

**FCC PART 18
EMI MEASUREMENT AND TEST REPORT**

For

**Panasonic Home Appliances Microwave Oven (Shanghai)
Co.,Ltd**

898 Long Dong Rd. Pu Dong Shanghai

FCC ID: ACLAP8S71

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Microwave Oven
Test Engineer: Leon Zhou <i>Leon Zhou</i>	
Report Number: RSH07042951	
Test Date: 2007-05-09 to 2007-05-16	
Report Date: 2007-05-17	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Panasonic Home Appliances Microwave Oven (Shanghai) Co., Ltd* 's model: *NN-CS597S* or the "EUT" as referred to in this report is a *Microwave Oven*, which measures approximately 52.0 cm L x 54.0 cm W x 32.0 cm H, rated input voltage: AC 120V/60Hz, the other information as following:

Sample No.: PP07007, Output rating: 1000W, Operation frequency: 2450MHz, Magnetron type: 2M261-M32, Employed mode: Non-Turntable, Door seal type: Choke

* The test data gathered are from production sample, serial number: 0704119 provided by the manufacturer, we received EUT on 2007-04-29.

Objective

The following test report is prepared on behalf of *Panasonic Home Appliances Microwave Oven (Shanghai) Co., Ltd* in accordance with Part 2, Subpart J, and Part 18, Subparts A, B and C of the Federal Communication Commissions rules and regulations.

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 Laboratory 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, China.

Test site at Bay Area Compliance Laboratory 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.

Additionally, Bay Area Compliance Laboratory 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 I/O Cable

Cable Description	Length (M)	From/Port	To
Unshielded Undetachable AC Cable	1.25	EUT	LISN

SYSTEM TEST CONFIGURATION

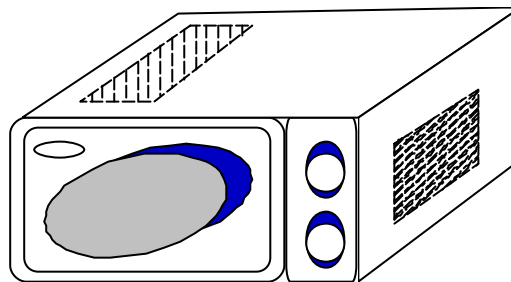
Justification

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

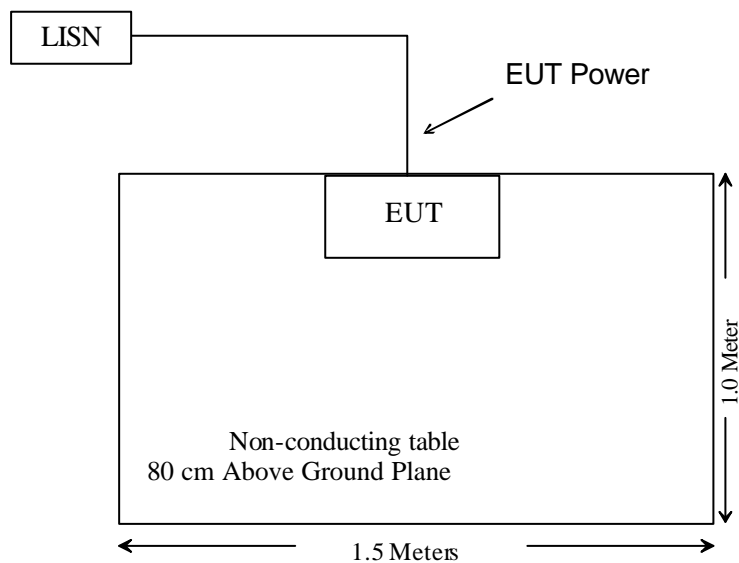
Bay Area Compliance Laboratory Corp. (Shenzhen) has not done any modification on the EUT.

