EXHIBIT B.6

REPORT OF RADIATED AND CONDUCTED EMISSION MEASUREMENTS.

Listed By FCC
Cl. B Submittals
FCC/MIL-STD Testing
Established 1975

ENGINEERING, Inc.
Electro Magnetic Controlled Environment

Stephen A. Sawyer, NCE

CERTIFICATE OF COMPLIANCE

REPORT NUMBER: **MIC 6236**
REPORT DATE: **December 12, 1998**
APPLICABLE SPECIFICATION:
47 CFR Part 15, Subpart C, Intentional Radiator

PREPARED FOR:
Micron Communications, Inc.
3176 South Denver Way
Boise, Idaho 83705

I Hereby Certify that the measurements shown in this test report were made in accordance with the procedures of American National Standards Institute Specification ANSI C63.4. The voltage radiated by the equipment listed below meets the Commissions Limits for an Intentional Radiator as defined in 47 CFR Part 15, Subpart C. Conducted emissions test was not required. **Tests were performed on December 3 and 4, 1998.**

Equipment Under Test	Model Number	Serial Number
Proximity Card Reader	**MB-I-M**	**001**

The EMCE Engineering, Inc. has been added to the Commission's list of recognized facilities under Parts 15 and 18 of the Commission's Rules. The signature below attests to the fact that all measurements reported herein were performed by me or were made under my supervision by qualified EMCE personnel utilizing test equipment maintained in a "Current" state of calibration with traceability to NIST. All test indications are correct to the best of my knowledge and belief as of the date specified. EMCE Engineering, Inc. assumes no responsibility for the continuing validity of test data when the Equipment Under Test is not under the continuous physical control of EMCE.

Note
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CERTIFIED BY:

Mr. Stephen A. Sawyer, NCE

ELECTROMAGNETIC INTERFERENCE TEST REPORT

47 CFR Part 15, Subpart C, Intentional Radiator

Report Number:	**MIC 6236**
Report Date:	**December 12, 1998**
Test Report For:	**Micron Communications, Inc.**
Equipment Under Test (EUT):	**Proximity Card Reader**
Model Number:	**MB-I-M**
Serial Number:	**001**
Test Performed By:	EMCE Engineering, Inc. 44366 S. Grimmer Blvd. Fremont, CA 94538 Phone: 510-490-4307 Fax: 510-490-3441
Test Authorized By:	**Micron Communications, Inc. 3176 South Denver Way Boise, Idaho 83705**
Test Started:	**December 3, 1998**
Test Completed:	**December 4, 1998**
Test Engineer:	**Don Ballard**

<u>Note</u>

1. This report or certificate does not represent endorsement by NVLAP or any agency of the US government.
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1.0 SCOPE

This test report describes the equipment setup, test methods employed and results obtained during testing of an Intentional Radiator as defined in Part 15, Subpart C, Paragraph 15.201 of 47 CFR. The tests described herein measured the RF radiated (RFI field strength) emissions of the Equipment Under Test (EUT). The tests conformed to the measurement and test site requirements of ANSI C63.4.

1.1 Objective

The tests described herein were performed to establish compliance with the requirements of Part 15, Subpart C - Intentional Radiators.

1.2 Description of EUT

The EUT is a **Proximity Card Reader** manufactured by **Micron Communications, Inc.**, Model Number: **MB-I-M**, Serial Number: **001.**

1.3 Results/Modifications

The EUT passed radiated emissions test requirements for an FCC Intentional Radiator. During testing the following modification was made in order to pass the limits: A snap on ferrite core (P/N: 28A2025-0A0) was placed on the external power supply leads in order to reduce radiated emissions at 128.15MHz and 144.17MHz. A photograph of the modification is contained in Appendix F of this report.

Conducted emisssions test was not performed as the EUT was powered by an external power supply.

1.4 Test Limits

FCC Intentional Radiator radiated emission limits are:

Radiated Emission Limits (at 3 meters)	
9kHz - 30MHz	See Appendix E
30 - 88MHz	40.0dBuV/m
88 - 216MHz	43.5dBuV/m
216 - 960MHz	46.0dBuV/m
960 - 1000MHz	54.0dBuV/m

2.0 APPLICABLE DOCUMENTS

2.1 FCC Document

Document	Title
Title 47 Code of Federal Regulations, Parts 2 and 15	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations (Part 2). Radio Frequency Devices (Part 15).

2.2 Other Documents

ANSI C63.4-1992	American National Standards for Methods of Measurement of Radio-Noise Emissions From Low-Voltage Electrical and Electronic Equipment In the Range of 9kHz to 40GHz.
ANSI C63.5-1988	American National Standards for Calibration of Antennas Used for Radiated Emissions Measurement.

3.0 GENERAL TEST CONDITIONS

3.1 Test Facility

The tests described herein were performed at EMCE Engineering, Inc. located at 44370 S. Grimmer Blvd., Fremont, CA 94538. EMCE Engineering, Inc. has been added to the Commission's list of recognized facilities under parts 15 and 18 of the Commission's Rules. The FCC certification is contained in Appendix D.

The test facility has one electromagnetic shielded enclosure and a 3 meter and 10 meter Open Area Test Site (OATS). The shielded room is available for preliminary determination of radiated emission frequencies, formal conducted emission measurements and immunity testing. EMCE test site layout is shown in Figure 1.

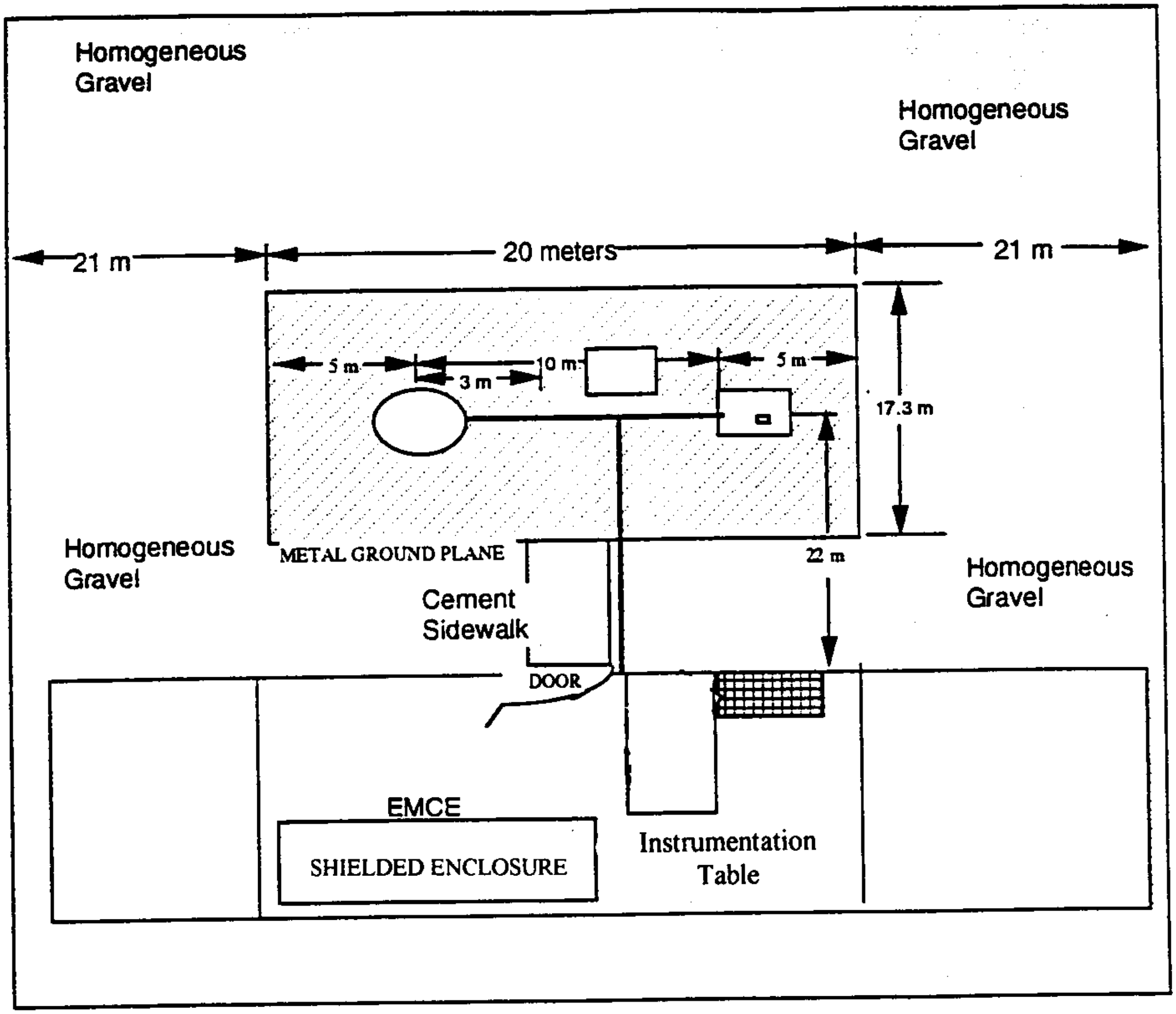

Figure 1
EMCE Test Site Layout

3.2 Description of Open-Field Test Site

The description of the 3 and 10 meter site is on file with the FCC according to the requirements of 47 CFR Part 2.948. This 3 and 10 meter site is located outdoors in an open field whose size is 212 feet long by 206 feet wide. The dimensions of the test area are 66 feet wide by 59 feet long (20m x 18m).

3.3 Site Attenuation

The site attenuation for radiated measurements has been determined for this test site using the method described in ANSI C63.4. This method measures how closely the test site approximates free space transmission with plane wave (far field conditions) as modified by the influence of ground plane reflections. The site attenuation for both the 3 meter and 10 meter site have been measured and found to be within the +/- 4dB limit.

3.4 Ground Plane

The site has a 3900 square foot (20m x 18m) floor area of poured reinforced concrete, 6 to 8 inches thick. A 20m x 18m solid 24 gauge galvanized sheet steel ground plane is centered on the test area with its long dimension along the major axis of the test site. It is made up of 4 foot wide sheets overlapped one inch on each other and MIG welded at 18 inch intervals. The antenna mast and turntable are located 3 or 10 meters apart on the center line of the major axis so that each is >3 meters from the edges of the ground plane. The ground plane is connected to a nine foot long earth ground rod at each corner of the ground plane.

3.5 Input Power for EUT

Electricity for the EUT is provided by buried power lines in metallic conduit with an outlet box placed near the EUT. Power for the EUT is taken from the outlet box of either of two "shielded enclosure" quality power line filters located on the ground plane near the EUT. The filters are electrically bonded to the ground plane.

3.6 Accessory Equipment Precautions

Care was taken that accessory equipment or adjacent equipment did not produce unacceptable interference so as to contaminate the final test data. The EMI receiver and its associated computer, printer and plotter were located >15 meters away from the EUT during testing and were powered from a separately filtered power source.

3.7 Ambient Interference

Ambient interference from radio and television stations, vehicles, mobile radio, etc. were present at the open test site during testing. Care was taken to assure that ambient interference did not overload the receiver or mask emissions from the EUT. The method of measurement used to deal with ambient noise during radiated emission testing is described in Paragraph 5.2.1 of this report.

3.8 Personnel

All testing was performed by EMCE Engineering personnel who were properly trained for the instruments and procedures used. The test data sheets have been signed off by the attending EMCE Test Engineer.

3.9 Use of Interference Measurement Equipment

All of the emission measurements and field strength measurements were performed with a Hewlett-Packard 8568B Spectrum Analyzer. The spectrum analyzer utilizes the following basic instruments:

1. HP-9836 Desktop Computer/Controller
2. HP-2673A Printer
3. HP-7475A Plotter
4. HP-85650A Quasi Peak Detector

General details of the operation of these instruments is given in Appendix A (EMI Measurement With the Automatic Spectrum Analyzer). Specific details are given in the separate sections of emission testing. Antenna factors and cable loss characteristics programmed into the computer are listed in Appendix B. Appendix C contains measuring equipment error analysis for conducted and radiated emissions test.

Test results are recorded on both tabular data sheets and graphical plot charts and show final corrected values compared to the specification limit. A sample calculation on the data sheet show how the antenna factors, cable losses, amplifier gain, etc. are combined in the automatic analyzer program to produce the final corrected values shown on the graphs and data sheets.

3.10 Calibration of Measuring Equipment

The EMI Receiver (spectrum analyzer) is calibrated by an outside calibration laboratory on a 12 month basis. The laboratory provides certification to NIST. The laboratory name and address of the lab as well as the calibration certifications are contained in Appendix D. Antenna factors are measured at 1 year interval by EMCE Engineering, Inc. using the reference antenna method of ANSI C63.5. Cable losses as well as amplifier gains are swept at least every month to verify accurate values.

4.0 PREPARATION FOR TEST

4.1 Setup of EUT

Power to EUT: **5 VDC**
Grounding of EUT: **Chassis**
Cable: **Power leads, unshielded, 8 inches in length.**
Special Software: **None**

4.2 Peripherals Connected

The following peripherals were used during test.

Name	M/N
Power Designs Power Supply	**5015-S**

5.0 DETAILED MEASUREMENTS

5.1 Radiated Emissions Test, 9kHz to 30MHz

Radiated emissions were measured from 9kHz to 30MHz or from the fundamental frequency up to the 9th harmonic. The EUT was placed on a nonmetallic stand in the open-field site, 0.8 meters above the ground plane as shown in Figure 2. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions. The EUT was operated as described in Paragraph 4.0, in a mode which was intended to produce maximum emissions.

The electric fields were measured at a test distance of 3 meters with the measurement antenna connected to the preamplifier and spectrum analyzer through a 50 foot RG-214 coaxial cable. The receiving antenna was scanned over the height range of 1 to 4 meters and rotated to determine maximum emissions. The data was plotted for each harmonic fequency measured.

Data sheets of the radiated emissions are contained in Appendix E. The summary sheet shows how the antenna factors, cable loss and amplifier gain were calculated with the spectrum analyzer readings to determine final corrected values.

5.1.1 Test Results

The EUT passed the FCC Intentional Radiator radiated emissions limits from 9kHz to 30MHz.

