

FCC 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: PU7M7017X-Y

August 31, 2001

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Microwave Oven – Consumer ISM Equipment
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Test Date: August 20, 2001	
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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 product, model: *M7017X-Y* or the "EUT" as referred to in this report is a microwave oven which measures 12.75" L x 17.75" W x 11.50" H. The EUT is provided with an electronic control. The electronic control provides the user with a selection of time duration and power level. The maximum time duration setting is 99.99(minutes: seconds). Maximum power level setting is 10(100%). The input electrical rating is 120Vac/ 60Hz, 9.62A.

The circuit board enclosed is a two-layered crystal.

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 Related Submittal(s)/Grant(s)

No Related Submittal(s).

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, 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.

1.5 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, Suite 2, 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 C63.4-1992 and CISPR 22.

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.

1.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Data	Cal. Due Data
HP	Spectrum Analyzer	8568B	2610A02165	12/6/00	12/6/01
HP	Spectrum Analyzer	8593B	2919A00242	12/20/00	12/20/01
HP	Amplifier	8349B	2644A02662	12/20/00	12/20/01
HP	Quasi-Peak Adapter	85650A	917059	12/6/00	12/6/01
HP	Amplifier	8447E	1937A01046	12/6/00	12/6/01
A.H. System	Horn Antenna	SAS0200/571	261	12/27/00	12/27/01
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/00	11/2/01
Com-Power	Biconical Antenna	AB-100	14012	11/2/00	11/2/01
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/00	12/28/01
Com-Power	LISN	LI-200	12208	12/20/00	12/20/01
Com-Power	LISN	LI-200	12005	12/20/00	12/20/01
BACL	Data Entry Software	DES1	0001	12/20/00	12/20/01

1.7 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Shunde MD Microwave Oven Manufactory Co., Ltd.	Microwave Oven	M7017X-Y	None	PU7M7017X-Y

1.8 Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
TDGC	Variable Voltage Controller	2KVA	026	None
Valhalla Scientific	Digital Power Analyzer	2101	20314	DOC
BACL CORP.	Power Switching Box	#1	04	None

1.9 EUT Configuration Details

Manufacturer	Description	Model	Serial Number	FCC ID
Panasonic	Micro Wave Main Unit	2M210-M1	F13-03011-1	None
Digital Power Communications Co.,Ltd	X-FORM	YMD-708ATD	B0210BA	None
Heng Cheng	Power and Time Controller	VF30M104IIT-5J	2011	None

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

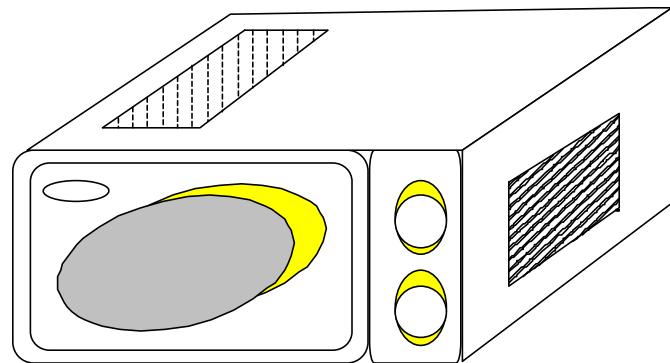
Appendix A contains a copy of the EUT's block diagram as reference.

2.3 Equipment Modifications

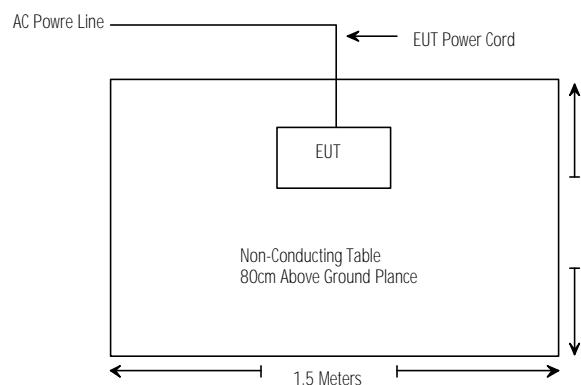
No modification to the EUT was made by BACL Corporation to make sure the EUT comply with applicable limits and requirements.

