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: PR4GH4155

July 25, 2005,

This Report Concerns:	**Equipment Type:**
☒ Class II permissive change	Microwave Oven

Test Engineer:	Sam Lin
Report Number:	RSZ05072551
Test Date:	May 26-June 6, 2005
Reviewed By:	Chris Zeng
Prepared By:	Bay Area Compliance Lab Corp. (ShenZhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone, ShenZhen, Guangdong 518038, P.R.China Tel: +86-755-33320018 Fax: +86-755-33320008

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Whirlpool Microwave Products Development Ltd*'s model: GH4155 or the "EUT" as referred to in this report is a microwave oven which measures approximately 76cmL x 39cmW x 41.5cmH, rated input voltage: AC 120 V/60 Hz.

* *The test data gathered are from production sample, serial number: GH41550012, 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.

This is the C2PC application of the device. The difference between the original device and the current two is as follows:

Original Filter Model	New Filter Model
Iskra， KPL3009	DPC， DFCA-2516R

Original Transformer Model	New Transformer Model
DPC, DW-950	Eledex, HK-JK100V

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

Related Submittal(s)/Grant(s)

This is a C2PC application. The original application was granted on 2005-1-28.

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 Test site used by Bay Area Compliance Lab 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 518038, P.R.China.

Test site at Bay Area Compliance Lab 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 Lab Corp. (ShenZhen) is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200707-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2007070.htm

External Cable List and Details

Cable Description	Length (M)	From/Port	To
Unshielded Undetachable AC Power Cable	1.0	EUT	AC Power

OPERATING CONDITION/TEST CONFIGURATION

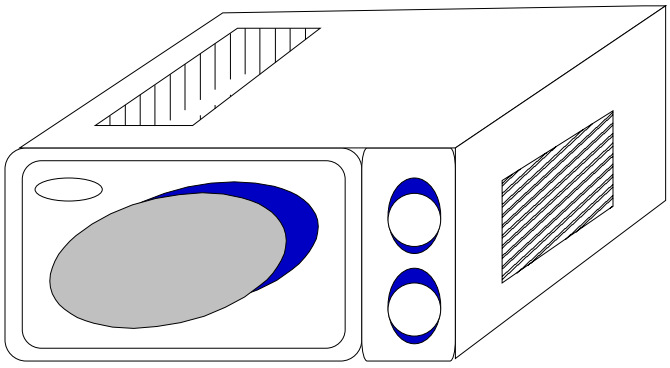
Justification

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.

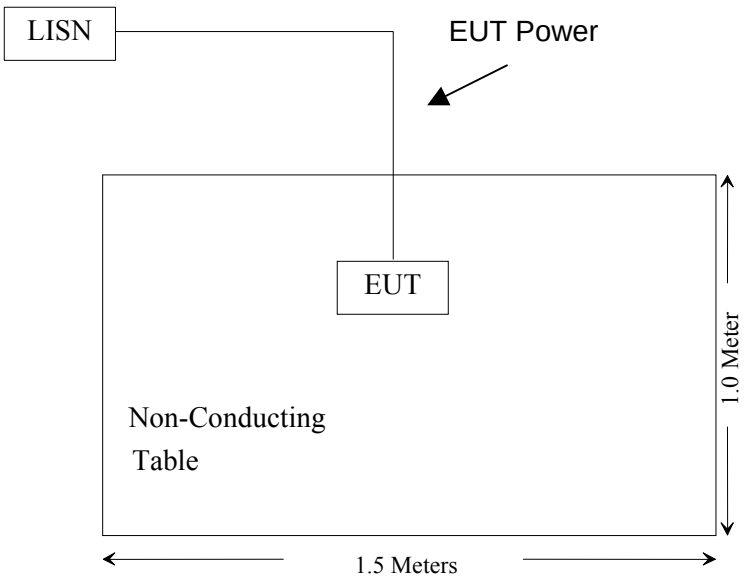
Equipment Modifications

Bay Area Compliance Lab Corp. (ShenZhen) has not done any modification on the EUT.

Configuration of Test Setup



Block Diagram of Test Setup



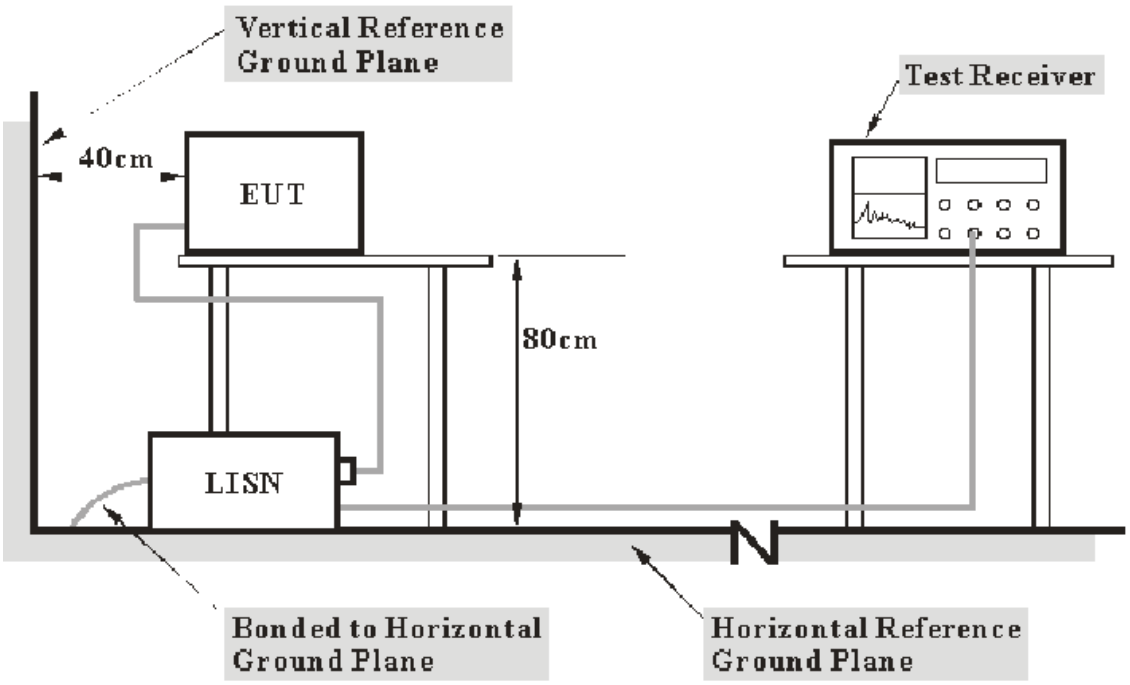
CONDUCTED EMISSION

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 Bay Area Compliance Lab 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:

Frequency Range	***IF B/W***
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	830245/006	2005-1-26	2006-1-26
Rohde & Schwarz	L.I.S.N.	ESH2-Z5	892107/021	2005-2-28	2006-2-28

***** Com-Power's LISN were used as the supporting equipment.
*** Statement of Traceability:** Bay Area Compliance Lab 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:

-7.55 dB at **12.276 MHz** in the **Line** conductor mode.

Test Data

Environmental Conditions

Temperature:	27°C
Relative Humidity:	54%
ATM Pressure:	1175mbar

Testing was performed by Sam Lin on 2005-5-26.

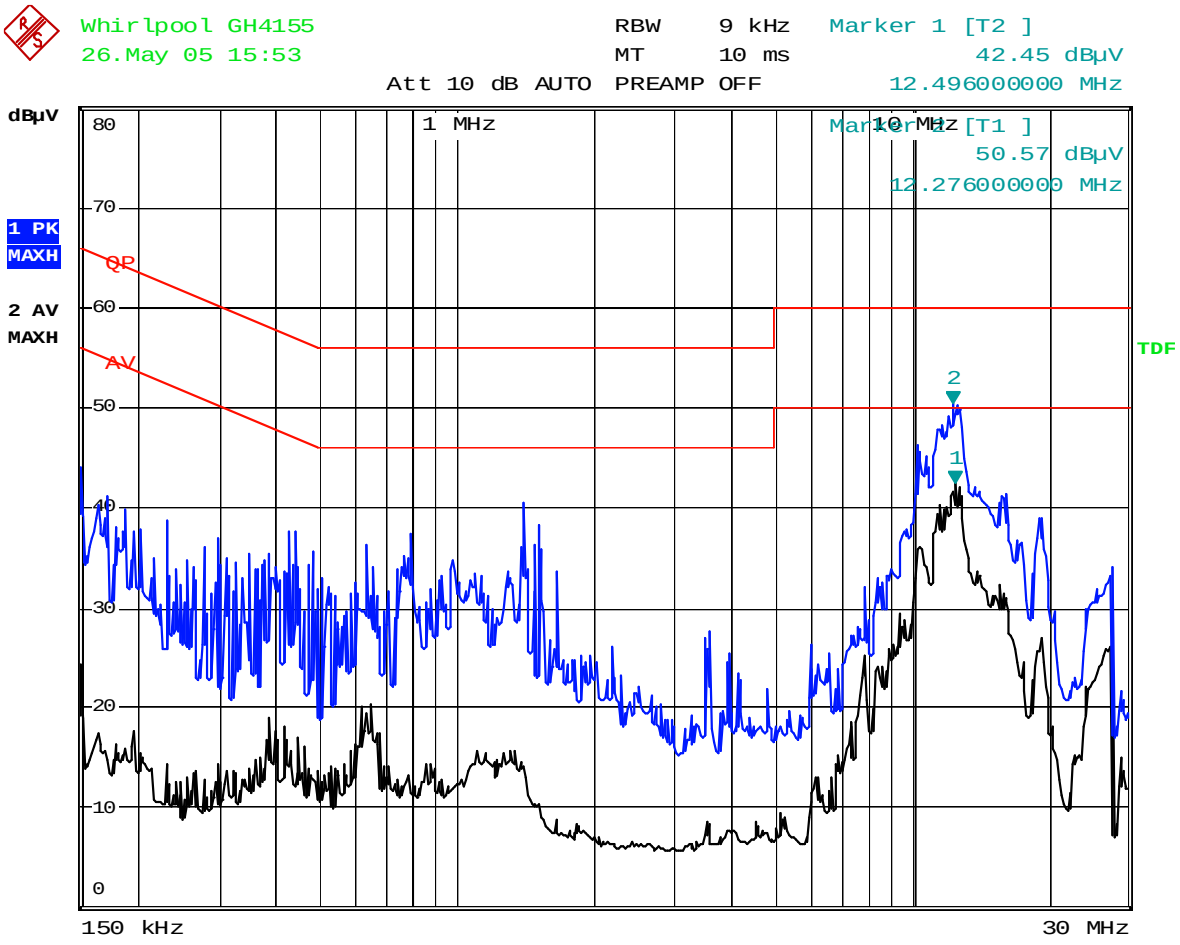
Test Mode: Max Power

LINE CONDUCTED EMISSIONS				FCC PART 18	
Frequency MHz	Amplitude DBµV	Detector QP/AV	Phase Line/Neutral	Limit dBµV	Margin dB
12.276	42.45	AV	Line	50.00	-7.55
12.276	50.57	QP	Line	60.00	-9.43
10.292	46.35	QP	Line	60.00	-13.65
10.292	36.11	AV	Line	50.00	-13.89
0.422	42.21	QP	Neutral	57.41	-15.20
1.406	40.32	QP	Line	56.00	-15.68
10.936	31.86	AV	Neutral	50.00	-18.14
10.936	41.70	QP	Neutral	60.00	-18.30
12.704	41.46	QP	Neutral	60.00	-18.54
0.630	36.32	QP	Line	56.00	-19.68
16.272	29.46	AV	Neutral	50.00	-20.54
16.272	39.41	QP	Neutral	60.00	-20.59
12.704	29.01	AV	Neutral	50.00	-20.99
19.120	39.00	QP	Line	60.00	-21.00
1.070	34.45	QP	Neutral	56.00	-21.55
27.680	27.41	AV	Line	50.00	-22.59
19.120	27.00	AV	Line	50.00	-23.00
19.064	36.76	QP	Neutral	60.00	-23.24
0.630	20.25	AV	Line	46.00	-25.75
27.680	34.08	QP	Line	60.00	-25.92
19.064	23.24	AV	Neutral	50.00	-26.76
0.422	18.11	AV	Neutral	47.41	-29.30
1.070	15.84	AV	Neutral	46.00	-30.16
1.406	15.70	AV	Line	46.00	-30.30

Plot(s) of Test Data

Plot(s) of test data is presented hereinafter as reference.

