# FCC PART 18
# EMI MEASUREMENT AND TEST REPORT

For

## Guangdong MD Microwave Oven Manufacturing Co., Ltd

Penglai Road, Beijiao, Shunde, Foshan, Guangdong Province, People's Republic of China

FCC ID: RSFEV1044P

March 25, 2005

| **This Report Concerns:** | **Equipment Type:** |
|---|---|
| ☒ Original Report | Microwave Oven |

| | |
|---|---|
| **Test Engineer:** | Sam Lin |
| **Report Number:** | RSZ05030357 |
| **Test Date:** | March 15-16, 2005 |
| **Reviewed By:** | Lisa Zhu |
| **Prepared By:** | Bay Area Compliance Lab Corp. (ShenZhen)<br>6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone, ShenZhen, GuangDong 518038, P.R.China<br>Tel: +86-755-33320018<br>Fax: +86-755-33320008 |

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# GENERAL INFORMATION

## Product Description for Equipment Under Test (EUT)

The *Guangdong MD Microwave Oven Manufacturing Co., Ltd*'s FCC ID: RSFEV1044P or the "EUT" as referred to in this report is a Microwave Oven which measures approximately 76.0 cmL x 38.0cmW x 42.5cmH, rated input voltage: AC 120 V/60 Hz.

* *The test data gathered are from production sample, serial number: 27080002, provided by the manufacturer.*

## Objective

The following test report is prepared on behalf of *Guangdong MD Microwave Oven Manufacturing Co., Ltd* in accordance with Part 2, Subpart J, and Part 18, Subparts A, B and C of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC Part 18 limits

## Related Submittal(s)/Grant(s)

No related submittal(s).

## Test Methodology

All measurements contained in this report were conducted with MP-5, FCC Methods of Measurements of Radio Noise Emissions from ISM Equipment, February 1986. All measurement was performed at Bay Area Compliance Laboratory Corporation. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Test Facility

The Test site used by Bay Area Compliance Lab Corp. (ShenZhen) to collect radiated and conducted emission measurement data is located in the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone, ShenZhen, Guangdong 518038, P.R.China.

Test site at Bay Area Compliance Lab Corp. (ShenZhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 04, 2004. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003 and FCC MP-5.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## External Cable List and Details

| Cable Description | Length (M) | From/Port | To |
|---|---|---|---|
| Unshielded Undetachable AC Line | 1.2 | EUT | AC Power |

# OPERATING CONDITION/TEST CONFIGURATION

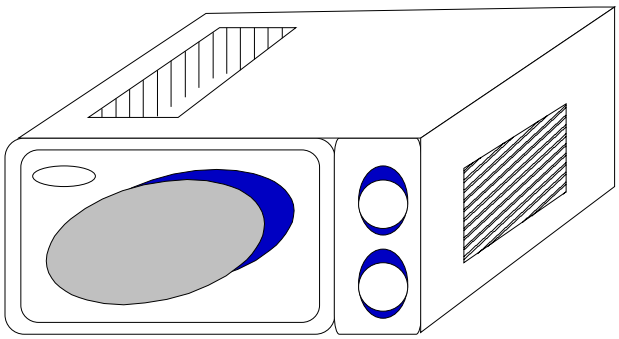
## Justification

The EUT was provided for tests as a stand-alone device. It was prepared for testing in accordance with the manufacturer's instructions. The EUT was operated at maximum (continuous) RF output power. The loads consisted of water in a glass beaker in the amounts specified in the test procedure.

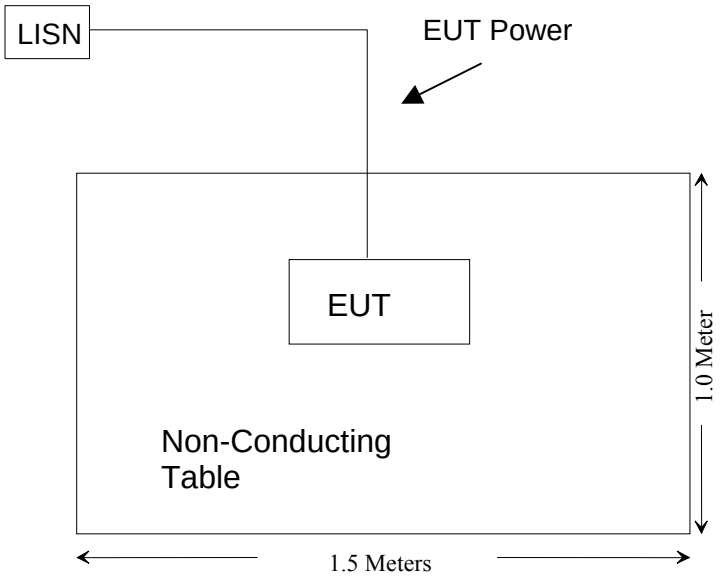
## Equipment Modifications

The EUT tested was not modified by BACL.