Configuration of Test Setup



EUT

Block Diagram of Test Setup



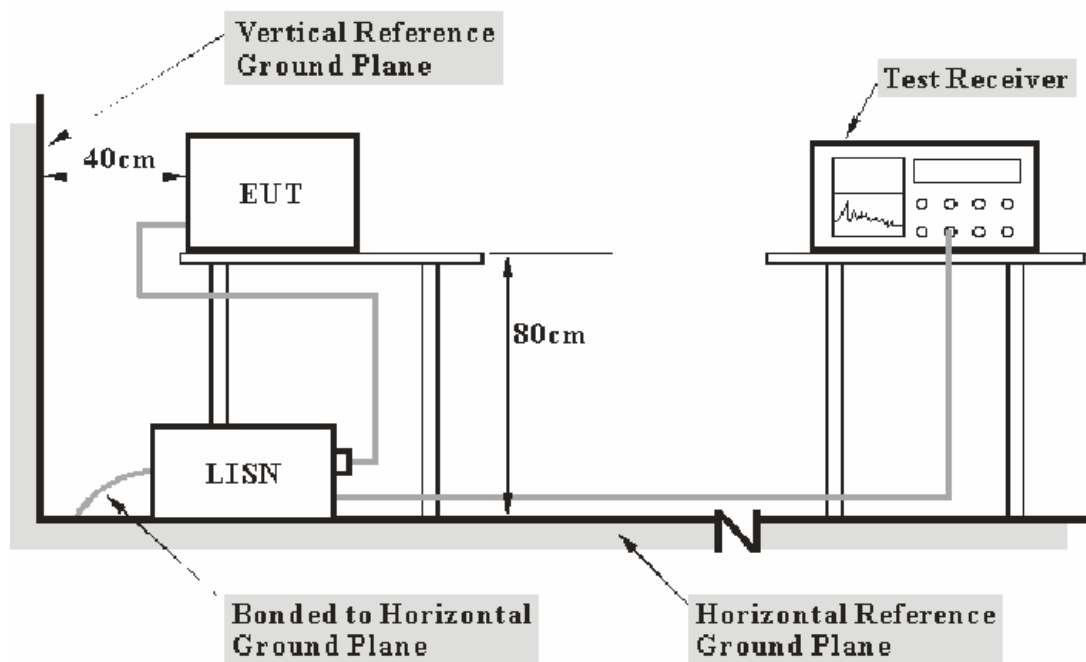
CONDUCTED EMISSION

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 Laboratory 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 MP-5: 1986 measurement procedure. Specification used was with the FCC Part 18 limits.

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

Test Receiver Setup

The test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the 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	12208	N/A	N/A
Rohde & Schwarz	EMI Test Receiver	ESCS30	DE25330	2007-03-26	2008-03-26
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2007-03-26	2008-03-26

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

* **Statement of Traceability:** Bay Area Compliance Laboratory 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:

5.32 dB at 0.220 MHz in the **Neutral** conductor mode.

Test Data**Environmental Conditions**

Temperature:	25° C
Relative Humidity:	56%
ATM Pressure:	94.0kPa

