

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: RSFE1028NX-Y

December 27, 2005

This Report Concerns: ☒ Class II permissive change	Equipment Type: Microwave cooking appliance
Test Engineer: Hansen Hu	<i>Hansen Hu</i>
Report Number: RSZ05091354	
Test Date: December 23-25, 2005	
Reviewed By: Chris Zeng	<i>Chris Zeng</i>
Prepared By:	Bay Area Compliance Lab Corp. (ShenZhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone, ShenZhen, Guangdong 518038, P.R.China Tel: +86-755-33320018 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 model: EG028ADK-P or the "EUT" as referred to in this report is a Microwave cooking appliance which measures approximately 52.0cmL x 43.5cmW x 31.5cmH, rated input voltage: AC 120 V/60 Hz.

The series products, model E(A)G028A##--P, the # should be 0-9 or A-Z stand for different Appearance, we select EG028ADK-P to test. The all model have same circuit diagram, PCB and magnetron.

* The test data gathered are from production sample, serial number: 0509109, provided by the manufacturer, we receive the EUT on 2005-9-13.

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.

This is the C2PC application of the device. The difference between the original device and the current one is as follows:

	Original Magnetron	New Magnetron
Manufacture:	Panasonic	WITOL
Type:	2M210	2M219J
	Original Transformer	New Transformer
Manufacture:	Welling	YunLu
Type:	MD-102AMR-1	MD-101AMR-1

For the changes made to the device, conducted, radiated, radiation hazard emission testing was performed.

Related Submittal(s)/Grant(s)

This is a C2PC application. The original application was granted on 2004-12-30.

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 test 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.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179 and Industrial Canada registration test site No.: 5500A. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Lab Corp. (ShenZhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2007070.htm>

External Cable List and Details

Cable Description	Length (M)	From/Port	To
Unshielded Undetachable AC Power Cable	1.0	EUT	AC Power

OPERATING CONDITION/TEST CONFIGURATION

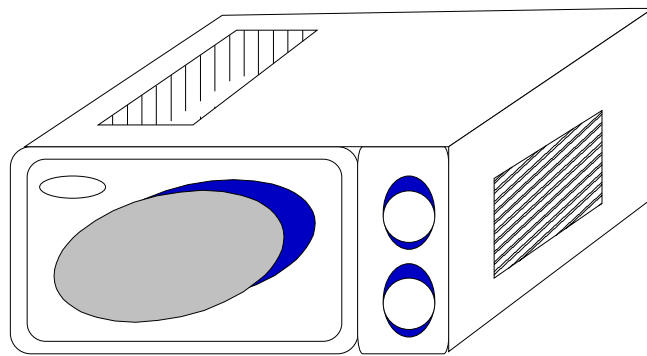
Justification

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.

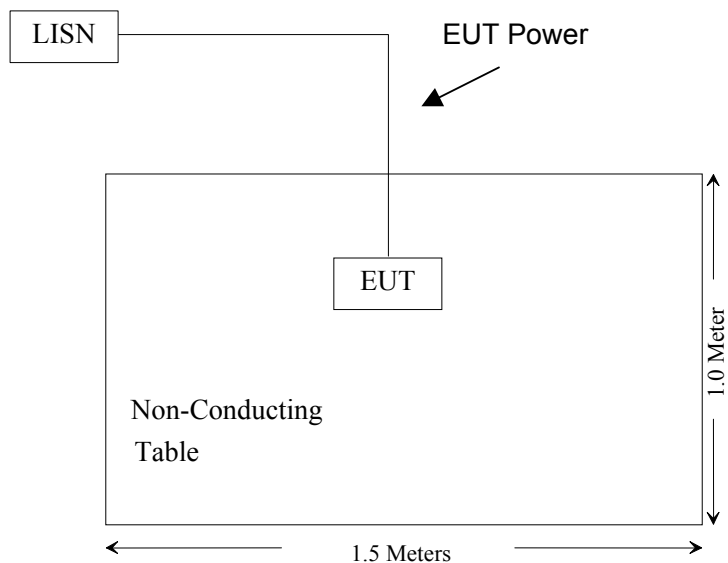
Equipment Modifications

Bay Area Compliance Lab Corp. (ShenZhen) has not done any modification on the EUT.

