

Nemko Korea Co., Ltd.

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

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

LG Electronics Inc.

19-1, Cheongho-Ri, Jinwuy-Myun,

Pyungtaek-Shi, Kyunggi-Do, 451-713, Korea

Attn : Mr. Y. G. Yoon

Dates of Issue : December 22, 2004

Test Report No. : NK2EE962

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

Brand Name

Contact Person

BEJDT-EG**LG****LG Electronics Inc.****19-1, Cheongho-Ri, Jinwuy-Myun, Pyungtaek-Shi,****Kyunggi-Do, 451-713, Korea****Mr. Y. G. Yoon****Telephone No. : +82 31 610 5338**

Applied Standard:

Part 15 & 2

Classification :

FCC Class B Device

EUT Type:

Personal Computer

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 : D. H. Ryu
Engineer



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

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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 :	LG Electronics Inc.
Contact Person :	Mr. Y. G. Yoon Tel No.: +82 31 610 5338
Manufacturer :	LG Electronics Inc. 19-1, Cheongho-Ri, Jinwuy-Myun, Pyungtaek-Shi, Kyunggi-Do, 451-713, Korea
Factory :	LG Electronics Inc. 19-1, Cheongho-Ri, Jinwuy-Myun, Pyungtaek-Shi, Kyunggi-Do, 451-713, Korea

- FCC ID: BEJDT-EG
- Model: EG
- Alternate Model : EM
- Brand Name: LG
- EUT Type: Personal Computer
- Electric Rating: 100-127/200-240V AC, 50/60Hz, 5.0A/4.0A
- Port/Connector: Audio Jacks (Headphone, Microphone x 2EA, Line-in, Speaker),
USB x 6EA, PS/2 x 2EA (Keyboard, Mouse), Parallel, Serial,
Video, LAN, IEEE 1394
- Classification: FCC Class B
- Applied Standard: FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (2001)
- Dates of Test: December 15, 2004 to December 16, 2004
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2EE962

***) EM : Without IEEE1394 Port and AGP Slot**

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 **LG Electronics Inc.**

FCC ID : **BEJDT-EG, Personal Computer.**

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.

