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 PART 15 Class II Permissive Change

Manufacturer:

Hansol Electronics Inc.
#27-29, Hanchun-ri, Ducksan-Myun,
Jinchun-Kun, Choongbuk, Korea
Attn : Mr. S. P. Yang

Dates of Issue :November 4, 2002
Test Report No. : NK2CE706
Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID	***MSAB17BF-1***
Brand Name	***Hansol***
Contact Person	**Hansol Electronics Inc.** **#27-29, Hanchun-ri, Ducksan-Myun, Jinchun-Kun,** **Choongbuk, Korea** **Mr. S. P. Yang** **Telephone No. : +82 43 530 8503**

FCC Rule Part(s): Part 15 & 2
Classification : FCC Class B Device
EUT Type: 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.

Tested By : C. S. Choi
Engineer

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

TABLE OF CONTENTS

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 Electronics Inc.
Contact Person :	Mr. S. P. Yang
	Tel No.: +82 43 530 8503
Manufacturer :	Hansol Electronics Inc.
	#27-29, Hanchun-ri, Ducksan-Myun, Jinchun-Kun, Choongbuk, Korea
	Tel No.: +82 43 530 8503

- FCC ID: MSAB17BF-1
- Brand Name: Hansol
- EUT Type: LCD Monitor
- Classification: FCC Class B
- Rule Part(s): FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (1992)
- Dates of Test: October 17, 2002 to October 28,2002
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2CE706

Description of the Changes according to FCC part 2.1043

1. Change tuner pack for the upgrade of caption menu(TCPN9082DC27B /Samsung)

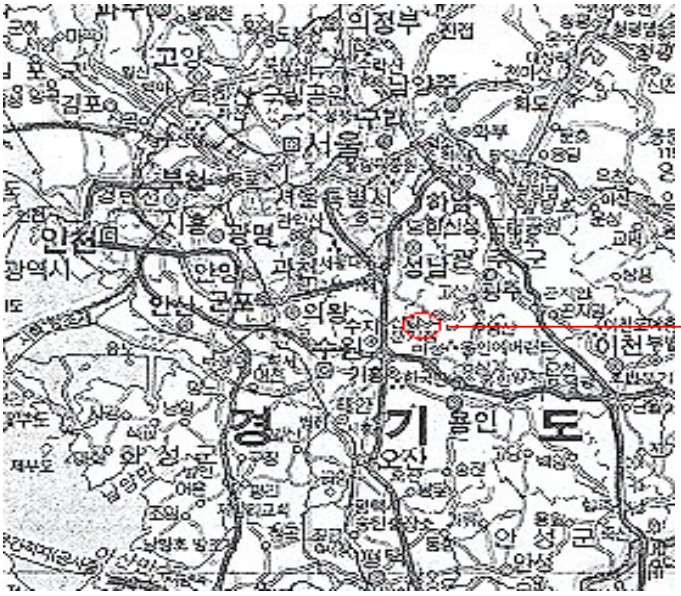
2. Change Adapter (EA1050A / EDAC Power Electronics)

** NOTE: Please refer to the duties and responsibilities of the Responsible Party attached.*

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 Electronics Inc.**
FCC ID : **MSAB17BF-1, 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 50 kilometers (30 miles) southeast and Seoul International Airport (Kimpo 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 Kimpo Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was connected to PC and the monitor was displayed “H” pattern on the screen.
And the EUT was set to video resolution 1280*1024, vertical refresh rate 75Hz
The receiver was tuned to the output frequency of color bar signal generator, with a pattern defined as 100/0/75/0 in the CCIR recommendation 471.

