FCC ID PER PART 18
EMI MEASUREMENT AND TEST REPORT

For

QINGDAO HAIER MICROWAVE PRODUCTION CO., LTD.

Qingdao Industry Park, Qingdao Development District,
Qingdao, Shandong 266510, China

FCC ID: PKAFGTHR750

July 12, 2002

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

Test Engineer:	Eastern Chan
Report Number:	B0207019
Test Date:	June 12, 2002
Reviewed By:	Wayne Chia
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *QINGDAO HAIER MICROWAVE PRODUCTION CO., LTD.*'s model, *MS171EWAAN* or the "EUT" as referred to in this report is a microwave oven. The EUT provides an electric control and a mechanical control.

For marketing purpose, the manufacturer applies thirteen model names: *MS171EWAAN, MS171TWAAN, HM06T750W, HM06T750B, HM06T750S, HM06R750W, HM06R750B, HM06R750S, HM09T1000B, HM09T1000S, MHMK-6WTP, MHMK-6 and MHMK-6W* to the same EUT. The above applicant affirms that no changes have been made that warrant retest or resubmission. .

1.2 Objective

The following test report is prepared on behalf of *QINGDAO HAIER MICROWAVE PRODUCTION 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 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.

1.5 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 Local Support Equipment List and Details

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

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.

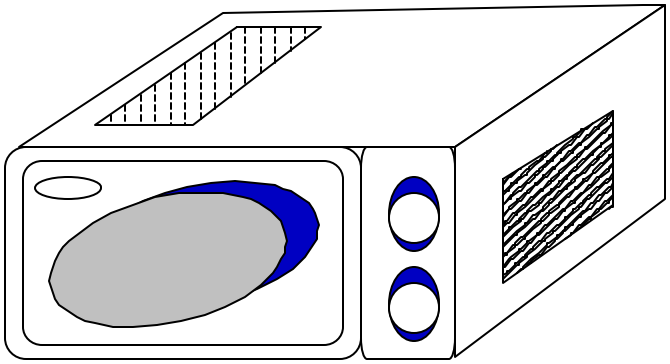
2.2 Schematics / Block Diagram

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

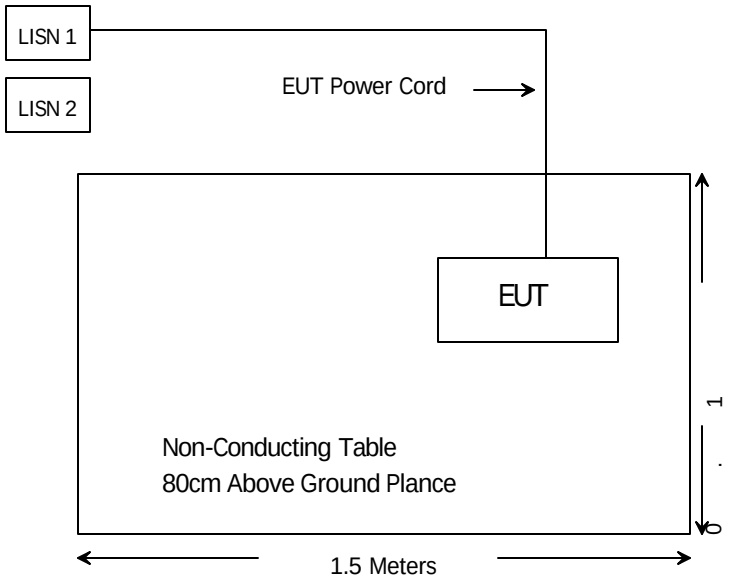
2.3 Equipment Modifications

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 – 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 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 0.04mW/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 1000ml water load was placed in the center of the oven and the oven was operated at maximum output power. A 1000ml water load was chosen for its compatibility with the procedure commonly used by manufacturers to determine their input ratings.

Sample S/N	Input Voltage (Vac/MHz)	Input Current (amps)	Measured Input Power (watts)	Rated Input Power (watts)
0418016-02	120/60	10.72	1168	1250

☒ 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 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

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.

Sample S/N	Quality of Water (ml)	Starting Temperature (ºC)	Final Temperature (ºC)	Elapsed Time (Seconds)	RF Power
0418016-02	1000	10.1	28.1	120	630.0
0418016-05	1000	10.0	28.0	120	630.0
0418016-06	1000	10.1	28.7	120	651.0

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

RF Average Power = (630.0+630.0+651.0)/3 = 637.0watts

☐ 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:

Radiation Limit = 25*SQRT(Power Output/500)@300m(uv/m)

= 25 * SQRT(637.0/500)@300m(uv/m)

= 28.2uv/m@300m(uv/m)

=29.01dBuv/m)@300m(uv/m)

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:

Minimum Frequency Observed	Minimum Frequency Allowed	Maximum Frequency Observed	Maximum Frequency Allowed
2430 MHz	2400 MHz	2468 MHz	2500 MHz

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:

