

FCC PART 18 ID EMI MEASUREMENT AND TEST REPORT

For

Guangdong MD Microwave Oven Manufacturing Co., Ltd

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

FCC ID: RSFE8021TX-Y

May 20, 2004

This Report Concerns: ☒ Original Report	Equipment Type: Microwave Oven
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Note: The test report is specially limited to the use of the above client company and the product model. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
TEST FACILITY	3
EXTERNAL CABLE LIST AND DETAILS	3
OPERATING CONDITION/TEST CONFIGURATION.....	4
JUSTIFICATION	4
EQUIPMENT MODIFICATIONS	4
CONFIGURATION OF TEST SYSTEM	4
TEST SETUP BLOCK DIAGRAM.....	4
CONDUCTED EMISSION.....	5
MEASUREMENT UNCERTAINTY	5
EUT SETUP.....	5
SPECTRUM ANALYZER SETUP	6
TEST EQUIPMENT LIST AND DETAILS.....	6
TEST PROCEDURE	6
TEST DATA	7
TEST RESULT: PASS	7
PLOT(S) OF TEST DATA	7
RADIATION HAZARD MEASUREMENT	9
ENVIRONMENTAL CONDITIONS	9
RADIATION HAZARD MEASUREMENT	9
INPUT POWER.....	9
LOAD FOR MICROWAVE OVENS	10
RF OUTPUT POWER MEASUREMENT.....	11
OPERATING FREQUENCY MEASUREMENT	12
RADIATED EMISSION DATA.....	16
MEASUREMENT UNCERTAINTY	16
EUT SETUP.....	16
SPECTRUM ANALYZER SETUP	17
TEST EQUIPMENT LIST AND DETAILS.....	17
TEST PROCEDURE	17
CORRECTED AMPLITUDE & MARGIN CALCULATION	18
RADIATED EMISSIONS TEST DATA.....	18

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Guangdong MD Microwave Oven Manufacturing Co., Ltd*'s model: E8021TX-Y or the "EUT" as referred to in this report is a microwave oven which measures approximately 49.0cmL x 34.0cmW x 29.0cmH, rated input voltage: 120V/60Hz

* The test data gathered are from production sample, serial number: 040509, 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

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test sites has been listed with the FCC and approved by the VCCI 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 Power Cable	1.0	AC Mains	EUT

OPERATING CONDITION/TEST CONFIGURATION

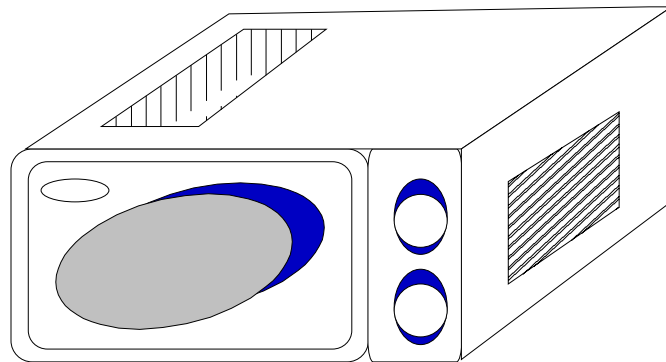
Justification

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.

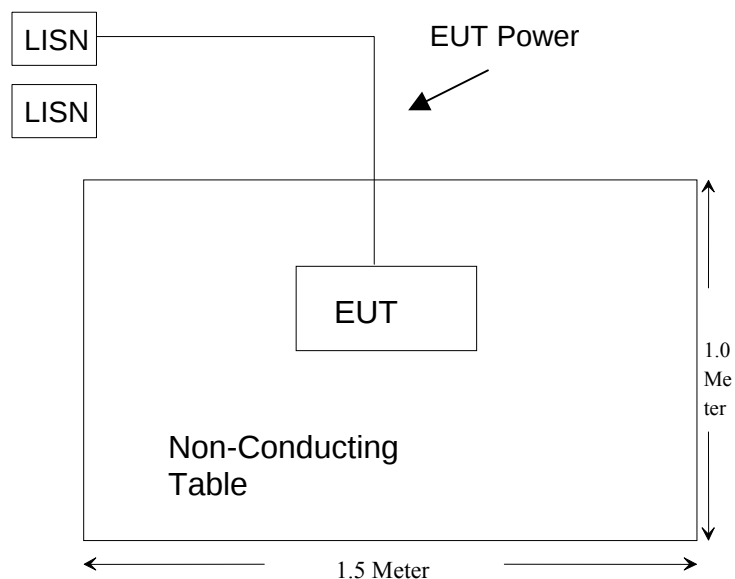
Equipment Modifications

The EUT tested was not modified by BACL.

