FCC ID PER PART 18
EMI MEASUREMENT AND TEST REPORT

For

Shunde MD Microwave Oven Manufactory Co., Ltd.

Penglai Road, Beijiao, Shunde,
Guangdong, P.R. China

FCC ID: PU7E1037X-Y

July 11, 2002

This Report Concerns:	**Equipment Type:**
☒ Original Report	Microwave Oven – Consumer ISM Equipment

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Note: The test report is specially limited to the use of the above client company and the product model. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Shunde MD Microwave Oven Manufactory Co., Ltd.*'s model, *E1037X-Y* or the "EUT" as referred to in this report is a microwave oven which measures approximately 17.5"L x 21"W x 13"H.

1.2 Objective

The following test report is prepared on behalf of *Shunde MD Microwave Oven Manufactory Co., 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 demonstrate compliance with FCC Part 18 limits for Industrial, Scientific and Medical Equipment.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –2000, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory Corporation. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.4 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 back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

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 C63.4-2000 and CISPR 11.

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.

1.5 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Data	Cal. Due Data
HP	Spectrum Analyzer	8564E	08303	12/6/01	12/6/02
HP	Spectrum Analyzer	8593B	2919A00242	12/20/01	12/20/02
HP	Amplifier	8349B	2644A02662	12/20/01	12/20/02
HP	Quasi-Peak Adapter	85650A	917059	12/6/01	12/6/02
HP	Amplifier	8447E	1937A01046	12/6/01	12/6/02
A.H. System	Horn Antenna	SAS0200/571	261	12/27/01	12/27/02
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/01	11/2/02
Com-Power	Biconical Antenna	AB-100	14012	11/2/01	11/2/02
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/01	12/28/02
Com-Power	LISN	LI-200	12208	12/20/01	12/20/02
Com-Power	LISN	LI-200	12005	12/20/01	12/20/02
BACL	Data Entry Software	DES1	0001	12/20/01	12/20/02

1.6 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Shunde MD Microwave Oven Manufactory Co., Ltd.	Microwave Oven	E1037X-Y	N/A	PU7E1037X-Y

2 – OPERATING CONDITION/TEST CONFIGURATION

2.1 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.

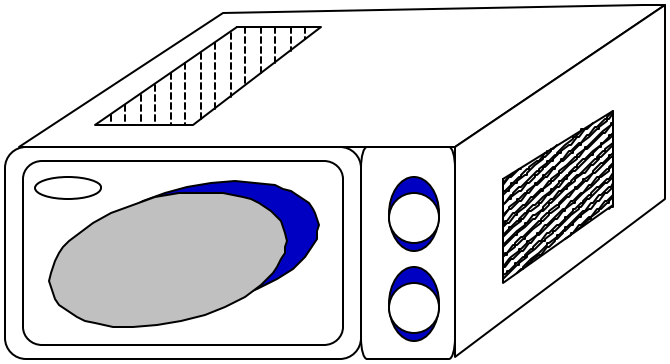
2.2 Schematics / Block Diagram

Appendix A contains a copy of the EUT's block diagram as reference.

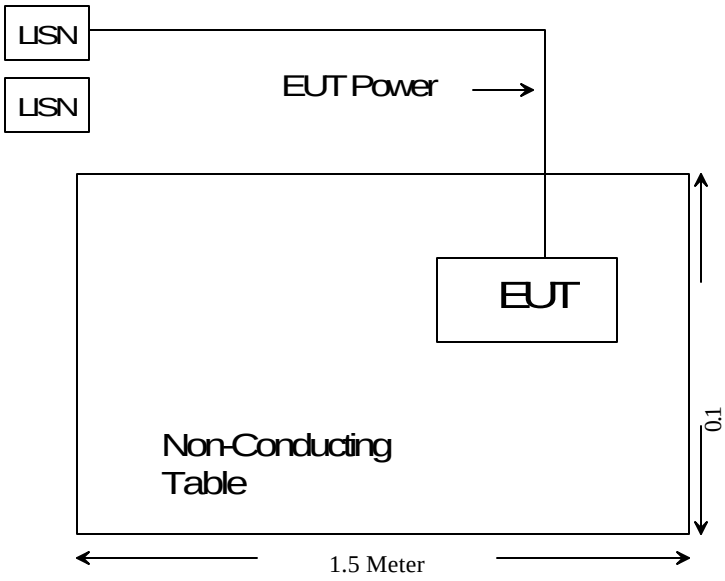
2.3 Equipment Modifications

No modification to the EUT was made by BACL Corp to make sure the EUT comply with applicable limits.

2.4 Configuration of Test System



2.5 Test Setup Block Diagram



3 - CONDUCTED EMISSIONS TEST DATA

3.1 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.

3.2 EUT Setup

The measurement was performed at the **O**pen **A**rea **T**est **S**ite, using the same setup per ANSI C63.4 - 2000 measurement procedure. Specification used was with the FCC Part 18 limits.

The EUT was placed on the edge of the test table. The EUT was connected to 110Vac/60Hz power source.

3.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conducted emission test:

Start Frequency .....450 kHz
Stop Frequency .....30 MHz
Sweep Speed.....Auto
IF Bandwidth.....10 kHz
Video Bandwidth .....10 kHz
Quasi-Peak Adapter Bandwidth.....9 kHz
Quasi-Peak Adapter Mode.....Normal

3.4 Test Procedure

Since the EUT has only one operating mode, this mode was tested to represent worst case results for the final qualification test. Therefore, these results were used for final test data recorded in the table listed under section 3.6 of this report.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination. All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBµV of specification limitation). Quasi-peak readings are distinguished with a "**Qp**".