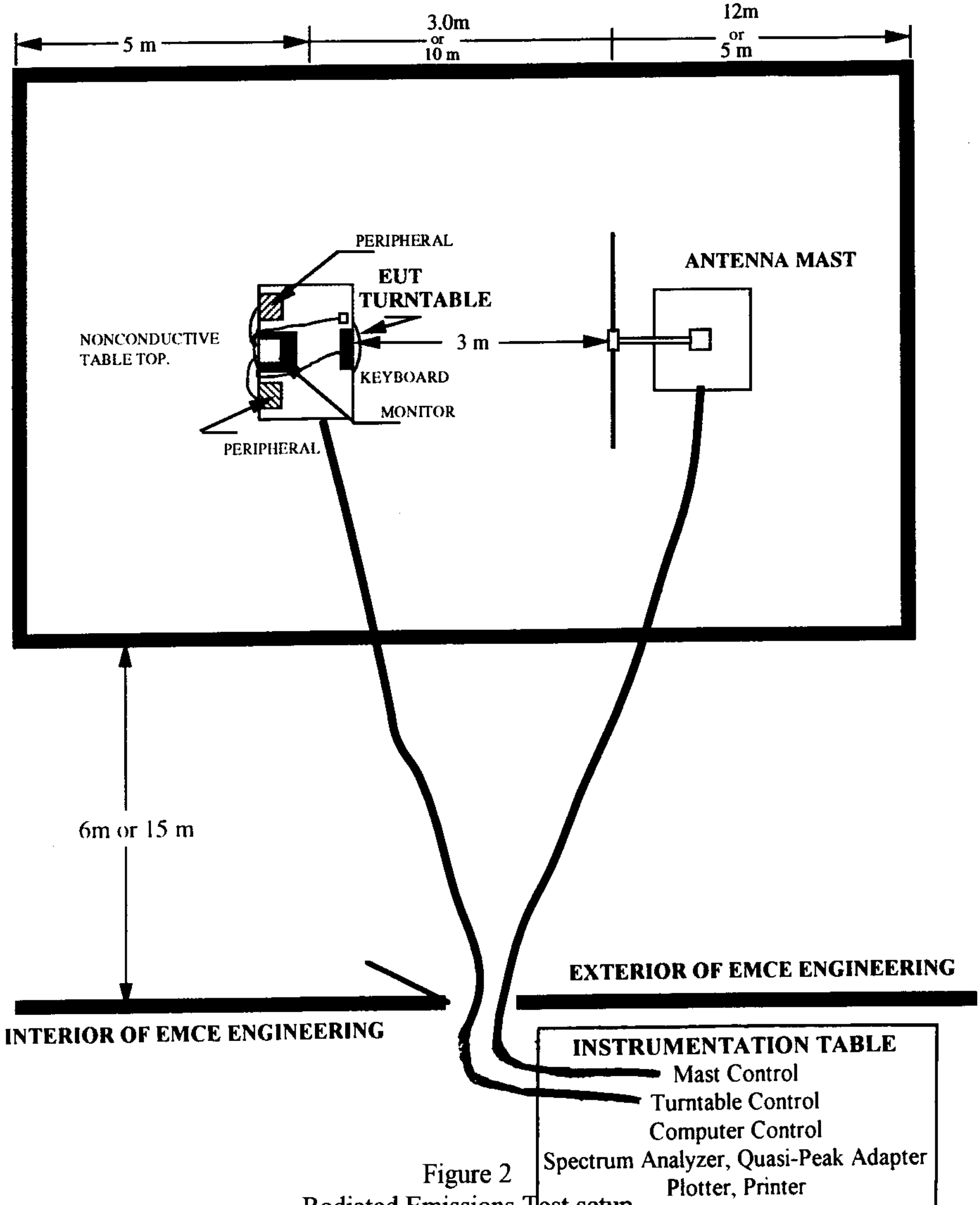

Figure 2
Radiated Emissions Test setup

5.1.2 Test Instrumentation

The following equipment were used for radiated emissions test from 9kHz to 30MHz.

Name	Manufacturer	Model	Cal. Due Date
Controller/Computer	Hewlett-Packard	9836	N/A
Spectrum Analyzer	Hewlett-Packard	8568B	12/14/98
Quasi-Peak Detector	Hewlett-Packard	85650A	12/14/98
LISN	Solar	8012-50-R-24	12/14/98
Antenna Mast	EMCO	1050	N/A
Rotating Table	EMCO	1060	N/A
Loop Antenna	Empire Devices	LG-105	N/A
Loop Antenna	Empire Devices	LP-105	N/A
Preamplifier	Hewlett-Packard	8447D	N/A
Plotter	Hewlett-Packard	7475A	N/A

5.2 Radiated Emissions Test, 30MHz to 1000MHz

Radiated emissions were measured from 30MHz to 1000MHz. The measurement bandwidth was 120kHz according to the methods defined in ANSI C63.4 Section 8.0. The EUT was placed on a nonmetallic stand in the open-field site, 0.8 meters above the ground plane as shown in Figure 2. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions. The electric fields were measured at a final test distance of 3 meters. The antenna height was searched from 1 to 4 meters to maximize the electric fields.

The EUT was setup as described in Paragraph 4.0 and operated in a mode which was intended to produce maximum emissions. Preliminary scans of the frequency range were used to determine the cable configurations and equipment positions which produce maximum emissions. These configurations were then kept intact while both angle of rotation of the EUT with respect to the antenna and antenna height were scanned for maximum readings. The angles and antenna polarization are shown on the data sheets in Appendix E.

5.2.1 Vertical Polarization Measurements

Radiated emission measurements were started with the antenna in a vertical orientation at 1.5 meter in height and 1.0 meters from the EUT with the front of the EUT facing the antenna. The measurement antenna was connected to the preamplifier and spectrum analyzer through a 50 foot RG-214 coaxial cable.

The automatic spectrum analyzer scanning procedure used for radiated measurements is a two-step process, described in detail in Appendix A. Readings were made at this point using sampling techniques. The first pass accumulates and stores both EUT and background ambient emissions received by the measurement antenna for 1001 samples per frequency segment. The second pass was performed with the EUT turned off thus accumulating only background ambient emissions for 1001 samples per frequency segment. The computer was programmed to subtract the second pass data from the first pass on a point by point basis per frequency segment, thus removing steady state ambients and leaving only EUT emissions. This culling process reduces the total number of emissions which must be examined manually.

A preliminary list of possible EUT frequencies was printed at the end of the second pass after the subtraction process. This list contained both EUT emissions and background ambients, particularly ambient signals which fluctuated in amplitude or which went on and off rapidly (such as communication transmitters). At this point each listed frequency was individually examined by a manual procedure. Some of these signals were ambients and some were EUT signals. They were sorted and the EUT signals were accurately measured with the quasi-peak detector after maximizing the signal in both azimuth and height.

As the evaluation process continues, each signal attributed to the EUT is further examined for maximum value. The dipole antenna (for electric fields) was adjusted to the proper length, the height of the measurement antenna was searched from one to four meters, and the angle of rotation of the EUT with respect to the antennas was varied from 0 to 360 degrees.

5.2.1 Vertical Polarization Measurements (Continued)

Upon completion of the evaluation process a data sheet is printed out listing the final radiated results. This lists those signals which were within 15dB of the limit and which were actually attributed to the EUT. Along with other information the data sheet indicates signal level and the limit, turntable angle and antenna height. Data sheets and plotted charts of vertical polarized radiated emissions are contained in Appendix E.

5.2.2 Horizontal Polarization Measurements

The full electric field from 30MHz to 1000MHz frequency range was scanned with the EUT operating and the measurement antenna oriented in a horizontal polarization . A set of radiated emission readings were collected, evaluated, stored and printed out using the same procedure described above for vertical polarization. The data sheets and plotted charts are contained in Appendix E.

5.2.3 Test Results

The EUT passed the FCC Intentional Radiator vertical and horizontal radiated emissions limits from 30MHz to 1000MHz.

5.2.4 Test Instrumentation

The following equipment were used for radiated emissions test from 30MHz to 1000MHz.

Name	Manufacturer	Model	Cal. Due Date
Controller/Computer	Hewlett-Packard	9836	N/A
Spectrum Analyzer	Hewlett-Packard	8568B	12/14/98
Quasi-Peak Detector	Hewlett-Packard	85650A	12/14/98
LISN	Solar	8012-50-R-24	12/14/98
Antenna Mast	EMCO	1050	N/A
Rotating Table	EMCO	1060	N/A
Antenna Biconical	EMCO	3104	5/27/99
Antenna Dipole Set	CDI	A100	4/25/99
Preamplifier	Hewlett-Packard	8447D	N/A
Printer	Hewlett-Packard	2673A	N/A
Plotter	Hewlett-Packard	7475A	N/A

APPENDIX A

EMI Measurement With the Automatic Spectrum Analyzer

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1.0 INTRODUCTION

This document describes the application of the Automatic Spectrum Analyzer and its necessary Peripheral Equipment for measurement of Electromagnetic Interference (EMI) emissions for FCC, European ITE/ISM or VCCI Compliance Testing. The measurement methods are designed to comply with FCC Measurement Procedure ANSI C63.4 as well as EN 55022 and CISPR 22.

The measurement of EMI involves a repetitive process of collecting, analyzing and reformatting large amounts of data. It is a process which lends itself to computer controlled automation. The benefits are: reduced setup time, reduced operation time, increased accuracy and better repeatability.

The detailed description which follows provides insight into the programming of the analyzer and computer. The steps describe how data is collected, analyzed, displayed and reproduced.

2.0 OVERVIEW

The Hewlett-Packard 8568B is a general purpose programmable Spectrum Analyzer and the Hewlett-Packard 85650A Quasi-Peak Detector is a programmable accessory which sets the overall measurement bandwidth and detector time constants to those required by the various regulatory agencies. By adding appropriate transducers such as antennas or LISNs and the proper software, the system becomes an interference measurement set operating under the control of Hewlett-Packard 9836 Computer. A Hewlett-Packard 7475A Plotter and a Hewlett-Packard 2673A Printer are accessories which provide hard copy output in the form of graphs and data sheets.

Several measurement sweeps are taken to characterize the interference from the Equipment Under Test (EUT). The data is analyzed in the computer and later reformatted in both semi-log graph and a measurement summary data sheet. The data sheets indicate compliance by including "PASS/FAIL" messages and specification limits.

3.0 PROGRAM OPERATION

3.1 General Operation

The spectrum analyzer has a built-in 100MHz Crystal Controlled Oscillator as its frequency standard. This oscillator is contained in a temperature oven and is extremely accurate. One of the features of the analyzer is its self calibration microprocessor. A computer program utilizing the analyzer self calibration feature is loaded into the computer memory and is exercised each time the analyzer is set up for testing. It checks all of the critical analyzer accuracy parameters and displays error for each value. This error summary is sent to a hard copy listing and is printed out. The error coefficients are used by the analyzer to reduce its error to as small a value as possible. The final corrected values use this correction data. The self calibration gives a status message on the usability of the spectrum analyzer (i.e. "SYSTEM OPERATIONAL").

Next, a stored measurement program is selected and loaded into the computer. This program is selected for conducted or radiated emissions measurement. It contains all of the necessary operation steps, the antenna factors, and any data needed for calculation of final emission values. This program begins by prompting the operator to provide administrative data such as date, customer, model number, serial number and setup diagram on the analyzer display. This prompts the operator to check the setup to see that the equipment is properly connected before making measurements. A blinking message on the display reminds the operator that program execution will continue after the "Hz" key on the analyzer keyboard is pressed.

The total frequency span to be measured is divided into several intermediate ranges which are swept separately. An "Instrument Preset" is performed first and then the analyzer frequency span, resolution bandwidth, video bandwidth and sweep time are set to programmed values at this time. The QP detector is also set to programmed values. The QP detector is changed from "BYPASS" to "NORMAL" mode with the QP detector set to "ON". The system is now ready for the first measurement sweep.

3.1 General Operation (Continued)

Table 1 shows the sweep ranges and sweep times programmed for both conducted and radiated emissions measurements. The analyzer divides the spectrum scanned sweep into 1001 separate incremental measurement segments and stores these in arrays for processing. The width of the scan divided by 1001 determines the width of each incremental segment. The column "Analyzer Bandwidth" in Table 1 shows the ANSI and CISPR mandated bandwidths for a given frequency range. These have been selected to be narrow enough for the assured sensing of all EUT emissions in the presence of typical ambient signals. Scan time is slow enough to allow EUT signals to reach a peak value and be sensed. Sweep time is increased for QP detection.

Table 1

Analyzer Bandwidth RBW-VBW MHz	System Bandwidth (Note 1) kHz	Range of Test Segment MHz	Span of Test Segment (Note 2) MHz	SweepTime Per Segment Note 3) Seconds
CONDUCTED EMISSIONS				
0.003	0.2	0.01-0.15	0.14	90
0.1	9	0.15-0.45	0.30	90
0.1	9	0.45-1.6	1.15	90
0.1	9	1.6-8.0	6.4	90
0.1	9	8.0-30.0	22.0	90
RADIATED EMISSIONS				
0.003	0.2	0.01-0.15	0.14	90
0.1	9	0.15-0.45	0.30	90
0.1	9	0.45-1.6	1.15	90
0.1	9	1.6-8.0	6.4	90
0.1	9	8.0-30.0	22.0	90
1.0	120	30-60	30	90
1.0	120	60-88	28	90
1.0	120	88-108	20	90
1.0	120	108-200	92	90
1.0	120	200-400	200	90
1.0	120	400-700	300	90
1.0	120	700-1000	300	90

Note 1. System Bandwidth is determined by the QP detector when its "NORMAL" function is selected. The automatic scans are made with the QP detector in the "OFF" condition. In the "BYPASS" mode the QP detector is bypassed and the analyzer settings for bandwidth prevail.

3.1 General Operation (Continued)

Note 2. Bandwidth of stored segment is equal to the range of band scanned divided by the number of data points. The analyzer provides 1001 data points for any span. For example, the scan from 30MHz to 60MHz equals scanned range of 30MHz. When this is divided by 1001, the span of the stored segment is 30kHz per data point (less than the RBW of 120kHz).

Note 3. The analyzer system is set up to process peak signals during the automatic scan. When the QP detector is placed to "NORMAL", the signals must be analyzed with the QP detector "ON" using the procedures described in paragraphs on conducted and radiated emissions testing.

Upon completion of the first measurement sweep the analyzer sends an "End of Sweep" interrupt message along the bus which tells the computer that the analyzer is ready to output its trace data.

A fast Read/Write routine then transfers the 1001 data points from the analyzer internal buffer to the computer memory array and at the same time the analyzer is set for a second measurement sweep. While the analyzer is collecting data during the next sweep, the computer is analyzing and reformatting the previous sweep data. The final formatted data contains up to 3000 data points overall after all of the sweeps are combined and includes all significant EUT emissions.

3.2 EUT Configuration

Attempts shall be made to maximize the interference consistent with the typical applications of use of the EUT by varying the configuration of the EUT. Interface cables shall be connected to the available interface ports of the EUT. This includes but is not limited to standard interface bus ports (i.e. IEC 625 and CCITT V.24) provided on computers and peripherals. The effect of varying the position of the cables shall be investigated to find the configuration that produces maximum disturbance. The configuration shall be noted in the test report.

Interconnecting cables should be of the type and length specified in the individual equipment requirements. If the length can be varied the length shall be selected to produce maximum interference. If shielded or special cables are used during the tests to achieve compliance, then a note shall be included in the instruction manual advising of the need to use such cables.

3.2 EUT Configuration (Continued)

Excess lengths of cables shall be bundled at the approximate center of the cable with the bundles 30cm to 40cm in length. If it is impractical to do so because of cable bulk or stiffness, or because the testing is done at a user installation, the disposition of the excess cable shall be noted in the test report. Where there are multiple interface ports all of the same type, connecting a cable to just one of that type of port is sufficient provided it can be shown that the additional cables would not significantly affect the results.

The final results shall be accompanied by a complete description of the cable and equipment orientation so that the results can be repeated. If specific conditions of use are required to meet the limits, those conditions shall be specified and documented; for example cable length, cable type, shielding and grounding. These conditions shall be included in the instructions to the user.

One module of each type shall be operative in each ITE evaluated in an EUT. For a system EUT, one of each type of ITE that can be included in the possible system configuration shall be included in the EUT. The results of an evaluation of EUT's having one of each type of module or ITE can be applied to configurations having more than one of each of those modules or ITE. This is permissible because it has been found that interference from identical modules of ITE are in practice generally not additive.

In the case of EUT's which functionally interact with other ITE including any ITE that is dependent on a host unit for its power interface, either the actual interfacing ITE or simulators may be used to provide representative operating conditions provided the effects of the simulator can be isolated or identified. If an ITE is designed to be a host unit to other ITE such ITE may have to be connected in order that the host unit shall operate under normal conditions.

It is important that any simulator used instead of an actual interfacing ITE, properly represents the electrical and in some cases the mechanical characteristics of the interfacing ITE, especially RF signals and impedances. Following this procedure will permit the results of measurements of individual ITE to remain valid for system application and integration of the ITE with other similarly tested ITE, including ITE produced and tested by different manufacturers.

3.3 Conducted Emissions Measurement

Power line conducted emissions measurement is generally performed inside a shielded enclosure. If they are measured in the Open Area Test Site (OATS) then it should be so stated in the report. Measurements of conducted emissions on the power input lines are made using a Line Impedance Stabilization Network (LISN) and a Solar 76205-0.35 Highpass Filter having a cutoff frequency of 350Hz to prevent power frequency harmonics from overloading the analyzer.

The LISN and highpass filter are connected through 50 feet of RG-214 coaxial cable to the spectrum analyzer input. The switch on the LISN is set to the supply line position and the power is applied to the EUT. The EUT is operated in the mode producing the greatest electrical noise.

