

Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT : LCD MONITOR
MODEL/Serial No. : L22C0E080 / NONE
FCC ID : PJIL22C0E080
APPLICANT : HYUNDAI IT CORP.
San 136-1, Ami-ri, Bubal-eub, Icheon-si, Gyeonggi-do,
467-701, Korea
Attn. : Kim, Kyoung-Ok / Assistant Manager
MANUFACTURER : HYUNDAI IT CORP.
San 136-1, Ami-ri, Bubal-eub, Icheon-si, Gyeonggi-do,
467-701, Korea
FCC CLASSIFICATION : Class B Personal computers and peripherals
RULE PART(S) : FCC Part 15 Subpart B
FCC PROCEDURE : ANSI C63.4-2003
TEST REPORT No. : ETLE080402.274
DATES OF TEST : April 02, 2008 to April 10, 2008
REPORT ISSUE DATE : April 18, 2008
TEST LABORATORY : ETL Inc. (FCC Registration Number : 95422)

This LCD MONITOR, Model L22C0E080 has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B:

I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is 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.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Hyung Seok, Lee / Chief Engineer

ETL Inc.

#584, Sangwhal-ri, Ganam-myeon, Yoju-gun, Gyeonggi-do, 469-885, Korea

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This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the ETL Inc.

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FCC MEASUREMENT REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

General Information

Applicant Name	: HYUNDAI IT CORP.
Address	: San 136-1, Ami-ri, Bubal-eub, Icheon-si, Gyeonggi-do, 467-701, Korea
Attention	: Kim, Kyoung-Ok / Assistant Manager

- **EUT Type :** LCD MONITOR
- **Model Number :** L22C0E080
- **S/N :** NONE
- **Frequency Range :** X-TAL → 14.31818 MHz
- **FCC Rule Part(s) :** FCC Part 15 Subpart B
- **Test Procedure :** ANSI C63.4-2003
- **FCC Classification :** Class B Personal computers and peripherals
- **Dates of Tests :** April 02, 2008 to April 10, 2008
- **Place of Tests :** ETL Inc. Testing Lab.

Radiated Emission test;
#584, Sangwhal-ri, Ganam-myeon, Yoju-gun,
Gyeonggi-do, 469-885, Korea
- **Test Report No. :** ETLE080402.274

Conducted Emission test;
ETL Inc. Testing Lab.
371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea

1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC Registration Number : 95422).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the HYUNDAI IT CORP. Model: L22C0E080

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the HYUNDAI IT CORP. (model: L22C0E080)

In addition, the model L22C0E080 has a LCD Panel of two types (LTM220M1-L01 and LM220WE1).

LCD Panel of models may be used the one of two type selected by manufacture.

The model L22C0E080 was tested with LCD Panel of two types.

2.2 General Specification

LCD	22" viewable, Diagonal, Pixel pitch 0.270mm, A-si TFT
Display area	473.78(H) X 298.1(V), 22" Diagonal
Number of color	16.7 million colors (true 8-bit color)
Input signals	R.G.B Analog, 15pin D-sub / DVI-D / HDMI
Frequency rate	Horizontal: 30.0 kHz to 80.0 kHz, Vertical: 56 Hz to 75 Hz
Maximum bandwidth	162 MHz
Maximum resolution	1920 X 1200 @ 60 Hz
Recommended resolution	1920 X 1200 @ 60 Hz
Input voltage	100 V – 240 V AC, 2.0 A
Power consumption	50 W (Typ.)
Power management	VESA DPMS
Plug & Play	VESA DDC 1/2B
OSD menu	BRIGHTNESS, CONTRAST, H/W POSITION, CLOCK, PHASE, AUTO ADJUSTAUTO COLOR, SOUND, OSD CONFIGURATION, INPUT SOURCE, DISPLAYCONTROL, GENERAL RECALL, LANGUAGE
Audio system	2 CH x 3 watts / Ear Phone Jack
VESA FPM PMI	75 mm x 75 mm screw mounting
Ergonomics, Safety and EMC	Energystar cTUVus, TUV-GS, CB, FCC, CE, VCCI, GOST
Operating Temperature	5 °C ~ 40 °C
Weight	9.9 kg unpacked, 13.8 kg packed
Dimensions (W X H X D mm)	200 mm x 494 mm x 240 mm

3. DESCRIPTION OF TESTS

3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2003. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50Ω / $50 \mu\text{H}$ LISN as the input transducer to a Spectrum Analyzer or a Test Receiver. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 9 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8 m wooden table which is placed 0.4 m away from the vertical wall and 1.5 m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the LISN. Non-inductive bundling to a 1 m length shortened all interconnecting cables more than 1 m. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the EMI Test Receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 MHz to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup in Appendix B.