Support Equipment

PC	Fujitsu Siemens Computers , Model: SCENIC 661 PIII 405 1.8m unshielded AC power cable	S/N: N/A
Monitor(EUT)	Hansol, FCC ID: MSAB17BF-1 1.8m shielded D-sub cable	S/N: N/A
Adapter	EDAC Power Electronics Model: EA1050A, 1.8m unshielded AC power cable 1.5m unshielded DC power cable with ferrite core	S/N: N/A
Keyboard	Sejin, Model: SKR-2239 1.8m shield Din cable	S/N: OFA024809
PS/2 Mouse	Logitech, Model: M-S48a 1.5m shield Din cable	S/N: HCA11807841
Printer	HP, Model No: C5870K 1.8m unshielded AC power cable 1.8m Shield D-sub cable	S/N: SG88R131GW

EUT Information

Clock	125MHz(X1), 27.0105MHz(X2), 12MHz(X3, Y1)
Chipset(s)	AD9883A(U1), S5D2530(U2), TW9901(U3), NT68F63(U20)
Horizontal Frequency	79.9kHz(Max)
Vertical Frequency	75Hz(Max)
Port(s)	VGA, S-video, Audio/Video Input, Audio stereo Input,
	Headphone, Tuner

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 and Kyoritsu LISN KNW-408 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 450KHz 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.
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.

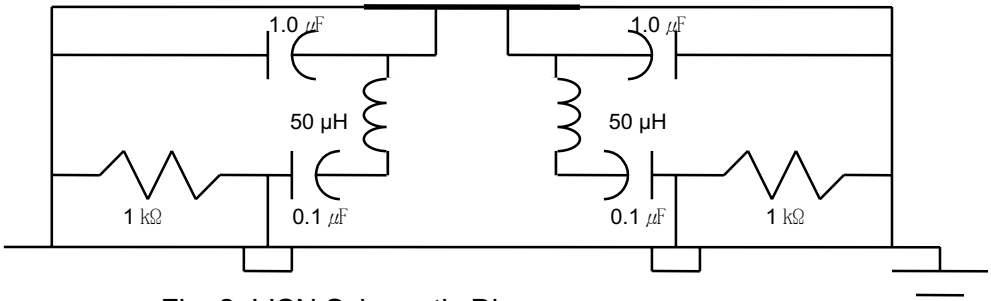


Fig. 2. LISN Schematic Diagram

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 1 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 was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120KHz or 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.

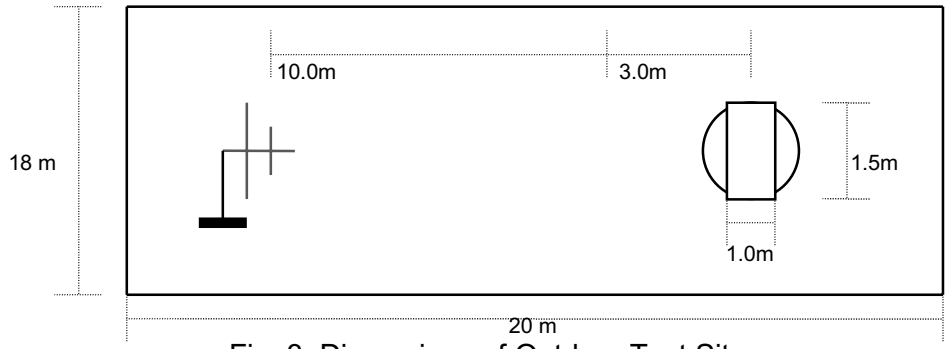


Fig. 3. Dimensions of Outdoor Test Site

DESCRIPTION OF TESTS

Antenna-Conducted Power Measurements

Power on the receive antenna terminals was to be determined by measurement of the voltage present at these terminals.
Antenna –conducted power measurements was performed with the EUT antenna terminals connected directly to measuring instrument (Rohde&Schwarz, ESCS 30) using a impedance-matching network(Rohde&Schwarz, RAM358.5414.02) to connect the measurement instrument to the antenna terminals of the EUT. Losses in decibels in impedance-matching network used was added to the measured values in dBuV.
With the receiver tuned to one of the number of frequency and voltage present at the antenna input terminals over the frequency range specified in the individual equipment requirements. The measurements was repeated with the receiver tuned to another frequency until the number of frequencies had been successively measured.
Power on the receive antenna terminals in the ratio of V^2/R, where V is the loss-corrected voltage measured at the antenna terminals, and R is the impedance of the measuring instrument.