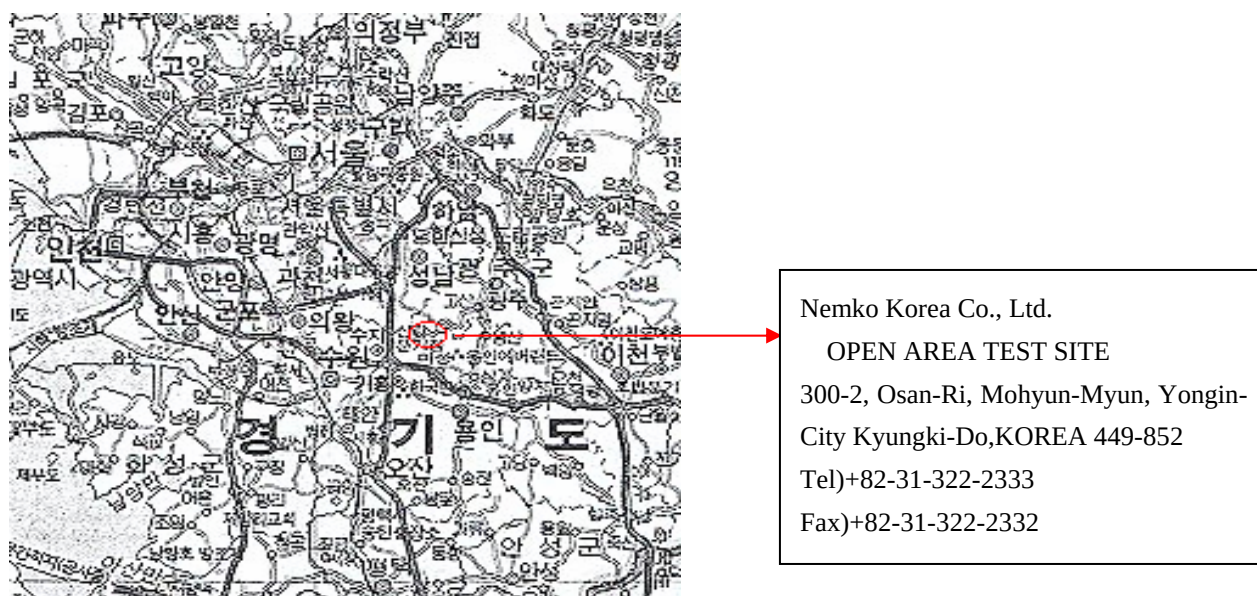


Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab and Incheon Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

The EUT was operated by the software. The EUT sent "H" pattern to monitor and the monitor displayed "H" pattern on screen. It also sent "H" pattern to printer, then the printer printed it out. It also sent and received to hard & floppy disk. The LAN were operated at download mode during internet connection.

And the CD-ROM was operated at playback mode. This software had above all functions conduct in order.

Support Equipment

PC(EUT)	LG Electronics Inc., FCC ID: BEJDT-EG 1.5m Unshielded AC power cable	S/N : N/A
LCD Monitor	Hansol LCD Inc., Model: B17DF 1.8m Shielded D-sub cable 1.5m Unshielded AC power cable	S/N : N/A
Keyboard	Sejin Electronics, Model: SKR-2239 1.5m Unshielded Din cable	S/N : OFA024809
PS/2 Mouse	Samsung Electro-Mechanics, Model: SMOP5000WX 1.5m Unshielded Din cable	S/N : 04070064927
USB Mouse	Logitech, Model: M-UR69 1.5m Shielded USB cable	S/N : LNA31701876
USB Mouse	Logitech, Model : M-UB48 1.5m Shielded USB cable	S/N : LZA71148729
Serial Mouse	ALLSPIRIT, Model : WS-V1-400 1.5m Unshielded D-Sub cable	S/N : B050402
Speaker	Gowoonsori, Model : 9802 1.8m Unshielded Stereo-Jack cable	S/N : N/A
HDD	VST Technologies Inc Model : FW1280 1.0m Shielded IEEE 1394 cable	S/N : 90943222583
AC/DC Adaptor	Alto Electronics Co., Ltd. Model : SDP-AA181D 1.8m Unshielded DC power cable	S/N : N/A
Printer	HP, Model: C5870A 1.8m shielded Parallel cable	S/N : D3FE005162

AC/DC Adaptor	Yokogawa, Model : C11557-60104 1.8m unshielded AC power cable	S/N : N/A
Earphone	Amac, M/N: N/A 0.8m Unshielded Stereo Jack cable	S/N : N/A
Hub	3Com, Model : Dual Speed Switch 16 3.0m Unshielded Modular Jack Cable	S/N : N/A
Hub (Adaptor)	Ault Inc., Model : 7900-000-046-1.00 1.8m Unshielded DC power cable	S/N : N/A
USB Cable	1.5m Shielded USB cable	S/N : N/A
Microphone Cable	1.8m Unshielded Stereo-Jack cable	S/N : N/A
Line Out Cable	1.8m Unshielded Stereo-Jack cable	S/N : N/A

EUT Information

Clock	200MHz, 133MHz, 66MHz 14MHz
Chipset(s)	CPU1 (SOCK478), U11 (CY28405)
Port(s)	Audio Jacks (Headphone, Microphone x 2EA, Line-in, Speaker), USB x 6EA, PS/2 x 2EA (Keyboard, Mouse), Parallel, Serial, Video, LAN, IEEE 1394
CPU	Intel Pentium IV, 3.4GHz
System memory	1GB (up to 4GB)
Hard disk drive	120GB (E-IDE type)
Floppy disk drive	3.5inch 1.44MB drive
Video	Integrated AGP Graphic 96MB
Slot	PCI x 3EA, AGP x 1EA, Memory DIMM x 4EA
Product size	100(W) x 345(H) x 421.5(D) : mm

