# LG Electronics Inc.

## Digital Appliance Company, EMC Center

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## *CLASS II PERMISSIVE CHANGE CERTIFICATION OF COMPLIANCE*

**Date of Issue: July 21, 2005** **Test Report No: 05-LAE-M175**

**Test Site: LG Electronics Changwon EMC Center**

FCC ID: BEJS174ZHA dated 04/19/2005 was complied with the line conducted requirements for unintentional radiators and consumer Industrial, Scientific and Medical (ISM) device in ET Docket 98-80, FCC 02-157.

This class II permissive change is to use the alternative Magnetron on the previous granted model MS-1642KSZ, FCC ID: BEJS174ZHA (Test Report No.: 05-LAE-M086) dated 04/19/2005.

| | |
|---|---|
| Applicant: | LG Electronics Inc. |
| Regulation: | FCC Part 18 – ISM Consumer Device |
| Test Procedure: | MP-5: 1985 |
| Equipment Class: | Industrial, Scientific, and Medical equipment |
| EUT Type: | Microwave oven |
| Magnetron Type: | 2M282 (TOSHIBA) and 2M246 (LG Electronics Inc.) |
| Brand Name(s): | LG |
| Model No.: | MS-1642KSZ |
| FCC ID: | BEJS174ZHA |

This device has been verified to comply with the applicable requirements in the FCC Part 18 and was tested in accordance with the measurement procedures specified in MP-5: 1985.
I assure full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Kwan Sung

Kwan Y. Sung / Chief Research Engineer
Digital Appliance Company,
EMC Center
LG Electronics Inc.

# *CLASS II PERMISSIVE CHANGE REPORT FOR A MICROWAVE OVEN*

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

| | |
|---|---|
| **EUT Type:** | Microwave oven |
| **Model No.:** | MS-1642KSZ |
| **FCC ID:** | BEJS174ZHA |
| **Rule Part:** | FCC Part 18 |
| **Test Procedure:** | MP-5: 1985 |
| **Date of Test:** | July 5, 2005 – July 19, 2005 |
| **Date of Issue:** | July 21, 2005 |
| **Test Result:** | Pass |



*The EMC Center facilities has been placed on file and the name of our organization added to the FCC's list for the FCC Part 15 and 18 of the Commission's Rules under Registration Number 93197.*

Tested by:

Kwang M. Son / Research Engineer
Digital Appliance Company,
EMC Center
LG Electronics Inc.

Reviewed by:

Kwan Y. Sung / Chief Research Engineer
Digital Appliance Company,
EMC Center
LG Electronics Inc.

# *CONTENTS*

## 1. CLIENT INFORMATION

The EUT has been tested by request of:

| | |
|---|---|
| Company:<br>(Manufacturer) | 1. LG Electronics Inc. Cooking Appliances Division<br>391-2, Ga Eum Jeong - Dong, Changwon City, Gyeong Nam,<br>641-711, Korea<br>2. LG Electronics Tianjin Appliance Co., Ltd.<br>Xing Dian Road, Bei Chen Distr., Tianjin 300402,<br>People's Republic of China |
| Name of contact: | Jang Sup Lee |
| Telephone: | +82-551-260-3463 |
| Fax: | +82-551-260-3223 |

## 2. EQUIPMENT UNDER TEST (EUT)

EUT is the LG Electronics Inc. Microwave Oven as followings:

| | |
|---|---|
| Equipment: | Microwave oven |
| Model: | MS-1642KSZ |
| Brand name: | LG |
| Serial number: | N/A |
| Magnetron: | 2M282 by TOSHIBA<br>2M246 by LG Electronics Inc. |
| RF Frequency: | 2,450 MHz |
| RF Power Output (IEC 705): | 1200 W |
| Power Consumption | |
| Microwave Mode: | 1600 W |
| Rated Input Voltage: | 120 V~, 60 Hz |
| Rated Input Current | |
| Microwave Mode: | 13.8 A |
| Cavity Volume: | 1.6 Cu.ft |
| Oven Type: | Countertop / Household |
| Mode Stirrer: | Turntable |
| Power Cord: | Shielded |
| Outer Dimensions (inch) | 22.6 (W) * 13.5 (H) * 17.3 (D) |

EMI suppression device(s) installed in production: See schematics (Appendix C)
EMI suppression device(s) added and/or modified during test: None

**This class II permissive change certification of compliance is to use alternative magnetron type 2M282 by TOSHIBA and 2M246 by LG Electronics Inc. on the previous granted model MS-1642KSZ, FCC ID: BEJS174ZHA dated 04/19/2005.**

## 3. TEST SITE

Measurement of radiated emissions from EUT was made at semi-anechoic chamber that has been in compliance with Federal Communications Commissions (FCC) requirements of clause 2.948 according to ANSI C63.4-1992 on March 21, 2003.

## 4. CALIBRATIONS OF MEASURING INSTRUMENT

All measurement was made with instruments calibrated according to the recommendation by manufacturer. Measurement of radiated emissions and power line conducted emissions were made with instruments conforming to American National Standard Specification, ANSI C63.4-1992. The calibration of measuring instrument, including any accessories that may affect test results, was performed according to the recommendation by manufacturer.

## 5. DESCRIPTION OF TEST CONDITION

### 5.1 Power line conducted emission measurements

Power line conducted emission measurements were based on the std. CISPR 11:1998+A1:1999.

5.1.1 Shielded enclosure
The measurement for power-line emissions from EUT was made in shielded enclosure that provides sufficient shielding effectiveness enough not to affect test results.

5.1.2 Detector function selection and bandwidth
During conducted emission measurement, a radio noise meter that has a CISPR quasi-peak detector with 10 kHz IF bandwidth of 6 dB was utilized.

5.1.3 Frequency range to be scanned
For conducted emissions measurement, frequency range of 150 kHz to 30 MHz included, was investigated.

5.1.4 Unit of measurement
Test results for conducted emissions are reported in micro-volt.

5.1.5 Line impedance stabilization network (LISN)
A LISN with characteristics that conform to the requirements of ANSI C63.4-1992 was used for the measurement of conducted power-line radio noise; (50 micro-henries / 50 ohms). Chassis and earth-points for grounding of the LISN were earth-grounded.

5.1.6 Test conditions and configuration of EUT
The EUT was configured and operated in all modes of operation so as to find the maximum enumeration of emissions from EUT.
The EUT has designed to use the public AC lines with rated AC voltage as specified in owner's manual and Installation's manual of EUT and filtered to meet the requirement. AC

power was supplied to the EUT through LISN with characteristics described in 5.1.5 of part I of this report.
The EUT was placed on a 1 m×1.5 m×40 cm high wooden table which is placed on the earth-grounded conducting surface larger than 2 square meter. The vertical conducting surface was replaced with horizontal ground plane. Length of the power lead in excess of 80 cm horizontally separating the EUT from LISN was folded back-and-forth form at the center of the power cord not exceeding 40 cm in length.
The EUT was operated with a load of 1000 ml water initially at 20 °C ± 5 °C placed at the center of the load-carrying surface.
Each type of accessory provided by manufacturer or typically used and support equipment were connected to the EUT during measurement to the typical usage and applicable as nearly as practicable.

5.1.7 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above-mentioned way.

The measurement uncertainty was calculated in accordance with NAMAS NIS 81:
"The treatment of uncertainty in EMC measurement."
For calculated uncertainty of each item, refer the next page.

The measurement uncertainty was given with a confidence of 95%.

## 5.2 Radiated emissions measurement

5.2.1 Test site
Measurement was made in semi-anechoic chamber as described at Clause 3 in this report.

5.2.2 Detector function selection and bandwidth
In radiated emissions measurement, field strength meter that has CISPR quasi-peak and average detector was used. The bandwidth of the detector of instrument is 120 kHz for frequency range of 30 MHz – 1,000 MHz, and 1 MHz for frequency range of 1 GHz to 26 GHz. Emissions to be measured are detected in average mode.

5.2.3 Unit of measurement
Test results of radiated emissions measurement are reported in microvolts per meter at the specific distance. Using the unit of dBμV on the test instrument, the indication unit was converted to field strength unit of μV/m as following method;

$$F / S = 10^{\{(R+AF+CF)/20\}} \ (\mu V/m)$$

here,

F / S: Field Strength in μV/m, R: Meter Reading Level in dB(μV),
AF: Antenna Factor in dB/m
CF: Conversion Factor
* 30 MHz ~ 1 GHz: CF = CL
* Above 1 GHz: CF = CL – PG + FL + AL
CL: Cable Loss (dB) FL: Filter Loss (dB)
PG: Preamplifier Gain (dB) AL: Attenuator Loss (dB)

5.2.4 Antennas

Measurements were made using calibrated biconical antenna in range of 30 MHz to 300 MHz, log-periodic antenna in range of 300 MHz to 1,000 MHz and horn antenna in range of 1 to 26 GHz to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization.

The horizontal distance between the receiving antenna and the closest periphery of the EUT was 3 meters for horn antenna and 10 meters for biconical and log-periodic antenna.

5.2.5 Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 30 to 1,000 MHz and above, if found, was investigated.

5.2.6 Test conditions and configuration of EUT

The EUT was configured and operated in all modes of operation so as to find the maximum RF energy generated from EUT.

The power was furnished with rated (normal) AC 120 volts, as specified in the Owner's manual of EUT. The EUT was placed on a 1 m high non-metallic table. The turntable containing the system was rotated and the antenna height was varied 4 m to find the maximum RF energy detected from EUT.

Each type of accessory provided by manufacturer or typically used and support equipment were connected to the EUT during measurement to the typical usage and applicable as nearly as practicable.

5.2.7 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in mentioned above way.

The measurement uncertainty was calculated in accordance with NAMAS NIS 81: "The treatment of uncertainty in EMC measurement."

For calculated uncertainty of each item, refer the next page.

The measurement uncertainty was given with a confidence of 95%.