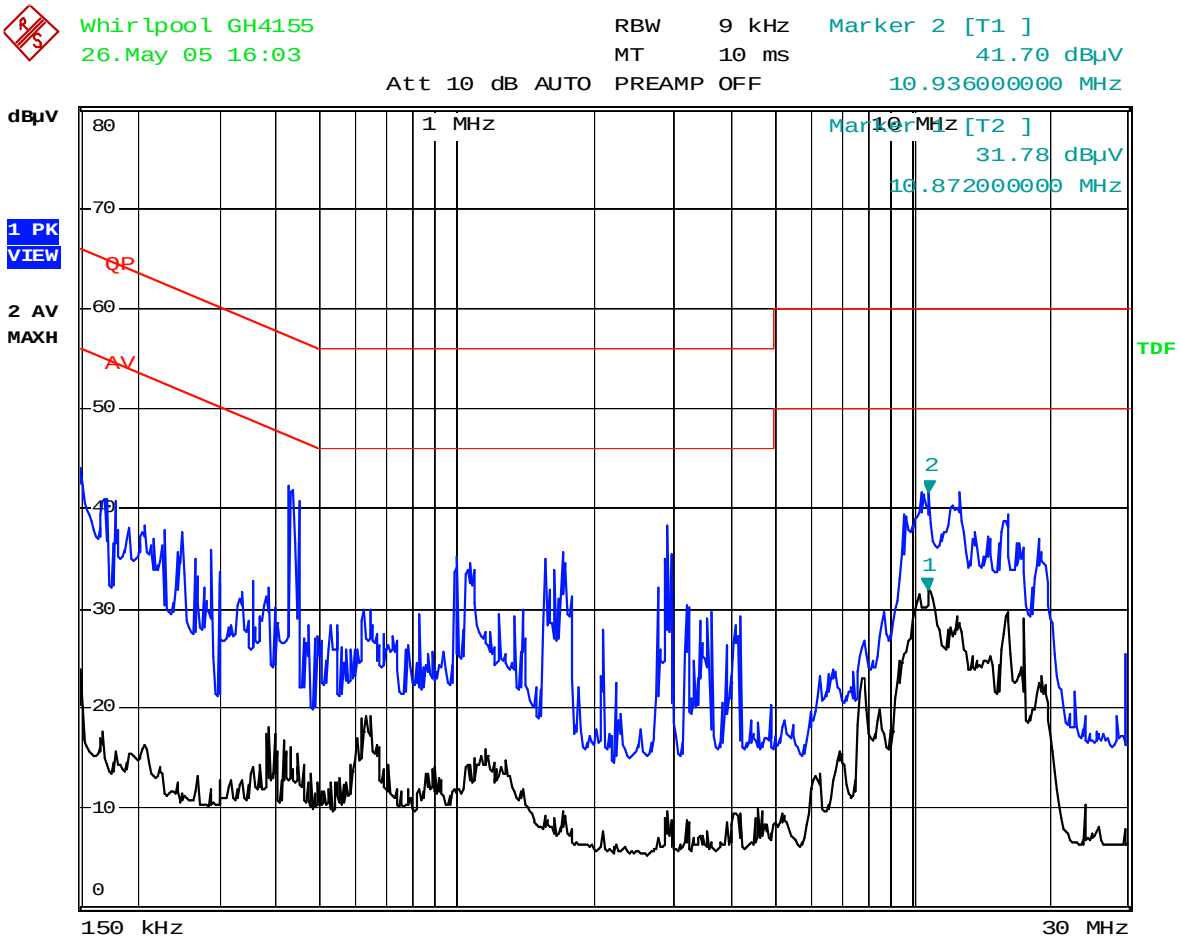
Line:



Whirlpool GH4155 Conduction L

Date: 26.MAY.2005 15:53:02

Neutral:



Whirlpool GH4155 Conduction N

Date: 26.MAY.2005 16:03:25

RADIATION HAZARD MEASUREMENT

Environmental Conditions

Temperature:	26°C
Relative Humidity:	55%
ATM Pressure:	940mbar

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2004-9-15	2005-9-15
Sunol Sciences	Horn Antenna	DRH-118	A052604	2005-6-2	2006-6-2
HP	Preamplifier	8449B	3008A00277	2004-9-1	2005-8-31
Ainuo	Digital Power Analyzer	8732B	028706117	2004-12-23	2005-12-23
HY	AC Power Source	9020117	GY053(1)	2004-8-21	2005-8-21

*** Statement of Traceability:** Bay Area Compliance Lab 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 0.69mWfcm^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. A1000ml 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	13.7	1642	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 = 700milliliters 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 100 seconds, the temperature of the water was re-measured.

Quality of Water (ml)	Starting Temperature (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
1000	23	46.7	100

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

Power = 4.2 joules/calorie x 1000 x (46.7-23) / 100

Power = 995.40 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-meters 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 (995.40/500)

LFS ≈ 35.3

Where: LFS is the maximum allowable field strength for out-of-band emissions in µV/meter at a 300-meters 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	GH4155 Series	35.3	30.96	70.96