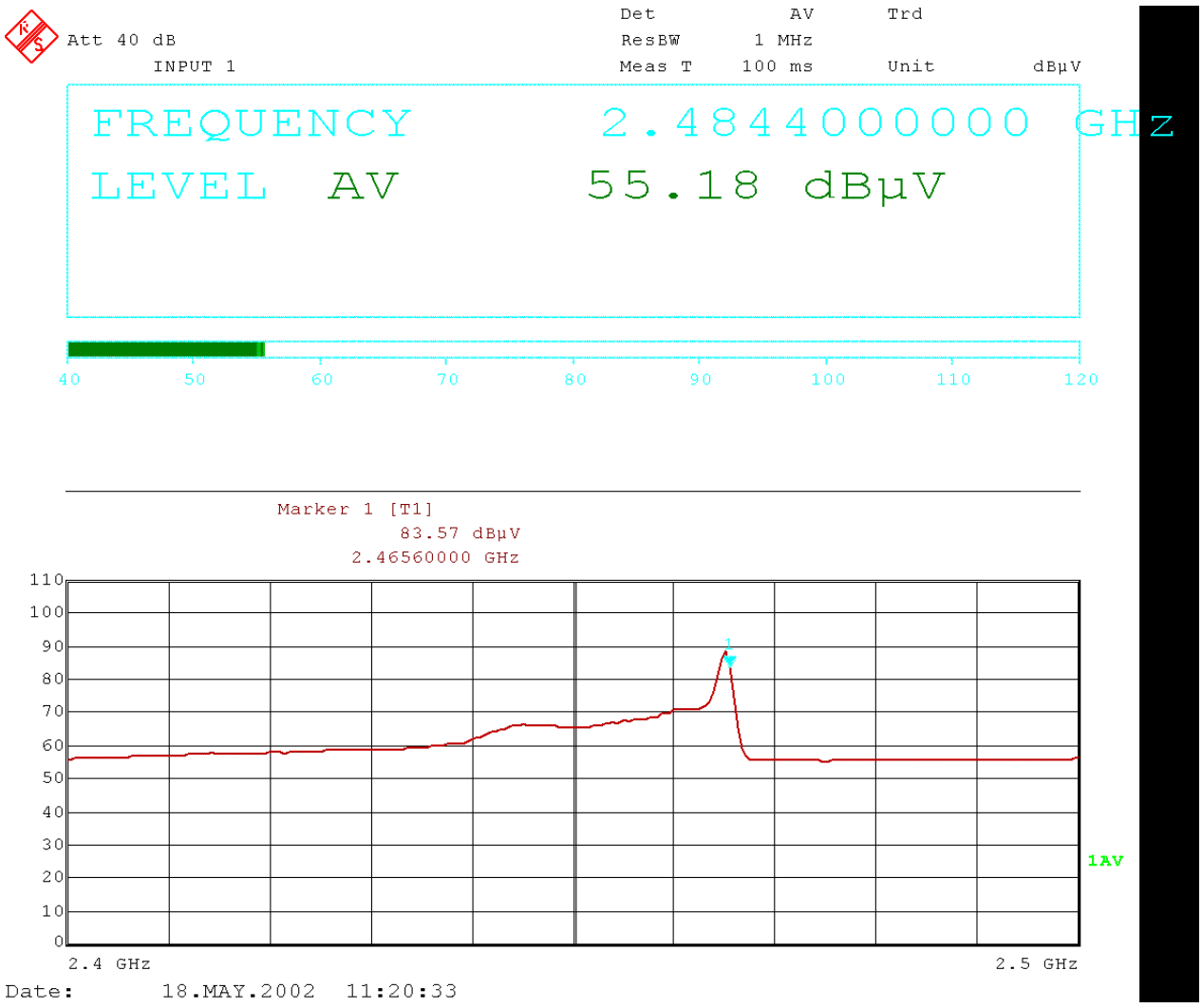
Line voltage varied from 96Vac to 150Vac.

Voltage	Minimum Frequency Observed	Maximum Frequency Observed
96V	2431 MHz	2466 MHz
120V	2430 MHz	2468 MHz
150V	2432 MHz	2467 MHz

