

Nemko Korea Co., Ltd.

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :**Daewoo Electronics Corporation****M/W Oven Div. R&D Center, 412-2,****Chungchun-Dong, Bupyong-Gu, Incheon,****403-032, Korea****Attn : Mr. Gun-Woo, Ro****Dates of Issue : May 04, 2006****Test Report No. : NK2GE330****Test Site : Nemko Korea Co., Ltd.****EMC site, Korea****FCC ID****Brand Name****Contact Person*****C5F7NF18MO120N******DAEWOO***

**Daewoo Electronics Corporation
M/W Oven Div. R&D Center, 412-2,
Chungchun-Dong, Bupyong-Gu, Incheon,
403-032, Korea
Mr. Gun-Woo, Ro
Telephone No. : +82 32 510 7923**

Applied Standard:

Part 18 & 2

Classification :

Consumer ISM equipment

EUT Type:

Microwave oven

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 MP-5:1986.

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

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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 18.

Responsible Party : Daewoo Electronics Corporation

Contact Person : Mr. Gun-Woo. Ro
Tel No.: +82 32 510 7923

Manufacturer : Daewoo Electronics Corporation
M/W Oven Div. R&D Center, 412-2, Chungchun-Dong,
Bupyong-Gu, Incheon, 403-032, Korea

Factory : 1) Daewoo Microwave Oven Co., Ltd.
981-1, Jangduck-Dong, Gwangsan-Gu, Kwangju-Shi,
506-251, Korea
2) Daewoo Electronics Corporation.
Detda, Dagang District, Tianjin, Chaina

- FCC ID: C5F7NF18MO120N
- Model: KOR-181G
- Brand Name: DAEWOO
- EUT Type: Microwave Oven
- Applied Standard: FCC Part 18 & Part 2
- Test Procedure(s): MP-5:1986
- Dates of Test: April 25, 2006 to May 04,2006
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2GE330

INTRODUCTION

The measurement procedure described in MP5:1986 for Methods of Measurement of radiated, powerline conducted radio noise, frequency and power output was used in determining emissions emanating from **Daewoo Electronics Corporation**.

FCC ID : **C5F7NF18MO120N**, Microwave Oven.

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
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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.

EUT INFORMATION

EUT Information

Electric Rating:	120VAC, 60Hz
Clock:	4MHz (CR1)
Magnetron Type:	RM259 / Daewoo Electronics Corporation
Operating Frequency	2.45GHz
Rated Output Power	1200W

DESCRIPTION OF TESTS

Radiation Hazard

A 700-ml water load was placed in the center of the oven.

The power setting was set to maximum power.

While the oven was operating, the Microwave Survey Meter probe was moved slowly around the door seams to check for leakage.

Input Power Measurement

The EUT was placed on a wooden table 0.8m at 1m distance Horn antenna.

A 700ml water load was placed in the center of the oven and the oven set to maximum power. A 700ml water load was chosen for its compatibility.

Input power and current were measured using a Power Analyzer.

Manufacturers to determine their input ratings commonly use this procedure.

Output Power Measurement

The Caloric Method was used to determine maximum output power.

The initial temperature of a 1000ml water load was measured. The water load was placed in the center of the oven. The oven was operated at maximum output power for 120 seconds. Then the temperature of the water re-measured.

Frequency Measurements

Following the above test, after operating the oven long enough to assure that stable operating temperature were obtained, the operating frequency was monitored as the input voltage was varied between 80 to 125 percent of the nominal rating.

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 0.4m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room

Kyoritsu (KNW-407) of the 50ohm/50uH Line Impedance Stabilization Network(LISN) is bonded to the shielded room.

The EUT is powered from the Kyoritsu LISN.

Power to the LISN is 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 LISN,

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 EME reported was calibrated using the R&S signal generator.

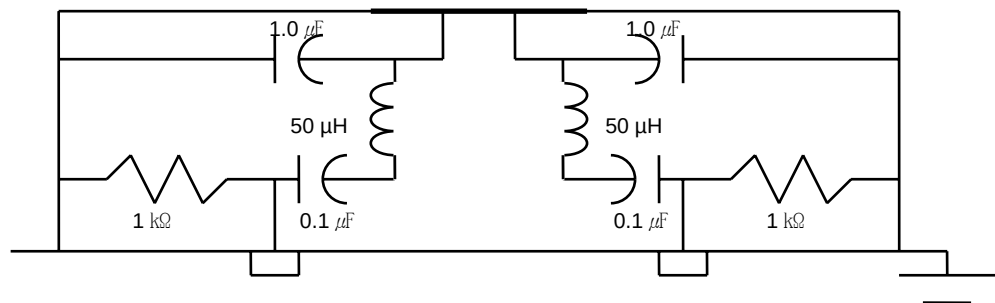


Fig. 2. LISN Schematic Diagram

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 0.15 to 30MHz using Loop Antenna (EMCO, 6502) and from 30 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, Double Ridged Broadband Horn antenna (Schwarzbeck, BBHA 9120 D) was used.

Final Measurements were made indoors at 3m using Loop Antenna (EMCO, 6502) for measurement from 0.15 to 30MHz and made outdoors at 10m using Biconical log Antenna (Schwarzbeck, VULB 9166) for measurement from 30MHz to 1000MHz and made indoors at 3m using Double Ridged Broadband Horn antenna (Schwarzbeck, BBHA 9120 D) for measurement from 1GHz to 24GHz.

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 EUT is rotated about its vertical axis on the turntable, and the polarization and height of the receiving antenna are varied to obtain the highest field strength on the particular frequency under observation.

