

**Nemko Korea Co., Ltd.**

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

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**Applicant :**

HEINESYS INC.

#456-13, Sungkwang Bldg., Sungnae-Dong,  
Kwangdong-Gu, Seoul, Korea

Attn : Mr. B. C. Lee

Dates of Issue : August 17, 2005

Test Report No. : NK2FE418

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

**TJ4NTG100**

Brand Name

**NETORAGE**

Contact Person

**HEINESYS INC.**#456-13, Sungkwang Bldg., Sungnae-Dong,  
Kwangdong-Gu, Seoul, Korea

Mr. B. C. Lee

Telephone No. : +82 2 470 4204

Applied Standard:

Part 15 &amp; 2

Classification :

FCC Class B Device

EUT Type:

NETORAGE

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 C63.4-2003.

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

HEINESYS INC.

FCC ID:TJ4NTG100

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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 :** HEINESYS INC.

**Contact Person :** Mr. B. C. Lee

Tel No.: +82 2 470 4204

**Manufacturer :** HEINESYS INC.

#456-13, Sungkwang Bldg., Sungnae-Dong, Kwangdong-Gu,  
Seoul, Korea

**Factory :** RF Hitec Inc.

#562 Wolgye 2-Dong, Nowon-Gu, Seoul, Korea

- FCC ID: TJ4NTG100
- Model: NTG-100
- Brand Name: NETORAGE
- EUT Type: NETORAGE
- Electric Rating:
  - Input : 100-240VAC, 50/60Hz, 1.2A
  - Output : +12VDC, 3A
- Port/Connector: WAN x 1EA, LAN x 3EA, DC In
- Classification: FCC Class B
- Applied Standard: FCC Part 15 & Part 2
- Test Procedure(s): ANSI C63.4 (2003)
- Dates of Test: June 28, 2005 to August 01,2005
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2FE418

## 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 C63.4-2003) was used in determining radiated and conducted emissions emanating from **HEINESYS INC.**

FCC ID : **TJ4NTG100, NETORAGE.**

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 C63.4-2003.



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

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### Operating During Test

The EUT connected to the PC & internet via RJ-45 cable and tested during upload/download  
The random data.

### Support Equipment

NETORAGE (EUT)	HEINESYS INC., FCC ID : TJ4NTG100 3.0m Unshielded LAN cable Adaptor : Dee Van Electronics Co., Ltd. DSA-0421S-12 1.5m Unshielded DC power cable with ferrite core at dc jack end. 1.8m Unshielded AC power cable	S/N : 3400000256 S/N : N/A
PC	Dell Asia Pacific Sdn. Model : DHM(Dimension 4550) 1.8m Unshielded AC power cable	S/N : N/A
Monitor	Sony Ichinomiya Corp., Model : P992 2.5m Shielded D-sub cable 1.8m Unshielded AC power cable	S/N : 5904614
Keyboard	Samsung Electro-Mechanics Co., Ltd. Model : SEM-C19V2 2.0m Unshielded Din cable	S/N : KB008594
PS/2 Mouse	Samsung Electro-Mechanics Co., Ltd., Model : SMOP5000WX 2.0m Unshielded Din cable	S/N : 3100016732
Serial Mouse	ALLSPIRIT, Model : WS-V1-400 2.0m Unshielded D-Sub cable	S/N : B050402
USB Mouse	Samsung Electro-Mechanics Co., Ltd., Model : OMC3CH 2.0m Shielded USB cable	S/N : N/A
Printer	HP, Model: C5870A 1.8m Shielded Parallel cable Adaptor : YOKOGAWA Model : C4557-60104 1.5m Unshielded DC power cable 1.8m Unshielded AC power cable	S/N : N/A S/N : N/A
Hub	3Com, Model : Dual Speed Switch 16 3.0m Unshielded Modular Jack Cable Adaptor : Ault Inc. Model : 7900-000-046-1.00 1.8m Unshielded DC power cable	S/N : N/A S/N : N/A
LAN Cable	2.0m Unshielded LAN cable	S/N : N/A