Minimum frequency allowed: 2400MHz

Maximum frequency allowed: 2500MHz

Please refer to following pages for details of the variation in operating frequency with line voltage measurement.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Meas T 100 ms
Trd
Unit dBµV
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40 50 60 70 80 90 100 110 120
Marker 1 [T1]
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2.5 GHz
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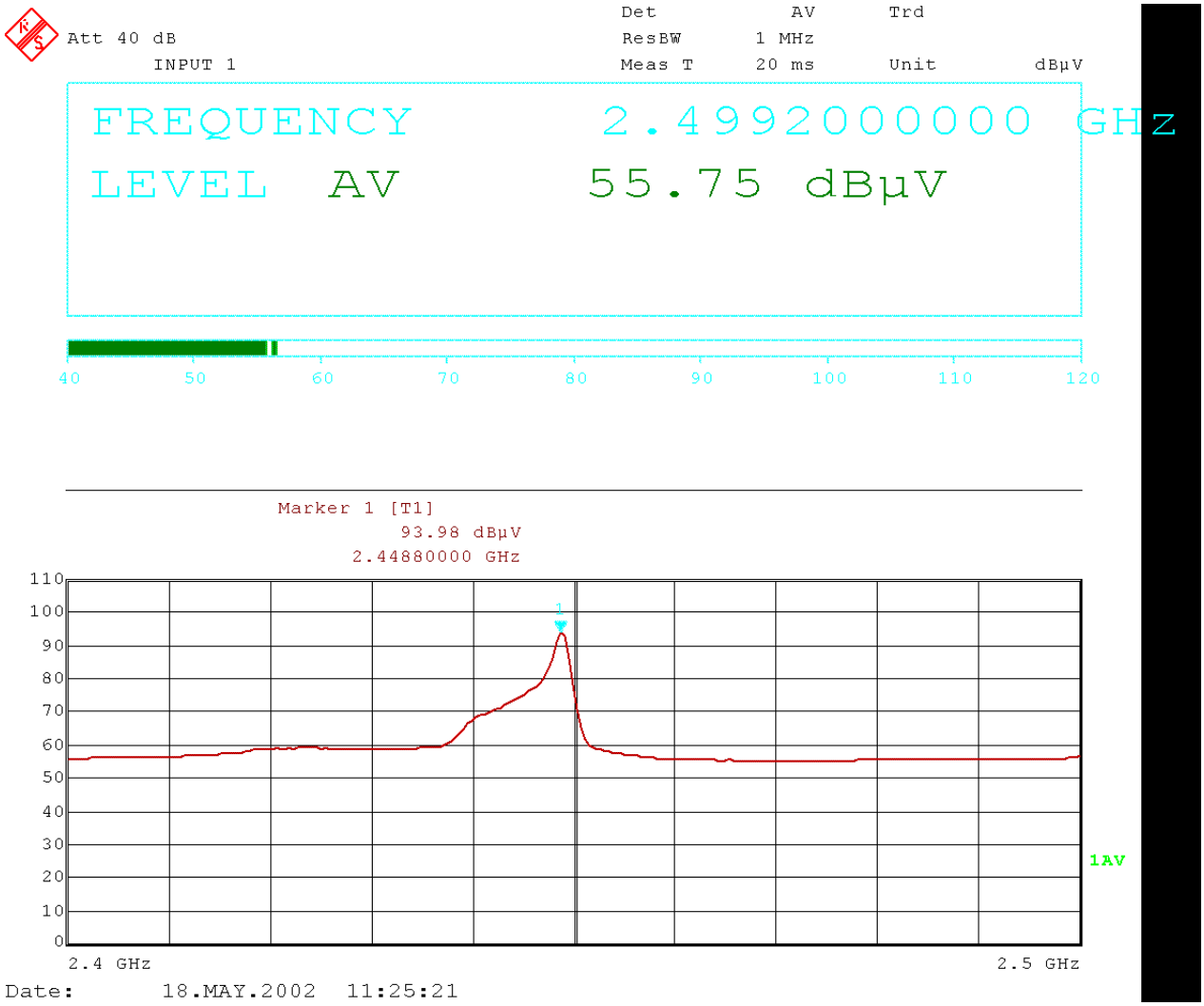
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Unit dBµV
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1AV
