FCC PART 18 ID
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: PR4MH3185Y

February 27, 2004

This Report Concerns:	Equipment Type:
☒ Original Report	Microwave Oven

Test Engineer:	Jandy Su
Report Number:	RSZ04021702
Test Date:	Feb 20-23,2004
Reviewed By:	Ling Zhang
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Whirlpool Microwave Products Development Ltd*'s model: MH3185 series *or* the "EUT" as referred to in this report is a microwave oven which measures approximately 85.0cmL x 45.0cmW x 40.0cmH, rated input voltage: 120V/60Hz

* *The test data gathered are from production sample, serial number: 040218, provided by the manufacturer*

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

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All measurements contained in this report were conducted with MP-5, FCC Methods of Measurements of Radio Noise Emissions from ISM Equipment, February 1986. All measurement was performed at Bay Area Compliance Laboratory Corporation. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the No. 3 building JingHua Courtyard, Shennanzhong Rd ShenZhen, Guandong 518031, P.R. C.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4–2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test sites has been listed with the FCC and approved by the VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 11: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

External Cable List and Details

Cable Description	Length (M)	From/Port	To
Unshielded Undetachable Power Cable	1.2	AC Mains	EUT

OPERATING CONDITION/TEST CONFIGURATION

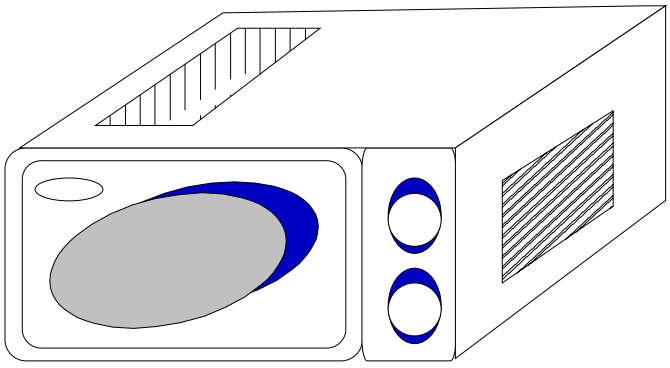
Justification

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.

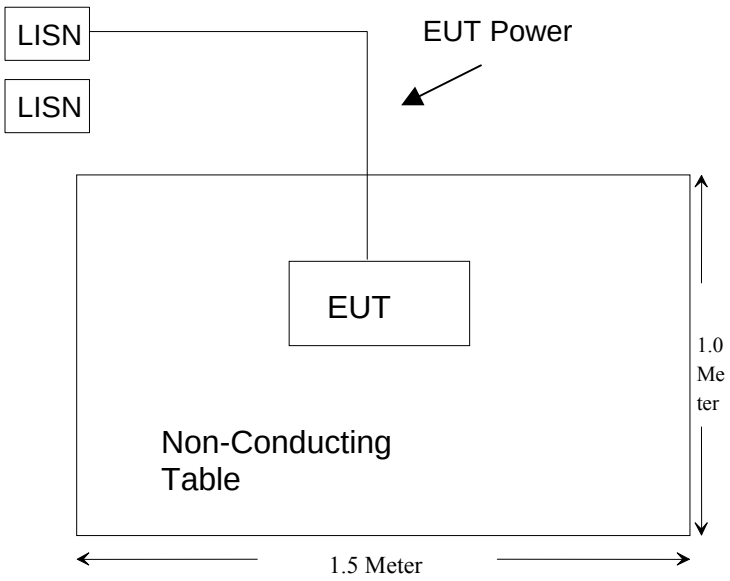
Equipment Modifications

The EUT tested was not modified by BACL.