Configuration of Test System



Test Setup Block Diagram



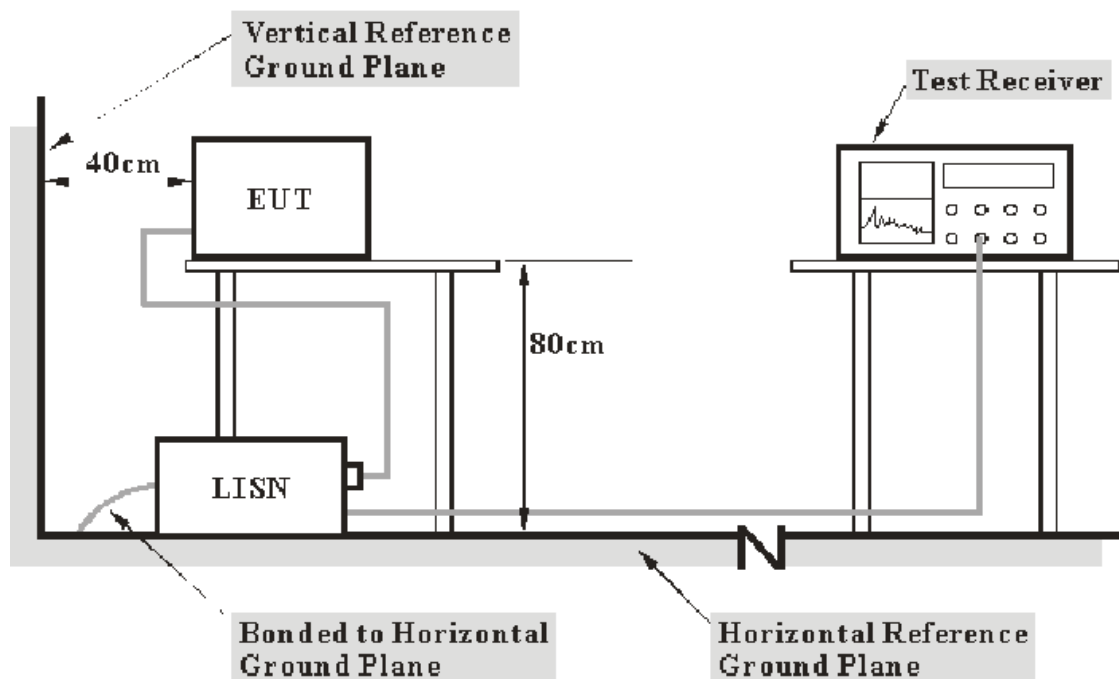
CONDUCTED EMISSION

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 Consumer Product limits.

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

Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 KHz to 30MHz.

During the conducted emission test, the spectrum analyzer was set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
150KHz – 30MHz	10KHz	10KHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMI TEST RECEIVER	Rohde&Schwarz	ESCS30	100038	2003-11-12	2004-11-11
ARTIFICIAL MAINS	Rohde&Schwarz	ESH2-Z5	100028	2003-11-12	2004-11-11

* **Statement of Traceability: BACL Corp.** attested 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 detection mode.

Test Data

Date of Test	:	May 19, 2004	Temperature	:	25°C
EUT	:	Microwave oven	Humidity	:	70%
M/N	:	E8021TX-Y	Operating Mode	:	Max power
S/N	:	040509	Test Engineer	:	Jandy Su

LINE CONDUCTED EMISSIONS				FCC PART 18	
Frequency MHz	Amplitude DB μ V	Detector QP/AV/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
0.82	52.5	QP	Neutral	56	-3.5
0.72	52.1	QP	Neutral	56	-3.9
0.86	50.8	QP	Line	56	-5.2
0.70	50.6	QP	Line	56	-5.4
0.57	48.2	QP	Line	56	-7.8
1.71	37.4	QP	Neutral	56	-18.6
0.72	23.7	AV	Neutral	46	-22.3
0.82	23.3	AV	Neutral	46	-22.7
0.86	22.8	AV	Line	46	-23.2
0.70	21.6	AV	Line	46	-24.4
0.57	20.9	AV	Line	46	-25.1
1.71	13.2	AV	Neutral	46	-32.8