2.4 GHz
2.5 GHz
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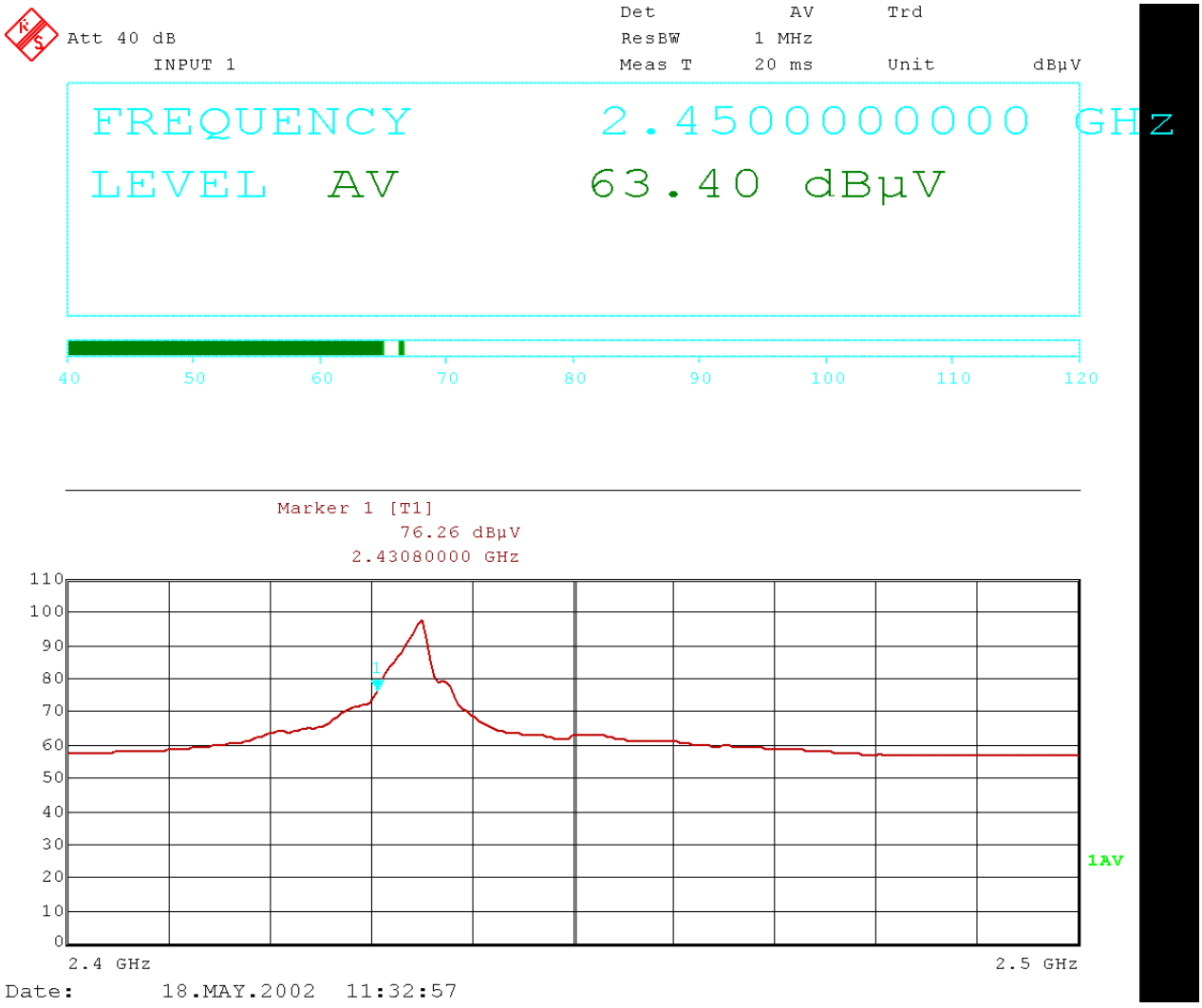
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Det AV
ResBW 1 MHz
Meas T 20 ms
Trd
Unit dBµV
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40 50 60 70 80 90 100 110 120
Marker 1 [T1]
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2.5 GHz
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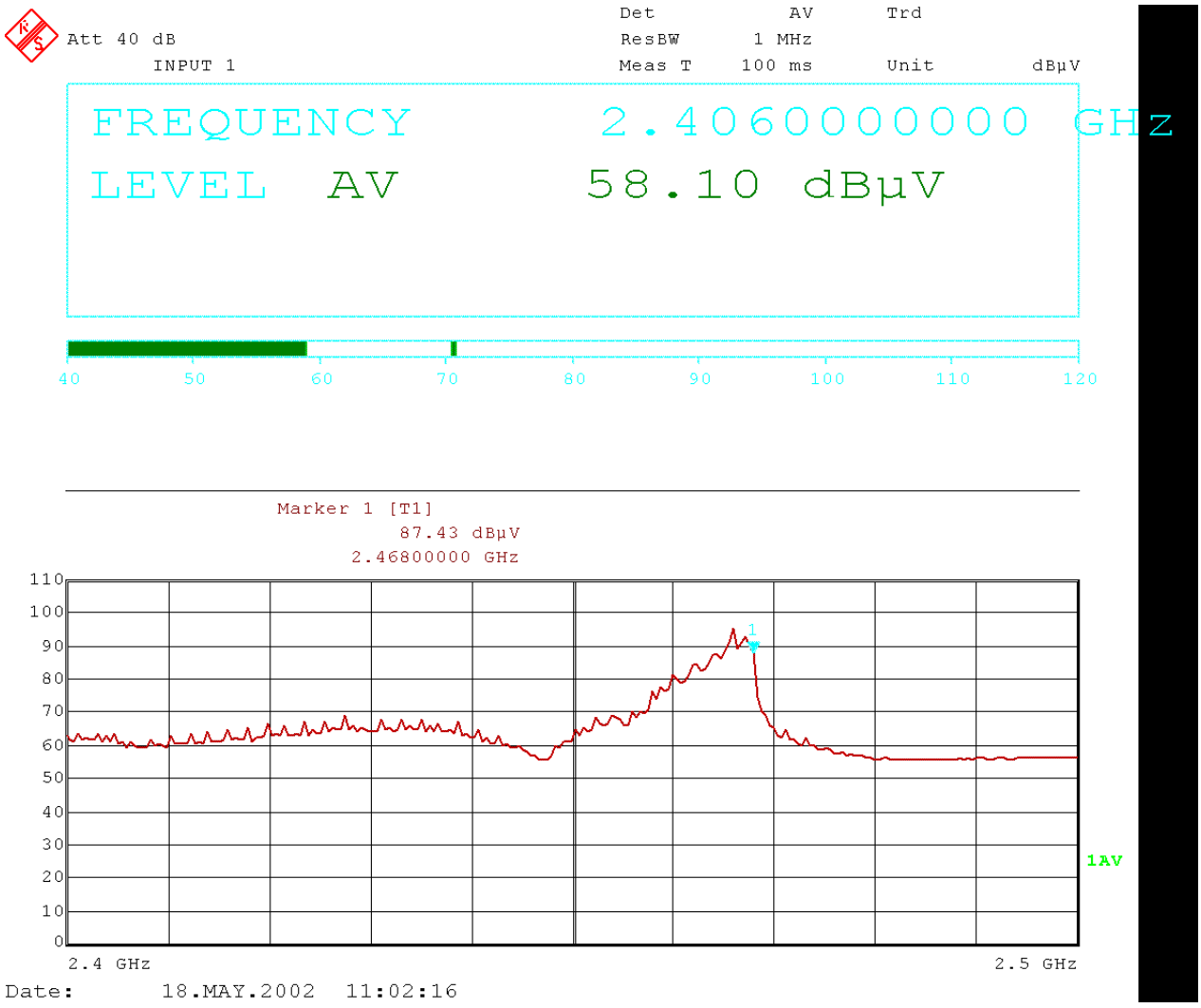
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Unit dBµV
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40 50 60 70 80 90 100 110 120