3.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the FCC 18 Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-001 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

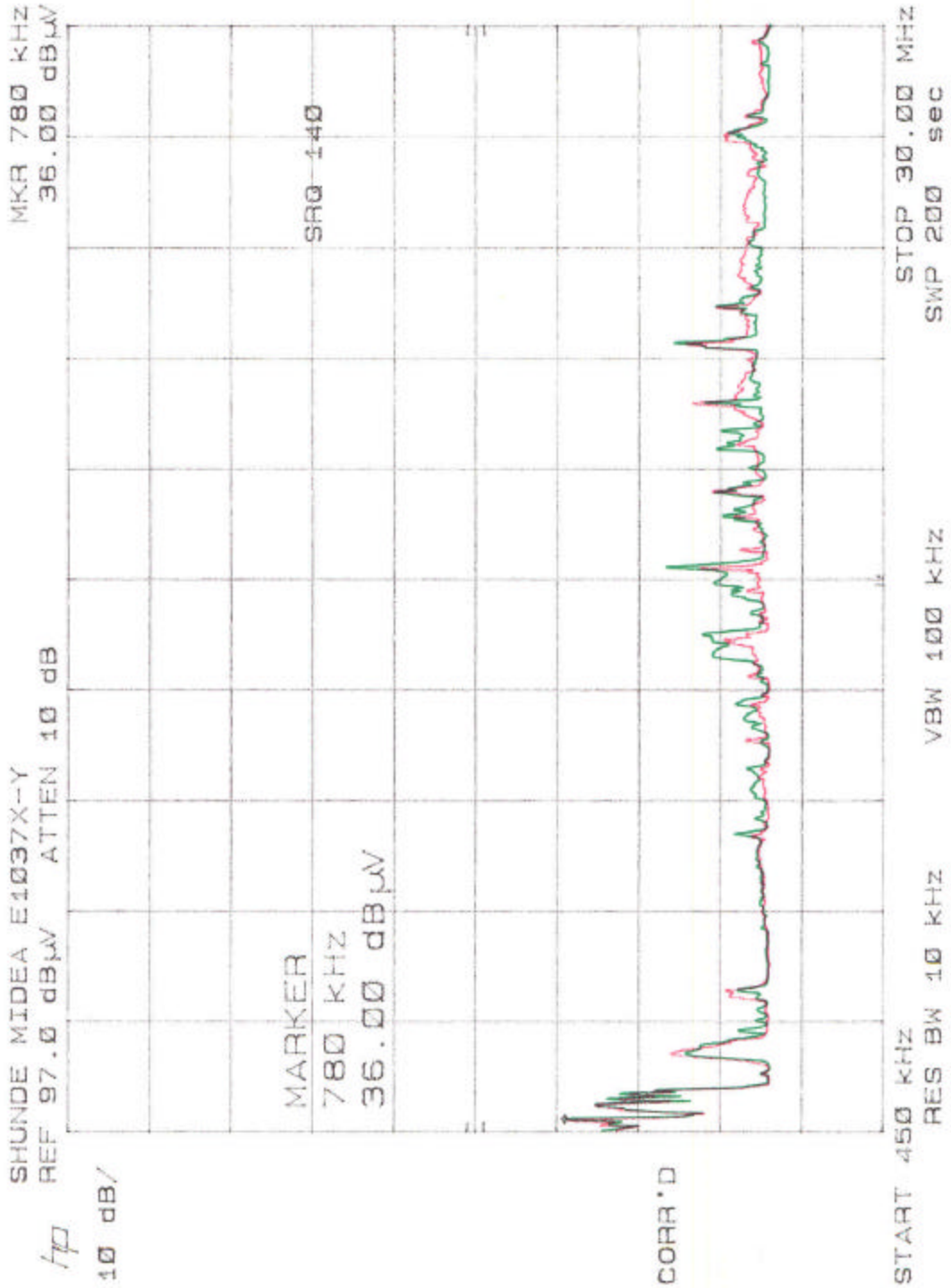
-12.0 dBmV at **0.78 MHz** in the ***Neutral*** mode .

3.6 Conducted Emissions Test Data

3.6.1 Test Data for Power Supply, 0.45 - 30 MHz.

LINE CONDUCTED EMISSIONS				FCC 18 CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dBµV	Qp/Ave/Peak	Line/Neutral	dBµV	dB
0.78	36.0	QP	Neutral	48	-12.0
0.78	35.6	QP	Line	48	-12.4
1.16	32.4	QP	Line	48	-15.6
1.34	29.3	QP	Line	48	-18.7
1.445	29.3	QP	Neutral	48	-18.7
1.37	28.6	QP	Neutral	48	-19.4

3.7 Plot of Conducted Emissions Test Data


SHUNDE MIDEA E1037X-Y
REF 97.0 dBμV
ATTEN 10 dB
MKR 780 kHz
36.00 dBμV
10 dB/
SRQ 140
MARKER
780 kHz
36.00 dBμV
CORR'D
START 450 kHz
RES BW 10 kHz
VBW 100 kHz
STOP 30.00 MHz
SWP 200 sec

4 – RADIATION HAZARD MEASUREMENT

4.1 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 0.5mWfcm^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.

4.2 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/MHz)	Input Current (amps)	Measured Input Power (watts)	Rated Input Power (watts)
120/60	12.82	1443	1300

☒ Based on the measured input power, the EUT was found to be operating within the intended specifications.

4.3 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 evens 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 1300 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

4.4 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	22.5	38	200

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

Power = 4.2 joules/calorie x 2600 x (38-22.5) / 200

Power = 846.3 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 25ìV/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(846.3/500)

LFS ≈ 32.52

Where: LFS is the maximum allowable field strength for out-of-band emissions in ìV/meter at a 300-meter measurement distance. Power Output is the measured output power in watts.