Configuration of Test System



Test Setup Block Diagram



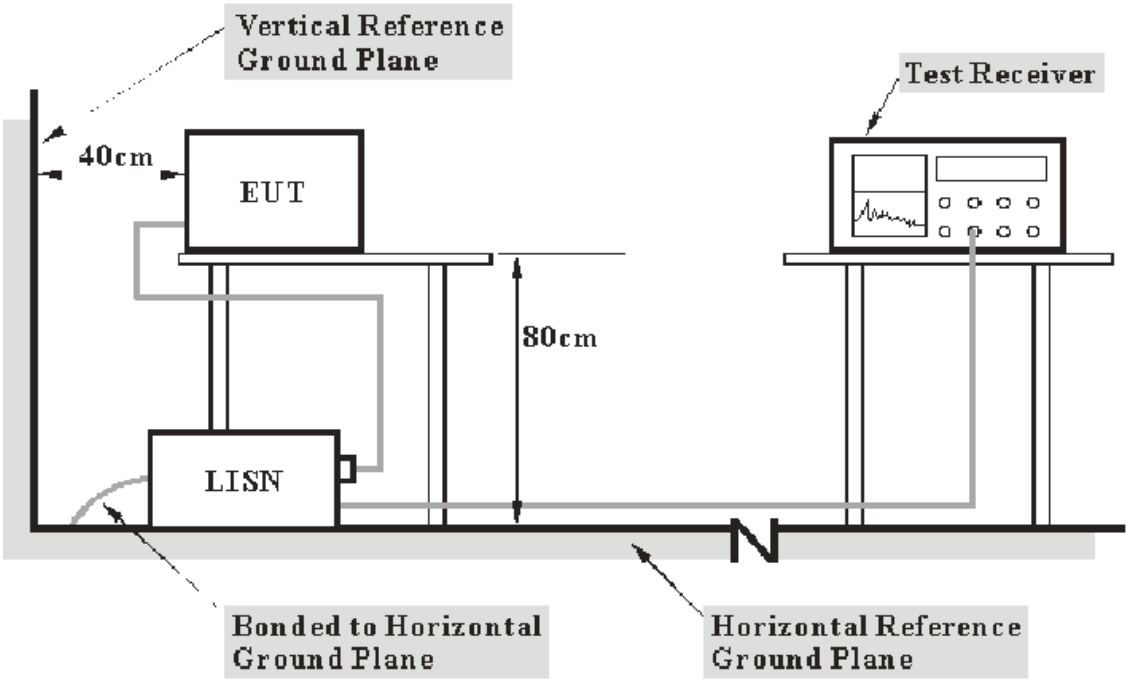
CONDUCTED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL 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 Consumer Product limits.

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

Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 KHz to 30MHz.

During the conducted emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10KHz	10KHz
30 – 1000MHz	100KHz	100KHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EMI TEST RECEIVER	Rohde&Schwarz	ESCS30	100038	2003-11-12	2004-11-11
ARTIFICIAL MAINS	Rohde&Schwarz	ESH2-Z5	100028	2003-11-12	2004-11-11

*** Statement of Traceability: BACL Corp.** certifies 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 auxiliary outlet of the LISN.

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

All data was recorded in quasi-peak and average. Average readings are distinguished with an “Ave”. Quasi-peak readings are distinguished with an “Qp”.

Test Data

Date of Test	:	Feb 21-23,2004	Temperature	:	25℃
EUT	:	Microwave oven	Humidity	:	70%
M/N	:	MH3185 series	Operating Mode	:	Full Load
S/N	:	040218	Test Engineer	:	Jandy Su

LINE CONDUCTED EMISSIONS				FCC PART 18	
Frequency MHz	Amplitude dBμV	Detector QP/AV/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.89	40.0	AV	Line	46	-6.0
0.88	36.5	AV	Neutral	46	-9.5
0.89	45.3	QP	Line	56	-10.7
0.45	34.7	AV	Line	46.88	-12.2
0.43	33.1	AV	Line	47.25	-14.1
0.88	41.2	QP	Neutral	56	-14.8
0.45	40.2	QP	Line	56.88	-16.7
0.43	38.6	QP	Line	57.25	-18.7
0.35	25.1	AV	Neutral	48.96	-23.8
0.35	30.5	QP	Neutral	58.96	-28.5
9.12	20.2	AV	Neutral	50	-29.8
9.12	25.7	QP	Neutral	60	-34.3