Testing was performed by Leon Zhou on 2007-05-09.

Test mode: Running (MAX Power)

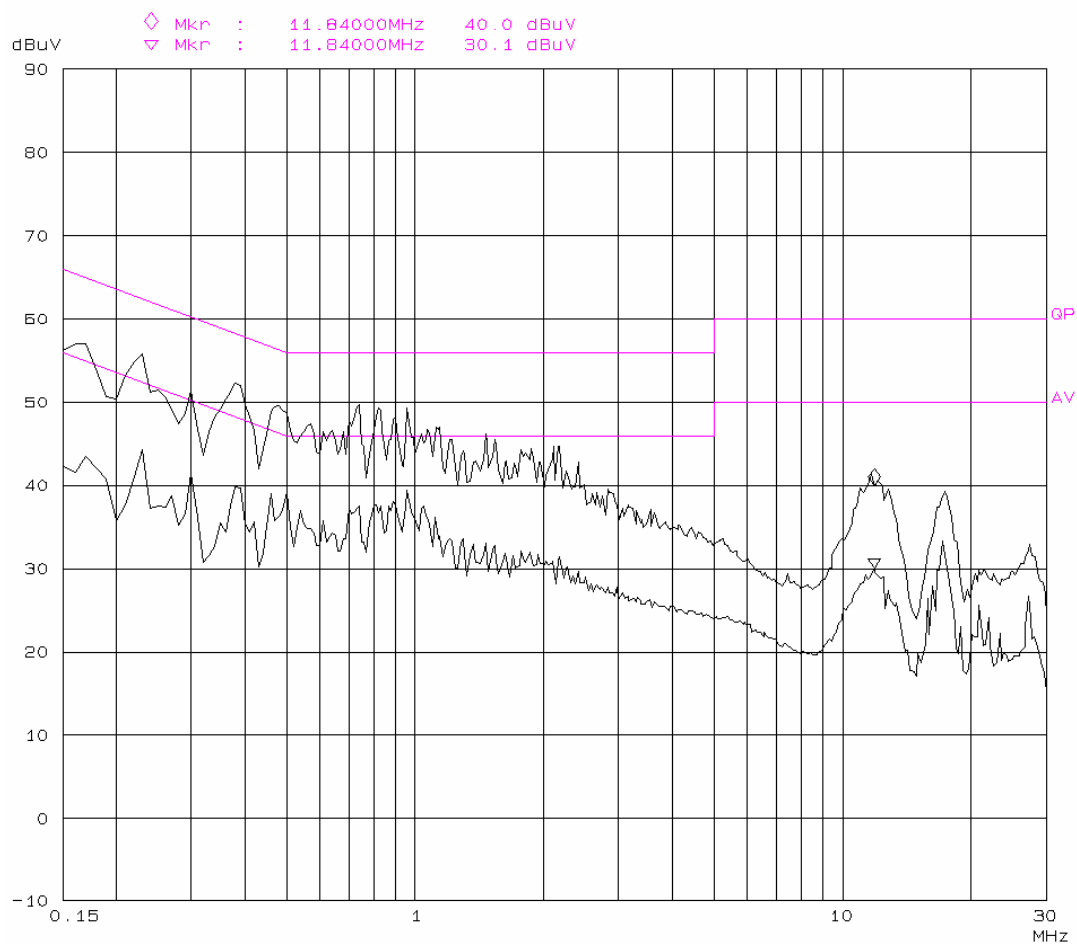
LINE CONDUCTED EMISSIONS				FCC Part 18	
Frequency MHz	Amplitude dBu V	Detector QP	Phase Live/Neutral	Limit dBu V	Margin dB
0.220	57.50	QP	Neutral	62.82	5.32
0.930	50.10	QP	Neutral	56.00	5.90
0.620	49.80	QP	Neutral	56.00	6.20
0.960	39.40	AV	Live	46.00	6.60
0.300	53.60	QP	Neutral	60.24	6.64
0.230	55.80	QP	Live	62.45	6.65
0.820	49.30	QP	Live	56.00	6.70
0.960	49.20	QP	Live	56.00	6.80
0.220	45.50	AV	Neutral	52.82	7.32
0.930	38.50	AV	Neutral	46.00	7.50
1.000	48.40	QP	Neutral	56.00	7.60
0.620	38.20	AV	Neutral	46.00	7.80
0.170	57.00	QP	Live	64.96	7.96
0.230	44.30	AV	Live	52.45	8.15
1.000	37.30	AV	Neutral	46.00	8.70
0.300	41.20	AV	Neutral	50.24	9.04
0.820	36.70	AV	Live	46.00	9.30
0.170	43.60	AV	Live	54.96	11.36
17.660	43.70	QP	Neutral	60.00	16.30
17.660	33.40	AV	Neutral	50.00	16.60
17.390	32.40	AV	Live	50.00	17.60
11.840	30.10	AV	Live	50.00	19.90
11.840	40.00	QP	Live	60.00	20.00
17.390	39.30	QP	Live	60.00	20.70