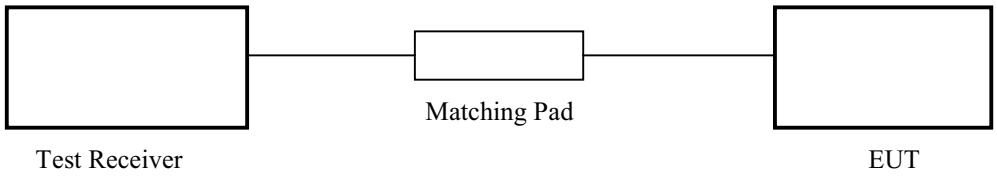


Fig. 4. Description of Test

TEST DATA

Conducted Emissions

FCC ID : MSAB17BF-1
Test Mode : Display "H" pattern on the screen

FREQ (MHz)	LEVEL(dBμV)	LINE	LIMIT(μV)	(μV)	MARGIN*(dB)
1.67	37.1	L	250	71.61	10.9
1.97	43.4	N	250	147.91	4.6
2.12	39.8	N	250	97.72	8.2
15.30	36.3	L	250	65.31	11.7
16.70	40.4	N	250	104.71	7.6
18.22	36.0	N	250	63.10	12.0

Table 1. Line Conducted Emissions Tabulated Data

NOTES:
1. Measurements using CISPR quasi-peak 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 250 μV from 450 kHz to 30MHz.
4.LINE : L =Line , N = Neutral

Tested by **C. S. Choi**

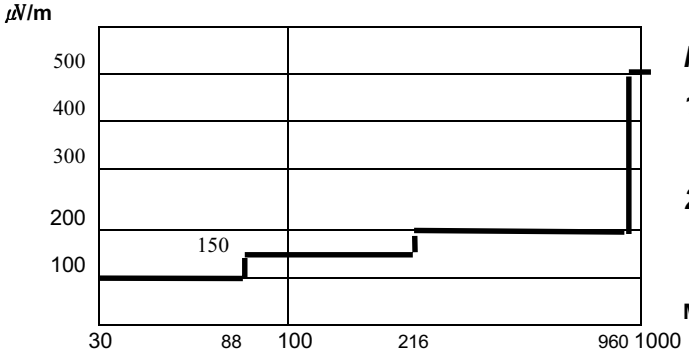
TEST DATA

Radiated Emissions

FCC ID : MSAB17BF-1
Test Mode : Display "H" pattern on the screen

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
134.90	41.7	H	-15.0	26.7	43.5	16.8
269.80	50.3	H	-12.0	38.3	46.0	7.7
404.71	41.7	H	-8.6	33.1	46.0	12.9
674.53	42.3	H	-1.6	40.7	46.0	5.3
809.43	30.9	V	1.8	32.7	46.0	13.3
944.34	33.7	H	4.7	38.4	46.0	7.6

Table 2. 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 ***C. S. Choi***

TEST DATA

Antenna-Conducted Power Measurements

FCC ID : MSAB17BF-1
Test Mode : Tuned to the output frequency of color bar signal

