-Video, A/V 1,2 Input, A/V Output, A/V 3 Output, Antenna Input

Cable(s) : Shielded D-Sub, Shielded S-Video(with ferrite on bothends), Shielded A/V Input(with ferrite on bothends), Shielded A/V Output, Shielded Antenna(with ferrite on bothends)

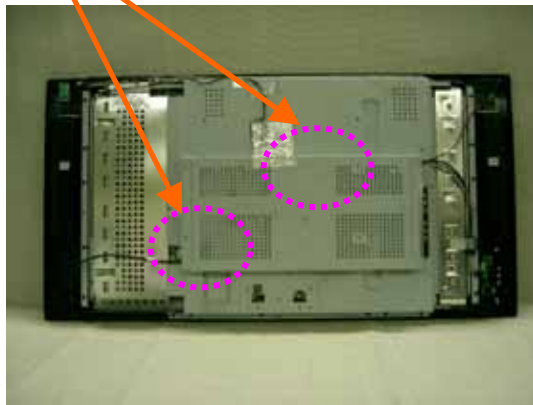
Dimensions (WxHxD) : 957x495x236mm (WxHxD)

Weight (Net) : 18Kg(With stand)

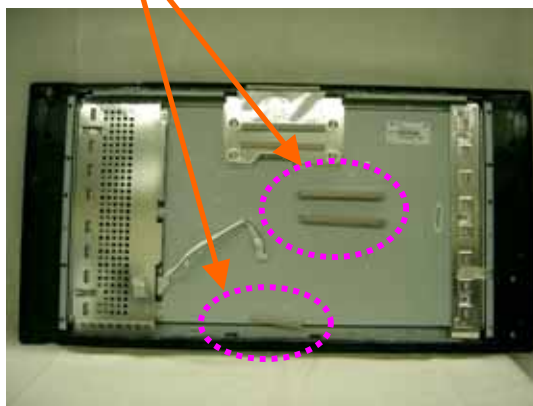
EMI Suppression Devices:

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

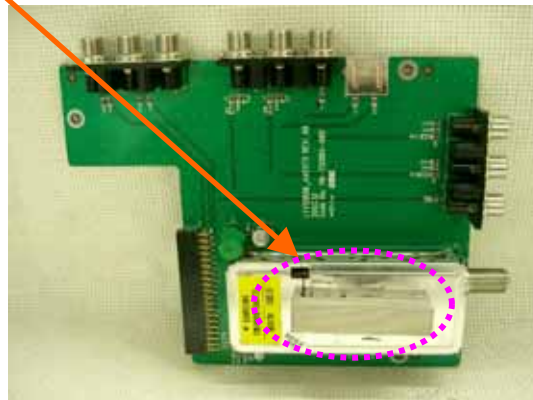
1. Attach aluminum tape on the frame and lcd panel.



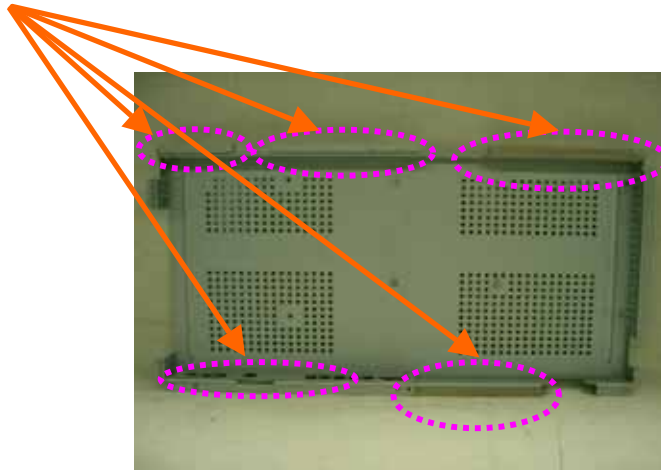
2. Attach a gasket on the LCD Panel back cover inside.