## Configuration of Test Setup



## Block Diagram of Test Setup



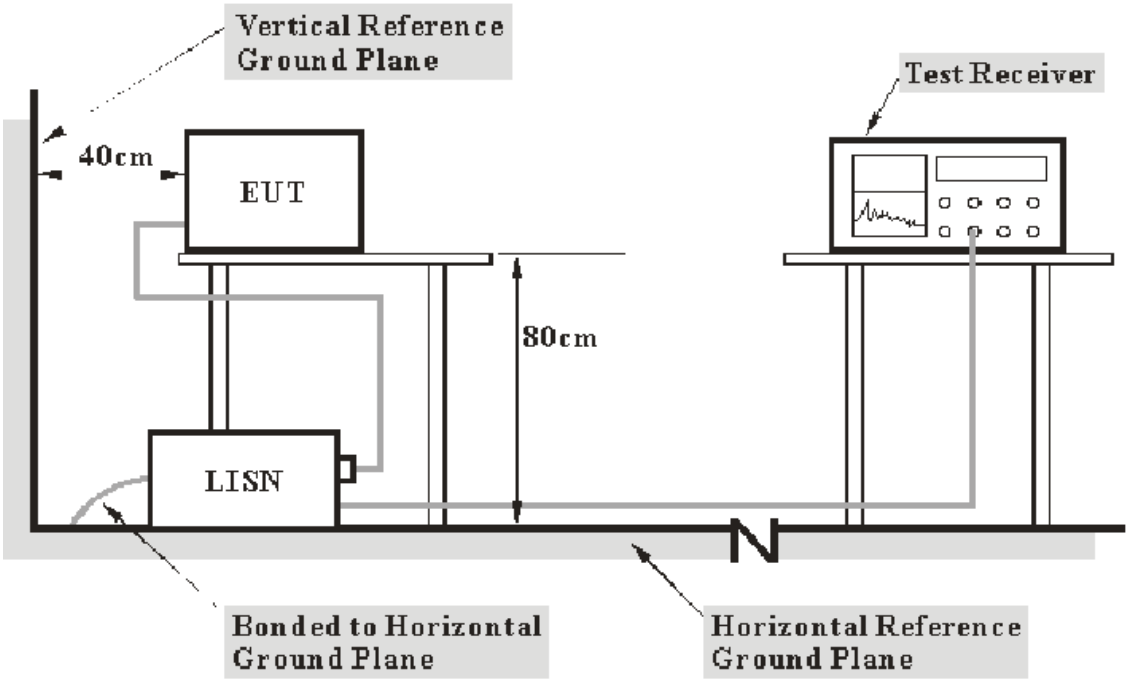
# CONDUCTED EMISSION

## Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

## EUT Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per MP-5: 1986 measurement procedure. Specification used was with the FCC Part 18.

The EUT was connected to a 120 VAC/ 60Hz power source.

## EMI Test Receiver Setup

The EMI Test Receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI Test Receiver was set with the following configurations:

| ***Frequency Range*** | ***IFBW*** |
|---|---|
| 150 kHz – 30 MHz | 9 kHz |

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| Com-Power | L.I.S.N. | LI-200 | 12005 | 2004-09-01 | 2005-08-31 |
| Com-Power | L.I.S.N. | LI-200 | 12008 | 2004-09-01 | 2005-08-31 |
| Rohde & Schwarz | Test Receiver | ESCS30 | 830245/006 | 2005-01-26 | 2006-01-26 |
| Rohde & Schwarz | L.I.S.N. | ESH2-Z5 | 892107/021 | 2005-02-28 | 2006-02-27 |
| Rohde & Schwarz | Pulse Limiter | ESH3Z2 | DE25985 | 2004-09-01 | 2005-08-31 |

***** Com-Power's LISN were used as the supporting equipment.
*** Statement of Traceability: BACL** attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

During the conducted emission test, the EUT power cord was connected to the outlet of the LISN.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 18, with the worst margin reading of:

**-2.90 dB** at **0.525 MHz** in the **Line** conductor mode.

## Test Data

### Environmental Conditions

| | |
|---|---|
| Temperature: | 21° C |
| Relative Humidity: | 57% |
| ATM Pressure: | 1082mbar |