The computer is commanded to begin data collection scanning process as described in Paragraph 3.1. Correction factors for filter loss are programmed into the computer and are used in the final corrected values. Data tabulations and graphical plots of peak values produced by the system are printed and plotted at the conclusion of the test sequence. The six highest EUT emission measurement values, two from each of the three scan ranges are listed on the data sheet.

The switch in the LISN is then set to the return line position and the interference scan is repeated and an additional set of data sheets and plot charts are prepared. The six highest EUT emission measurement values, two from each of the three scan ranges are listed on the data sheet.

When performing CISPR 22 measurements all signals must be less than the "Average" limits while measuring with the QP detector "ON". A 4dB guard band should be maintained to account for measurement system errors.

3.3.1 Conducted Emissions Step-by-Step Procedure

a. Turn on spectrum analyzer, computer, QP detector, printer and plotter. The EUT should be turned on and operating in the maximum emissions mode.

b. Connect a 50ohm, 50 foot, double shielded coax cable from the highpass filter to the analyzer input.

c. Allow 30 minutes warm-up time for the analyzer. At the end of this time perform calibration procedure on the analyzer.

d. Insert the floppy disk into the HP9836 Computer and load the program "PROGSEL".

e. Select the Measurement Program from among the following listed on the analyzer display.

1. FCC B Radiated
2. FCC A Conducted
3. FCC A Radiated
4. FCC B Conducted
5. EN55022 B Radiated
6. EN55022 B Conducted
7. Return to Local Operation

f. Choose "FCC B Conducted" program by depressing the number "4" on the analyzer numeric keypad on the lower right side of the front panel.

g. Enter after Prompt: "CUSTOMER NAME", "DATE", "MODEL NUMBER", "SERIAL NUMBER", "CUSTOMER", "PRODUCT NAME" and "MEASUREMENT POINT".

h. The analyzer displays the prompt that a report cover sheet can be printed by depressing "1" on the analyzer keypad. If "1" is depressed the cover sheet will be printed.

3.3.1 Conducted Emissions Step-by-Step Procedure (Continued)

i. The following set-up parameters are automatically selected by the computer for FCC B measurements. The sweep frequency ranges and time are slightly different for CISPR measurements.

Sweep #	Frequency Range	RBW	VBW	Time	Trigger S/A
1	450kHz - 1.6MHz	0.1MHz	0.1MHz	90 sec	Press “kHz”
2	1.6MHz - 8MHz	0.1MHz	0.1MHz	90 sec	Press “kHz”
3	8MHz - 30MHz	0.1 MHz	0.1MHz	90 Sec	Press “kHz”

j. After pressing “kHz” the Trigger Level knob should be rotated “CW” until the sweep begins. These scans are performed with the EUT turned on and operating. Any of the above scans can be re-swept if the “Hz” key were depressed instead of the “kHz” key. There are 1000 data points for each sweep range (i.e. 3000 total). The data points are stored into an indexed array (i.e. A1,001 to A1,1000...A3,001 to A3,1000) in the computer memory.

k. At the point where the entire frequency range of 450kHz to 30MHz has been successfully scanned the test is complete and the test data is printed and plotted.

l. Repeat the steps above for all hot phases and neutral leads. The protective earth green wire does not require testing.

Note:
When testing under CISPR requirements the EUT must pass the “Average” limits with Quasi-Peak detector.

3.4 Radiated Emissions Measurement

Radiated emissions from the EUT are measured in the Open Area Test Site (OATS) over the frequency range from 30MHz to 1000MHz using a combination of automatic and manual methods which conform to ANSI C63.4:1992. The EUT is placed on a nonmetallic stand 0.8 meters above the ground plane in an open-field test site. The interface cables and equipment positions are varied within limits of reasonable applications to determine the positions producing maximum radiated emissions.

3.4 Radiated Emissions Measurement (Continued)

Preliminary manual scans of the frequency range are used to determine the cable configurations and equipment positions which produce maximum emissions. These configurations are then kept intact while both angle of rotation of the EUT with respect to the antenna and antenna height are scanned for maximum readings. Automatic scans with the antenna first vertically polarized and then horizontally polarized are made to determine a set of preliminary maximum peak values. These are then processed manually with the quasi-peak detector to determine exact emission values from the EUT. The automatic scanning proceeds in general as described in Paragraph 3.1.

Radiated emission measurements are started with the test antenna in a vertical orientation at 1.5 meters in height and 1.0 meters from the EUT with the front of the EUT facing the antenna. The measurement antenna is connected to the preamplifier and spectrum analyzer through 50 feet RG-214 coaxial cable. The EUT is turned on in the operating mode to be used during the test.

The automatic spectrum analyzer scanning procedure used for radiated measurements is a two-step process. Two separate scans of each frequency range are made. The test operator has the choice of selecting either the peak detector or signal sampling techniques to utilize in signal detection. The first pass accumulates and stores both EUT and background ambient emissions received by the measurement antenna. The second pass is run with the EUT turned "OFF" and accumulates only background ambient emissions. The quasi-peak detector is in "BYPASS" mode and the readings are peak values. The computer is programmed to subtract the second scan from the first scan on a point by point basis, removing steady state ambients and leaving only EUT emissions and fluctuating ambients. This reduces the total number of emissions which must be examined manually.

The automatic scanning procedure divides the total frequency range of 30MHz to 1000MHz into 7 segments which are arranged to yield the greatest resolution possible over the entire frequency range of the test. These are listed in Table 1. In the signal sampling mode each sweep consists of 260 averages done automatically by the analyzer. This tends to reduce the effect of random or short- term ambient signals. Antenna changes are made as required at the end of each sweep.

3.4 Radiated Emissions Measurement (Continued)

A preliminary list of residual frequencies is printed at the end of the second pass after the subtraction process. This list contains both EUT emissions and background ambients, particularly ambient signals which fluctuated in amplitude or which went on and off quickly. At this point each listed frequency is individually examined manually by maximizing the signal in direction and antenna height. The dipole antenna is "cut" for the frequency of interest and the quasi-peak detector is engaged. A long sweep time is selected to allow the QP detector to fully charge. The final reading of the signal under these conditions is then modified by the antenna factor, cable loss and preamplifier gain. This preliminary list is printed on the computer display and on the hard copy printer.

The EUT is turned on again and the computer is set to display each frequency from the preliminary list on the analyzer starting at the 30MHz end of the range. A manual command is used to end investigation of one listed frequency and then go on to the next. This allows sufficient time to evaluate each suspected signal. Several methods are used to separate residual ambients from EUT signals:

1. If the signal disappears from the screen when the analyzer is tuned to the indicated frequency with the EUT operating, the signal is not caused by the EUT and is considered to be an ambient.

2. With the EUT operating and the analyzer tuned to the indicated frequency, if the demodulated signal from the speaker on the quasi-peak detector is voice or music, the signal is recognized as a Radio or TV station and is considered ambient.

3. If either step 1 or 2 above is inconclusive, the analyzer is tuned to the indicated frequency and the EUT power is turned OFF. If the signal on the analyzer remains unchanged, the signal is considered to be an ambient.

4. While performing the above steps, sometimes it is helpful to decrease the analyzer resolution bandwidth so that resolution of close together frequencies can be achieved.

As the evaluation process continues each signal attributed to the EUT is further examined for maximum value. The dipole antenna is adjusted to the proper length, the height of the measurement antenna is searched from one to four meters, and the angle of rotation of the EUT with respect to the antenna is varied from 0 to 360 degrees.

3.4 Radiated Emissions Measurement (Continued)

The quasi-peak detector is engaged and set to sweep time of 90 seconds. The analyzer display is cleared and signal is traced on the screen. After the maximum quasi-peak signal is displayed, the "Continue" button on the computer is pressed and the amplitude and frequency information is stored in the computer for later printout and plot display. The angle of the EUT and height of the antenna are also stored for print out on the data sheet.

If the four steps above indicate that the signal is not an EUT signal, then that signal is passed over and not recorded for final printout. The screen is cleared and manual actuation of the "Continue" button steps the analyzer to the next signal for evaluation. Evaluation of the preliminary frequency list continues until all of the signals are confirmed, maximized and measured, or are rejected as not originating from the EUT. Then the computer prints out a final data sheet showing frequency, amplitude, specification limit, antenna height and angle of rotation of the EUT. A graphical plot of the data is also traced by the plotter.

3.4.1 Radiated Emissions Step-by-Step Procedure

a. Turn on analyzer, QP detector, printer, plotter, preamplifier, antenna mast controller and turntable controller. The EUT should be turned on and operating in the maximum emissions mode.

b. Set antenna mast to the erect position at the appropriate test distance (3 or 10 meters).

c. Connect a 50ohm, 50 foot, double shielded coax cable to the preamplifier input and uncoil rest of cable to antenna mast.

d. Attach broadband antenna (Biconical or Log Periodic) to antenna mast. Attach coax cable to antenna.

e. Allow 30 minutes warm-up time for the analyzer. At the end of this time perform calibration procedure on the analyzer.

f. Insert floppy disk into HP9836 computer and load program "PROGSEL".

3.4.1 Radiated Emissions Step-by-Step Procedure (Continued)

g. Select the Measurement Program from among the following listed on the analyzer display.

1. FCC B Radiated
2. FCC A Conducted
3. FCC A Radiated
4. FCC B Conducted
5. EN55022 B Radiated
6. EN55022 B Conducted
7. Return to Local Operation

h. Choose "FCC B Radiated" program by depressing the number "1" on the analyzer numeric keypad on the lower right side of the front panel.

i. Enter after Prompt: "CUSTOMER NAME", "DATE", "MODEL NUMBER", "SERIAL NUMBER", "CUSTOMER", "PRODUCT NAME", and "MEASUREMENT POINT".

j. The analyzer displays the prompt that a report cover sheet can be printed by depressing "1" on the analyzer keypad. If "1" is depressed the cover sheet will be printed.

k. The analyzer displays the prompt that a test setup information sheet can be printed by depressing "1" on the analyzer keypad. If "1" is depressed the test setup information sheet will be printed. The following test setup information is printed to the analyzer:

Host Device, Users Manual, Special Software for the EUT, Date of Special Software, Power Source, Interfaces in Use, Test Cable Length, Test Cable Type, Grounding of EUT, Margin Desired (in dB).

l. After this page is printed the analyzer is set-up to begin taking measurements. The prompt "Press the Hz Key to Begin Sweep" is displayed on the analyzer .

3.4.1 Radiated Emissions Step-by-Step Procedure (Continued)

m. After the Hz key is depressed the computer prompts "Use Peak Detector or Signal Sampling?". Depress "P" or "S" on the computer keyboard then press "ENTER". At this point the analyzer begins sweeping using the following programmed parameters.

Sweep #	Frequency Range	RBW	VBW	Time	Trigger S/A
1	30MHz - 60MHz	1MHz	1MHz	90 sec	Press "kHz"
2	60MHz - 88MHz	1MHz	1MHz	90 sec	Press "kHz"
3	88MHz - 108MHz	1 MHz	1MHz	90 Sec	Press "kHz"
4	108MHz - 216MHz	1MHz	1MHz	90 sec	Press "kHz"
5	216MHz - 400MHz	1MHz	1MHz	90 sec	Press "kHz"
6	400MHz - 700MHz	1 MHz	1MHz	90 Sec	Press "kHz"
7	700MHz - 1000MHz	1 MHz	1MHz	90 Sec	Press "kHz"

n. These scans are performed with the EUT turned on and operating. Any of the above scans can be re-swept if the "Hz" key were depressed instead of the "kHz" key. There are 1000 data points for each sweep range (i.e. 7000 total). The data points are stored into an indexed array (i.e. A1,001 to A1,1000...A7,001 to A7,1000) in the computer memory.

o. At the point where the entire frequency range of 30MHz to 1000MHz has been successfully scanned, the EUT is turned "OFF" (all the peripherals connected left "ON") and the above scans are swept again. This set of scans is characterized by data being read into TRACE B of the analyzer whereas the initial set were read into TRACE A.

p. When the entire frequency range of 30MHz to 1000MHz has been scanned and transferred to TRACE B, the computer begins to format the final results of this initial stage. Data point B1,001 is compared to A1, 001. If its magnitude is within 6dB of A1,001 then the computer judges this value to be an ambient signal and it is discarded. Otherwise the signal is judged to be a valid EUT emission and it is saved for further processing. At the point where all array B data has been compared to the array A data and ambients discarded, the remaining data are corrected by adding antenna correction factors and removing preamplifier gain effects. A preliminary data sheet is printed showing all signals within "MARGIN" dB or greater of the specification limit. Also a graph is printed to show the data in the magnitude versus frequency representation on a semi-log graph.

q. This preliminary list contains both valid EUT emissions and a few ambient signals that somehow made it into the valid list. All of these signals will be manually examined one at a time. Only the six largest EUT emissions will be remeasured.

r. From the preliminary list choose all "Out of Spec" signals to examine. Place a pencil check mark next to the selected signals. If no signals are out of spec then select the six largest signals for final measurement. Keep the preliminary list nearby to work from.

s. At this point the EUT must be energized and set into operation. Set the resonant half wave dipole antenna onto the antenna mast in the polarization of the preliminary test and begin remeasurement of the selected signals. The analyzer will be tuned to the first frequency on the preliminary list. Here the analyzer parameters are set for measurement with the quasi-peak detector. The span for each signal is set to 300kHz. If the signal is not one of the pre-sorted signals (pencil check mark) it should be rejected when the computer requests whether the signal should be saved or discarded. If discarded, the computer will tune the analyzer to the next signal on the preliminary list. If saved, then it is at this point that the signal is maximized by rotation of the turntable and raising the receiving antenna between 1 to 4 meters. Usually it works best to maximize in azimuth before elevation. In order to assure that the QP detector is fully charging to the maximum, a scan time of 300 seconds is selected. The QP detector is placed "ON" and the analyzer trace displays the EUT emission that is filtered by the QP detector. When the maximum indication is achieved press "MHz" on the analyzer numeric keypad to save this final value for the final list and graph.

t. When each signal on the preliminary list has been examined and either discarded as an ambient or maximized and remeasured then the final results can be printed and plotted. Both the tabular list and graphical plots show the relation of the EUT emissions to the specification limit.

u. The above steps are repeated for the horizontal orientation of the receiving antenna. This procedure can be stopped at the end of preliminary printouts to examine out of spec emissions or evaluate fixes.

APPENDIX B

Measuring Equipment Data

Antenna Factors, Loop, LG-105
Antenna Factors, Loop, LP-105
Antenna Factors, Biconical, EMCO-3104
Antenna Factors, CDI A100 Roberts
Preamplifier Gain, 30MHz -1000MHz
Coaxial Cable Loss, 30MHz-1000MHz

Antenna Factors, Loop Antenna
Model: LG-105

BAND 1		BAND 2		BAND 3	
Frequency (kHz)	Gain (dB)	Frequency (kHz)	Gain (dB)	Frequency (kHz)	Gain (dB)
14	37.7	25	34.5	62	30.5
15	37.5	30	34.2	70	27.9
16	37.4	35	33.0	80	25.5
18	36.7	40	32.0	90	25.5
20	36.3	45	31.3	100	26.0
22	35.8	50	31.5	120	25.2
24	35.2	55	32.0	140	26.5
25	35.0	60	32.0	150	26.0

Note:
1. For substitution measurements, add 20dB to the above factors.
2. Addition of 20dB is not required for series injection and no antenna factor is used for antenna induced measurement.
3. The amplitude with above factors is in dBuV/m. Subtract 51dB from the above factors to get into H-Field amplitude levels.

