

# Nemko Korea Co., Ltd.

67-1 & 300-2, Osan-Ri, Mohyun-Myun, Cheoin-Gu, Yongin-City, Gyeonggi-Do, KOREA

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## FCC EVALUATION REPORT FOR CERTIFICATION

**Applicant :**

Daewoo Electronics Corporation  
Kitchen Appliances Div. R&D Center,  
412-2, Cheongcheon2-Dong, Bupyeong-Gu,  
Incheon, 403-032, Korea  
Attn : Mr. Seongok Kim

Dates of Issue : May 03, 2012  
Test Report No. : NK-12-E-204  
Test Site : Nemko Korea Co., Ltd.  
EMC site, Korea

FCC ID

Brand Name

Contact Person

**C5F7NF9FMO120N**

**DAEWOO**

**Daewoo Electronics Corporation  
Kitchen Appliances Div. R&D Center,  
412-2, Cheongcheon2-Dong, Bupyeong-Gu,  
Incheon, 403-032, Korea  
Mr. Seongok Kim  
Telephone No. : + 82 32 510 7919**

Applied Standard: Part 18 & 2  
Classification : Consumer ISM equipment  
EUT Type: Commercial 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.



May 03, 2012

**Tested By : Kiwang Kim**  
Engineer



May 03, 2012

**Reviewed By : Deokha Ryu**  
Manager & Chief Engineer

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## SCOPE

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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. Seongok Kim  
Tel No.: + 82 32 510 7919

**Manufacturer :** Daewoo Electronics Corporation  
Kitchen Appliances Div. R&D Center, 412-2,  
Cheongcheon2-Dong, Bupyeong-Gu, Incheon, 403-032,  
Korea

**Factory :** 1) Daewoo Microwave Oven Co., Ltd.  
Dagang, District, Development Area Tianjin, China  
2) INA Inc.  
729-6, Ancheong-dong, Gwangsan-gu, Gwangju, Korea

- FCC ID: C5F7NF9FMO120N
- Model: KOM-9F0CDA
- Brand Name: DAEWOO
- EUT Type: Commercial Microwave Oven
- Applied Standard: FCC Part 18 & Part 2
- Test Procedure(s): MP-5:1986
- Dates of Test: February 21, 2012 to May 03, 2012
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK-12-E-204

## INTRODUCTION

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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 : **C5F7NF9FMO120N, Commercial Microwave Oven.**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 67-1 & 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-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 (18 miles) 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 2003.



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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***

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### **EUT Information**

Electric Rating :	a.c. 120 V, 60 Hz
Clock :	4 MHz
Magnetron Type :	2M303 (TOSHIBA)
Operating Frequency :	2.45 GHz

## ***DESCRIPTION OF TESTS***

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### **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 0.8 m at 1 m distance Horn antenna.

A 700ml water load was placed in the center of the oven and the oven set to maximum power. A 700 ml 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 1000 ml 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.

And the load quantity was reduced by evaporation to approximately 20 % of the original quantity with 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 1 m X 1.5 m wooden table 0.4 m height is placed 0.4 m away from the vertical wall and 1.5 m away from the side of wall of the shielded room

Rohde & Schwarz (ESH2-Z5) of the 50 ohm/50 uH Line Impedance Stabilization Network (LISN) is bonded to the shielded room.

The EUT is powered from the Rohde & Schwarz 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 150 kHz to 30 MHz with 20 m sec 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 9 kHz. 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.

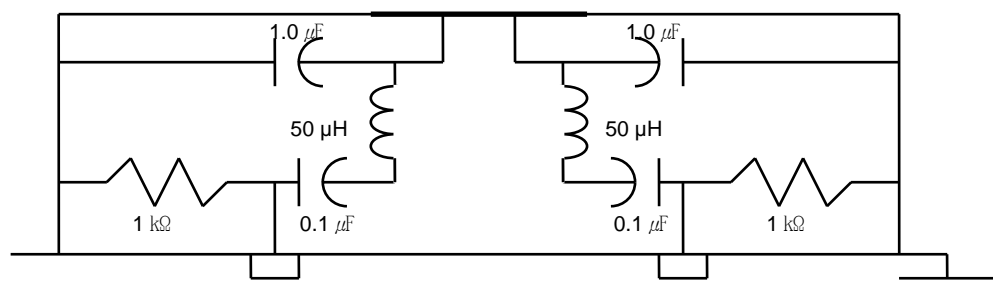


Fig. 2. LISN Schematic Diagram

## DESCRIPTION OF TESTS

### Radiated Emissions

Preliminary measurements were made indoors at 3 meters using broadband 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 noted for each frequency found. The spectrum was scanned from 0.15 to 30 MHz using Loop Antenna (EMCO/6502) and from 30 to 1000 MHz using Biconical log Antenna (ARA, LPB-2520/A). Above 1 GHz, Double Ridged Broadband Horn antenna (Schwarzbeck, BBHA 9120 D) was used.

Final Measurements were made indoors at 3 m using Loop Antenna (EMCO/6502) for measurement from 0.15 to 30 MHz with RBW 9 kHz & VBW 9 kHz and made indoors at 3 m using Trilog-Broadband Antenna (Schwarzbeck, VULB9168) for measurement from 30 MHz to 1000 MHz with RBW 100 kHz & VBW 100 kHz and made indoors at 3 m using Double Ridged Broadband Horn antenna (Schwarzbeck, BBHA 9120 D) for measurement from 1 GHz to 25 GHz with RBW 1 MHz & VBW 1 MHz.

Each frequency found during pre-scan measurements was reexamined and investigated using EMI test receiver. (FSP40)

The detector function was set to CISPR quasi peak mode and the bandwidth of the receiver was set to 9 kHz, 100 kHz and peak mode 1 MHz depending on the frequency or type of signal.

The Double Ridged Broadband Horn 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 0.8 m high non-metallic 1.0 X 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.

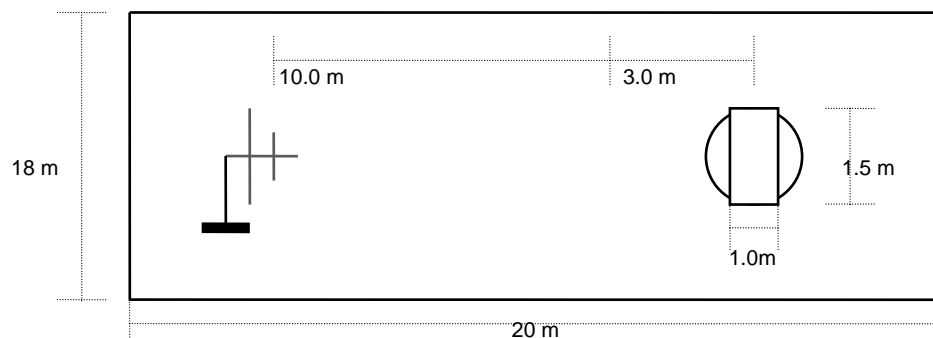


Fig. 3. Dimensions of Outdoor Test Site



## *TEST DATA*

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### Radiation Hazard

Probe Location	Maximum Leakage [mW/Cm2]	Limit [mW/Cm2]
A	0.2	1.00
B	0.1	1.00
C	0.1	1.00
D	0.1	1.00
All others	0.1	1.00

### Input Power Measurement

Operation mode	P rated (W)	P (W)	dP (%)	Required dP (%)
Power Input	2100	2050	-2.38	+ 15 %

### RF Output Power Measurement

Quantity of Water [ml]	Starting Temperature [Centigrade]	Final Temperature [Centigrade]	Temp. Rise	Elapsed Time [seconds]	RF Power [watts]
1000	10	40	30	120	1047

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




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Tested by : *K. W. Kim*

## TEST DATA

### Operating Frequency measurements

► Frequency vs Line Voltage Variation Test

[ Room Temperature : 24.0 °C ]

Line Voltage Variation (a.c. V)	*)Pole	Frequency [MHz]	Allowed Tolerance for the ISM Band
96 (80%)	H	Lower : 2400.0	Lower : 2400 MHz Upper : 2500 MHz
	H	Upper : 2434.4	
	V	Lower : 2400.8	
	V	Upper : 2432.0	
108 (90%)	H	Lower : 2403.8	
	H	Upper : 2483.6	
	V	Lower : 2403.2	
	V	Upper : 2482.4	
132 (110%)	H	Lower : 2403.2	
	H	Upper : 2486.6	
	V	Lower : 2402.0	
	V	Upper : 2492.6	
150 (125%)	H	Lower : 2402.0	
	H	Upper : 2485.4	
	V	Lower : 2402.0	
	V	Upper : 2484.8	

**NOTE :**

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

**RESULT : Pass**



Tested by : K. W. Kim

## TEST DATA

► Frequency vs Load Variation Test

[ Room Temperature : 24.0 °C ]

Volume of water (ml)	*)Pole	Frequency [MHz]	Allowed Tolerance for the ISM Band
1000	H	Lower : 2403.2	Lower : 2400 MHz Upper : 2500 MHz
	H	Upper : 2486.0	
	V	Lower : 2400.8	
	V	Upper : 2486.0	
800	H	Lower : 2402.0	
	H	Upper : 2480.6	
	V	Lower : 2402.0	
	V	Upper : 2474.0	
600	H	Lower : 2402.0	
	H	Upper : 2492.0	
	V	Lower : 2405.0	
	V	Upper : 2485.4	
400	H	Lower : 2412.8	
	H	Upper : 2484.8	
	V	Lower : 2412.2	
	V	Upper : 2478.2	
200	H	Lower : 2400.0	
	H	Upper : 2483.6	
	V	Lower : 2400.2	
	V	Upper : 2491.4	

**NOTE :**

1. \*Pol. H = Horizontal, V = Vertical
2. The water load was varied between 200 ml to 1000 ml.
3. Frequency was measured by using nominal voltage (a.c. 120 V).
4. ISM Frequency : 2450 MHz, Tolerance : ± 50 MHz

**RESULT :** Pass



Tested by : K. W. Kim

## TEST DATA

### Conducted Emissions

FCC ID : C5F7NF9FMO120N

[Room Temperature : 23.0 °C]

Frequency (MHz)	Level(dB $\mu$ V)		Factor (dB)	Line	Limit(dB $\mu$ V)		Margin(dB)	
	Q-Peak	Average			Q-Peak	Average	Q-Peak	Average
0.15	51.2	24.0	0.2	L	66.0	56.0	14.8	32.0
0.16	54.8	30.3	0.2	N	65.5	55.5	10.7	25.2
0.18	51.5	27.0	0.2	N	64.5	54.5	13.0	27.5
0.21	46.5	24.3	0.2	N	63.2	53.2	16.7	28.9
0.40	37.6	14.2	0.1	N	57.9	47.9	20.3	33.7
16.01	27.0	23.9	1.3	N	60.0	50.0	33.0	26.1

**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 : K. W. Kim

# TEST DATA

## Radiated Emissions

FCC ID : C5F7NF9FMO120N

▶ 0.15 MHz ~ 30 MHz

[Room Temperature : 23.0 °C]

Frequency (MHz)	Reading (dB $\mu$ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
The level was under 20 dB below limit.						

<Radiated Measurements at 3 meters>

**NOTES:**

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



Tested by : **K. W. Kim**

# TEST DATA

## Radiated Emissions

FCC ID : C5F7NF9FMO120N

► 30 MHz ~ 1 GHz

[Room Temperature : 24.0 °C]

Frequency (MHz)	Reading (dB $\mu$ N/m)	Pol* (H/V)	Antena Heights(cm)	Turntable Angles (°)	AF+CL+Amp (dB)**	Result (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
155.13	32.3	H	130	62	-11.3	21.0	71.1	50.1
192.96	28.7	H	130	294	-8.9	19.8	71.1	51.3
234.67	28.9	H	160	287	-7.4	21.5	71.1	49.6
993.39	29.4	H	190	128	-2.0	27.4	71.1	43.7
961.20	31.4	V	190	296	-2.0	29.4	71.1	41.7
996.12	31.7	V	160	207	-2.0	29.7	71.1	41.4

<Radiated Measurements at 3 meters>

### NOTES:

- \*Pol. H = Horizontal V = Vertical
- \*\*AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
- Distance Correction factor :  $20 * \log (300/3) \doteq 40 \text{ dB } \mu\text{N/m}$
- The limit at 300 meters is  $20 * \log (25 * \text{SQRT} (\text{RF Power}/500))$
- All other emissions were measured while a 700 ml load was placed in the center of the oven.
- If no frequencies are specified in the tables, no measurement for peak with RBW 120 kHz & VBW 10 Hz.
- The limit for consumer device is on the FCC Part section 18.305.