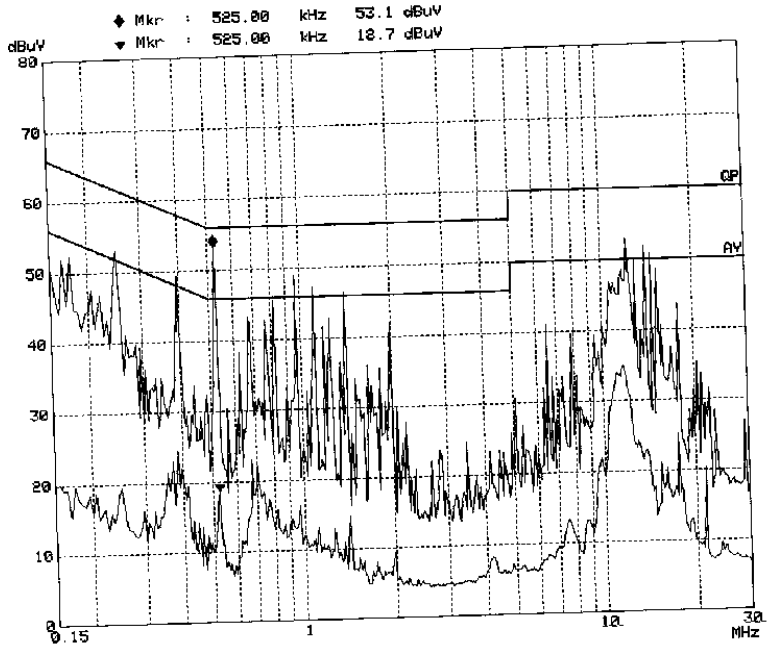
*Testing was performed by Sam Lin on 2005-03-15.*

| LINE CONDUCTED EMISSIONS | | | | FCC PART 18 | |
|---|---|---|---|---|---|
| Frequency MHz | Amplitude DBµV | Detector QP/AV | Phase Line/Neutral | Limit dBµV | Margin dB |
| 0.525 | 53.10 | QP | Line | 56.00 | -2.90 |
| 0.445 | 53.70 | QP | Neutral | 56.97 | -3.27 |
| 0.350 | 54.80 | QP | Neutral | 58.96 | -4.16 |
| 15.985 | 53.90 | QP | Neutral | 60.00 | -6.10 |
| 0.305 | 53.70 | QP | Neutral | 60.11 | -6.41 |
| 0.965 | 49.00 | QP | Line | 56.00 | -7.00 |
| 12.120 | 52.80 | QP | Line | 60.00 | -7.20 |
| 0.250 | 53.00 | QP | Line | 61.76 | -8.76 |
| 0.395 | 49.20 | QP | Line | 57.96 | -8.76 |
| 0.770 | 47.10 | QP | Neutral | 56.00 | -8.90 |
| 0.675 | 43.30 | QP | Line | 56.00 | -12.70 |
| 12.120 | 35.10 | AV | Line | 50.00 | -14.90 |
| 11.100 | 44.90 | QP | Neutral | 60.00 | -15.10 |
| 11.100 | 32.00 | AV | Neutral | 50.00 | -18.00 |
| 0.675 | 23.10 | AV | Line | 46.00 | -22.90 |
| 0.350 | 25.60 | AV | Neutral | 48.96 | -23.36 |
| 0.395 | 24.60 | AV | Line | 47.96 | -23.36 |
| 15.985 | 26.10 | AV | Neutral | 50.00 | -23.90 |
| 0.445 | 22.00 | AV | Neutral | 46.97 | -24.97 |
| 0.770 | 19.00 | AV | Neutral | 46.00 | -27.00 |
| 0.525 | 18.80 | AV | Line | 46.00 | -27.20 |
| 0.965 | 16.50 | AV | Line | 46.00 | -29.50 |
| 0.305 | 19.60 | AV | Neutral | 50.11 | -30.51 |
| 0.250 | 19.40 | AV | Line | 51.76 | -32.36 |