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1AV
2.4 GHz
2.5 GHz
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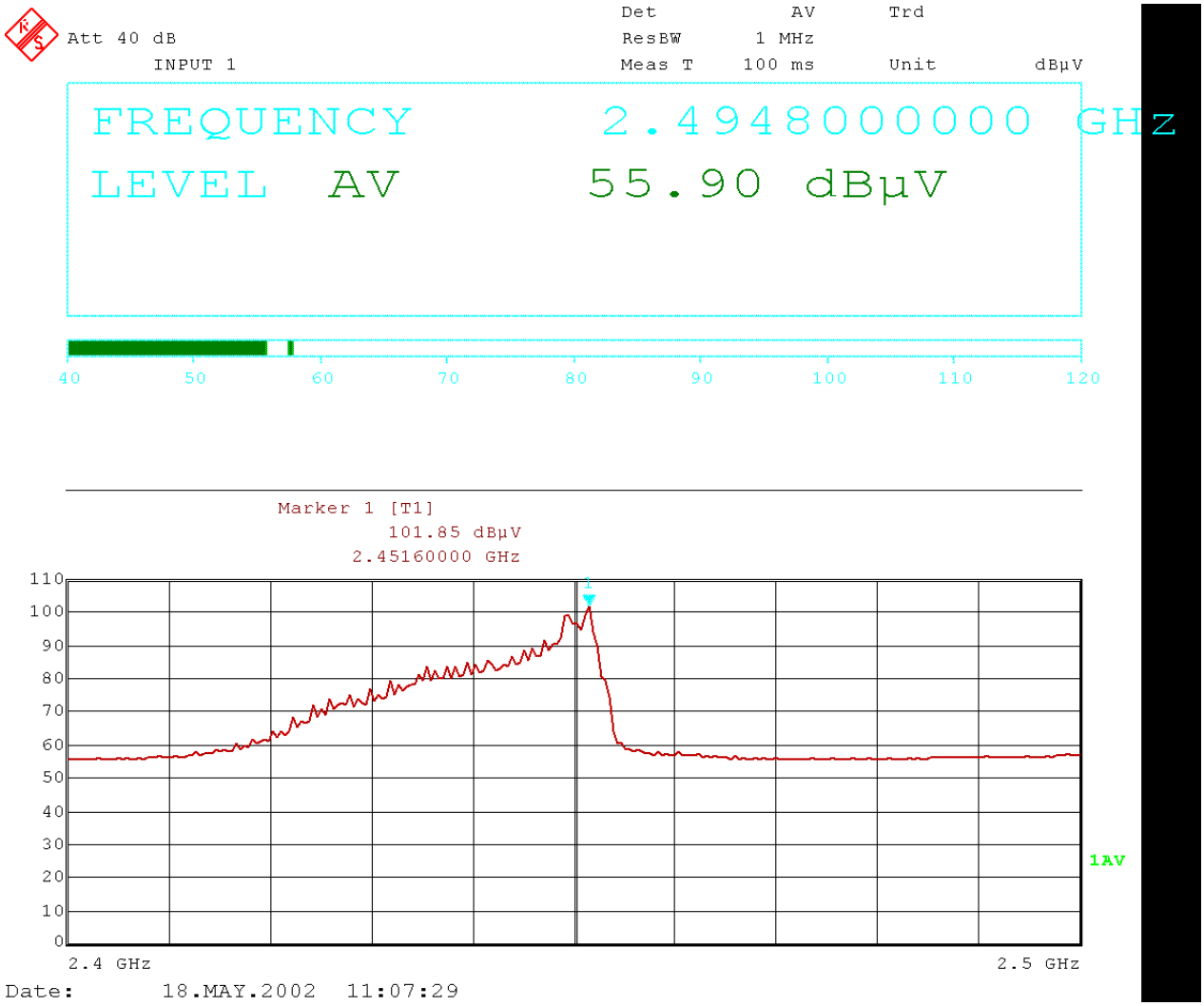
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Unit dBµV
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40 50 60 70 80 90 100 110 120
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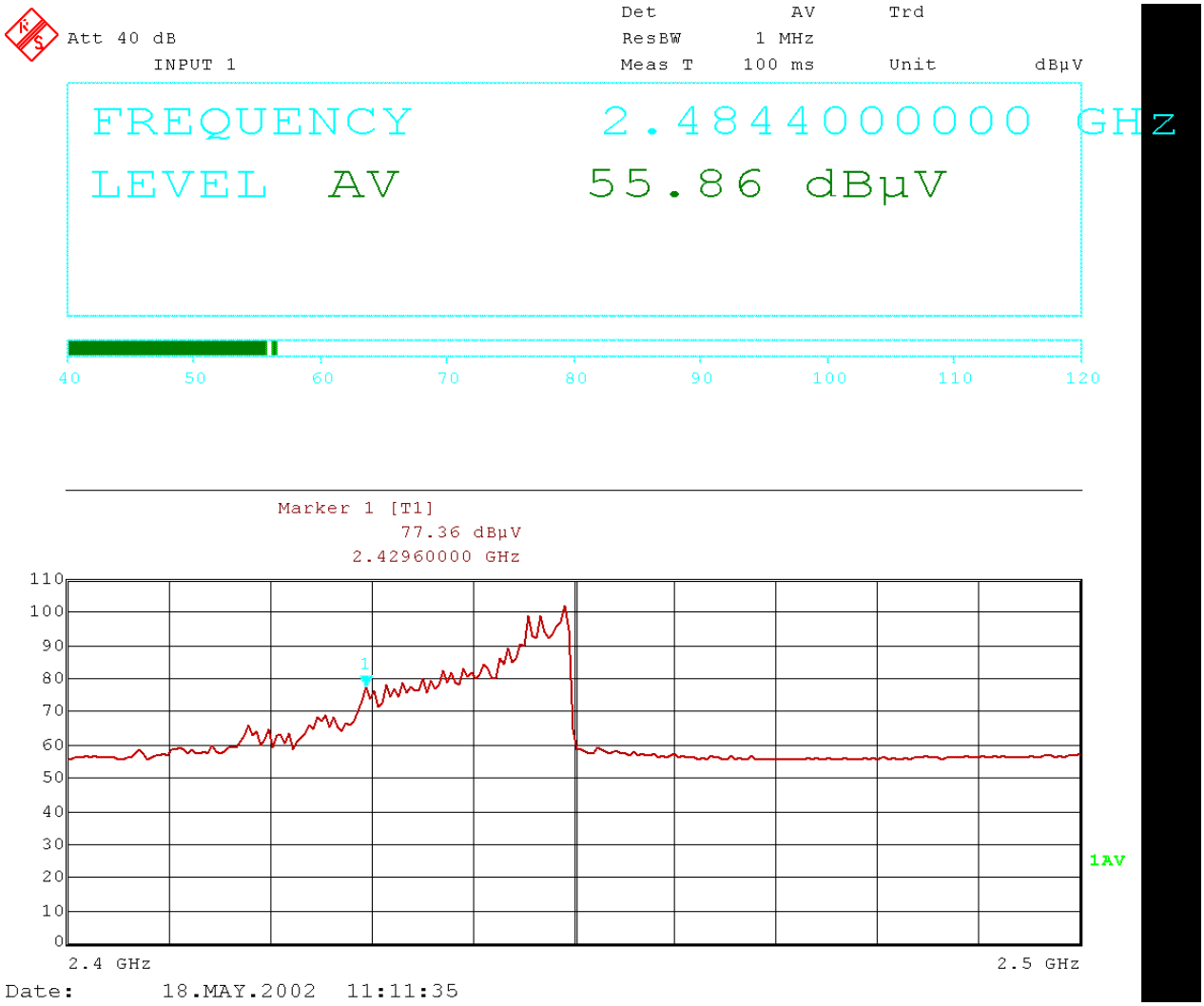
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ResBW 1 MHz
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Unit dBµV
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77.36 dBµV
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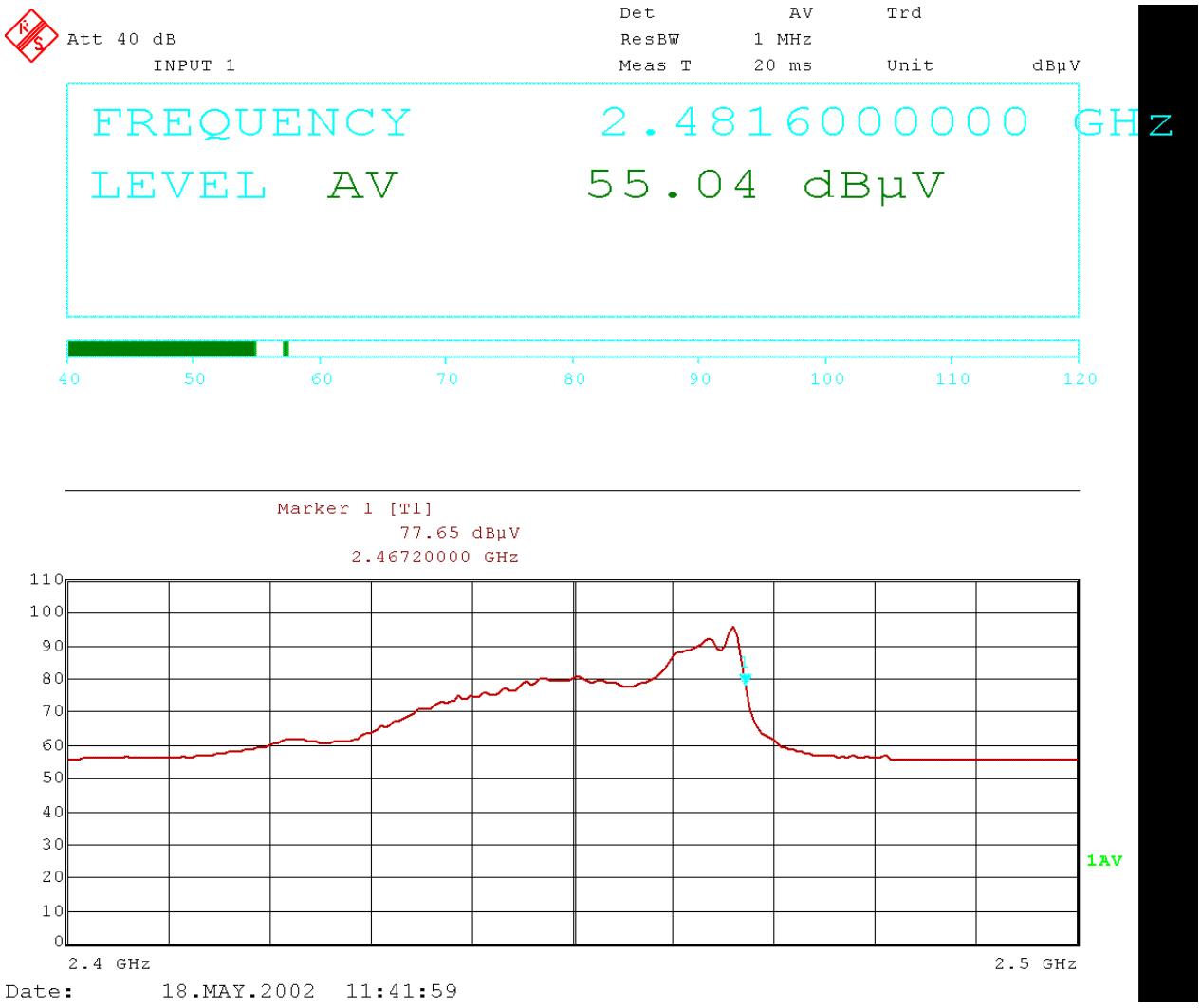