Configuration of Test Setup



Block Diagram of Test Setup



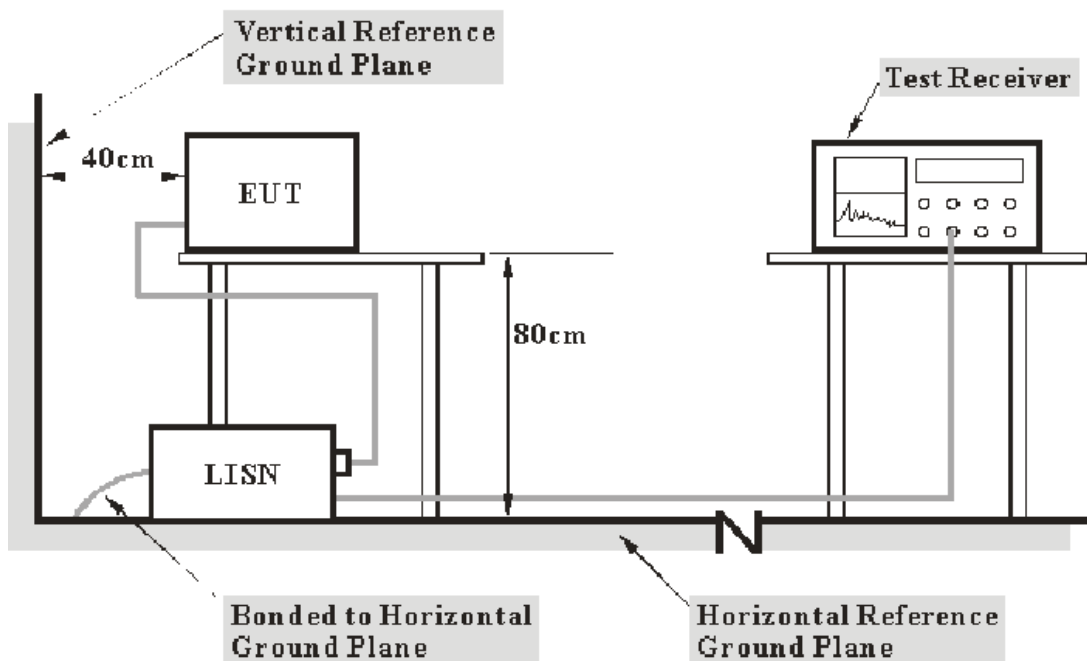
CONDUCTED EMISSION

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 Bay Area Compliance Lab Corp. (ShenZhen) 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:

<i>Frequency Range</i>	<i>IF B/W</i>
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	N/A	N/A
Com-Power	L.I.S.N.	LI-200	12008	N/A	N/A
Rohde & Schwarz	EMI Test Receiver	ESCS30	830245/006	2005-1-26	2006-1-26
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2005-2-28	2006-2-28

* Com-Power's LISN were used as the supporting equipment.

* **Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) 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:

-0.26 dB at 0.390 MHz in the Line conductor mode.

Test Data**Environmental Conditions**

Temperature:	25°C
Relative Humidity:	55%
ATM Pressure:	1002mbar

The testing was performed by Hansen Hu on 2005-12-23.