Each EME reported was calibrated using the R/S signal generator.

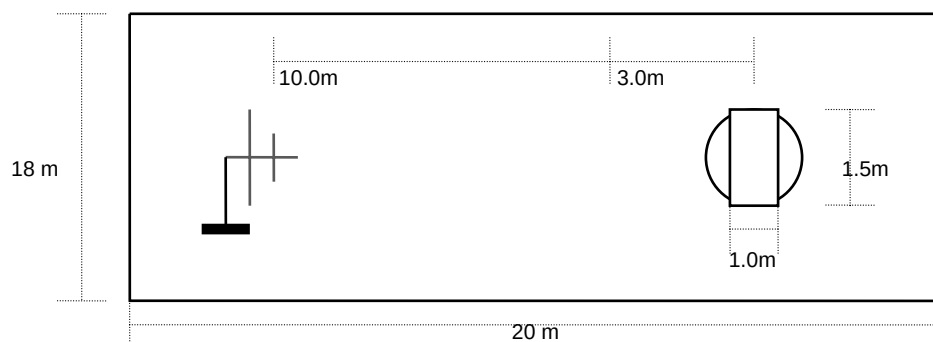


Fig. 3. Dimensions of Outdoor Test Site

TEST DATA

Radiation Hazard

Probe Location	Maximum Leakage [mW/Cm2]	Limit [mW/Cm2]
A	0.02	1.00
B	0.01	1.00
C	0.01	1.00
D	0.01	1.00
All others	0.01	1.00

Input Power Measurement

Operation mode	P rated (W)	P (W)	dP (%)	Required dP (%)
Power Input	1600	1593	-0.43	± 15%

RF Output Power Measurement

Quantity of Water [ml]	Starting Temperature [Centigrade]	Final Temperature [Centigrade]	Elapsed Time [seconds]	RF Power [watts]
1000	10	38.7	120	1001

$$\text{RF Power} = \frac{(4.187 \text{ Joules/Cal}) \times (\text{Volume in ml}) \times (\text{Temp. Rise})}{\text{Time in seconds}}$$



Tested by : C. S. Choi

TEST DATA

Operating Frequency measurements

► Frequency vs Line Voltage Variation Test

[Room Temperature : 24.6℃]

Line Voltage Variation (Vac)	*)Pole	Frequency [MHz]	Allowed Tolerance for the ISM Band
96 (80%)	H	Lower : 2404.10	Lower : 2400.00MHz Upper : 2500.00MHz
	H	Upper : 2462.90	
	V	Lower : 2402.90	
	V	Upper : 2458.60	
108 (90%)	H	Lower : 2403.70	
	H	Upper : 2472.70	
	V	Lower : 2402.40	
	V	Upper : 2472.30	
132 (110%)	H	Lower : 2402.90	
	H	Upper : 2469.30	
	V	Lower : 2401.60	
	V	Upper : 2468.00	
150 (125%)	H	Lower : 2402.90	
	H	Upper : 2466.70	
	V	Lower : 2402.00	
	V	Upper : 2465.00	

NOTE :

1. *Pol. H =Horizontal V=Vertical
2. Initial load : 1000ml of water in the beaker.
3. Line voltage varied from 96Vac to 150Vac.
4. ISM Frequency : 2450MHz, Tolerance : ± 50 MHz

RESULT : Pass



Tested by : C. S. Choi

TEST DATA

Conducted Emissions

FCC ID : C5F7NF18MO120N

[Room Temperature : 23.7℃]

Frequency (MHz)	Level(dB μ V)		Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	42.2	20.3	N	66.0	56.0	23.8	35.7
0.18	47.4	19.2	N	64.5	54.5	17.1	35.3
0.50	42.5	16.6	N	56.0	46.0	13.5	29.4
0.56	42.6	15.0	N	56.0	46.0	13.4	31.0
0.62	34.8	6.9	N	56.0	46.0	21.2	39.1
1.68	21.8	4.2	N	56.0	46.0	34.2	41.8

*) Correction factor was included to Test Level (dBuV)

NOTES:

1. Measurements using CISPR quasi-peak mode & average mode.
2. If no frequencies are specified in the tables, no measurement for quasi-peak or average was necessary.
3. See attached Plots.
4. Line : L =Line , N = Neutral
5. The limit for consumer device is on the FCC Part section 18.307(b).



Tested by : C. S. Choi

TEST DATA

Radiated Emissions

FCC ID : C5F7NF18MO120N

▶ 0.15MHz ~ 30MHz

[Room Temperature : 24.0℃]

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)
The level was under 20dB below limit.						

<Radiated Measurements at 3meters>

NOTES:

- *Pol. H=Horizontal V=Vertical
- **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
- Distance Correction factor : $20 * \log (300/3)=40\text{dB}\mu\text{V/m}$
- The limit at 300meters is $20 * \log (25 * \text{SQRT} (\text{RF Power}/500))$
- All other emissions were measured while a 700ml load was placed in the center of the oven.
- See attached Plots.
- The limit for consumer device is on the FCC Part section 18.305.



