

Operational Manual

Model MF-130D Attenuation Meter



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OPERATIONAL MANUAL

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1 GENERAL INFORMATION

1.1 Introduction

During the acceptance of a shielded enclosure, a test report is generally presented with measurement data which is relevant to the particular shielding effectiveness of the enclosure.

There are three methods for testing the shielding effectiveness that have long been accepted:

- MIL-STD-285
- NSA 65-6
- IEEE STD-299

1.2 Purpose and use of Euroshield RF Attenuation Meter

The ETS-Euroshield RF Attenuation Meter MF-130D was designed to simplify the check-out of the performance of a shielded enclosure.

With the possibility of generating frequencies, the engineer is able to check the shielding effectiveness very quickly.

The test system consists of two items, a transmitter and a receiver. The test frequencies were chosen so that the attenuation curve can be generated starting from 10 kHz and ending at 64 MHz. The possibility of choosing these frequencies is depending on the antenna set you are using.

1.3 MIL-STD-285

MIL-STD-285 was originally a part of a governmental specification (MIL-S-4957A) for screen mesh enclosures. It was designed in the early 1950's to procure some wire mesh rooms for a research project. The testing portion was later published as MIL-STD-285.

The test methods specified in this document became the standard for determining the performance of all RF shielded rooms. The methods provide the technician with antenna placements for conducting reference measurements, a detailed measurement procedure, and a description of the test equipment to be used.

During the last 30 years the test procedures have somewhat changed, with a major change of the advancement in test equipment. The attenuation requirements were 70 dB for magnetic fields from 150 to 200 kHz, 100 dB for 200 kHz to 18 MHz at the electrical field, and 100 dB at 400 MHz. 2

1.4 NSA 65-6

In 1964 the NSA published NSA 65-6. This document was a general specification issued to standardize the requirements for the agency's RF shielded enclosures. A test procedure for measuring the shielding effectiveness for the enclosures was also included. The procedures are basically the same as those in MIL-STD-285, with some minor differences. The antenna positioning specifications for magnetic field measurements were coaxial instead of coplanar.

1.5 IEEE STD-299

In 1969 the IEEE published the Recommended Practice for Measurement of Shielding Effectiveness of High-performance Shielded Enclosures. The standard allows the use of a small loop antenna from 100 Hz to 20 MHz which is considerably wider range of test frequencies compared with both standards above. ?

The measurement method and positioning of transmitting and receiving antenna correspond to NSA-65-6.

1.6 Maintenance aspect

A shielded enclosure may require some maintenance from time to time. In practice the weakest points in the enclosure are the openings and the entrance. When carrying in equipment, damage may be caused to joints and the door contact springs, and the shielding properties may be deteriorated. With the ETS-Euroshield RF Attenuation Meter MF-130D it is very easy to do tests both in laboratory and field environments.

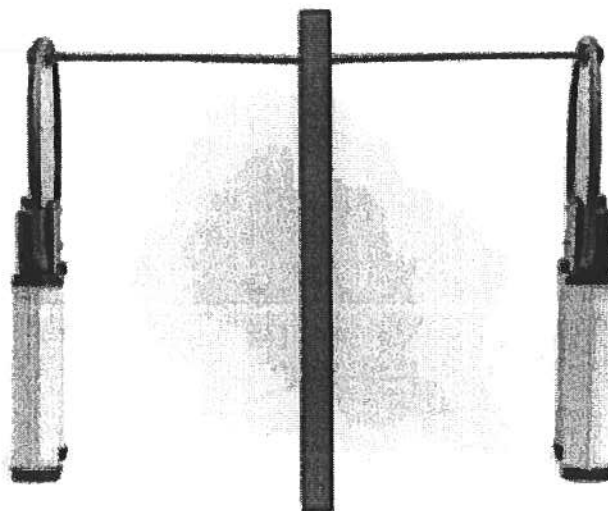


Figure 1: Measuring shielding effectiveness with the ETS-Euroshield RF Attenuation Meter MF-130D.

2 UNPACKING AND SET-UP

2.1 Unpacking and physical inspection

Examine the shipping package before unpacking the equipment. If the carton has been damaged, check with care if the equipment has been damaged and retain the shipping carton. Check that the equipment is complete as listed on the package list. Examine the contents of the carrying case visually. If any damage is evident, notify the carrier and your local ETS-Lindgren distributor, or the factory.

- 1 pc Carrying case
- 1 pc Transmitter
- 1 pc Receiver
- 2 pcs Battery charger
- 2 pc Software diskette
- 1 pc ESD protected RS 232 cable
- 2 pcs Spacer
- 1 pc Operator's Manual
- 1 pc Warranty certificate
- 1 pc Soft foam sheet
- Certificate of Conformance
- Antenna set depend on what you have ordered

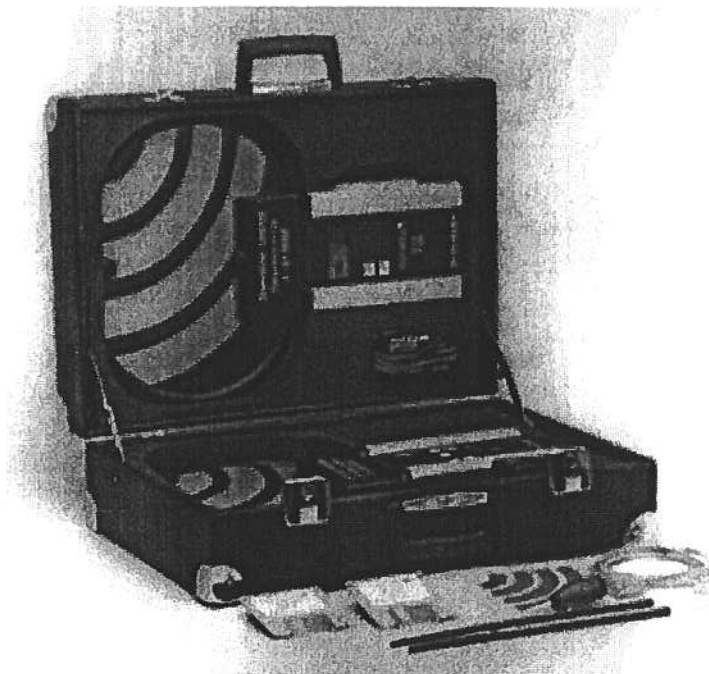


Figure 2: ETS-Euroshield RF Attenuation Meter MF-130D set in the carrying case.