EUT System

Equipment	Model	Manufacturer	Serial Number
Main board	MS-6743	MSI	N/A
CPU	Intel Pentium IV	Intel	N/A
HDD	ST3120022A	Seagate	5JT2YTNA
CD-ROM	GCR-8523B	HLDS	403HB070132
FDD	SFD-321B	Samsung	N/A
Video	RG82865G	Intel	N/A
SMPS	SH250T05A	Sungho Electronics	N/A

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 **LG Electronics Inc.**

FCC ID : **BEJDT-EG, Personal Computer.**

The highest emission observed was at **10.23 MHz** for conducted emissions with a A.V margin of **9.7 dB**, at **172.04 MHz** for radiated emissions with a margin of **10.7 dB**.

SAMPLE CALCULATION

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

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

EX. 1.

@165.0 MHz

Class B limit = 30.0 dB $\mu V/m$

Reading = 38.2 dB μV (calibrated level)

Antenna factor + Cable Loss + Amplifier Gain = -12.9 dB

Total = 25.30 dB $\mu V/m$

Margin = 30.0 – 25.30 = 4.70

4.70 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-407) 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.

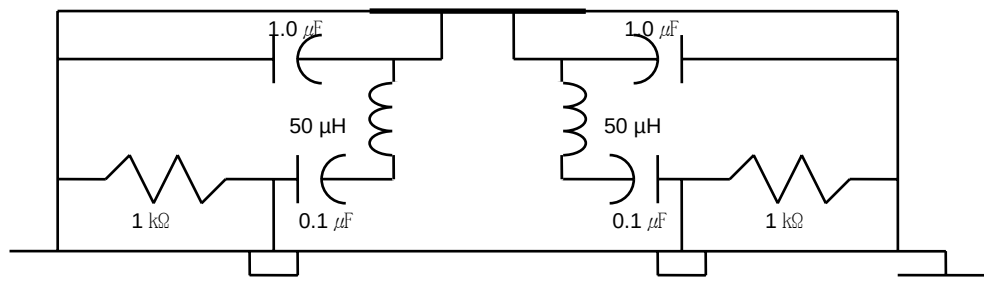


Fig. 2. LISN Schematic Diagram

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) 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 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.

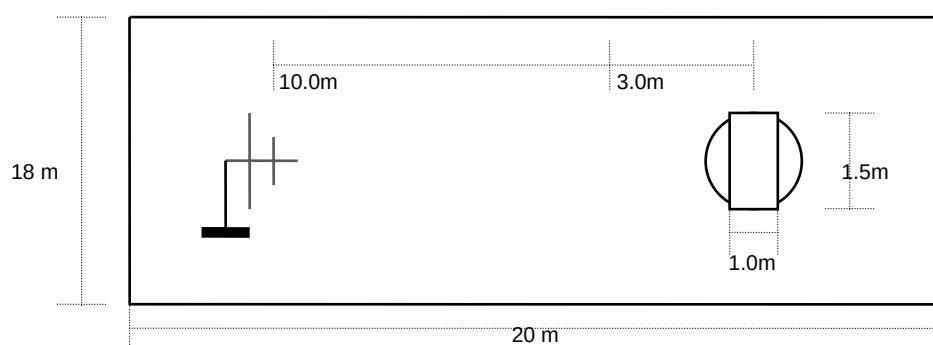


Fig. 3. Dimensions of Outdoor Test Site

TEST DATA

Conducted Emissions

FCC ID : BEJDT-EG

Frequency (MHz)	Level(dB μ V)		Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.24	41.33	39.42	N	62.1	52.1	20.8	12.7
0.43	36.76	36.11	N	57.3	47.3	20.5	11.1
0.62	34.44	34.83	N	56.0	46.0	21.6	11.2
1.74	33.01	33.28	N	56.0	46.0	23.0	12.7
10.23	46.07	40.34	N	60.0	50.0	13.9	9.7
16.04	45.29	33.69	N	60.0	50.0	14.7	16.3

*) Correction factor was included to Test Level (dB μ V)

Table 1. Line Conducted Emissions Tabulated Data

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.
2. All modes were measured and the worst -case emission (1280 x 1024, 75Hz) are reported. See attached Plots.
3. LINE : L =Line , N = Neutral
4. The limit for Class B device is on the FCC Part section 15.107(a).



