Nemko Korea Co., Ltd.

300-2, Osan-Ri, 7Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA
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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 :May 14, 2004
Test Report No. : NK2EE312
Test Site : Nemko Korea Co., Ltd.
EMC site, Korea

FCC ID	***MSAB15AC***
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**

Applied Standard: Part 15 & 2
Classification : FCC Class B Device
EUT Type: 15” CCTV 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 C63.4-2001.

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 : Y. S. Park
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.

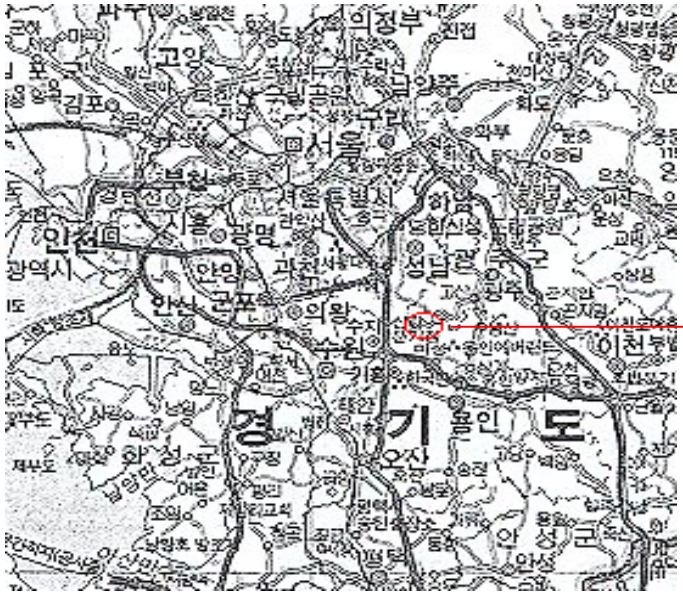
Responsible Party :	Hansol LCD Inc.
Contact Person :	Mr. W. S. Lee
	Tel No.: +82 43 530 8554
Manufacturer :	Hansol LCD Inc.
	#27-29, Hancheon-ri, Ducksan-Myun, Jincheon-Gun,
	Choongbuk, Korea
	Tel No.: +82 43 530 8554
Factory :	Hansol Electronics (Thailand) Co., Ltd.
	168 Moo 1 Tambon Banbung, Amphoe Banbung, Chonburi Province 20170 Thailand

- FCC ID: MSAB15AC
- Model: B15AC
- Brand Name: Hansol
- EUT Type: 15” CCTV Monitor
- Electric Rating: 100-240V AC, 50/60Hz, 0.45A
- Port/Connector: BNC In, S-VHS In, Analog D-sub
- Classification: FCC Class B
- Applied Standard: FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (2001)
- Dates of Test: May 10, 2004 to May 13,2004
- Place of Tests: Nemko Korea Co., Ltd.
- Test Report No.: NK2EE312

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 **Hansol LCD Inc.**
FCC ID : **MSAB15AC, 15" CCTV 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 June 06, 2001.



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 connected to PC and displayed “H” pattern on the screen.
The EUT were connected to CCTV camera, then the video signal of CCD camera captured was sent to the EUT(CCTV Monitor).
The EUT was displayed continuously the video signal on screen.
The worst emission level was found when the EUT was tested under 1024 X 768, 75Hz resolution, therefore, the test data of this modes were recorded in the report.

Support Equipment

15” CCTV Monitor (EUT)	Hansol, FCC ID: MSAB15AC 1.5m unshielded AC power cable 1.8m shielded D-sub cable 1.2m shielded BNC cable	S/N: N/A
PC	Dell Asia Pacific Sdn., Model: DHM(Dimension 4550) 1.8m unshielded AC power cable	S/N: N/A
PS/2 Mouse	CHIC TECH, Model: SMP2000WX 1.5m shielded Din cable	S/N: N/A
Serial Mouse	ALLSPIRIT, Model: WS-V1-400 1.5m shielded D-sub cable	S/N: B050402
USB Mouse	Logitech, Model : M-BD53 1.5m shielded D-sub cable	S/N: LZE04251831
Keyboard	Sejin Electronics, Model: 104DYW10-100 1.8m shielded Din cable	S/N: 0FA024809
Printer	H.P., Model: C5870A 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
Joystick	Logitech, Model : J-ZA10 2.0m shielded D-sub cable	S/N: YED20300268
Color Camera	Sunline, Model : CCY-009	S/N: N/A
Adaptor (Camera)	Sunny computer Technology Co., Ltd. Model : SYS1126-6012 2.0m unshielded Din cable	S/N: 0302030590

