EMC TEST REPORT

According to FCC CFR47 Part 18 Subpart C

JOB Number : LBE041950

1. *This test reports does not constitute an endorsement by NIST/NVLAP or U.S Government.*
2. *This test report is to certify that the tested device properly complies with the requirements of FCC Rules and Regulations Part 18 CFR47 Subpart C Intentional Radiators. All tests necessary to show compliance to the requirements were and these results met the specifications requirement.*

This laboratory is registered by the NIST/NVLAP, U.S.A. The test reported herein have been performed in accordance with its terms of registration.

NVLAP LAB CODE 200623-0

1. Applicant Name : SAMSUNG ELECTRONICS CO., LTD.
416 Maetan-3 Dong, Yeongtong-Gu, Suwon Si,
Gyeonggi-Do, Korea, 443-742

2. Identification of tested device

2.1 FCC ID : A3LMO4150N
2.2 Device Name : MICROWAVE OVEN
2.3 Trade Name : SAMSUNG Electronics Co.,Ltd.
2.4 Model Number : SMH4150BD
Variant Model :
2.5 RF Output Power : **1000** W (by IEC 705 method)

3. Test Procedure and Items

3.1 FCC/OST MP-5 : 1986

4. Issued Date : Jan 4, 2005

Tested by: J. Y Park

Jay Yong, PARK / Test Engineer

Reviewed by: N. C. Park

No Cheon, PARK / Manager of EMC Lab.

Authorised by: K. B. Chung

Kyu Baek, CHUNG / Chief of EMC Lab.

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5. Measurement Equipment List

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1. Product Description

The equipment under test is a microwave oven sold for consumer use.
Model : SMH4150BD is a 1000 W microwave oven with digital controls.
Installation Type: Over-the-range
Clock Frequency : 8.0MHz

< Magnetron >
Model : OM-75P manufactured by Samsung Electronic Co., Ltd.

2. Test Facility

The Semi-anechoic chamber and Conducted measurement facilities used to collect the radiated data are located at 416, Maetan 3-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea.
The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22.

3. Accreditation and Listing

The test facilities used to perform radiated and conducted emissions tests are accrediated by National Voluntary Laboratory Accreditation Program for the specific of accreditation under Lab Code: 200447-0 to perform Electromagnetic Interference tests according to FCC PART 15 and CISPR 22 requirements.
No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission(Registration Number:98856, Anechoic Chamber #1).

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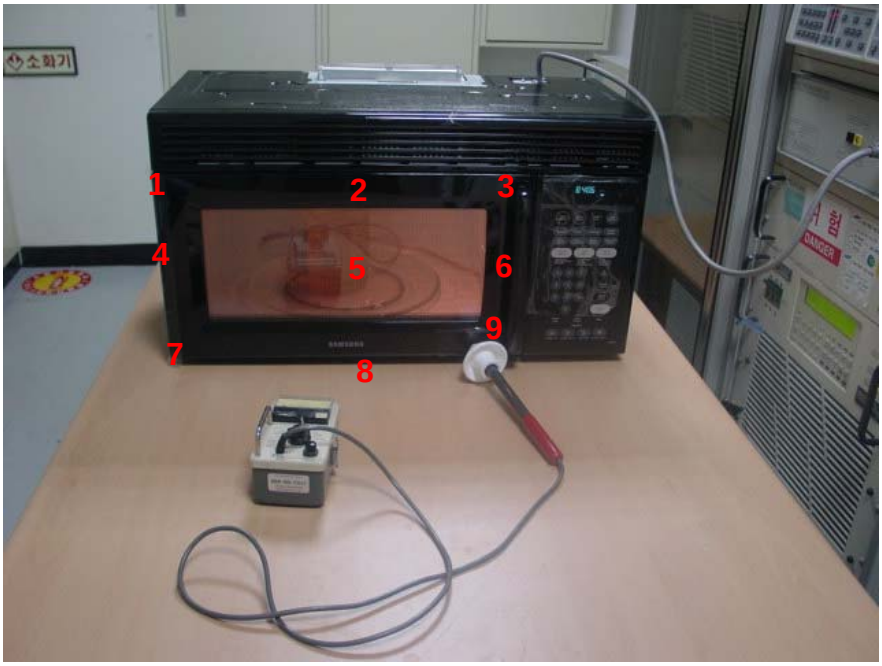
4. Radio Noise Emission Measurement Procedures/Results

4.1 Radiation Hazard Measurement

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.



The results of this test are as follows.

Probe Location	Maximum Leakage [mW/Cm2]	Limit [mW/Cm2]
1	0.10	1.0
5	0.10	1.0
6	0.05	1.0
All others	0.08	1.0

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4.2 Input Power Measurement

Input power and current were measured using a Power Analyzer.
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. Manufacturers to determine their input ratings commonly use this procedure.

Fig. 2 Test Setup for Input power

The results of this test are as follows.

Input Voltage [Vac]	Input Current [amps]	Measured Input power [watts]	EUT Spec. Input power [watts]
120	**13.83**	**1582**	**1580**

Based on the measured input power, the EUT was found to be operating within the intended specifications.

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4.3 RF 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.

Fig.3 Test Setup for RF output power

Quantity of water [ml]	Starting Temperature [centigrade]	Final Temperature [centigrade]	Elapsed Time [seconds]	RF Power [watts]
1000	10	**34.8**	120	865.3
1000	10	**34.4**	120	851.4
1000	10	**34.1**	120	840.9
Average RF Power of 3 Trials				852.5

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

The measured output was found to be **ABOVE 500Watts**. Therefore, in accordance with section 18.305 of Subpart C, the measured out-of-band emissions were compared to the 25xSQRT(power/500)[uV/m] @ 300M limit.

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4.4 Operation Frequency Measurement

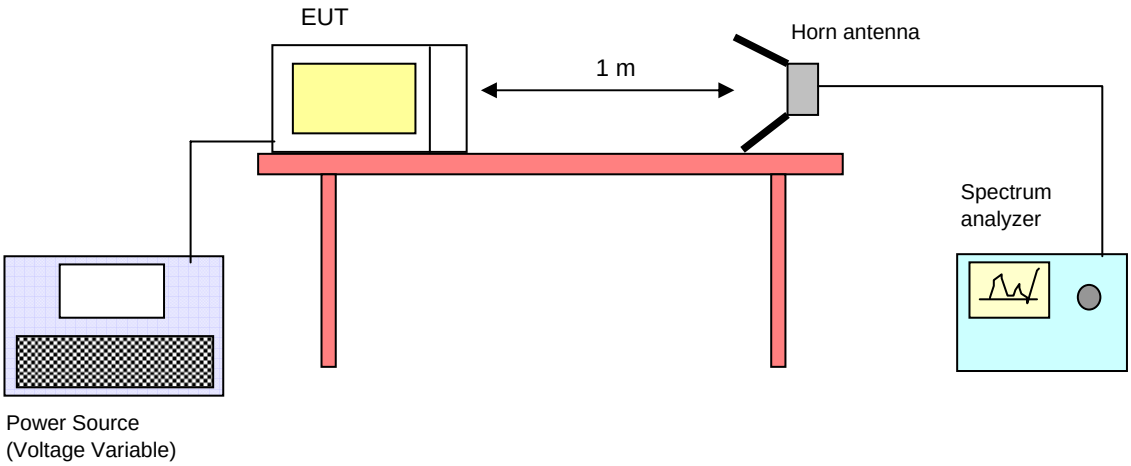

Fig. 4 Operating Frequency Measurements Configuration

4.4.1 Frequency Measurement

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.