< Fundamental Frequency Uncerntainty (2,450 MHz) >

| Symbol | Contribution | Value (dB) | | Probability Distribution | Divisor | Standard Uncertainty Horn Antenna (Value / Divisor) | Standard Uncertainty Squared |
|---|---|---|---|---|---|---|---|
| | | | 3 m | | | 3 m | 3 m |
| $V_1$ | Ambient signals | | | | 1 | 0.00 | 0.0 |
| $V_2$ | Antenna factor calibration | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_3$ | Cable loss calibration | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_4$ | Receiver specification | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_5$ | Measurement distance variation | Tolerance | 0.6 | rectangular | 1.732 | 0.35 | 0.1 |
| $V_6$ | Site imperfections | Tolerance | 2.0 | rectangular | 1.732 | 1.15 | 1.3 |
| $V_7$ | Mismatch<br>Receiver VRC: $\Gamma_l$ = 0.33<br>Antenna VRC: $\Gamma_g$ = 0.20<br>Uncertainty limits 20Log(1$\pm$ $\Gamma_l$ $\Gamma_g$) | Tolerance | 0.6 | U-shaped | 1.414 | 0.42 | 0.2 |
| $V_8$ | System repeatability (previous assessment of s($q_k$) from 5 repeats, 1 reading on EUT Repeatability of EUT* | | 0.5 | Std Deviation | 1 | 0.50 | 0.3 |
| | Combined standard uncertainty $u_c(y)$ | | 1.53 | normal | | | |
| | Expanded uncertainty U | | 3.06 | normal (k = 2) | | | |

$$u_c(y) = \sqrt{\left(\frac{0.0}{1}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \frac{1.0^2 + 0.6^2 + 2.0^2}{3} + \frac{0.6^2}{2} + 0.5^2}$$

The level of confidence will be approximately 95%. (The coverage factor: k=2)

U = 2 $u_c(y)$ = 2 x 1.53 = $\pm$ 3.1 dB

< Radiated Emission Uncerntainty (Above 1 GHz) >

| Symbol | Contribution | Value (dB) | | Probability Distribution | Divisor | Standard Uncertainty Horn Antenna (Value / Divisor) | Standard Uncertainty Squared |
|---|---|---|---|---|---|---|---|
| | | | 3 m | | | 3 m | 3 m |
| $V_1$ | Ambient signals | | | - | 1 | 0.00 | 0.0 |
| $V_2$ | Antenna factor calibration #1 | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_3$ | Antenna factor calibration #2 | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_4$ | Cable loss calibration | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_5$ | Receiver specification | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_6$ | Highpass filter | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_7$ | Measurement distance variation | Tolerance | 0.6 | rectangular | 1.732 | 0.35 | 0.1 |
| $V_8$ | Site imperfections | Tolerance | 2.0 | rectangular | 1.732 | 1.15 | 1.3 |
| $V_9$ | Mismatch<br>Receiver VRC: $\Gamma_l$ = 0.33<br>Antenna VRC: $\Gamma_g$ = 0.2<br>Uncertainty limits 20Log(1$\pm$ $\Gamma_l$ $\Gamma_g$) | Tolerance | 0.6 | U-shaped | 1.414 | 0.42 | 0.2 |
| $V_{10}$ | System repeatability (previous assessment of s($q_k$) from 5 repeats, 1 reading on EUT Repeatability of EUT* | | 0.5 | Std Deviation | 1 | 0.50 | 0.3 |
| | Combined standard uncertainty $u_c(y)$ | | 1.65 | normal | | | |
| | Expanded uncertainty U | | 3.31 | normal (k = 2) | | | |

$$u_c(y) = \sqrt{\left(\frac{0.0}{1}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \frac{1.0^2 + 1.0^2 + 0.6^2 + 2.0^2}{3} + \frac{0.6^2}{2} + 0.5^2}$$

The level of confidence will be approximately 95%. (The coverage factor: k=2)

U = 2 $u_c(y)$ = 2 x 1.65 = $\pm$ 3.4 dB

## < Electric Field Strength Uncerntainty (30 MHz – 1 GHz) >

| Symbol | Contribution | Value (dB) | | Probability Distribution | Divisor | Standard Uncertainty UltraLog Antenna (Value / Divisor) | Standard Uncertainty Squared |
|---|---|---|---|---|---|---|---|
| | | | 10 m | | | 10 m | 10 m |
| $V_1$ | Ambient signals | | | Std Deviation | 1 | 0.00 | 0.0 |
| $V_2$ | Antenna factor calibration | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_3$ | Cable loss calibration | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_4$ | Receiver specification | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_5$ | Antenna directivity | Tolerance | 3.0 | rectangular | 1.732 | 1.73 | 3.0 |
| $V_6$ | Antenna factor variation with height | Tolerance | 0.5 | rectangular | 1.732 | 0.29 | 0.1 |
| $V_7$ | Antenna phase center variatior | Tolerance | 0.2 | rectangular | 1.732 | 0.1 | 0.0 |
| $V_8$ | Antenna factor frequency interpolatior | Tolerance | 0.25 | rectangular | 1.732 | 0.14 | 0.0 |
| $V_9$ | Measurement distance variation | Tolerance | 0.4 | rectangular | 1.732 | 0.23 | 0.1 |
| $V_{10}$ | Site imperfections | Tolerance | 2.0 | rectangular | 1.732 | 1.15 | 1.3 |
| $V_{11}$ | Mismatch<br>Receiver VRC: $\Gamma_l$ = 0.09<br>Antenna VRC: $\Gamma_g$ = 0.33<br>Uncertainty limits 20Log(1$\pm$ $\Gamma_l$ $\Gamma_g$) | Tolerance | 0.3 | U-shaped | 1.414 | 0.21 | 0.0 |
| $V_{12}$ | System repeatability (previous assessment of s($q_k$) from 5 repeats, 1 reading on EUT Repeatability of EUT* | | 0.5 | Std Deviation | 1 | 0.50 | 0.3 |
| | Combined standard uncertainty $u_c(y)$ | | 2.35 | normal | 2 | | |
| | Expanded uncertainty U | | 4.70 | normal (k = 2) | 2 | | |

$$u_c(y) = \sqrt{\left(\frac{0.0}{1}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \frac{1.0^2 + 1.0^2 + 3.0^2 + 0.5^2 + 0.2^2 + 0.25^2 + 0.4^2 + 2.0^2}{3} + \left(\frac{0.30}{2}\right)^2 + 0.5^2}$$

The level of confidence will be approximately 95%. (The coverage factor: k=2)

$U = 2\,u_c(y) = 2 \times 2.35 = \pm 4.7$ dB

## < Line Conducted Uncerntainty >

| Symbol | Contribution | Value (dB) | | Probability Distribution | Divisor | Standard Uncertainty (dB) 150 kHz - 30 MHz (Value / Divisor) | Standard Uncertainty Squared |
|---|---|---|---|---|---|---|---|
| $V_1$ | Receiver specification | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_2$ | LISN coupling specification | Tolerance | 1.0 | rectangular | 1.732 | 0.58 | 0.3 |
| $V_3$ | Cable and input attenuator calibration | Expanded Uncertainty | 0.5 | normal (k = 2) | 2 | 0.25 | 0.1 |
| $V_4$ | Mismatch<br>Receiver VRC: $\Gamma_l$ = 0.09<br>LISN VRC: $\Gamma_g$ = 0.8<br>Uncertainty limits 20Log (1$\pm$ $\Gamma_l$ $\Gamma_g$) | Tolerance | 0.6 | U-shaped | 1.414 | 0.42 | 0.180 |
| $V_5$ | System repeatability (previous assessment of s($q_k$) from 10 repeats, 1 reading on EUT) | | 0.35 | standard deviation | 1 | 0.35 | 0.12 |
| | Combined standard uncertainty $u_c(y)$ | | 1.02 | normal | | | |
| | Expanded uncertainty U | | 2.03 | normal (k = 2) | | | |

$$u_c(y) = \sqrt{\frac{1.0^2 + 1.0^2}{3} + \left(\frac{0.5}{2}\right)^2 + \left(\frac{0.6}{2}\right)^2 + 0.35^2} = \quad dB$$

The level of confidence will be approximately 95%. (The coverage factor: k=2)

$U = 2\,u_c(y) = 2 \times$ *1.02* $= \pm$ 2.1 dB

## 6. MEASURING INSTRUMENT

| Instrument | Model | Cal. Due date | Serial No. | Control No. |
|---|---|---|---|---|
| Microwave Spectrum Analyzer | HP8566B | 11/02/2005 | 3340A08173 | 99-IRE-05 |
| RF Preselector | HP85685A | 11/02/2005 | 3221A01441 | 99-IRE-04 |
| Qusi-Peak Adapter | HP85650A | 11/02/2005 | 3303A01732 | 99-TRE-01 |
| R/B Spectrum Display | HP462 | 11/02/2005 | 3340A21397 | 99-IRE-02 |
| Attenuator Switch Driver | HP11713A | 11/02/2005 | 3334A11152 | 99-IRE-03 |
| Preamplifier | HP8449B OPT H02 | 11/02/2005 | 3008A00525 | 99-IRE-06 |
| Power Meter | HP436A | 11/02/2005 | 2604A24567 | 99-IRE-12 |
| Power Sensor | HP8481A | 11/02/2005 | 2552A50829 | 99-IRE-14 |
| Power Sensor | HP8482A | 11/02/2005 | 2607A11242 | 99-IRE-15 |
| Accessory Kit | - | - | 7044/45-002 | 99-IRE-16 |
| Horn Antenna | RGA-180 (Electro Metrics)<br>RGA-60 (Electro Metrics)<br>BBHA 9170 (Schwarz beck) | 07/23/2005<br>07/22/2006<br>06/15/2006 | 2517<br>6104<br>168 | 99-IRE-22<br>99-IRE-21<br>03-IRE-34 |
| Antenna Master | 2070-2 (EMKO) | - | 9903-2231 | 99-IRE-23 |
| Ultra Log Antenna | HL562 (Chase) | 07/12/2006 | 830547/007 | 99-IRE-27 |
| High Pass Filter | 11SH10-2500/X1800-010 | 11/02/2005 | 2 | 99-IRE-07 |
| EMI Receiver | ESI26 (R&S)<br>ESIB7 (R&S) | 11/02/2005<br>06/08/2006 | 835336/008<br>100090 | 00-IRE-30<br>02-IRE-32 |
| LISN | ESH2-Z5 (R&S)<br>ENV4200 (R&S) | 06/09/2006<br>11/01/2005 | 825640/003<br>100024 | 99-ICE-02<br>02-ICE-07 |
| Microwave Cable | Sucoflex 104 | - | 125484/4 | - |
| Microwave Cable | Sucoflex 106 | - | 13417/6 | - |
| Microwave Cable | Sucoflex 106 | - | 13419/6 | - |
| Microwave Cable | Sucoflex 106 | - | 13418/6 | - |
| Microwave Cable | Sucoflex 104 | - | 125483/4 | - |
| Microwave Cable | Sucoflex 104 | - | 12548/4 | - |
| Microwave Cable | Sucoflex 106 | - | 13416/6 | - |
| Microwave Cable | Sucoflex 106 | - | 13416/6 | - |
| Semi Anechoic Chamber | YES INC. | - | - | 99-CFA-01 |
| Shield Screen Room | YES INC. | - | - | 99-CFA-02 |
| Microwave Survey Meter | Holaday HI-1710/HI-2623 | 07/24/2005 | 93083 | FJZ431HA |

# 7. TEST DATA

## 7.1 Input Power

The input power was measured using Wattmeter. A 275 ml water load in a polypropylene beaker is placed in the center of the oven. The 275 ml water was chosen for its compatibility with UL procedure to determine input ratings. The oven was operated at the rated input and full output power for 6 minutes.