**EUT Information**

Clock	25MHz(Y1), 20MHz(X1)
Chipset(s)	U6 (RTL8305SB), U4 (AM29DL323DT90EI)
Port(s)	WAN x 1EA, LAN x 3EA, DC In
HDD	Model : SP6003H (Samsung Electronics)
	60GB / 7200rpm

## SUMMARY OF TEST RESULTS

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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

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The data collected shows that the **HEINESYS INC.**

FCC ID : **TJ4NTG100, NETORAGE.**

The highest emission observed was at **21.66 MHz** for conducted emissions with a A.V margin of **3.1 dB**, at **499.99 MHz** for radiated emissions with a margin of **2.0 dB**.

## SAMPLE CALCULATION

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

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

### EX. 1.

@57.7 MHz

Class B limit = 100  $\mu\text{V}/\text{m}$  = 40.0 dB  $\mu\text{V}/\text{m}$

Reading = 19.1 dB  $\mu\text{V}$  (calibrated level)

Antenna factor + Cable Loss = 10.12 dB

Total = 29.22 dB  $\mu\text{V}/\text{m}$

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-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.

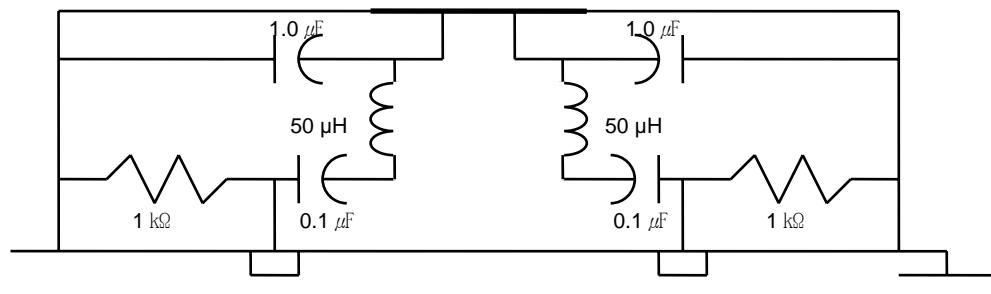


Fig. 2. LISN Schematic Diagram

## 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 30 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A).

Final Measurements were made outdoors at 3m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166). 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.

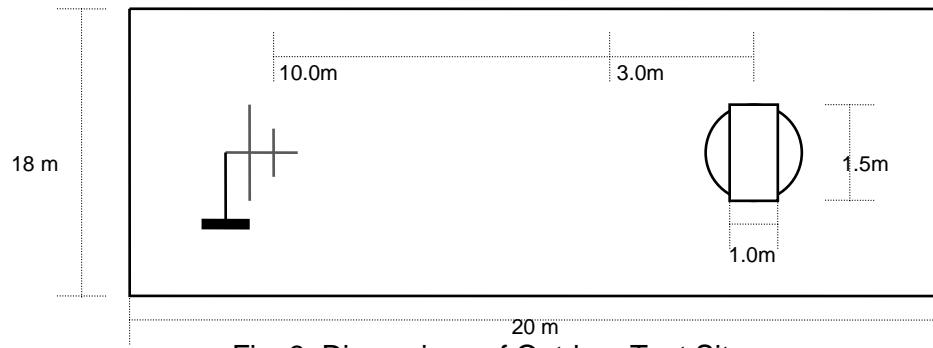


Fig. 3. Dimensions of Outdoor Test Site

## TEST DATA

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### Conducted Emissions

FCC ID : TJ4NTG100

Test Mode : Upload

Frequency (MHz)	Level(dB $\mu$ V)		Line	Limit(dB $\mu$ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.17	39.3	30.3	L	65.0	55.0	25.7	24.7
0.41	38.9	38.0	L	57.6	47.6	18.7	9.6
11.89	37.0	35.4	L	60.0	50.0	23.0	14.6
16.22	43.4	43.4	N	60.0	50.0	16.6	6.6
21.66	47.2	46.9	N	60.0	50.0	12.8	3.1
26.61	43.0	42.7	N	60.0	50.0	17.0	7.3

\*) Correction factor was included to Test Level (dB $\mu$ 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 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).