Operating Frequency Measurement

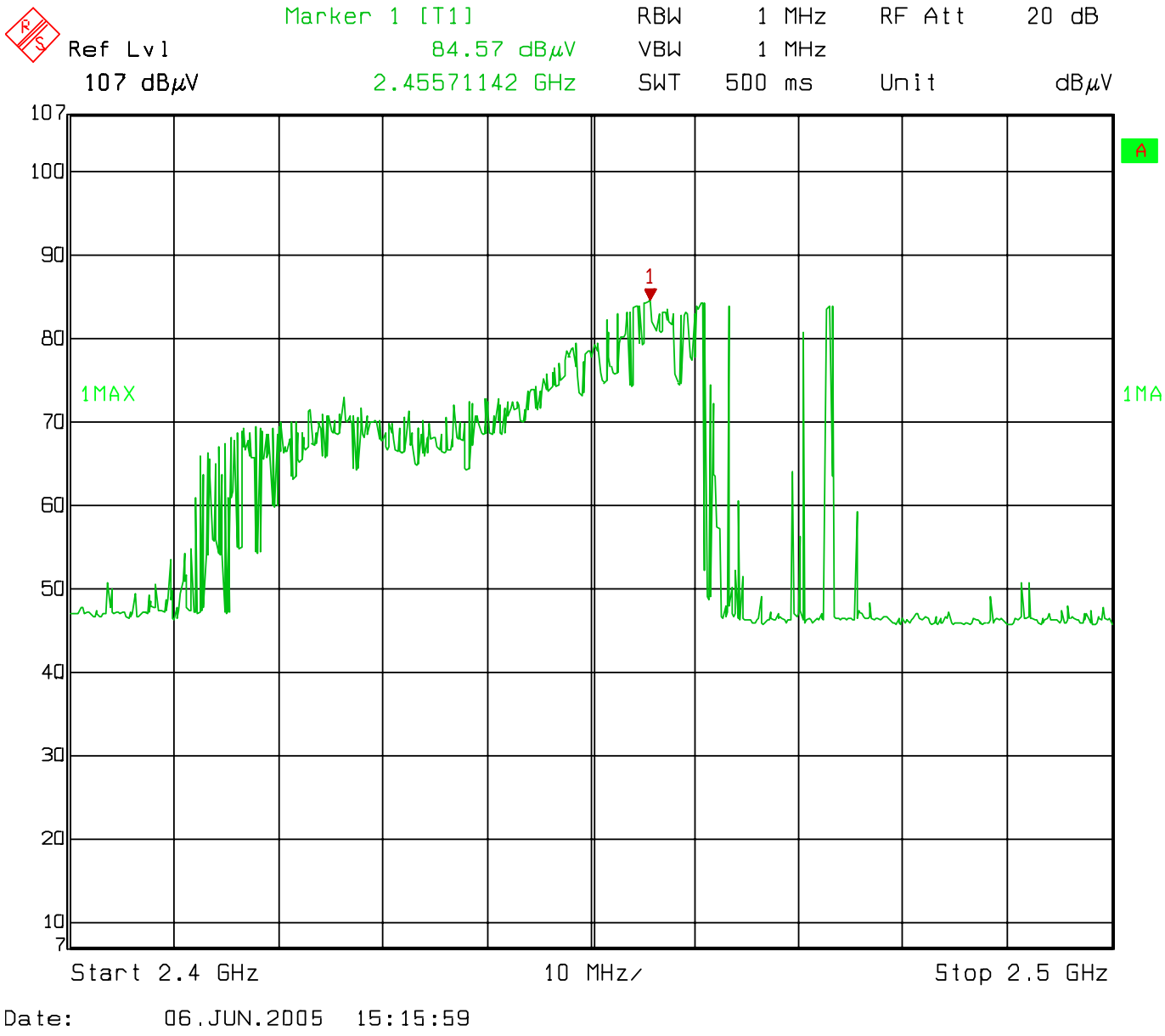
Variation in Operating Frequency with Time

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)
Whirlpool Microwave Products Development Ltd	GH4155 Series	2446.09	2455.71

Refer to data pages for details of the variation in operating frequency with time measurement.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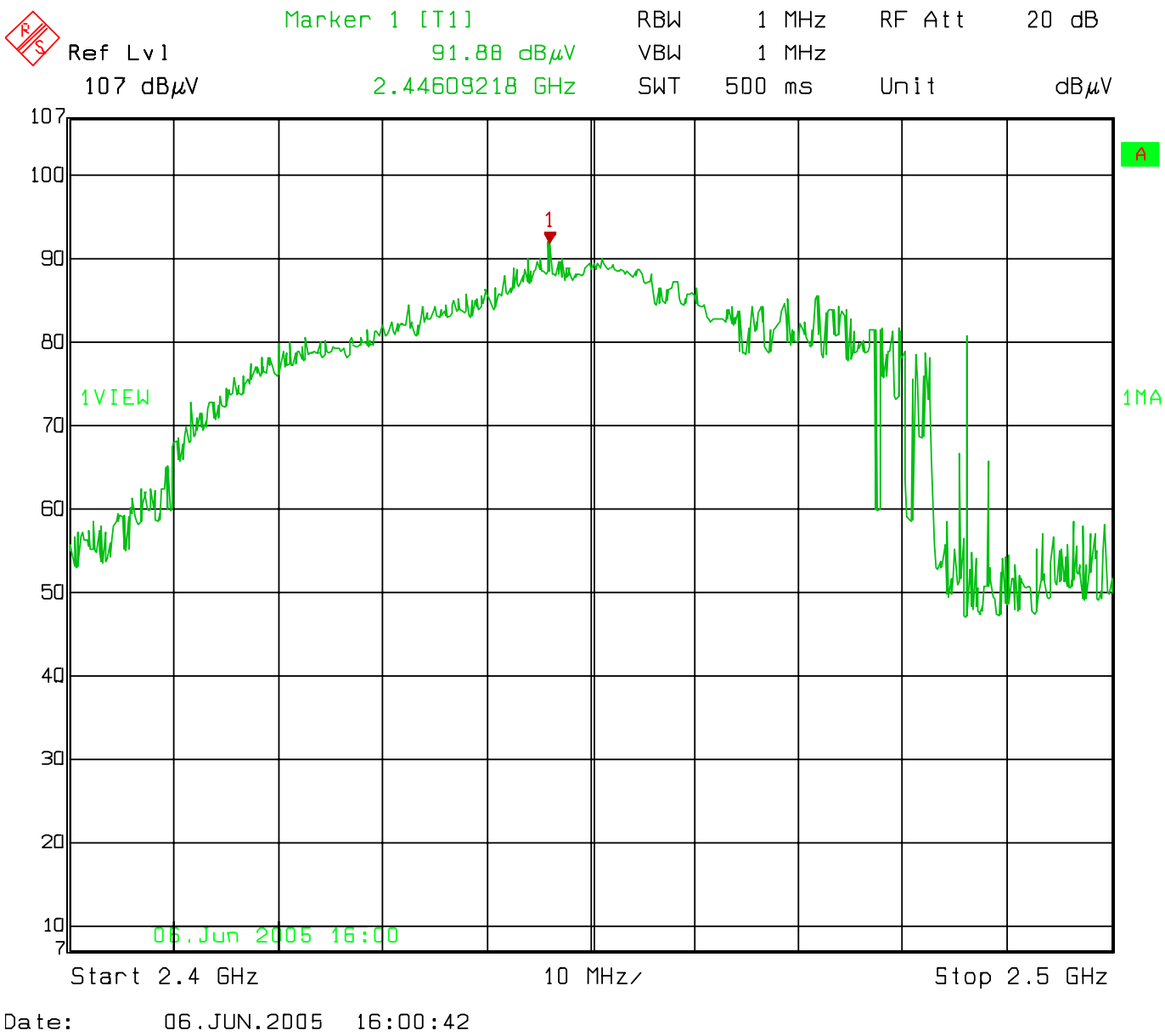
RBW 1 MHz
RF Att 20 dB
Ref Lvl
84.57 dBµV
VBW 1 MHz
107 dBµV
2.45571142 GHz
SWT 500 ms
Unit dBµV
107
100
90
80
70
60
50
40
30
20
10
7
1MAX
1MA
A
1
Start 2.4 GHz
10 MHz/
Stop 2.5 GHz
Date: 06.JUN.2005 15:15:59