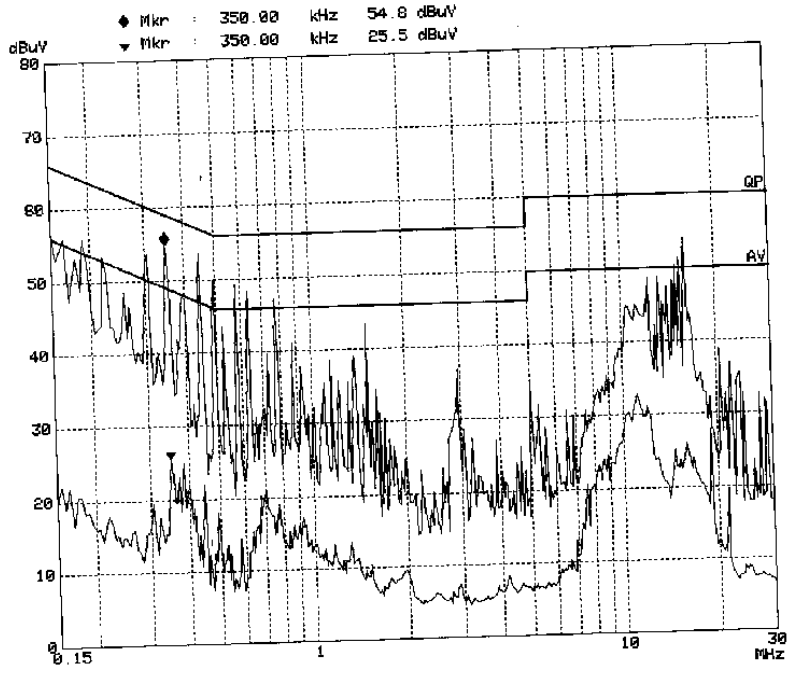
## Plot(s) of Test Data

Plot(s) of Test Data is presented hereinafter as reference.

Line:




Neutral:



# RADIATION HAZARD MEASUREMENT

## Environmental Conditions

| | |
|---|---|
| Temperature: | 22°C |
| Relative Humidity: | 68% |
| ATM Pressure: | 1082mbar |

## Radiation Hazard Measurement

Radiation leakage was measured in the as-received condition with the oven door closed using a microwave leakage meter.

A 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power.

☒ There was no microwave leakage exceeding a power level of 0.69mWfcm$^2$ observed at any point 5cm or more from the external surface of the oven.

A maximum of 1.0mW/cm$^2$ is allowed in accordance with the applicable Federal Standards. Hence, microwave leakage in the as-received condition with the oven door closed was below the maximum allowed.

## Input Power

Input power and current was measured using a power analyzer. A1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. A 1000ml water load was chosen for its compatibility with the procedure commonly used by manufacturers to determine their input ratings.

| Input Voltage (Vac/Hz) | Input Current (amps) | Measured Input Power (watts) | Rated Input Power (watts) |
|---|---|---|---|
| 120/60 | 12.3 | 1482 | 1600 |

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

## Load for Microwave Ovens

For all measurements, the energy developed by the oven was absorbed by a dummy load consisting of a quantity of tap water in a beaker. If the oven was provided with a shelf or other utensil support, this support was in its initial normal position. For ovens rated at 1000 watts or less power output, the beaker contained quantities of water as listed in the following subparagraphs. For ovens rated at more than 1000watts output, each quantity was increased by 50% for each 500watts or fraction thereof in excess of 1000watts. Additional beakers were used if necessary.

- Load for power output measurement: 1000 milliliters of water in the beaker located in the center of the oven.

- Load for frequency measurement: 1000 milliliters of water in the beaker located in the center of the oven.

- Load for measurement of radiation on second and third harmonic: Two loads, one of 700 and the other of 300 milliliters, of water are used. Each load is tested both with the beaker located in the center of the oven and with it in the right front corner.

**The RF output power is rated at 1000 watts**

Load used for power output measurement = 1000 milliliters of water
Load used for frequency measurement = 1000 milliliters of water
Load used for harmonic measurement = 700 & 300 milliliters of water
Load used for other measurement = 700 milliliters of water

## RF Output Power Measurement

The Caloric Method was used to determine maximum RF output power. The initial temperature of the water load was measured. The water load was placed in the center of the oven. The oven was operated at maximum output power for 100 seconds, the temperature of the water was re-measured.

| Quality of Water (ml) | Starting Temperature (°C) | Final Temperature (°C) | Elapsed Time (Seconds) |
|---|---|---|---|
| 1000 | 2.3 | 25.9 | 100 |

Power = (4.2 joules/calorie)(volume in milliliters)(temperature rise)/(time is seconds)

Power = 4.2 joules/calorie x 1000 x (25.9-2.3) / 100

Power = 991.2 watts

☐ The measurement output power was found to be less than 500watts. Therefore, in accordance with Section 18.305 of Subpart-C, the measured out-of-band emissions were compared to the limit of 25μV/meter at a 300-meter measurement distance.