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Tested by : D. H. Ryu

## TEST DATA

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### Conducted Emissions

FCC ID : TJ4NTG100

Test Mode : Download

Frequency (MHz)	Level(dB $\mu$ V)		Line	Limit(dB $\mu$ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.17	39.1	30.3	L	65.0	55.0	25.9	24.7
0.47	38.3	36.0	L	56.5	46.5	18.2	10.5
0.59	33.4	31.5	L	56.0	46.0	22.6	14.5
12.19	36.7	32.7	L	60.0	50.0	23.3	17.3
17.69	42.8	42.3	L	60.0	50.0	17.2	7.7
21.66	46.6	45.7	L	60.0	50.0	13.4	4.3

\*) Correction factor was included to Test Level (dB $\mu$ V)

Table 2. 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 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).



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Tested by : D. H. Ryu

## TEST DATA

### Radiated Emissions

FCC ID : TJ4NTG100

Test Mode : Upload

Frequency (MHz)	Reading (dB $\mu$ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
108.83	52.2	H	-17.3	34.9	43.5	8.6
125.01	52.0	H	-16.5	35.5	43.5	8.0
200.02	52.7	H	-13.7	39.0	43.5	4.5
250.02	54.1	V	-12.5	41.6	46.0	4.4
300.05	52.8	H	-11.3	41.5	46.0	4.5
450.20	43.7	H	-7.5	36.2	46.0	9.8
499.99	50.3	H	-6.3	44.0	46.0	2.0
700.00	34.5	V	-0.9	33.6	46.0	12.4

**NOTES:** Measurements using CISPR quasi-peak mode.

**Table 3. Radiated Measurements at 3meters**

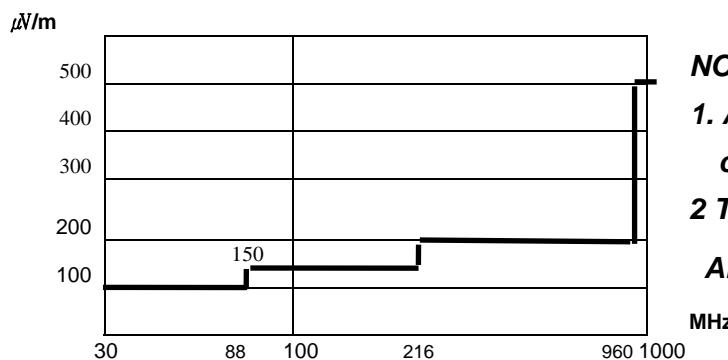


Fig. 4. Limits at 3 meters

**NOTES:**

1. All modes were measured and the worst-case emission was reported.
- 2 The radiated limits are shown on Figure 4.
- Above 1GHz the limit is 500  $\mu$ N/m.

**NOTES:**

1. \*Pol. H =Horizontal V=Vertical
2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. The limit for Class B device is on the FCC Part section 15.109(a).