The results of this test are as follows.
Line voltage varied from 96Vac to 150Vac.

Initial load : 1000 ml water in the glass beaker

(1) Frequence vs Line Voltage Variation Test

[Room Temperature : 23.0 ℃]

Line Voltage Variation (V)	Frequency (MHz)	Allowed Tolerance for the ISM Band (2450MHz)
150 (125%)	Lower : 2411	Lower: 2400 MHz Upper : 2500 MHz
	upper : 2494	
132(110%)	Lower : 2403	
	upper : 2475	
120 (Nominal)	Lower : 2410	
	upper : 2473	
108 (90%)	Lower : 2408	
	upper : 2474	
96 (80%)	Lower : 2404	
	upper : 2471	

Result : PASSED

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(2) Frequence vs Load Variation Test

Initial load : 1000 ml water in the glass beaker

[Room Temperature : 23 ℃]

Volume of Water (cc)	Frequency (MHz)		Allowed Tolerance for the ISM Band (2450MHz)
1000	Lower :	2410	Lower: 2400 MHz Upper : 2500 MHz
	upper :	2473	
800	Lower :	2407	
	upper :	2474	
600	Lower :	2422	
	upper :	2475	
400	Lower :	2404	
	upper :	2475	
200	Lower :	2412	
	upper :	2474	

Note : Friquency was measured by using nominal voltage (AC120V)

Result : PASSED

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4.5 Conducted Emission Measurement

4.5.1 Conducted Emission Measurement Procedure

Configurate the EUT System in accordance with ANSI C63.4-2000 section 7 and 11.
Connect the EUT's AC line cord to the EUT port of LISN.
All input terminals are terminated in the proper impedance.
The output ports are connected to the cable provided with the device and the ending port are terminated in the proper impedance.

Using a calibrated coaxial cable, the TEST RECEIVER is connected to the measuring port of the LISN for EUT.
To find out the maximum emission, change the position of the cable, and the EUT operation mode under normal usage of the EUT.
Then, the emission are scanned from 0.15MHz to 30MHz relative to the limit are recorded.

4.5.2 Radiated Emission Measurement Configuration

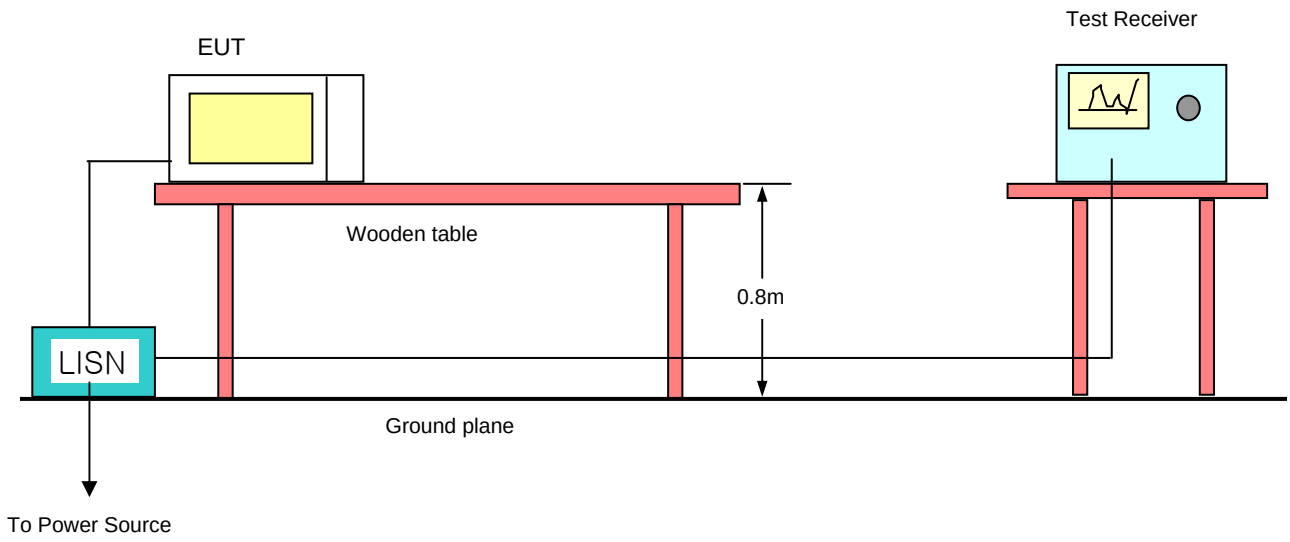


Fig. 5 Conducted Emission Configuration(0.15 - 30MHz)

4.5.3 Conducted Emission Measurement Data(0.15 - 30MHz)

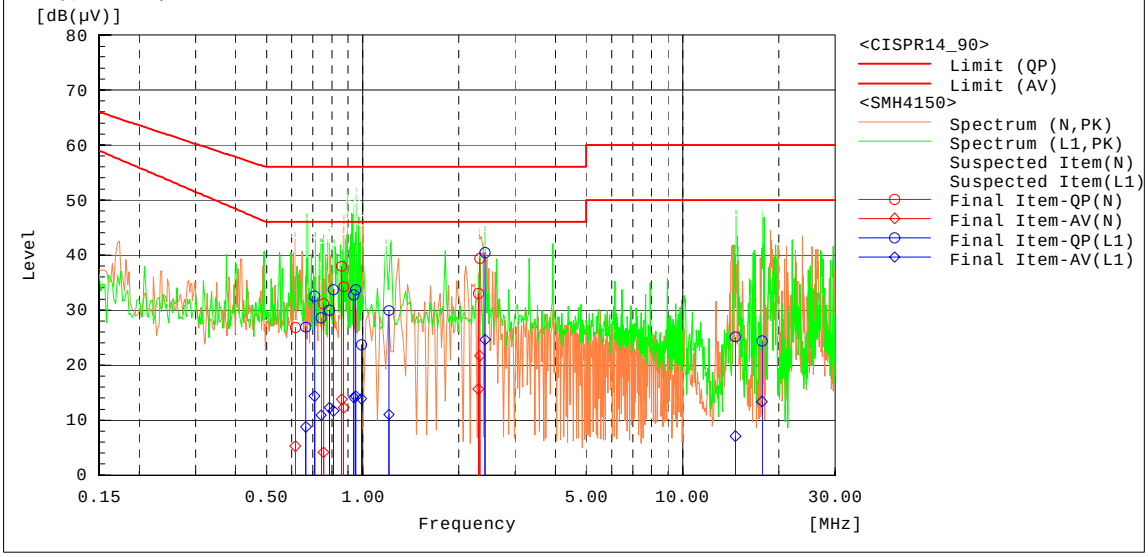
Samsung
- EMC Site -

<<Conducted Emission>>

26 October,2004 09:43
SMH4150.dat

Model : SMH4150
Project Num :
Operator :
OP Mode :
Temp,Humidity:

Standard : CISPR 14 Amd 3/90 (House)
Remark1 :
Remark2 :
Remark3 :
Remark4 :