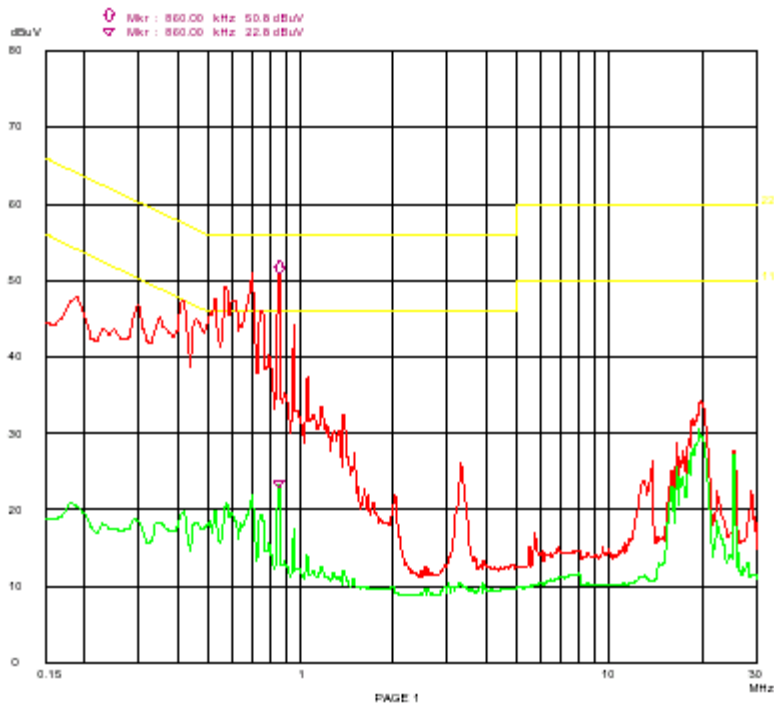
Test Result: Pass**Plot(s) of Test Data**

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

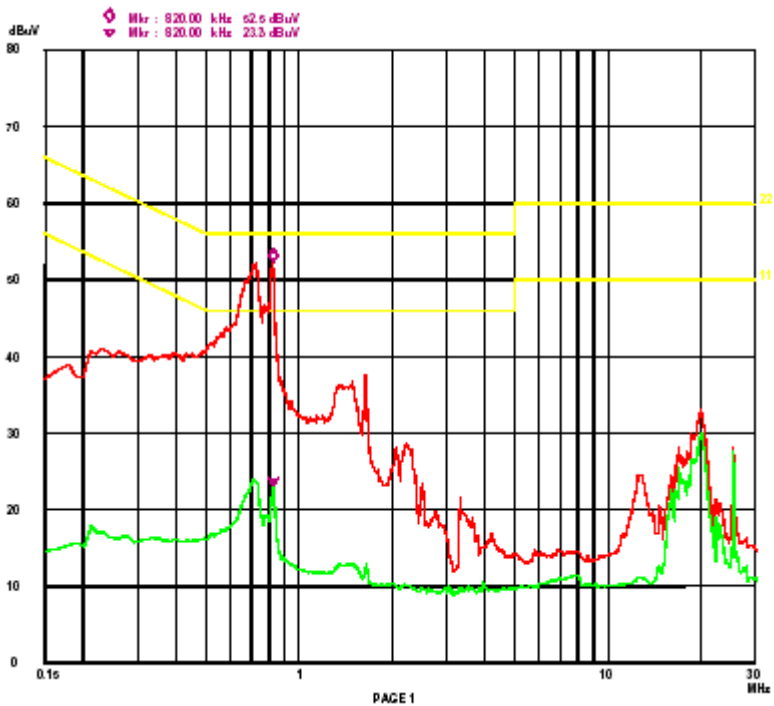
Note:

In the plots, the green curve detector mode is AV, the red curve detector mode is QP, we select six high points of red curve to measure QP and AV value, the QP and AV value please refer to section: test data

Line:



Neutral:



RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	25°C
Relative Humidity:	70%
ATM Pressure:	1175mbar

Radiation Hazard Measurement

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

A 2600ml 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 $0.69\text{mW}/\text{cm}^2$ observed at any point 5cm or more from the external surface of the oven.