Antenna Factors, Loop Antenna
Model: LP-105

Frequency (kHz)	Gain (dB)	Frequency (MHz)	Gain (dB)
150	41.9	2.4	29.6
175	40.6	2.7	28.7
200	39.4	3.0	27.6
225	38.4	3.4	26.6
250	37.5	3.7	25.8
275	36.6	4.0	25.2
300	35.9	4.4	24.4
325	35.2	4.7	23.7
360	34.3	5.2	22.9
400	38.3	6.0	26.7
450	37.2	7.0	25.4
500	36.3	8.0	24.3
560	35.3	9.0	23.3
620	34.4	10.0	22.3
700	33.4	11.0	21.5
760	32.7	12.0	20.7
870	31.5	12.7	20.0
900	33.7	15.0	18.8
1100	31.9	19.0	16.8
1300	30.5	21.0	15.9
1500	29.3	24.0	14.7
1700	28.1	27.0	13.7
1900	27.2	30.0	12.7
2100	26.3		

Note:

1. For substitution measurements, add 20dB to the above factors.
2. Addition of 20dB is not required for series injection and no antenna factor is used for antenna induced measurement.
3. The amplitude with above factors is in dBuV/m. Subtract 51dB from the above factors to get into H-Field amplitude levels.

Antenna Factors, Biconical Antenna
Model: EMCO-3104

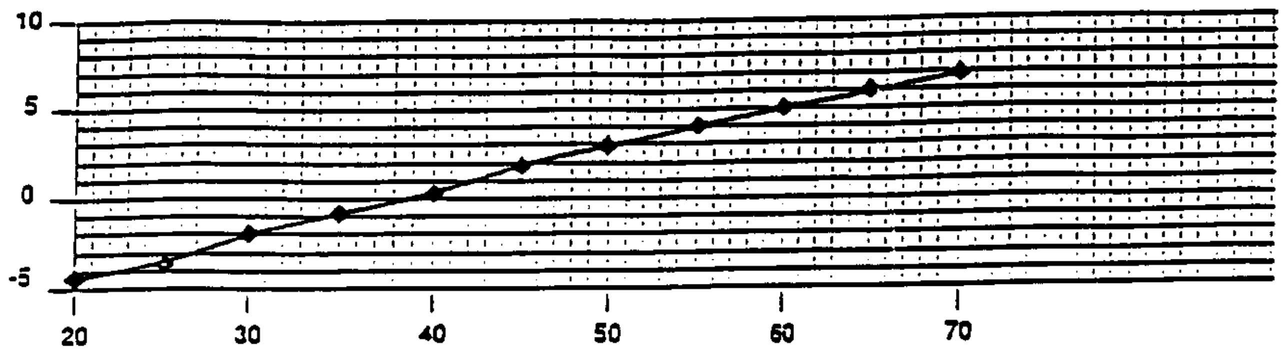
Frequency (Mhz)	Antenna Factor	Gain Numeric	Gain (dB)
20	8.11	.065	-11.8
30	13.10	.047	-13.3
40	8.64	.232	-6.4
50	9.38	.305	-5.2
60	11.20	.289	-5.4
70	15.15	.159	-8.0
80	10.88	.554	-2.6
90	14.52	.303	-5.2
100	8.89	1.367	1.4
110	14.96	.409	-3.9
120	11.24	1.147	.6
130	10.12	1.740	2.4
140	11.50	1.470	1.7
150	13.09	1.169	.7
160	17.37	.496	-3.0
170	19.63	.333	-4.8
180	16.58	.754	-1.2
190	15.63	1.046	.2
200	14.89	1.375	1.4

Note:
Specification compliance testing factor (1 meter spacing) to be added to receiver meter reading in dBuV to convert to field intensity in dBuV/meter.

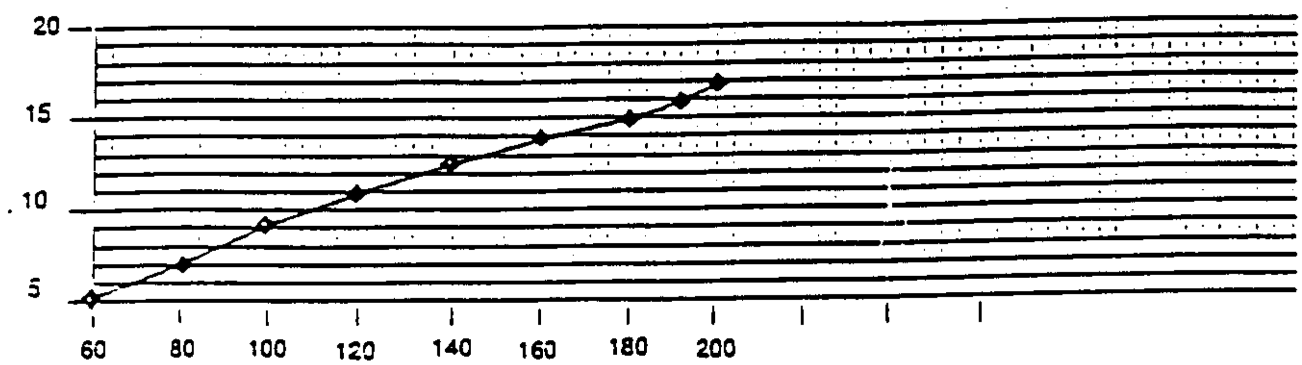
ROBERTS ANTENNA FACTORS

Factors include 30' of RG-58/U cable

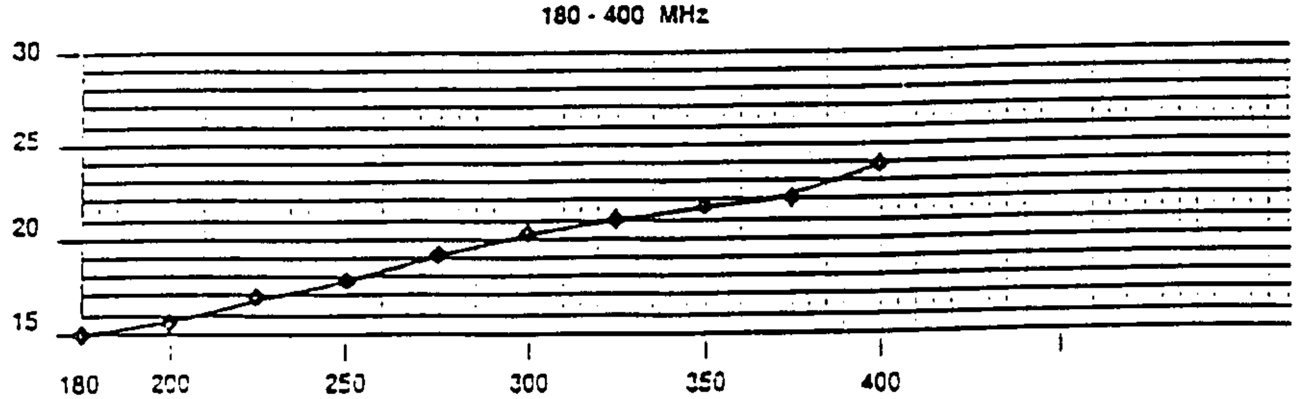
20 - 65 MHz



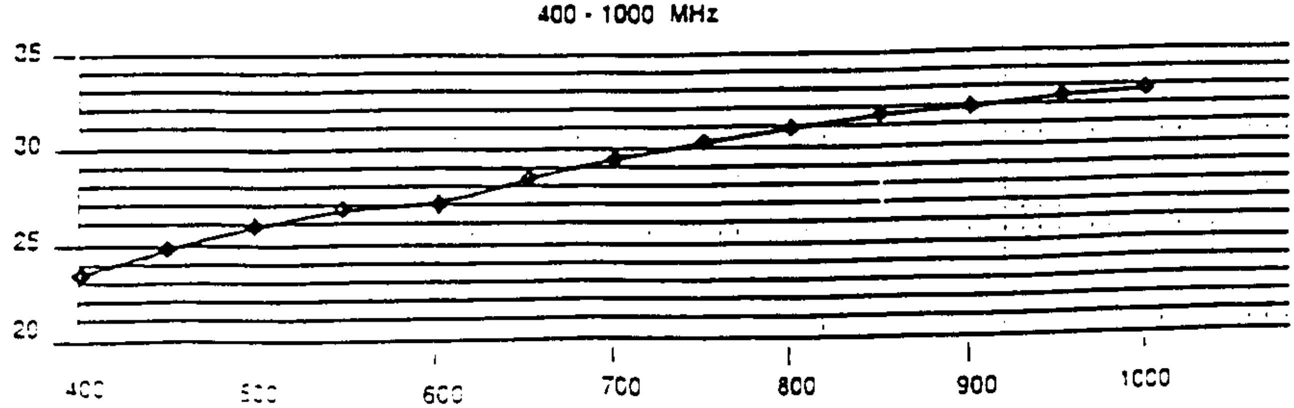
65 - 180 MHz



180 - 400 MHz



400 - 1000 MHz

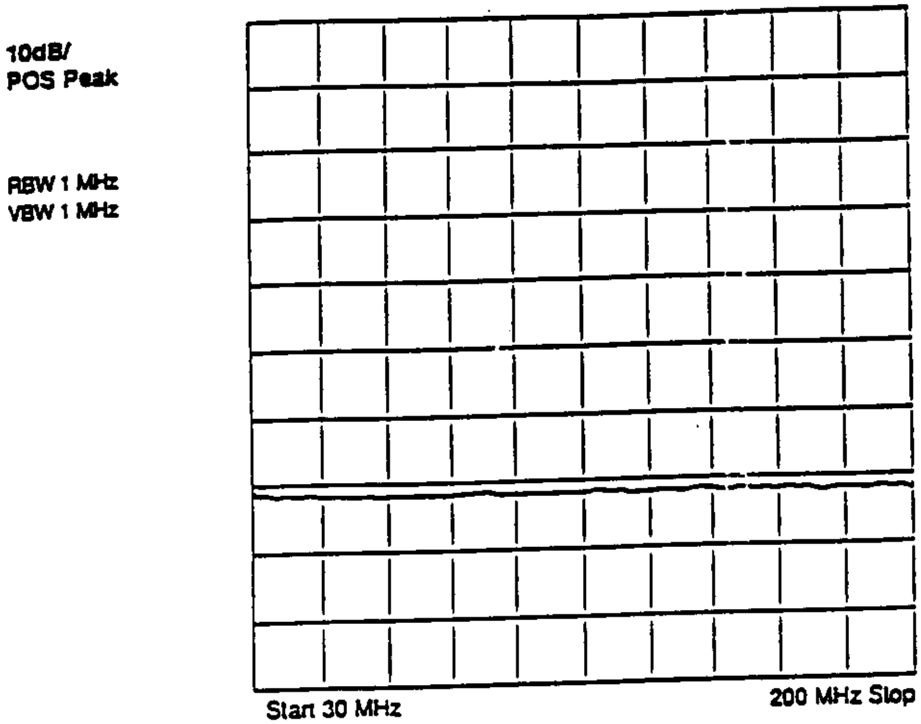


Amplifier Gain for HP 8447D Preamplifier

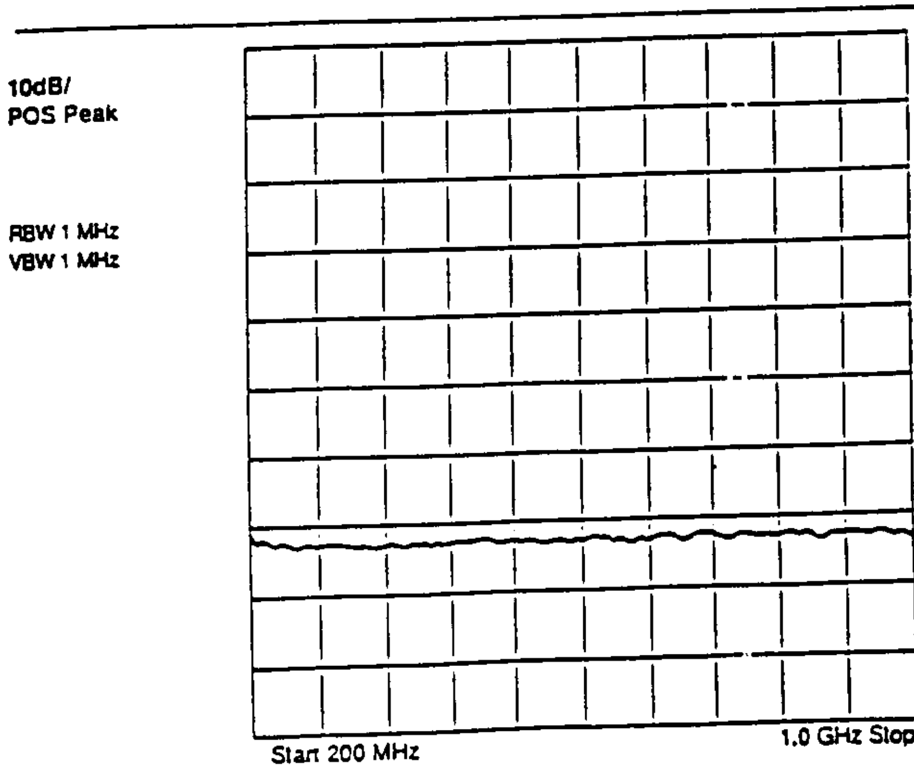
REF. 100.0 dBµV ATTEN 10 dB

Original plotter scans on file

30 MHz. - 200 MHz.



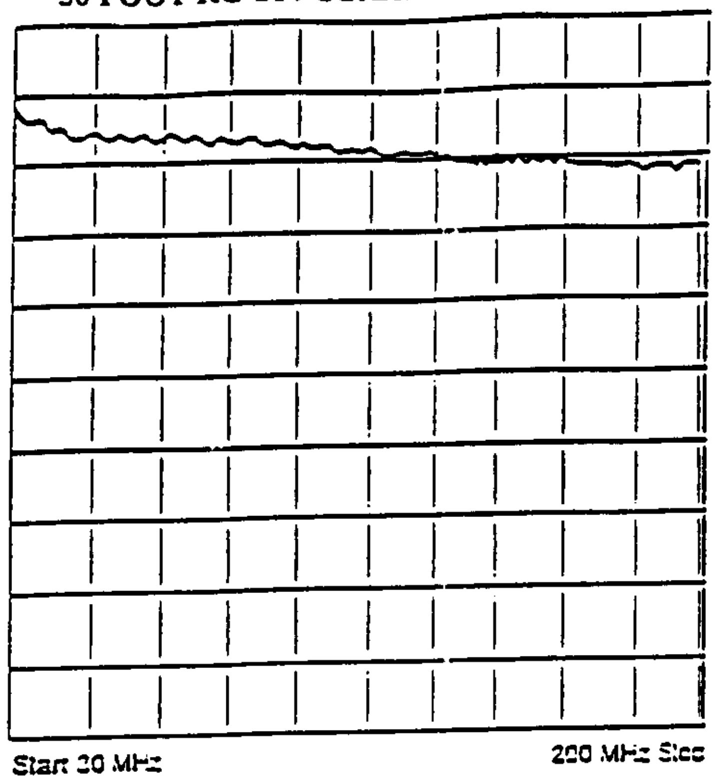
200 MHz - 1.0 GHz



50 FOOT RG-214 COAXIAL CABLE LOSS

1dB/
POS Peak

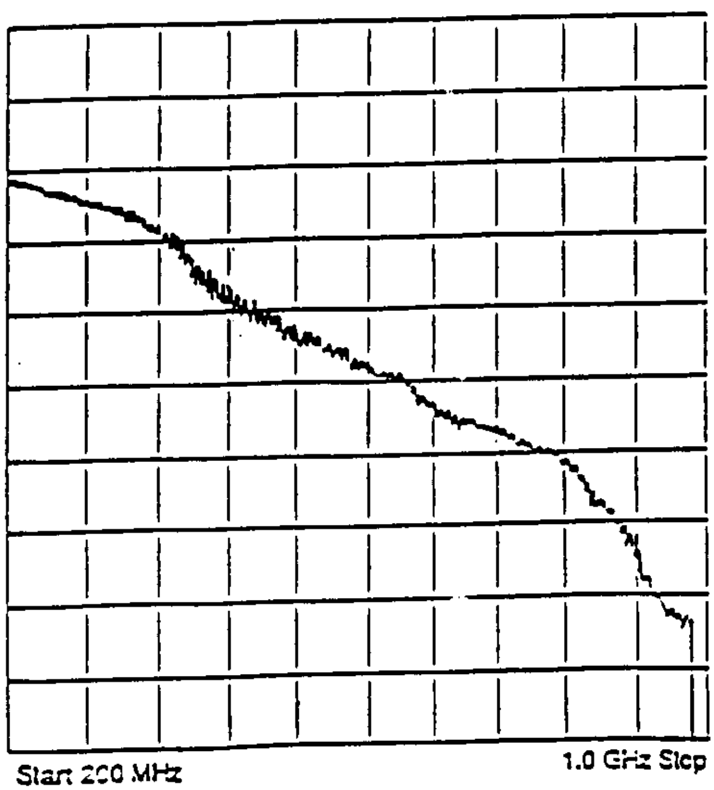
RBW 1 MHz
VBW 3 MHz
SWP 20.0 msec.