CHANNEL	Frequency (MHz)	Reading ($dB\mu N$)	MPL ** (dB)	Result ($dB\mu N$)	Limit (nW)	Limit ($dB\mu N$)	Margin (dB)
2	101.00		7.8		2.0	50.0	
	202.00		7.8		2.0	50.0	
3	107.00		7.8		2.0	50.0	
	214.00		7.8		2.0	50.0	
4	113.00		7.8		2.0	50.0	
	226.00		7.8		2.0	50.0	
5	123.00		7.8		2.0	50.0	
	246.00		7.8		2.0	50.0	
6	129.00		7.8		2.0	50.0	
	258.00		7.8		2.0	50.0	
7	221.00		7.8		2.0	50.0	
	442.00		7.8		2.0	50.0	
8	227.00		7.8		2.0	50.0	
	454.00		7.8		2.0	50.0	
9	233.00		7.8		2.0	50.0	
	466.00		7.8		2.0	50.0	
10	239.00		7.8		2.0	50.0	
	478.00		7.8		2.0	50.0	
11	245.00	7.2	7.8	15.0	2.0	50.0	35.0
	490.00		7.8		2.0	50.0	
12	251.00	8.2	7.8	16.0	2.0	50.0	34.0
	502.00		7.8		2.0	50.0	
13	257.00	9.3	7.8	17.1	2.0	50.0	32.9
	514.00		7.8		2.0	50.0	
14	517.00		7.8		2.0	50.0	
	1034.00	13.9	7.8	21.7	2.0	50.0	28.3
19	547.00		7.8		2.0	50.0	
	1094.00	15.3	7.8	23.1	2.0	50.0	26.9
28	601.00		7.8		2.0	50.0	
	1202.00	15.8	7.8	23.6	2.0	50.0	26.4
36	649.00		7.8		2.0	50.0	
	1298.00	20.2	7.8	28.0	2.0	50.0	22.0
44	697.00		7.8		2.0	50.0	
	1394.00	28.8	7.8	36.6	2.0	50.0	13.4
53	751.00		7.8		2.0	50.0	
	1502.00	30.7	7.8	38.5	2.0	50.0	11.5
61	799.00		7.8		2.0	50.0	
	1598.00	31.8	7.8	39.6	2.0	50.0	10.4
69	847.00	11.9	7.8	19.7	2.0	50.0	30.3
	1694.00	28.4	7.8	36.2	2.0	50.0	13.8

***)** No values higher than 30dB below the limit was measured during Antenna-Conducted Power testing.

Table 3. Antenna-Conducted Power Measurements

NOTES:

1. *T. Freq. = Tuned Frequency

2. **MPL = Impedance Matching Network Loss

3. Measurements using CISPR quasi-peak mode. The limits is 2.0 nanowatts from 30MHz to 960MHz.

*Tested by **C. S. Choi***

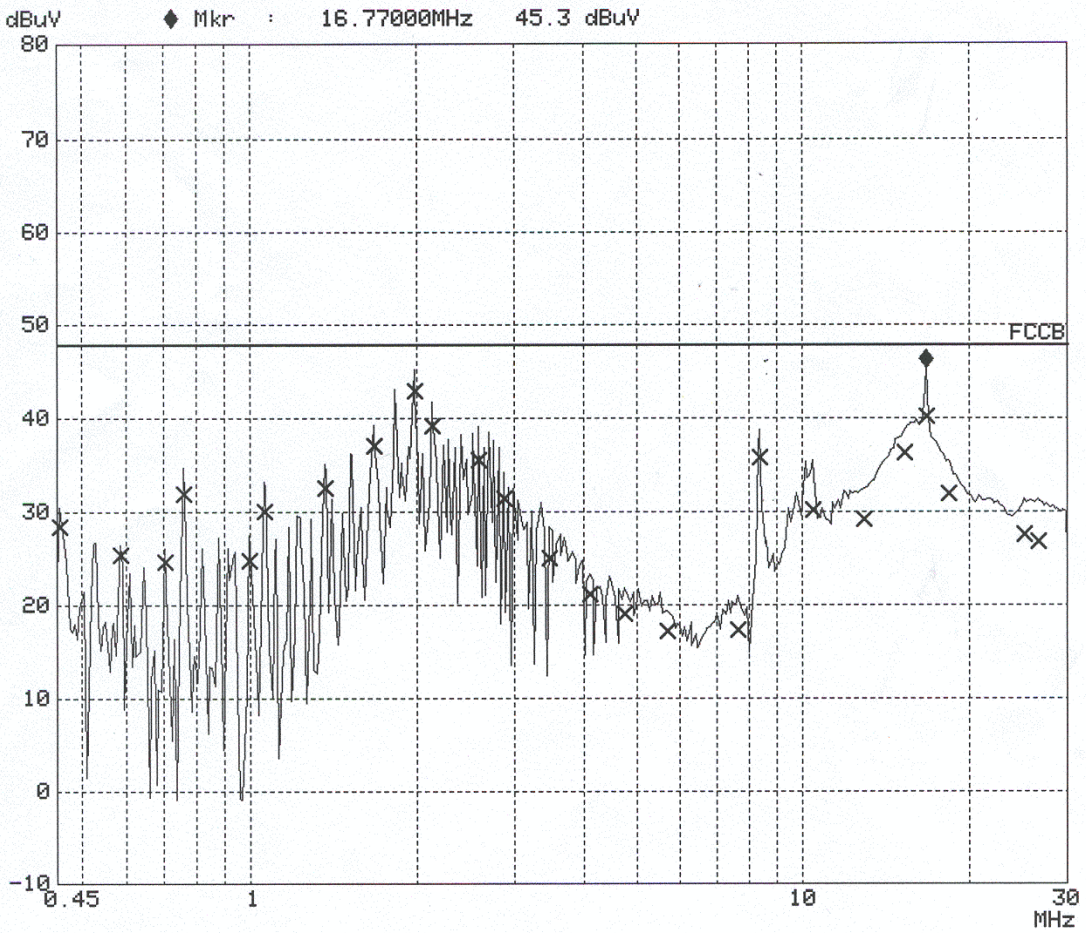
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port(Line)***

```
Scan Settings (1 Range)
|--------- Frequencies -----------||--------- Receiver Settings ---------|
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 450k          30M           5k          9k       PK      20ms AUTO LN    OFF

Transducer No. Start       Stop       Name
             2   100k        30M      CE_NEUTL

Final Measurement: x QP
                   Meas Time:     1 s
                   Subranges:    25
                   Acc Margin:   50dB
```



