Lab Code: 200707-0

FCC PART 18
EMI MEASUREMENT AND TEST REPORT

For

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

898 Long Dong Road, Pudong Shanghai, China

FCC ID: ACLAPBA71

Report Type:	**Product Type:**
Original Report	Microwave Oven

Test Engineer:	Jack Wang
Report No.:	R1SH111124001-00
Report Date:	2012-03-01
Test Date:	2011-12-05 to 2011-12-18
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Panasonic Appliances Microwave Oven (Shanghai) Co., Ltd. '*s model: *NN-SD372S (FCC ID:* ACLAPBA71*)* or the "EUT" as referred to in this report was a *Microwave Oven*, which was measured approximately 48.0 cm (L) x 36.5 cm (W) x 28.0 cm (H), rated input voltage: AC 120 V/60 Hz.

Output Rating: 950W (By IEC 705)
Operating Frequency: 2450MHz
Magnetron: 2M236－M36
Employed Mode: Turntable
Door Seal Type: Choke

** All measurement and test data in this report was gathered from production sample serial number: 1111241 (Assigned by BACL, Shenzhen). The EUT was received on 2011-11-24.*

Objective

This test report is prepared on behalf of *Panasonic 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 the compliance of EUT with FCC Part 18 limits.

Related Submittal(s)/Grant(s)

No related submittal

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 measurements were 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 Laboratories 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, China.

Test site at Bay Area Compliance Laboratories 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 December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009 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 Laboratories Corp. (Shenzhen) is an ISO/IEC 17025 accredited laboratory, and is accredited by National Voluntary Laboratory Accredited Program (Lab Code 200707-0).

The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2007070.htm

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.

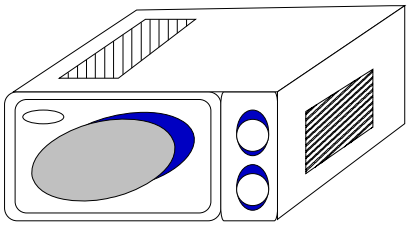
Equipment Modifications

No modification was made to the EUT tested.

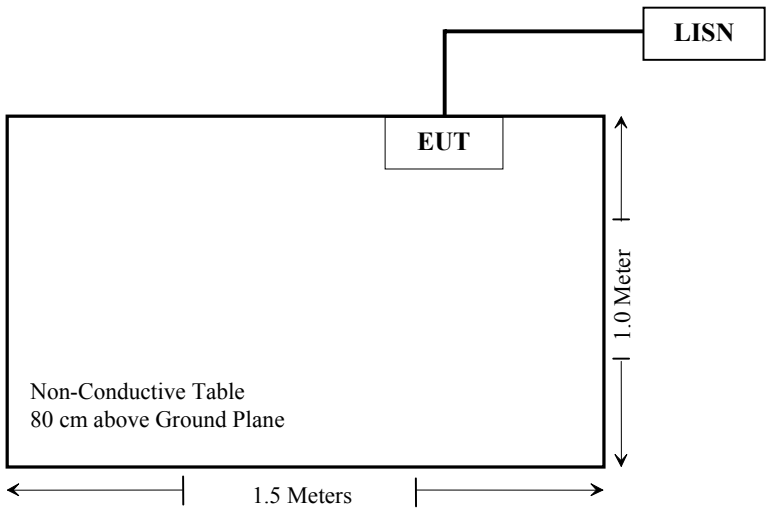
External Cable List and Details

Cable Description	Length (m)	From/Port	To
Unshielded Undetachable Power Cable	1.18	EUT	LISN

Configuration of Test Setup



Block Diagram of Test Setup



CONDUCTED EMISSIONS

Applicable Standard

For the following equipment, when designed to be connected to the public utility (AC) power line the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies shall not exceed the limits in the following tables. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal using a 50 µH/50 ohms line impedance stabilization network (LISN).

