



NVLAP LAB CODE 200707-0



FCC PART 18

EMI MEASUREMENT AND TEST REPORT

For

Whirlpool Microwave Products Development Ltd

16/F, Paliburg Plaza, 68 Ye Wo Street, Causeway Bay, Hong Kong

FCC ID: PR4MH1170Y

This Report Concerns: <input checked="" type="checkbox"/> Class II permissive change		Equipment Type: Microwave Oven	
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Report Number:	RSZ07121051		
Test Date:	2008-02-19		
Report Date:	2008-02-22		
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Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Shenzhen). This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal 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	4
OPERATING CONDITION/TEST CONFIGURATION.....	5
JUSTIFICATION	5
EQUIPMENT MODIFICATIONS	5
EXTERNAL CABLE LIST AND DETAILS	5
CONFIGURATION OF TEST SETUP	5
BLOCK DIAGRAM OF TEST SETUP	6
CONDUCTED EMISSIONS	7
MEASUREMENT UNCERTAINTY	7
EUT SETUP	7
EMI TEST RECEIVER SETUP.....	8
TEST EQUIPMENT LIST AND DETAILS.....	8
TEST PROCEDURE	8
TEST RESULTS SUMMARY.....	8
TEST DATA	9
PLOT(S) OF TEST DATA	9
RADIATION HAZARD MEASUREMENT	12
ENVIRONMENTAL CONDITIONS.....	12
TEST EQUIPMENT LIST AND DETAILS.....	12
RADIATION HAZARD MEASUREMENT	12
INPUT POWER.....	12
LOAD FOR MICROWAVE OVENS.....	13
RF OUTPUT POWER MEASUREMENT	14
OPERATING FREQUENCY MEASUREMENT	15
RADIATED EMISSIONS.....	21
MEASUREMENT UNCERTAINTY	21
EUT SETUP	21
EMI TEST RECEIVER SETUP AND SPECTRUM ANALYZER SETUP.....	22
TEST EQUIPMENT LIST AND DETAILS.....	22
TEST PROCEDURE	22
CORRECTED AMPLITUDE & MARGIN CALCULATION	23
TEST RESULTS SUMMARY.....	23
TEST DATA AND PLOTS.....	23

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Whirlpool Microwave Products Development Ltd.*'s model: IMH 16 series or the "EUT" as referred to in this report is a Microwave Oven which measures approximately 76.0 cm L x 40.0cm W x 43.0cm H, rated input voltage: AC 120 V/60 Hz.

* All measurement and test data in this report was gathered from production sample serial number: 0712002 (Assigned by BACL, Shenzhen). The EUT was received on 2007-12-10.

Objective

The following test report is prepared on behalf of *Whirlpool Microwave Products Development 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	New
Magnetron	LG 2M226	Panasonic 2M167B
HV Transformer	ELEDEX EDX-JK1012A	ELEDEX EDX-JK1013A

For the changes made to the device, conducted emission testing and Radiated emission testing were performed.

Related Submittal(s)/Grant(s)

This is a C2PC application. The original application was granted on 2005-12-02.

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 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. 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 a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0).



NVLAP 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.

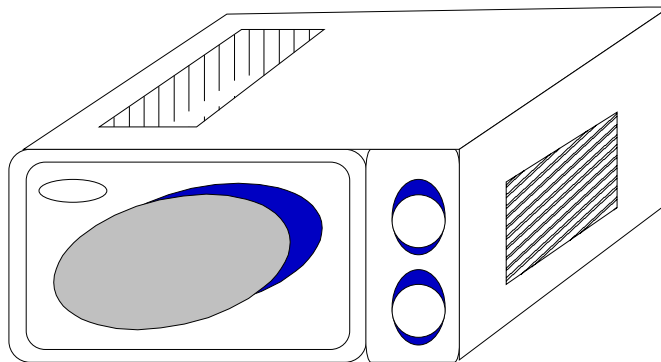
Equipment Modifications

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

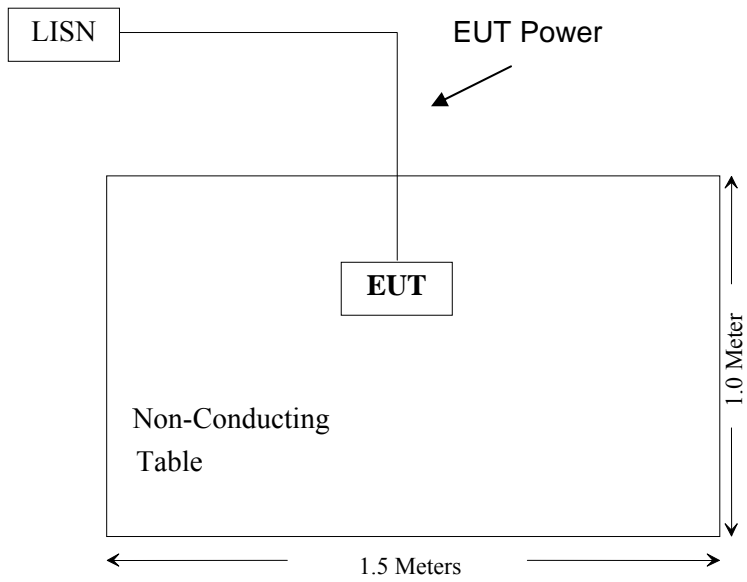
External Cable List and Details

Cable Description	Length (m)	From/Port	To
Unshielded Undetachable AC Cable	1.00	EUT	Main Power Port