Test Mode: Max Power

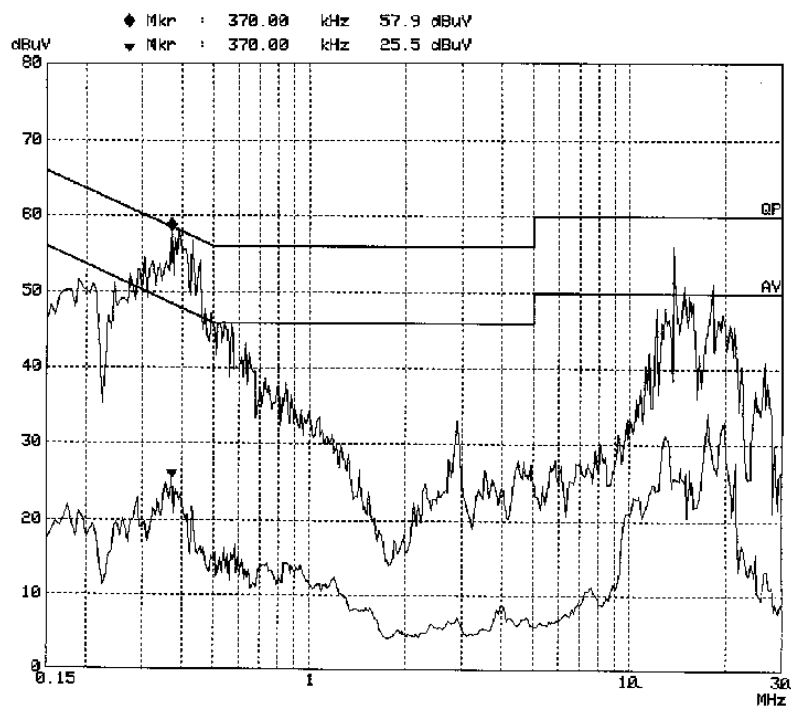
LINE CONDUCTED EMISSIONS				FCC PART 18	
Frequency MHz	Amplitude dBμV	Detector QP/AV	Phase Line/Neutral	Limit dBμV	Margin dB
0.390	57.8	QP	Line	58.06	-0.26 *
0.430	56.7	QP	Line	57.25	-0.55 *
0.370	57.9	QP	Line	58.50	-0.60 *
13.735	56.0	QP	Line	60.00	-4.00
18.215	51.1	QP	Line	60.00	-8.90
0.285	51.4	QP	Neutral	60.67	-9.27
0.220	53.1	QP	Neutral	62.82	-9.72
19.710	46.3	QP	Line	60.00	-13.70
19.710	33.1	AV	Line	50.00	-16.90
19.640	43.0	QP	Neutral	60.00	-17.00
0.445	39.5	QP	Neutral	56.97	-17.47
13.005	32.5	AV	Neutral	50.00	-17.50
17.665	32.3	AV	Neutral	50.00	-17.70
19.640	32.3	AV	Neutral	50.00	-17.70
13.005	41.5	QP	Neutral	60.00	-18.50
17.665	41.4	QP	Neutral	60.00	-18.60
18.215	27.8	AV	Line	50.00	-22.20
0.370	25.5	AV	Line	48.50	-23.00
13.735	25.7	AV	Line	50.00	-24.30
0.285	25.7	AV	Neutral	50.67	-24.97
0.390	22.6	AV	Line	48.06	-25.46
0.430	21.7	AV	Line	47.25	-25.55
0.220	25.7	AV	Neutral	52.82	-27.12
0.445	16.2	AV	Neutral	46.97	-30.77

* Within the measurement uncertainty.

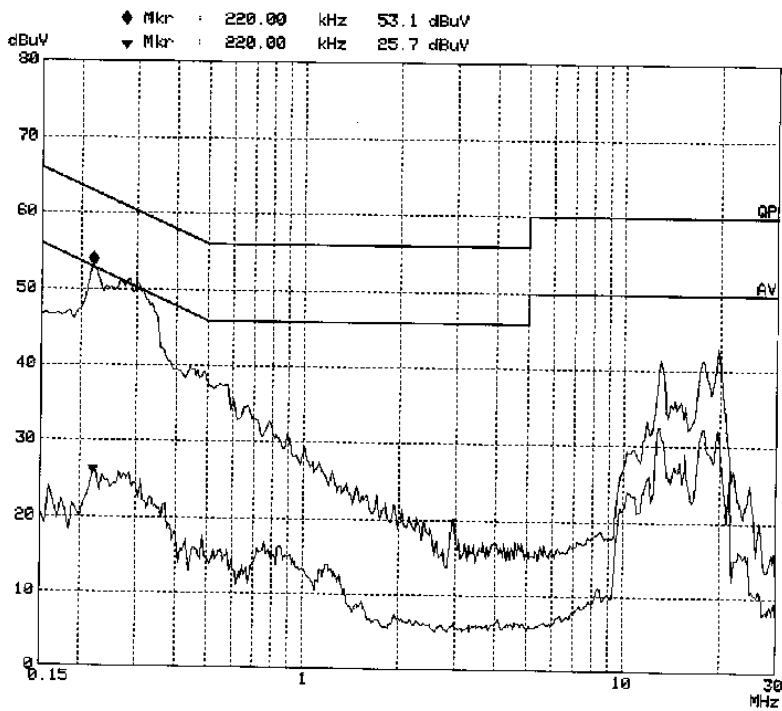
Plot(s) of Test Data

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

Line:



Neutral:



RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	26°C
Relative Humidity:	54%
ATM Pressure:	1000mbar

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2005-8-17	2006-8-17
Sunol Sciences	Horn Antenna	DRH-118	A052604	2005-7-20	2006-7-20
Ainuo	Digital Power Analyzer	8732B	028706117	2005-4-21	2006-4-21
Holday	Leakage Meter	HI-1710	05/2731	2005-6-2	2006-6-2

* **Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

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 0.78mW/cm² observed at any point 5cm or more from the external surface of the oven.

A maximum of 1.0mW/cm² 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 1000ml 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	14.28	1470	1500

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

Load for Microwave cooking appliances

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 1100 W

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 200 seconds, the temperature of the water was re-measured.