Tested by : C. S. Choi

TEST DATA

Radiated Emissions

FCC ID : C5F7NF18MO120N

▶ 30MHz ~ 1GHz

[Room Temperature : 25.1℃]

Frequency (MHz)	Reading (dB μ N)	Pol* (H/V)	AF+CL+Amp (dB)**	Result(PK) (dB μ N/m)	Limit(10m) (dB μ N/m)	Margin (dB)
58.23	54.3	V	-21.6	32.7	60.97	28.3
62.12	56.6	V	-21.5	35.1	60.97	25.9
72.25	55.3	V	-21.1	34.2	60.97	26.8
731.21	30.2	H	-0.1	30.1	60.97	30.9
752.25	36.8	H	0.4	37.2	60.97	23.8
815.24	27.5	H	2.0	29.4	60.97	31.6

<Radiated Measurements at 10meters>

NOTES:

1. *Pol. H=Horizontal V=Vertical
2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Distance Correction factor : $20 * \log (300/10) \approx 30\text{dB}\mu\text{V/m}$
4. The limit at 300meters is $20 * \log (25 * \text{SQRT} (\text{RF Power}/500))$
5. All other emissions were measured while a 700ml load was placed in the center of the oven.
6. If no frequencies are specified in the tables, no measurement for peak & average was necessary.
7. The limit for consumer device is on the FCC Part section 18.305.



Tested by : C. S. Choi

TEST DATA

Radiated Emissions

FCC ID : C5F7NF18MO120N

▶ 1GHz ~ 24GHz

[Room Temperature : 21.5℃]

Frequency (MHz)	Reading (dB μ V)	Pol* (H/V)	AF+CL+Amp (dB)**	K (dB)**	Limit (with K) (dB μ V/m)	Results (dB μ V/m)	Margin (dB)
4304.96	32.2	H	10.00	40.26	70.97	42.20	28.77
4909.12	46.2	H	10.90	40.00	70.97	57.10	13.87
****4909.76	46.4	H	10.90	40.00	70.97	57.30	13.67
7088.01	33.6	H	14.00	40.00	70.97	47.60	23.37
7352.40	37.4	H	14.95	40.00	70.97	52.35	18.62
****7352.86	46.1	H	14.95	40.00	70.97	61.05	9.92
8432.92	36.9	H	17.35	40.00	70.97	54.25	16.72
8595.81	36.7	H	17.00	40.00	70.97	53.70	17.27

<Radiated Measurements at 3meters>

NOTES:

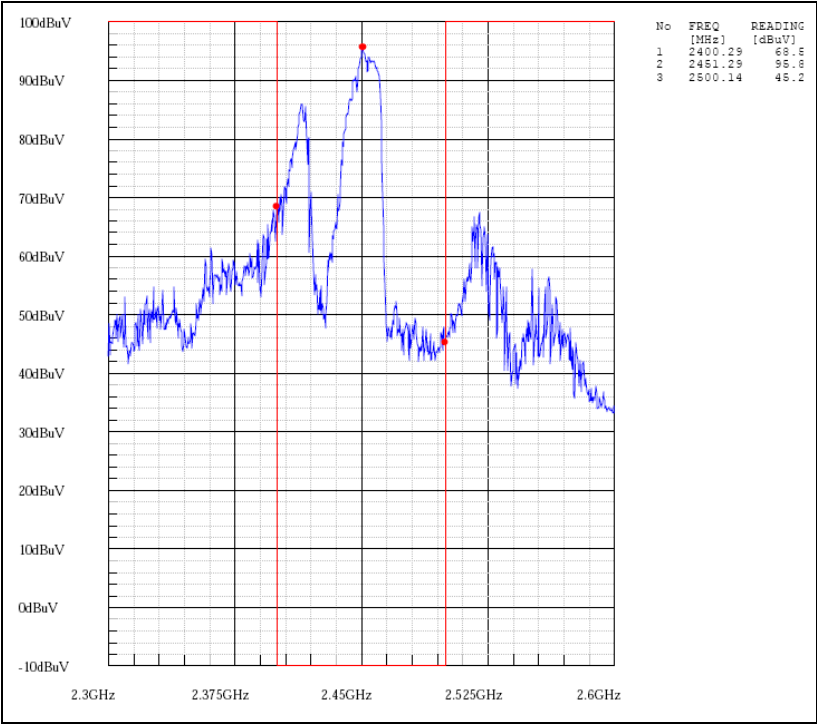
- *Pol. H =Horizontal V=Vertical
- **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
- ***Computations to determine compliance
- ****emissions were measured while a 300ml load.
- Distance Correction factor : $20 * \log (300/3)=40\text{dB}\mu\text{V/m}$
- The limit at 300meters is $20 * \log (25 * \text{SQRT} (\text{RF Power}/500))$
- Load for measurement of radiation on second and third harmonic : Two loads, one of 700ml and the other of 300ml, of water were used. Each load was tested both with the beaker located in the center of the oven and with it in the corner.
- The test was performed at peak detector mode with RBW 1MHz, VBW 10Hz.
- If no frequencies are specified in the tables, no measurement for peak with RBW 1MHz & VBW 10Hz.
- The limit for consumer device is on the FCC Part section 18.305.