Test Result: Pass

Plot(s) of Test Data

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

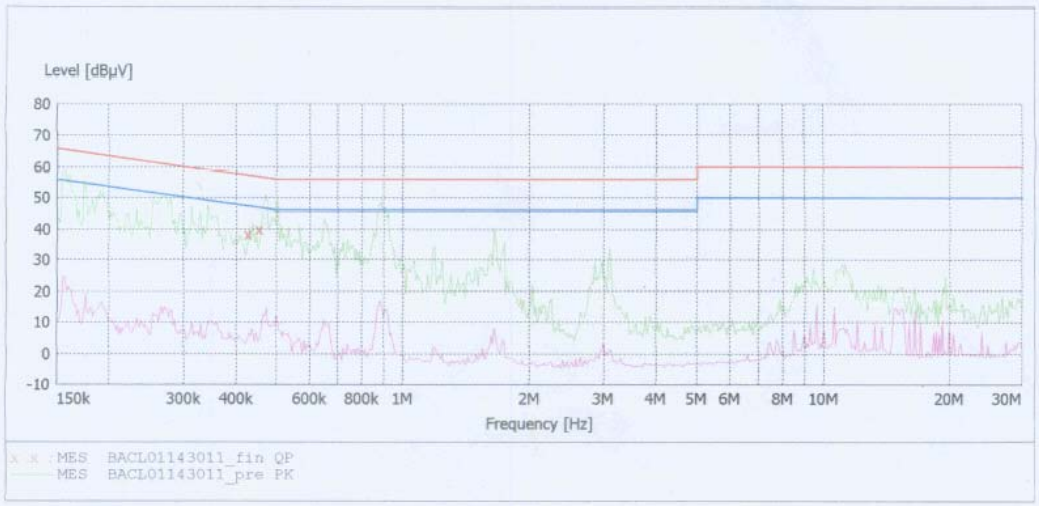
Note:
In the plots, the green curve detector mode is peak, the red curve detector mode is Average, we select six high points of green curve to measure QP and AV value, the QP and AV value please refer to section: test data

Conducted Emission Test FCC PART 18

EUT:
Manufacturer:
Operating Condition:
Test Site: 3# Shielded room
Operator: EAST
Test Specification: L 120V/60Hz
Comment:
Start of Test: 14/01/04 / 17:42:22

SCAN TABLE: "Voltage (150K-30M)"

Short Description: 150K-30M Voltage

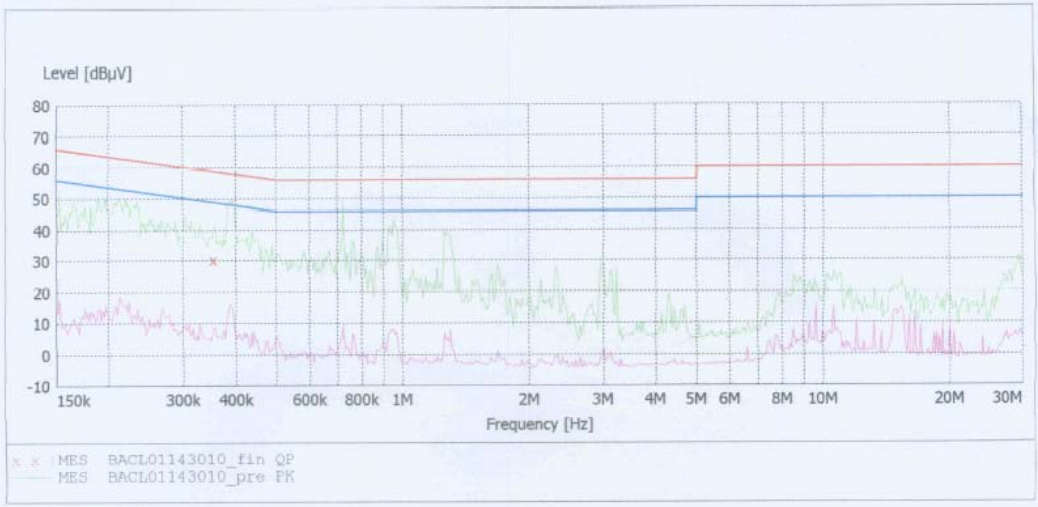


Conducted Emission Test FCC PART 18

EUT:
Manufacturer:
Operating Condition:
Test Site: 3# Shielded room
Operator: EAST
Test Specification: N 120V/60Hz
Comment:
Start of Test: 14/01/04 / 17:39:20

SCAN TABLE: "Voltage (150K-30M)"

Short Description: 150K-30M Voltage



RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	25°C
Relative Humidity:	70%
ATM Pressure:	1175mbar