Tested by : K. W. Kim

# TEST DATA

## Radiated Emissions

FCC ID : C5F7NF9FMO120N

► Above 1 GHz

[Room Temperature : 22.0 °C]

Frequency (MHz)	Pol* (H/V)	Antena Heights (cm)	Turntable Angles (°)	Reading Level (dB $\mu$ V)	Total Loss** (dB)	Result at 3 m		K	Results at 300 m	Limits at 300 m
						(dB $\mu$ V/m)	( $\mu$ V/m)		( $\mu$ V/m)	( $\mu$ V/m)
4924.27	V	130	195	56.0	9.6	65.6	1905.5	0.01	19.1	36.1
7090.60	V	130	105	37.2	15.1	52.3	412.1	0.01	4.1	36.1
7321.32	V	130	315	33.7	16.2	49.9	312.6	0.01	3.1	36.1
8170.35	V	130	210	29.5	17.4	46.9	221.3	0.01	2.2	36.1
9791.17	V	160	210	35.9	20.0	55.9	623.7	0.01	6.2	36.1
12335.17	V	190	315	33.4	23.8	57.2	724.4	0.01	7.2	36.1

<Radiated Measurements at 3 meters>

**NOTES:**

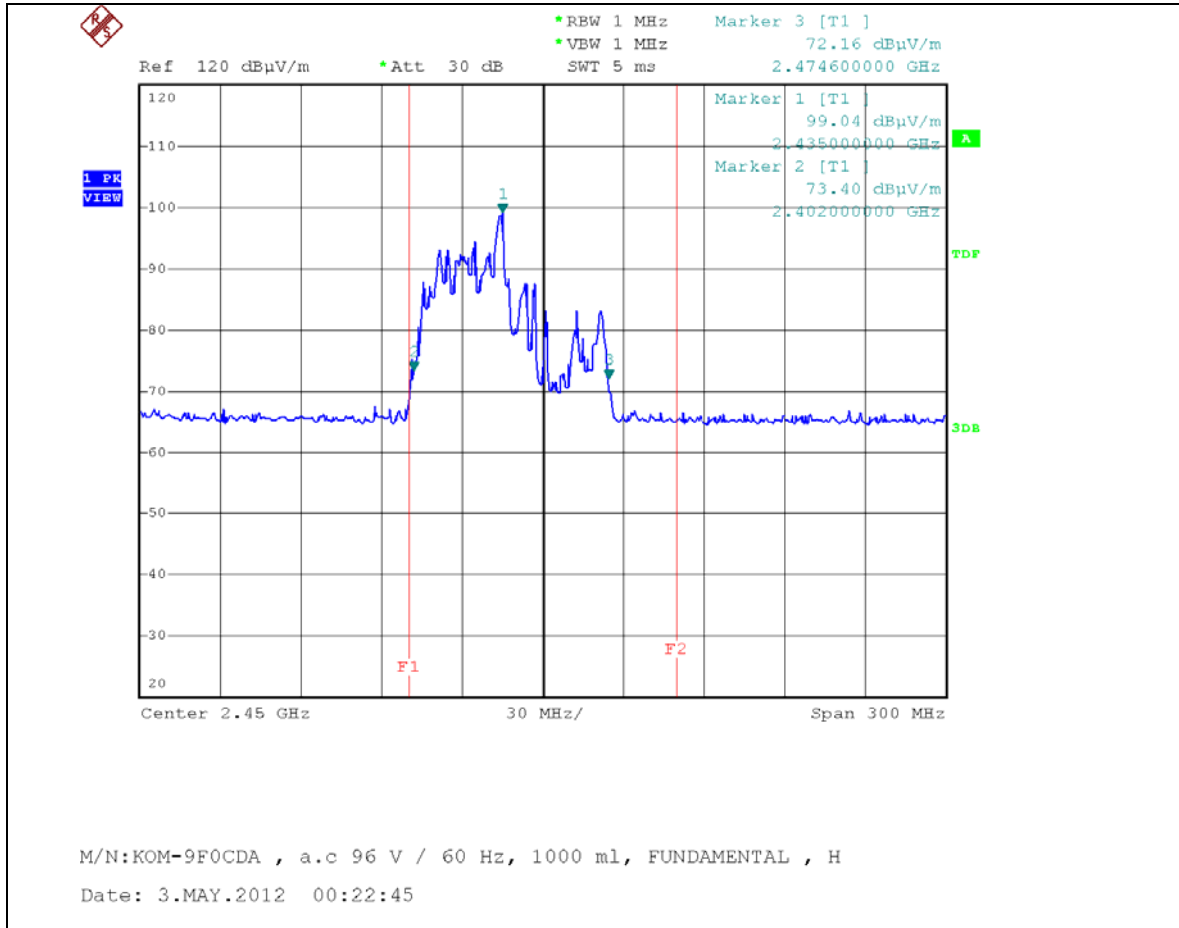
1. \* Pol. H=Horizontal V=Vertical
2. \*\* Total Loss = Antenna Factor + Cables Loss + Amplifier + HPF (High Pass Filter)
3. Field Strength (at 300 m) (uV/m) =  $K * 10^{[Fieldstrength\ at\ 3\ m\ (dBuV/m) / 20]}$
4. The limit at 300 meters is  $25 * SQRT (RF\ Power/500)$
5. Load for measurement of radiation on second and third harmonic : Two loads, one of 700 ml and the other of 300 ml, 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.
6. The test was performed at peak detector mode with average.
7. If no frequencies are specified in the tables, no measurement for peak with RBW 1 MHz & VBW 10 Hz.
8. The limit for consumer device is on the FCC Part section 18.305.



Tested by : K. W. Kim

# PLOTS OF EMISSIONS

- **Frequency vs Line Voltage Variation Test**

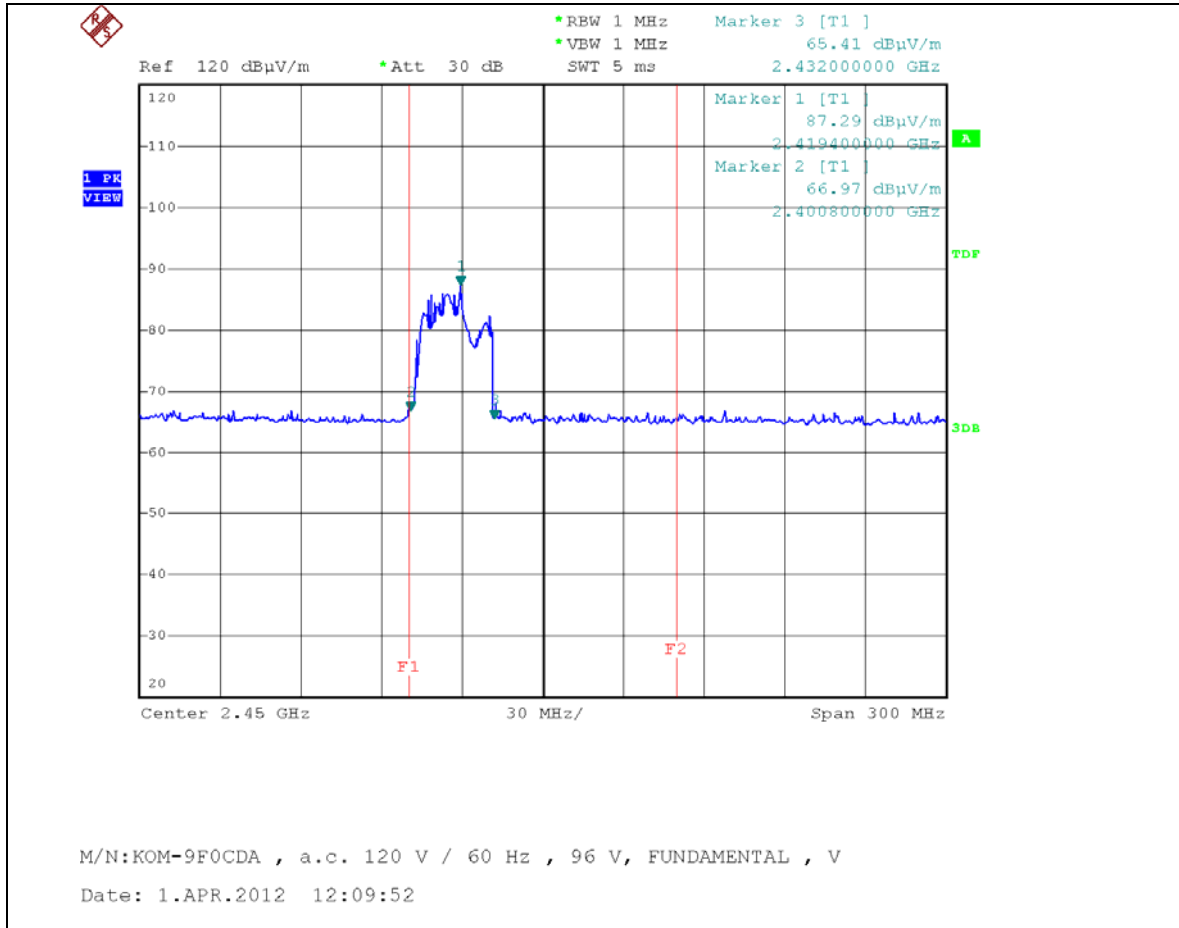


**Horizontal (96 V, 1000 ml)**



# PLOTS OF EMISSIONS

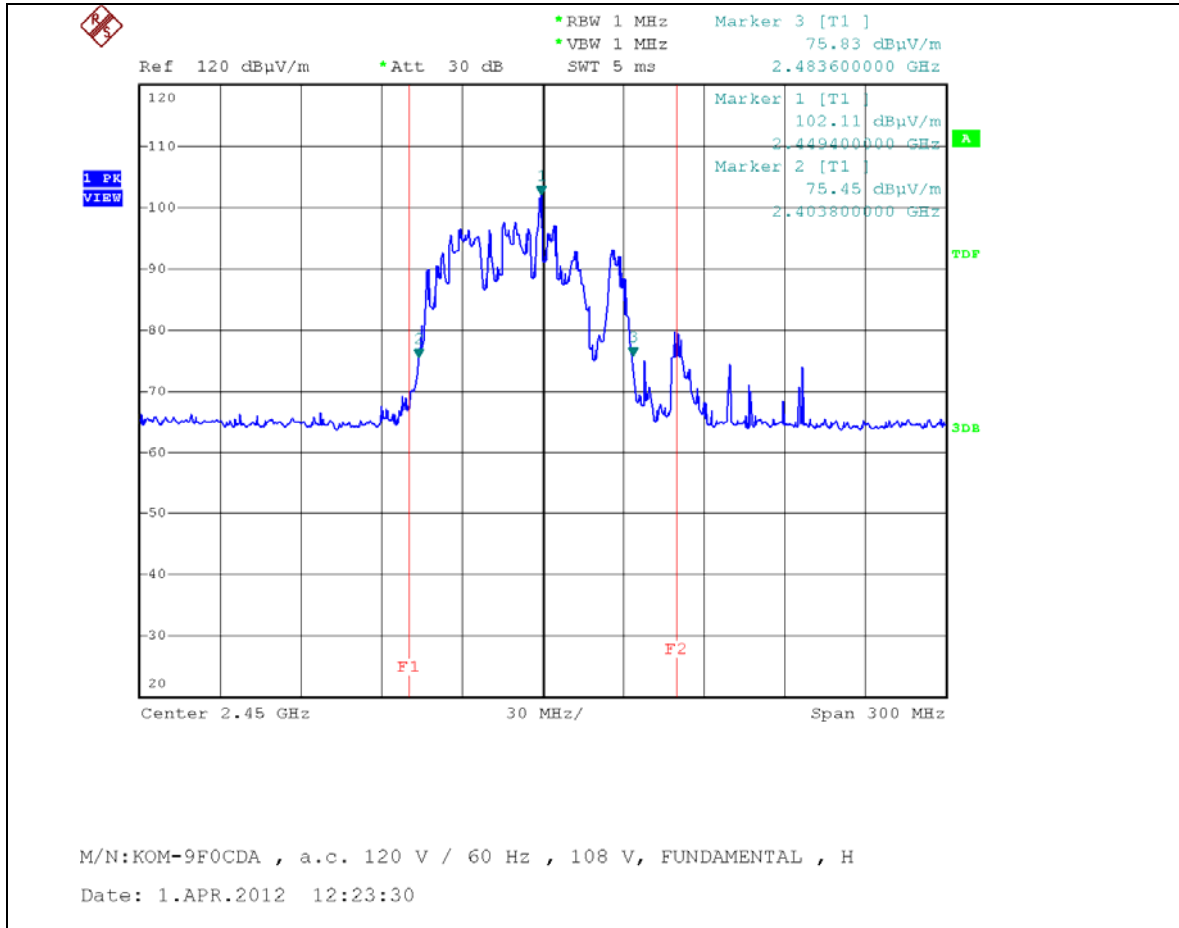
- **Frequency vs Line Voltage Variation Test**