3.2 Radiated Emission Measurement

Radiated emission measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2003. The measurements were performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a spectrum analyzer or a field intensity meter. The measurements were made with the detector set for "Quasi-peak" within a bandwidth of 120 kHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determined the frequency producing the maximum emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10 m. The test equipment was laced on a wooden turn-table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8 m high nonmetallic 1m x 1.5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

4. TEST CONDITION

4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

4.2 EUT operation

Operating Mode	The worst operating condition
Stand by mode	X
“H” pattern display and MP3 file play mode	O

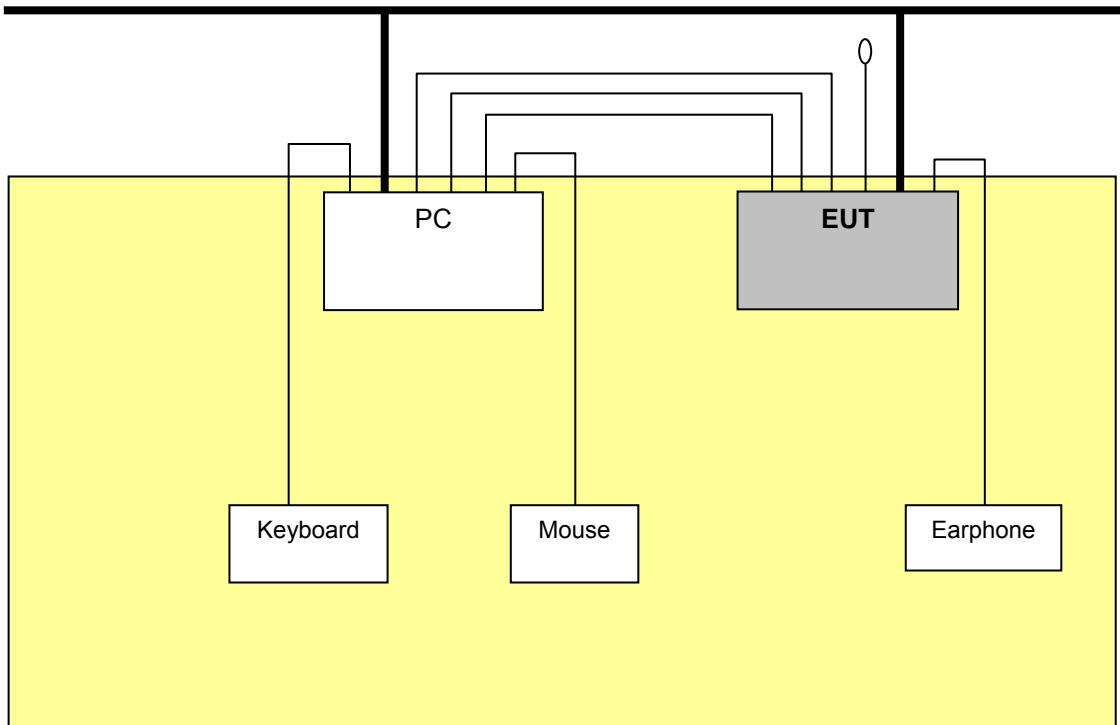
O: Worst case investigated during the Test

4.3 Support Equipment Used

Description	Model Name	Serial No.	Manufacturer
PC	DHM	GN TGB1S	DELL
Keyboard	KB-9963	B26960GBUKO13F	Chicony Electronics
Mouse	M-S48a	NONE	Suzhou Logitech Electronic
Earphone	NONE	NONE	NONE

4.4 Type of Cables Used

Device from	Device to	Type of I/O port	Length(m)	Type of shield
EUT	PC	RGB	1.5	Shielded
EUT	PC	DVI	1.5	Shielded
EUT	PC	Audio In	1.5	Shielded
EUT	Ear-phone	Ear-phone	1.2	Unshielded
EUT	Termination	HDMI	1.8	Shielded
EUT	Power socket	AC Input	1.0	Unshielded
PC	Keyboard	PS/2	1.2	Shielded
PC	Mouse	PS/2	1.2	Shielded
PC	Power socket	AC Input	1.0	Unshielded