30 MHz - 200 MH

1dB/
POS Peak

RBW 1 MHz
VBW 3 MHz
SWP 20.0 msec.



200 MHz - 1.0 GHz

APPENDIX C
Measuring Equipment Error Analysis

1.0 MEASURING EQUIPMENT ERROR ANALYSIS

1.1 Radiated Emissions Measurement

Table 1 shows the calculated measurement accuracy for radiated emissions test (9kHz-1000MHz). The radiated emissions amplitude accuracy is determined as follows: Antenna Factor Error + Cable Loss Error + Pre-amplifier Gain Error + Spectrum Analyzer Amplitude Error. The spectrum analyzer amplitude error is obtained from the manufacturer's specification sheet. Antenna factors are measured at 1 year interval by EMCE Engineering and cable losses as well as amplifier gains are swept at least every month by EMCE Engineering to verify accurate values. The measurement accuracy for these are determined by EMCE.

Table 1
Radiated Emissions Measurement Accuracy

Equipment	Manufacturer	Model		Accuracy
Spectrum Analyzer	Hewlett-Packard	8568B		+/- 1.6dB
Antennas	EMCO/Roberts	3104/Roberts		+/- 1.0dB
Pre-amplifier	Hewlett-Packard	8447D		+/- 0.5dB
Double Shielded Coax Cable	50 ohm, Type N	50 feet	+	+/- 0.5dB
			=	+/- 3.6dB

1.2 Conducted Emissions Measurement

Table 2 shows the calculated measurement accuracy for conducted emissions test (450kHz-30MHz). The conducted emissions amplitude accuracy is determined as follows: LISN Attenuation Error + Cable Loss Error + Spectrum Analyzer Amplitude Error. The spectrum analyzer amplitude error and LISN attenuation error are obtained from the manufacturer's specification sheet. Cable loss below 30MHz is negligible therefore error presented by the cable is not considered.

Table 2
Conducted Emissions Measurement Accuracy

Equipment	Manufacturer	Model		Accuracy
Spectrum Analyzer	Hewlett-Packard	8568B		+/- 1.6dB
LISN	Solar	8012-50-R-24	+	+/- 0.5dB
			=	+/- 2.1dB

APPENDIX D

Certifications

EMCE Facility Certification
Spectrum Analyzer Calibration Certification
Quasi-Peak Detector Calibration Certification

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
Telephone: 301-725-1585 (ext-218)
Facsimile: 301-344-2050

September 30, 1997

IN REPLY REFER TO
31040/SIT
1300F2

EMCE Engineering, Inc.
44370 S. Grimmer Boulevard
Fremont, CA 94538

Attention: Stephen A. Sawyer

Re: Measurement facility located at above address
(3 and 10 meter site)

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for certification or notification under Parts 15 or 18 of the Commission's Rules. Our list will also indicate that the facility complies with the radiated and AC line conducted test site criteria in ANSI C63.4-1992. Please note that this filing must be updated for any changes made to the facility, and at least every three years the data on file must be certified as current.

Per your request, the above mentioned facility has been also added to our list of those who perform these measurement services for the public on a fee basis. This list is updated monthly and is available on the Laboratory's Public Access Link (PAL) at 301-725-1072, and also on the internet at the FCC Web site www.fcc.gov/oet/info/database/testsite/.

Sincerely,

Thomas W. Phillips
Electronics Engineer
Customer Service Branch

TEC RENTALS
Testing Equipment Corporation

2232 Old Middlefield Way, Mountain View, CA 94043

Rentals and Sales of Electronic Test Equipment
(415) 964-3923 (800) 227-1995

CALIBRATION DATA SHEET NO. 972

CUSTOMER		PHONE
Emcee		(510) 492-7056
MANUFACTURER	MODEL NO.	ASSET NR.
HPC	8568B	00488
DATE RECEIVED	☐ REPAIR ☒ CALIBRATE	CONTACT NAME
12-14-97		STEVE

TECHNICIAN	TEMPERATURE
Tom A	68°
CALIBRATION DATE	RELATIVE HUMIDITY
12-14-97	<45%
DUE DATE	
12-14-98	

TEST EQUIPMENT CORPORATION WARRANTS REPAIRS AND CALIBRATION SERVICES TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF THIRTY DAYS FROM DATE OF SERVICE. LIMIT OF LIABILITY UNDER THIS WARRANTY SHALL BE REPLACEMENT OF MATERIALS AND RECALIBRATION OF THE INSTRUMENT. THIS WARRANTY SHALL EXCLUDE EQUIPMENT FAILURES DUE FROM DAMAGES CAUSED BY MISUSE, NEGLIGENCE, ABUSE, ACCIDENT, FIRE, OR OTHER ABNORMAL USE. TEST EQUIPMENT CORPORATION'S STANDARDS ARE TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS. TEC'S CALIBRATION PROCEDURE CONFORMS TO MIL STD- 45662A.

MEASUREMENT STANDARDS USED DURING CALIBRATION

MANUFACTURER	MODEL	ASSET NUMBER	RECALL - DATE
EAf	PTB100	28114	11-27-98
HPC	436A	36750	12-1-98
HPC	8485A	32875	12-1-98
HPC	8350A	21971	9-21-98
HPC	83592A	27847	9-21-98
HPC	355C	36476	3-1-98
HPC	355D	32483	3-1-98

PARTS REPLACED

COMMENTS - INCOMING

CUSTOMER P.O. NO. DATE

LAST CALIBRATION DATE

INOPERATIVE

MEETS MFG.'S SPEC. (NO ADJUSTMENT REQ.) X

OUT OF MFG.'S SPEC.

COMMENTS - OUTGOING

DATE

RECEIVED BY

COMPANY

PAID ☐
BILL ☐

CALIBRATION DATA SHEET NO. 974

TEC RENTALS
Testing Equipment Corporation
2232 Old Middlefield Way, Mountain View, CA 94043
Rentals and Sales of Electronic Test Equipment
(415) 964-3923 (800) 227-1995

CUSTOMER		PHONE
EMCE		(510) 490 4307
MANUFACTURER	MODEL NO.	ASSET NR.
HP	85650A	00485
DATE RECEIVED	☐ REPAIR ☑ CALIBRATE	CONTACT NAME
12-14-97		STEVE

TECHNICIAN	TEMPERATURE
Tom A	68°
CALIBRATION DATE	RELATIVE HUMIDITY
12-14-97	<45%
DUE DATE	
12-14-98	

TEST EQUIPMENT CORPORATION WARRANTS REPAIRS AND CALIBRATION SERVICES TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF THIRTY DAYS FROM DATE OF SERVICE. LIMIT OF LIABILITY UNDER THIS WARRANTY SHALL BE REPLACEMENT OF MATERIALS AND RECALIBRATION OF THE INSTRUMENT. THIS WARRANTY SHALL EXCLUDE EQUIPMENT FAILURES DUE FROM DAMAGES CAUSED BY MISUSE, NEGLIGENCE, ABUSE, ACCIDENT, FIRE, OR OTHER ABNORMAL USE. TEST EQUIPMENT CORPORATION'S STANDARDS ARE TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS. TEC'S CALIBRATION PROCEDURE CONFORMS TO MIL STD- 45662A.

MEASUREMENT STANDARDS USED DURING CALIBRATION

MANUFACTURER	MODEL	ASSET NUMBER	RECALL - DATE
EAG	PTB100	28114	11-27-98
HPC	436A	36750	12-1-98
HPC	8485A	32875	12-1-98
HPC	8350A	21971	9-21-98
HPC	83592A	27847	9-21-98
HPC	355C	36476	3-1-98
HPC	355D	32483	3-1-98

PARTS REPLACED

COMMENTS - INCOMING

CUSTOMER P.O. NO. DATE	
LAST CALIBRATION DATE	
INOPERATIVE	
MEETS MFG.'S SPEC. (NO ADJUSTMENT REQ.)	X
OUT OF MFG.'S SPEC.	

COMMENTS - OUTGOING

DATE	
RECEIVED BY	
COMPANY	
PAID ☐ BILL ☐	

ORIGINAL - WHITE

APPENDIX E
Test Data Sheets

Radiated Emissions

Radiated Emissions (9kHz to 30MHz)
Data Sheet Summary

Equipment Under Test: **Proximity Card Reader**
Model Number: **MB-I-M**
Serial Number: **001**

Measured Frequency (kHz)	Analyzer Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Distance Factor (dB)	PreAmp Gain (dB)	Corrected Reading (dBuV/m)	Spec Limit (dBuV/m)	Pass Margin dB
249.05	14.3	57.5	< 0.5	40	27	5.3	19.6	14.3
375.42	25.0	54.3	< 0.5	40	27	12.8	16.1	3.3
499.57	15.0	56.3	< 0.5	20	27	24.8	33.6	8.8
625.62	20.5	54.4	< 0.5	20	27	28.4	31.7	3.3
750.08	21.3	52.7	< 0.5	20	27	27.5	30.1	2.6
876.13	18.5	51.5	< 0.5	20	27	23.5	28.8	5.3
1002.21	19.7	52.8	< 0.5	20	27	26.0	27.6	1.6
1125.64	No signals noted							
1252.18	No signals noted							

*** NONE OUT OF SPECIFICATION***

Notes:

1. Fundamental Frequency: 125kHz
2. Test Distance: 3 meters
3. Distance Factor: 20log(300/test distance) from 9kHz to 490kHz
   = 20log(300/3) = 40dB
   20log(30/test distance) from 490kHz to 30MHz
   = 20log(30/3) = 20dB
4. Corrected Reading: Analyzer Reading + Antenna Factor + Cable Loss - Distance Factor -PreAmp Gain
5. Spec Limits: 20log(2400/freq in kHz) from 9kHz to 490kHz
   20log(24000/freq in kHz) from 490kHz to 1.7MHz
   29.5dBuV/m from 1.7MHz to 30MHz
6. Antenna Height: 100 cm
7. Antenna Angle: 180 deg

EMCE ENGINEERING, INC.
44370 S. GRIMMER BLVD
FREMONT, CA 94538

DATE: 12/3/98
FILE:

PERFORMED FOR: MICRON COMMUNICATIONS
TEST SPECIMEN: PROXIMITY CARD READER

MODEL NUMBER: MB-I- M
SERIAL NUMBER: 001

LOCATION: VERT POL

FINAL FCC-B, RADIATED RESULTS:

Freq MHz	Analyzer Reading dBuV	CF dB	Correct Reading dBuV/m	Spec Limit dBuV/m	margin dB	Ht cm	Angle Deg
79.97	35.1	-16.5	18.64	40.00	21.36	150	356
112.13	35.3	-11.5	23.84	43.00	19.16	155	241
128.15	41.6	-11.8	29.84	43.00	13.16	178	347
144.17	37.8	-11.8	25.96	43.00	17.04	159	360
160.19	32.1	-13.4	18.74	43.00	24.26	155	359

NONE OUT OF SPECIFICATION

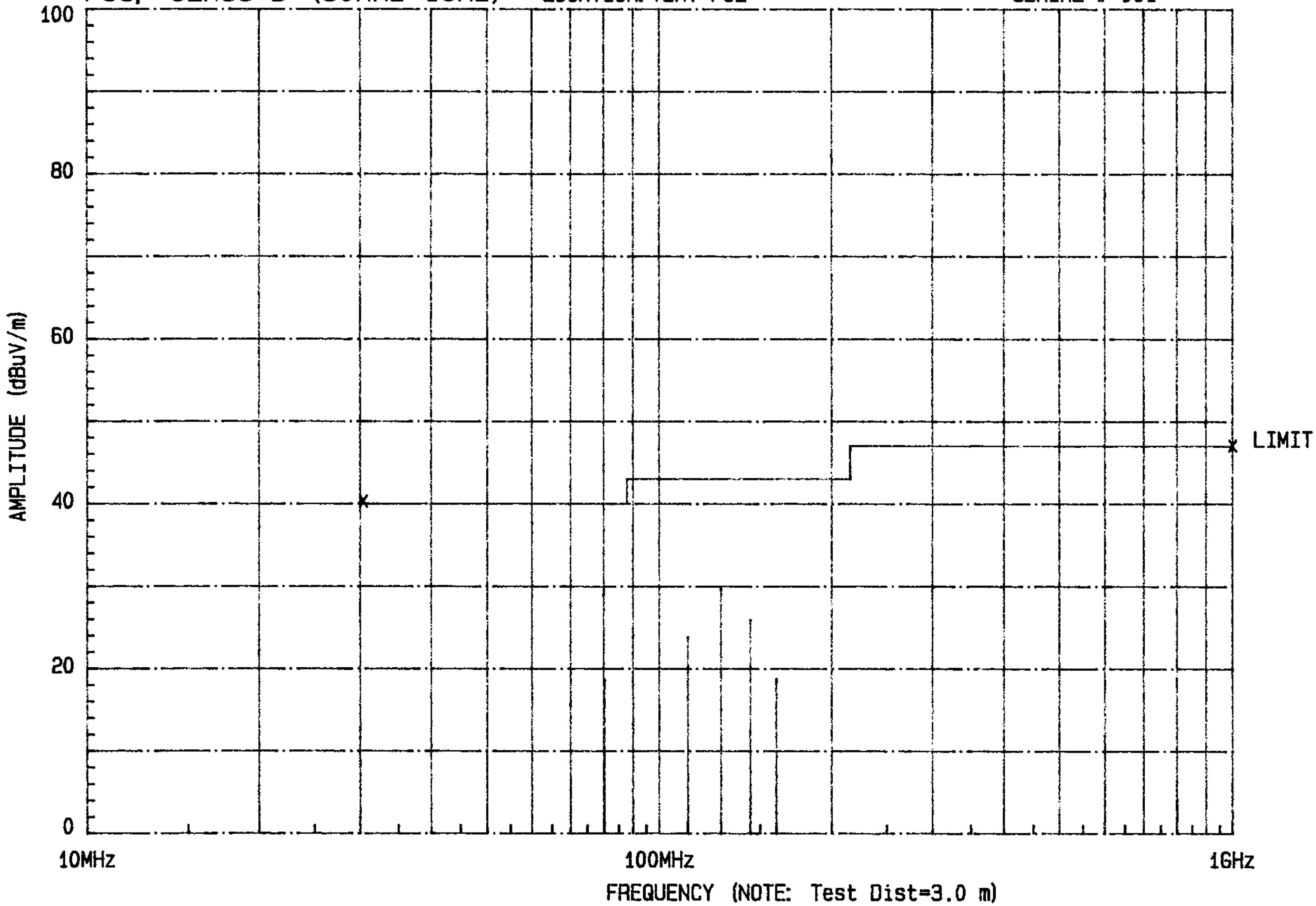
COMMENTS: Test Dist = 3.0 m. QP detector ON.
SAMPLE CALCULATION:
At 160.19 MHz
Analyzer Reading = 32.10 dBuV
Correction Factor,CF,= AF 10.44 dB + Cable 3.20 dB
-Preamp Gain 27.00 dB =-13.36 dB
CORRECTED READING = 18.74 dBuV/m