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.61569	26.8	5.2	0.1	26.9	5.3	56.0	46.0	29.1	40.7
2	0.75429	30.9	4.0	0.2	31.1	4.2	56.0	46.0	24.9	41.9
3	0.86088	37.8	13.6	0.2	38.0	13.8	56.0	46.0	18.0	32.2
4	0.87301	34.0	12.1	0.2	34.2	12.3	56.0	46.0	21.8	33.8
5	2.3244	39.3	21.6	0.1	39.4	21.7	56.0	46.0	16.6	24.3
6	2.2996	32.9	15.5	0.1	33.0	15.6	56.0	46.0	23.0	30.4

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.6644	26.8	8.7	0.1	26.9	8.8	56.0	46.0	29.1	37.2
2	0.70658	32.4	14.3	0.1	32.5	14.4	56.0	46.0	23.5	31.6
3	0.74047	28.5	10.8	0.1	28.6	10.9	56.0	46.0	27.4	35.1
4	0.78708	29.9	12.1	0.1	30.0	12.2	56.0	46.0	26.0	33.8
5	0.81022	33.6	11.6	0.1	33.7	11.7	56.0	46.0	22.3	34.3
6	0.93774	32.7	14.1	0.1	32.8	14.2	56.0	46.0	23.3	31.9
7	0.9521	33.6	14.2	0.1	33.7	14.3	56.0	46.0	22.3	31.7
8	0.99139	23.6	13.8	0.1	23.7	13.9	56.0	46.0	32.3	32.1
9	1.2084	29.8	10.8	0.2	30.0	11.0	56.0	46.0	26.1	35.0
10	2.4146	40.4	24.5	0.1	40.5	24.6	56.0	46.0	15.5	21.4
11	14.6365	24.2	6.2	0.9	25.1	7.1	60.0	50.0	34.9	42.9
12	17.702	23.2	12.3	1.1	24.3	13.4	60.0	50.0	35.7	36.6

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4.6 Radiated Emission Measurement

4.6.1 Radiated Emission Measurement Procedure

Radiated emission were measured over an inclusive frequency range to 30MHz through the tenth harmonic of the operating frequency. For this test, a 0.8-meter high wooden table in a semi-anechoic chamber supported the device under test. The table was placed on a turntable.

The measurement antenna was placed 3 meters for measurement from 30 to 1,000MHz and 1 meter for measurement from 1 - 25GHz, respectively, for the device under test. The indicated frequency range was swept as device under test was rotated along its vertical axis in 90 degree increments.

During the preliminary tests, the load consisted of 700-ml tap water placed in the center of the oven. The emissions were observed while the device under test was operated at maximum output power.

The level of the emissions near the edge of the designated ISM frequency band was measured. For this test, the load consisted of 700-ml water load located in the center of the oven.

The level of the second and third harmonic were measured inclusively with a 300-ml and 700-ml water load alternately placed in the center and side(or right front corner) of the oven.
The data obtained during these tests is contained on this report.

All other out-of-band emissions were measured while a 700-ml load was placed in the center of the oven. Maximum readings were recorded after variations in antenna polarizations, height, device orientation, load position, and size.
For frequencies above 1GHz, the test receiver detecting mode was set to average detection mode(Model no.:ESI , Rohde & Schwarz).

For all emissions the equivalent 300 meters intensity was calculated assuming linear decrease in the described, there were no over-limit emissions discorvered.

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4.6.2 Radiated Emission Measurement Configuration

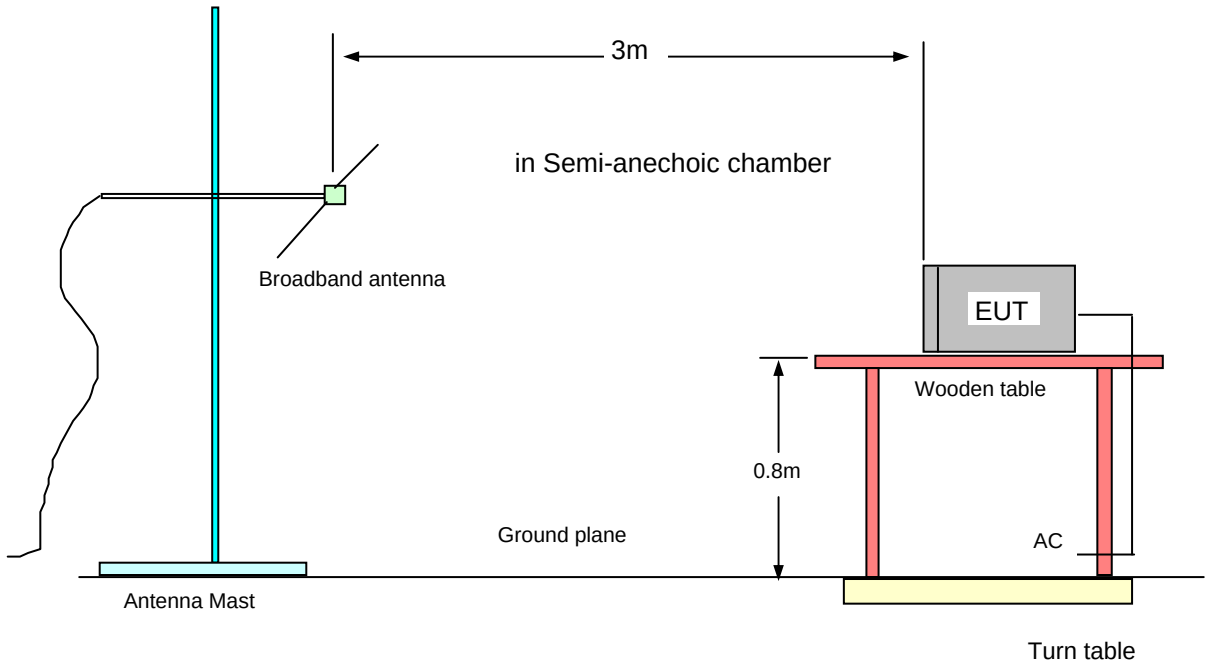

Fig. 6 Radiated Emission Configuration(30 - 1000MHz)

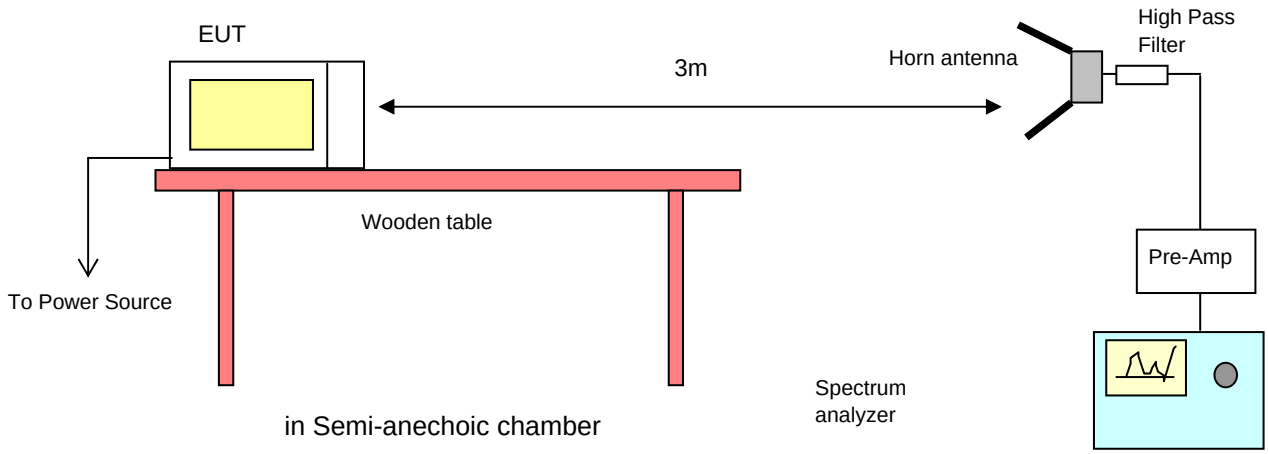

Fig. 7 Radiated Emission Configuration(1 - 25GHz)