Tested by : D. H. Ryu

TEST DATA

Radiated Emissions

FCC ID : BEJDT-EG

● 30MHz ~ 1GHz

Frequency (MHz)	Reading (dB μ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
75.10	41.1	H	-20.9	20.20	40.00	19.80
79.74	45.7	H	-20.7	25.00	40.00	15.00
172.04	45.9	H	-13.1	32.80	43.50	10.70
150.76	37.7	H	-12.6	25.10	43.50	18.40
272.05	44.0	H	-12.0	32.00	46.00	14.00
375.00	43.0	H	-9.4	33.60	46.00	12.40
644.41	37.6	H	-2.4	35.20	46.00	10.80

● 1GHz ~ 34GHz

Frequency (MHz)	Reading (dB μ V)		Pol* (H/V)	AF+CL+Amp (dB)**	Limit (dB μ V/m)		Final Result(dB μ V/m)	
	Peak	Average			Peak	Average	Peak	Average
1190.00	57.7	32.4	H	-6.0	74.00	54.00	51.70	26.40
1570.00	55.6	30.3	H	-3.2	74.00	54.00	52.40	27.10
1600.00	53.1	26.3	H	-2.2	74.00	54.00	50.90	24.10
1800.00	57.6	29.6	H	-5.6	74.00	54.00	52.00	24.00
2400.00	50.4	29.1	H	0.0	74.00	54.00	50.40	29.10
2750.00	55.6	30.4	H	0.8	74.00	54.00	56.40	31.20

Table 2. Radiated Measurements at 3meters

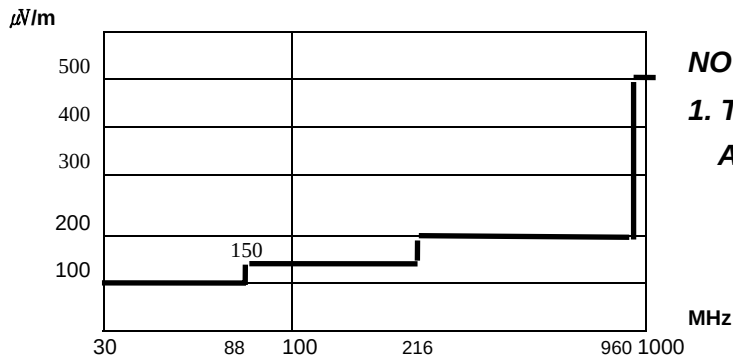


Fig. 4. Limits at 3 meters

NOTES:

1. The radiated limits are shown on Figure 4.
Above 1GHz the limit is 500 $\mu\text{V/m}$.

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.
Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.
4. All modes were measured and the worst -case emission (1280 x 1024, 75Hz) are reported.
5. The limit for Class B device is on the FCC Part section 15.109(a).



Tested by : D. H. Ryu

PLOTS OF EMISSIONS

- Conducted Emission at the Mains port (Line)

NEMKO KOREA (NK-2E-E-962)

16 Dec 2004 13:39

Conducted Emissions

EUT: PERSONAL COMPUTER

Manuf: LG Electronics

Op Cond:

Operator:

Test Spec:

Comment: MODEL : EG

LINE : LINE-PE

Result File: E962-L.dat : New Measurement

Scan Settings

(1 Range)

