

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: PR4RED199X

| | | | |
|---|--|--|--|
| Report Type: Class II Permissive Change | | Product Type: Microwave Oven | |
| Test Engineer: | Youilly Ao | <i>Youilly Ao</i> | |
| Report No.: | RSZ120116550-00 | | |
| Report Date: | 2012-02-17 | | |
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. 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.

* This report contains data that are not covered by the NVLAP accreditation and are marked with an asterisk "★" (Rev.2)

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Whirlpool Microwave Products Development Limited's* model: *WMH31017 (FCC ID: PR4RED199X)* (the "EUT") in this report is a *Microwave Oven*, which was measured approximately 75.0 cm (L) x 43.0 cm (W) x 41.0 cm (H), rated input voltage: AC 120 V/60 Hz, and the operating frequency is 2450 MHz.

* All measurement and test data in this report was gathered from production sample serial number: 1112007 (Assigned by BACL, Shenzhen). The EUT was received on 2012-01-16.

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 as follows:

| Part | Original | New |
|-----------|-------------------------|------------|
| Magnetron | 2M 167B-M16(Matsushita) | 2M226 (LG) |

For the change made to the device, all test items were performed.

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 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.

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.

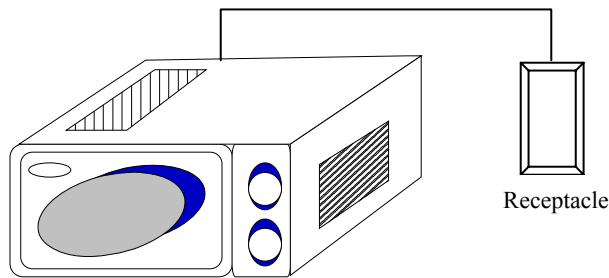
Equipment Modifications

No modifications were made to the unit tested.

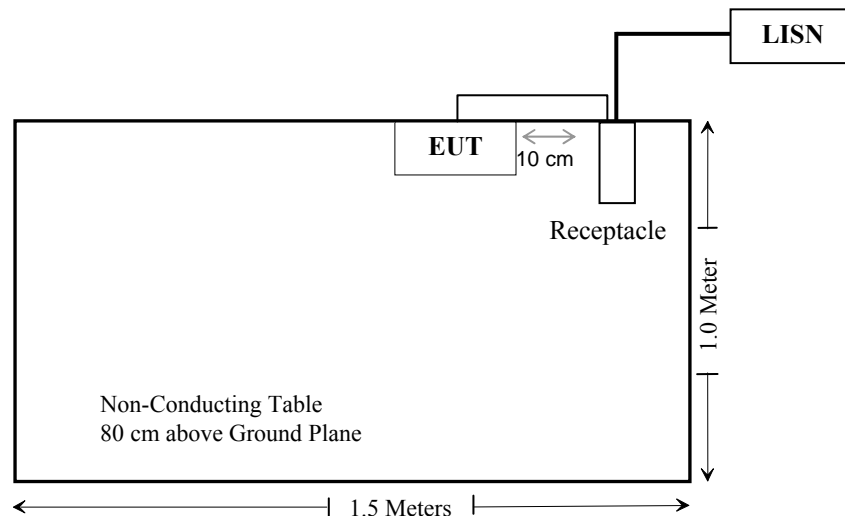
External Cable List and Details

| Cable Description | Length (m) | From/Port | To |
|--|------------|-----------|----------|
| Unshielded Undetachable AC Power Cable | 1.0 | EUT | AC mains |