2.2 Battery installation

Both units, the transmitter and the receiver, are delivered with batteries inside the units. Please note that when using new equipment, the batteries need a longer charging time. 24 hours is sufficient.

If you have to remove the NiCd batteries for some reason, read the following:

Open the bottom covers of both units with a Pozidrive screwdriver. Insert or remove the NiCd batteries as in Figure 3. Both units require 6 batteries. You have to use rechargeable NiCd batteries (1.2 V size D).

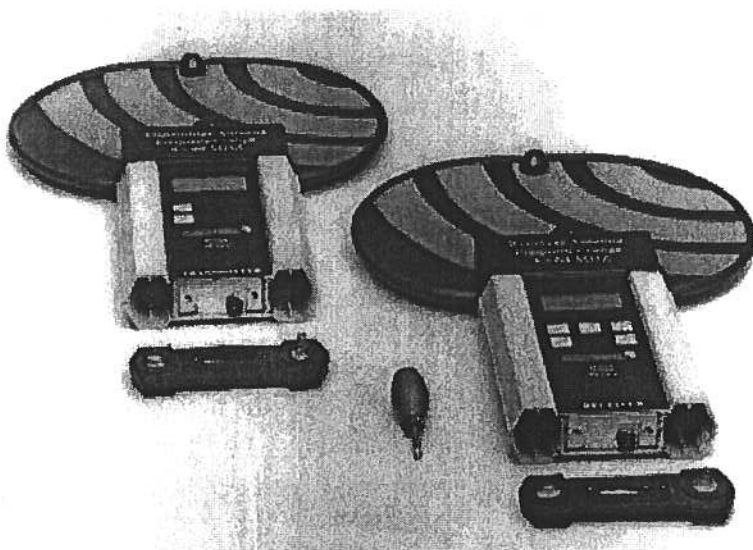


Figure 3. Inserting or removing the NiCd batteries.

2.3 Recharging the NiCd batteries

If the voltage is too low you have to recharge the batteries with the battery chargers provided by ETS-Euroshield. Normal charging time is 14-16 hours.

If you use any other battery charger than the ones provided with the delivery ETS-Euroshield is not liable for incidental or consequential damages, and the warranty is in lieu of all other warranties.

3 TECHNICAL SPECIFICATIONS

3.1 Functional description

The ETS-Euroshield RF Attenuation Meter set MF-130D consists of two units; a Transmitter and a Receiver. Both assemblies are completely solid state in design, hand-held and easy-to-use. The transmitter generates a magnetic field depending on the antenna front-end.

With an LF-Antenna set you are able to generate four operating frequencies: 10 kHz, 156 kHz, 1 MHz and 10 MHz.

With HF-Antenna set you are able to generate four operating frequencies: 8 MHz, 16 MHz, 32 MHz and 64 MHz.

The magnetic field strength obtained during the measurements of shielding effectiveness is compared to the magnetic field strength during calibration. The display shows the relative magnitudes of the fields in dB units.

3.2 Physical description

The carrying case is a standard travel case 530 mm x 190 mm x 395 (h) mm (20.87 " x 7.48 " x 15.55 ") in dimension. The entire system, including the carrying case, weights 10.6 kg (23.4 lbs.) with the NiCd batteries. The cover of the transmitter and the receiver is made of aluminium which is painted gray.

The system includes the following units; (All possibilities)

- 1 pc Carrying Case
- 1 pc Transmitter
- 1 pc Receiver
- 2 pc Antenna front-end pairs (LF-Ant & HF-Ant)
- 2 pcs Battery Charger
- 2 pcs Software Diskette
- 1 pc ESD protected RS 232 Cable
- 2 pcs Spacer
- 1 pc Soft Foam Sheet
- 1 pc Operator's Manual
- 1 pc Warranty Certificate
- 1 pc Certificate of Conformance

3.3 Storage and operating environment

The storage temperature should be -5°C to +45°C (23°F to 113°F). Keep the attenuation meter in a dry place. Make sure that the transmitter and the receiver are in a correct position in the carrying case, i.e. front sides against each other and the provided soft foam sheet between the units. The Euroshield RF Attenuation Meter MF-130D can operate in the temperature range from +5°C to +40°C (41°F to 103°F). However, during the measurement the temperature must not vary more than 3°C. Therefore a warm-up period (10 min) may be needed before measurement if the attenuation meter has been stored in a very different temperature than the measurement temperature.