### 1) Magnetron type: 2M282 by TOSHIBA

| Mode | Input Voltage | Current [A] | Power Consumption [W] | Manufacturer Rating [A] |
|---|---|---|---|---|
| Microwave | 120 Vac, 60 Hz | 15.8 | 1,786 | 13.8 |

### 2) Magnetron type: 2M246 by LG

| Mode | Input Voltage | Current [A] | Power Consumption [W] | Manufacturer Rating [A] |
|---|---|---|---|---|
| Microwave | 120 Vac, 60 Hz | 16.0 | 1,762 | 13.8 |

### 7.2 RF Power Output Measurement according to MP-5.

The Calorimetric Method was used to determine maximum output power. A 1,000 ml water load was placed in the center of the oven. A mercury thermometer was used to measure temperature rise. The test method was described in MP-5.

**1) Magnetron type: 2M282 by TOSHIBA**

$$\text{Power [W]} = \frac{\text{(4.187 Joules/Cal) * (Volume in ml) * (Temperature Rise)}}{\text{Time in Seconds}}$$

| Quantity of Water | Starting Temperature | Final Temperature | Elapsed Time |
|---|---|---|---|
| 1,000 ml | 55.5 °C | 26.7 °C | 120 Sec |

$$\text{Power [W]} = \frac{4.187 * 1{,}000 * 28.8}{120}$$

Power [W] = 1,004.9 Watts

**2) Magnetron type: 2M246 by LG**

$$\text{Power [W]} = \frac{\text{(4.187 Joules/Cal) * (Volume in ml) * (Temperature Rise)}}{\text{Time in Seconds}}$$

| Quantity of Water | Starting Temperature | Final Temperature | Elapsed Time |
|---|---|---|---|
| 1,000 ml | 54.0 °C | 26.7 °C | 120 Sec |

$$\text{Power [W]} = \frac{4.187 * 1{,}000 * 27.3}{120}$$

Power [W] = 952.5 Watts

### 7.3 RF Power Output Measurement according to IEC 60705.

The test was performed according to the IEC Publication 60705/1999.
A cylindrical container of borosilicate glass was used. It has a maximum thickness of 3 mm, external diameter of approximately 190 mm and height of approximately 90 mm.
Water having an initial temperature of 10 °C ± 1 °C and quantity of 1000 g ± 5 g was used.
Before starting the measurement, measure the initial temperature of water.
And then the container was placed in the center of the oven. The oven was operated until attaining temperature of water as 20 °C ± 2 °C and then measured the final water temperature.
A mercury thermometer was used to measure temperature rise. The RF output power was calculated as below formula.

$$\text{Power [W]} = \frac{(4.187) * M_w * (T_2\text{-}T_1) + 0.55*M_c*(T_2\text{-}T_0)}{t}$$

#### 1) Magnetron type: 2M282 by TOSHIBA

| | | | |
|---|---|---|---|
| $M_w$ | : | Mass of the water, in grams | 1000 |
| $M_c$ | : | Mass of the container, in grams | 454 |
| $T_2$ | : | Final temperature of the water, in °C | 19.8 |
| $T_1$ | : | Initial temperature of the water, in °C | 9.8 |
| $T_0$ | : | Ambient temperature, in °C | 25.1 |
| t | : | Heating time in seconds, excluding the magnetron filament heat-up time. | 35 |

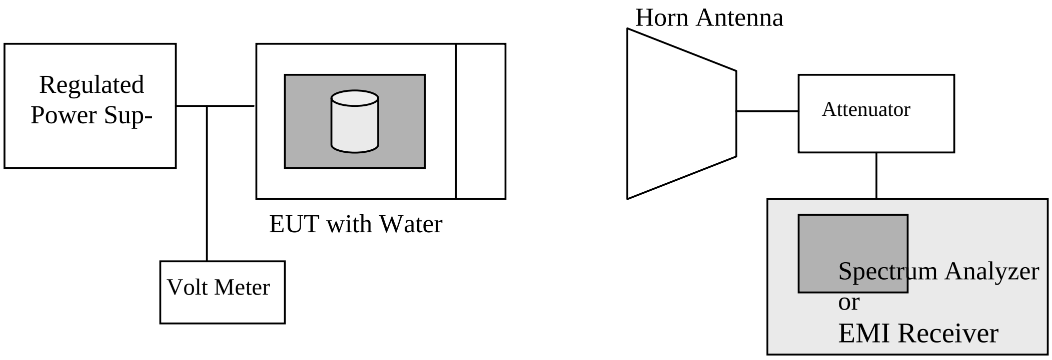
$$\text{Power [W]} = \frac{4.187 * 1{,}000 * 10.0 + 0.55 * 454 * (-5.3)}{35} = \text{1,158.5 Watts}$$

#### 2) Magnetron type: 2M246 by LG

| | | | |
|---|---|---|---|
| $M_w$ | : | Mass of the water, in grams | 1000 |
| $M_c$ | : | Mass of the container, in grams | 473 |
| $T_2$ | : | Final temperature of the water, in °C | 20.2 |
| $T_1$ | : | Initial temperature of the water, in °C | 10.1 |
| $T_0$ | : | Ambient temperature, in °C | 25.5 |
| t | : | Heating time in seconds, excluding the magnetron filament heat-up time. | 35 |

$$\text{Power [W]} = \frac{4.187 * 1{,}000 * 10.1 + 0.55 * 473 * (-5.3)}{35} = \text{1,168.8 Watts}$$

### 7.4 Frequency measurements




**1) Magnetron type: 2M282 by TOSHIBA**

(1) Frequency vs Line Voltage Variation Test

Variation of line voltage from 80 % (96 V) to 125 % (150 V)
Load: 1,000 ml
Fundamental Frequency: 2,450 MHz
Limit: 2.4 GHz < f < 2.5 GHz

| | |
|---|---|
| Maximum Frequency Observed: | 2,472 MHz |
| Minimum Frequency Observed: | 2,469 MHz |
| **Result:** | **Pass** |

(2) Frequency vs Load Variation Test

*Frequency was measured at the rated input voltage (AC 120 V).*
Initial Load: 1,000 ml
Final Load: 200 ml
Fundamental Frequency: 2,450 MHz
Limit: 2.4 GHz < f < 2.5 GHz

| | |
|---|---|
| Maximum Frequency Observed: | 2,482 MHz |
| Minimum Frequency Observed: | 2,469 MHz |
| **Result:** | **Pass** |

**2) Magnetron type: 2M246 by LG**

(1) Frequency vs Line Voltage Variation Test

Variation of line voltage from 80 % (96 V) to 125 % (150 V)
Load: 1,000 ml
Fundamental Frequency: 2,450 MHz
Limit: 2.4 GHz < f < 2.5 GHz

| | |
|---|---|
| Maximum Frequency Observed: | 2,468 MHz |
| Minimum Frequency Observed: | 2,466 MHz |
| **Result:** | **Pass** |

(2) Frequency vs Load Variation Test

*Frequency was measured at the rated input voltage (AC 120 V).*
Initial Load: 1,000 ml
Final Load: 200 ml
Fundamental Frequency: 2,450 MHz
Limit: 2.4 GHz < f < 2.5 GHz

| | |
|---|---|
| Maximum Frequency Observed: | 2,470 MHz |
| Minimum Frequency Observed: | 2,454 MHz |
| **Result:** | **Pass** |

### 7.5 Power Density Safety Check

The power density was check to ensure that the power is not greater than 1.0 mW/㎠ at any location of the oven. The 1.0 mW/㎠ is in accordance with CDRH and UL923 standard.

***A microwave survey meter was placed on all sides, door and viewing, bottom, top and rear. No power greater than 0.12 mW/㎠ was observed and did not exceed the specified limits.***

**1) Magnetron type: 2M282 by TOSHIBA**

| | |
|---|---|
| Maximum Leakage Microwave Observed: | 0.04 ***mW/㎠*** |
| **Result:** | **Pass** |

**2) Magnetron type: 2M246 by LG**

| | |
|---|---|
| Maximum Leakage Microwave Observed: | 0.03 ***mW/㎠*** |
| **Result:** | **Pass** |

### 7.6 Conducted emissions (Section 18.307)

Conducted emission was measured at a frequency range 150 kHz to 30 MHz. The Power Line disturbance voltage was measured with the equipment under test (EUT) in a shielded room. The EUT was connected to a line impedance stabilization network (LISN) placed on the floor. The EUT was placed on a non-metallic table 0.4 m above the metallic, grounded floor. The distance to other metallic surfaces was at least 0.4 m.
The line conducted emission measurement procedure and test configuration is based on CISPR 11:1998 and Amendment 1:1999.
Amplitude measurements were performed with a quasi-peak detector and, if required, with an average detector.