Configuration of Test Setup



Block Diagram of Test Setup



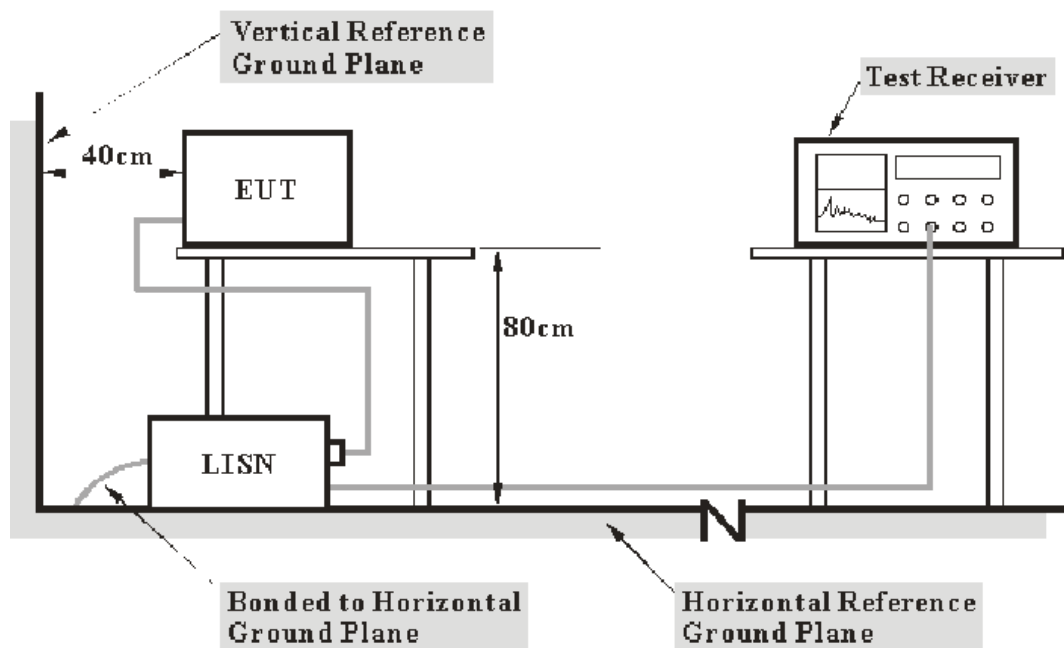
CONDUCTED EMISSIONS

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 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.

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 spacing between the peripherals was 10 cm.

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 |
|-----------------|-------------------|---------|---------------|------------------|----------------------|
| 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 |
| Rohde & Schwarz | Pulse limiter | ESH3Z2 | DE25985 | 2011-07-08 | 2012-07-07 |

* **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 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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC PART 18, with the worst margin reading of:

5.11 dB at 13.460 MHz in the **Line** conductor mode

Test Data

Environmental Conditions

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

The testing was performed by Yoully Ao on 2012-01-18.

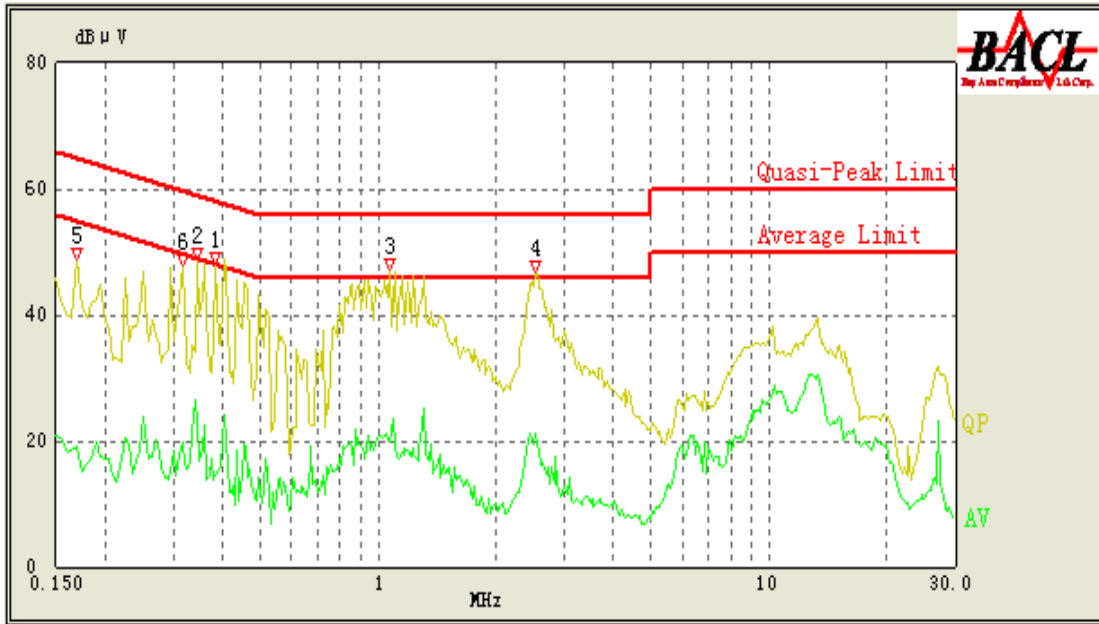
Test Mode: Running (Max Power)