Plot(s) of Test Data

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

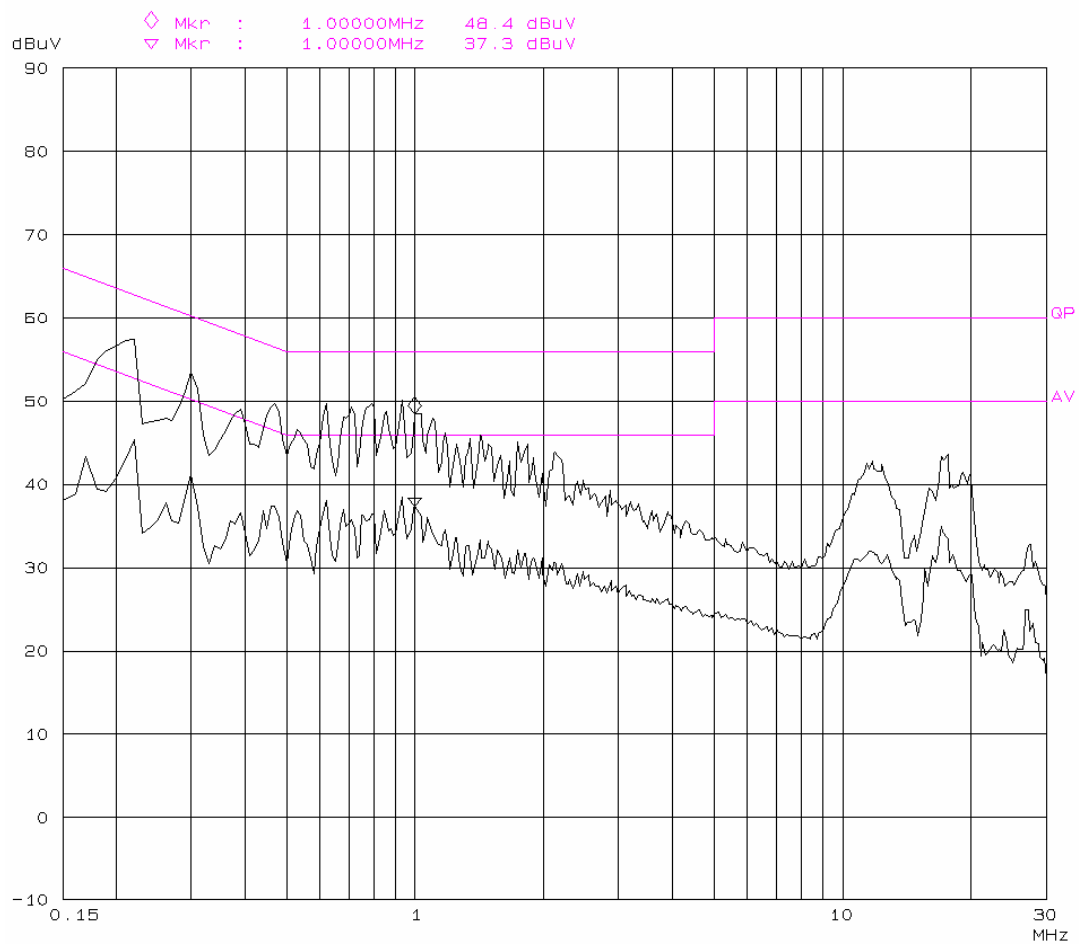
CONDUCTED EMISSION TEST
FCC Part18

EUT: Microwave oven M/N: NN-CS596S
Manuf: Panasonic
Op Cond: Max Power
Operator: leon.zhou
Test Spec: AC 120V/60Hz L
Comment: Temp: 25°C Humi: 56%



CONDUCTED EMISSION TEST
FCC Part18

EUT: Microwave oven M/N: NN-CS596S
Manuf: Panasonic
Op Cond: Max Power
Operator: leon.zhou
Test Spec: AC 120V/60Hz N
Comment: Temp: 25°C Humi: 56%



RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	26°C
Relative Humidity:	55%
ATM Pressure:	94.0kPa

Radiation Hazard Measurement

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

A 275ml 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 $0.71\text{mW}/\text{cm}^2$ 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 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)
120V/60Hz	13.54	1624.8	1650

☒ 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 Radiation leakage measurement = 275 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.

Load of Water (ml)	Starting Temperature (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
1000	20	64.5	200

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

RF Output Power = $4.2 \times 1000 \times (64.5 - 20) / 200$

RF Output Power = 934.5 Watts

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

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

$$\text{LFS} = 25 * \text{SQRT} (934.5/500) (\mu \text{ V/m})$$

$$\text{LFS} = 34.18(\mu \text{ V/m})$$

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

Manufacturer	Model Number	LFS($\mu \text{ V/m}$)	dB($\mu \text{ V/M}$) @300m	dB($\mu \text{ V/M}$)@3m
Panasonic Home Appliances Microwave Oven (Shanghai) Co.,Ltd	NN-CS597S	34.18	30.70	70.70

Operating Frequency Measurement

Variation in Operating Frequency with Time

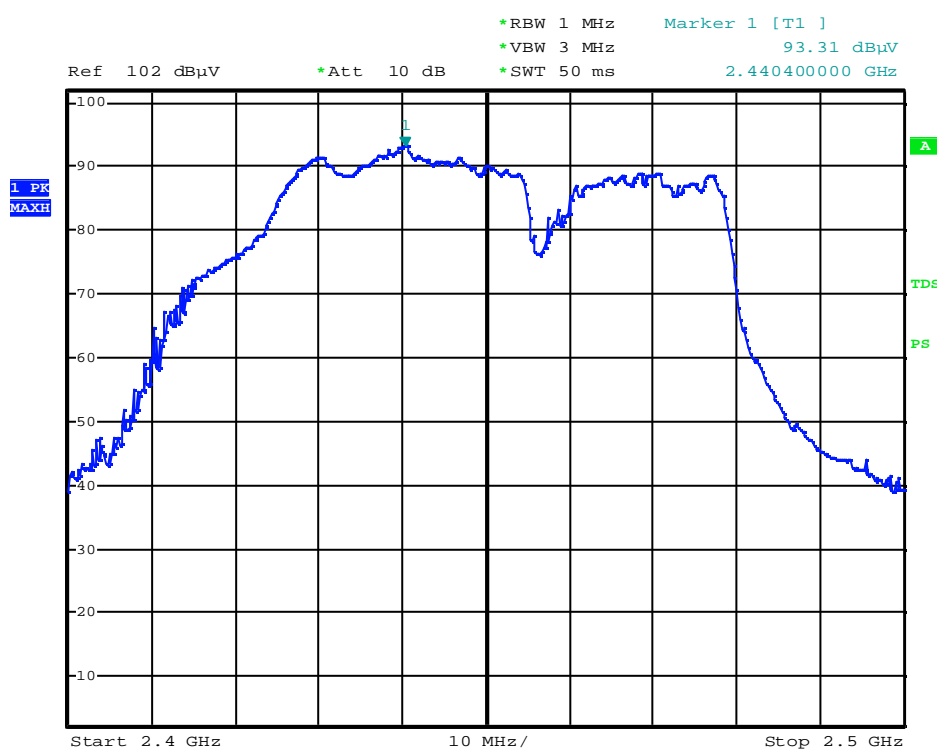
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Manufacturer	Model	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Panasonic Home Appliances Microwave Oven (Shanghai) Co.,Ltd	NN-CS597S	2440.4	2485.6