2.4 Configuration of Test System

EUT: M7017X-Y



2.5 Test Setup Block Diagram



3 – RADIATION HAZARD MEASUREMENT

3.1 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 0.5mW/cm^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.

3.2 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	9.62	1042	1100

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

3.3 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 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 1100watts

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

3.4 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 (°C)	Final Temperature (°C)	Elapsed Time (Seconds)
2600	30.0	43.0	200

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

Power=709.8watts

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

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:

$$LFS = 25 * \text{SQRT}(\text{Power Output}/500)$$

Where: LFS is the maximum allowable field strength for out-of-band emissions in $\mu\text{V}/\text{meter}$ at a 300 meter measurement distance. Power Output is the measured output power in watts.

Manufacturer	Model Number	LFS	dB($\mu\text{V}/\text{M}$)	dB($\mu\text{V}/\text{M}$)@3m	dB($\mu\text{V}/\text{M}$)@1m
Shunde MD Microwave Oven Manufactory Co., Ltd.	M7017X-Y	29.79	29.48	69.48	79.02

3.5 Operating Frequency Measurement

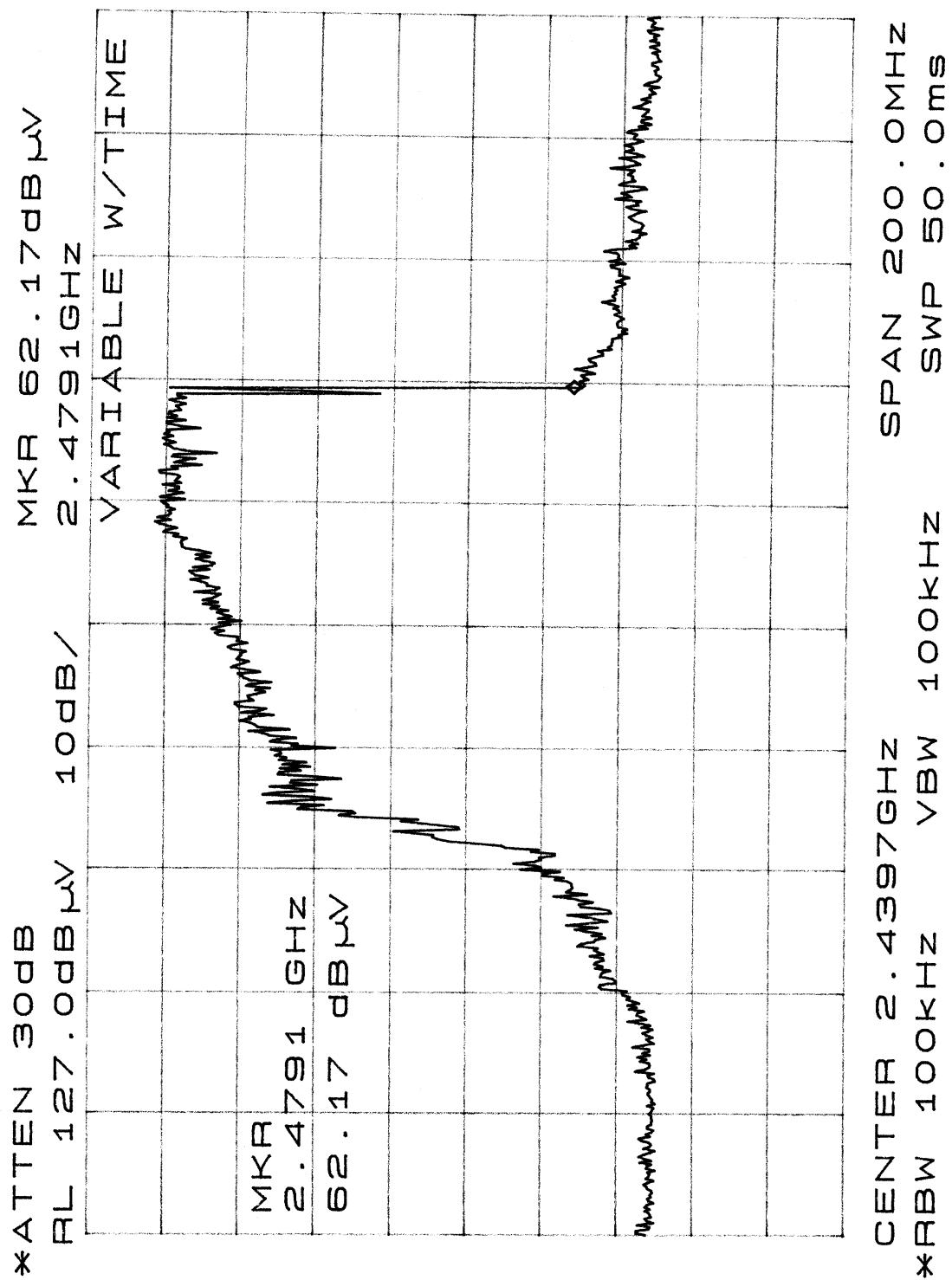
3.5.1 Variation in Operating Frequency with Time