☒ The measured output power was found to exceed 500watts. Therefore, in accordance with Section 18.305 of Subpart-C, the measured out-of-band emissions were compared with the limit calculated as following:

LFS = 25*SQRT (Power Output/500)

LFS = 25 * SQRT (991.2/500)

LFS ≈ 35.2

Where: LFS is the maximum allowable field strength for out-of-band emissions in μV/meter at a 300-meter measurement distance. Power Output is the measured output power in watts.

| Manufacturer | FCC ID | LFS | dB(μV/M) | dB(μV/M)®3m |
|---|---|---|---|---|
| Guangdong MD Microwave Oven Manufacturing Co., Ltd | RSFEV1044P | 35.2 | 30.9 | 70.9 |

## Operating Frequency Measurement

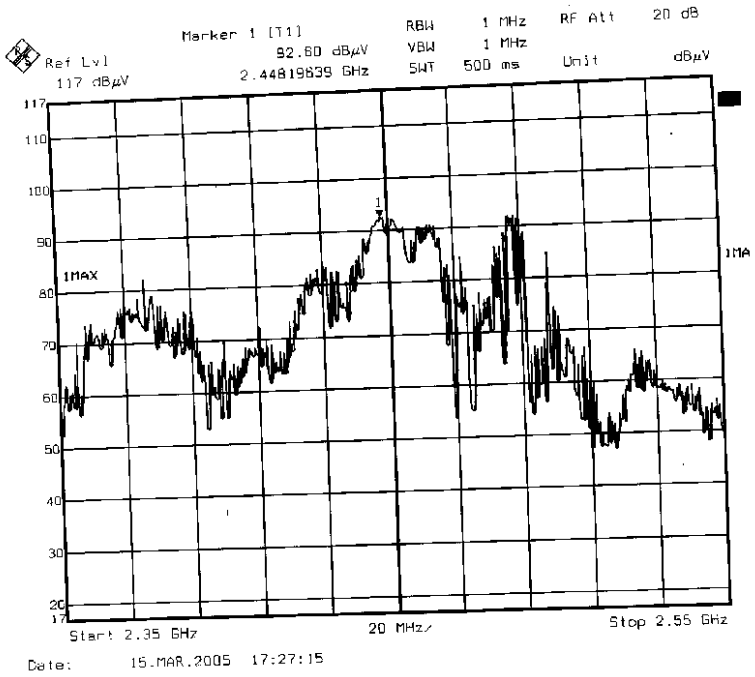
### Variation in Operating Frequency with Time

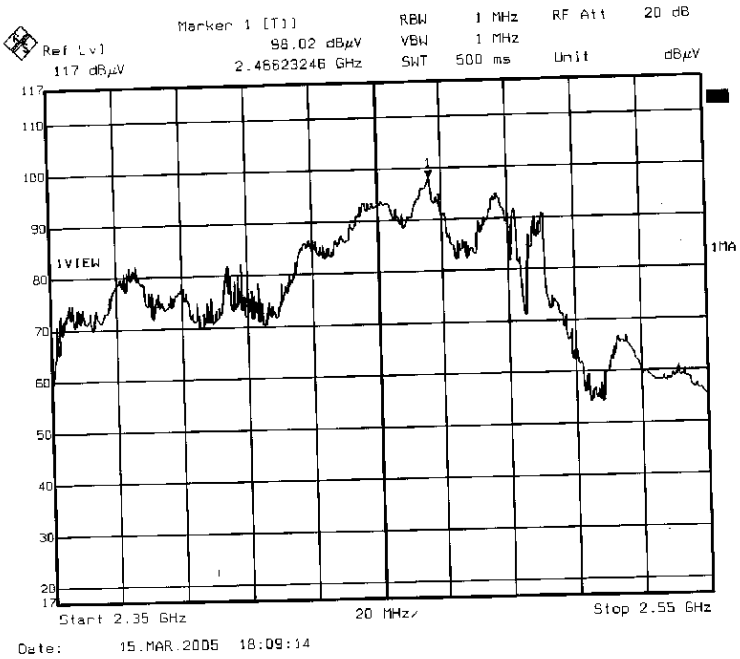
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to 20 percent of the original load.

The results of this test are as follows:

| Manufacturer | FCC ID | Minimum Frequency (MHz) | Maximum Frequency (MHz) |
|---|---|---|---|
| Guangdong MD Microwave Oven Manufacturing Co., Ltd | RSFEV1044P | 2448.19 | 2466.23 |

Refer to data pages for details of the variation in operating frequency with time measurement.