Below data are the highest levels in Microwave mode.
An overview sweep performed with peak detector is included in the APPENDIX A (Test Plot).

**1) Magnetron type: 2M282 by TOSHIBA**

| | Quasi-Peak | | | Average | | | |
|---|---|---|---|---|---|---|---|
| Frequency [MHz] | Disturbance Level [dBuV] | Permitted Limit [dBuV] | Margin [dB] | Disturbance Level [dBuV] | Permitted Limit [dBuV] | Margin [dB] | Result |
| 0.150 | 53.2 | 66.0 | -12.8 | 22.0 | 56.0 | -34.0 | PASS |
| 13.990 | 40.3 | 60.0 | -19.7 | 39.4 | 50.0 | -10.6 | PASS |
| 15.980 | 33.8 | 60.0 | -26.2 | 31.5 | 50.0 | -18.5 | PASS |

Remark: 1. “<<” means that disturbance level is lower than 20 dB below the limit.

**2) Magnetron type: 2M246 by LG**

| | Quasi-Peak | | | Average | | | |
|---|---|---|---|---|---|---|---|
| Frequency [MHz] | Disturbance Level [dBuV] | Permitted Limit [dBuV] | Margin [dB] | Disturbance Level [dBuV] | Permitted Limit [dBuV] | Margin [dB] | Result |
| 0.150 | 32.5 | 66.0 | -33.5 | 8.3 | 56.0 | -47.7 | PASS |
| 0.420 | 41.0 | 57.4 | -16.4 | 11.6 | 47.4 | -35.8 | PASS |
| 13.980 | 31.2 | 60.0 | -28.8 | 30.6 | 50.0 | -19.4 | PASS |
| 15.980 | 35.7 | 60.0 | -24.3 | 32.2 | 50.0 | -17.8 | PASS |

Remark: 1. “<<” means that disturbance level is lower than 20 dB below the limit.

### 7.7 Radiated emissions (Section 18.305)

Radiated emission was measured at a frequency range 30 MHz to 26 GHz. The EUT was supported by a 1 m high wood table, measurement above 1 GHz and below 1 GHz.
Preliminary measurements were made inside an anechoic chamber at 3 m to determine to emission characteristics of EUT. The EUT is configured and operated in a manner, which produces the maximum emission in a typical configuration. Final measurements were made outdoor in control room at 3-meter test method.

**1) Magnetron type: 2M282 by TOSHIBA**

*Test distance: 3 m*

| Freq. [MHz] | Ant. Factor [dB] | Cable Loss [dB] | Load [ml] | Load Location | Meter Reading [dBuV] | Field Strength @ 3 m [dBuV/m] | Field Strength @ 3 m [uV/m] | Field Strength @ 300 m [uV/m] | FCC Limit @ 300 m [uV/m] | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| 2,382 | 28.8 | 3.8 | 700 | Center | 26.3 | 58.9 | 881.0 | 8.8 | 35.4 | PASS |
| 2,525 | 29.1 | 3.8 | 700 | Center | 20.8 | 53.7 | 484.2 | 4.8 | 35.4 | PASS |
| 4,939 | 33.7 | 6.1 | 700 | Center | 7.1 | 46.9 | 221.3 | 2.2 | 35.4 | PASS |
| 4,921 | 33.7 | 6.1 | 700 | Rt. Front | 26.9 | 66.7 | 2162.7 | 21.6 | 35.4 | PASS |
| 4,928 | 33.7 | 6.1 | 300 | Center | 21.8 | 61.6 | 1202.3 | 12.0 | 35.4 | PASS |
| 4,921 | 33.7 | 6.1 | 300 | Rt. Front | 13.2 | 53.0 | 446.7 | 4.5 | 35.4 | PASS |
| 7,303 | 36.6 | 7.5 | 700 | Center | 6.9 | 51.0 | 354.8 | 3.5 | 35.4 | PASS |
| 7,284 | 36.6 | 7.5 | 700 | Rt. Front | 11.1 | 55.2 | 575.4 | 5.8 | 35.4 | PASS |
| 7,293 | 36.6 | 7.5 | 300 | Center | 8.6 | 52.7 | 431.5 | 4.3 | 35.4 | PASS |
| 7,373 | 36.6 | 7.5 | 300 | Rt. Front | 24.4 | 68.5 | 2660.7 | 26.6 | 35.4 | PASS |
| 9,878 | 38.3 | 8.7 | 700 | Center | 7.3 | 54.3 | 518.8 | 5.2 | 35.4 | PASS |
| 17,036 | 43.8 | 15.2 | 700 | Center | -3.5 | 55.5 | 595.7 | 6.0 | 35.4 | PASS |

Other frequencies: No detected.
For measurement of 30 MHz – 1,000 MHz, refer to APPENDIX A (Test Plot).

**Result: Pass**

* Limit (at 300 m) = 25 * (RF Power/500) $^{1/2}$ [μV/m]
* Field Strength below 1,000 MHz (at 300 m) [μV/m] = 10 $^{[(\text{Field strength at 10m(dBuV/m)}-29.5)/20]}$
* Field Strength above 1,000 MHz (at 300 m) [μV/m] = K * 10 $^{[\text{Field strength at 3m(dBuV/m)}/20]}$

NOTES:

1. Two representative modes (full power and defrost) of operation were investigated.
2. A glass beaker was used as the container and the test was made with a shelf in its initial normal position.
3. Load for measurement of radiation on second and third harmonic: Two loads, one of 700 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.
4. Load for all other measurements: 700 ml of water, with the beaker located in the center of the oven
5. All other emissions are non-significant.
6. The tests were made with average detector for frequency range of 30 MHz to 26 GHz.

**2) Magnetron type: 2M246 by LG**

*Test distance: 3 m*

| Freq. [MHz] | Ant. Factor [dB] | Cable Loss [dB] | Load [ml] | Load Location | Meter Reading [dBuV] | Field Strength @ 3 m [dBuV/m] | Field Strength @ 3 m [uV/m] | Field Strength @ 300 m [uV/m] | FCC Limit @ 300 m [uV/m] | Result |
|---|---|---|---|---|---|---|---|---|---|---|
| 2,397 | 28.8 | 3.8 | 700 | Center | 26.5 | 59.1 | 901.6 | 9.0 | 34.5 | PASS |
| 2,699 | 29.1 | 3.8 | 700 | Center | 23.5 | 56.4 | 660.7 | 6.6 | 34.5 | PASS |
| 4,937 | 33.7 | 6.1 | 700 | Center | 20.2 | 60.0 | 1000.0 | 10.0 | 34.5 | PASS |
| 4,901 | 33.7 | 6.1 | 700 | Rt. Front | 10.2 | 50.0 | 316.2 | 3.2 | 34.5 | PASS |
| 4,909 | 33.7 | 6.1 | 300 | Center | 20.2 | 60.0 | 1000.0 | 10.0 | 34.5 | PASS |
| 4,889 | 33.7 | 6.1 | 300 | Rt. Front | 19.1 | 58.9 | 881.0 | 8.8 | 34.5 | PASS |
| 7,416 | 36.6 | 7.5 | 700 | Center | 12.1 | 56.2 | 645.7 | 6.5 | 34.5 | PASS |
| 7,358 | 36.6 | 7.5 | 700 | Rt. Front | 0.1 | 44.2 | 162.2 | 1.6 | 34.5 | PASS |
| 7,358 | 36.6 | 7.5 | 300 | Center | 10.7 | 54.8 | 549.5 | 5.5 | 34.5 | PASS |
| 7,334 | 36.6 | 7.5 | 300 | Rt. Front | 3.6 | 47.7 | 242.7 | 2.4 | 34.5 | PASS |
| 9,891 | 38.3 | 8.7 | 700 | Center | 8.0 | 55.0 | 562.3 | 5.6 | 34.5 | PASS |
| 14,120 | 40.2 | 14.5 | 700 | Center | -4.5 | 50.2 | 323.6 | 3.2 | 34.5 | PASS |
| 17,290 | 43.8 | 15.2 | 700 | Center | -4.0 | 55.0 | 562.3 | 5.6 | 34.5 | PASS |

Other frequencies: No detected.
For measurement of 30 MHz – 1,000 MHz, refer to APPENDIX A (Test Plot).

**Result: Pass**

* Limit (at 300 m) = 25 * (RF Power/500) $^{1/2}$ [μV/m]

* Field Strength below 1,000 MHz (at 300 m) [μV/m] = 10 $^{[(\text{Field strength at 10m(dBuV/m)}-29.5)/20]}$

* Field Strength above 1,000 MHz (at 300 m) [μV/m] = K * 10 $^{[\text{Field strength at 3m(dBuV/m)}/20]}$

NOTES:

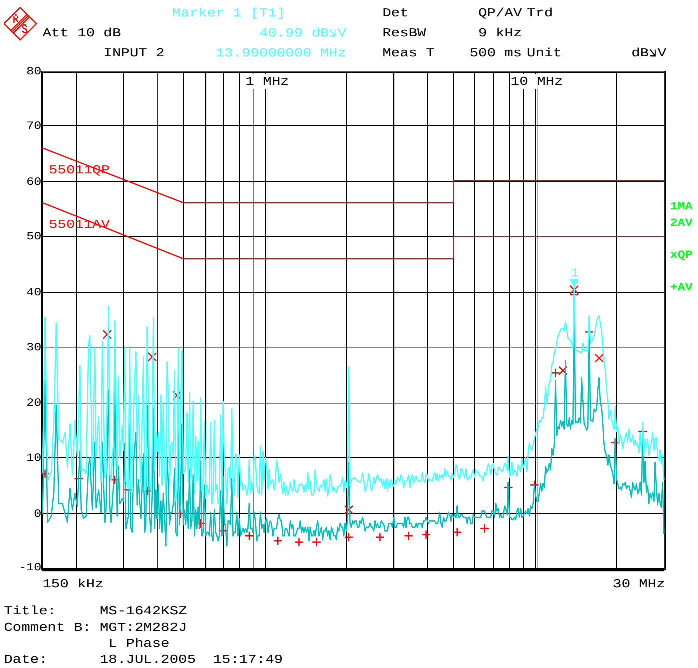
1. Two representative modes (full power and defrost) of operation were investigated.
2. A glass beaker was used as the container and the test was made with a shelf in its initial normal position.
3. Load for measurement of radiation on second and third harmonic: Two loads, one of 700 and the other of 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.
4. Load for all other measurements: 700 ml of water, with the beaker located in the center of the oven
5. All other emissions are non-significant.
6. The tests were made with average detector for frequency range of 30 MHz to 26 GHz.