EUT Information

Clock	12MHz(Y1), 24.576MHz(Y2), 27.0105MHz(X1)
Chipset(s)	CN1(SMW200-8), U1(GS1086-3.3V/TO-263)
Horizontal Frequency	60kHz(Max)
Vertical Frequency	75Hz(Max)
LCD panel	LTM150XH (Samsung Electronics Co., Ltd)
Combo Board	Hips 17 (Hansol LCD Inc)
Main Board	H550V (Hansol LCD Inc)
OSD Board	H550 / H750D (Hansol LCD Inc)
Port(s)	BNC In, S-VHS In, Analog D-sub

Description of Test Modes

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

For Analogue video interface port(D-Sub)

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

The worst emission level was found when the EUT was tested under 1024 X 768 resolution, therefore, the test data of this mode was recorded in the report.

SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	Paragraph No.	Result	Remark
Conducted Emission	15.107(a)	Complies	
Radiated Emission	15.109(a)	Complies	

RECOMMENDATION/CONCLUSION

The data collected shows that the **Hansol LCD Inc.**
FCC ID : **MSAB15AC, 15" CCTV Monitor.**
The highest emission observed was at **0.19 MHz** for conducted emissions with a A.V margin of **12.96 dB,** at **286.04 MHz** for radiated emissions with a margin of **8.30 dB.**

SAMPLE CALCULATION

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

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

EX. 1.

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

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

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 1m X 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 (ESH3-Z5) and Kyoritsu (KNW-408) of the 50ohm/50uH Line Impedance Stabilization Network(LISN) 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 were 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.

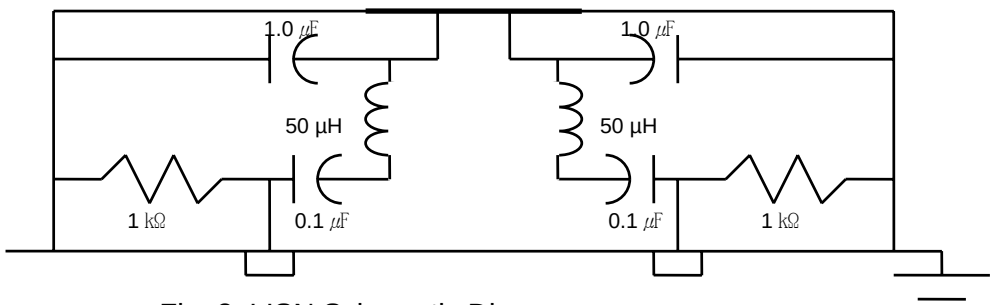


Fig. 2. LISN Schematic Diagram

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 27 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, Doppels Teg Horn antenna (EMCO, DAA-37121:upto 1~18GHz) was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(ARA, LPB-2520/A) or Doppels Teg Horn antenna.(EMCO, DAA-37121)

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 peak mode or quasi-peak mode or average 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.

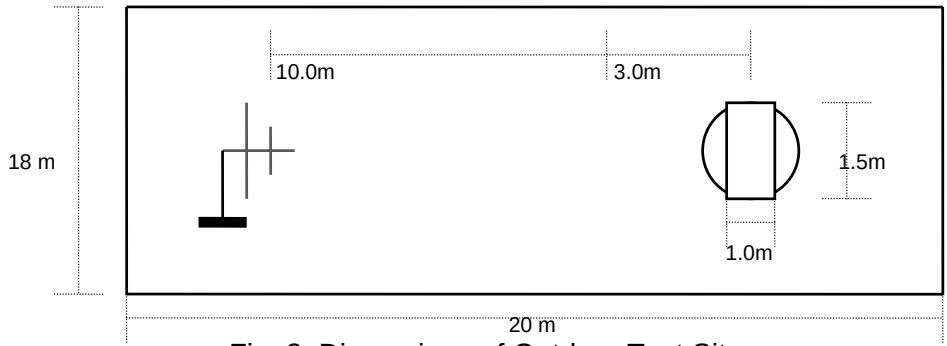


Fig. 3. Dimensions of Outdoor Test Site

TEST DATA

Conducted Emissions

FCC ID : MSAB15AC

Test Mode : Analog (1024 x 768, 75Hz)