All other part 18 consumer devices:

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

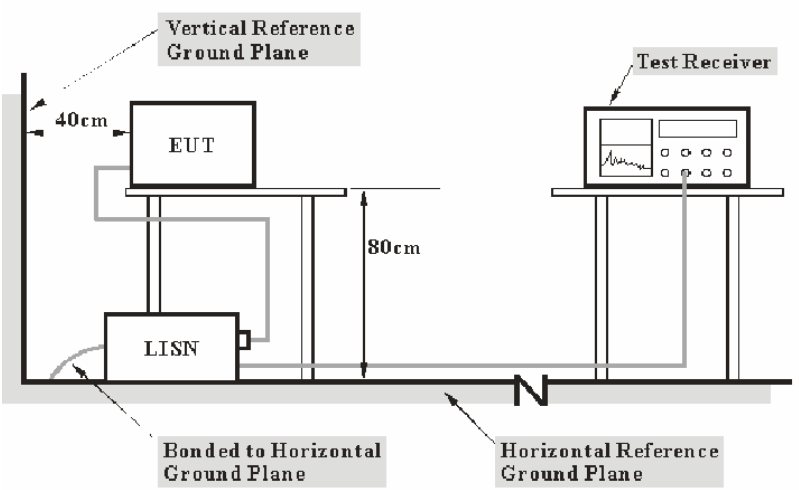
*Decreases with the logarithm of the frequency.

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 CISPR 16-4-2, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is 2.4 dB(k=2, 95% level of confidence).

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	***IF B/W***
150 kHz – 30 MHz	9 kHz

Test Procedure

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

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	830245/006	2011-03-03	2012-03-02
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2011-03-09	2012-03-08

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

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:

2.42 dB at **26.225 MHz** in the **Line** conductor mode
1.75 dB at **0.205 MHz** in the **Neutral** conductor mode

Test Data and Plots

Environmental Conditions

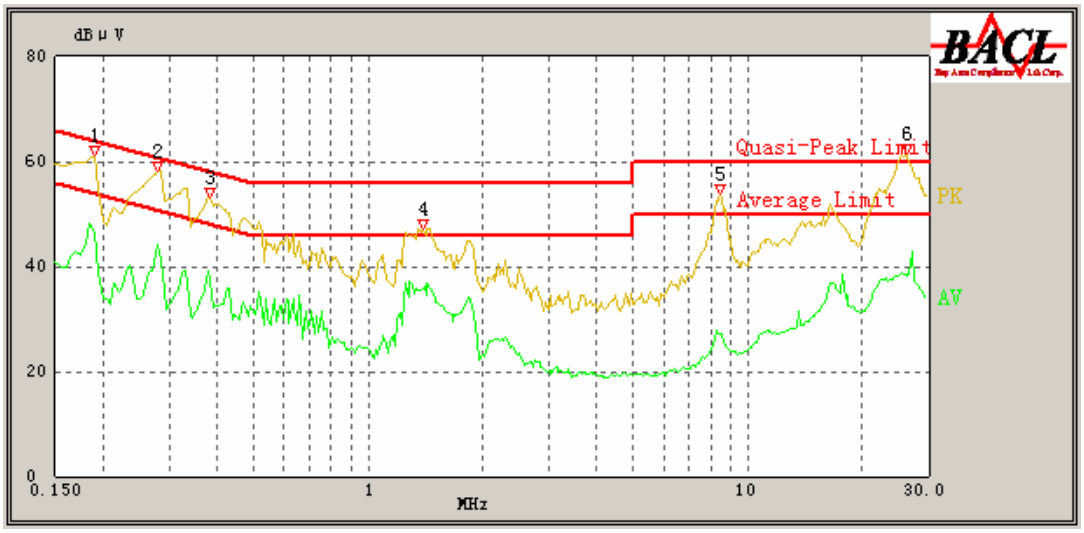
Temperature:	25° C
Relative Humidity:	48%
ATM Pressure:	100.2kPa

The testing was performed by Jack Wang on 2011-12-05.

Test Mode: Running (Max Power)