Tested by : D. H. Ryu

## TEST DATA

### Radiated Emissions

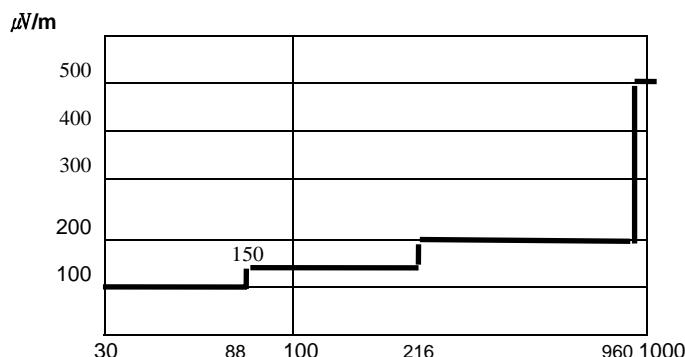
FCC ID : TJ4NTG100

Test Mode : Download

Frequency (MHz)	Reading (dB $\mu$ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
200.02	54.7	H	-13.7	41.0	43.5	2.5
250.02	53.5	H	-12.5	41.0	46.0	5.0
300.00	53.0	H	-11.3	41.7	46.0	4.3
450.05	49.8	H	-7.5	42.3	46.0	3.7
499.99	50.0	V	-6.3	43.7	46.0	2.3
500.05	49.4	H	-6.3	43.1	46.0	2.9
699.99	33.2	H	-0.9	32.3	46.0	13.7

**NOTES: Measurements using CISPR quasi-peak mode.**

**Table 4. Radiated Measurements at 3meters**



**Fig. 5. Limits at 3 meters**

#### **NOTES:**

1. **All modes were measured and the worst-case emission was reported.**
- 2 **The radiated limits are shown on Figure 5.**
- Above 1GHz the limit is 500  $\mu$ V/m.**

#### **NOTES:**

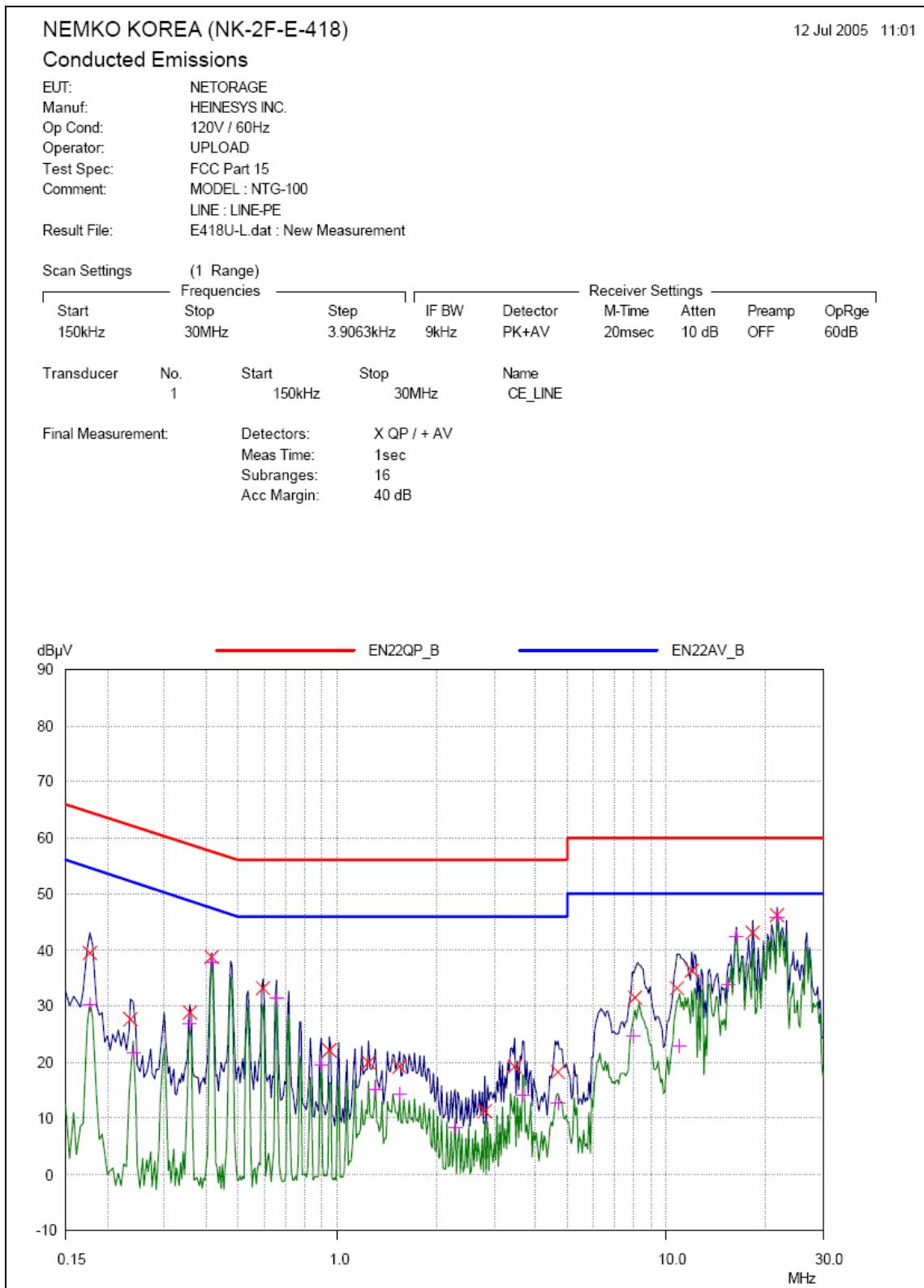
1. \*Pol. H =Horizontal V=Vertical
2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. The limit for Class B device is on the FCC Part section 15.109(a).