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Variation in Operating Frequency with Line Voltage

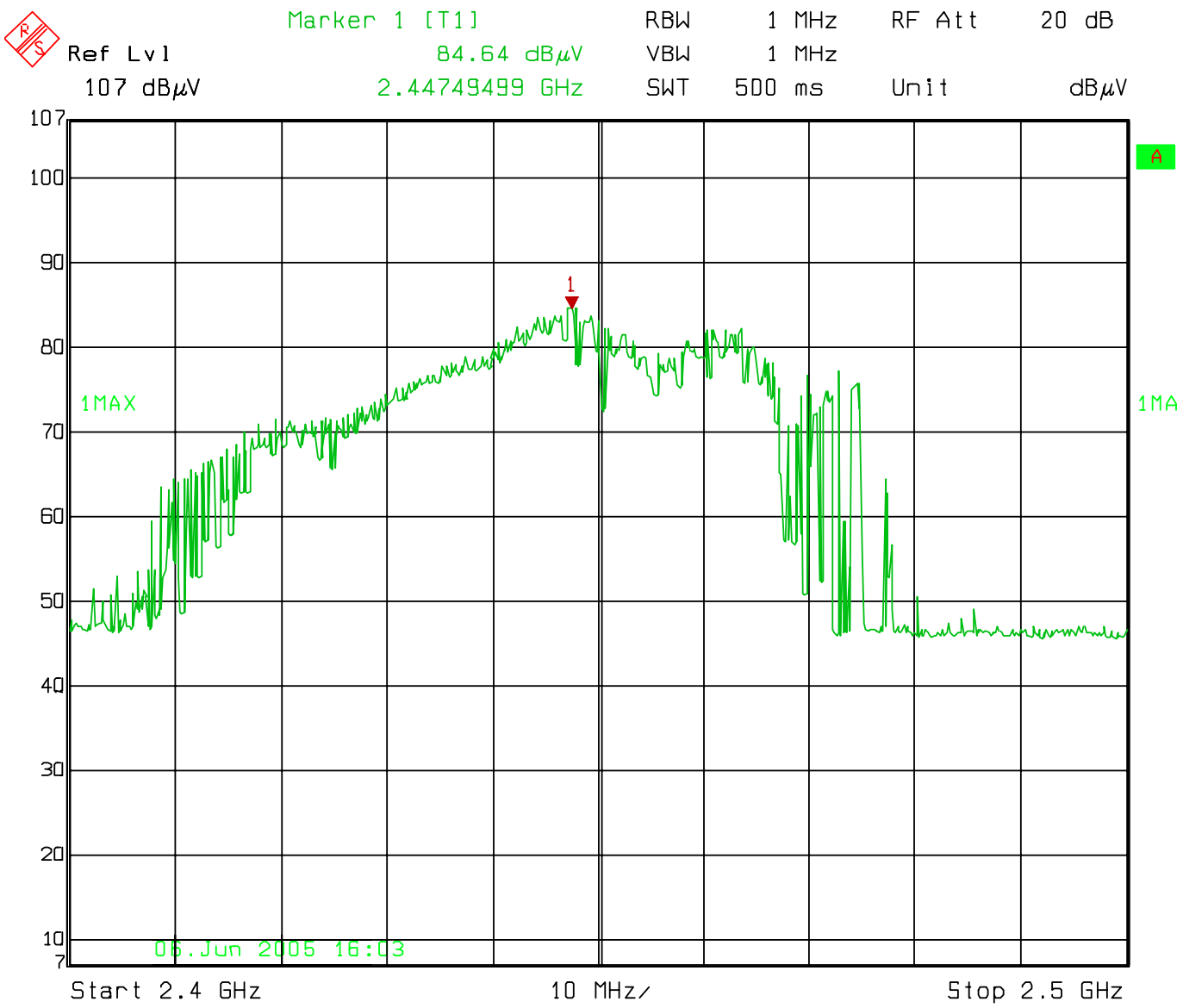
The EUT was operated / warmed by at least 10 minutes of use with a 1000ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency (MHz)	Maximum Frequency (MHz)
Whirlpool Microwave Products Development Ltd	GH4155 Series	2447.49	2448.89