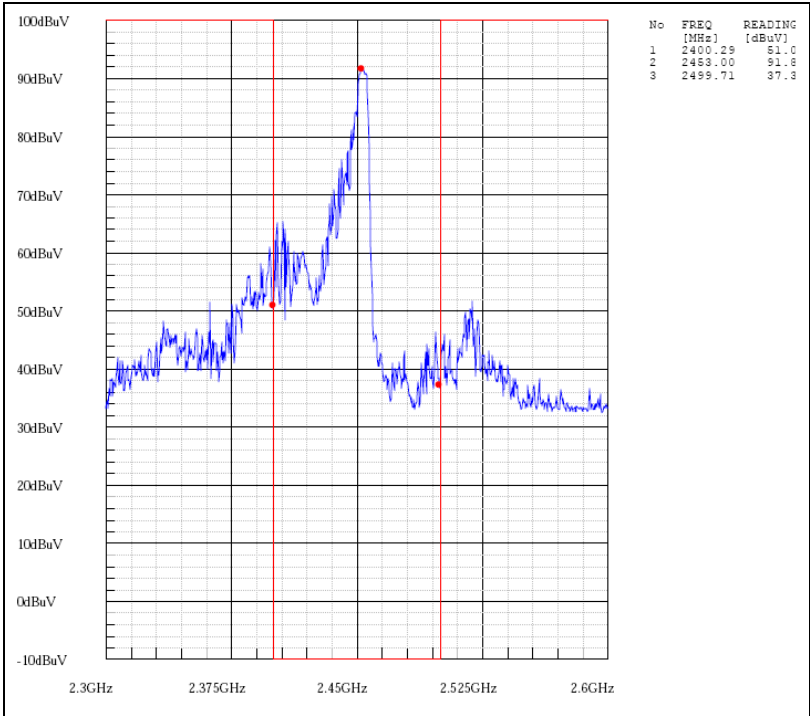
Tested by : C. S. Choi

PLOTS OF EMISSIONS

Frequency vs Line Voltage Variation Test



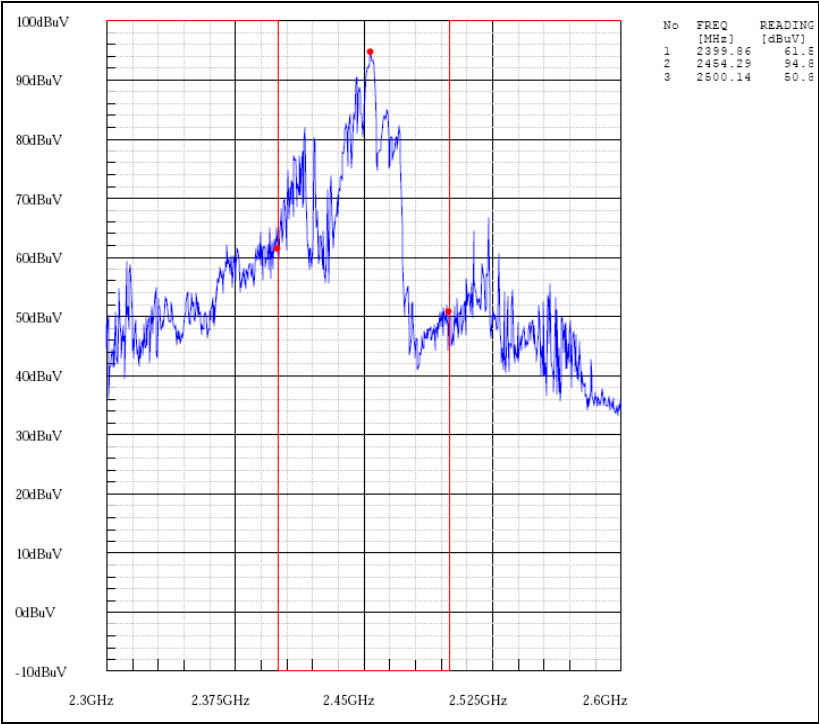
Horizontal (96V, 1000cc)



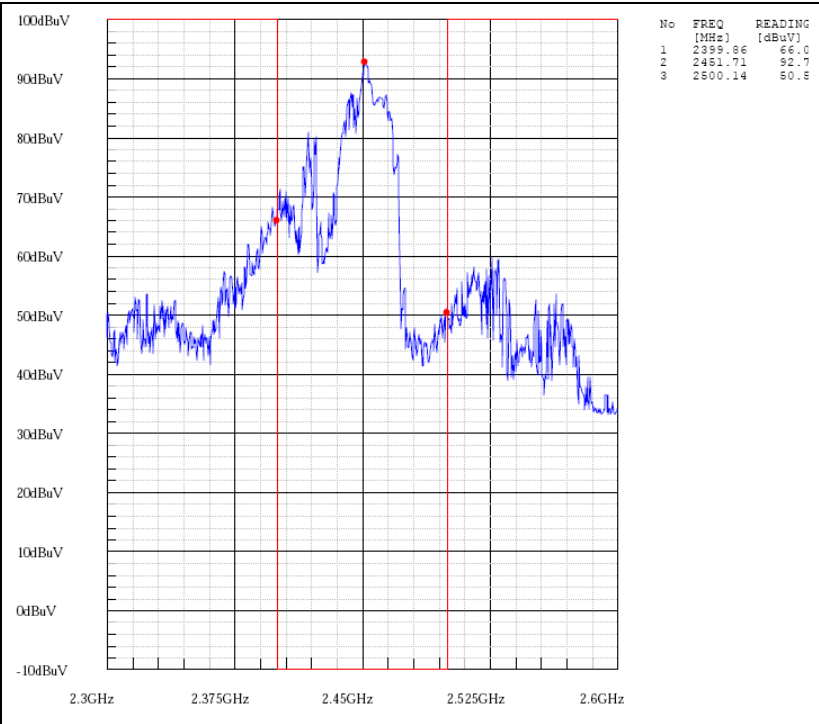
Vertical (96V, 1000cc)