Radiation Hazard Measurement

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

A 2600ml 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 0.67mWfcm^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 2600ml water load was placed in the center of the oven and the oven was operated at maximum output power. A 2600ml 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	14.84	1781	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 1400 watts

Load used for power output measurement = 1050 milliliters of water
Load used for frequency measurement = 1050 milliliters of water
Load used for harmonic measurement = 735 & 315 milliliters of water
Load used for other measurement = 735 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 (Seconds)
2600	20	36.24	200

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

Power = 4.2 joules/calorie x 2600 x (36.24-20) / 200

Power = 886.7 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-of0band emissions were compared with the limit calculated as following:

LFS = 25*SQRT(Power Output/500)

LFS = 25 * SQRT(886.7/500)

LFS ≈ 33.32

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 Number	LFS	dB(µV/M)	dB(µV/M)®3m
Whirlpool Microwave Products Development Ltd	MH3185 series	33.3	30.44	70.4

Operating Frequency Measurement

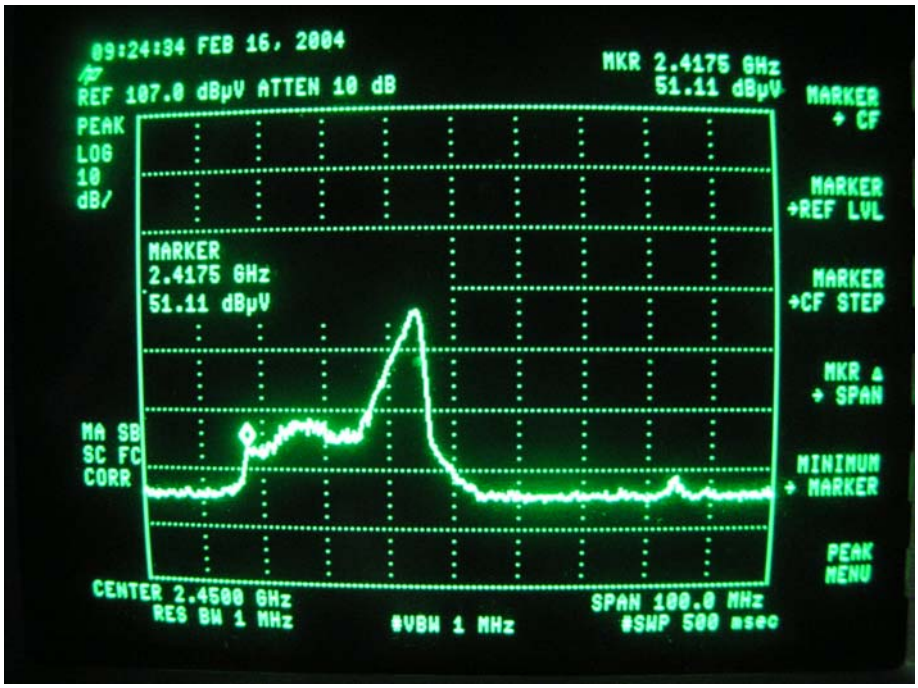
Variation in Operating Frequency with Time

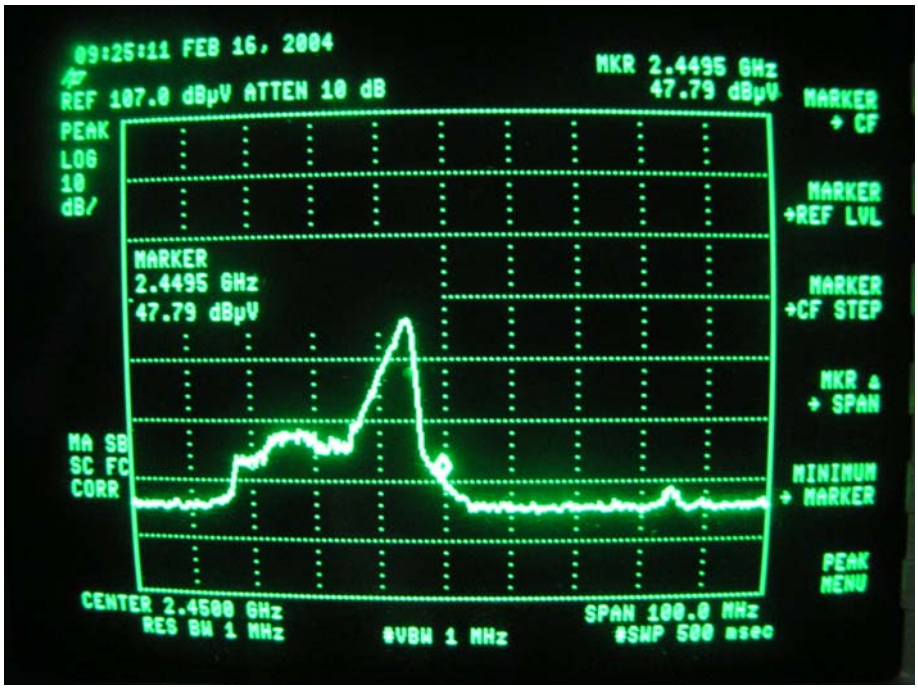
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 2600ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to 20 percent of the original load.

