FCC PART 15 CLASS B
EMI MEASUREMENT AND TEST REPORT

FOR

MICROTEK LABS. INC.

3715 Doolittle Drive
Redondo, CA 90278

FCC ID: EF9MRS-1200LC

August 21, 1998

This Report Concerns:	**Equipment Type:**
☒ Original Report	Scanner - Subassembly, ITE

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Test Date:	July 19, 1998
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The MICROTEK LAB. INC.'s MRS-1200LC or the "EUT" as referred to in this report is a 36-bit, legal-size high-resolution scanner.

The EUT has a four-layered printed circuit board and a two-layered printed Power Supply circuit boards.

The EUT measures approximately 21.5"L x 12.0"W x 3.5"H.

1.2 Objective

The following Class B report is prepared on behalf of *MICROTEK LAB. INC.* in accordance with Part 2, Subpart J, and Part 15, Subparts A and B of the Federal Communication Commissions rules and regulations and to ICES-003 of the Canadian Interference-Causing Equipment Regulations.

The objective of the manufacturer is to demonstrate compliance with FCC Part 15 Class B limits and to ICES-003 requirements for Information Technology Equipment.

1.3 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, Corp. The radiated testing was performed at an antenna-to-EUT distance of 10 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, Suite 2, Sunnyvale, California, USA.

Test sites 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.

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-674 and R-657. The test sites has been approved by the FCC and 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 22: 1993, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of

Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.5 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8568B	2610A02165	2/6/99
HP	Spectrum Analyzer	8593B	2919A00242	12/20/98
HP	Amplifier	8349B	2644A02662	12/20/98
HP	Quasi-Peak Adapter	85650A	917059	2/6/99
HP	Amplifier	8447E	1937A01046	2/6/99
A.H. System	Horn Antenna	SAS0200/571	261	2/27/99
Com-Power	Log Periodic Antenna	AL-100	16005	1/2/99
Com-Power	Biconical Antenna	AB-100	14012	1/2/99
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/98
Com-Power	LISN	LI-200	12208	12/20/98
Com-Power	LISN	LI-200	12005	12/20/98
BACL	Data Entry Software	DES1	0001	12/20/98

1.6 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
MICROTEK LAB. INC.	Scanner	MRS-1200LC	985A201341	EF9MRS-1200LC

1.7 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
EPoX	Motherboard	EP-61BXA-M	980348300	None
SONY	Floppy Drive	MPF920E	50478514	None
SPI	Power Supply	SPI-235HP	W10872277	None
Jaton	Video Card	VCS38261 PCI	None	None
In Win	Chassis	Q-500	None	None

1.8 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Epox	PC System	Full Tower	None	None
Honeywell	Keyboard	102RXi	A0339	GJK101RX-5
Microsoft	Mouse	Mouse2.0A	00826824	C3JSMP1
NEC	Monitor	JC-14W1VMA	5122300408	C5F7NFCMC1423B
Everex	Modem	EV-945	None	E3E5UVEV-945

1.9 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded Printer Cable	2.0	Parallel Port/Host	Scanner/EUT
Shielded Keyboard Cable	1.6	Keyboard /Host	Keyboard
Shielded Mouse Cable	1.8	Mouse/Host	Mouse
Shielded Video Cable	1.8	Video Card/Host	Monitor
Shielded Modem Cable	1.5	Modem Port/Host	Modem

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as a normally used by a typical user).

The motherboard provided the following I/O ports and connectors: two (2) serial ports, one (1) parallel port, one (1) ATX keyboard port, one (1) floppy interface connector, and two (2) IDE interface connectors.

The EUT was tested in the native mode to represent worst case results during the final qualification test. The parallel port (LPT1), ATX keyboard port, and both serial ports (COM1 and COM2) were also tested.

2.2 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software, contained on the hard drive is started the Windows 95 terminal program under the Windows 95 operating system. Once loaded, the program sequentially exercises each system component.

The sequence used is as follows:

1) Send H pattern to the monitor
2) The H program sends commands to the PC System.
3) The modem receives Hs.

This process is continuous throughout all tests.