Marker 1 [T1]
92.60 dBµV
2.44819839 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 20 dB
Unit dBµV
Ref Lvl
117 dBµV
1MAX
1MA
Start 2.35 GHz
20 MHz/
Stop 2.55 GHz
Date: 15.MAR.2005 17:27:15


Marker 1 [T1]
98.02 dBµV
2.46623246 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 20 dB
Unit dBµV
Ref Lvl
117 dBµV
1VIEW
1MA
Start 2.35 GHz
20 MHz/
Stop 2.55 GHz
Date: 15.MAR.2005 18:09:14

**Variation in Operating Frequency with Line Voltage**

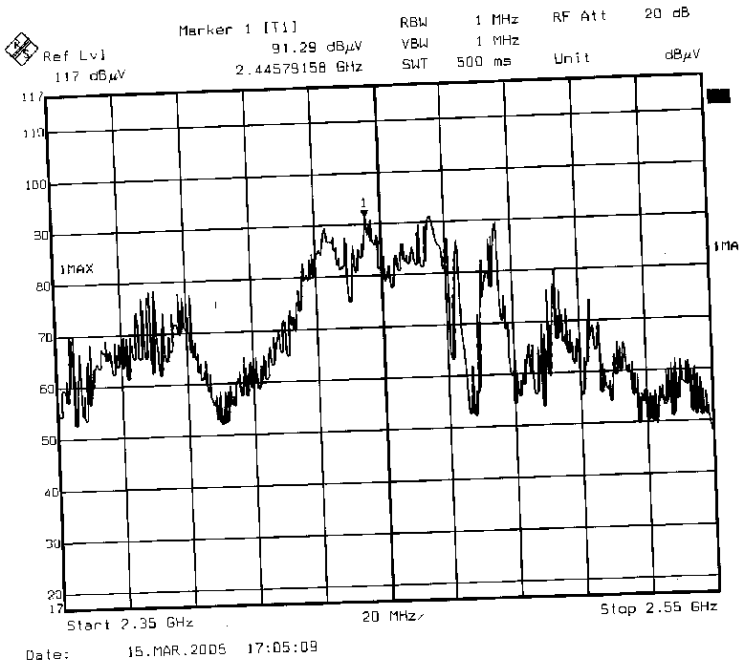
The EUT was operated / warmed by at least 10 minutes of use with a 1000ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

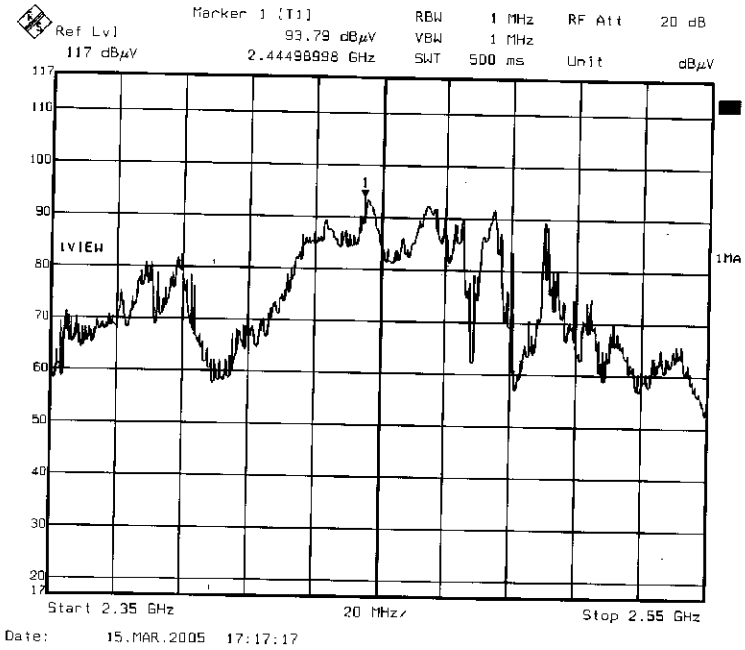
The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

| Manufacturer | FCC ID | Minimum Frequency (MHz) | Maximum Frequency (MHz) |
|---|---|---|---|
| Guangdong MD Microwave Oven Manufacturing Co., Ltd | RSFEV1044P | 2444.98 | 2445.79 |

Please refer to following pages for details of the variation in operating frequency with line voltage measurement.