The results of this test are as follows:

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Whirlpool Microwave Products Development Ltd	MH3185 series	2417.5MHz	2449.5MHz

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


09:24:34 FEB 16, 2004
MKR 2.4175 GHz
51.11 dBµV
REF 107.0 dBµV ATTEN 10 dB
PEAK
LOG
10
dB/
MARKER
2.4175 GHz
51.11 dBµV
MARKER
→CF
MARKER
→REF LVL
MARKER
→CF STEP
MKR Δ
→ SPAN
MINIMUM
→ MARKER
PEAK
MENU
MA SB
SC FC
CORR
CENTER 2.4500 GHz
RES BW 1 MHz
#VBW 1 MHz
SPAN 100.0 MHz
#SWP 500 msec


09:25:11 FEB 16, 2004
MKR 2.4495 GHz
47.79 dBµV
REF 107.0 dBµV ATTEN 10 dB
PEAK
LOG
10
dB/
MARKER
2.4495 GHz
47.79 dBµV
MARKER
→CF
MARKER
→REF LVL
MARKER
→CF STEP
MKR Δ
→ SPAN
MINIMUM
→ MARKER
PEAK
MENU
MA SB
SC FC
CORR
CENTER 2.4500 GHz
RES BW 1 MHz
#VBW 1 MHz
SPAN 100.0 MHz
#SWP 500 msec

Variation in Operating Frequency with Line Voltage

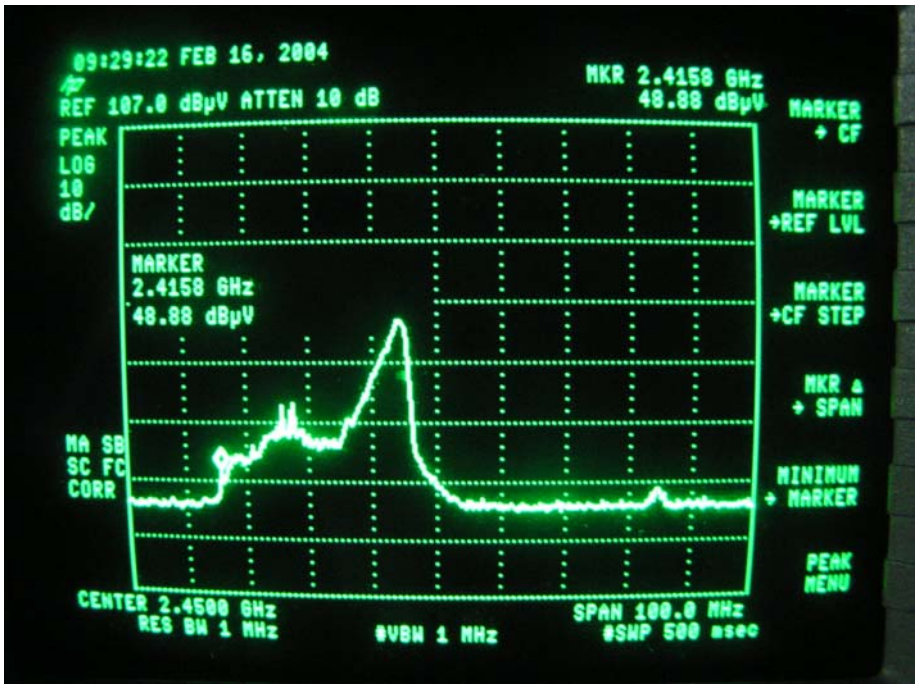
The EUT was operated / warmed by at least 10 minutes of use with a 2600ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