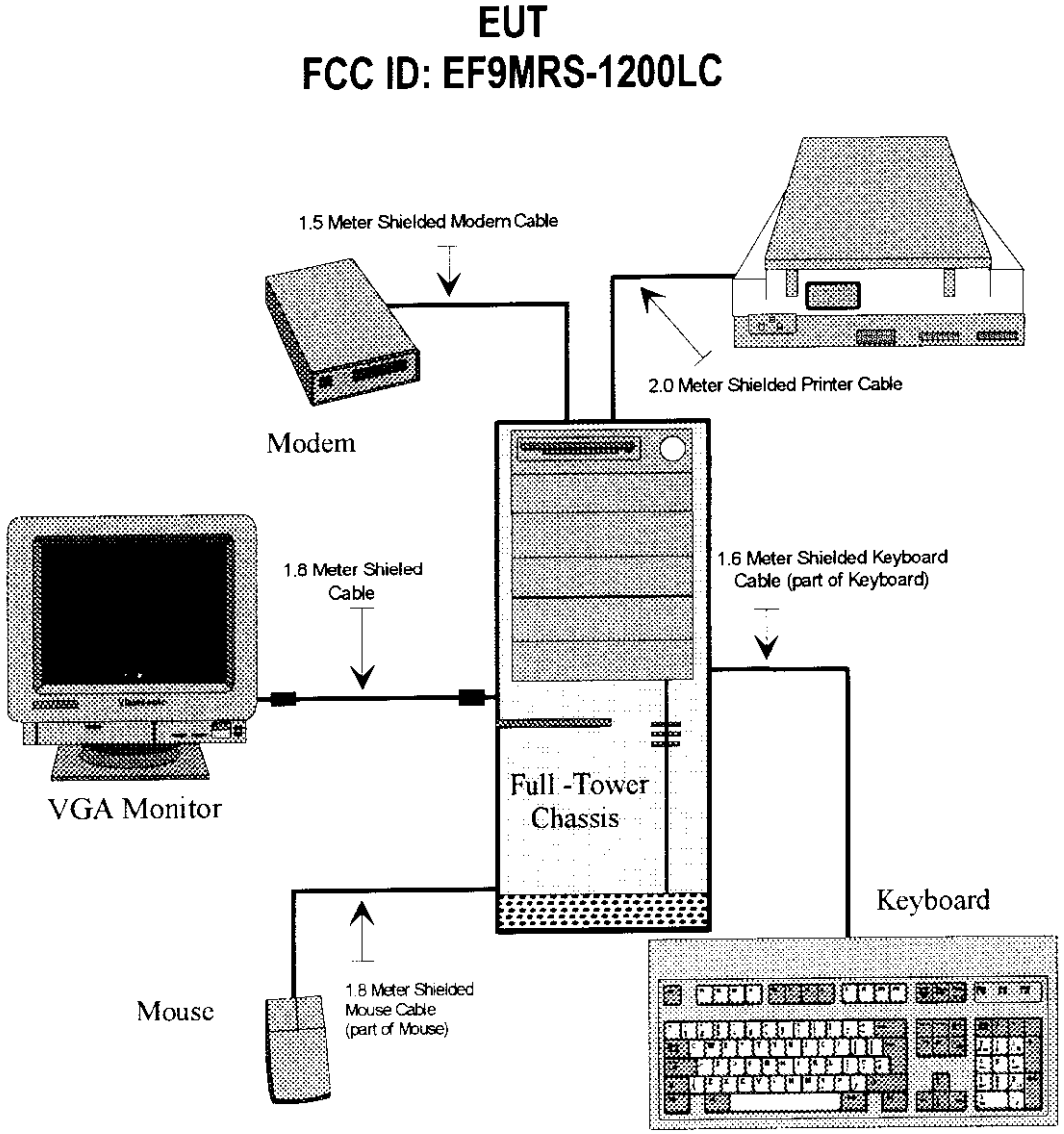
2.3 Special Accessories

As shown in section 2.5, all interface cables used for compliance testing are shielded as normally supplied by INMAC and their respective support equipment manufacturers. The monitor featured shielded metal connectors.