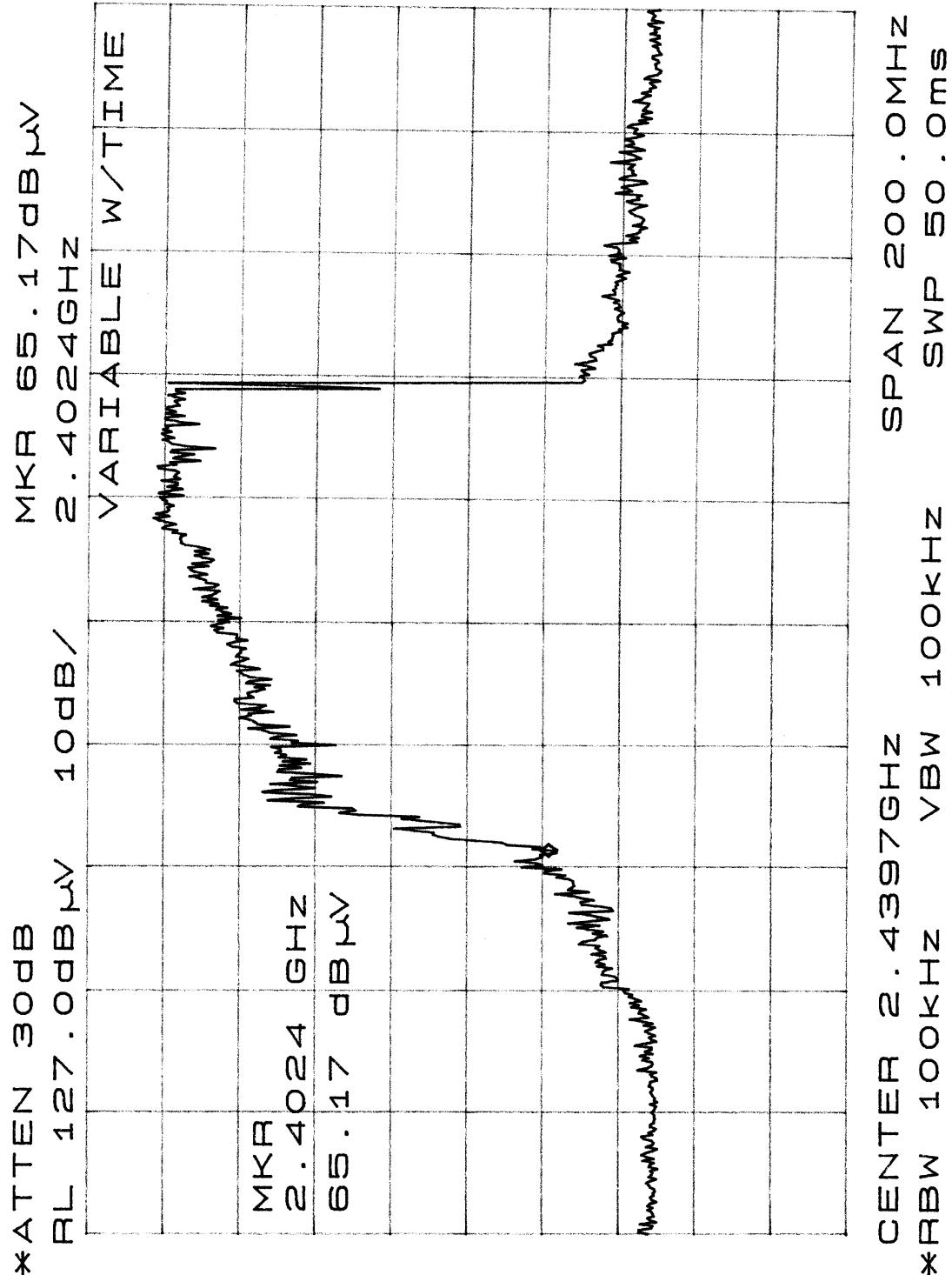
The operating frequency was measured using a spectrum analyzer. Starting with the EUT at room temperature, a 2600ml water load was placed in the center of the oven and the oven was operated at maximum output power. The fundamental operating frequency was monitored until the water load was reduced to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