# APPENDIX A. Test Plot

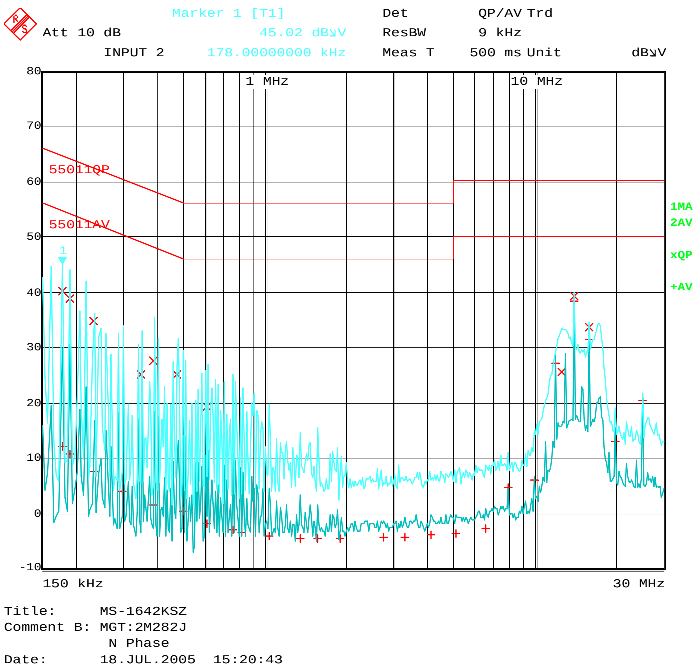
♦ **150 kHz ~ 30 MHz (Magnetron type: 2M282 by TOSHIBA)**

- Operating Mode: Maximum RF Power Output
- Detect Mode: Quasi-Peak(x)/Average(+), Scan Mode: Peak

**<Phase: L1>**



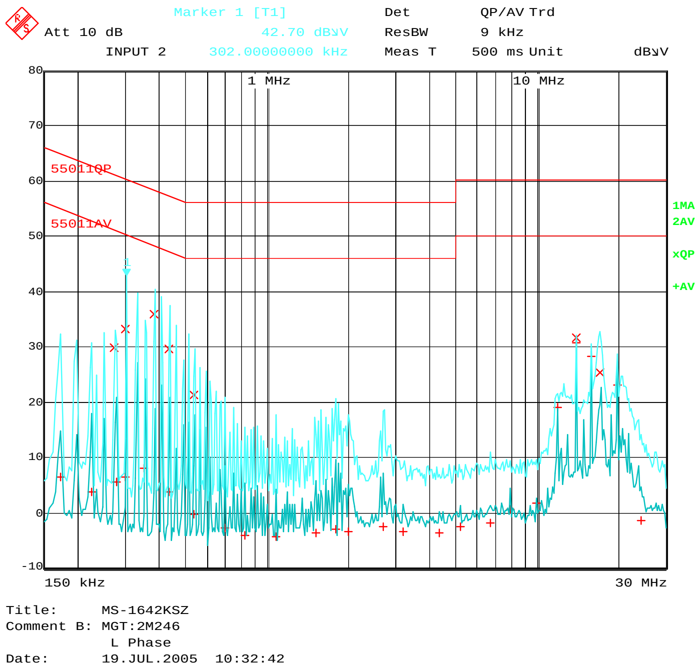

**<Phase: N>**



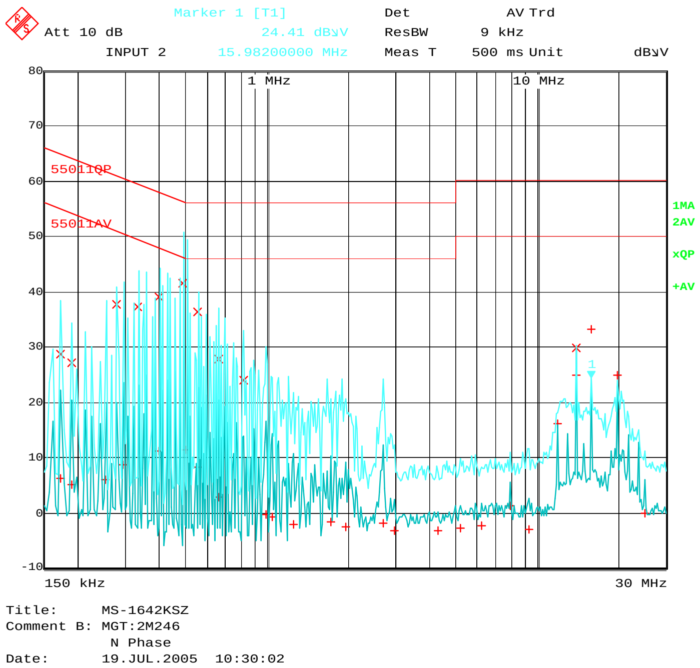
♦ **150 kHz ~ 30 MHz (Magnetron type: 2M246 by LG)**

- Operating Mode: Maximum RF Power Output
- Detect Mode: Quasi-Peak(x)/Average(+), Scan Mode: Peak

**<Phase: L1>**



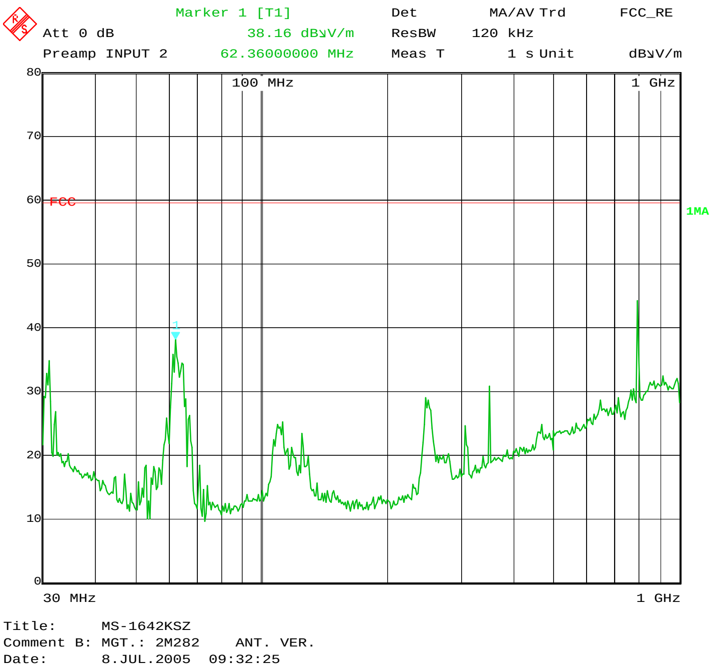

**<Phase: N>**



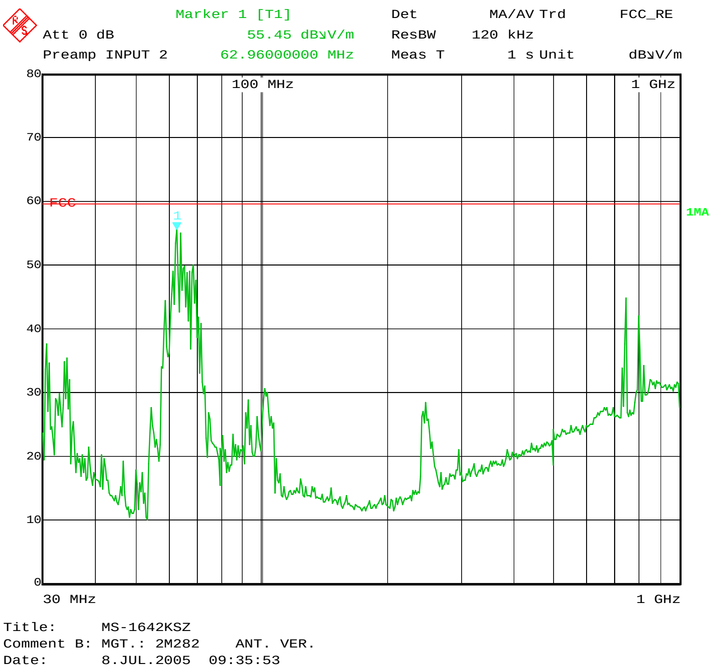
### ♦ 30 MHz ~ 1000 MHz (Magnetron type: 2M282 by TOSHIBA)

- Operating Mode: Maximum RF Power Output
- Detect Mode: Average,    Scan Mode: Peak
- Measurement Distance: 10 meters