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



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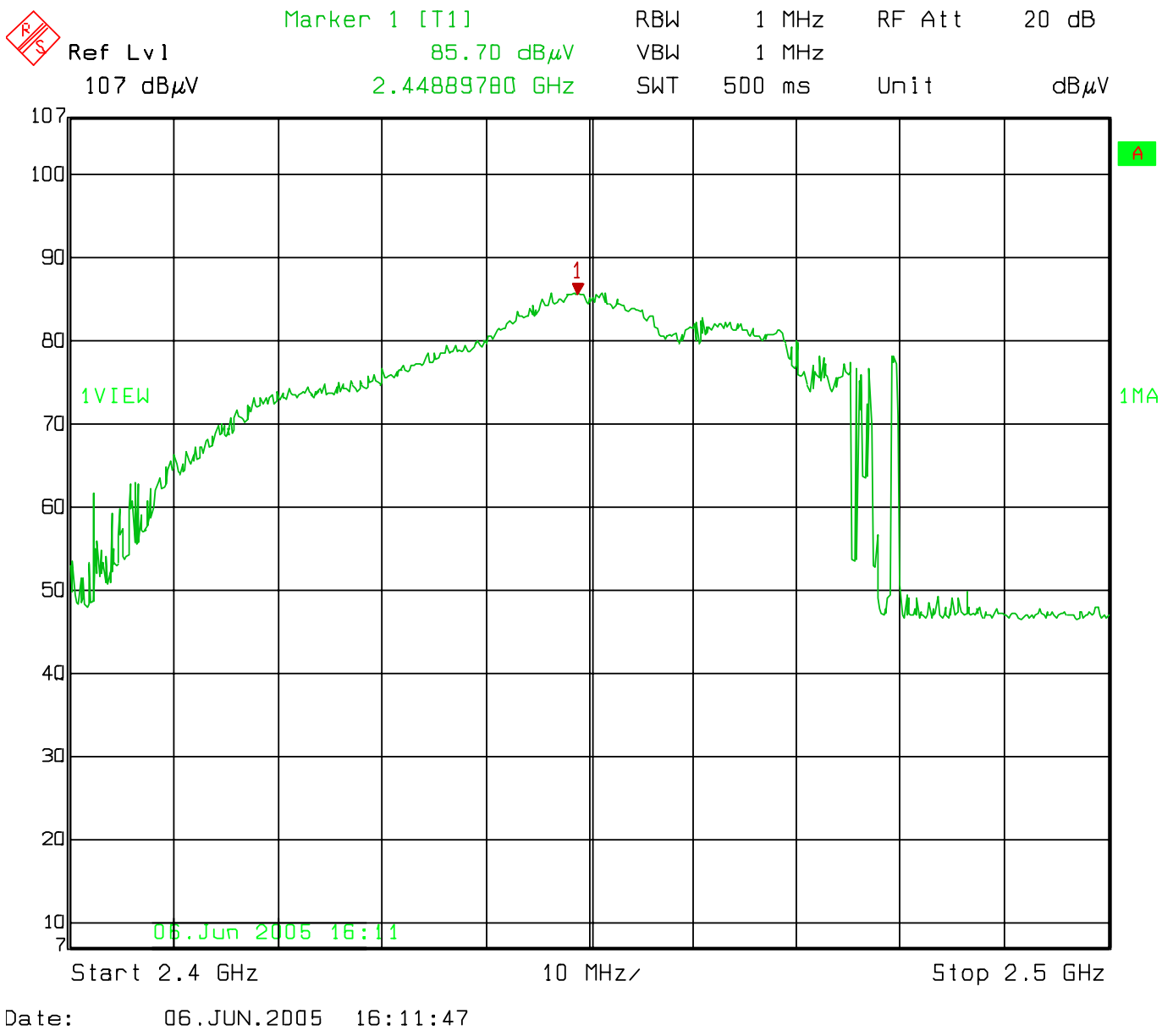

Marker 1 [T1]
RBW 1 MHz
RF Att 20 dB
Ref Lvl
85.70 dBµV
VBW 1 MHz
107 dBµV
2.44889780 GHz
SWT 500 ms
Unit dBµV
107
100
90
80
70
60
50
40
30
20
10
7
1VIEW
1MA
A
06.Jun 2005 16:11
Start 2.4 GHz
10 MHz/
Stop 2.5 GHz
Date: 06.JUN.2005 16:11:47

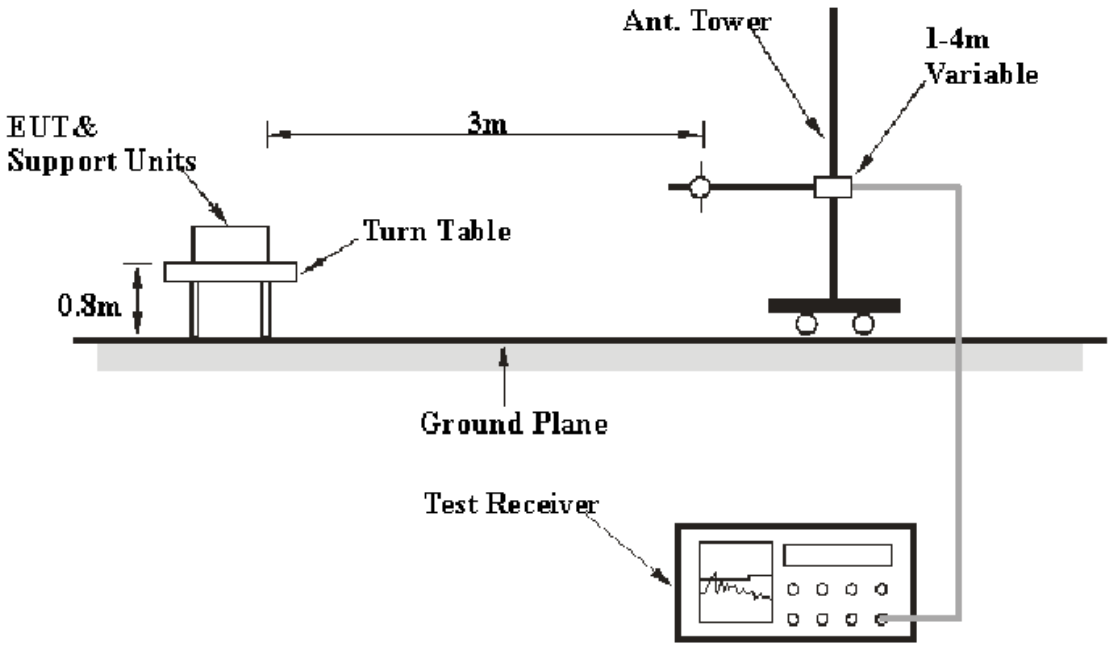
RADIATED EMISSION DATA

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 3 meters chamber A 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.