4.6.3 Radiated Emission Measurement Data(30 - 1000MHz)

Test distance : 3m

Tested Frequency [MHz]	Meter Reading [A] [dBuV]	Total Loss [B] [dB]	Results [A+B] [dBuV/m]	Limits at 300m [dBuV/m]	ANT Pol.	Margin (Result-Limit) [dB]	Antenna Height [Cm]	Turn table Degree [Deg]
	Pk		**Pk**			**Pk**		
62.7	62.7	-20.5	42.2	70.28	V	-28.08	100	0
531.5	51.1	-2.2	48.9	70.28	H	-21.38	100	30
955.7	61.2	3.9	65.1	70.28	V	-5.18	100	0
957.5	61.8	4.0	65.8	70.28	H	-4.48	350	30
977.0	62.7	4.5	67.2	70.28	V	-3.08	100	0

[NOTE]

** fo = 2450MHz*

** Test distance : 3m*

** Results = Meter Reading + Total Loss(Antenna factor + Cable loss)*

** Distance Correction factor : 20 x log(d1/d2)[dBuV/m]*

20 x log(300/3) = + 40dBuV/m

** The limit at 300 meters is* 30.28 *dBuV/m.*

Add 40dB 30.28 *dBuV/m gives a* 70.28 *dBuV/m @ 3 meters.*

** Spectrum analyzer setting*

Peak(Pk) : Resolution Bandwidth(1MHz), Video Bandwidth(1MHz)

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4.6.4 Radiated Emission Measurement Data(1 - 25GHz)

Test distance : 3m

Tested Frequency [MHz]	Meter Reading [dBuV]	Total Loss [dB]	AMP [dB]	HPF [dB]	k Factor	Results [A+B] [dBuV/m]	Limits at 300m [dBuV/m]	ANT Pol.	Margin [dB]
1234	39.8	24.7	38.7	0	0.0023	0.04	30.27	V	-30.23
2312	40.6	26.3	40.4	0	0.0060	0.13	30.27	V	-30.14
2390	48.0	26.3	40.4	0	0.0062	0.31	30.28	V	-29.97
2527	44.5	33.6	40.4	0	0.0065	0.50	30.28	V	-29.78
4925	39.2	37.0	42.0	1	0.01	0.58	30.28	V	-29.70
5468	41.8	37.0	42.0	1	0.01	0.78	30.28	V	-29.50
5882	39.8	39.5	42.0	1	0.01	0.83	30.28	V	-29.45
7389	45.6	41.1	41.5	1	0.01	2.05	30.28	V	-28.23
9849	45.1	38.4	41.4	1	0.01	1.43	30.28	V	-28.85
12337	37.5	41.2	40.7	1	0.01	0.89	30.28	V	-29.38
14750	38.0	42.1	41.7	1	0.01	0.93	30.28	V	-29.35
15263	38.1	42.1	42.5	1	0.01	0.87	30.28	V	-29.41
17252	37.1	43.0	41.5	1	0.01	0.96	30.28	V	-29.31

** **f**o = 2450MHz*
** **Total Loss** : Antenna Factor+ Cable Loss, **HPF** : High Pass Filter(4.5GHz)*
** **AMP** : Pre-amplifier*
** The limit at 300 meters is 20 * LOG (25 * RF Power/500)*
** Results : Field Strength abobe 1000MHz (at 300m)(uV/m) = K*10 [Field strengh at 3m(dBuV/m)/20]*
** Margin = Result-Limit*

[NOTE]

1. Load for measurement of radiation on second and third harmonic : Two loads, one of 1000ml and the other of 450ml, 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.

** k : Conversion Factor*

$K = 0.0137 * \log F - 0.0401$ (if $F < 4575$ MHz)

$K = 0.01$ (if $F \geq 4575$ MHz)

F = Meter Reading Frequency

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5. Measurement Equipment List

Equipment	Model No.	Serial No.	Makers	Latest calibration and Interval
Field strength meter	ESCS30	839809/002	R & S	04/04/28, 12Months
	ESI26	832692/002	R & S	04/05/24, 12Months
Measurement Software	EP5RE	-	TOYO	N/A
Pre-Amplifier	8449B	3008A00705	H.P	04/07/20, 12Months
Double Ridged Guide Antenna	3115	9505-4441	EMCO	04/05/23, 24Months
Microwave Survey Meter	HI-1501	93661	H.I	04/10/02, 12Months
High Pass Filter	3H10-4500	2	K & L	04/11/11, 12Months
Amplifier	DWT-18213	004-9942	DSB Microwave	04/11/10, 12Months
Biconilog Antenna	CBL6112B	2767	SCHAFFNER	04/05/22, 12Months
Spectrum Analyzer	E7405A	MY42000052	Agilent	04/08/04, 12Months
Field strength meter	ESS	844661/005	R&S	04/01/05, 12Months
L.I.S.N	ESH3-Z5	100262	R&S	04/02/11, 12Months
Measurement Software	EP5CE	-	TOYO	N/A