Manufacturer	Model Number	LFS	dB(ìV/M)	dB(ìV/M)®3m	dB(ìV/M)®1m
Midea	E1037X-Y	32.52	30.24	70.24	80.24

4.5 Operating Frequency Measurement

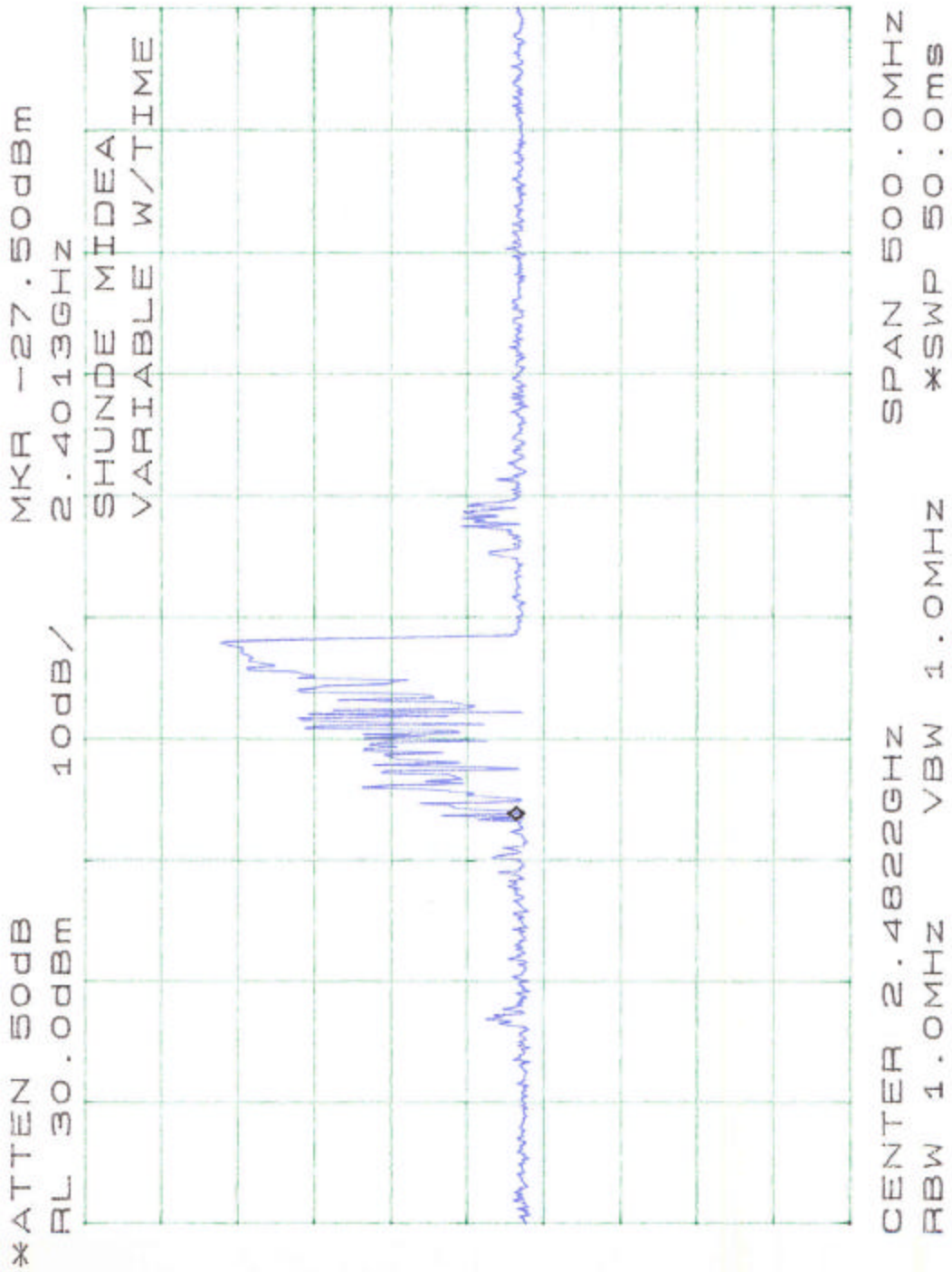
4.5.1 Variation in Operating Frequency with Time

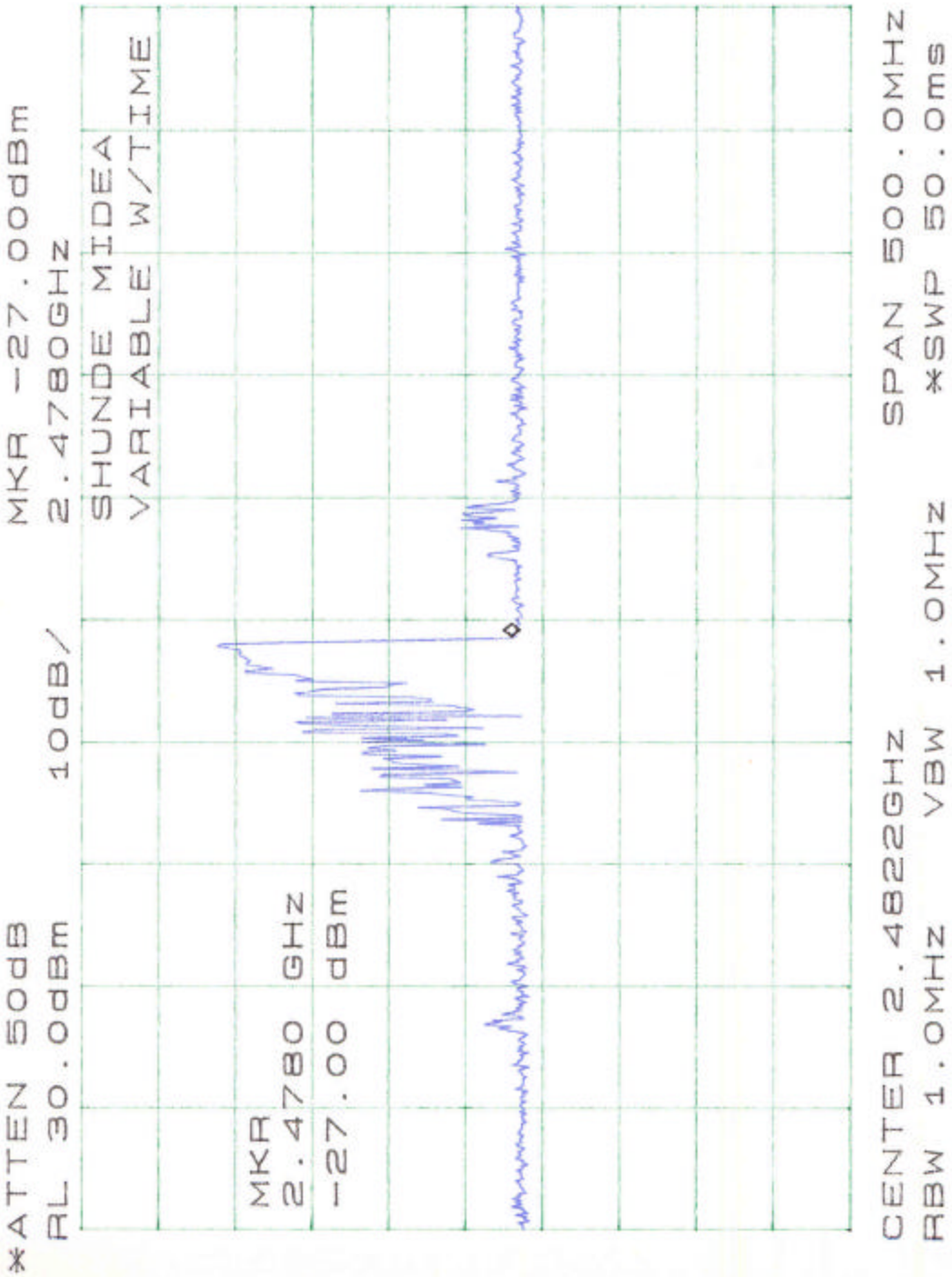
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 2600ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Midea	E1037X-Y	2401 MHz	2478 MHz