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Trd
Unit dBµV
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2.5 GHz
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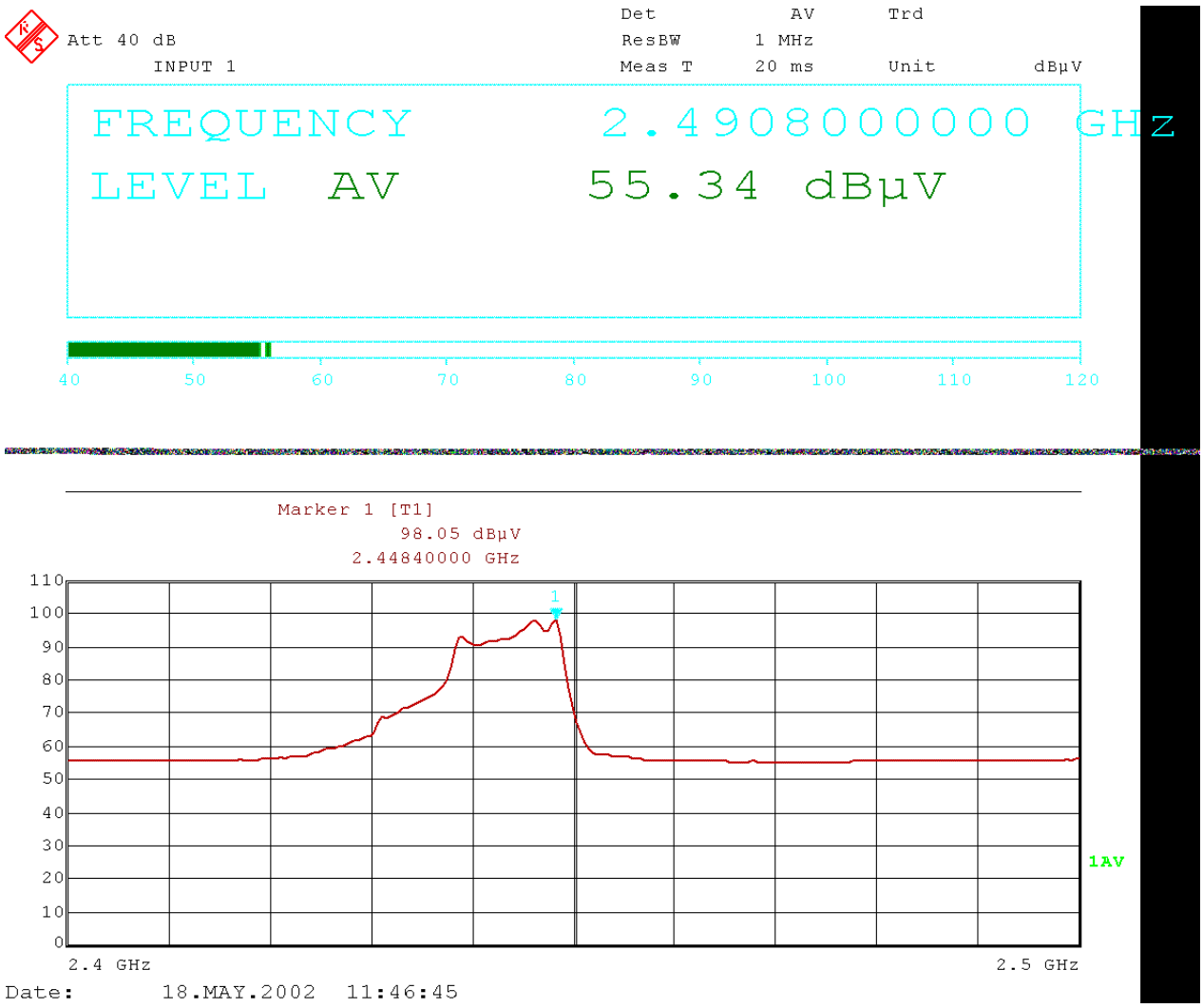
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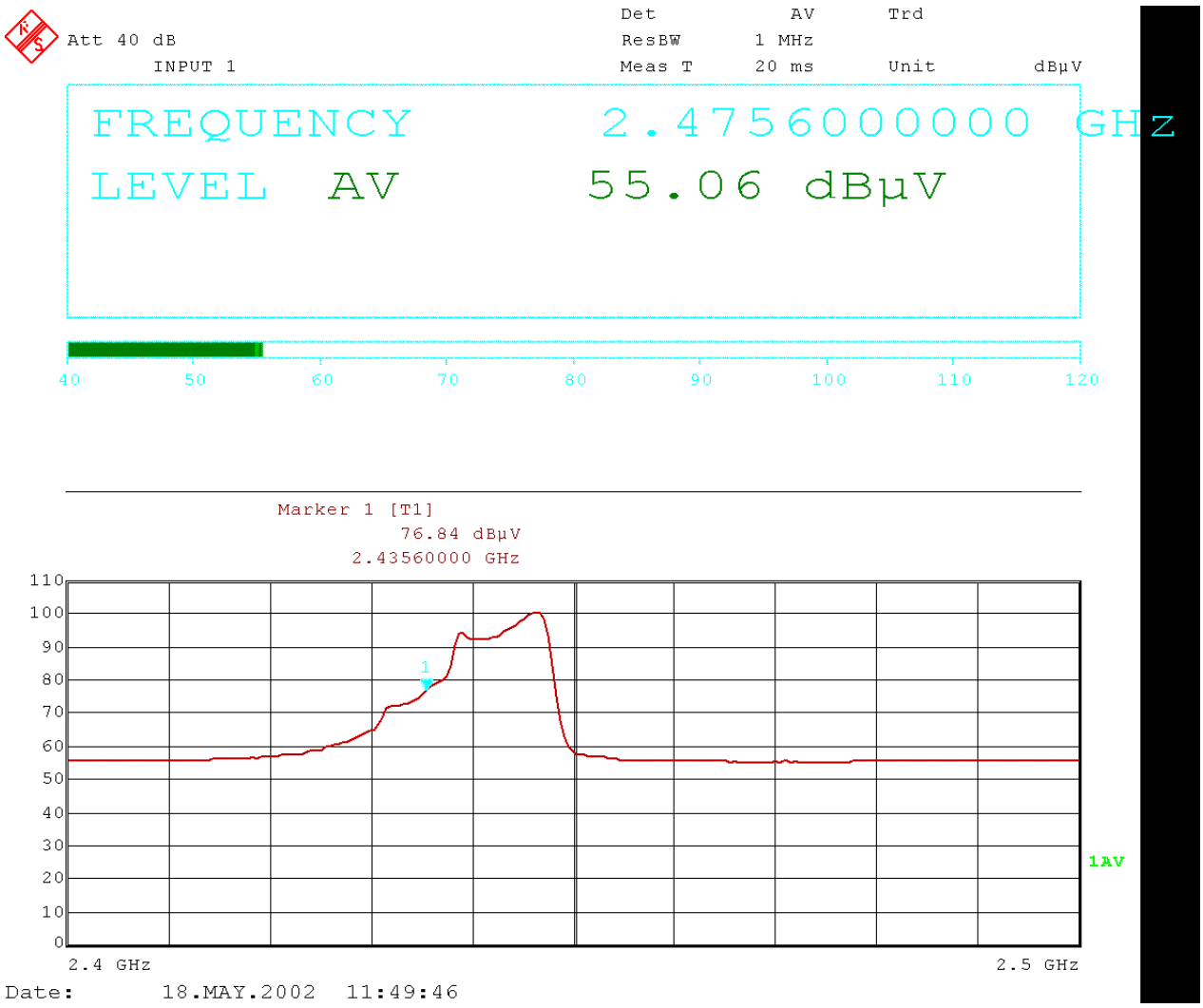
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ResBW 1 MHz
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Trd
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2.4 GHz
2.5 GHz
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4 - RADIATED EMISSION DATA