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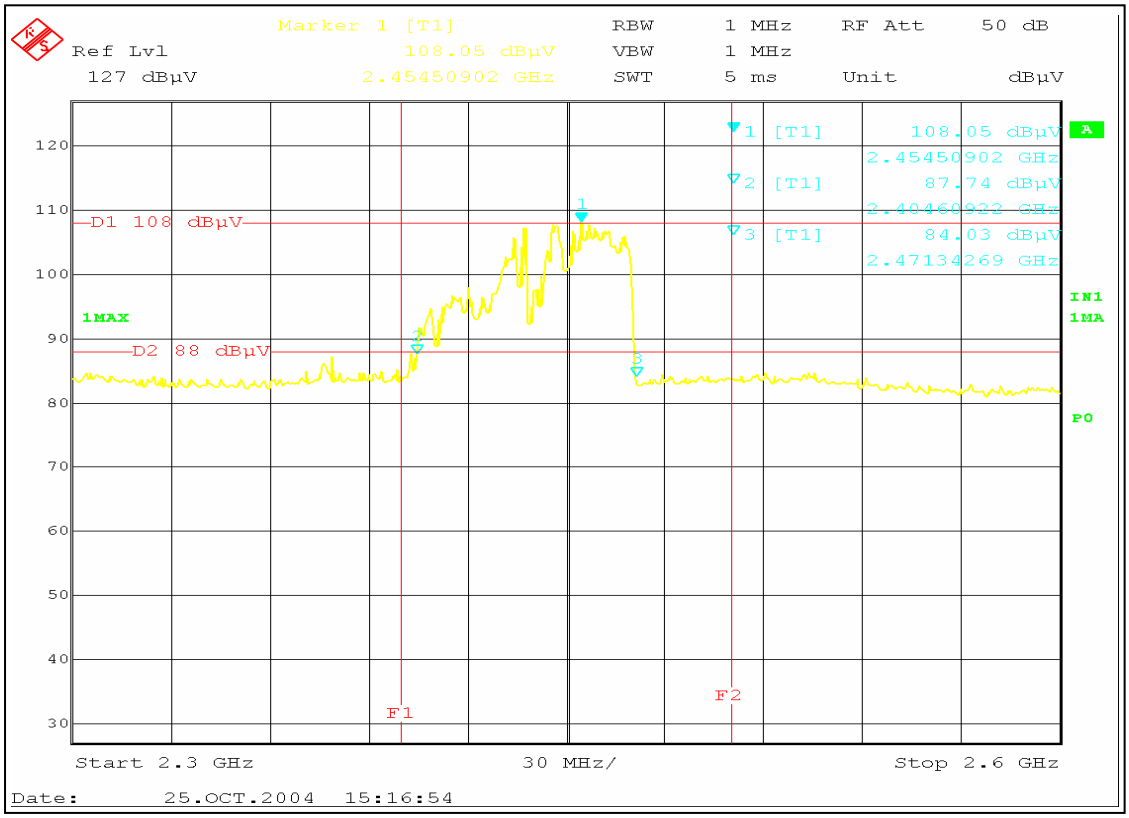
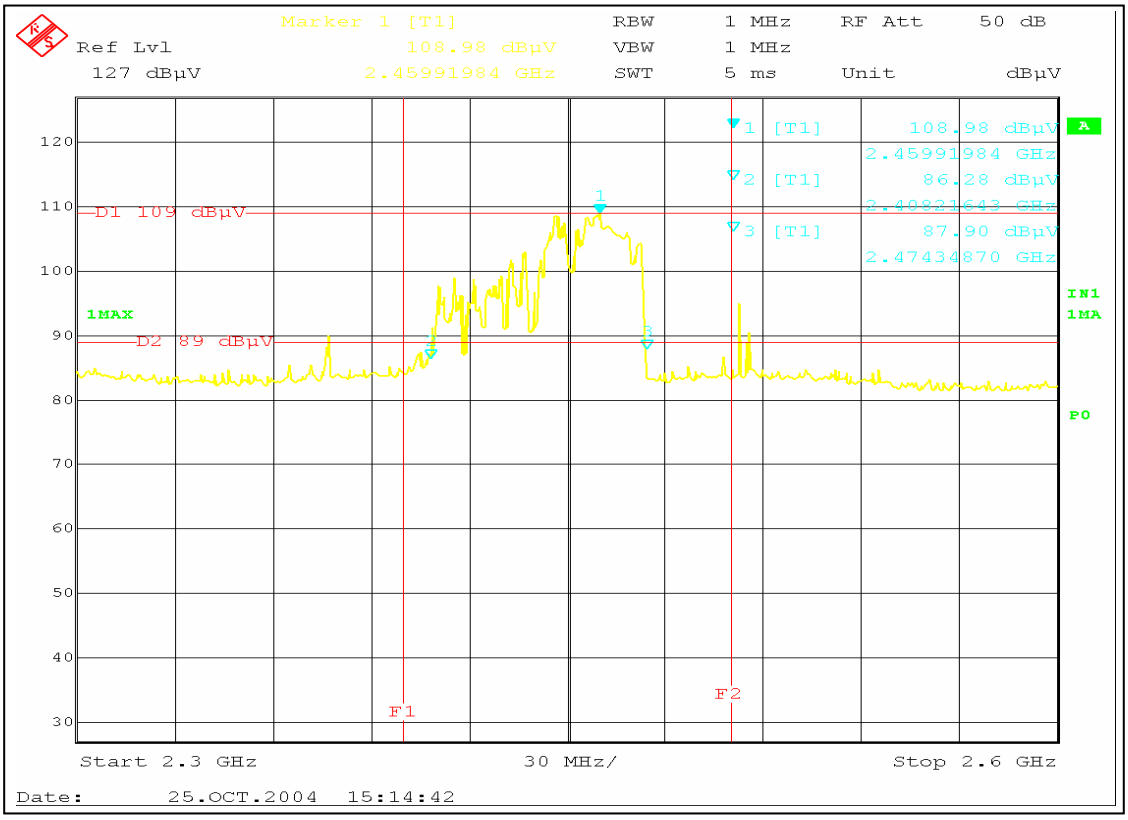
Frequence vs Line Voltage Variation Test

96V(80%)

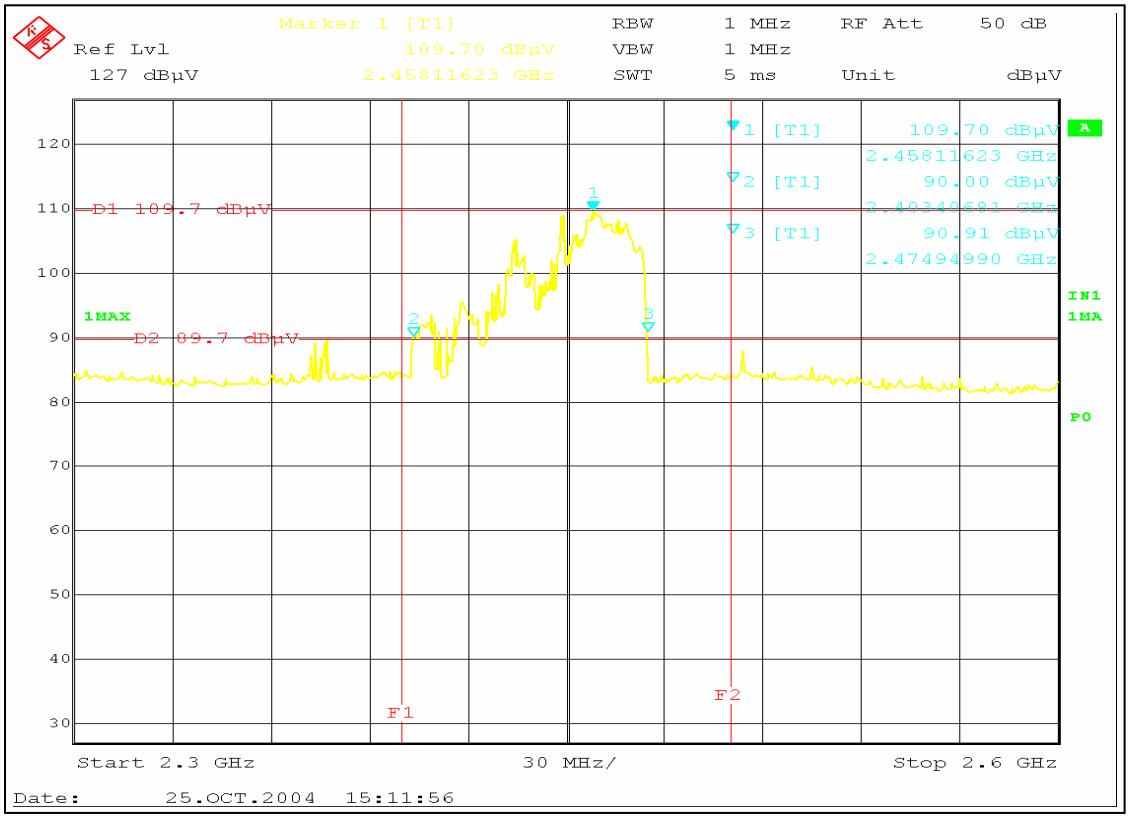


108V(90%)