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


*ATTEN 50dB
RL 30.0dBm
10dB/
MKR -27.50dBm
2.4013GHz
SHUNDE MIDEA
VARIABLE W/TIME
CENTER 2.4822GHz
RBW 1.0MHz
VBW 1.0MHz
SPAN 500.0MHz
*SWP 50.0ms


*ATTEN 50dB
RL 30.0dBm
10dB/
MKR -27.00dBm
2.4780GHz
SHUNDE MIDEA
VARIABLE W/TIME
MKR
2.4780 GHz
-27.00 dBm
CENTER 2.4822GHz
RBW 1.0MHz
VBW 1.0MHz
SPAN 500.0MHz
*SWP 50.0ms

4.5.2 Variation in Operating Frequency with Line Voltage

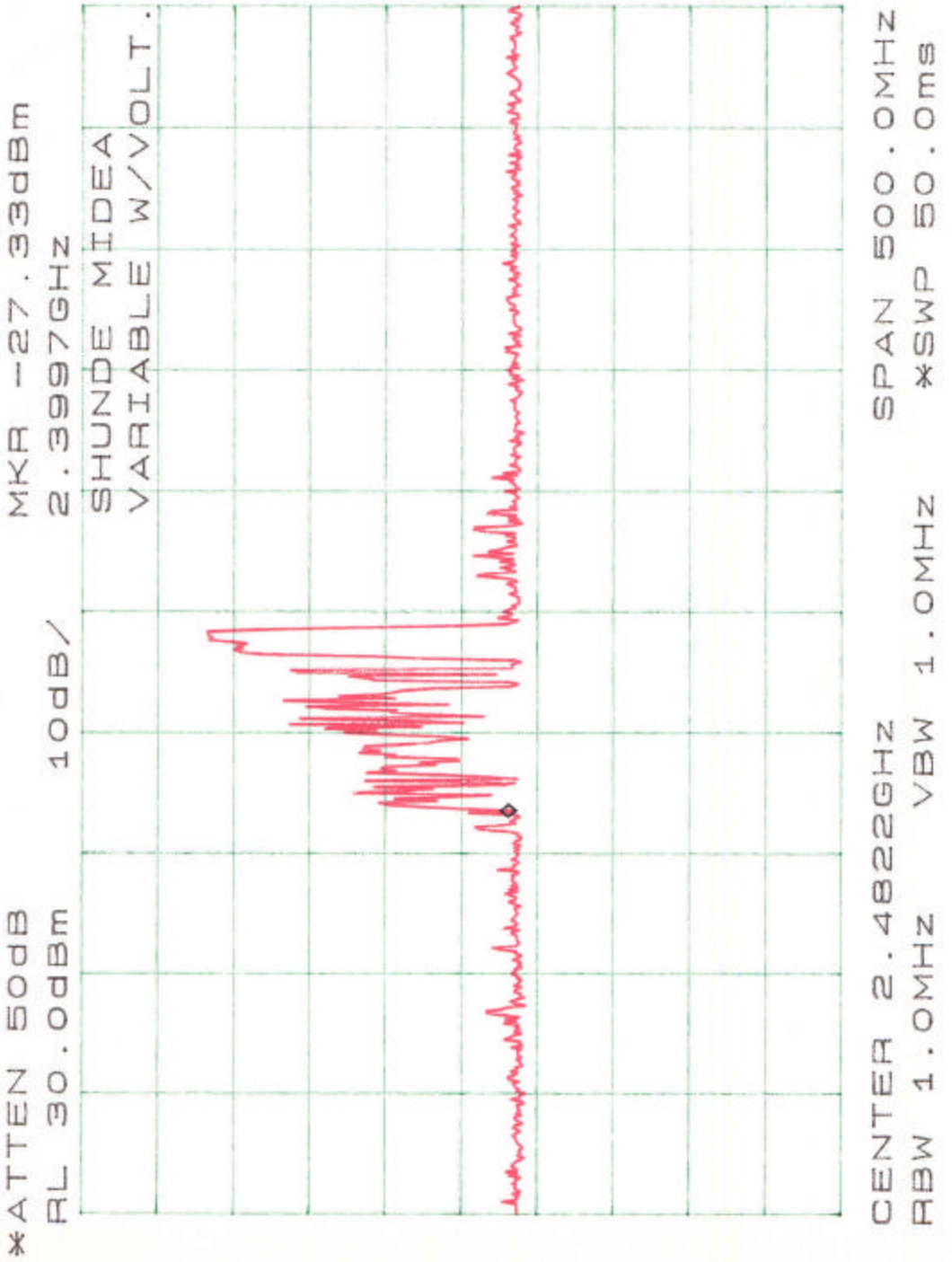
The EUT was operated / warmed by at least 10 minutes of use with a 2600ml water load at room temperature at the beginning of the test. Then the operating frequency was monitored as the input voltage was varied between 80 and 125 percent of the nominal rating.