3.4 Specifications

Frequency range	LF-Antennas	HF-Antennas	
	10 kHz	8 MHz	
	156 kHz	16 MHz	
	1 MHz	32 MHz	
	10 MHz	64 MHz	
Frequency accuracy	max (5ppm / 10 Hz)		
Dynamic range	Standard	LF-Antennas	HF-Antennas
	NSA 65-6	130 dB	130 dB
	IEEE STD-299	130 dB	130 dB
	MIL STD-285	120 dB	120 dB
Attenuation accuracy	± 2 dB		
Output power	2W max.		
Antenna	1 layer PCB antenna.		
Display	128*64 LCD matrix display with background light		
Memory	63 memory locations for attenuation value for every frequency		
Preset functions	Attenuation limit in dB		
Calibration	Auto calibration		
Power supply	Receiver power supply	6 x 1.2 Volt NiCd battery (D)	
	Transmitter power supply	6 x 1.2 Volt NiCd battery (D)	

Weight	Receiver weight	2.9 kg (6.4 lbs.)
	Transmitter weight	2.8 kg (6.2 lbs.)
	Total weight (case included)	10.6 kg (23.4 lbs.)
Dimensions	Receiver	480 x 330 x 55 mm (HxWxD)
		18.9" x 13" x 2.2" (HxWxD)
	Transmitter	480 x 330 x 55 mm (HxWxD)
		18.9" x 13" x 2.2" (HxWxD)
Includes	Carrying case, 2 pcs 300 mm (12") spacer, software diskette, 2 pcs battery charger, operator's manual, maintenance manual.	
Optional Accessories	2 different antenna front-end pairs.	
Battery life	Transmitter	5 to 7 hours
	Receiver	10 to 12 hours
Temperature range	+5°C to +40°C (41°F to 103°F)	
Storage temperature	-5°C to +45°C (23°F to 113°F)	

This device is in compliance with the following standards:

EN 50081-1 (1992)
EN 50082-1 (1992)

3.5 Safety precautions

You should remove the NiCd batteries and place them in the carrying case when e.g. travelling by aircraft.

Never store the meter for extremely long periods with the batteries installed or battery leakage may cause damage. For low battery voltage, see chapter 2.3.

3.6 Warranty

Euroshield Oy warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

Electrical and Electronic Measuring Equipment... 1 Year

Repair or replacement (at our option) without charge (FCA) will be effected when our examination indicates that defects are due to materials or workmanship. Warranty returns must first be authorized by the factory.

If the instruments or any portion thereof has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, or the warranty is void, Euroshield is not liable for incidental or consequential damages, and the warranty is in lieu of all other warranties.

3.7 Repair and Maintenance

Instruments may be returned only on prior authorization from the Representative or the factory. Validity of warranty will be determined by the factory.

Additional service information is available at our addresses:

EUROSHIELD OY
FIN-27510 Eura
Finland

tel. +358 2 83 83 300
fax. +358 2 86 51 233

4 PRINCIPLE OF OPERATION

4.1 Transmitter



Figure 4: Transmitter.

The transmitter antenna consists of one PCB square antenna which is inside the covering. RF current through the antenna depends on the frequency in use.

4.2 Button operations of MF-130D transmitter

There are only two buttons in the transmitter unit: ON/OFF and FREQ. With ON/OFF button you can turn the transmitter on by pressing it for approx. 2 seconds.

When the transmitter is on you can switch the LCD display back light on and off by briefly (approx. 1 second) pressing the ON/OFF button. With the FREQ button you can change the transmitting frequency depending on which antenna front-end is in use. When you want to switch the transmitter off you can do it by pressing the ON/OFF button for approx. 4 seconds.

4.3 Receiver



Figure 5: Receiver

The receiver is designed to measure the relative field strength. Frequencies depend on which antenna set is in use.

The receiver starts off with only one crystal oscillator. By digital division, the 10MHz reference local oscillator needed for the CPU is achieved as well as the local oscillator frequencies for each frequency to be received.

The receiver antenna is a one layer PCB antenna which is inside the covering.

4.4 Button operations of MF-130D receiver

There are five buttons in the receiver unit: ON/OFF, FREQ, CAL, ALARM and MEMO. With ON/OFF button you can turn the transmitter on by pressing it for approx. 2 seconds. When you want to switch the transmitter off you do it by pressing the ON/OFF button for approx. 4 seconds.

When the receiver is on you can turn the LCD display back light on and off by briefly (approx. 1 second) pressing the ON/OFF button. With the FREQ button you can change the receiving frequency according to which antenna front-end you are using.

You can check the status of the memory by pressing the FREQ button once, when the antenna front-ends highest frequency is displayed on the LCD screen. The first display presents the values of the memory storage for first frequency. If you have more memory values than you can see in the LCD display you can press the MEMO button and it shows you either the same frequency values or the next frequency values that you have stored into the memory. When you press the FREQ button once more the meter starts from the lowest frequency of that antenna front-end.

There are three numbers for one measurement in the memory display. The first number is the frequency used, the second number is the memory storage number and the last number is the value of the measurement. For example numbers 16 8 128 in the display indicate that you have measured with 16 MHz, the memory storage number is 8 and the value of attenuation is 128 dB.

The CAL button has three operations. After you have pressed the button to select the calibration method you have to press the CAL button to start the calibration. The CAL button also clears the memory when you press it in the memory display. After you have pressed it once the LCD display asks you "SURE TO CLR MEM". If you then press the CAL button again it clears the memory. If you do not want to clear the memory, just wait until the text "SURE TO CLR MEM" disappears from the LCD display. If you want to clear the memory one by one with every frequency you must select the corresponding frequency measuring display and press the CAL button. It clears the last memory storage you inserted in the memory at this frequency. This works with every frequency. This is very useful if you are not sure the last measurement went right. You can simply remove it from the memory and do the measurement again without clearing the entire memory. Please note that switching off the unit will result in the loss of all memorized data!

The MEMO button has three functions. You can choose from two calibration procedures: the NSA 65-6 and the IEEE STD 299. By pressing the MEMO button in the measuring display you can shift the attenuation value to the next memory location in the same frequency. There are 64 memory locations for each frequency. While in memory display, you can scan by pressing the MEMO button. The meter will display every memory location from first frequency and then moving on to the following frequencies.

The ALARM button has two operations. You can set the attenuation base level so that the receiver signals whenever the attenuation drops below the base level. Setting the base level is simple: wait until the display shows the correct attenuation level and then press the ALARM button. You can see the status of ALARM in low right hand corner of the LCD display (ON or OFF). If you want to take the alarm off you just press the ALARM button for approx. 2 seconds.