AC 120V/60Hz, Line



| Frequency (MHz) | Corrected Amplitude (dBμV) | Correction Factor (dB) | Limit (dBμV) | Margin (dB) | Detector (PK/Ave./QP) |
|-----------------|----------------------------|------------------------|--------------|-------------|-----------------------|
| 13.460 | 54.89 | 10.10 | 60.00 | 5.11 | QP |
| 0.910 | 49.32 | 10.10 | 56.00 | 6.68 | QP |
| 0.995 | 49.29 | 10.10 | 56.00 | 6.71 | QP |
| 0.600 | 46.84 | 10.10 | 56.00 | 9.16 | QP |
| 0.425 | 46.87 | 10.10 | 58.14 | 11.27 | QP |
| 0.155 | 51.85 | 10.10 | 65.86 | 14.01 | QP |
| 13.460 | 29.86 | 10.10 | 50.00 | 20.14 | Ave. |
| 0.995 | 25.77 | 10.10 | 46.00 | 20.23 | Ave. |
| 0.910 | 23.69 | 10.10 | 46.00 | 22.31 | Ave. |
| 0.600 | 22.68 | 10.10 | 46.00 | 23.32 | Ave. |
| 0.155 | 25.53 | 10.10 | 55.86 | 30.33 | Ave. |
| 0.425 | 17.22 | 10.10 | 48.14 | 30.92 | Ave. |

AC 120V/60Hz, Neutral



| Frequency (MHz) | Corrected Amplitude (dBμV) | Correction Factor (dB) | Limit (dBμV) | Margin (dB) | Detector (PK/Ave./QP) |
|-----------------|----------------------------|------------------------|--------------|-------------|-----------------------|
| 1.070 | 47.05 | 10.10 | 56.00 | 8.95 | QP |
| 2.530 | 46.97 | 10.10 | 56.00 | 9.03 | QP |
| 0.385 | 48.13 | 10.10 | 59.29 | 11.16 | QP |
| 0.345 | 48.99 | 10.10 | 60.43 | 11.44 | QP |
| 0.315 | 47.95 | 10.10 | 61.29 | 13.34 | QP |
| 0.170 | 48.77 | 10.10 | 65.43 | 16.66 | QP |
| 2.535 | 21.13 | 10.10 | 46.00 | 24.87 | Ave. |
| 1.070 | 19.99 | 10.10 | 46.00 | 26.01 | Ave. |
| 0.345 | 22.73 | 10.10 | 50.43 | 27.70 | Ave. |
| 0.315 | 19.89 | 10.10 | 51.29 | 31.40 | Ave. |
| 0.385 | 14.64 | 10.10 | 49.29 | 34.65 | Ave. |
| 0.170 | 19.11 | 10.10 | 55.43 | 36.32 | Ave. |

RADIATION HAZARD MEASUREMENT

Environmental Conditions

| | |
|--------------------|----------|
| Temperature: | 25° C |
| Relative Humidity: | 56% |
| ATM Pressure: | 100.2kPa |

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|-----------------|------------------------|----------|---------------|------------------|----------------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI | 100035 | 2011-11-24 | 2012-11-23 |
| Sunol Sciences | Horn Antenna | DRH-118 | A052604 | 2011-05-05 | 2012-05-04 |
| Mini-Circuits | Amplifier | ZVA-213+ | T-E27H | 2011-03-08 | 2012-03-07 |
| Ainuo | Digital Power Analyzer | 8732B | 028706117 | 2011-12-23 | 2012-12-22 |
| HY | AC Power Source | 9020117 | GY053(1) | 2011-08-21 | 2012-08-20 |
| Holday | Leakage Meter | HI-1710 | 05/2731 | 2011-06-02 | 2012-06-01 |

* **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.