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 $\pm$4.0 dB.

4.2 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.

4.3 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

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 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.

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:

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

4.6 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:

-20.10 dBmV at **271.44 MHz** in the **Horizontal** polarization, **30MHz to 24GHz. (Electric)**

-11.75 dBmV at **4900.0 MHz** in the **Horizontal** polarization, **30MHz to 24GHz. (Mechanical)**

4.7 Radiated Emissions Test Result Data

4.7.1 Final Test Data, 30MHz –24GHz, 3 Meters, Electronic

INDICATED		TABLE	ANTENNA		FCC PART 18	
Frequency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Limit dBmV/m	Margin dB
271.44	49.00	16.0	98.0	H	69.1	-20.10
30.42	46.70	0.0	98.0	V	69.1	-22.40
4920.0	44.73	356.0	98.0	H	69.1	-24.37
279.00	43.20	294.0	134.0	H	69.1	-25.90
278.78	42.30	136.0	98.0	H	69.1	-26.80
9390.0	42.29	0.0	123.0	V	69.1	-26.81
14730.0	41.70	40.0	110.0	V	69.1	-27.40
15220.0	41.44	347.0	98.0	H	69.1	-27.66
42.12	40.80	161.0	98.0	V	69.1	-28.30
42.78	40.80	82.0	100.0	V	69.1	-28.30
1260.0	39.57	32.0	100.0	V	69.1	-29.53
11020.0	38.94	347.0	100.0	H	69.1	-30.16
38.82	38.60	0.0	98.0	V	69.1	-30.50
40.68	36.80	0.0	138.0	V	69.1	-32.30
31.50	36.30	340.0	309.0	V	69.1	-32.80
278.88	35.50	0.0	98.0	H	69.1	-33.60
2670.0	32.42	0.0	98.0	V	69.1	-36.68
1280.0	32.21	297.0	121.0	H	69.1	-36.89
279.48	29.60	56.0	230.0	H	69.1	-39.50
278.40	29.10	61.0	364.0	H	69.1	-40.00

4.7.2 Final Test Data, 30MHz –24GHz, 3 Meters, Mechanical

INDICATED		TABLE	ANTENNA		FCC PART 18	
Frequency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Limit dBmV/m	Margin dB
4900.0	57.35	161	98	H	69.1	-11.75
3140.0	42.64	340	309	V	69.1	-26.46
14710.0	41.93	0	98	H	69.1	-27.17
16070.0	41.15	356	98	V	69.1	-27.95
968.28	38.90	0	123	H	69.1	-30.20
968.46	38.80	40	110	H	69.1	-30.30
8640.0	38.24	0	98	V	69.1	-30.86
8640.0	37.74	82	100	H	69.1	-31.36
968.58	37.00	0	117	H	69.1	-32.10
588.96	34.20	347	98	H	69.1	-34.90
902.64	33.60	297	121	V	69.1	-35.50
903.18	33.60	356	98	V	69.1	-35.50
902.40	32.40	0	100	V	69.1	-36.70
30.36	31.50	276	179	V	69.1	-37.60
2280.0	30.75	0	138	V	69.1	-38.35
31.32	30.40	305	98	V	69.1	-38.70
903.78	30.20	347	100	V	69.1	-38.90
591.78	29.50	0	98	H	69.1	-39.60
2360.0	28.66	136	98	H	69.1	-40.44
590.64	26.00	32	100	H	69.1	-43.10

5 – FCC PRODUCT LABELING AND WARNING STATEMENT

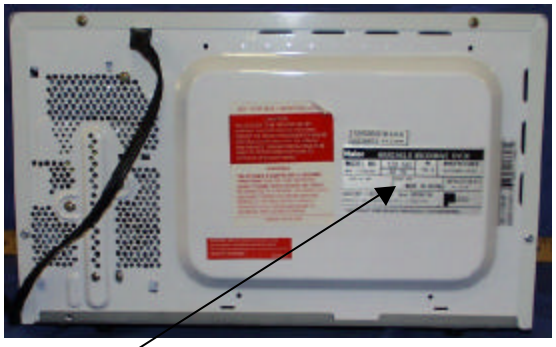
5.1 Proposed FCC Label Format

FCC ID: PKAFGTHR750

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.

5.2 Proposed Label Location on EUT

Rear View of EUT



Proposed FCC ID Location

5.3 FCC Warning Statement

Generally the FCC Warning Statement is provided in the product manual.

Per FCC Section 15.19 (3), all devices shall bear the following statement in a conspicuous location on the device:

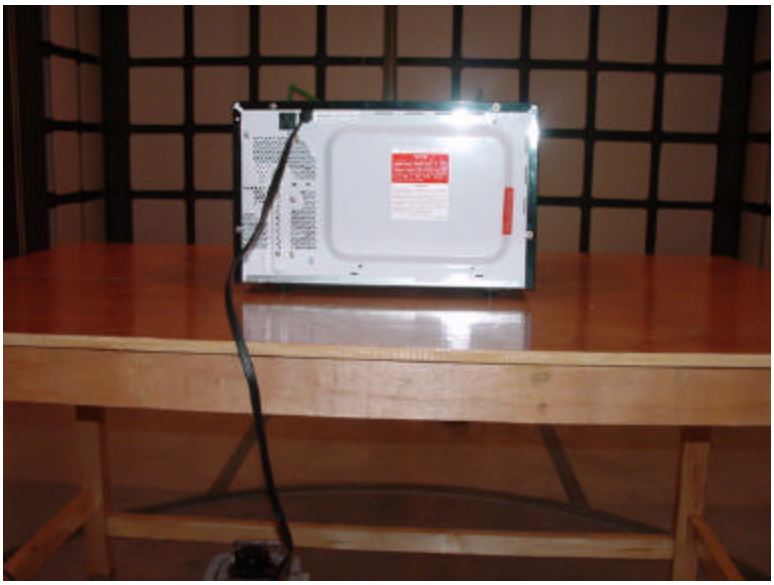
"This device complies with Part 15 of the FCC Rules. Operation is subject to the flowing two conditions: (1) this device may not cause harmful interference, (2) this device must accept any interference received, including interference that may cause undesired operation."

