Nemko Korea Co., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

TEL:+82 31 322 2333 FAX:+82 31 322 2332

FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Hansol LCD Inc.
#27-29, Hancheon-Ri, Ducksan-Myun,
Jincheon-Gun, Choongbuk, Korea
Attn : Mr. W. S. Lee

Dates of Issue :August 18, 2003
Test Report No. : NK2DE505
Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID	***MSAB17DF-1***
Brand Name	***Hansol***
Contact Person	**Hansol LCD Inc.** **#27-29, Hancheon-Ri, Ducksan-Myun, Jincheon-Gun, Choongbuk, Korea** **Mr. W. S. Lee** **Telephone No. : +82 +43 530 8554**

FCC Rule Part(s): Part 15 & 2
Classification : FCC Class B Device
EUT Type: 17" LCD Monitor

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.
I attest to the accuracy of data and 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.

Baek sung hun

Tested By : S. H. Baek
Engineer

Reviewed By : H.H. Kim
Manager & Chief Engineer

TABLE OF CONTENTS

SCOPE	**3**
INTRODUCTION (Site Description)	**4**
TEST CONDITION & EUT INFORMATION	**5**
DESCRIPTION OF TESTS (Conducted Emissions)	**7**
DESCRIPTION OF TESTS (Radiated Emissions)	**8**
TEST DATA (Conducted Emissions)	**9**
TEST DATA (Radiated Emissions)	**12**
PLOTS OF EMISSIONS	**18**
Conducted Emissions Diagram	
SAMPLE CALCULATIONS	**30**
ACCURACY OF MEASUREMENT	**31**
LIST OF TEST EQUIPMENT	**32**
RECOMMENDATION/CONCLUSION	**33**
APPENDIX A – SAMPLE LABEL	**34**
APPENDIX B - CIRCUIT DIAGRAM	**35**
APPENDIX C - PHOTOGRAPHS OF TEST SET-UP	**36**
APPENDIX D - EUT PHOTOGRAPHS	**38**
APPENDIX E - USER'S MANUAL	**54**
APPENDIX F - SCHEMATIC DIAGRAM	**55**

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 under FCC part 15.

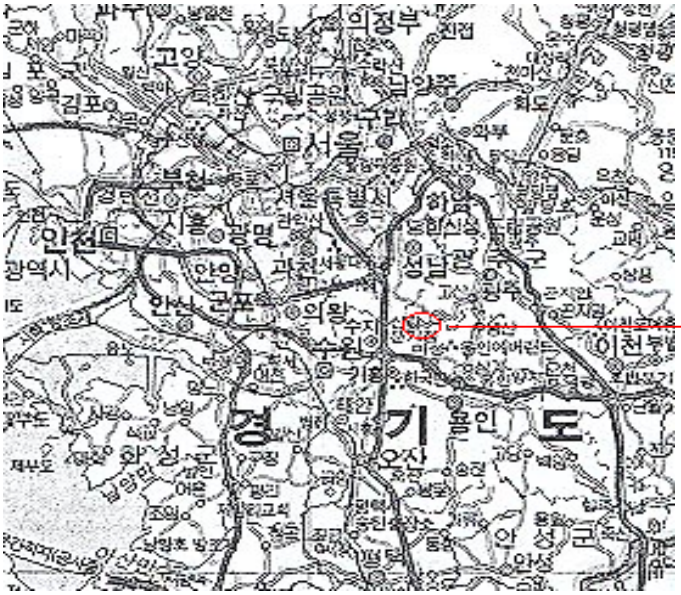
Responsible Party* :	Hansol LCD Inc.
Contact Person :	Mr. W. S. Lee Tel No.: +82 +43 530 8554
Manufacturer :	Hansol LCD Inc. #27-29, Hancheon-ri, Ducksan-Myun, Jincheon-Gun, Choongbuk, Korea Tel No.: +82 +43 530 8554
Factory :	1) Hansol Electronics (Thailand) Co., Ltd. 168 Moo 1 Tambon Banbung, Amphoe Banbung, Chonburi Province 20170 Thailand 2) Namsong Industrial Co., Ltd. 2-Da, 509 Sihwa Industrial Complex, Shiheung-Shi, Kyonggi-Do, 429-450(429-849), Korea

- FCC ID: MSAB17DF-1
- MODEL: B17DF
- Brand Name: Hansol
- EUT Type: 17” LCD Monitor
- Electric Rating: 100-240V AC, 50/60Hz, 0.6A
- Port/Connector: D-Sub, DVI, Audio In, Headphone or Speaker Output
- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: August 05, 2003 to August 08,2003
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2DE505

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 C63.4-1992) was used in determining radiated and conducted emissions emanating from **Hansol LCD Inc.**
FCC ID : **MSAB17DF-1, 17" LCD Monitor.**

These measurement tests were conducted at ***Nemko Korea Co., Ltd. EMC Laboratory*** .
The site address is 300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA
The area of Nemko Korea Corporation LTD. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.
It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.
The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.



Nemko Korea Co., Ltd.
OPEN AREA TEST SITE
300-2, Osan-Ri, Mohyun-Myun, Yongin-City Kyungki-Do,KOREA 449-852
Tel)+82-31-322-2333
Fax)+82-31-322-2332

Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab and Incheon Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was operated by the software. The PC sent “H” pattern to monitor(EUT) and The monitor displayed “H” pattern on screen. It also sent “H” pattern to printer, then the printer printed it out. This software had above all functions conduct in order.
And a audio signal from HDD was played continuously.
The two video interface ports of EUT(monitor) were applied to the tests.
Three kinds of combo board and a LCD panel of EUT (monitor) were applied to the emission tests.

Support Equipment

Monitor(EUT)	Hansol, FCC ID: MSAB17DF-1 1.5m unshielded AC power cable 1.8m shielded D-sub cable 1.8m shielded DVI cable	S/N: N/A
PC	Dell ,Model: Dimension 4550 1.8m unshielded AC power cable	S/N: B56481S
PS/2 Mouse	Logitech, Model: 851028-10000 1.5m unshielded Din cable	S/N: HCA11814927
USB Mouse	Immanuel, Model: OMS3CE 1.5m shielded USB cable	S/N: N/A
Serial Mouse	IO.Tec., Model: Laser Mouse 1.5m unshielded Dsub cable	S/N: N/A
Keyboard	Silitek Yet Foundate, Model: SK-8110 1.8m unshielded Din cable	S/N: N/A
Printer	H.P., Model: C5870A 1.5m unshielded AC power cable 1.8m shielded D-sub cable	S/N: SG88R131GW
Adaptor (Printer)	YOKOGAWA, Model: C4557-60104 1.8m unshielded AC power cable 1.2m unshielded DC power cable	S/N: N/A
Speaker	Gounsori, Model: DS.9802 1.0m unshielded Stereo Jack cable	S/N: N/A

EUT Information

Clock	12MHz(Y1), 14.31818MHz(Y2)
Chipset(s)	U2(WT61P4L44), U4(MST9131), U8(TDA7496L)
Horizontal Frequency	79.976kHz(Max)
Vertical Frequency	75.025Hz(Max)
LCD panel	LTM170EU-*** / Samsung Electronics Co., Ltd.
Combo Board	1) IPHS4L-S / IPT Research Co., Ltd.
	2) AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.
	3) IPHS4L / IPT Research Co., Ltd.
Port(s)	D-Sub, DVI, Audio Input, Headphone or Speaker Output

Description of Test Modes

The EUT was pre-tested under the following resolutions mode:

For Analogue video interface port(Dsub)

1. 1280 X 1024 (75Hz/ 79.976kHz), clock frequency 135.00MHz
2. 1024 X 768 (75Hz/ 60.023kHz), clock frequency 78.75MHz
3. 800 X 600 (75Hz/ 46.875kHz), clock frequency 49.50MHz
4. 640 X 480 (75Hz/ 37.500kHz), clock frequency 31.50MHz

For Digital video interface port(DVI)

1. 1280 X 1024 (75Hz/ 79.976kHz), clock frequency 135.00MHz
2. 1024 X 768 (75Hz/ 60.023kHz), clock frequency 78.75MHz
3. 800 X 600 (75Hz/ 46.875kHz), clock frequency 49.50MHz
4. 640 X 480 (75Hz/ 37.500kHz), clock frequency 31.50MHz

The worst emission level was found when the EUT was tested under 1280 X 1024 resolution, therefore, the test data this mode was recorded in the report.

DESCRIPTION OF TESTS

Conducted Emissions

The Line conducted emission test facility is located inside a 4 X 7 X 2.5 meter shielded enclosure.
It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6.
A 1mX 1.5M wooden table 0.8m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room
Rohde & Schwarz LISN ESH3-Z5 and Kyoritsu LISN KNW-407 50ohm/50uH line impedance stabilization network are bonded to the shielded room.
The EUT is powered from the Rohde & Schwarz LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN s are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1/2”.
If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,
All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentine fashion) to a 1 meter length.
Sufficient time for 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 spectrum analyzer to determine the frequency producing the maximum EME from the EUT.
The spectrum was scanned from 150KHz to 30MHz with 20msec sweep time.
The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).
The detector function was set to CISPR quasi-peak mode & average mode.
The bandwidth of receiver was set to 9KHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.
Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.
Each EME reported was calibrated using the R&S signal generator.