VERIFIED BY Don Bullis

EMCE ENGINEERING INC. 44370 S. GRIMMER BLVD. FREMONT, CA 94538 DATE: 12/3/98

NARROWBAND RADIATED EMI
FCC, CLASS B (30MHz-1GHz)

PERFORMED FOR: MICRON COMMUNICATIONS MODEL # MB-I- M
LOCATION: VERT POL SERIAL # 001



EMCE ENGINEERING, INC.
44370 S. GRIMMER BLVD
FREMONT, CA 94538

DATE: 12/3/98
FILE:

PERFORMED FOR: MICRON COMMUNICATIONS
TEST SPECIMEN: PROXIMITY CARD READER

MODEL NUMBER: MB-I- M
SERIAL NUMBER: 001

LOCATION: HORIZ POL

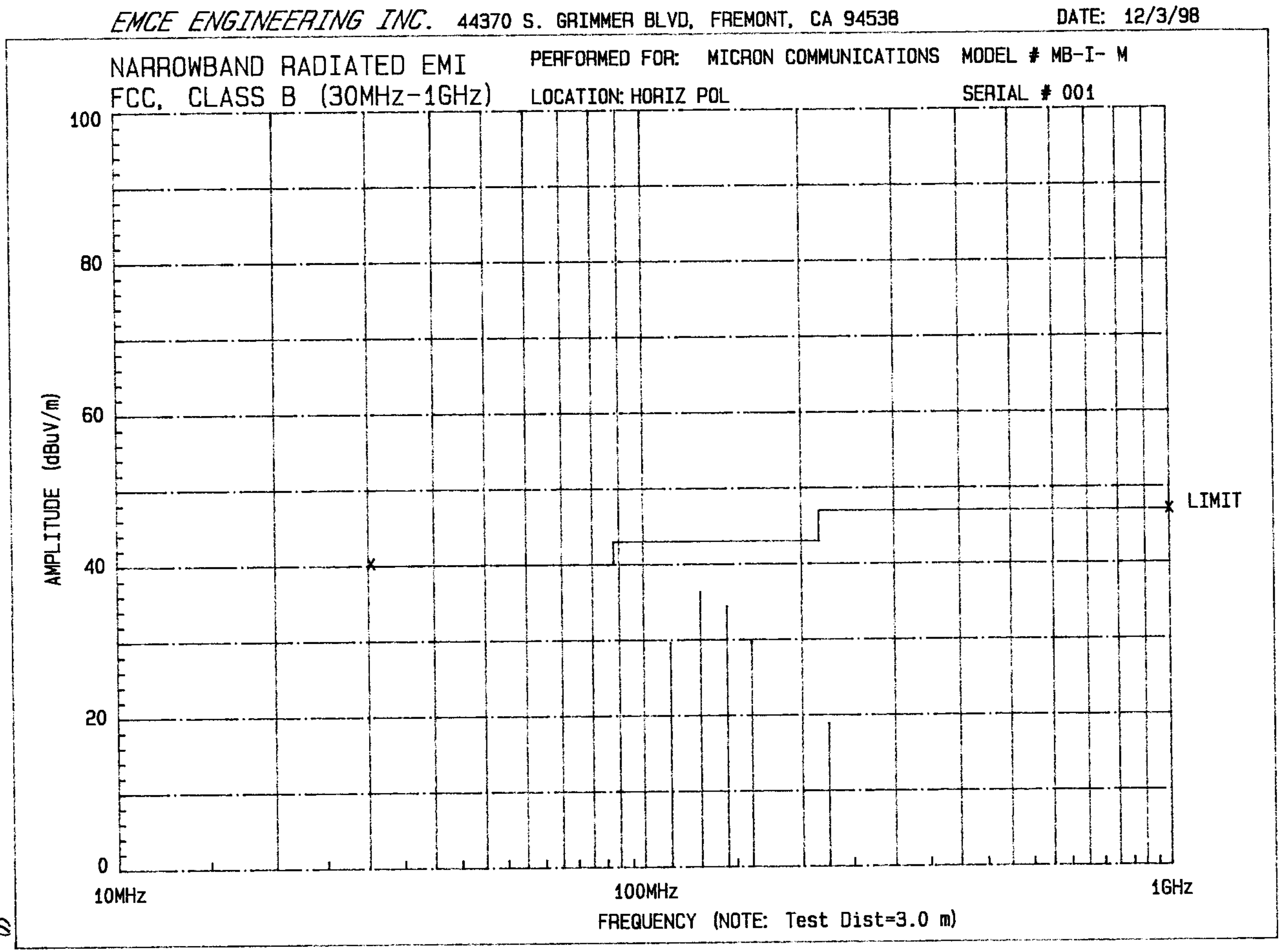
FINAL FCC-B, RADIATED RESULTS:

Freq MHz	Analyzer Reading dBuV	CF dB	Correct Reading dBuV/m	Spec Limit dBuV/m	margin dB	Ht cm	Angle Deg
112.13	41.1	-11.5	29.64	43.00	13.36	174	271
128.15	48.1	-11.8	36.34	43.00	6.66	156	180
144.17	46.3	-11.8	34.46	43.00	8.54	155	277
160.19	43.1	-13.4	29.74	43.00	13.26	151	272
224.26	29.1	-10.2	18.91	47.00	28.09	150	277

NONE OUT OF SPECIFICATION

COMMENTS: Test Dist = 3.0 m. QP detector ON.
SAMPLE CALCULATION:
At 224.26 MHz
Analyzer Reading = 29.10 dBuV
Correction Factor,CF,= AF 12.96 dB + Cable 3.84 dB
-Preamp Gain 27.00 dB =-10.19 dB
CORRECTED READING = 18.91 dBuV/m

VERIFIED BY Don Bullard


EMCE ENGINEERING INC. 44370 S. GRIMMER BLVD, FREMONT, CA 94538
DATE: 12/3/98
NARROWBAND RADIATED EMI
FCC, CLASS B (30MHz-1GHz)
PERFORMED FOR: MICRON COMMUNICATIONS MODEL # MB-I- M
LOCATION: HORIZ POL
SERIAL # 001
100
80
60
40
20
0
AMPLITUDE (dBuV/m)
LIMIT
10MHz
100MHz
1GHz
FREQUENCY (NOTE: Test Dist=3.0 m)

PRE AMP USED

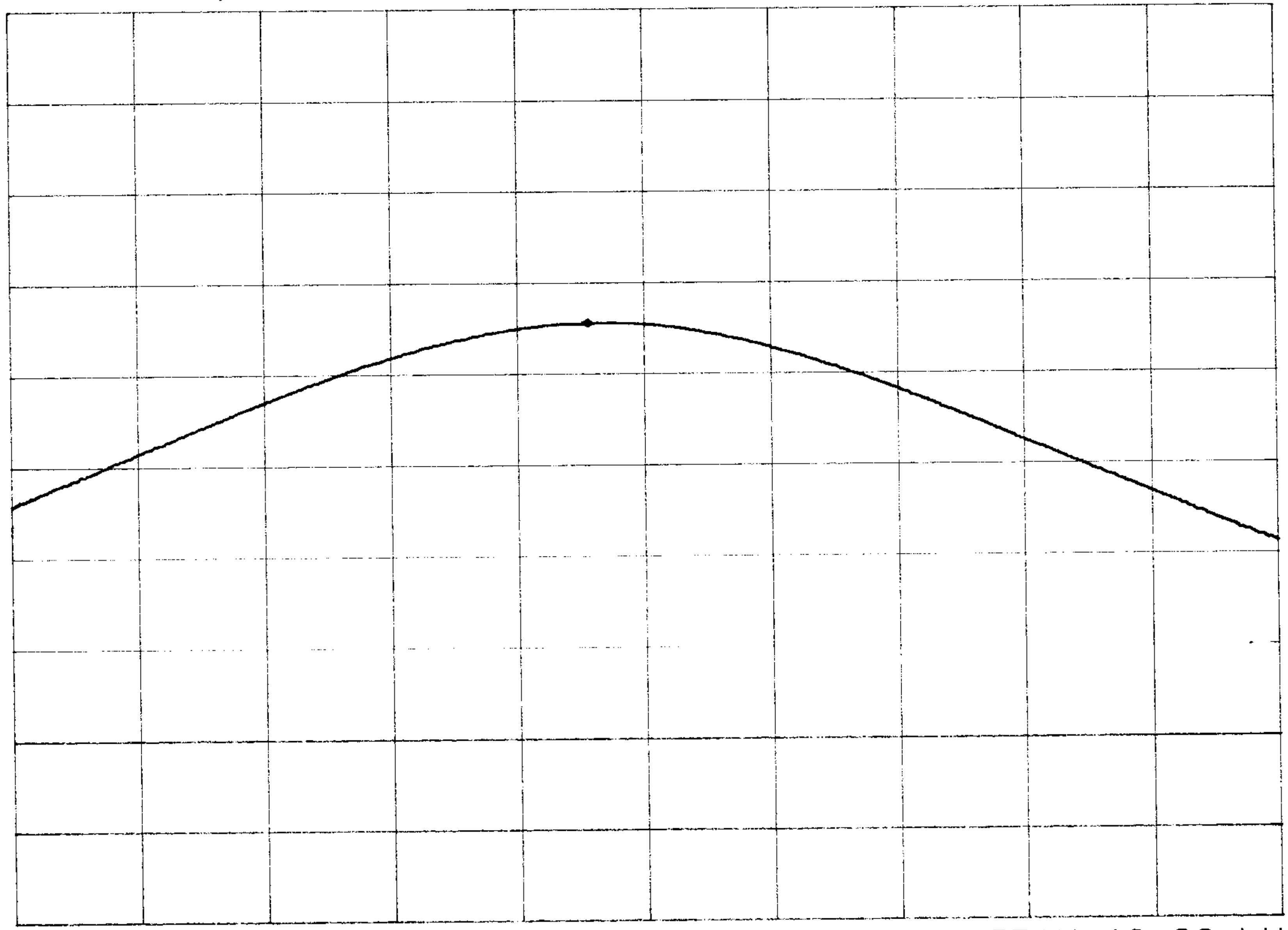
M/N: MB-I-M

3METERS	DATE	ANTENNA	ANGLE	HEIGHT
3M TD	12/4/98	LG105A	180DEG	100AH

hp REF 100.0 dBµV ATTEN 10 dB

MKR 124.75 kHz
65.60 dBµV

10 dB/



CENTER 125.20 kHz
RES BW 3 kHz
VBW 3 kHz
SPAN 10.00 kHz
SWP 100 msec

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1st

PRE-AMP USED

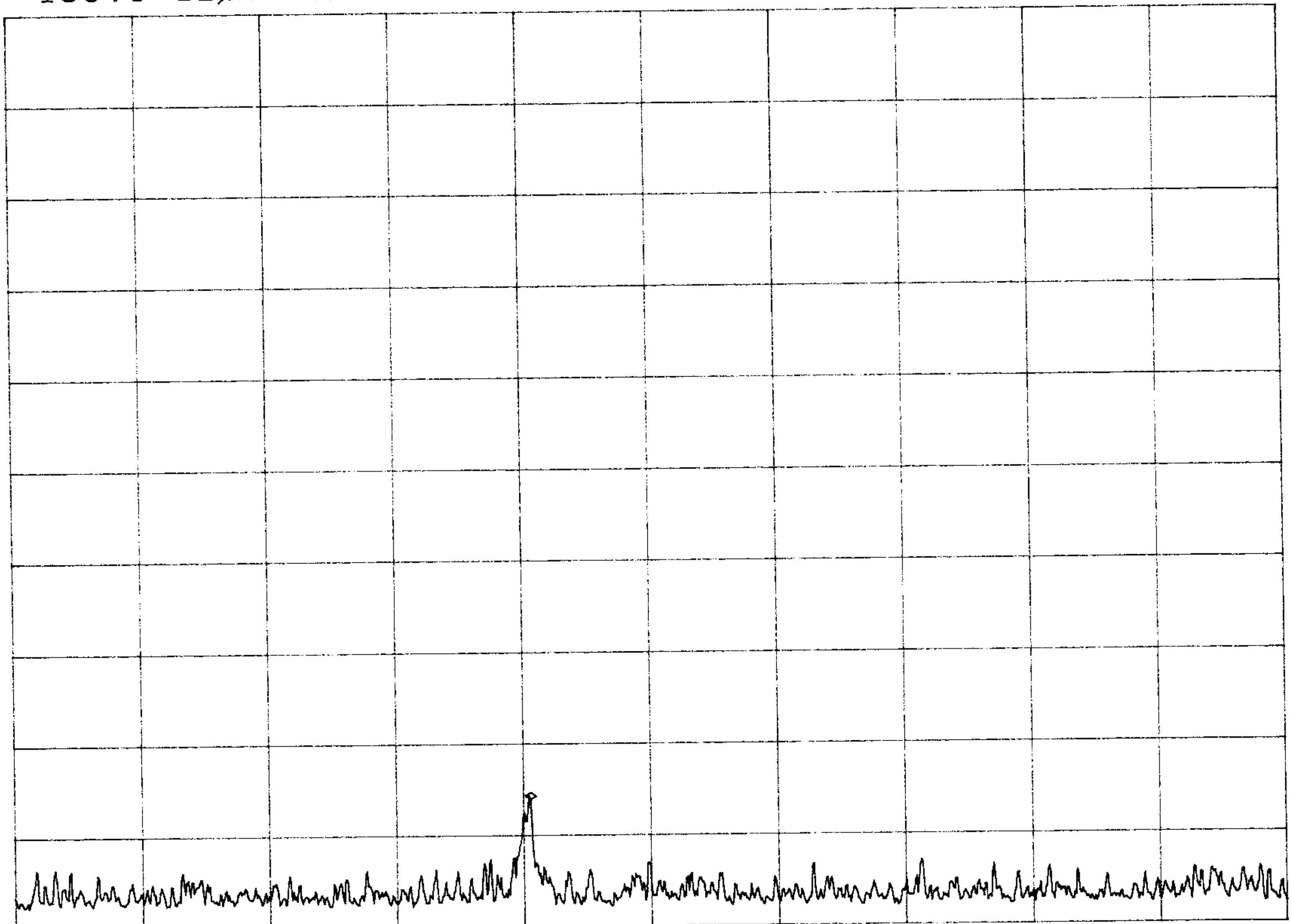
MN: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT
3M TD 12/4/98 LP 105 180DEG 210AH