**<Antenna Polarization: Horizontal>**



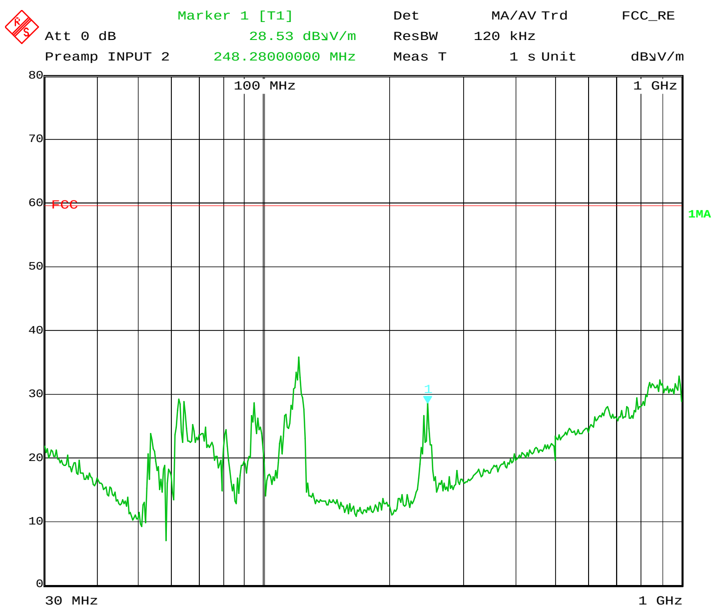

**<Antenna Polarization: Vertical>**



### ♦ 30 MHz ~ 1000 MHz (Magnetron type: 2M246 by LG)

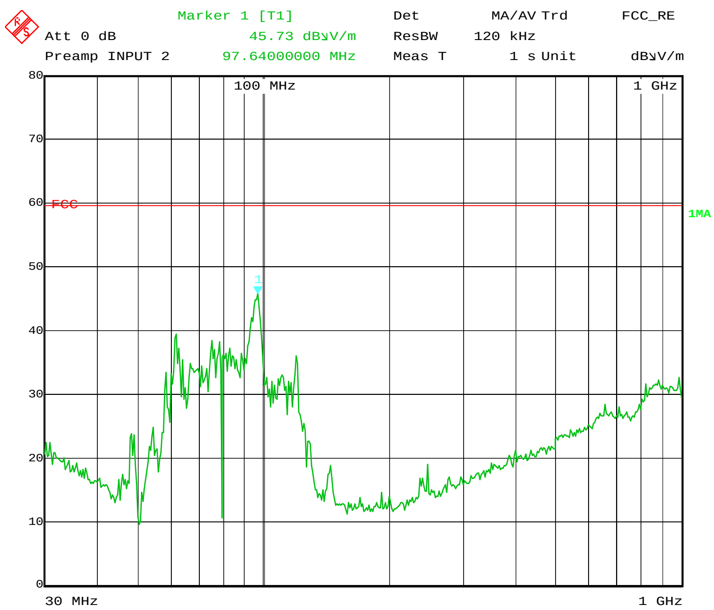
- Operating Mode: Maximum RF Power Output
- Detect Mode: Average,    Scan Mode: Peak
- Measurement Distance: 10 meters

**<Antenna Polarization: Horizontal>**




Title: MS-1642KSZ
Comment B: MGT.: 2M246 ANT. HOR.
Date: 8.JUL.2005 09:10:03

**<Antenna Polarization: Vertical>**

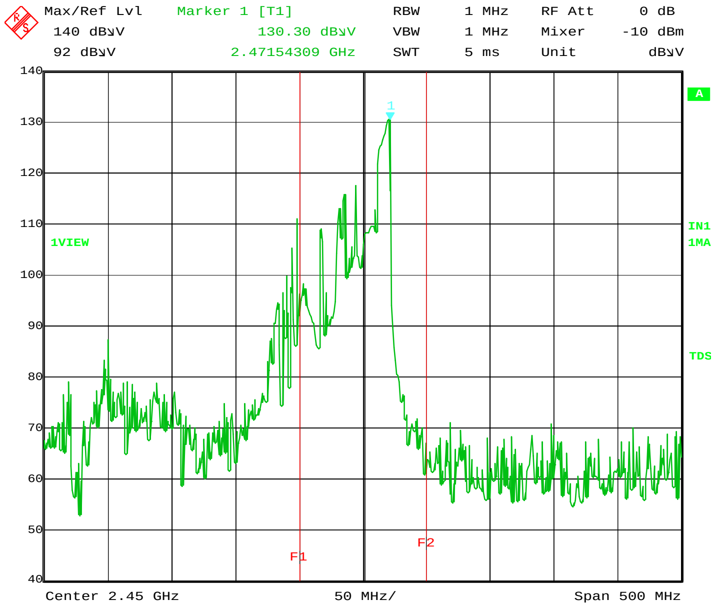



Title: MS-1642KSZ
Comment B: MGT.: 2M246 ANT. VER.
Date: 8.JUL.2005 09:07:05

## ♦ Voltage Variation (Magnetron type: 2M282 by TOSHIBA)

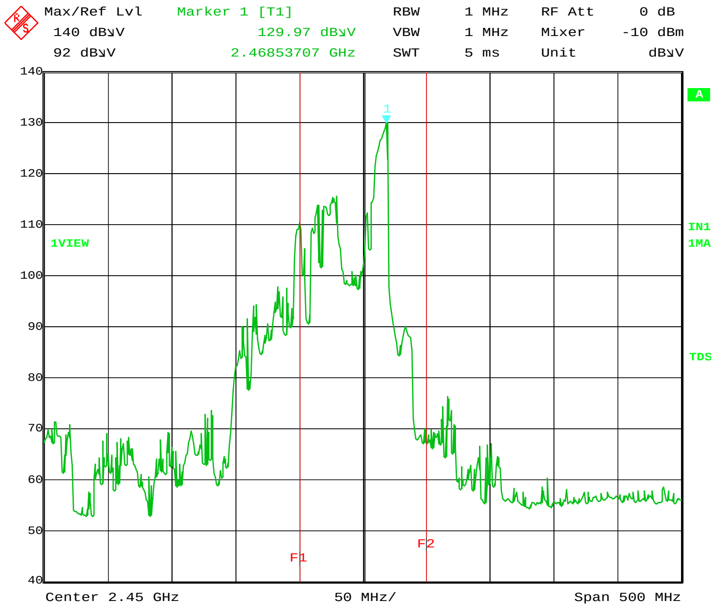
- Detect Mode: Average, Scan Mode: Peak

### <Maximum Frequency Observed: 2,472 MHz>




Title: MS-1642KSZ 2M282J
Comment A: Freq.150V
Date: 18.JUL.2005 13:46:56

### <Minimum Frequency Observed: 2,469 MHz>

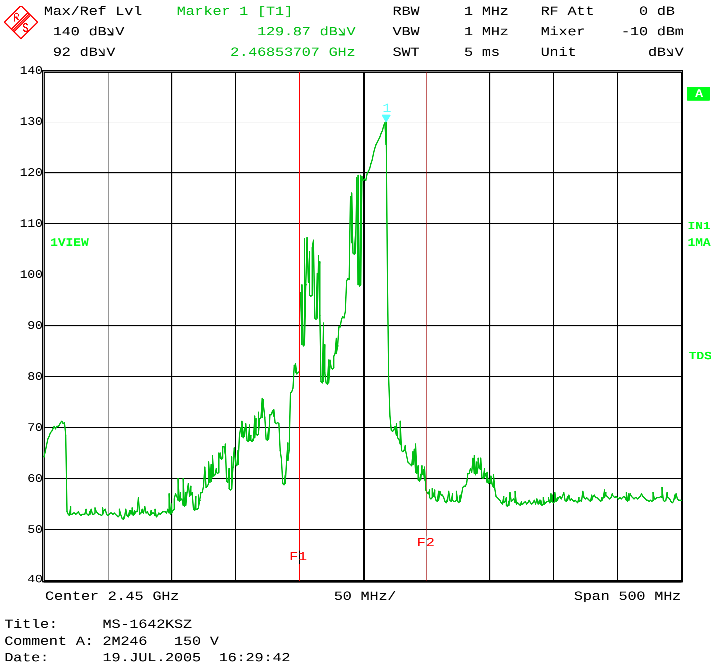



Title: MS-1642KSZ 2M282J
Comment A: Fund. Freq.1000ml
Date: 18.JUL.2005 13:27:30

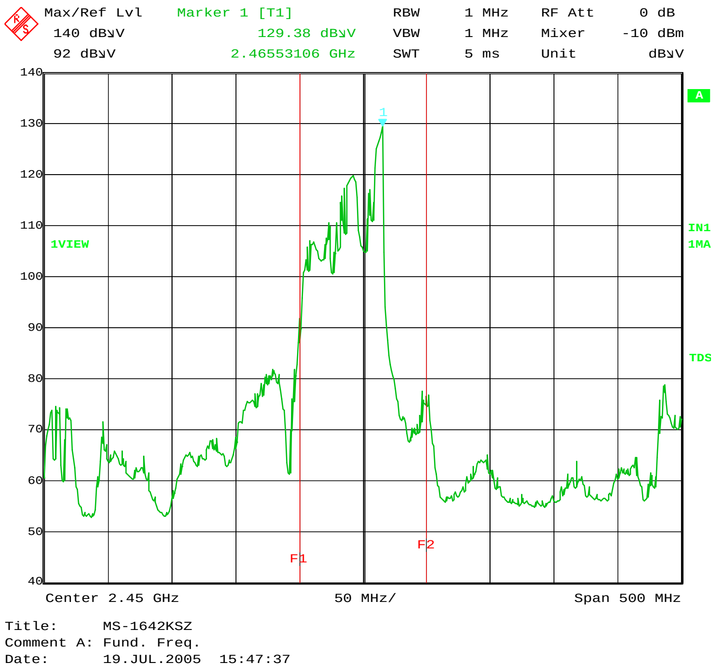
### ♦ Voltage Variation (Magnetron type: 2M246 by LG)