Configuration of Test Setup



Block Diagram of Test Setup



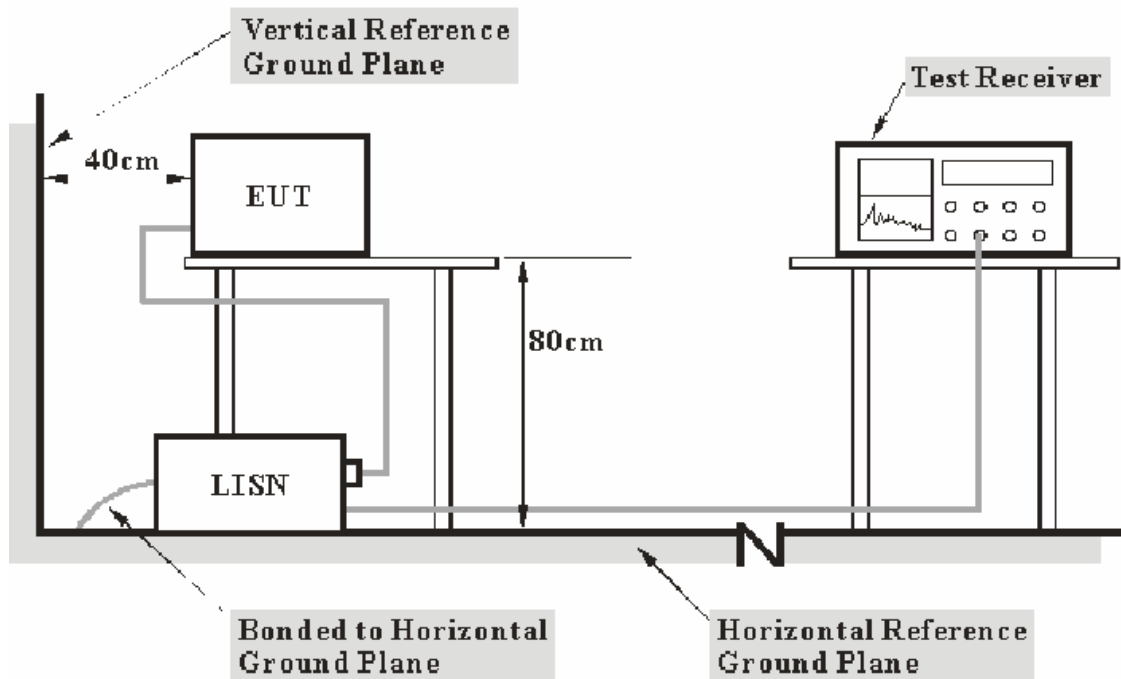
CONDUCTED EMISSIONS

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, 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 Laboratories 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	DE25330 or 830245/006	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 Laboratories 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:

6.00 dB at 1.065 MHz in the **Hot** conductor mode.

Test Data**Environmental Conditions**

Temperature:	25° C
Relative Humidity:	50%
ATM Pressure:	1000mbar

The testing was performed by Simon Mo on 2008-02-19.