PLOTS OF EMISSIONS

● **Frequency vs Line Voltage Variation Test**



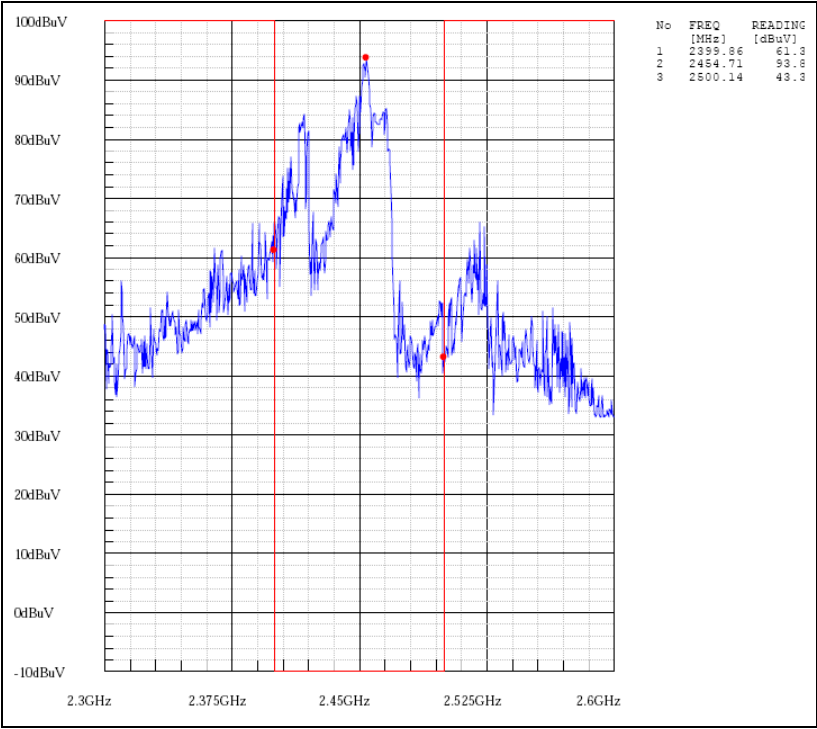
Horizontal (108V, 1000cc)



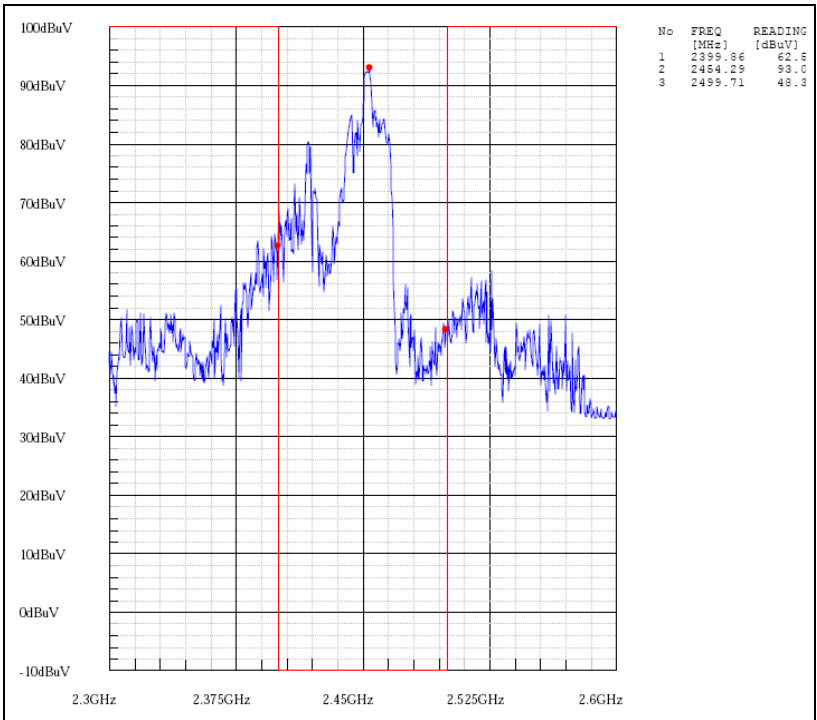
Vertical (108V, 1000cc)

PLOTS OF EMISSIONS

● **Frequency vs Line Voltage Variation Test**



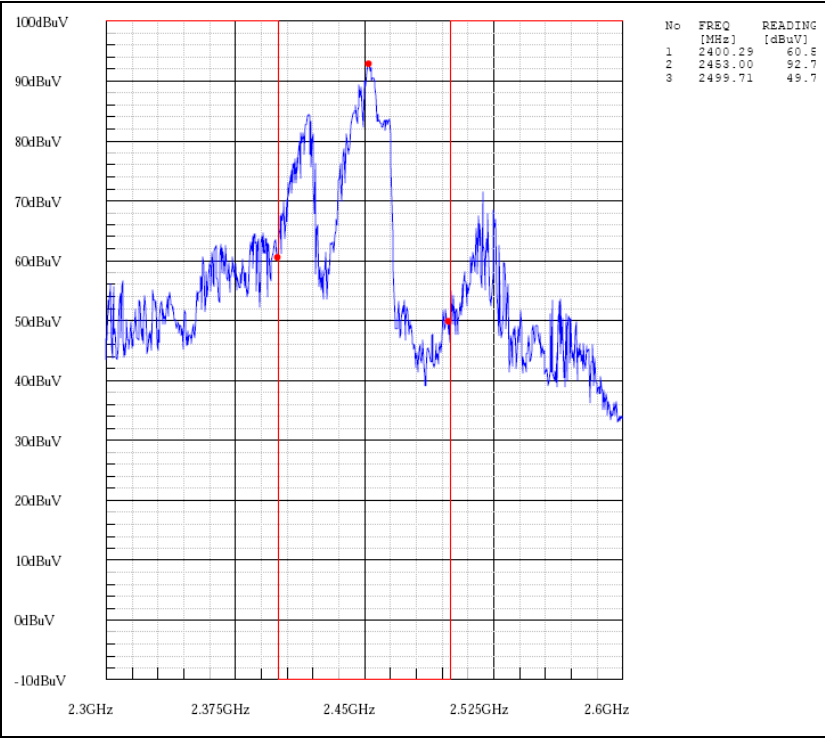
Horizontal (132V, 1000cc)