Quantity of Water (ml)	Starting Temperature (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
1000	25	74	200

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

Power = 4.2 joules/calorie x 1000 x (74-25) / 200

Power = 1029 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:

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

$$\text{LFS} = 25 * \text{SQRT}(1029/500)$$

$$\text{LFS} \approx 35.86$$

Where: LFS is the maximum allowable field strength for out-of-band emissions in $\mu\text{V}/\text{meter}$ at a 300-meter measurement distance. Power Output is the measured output power in watts.

Manufacturer	Model Number	LFS	dB $\mu\text{V}/\text{M}$	dB $\mu\text{V}/\text{M}@3\text{m}$
Guangdong MD Microwave Oven Manufacturing Co., Ltd	EG028ADK-P	35.86	31.09	71.09

Operating Frequency Measurement

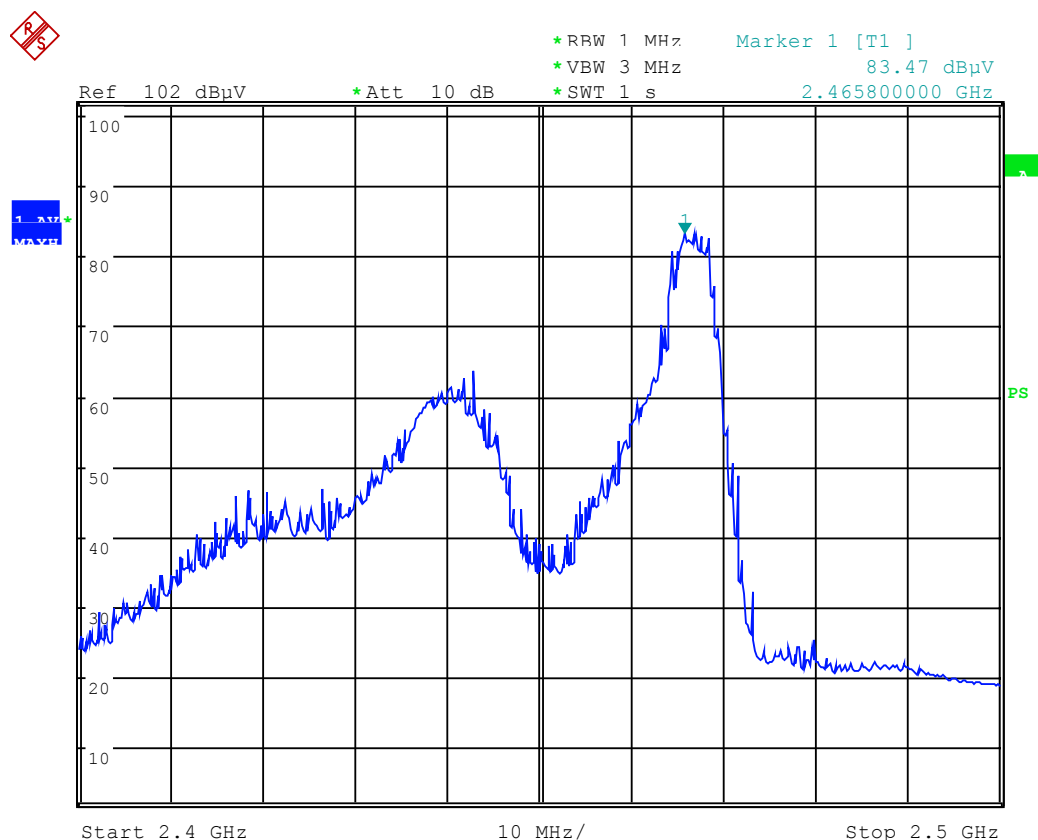
Variation in Operating Frequency with Time