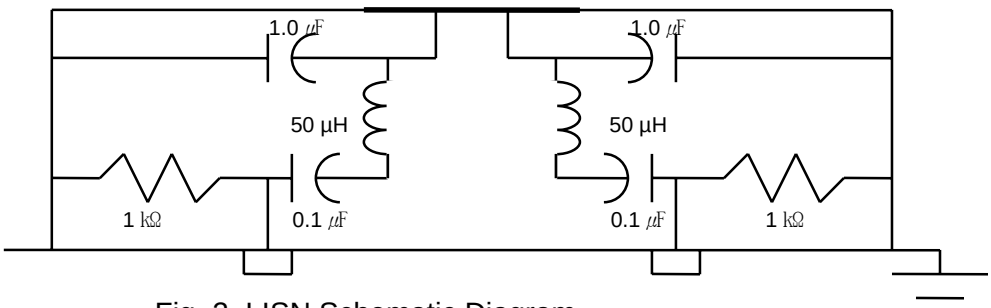


Fig. 2. LISN Schematic Diagram

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band 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 Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found. The spectrum was scanned from 30 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, log periodic antenna (Rohde Schwarz HL025:upto 18GHz) was used.
Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or log periodic antenna.(Rohde Schwarz HL025)
The test equipment was placed on a wooden 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 reexamined and investigated using EMI test receiver.(ESCS30)
The detector function were set to CISPR quasi-peak and peak mode and the bandwidth of the receiver were set to 120KHz and 1MHz depending on the frequency or type of signal.
The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.
The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non- metallic 1.0X 1.5 meter table.
The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.
The turn table containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.
Each EME reported was calibrated using the R/S signal generator.

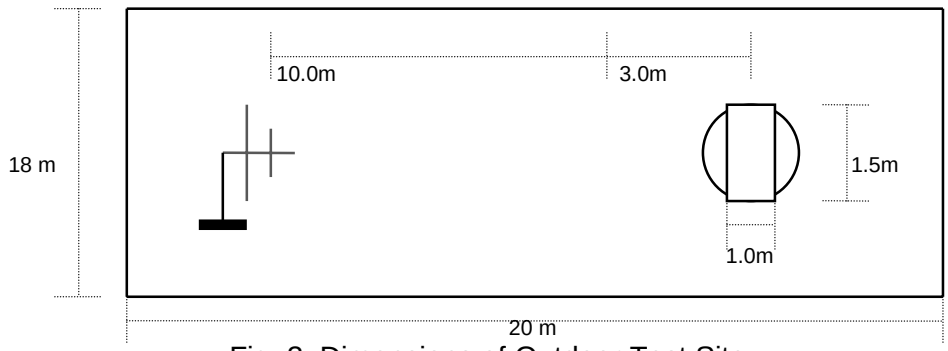


Fig. 3. Dimensions of Outdoor Test Site

TEST DATA

Conducted Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : IPHS4L-S / IPT Research Co., Ltd.

▶ **DVI mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	51.0	41.6	N	63.6	53.6	12.6	12.0
0.30	37.6	30.6	N	60.2	50.2	22.6	19.6
0.70	24.9	24.4	N	56.0	46.0	31.1	21.6
3.00	26.0	24.2	N	56.0	46.0	30.0	21.8
9.82	34.1	27.8	N	60.0	50.0	25.9	22.2
15.23	33.7	27.1	N	60.0	50.0	26.3	22.9

Table 1. Line Conducted Emissions Tabulated Data

▶ **Analogue mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	51.2	40.6	N	63.6	53.6	12.4	13.0
0.30	37.8	30.2	N	60.2	50.2	22.4	20.0
1.20	24.6	23.6	N	56.0	46.0	31.4	22.4
4.00	25.7	23.2	N	56.0	46.0	30.3	22.8
9.61	30.4	25.7	N	60.0	50.0	29.6	24.3
16.83	31.3	27.6	N	60.0	50.0	28.7	22.4

Table 2. Line Conducted Emissions Tabulated Data

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.

2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.

3. The limit for Class B device is on the FCC part section 15.107 (a).

4.LINE : L =Line , N = Neutral

Baek sunghun

Tested by : ***S. H. Baek***

TEST DATA

Conducted Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.

▶ **DVI mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	45.2	37.6	L	63.6	53.6	18.4	16.0
0.30	33.3	27.2	L	60.2	50.2	26.9	23.0
0.90	28.2	26.2	N	56.0	46.0	27.8	19.8
1.10	30.5	26.7	N	56.0	46.0	25.5	19.3
4.31	30.6	25.0	N	56.0	46.0	25.4	21.0
27.80	34.7	30.6	N	60.0	50.0	25.3	19.4

Table 3. Line Conducted Emissions Tabulated Data

▶ **Analogue mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	45.1	37.4	N	63.6	53.6	18.5	16.2
0.30	33.1	26.2	N	60.2	50.2	27.1	24.0
0.92	21.8	18.2	N	56.0	46.0	34.2	27.8
1.10	30.7	29.0	N	56.0	46.0	25.3	17.0
4.11	31.8	27.4	N	56.0	46.0	24.2	18.6
28.31	34.7	29.7	L	60.0	50.0	25.3	20.3

Table 4. Line Conducted Emissions Tabulated Data

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.

2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.

3. The limit for Class B device is on the FCC part section 15.107 (a).

4.LINE : L =Line , N = Neutral

Baek sung khun

*Tested by : **S. H. Baek***

TEST DATA

Conducted Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : IPHS4L / IPT Research Co., Ltd.

▶ **DVI mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	49.1	39.6	L	63.6	53.6	14.5	14.0
0.30	37.1	31.5	L	60.2	50.2	23.1	18.7
8.68	37.4	30.0	L	60.0	50.0	22.6	20.0
15.52	42.6	32.8	N	60.0	50.0	17.4	17.2
22.97	36.5	35.7	L	60.0	50.0	23.5	14.3
25.01	36.4	30.0	L	60.0	50.0	23.6	20.0

Table 5. Line Conducted Emissions Tabulated Data

▶ **Analogue mode**

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dBuV)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	54.0	46.3	N	63.6	53.6	9.6	7.3
0.30	41.0	34.3	N	60.2	50.2	19.2	15.9
1.94	29.4	27.0	L	56.0	46.0	26.6	19.0
3.88	31.5	28.0	L	56.0	46.0	24.5	18.0
7.96	37.3	33.6	L	60.0	50.0	22.7	16.4
15.31	43.8	38.5	N	60.0	50.0	16.2	11.5

Table 6. Line Conducted Emissions Tabulated Data

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.

2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.

3. The limit for Class B device is on the FCC part section 15.107 (a).

4.LINE : L =Line , N = Neutral

Baek sung Hun

Tested by : ***S. H. Baek***

TEST DATA

Radiated Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : IPHS4L-S / IPT Research Co., Ltd.

▶ DVI mode

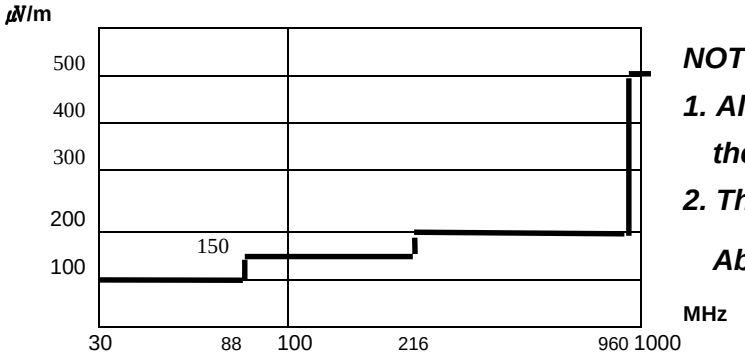
Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
242.43	42.9	H	-12.7	30.2	46.0	15.8
406.36	46.1	V	-8.6	37.5	46.0	8.5
539.99	47.7	H	-5.2	42.5	46.0	3.5
675.01	45.6	H	-1.6	44.0	46.0	2.0
809.95	39.0	H	1.8	40.8	46.0	5.2
945.00	37.4	H	4.7	42.1	46.0	3.9

Table 7. Radiated Measurements at 3meters

▶ Analogue mode

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
66.86	55.5	V	-21.3	34.2	40.0	5.8
299.66	50.8	V	-11.3	39.5	46.0	6.5
633.34	37.6	H	-2.7	34.9	46.0	11.1
681.84	34.8	H	-1.4	33.4	46.0	12.6
878.75	40.5	H	3.4	43.9	46.0	2.1
914.64	32.7	V	4.2	36.9	46.0	9.1

Table 8. Radiated Measurements at 3meters



NOTES:

1. All modes of operation were investigated the worst-case emission are reported.

2. The radiated limits are shown on Figure 4. Above 1GHz the limit is 500 µV/m.

Fig. 4. Limits at 3 meters

NOTES:

1. *Pol. H =Horizontal V=Vertical

2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

3. 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.