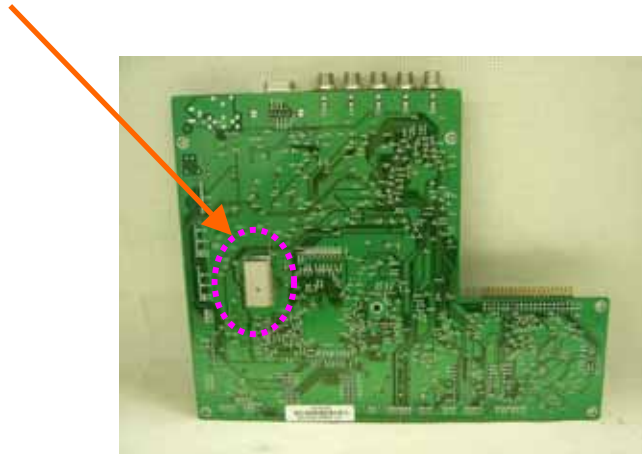
3. Attach a gasket on the tuner.



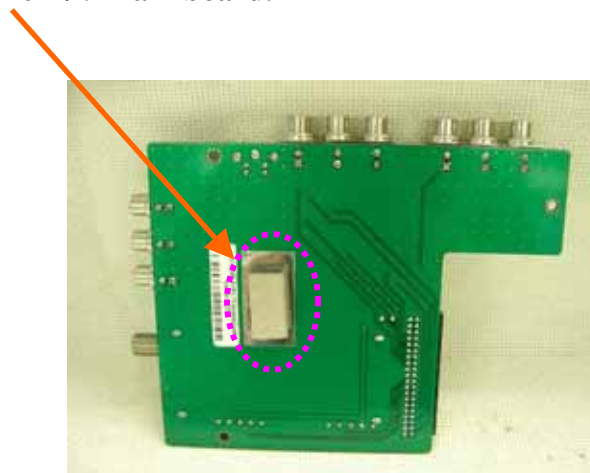
4. Attach a gasket on the main board case.



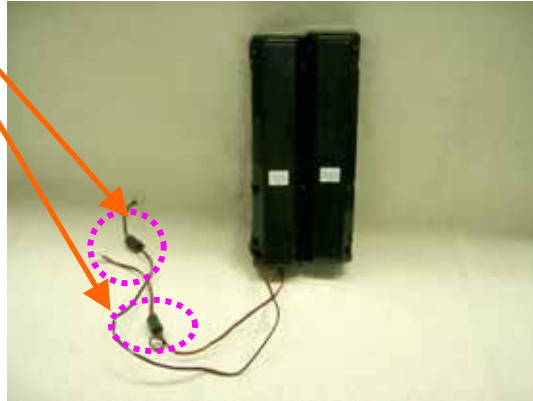
5. Attach a gasket on the main board.



6. Attach a gasket on the A/V main board.



7. Apply a ferrite core to the audio speaker cable.



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 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 Limits dB(uV/m)	
	CISPR 22 Quasi-Peak	CISPR 22 Average
Freq. Range		
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
LCD TV (EUT)	HYUNDAI IMAGEQUEST CO., LTD.	HQL320WR	PJILT32W000	P.C
P.C	H/P	HP Pavilion 730K	DoC	N/A
MOUSE	Microsoft	IntelliMouse Optical USB and PS/2 Compatible	DoC	P.C
SERIAL MOUSE	Logitech	M-M35	DoC	P.C
KEY BOARD	H/P	5181	DoC	P.C
PRINTER	H/P	C4569A	DoC	P.C
Head Set	HYUNDAI	JPC-914MV	DoC	EUT

Cable Termination	Component port 75 S-Video Port 75 Composite Audio 30K Composite Video 75
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5.2 Cable Description

		Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
LCD TV Monitor (EUT)	Power	N	N/A	1.8(P)
	D-Sub	N/A	Y	1.8(D)
	Component	N/A	Y	1.6(D)
	Audio	N/A	Y	1.6(D)
	ANT	N/A	Y	3.0(D)
	Composite1	N/A	Y	1.6(D)
	Composite2	N/A	Y	1.6(D)
	Composite3	N/A	Y	1.6(D)
	Composite Out	N/A	Y	1.6(D)
	S-Video	N/A	Y	1.6(D)
Head Set	N/A	Y	2.7(D)	
PC		N	N/A	1.8(D)
Key Board		N/A	Y	1.8(D)
Mouse		N/A	Y	1.8(D)
Serial Mouse		N/A	Y	1.8(D)
Printer		N	Y	1.8(D), 1.8(P)
Head Set		N/A	Y	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 (Y/N)	Location	Metal Hood (Y/N)	Location
LCD TV Monitor (EUT)	D-Sub	Y	BOTH END	Y	BOTH END
	Component	N	N/A	Y	BOTH END
	Audio	N	N/A	Y	BOTH END
	ANT	N	N/A	Y	BOTH END
	Compsite1,2,3	N	N/A	Y	BOTH END
	Composite Out	N	N/A	Y	BOTH END
	S-Video	N	N/A	Y	BOTH END
	Head Set	N	N/A	Y	EUT END
PC		N	N/A	N/A	N/A
Key Board		N	N/A	Y	PC END
Mouse		Y	PC END	Y	PC END
Serial Mouse		Y	PC END	Y	PC END
Printer		Y	BOTH END	Y	BOTH END
Head Set		N	EUT END	Y	EUT END