Tested by : **D. H. Ryu**

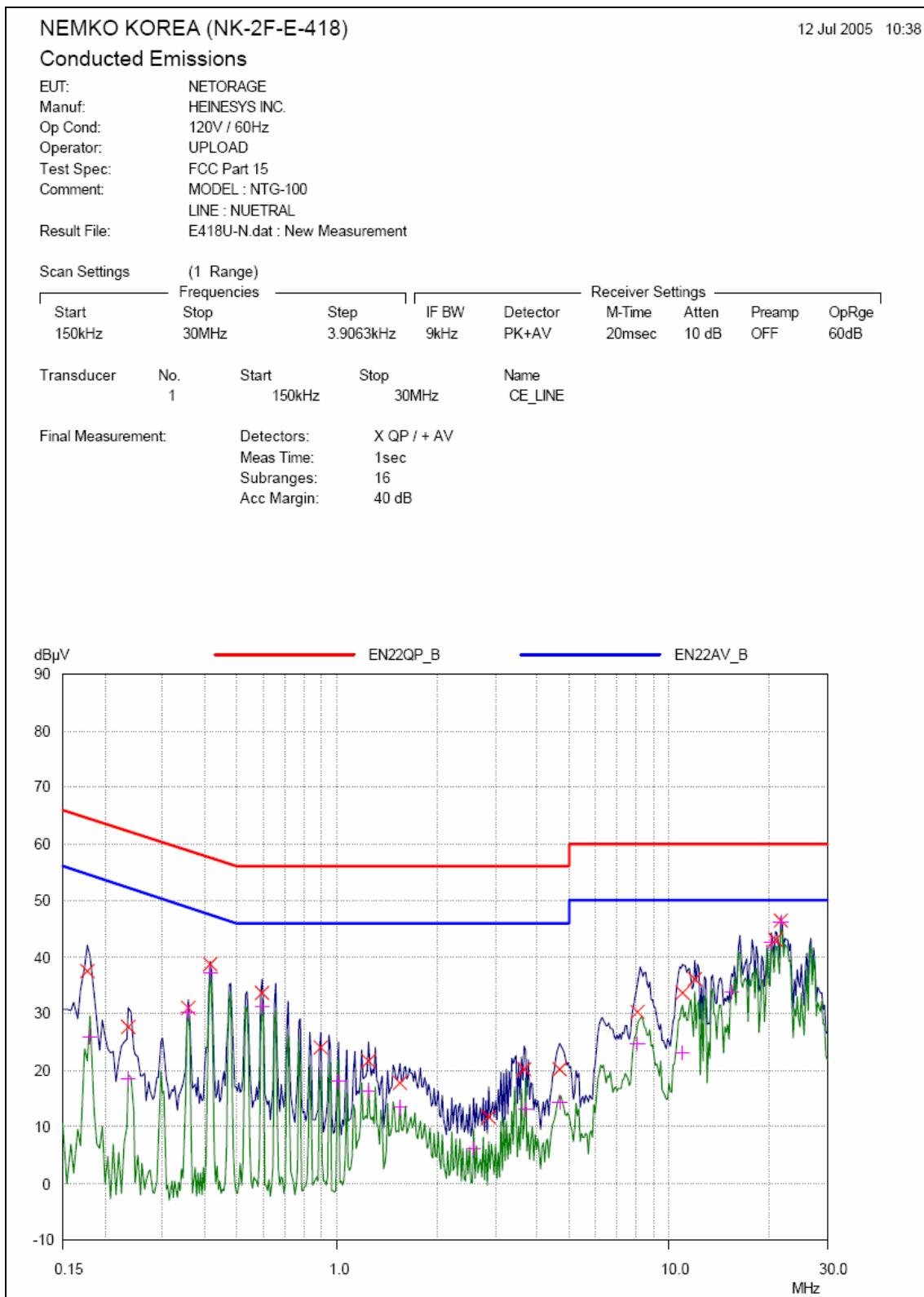
## ***PLOTS OF EMISSIONS***

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