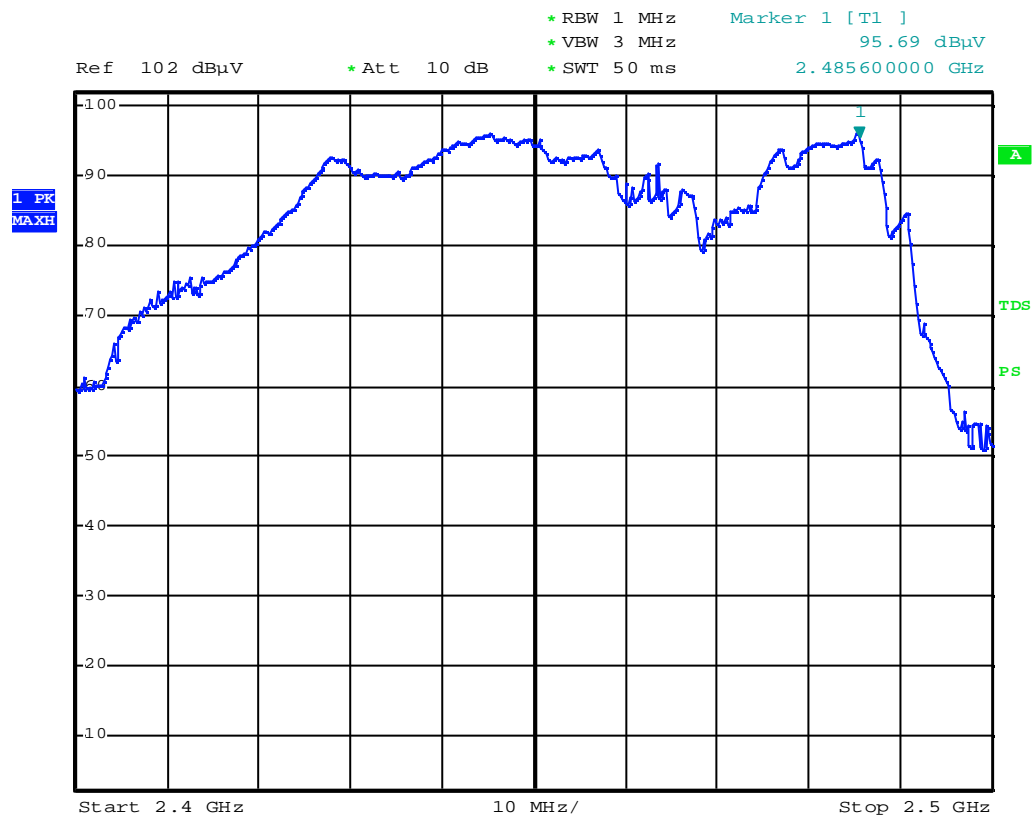
Refer to data pages for details of the variation in operating frequency with time measurement.

VS Time:



Operating Frequency with Time (1)

Date: 15.MAY.2007 23:02:36



Operating Frequency with Time (2)

Date: 16.MAY.2007 00:29:53

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.