**Vertical (96 V, 1000 ml)**

# PLOTS OF EMISSIONS

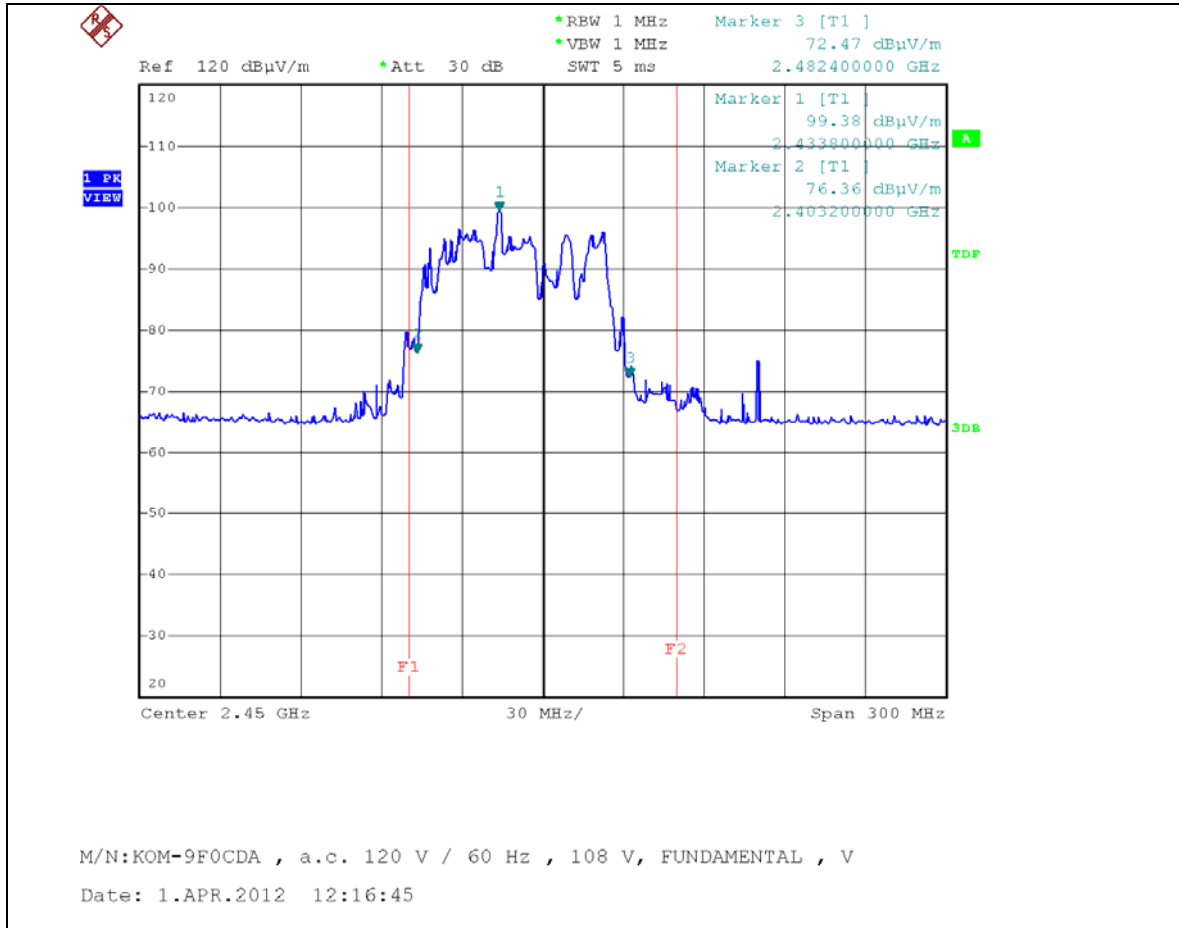
- **Frequency vs Line Voltage Variation Test**



**Horizontal (108 V, 1000 ml)**

# PLOTS OF EMISSIONS

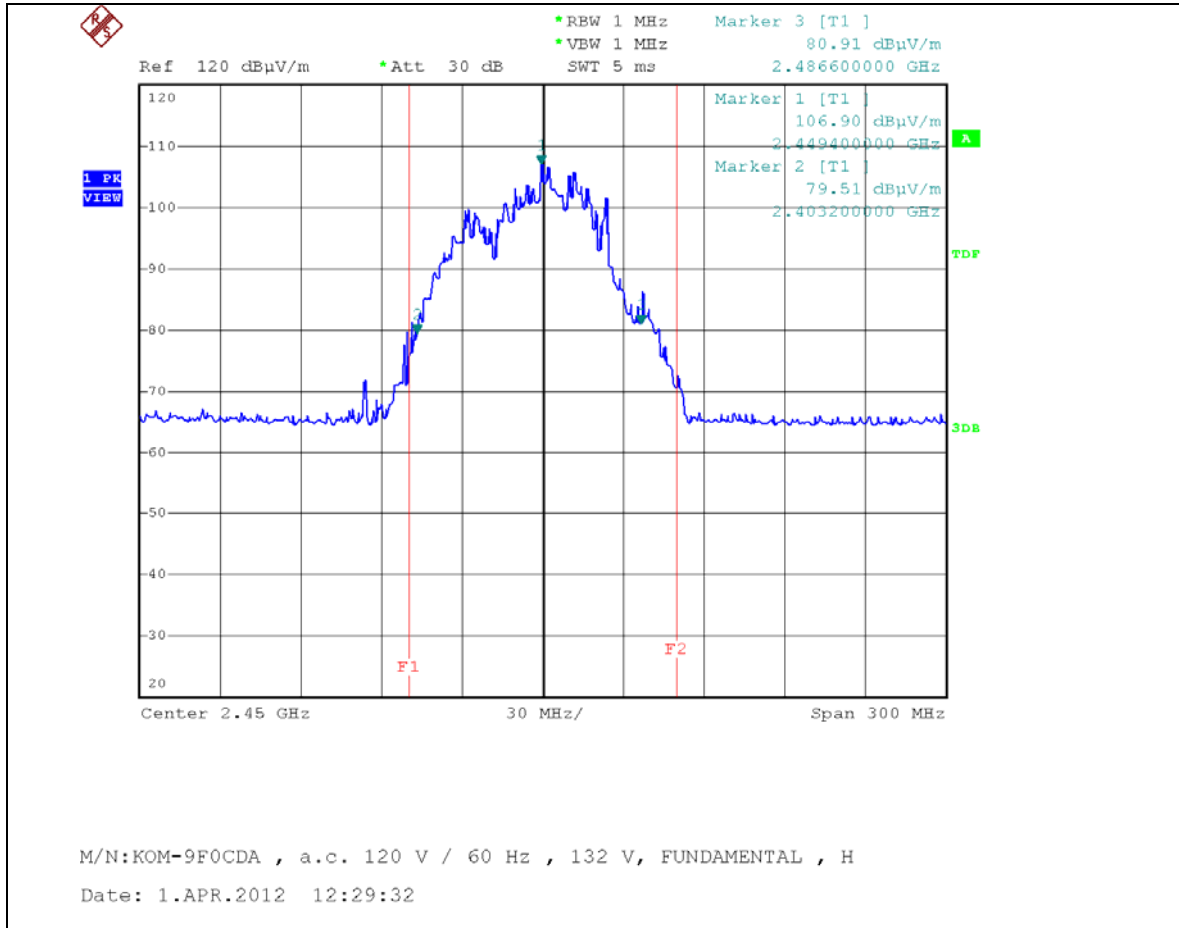
- **Frequency vs Line Voltage Variation Test**



**Vertical (108 V, 1000 mI)**

# PLOTS OF EMISSIONS

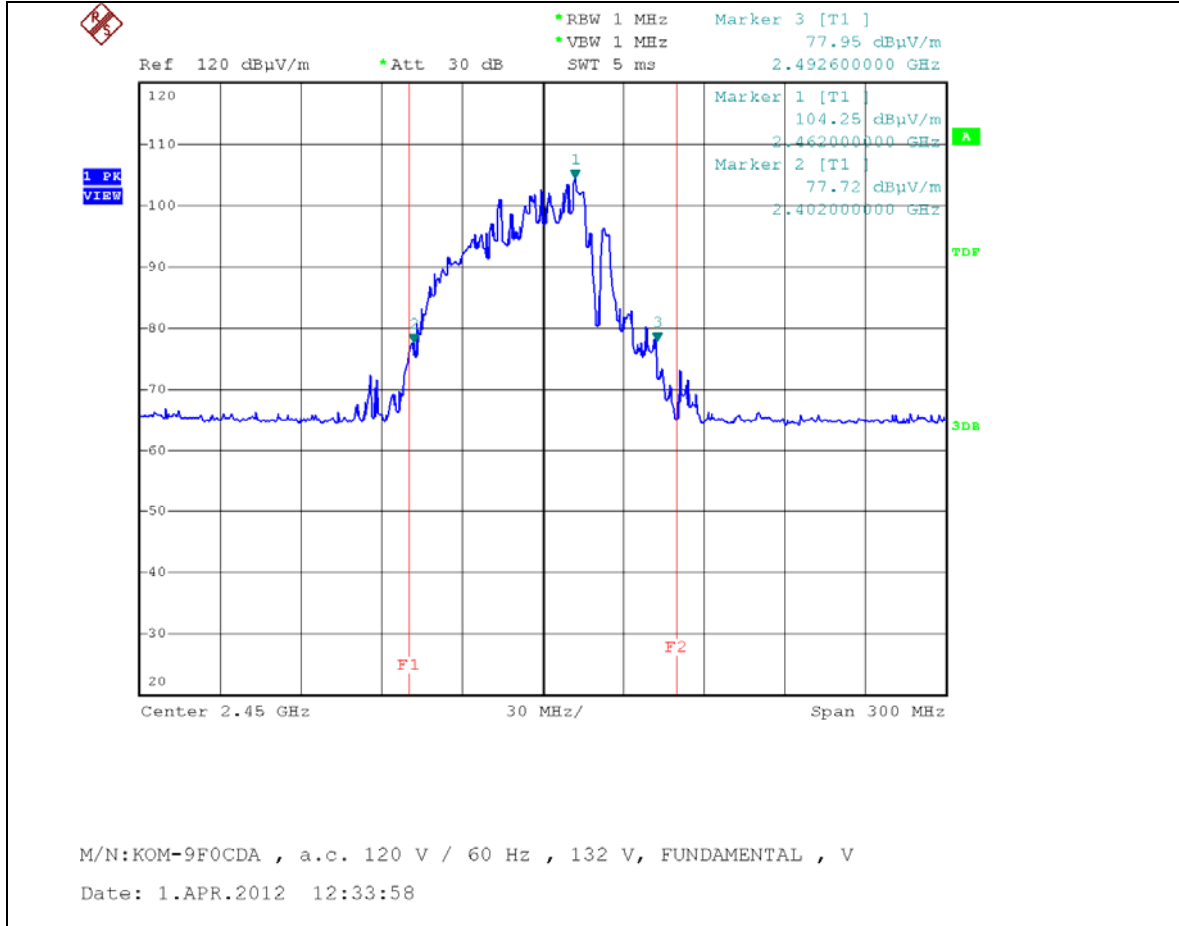
- **Frequency vs Line Voltage Variation Test**



**Horizontal (132 V, 1000 ml)**

# PLOTS OF EMISSIONS

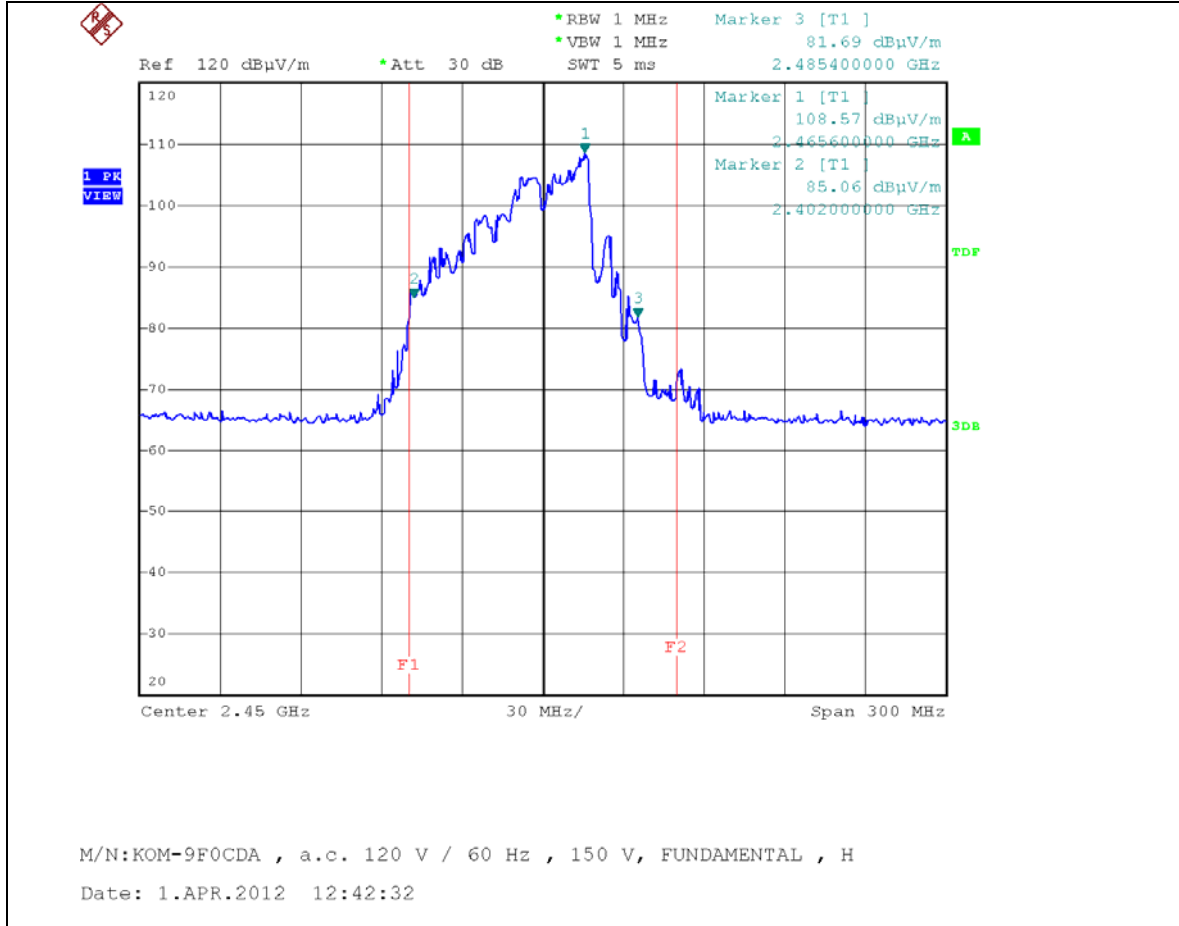
- **Frequency vs Line Voltage Variation Test**