The results of this test are as follows:

Manufacturer	Model	Minimum Frequency	Maximum Frequency
Shunde MD Microwave Over Manufactory Co., Ltd	M7017X-Y	2400 MHz	2450 MHz

Refer to data pages of 10 to 11 for details of the variation in operating frequency with time measurement.





3.5.2 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:

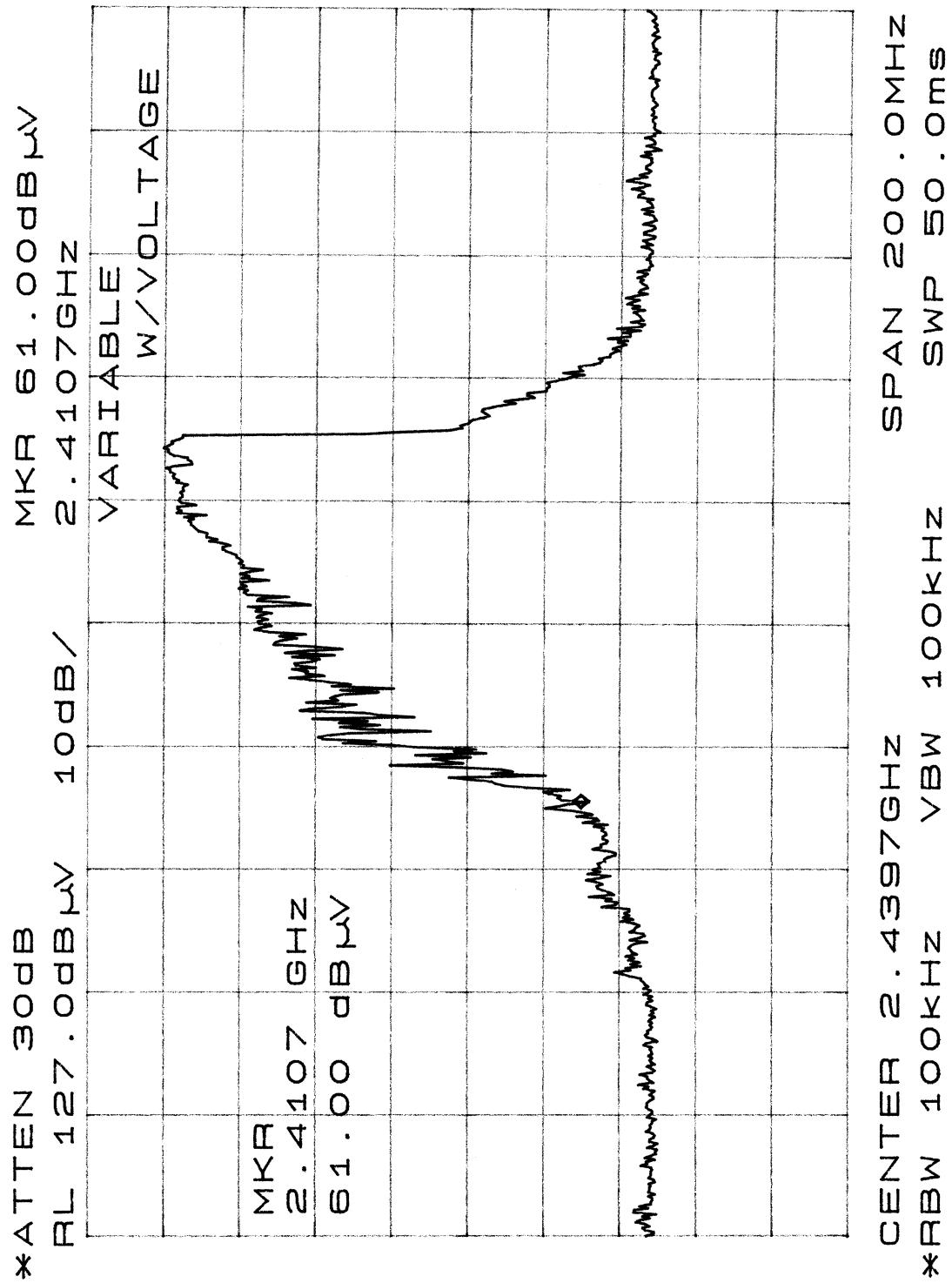
Line voltage varied from 96Vac to 150Vac.