Frequencies

Start 150kHz

Stop 30MHz

Step 3.9063kHz

IF BW 9kHz

Detector PK+AV

Receiver Settings

M-Time 20msec

Atten 10 dB

Preamp OFF

OpRge 60dB

Transducer

No. 1

Start 150kHz

Stop 30MHz

Name CE_LINE

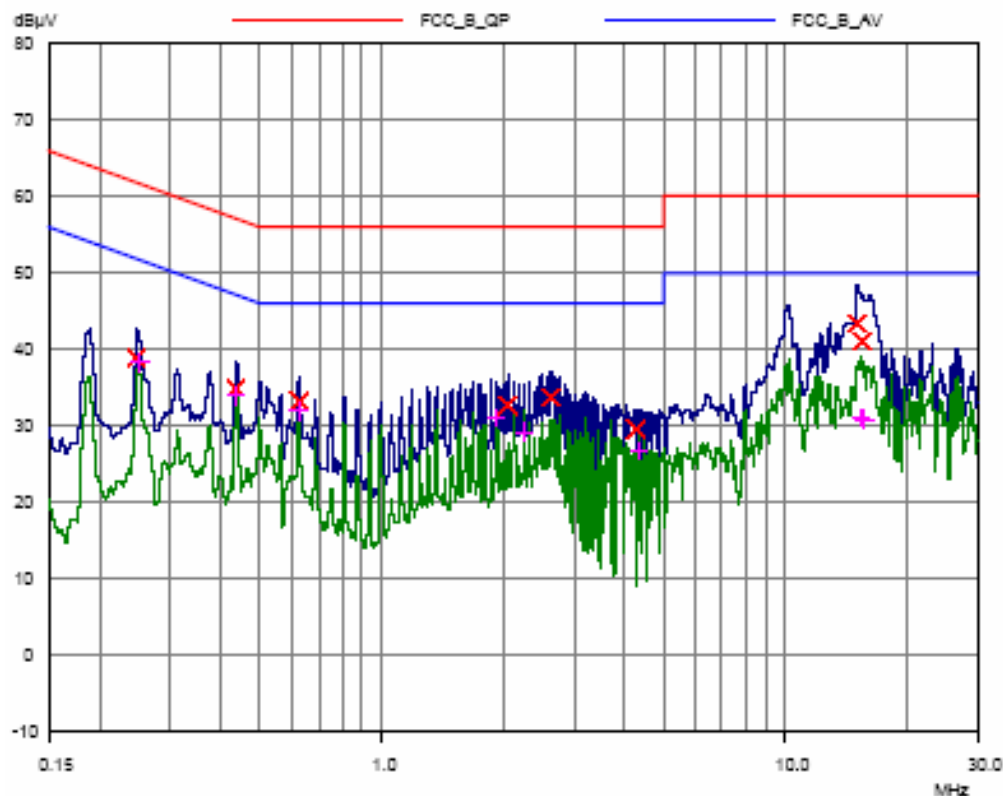
Final Measurement:

Detectors: X QP / + AV

Meas Time: 1sec

Subranges: 8

Acc Margin: 60 dB



PLOTS OF EMISSIONS

Conducted Emission at the Mains port (Neutral)

NEMKO KOREA (NK-2E-E-962)

16 Dec 2004 13:33

Conducted Emissions

BUT: PERSONAL COMPUTER

Manuf: LG Electronics

Op Cond:

Operator:

Test Spec:

Comment: MODEL: EG

LINE: NEUTRAL-PE

Result File: e962-n.dat : New Measurement

Scan Settings

(1 Range)