**Vertical (132 V, 1000 mI)**

# PLOTS OF EMISSIONS

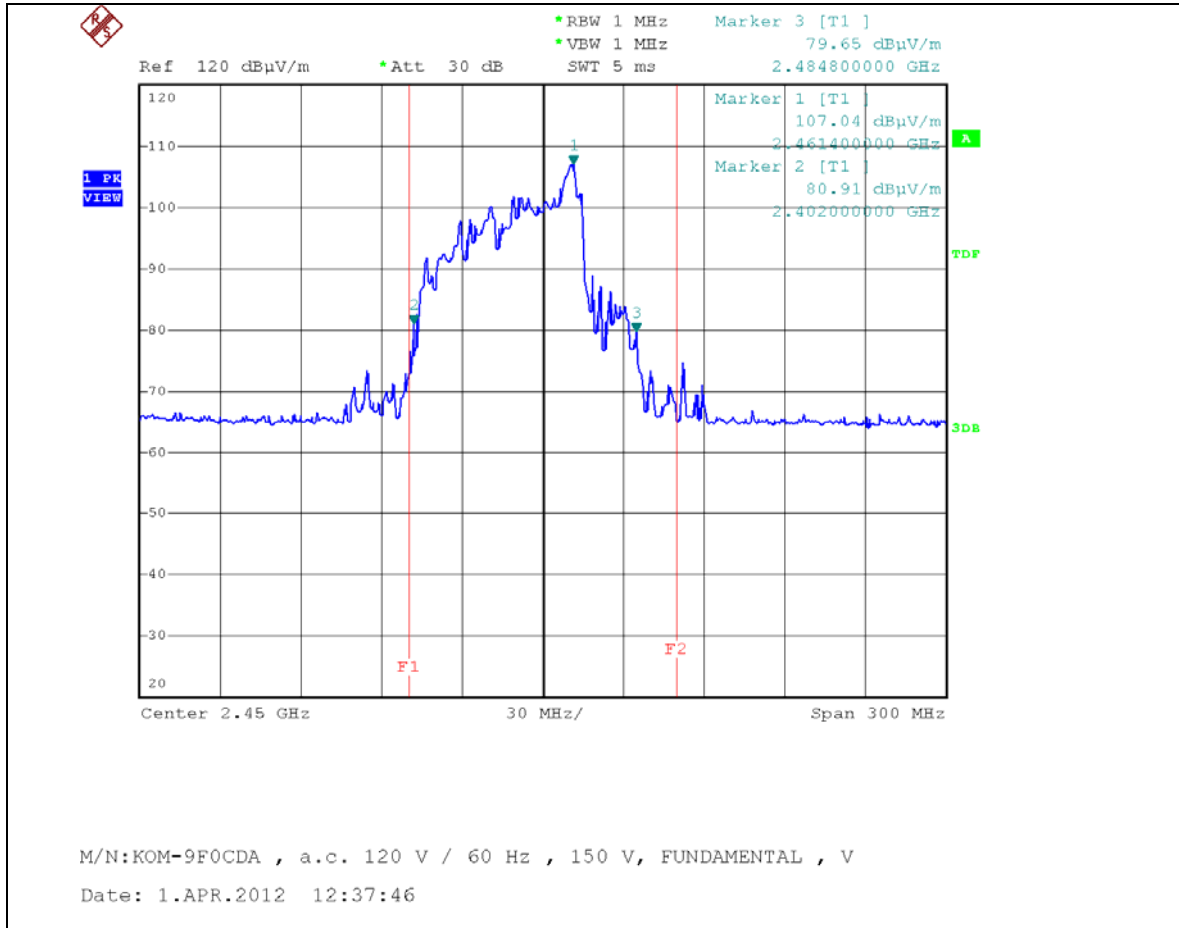
- **Frequency vs Line Voltage Variation Test**



**Horizontal (150 V, 1000 ml)**

# PLOTS OF EMISSIONS

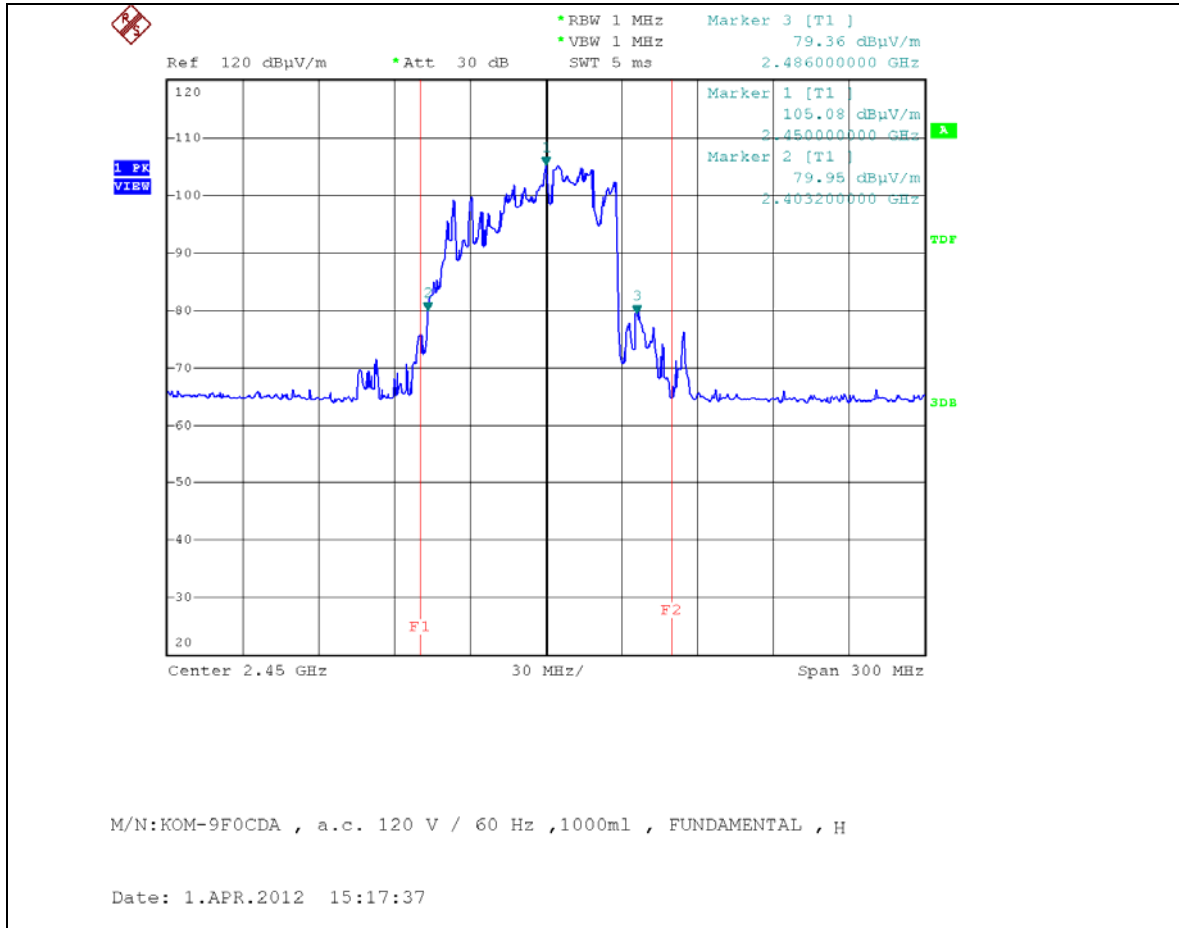
- **Frequency vs Line Voltage Variation Test**