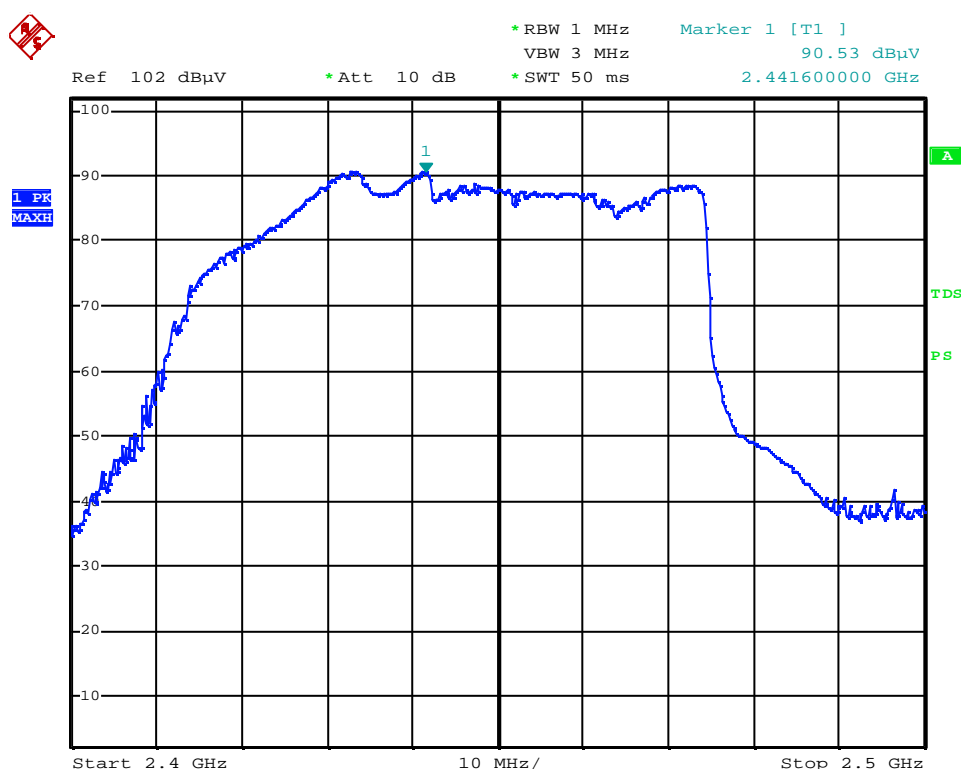
The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Panasonic Home Appliances Microwave Oven (Shanghai) Co.,Ltd	NN-CS597S	2433.4	2441.6

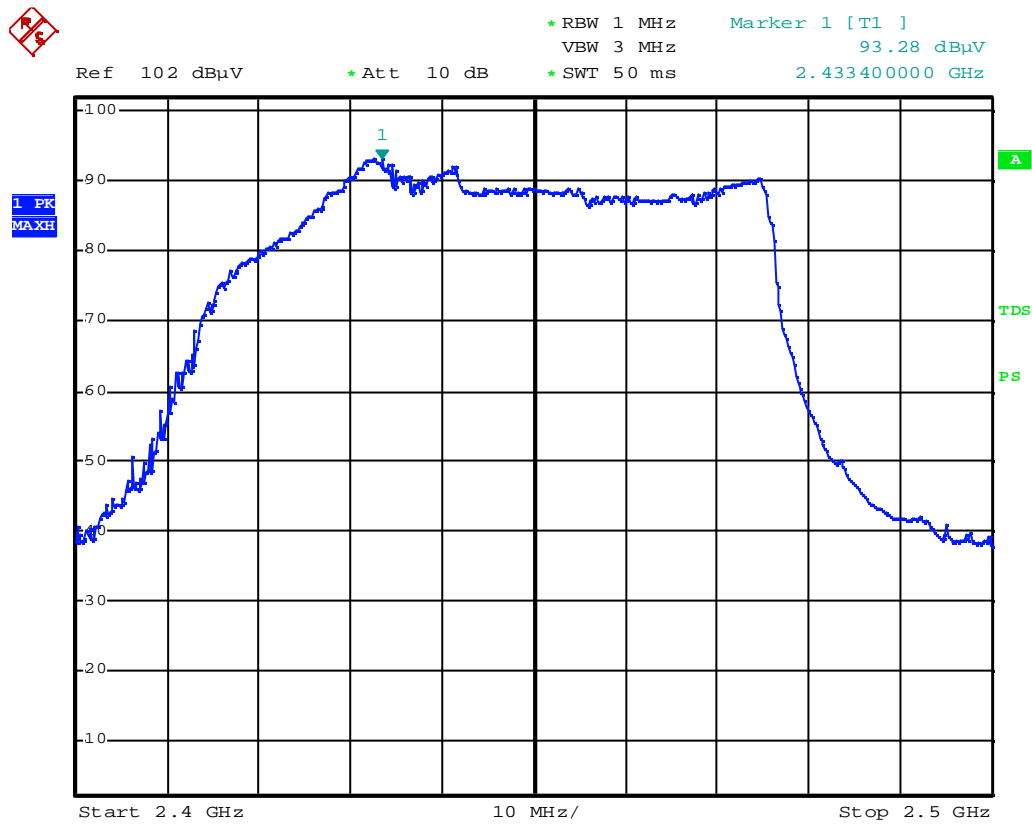
Please refer to following pages for details of the variation in operating frequency with line voltage measurement.