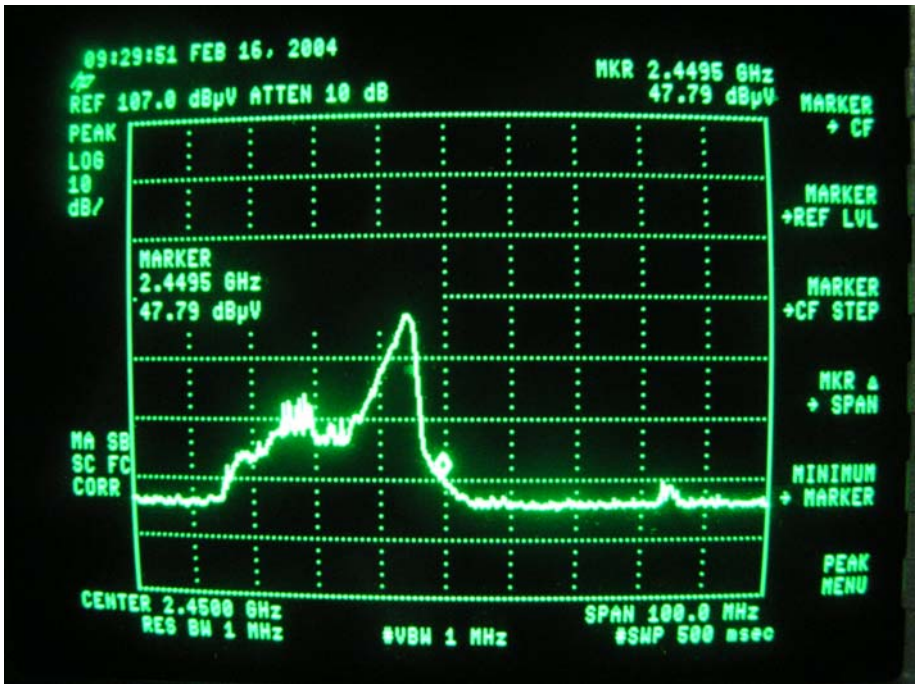
The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Whirlpool Microwave Products Development Ltd	MH3185 series	2415.58MHz	2449.5MHz

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


09:29:22 FEB 16, 2004
MKR 2.4158 GHz
48.88 dBµV
REF 107.0 dBµV ATTEN 10 dB
PEAK
LOG
10
dB/
MARKER
2.4158 GHz
48.88 dBµV
MARKER
→ CF
MARKER
→REF LVL
MARKER
→CF STEP
MKR Δ
→ SPAN
MINIMUM
→ MARKER
PEAK
MENU
MA SB
SC FC
CORR
CENTER 2.4500 GHz
RES BW 1 MHz
#VBW 1 MHz
SPAN 100.0 MHz
#SWP 500 msec


09:29:51 FEB 16, 2004
MKR 2.4495 GHz
47.79 dBµV
REF 107.0 dBµV ATTEN 10 dB
PEAK
LOG
10
dB/
MARKER
2.4495 GHz
47.79 dBµV
MARKER
→ CF
MARKER
→REF LVL
MARKER
→CF STEP
MKR Δ
→ SPAN
MINIMUM
→ MARKER
PEAK
MENU
MA SB
SC FC
CORR
CENTER 2.4500 GHz
RES BW 1 MHz
#VBW 1 MHz
SPAN 100.0 MHz
#SWP 500 msec