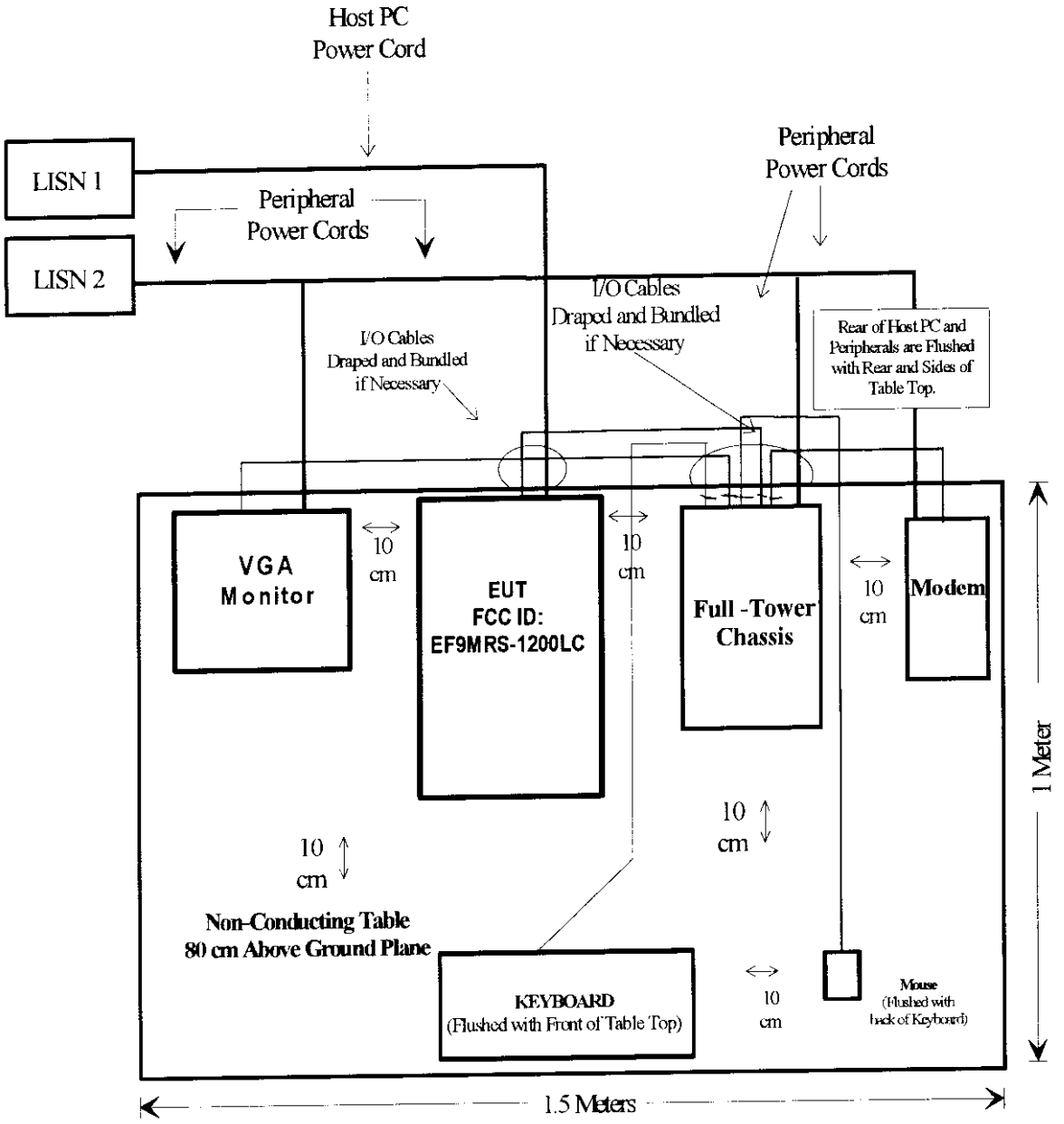
2.4 Schematics / Block Diagram

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

2.5 Configuration of Test System



2.6 Test Setup Block Diagram



2.7 Equipment Modifications

No modification(s) were necessary for the EUT to comply with the applicable standards and limits.

3 - CONDUCTED EMISSIONS TEST DATA

3.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

3.2 EUT Setup

The measurement was performed at the Open Area Test Site, using the same setup per ANSI C63.4 - 1992 measurement procedure. The specification used was the EN55022 Class B limits.

The EUT was placed on the test table. The VGA monitor was placed on one side of the EUT with the Full Tower chassis and the modem on the other side. The rear of the host system and peripherals were placed flushed with the rear/sides of the tabletop.

The keyboard was placed in front of the EUT, flushed with the front of the tabletop. The mouse was placed next to the keyboard and flushed with the back of the keyboard.

The spacing between the peripherals was 10 cm.

3.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configuration during the conduction test:

Start Frequency	150 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	100 kHz
Video Bandwidth	100 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

3.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN. The VGA monitor and all other support equipment power cords were connected to the auxiliary power outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (less than -4 dBμV). Quasi-peak readings are distinguished with a "**Qp**".

The EUT was operating at normal (native) mode tested during the final qualification test to represent worst case results.

Additionally, the EUT was tested with the *EUT Inside Power Supply (110 V)*.