6.1 LINE-CONDUCTED TEST DATA

Test

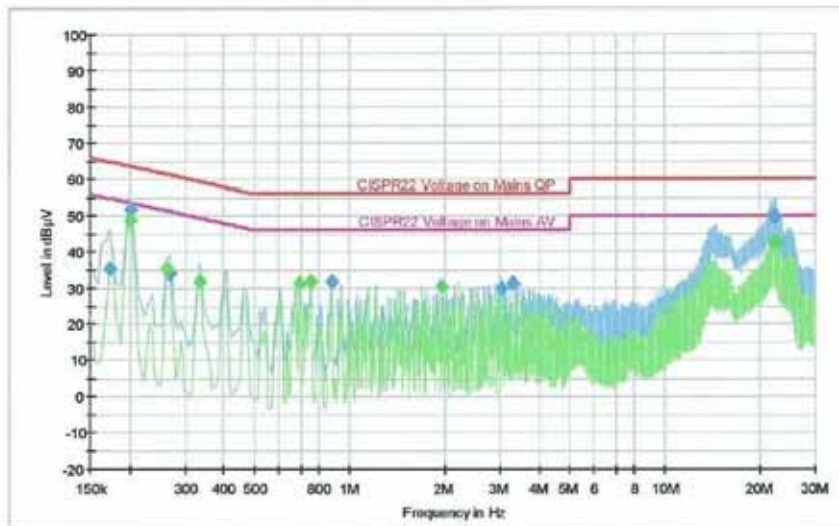
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Conducted Emission Report

Test Information

EUT Name:	HQL320WR
Serial Number:	-
Test Description:	CISPR22 CLASS B
Operating Conditions:	1024 X 768 75Hz
Operator Name:	GS,KIM
Comment:	N
Description:	-

CISPR22 CLASS B Neutral Line



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Test

2

Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.172500	35.1	N	10.1	29.7	64.8
0.199500	51.6	N	10.2	12.0	63.6
0.267000	33.9	N	9.8	27.3	61.2
0.873500	31.7	N	9.7	24.3	56.0
3.024500	29.8	N	9.9	26.2	56.0
3.294500	31.4	N	9.9	24.6	56.0
22.118000	49.7	N	11.0	10.3	60.0
22.185500	50.0	N	11.0	10.0	60.0
22.455500	49.5	N	11.1	10.5	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dB μ V)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.199500	48.6	N	10.2	5.1	53.6
0.262500	35.2	N	9.9	16.1	51.4
0.334500	31.8	N	9.7	17.5	49.3
0.698000	31.3	N	9.7	14.7	46.0
0.756500	31.6	N	9.7	14.4	46.0
1.949000	30.4	N	9.7	15.6	46.0
22.253000	42.7	N	11.0	7.3	50.0
22.388000	42.8	N	11.1	7.2	50.0
22.523000	42.7	N	11.1	7.3	50.0