4.5 Short description of button operations with the MF-130D

Press Button	Functions
ON / OFF	<ul style="list-style-type: none"> • Switch on • Switch off (press approx. 4sec) • Background light on (short press) • Background light off (short press)
FREQ	<ul style="list-style-type: none"> • Select frequency (Example with HF-Antenna front-ends) 8 → 16 → 32 → 64 → Display Memory
CAL	<ul style="list-style-type: none"> • Start Calibration • Memory clearance in Memory Display (press twice) • Memory clearance one by one in measuring Display
ALARM	<ul style="list-style-type: none"> • Alarm on; attenuation level displayed will be memorized as base level • Sound signal once attenuation level falls below base level • Memorize new base level (short press) • Alarm off (extended press)
MEMO	<ul style="list-style-type: none"> • Each press memorizes the frequency, the number of the memory storage and the attenuation level • Scan memory in Display memory mode

5 CALIBRATION PROCEDURE AND PERFORMANCE VERIFICATION

5.1 Calibration procedure

When you switch on both units they check the voltage of the batteries. After that you must calibrate the unit. Instructions appear on the LCD display. First you must choose the calibration, either NSA 65-6 or MIL-STD-285. NSA 65-6 and IEEE STD-299 calibration does not differ in any way from each other. So if you choose NSA 65-6 calibration by pressing the MEMO button it makes both NSA 65-6 and IEEE STD-299 calibrations. If you want to choose MIL-STD-285 calibration you must press the FREQ button. Before you press either button you must place the units in the right position. See figures 6 and 7. Please note that when choosing the MIL-STD-285 calibration procedure, any conductive materials should not be closer than 0,5 meter from the equipment.



Figure 6 . Calibration setup for MIL-STD-285

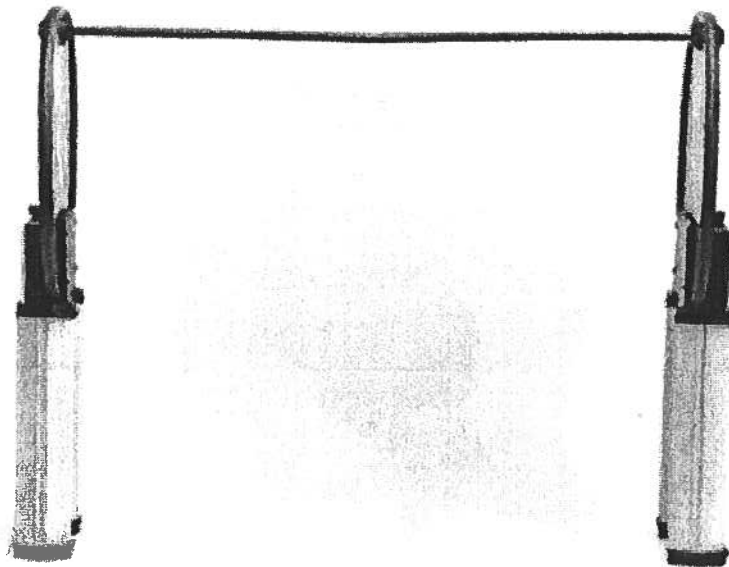


Figure 7 . Calibration setup for NSA 65-6 and IEEE STD-299

5.2 Performance verification test

You can check the dynamic range of the RF Attenuation Meter MF-130D by switching off the transmitter after the calibration. Then you must take the receiver to a shielded enclosure or anywhere where RF disturbance is at its minimum. The LCD display indicates the maximum attenuation level that the MF-130D can measure. It can vary a little depending on the circumstances when calibrating the MF-130D and on the location where you check the dynamic range.

Please note that after turning the transmitter off you can not do the measurements before calibrating it again. Therefore you can not check the dynamic range before every single measurement. !

6 MEASUREMENT PROCEDURE

6.1 Measuring in accordance with MIL-STD-285

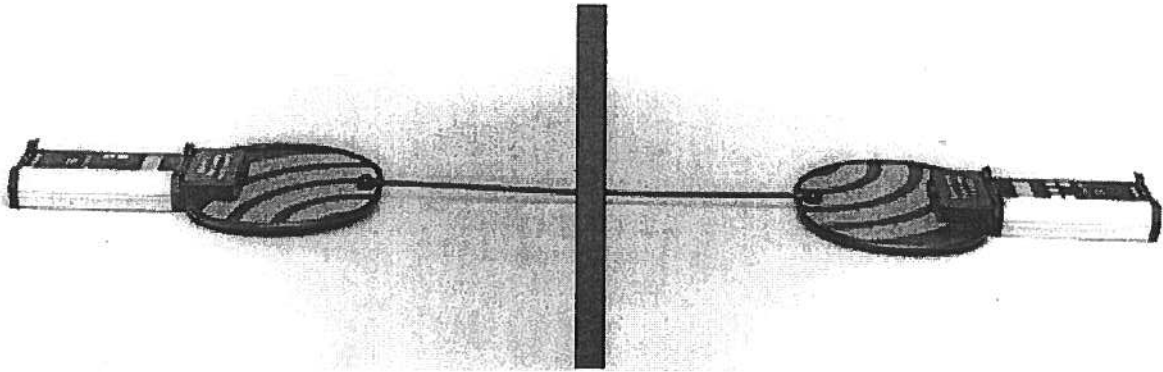


Figure 8: Measuring in accordance with MIL STD-285

Place the transmitter and the receiver at the antenna point to be measured as shown in Figure 8. The receiver should be outside the enclosure and the transmitter should be inside. Turn the antenna of the transmitter and the receiver until the minimum attenuation reading is obtained. The minimum reading indicates shielding effectiveness at that point.