hp REF 100.0 dBμV ATTEN 10 dB

MKR 249.05 kHz
14.30 dBμV

10 dB/



CENTER 250.00 kHz
RES BW 100 Hz VBW 100 Hz
SPAN 10.00 kHz
SWP 3.0 sec

2nd

PRE AMP USED

MW: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT

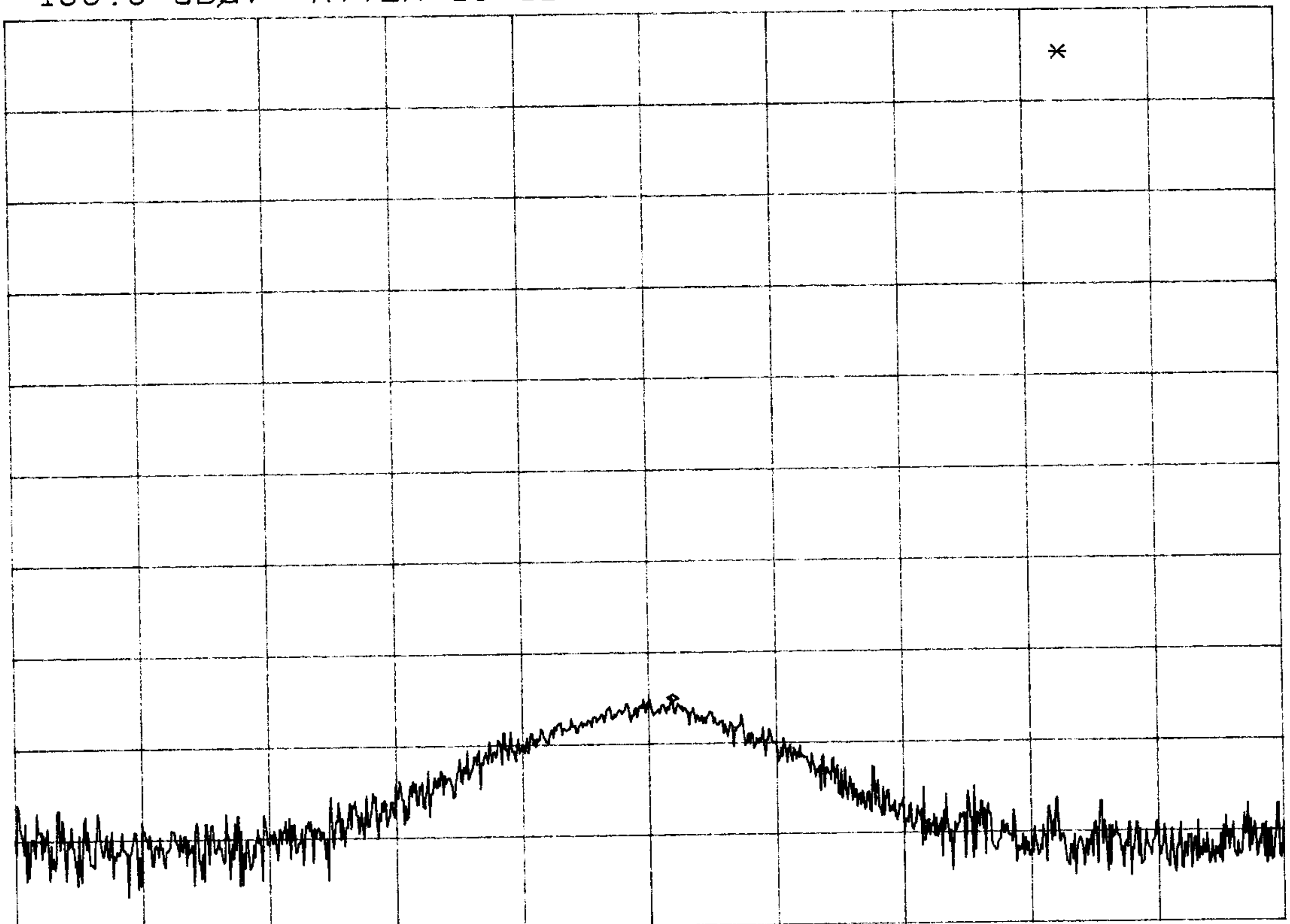
3M TD 12/4/98 LP 105 180DEG 100AH

MKR 375.424 kHz

25.00 dBμV

hp REF 100.0 dBμV ATTEN 10 dB

10 dB/



CENTER 375.388 kHz

RES BW 300 Hz VBW 3 kHz

SPAN 2.000 kHz

SWP 1.0 sec

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3rd

PRE AMP USED

M/N: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT

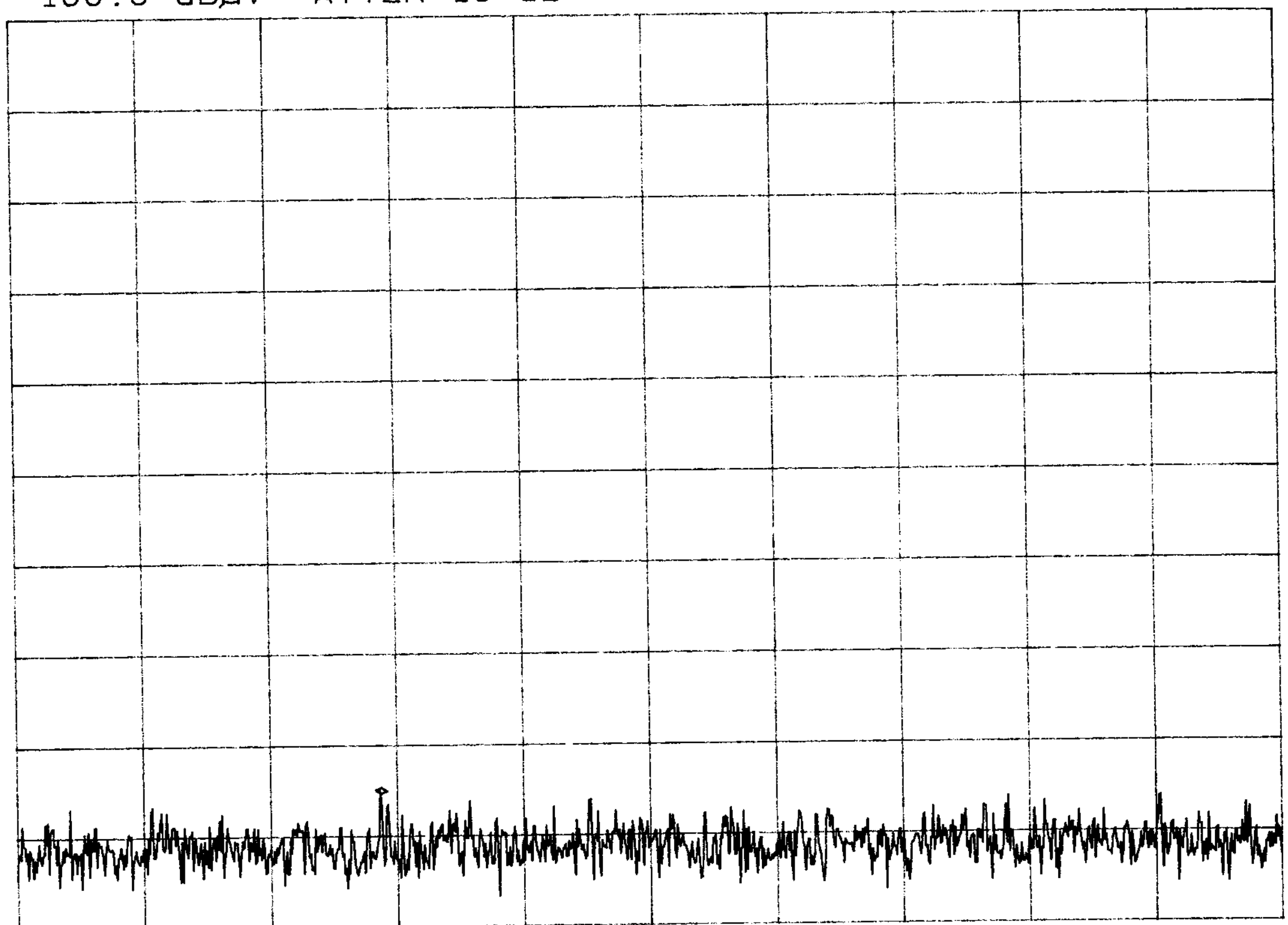
3M TD 12/4/98 LP 105 180DEG 100AH

MKR 499.574 kHz

15.00 dBµV

hp REF 100.0 dBµV ATTEN 10 dB

10 dB/



CENTER 500.000 kHz

RES BW 300 Hz

VBW 3 kHz

SPAN 2.000 kHz

SWP 1.0 sec

4th

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PRE-AMP USED

M/W: MB-I-M

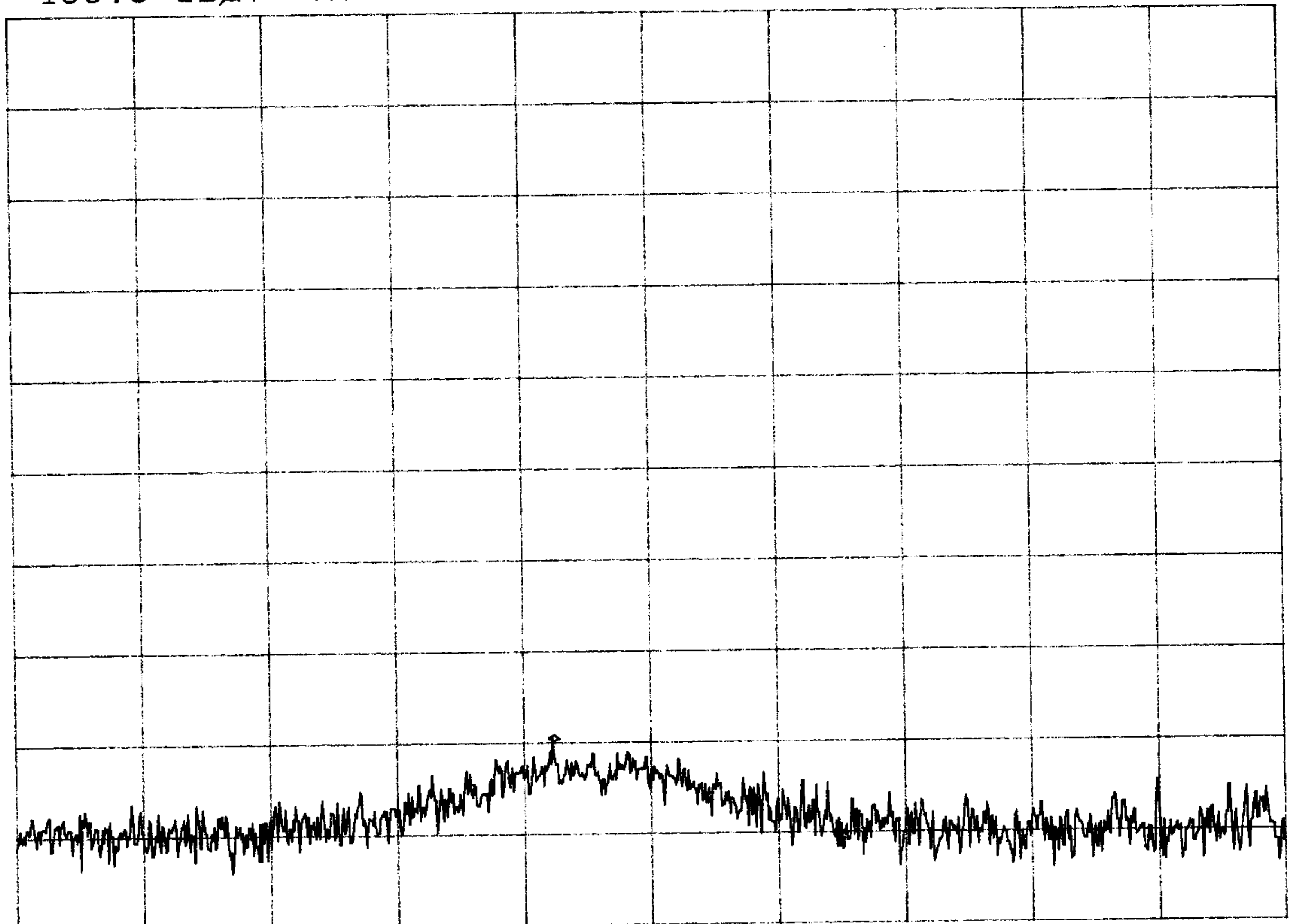
3 METERS DATE ANTENNA ANGLE HEIGHT

3M TD 12/4/98 LP 105 180DEG 100AH

MKR 625.620 kHz
20.50 dBµV

hp REF 100.0 dBµV ATTEN 10 dB

10 dB/



CENTER 625.774 kHz
RES BW 300 Hz VBW 3 kHz

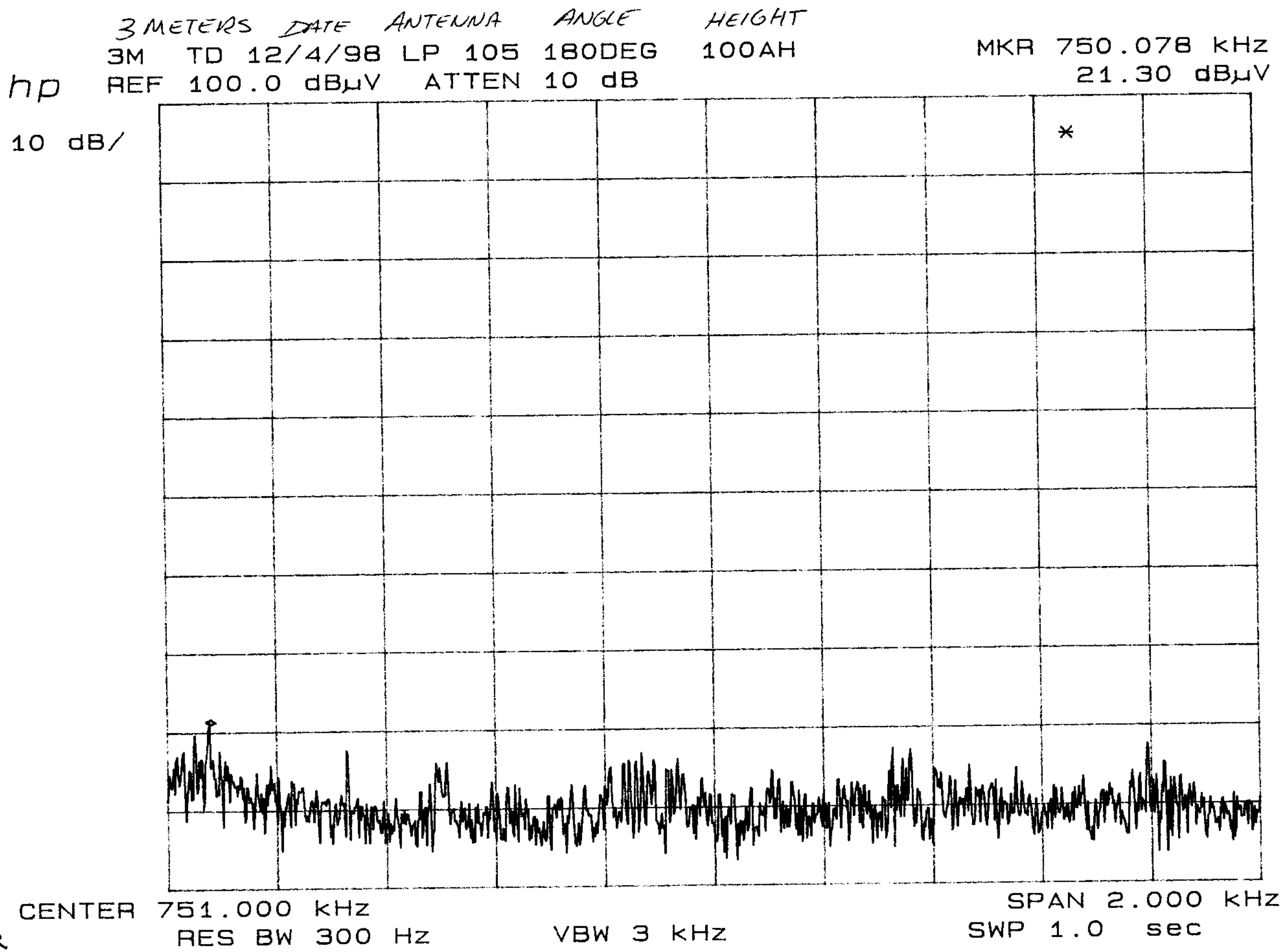
SPAN 2.000 kHz
SWP 1.0 sec

55 of 69

5th

PRE AMPUSED

M/N: MB-I-M



6th

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PRE-AMP USED

M/N: MB-I -M

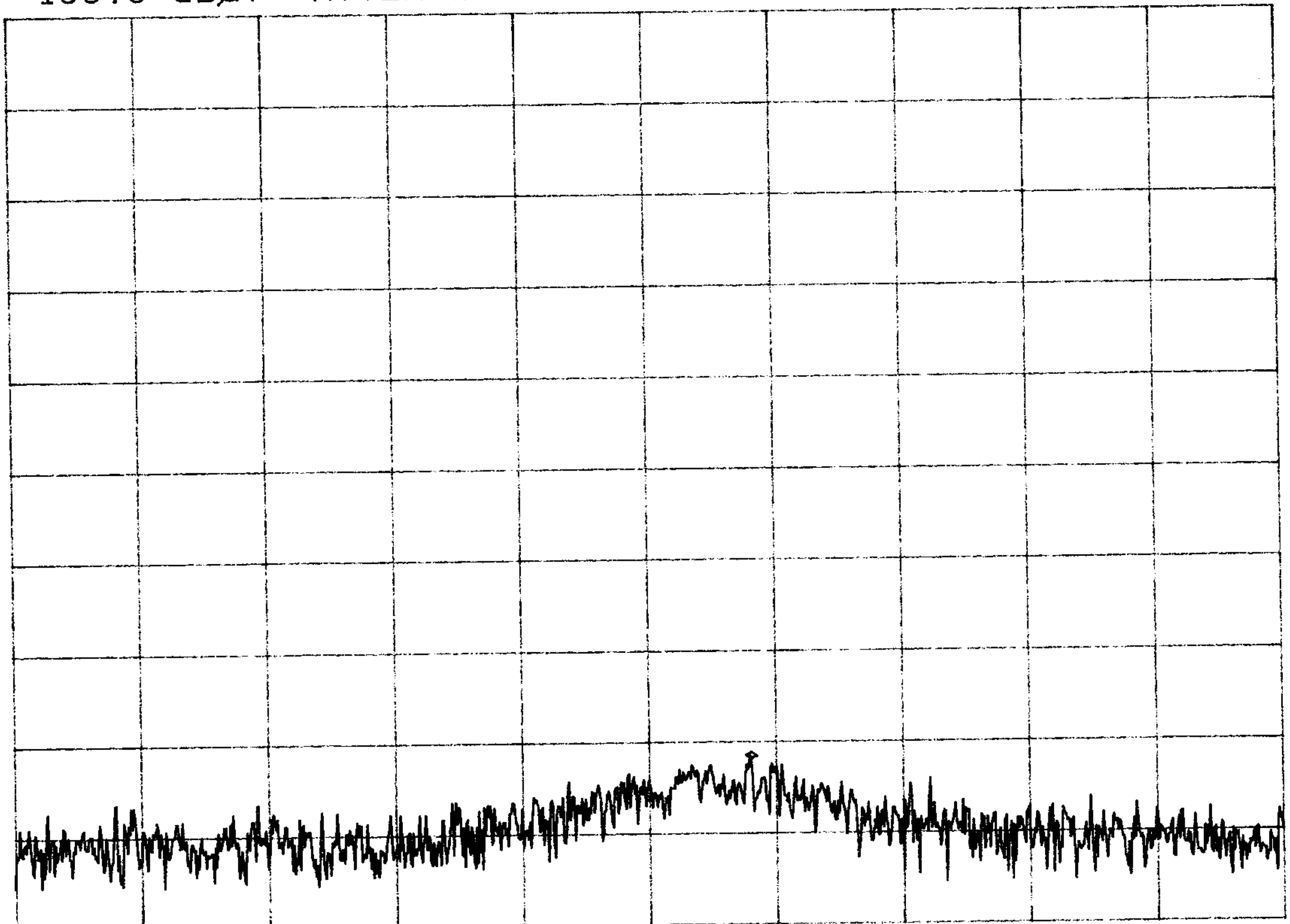