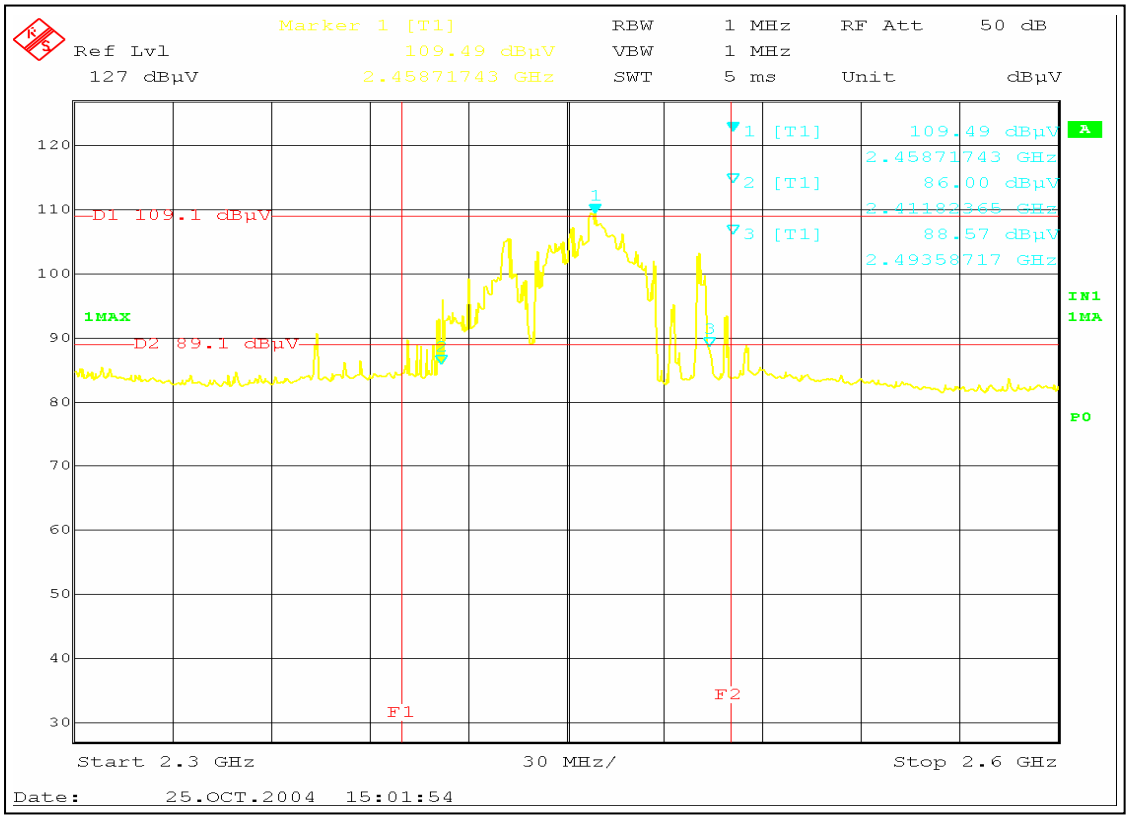


Frequence vs Line Voltage Variation Test

132V(110%)

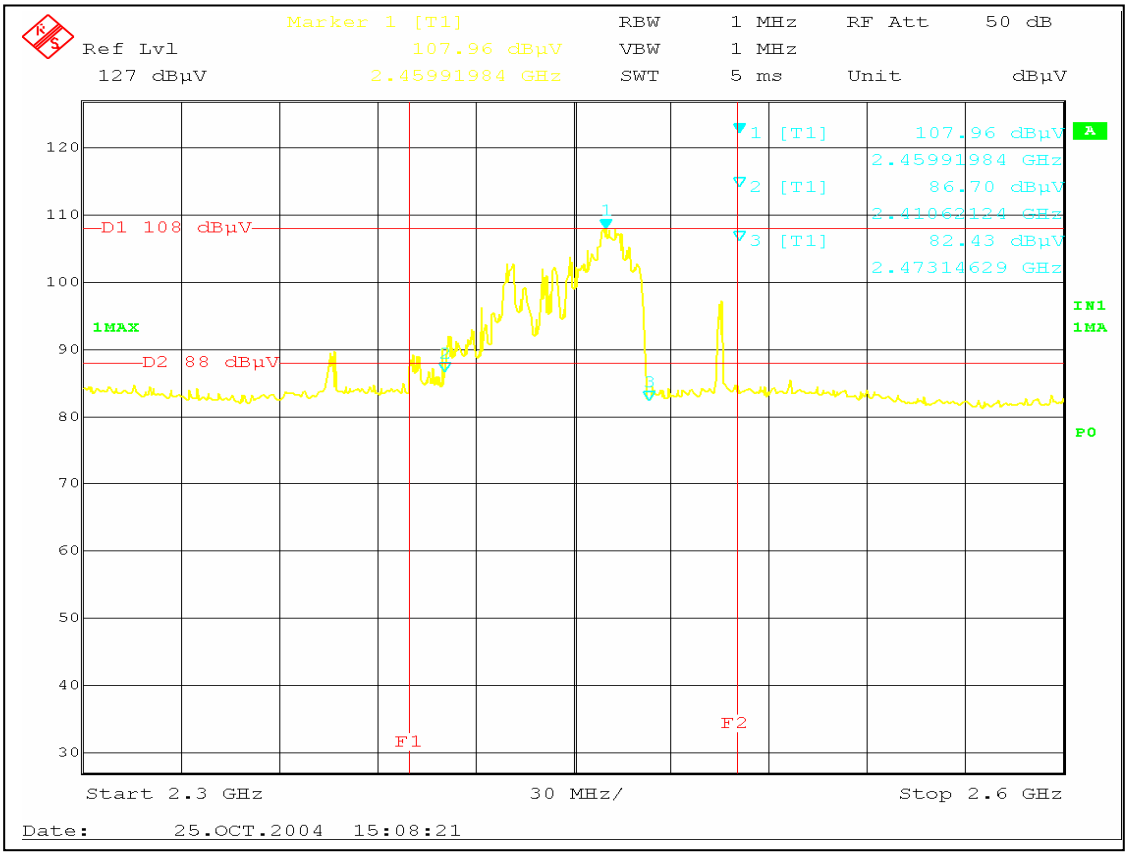


150V(125%)