6.2 Measuring in accordance with NSA 65-6/ IEEE STD-299

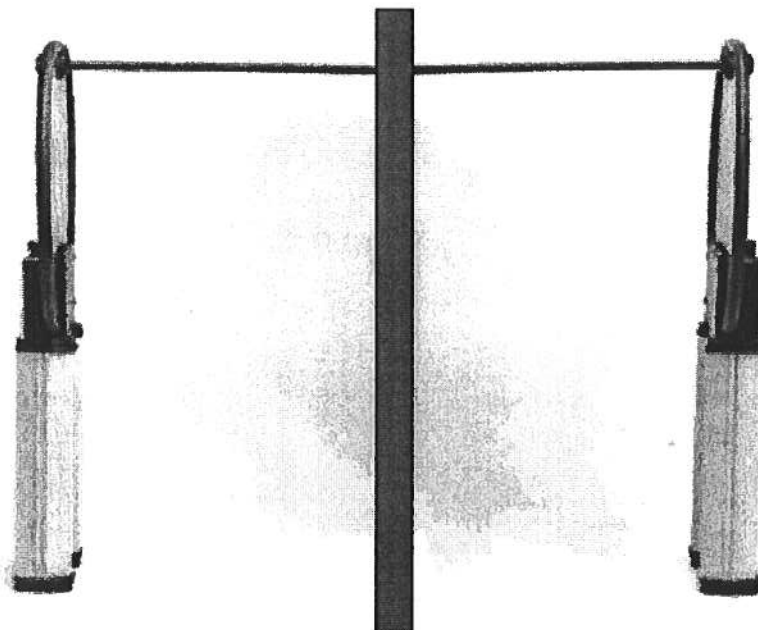


Figure 9: Measuring in accordance with NSA 65-6 and IEEE STD-299.

Place the transmitter and the receiver at the point to be measured as shown in Figure 9. The receiver should be outside the enclosure and the transmitter should be inside. The attenuation value is shown in dB scale on the meter display.

6.3 Using a tripod

Both the transmitter and the receiver can be placed on a non-metal tripod as the bottom covers are equipped with a Whitworth 1/4" thread.

7 USING THE SOFTWARE

The MF-130D Attenuation Meter set is provided with two diskettes. These diskettes are for downloading the measuring information into a computer. One diskette is for a Windows 3.1x operating system and the other is for a Windows 95 operating system.

Select the right diskette for your operating system. Place it in your floppy drive and run the setup.exe. Install Wizard will advise you throughout the setup. After you have installed the program into your computer you can start it by clicking the ETS-Euroshield logo in the MF-130D folder. The display shown in figure 10 will appear.

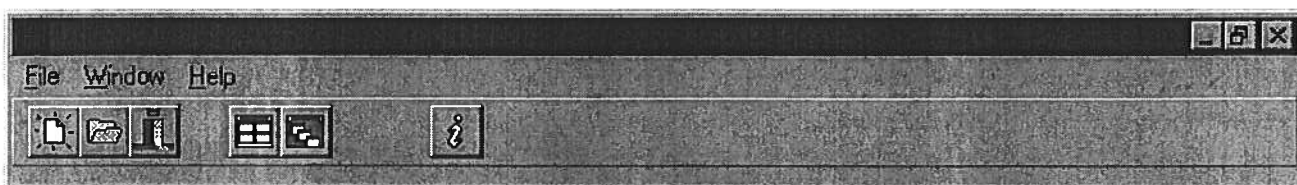


Figure 10.

Clicking the File button will show you a menu with three options (see Figure 11). Clicking the New button will open a blank Test Report document. By clicking the Open button you can open an existing document. Click the Exit button if you want to exit the program.

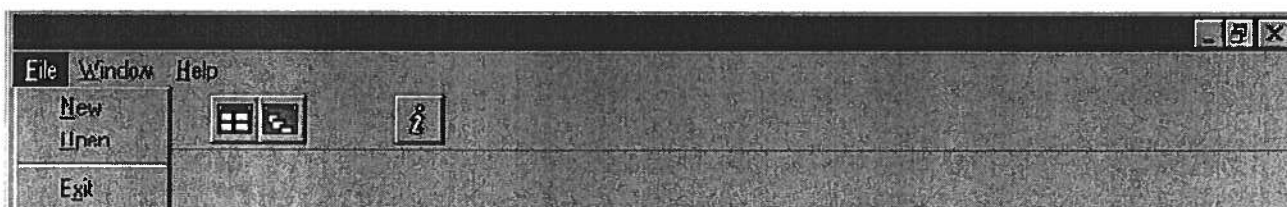


Figure 11.

Figure 12 shows you the picture of a new Test Report after you have pressed the New button. Figure 13 shows you the menu of the selection menu after you have pressed the Open button.