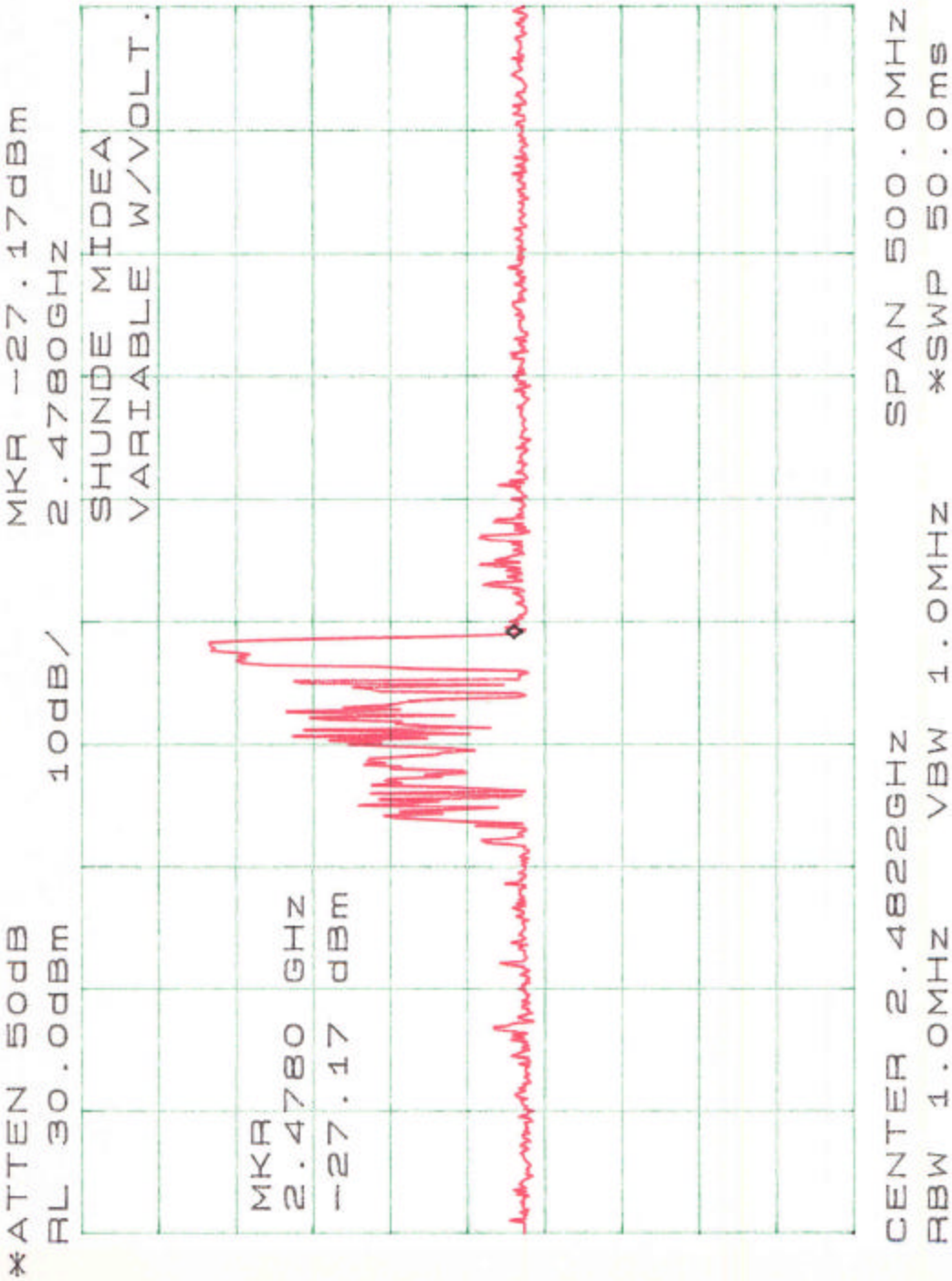
The results of this test are as follows:

Line voltage varied from 96Vac to 150Vac.

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Midea	E1037X-Y	2400 MHz	2478 MHz

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


*ATTEN 50dB
RL 30.0dBm
10dB/
MKR -27.33dBm
2.3997GHz
SHUNDE MIDEA
VARIABLE W/VOLT.
CENTER 2.4822GHz
RBW 1.0MHz
VBW 1.0MHz
SPAN 500.0MHz
*SWP 50.0ms


*ATTEN 50dB
RL 30.0dBm
10dB/
MKR -27.17dBm
2.4780GHz
SHUNDE MIDEA
VARIABLE W/VOLT.
MKR
2.4780 GHz
-27.17 dBm
CENTER 2.4822GHz
RBW 1.0MHz
VBW 1.0MHz
SPAN 500.0MHz
*SWP 50.0ms

5 - RADIATED EMISSION DATA

5.1 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.

5.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4 – 2000. The specification used was the FCC part 18 Subpart C limits.

The EUT was placed on the edge of the turntable. The EUT was connected to 110Vac/60Hz power source.

5.3 Spectrum Analyzer Setup

According to FCC rules, 47 CFR 18.309(a), the EUT was tested to 10th harmonic (24GHz).