Test mode: MAX Power

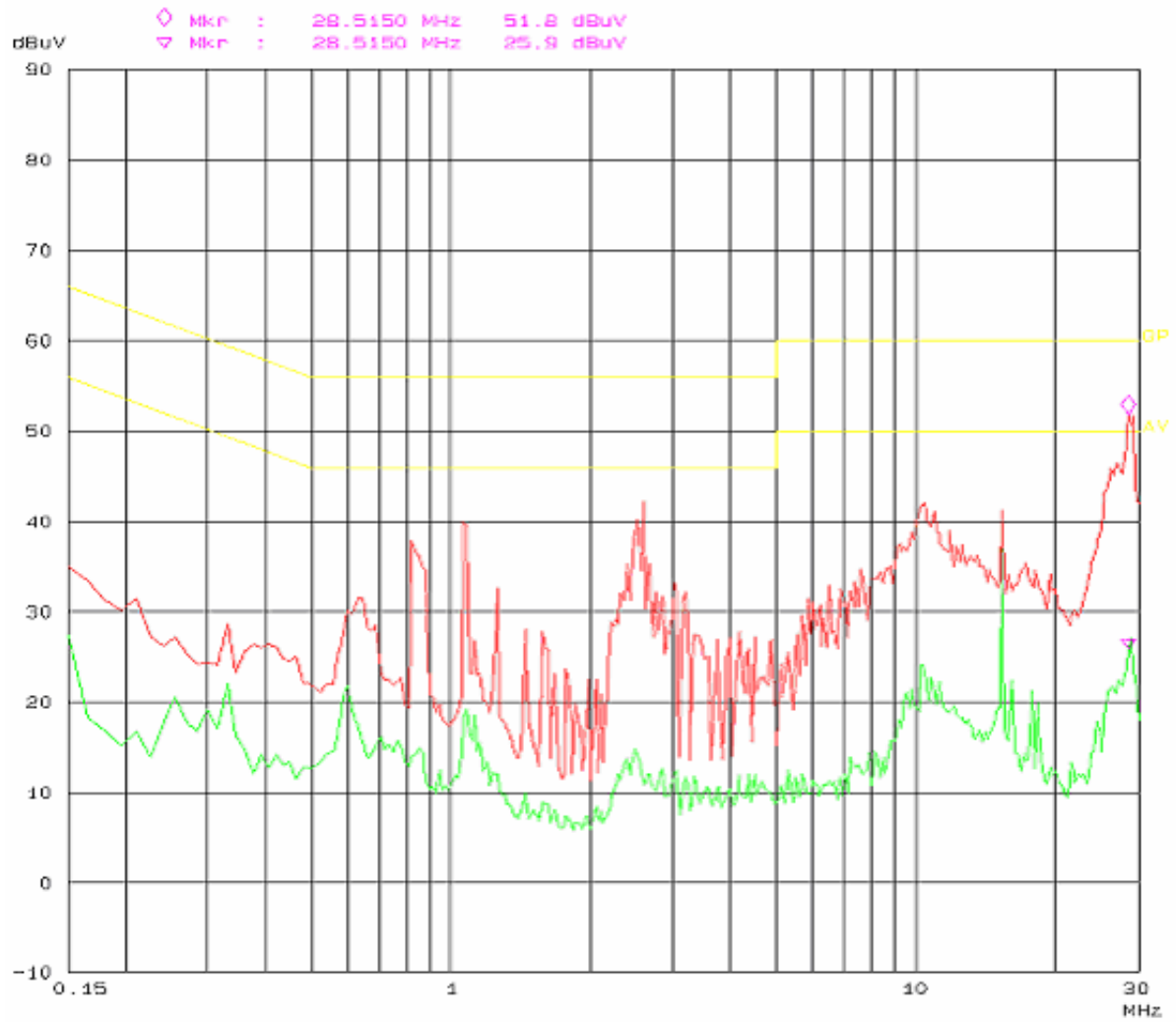
Line Conducted Emissions				FCC Part 18.307	
Frequency (MHz)	Amplitude (dB μ V)	Detector (QP/AV)	Conductor (Hot/Neutral)	Limit (dB μ V)	Margin (dB)
1.065	40.00	AV	Hot	46.00	6.00
28.515	51.80	QP	Hot	60.00	8.20
1.290	44.70	QP	Neutral	56.00	11.30
1.100	44.20	QP	Neutral	56.00	11.80
2.610	42.30	QP	Hot	56.00	13.70
2.590	40.30	QP	Neutral	56.00	15.70
1.065	40.00	QP	Hot	56.00	16.00
29.460	42.60	QP	Neutral	60.00	17.40
10.440	42.00	QP	Hot	60.00	18.00
0.825	37.90	QP	Hot	56.00	18.10
12.000	26.00	AV	Neutral	50.00	24.00
28.515	25.90	AV	Hot	50.00	24.10
12.000	35.30	QP	Neutral	60.00	24.70
1.100	21.00	AV	Neutral	46.00	25.00
0.330	22.00	AV	Hot	49.45	27.45
10.440	22.20	AV	Hot	50.00	27.80
1.290	18.00	AV	Neutral	46.00	28.00
29.460	20.60	AV	Neutral	50.00	29.40
2.590	16.00	AV	Neutral	46.00	30.00
0.330	28.60	QP	Hot	59.45	30.85
0.825	14.00	AV	Hot	46.00	32.00
0.260	18.90	AV	Neutral	51.43	32.53
0.260	27.30	QP	Neutral	61.43	34.13
2.610	10.70	AV	Hot	46.00	35.30