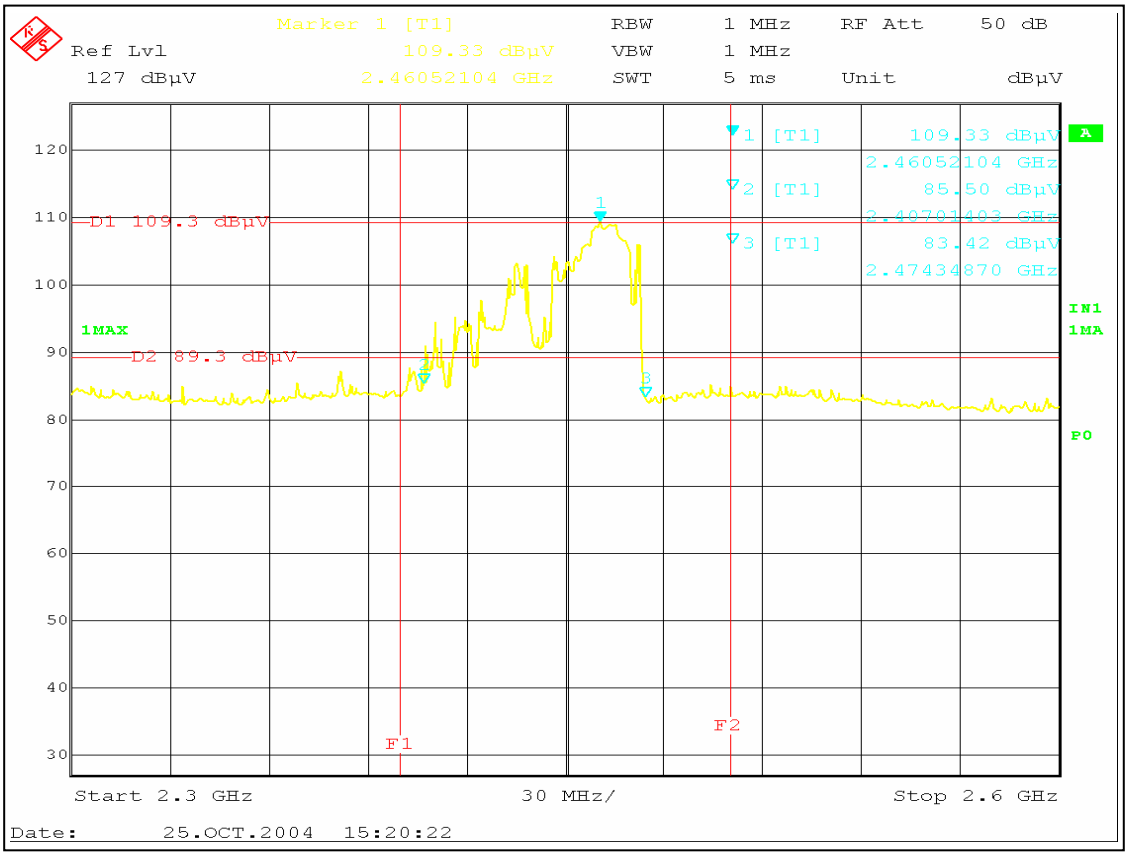


Frequence vs Load Variation Test

120V(1000ml)

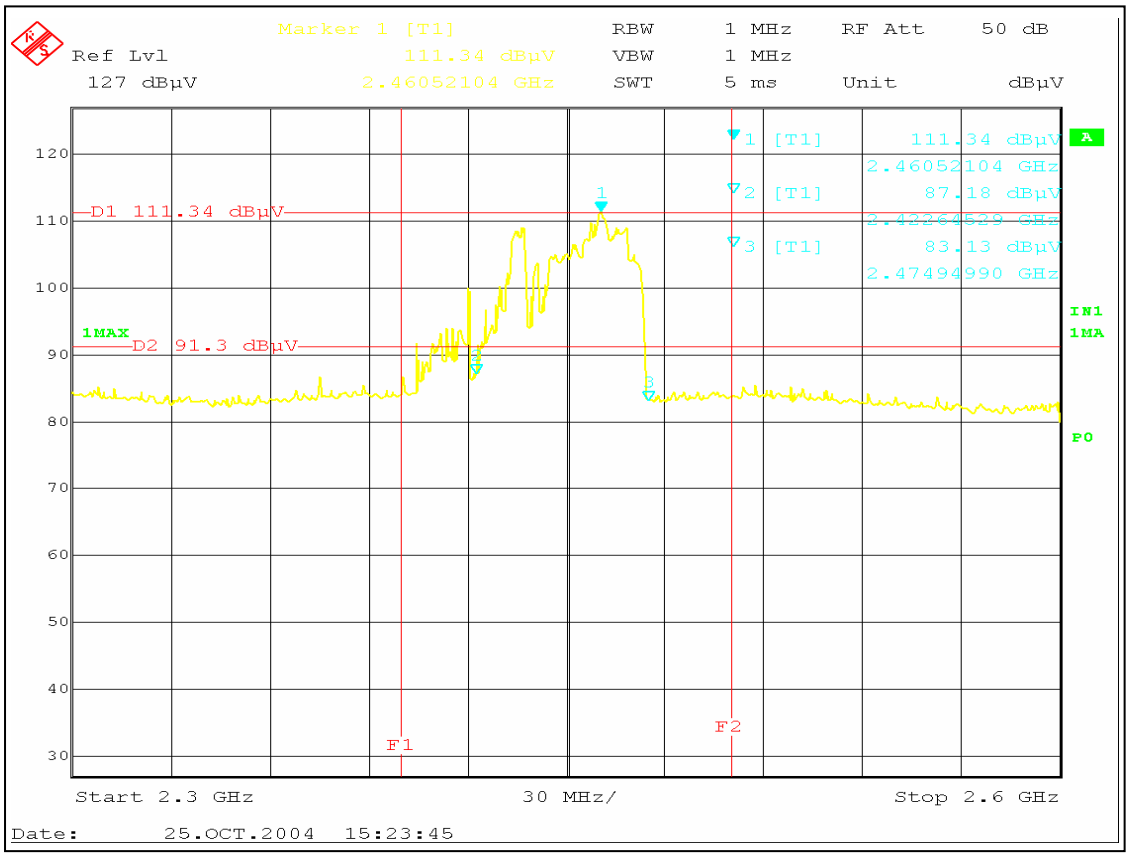


120V(800ml)

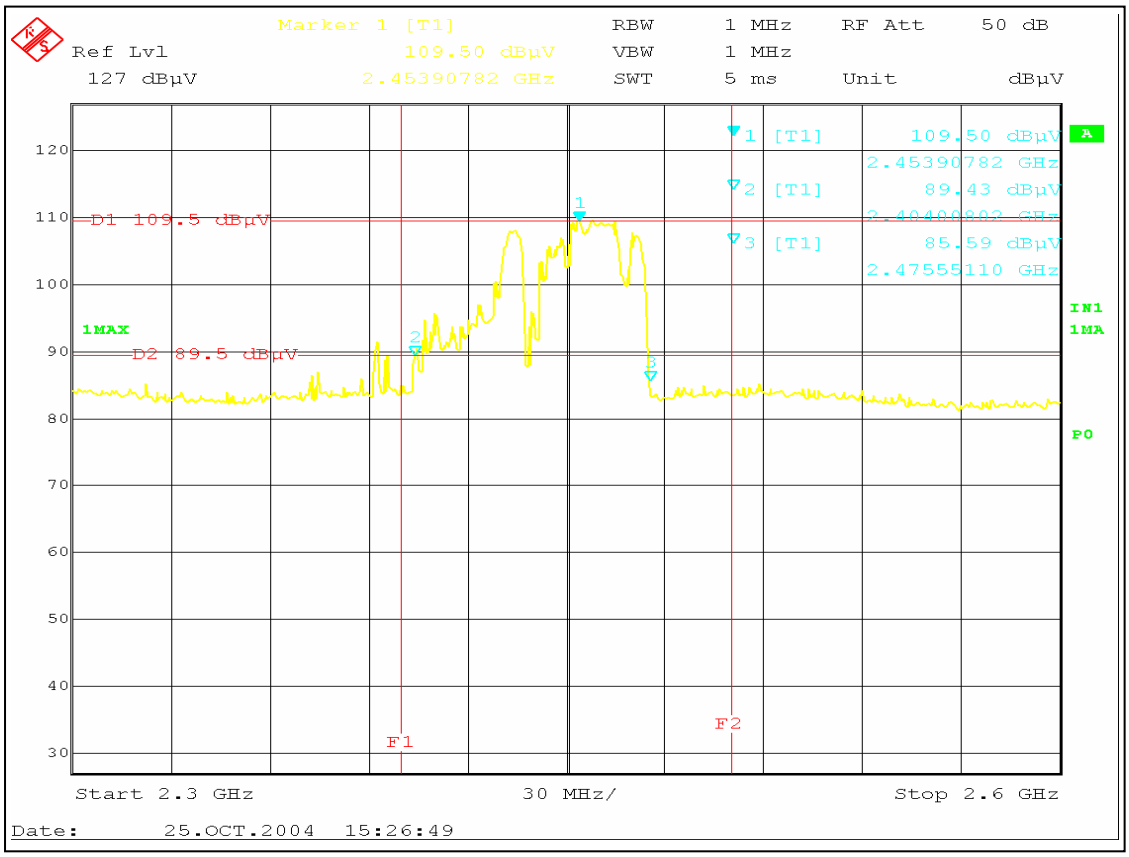


Frequence vs Load Variation Test

120V(600ml)