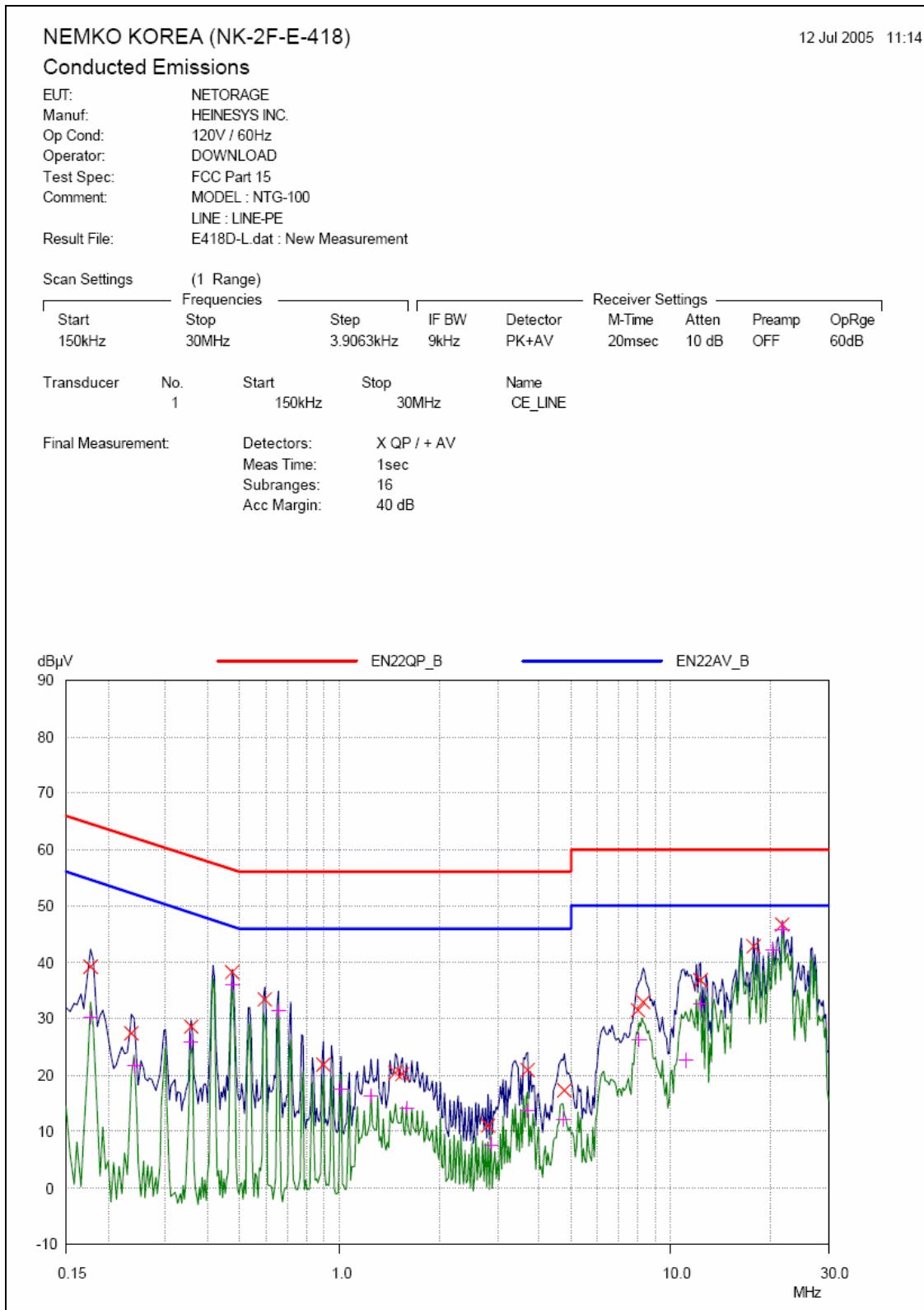
## PLOTS OF EMISSIONS

- Conducted Emission at the Mains port (Upload, Neutral)