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

Start Frequency .....30 MHz
Stop Frequency .....24 GHz
Sweep Speed.....Auto
IF Bandwidth.....1 MHz
Video Bandwidth .....1 MHz
Quasi-Peak Adapter Bandwidth.....120 kHz
Quasi-Peak Adapter Mode.....Normal
Resolution Bandwidth.....1MHz

5.4 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 (native) operating mode during the final qualification test to represent the worst results.

5.5 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

5.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the FCC Part 18 Subpart C, and had the worst margin of:

-2.2 dBmV at **957.46 MHz** in the **Horizontal** polarization, **30MHz to 24.5GHz.**

5.7 Radiated Emissions Test Result Data

5.7.1 Final Test Data, 30MHz –24.5GHz, 3 Meters

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC PART 18	
Frequency MHz	Ampl. dBmV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
2450.1	71.5	Fundamental	0	1	V	28.1	3.4	31.5	71.5		
2457.8	85.5	Fundamental	45	1	H	28.1	3.4	31.5	85.5		
957.46	35.6		180	1	H	23.4	9.8	25.0	43.8	46	-2.2
82	50.1		300	1.2	V	9.6	2.7	25.0	37.4	40	-2.6
86	46.7		45	1	V	9.7	2.9	25.0	34.3	40	-5.7
407.35	43.2		45	1	H	16.2	5.8	25.0	40.2	46	-5.8
518	37.9		0	1.2	V	18.5	6.5	25.0	37.9	46	-8.1
84	43.3		45	1	V	9.6	2.7	25.0	30.6	40	-9.4
516	35.1		300	1	V	18.5	6.5	25.0	35.1	46	-10.9
80	40.4		0	1	V	9.6	2.7	25.0	27.7	40	-12.3
269.16	42.0		0	1	H	12.0	4.6	25.0	33.6	46	-12.4
234.23	41.4		45	1	H	11.8	4.4	25.0	32.6	46	-13.4
520	32.2		300	1	V	18.5	6.6	25.0	32.3	46	-13.7
58	37.2		45	1	H	10.0	2.6	25.0	24.8	40	-15.2
87	34.8		0	1	H	9.7	2.9	25.0	22.4	40	-17.6
85	31.8		45	1.2	H	9.7	2.9	25.0	19.4	40	-20.6

6 – FCC PRODUCT LABELING AND WARNING STATEMENT

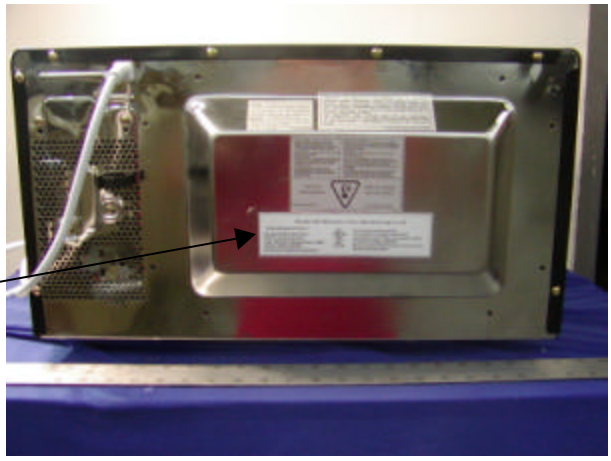
6.1 Proposed FCC Label Format

FCC ID: PU7E1037X-Y

Specifications: Text is white in color and is left justified. Labels are silk-screened and shall be "permanently affixed" at a conspicuous location on the EUT.

6.2 Proposed Label Location on EUT

Rear View of EUT



Proposed FCC ID Location

6.3 FCC Warning Statement

This device complies with Part 18 of FCC rules.

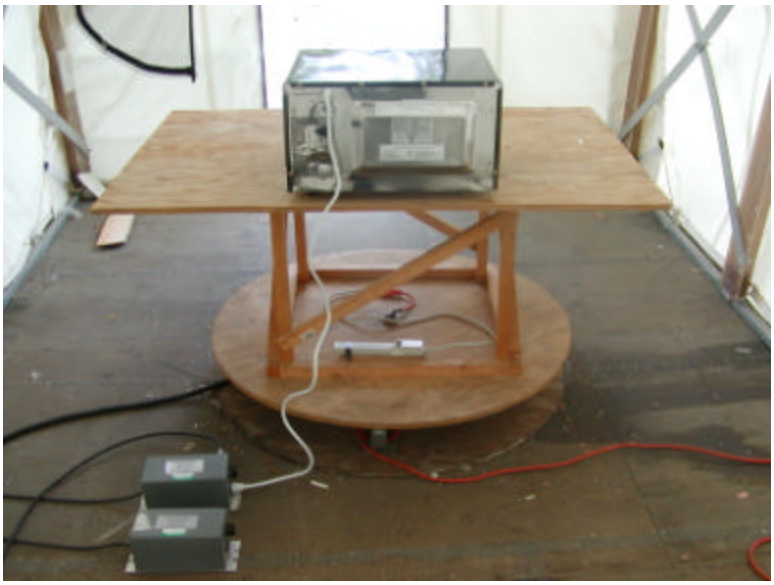
Information on the following matters shall be provided to the user in the instruction manual or on the packaging if an instruction manual is not provided for any type of any ISM equipment:

a. The interference potential of the device or system
b. Maintenance of the system
c. Simple measures that can be taken by the user to correct interference.