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.19	48.99	41.08	N	64.04	54.04	15.05	12.96
0.25	40.65	33.98	N	61.76	51.76	21.11	17.78
6.73	36.59	33.32	L	60.00	50.00	23.41	16.68
6.86	36.74	32.64	L	60.00	50.00	23.26	17.36
18.17	40.44	29.18	N	60.00	50.00	19.56	20.82
21.89	38.03	24.53	L	60.00	50.00	21.97	25.47
25.75	39.22	28.44	L	60.00	50.00	20.78	21.56

Table 1. 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

Tested by : ***Y. S. Park***

TEST DATA

Conducted Emissions

FCC ID : MSAB15AC

Test Mode : CCTV (1024 x 768, 75Hz)

Frequency (MHz)	Level(dBμV)		Line	Limit(dBμV)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.19	48.51	40.03	L	64.04	54.04	15.53	14.01
0.26	40.33	33.43	N	61.43	51.43	21.10	18.00
6.60	36.56	33.17	L	60.00	50.00	23.44	16.83
14.10	36.66	35.01	N	60.00	50.00	23.34	14.99
17.86	40.26	30.21	N	60.00	50.00	19.74	19.79
25.09	37.55	27.35	L	60.00	50.00	22.45	22.65

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

Tested by : ***Y. S. Park***

TEST DATA

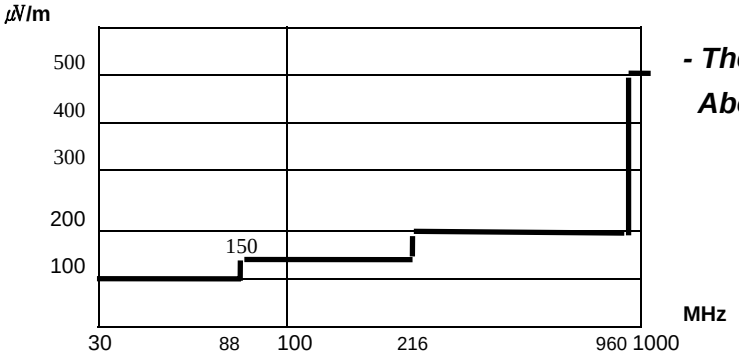
Radiated Emissions

FCC ID : MSAB15AC

Test Mode : Analog (1024 x 768, 75Hz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
33.64	53.50	V	-22.30	31.20	40.00	8.80
55.89	47.26	V	-21.56	25.70	40.00	14.30
135.76	40.73	H	-14.83	25.90	43.50	17.60
139.74	38.01	H	-14.21	23.80	43.50	19.70
142.85	45.02	H	-13.72	31.30	43.50	12.20
162.03	40.56	H	-12.86	27.70	43.50	15.80
279.49	36.39	V	-11.79	24.60	46.00	21.40
580.48	28.83	V	-4.13	24.70	46.00	21.30
647.97	28.60	V	-2.30	26.30	46.00	19.70

Table 3. Radiated Measurements at 3meters



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

4. The limit for Class B device is on the FCC Part section 15.109(a).

Tested by : ***Y. S. Park***

TEST DATA

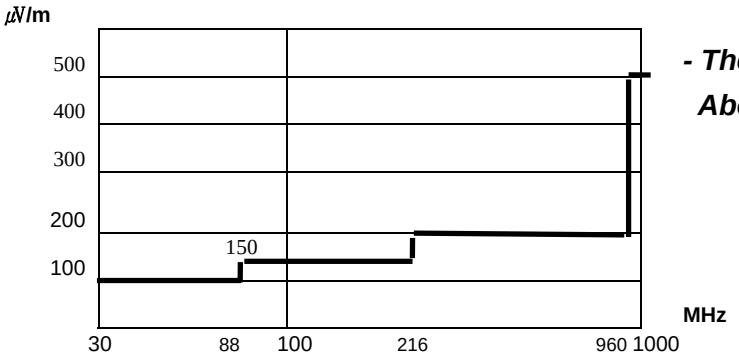
Radiated Emissions

FCC ID : MSAB15AC

Test Mode : CCTV (1024 x 768, 75Hz)