Marker 1 [T1]
91.29 dBµV
2.44579158 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 20 dB
Unit dBµV
Ref Lvl
117 dBµV
1MAX
1MA
Start 2.35 GHz
20 MHz/
Stop 2.55 GHz
Date: 15.MAR.2005 17:05:09


Marker 1 [T1]
93.79 dBµV
2.44498998 GHz
RBW 1 MHz
VBW 1 MHz
SWT 500 ms
RF Att 20 dB
Unit dBµV
Ref Lvl
117 dBµV
1VIEW
1MA
Start 2.35 GHz
20 MHz/
Stop 2.55 GHz
Date: 15.MAR.2005 17:17:17

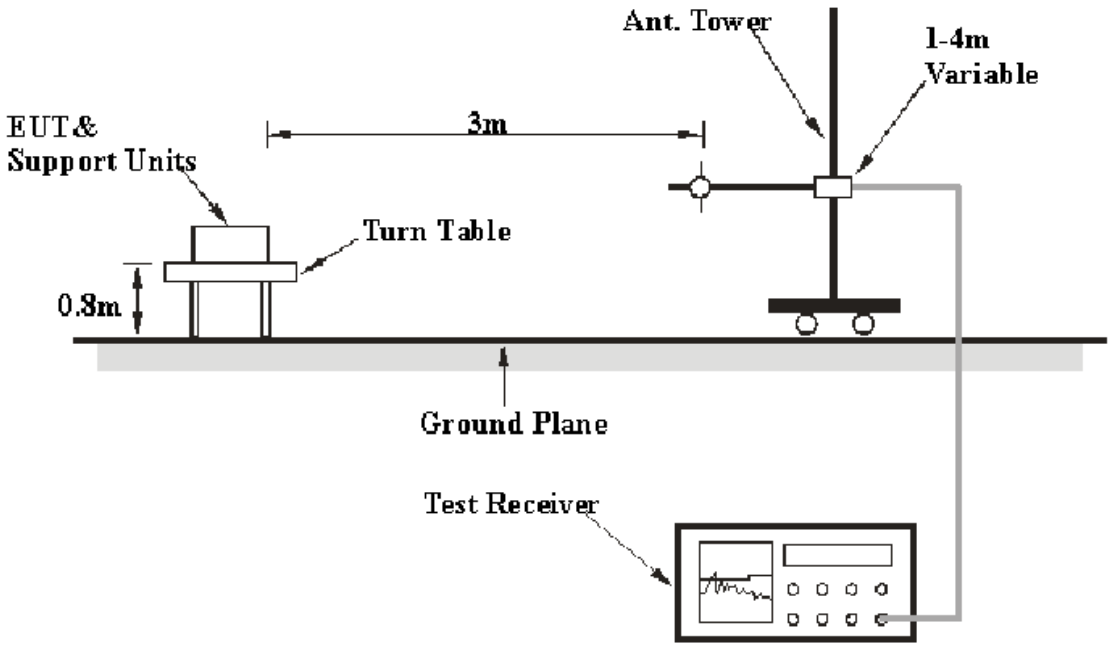
# RADIATED EMISSION DATA

## Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

## EUT Setup




The radiated emission tests were performed in the 3 meters chamber, using the setup accordance with the FCC MP - 5. The specification used was the FCC part 18 limits.

The EUT was connected to 120 VAC/60 Hz power source.

## EMI Test Receiver Setup

The system was investigated from 30 MHz to 24.5 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

| ***Frequency Range*** | ***RBW*** | ***Video B/W*** |
|---|---|---|
| 30 – 1000 MHz | 100 kHz | 100 kHz |
| Above 1000 MHz | 1 MHz | 1 MHz |

## Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| HP | Amplifier | 8447E | 1937A01046 | 2004-09-01 | 2005-08-31 |
| HP | Amplifier | 8449B | 3008A00277 | 2004-09-01 | 2005-08-31 |
| Rohde & Schwarz | Test Receiver | ESCI | 100035 | 2004-09-15 | 2005-09-14 |
| Sunol Sciences | Bilog Antenna | JB1 | A040904-1 | 2004-04-19 | 2005-04-18 |
| Sunol Sciences | Bilog Antenna | JB1 | A040904-2 | 2004-04-19 | 2005-04-18 |

*** Statement of Traceability: BACL** attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

For the radiated emissions test, the EUT power cord was connected to the AC floor outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure that the EUT complied with all installation combinations.

The EUT was in the normal (naïve) operating mode during the final qualification test to represent the worst results.

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1 GHz and average detection mode above 1 GHz

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit ,The equation for margin calculation is as follows:

Margin = Corr. Ampl. –Limit

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 18, with the worst margin reading of:

30MHz to 1000MHz: **-5.47 dB** at **939.86 MHz** in the **Vertical** polarization.

Above 1 GHz: **-8.0dB** at **4925.95 MHz** in the **Vertical** polarization.