7 - Setup Photographs

7.1 Conducted Setup Photograph – Front View

7.2 Conducted Setup Photograph – Side View

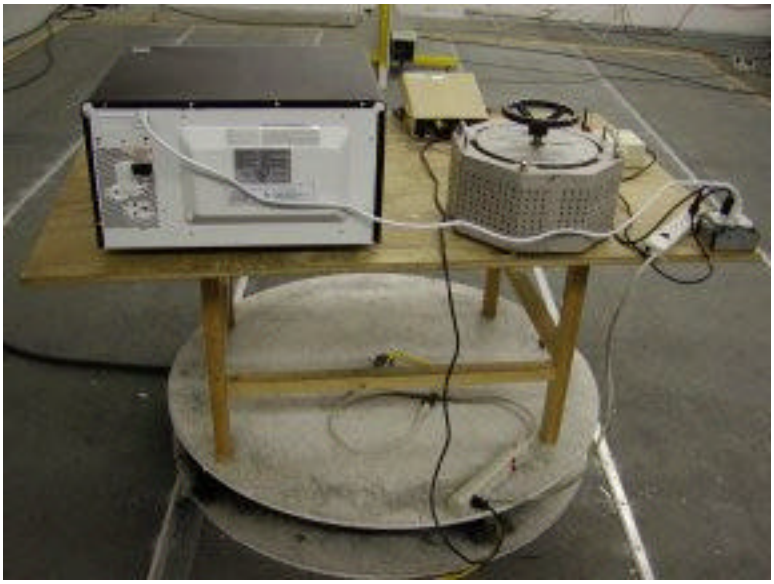


7.3 Radiated Setup Photograph – Front View

7.4 Radiated Setup Photograph – Rear View

7.5 Variation with Voltage Setup – Front View

7.6 Variation with Voltage Setup – Rear View



7.7 Variation with Time Setup – Front View

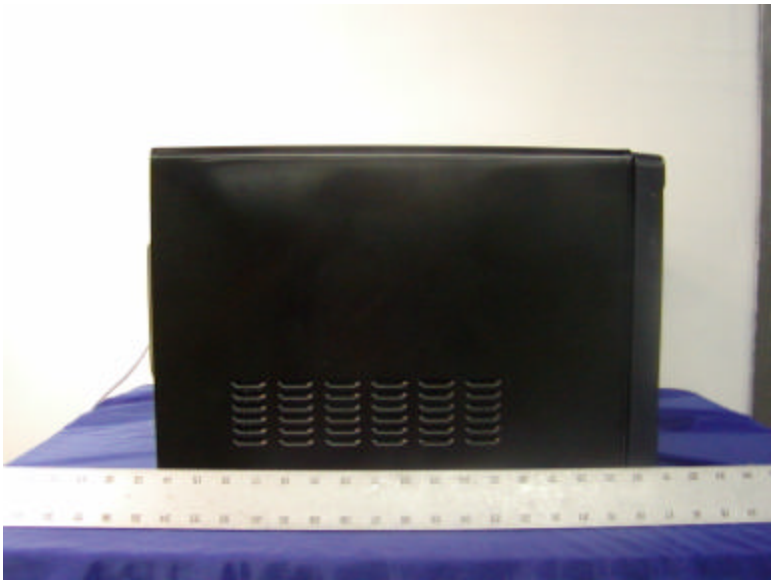
7.8 Variation with Time Setup – Rear View