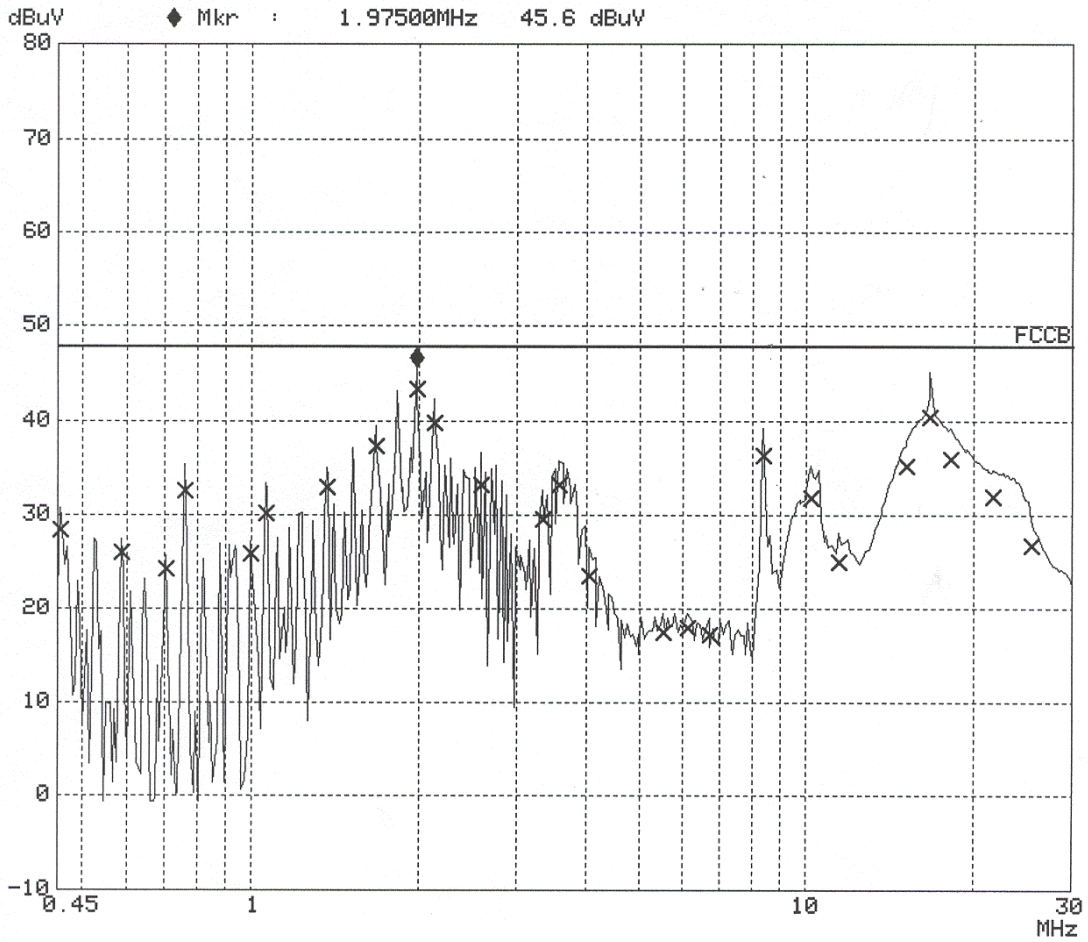
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port(Neutral)***

```
Scan Settings (1 Range)
|--------- Frequencies -----------||--------- Receiver Settings ---------|
   Start        Stop         Step      IF BW  Detector  M-Time  Atten Preamp
 450k          30M           5k          9k       PK      20ms AUTO LN   OFF

Transducer No. Start       Stop       Name
             2   100k        30M      CE_NEUTL

Final Measurement: x QP
                   Meas Time:    1 s
                   Subranges:   25
                   Acc Margin:  50dB
```