4.5 The setup drawing(s)

— : Data Line

○— : Termination

— : Power Line

5. TEST RESULTS

5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

FCC Rule	Measurement Required	Result
15.107	Conducted Emission Measurement	Passed by 13.40 dB
15.109(g)	Radiated Emission Measurement	Passed by 3.10 dB

The data collected shows that the HYUNDAI IT CORP. / LCD MONITOR / L22C0E080 complied with technical requirements of above rules part 15.107 and 15.109(g) Class B Limits and CISPR Publication 22.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

5.2 Conducted Emissions Measurement

EUT	LCD MONITOR / L22C0E080 (S/N: N/A)		
Limit apply to	FCC Part 15.107 Class B		
Test Date	April 08, 2008		
Operating Condition	"H" pattern display and MP3 file play mode		
LCD Panel Model	LTM220M1-L01		
Result	Passed by 13.40 dB		

Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarizations of hot and neutral line.
Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 9 kHz)

Frequency [MHz]	Result [dB μ V]		Phase (*L/**N)	Limit [dB μ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.198	47.40	38.70	H	63.70	53.70	16.30	15.00
0.262	45.00	37.50	H	61.30	51.30	16.30	13.80
0.329	37.50	32.80	H	59.50	49.50	22.00	16.70
0.650	32.50	28.40	H	56.00	46.00	23.50	17.60
1.169	34.00	29.40	N	56.00	46.00	22.00	16.60
1.361	34.00	29.10	N	56.00	46.00	22.00	16.90
7.450	39.60	34.80	N	60.00	50.00	20.40	15.20
15.676	46.60	30.90	H	60.00	50.00	13.40	19.10
26.941	37.60	29.40	H	60.00	50.00	22.40	20.60

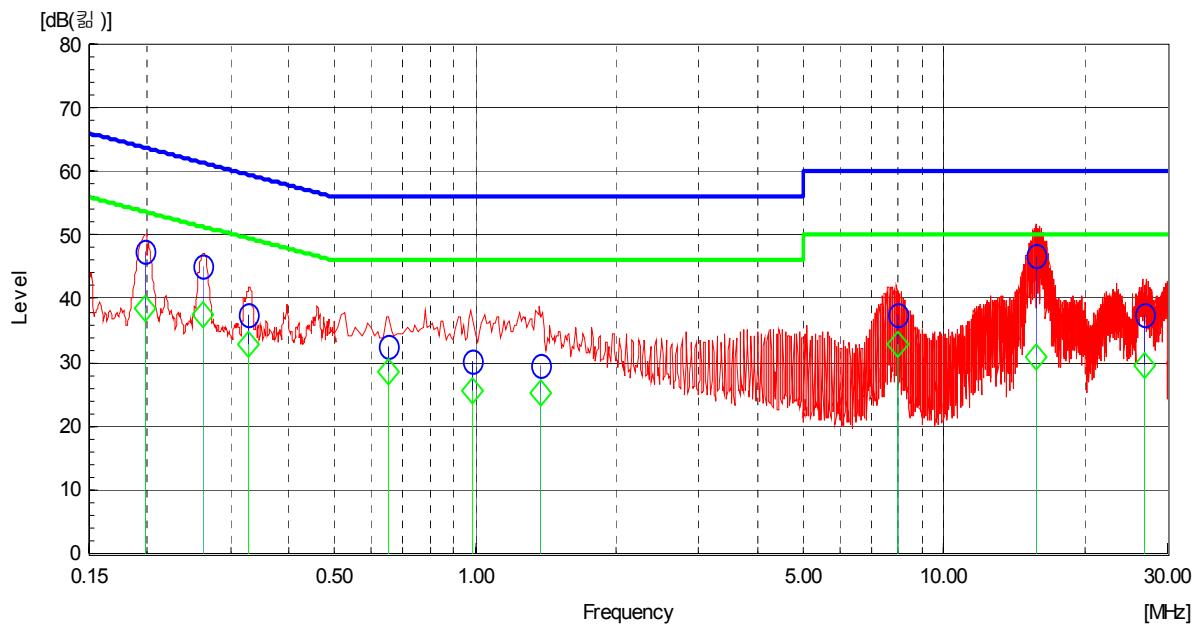
NOTES:

1. * H : HOT Line , **N : Neutral Line
2. Margin value = Limit – Result
3. Measurement were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15