8 – EUT PHOTOGRAPHS

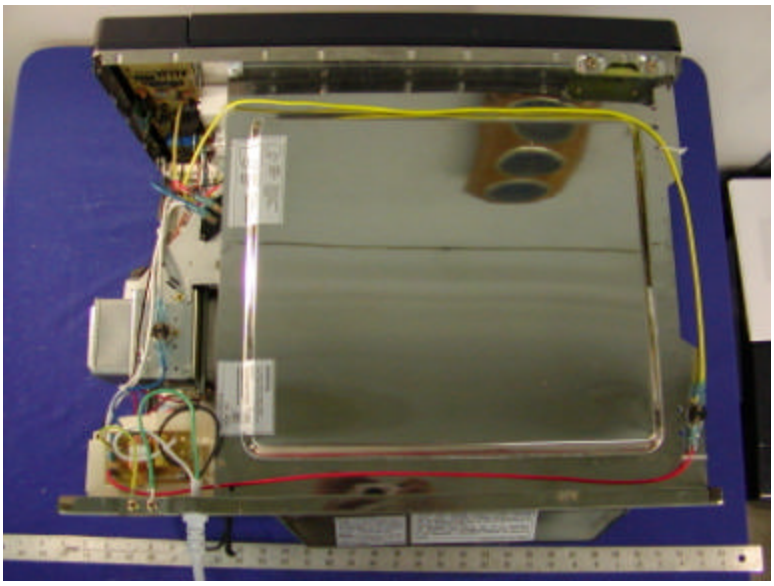
8.1 EUT – Chassis Front View

8.2 EUT – Chassis Rear View

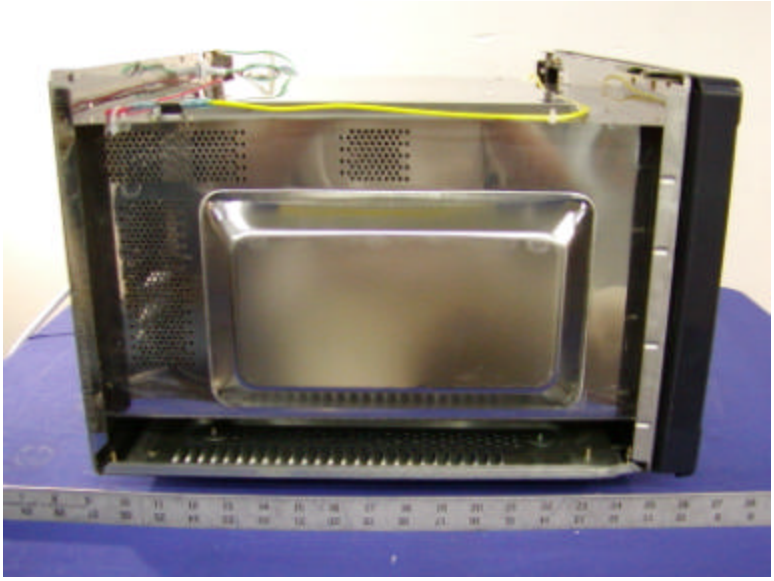
8.3 EUT – Chassis Side View



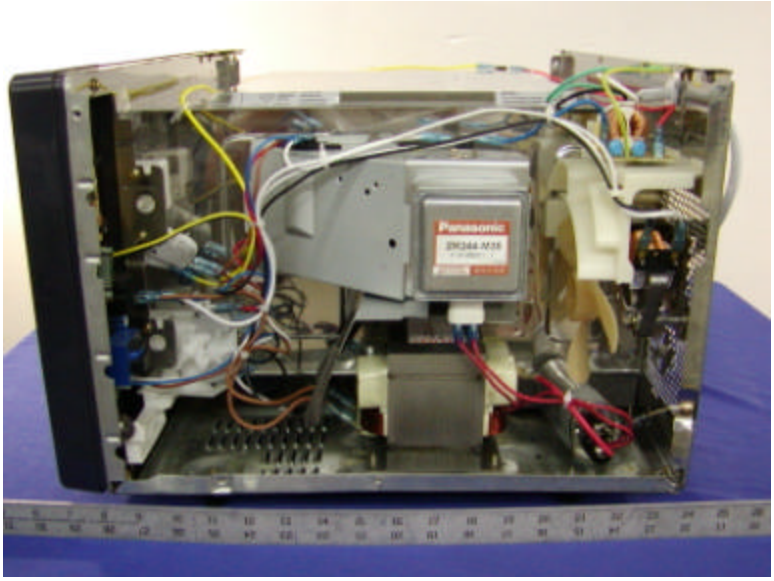
8.4 EUT – Top View



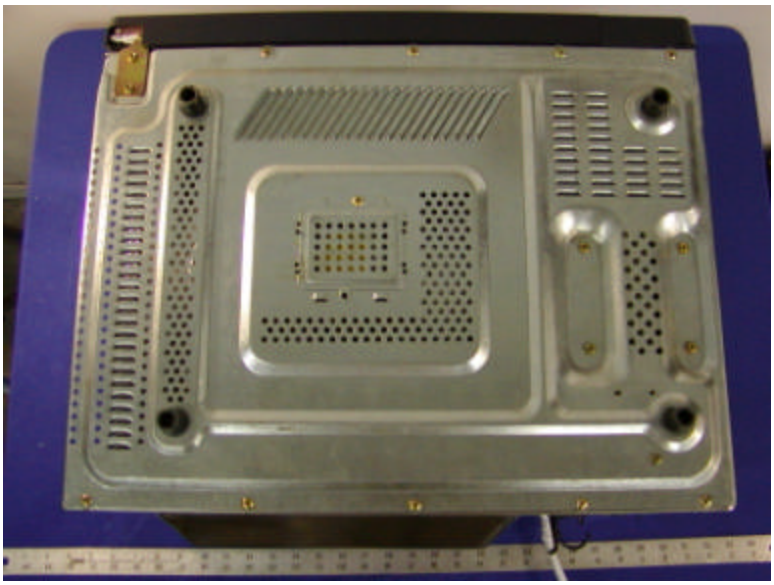
8.5 EUT – Left View



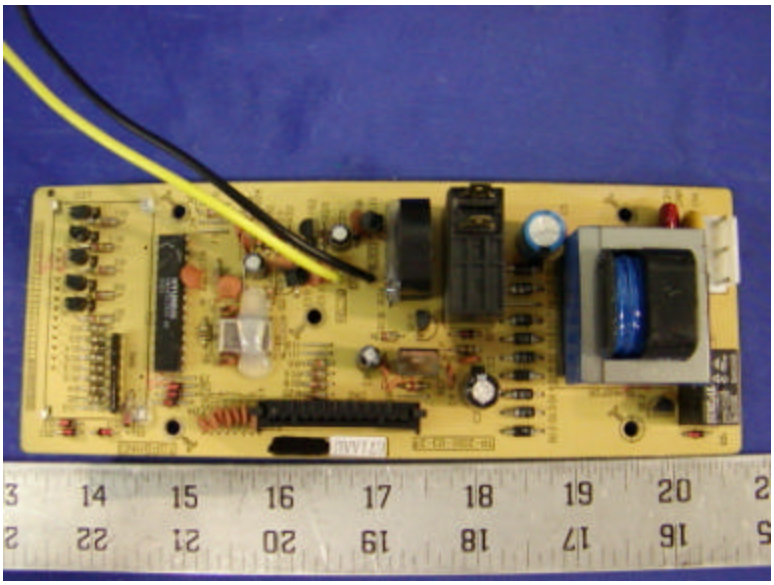
8.6 EUT – Right View



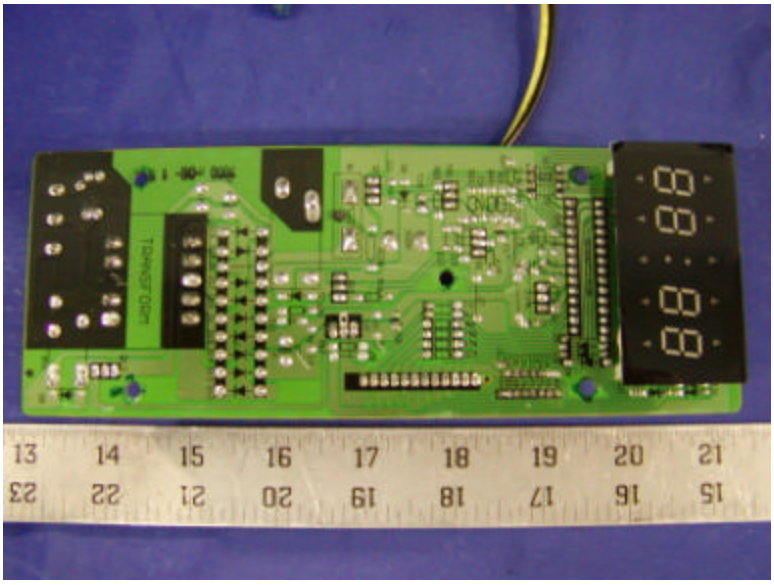
8.7 EUT – Bottom View



8.8 EUT – Display Panel Component View



8.9 EUT – Display Panel Solder View



Appendix A – Block Diagram / Schematics / Parts List

Appendix B – User Manual