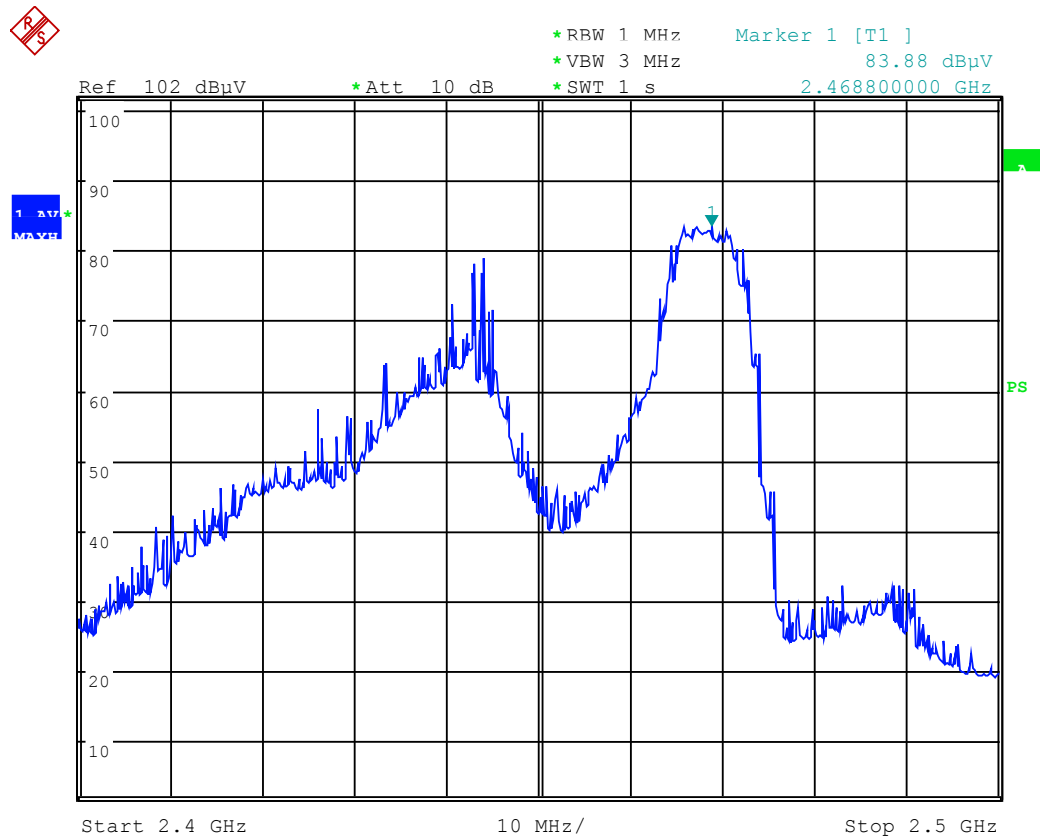
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Manufacturer	Model Number	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Guangdong MD Microwave Oven Manufacturing Co., Ltd	EG028ADK-P	2465.8	2468.8

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





Variation in Operating Frequency with Line Voltage

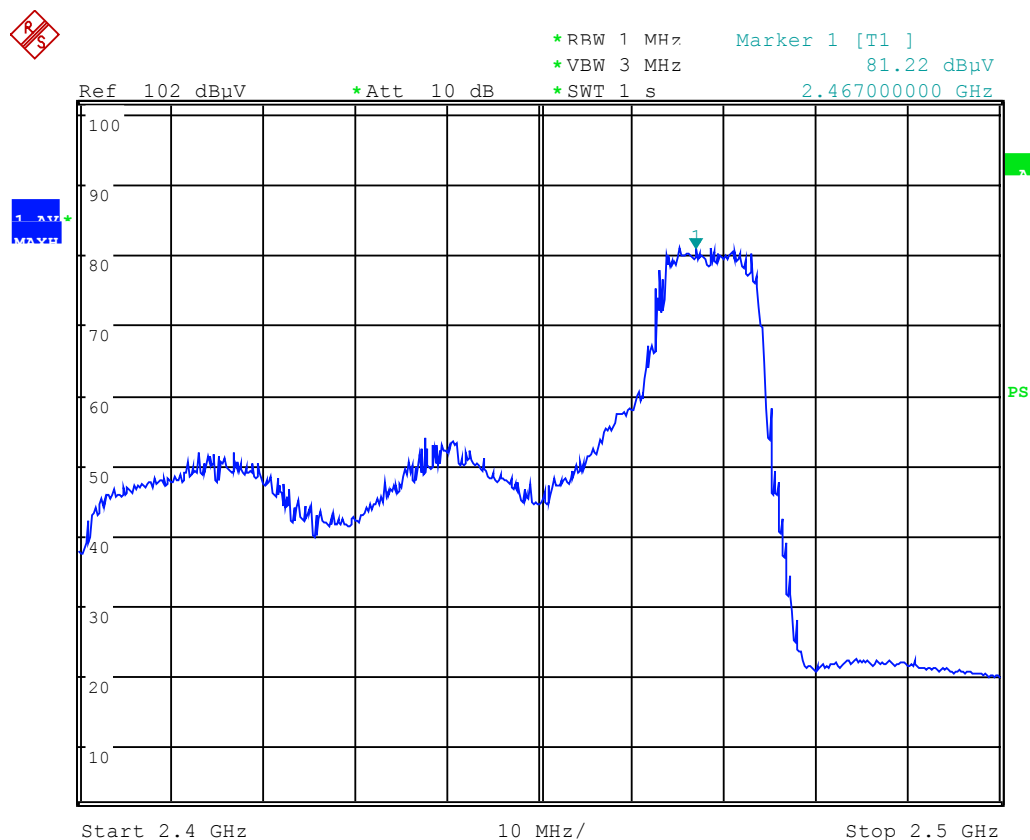
The EUT was operated / warmed by at least 10 minutes of use with a 1000ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