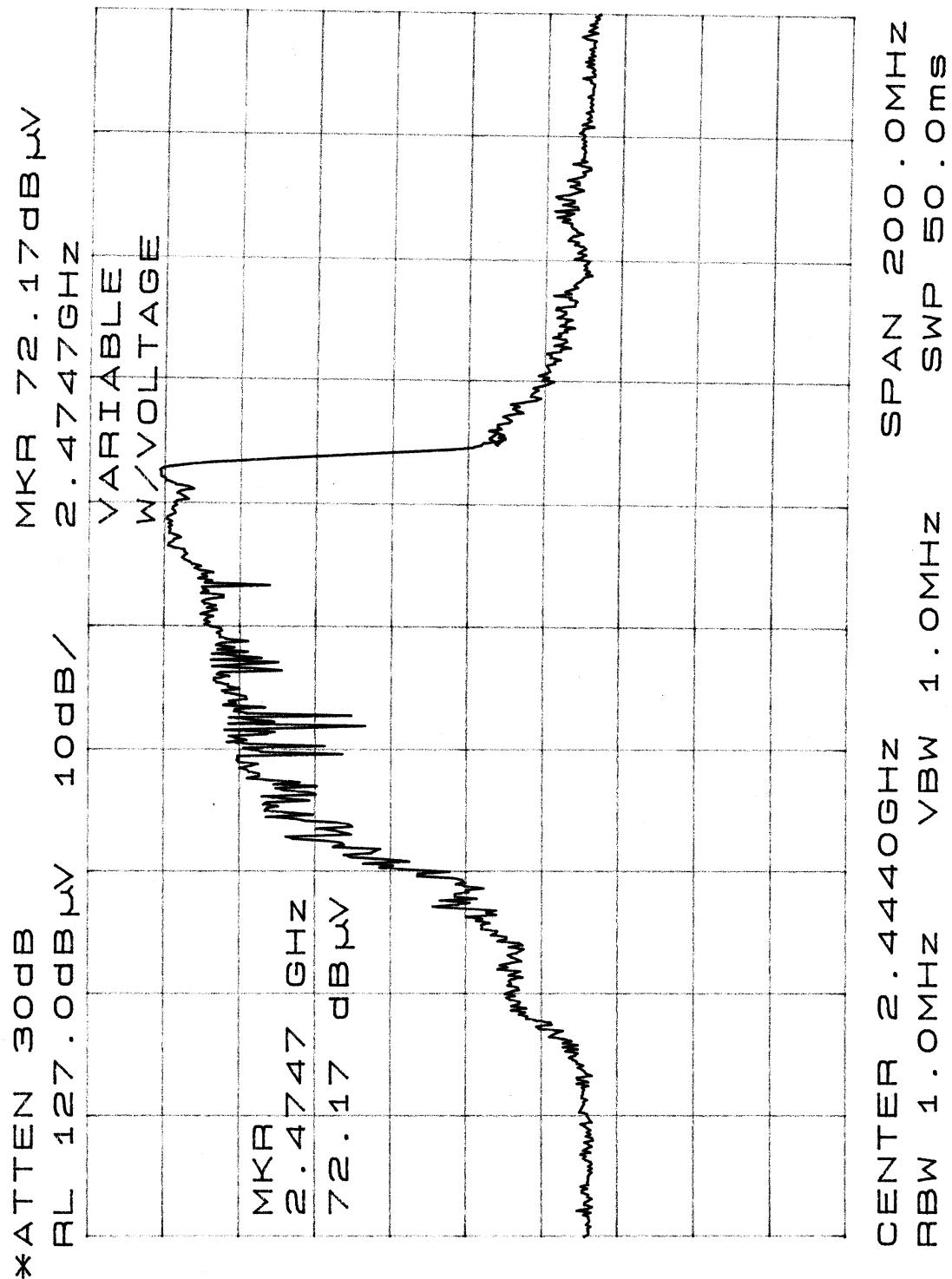
Manufacturer	Model	Minimum Frequency	Maximum Frequency
Shunde MD Microwave Over Manufactory Co., Ltd	M7017X-Y	2400 MHz	2450 MHz