A maximum of $1.0\text{mW}/\text{cm}^2$ 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. A 2600ml water load was placed in the center of the oven and the oven was operated at maximum output power. A 2600ml 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	9.81	1177	1300

☒ 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 800 watts

Load used for power output measurement = 1050 milliliters of water
Load used for frequency measurement = 1050 milliliters of water
Load used for harmonic measurement = 735 & 315 milliliters of water
Load used for other measurement = 735 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 200 seconds, the temperature of the water was re-measured.

Quality of Water (ml)	Starting Temperature (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
2600	23.2	37.63	200

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

Power = 4.2 joules/calorie x 2600 x (37.63-23.2) / 200

Power = 787.63 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:

$$LFS = 25 * \text{SQRT}(\text{Power Output}/500)$$

$$LFS = 25 * \text{SQRT } 787.63/500)$$

$$LFS \approx 31.38$$

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	Model Number	LFS	dB(µV/M)	dB(µV/M)@3m
Guangdong MD Microwave Oven Manufacturing Co., Ltd	E8021TX-Y	31.38	29.93	69.9

Operating Frequency Measurement

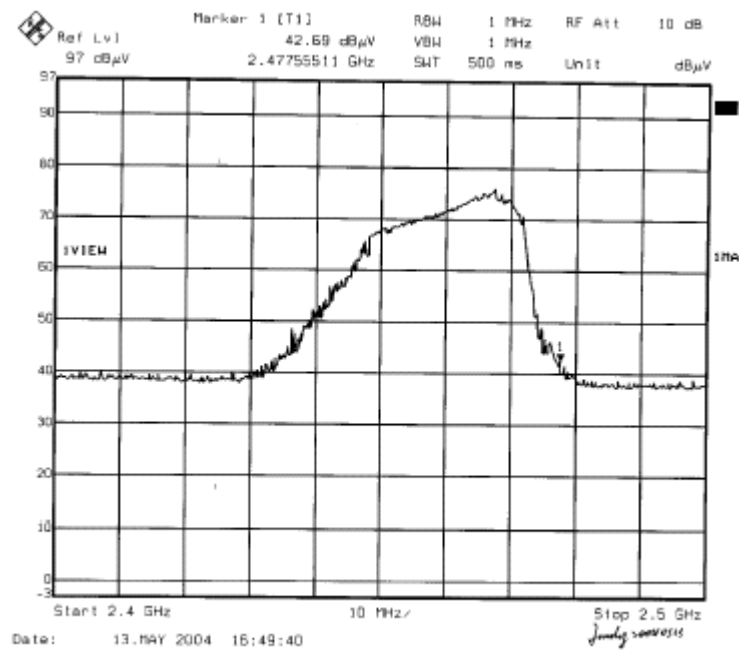
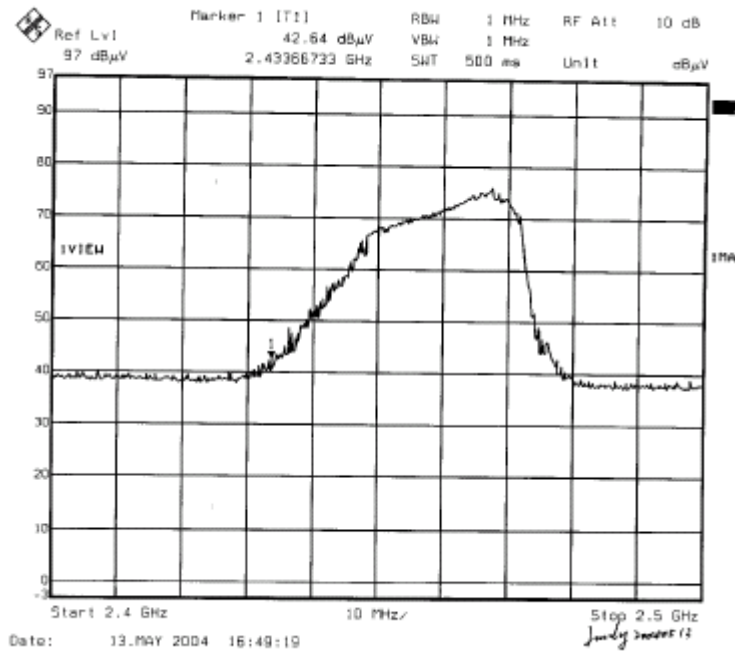
Variation in Operating Frequency with Time