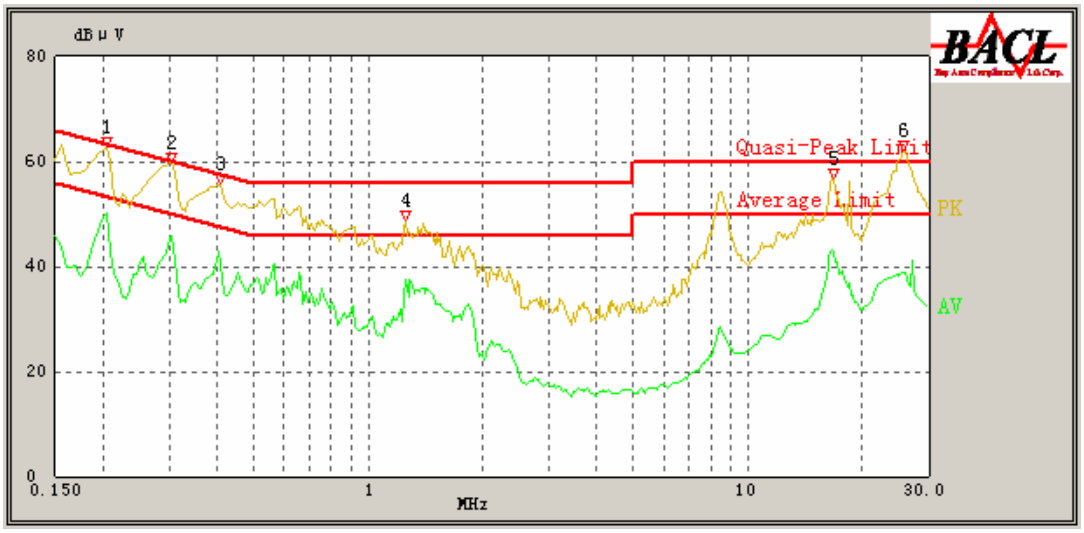
AC 120V/60 Hz

Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
26.225	57.58	1.10	60.00	2.42	QP
0.190	60.13	1.10	64.86	4.73	QP
0.280	58.13	1.10	62.29	4.16	QP
0.385	53.24	1.10	59.29	6.05	QP
8.490	53.93	1.10	60.00	6.07	QP
0.280	44.33	1.10	52.29	7.96	Ave.
0.190	46.47	1.10	54.86	8.39	Ave.
1.400	47.16	1.10	56.00	8.84	QP
1.405	36.30	1.10	46.00	9.70	Ave.
26.225	38.45	1.10	50.00	11.55	Ave.
0.385	37.54	1.10	49.29	11.75	Ave.
8.425	27.31	1.10	50.00	22.69	Ave.

Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.205	62.68	1.10	64.43	1.75*	QP
0.305	59.74	1.10	61.57	1.83*	QP
25.795	57.99	1.10	60.00	2.01*	QP
0.410	55.71	1.10	58.57	2.86	QP
16.770	56.90	1.10	60.00	3.10	QP
0.205	50.05	1.10	54.43	4.38	Ave.
0.305	45.90	1.10	51.57	5.67	Ave.
1.260	48.89	1.10	56.00	7.11	QP
16.770	42.83	1.10	50.00	7.17	Ave.
0.410	40.38	1.10	48.57	8.19	Ave.
1.260	37.37	1.10	46.00	8.63	Ave.
25.765	38.95	1.10	50.00	11.05	Ave.

*Within measurement uncertainty.

RADIATION HAZARD MEASUREMENT

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10
Sunol Sciences	Horn Antenna	DRH-118	A052604	2011-05-05	2012-05-04
Mini-Circuits	Amplifier	2VA-213+	T-E27H	2011-03-08	2012-03-07
Ainuo	Digital Power Analyzer	8732B	028706117	2011-12-23	2012-12-23
HY	AC Power Source	9020117	GY053(1)	2011-08-21	2012-08-21
Holaday	Leakage Meter	HI-1710	00083001	2011-06-02	2012-06-02
Holaday	Probe	HI-2623	108174	2011-06-02	2012-06-02

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

Environmental Conditions

Temperature:	25° C
Relative Humidity:	48%
ATM Pressure:	100.2 kPa

The testing was performed by Jack Wang on 2011-12-18.

Radiation Hazard Measurement

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

A 275 ml 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 0.71mW/cm^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. 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 (V_{AC}/Hz)	Input Current (Amps)	Measured Input Power (Watts)	Rated Input Power (Watts)
120/60	10.63	1202	1200

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

Quality of Water (ml)	Starting Temperature (ºC)	Final Temperature (ºC)	Elapsed Time (s)
1000	22	62.5	200

Power = (4.2 joules/calorie)* (volume in milliliters)*(Final temperature- Start temperature)/ (Elapsed time)

Power = 4.2 x 1000 x (62.5-22.0) / 200

Power = 850.5 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 (850.5/500)

LFS ≈ 32.6

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	LFS	dBμV/m@300m	dBμV/m@3m
Panasonic Appliances Microwave Oven (Shanghai) Co., Ltd.	NN-SD372S	32.6	30.26	70.26