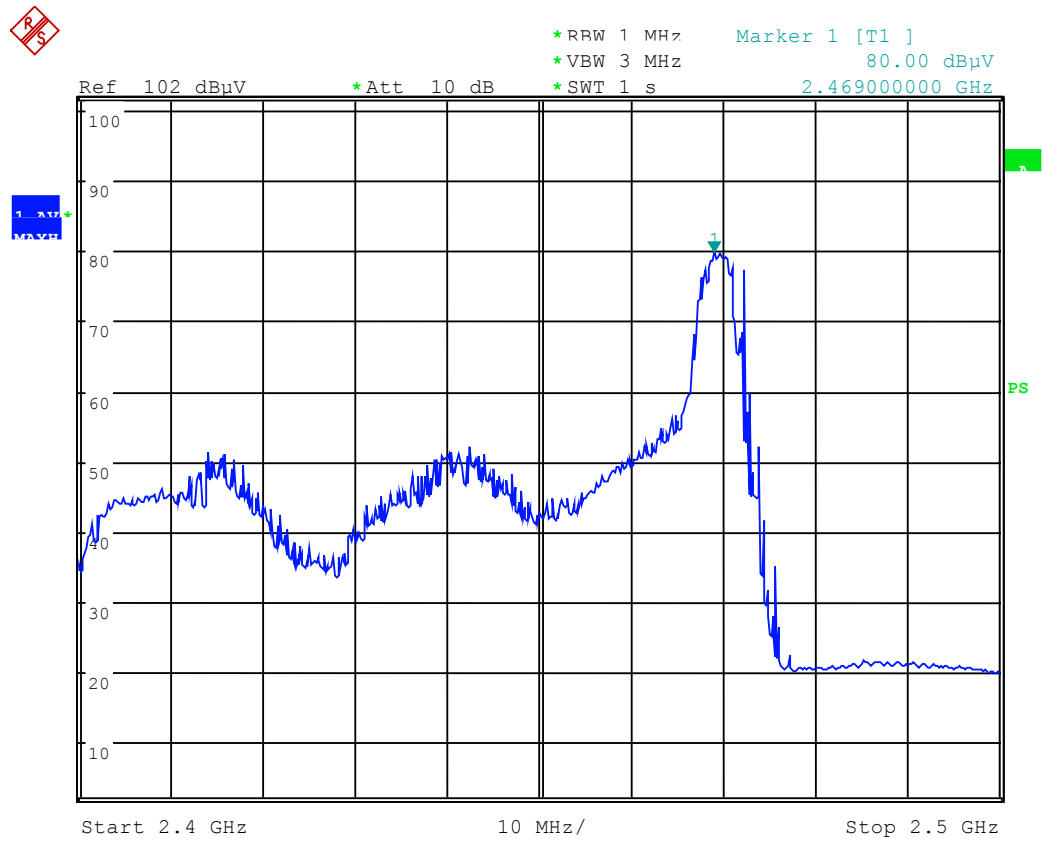
The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model Number	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Guangdong MD Microwave Oven Manufacturing Co., Ltd	EG028ADK-P	2469	2467