The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 2600ml 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	Model	Minimum Frequency	Maximum Frequency
Guangdong MD Microwave Oven Manufacturing Co., Ltd	E8021TX-Y	2433.66MHz	2477.56MHz

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



Variation in Operating Frequency with Line Voltage

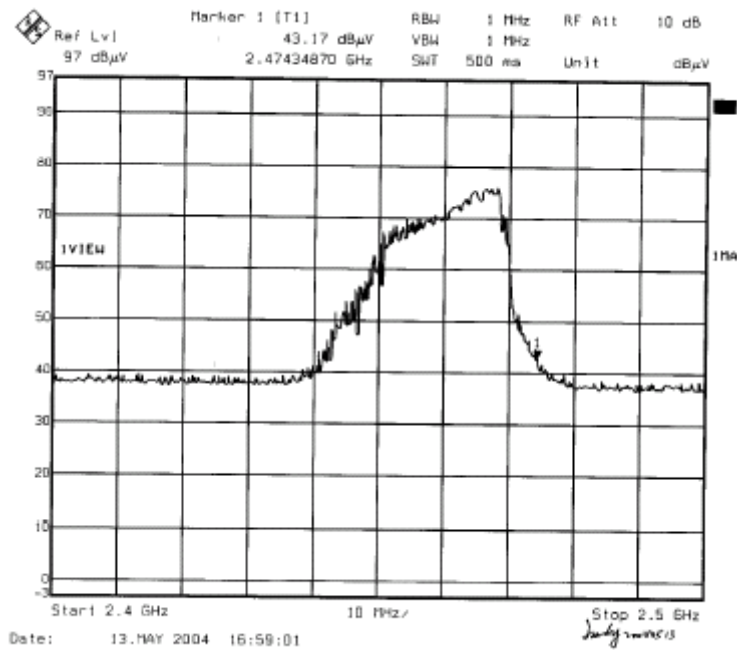
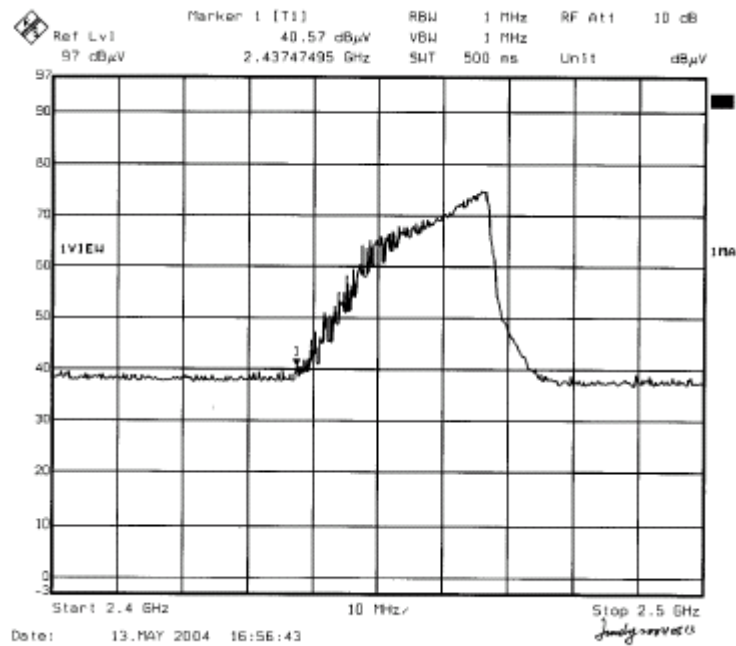
The EUT was operated / warmed by at least 10 minutes of use with a 2600ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Guangdong MD Microwave Oven Manufacturing Co., Ltd	E8021TX-Y	2437.47MHz	2474.35MHz