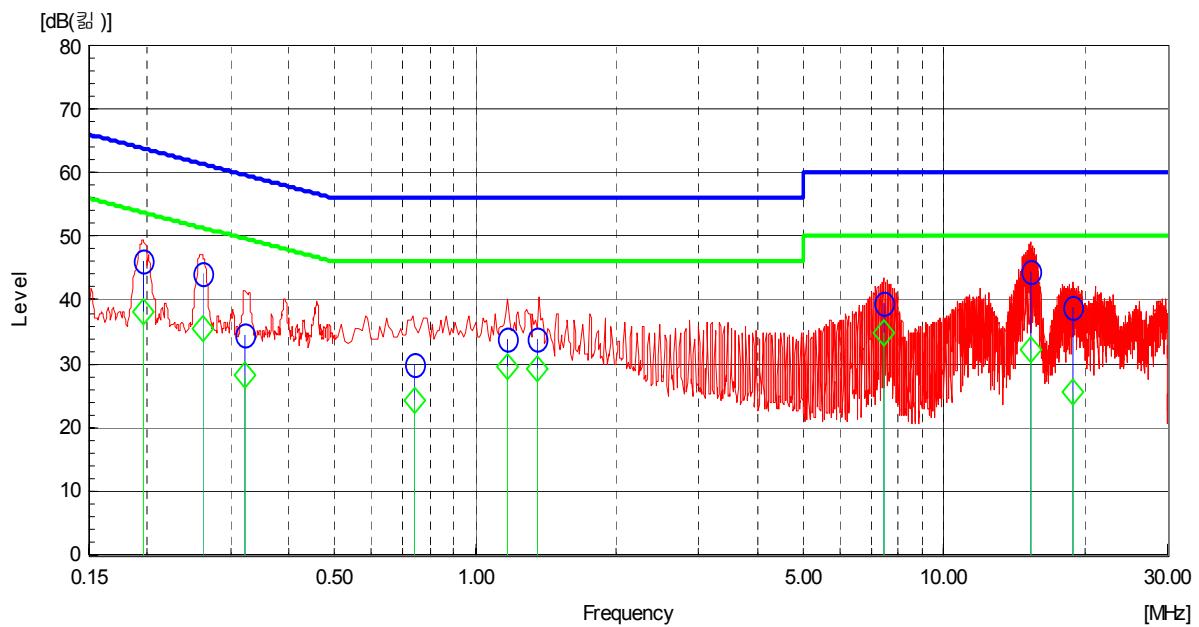


Test Engineer: **Hyung-min, Choi**

Line: HOT Line

Limit :
Quasi-Peak (Blue Line)
Average (Green Line)

Line: Neutral Line



Quasi-peak



Average



EUT	LCD MONITOR / L22C0E080 (S/N: N/A)		
Limit apply to	FCC Part 15.107 Class B		
Test Date	April 08, 2008		
Operating Condition	"H" pattern display and MP3 file play mode		
LCD Panel Model	LM220WE1		
Result	Passed by 14.90 dB		

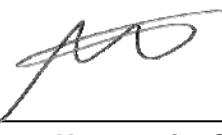
Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarizations of hot and neutral line.
Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 9 kHz)

Frequency [MHz]	Result [dB μ V]		Phase (*L/**N)	Limit [dB μ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.260	41.80	34.20	H	61.40	51.40	19.60	17.20
0.325	37.10	31.10	H	59.60	49.60	22.50	18.50
0.454	36.70	31.70	H	56.80	46.80	20.10	15.10
0.777	34.80	29.90	N	56.00	46.00	21.20	16.10
1.290	31.30	26.40	N	56.00	46.00	24.70	19.60
1.357	32.30	27.60	H	56.00	46.00	23.70	18.40
6.861	35.00	32.80	N	60.00	50.00	25.00	17.20
13.593	35.80	34.30	N	60.00	50.00	24.20	15.70
18.511	45.10	32.40	H	60.00	50.00	14.90	17.60