- Detect Mode: Average, Scan Mode: Peak

#### <Maximum Frequency Observed: 2,468 MHz>



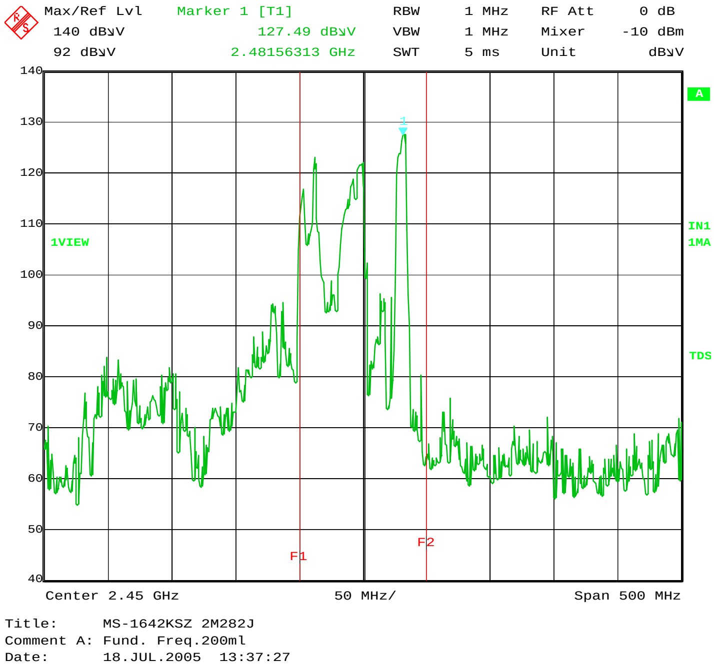

#### <Minimum Frequency Observed: 2,466 MHz>



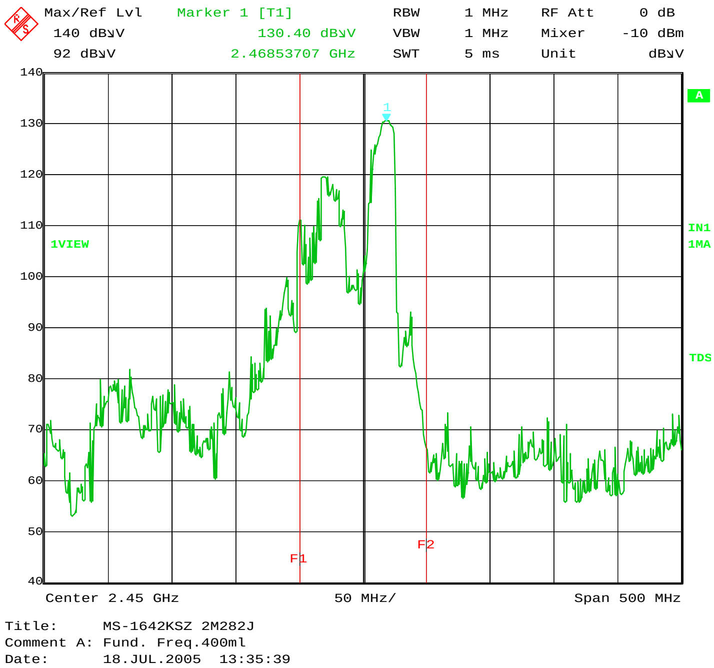
## ♦Load Variation (Magnetron type: 2M282 by TOSHIBA)

- Detect Mode: Average, Scan Mode: Peak

### <Maximum Frequency Observed: 2,482 MHz >



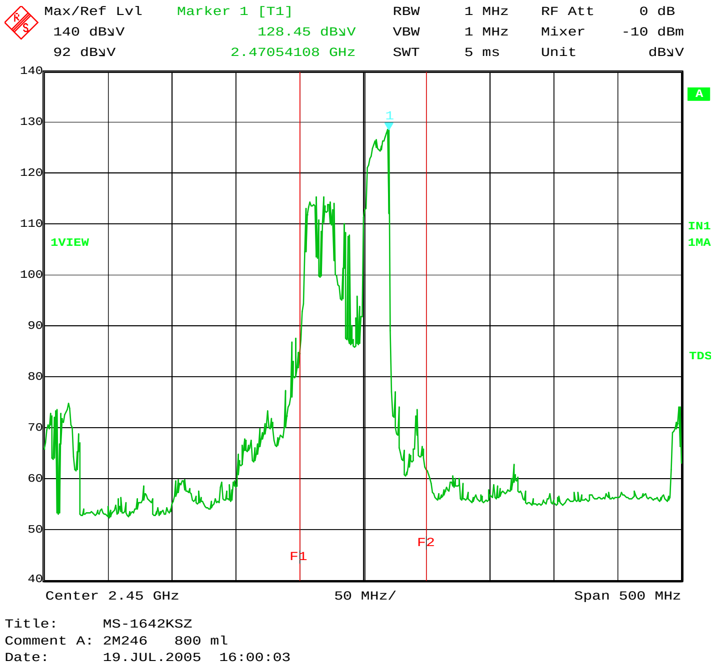

### < Minimum Frequency Observed: 2,469 MHz >



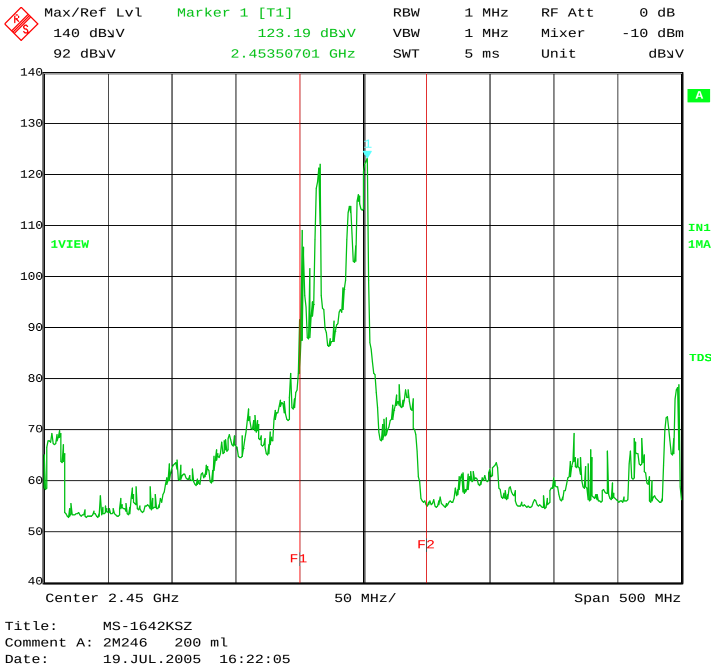
### ♦Load Variation (Magnetron type: 2M246 by LG)

- Detect Mode: Average, Scan Mode: Peak

**<Maximum Frequency Observed: 2,470 MHz >**




**< Minimum Frequency Observed: 2,454 MHz >**



# APPENDIX B. Labeling Requirements

Labeling requirements per Section 2.925 and 15.19.

The label shown shall be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time purchase.

**LG** **MICROWAVE OVEN (HOUSEHOLD)**

LISTE
D

MODEL NO. MS-1642KSZ
CATALOG NO.

INPUT 120V 13.8 A SINGLE PHASE
WITH GROUNDING 60Hz AC
OUTPUT FREQUENCY 2450MHz

COMPLIES WITH DHHS RADIATION PERFORMANCE
STANDARDS 21CFR SUBCHAPTER J.

MANUFACTURED: SERIAL NO:

DHHS CODE NO.: GC
FCC ID: BEJS174ZHA
MADE IN KOREA

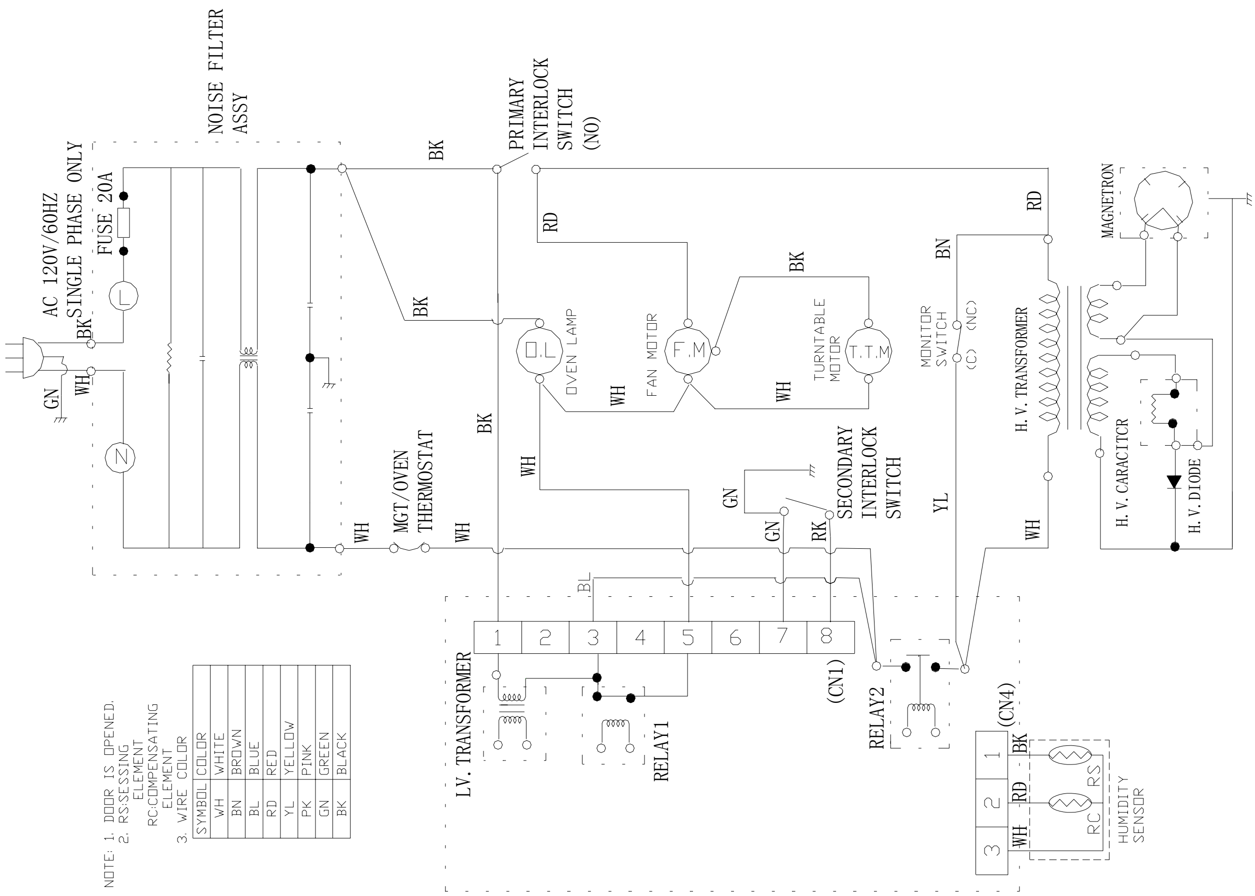
Distributed by LG Electronics USA

<Fig. 1. Sample Label of Nameplate>

* Alternate location:
The nameplate may be alternatively affixed on the left side of control panel or internal surface of oven cavity or rear surface of oven.