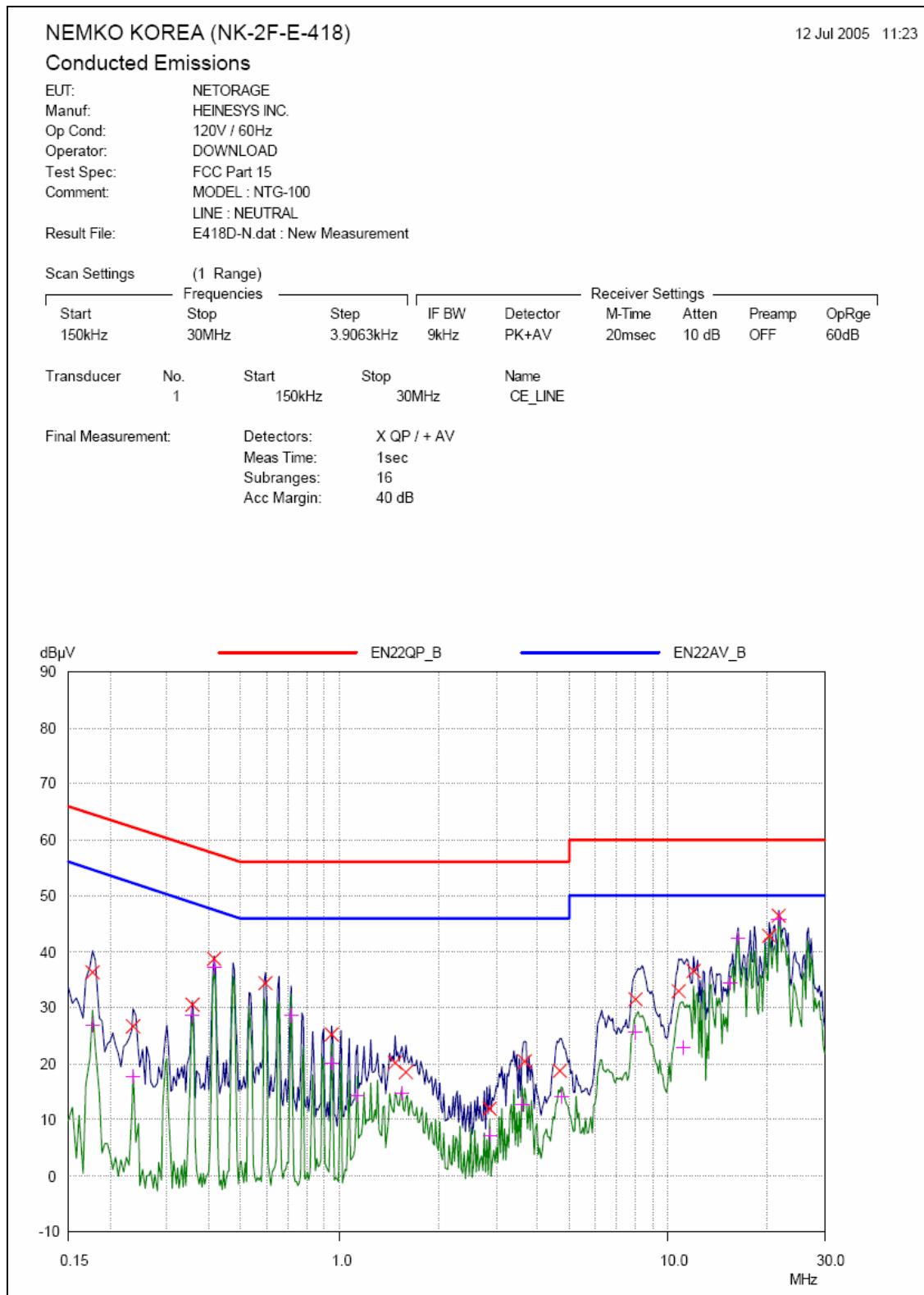
## ***PLOTS OF EMISSIONS***

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



## ***PLOTS OF EMISSIONS***

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



## **ACCURACY OF MEASUREMENT**

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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**

<b>Contribution</b>	<b>Probability Distribution</b>	<b>Uncertainty(+/-dB)</b>
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity		
Antenna Factor variation with Height		
Antenna Phase Center Variation	Rectangular	± 1.0
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC $r_i=0.3$		
Antenna VRC $r_R=0.1(B_i)0.4(L_p)$	U-Shaped	+ 0.25 / - 0.26
Uncertainty Limits $20\log(1+/-r_i r_R)$		
System Repeatability	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**

<b>Contribution</b>	<b>Probability Distribution</b>	<b>Uncertainty(+/-dB)</b>
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 $r_g=0.1$	U-Shaped	± 0.26
Uncertainty Limits $20\log(1+/-r_i r_R)$		
System Repeatability	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***

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No.	Instrument	Manufacturer	Model	Calibration Date
