

EMI Test Report

On Model Name: Microwave oven
Model Numbers: P90DXY-Z
Brand Name: Galanz
FCC ID: UHW9035

Prepared for
Guangdong Galanz Enterprises Co., Ltd

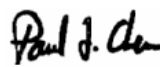
According to

FCC Part 18
Industrial, Scientific and Medical Equipment

FCC/OST MP-5(1986)
FCC methods of measurements of radio noise emission from
industrial, scientific and medical equipment

Test Report #: PSZ-0703-0363-FCC+ID
Prepared by: King Su
Reviewed by: Ivan Wen
QC Manager: Paul Chen

Test Report Released by:



Paul Chen

2007, Apr 10

Date

List Attached Files

Exhibit Type	File Description	File Name
Test Report	Test Report	UHW9035 _Test report.pdf
Operation Description	Technical Description	UHW9035 _Operation description.pdf
External Photos	External Photos	UHW9035 _External Photos
Internal Photos	Internal Photos	UHW9035 _Internal Photos
Block Diagram	Block Diagram	UHW9035 _Block Diagram.pdf
Schematics	Circuit Diagram	UHW9035 _Schematics.pdf
ID Label/Location	Label Artwork and Location	UHW9035 _Label & Location.pdf
User Manual	User Manual	UHW9035 _User Manual.pdf
Test setup photos	Test setup photos	UHW9035 _Test Setup Photos

Test Location

Tests performed at Galanz in a Certified ANSI Semi-Anechoic Chamber and Shielded Room.

Test Site Location: Guangdong Galanz Enterprises Co., Ltd
25 South Ronggui Rd., Shunde, Foshan,
Guangdong, China.
Tel: 86-757-23612785
Fax: 86-757-23612537

FCC Registration Number: 580210

Accreditation Bodies

EMC Compliance Management Group is a fully accredited Test Laboratory for ITE, ISM, MIL-STD and Telecommunications Products.



In compliance with the site registration requirements of Section 2.948 of the FCC Rules to perform EMI measurements for the general public. FCC Registration #: 894293.



Accredited by the National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code # 200068-0.

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Opinions and Interpretations

This test report relates to the abovementioned equipment under test (EUT). Without the permission of EMC Compliance Management Group Test Lab this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark on this or similar products. The manufacturer has sole responsibility of continued compliance of the device.

Statement of Measurement Uncertainty

The data and results referenced in the document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities that can account for a nominal measurement error. Furthermore, component and process variability of devices similar to that tested may result in additional deviation.

Administrative Data

Test Sample : Microwave Oven

Model Numbers : P90DXY-Z

Model Tested : P90D25EP-D4

Brand Name : Galanz

Date Tested : 2007, April 2th

Applicant : Guangdong Galanz Enterprises Co., Ltd.
25 Ronggui Nan Rd., Shunde, Foshan, Guangdong,
China.

Telephone : 86-0757-23612785

Fax : 86-757-23612537

Manufacturer : Guangdong Galanz Enterprises Co., Ltd.
25 Ronggui Nan Rd., Shunde, Foshan, Guangdong,
China.

EUT Description

Guangdong Galanz Enterprises Co., Ltd. model tested P90D25EP-D4 (referred to the EUT in this report) is a Microwave Oven.

Specifications:

Model Number	P90D25EP-D4
Power Consumption:	230V~50Hz, 1400W(Microwave)
Output:	900W
Operation Frequency:	2450MHz
Magnetron Manufacturer	Galanz
Magnetron Model Number	M24FB-610A
Outside Dimensions:	281mm(H)×483mm(W)×378mm(D)
Oven Cavity Dimensions:	219mm(H)×350mm(W)×355mm(D)
Oven Capacity:	25 Litres
Cooking Uniformity:	Turntable System {Φ314 mm}
Net Weight:	Approx.14.5 kg

Type of Deriver

P90DXY-Z model designations:

P: denotes only the Microwave functions.

90: denotes the output power is 900W.

23,25: denote different capacity in 23 or 25 liters.