< Fig. 2. Photo of the physical location of the label>

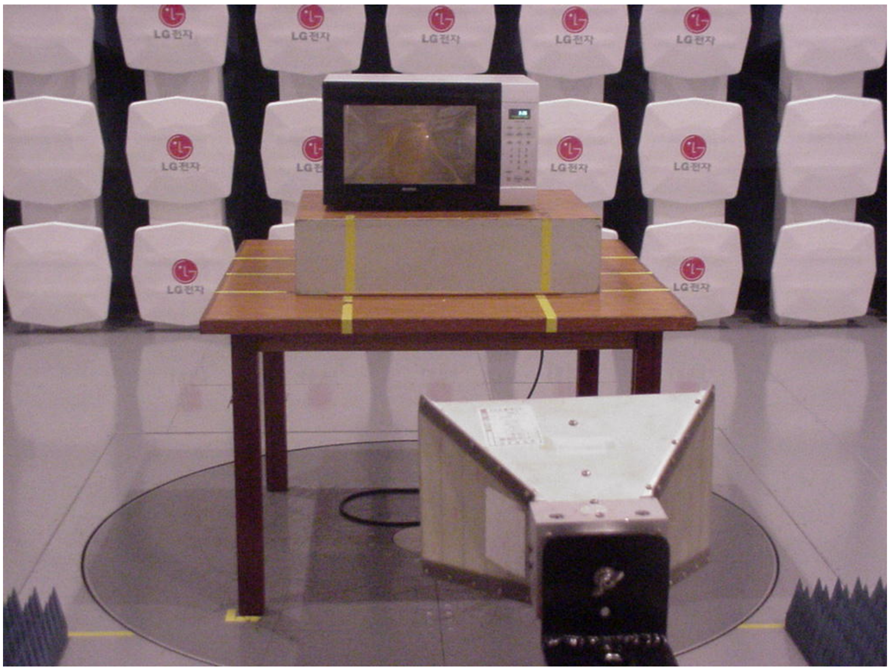
# APPENDIX C. Block Diagram / Schematics

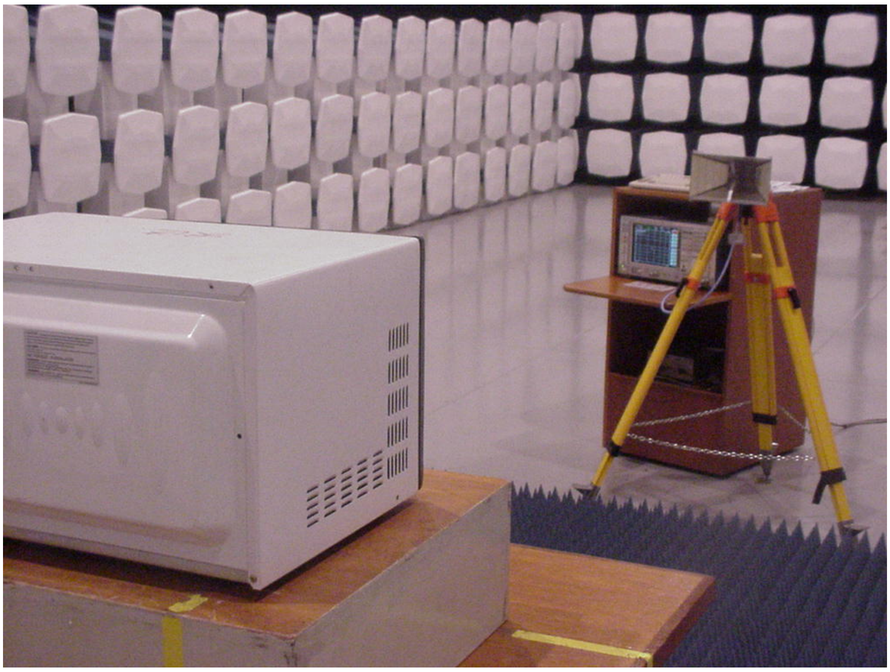


<Fig. 3. Schematic Diagram>

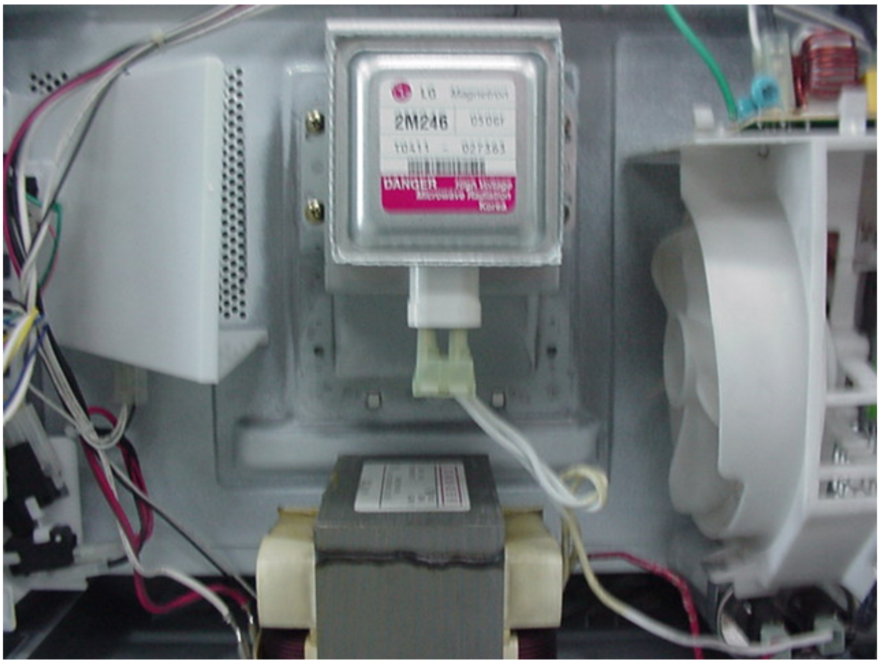
## APPENDIX D. Test Photos

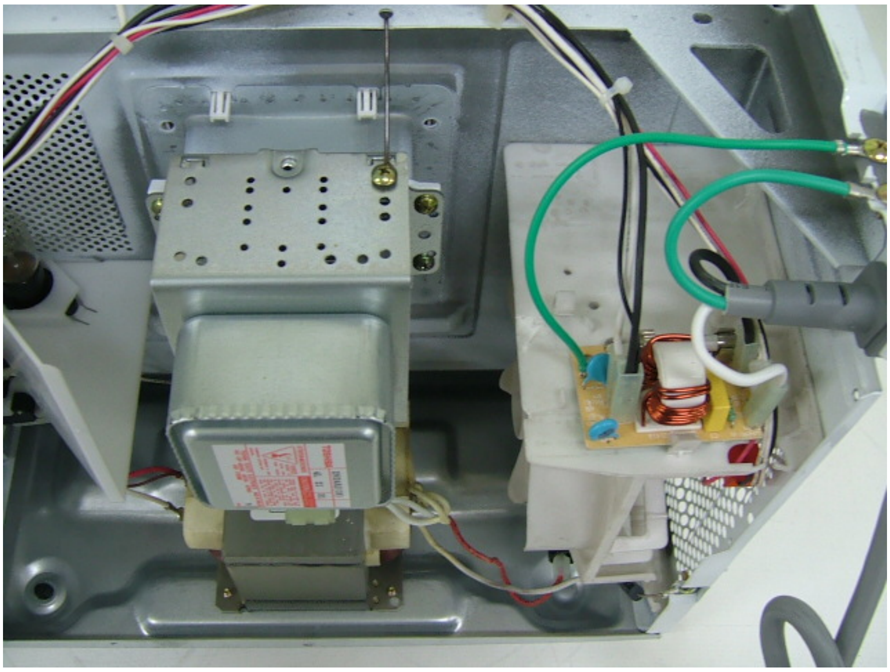
Test photos show the worst case configuration and cable placement with a minimum margin to the specifications.



# APPENDIX E. EUT Photos


2M246
DANGER




P1-2115
6870W1A115B
6871W1S115

# APPENDIX F. Owner's Manual with regard to FCC Instruction

## SAFETY

- **To avoid improperly cooking some foods.**
  - **Do not heat any types of baby bottles or baby food.** Uneven heating may occur and possibly cause personal injury.
  - **Do not heat small-necked containers,** such as syrup bottles.
  - **Do not deep-fat fry in your microwave oven.**
  - **Do not attempt home canning in your microwave oven.**
  - **Do not heat the following items in the microwave oven:** whole eggs in the shell, water with oil or fat, sealed containers, or closed glass jars. These items may explode.
- Do not cover or block any openings in the oven.
- Use your oven only for the operations described in this manual.
- Do not run the oven empty, without food in it.
- Do not let cord hang over edge of table or counter.
- **Preserve the oven floor:**
  - **Do not heat the oven floor excessively.**
  - **Do not** allow the gray film on special microwave-cooking packages to touch the oven floor. Put the package on a microwavable dish.
  - **Do not** cook anything directly on the oven floor or turntable. Use a microwavable dish.
  - Keep a browning dish at least 3/16 inch above floor. Carefully read and follow the instructions for the browning dish. If you use a browning dish incorrectly, you could damage the oven floor.
- Install or locate this appliance only in accordance with the provided installation instructions.
- This appliance should be serviced only by qualified service personnel. Contact the nearest authorized service facility for examination, repair, or adjustment.

## SAVE THESE INSTRUCTIONS

## FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT ( U.S.A. ONLY)

### ⚠ WARNING:

This equipment generates and uses ISM frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with limits for ISM Equipment pursuant to part 18 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following:

- Reorient the receiving antenna of the radio or television.
- Relocate the Microwave Oven with respect to the receiver.
- Move the microwave oven away from the receiver.
- Plug the microwave oven into a different outlet so that the microwave oven and the receiver are on different branch circuits.

**The manufacturer** is not responsible for any radio or TV interference caused by **unauthorized modification** to this microwave oven. It is the responsibility of the user to correct such interference.