Tested by : **S. H. Baek**

TEST DATA

Radiated Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.

▶ DVI mode

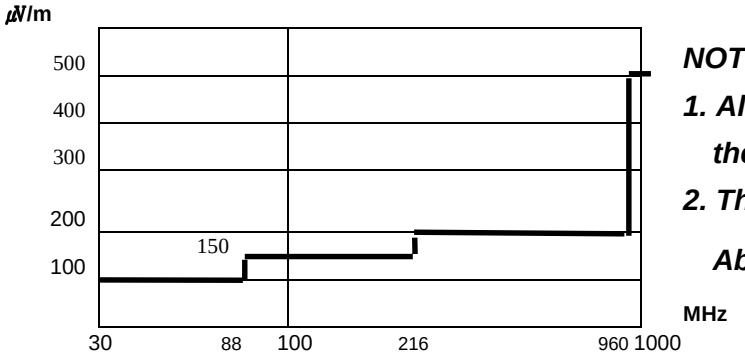
Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
33.88	56.9	V	-22.3	34.6	40.0	5.4
63.95	54.6	V	-21.4	33.2	40.0	6.8
539.99	48.2	V	-5.2	43.0	46.0	3.0
674.99	45.7	H	-1.6	44.1	46.0	1.9
809.00	38.6	H	1.8	40.4	46.0	5.6
945.00	39.3	H	4.7	44.0	46.0	2.0

Table 9. Radiated Measurements at 3meters

▶ Analogue mode

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
33.84	57.0	H	-22.3	34.7	40.0	5.3
63.75	56.3	H	-21.4	34.9	40.0	5.1
300.63	49.2	V	-11.3	37.9	46.0	8.1
342.34	49.5	H	-10.2	39.3	46.0	6.7
433.52	45.8	H	-7.9	37.9	46.0	8.1
877.78	39.0	H	3.4	42.4	46.0	3.6

Table 10. Radiated Measurements at 3meters



NOTES:

1. All modes of operation were investigated the worst-case emission are reported.

2. The radiated limits are shown on Figure 5. Above 1GHz the limit is 500 µV/m.

Fig. 5. Limits at 3 meters

NOTES:

1. *Pol. H =Horizontal V=Vertical

2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

3. 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.

Tested by : **S. H. Baek**

TEST DATA

Radiated Emissions

FCC ID : MSAB17DF-1

LCD Panel : LTM170EU-* / Samsung Electronics Co., Ltd.**

Combo Board : IPHS4L / IPT Research Co., Ltd.

▶ **DVI mode**

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
310.33	45.5	V	-11.0	34.5	46.0	11.5
406.36	45.3	V	-8.6	36.7	46.0	9.3
529.55	38.0	V	-5.5	32.5	46.0	13.5
540.04	48.1	V	-5.2	42.9	46.0	3.1
674.99	45.5	H	-1.6	43.9	46.0	2.1
944.99	39.3	H	4.7	44.0	46.0	2.0

Table 11 Radiated Measurements at 3meters

▶ **Analogue mode**

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
265.71	50.5	H	-12.1	38.4	46.0	7.6
389.87	44.4	V	-9.0	35.4	46.0	10.6
567.38	36.9	H	-4.5	32.4	46.0	13.6
681.84	36.3	H	-1.4	34.9	46.0	11.1
877.78	37.4	V	3.4	40.8	46.0	5.2
924.34	38.7	V	4.3	43.0	46.0	3.0

Table 12 Radiated Measurements at 3meters

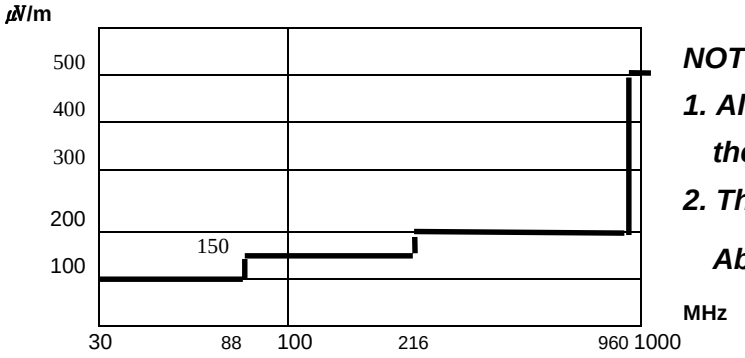


Fig. 6. Limits at 3 meters

NOTES:

1. All modes of operation were investigated the worst-case emission are reported.

2. The radiated limits are shown on Figure 6. Above 1GHz the limit is 500 μV/m.

NOTES:

1. *Pol. H =Horizontal V=Vertical

2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.

3. 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.

Tested by : **S. H. Baek**

PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, DVI mode)***

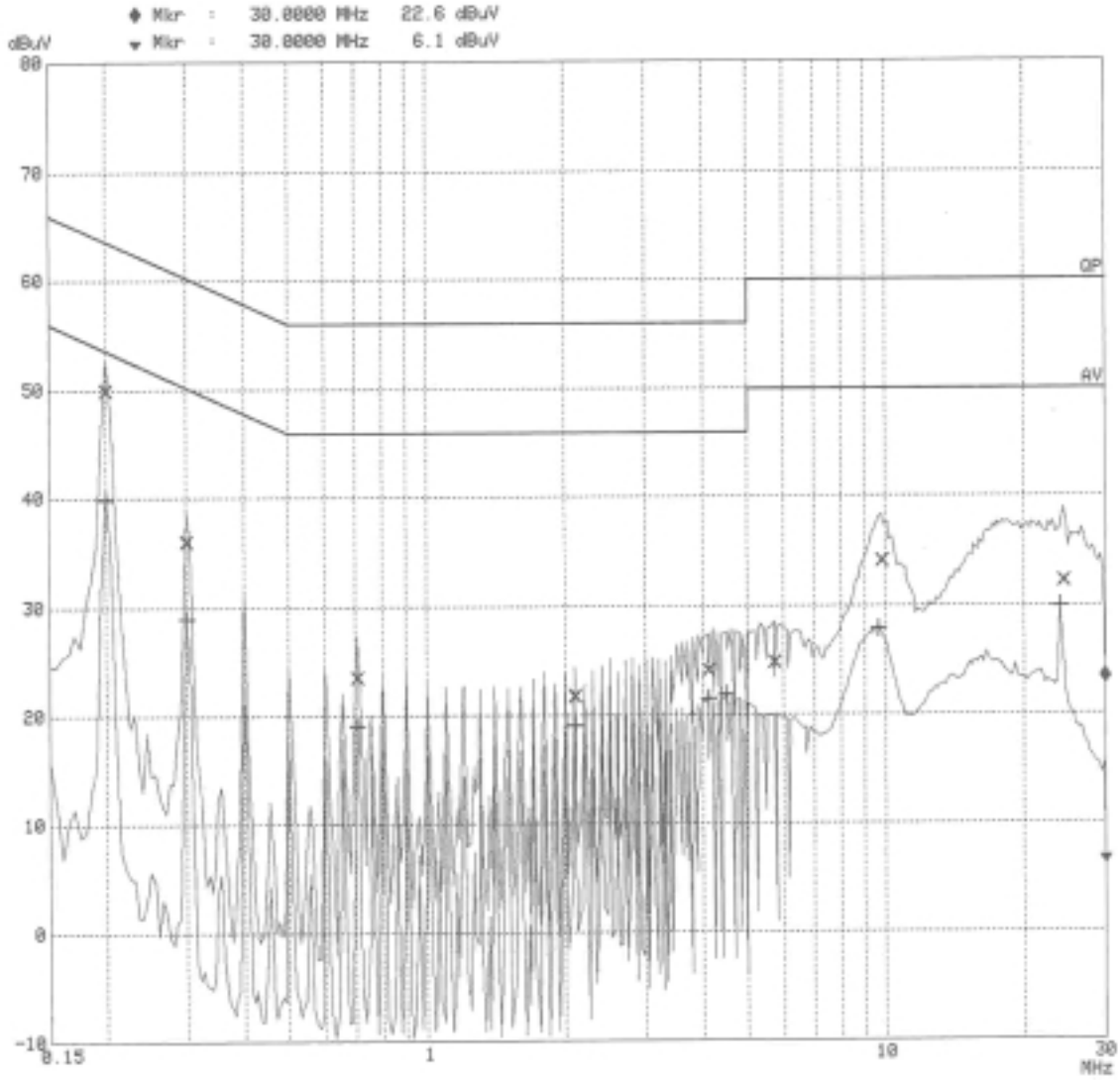
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L-S / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k         9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  34dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, DVI mode)***