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 $0.71\text{mW}/\text{cm}^2$ 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 (V _{AC} /Hz) | Input Current (Amps) | Measured Input Power (Watts) | Rated Input Power (Watts) |
|--|-------------------------|---------------------------------|------------------------------|
| 120/60 | 11.9 | 1428 | 1800 |

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 (s) |
|-----------------------|---------------------------|------------------------|------------------|
| 1000 | 24 | 66 | 200 |

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

$$\text{Power} = 4.2 \times 1000 \times (66-24) / 200$$

$$\text{Power} = 882 \text{ watts}$$

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 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:

$$\begin{aligned} \text{LFS} &= 25 * \text{SQRT} (\text{Power Output}/500) \\ \text{LFS} &= 25 * \text{SQRT} (882/500) \\ \text{LFS} &\approx 33.2 \end{aligned}$$

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 |
|--------------|---------|------|--------------|------------|
| Whirlpool | IMH1205 | 33.2 | 30.4 | 70.4 |

Operating Frequency Measurement

Variation in Operating Frequency with Time

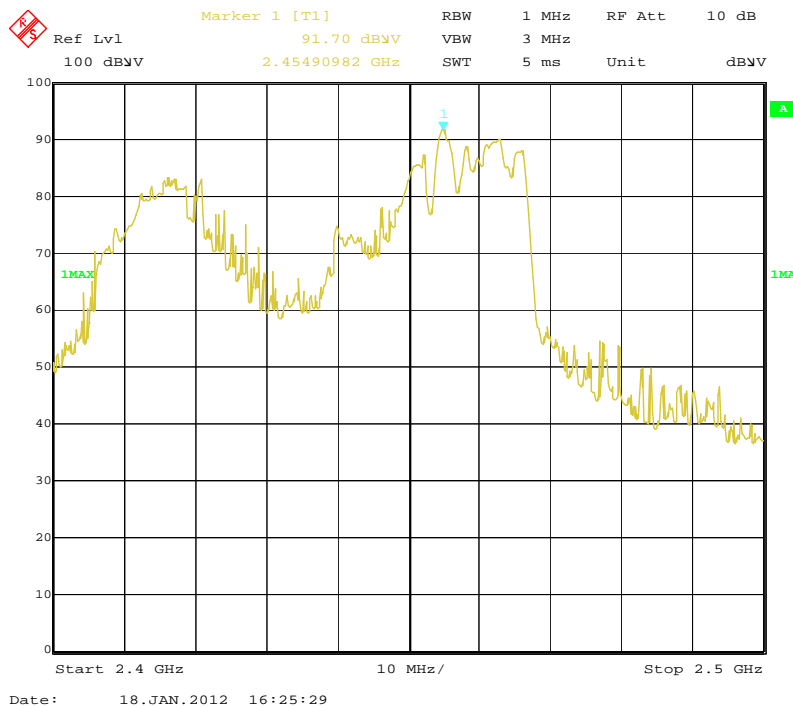
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

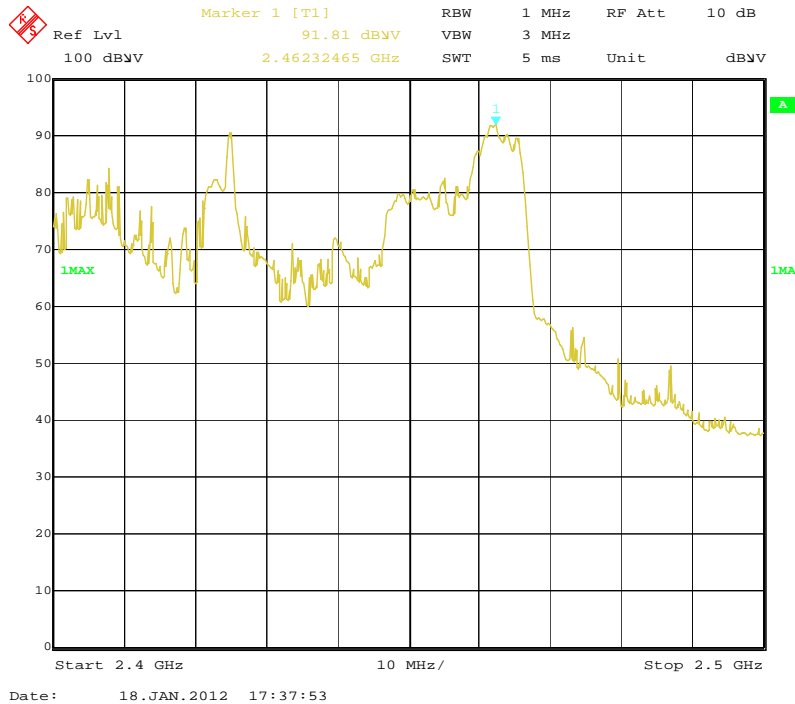
| Manufacturer | Model | (Star time) Frequency (MHz) | (End time) Frequency (MHz) |
|--------------|----------|------------------------------------|-----------------------------------|
| Whirlpool | WMH31017 | 2454.9 | 2462.3 |

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.