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





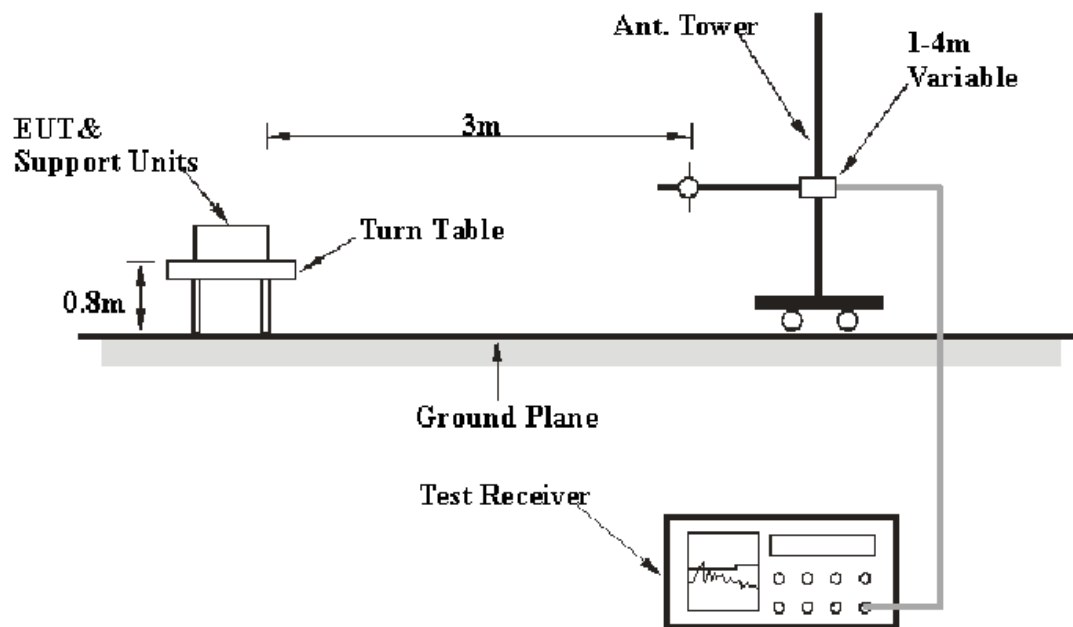
RADIATED EMISSION DATA

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 Bay Area Compliance Lab Corp. (ShenZhen) is ± 4.0 dB.

EUT Setup



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

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

EMI Test Receiver Setup and Spectrum Analyzer

The system was investigated from 30 MHz to 25 GHz.

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

<i>Frequency Range</i>	<i>R B/W</i>	<i>Video B/W</i>	<i>IF B/W</i>
30 – 1000 MHz	100 kHz	300 kHz	120 kHz
Above 1000 MHz	1 MHz	10 Hz	

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2005-8-17	2006-8-17
HP	Amplifier	HP8447E	1937A01046	2005-8-17	2006-8-17
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2005-11-10	2006-11-10
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2005-4-28	2006-4-28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2005-7-20	2006-7-20
HP	Preamplifier	8449B	3008A00277	2005-8-17	2006-8-17

* **Statement of Traceability:** Bay Area Compliance Lab Corp. (ShenZhen) attests that all calibrations have been performed per the NVLAP requirements, traceable to 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.

All data was recorded in the Quasi-peak detection mode. from 30 MHz to 1000 MHz, and average detection mode above 1 GHz.

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 Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

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

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

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

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: **-14.7 dB** at **776.87 MHz** in the **Horizontal** polarization.
Above 1 GHz: **-4.00 dB** at **4931.5 MHz** in the **Vertical** polarization.

Test Data

Environmental Conditions

Temperature:	27°C
Relative Humidity:	56%
ATM Pressure:	1005mbar

The testing was performed by Hansen Hu on 2005-10-25.

Test Mode: Max Power

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC PART 18	
Frequency	Meter Reading	Angle	Height	Polar	Antenna Loss	Cable Loss	Amplifier Gain	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/ V	dB	dB	dB	dBμV/m	dBμV/m	dB
30 MHz to 1000 MHz										
776.87	60.2	90	1.2	H	21.0	3.3	28.1	56.39	71.09	-14.7
495.93	62.4	270	1.0	H	18.2	2.4	28.5	54.52	71.09	-16.6
492.46	56.3	60	1.0	V	18.2	2.4	28.5	48.42	71.09	-22.7
309.99	60.1	60	1.2	H	13.9	1.6	27.7	47.87	71.09	-23.2
32.4	48.3	90	1.0	V	24.1	0.6	28.8	44.16	71.09	-26.9
744.86	46.6	45	1.2	H	21.4	3.2	28.2	43.02	71.09	-28.1
900.14	44.2	60	1.0	V	22.9	3.5	27.9	42.65	71.09	-28.4
945.43	43.1	45	1.2	V	23.4	3.6	27.7	42.42	71.09	-28.7
30.63	45.5	180	1.2	V	24.1	0.6	28.8	41.36	71.09	-29.7
78.41	60.6	45	1.2	H	8.6	0.8	28.7	41.34	71.09	-29.8
651.94	41.3	60	1.2	V	20.3	2.9	28.5	36.03	71.09	-35.1
282.98	47.9	45	1.0	H	13.8	1.5	27.6	35.63	71.09	-35.5