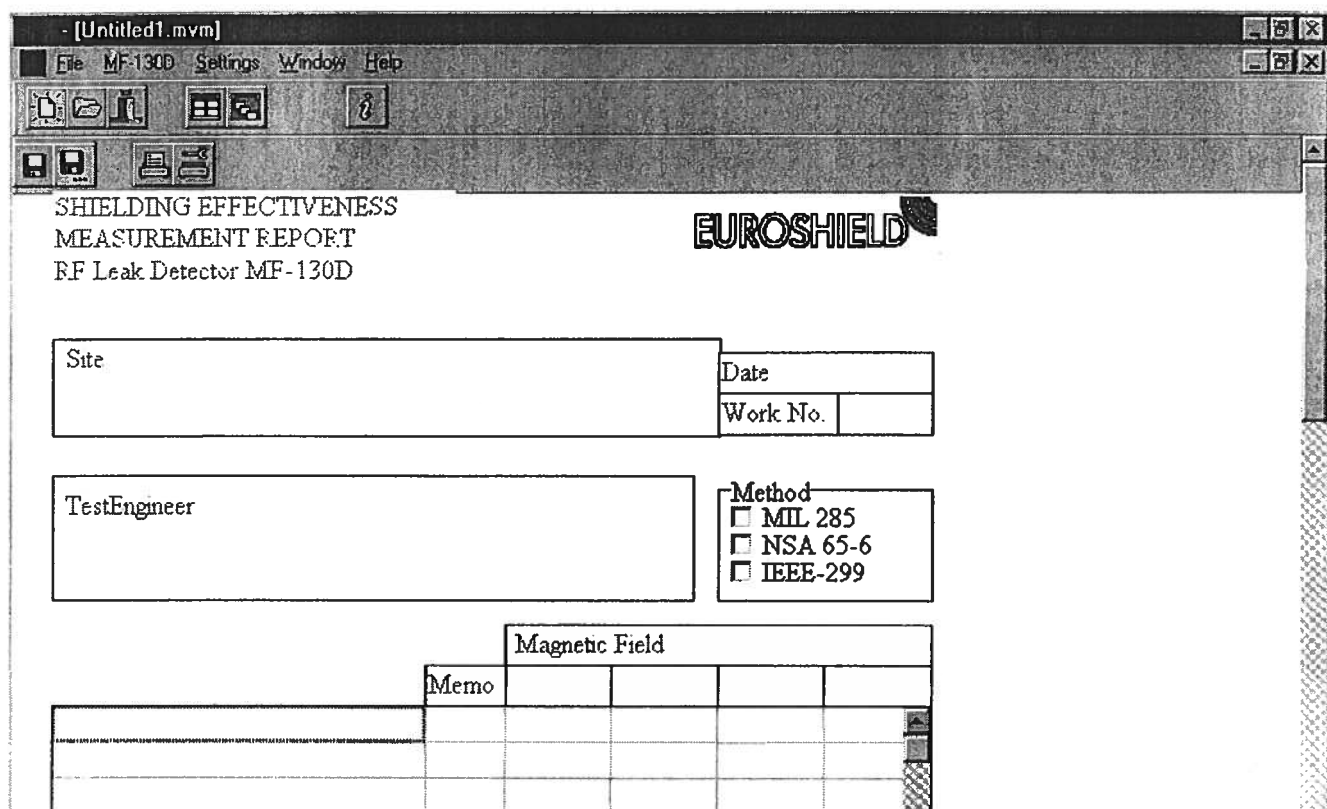


Figure 12.

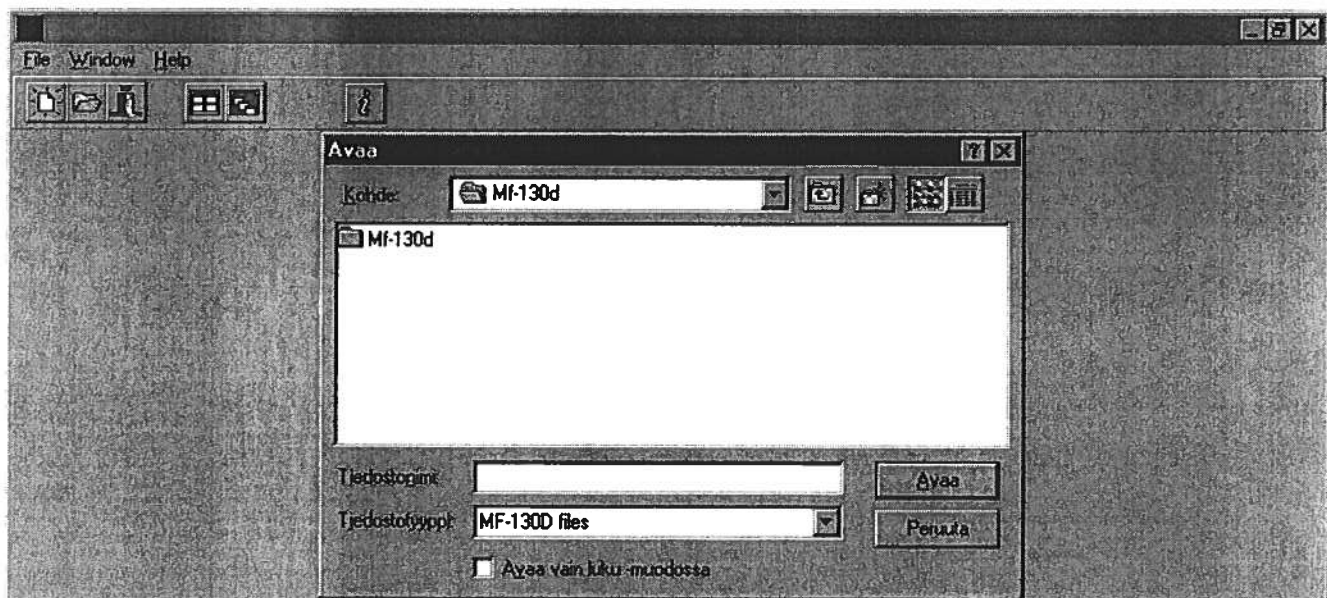


Figure 13.

If you press the Window button you will get a display like in figure 14. Window menu has three options to set the screen lay-out.

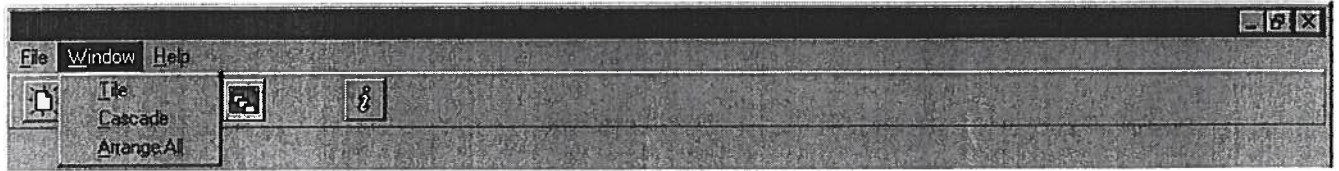


Figure 14.