Minimum frequency allowed: 2400MHz

Maximum frequency allowed: 2480MHz

Refer to data pages 13 to 14 for details of the variation in operating frequency with line voltage measurement.





4 - RADIATED EMISSION DATA

4.1 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.

4.2 EUT Setup

The radiated emission tests were performed in the open area 3 meters test site, using the setup accordance with the ANSI C63.4 – 1992. The specification used was the FCC part 18 limits.

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

4.3 Spectrum Analyzer Setup

According to FCC rules, 47 CFR 18.309(a), the EUT was tested to 10 harmonic (24.5GHz).

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

Start Frequency.....	.30 MHz
Stop Frequency.....	.24.5 GHz
Sweep Speed.....	.Auto
IF Bandwidth.....	.1 MHz
Video Bandwidth.....	.1 MHz
Quasi-Peak Adapter Bandwidth.....	.120 kHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth.....	.1MHz

4.4 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 dB μ V of specification limits), 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.

4.5 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

4.6 Summary of Test Results

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

3.4 dBmV at 4919.00 MHz in the Horizontal polarization, at 30MHz-24.5 GHz, 3 Meters

4.7 Radiated Emissions Test Result Data

4.7.1 Final Test Data for Normal (Native) Operating Mode, 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
4919.00	61.2		180	1.2	H	32.5	4.9	32.5	66.1	69.5	-3.4
4919.00	60.9		180	1.2	V	32.5	4.9	32.5	65.8	69.5	-3.7
7411.00	56.0		360	1.2	V	35.1	5.6	32.0	64.7	69.5	-4.8
7411.00	55.5		360	1.4	H	35.1	5.6	32.0	64.2	69.5	-5.3
9833.00	53.0		360	1.4	H	35.1	5.6	31.5	62.2	69.5	-7.3
9833.00	50.0		360	1.2	V	35.1	5.6	31.5	59.2	69.5	-10.3
12279.00	48.0		180	1.4	H	35.1	5.6	31.7	57.0	69.5	-12.5
12279.00	44.0		180	1.2	V	35.1	5.6	31.7	53.0	69.5	-16.5
2457.80	118.5	Fundamental	180	1.4	H	28.1	3.4	31.5	118.5		
2469.80	117.7	Fundamental	145	1.0	V	28.1	3.4	31.5	117.7		