1	*Test Receiver	R & S	ESCS 30	2004.08
2	*Test Receiver	R & S	ESCS 30	2004.12
3	Amplifier	HP	8447F	2005.07
4	*Amplifier	HP	8447F	2005.01
5	*Amplifier	HP	8447F	2004.10
6	Amplifier	HP	8449B	2005.03
7	Spectrum Analyzer	HP	8566B	2005.03
8	*Spectrum Analyzer	HP	8568B	2004.10
9	Spectrum Analyzer	Anritsu	MS2668C	2004.12
10	*Logbicon Super Antenna	Schwarzbeck	VULB9166	2005.05
11	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	2005.04
12	*Biconical Log Antenna	ARA	LPB-2520/A	2005.01
13	Loop Antenna	EMCO	6502	2004.10
14	Microwave Survey Meter	Holaday Industries	H1-1801	2005.07
15	Signal Generater	R & S	SMP02	2005.03
16	*LISN	R & S	ESH3-Z5	2004.10
17	*LISN	Kyoritsu	KNW-407	2005.03
18	LISN	Kyoritsu	KNW-408	2004.12
19	*Position Controller	DAEIL EMC	N/A	N/A
20	*Turn Table	DAEIL EMC	N/A	N/A
21	*Antenna Mast	DAEIL EMC	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 – BLOCK DIAGRAM***

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## APPENDIX E – USER'S MANUAL

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## ***APPENDIX F – SCHEMATIC DIAGRAM***

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