Plot(s) of Test Data

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

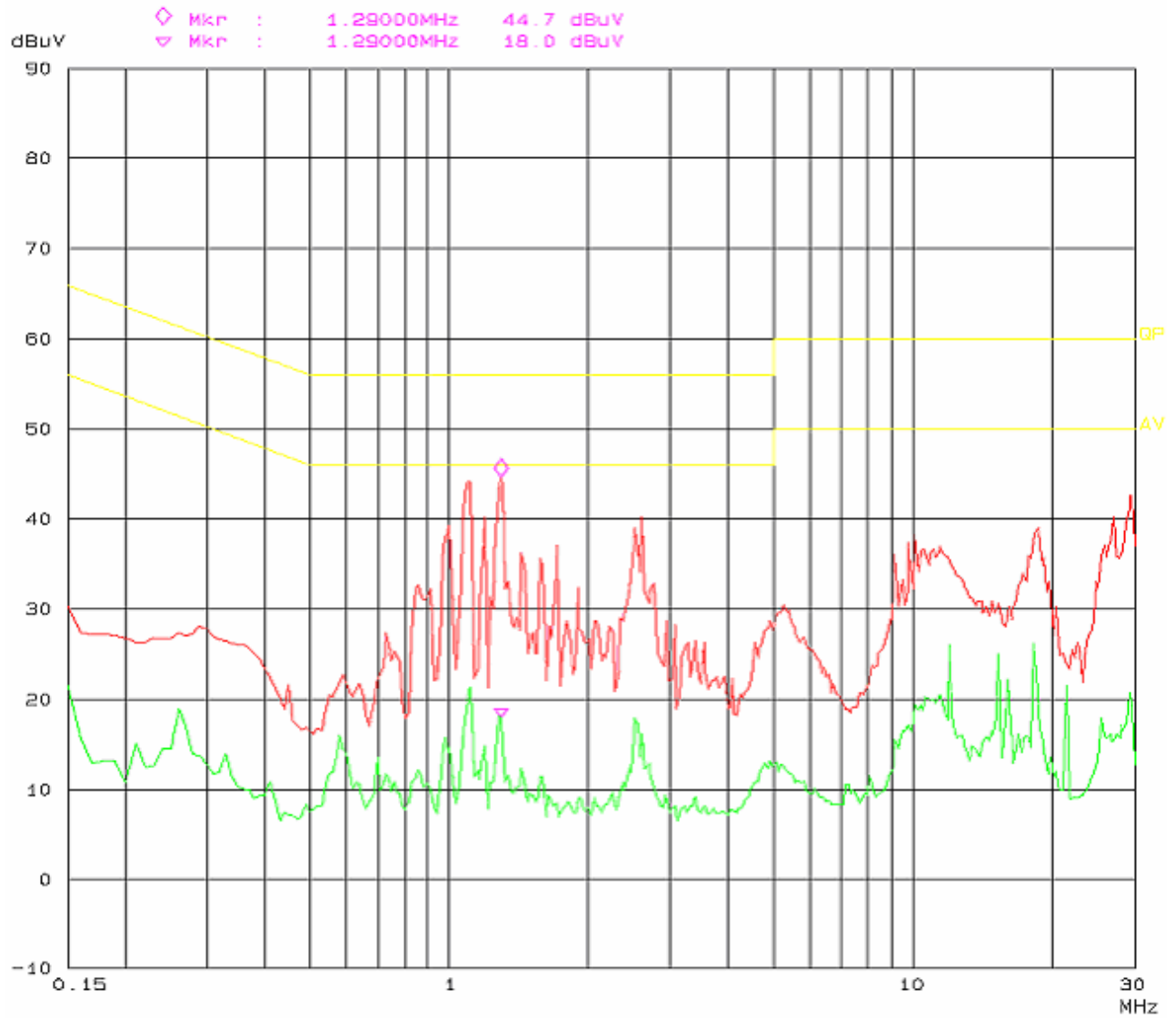
Conducted Emission Test FCC Part18

EUT: Microwave Oven
Manuf: Whirlpool
Op Cond: MAX POWER
Operator: SIMON
Test Spec: AC 120V/60Hz hot



Conduction Disturbance Test FCC Part18

EUT: Microwave Oven
Manuf: Whirlpool
Op Cond: MAX POWER
Operator: SIMON
Test Spec: AC120V/60Hz Neutral



RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	25°C
Relative Humidity:	50%
ATM Pressure:	1175mbar

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2007-08-17	2008-08-17
Sunol Sciences	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
HP	Preamplifier	8449B	3008A00277	2007-09-29	2008-09-29
Ainuo	Digital Power Analyzer	8732B	028706117	2007-12-23	2008-12-23
HY	AC Power Source	9020117	GY053(1)	2007-08-21	2008-08-21

* **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.

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 0.66mW/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 (Vac/Hz)	Input Current (amps)	Measured Input Power (watts)	Rated Input Power (watts)
120/60	12.8	1540	1500

- 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 (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
1000	20	62.7	200

$$\text{Power} = (4.2 \text{ joules/calorie})(\text{volume in milliliters})(\text{temperature rise})/(\text{time in seconds})$$

$$\text{Power} = 4.2 \text{ joules/calorie} \times 1000 \times (62.7-20) / 200$$

$$\text{Power} = 897 \text{ watts}$$

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 25 μ V/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:

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

$$\text{LFS} = 25 * \text{SQRT}(897/500)$$

$$\text{LFS} \approx 33.49$$

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

Manufacturer	Model	LFS	Field Strength @300m (dB μ V/m)	Field Strength @3m (dB μ V/m)
Whirlpool Microwave Products Development Ltd	IMH 16 series	33.49	30.5	70.5

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.