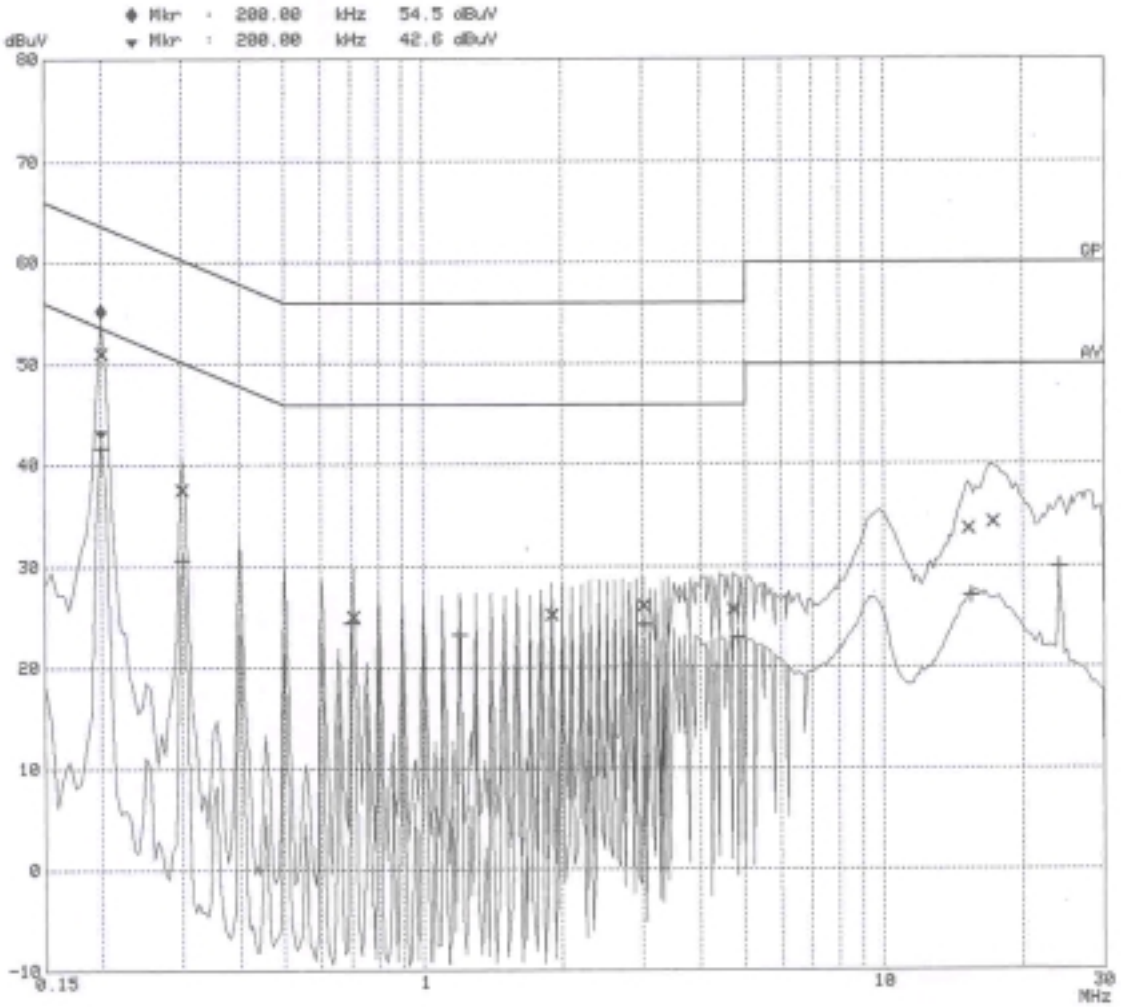
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L-S / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k         9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  34dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, Analogue mode)***

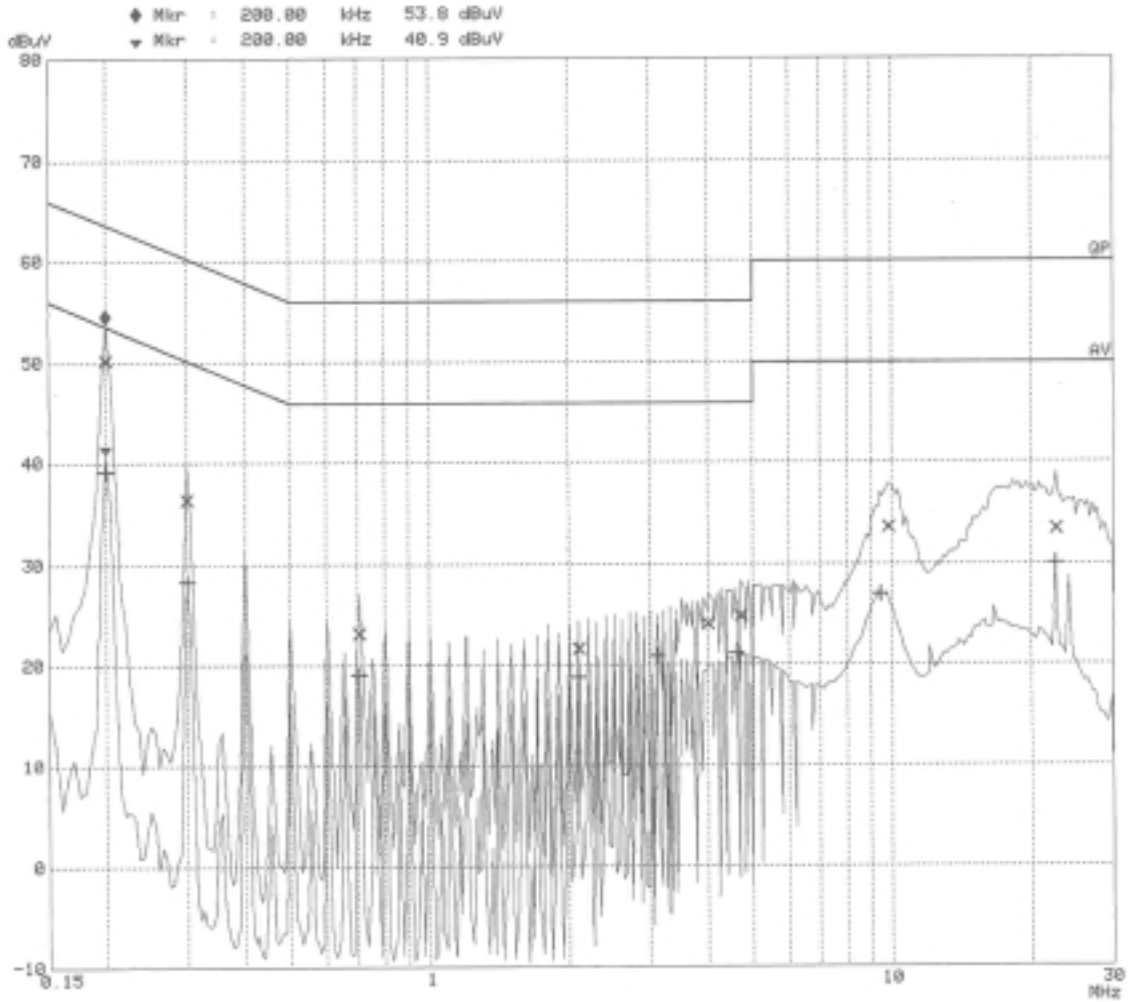
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L-S / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  34dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, Analogue mode)***