Operating Frequency Measurement

Variation in Operating Frequency with Time

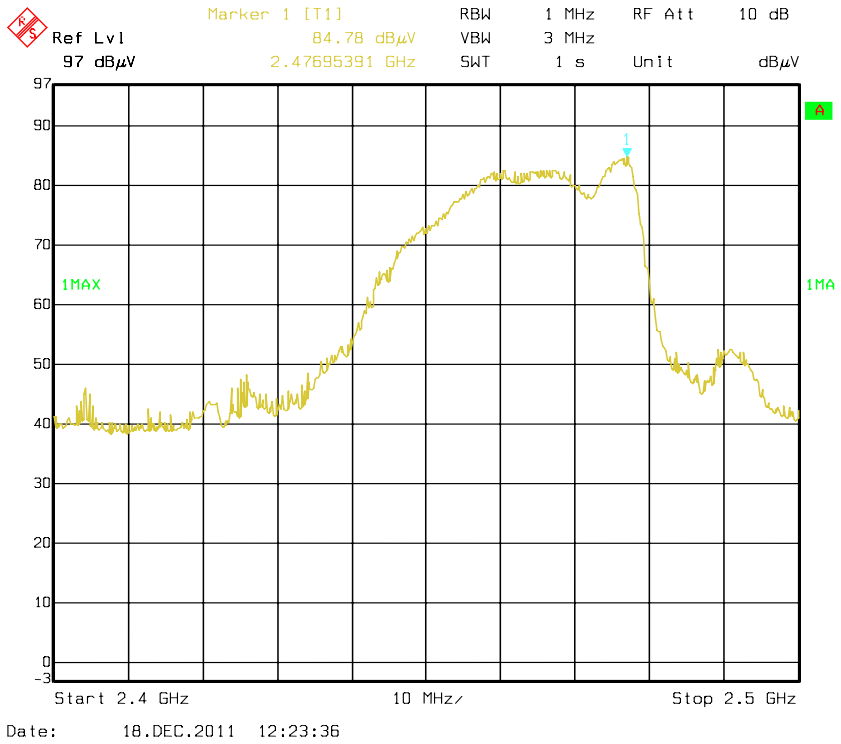
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

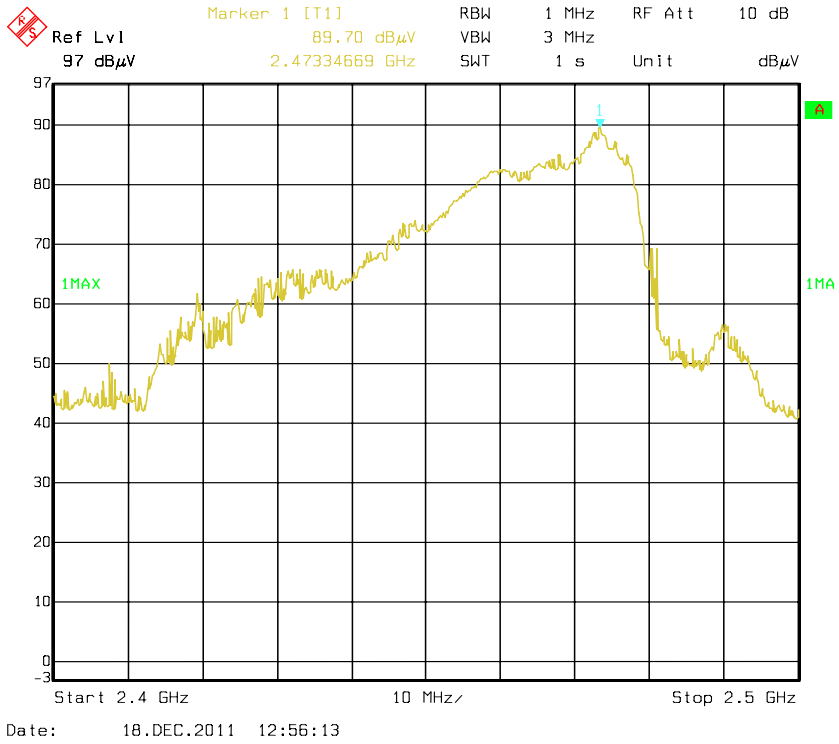
Manufacturer	Model	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Panasonic Appliances Microwave Oven (Shanghai) Co., Ltd.	NN-SD372S	2473.34669	2476.95391