X may be 23, 25, Y may be "L", "AL", "EL", "SL", "TL", "YL", "P", "AP", "EP", "SP", "ASL", "ESL", "YSL", "ASP", "ATP", "ESP", "ESL", "ETP": "A, Y, E" denote the electrical control model; "L, P" just denote the different open mode for door; "L" denotes the door handle is on the side of the door; "P" denotes the push-down type door; "S" denotes the stainless steel cavity.

Z may be blank, -T1, -T3, -T7, -T8, -T9, -D2, -D4, -DA, -DH, -A5, -A9, -J3, -Q5, -Q6, -B1, -B4, -KE1, -K9, -C1, -FY1: denotes the different appearance.

Test Summary

The Electromagnetic Compatibility requirements on model tested P90D25EP-D4 for this test is stated below. All results listed in this report relate exclusively to this above-mentioned model as the Equipment Under Test. This report confers no approval or endorsement upon any other component, host or subsystem used in the test set-up.

Emission Tests				
Specifications	Description	Test Results	Test Point	Remark
FCC Part 18:2004 FCC/OST MP-5:1986 ANSI C63.4: 2003	Radiation Hazard Measurement	Passed by 0.0031mW/cm ²	EUT	Attachment 1
FCC Part 18:2004 FCC/OST MP- 5:1986 ANSI C63.4: 2003	Input Power Measurement	Refer to Attachment2	EUT	Attachment 2
FCC Part 18:2004 FCC/OST MP-5:1986 ANSI C63.4: 2003	RF Output power Measurement	Refer to Attachment3	EUT	Attachment 3
FCC Part 18:2004 FCC/OST MP-5:1986 ANSI C63.4: 2003	Operating Frequency Measurement	Passed	EUT	Attachment 4
FCC Part 18:2004 FCC/OST MP-5:1986 ANSI C63.4: 2003	Conducted Emission	Passed by 6.20 of QP	AC Input Port	Attachment 5
FCC Part 18:2004 FCC/OST MP-5:1986 ANSI C63.4: 2003	Radiated Emission	Passed by 13.08 of AVE	Enclosure	Attachment 6

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 1000watts 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.

--Load for all other measurements: 700 milliliters of water, with the beaker located in the center of the oven.

Equipment Modification

Any modifications installed previous to testing by Guangdong Galanz Enterprises Co., Ltd. will be incorporated in each production model sold or leased in United States.

There were no modifications installed by EMC Compliance Management Group (China) test personnel.