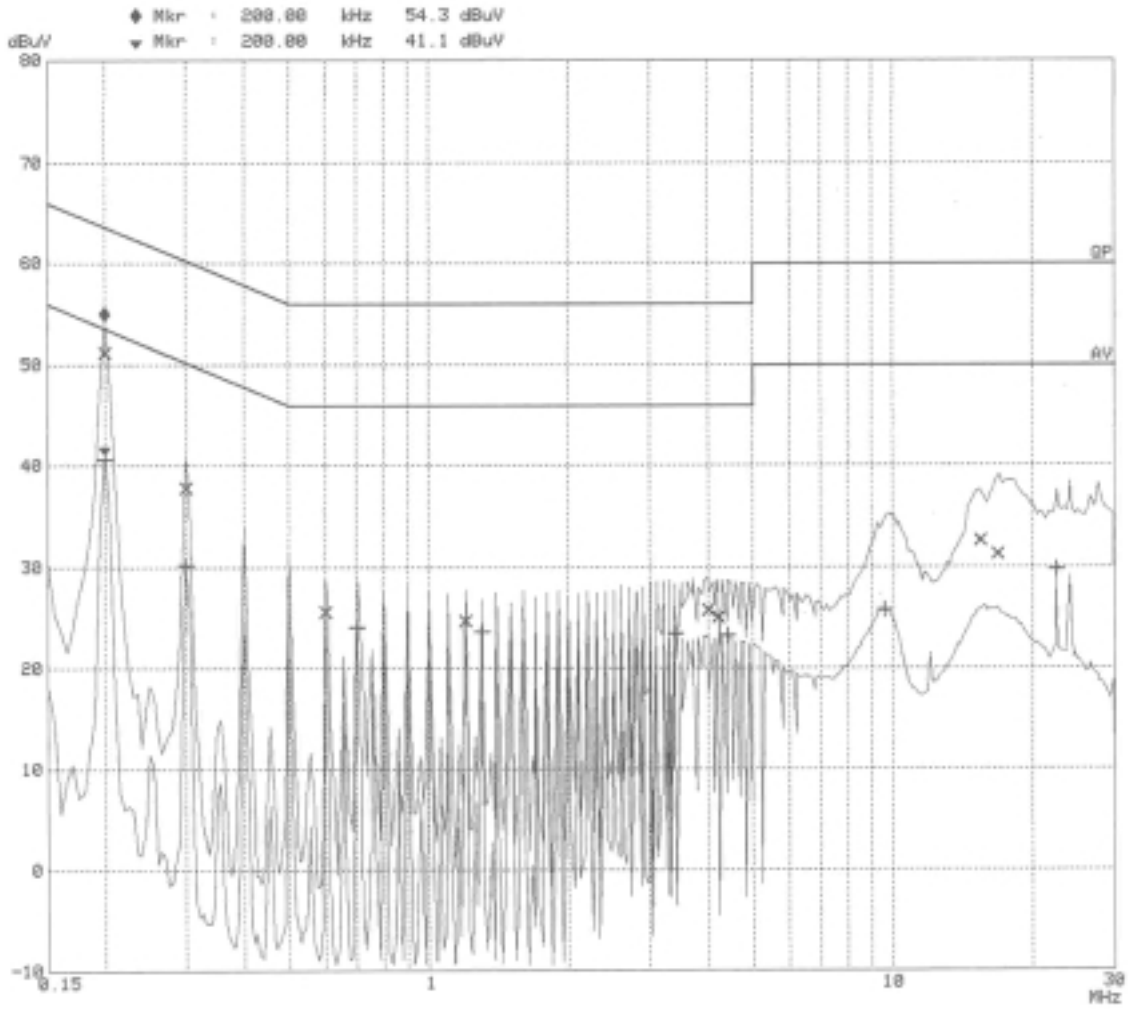
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L-S / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k         9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  34dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, DVI mode)***

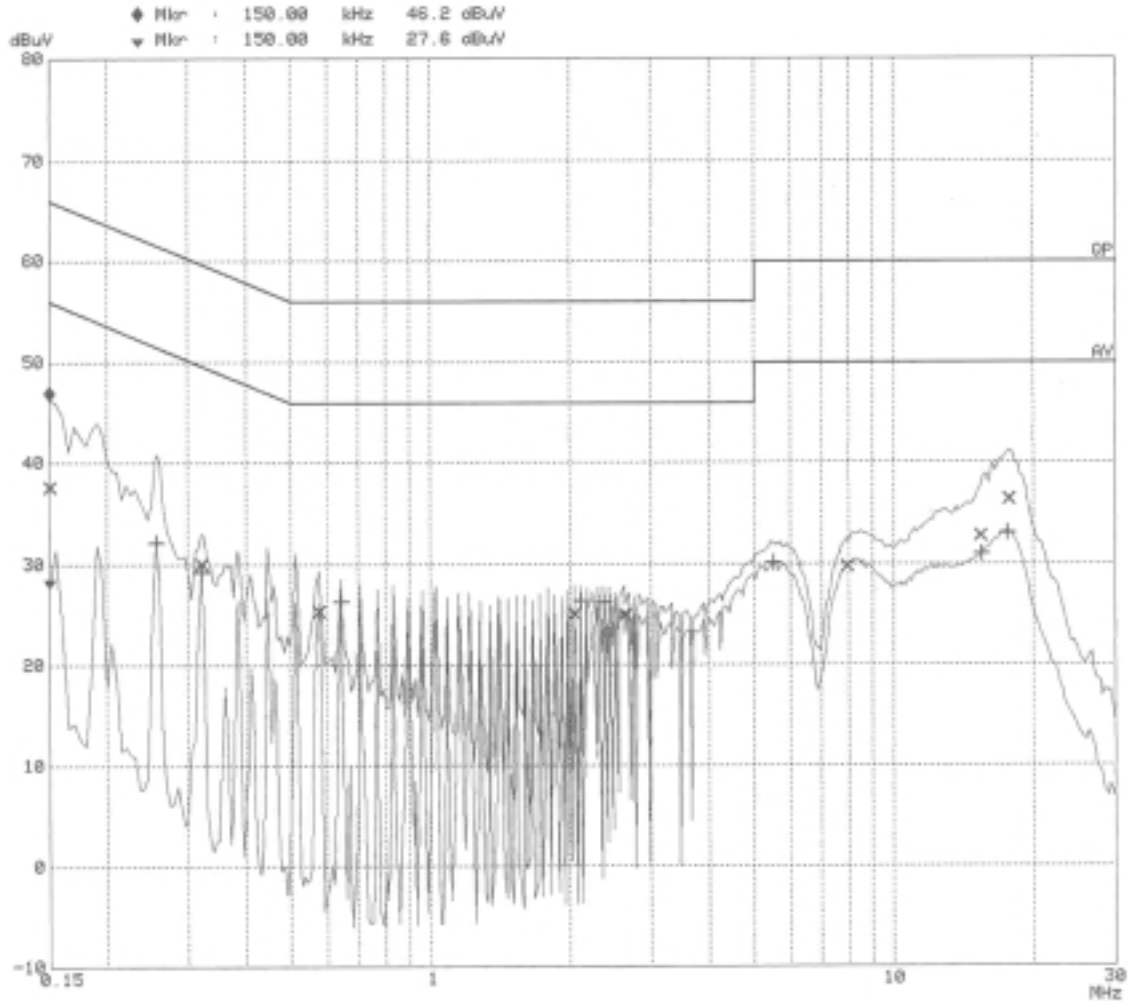
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  30dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, DVI mode)***

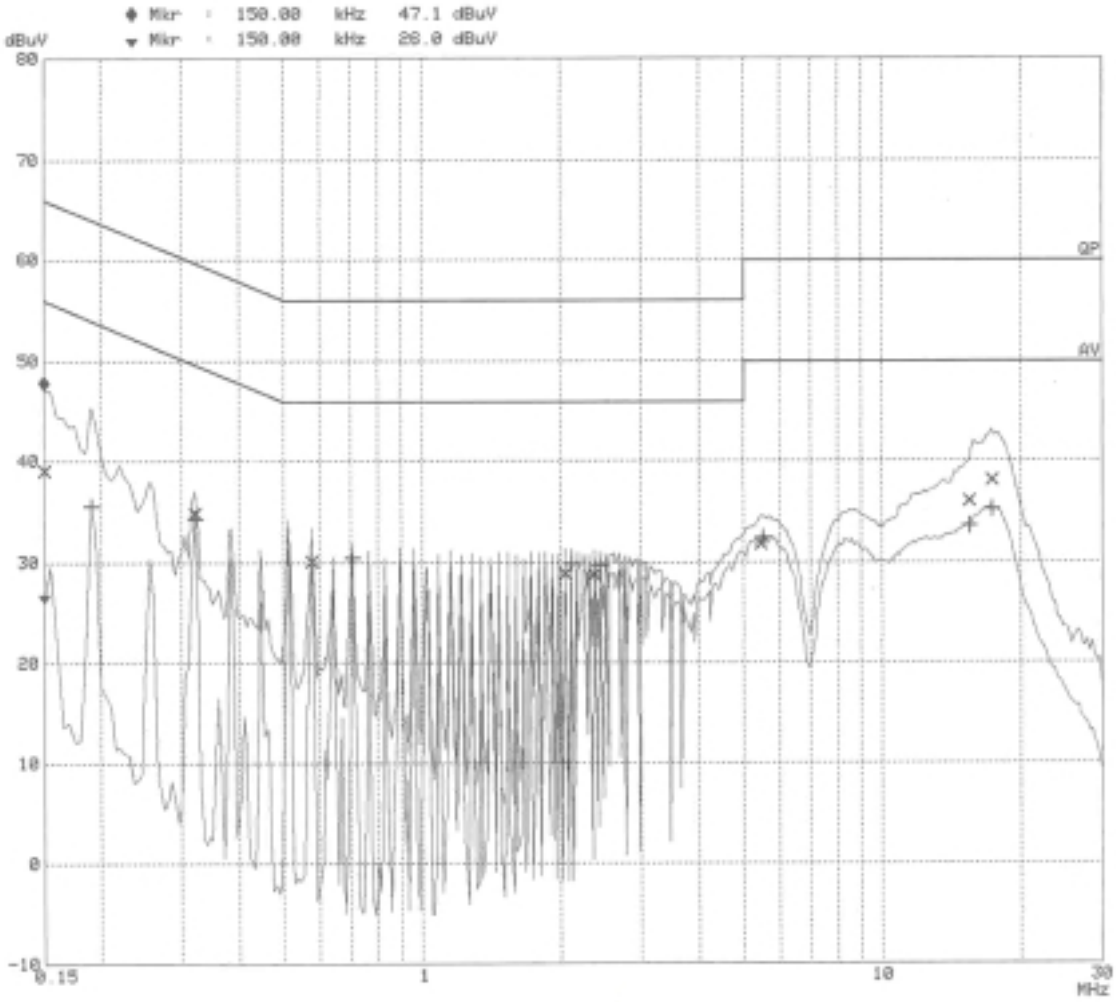
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop        Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M          5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  30dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, Analogue mode)***