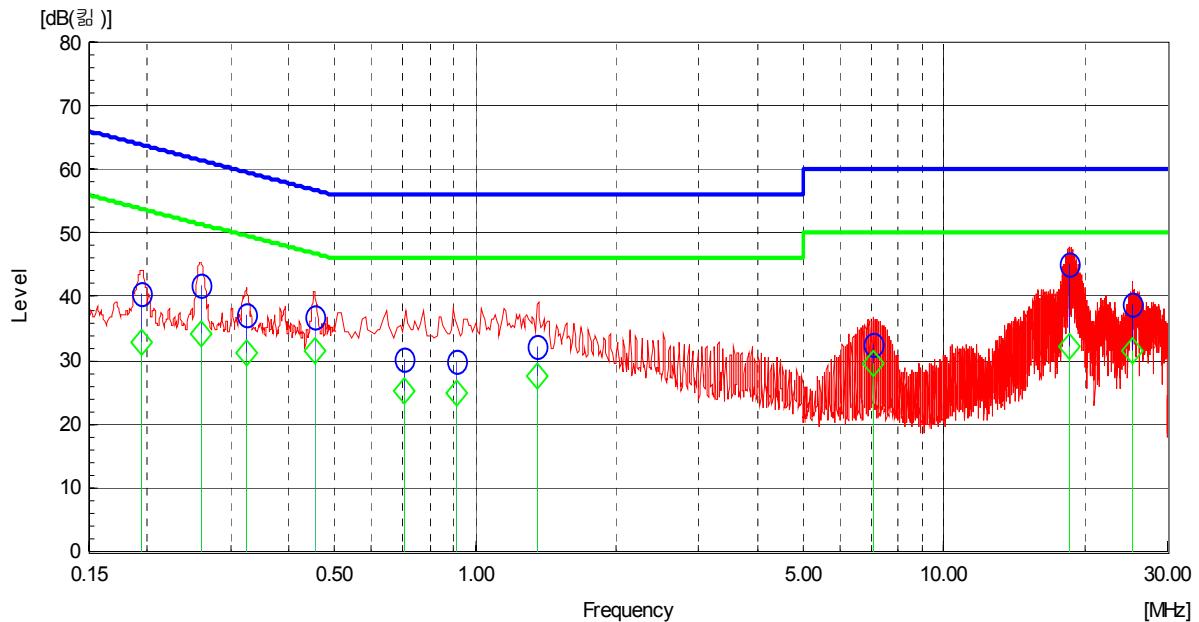
NOTES:

1. * H : HOT Line , **N : Neutral Line
2. Margin value = Limit – Result
3. Measurement were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15

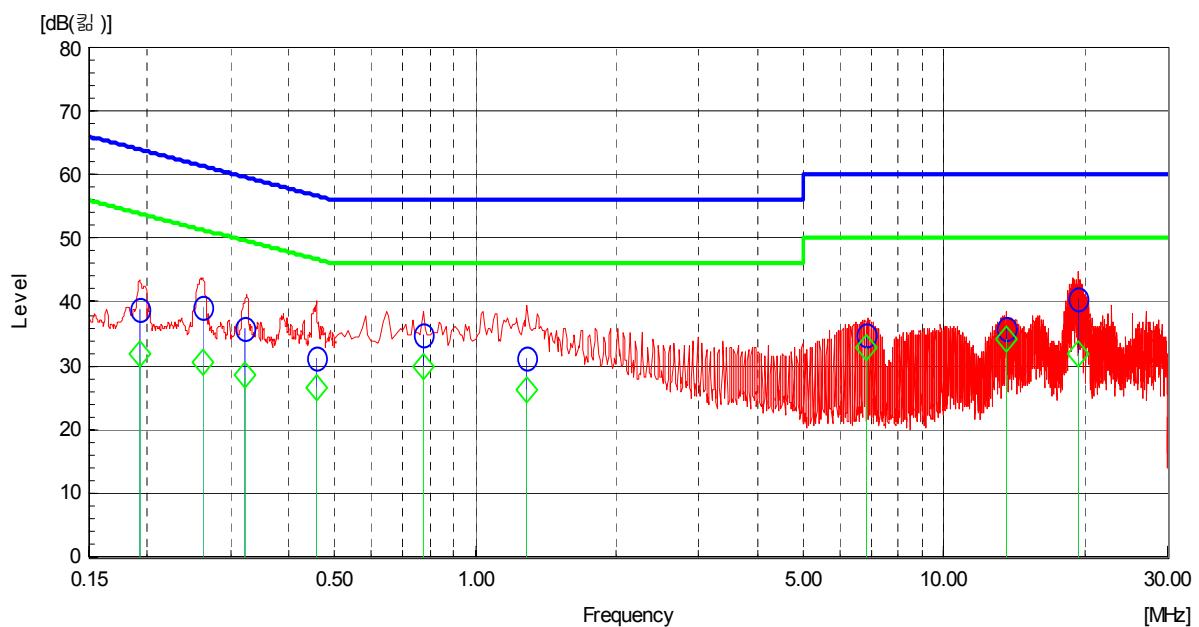


Test Engineer: **Hyung-min, Choi**

Line: HOT Line

Limit :
Quasi-Peak (Blue line)
Average (Green line)