Voltage:



Operating Frequency with Voltage (1)

Date: 16.MAY.2007 20:28:47



Operating Frequency with Voltage (2)

Date: 16.MAY.2007 20:34:56

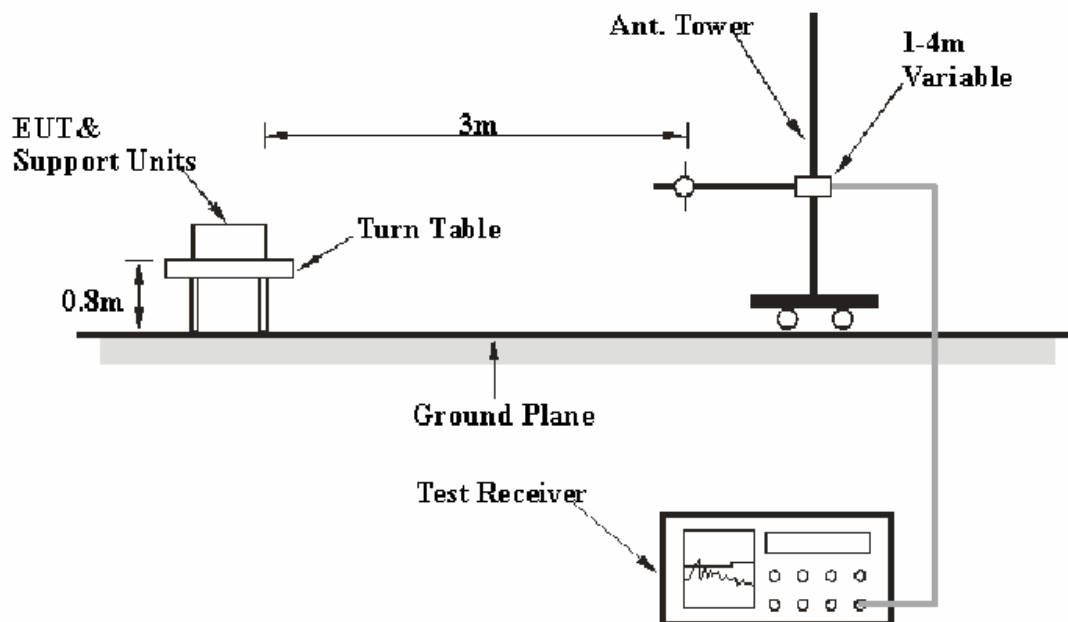
RADIATED EMISSION DATA

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 Laboratory Corp. (Shenzhen) is ± 4.0 dB.

EUT Setup



The radiated emission tests were performed in the 3 meters chamber A test site, 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.

Test Receiver Setup and Spectrum Analyzer 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:

<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

Start Frequency1 GHz
 Stop Frequency.....24.5 GHz
 Sweep Speed.....Auto
 Video Bandwidth30 Hz
 Resolution Bandwidth.....1 MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2006-11-15	2007-11-15
Agilent	Spectrum Analyzer	8564E	3943A01781	2006-11-22	2007-11-22
Sunol Sciences	Bilog Antenna	JB1	A040904-2	2006-08-14	2007-08-14
Sunol Sciences	System Controller	SC99V	041304-1	N/A	N/A
HP	Amplifier	8449B	3008A00277	2006-09-29	2007-09-29
Rohde & Schwarz	Spectrum Analyzer	ESCI	100035	2006-09-26	2007-09-26
Sunol Sciences	Horn Antenna	DRH-118	A052604	2006-09-25	2007-09-25

* **Statement of Traceability:** Bay Area Compliance Laboratory Corp. (Shenzhen) 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 Loss and Cable Loss, and subtracting the Amplifier Gain from the Amplitude 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 maximum limit; the equation for margin calculation is as follows:

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

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:

Above 1 GHz: **2.11dB** at **2400 MHz** in the **Vertical** polarization.
30 MHz to 1GHz: **20.30 dB** at **487.092050 MHz** in the **Vertical** polarization.

Test Data and Plots**Environmental Conditions**

Temperature:	22° C
Relative Humidity:	62%
ATM Pressure:	94.0kPa

Testing was performed by Leon Zhou on 2007-05-16.

Test mode: MAX Power (Above 1 GHz)