**Vertical (150 V, 1000 mI)**

# PLOTS OF EMISSIONS

- **Frequency vs Load Variation Test**

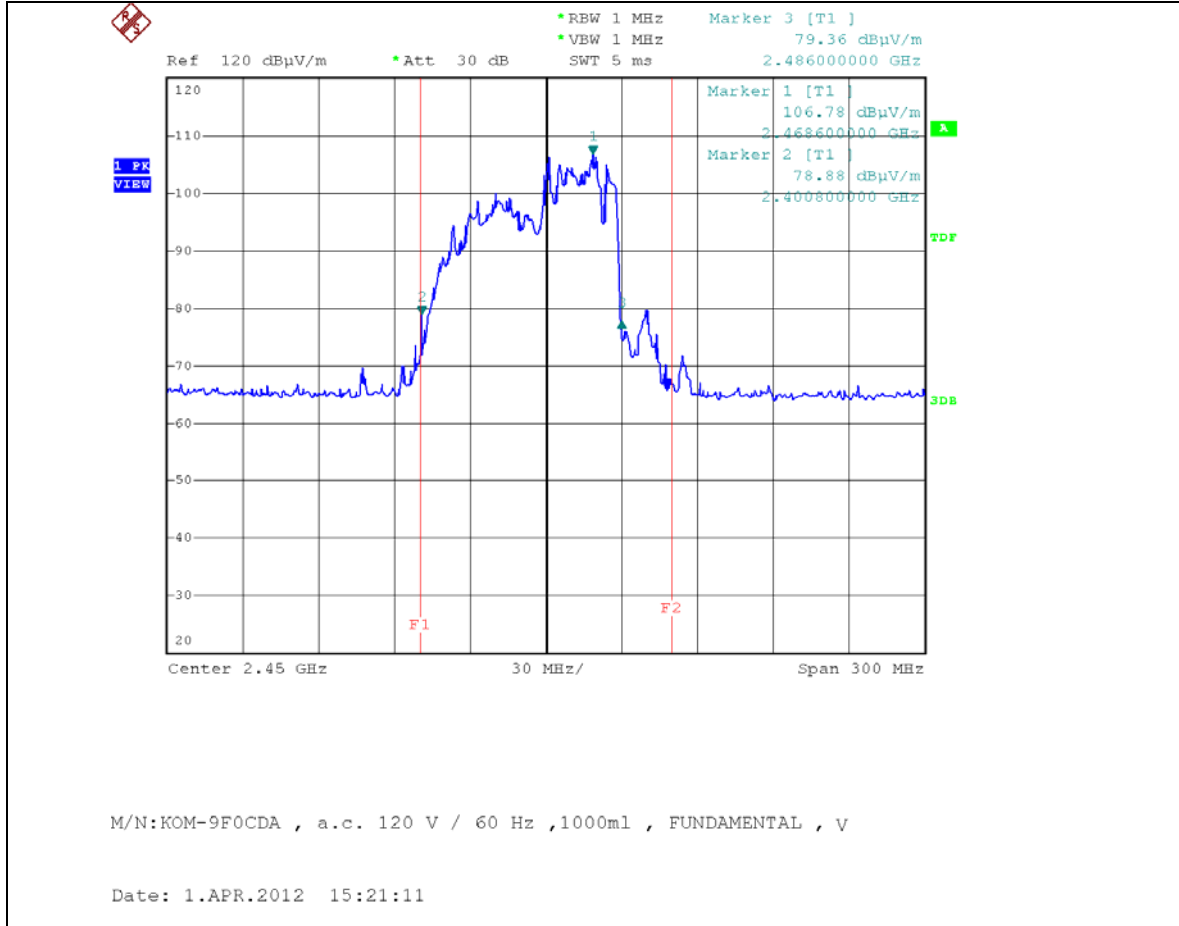


**Horizontal (120 V, 1000 ml)**



# PLOTS OF EMISSIONS

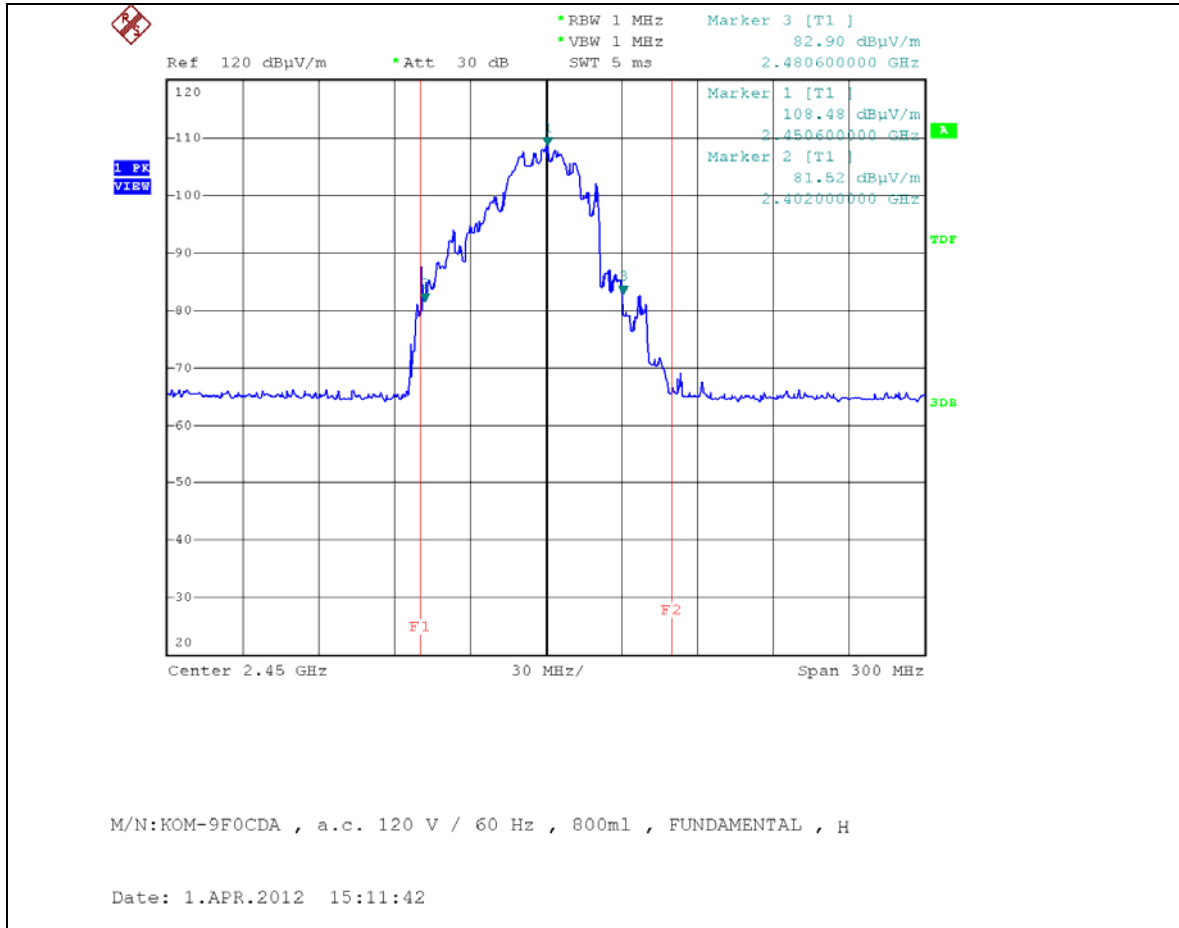
- **Frequency vs Load Variation Test**



**Vertical (120 V, 1000 ml)**

# PLOTS OF EMISSIONS

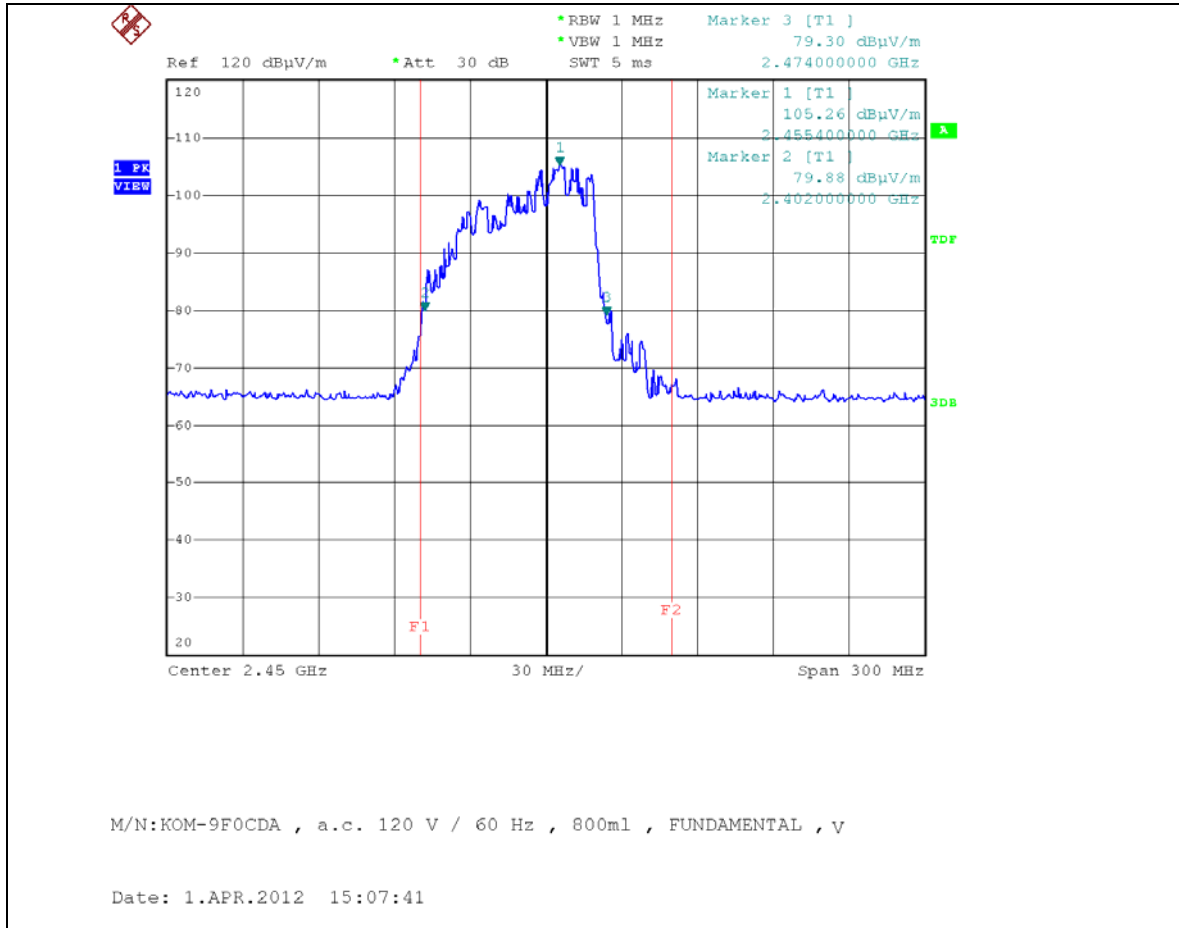
- **Frequency vs Load Variation Test**



**Horizontal (120 V, 800 ml)**

# PLOTS OF EMISSIONS

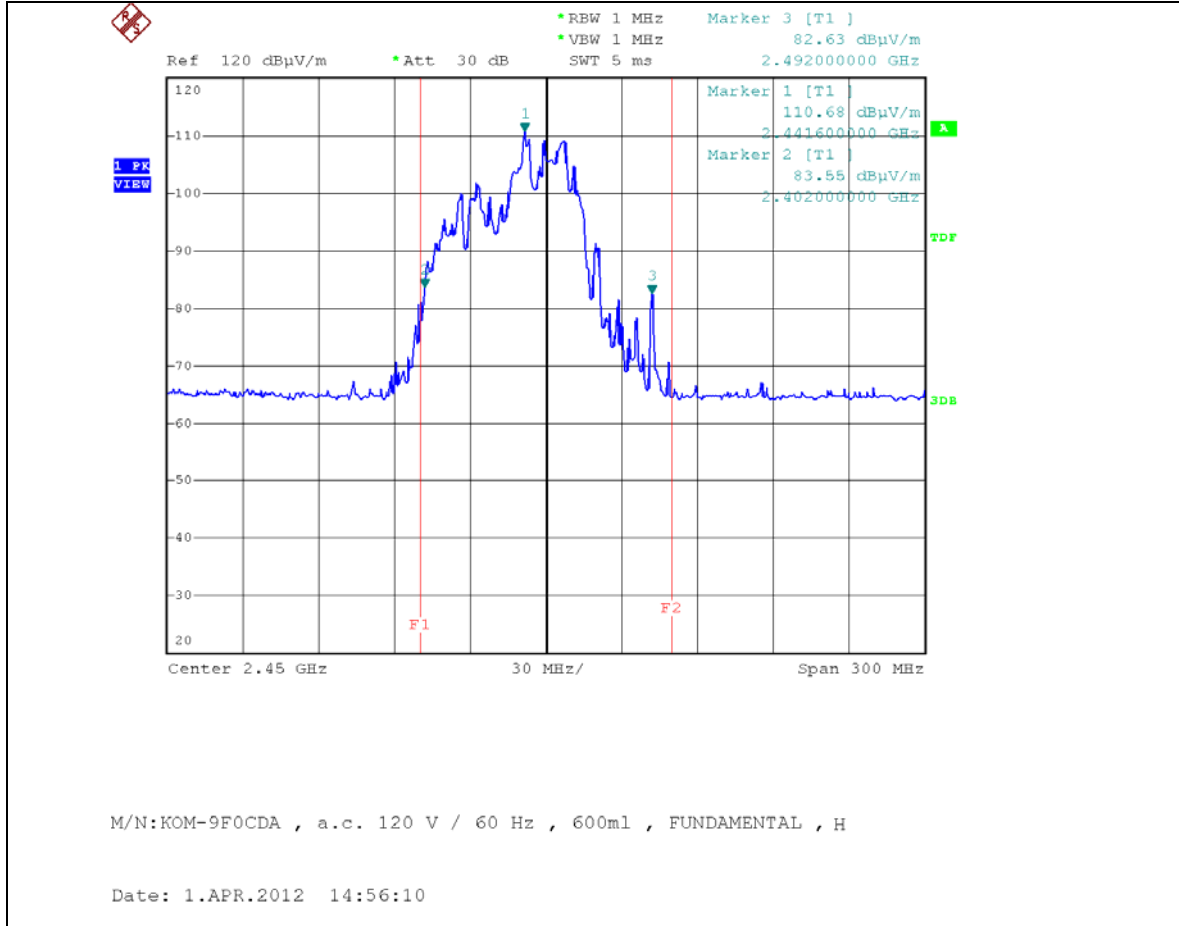
- **Frequency vs Load Variation Test**