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

Start time:



End time:



Variation in Operating Frequency with Line Voltage

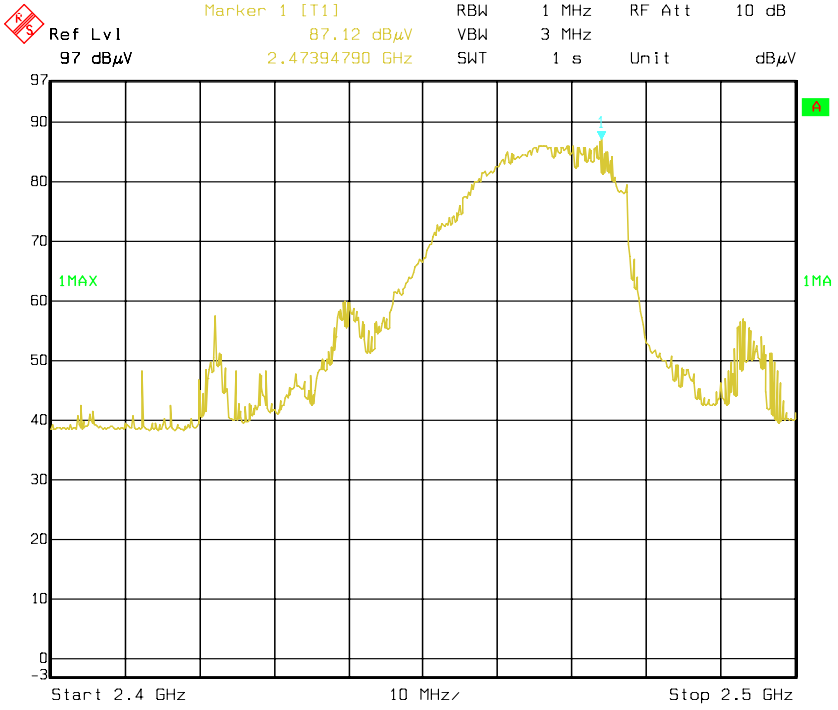
The EUT was operated / warmed by at least 10 minutes of use with a 1000 ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

The results of this test are as follows:

Line voltage varied from 96 V_{AC} to 150 V_{AC}.

Manufacturer	Model	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Panasonic Appliances Microwave Oven (Shanghai) Co., Ltd.	NN-SD372S	2473.94790	2475.75150

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



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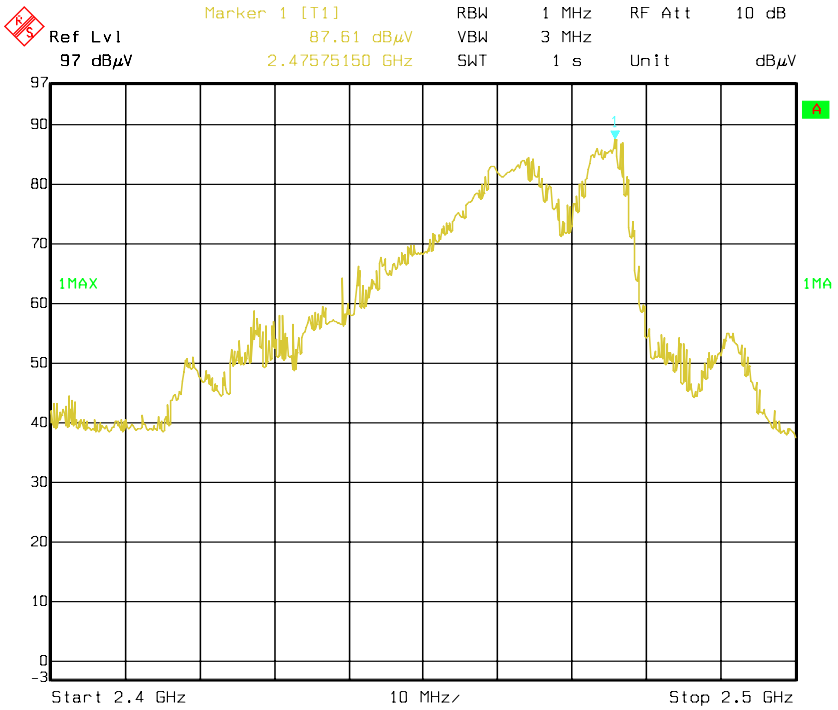