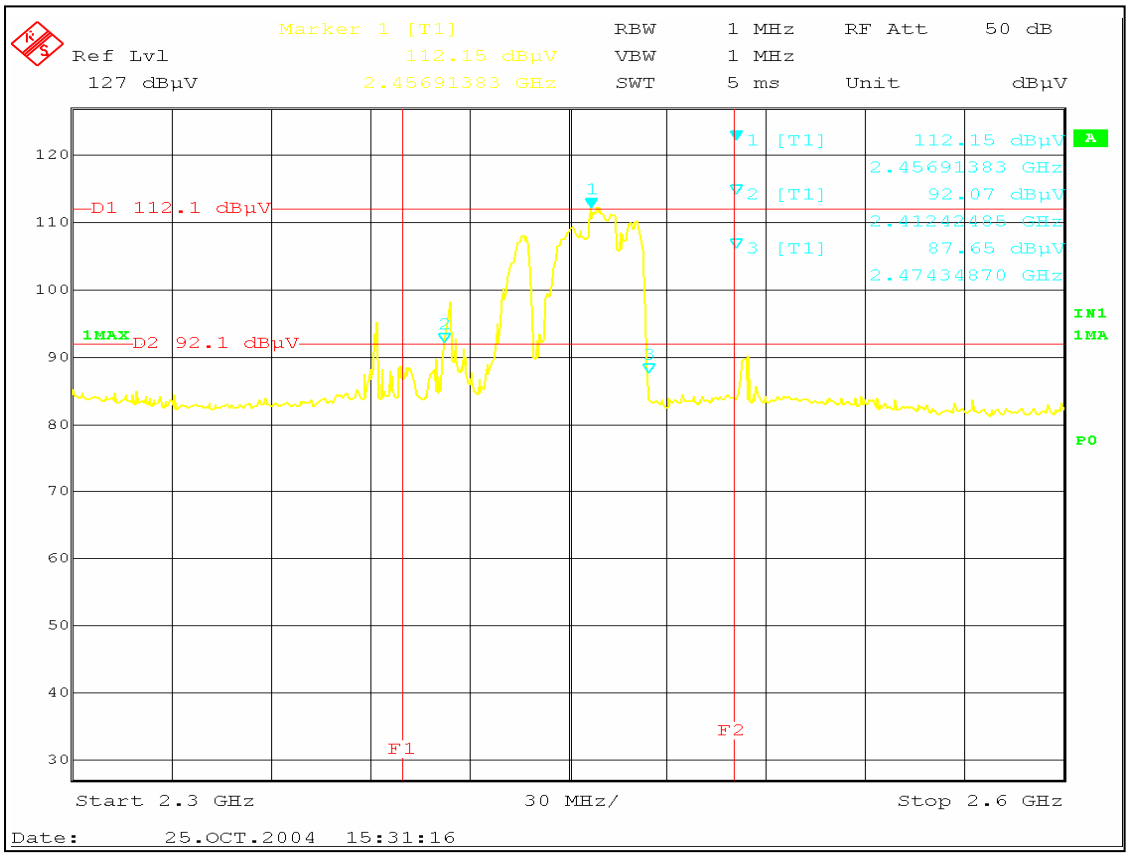


120V(400ml)



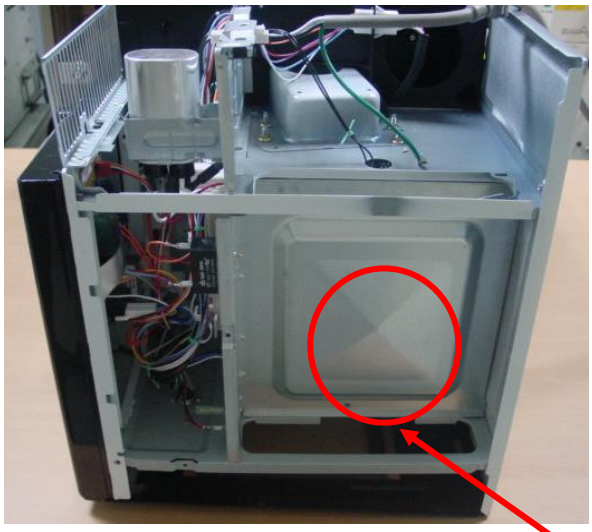
Frequence vs Load Variation Test

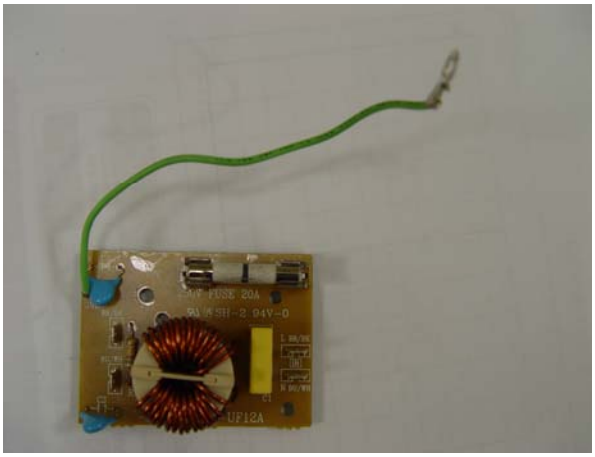
120V(200ml)



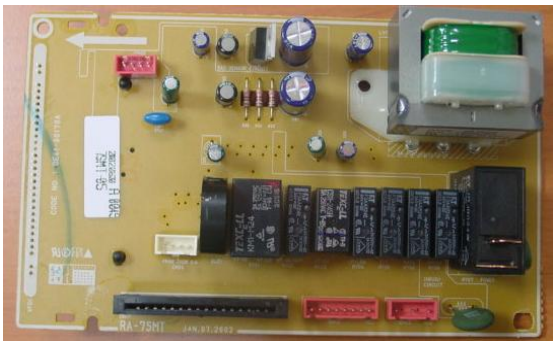
SAMSUNG

SAMSUNG





SAMSUNG
OM75P(10)
DANGER HIGH VOLTAGE
MADE IN KOREA


RA-75MT

RA-75MT

DANGER
HIGH VOLTAGE
DISCHARGE CAPACITOR BEFORE SERVICING
SAMSUNG
OBJY2
SHV-7778UC1

H.V.CAPACITOR
HCH-212091C S
2100Vac 60/50Hz
0.91 µF± 3% 10/085/21
NO PCB'S
DANGER H. V.
2501-001011
C2088