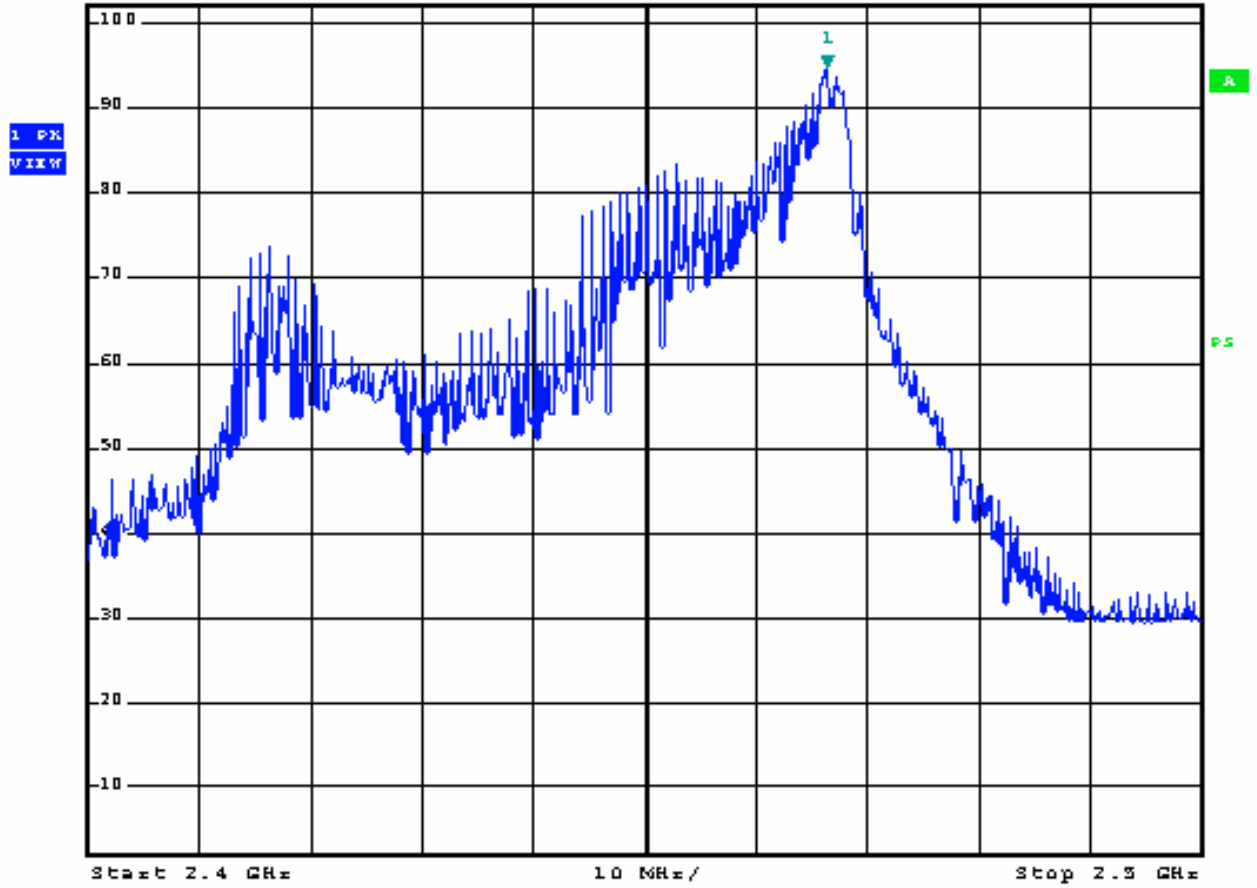
The results of this test are as follows:

Manufacturer	Model	Minimum Frequency (GHz)	Maximum Frequency (GHz)
Whirlpool Microwave Products Development Ltd	IMH 16 series	2.4664	2.4696

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



Ref 102 dB μ V Att 10 dB REW 1 MHz Marker 1 [T1]
VIEW VEW 3 MHz 94.74 dB μ V
SWT 1 μ s 2.466400000 GHz