3METERS DATE ANTENNA ANGLE HEIGHT

3M TD 12/4/98 LP 105 180DEG 100AH

hp REF 100.0 dBµV ATTEN 10 dB

MKR 876.134 kHz
18.50 dBµV

10 dB/



CENTER 875.974 kHz
RES BW 300 Hz VBW 3 kHz

SPAN 2.000 kHz
SWP 1.0 sec

7th

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PRE-AMP USED

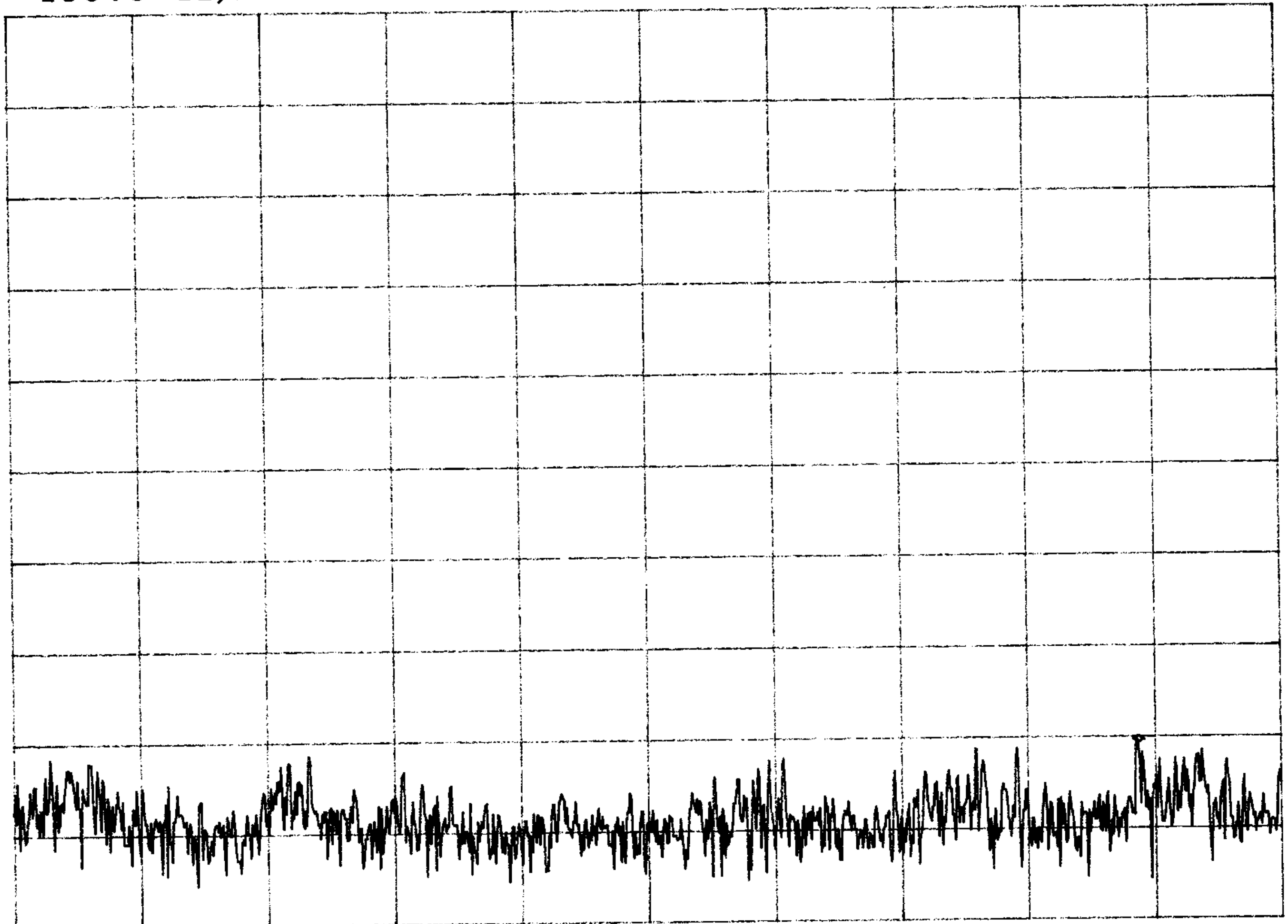
M/W: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT
3M TD 12/4/98 LP 105 180DEG 100AH

MKR 1.002212 MHz
19.70 dBµV

hp REF 100.0 dBµV ATTEN 10 dB

10 dB/



CENTER 1.001440 MHz
RES BW 300 Hz

VBW 3 kHz

SPAN 2.000 kHz
SWP 1.0 sec

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8th

PRE AMP USED

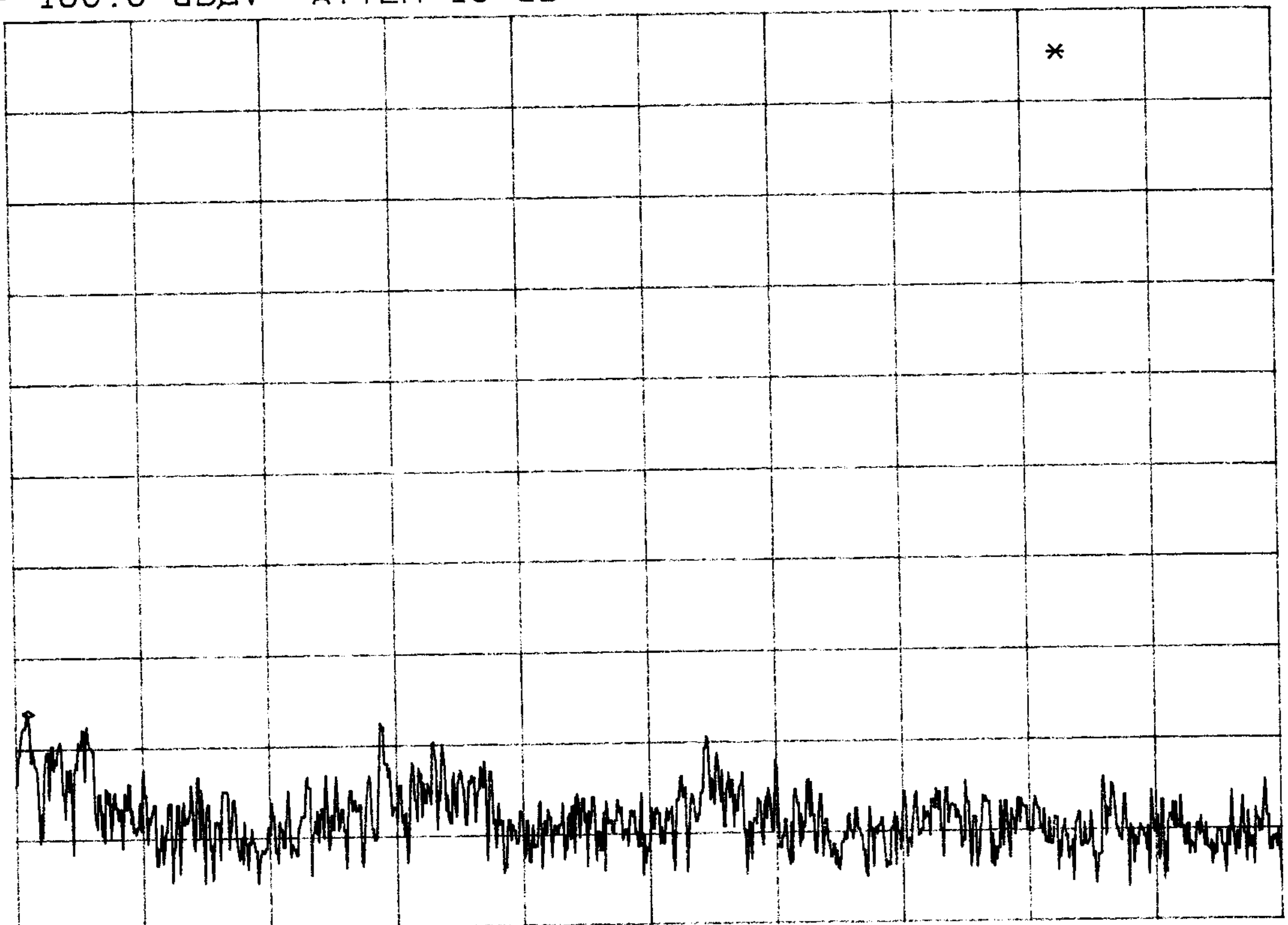
M/N: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT
3M TD 12/4/98 LP 105 180DEG 100AH

MKR 1.125638 MHz
23.90 dBµV

hp REF 100.0 dBµV ATTEN 10 dB

10 dB/



CENTER 1.126620 MHz
RES BW 300 Hz VBW 10 kHz

SPAN 2.000 kHz
SWP 1.0 sec

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9th

PRE-AMP USED

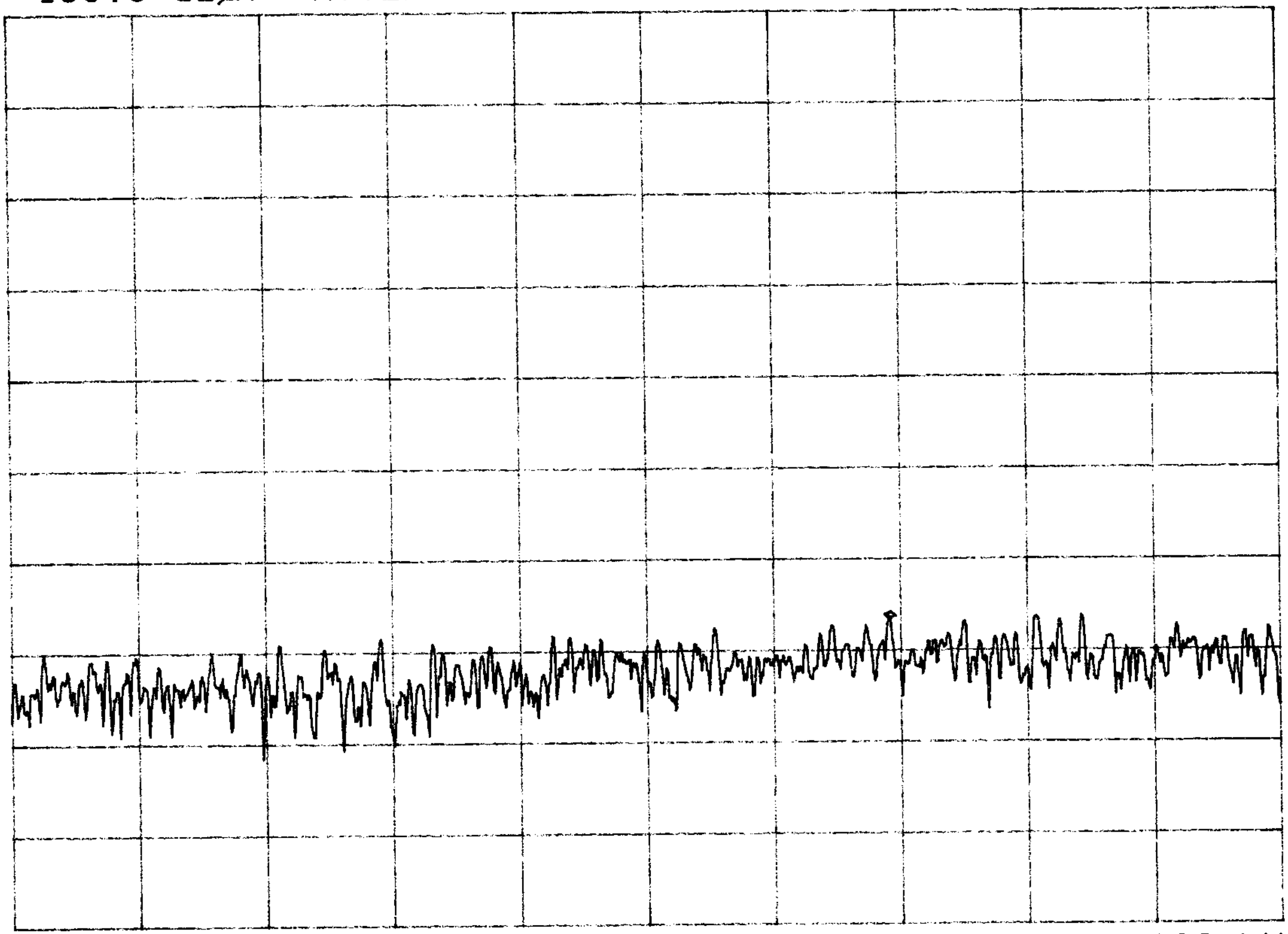
M/N: MB-I-M

3 METERS DATE ANTENNA ANGLE HEIGHT
3M TD 12/4/98 LP 105 180DEG 100AH

MKR 1.252182 MHz
33.80 dBμV

hp REF 100.0 dBμV ATTEN 10 dB

10 dB/



CENTER 1.251800 MHz
RES BW 30 kHz VBW 30 kHz

SPAN 2.000 kHz
SWP 20 msec

10th

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