Frequency (MHz)	Reading (dBμV)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
114.42	46.10	H	-17.3	28.80	43.50	14.70
123.95	48.28	H	-16.7	31.60	43.50	11.90
143.01	45.49	H	-13.7	31.80	43.50	11.70
257.44	46.22	V	-12.3	33.90	46.00	12.10
276.51	49.16	H	-11.9	37.30	46.00	8.70
286.04	49.34	H	-11.6	37.70	46.00	8.30
352.78	38.23	H	-9.9	28.30	46.00	17.70

Table 4. Radiated Measurements at 3meters



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

4. The limit for Class B device is on the FCC Part section 15.109(a).

Tested by : ***Y. S. Park***

PLOTS OF EMISSIONS

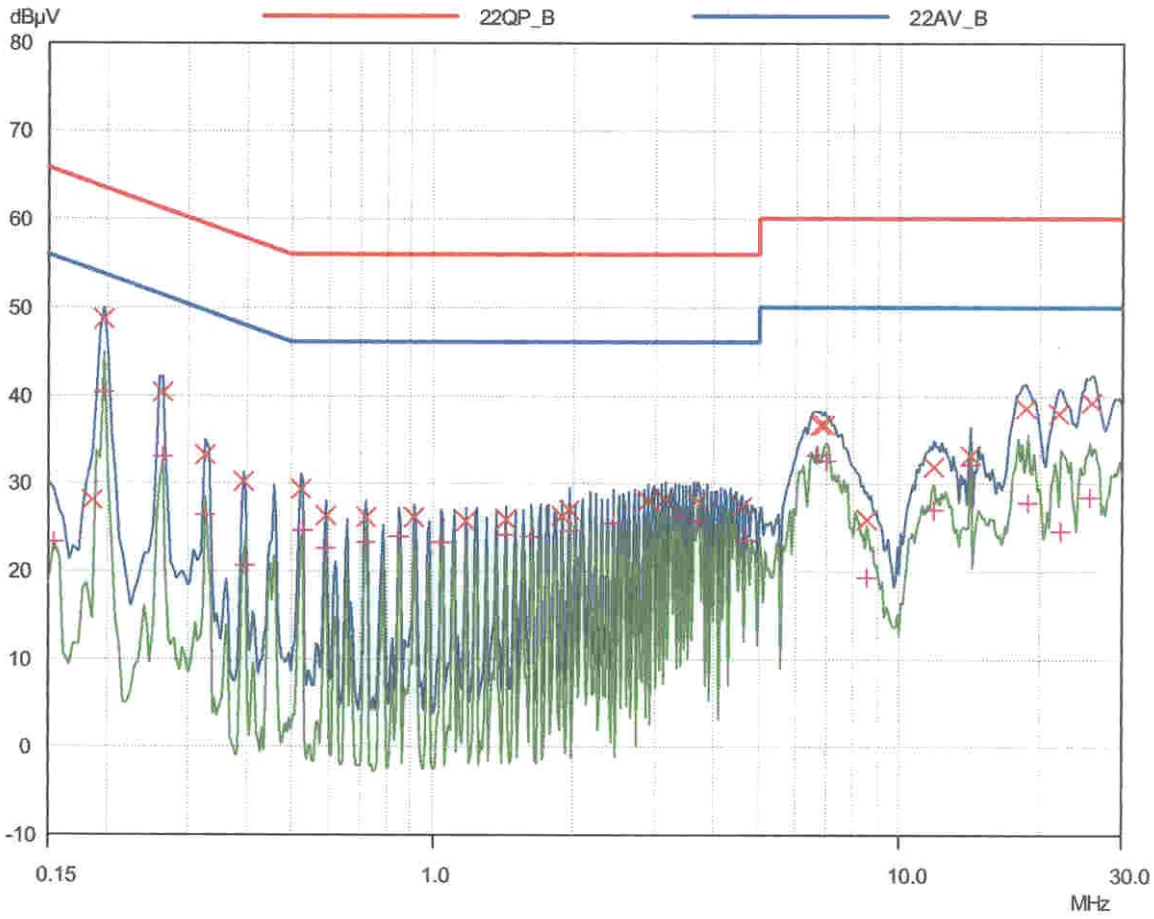
- ***Conducted Emission at the Mains port (Line)***
  - Test Mode : Analog (1024 x 768, 75Hz)