EUT Sample Photos for model P90D25EP-D4



Front & Top View



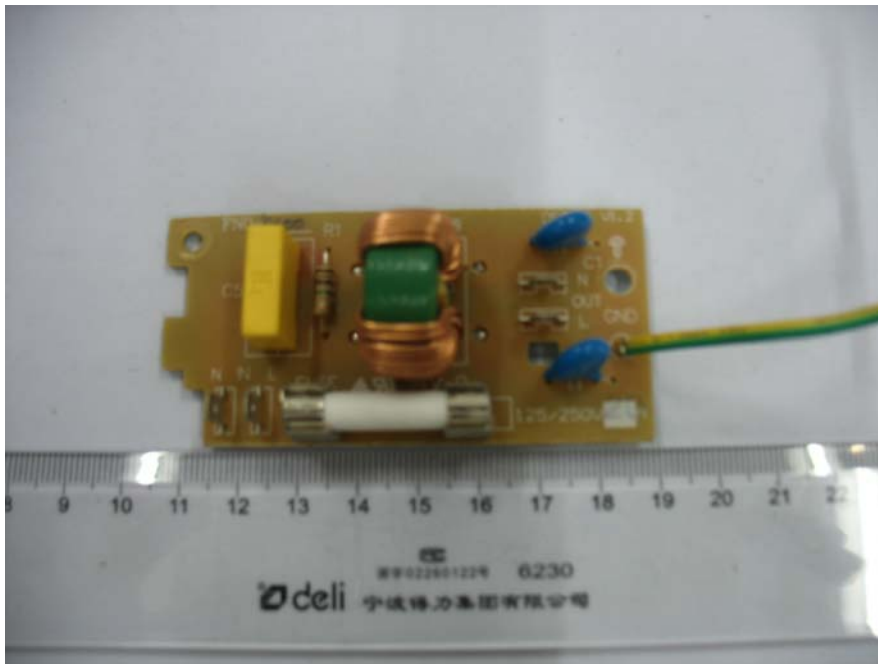
Rear View



Door opened View



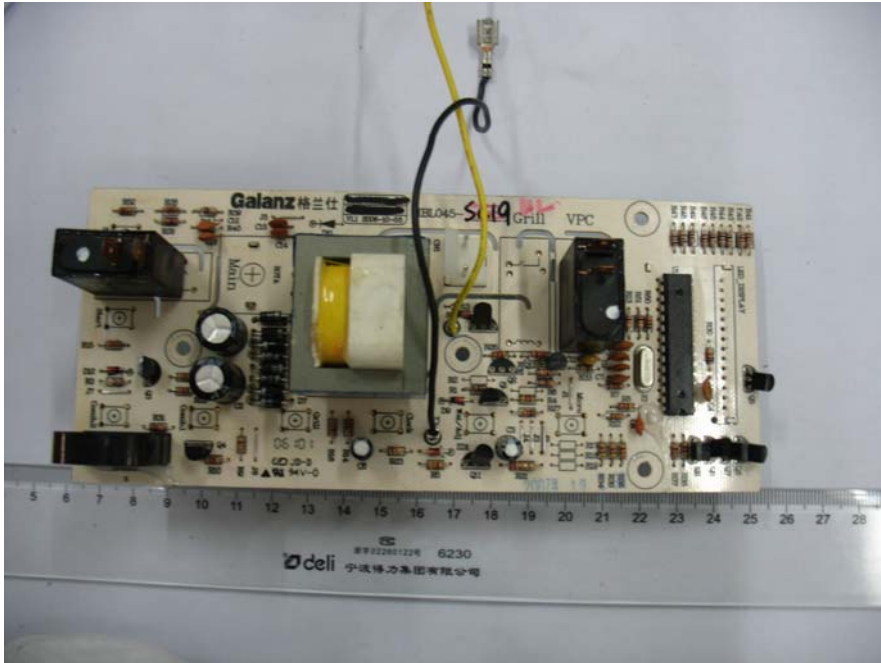
Uncovered View



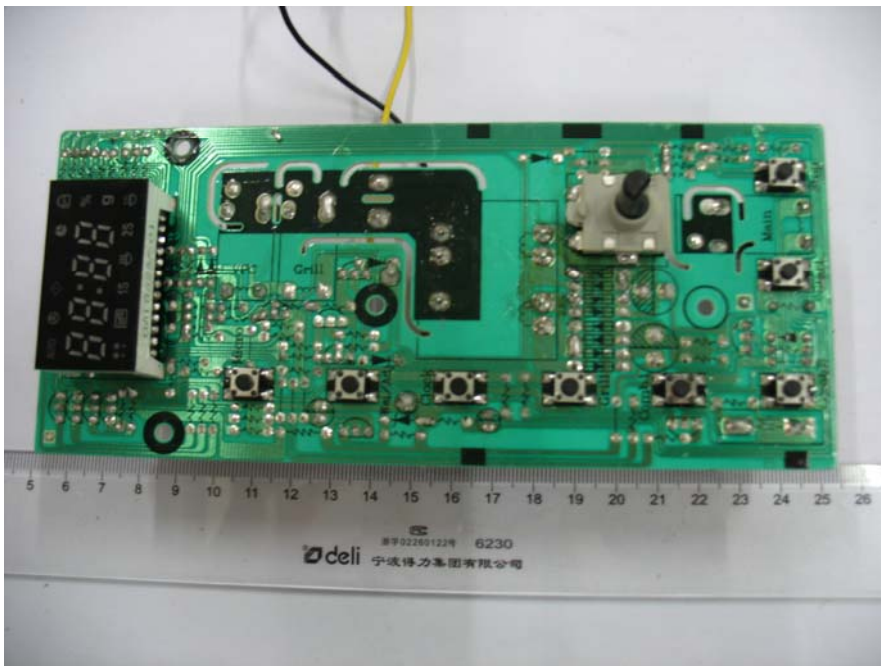
AC power filter board



AC power filter board - Reversed



PCB

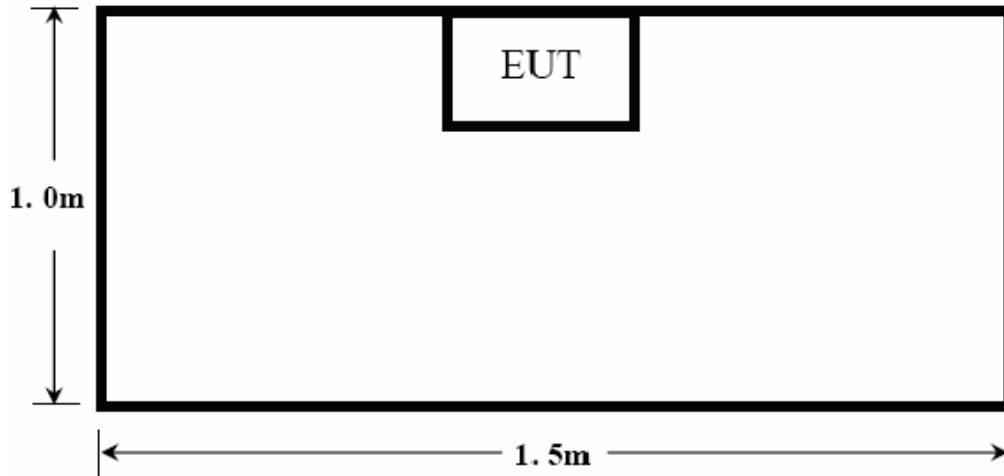


PCB - Reversed

Test System Details

EUT					
Model Numbers:	P90DXY-Z				
Model Tested:	P90D25EP-D4				
Description:	Microwave Oven				
Manufacturer:	Guangdong Galanz Enterprises Co., Ltd.				
Support Equipment					
N/A					
Cable Description					
Description	From	To	Length (Meters)	Shielded (Y/N)	Ferrite (Y/N)
Power Cable	EUT	Plug	1.20	N	N

Configuration of Tested System



ATTACHMENT 1 – RADIATION HAZARD TEST

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	The EUT was set up according to the FCC MP-5 and FCC Part 18 for Radiation Hazard Measurement. The measurement was using a microwave leakage meter to measure the Radiation leakage in the as-received condition with the oven door closed. A 1000ml water load in a beaker was located in the center of the oven and the Microwave oven was set to maximum power. While the oven operating, the microwave meter will check the leakage and then record the maximum leakage.		
TESTED RANGE:	N/A		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS:	<p>There was no microwave leakage exceeding a power level of 0.0031 mW/cm² observed at any point 5cm or more from the external surface of the oven.</p> <p>A maximum of 1.0mW/cm² is allowed in accordance with the applicable FCC standards. Hence, microwave leakage in the as-received condition with the oven door closed was below the maximum allowed.</p> <p>The test results relate only to the equipment under test provided by client.</p>		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY:	0.0001 mW/cm ²		

Test equipments list:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Field Monitor	R&S	AR FM5004	A0304252	25/05/06	24/05/07
Electric FieldProber	R&S	AR FP6001	A0304302	15/03/07	14/03/08

Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

Radiation Hazard Test Set-up :



SIGNED BY: King Su
ENGINEER

ATTACHMENT 2 – INPUT POWER MEASUREMENT

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	The EUT was set up according to the FCC MP-5 and FCC Part 18 for Input power Measurement. The input power and current was measured using a power analyzer. A 1000ml water load in a beaker was located in the center of the oven and the Microwave oven was set to maximum power. While the oven is operating, use a voltmeter and an ampmeter to test the AC input voltage and current		
TESTED RANGE:	N/A		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS :	Based on the measured input power, the EUT was found to be operating within the intended specifications. The test results relate only to the equipment under test provided by client.		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY :	± 5W		

Test Data:

Input Voltage (Vac/Hz)	Input Current (amps)	Measured Input Power (watts)	Rated Input Power (watts)
120	11.34	1340	1350

Test equipments list :

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Power frequency test system	Ainuo	AN8716PX	058704273	06/12/06	06/12/07

Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

Input Power Test Set-Up :