Test Receiver Setup and Spectrum Analyzer Setup

The system was investigated from 30 MHz to 24.5 GHz.

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

Frequency Range	***R B/W***	***Video B/W***	***IF B/W***
30 – 1000 MHz	100 kHz	100 kHz	120 kHz
Above 1 GHz	1 MHz	1 MHz	

Start Frequency..... 1 GHz
Stop Frequency..... 24.5 GHz
Sweep Speed..... Auto
Video Bandwidth..... 30 Hz
Resolution Bandwidth……..……1 MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2004-9-1	2005-8-31
Rohde & Schwarz	Test Receiver	ESCI	100035	2004-9-15	2005-9-15
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2005-4-28	2006-4-28
Sunol Sciences	System Controller	SC99V	041304-1	N/A	N/A
HP	Amplifier	8449B	3008A00277	2004-9-1	2005-8-31
Rohde & Schwarz	Spectrum Analyzer	FSEM30	849720/019	2004-11-10	2005-11-10
Sunol Sciences	Horn Antenna	DRH-118	A052604	2005-6-2	2006-6-2

*** Statement of Traceability: BACL** 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 detection 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:

Corr. Ampl. = Meter Reading + Antenna Loss + 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 -7dB means the emission is 7dB below the maximum limit; the equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

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:

30MHz to 1000MHz: **-28.86 dB** at **357.56 MHz** in the **Horizontal** polarization.

Above 1 GHz: **-1.76 dB** at **4906.31 MHz** in the **Vertical** polarization.

Test Data and Plots

Environmental Conditions

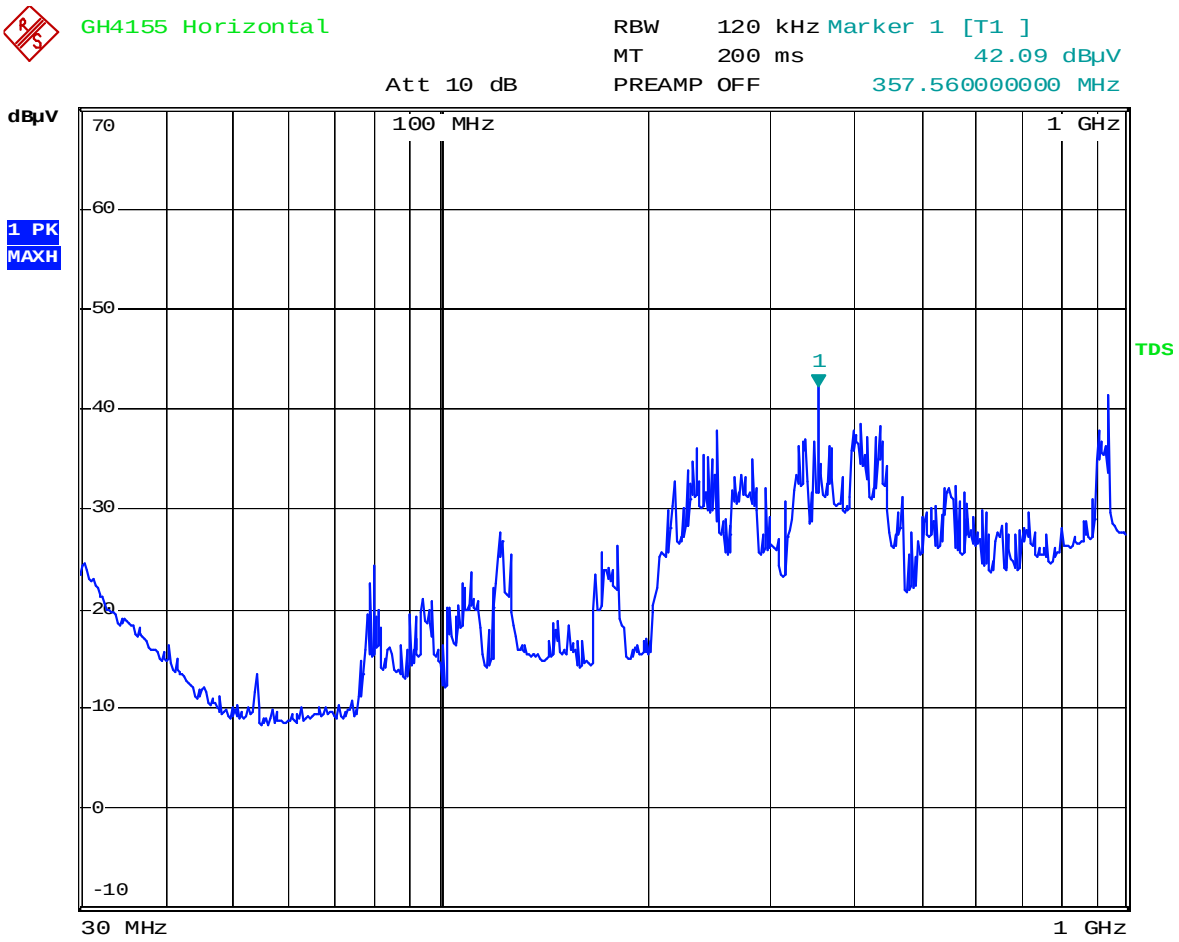
Temperature:	22° C
Relative Humidity:	62%
ATM Pressure:	940mbar

Testing was performed by Sam Lin on 2005-6-6.