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	10 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	CE_LINE

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	25
	Acc Margin:	60 dB



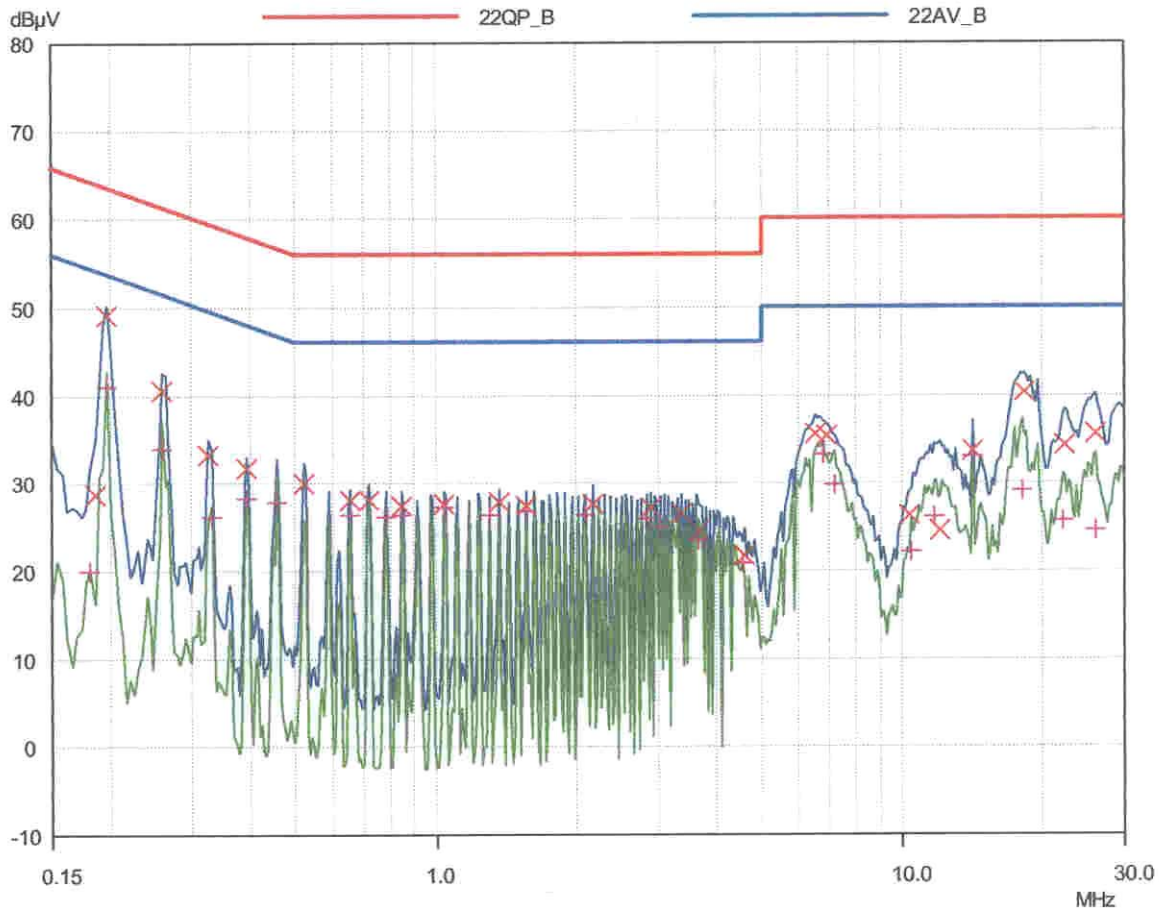
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Neutral)***
  - Test Mode : Analog (1024 x 768, 75Hz)

Scan Settings	(1 Range)							
Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	10 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	CE_LINE

Final Measurement:	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	25
	Acc Margin:	60 dB