SIGNED BY: King Su
ENGINEER

ATTACHMENT 3 – RF OUTPUT POWER MEASUREMENT

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	<p>The EUT was set up according to the FCC MP-5 and FCC Part 18C for RF output power Measurement. The Caloric Method was used to determine maximum RF output power. The initial temperature of the water load was measured. A 1000ml water load in a beaker was located in the center of the oven. The oven was operated at maximum output power for 120 seconds, the temperature of the water was re-measured.</p> <p>RF Output Power</p> $= (4.2\text{joules/calorie})(\text{volume in milliliters})(\text{temperature rise}) / (\text{time in seconds})$ $= 4.2 \text{ joules/calorie} \times 1000 \times (\text{Final Temp} - \text{Initial Temp}) / 120$		
TESTED RANGE:	N/A		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS:	<p>RF Output Power = 661.5watts</p> <p>The test results relate only to the equipment under test provided by client.</p>		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY:	± 0.3°C		

Test Data:

Quality of Water (ml)	Starting Temperature (°C)	Final Temperature (°C)	Elapsed Time (Seconds)	RF Output Power (watts)
120V/60Hz	14.50	33.40	120	661.50

Test equipments list :

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Data Acquisition	TES	TES-1310	020907011	12/03/07	11/03/08

Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

RF Output Power Test Set-Up :



SIGNED BY: King Su
ENGINEER

ATTACHMENT 4 – OPERATING FREQUENCY MEASUREMENT

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	<p>The EUT was set up according to the FCC MP-5 and FCC Part 18 for Operating Frequency Measurement.</p> <p>1) The variation of frequency with time.</p> <p>The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 1000ml water load in a beaker was located in the center of the oven. Set a spectrum analyzer with antenna at 3 meters distance form 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.</p> <p>2) The variation of frequency with Line Voltage.</p> <p>The operating frequency was measured using a spectrum analyzer. 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.</p>		
TESTED RANGE:	2450 ± 50MHz		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS:	<p>Please refer to following pages for details of the variation in operating frequency with time & line voltage measurement.</p> <p>The test results relate only to the equipment under test provided by client.</p>		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY:	Freq. ±10kHz		

Variation in Operating Frequency with Time:

Minimum Frequency (MHz)	Maximum Frequency (MHz)
2469.2	2471.8

Variation in Operating Frequency with Line Voltage:

Minimum Frequency (MHz)	Maximum Frequency (MHz)
2464.2	2471.8
Note: Line voltage varied from 96Vac to 150Vac.	

Test equipments list:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Ultra Broadband Antenna	ETS	3142C	00042672	04/12/07	03/12/08
Horn Antenna	ETS	3115	6587	04/07/07	03/07/08
EMI Receiver	R&S	FSP30	100755	04/12/07	03/12/08
5M Anechoic chamber	ETS	3m	N/A	19/03/06	18/03/08
Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).					

Operating Frequency Test Set-up :