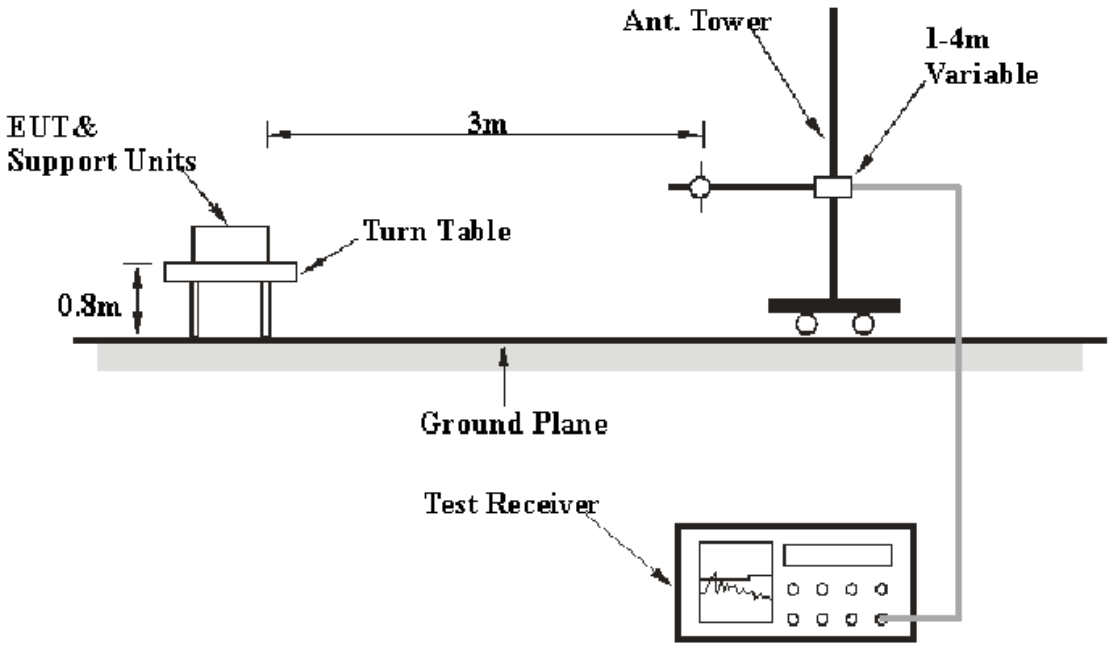
RADIATED EMISSION DATA

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

EUT Setup



The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the FCC MP - 5. The specification used was the FCC part 18 Subpart C limits.

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

Spectrum Analyzer Setup

The system was investigated from 30MHz to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10KHz	10KHz
30 – 1000MHz	100KHz	100KHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R/S	Spectrum Analyzer	FSEM	849720/019	2003-10-30	2004-10-29
HP	Amplifier	8447D	2944A09795	2003-8-5	2004-8-4
ETS	Log Periodic Antenna	3146	9603-4421	2003-8-5	2004-8-4
ETS	Biconical Antenna	3110B	3360	2003-8-5	2004-8-4
FLUKE	True RMS Multimeter	187	78540402	2003-3-24	2004-3-23
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2003-11-5	2004-11-4
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2003-11-5	2004-11-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 001	2003-8-5	2004-8-4
YOKOROWA	Coaxial Cable 1#	N/A	NO: 002	2003-8-5	2004-8-4

*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

For the radiated emissions test, the power cord of 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.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specified limitations), and are distinguished with a "**Qp**" in the data table.

The EUT was in the normal (naïve) operating mode during the final qualification test to represent the worst results.

Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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

Margin = Corr. Ampl. – Class B Limit

Radiated Emissions Test Data

Final Test Data, 30MHz –24.9GHz, 3 Meters

Date of Test	:	Feb 20-23,2004	Temperature	:	25℃
EUT	:	Microwave oven	Humidity	:	70%
M/N	:	MH3185 series	Operating Mode	:	Full Load
S/N	:	040218	Test Engineer	:	Jandy Su

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTEI AMPLITUDI	FCC PART 18	
Frequency	Ampl.	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/ V	dB	dB	dB	dBμV/m	dBμV/m	dB
2470.43	107.4	0	1	V	28.1	3.7	29	110.2		
2469.98	103.3	0	1.2	H	28.1	3.7	29	106.1		
7406.85	62.68	0	1	V	36	6.1	38.2	66.6	70.4	-3.8
4941.28	64.23	0	1	H	33.6	5.2	37.2	65.8	70.4	-4.6
7402.33	61.37	0	1.2	H	36	6.1	38.2	65.3	70.4	-5.1
4939.45	63.58	0	1.2	V	33.6	5.2	37.2	65.2	70.4	-5.2
9868.34	52.34	0	1.2	V	33.7	7.1	38.4	54.7	70.4	-15.7
9865.27	51.77	0	1.2	H	33.7	7.1	38.4	54.2	70.4	-16.2