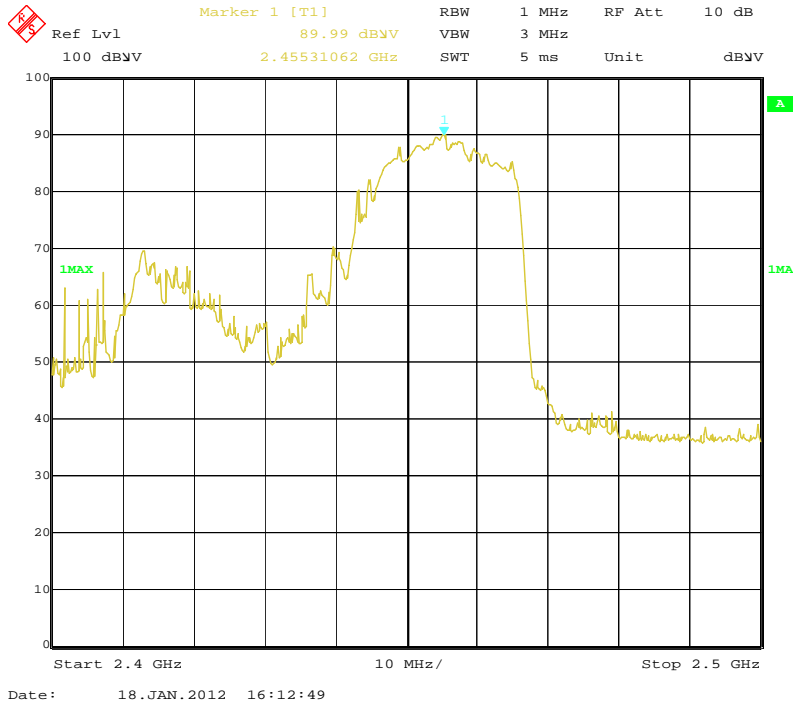
The results of this test are as follows:

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

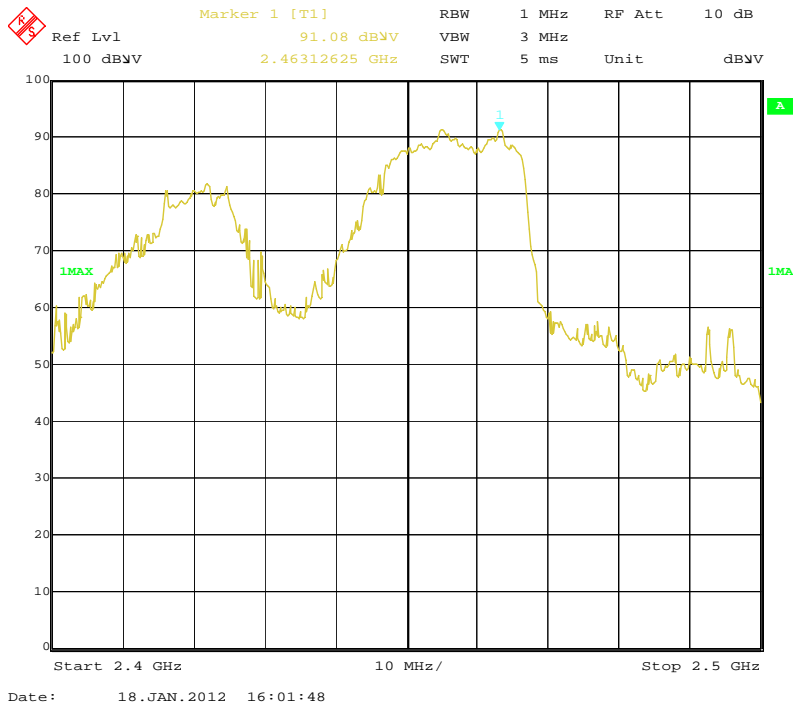
| Manufacturer | Model | (Low voltage) Frequency (MHz) | (High voltage) Frequency (MHz) |
|--------------|----------|-------------------------------|--------------------------------|
| Whirlpool | WMH31017 | 2455.3 | 2463.1 |