**Vertical (120 V, 800 ml)**

# PLOTS OF EMISSIONS

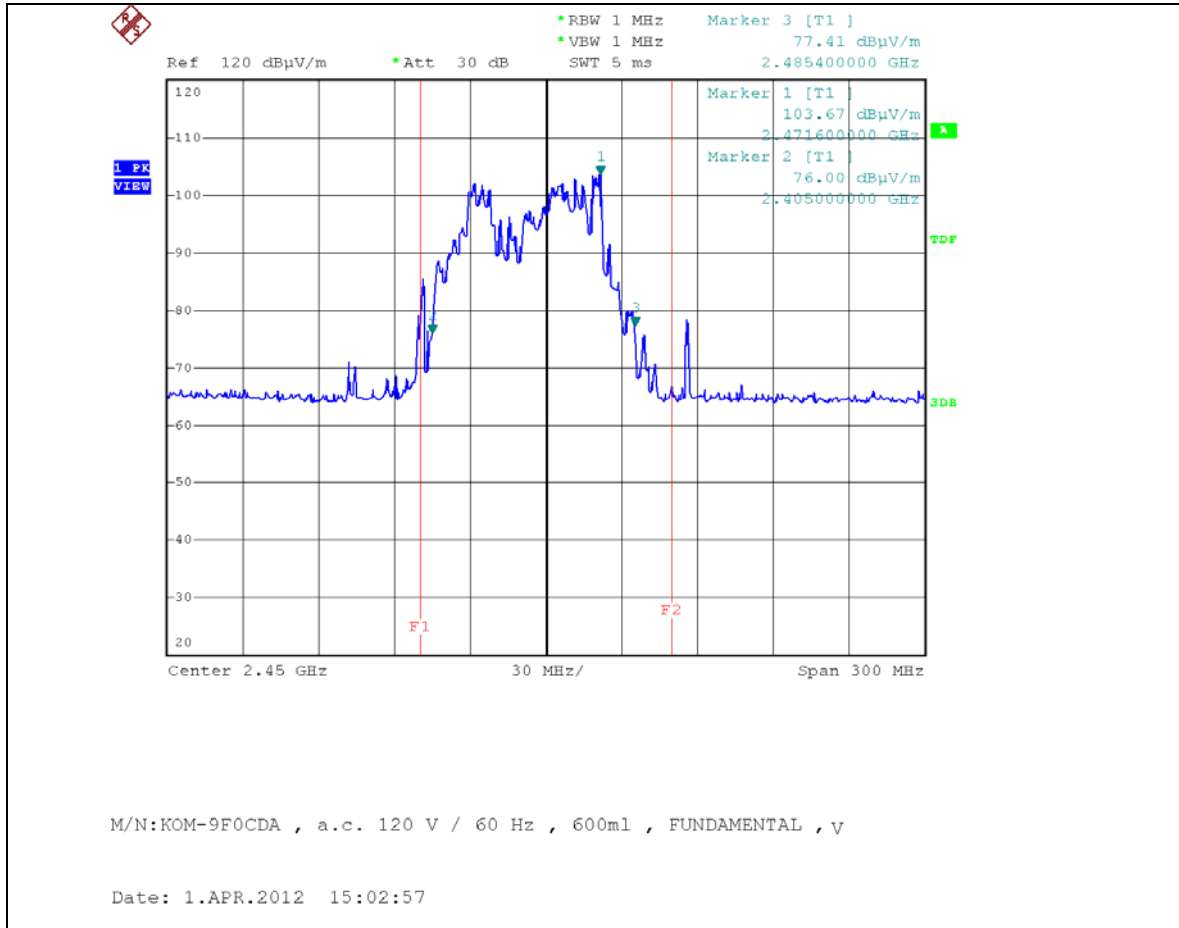
- **Frequency vs Load Variation Test**



**Horizontal (120 V, 600 ml)**

# PLOTS OF EMISSIONS

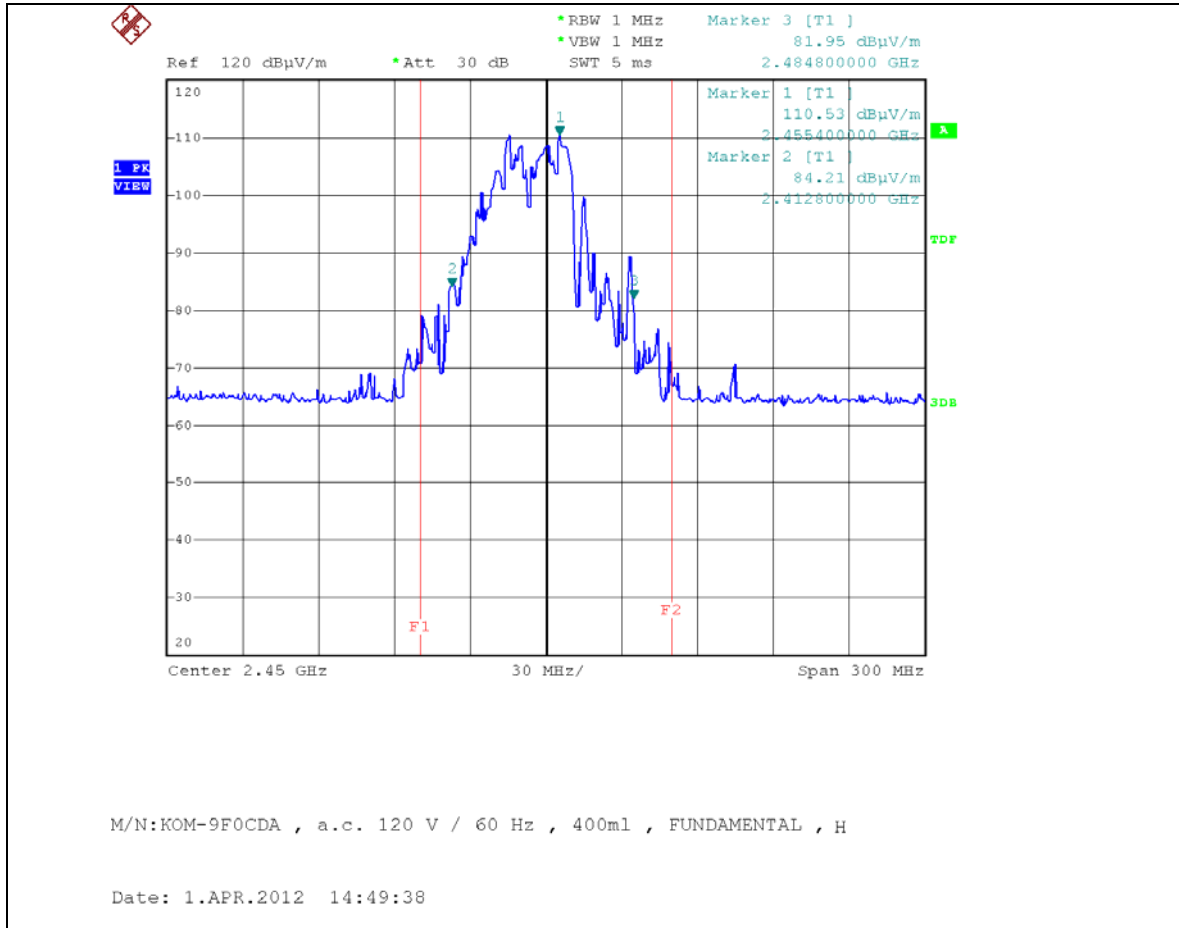
- **Frequency vs Load Variation Test**



**Vertical (120 V, 600 ml)**

# PLOTS OF EMISSIONS

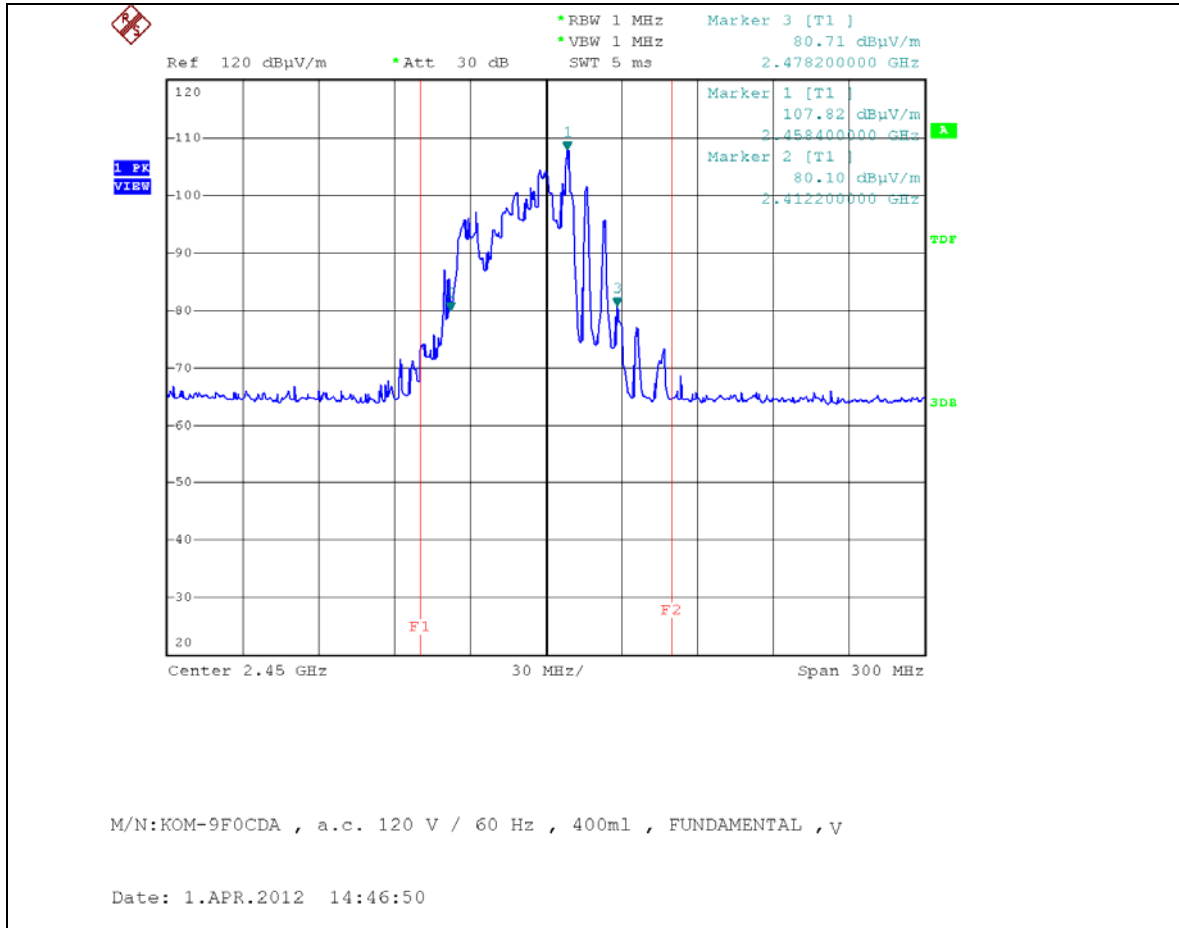
- **Frequency vs Load Variation Test**



**Horizontal (120 V, 400 ml)**

# PLOTS OF EMISSIONS

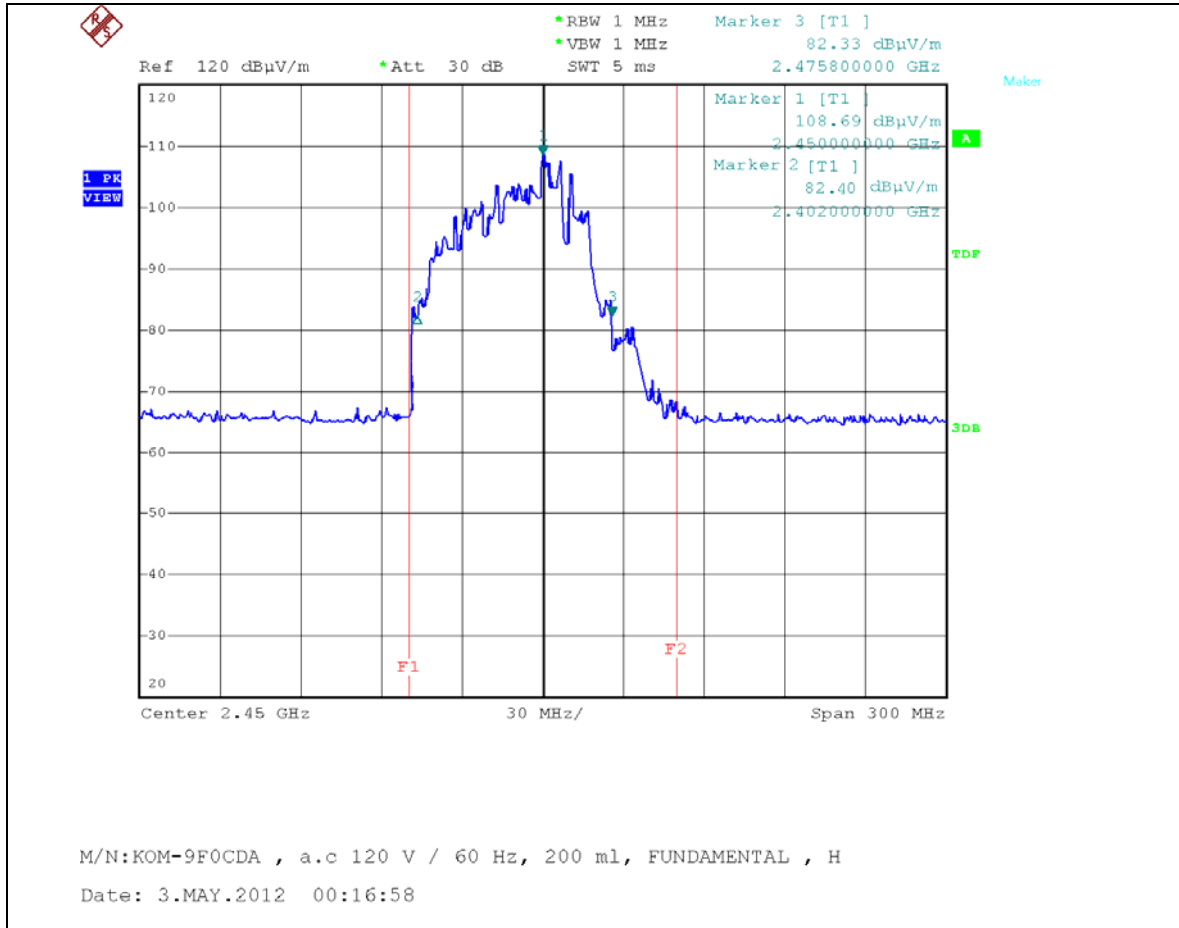
- **Frequency vs Load Variation Test**