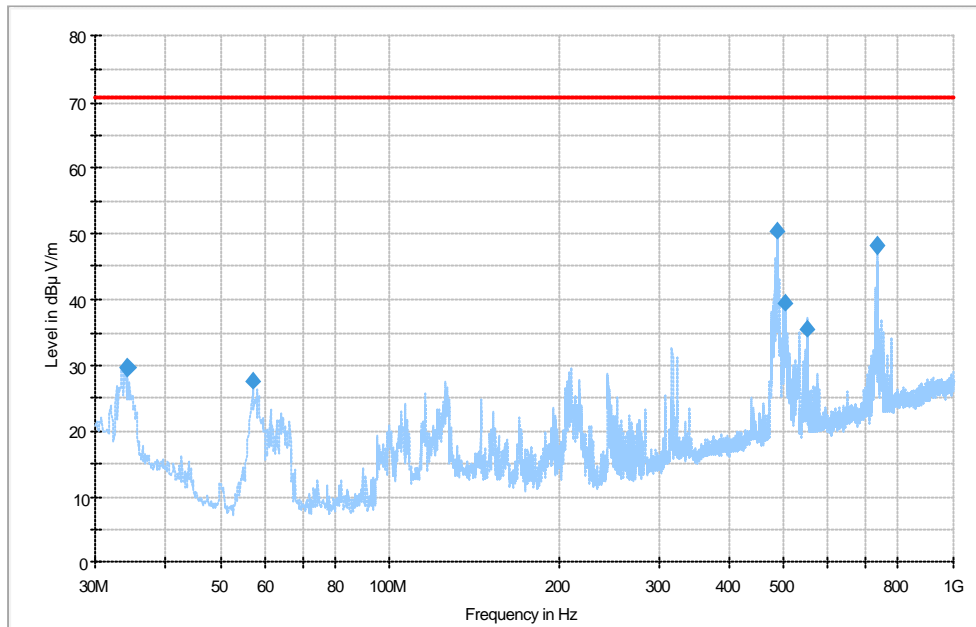
INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC PART 18		COMMENTS
Frequency MHz	Meter Reading dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna Factor dB	Cable Loss dB	Amplifier Gain dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB	
Above 1 GHz											
2450	93.67	360	1.5	H	27.4	3.61	0	124.68			PK (Fundamental)
2450	95.00	360	1.5	V	27.4	3.61	0	126.01			PK (Fundamental)
2500	69.27	360	1.5	H	27.4	3.61	34.0	66.28	70.7	4.42	AV(Spurious)
2500	70.85	360	1.5	V	27.4	3.61	34.0	67.86	70.7	2.84	AV(Spurious)
2400	70.32	180	1.5	H	27.4	3.61	33.8	67.53	70.7	3.17	AV(Spurious)
2400	71.38	180	1.5	V	27.4	3.61	33.8	68.59	70.7	2.11	AV(Spurious)
9800	39.85	360	1.5	V	38.2	5.77	34.1	49.72	70.7	20.98	AV(Harmonic)
7350	43.15	180	1.5	V	35.3	4.75	33.7	49.5	70.7	21.20	AV(Harmonic)
7350	41.76	180	1.5	H	35.3	4.75	33.7	48.11	70.7	22.59	AV(Harmonic)
9800	37.67	360	1.5	H	38.2	5.77	34.1	47.54	70.7	23.16	AV(Harmonic)
12250	36.75	360	1.5	H	42.6	7.12	35.2	51.27	70.7	19.43	AV (Harmonic)
12250	38.25	360	1.5	V	42.6	7.12	35.2	52.77	70.7	17.93	AV (Harmonic)
4900	44.33	360	1.5	V	32.0	4.55	33.4	47.48	70.7	23.22	AV(Harmonic)
4900	42.17	360	1.5	H	32.0	4.55	33.4	45.32	70.7	25.38	AV(Harmonic)
4188	34.65	180	1.5	V	30.8	4.51	32.5	37.46	70.7	33.24	AV(Spurious)
4353	34.50	90	1.5	V	30.8	4.25	32.5	37.05	70.7	33.65	AV(Spurious)
4353	33.47	90	1.5	H	30.8	4.25	32.5	36.02	70.7	34.68	AV (Spurious)
4188	32.50	180	1.5	H	30.8	4.51	32.5	35.31	70.7	35.39	AV(Spurious)
1215	38.45	120	1.5	V	24.8	2.50	36.0	29.75	70.7	40.95	AV(Spurious)
1215	36.50	120	1.5	H	24.8	2.50	36.0	27.8	70.7	42.90	AV(Spurious)

Note 1: According to §18.305 "Field strength limits", (a) ISM equipment operating on a frequency specified in §18.301 "Operation frequencies" is permitted unlimited radiated energy in the 2400MHz to 2500MHz.

Note 2: The emission level of 6th harmonic to 10th harmonic 20dB lower than limit.

30MHz to 1000MHz:

Auto Test (FCC Part18)



Frequency (MHz)	Quasi Peak (dBuV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Limit (dB μ V/m)	Margin (dB)
487.092050	50.4	118.0	V	128.0	-6.4	70.7	20.3
733.889600	48.2	115.0	V	14.0	-3.0	70.7	22.5
503.661625	39.4	190.0	V	71.0	-6.9	70.7	31.3
549.671250	35.5	236.0	V	83.0	-5.8	70.7	35.2
34.150975	29.7	102.0	V	212.0	-10.5	70.7	41.0
57.140300	27.6	102.0	V	14.0	-19.1	70.7	43.1