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

High voltage:



Low voltage:



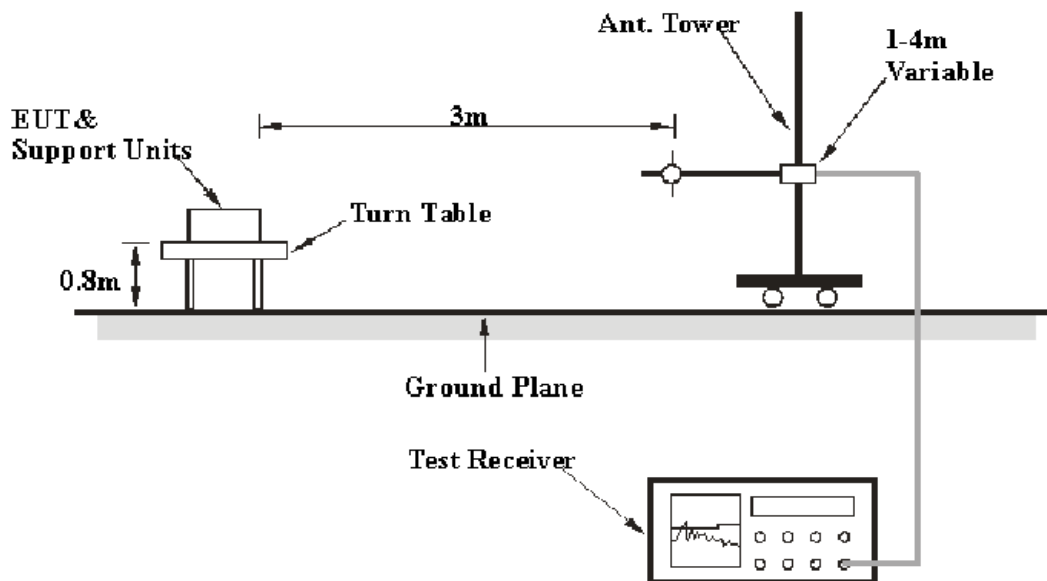
RADIATED EMISSIONS

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.

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 spacing between the peripherals was 10 cm.
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:

| <i>Frequency Range</i> | <i>R B/W</i> | <i>Video B/W</i> | <i>IF B/W</i> | <i>Detector</i> |
|------------------------|--------------|------------------|---------------|-----------------|
| 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 | 2012-08-01 |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 101122 | 2011-07-11 | 2012-07-10 |
| Sunol Sciences | Broadband Antenna | JB1 | A040904-1 | 2011-03-11 | 2012-03-10 |
| A.H. System | Horn Antenna | SAS-200/571 | 135 | 2011-05-17 | 2012-05-16 |
| Rohde & Schwarz | Signal Analyzer | FSIQ 26 | 609358 | 2011-07-08 | 2012-07-07 |
| Mini-Circuits | Amplifier | 2VA-213+ | T-E27H | 2011-03-08 | 2012-03-07 |
| Agilent | Spectrum Analyzer | 8564E | 3943A01781 | 2011-04-12 | 2012-04-11 |
| The electro-Mechanics Co. | Horn Antenna | 3116 | 9510-2270 | 2011-05-05 | 2012-05-04 |

* **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 frequencies 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 7 dB means the emission is 7 dB 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:

13.4 dB at 64.287000 MHz in the Vertical polarization

Test Data and Plots

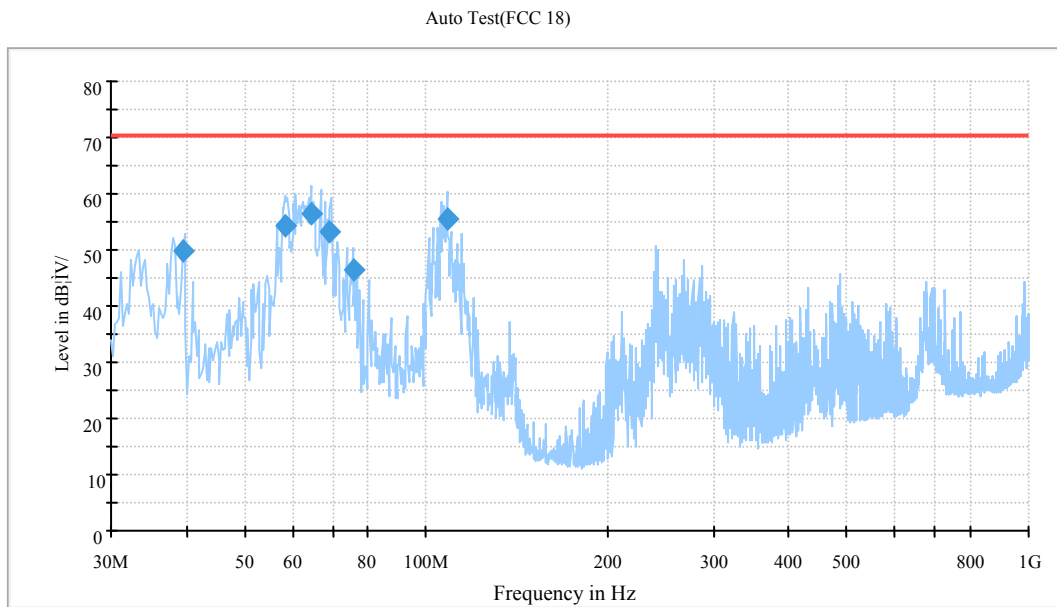
Environmental Conditions

| | |
|---------------------------|----------|
| Temperature: | 25° C |
| Relative Humidity: | 56% |
| ATM Pressure: | 100.2kPa |

The testing was performed by Yoully Ao on 2012-02-03.

Test Mode: Running (Max Power)

1) 30 MHz to 1 GHz:



| Frequency (MHz) | Corrected Amplitude (dBμV/m) | Ant. Height (cm) | Ant. Polarity (H/V) | Turntable Position (degree) | Correction Factor (dB) | Limit (dBμV/m) | Margin (dB) |
|-----------------|------------------------------|------------------|---------------------|-----------------------------|------------------------|----------------|-------------|
| 64.287000 | 56.6 | 207.0 | V | 303.0 | -18.5 | 70.4 | 13.4 |
| 108.189250 | 55.1 | 156.0 | V | 280.0 | -13.6 | 70.4 | 15.3 |
| 58.290000 | 54.3 | 125.0 | V | 340.0 | -18.4 | 70.4 | 16.1 |
| 69.037250 | 53.3 | 190.0 | V | 313.0 | -18.3 | 70.4 | 17.1 |
| 39.537500 | 49.3 | 124.0 | V | 42.0 | -11.8 | 70.4 | 21.1 |
| 76.081250 | 46.6 | 125.0 | V | 285.0 | -18.2 | 70.4 | 23.8 |

2) 1 GHz to 25 GHz

| Frequency (MHz) | S.A. Reading (dB μ V) | Detector (PK/QP/Ave.) | Test Antenna | | | Antenna Factor (dB) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dB μ V/m) | FCC Part 18 | |
|-----------------|---------------------------|-----------------------|--------------------|------------|-------------|---------------------|-----------------|--------------------|---------------------------|----------------------|-------------|
| | | | Direction (Degree) | Height (m) | Polar (H/V) | | | | | Limit (dB μ V/m) | Margin (dB) |
| 4934.2 | 36.27 | Ave. | 342 | 1.6 | H | 32.9 | 4.40 | 26.76 | 46.81 | 70.4 | 23.59 |
| 4934.2 | 36.18 | Ave. | 0 | 1.8 | V | 32.9 | 4.40 | 26.76 | 46.72 | 70.4 | 23.68 |
| 4559.1 | 32.51 | Ave. | 160 | 1.8 | V | 31.5 | 4.58 | 26.77 | 41.82 | 70.4 | 28.58 |
| 4559.1 | 31.00 | Ave. | 210 | 1.5 | H | 31.5 | 4.58 | 26.77 | 40.31 | 70.4 | 30.09 |
| 4424.8 | 29.22 | Ave. | 15 | 1.4 | H | 30.3 | 4.29 | 26.80 | 37.01 | 70.4 | 33.39 |
| 4424.8 | 27.23 | Ave. | 15 | 1.4 | V | 30.3 | 4.29 | 26.80 | 35.02 | 70.4 | 35.38 |

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