**Vertical (120 V, 400 ml)**

# PLOTS OF EMISSIONS

- **Frequency vs Load Variation Test**

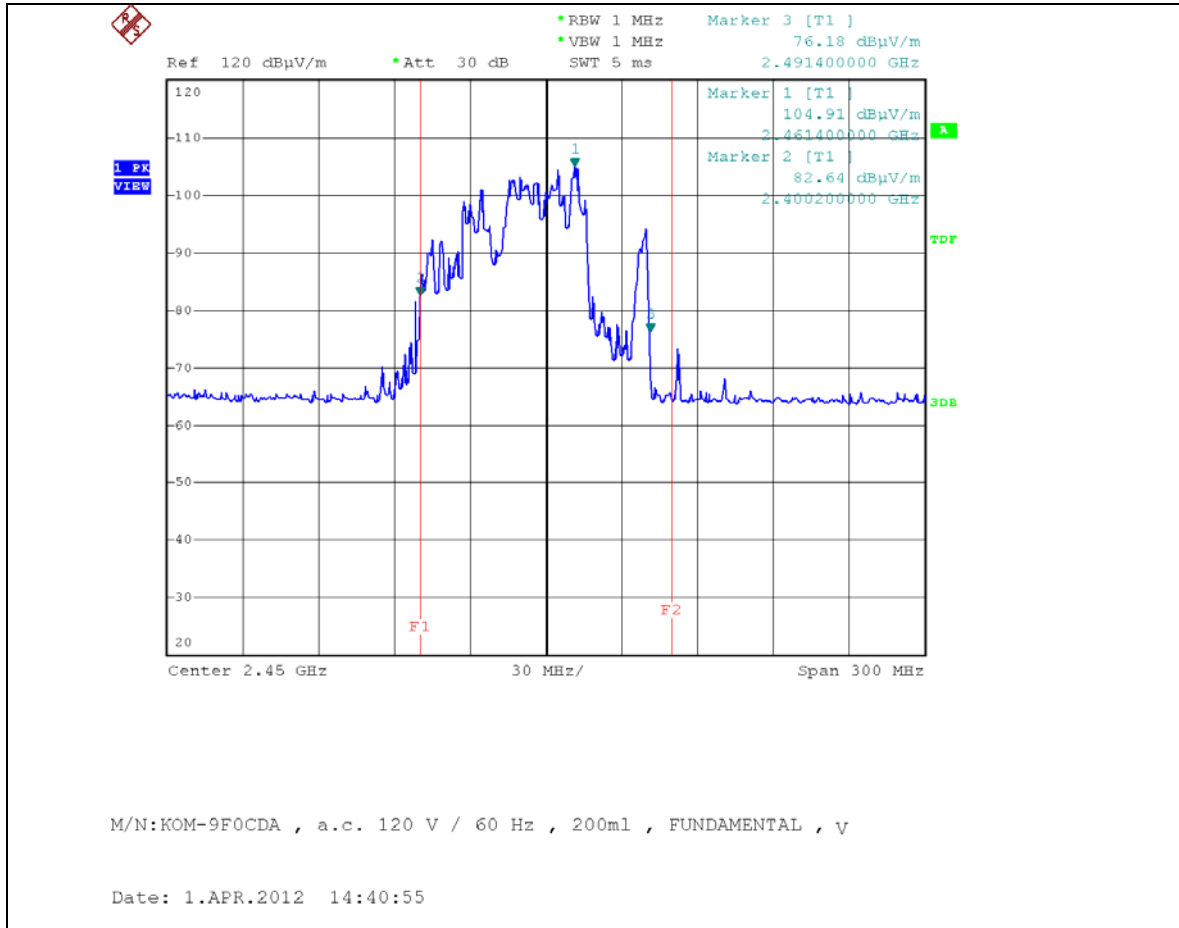


**Horizontal (120 V, 200 ml)**



# PLOTS OF EMISSIONS

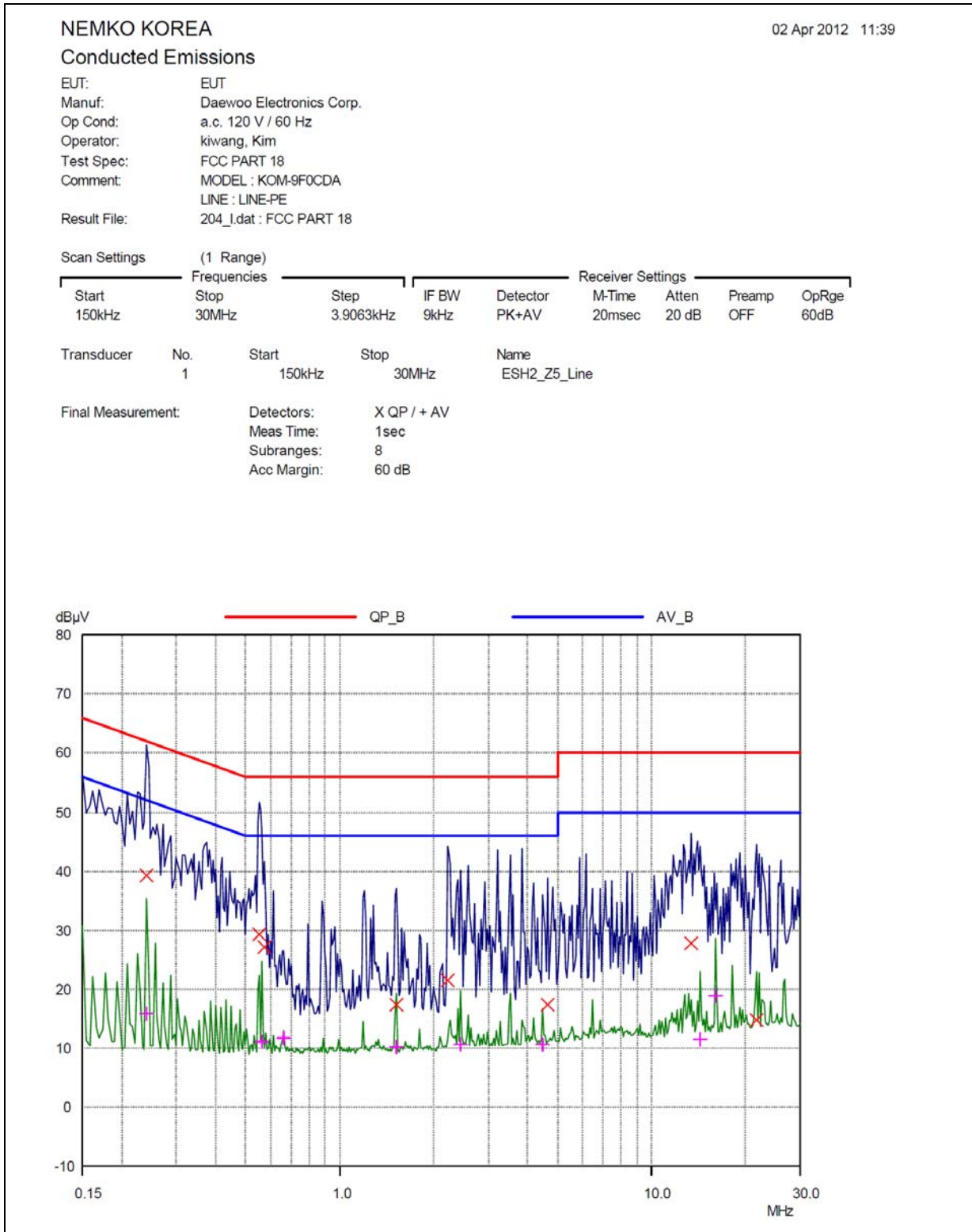
- **Frequency vs Load Variation Test**



**Vertical (120 V, 200 ml)**

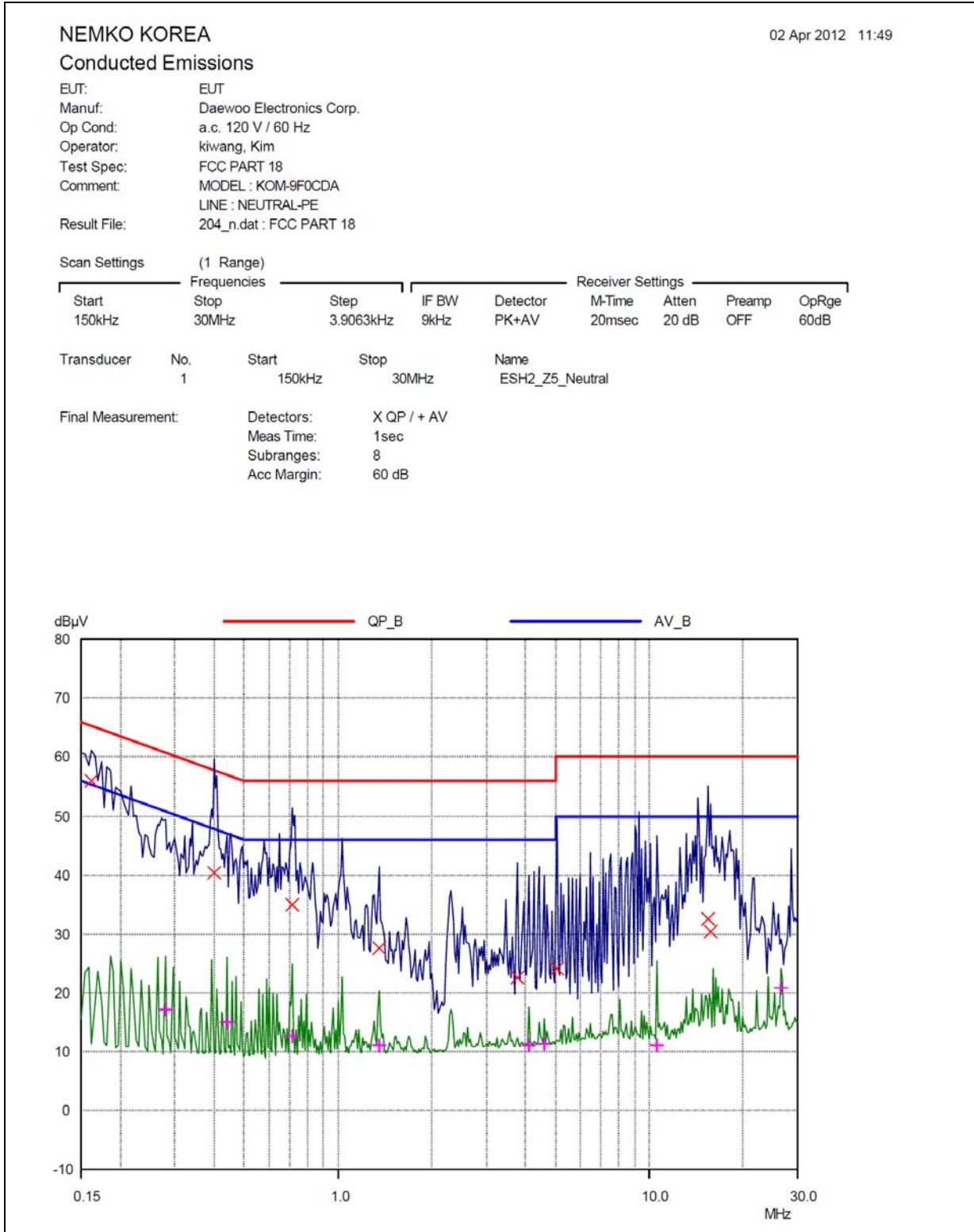
# PLOTS OF EMISSIONS

- Conducted Emission at the Mains port (Line)



# PLOTS OF EMISSIONS

- Conducted Emission at the Mains port (Neutral)



# PLOTS OF EMISSIONS

- Radiated Emission (0.15 MHz ~ 30 MHz)