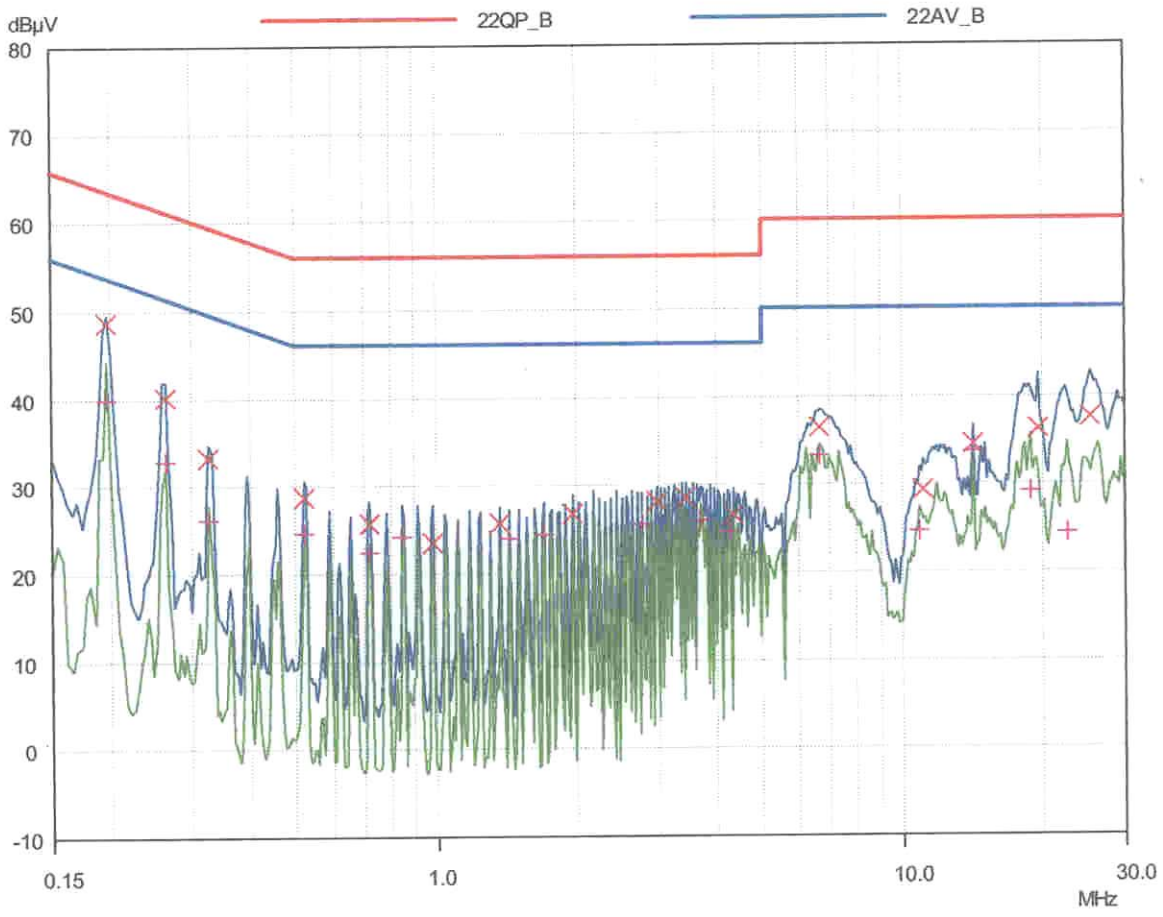
PLOTS OF EMISSIONS

- ***Conducted Emission at the Mains port (Line)***
  - Test Mode : CCTV (1024 x 768, 75Hz)

Scan Settings	(1 Range)							
Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	10 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	CE_LINE