If you choose a new Test Report or open an existing Test Report you will get a display like in figure 12. There are two more menus appeared in the screen when you have chosen either the New or Open. One is MF-130D and the other is Settings. When you want to download the data from the receiver you choose MF-130D menu and Load Data from MF-130D option (figure 15). Then the computer tells you to press ALARM button on the receiver. You have to make sure that the receiver is set on the right status. Receiver must be on memory display when you download the values and press the ALARM button.

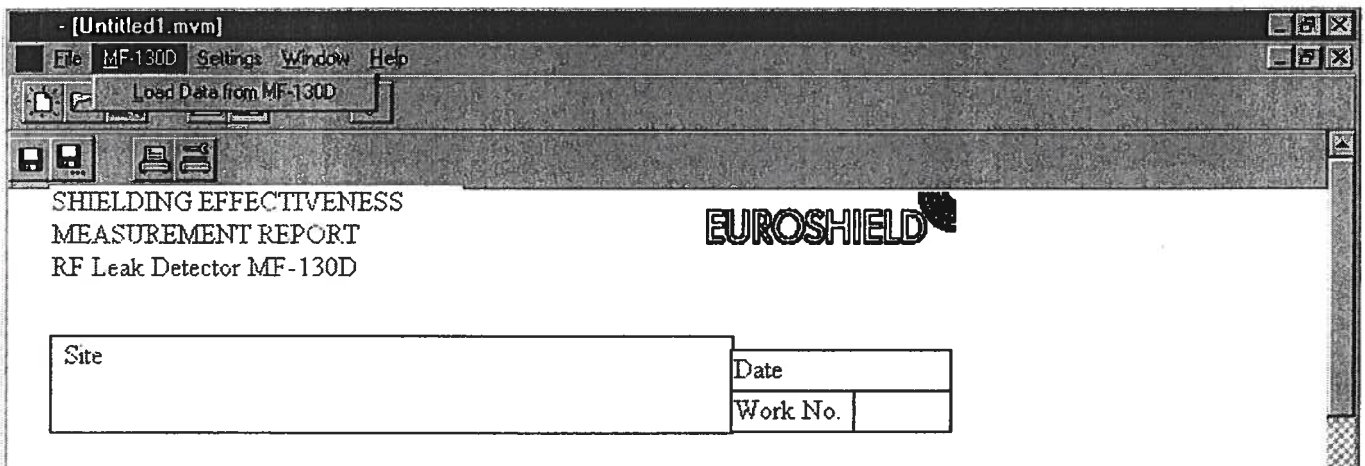


Figure 15.

When installing the cable to The Receiver you must first screw off the antenna front-end and then place the ESD protected RS-232 cable to the RS-232 connector. See figure 16. Place the other end of the cable to the correct COM port. If you have to change the COM port look at page 22.

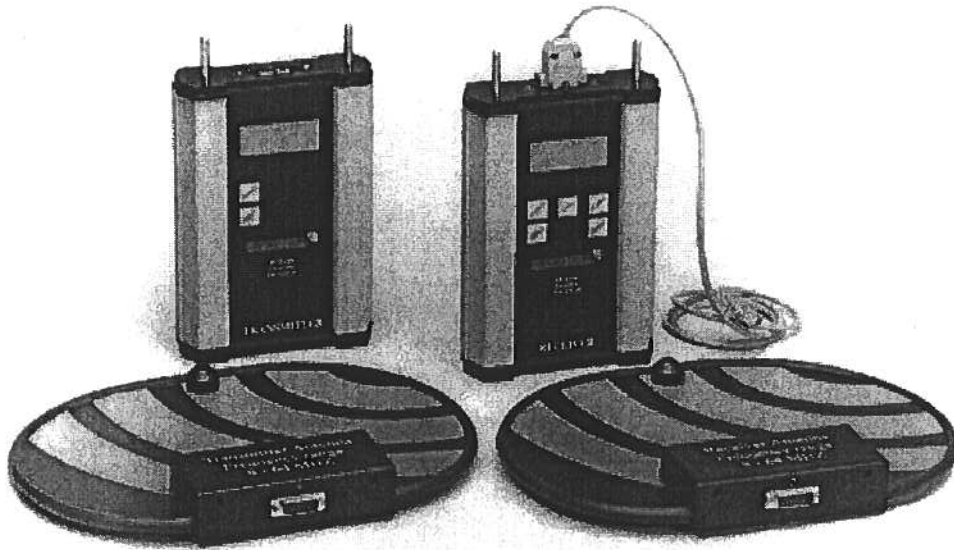


Figure 16.

When you want to select the COM port you want to use you have to choose the Settings and choose the option Select COM port (Figure 17.) There you can manually change the control to every possible COM port.

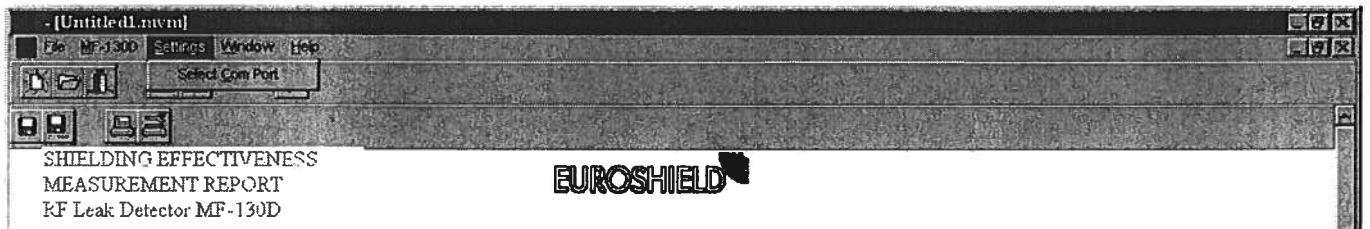


Figure 17.