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

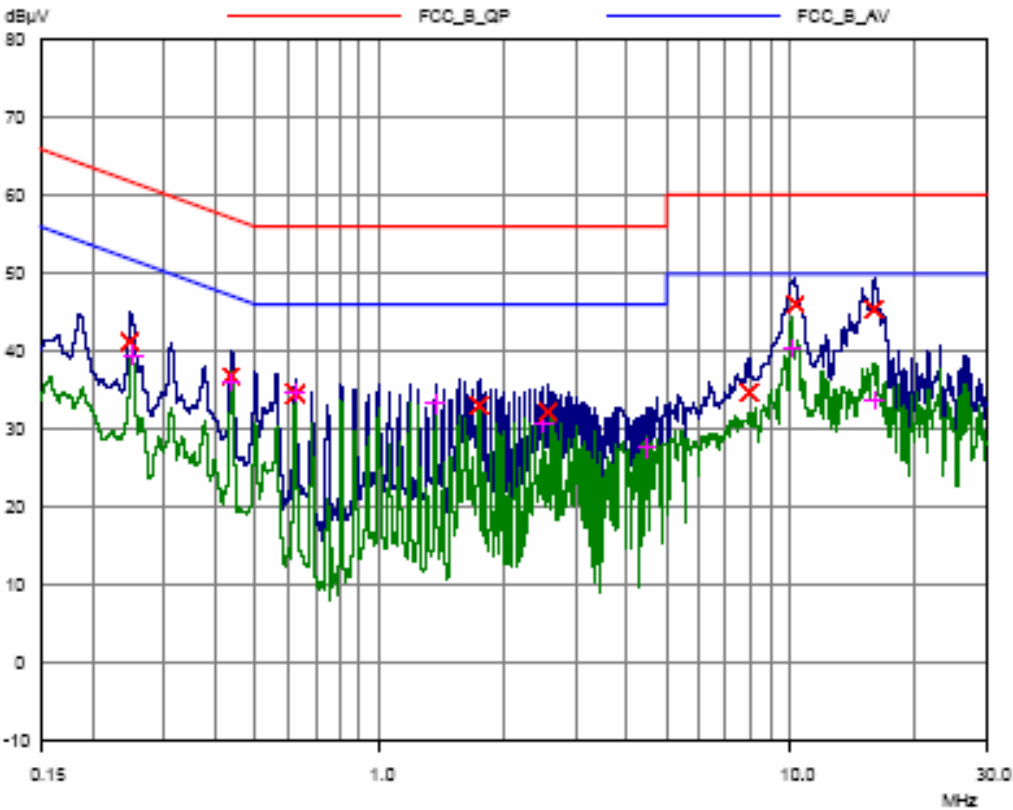
Final Measurement:

Detectors: X QP / + AV

Meas Time: 1sec

Subranges: 8

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 Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC $r_i=0.3$ Antenna VRC $r_R=0.1(B_i)0.4(L_p)$ Uncertainty Limits $20\text{Log}(1\pm r_i r_R)$	U-Shaped	$+ 0.25 / - 0.26$
System Repeatibility	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 $r_i=0.3$ LISN vrc $r_g=0.1$ Uncertainty Limits $20\text{Log}(1\pm r_i r_R)$	U-Shaped	± 0.26
System Repeatibility	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	2004.08
2	Test Receiver	R & S	ESCS 30	2003.12
3	*Amplifier	HP	8447F	2004.01
4	*Amplifier	HP	8449B	2004.03
5	*Spectrum Analyzer	HP	8566B	2004.03
6	Spectrum Analyzer	HP	8568B	2004.10
7	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2004.05
8	*Doppels Teg Horn	EMCO	DAA-37121	2004.10
9	Dipole Antenna	R & S	VHA9103	2004.05
10	Dipole Antenna	R & S	UHA9105	2004.05
11	*Biconical Log Antenna	ARA	LPB-2520/A	2004.05
12	High Voltage Probe	R & S	ESH2-Z3	2004.06
13	Signal Generater	R & S	SMP02	2004.03
14	*LISN	R & S	ESH3-Z5	2004.10
15	*LISN	Kyoritsu	KNW-407	2004.03
16	LISN	Kyoritsu	KNW-408	2003.12
17	CDN	FCC	NCD-T4	2004.05
18	CDN	FCC	NCD-T2	2004.05
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
23	*Shielded Room	EM Eng.	N/A	N/A
24	*Position Controller	Seo-Young EMC	N/A	N/A
25	*Turn Table	Seo-Young EMC	N/A	N/A
26	*Antenna Mast	Seo-Young EMC	N/A	N/A
27	*Anechoic Chamber	Seo-Young EMC	N/A	N/A
28	*Shielded Room	Seo-Young EMC	N/A	N/A

*) Test equipment used during the test

APPENDIX D – SCHEMATIC DIAGRAM

APPENDIX E – USER’S MANUAL

APPENDIX F – BLOCK DIAGRAM