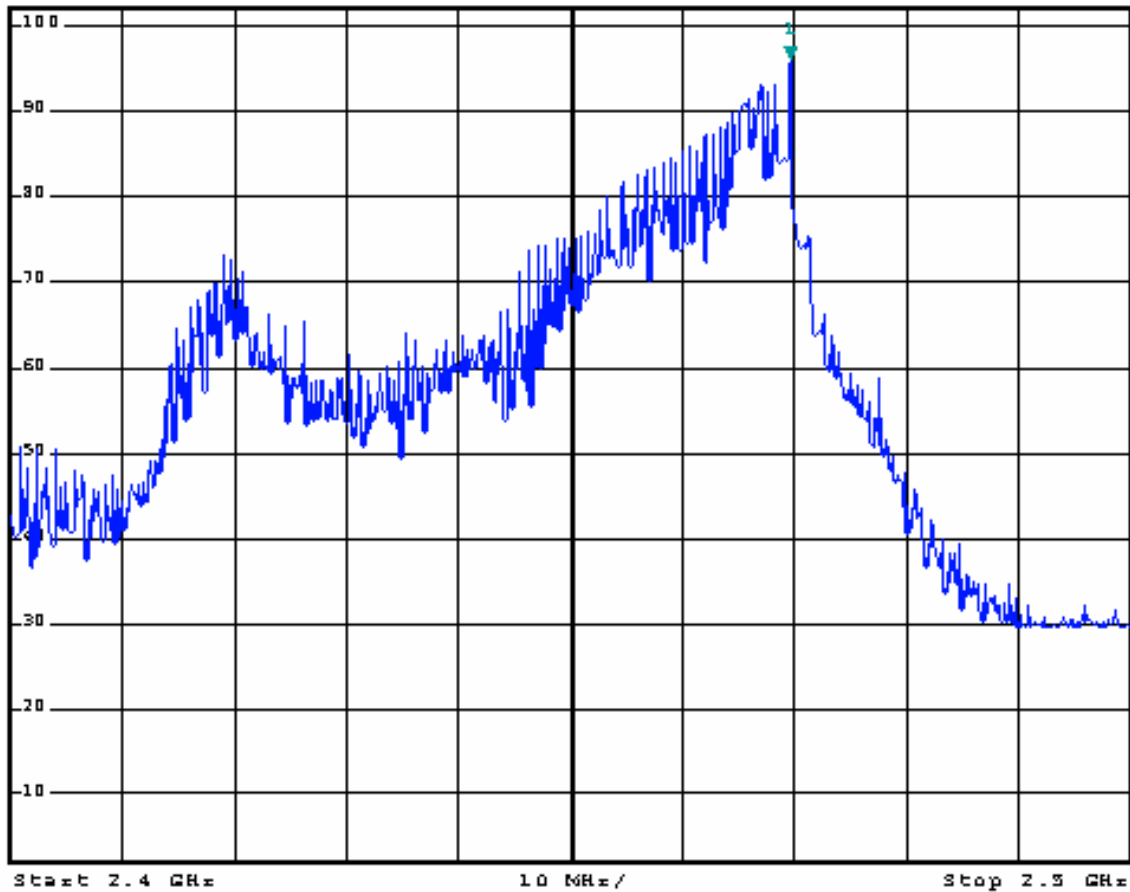


operation frequencies vs time-minimum frequency



Ref 102 dB μ V Att 10 dB RBW 1 MHz Mask 1 [E1]
V BW 3 MHz 93.97 dB μ V
SWT 1 μ 2.469600000 GHz

1 dB
VIEW



operation frequencies vs time-maximum frequency

Variation in Operating Frequency with Line Voltage

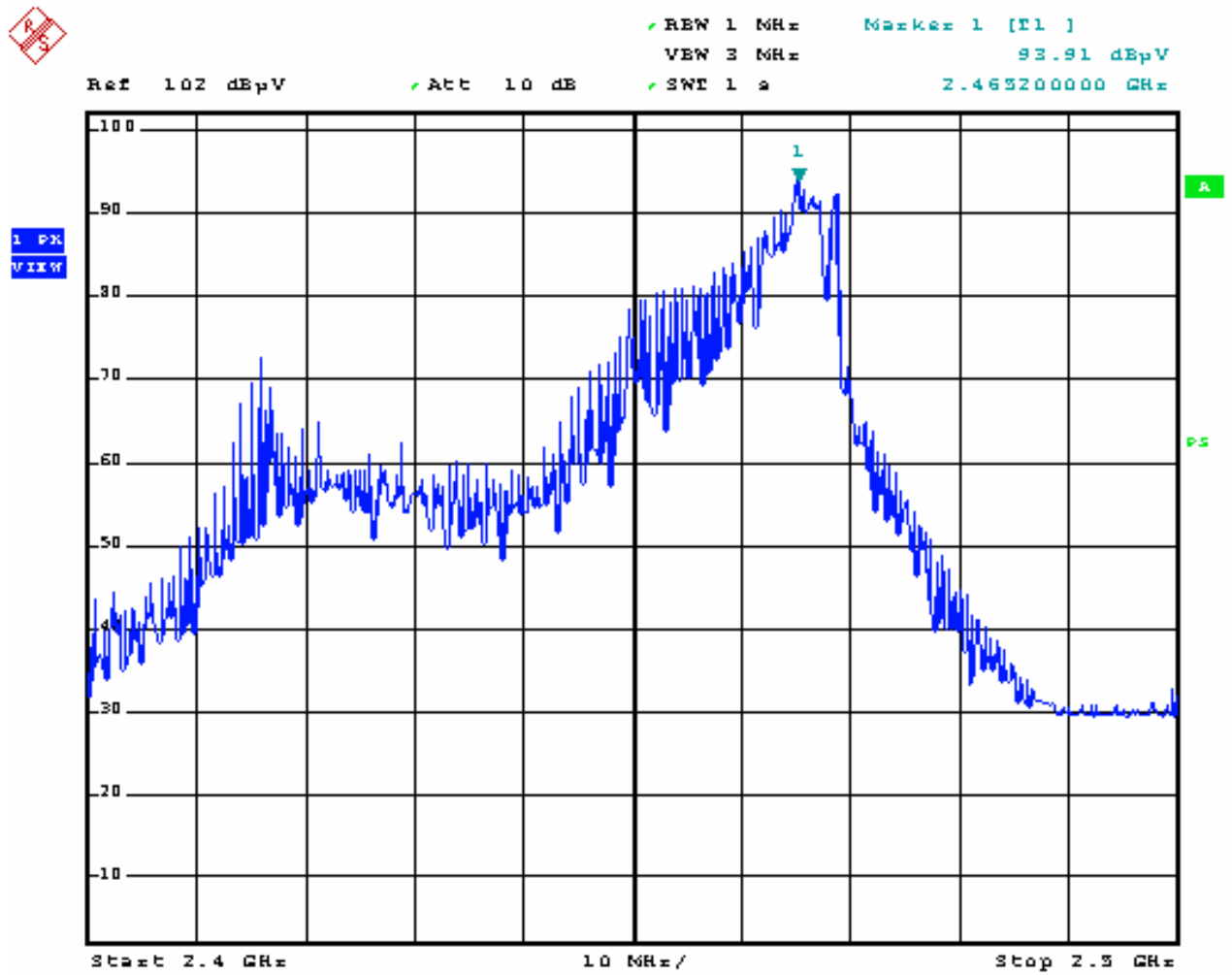
The EUT was operated / warmed by at least 10 minutes of use with a 1000ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency (GHz)	Maximum Frequency (GHz)
Whirlpool Microwave Products Development Ltd	IMH 16 series	2.4652	2.4678