When you have either opened an existing document or created a new one you can put your own information there. These places are the measured point information, test engineer, site, date, work number and method you have used. After that you can print it to your printer. You may have to change some of the printer settings, that you can do from the File menu. See figure 18. Software can support all the common printers e.g. Hewlett Packard LaserJet.

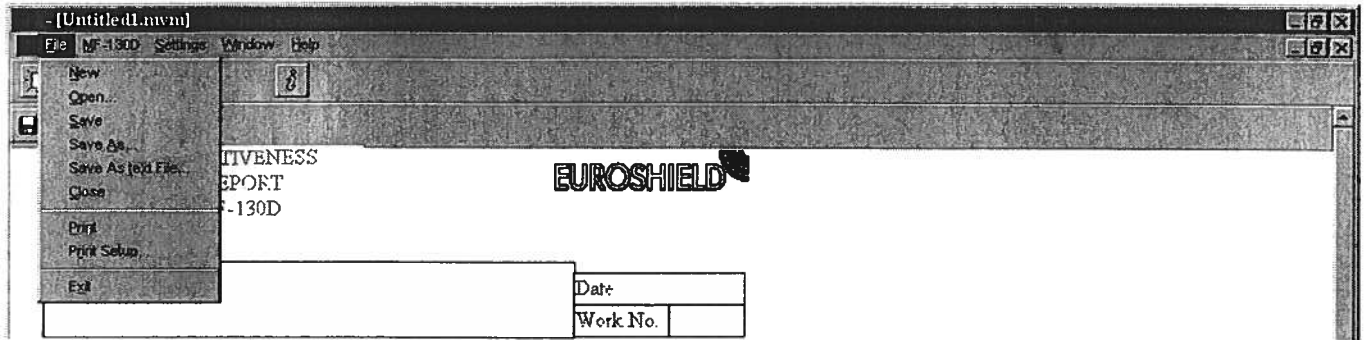


Figure 18.

There might be problems when using the Windows 95 software in the Windows NT.

In case you have any problems regarding this manual or the MF-130D operations please do not hesitate to contact your local ETS-Lindgren distributor or the factory directly.

8 FUNCTIONAL DIAGRAM

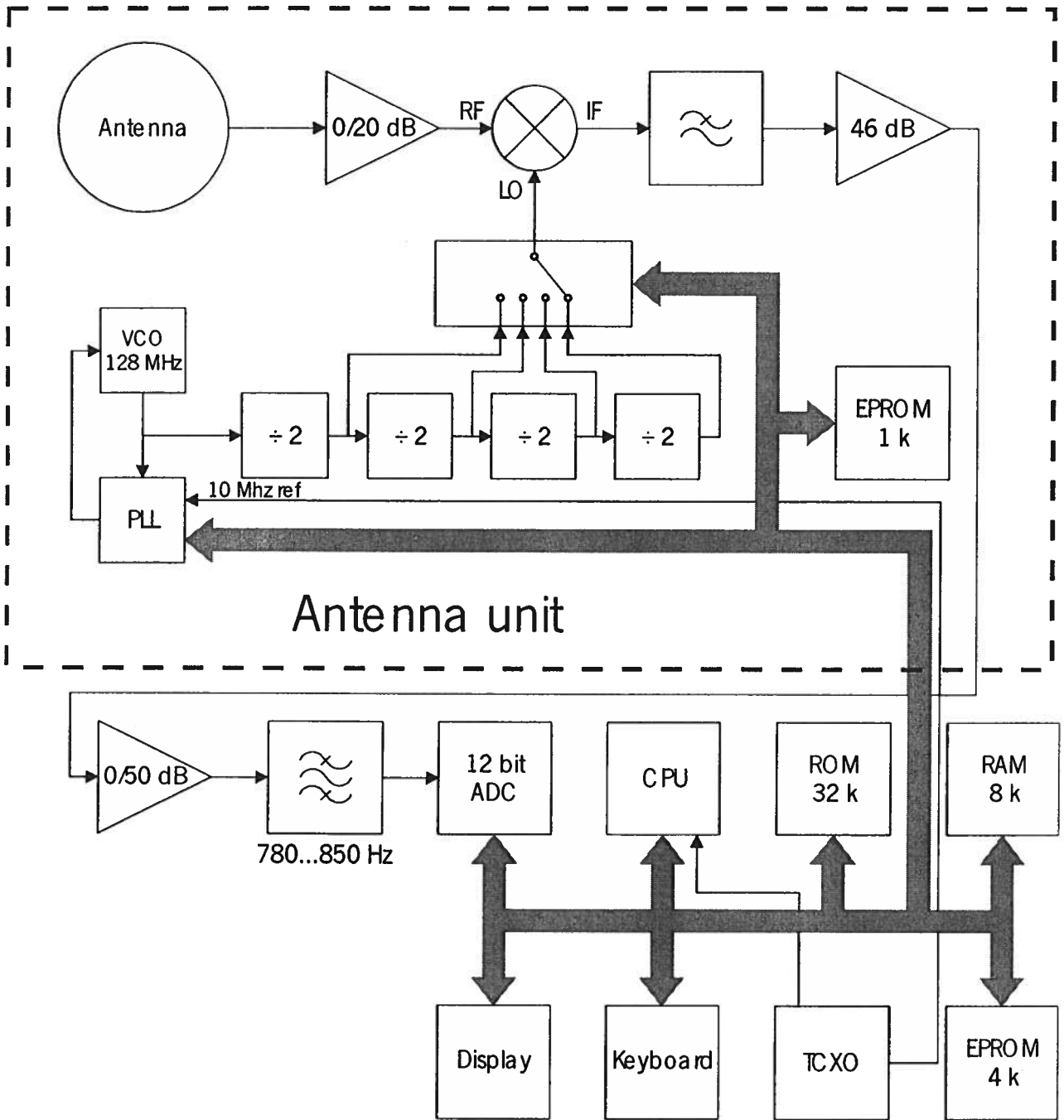


Figure 19.