SAMPLE CALCULATIONS

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

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

EX. 1.

@20.3 MHz Class B limit = 250 μV = 48.0 dB μV

Reading = 40.8 dB μV (calibrated level)
$10^{(40.8/20)}$ = 109.64 μV
Margin = 48.0 - 40.8 = 7.2
7.2 dB below limit

EX. 2.

@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

EX. 3.

@98.20 MHz Class B limit = 2 nW = 50.0 dB μV

Reading = 19.1 dB μV(calibrated level)
Impedance matching Network Loss = 7.5 dB
Total = 26.6 dB μV
Margin = 50.0 – 26.6 = 23.4
23.4 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

TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2002.02
2	Test Receiver	PMM	PMM9000	2002.06
3	*Amplifier	HP	8447F	2001.11
4	*Amplifier	HP	8447F	2001.11
5	*Spectrum Analyzer	Advantest	R3265A	2002.03
6	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2002.02
7	Log-Periodic Antenna	R & S	HL025	2002.01
8	Dipole Antenna	R & S	VHA9103	2002.05
9	Dipole Antenna	R & S	UHA9105	2002.05
11	Biconical Log Antenna	ARA	LPB-2520/A	2002.01
12	Asorbing Clamp	R & S	MDS21	2002.03
13	High Voltage Probe	R & S	ESH2-Z3	2002.10
14	Signal Generater	R & S	SMP02	2001.12
15	Matching Pad	R & S	RAM358.5414.02	2002.05
16	*LISN	R & S	ESH3-Z5	2002.10
17	LISN	Kyoritsu	KNW-407	2002.04
18	*LISN	Kyoritsu	KNW-408	2002.04
19	*Position Controller	EM Eng.	N/A	N/A
20	*Turn Table	EM Eng.	N/A	N/A
21	*Antenna Mast	EM Eng.	N/A	N/A
22	*Anechoic Chamber	EM Eng.	N/A	N/A

***) Test equipment used during the test**

RECOMMENDATION/CONCLUSION

The data collected shows that the **Hansol Electronics Inc.**
FCC ID : **MSAB17BF-1, LCD Monitor.** complies with § 15.107 ,15.109, 15.111 of the FCC Rules.
The highest emission observed was at **1.97 MHz** for conducted emissions with a margin of **4.6 dB,** at **674.53 MHz** for radiated emissions with a margin of **5.3 dB** and at **1598.00 MHz** for antenna power conducted emissions with a margin of **10.4 dB**.

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