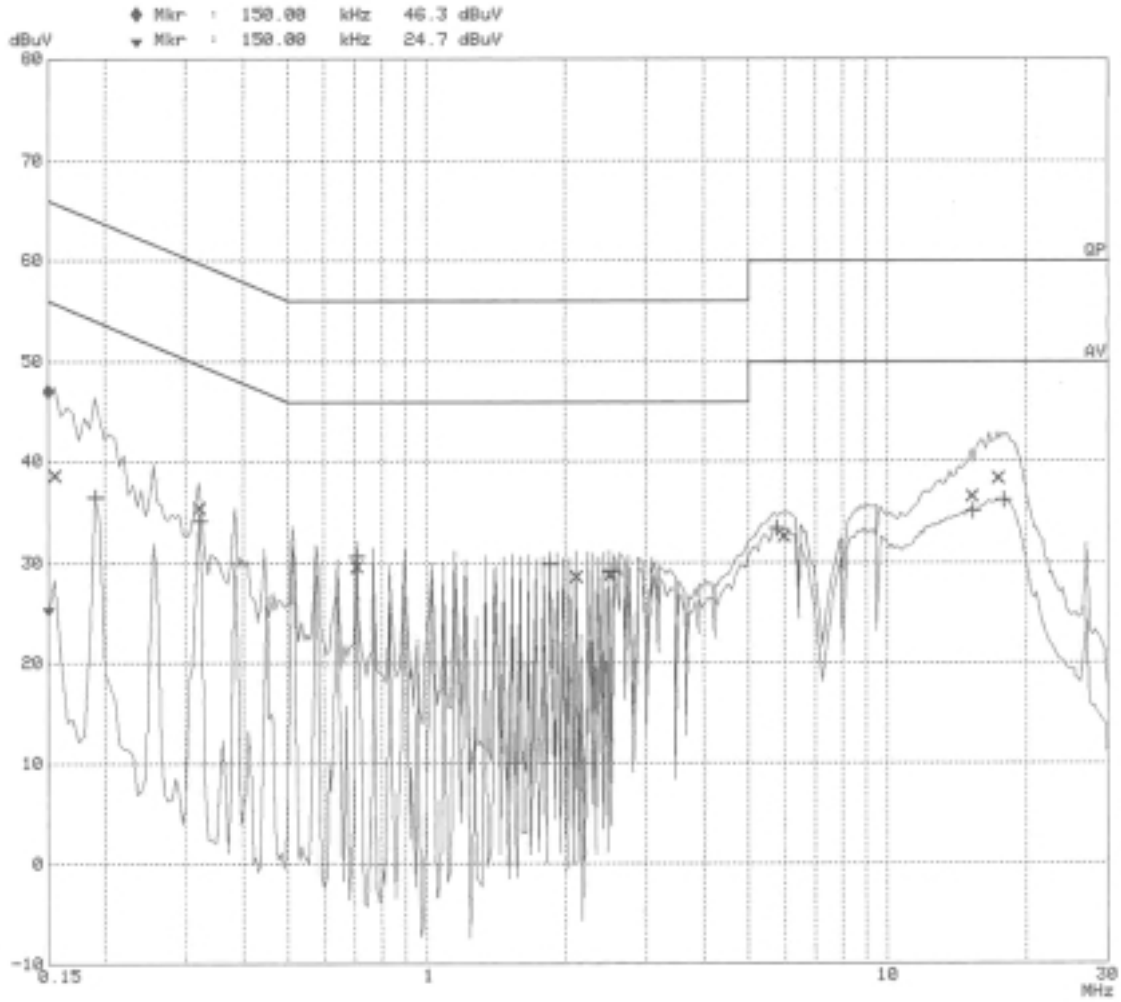
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  35dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, Analogue mode)***

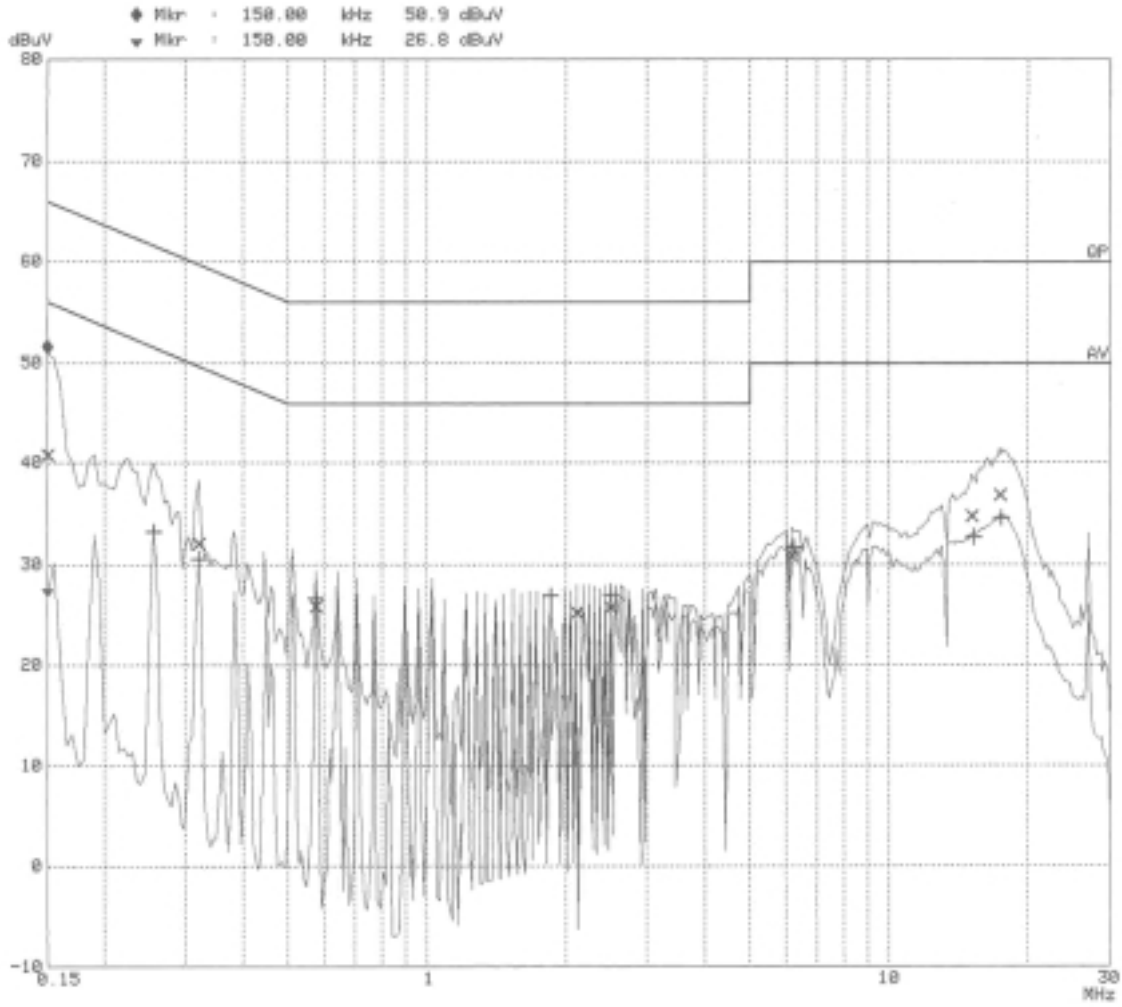
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : AI-0017 / Lien Chang Electronic Enterprise Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  35dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, DVI mode)***