Test mode: MAX Power

Frequency	Meter Reading	Detector	Direction	Height	Polar	Antenna Loss	Cable loss	Amplifier Gain	Corr.Ampl	FCC Part18	
MHz	dBuV/m	PK/AV	Degree	Meter	H / V	dB	dB	dB	dBuV/m	Limit dBuV/m	Margin dB
30 MHz to 1000 MHz											
357.56	49.8	PK	93	4.2	H	15.0	2.4	25.15	42.1	70.96	-28.86
332.76	49.5	PK	180	1.2	V	14.6	2.5	25.30	41.3	70.96	-29.66
939.04	40.3	PK	95	6.2	H	23.1	3.5	25.51	41.3	70.96	-29.66
273.16	50.8	PK	45	1.2	V	12.6	2.4	25.11	40.7	70.96	-30.26
428.4	46.5	PK	45	1.0	V	16.8	2.6	25.87	40.0	70.96	-30.96
908.76	39.3	PK	60	1.2	V	22.9	3.4	25.56	40.0	70.96	-30.96
560.4	44.8	PK	45	1.0	V	19.0	2.6	26.50	39.9	70.96	-31.06
411	45.2	PK	180	5.2	H	16.5	2.5	25.79	38.4	70.96	-32.56
253.12	49.2	PK	91	2.2	H	12.3	1.7	25.32	37.9	70.96	-33.06
46.12	51.9	PK	289	1.0	V	10.8	1.4	26.36	37.7	70.96	-33.26
340.44	44.8	PK	190	3.2	H	14.9	2.5	25.11	37.0	70.96	-33.96
237.12	47.9	PK	90	1.2	H	11.9	1.5	25.32	36.0	70.96	-34.96
171.24	42.8	PK	60	1.0	V	12.3	1.7	25.68	31.1	70.96	-39.86
32.12	30.3	PK	289	1.0	V	24.1	1.4	26.44	29.3	70.96	-41.66
122.92	38.0	PK	35	3.8	H	14.0	1.4	25.89	27.5	70.96	-43.46
181.44	38.3	PK	45	1.2	H	11.8	1.7	25.65	26.1	70.96	-44.86
79.96	40.6	PK	35	3.8	H	8.6	1.4	26.34	24.3	70.96	-46.66
Above 1 GHz											
2461.12	90.99	PK	45	1.0	V	28.1	3.7	0	122.8		
2458.52	89.28	PK	180	1.2	H	28.1	3.7	0	121.1		
4906.31	30.10	AV	45	1.0	V	33.9	5.2	0	69.2	70.96	-1.76
4906.91	29.89	AV	60	1.0	H	33.9	5.2	0	69.0	70.96	-1.96
7352.70	20.04	AV	45	1.2	V	37.3	6.1	0	63.4	70.96	-7.56
7366.53	19.04	AV	180	1.2	H	37.3	6.1	0	62.4	70.96	-8.56
9821.14	14.05	AV	45	1.2	V	37.8	7.1	0	59.0	70.96	-11.96
9817.33	13.83	AV	60	1.0	H	37.8	7.1	0	58.7	70.96	-12.26

Horizontal:



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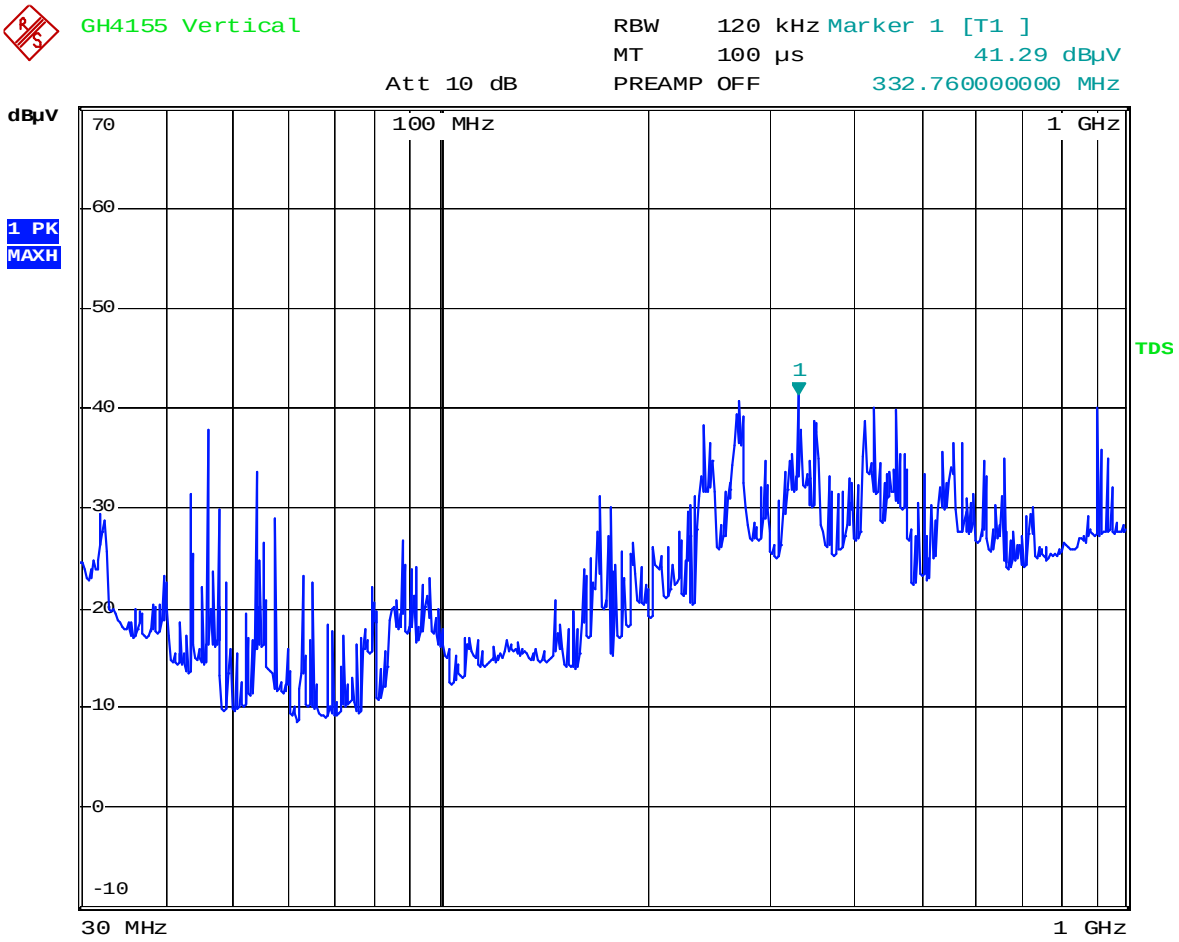
Vertical:



Whirlpool GH4155

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