3.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the EN55022 Conducted margin for a Class B device and these test results is deemed as satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

> **-14.0 dBμV** at **0.180 MHz** in the **Line** mode, native operating mode with the *EUT Inside* power supply (110V).

3.6 Conducted Emissions Test Data

3.6.1 Test Data with EUT Inside Power Supply, 110V, 0.15 - 30 MHz.

LINE CONDUCTED EMISSIONS				EN55022 CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	DBμV	Qp/Ave/Peak	Line/Neutral	dBμV	dB
0.180	50.5	QP	Line	64.5	-14.0
0.270	45.8	QP	Neutral	61.1	-15.3
16.990	29.5	QP	Line	60.0	-30.5
16.900	27.8	QP	Neutral	60.0	-32.2
3.080	20.7	QP	Line	56.0	-35.3
7.430	20.0	QP	Neutral	60.0	-40.0

3.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data with *EUT Inside Power Supply* is presented in Appendix B of this report as reference.

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 - 1992. The specification used was the FCC Part 15 Class B limits.

The EUT was placed on the test table. The VGA monitor was placed on one side of the EUT with the Full Tower chassis and the modem on the other side. The rear of the host system and peripherals were placed flushed with the rear/sides of the tabletop.

The keyboard was placed in front of the EUT, flushed with the front of the tabletop. The Mouse was placed next to the keyboard, Which was placed flushed with the back of the keyboard.

The spacing between the peripherals was 10 cm.

4.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, since the internal operating clock speed is below 108 MHz, the system was tested to 1000 MHz.

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

Start Frequency	30 MHz
Stop Frequency	1000 MHz
Sweep Speed	Auto
IF Bandwidth	100 KHz
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, VGA monitor and all support equipment were connected to the AC floor outlet since the power supply used inside the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the highest emissions to ensure EUT is compliant 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 (less than -4 dBμV), and are distinguished with a "**Qp**" in the data table.

The EUT was operating at normal (native) mode tested during the final qualification test to represent worst case 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 FCC Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Class B Limit

4.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the EN55022 Class B standards and these test results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, and had the worst margin of:

-4.1 dBμV at **80.03 MHz** in the **Vertical** polarization.

-3.4 dBμV at **80.03 MHz** in the **Vertical** polarization – **After maximized procedure.**