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



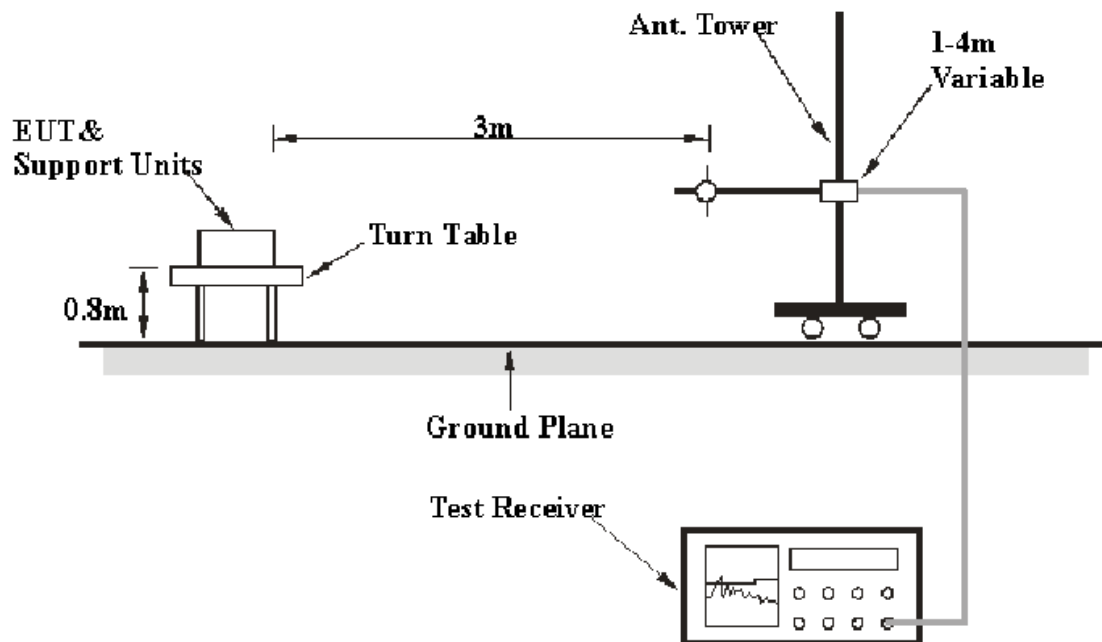
RADIATED EMISSION DATA

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 open area 3-meter test site, using the setup accordance with the FCC MP - 5. The specification used was the FCC part 18 Subpart C limits.

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

Spectrum Analyzer Setup

The system was investigated from 30MHz to 25GHz.

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

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
30 – 1000MHz	100KHz	100KHz
1-25GMHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
ETS	Log Periodic Antenna	3146	9603-4421	2003-8-5	2004-8-4
ETS	Biconical Antenna	3110B	3360	2003-8-5	2004-8-4
FLUKE	True RMS Multimeter	187	78540402	2004-3-23	2005-3-22
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2003-11-5	2004-11-4
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2003-11-5	2004-11-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 001	2003-8-5	2004-8-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 002	2003-8-5	2004-8-4

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

Test Procedure

For the radiated emissions test, the power cord of the EUT 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.

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

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

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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

Radiated Emissions Test Data

Date of Test	:	May 19, 2004	Temperature	:	25°C
EUT	:	Microwave oven	Humidity	:	70%
M/N	:	E8021TX-Y	Operating Mode	:	Max power
S/N	:	040509	Test Engineer	:	Jandy Su

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC PART 18	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/ V	dBμV/m	dB	dB	dBμV/m	dBμV/m	dB
2463.9	105.6	45	1.0	H	29.4	3.4	30	108.4		
2466.7	106.8	45	1.2	V	29.4	3.4	30	109.6		
4933.3	62.5	180	1.2	H	31.2	4.9	32.5	66.1	69.9	-3.8
4926.9	58.4	180	1.2	V	31.2	4.9	32.5	62.0	69.9	-7.9
7250.6	56.8	45	1.2	V	32.4	6.0	37.2	58.0	69.9	-11.9
7403	53.4	45	1.0	H	32.4	6.0	37.2	54.6	69.9	-15.3
9856.9	49.6	60	1.0	H	33.1	7.0	38.4	51.3	69.9	-18.6
9847.8	48	60	1.0	V	33.1	7.0	38.4	49.7	69.9	-20.2