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Test

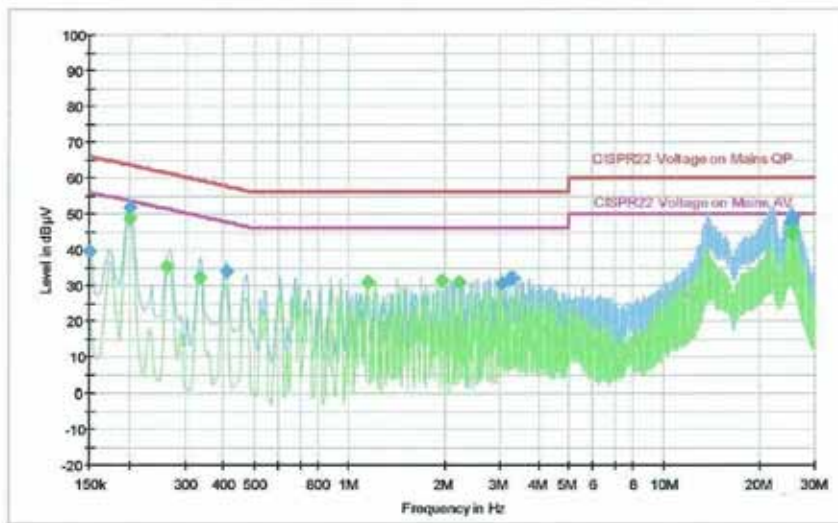
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Conducted Emission Report

Test Information

EUT Name:	HQL320WR
Serial Number:	-
Test Description:	CISPR22 CLASS B
Operating Conditions:	1024 X 768 75Hz
Operator Name:	GS,KIM
Comment:	H
Description:	-

CISPR22 CLASS B Hot Line



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Test

2

Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	39.4	L1	10.0	26.6	66.0
0.199500	51.7	L1	10.2	12.0	63.6
0.406500	34.0	L1	9.7	23.7	57.7
3.024500	30.4	L1	9.9	25.6	56.0
3.227000	31.7	L1	9.9	24.3	56.0
3.294500	32.2	L1	9.9	23.8	56.0
25.331000	47.6	L1	11.5	12.4	60.0
25.394000	49.0	L1	11.4	11.0	60.0
25.533500	48.4	L1	11.4	11.6	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.199500	48.6	L1	10.2	5.0	53.6
0.262500	35.2	L1	9.9	16.1	51.4
0.334500	32.1	L1	9.7	17.3	49.3
1.143500	30.8	L1	9.7	15.2	46.0
1.949000	31.2	L1	9.7	14.8	46.0
2.219000	31.1	L1	9.7	14.9	46.0
25.326500	44.7	L1	11.5	5.3	50.0
25.394000	44.6	L1	11.4	5.4	50.0
25.461500	44.5	L1	11.4	5.5	50.0

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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 9).**
- 3. Line H = Phase Line N = Neutral Line**

** 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
43.5	4.8	13.9	1.4	V	20.1	30	9.9
68.4	13.4	6.4	1.8	V	21.6	30	8.4
95.5	10.7	9.4	2.2	V	22.3	30	7.7
160.8	6.7	15.5	2.9	H	25.1	30	4.9
181.4	4.2	15.9	3.0	V	23.1	30	6.9
201.2	1.1	16.3	3.2	V	20.6	30	9.4
240.1	10.0	17.2	3.5	V	30.7	37	6.3
320.1	11.1	16.3	4.1	V	31.5	37	5.5
400.1	7.8	17.0	4.6	H	29.4	37	7.6
480.1	5.9	18.8	5.0	V	29.7	37	7.3
531.9	5.3	19.8	5.3	H	30.4	37	6.6
560.5	5.7	20.4	5.4	V	31.5	37	5.5

Radiated Measurements at 10-meters.

1024 X 768 (@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 10).

** 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

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

8.2 Example 1:

@ 22.2 MHz

Class B limit = 60.0 dB μV
Reading = 50.0 dB μV (calibrated level)

Margin = 50.0 – 60.0 = -10.0 dB μV
= **10.0 dB below limit**

8.3 Example 2:

@ 160.8 MHz

Class B limit = 30 dB $\mu\text{V/m}$
Reading = 6.7 dB $\mu\text{V/m}$ (calibrated level)
Antenna Factor + Cable Loss = 18.4 dB
Total = 25.1 dB $\mu\text{V/m}$

Margin = 25.1 - 30.0 = - 4.9
= **4.9 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	2006.03.31
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 (1280x768, 800x600, 640x480, 640x480, 720x400, 640x350) were investigated and tested

11.1 Conclusion

The data collected shows that the HYUNDAI IMAGEQUEST CO., LTD. 32-inch LCD TV Monitor **FCC ID: PJILT32W000** complies with §15.107 and §15.109 of the FCC Rules.