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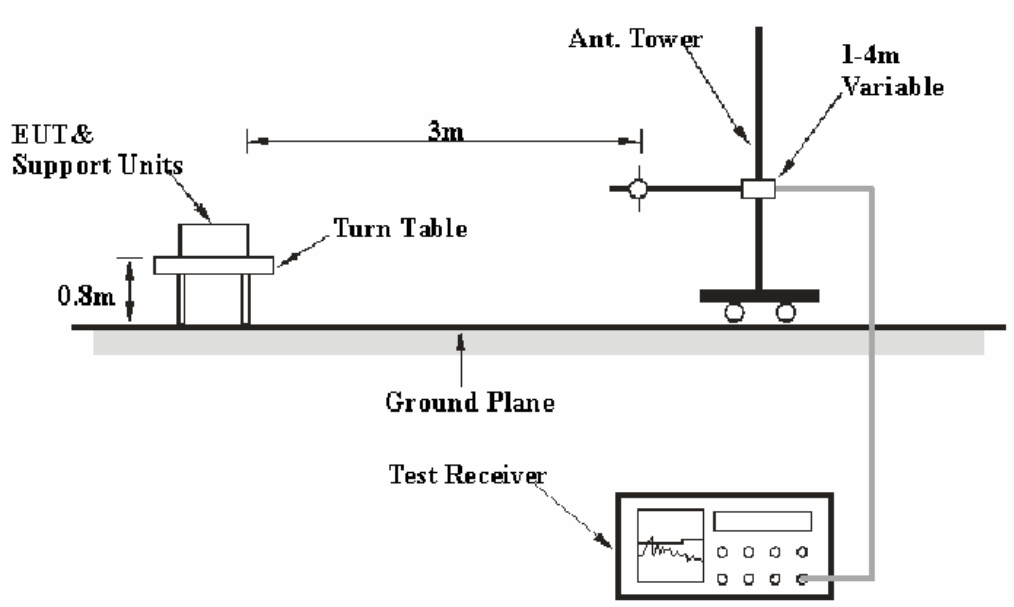
RADIATED EMISSIONS

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 CISPR 16-4-2, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Shenzhen) is 4.0 dB (k=2, 95% level of confidence).

EUT Setup



The radiated emission tests were performed in the 3 meters chamber 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.

EMI Test Receiver Setup and Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver and Spectrum Analyzer were set with the following configurations:

Frequency Range	***R B/W***	***Video B/W***	***IF B/W***	***Detector***
30 – 1000 MHz	100 kHz	300 kHz	120 kHz	Quasi-peak
Above 1 GHz	1 MHz	3 MHz		Peak
Above 1 GHz	1 MHz	10 Hz		Average

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447D	2944A09795	2011-08-02	2012-08-02
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2011-11-11	2012-11-10
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2011-07-05	2012-07-04
A.H. System	Horn Antenna	SAS-200/571	135	2011-05-17	2012-05-17
Rohde & Schwarz	Spectrum Analyzer	FSIQ26	609358	2011-07-08	2012-07-08
Mini-Circuits	Amplifier	2VA-213+	T-E27H	2011-03-08	2012-03-07
Electro-Mechanics	Horn Antenna	3116	9510-2270	2011-10-11	2012-10-10

*** Statement of Traceability:** Bay Area Compliance Laboratories 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 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 (native) 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, peak and average detection mode for the frequency above 1 GHz.

Corrected Amplitude & Margin Calculation

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

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Limit – Corrected Amplitude

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:

30 MHz-1 GHz

20.16 dB at **260.617500 MHz** in the **Horizontal** polarization

1-25 GHz

10.12 dB at **7417.31MHz** in the **Vertical** polarization

Test Data and Plots

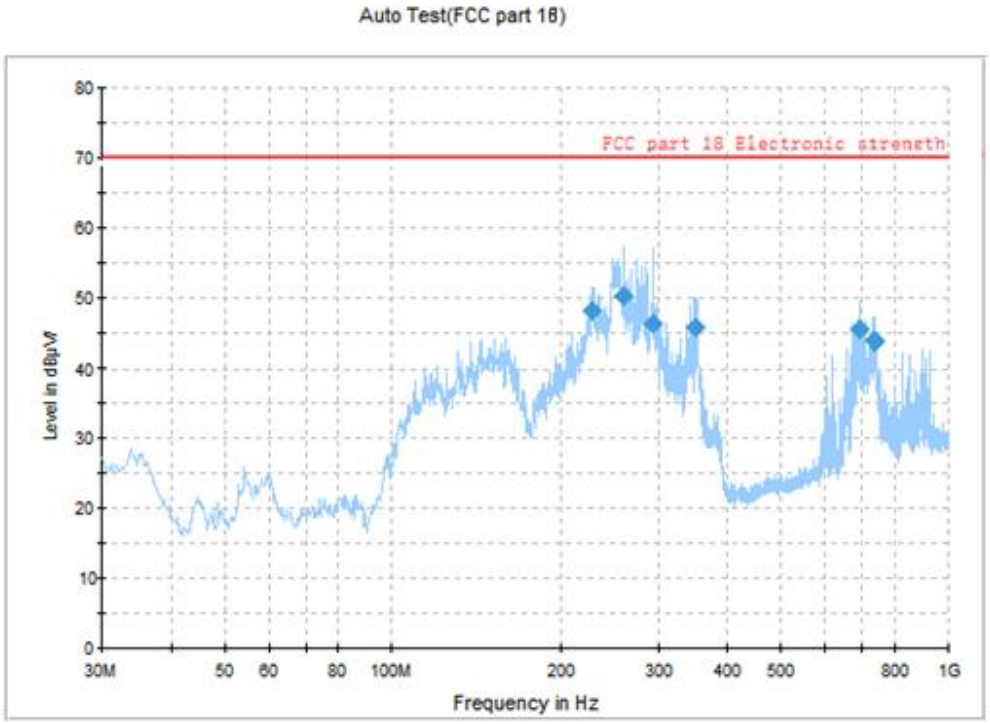
Environmental Conditions

Temperature:	25° C
Relative Humidity:	48%
ATM Pressure:	100.2kPa

The testing was performed by Jack Wang on 2011-12-05.

Test Mode: Running (Max Power)

30 MHz to 1 GHz:



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity	Turntable Position (degree)	Correction Factor (dB)	Limit (dBµV/m)	Margin (dB)
260.617500	50.1	100.0	H	84.0	-6.7	70.26	20.16
228.365000	48.1	101.2	H	0.0	-7.8	70.26	22.16
293.355000	46.3	100.0	H	71.0	-4.9	70.26	23.96
350.100000	45.6	117.6	H	98.0	-3.4	70.26	24.66
694.935000	45.5	154.5	V	143.0	1.5	70.26	24.76
736.887500	43.8	100.1	H	228.0	2.0	70.26	26.46

1 GHz to 25GHz:

Frequency MHz	Meter Reading (dBμV)	Detector (PK/QP/Ave.)	Antenna			Antenna Factor (dB)	Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC Part 18		
			Direction (Degree)	Height (m)	Polar (H/V)					Limit (dBμV/m)	Margin (dB)	Comments
2473.80	88.88	PK	0	1.2	H	27.5	3.9	0	120.28	/	/	Fund.
2473.10	85.60	PK	0	1.2	V	27.3	3.9	0	116.8	/	/	Fund.
2226.40	23.05	Ave.	167	1.3	H	29.7	3.7	9.1	47.35	70.26	22.91	spurious
2226.45	20.35	Ave.	183	1.3	V	29.7	3.7	9.1	44.65	70.26	25.61	spurious
4945.50	22.47	Ave.	185	1.5	H	33.6	5.6	7.2	54.47	70.26	15.79	harmonic
4947.90	24.64	Ave.	183	1.5	V	33.6	5.6	7.2	56.64	70.26	13.62	harmonic
7427.13	20.34	Ave.	185	1.5	H	39.2	7.8	7.3	60.04	70.26	10.22	harmonic
7417.31	20.44	Ave.	183	1.5	V	39.2	7.8	7.3	60.14	70.26	10.12	harmonic
9897.72	18.47	Ave.	185	1.5	H	39.3	8.8	7.6	58.97	70.26	11.29	harmonic
9895.29	18.06	Ave.	183	1.5	V	39.3	8.8	7.6	58.56	70.26	11.7	harmonic

Note: The emissions level of 5^{th} harmonic to 10^{th} harmonic were 20dB lower than the limit.

******* END OF REPORT *******