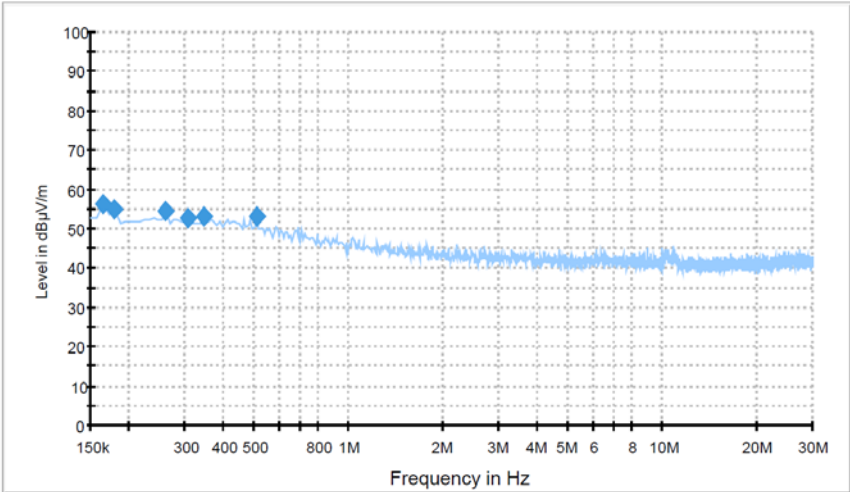
EMI Auto Test(2)
1 / 1

## Test Report

**Common Information**

Test Description:	NK-12-E-204( 150 kHz - 30 MHz )
Test Site:	Nemko 3m Chamber - CH2
Test Standard:	FCC Part 18
Environment Conditions:	a.c. 120 V / 60 Hz , Horizontal
Operator Name:	Ki Wang, Kim
Comment:	MODEL : KOM-9F0CDA

4. Electric Field Strength Loop Ant (9 kHz-30 MHz)-ch2



**Final Result 1**

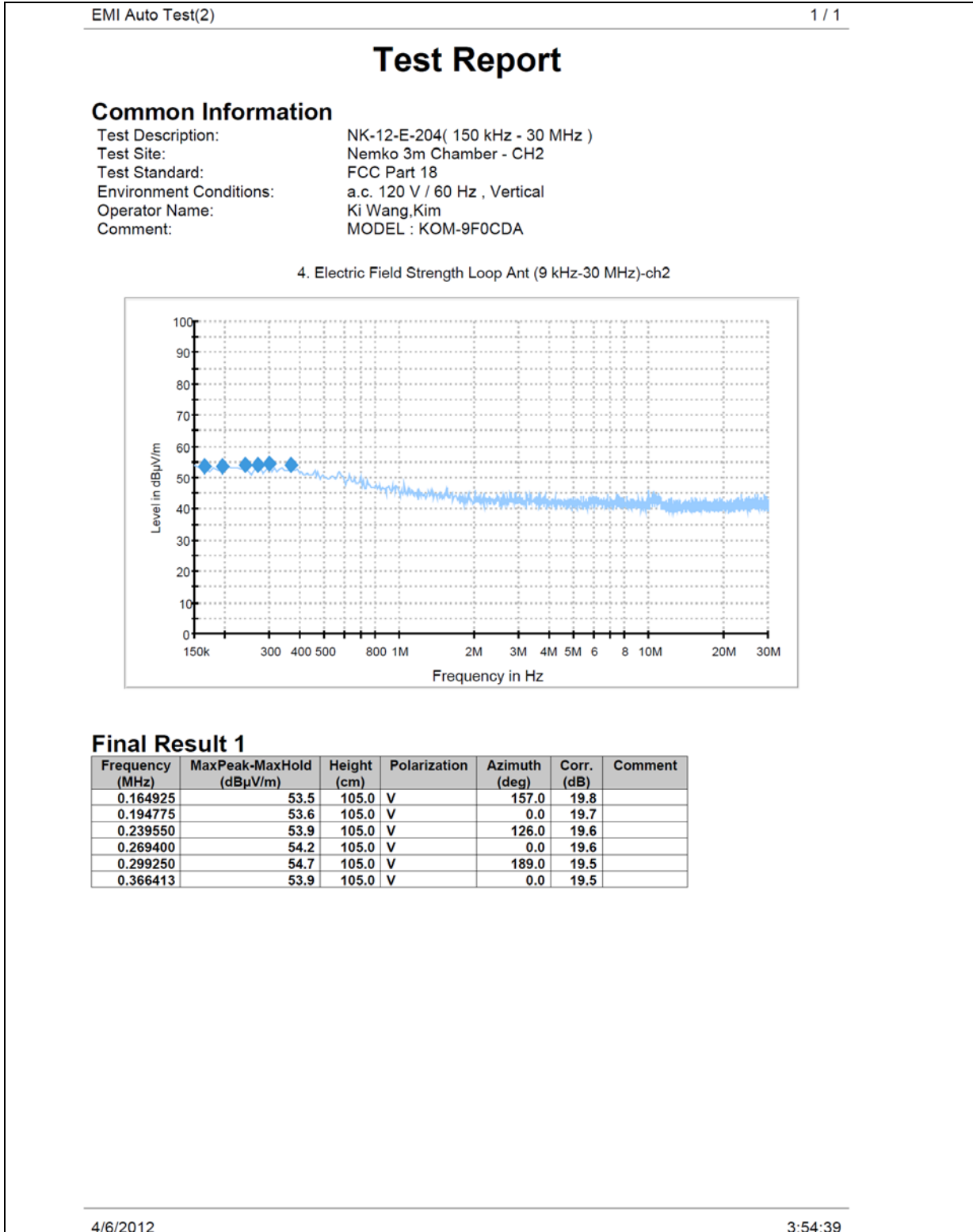
Frequency (MHz)	MaxPeak-MaxHold (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Comment
0.164925	56.3	105.0	H	61.0	19.8	
0.179850	54.9	105.0	H	0.0	19.8	
0.261938	54.3	105.0	H	280.0	19.6	
0.306713	52.8	105.0	H	218.0	19.5	
0.344025	53.3	105.0	H	124.0	19.5	
0.508200	53.1	105.0	H	342.0	19.4	

4/6/2012
3:46:42

(Horizontal)

# PLOTS OF EMISSIONS

- Radiated Emission (0.15 MHz ~ 30 MHz)



(Vertical)

## ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95 %

### 1. Conducted Uncertainty Calculation

Source of Uncertainty	$X_i$	Uncertainty of $X_i$		Coverage factor $k$	$u(X_i)$ (dB)	$C_i$	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	$RI$	$\pm 0.1$	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	$LC$	$\pm 0.08$	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	$LAMN$	$\pm 0.8$	normal 2	2.000	0.4	1	0.4
Sine wave voltage	$dVSW$	$\pm 2.00$	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	$dVPA$	$\pm 1.50$	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	$dVPR$	$\pm 1.50$	rectangular	1.732	0.87	1	0.87
Noise floor proximity	$dVNF$	$\pm 0.00$			0.00	1	0.00
AMN Impedance	$dZ$	$\pm 1.80$	triangular	2.449	0.73	1	0.73
Ⓐ Mismatch	$M$	+ 0.70	U-Shaped	1.414	0.49	1	0.49
Ⓑ Mismatch	$M$	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	$RS$	0.05	normal 1	1.000	0.05	1	0.05
Remark	Ⓐ: AMN-Receiver Mismatch : + Ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			$\pm 1.88$			
Expanded Uncertainty U	Normal ( $k = 2$ )			$\pm 3.76$			

**2. Radiation Uncertainty Calculation (Below 1 GHz)**

Source of Uncertainty	$X_i$	Uncertainty of $X_i$		Coverage factor $k$	$u(X_i)$ (dB)	$C_i$	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	$RI$	$\pm 0.10$	normal 2	2.00	0.05	1	0.05
Sine wave voltage	$dV_{sw}$	$\pm 0.17$	normal 2	2.00	0.09	1	0.09
Pulse amplitude response	$dV_{pa}$	$\pm 0.92$	rectangular	$\sqrt{3}$	0.53	1	0.53
Pulse repetition rate response	$dV_{pr}$	$\pm 0.35$	rectangular	$\sqrt{3}$	0.20	1	0.20
Noise floor proximity	$dV_{nf}$	$\pm 0.50$	normal 2	2.00	0.25	1	0.25
Antenna Factor Calibration	$AF$	$\pm 2.00$	normal 2	2.00	1.00	1	1.00
Cable Loss	$CL$	$\pm 1.00$	normal 2	2.00	0.50	1	0.50
Antenna Directivity	$AD$	$\pm 0.00$	rectangular	$\sqrt{3}$	0.00	1	0.00
Antenna Factor Height Dependence	$AH$	$\pm 2.00$	rectangular	$\sqrt{3}$	1.15	1	1.15
Antenna Phase Centre Variation	$AP$	$\pm 0.20$	rectangular	$\sqrt{3}$	0.12	1	0.12
Antenna Factor Frequency Interpolation	$AI$	$\pm 0.25$	rectangular	$\sqrt{3}$	0.14	1	0.14
Site Imperfections	$SI$	$\pm 4.00$	triangular	$\sqrt{6}$	1.63	1	1.63
Measurement Distance Variation	$DV$	$\pm 0.60$	rectangular	$\sqrt{3}$	0.35	1	0.35
Antenna Balance	$Dbal$	$\pm 0.90$	rectangular	$\sqrt{3}$	0.52	1	0.52
Cross Polarisation	$DCross$	$\pm 0.00$	rectangular	$\sqrt{3}$	0.00	1	0.00
Mismatch	$M$	- 0.18	U-Shaped	$\sqrt{2}$	- 0.13	1	- 0.13
Measurement System Repeatability	$RS$	$\pm 0.26$	normal 1	1.00	0.26	1	0.26
Remark	Mismatch Receiver VRC : 1.1 Antenna + Cable VRC : 1.8						

Combined Standard Uncertainty	Normal	2.48 dB
Expanded Uncertainty U	Normal ( $k = 2$ )	$\pm 5.0$ dB



### 3. Radiation Uncertainty Calculation (Above 1 GHz)

Source of Uncertainty	$X_i$	Uncertainty of $X_i$		Coverage factor $k$	$u(X_i)$ (dB)	$C_i$	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	$RI$	$\pm 0.10$	normal 1	1.000	0.10	1	0.10
Sine wave voltage	$dV_{sw}$	$\pm 2.00$	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	$dV_{pa}$	$\pm 1.50$	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	$dV_{pr}$	$\pm 1.50$	rectangular	1.732	0.87	1	0.87
Noise floor proximity	$dV_{nf}$	$\pm 0.50$	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	$AF$	$\pm 1.50$	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	$CL$	$\pm 0.52$	normal 2	2.000	0.26	1	0.26
Antenna Directivity	$AD$	$\pm 1.00$	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	$AH$	$\pm 0.50$	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	$AP$	$\pm 0.30$	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	$AI$	$\pm 0.30$	rectangular	1.732	0.17	1	0.17
Site Imperfections	$SI$	$\pm 4.00$	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	$DV$	$\pm 0.10$	rectangular	1.732	0.06	1	0.06
Antenna Balance	$Dbal$	$\pm 0.90$	rectangular	1.732	0.52	1	0.52
Cross Polarisation	$DCross$	$\pm 0.90$	rectangular	1.732	0.52	1	0.52
Ⓐ Mismatch	$M$	+ 0.25	U-Shaped	1.414	0.18	1	0.18
Ⓑ Mismatch	$M$	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
Ⓒ Mismatch	$M$	+ 0.98	U-Shaped	1.414	0.69	1	0.69
Ⓓ Mismatch	$M$	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79

Measurement System Repeatability	<i>RS</i>	0.09	normal 1	1.000	0.09	1	0.09
Remark	Ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) Ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) Ⓒ: Log Periodic Antenna-receiver Mismatch : + (≥ 200 MHz) Ⓓ: Log Periodic Antenna-receiver Mismatch : - (≥ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 (≥200 MHz)			
Expanded Uncertainty U	Normal ( $k = 2$ )			± 5.26 (< 200 MHz) ± 5.48 (≥200 MHz)			

## ***LIST OF TEST EQUIPMENT***

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 12 2012	1 year
2	*Test Receiver	R & S	ESCS 30	100302	Oct. 12 2011	1 year
3	*Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
4	*Signal Conditioning Unit	R & S	SCU 01	10029	Apr. 05 2012	1 year
5	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2012	1 year
6	*Spectrum Analyzer	R & S	FSP40	100361	July 19 2011	1 year
7	*Microwave Survey Meter	ETS-LINDGEN	HI-1801	33549	Mar. 05 2012	2 years
8	*Loop Antenna	R & S	HFH2-Z2	N/A	Feb. 21 2012	2 years
9	*Log Periodic/ Biconical Antenna	ARA	LPB-2520/A	1209	Dec. 21 2010	2 years
10	*Trilog Broadband Test Antenna	SCHWARZBECK	VULB 9163	9163-454	Feb. 24 2012	2 years
11	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-474	July 14 2010	2 years
12	Signal Generator	R & S	SMP02	833286/003	July 19 2011	1 year
13	LISN	R & S	ESH3-Z5	833874/006	Nov. 11 2010	1 year
14	*LISN	R & S	ESH2-Z5	100227	Apr. 04 2012	1 year
15	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
16	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
17	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
18	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
19	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
20	*Anechoic Chamber	SY Corporation	N/A	N/A	N/A	N/A
21	*Shielded Room	SY Corporation	N/A	N/A	N/A	N/A

*\*) Test equipment used during the test*

## ***APPENDIX D – SCHEMATIC DIAGRAM***

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## *APPENDIX E – USER’S MANUAL*

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## ***APPENDIX F – BLOCK DIAGRAM***

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