Line: Neutral Line



Quasi-peak



Average



5.3 Radiated Emissions Measurement

EUT	LCD MONITOR / L22C0E080 (S/N: N/A)		
Limit apply to	FCC Part 15.109(g) (CISPR 22 Class B)		
Test Date	April 07, 2008		
Operating Condition	"H" pattern display and MP3 file play mode		
LCD Panel Model	LTM220M1-L01		
Result	Passed by 3.10 dB		

Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. Detector mode: CISPR Quasi – Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
36.83	14.62	V	9.07	1.61	25.30	30.00	4.70
49.03	13.06	V	9.66	2.08	24.80	30.00	5.20
129.82	12.75	V	10.90	3.25	26.90	30.00	3.10
173.87	12.01	V	10.46	3.83	26.30	30.00	3.70
189.51	10.20	V	9.95	3.95	24.10	30.00	5.90
199.06	9.76	H	9.84	4.00	23.60	30.00	6.40
242.71	16.30	H	11.06	4.74	32.10	37.00	4.90
273.37	14.96	H	11.94	5.20	32.10	37.00	4.90
297.91	15.47	H	12.65	5.48	33.60	37.00	3.40
322.97	14.53	H	13.09	5.78	33.40	37.00	3.60
425.21	11.73	V	15.07	6.90	33.70	37.00	3.30

NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The measurement was performed for the frequency range 30 MHz – 1 000 MHz according to FCC Part 15.109(g) and CISPR 22 Class B.



Test Engineer: Hyung-min, Choi



FCC TEST REPORT

EUT	LCD MONITOR / L22C0E080 (S/N: N/A)		
Limit apply to	FCC Part 15.109(g) (CISPR 22 Class B)		
Test Date	April 07, 2008		
Operating Condition	"H" pattern display and MP3 file play mode		
LCD Panel Model	LM220WE1		
Result	Passed by 3.10 dB		

Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. Detector mode: CISPR Quasi – Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB μ N]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB μ N/m]	Limit [dB μ N/m]	Margin [dB]
36.18	15.51	V	9.01	1.58	26.10	30.00	3.90
72.34	14.95	V	8.12	2.23	25.30	30.00	4.70
129.59	11.66	V	10.89	3.25	25.80	30.00	4.20
148.61	11.42	V	11.36	3.52	26.30	30.00	3.70
173.83	12.30	V	10.46	3.84	26.60	30.00	3.40
223.13	10.17	V	10.50	4.53	25.20	30.00	4.80
248.16	17.86	H	11.22	4.82	33.90	37.00	3.10
272.72	16.28	H	11.93	5.19	33.40	37.00	3.60
297.24	15.50	H	12.63	5.47	33.60	37.00	3.40
322.96	13.93	H	13.09	5.78	32.80	37.00	4.20
425.24	11.83	V	15.07	6.90	33.80	37.00	3.20

NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The measurement was performed for the frequency range 30 MHz – 1 000 MHz according to FCC Part 15.109(g) and CISPR 22 Class B.



Test Engineer: Hyung-min, Choi

6. SAMPLE CALCULATION

Sample 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

$$dB(\mu V) = 20 \log_{10} (uV) : \text{Equation}$$

Example : @ 129.82 MHz

Class B Limit	=	30.00 dBuV/m
Reading	=	12.75 dBuV
Antenna Factor + Cable Loss	=	10.90 + 3.25 = 14.15 dBuV/m
Total	=	26.90 dBuV/m
Margin	=	30.00 – 26.90 = 3.10 Db
	=	3.10 dB below Limit



FCC TEST REPORT

7. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
<input checked="" type="checkbox"/>	EMI TEST Receiver	ESVS 10	R & S	835165/001	09.04.04
<input checked="" type="checkbox"/>	EMI TEST Receiver	ESPI 3	R & S	100478	08.10.04
<input checked="" type="checkbox"/>	LISN	3816-2	EMCO	1001	08.10.05
<input checked="" type="checkbox"/>	LISN	3816-2	EMCO	1002	08.10.05
<input checked="" type="checkbox"/>	LogBicon Antenna	VULB9165	Schwarzbeck	2023	09.08.28
<input checked="" type="checkbox"/>	Turn-Table	DETT-03	Daeil EMC	-	N/A
<input checked="" type="checkbox"/>	Antenna Master	DEAM-03	Daeil EMC	-	N/A