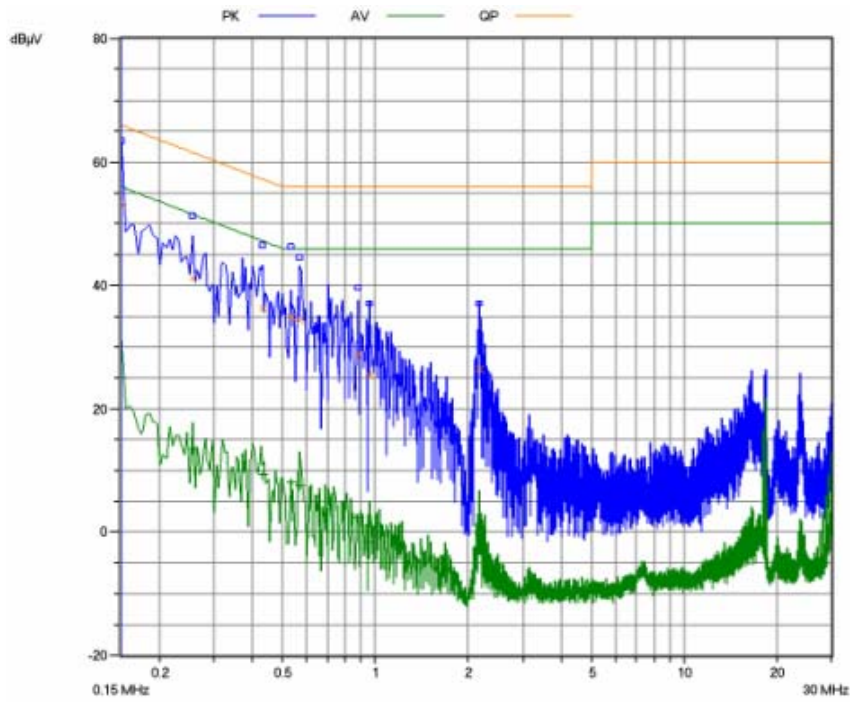


SIGNED BY: King Su
ENGINEER

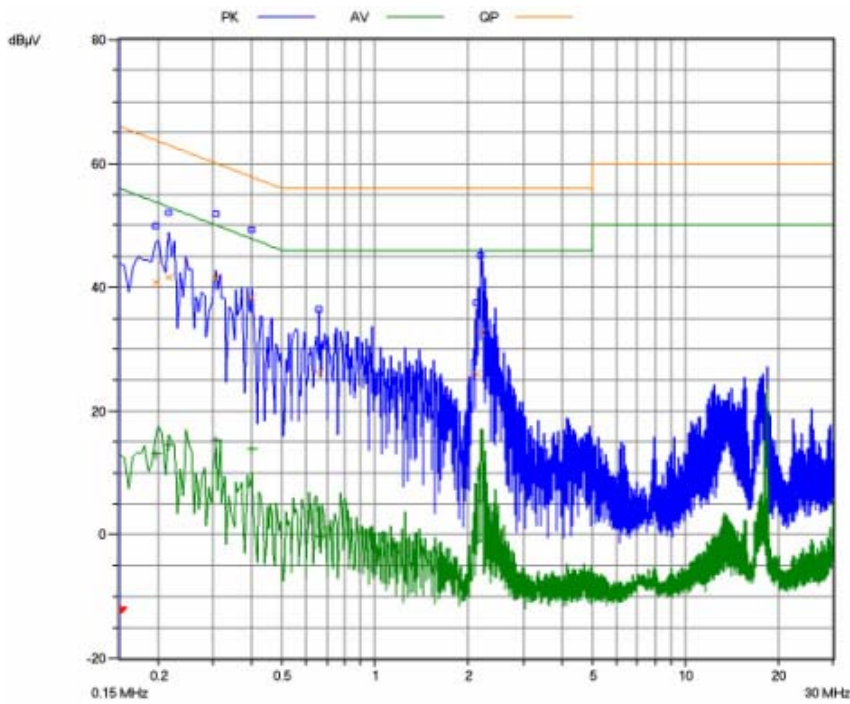
ATTACHMENT 5 - CONDUCTED EMISSION TEST RESULTS

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	The EUT was set up according to the guideline of ANSI C63.4: 2003 & FCC MP-5 for conducted emissions. The measurement was using a AMN on each line and an EMI receiver peak scan was made at the frequency measurement range. The six highest significant peaks were then marked, and these signals were then quasi-peaked and averaged. The frequency range investigated was from 150kHz to 30MHz.		
TESTED RANGE:	150kHz to 30MHz		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS:	The EUT meets the requirements of test reference for Conducted Emissions on line L by 6.20 dB of Quasi-Peak detector. The test results relate only to the equipment under test provided by client.		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY:	±2.5 dB		

Line L Conducted Emission Graph :



Line N Conducted Emission Graph :



Test data:

Line (L/N)	Frequency (MHz)	Corrected QP Level (dBuV)	Limits QP (dBuV)	Margin QP (dB)	Corrected AVE Level (dBuV)	Limits AVE (dBuV)	Margin AVE (dB)
L	0.1500	53.50	66.00	-12.50	24.70	56.00	-31.30
L	0.2550	47.30	61.60	-14.30	18.50	51.60	-33.10
L	0.5696	49.80	56.00	-6.20	20.70	46.00	-25.30
N	0.2155	41.80	63.00	-21.20	18.30	53.00	-34.70
N	0.3047	38.70	60.10	-21.40	--	50.10	--
N	2.1961	40.90	56.00	-15.10	--	46.00	--

Note: All readings are using a bandwidth of 9 kHz, with a 30 ms sweep time.