  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

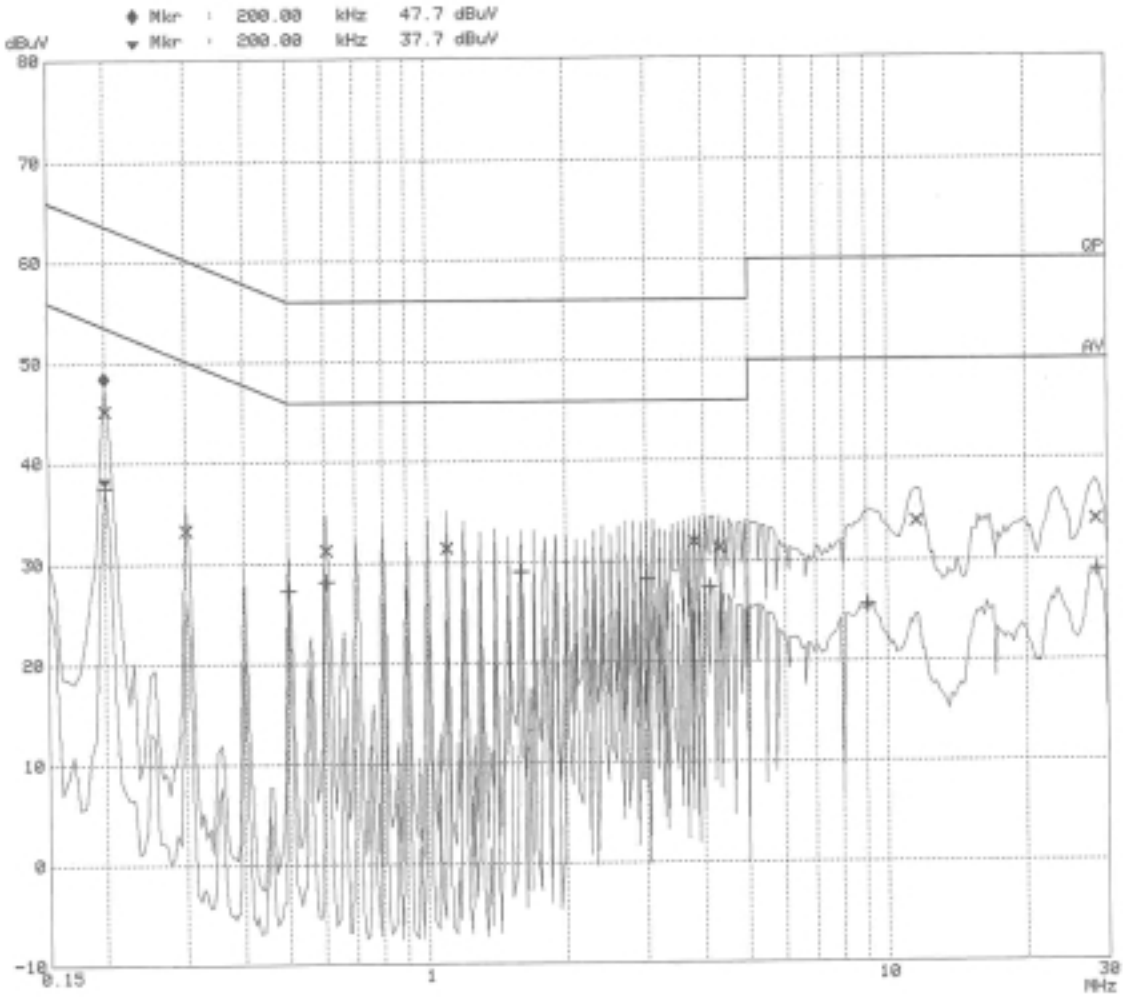
  ▶ *Combo Board : IPHS4L / IPT Research Co., Ltd.*

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	30M	5k	9k	PK+AV	20ms	AUTO LN	ON

Transducer No.	Start	Stop	Name
20	150k	30M	LISN_RS

Final Measurement: x QP / + AV
Meas Time: 200 ms
Subranges: 8
Acc Margin: 35dB



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, DVI mode)***

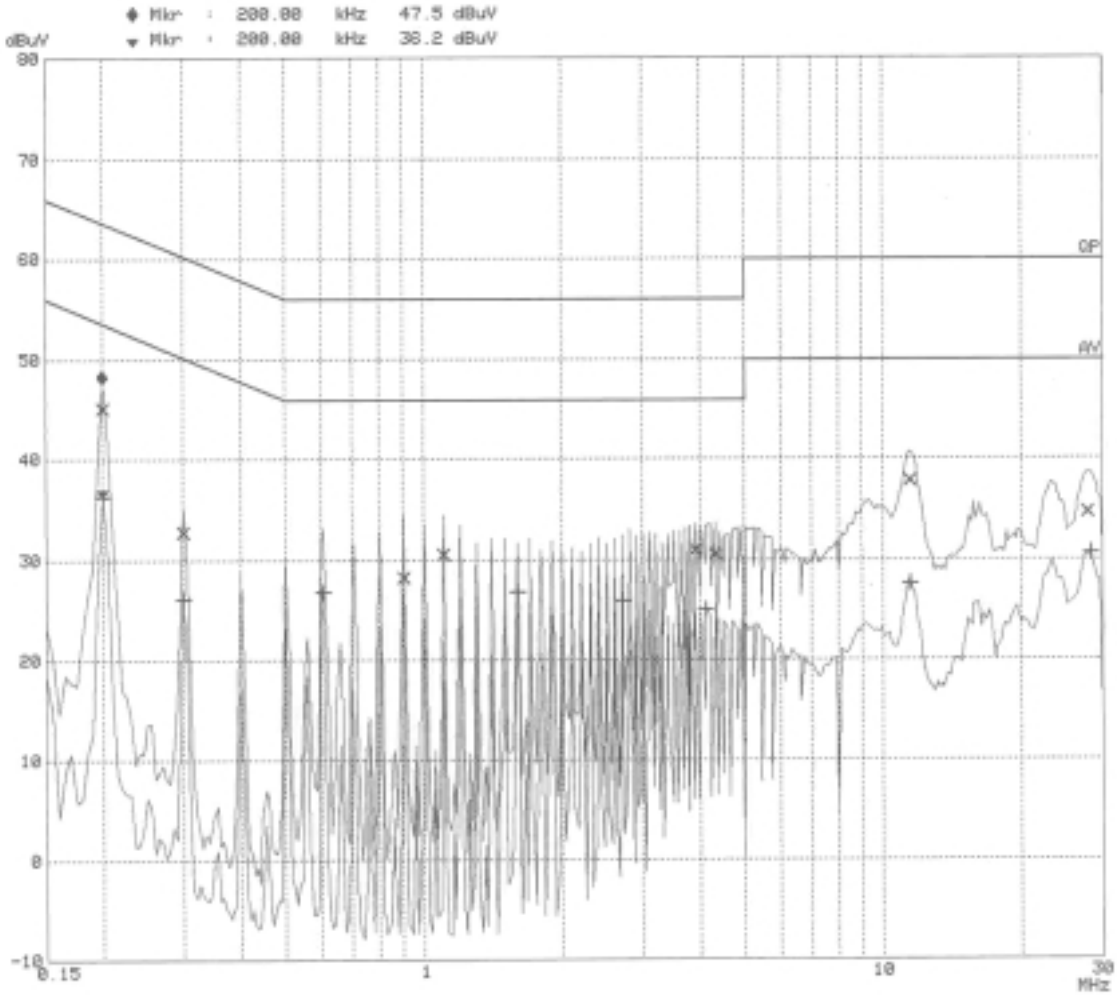
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
|--------- Frequencies -----------||--------- Receiver Settings ---------|
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
            20   150k       30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  35dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line, Analogue mode)***