# Test Data

## Environmental Conditions

| | |
|---|---|
| Temperature: | 22° C |
| Relative Humidity: | 68% |
| ATM Pressure: | 1082mbar |

*Testing was performed by Sam Lin on 2005-03-15.*

| INDICATED | | TABLE | ANTENNA | | CORRECTION FACTOR | | | CORRECTED AMPLITUDE | FCC PART 18 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Frequency MHz | Ampl. dBμV/m | Angle Degree | Height Meter | Polar H/ V | Antenna dB/m | Cable dB | Amp. dB | Corr. Ampl. dBμV/m | Limit dBμV/m | Margin dB |
| 30MHz to 1000MHz | | | | | | | | | | |
| 939.86 | 63.19 | 0 | 1.00 | V | 23.10 | 3.60 | 24.46 | 65.43 | 70.9 | -5.47 |
| 934.04 | 59.73 | 180 | 1.20 | H | 23.10 | 3.60 | 24.46 | 61.97 | 70.9 | -8.93 |
| 35.82 | 60.41 | 45 | 1.00 | H | 17.70 | 0.59 | 26.29 | 52.41 | 70.9 | -18.49 |
| 33.88 | 53.35 | 45 | 1.00 | V | 24.10 | 0.56 | 26.29 | 51.72 | 70.9 | -19.18 |
| 57.16 | 68.64 | 45 | 1.00 | V | 7.90 | 0.73 | 26.17 | 51.10 | 70.9 | -19.80 |
| 899.12 | 48.08 | 180 | 1.20 | H | 22.60 | 3.50 | 24.72 | 49.46 | 70.9 | -21.44 |
| 891.36 | 47.90 | 180 | 1.20 | V | 22.60 | 3.50 | 24.72 | 49.28 | 70.9 | -21.62 |
| 410.24 | 55.49 | 270 | 1.00 | V | 16.50 | 2.10 | 25.36 | 48.73 | 70.9 | -22.17 |
| 59.10 | 64.11 | 60 | 1.20 | H | 7.90 | 0.73 | 26.17 | 46.57 | 70.9 | -24.33 |
| 406.32 | 50.65 | 270 | 1.20 | H | 16.10 | 2.10 | 25.29 | 43.56 | 70.9 | -27.34 |
| 47.46 | 58.08 | 45 | 1.00 | H | 10.80 | 0.56 | 26.20 | 43.24 | 70.9 | -27.66 |
| 105.66 | 54.66 | 45 | 1.20 | H | 11.00 | 1.00 | 25.89 | 40.77 | 70.9 | -30.13 |
| 243.40 | 49.79 | 60 | 1.20 | V | 12.30 | 1.30 | 24.94 | 38.45 | 70.9 | -32.45 |
| 78.50 | 52.72 | 270 | 1.00 | H | 8.60 | 0.84 | 26.05 | 36.11 | 70.9 | -34.79 |
| 224.00 | 45.54 | 60 | 1.20 | H | 11.50 | 1.30 | 25.08 | 33.26 | 70.9 | -37.64 |
| Above 1 GHz | | | | | | | | | | |
| 2466.43 | 91.79 | 180 | 1.0 | V | 29.0 | 3.7 | 0 | 124.5 | | |
| 2444.89 | 95.68 | 45 | 1.0 | H | 29.0 | 3.7 | 0 | 128.4 | | |
| 4925.95 | 23.79 | 45 | 1.0 | V | 33.9 | 5.2 | 0 | 62.9 | 70.9 | -8.0 |
| 4926.75 | 24.44 | 60 | 1.0 | H | 33.9 | 5.2 | 0 | 63.5 | 70.9 | -7.4 |
| 7359.12 | 20.32 | 45 | 1.2 | V | 37.3 | 6.1 | 0 | 63.7 | 70.9 | -7.2 |
| 7342.08 | 23.18 | 180 | 1.2 | H | 37.3 | 6.1 | 0 | 66.6 | 70.9 | -4.3 |
| 2373.28 | 36.59 | 180 | 1.2 | H | 28.1 | 3.4 | 0 | 68.1 | 70.9 | -2.8 |
| 2521.10 | 35.41 | 270 | 1.0 | H | 29.0 | 3.7 | 0 | 68.1 | 70.9 | -2.8 |
| 9821.94 | 14.79 | 45 | 1.2 | V | 37.8 | 7.1 | 0 | 59.7 | 70.9 | -11.2 |
| 9807.71 | 15.60 | 60 | 1.0 | H | 37.8 | 7.1 | 0 | 60.5 | 70.9 | -10.4 |
| 2390.32 | 37.60 | 45 | 1.0 | V | 28.1 | 3.4 | 0 | 69.1 | 70.9 | -1.8 |
| 2534.72 | 36.56 | 180 | 1.2 | V | 29.0 | 3.7 | 0 | 69.3 | 70.9 | -1.6 |