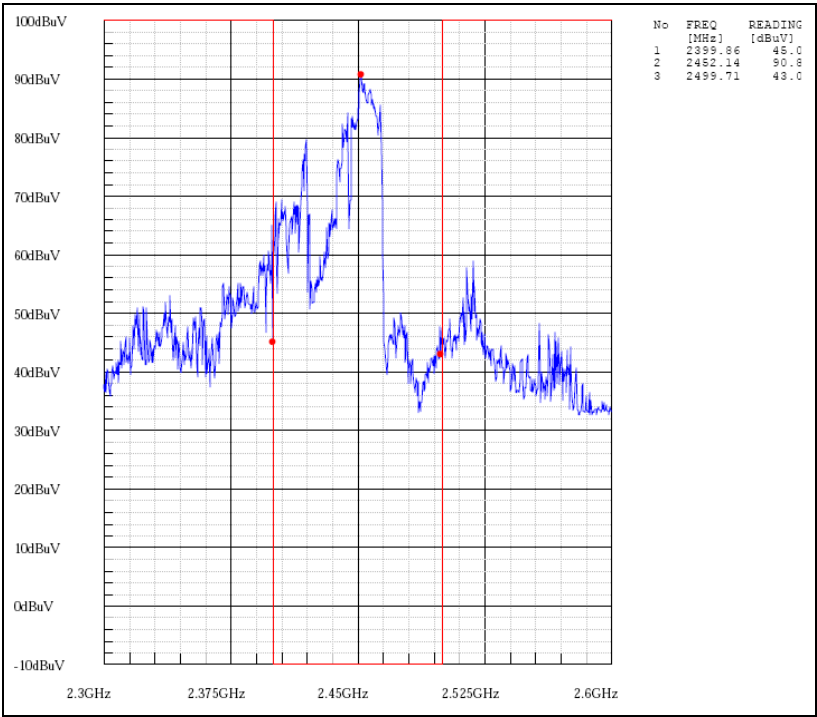
Vertical (132V, 1000cc)

PLOTS OF EMISSIONS

● **Frequency vs Line Voltage Variation Test**



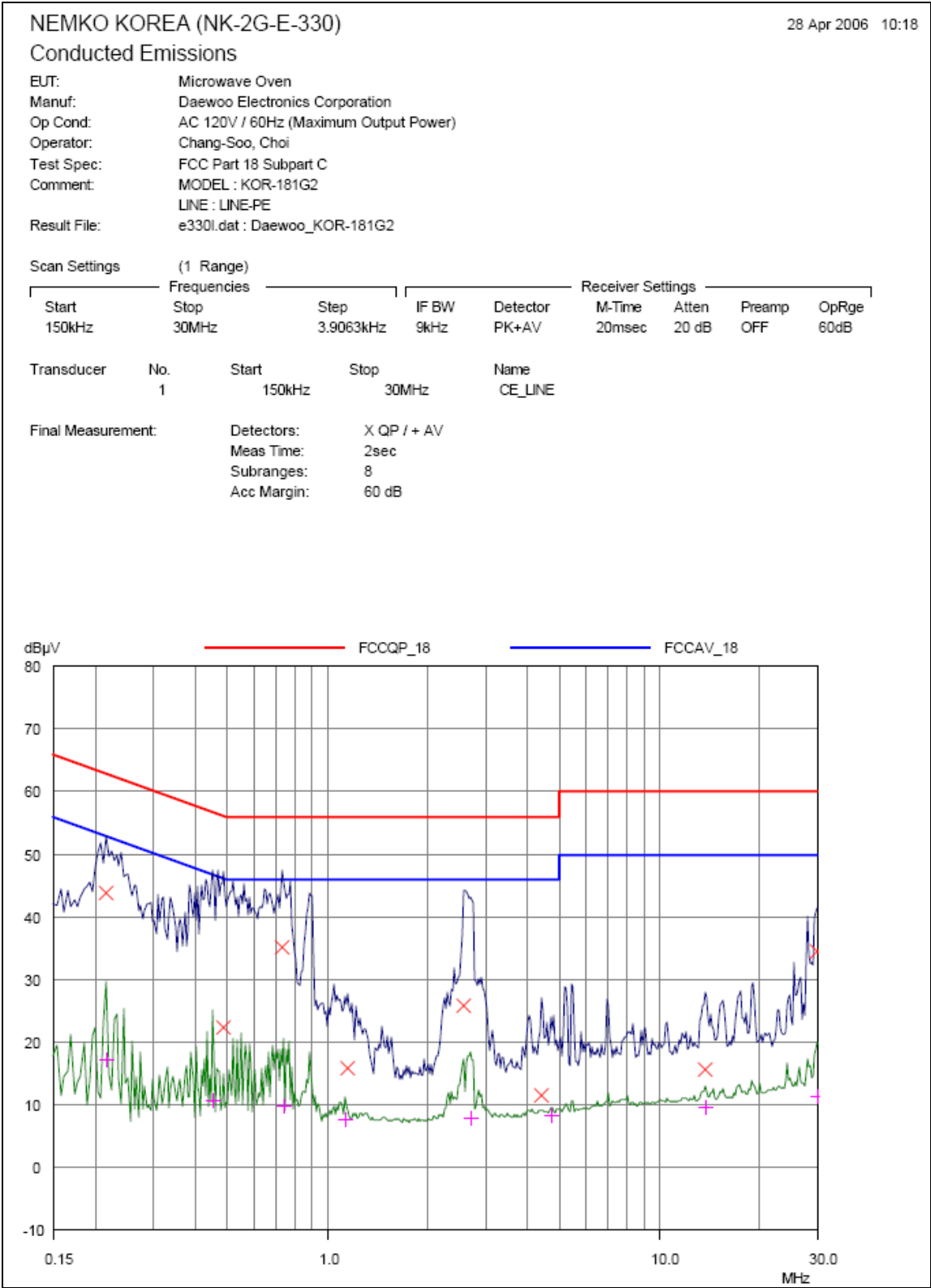
Horizontal (150V, 1000cc)