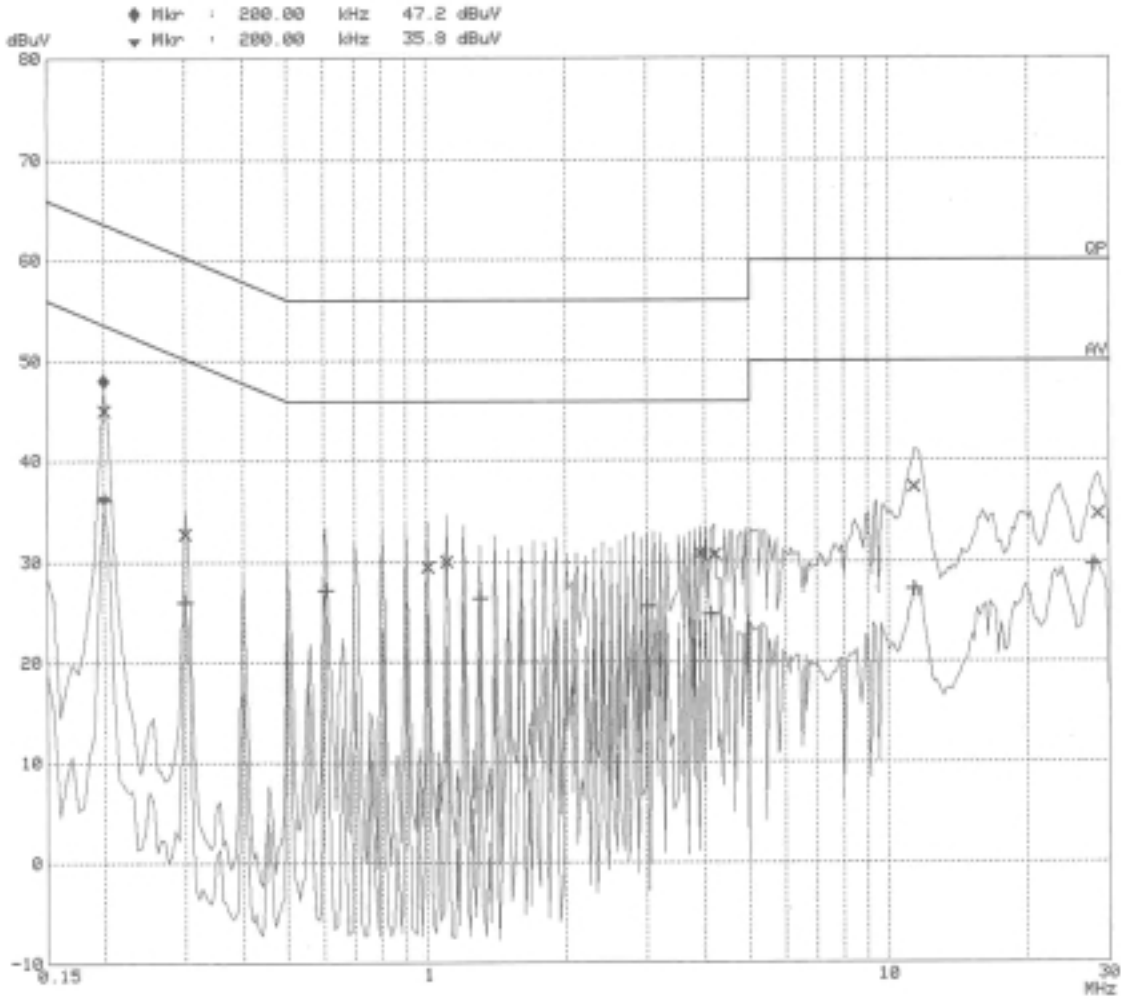
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  35dB
```



PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral, Analogue mode)***

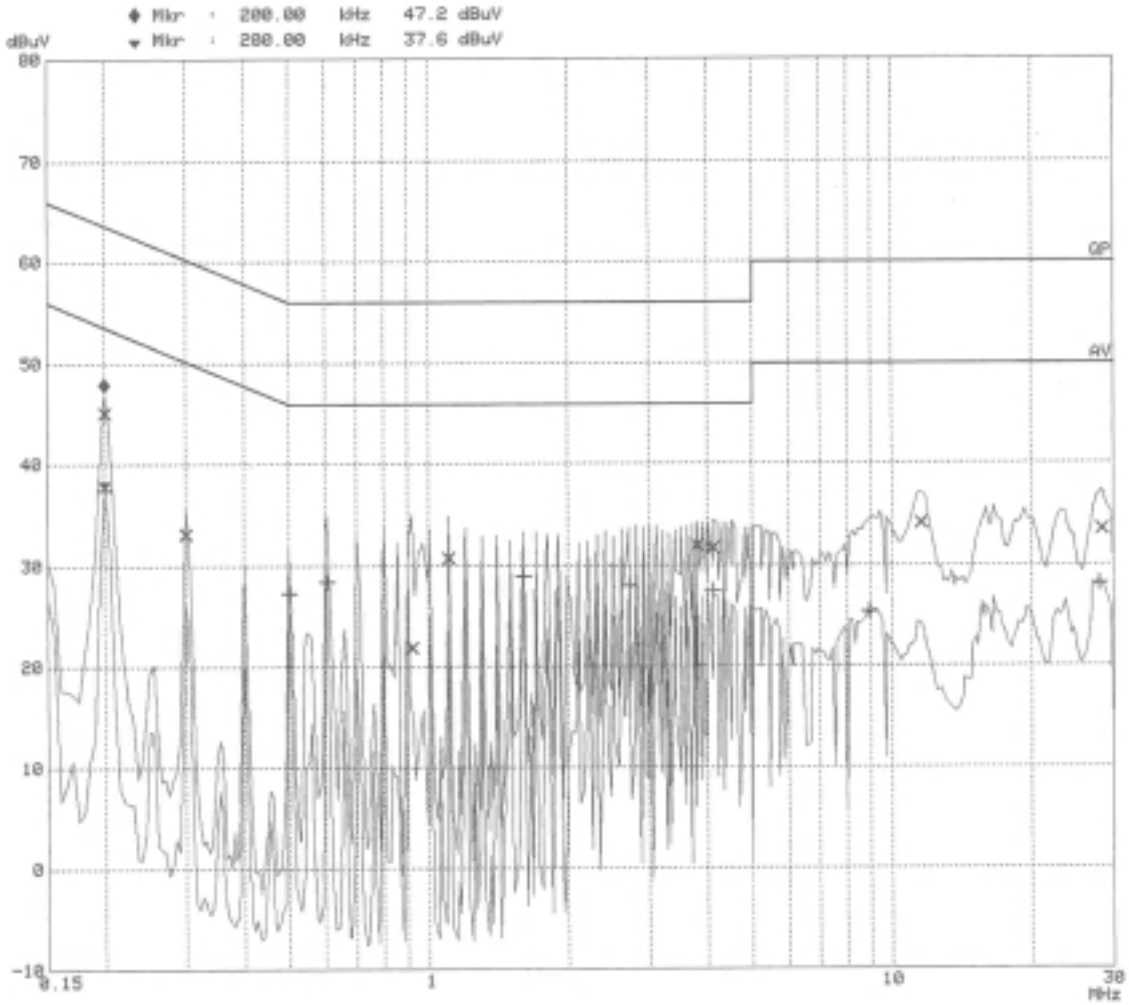
  ▶ *LCD Panel : LTM170EU-*** / Samsung Electronics Co., Ltd.*

  ▶ *Combo Board : IPHS4L / IPT Research Co., Ltd.*

```
Scan Settings (1 Range)
¦--------- Frequencies -----------¦¦--------- Receiver Settings ---------¦
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 150k          30M           5k          9k     PK+AV    20ms AUTO LN   ON

Transducer No. Start       Stop       Name
           20   150k        30M      LISN_RS

Final Measurement: x QP / + AV
                   Meas Time:  200 ms
                   Subranges:    8
                   Acc Margin:  35dB
```



SAMPLE CALCULATIONS

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

$$\mu V = 10^{(\text{dB}\,\mu V/20)}$$

EX. 1.

@57.7 MHz Class B limit = 100 μV/m = 40.0 dB μV/m

Reading = 19.1 dB μV(calibrated level)
Antenna factor + Cable Loss = 10.12 dB
Total = 29.22 dB μV/m
Margin = 40.0 - 29.22 = 10.78
10.78 dB below the limit

ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

1. Radiation Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity	Rectangular	± 1.0
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Inperfections	Rectangular	± 2.0
Mismatch:Receiver VRC ri=0.3 Antenna VRC rR=0.1(Bi)0.4(Lp) Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	+ 0.25 / - 0.26
System Repeatibilty	Std.deviation	± 0.05
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.77
Expended Uncertainty U	Normal (k=2)	± 3.5

2. Conducted Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Receiver Specification	Normal (k=2)	± 2.0
LISN coupling spec.	Normal (k=2)	± 0.4
Cable and input attenuator cal.	Rectangular	± 0.4
Mismatch:Receiver VRC ri=0.3 LISN vrc rg=0.1 Uncertainty Limits 20Log(1+/-ri rR)	U-Shaped	± 0.26
System Repeatibilty	Std.deviation	± 0.68
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.18
Expended Uncertainty U	Normal (k=2)	± 2.4

LIST OF TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2002.09
2	Test Receiver	PMM	PMM9000	2003.06
3	Amplifier	Agilent	8447F	2003.07
4	*Amplifier	HP	8447F	2002.11
5	*Amplifier	HP	8447F	2003.01
6	*Spectrum Analyzer	Advantest	R3265A	2003.03
7	Spectrum Analyzer	HP	8566B	2003.03
8	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2003.05
9	Log-Periodic Antenna	R & S	HL025	2003.01
10	Dipole Antenna	R & S	VHA9103	2003.05
11	Dipole Antenna	R & S	UHA9105	2003.05
12	*Biconical Log Antenna	ARA	LPB-2520/A	2003.05
13	Asorbing Clamp	R & S	MDS21	2003.06
14	High Voltage Probe	R & S	ESH2-Z3	2002.09
15	Signal Generater	R & S	SMP02	2002.12
16	Matching Pad	R & S	RAM358.5414.02	2003.05
17	*LISN	R & S	ESH3-Z5	2002.10
18	*LISN	Kyoritsu	KNW-407	2003.04
19	LISN	Kyoritsu	KNW-408	2002.12
20	*Position Controller	EM Eng.	N/A	N/A
21	*Turn Table	EM Eng.	N/A	N/A
22	*Antenna Mast	EM Eng.	N/A	N/A
23	*Anechoic Chamber	EM Eng.	N/A	N/A
24	*Shielded Room	EM Eng.	N/A	N/A

*) Test equipment used during the test

RECOMMENDATION/CONCLUSION

The data collected shows that the **Hansol LCD Inc.**
FCC ID : **MSAB17DF-1, 17" LCD Monitor.** complies with § 15.107 ,15.109 of the FCC Rules.
The highest emission observed was at **0.20 MHz** for conducted emissions with a margin of **9.6 dBuV,** at **674.99 MHz** for radiated emissions with a margin of **1.9 dBuV/m**.

APPENDIX A – SAMPLE LABEL

Labelling Requirements

The sample label shown shall be *permanently affixed* at a conspicuous location on the device and be readily visible to the user at the time of purchase.

- **FCC ID Location of EUT**

APPENDIX B – CIRCUIT DIAGRAM

APPENDIX E – USER'S MANUAL

APPENDIX F – SCHEMATIC DIAGRAM