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	16
	Acc Margin:	60 dB



PLOTS OF EMISSIONS

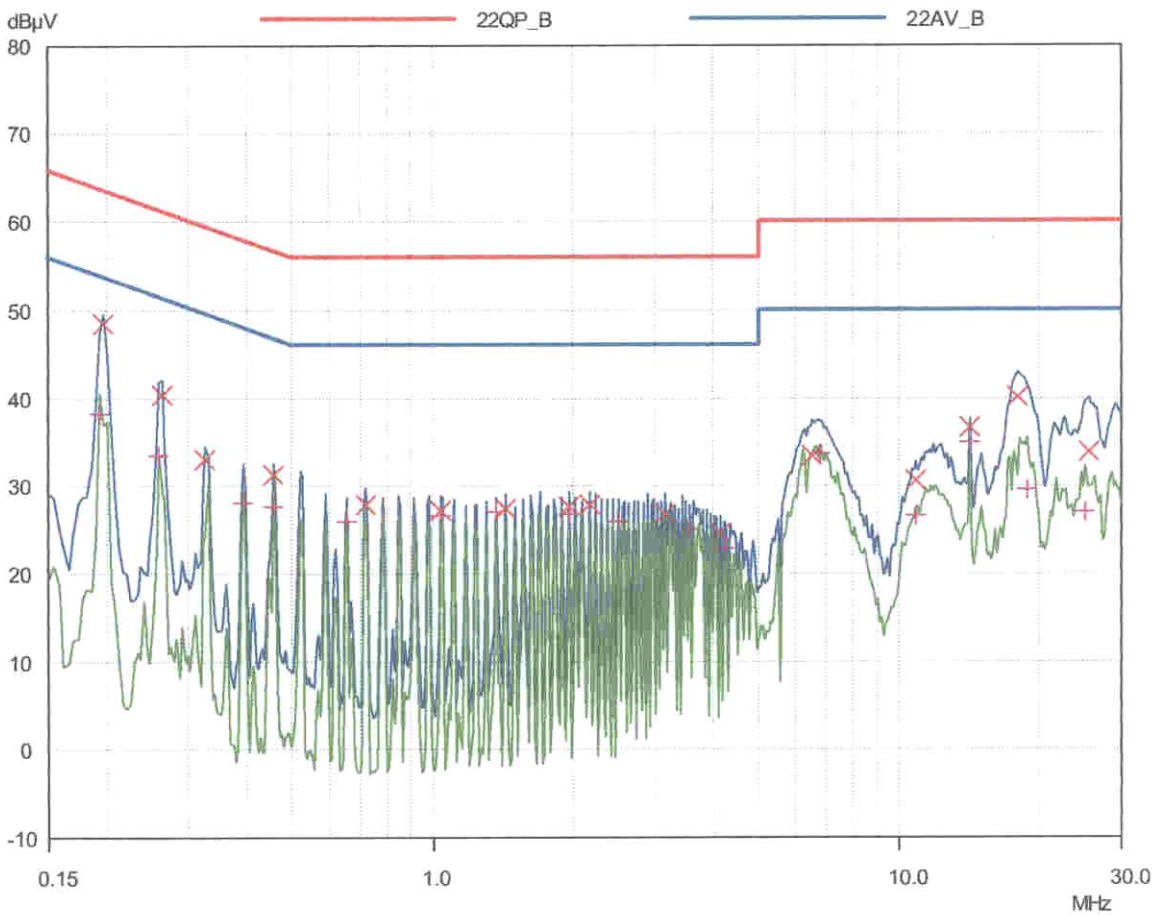
- ***Conducted Emission at the Mains port (Neutral)***
  - Test Mode : CCTV (1024 x 768, 75Hz)

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	10 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	150kHz	30MHz	CE_LINE

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Subranges:	16
	Acc Margin:	60 dB



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	2003.09
2	*Amplifier	HP	8447F	2004.01
3	*Amplifier	HP	8447F	2003.11
4	Spectrum Analyzer	Advantest	R3265A	2003.12
5	*Spectrum Analyzer	HP	8566B	2004.03
6	Logbicon Super Antenna	Schwarzbeck	VULB9166	2003.05
7	Doppels Teg Horn	EMCO	DAA-37121	2003.10
8	Dipole Antenna	R & S	VHA9103	2003.05
9	Dipole Antenna	R & S	UHA9105	2003.05
10	*Biconical Log Antenna	ARA	LPB-2520/A	2004.01
11	Asorbing Clamp	R & S	MDS21	2003.06
12	High Voltage Probe	R & S	ESH2-Z3	2003.10
13	Signal Generater	R & S	SMP02	2004.03
14	Matching Pad	R & S	RAM358.5414.02	2003.05
15	*LISN	R & S	ESH3-Z5	2003.11
16	LISN	Kyoritsu	KNW-407	2004.03
17	*LISN	Kyoritsu	KNW-408	2003.12
18	*Position Controller	EM Eng.	N/A	N/A
19	*Turn Table	EM Eng.	N/A	N/A
20	*Antenna Mast	EM Eng.	N/A	N/A
21	*Anechoic Chamber	EM Eng.	N/A	N/A
22	Matching Pad	R & S	BN18084	2003.06

*) Test equipment used during the test

APPENDIX D – SCHEMATIC DIAGRAM

APPENDIX E – USER'S MANUAL

APPENDIX F – BLOCK DIAGRAM