Test equipments list:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
EMI Receiver	SCHAFFNE	SMR4503	44	03/07/07	03/07/08
LISN	AGILENT	482512	1161	03/07/07	03/07/08

Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

Conducted Emission Test Set-up :



SIGNED BY: King Su
ENGINEER

ATTACHMENT 6 - RADIATED EMISSION TEST RESULTS

CLIENT:	Guangdong Galanz Enterprises Co., Ltd.	TEST STANDERD:	FCC Part 18
MODEL NUMBERS:	P90DXY-Z	PRODUCT:	Microwave Oven
MODEL TESTED:	P90D25EP-D4	EUT DESIGNATION:	Home or Office
TEMPERATURE:	22°C	HUMIDITY:	60%RH
ATM PRESSURE:	101.1kPa	GROUNDING:	Through AC Power Cord
TESTED BY:	King Su	DATE OF TEST:	2007, April 2 th
TEST REFERENCE:	ANSI C63.4: 2003, FCC/OST MP-5:1986		
TEST PROCEDURE:	<p>The EUT was set up according to the guidelines of ANSI C63.4: 2003 & FCC MP-5 for radiated emissions. Microwave oven was placed on a 1m *1.5m nonconductive table. The top of the table is 1.0 m above the ground. The table is placed on a flush mounted metal turntable.</p> <p>An EMI receiver peak scan was made at the frequency measurement range (pre-scan) in an Anechoic chamber. Signal discrimination was then performed and the significant peaks marked. All data was recorded in Quasi-peak detection mode from 30 MHz to 1GHz and average detector mode above 1GHz.</p> <p>The following data lists the significant emission frequencies, measured levels, correction factors (including cable and antenna correction factors), and the corrected readings against the limits. Explanation of the Correction Factor are given as follows:</p> <p>FS= RA + AF + CF - AG</p> <p>Where: FS = Field Strength</p> <p>RA = Receiver Amplitude</p> <p>AF = Antenna Factor</p> <p>CF = Cable Attenuation Factor</p> <p>AG = Amplifier Gain</p>		
TESTED RANGE:	30MHz to 24.5GHz		
TEST VOLTAGE:	120VAC / 60Hz		
RESULTS:	The EUT meets the requirements of test reference for Radiated Emissions on Vertical polarization by 13.08 dB of Average detector at 17.2559 GHz. The test results relate only to the equipment under test provided by client.		
Changes or Modifications:	There were no modifications installed by EMC Compliance Management Group (China) test personnel.		
M. UNCERTAINTY:	± 3.2 dB		

Test Data :

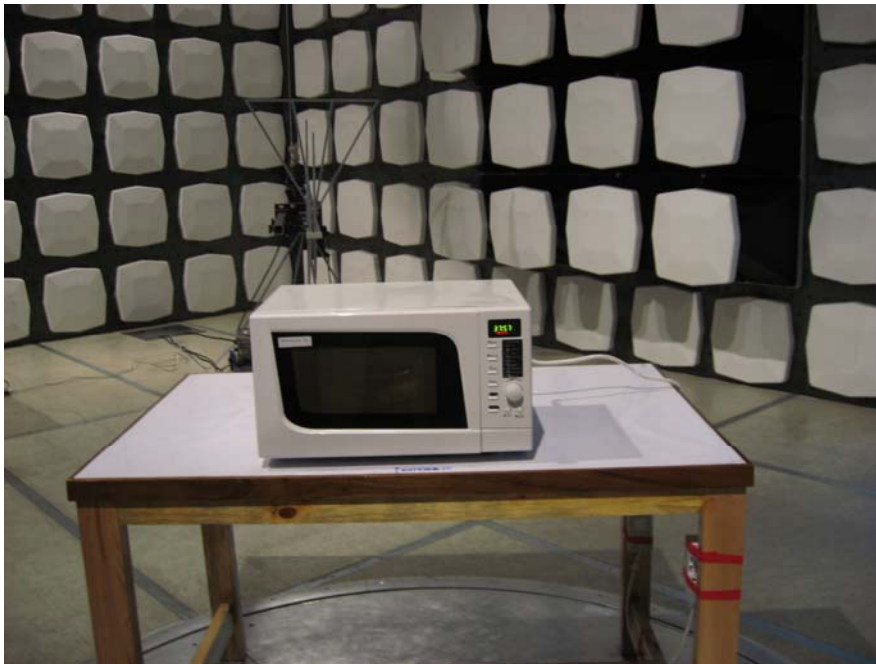
30MHz – 1GHz				
Frequency [MHz]	Antenna Polarization [V/H]	Corrected Reading [dB μ V/m]	Delta, QP [dB]	3 Meters Limits [dB μ V/m]
53.6080	H	31.90	-37.30	69.20
152.8300	H	25.30	-43.90	69.20
870.4300	H	28.30	-40.90	69.20
54.6000	V	37.40	-31.80	69.20
78.0000	V	29.60	-39.60	69.20
147.6000	V	27.90	-41.30	69.20
Note: All readings are quasi-peak unless stated otherwise, using a bandwidth of 120kHz, with a 30 ms sweep time. A video filter was not used.				
1GHz – 25GHz				
Frequency [MHz]	Antenna Polarization [V/H]	Corrected Reading [dB μ V/m]	Delta, AV [dB]	3 Meters Limits [dB μ V/m]
4.9352	H	45.24	-23.96	69.20
7.3988	H	45.65	-23.55	69.20
17.2488	H	55.93	-13.27	69.20
4.9352	V	48.39	-20.81	69.20
7.4046	V	44.79	-24.41	69.20
17.2559	V	56.12	-13.08	69.20
Comments: None				
Note: All readings are average unless stated otherwise, using a bandwidth of 1MHz, with a 30 ms sweep time. A video filter was not used.				