When the device is so small or for such use that it is not practicable to place the statement specified, the information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

6 - Setup Photographs

6.1 Radiated Setup Photograph – Front View

6.2 Radiated Setup Photograph – Side View



6.3 Variation with Voltage Setup – Front View

6.4 Leakage Test Setup – Front View

7 – EUT PHOTOGRAPHS

7.1 EUT – Chassis Front View

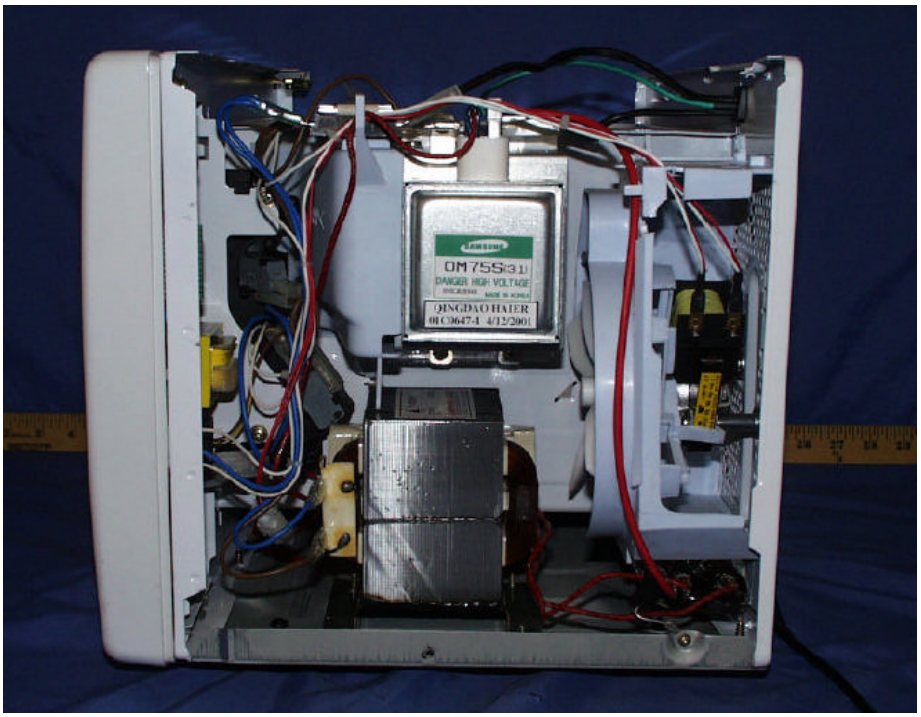
7.2 EUT – Chassis Rear View

7.3 EUT – Chassis Left Side View

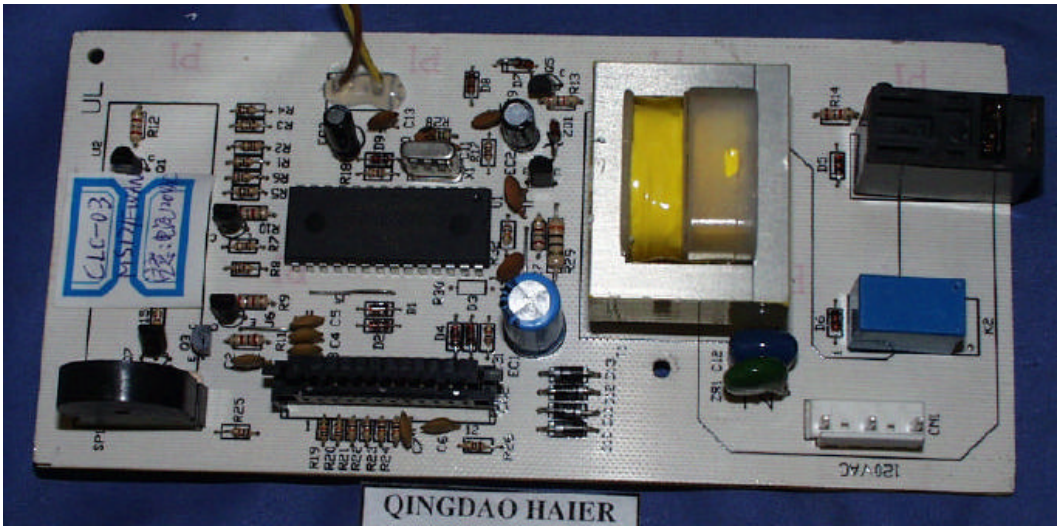
7.4 EUT – Chassis Right Side View

7.5 EUT – Chassis Uncovered Left View

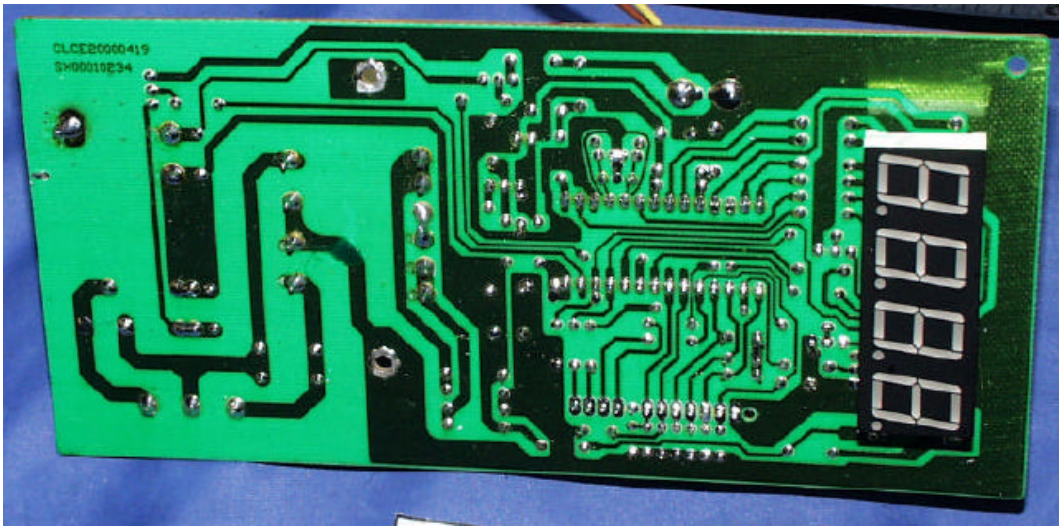
7.6 EUT – Chassis Uncovered Right View



7.7 Controller PCB Component View



7.8 Controller PCB Solder View



Appendix A – Block Diagram / Schematics / Parts List

Appendix B – User Manual