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



operation frequencies vs voltage-minimum frequency

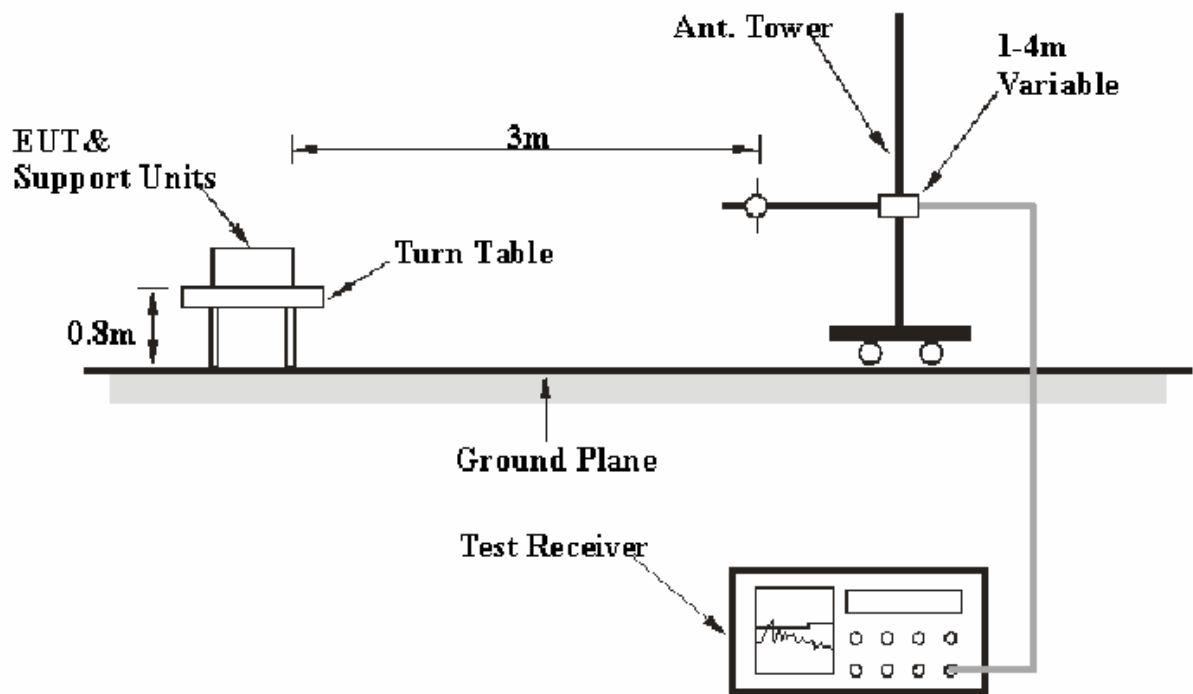
RADIATED EMISSIONS

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 NIS 81, 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.

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 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 1 GHz.

During the radiated emission test, the EMI test receiver and Spectrum Analyzer were 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 1 GHz	1MHz	30 Hz	

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2007-11-15	2008-11-15
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2007-10-16	2008-10-16
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2007-08-14	2008-08-14
SUNOL SCIENCES	Horn Antenna	DRH-118	A052604	2007-09-25	2008-09-25
HP	Preamplifier	8449B	3008A00277	2007-09-29	2008-09-29
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2007-05-09	2008-05-09

* **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 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 detector 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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

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:

8.7 dB at **303.278500 MHz** in the **Vertical** polarization, 30 MHz-1000MHz
3.23 dB at **9887.30 MHz** in the **Horizontal** polarization, above 1 GHz

Test Data and Plots

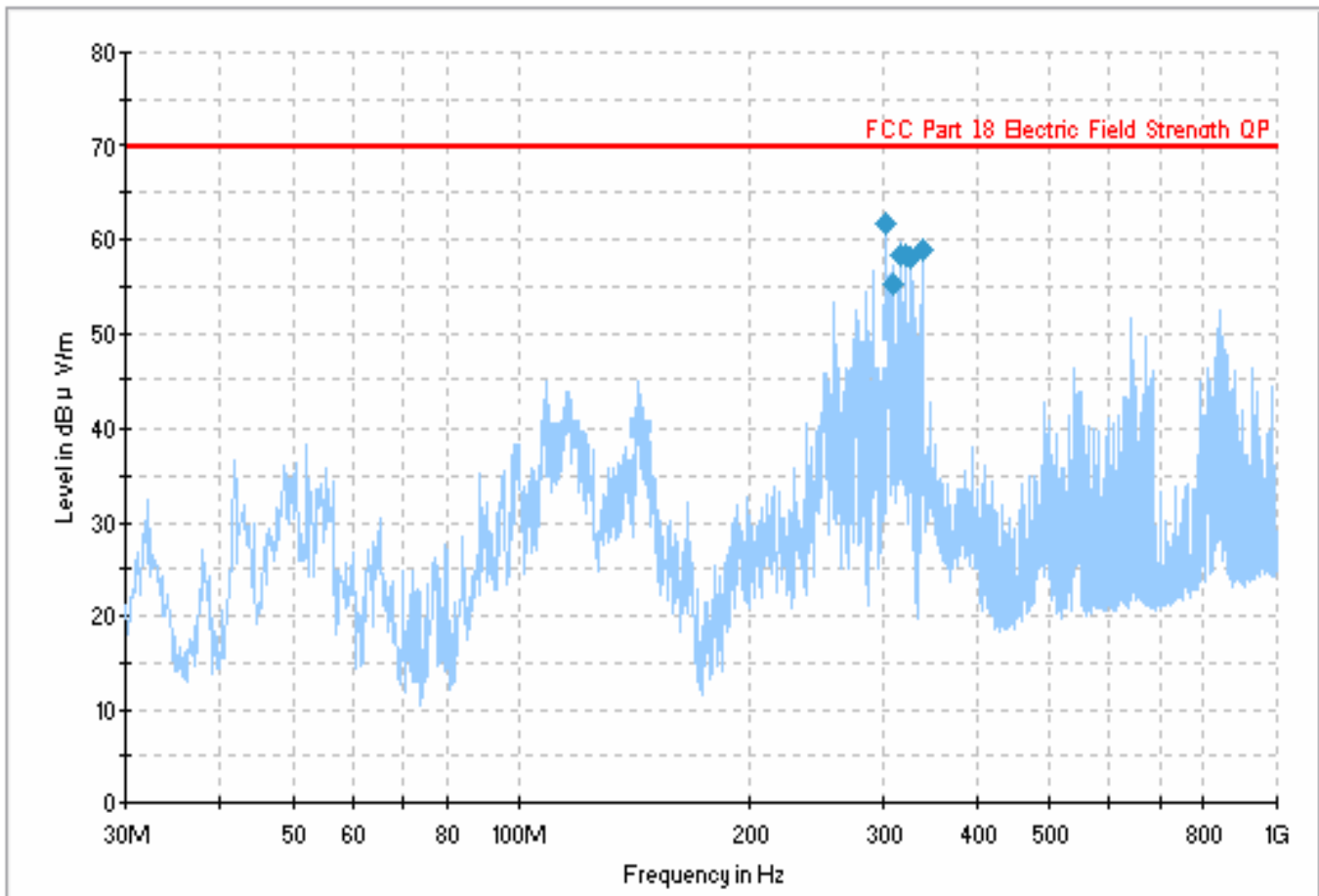
Environmental Conditions

Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1009 mbar

The testing was performed by Jim Li on 2008-02-19.

Test mode: MAX Power

30 -1000 MHz:



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Correction Factor (dB)	Limit (dBμV/m)	Margin (dB)
303.278500	61.8	181.0	V	0.0	-10.5	70.5	8.7
340.244500	58.8	129.0	V	0.0	-9.2	70.5	11.7
317.290875	58.3	154.0	V	0.0	-10.2	70.5	12.2
321.904125	58.3	400.0	H	86.0	-10.1	70.5	12.2
327.411812	57.9	124.0	V	356.0	-10.0	70.5	12.6
309.572875	55.3	113.0	V	2.0	-10.4	70.5	15.2

Above 1GHz:

Frequency (MHz)	Receiver Reading (dB μ V)	Detector (PK/QP/AV)	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. Gain dB	Cord. Amp. (dB μ V/m)	FCC Part 18	
				Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dB μ V/m)	Margin (dB)
9887.30	57.40	AV (Harmonic)	90	1.2	H	38.2	5.77	34.1	67.27	70.5	3.23*
9887.20	55.82	AV (Harmonic)	60	1.2	V	38.2	5.77	34.1	65.69	70.5	4.81
4917.80	62.23	AV (Harmonic)	180	1.0	H	32.0	4.55	33.4	65.38	70.5	5.12
7386.70	58.30	AV (Harmonic)	60	1.0	H	35.3	4.75	33.7	64.65	70.5	5.85
4917.80	57.44	AV (Harmonic)	180	1.2	V	32.0	4.55	33.4	60.59	70.5	9.91
1232.50	50.86	AV (Harmonic)	60	1.0	H	37.2	6.53	34.1	60.49	70.5	10.01
7386.70	52.51	AV (Harmonic)	45	1.0	V	35.3	4.75	33.7	58.86	70.5	11.64
1232.40	47.94	AV (Harmonic)	45	1.2	V	37.2	6.53	34.1	57.57	70.5	12.93

* Within measurement uncertainty

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