Vertical (150V, 1000cc)

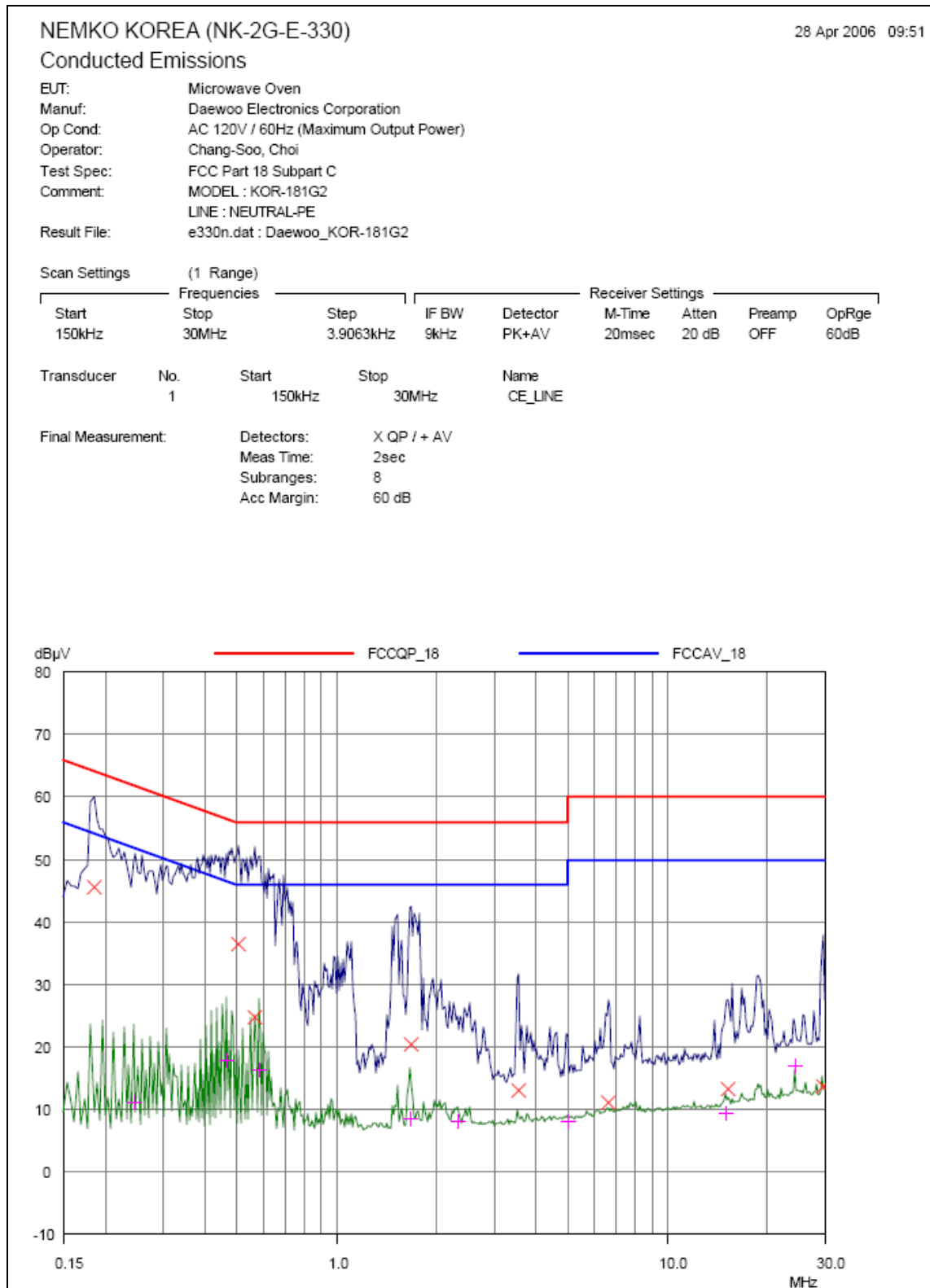
PLOTS OF EMISSIONS

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



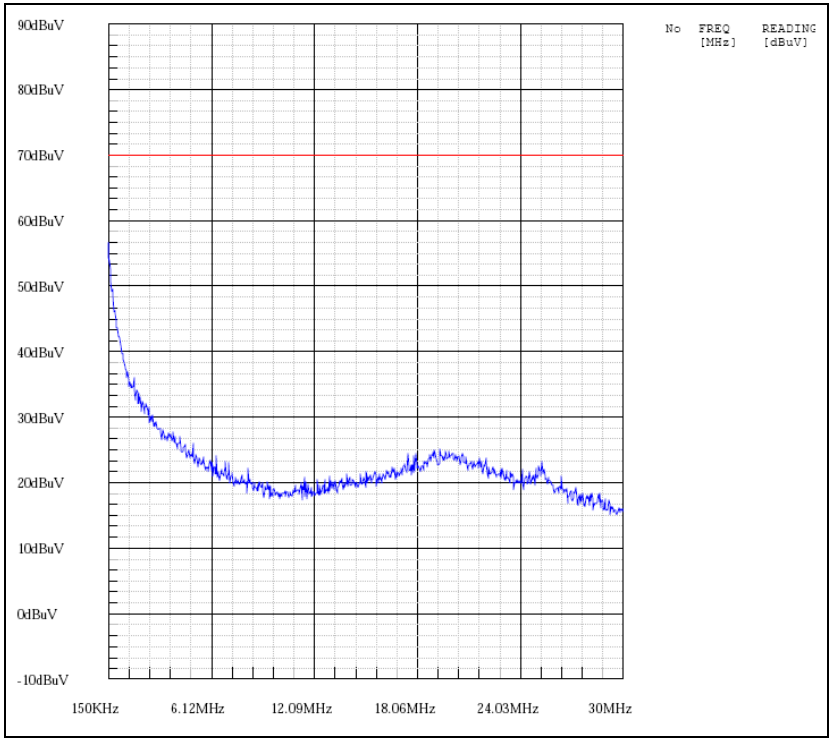
PLOTS OF EMISSIONS

● Conducted Emission at the Mains port (Neutral)

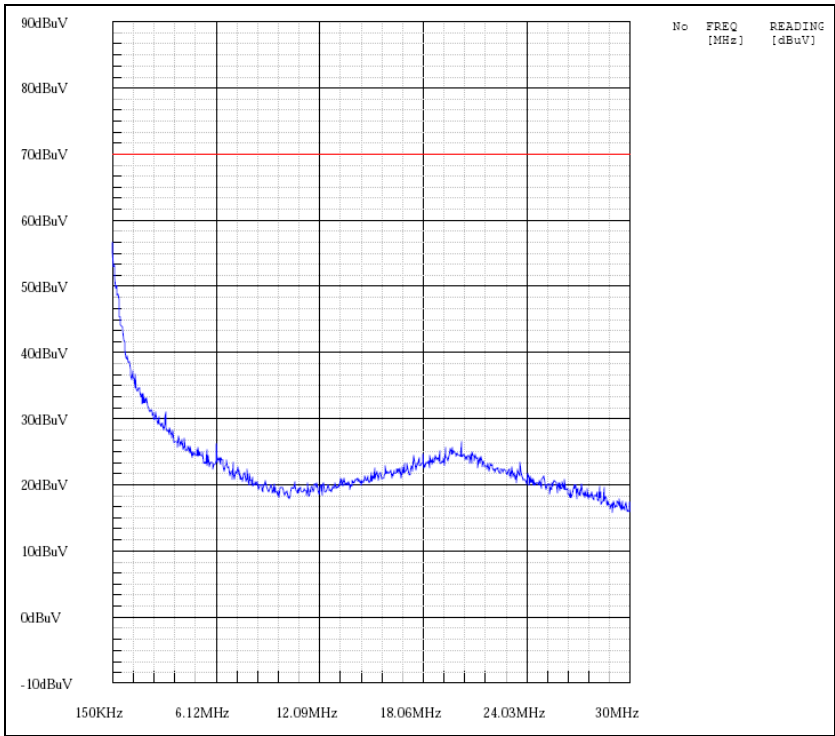


PLOTS OF EMISSIONS

- Radiated Emission (0.15MHz ~ 30MHz)



(Horizontal)



(Vertical)

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	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Aug. 17 2005	1year
2	*Test Receiver	R & S	ESCS 30	100302	Dec. 06 2005	1year
3	Amplifier	Agilent	8447F	3113A04549	Aug. 17 2005	1year
4	*Amplifier	HP	8447F	2944A03956	Aug. 17 2005	1year
5	*Amplifier	HP	8447F	2805A03351	Oct. 25 2005	1year
6	*Amplifier	HP	8449B	3008A00107	Mar. 27 2006	1year
7	*Spectrum Analyzer	HP	8566B	267A03469	Mar.10 2006	1year
8	Spectrum Analyzer	Advantest	R3265A	45060401	Dec.06 2005	1year
9	*Spectrum Analyzer	HP	8568B	1912A00573	Oct.25 2005	1year
10	*Loop Antenna	EMCO	6502	8911-2436	Dec. 20 2005	1year
11	*Biconical Log-Perio. Antenna	ARA	LBP-2520/A	1203	May. 02 2005	1year
12	*Logbicon Super Broadband Antenna	Schwarzbeck	VULB 9166	1067	Feb. 09 2006	1year
13	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-474	Apr. 05 2005	1year
14	*Microwave Survey Meter	Holaday Industries	H1-1801	N/A	July. 20 2005	1year
15	Signal Generater	R & S	SMP02	833286/003	Aug. 17 2005	1year
16	LISN	R & S	ESH3-Z5	833874/006	Oct. 25 2005	1year
17	*LISN	Kyoritsu	KNW-407	8-1034-10	Mar. 10 2006	1year
18	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
19	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
20	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
21	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
22	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
23	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
24	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
25	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
26	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
27	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A

*) Test equipment used during the test

APPENDIX D – SCHEMATIC DIAGRAM

APPENDIX E – USER’S MANUAL

APPENDIX F – BLOCK DIAGRAM