Test equipments list:

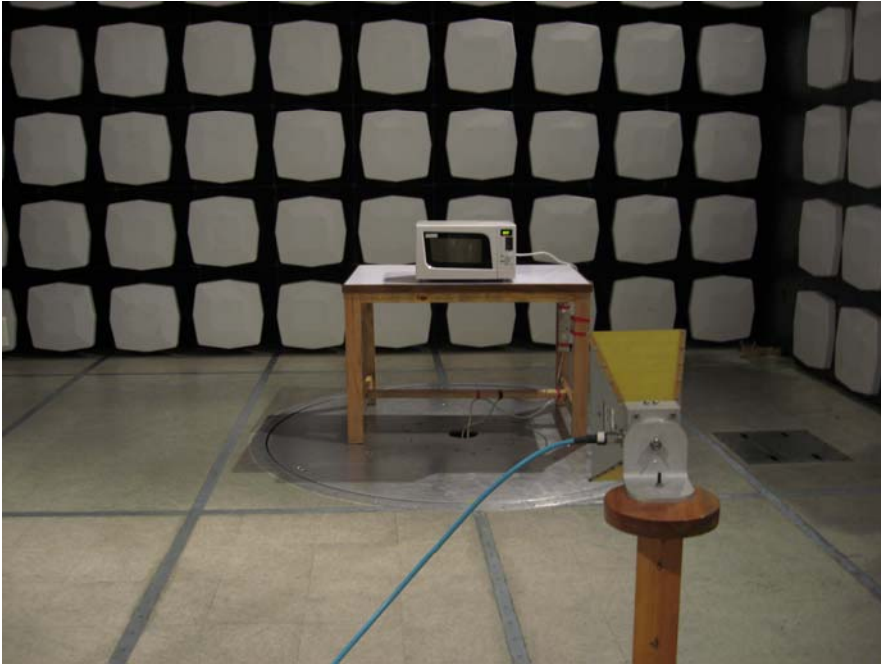
Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Ultra Broadband Antenna	ETS	3142C	00042672	20/07/06	19/07/07
Horn Antenna	ETS	3115	6587	03/07/07	03/07/08
Band-pass Filter	Micro-Tronics	BRM50702	SIN-030	03/07/07	03/07/08
EMI Receiver 1	SCHAFFNE	SMR4503	44	03/07/06	03/07/08
Semi-anechoic chamber	ETS	3m	N/A	19/03/07	18/03/09
EMI Receiver 2	R&S	FSP30	100755	03/12/07	03/12/08

Note: All testing were performed using internationally recognized standards. All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

Radiated Emission Test Set-up (30~1000MHz) :



Radiated Emission Test Set-up (1~25GHz)



SIGNED BY: King Su
ENGINEER