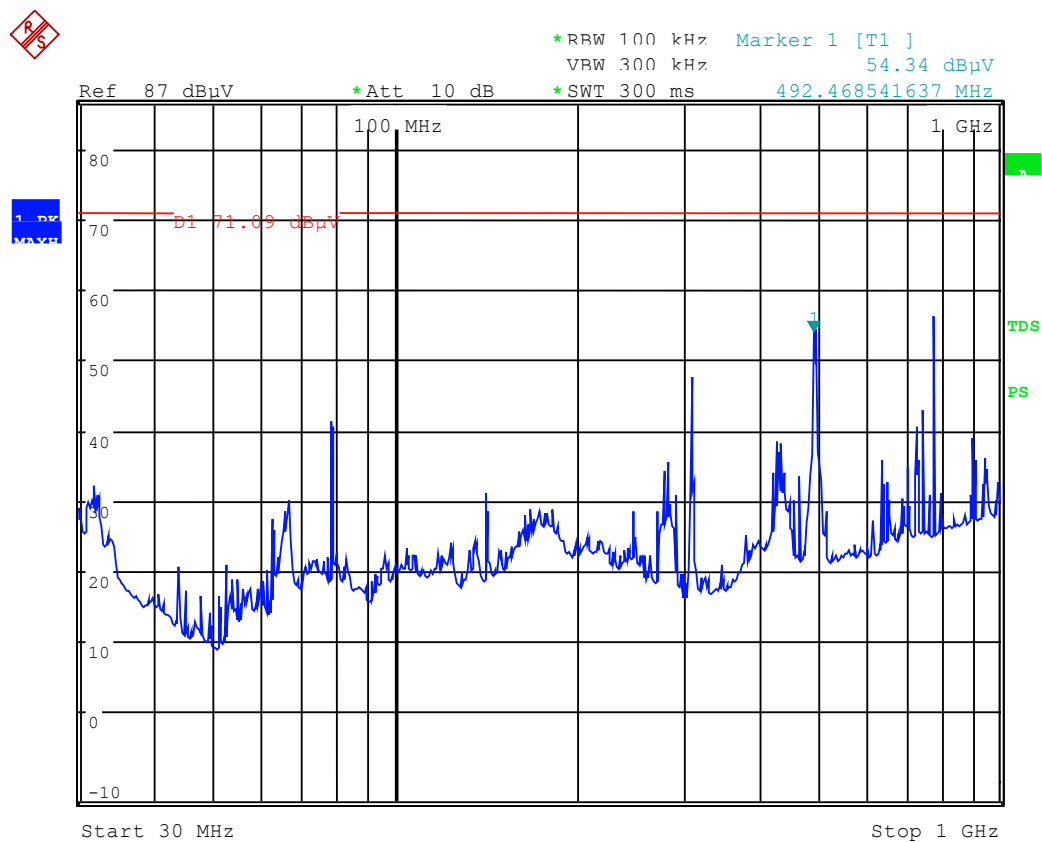
INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC PART 18		COMMENTS
Frequency MHz	Meter Reading dB μ V/m	Angle Degree	Height Meter	Polar H/ V	Antenna Loss dB	Cable Loss dB	Amplifier Gain dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB	
Above 1 GHz											
2467.40	90.24	45	1.0	V	28.1	3.7	0.00	122.04			Fundamental
2469.04	89.67	180	1.2	H	28.1	3.7	0.00	121.47			Fundamental
4931.50	61.09	180	1.2	V	33.8	5.2	33.00	67.09	71.09	-4.0*	Harmonic
7375.40	57.48	45	1.0	V	35.8	6.1	34.11	65.27	71.09	-5.8	Harmonic
4931.40	58.25	45	1.2	H	33.8	5.2	33.00	64.25	71.09	-6.8	Harmonic
7393.08	53.12	60	1.0	H	35.8	6.1	34.11	60.91	71.09	-10.2	Harmonic
9852.30	42.72	60	1.0	V	37.6	7.3	34.50	53.12	71.09	-18.0	Harmonic
9853.90	42.18	180	1.2	H	37.6	7.3	34.50	52.58	71.09	-18.5	Harmonic
12318.70	31.80	45	1.2	H	41.2	8.3	34.58	46.72	71.09	-24.4	Harmonic
13320.70	31.54	45	1.2	V	39.4	8.6	33.17	46.37	71.09	-24.7	Harmonic
8388.70	35.24	180	1.2	V	36.7	6.5	35.35	43.09	71.09	-28.0	Spurious
8565.10	34.30	60	1.0	H	36.7	6.5	35.35	42.15	71.09	-28.9	Spurious
1168.30	37.96	45	1.0	V	31.7	4.2	36.33	37.53	71.09	-33.6	Spurious
1168.30	37.14	45	1.0	H	32.0	4.2	36.33	37.01	71.09	-34.1	Spurious

* Within the measurement uncertainty.

Plot(s) of Test Data

Plot(s) of test data is presented hereinafter as reference.

Horizontal:



Vertical:

