

FCC PART 18  
TEST REPORT

For

**Whirlpool Microwave Products Development Limited**

16/F, Paliburg Plaza 68 Yee Woo Street, Causeway Bay, Hong Kong

**FCC ID: PR4I2205X**

<b>Report Type:</b> Class II Permissive Change	<b>Product Name:</b> Microwave Oven
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<b>Report Number:</b> RSZ130812550-00	
<b>Report Date:</b> 2013-10-12	
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**Note:** This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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**GENERAL INFORMATION**

**Product Description for Equipment under Test (EUT)**

The *Whirlpool Microwave Products Development Limited*'s product, model number: *IMH2205 (FCC ID: PR4I2205X)* or the "EUT" in this report was a *Microwave Oven*, which was measured approximately: 76.0 cm (L) x 40.5 cm (W) x 43.8 cm (H), the rated with input voltage: AC 120V/60Hz. The highest operating frequency is 2450 MHz.

*\*All measurement and test data in this report was gathered from production sample serial number: 1308004 (Assigned by BAACL, Shenzhen). The EUT supplied by the applicant was received on 2013-08-12.*

**Objective**

The following test report is prepared on behalf of *Whirlpool Microwave Products Development Limited* 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.

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

Part	Original	New
Magnetron	Whirlpool: 2M167B-M16	LG: 2M226

For the changes made to the device, all item testing were performed.

**Related Submittal(s)/Grant(s)**

Original submission with FCC ID: PR4I2205X which is granted on 01/30/2012.

**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 on 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.

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.

## 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.

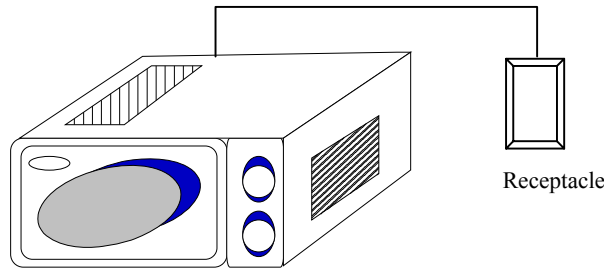
### Equipment Modifications

No modifications were made to the unit tested.

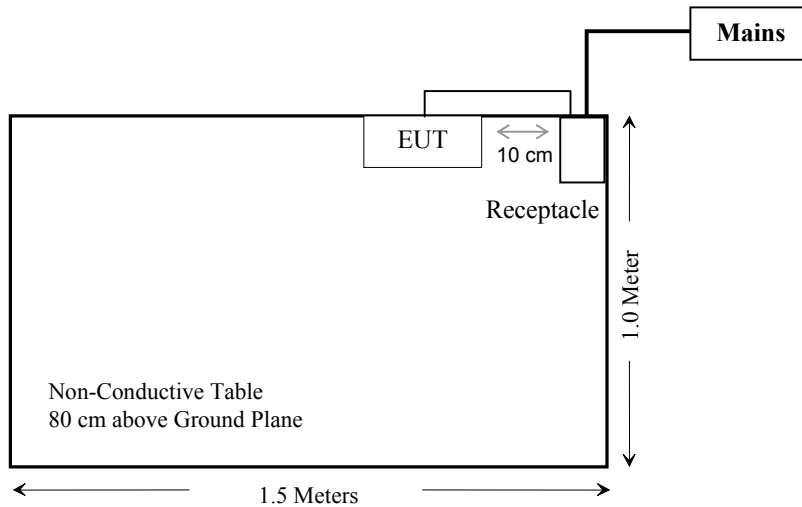
### External Cable List and Details

Cable Description	Length (m)	From/Port	To
Unshield Undetachable AC Cable	1.0	EUT	Receptacle
Unshield Undetachable AC Cable	1.5	Receptacle	Mains

### Configuration of Test Setup



### Block Diagram of Test Setup



## CONDUCTED EMISSIONS

### Applicable Standard

FCC §18.307

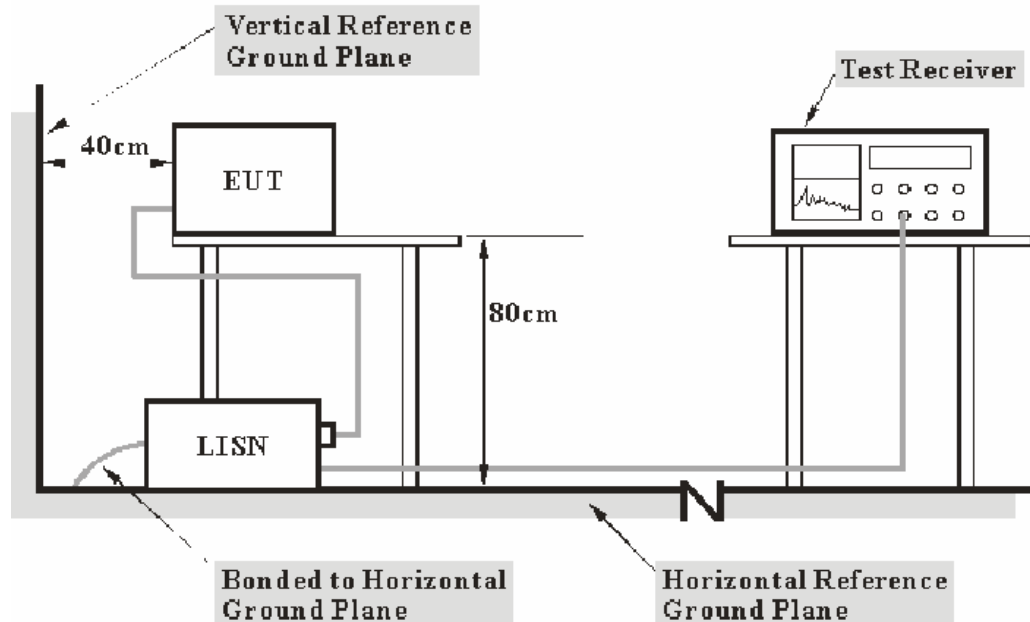
### Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between AMN/ISN and receiver, AMN/ISN voltage division factor, AMN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 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	100176	2013-06-17	2014-06-17
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2013-05-07	2014-05-07
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2013-08-09	2014-08-09
Rohde & Schwarz	CE Test software	EMC 32	8.95	-	-

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**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:

**11.4 dB at 0.926000 MHz in the Line conducted mode**

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(L_m)} \leq L_{lim} + U_{cispr}$$

in BACL.,  $U_{(L_m)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

## Test Data

### Environmental Conditions

<b>Temperature:</b>	26 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

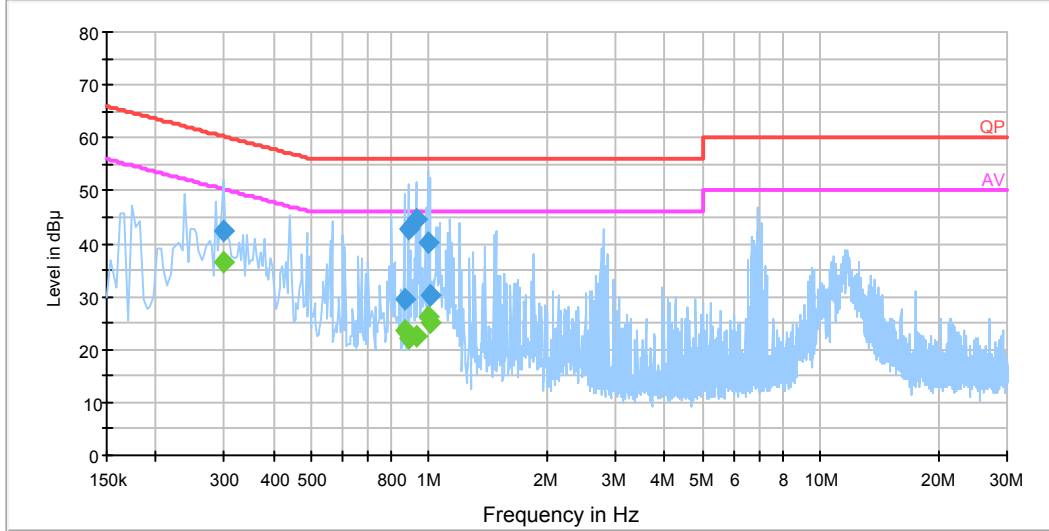
*The testing was performed by Sean Zhao on 2013-08-20.*

*Test Mode: Running (Max Power)*



**AC 120V/60Hz, Line:**

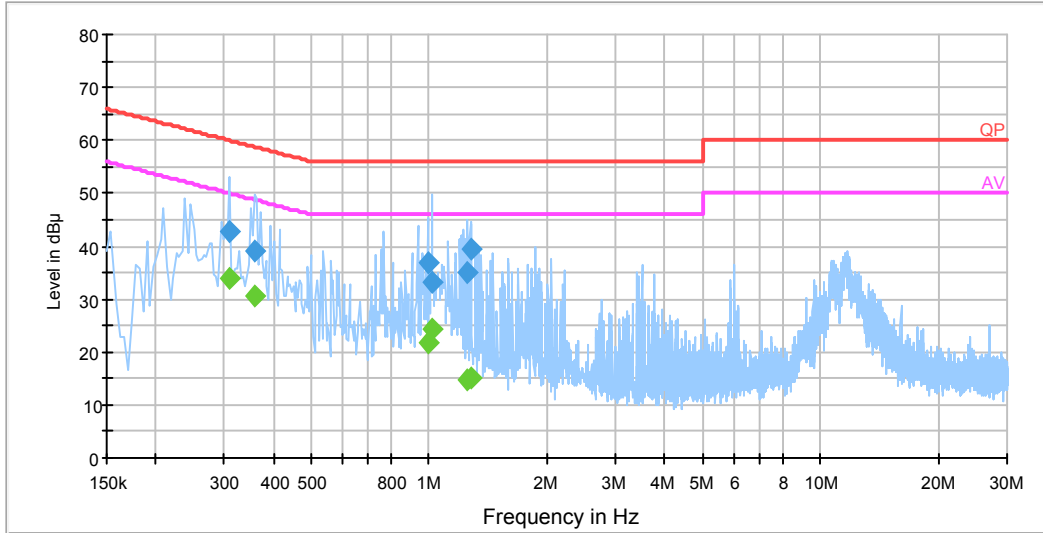
EMI Auto Test L



Frequency (MHz)	Corrected Amplitude (dBµV)	Corrected Factor (dB)	Limit (dBµV)	Margin (dB)	Remark (PK/ QP/Ave)
0.298000	42.6	19.5	60.3	17.7	QP
0.298000	36.6	19.5	50.3	13.7	Ave.
0.866000	29.4	19.5	56.0	26.6	QP
0.866000	23.5	19.5	46.0	22.5	Ave.
0.886000	42.8	19.5	56.0	13.2	QP
0.886000	22.0	19.5	46.0	24.0	Ave.
0.926000	44.6	19.5	56.0	11.4	QP
0.926000	22.6	19.5	46.0	23.4	Ave.
0.990000	40.1	19.5	56.0	15.9	QP
0.990000	26.0	19.5	46.0	20.0	Ave.
1.006000	30.2	19.5	56.0	25.8	QP
1.006000	25.1	19.5	46.0	20.9	Ave.

**AC 120V/60Hz, Neutral:**

EMI Auto Test N



Frequency (MHz)	Corrected Amplitude (dBμV)	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Remark (PK/ QP/Ave)
0.310000	42.8	19.5	60.0	17.1	QP
0.310000	34.0	19.5	50.0	16.0	Ave.
0.358000	39.0	19.5	58.8	19.7	QP
0.358000	30.7	19.5	48.8	18.1	Ave.
0.990000	37.0	19.5	56.0	19.0	QP
0.990000	21.9	19.5	46.0	24.1	Ave.
1.018000	33.0	19.5	56.0	23.0	QP
1.018000	24.3	19.5	46.0	21.7	Ave.
1.258000	34.9	19.5	56.0	21.1	QP
1.258000	14.8	19.5	46.0	31.2	Ave.
1.274000	39.6	19.5	56.0	16.4	QP
1.274000	15.2	19.5	46.0	30.8	Ave.

**Note:**

- 1) Corrected Amplitude = Reading + Correction Factor
- 2) Correction Factor = LISN/ISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter  
The corrected factor has been input into the transducer of the test software.
- 3) Margin = Limit - Corrected Amplitude

**RADIATION HAZARD MEASUREMENT**

**Applicable Standard**

FCC §18.301

**Environmental Conditions**

<b>Temperature:</b>	26 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	101.0 kPa

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2012-11-24	2013-11-24
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2014-11-30
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2013-04-03	2014-04-03
Ainuo	Digital Power Analyzer	8732B	28706117	2013-04-24	2014-04-24
HY	AC Power Source	9020117	GY053(1)	2013-08-21	2014-08-21
GW Instek	AC Power Meter	GPM-8212	CF170061	2012-11-19	2013-11-19

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

**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 0.33mW/cm<sup>2</sup> observed at any point 5 cm or more from the external surface of the oven.

A maximum of 1.0 mW/cm<sup>2</sup> 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 1000 ml 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 <sub>AC</sub> /Hz)	Input Current (Amps)	Measured Input Power (Watts)	Rated Input Power (Watts)
120/60	12.3	1476	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 1000 watts output, each quantity was increased by 50% for each 500watts or fraction thereof in excess of 1000 watts. 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 (s)
1000	30	50	200

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

Power = 4.2 x 1000 x (50-30) / 200

Power = 420 watts

The measurement output power was found to be less than 500 watts. 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 500 watts. Therefore, in accordance with Section 18.305 of Subpart-C, the measured out-of-band emissions were compared with the limit calculated as following:

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

$$LFS = 25 * \text{SQRT} (420/500)$$

$$LFS = \underline{22.91}$$

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 µV/m@300m	dBµV/m@300m	dBµV/m@3m
Guangdong Whirlpool Electrical Appliance Co., Ltd.	IMH2205	22.91	27.20	67.20

### Operating Frequency Measurement

#### Variation in Operating Frequency with Time

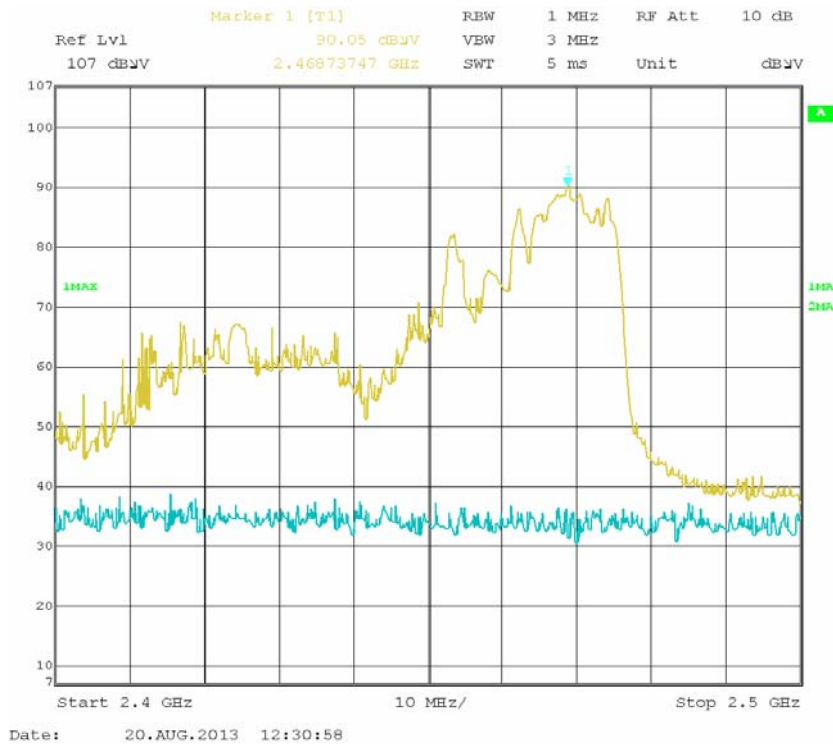
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

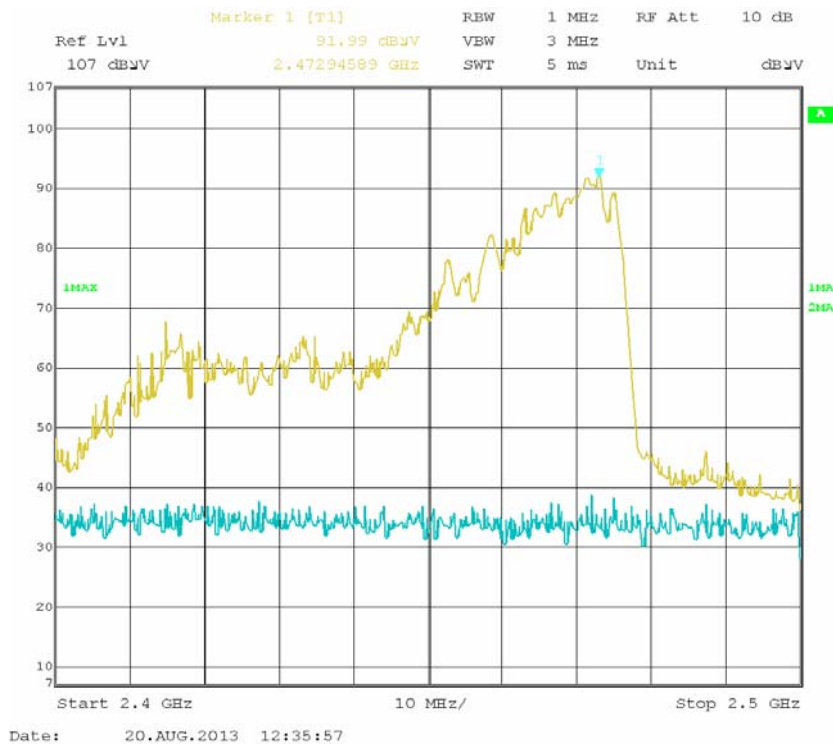
Manufacturer	Model	(Start Time) Frequency (MHz)	(End Time) Frequency (MHz)
Guangdong Whirlpool Electrical Appliance Co., Ltd.	IMH2205	2468.7	2472.9

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.

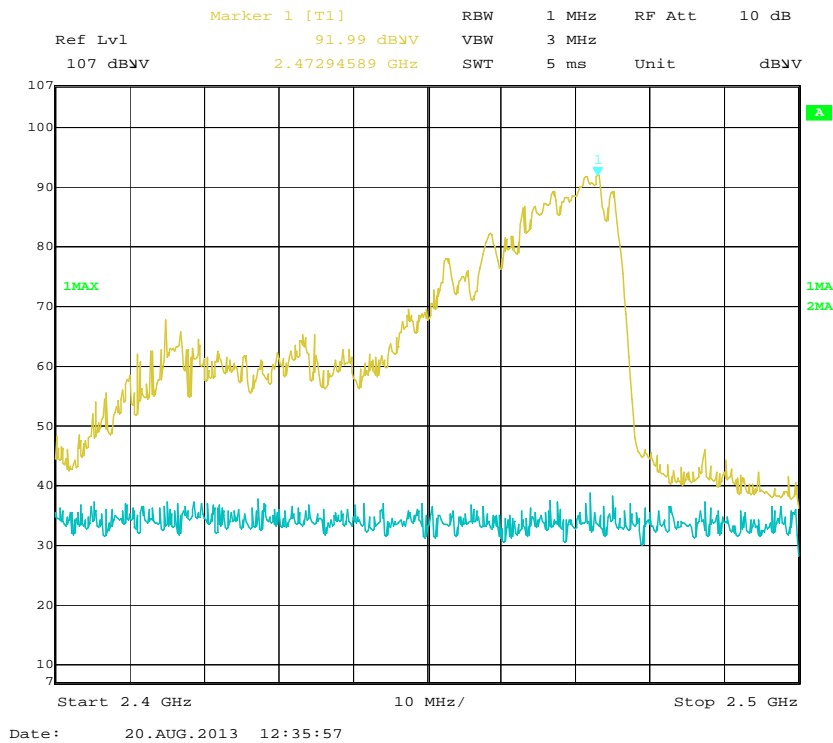
The results of this test are as follows:

Line voltage varied from 96 V<sub>AC</sub> to 150 V<sub>AC</sub>.

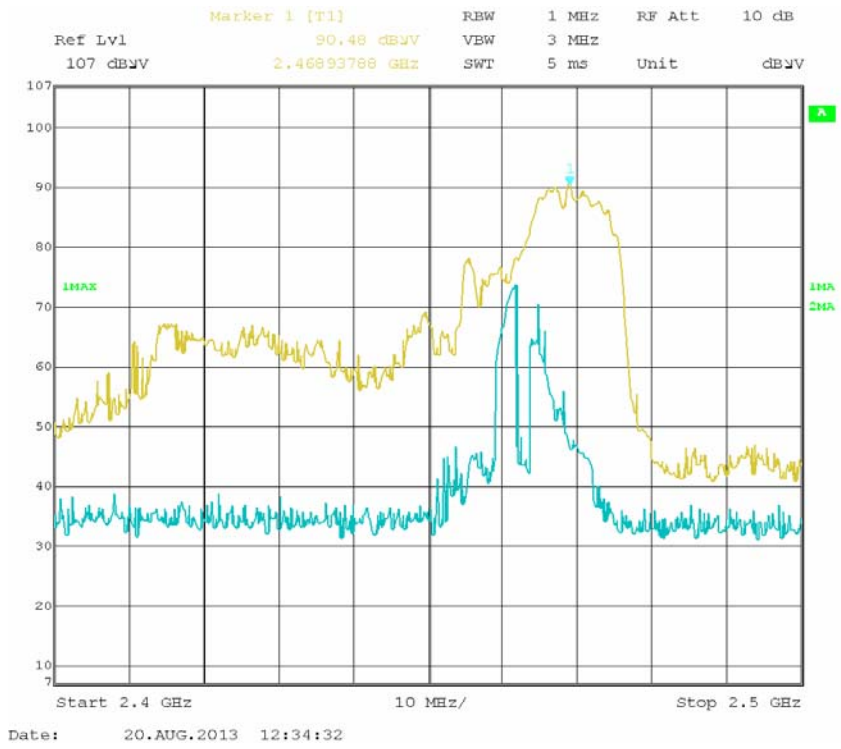
Manufacturer	Model	(Low voltage) Frequency (MHz)	(High voltage) Frequency (MHz)
Guangdong Whirlpool Electrical Appliance Co., Ltd.	IMH2205	2472.9	2468.9

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

#### Low voltage:



**High voltage:**





## RADIATED EMISSIONS

### Applicable Standard

FCC §18.305 and FCC §18.309

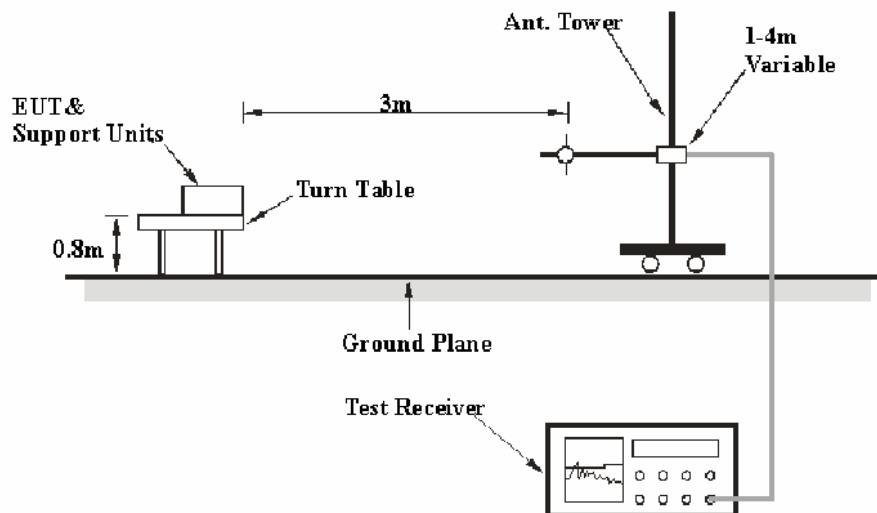
### Measurement Uncertainty

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 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report

Frequency	Polarity	Measurement uncertainty
30MHz~200MHz	Horizontal	4.62 dB (k=2, 95% level of confidence)
	Vertical	4.54 dB (k=2, 95% level of confidence)
200MHz~1GHz	Horizontal	4.84 dB (k=2, 95% level of confidence)
	Vertical	5.91 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	Horizontal / Vertical	4.68 dB (k=2, 95% level of confidence)
Above 6 GHz	Horizontal / Vertical	4.92 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	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	100 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

### 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 (naïve) operating mode during the final qualification test to represent the worst results.

The data was recorded in the Quasi-peak detection mode from 30 MHz to 1 GHz, peak and average detection mode for 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:

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

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447E	1937A01046	2013-08-09	2014-08-09
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2012-11-24	2013-11-24
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2012-11-24	2013-11-23
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2013-04-03	2014-04-03

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

### 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:

**15.99 dB at 7800.1 MHz in the Vertical polarization**

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(L_m)} \leq L_{lim} + U_{cispr}$$

in BACL.,  $U_{(L_m)}$  is less than  $U_{cispr}$ , if  $L_m$  is less than  $L_{lim}$ , it implies that the EUT complies with the limit.

### Test Data and Plots

#### Environmental Conditions

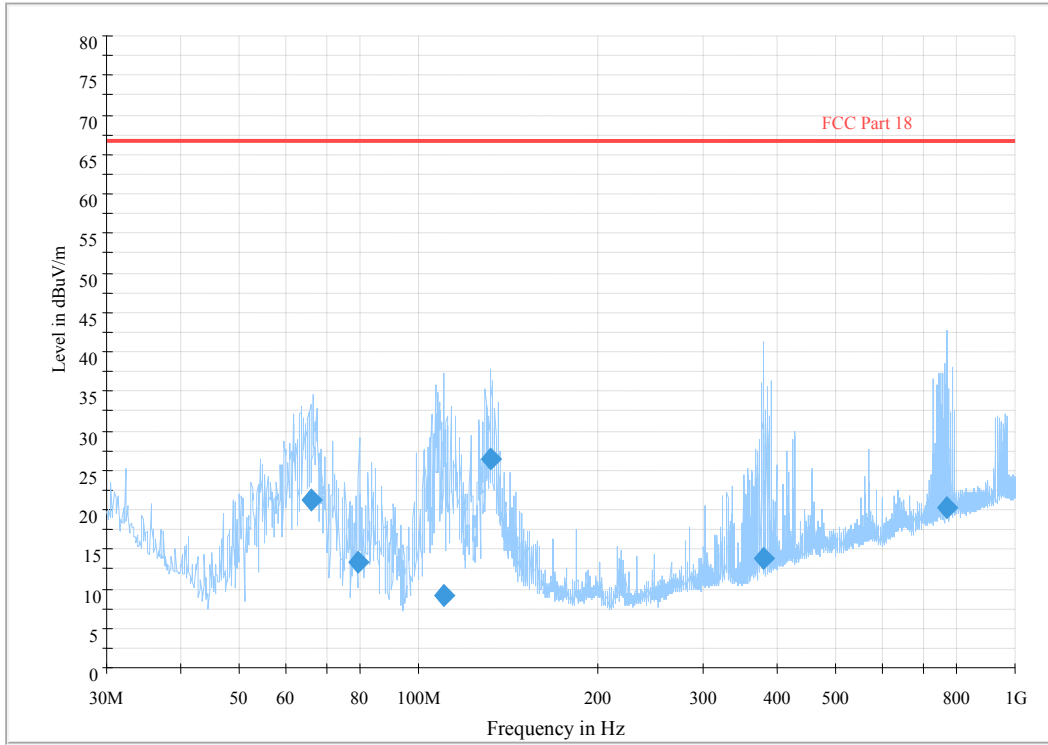
<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	100.1 kPa

*The testing was performed by Sean Zhao on 2013-08-19.*

Test Mode: Running (Max Power)

1) 30 MHz – 1 GHz

Auto Test(FCC part 18)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (deg)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)	Detector (PK/QP/Ave.)
66.001400	21.3	165.0	V	0.0	-20.6	67.20	45.9	QP
79.134050	13.5	121.0	V	17.0	-20.2	67.20	53.7	QP
110.224650	9.2	118.0	V	159.0	-14.9	67.20	58.0	QP
132.581250	26.3	109.0	H	131.0	-13.7	67.20	40.9	QP
380.178300	13.8	178.0	V	0.0	-12.8	67.20	53.4	QP
767.356450	20.3	137.0	V	152.0	-6.2	67.20	46.9	QP

## 2) Above 1 GHz

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Detector (PK/QP/Ave.)	Direction (Degree)	Height (m)	Ant. Polar (H/V)	Corrected Factor (dB/m)	Corrected Amplitude (dB $\mu$ V/m)	FCC Part 18	
								Limit (dB $\mu$ V/m)	Margin (dB)
2472.5	91.26	PK	179	1.3	H	33.71	124.97	/	/
2472.5	90.17	PK	164	1.3	V	33.71	123.88	/	/
2893.5	28.75	Ave.	165	1.5	V	8.91	37.66	67.20	29.54
4286.1	29.18	Ave.	113	1.3	H	11.51	40.69	67.20	26.51
4619.2	38.48	Ave.	156	1.3	V	12.21	50.69	67.20	16.51
4937.6	37.63	Ave.	54	1.4	H	12.48	50.11	67.20	17.09
7420.2	34.16	Ave.	119	1.3	V	15.90	50.06	67.20	17.14
7731.9	34.30	Ave.	116	1.2	H	16.50	50.80	67.20	16.40
7800.1	34.41	Ave.	134	1.4	V	16.80	51.21	67.20	15.99

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