4.7 Radiated Emissions Test Data

4.7.1 Test Data for Normal (Native) Mode, 30-1000 MHz –3 meters

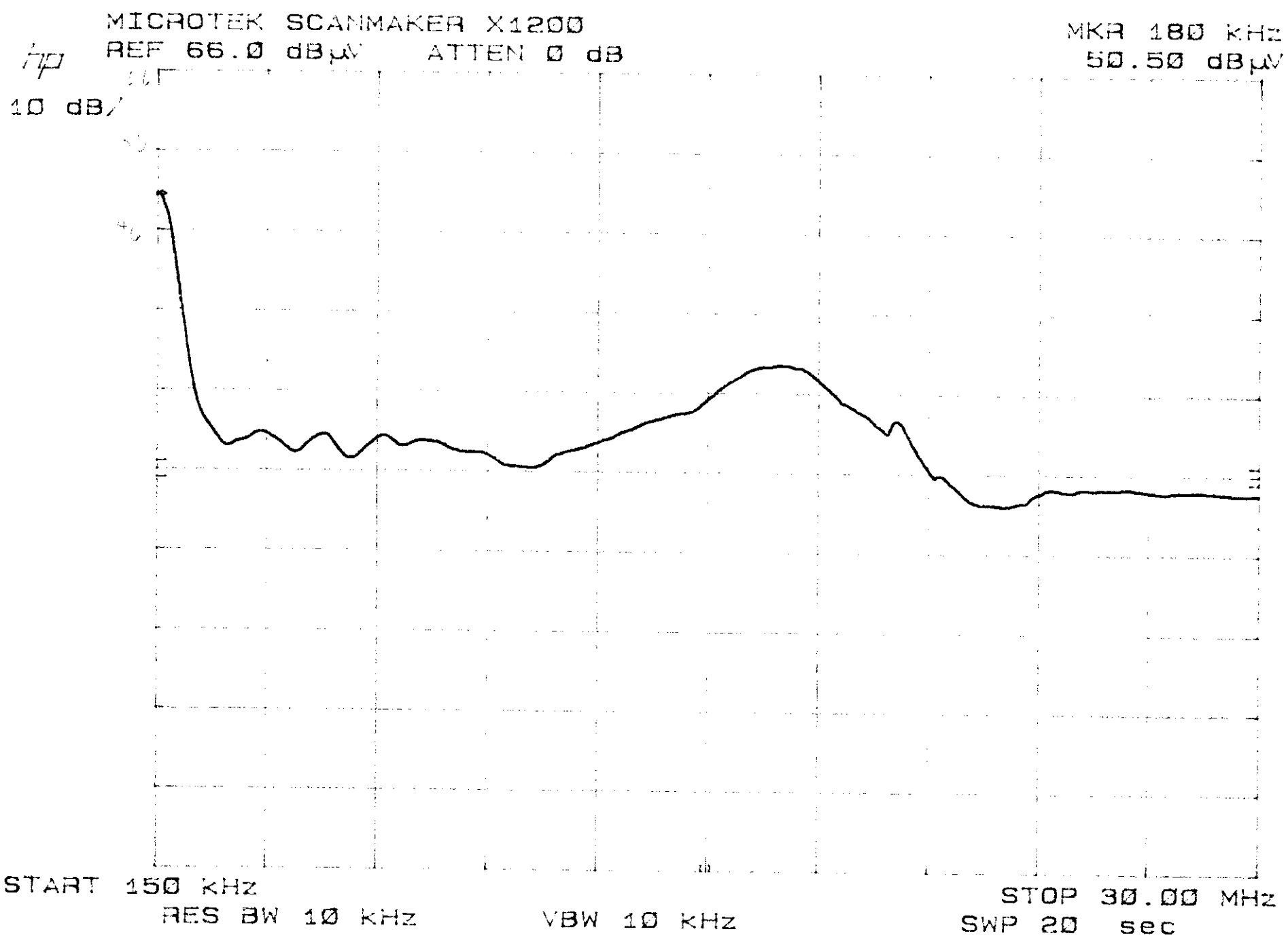
INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTE AMPLITUDE	EN55022 CLASS B	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
80.03	45.3	100	1.1	V	9.6	1.4	20.4	35.9	40	-4.1
66.75	44.4	180	1.1	V	9.6	1.2	20.1	35.1	40	-4.9
73.78	42.5	180	1.1	V	9.6	1.6	20.0	33.7	40	-6.3
80.02	42.3	350	1.4	H	9.6	1.4	20.4	32.9	40	-7.1
370.15	36.6	170	1.3	V	15.8	5.3	20.6	37.1	47	-9.9
195.09	32.1	180	1.4	H	15.0	3.9	21.4	29.6	40	-10.4
140.01	35.9	280	1.6	H	13.2	1.0	21.2	28.9	40	-11.1
360.15	35.1	180	1.3	V	15.5	5.2	21.6	34.2	47	-12.8
127.53	32.6	45	1.5	H	12.3	1.8	19.9	26.8	40	-13.2
320.17	37.2	80	1.8	H	15.5	2.8	21.9	33.6	47	-13.4
554.01	30.7	270	1.2	V	19.1	2.7	19.5	33.0	47	-14.0
290.11	33.6	90	1.9	H	14.9	5.1	21.9	31.7	47	-15.3
316.40	34.4	180	1.2	V	15.9	3.7	22.4	31.6	47	-15.4

4.7.2 Test Data for Normal (Native) mode, 30-1000 MHz –3 meters– After Maximized Procedure

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTE AMPLITUDE	EN55022 CLASS B	
Frequency MHz	Ampl. dBμV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable dB	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
80.03	46.0	90	1.1	V	9.6	1.4	20.4	36.6	40	-3.4
66.75	44.8	190	1.1	V	9.6	1.2	20.1	35.5	40	-4.5
73.78	43.4	190	1.1	V	9.6	1.6	20.0	34.6	40	-5.4
80.02	42.7	0	1.4	H	9.6	1.4	20.4	33.3	40	-6.7
370.15	37.1	180	1.3	V	15.8	5.3	20.6	37.6	47	-9.4
195.09	32.5	170	1.4	H	15.0	3.9	21.4	30.0	40	-10.0

Appendix A – EUT SCHEMATICS / BLOCK DIAGRAM

Appendix B – PLOT(S) OF CONDUCTED EMISSION TEST DATA


MICROTEK SCANMAKER X1200
REF 66.0 dBµV
ATTEN 0 dB
MKR 180 kHz
50.50 dBµV
10 dB/
START 150 kHz
RES BW 10 kHz
VBW 10 kHz
STOP 30.00 MHz
SWP 20 sec