User's Manual

EHP-50C

ELECTRIC AND MAGNETIC FIELD PROBE - ANALYZER

From 5 Hz up to 100 KHz

SERIAL NUMBER OF THE INSTRUMENT
You can find the Serial Number on the bottom cover of the instrument.
The Serial Number is in the form: 000XY00000.
The first three digits and the two letters are the Serial Number prefix, the last five digits are the Serial Number suffix. The prefix is the same for identical instruments, it changes only when a configuration change is made to the instrument.
The suffix is different for each instrument

NOTE:

® Names and Logo are registered trademarks of Narda Safety Test Solutions GmbH and L3 Communications Holdings, Inc. – Trade names are trademarks of the owners.

If the instrument is used in any other way than as described in this Users Manual, it may become unsafe

Before using this product, the related documentation must be read with great care and fully understood to familiarize with all the safety prescriptions.

To ensure the correct use and the maximum safety level, the User shall know all the instructions and recommendations contained in this document.

This product is a **Safety Class III** instrument according to IEC classification and has been designed to meet the requirements of EN61010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use).

In accordance with the IEC classification, the battery charger of this product meets requirements **Safety Class II** and **Installation Category II** (having double insulation and able to carry out mono-phase power supply operations).**.**

It complies with the requirements of **Pollution Class II** (usually only non-conductive pollution). However, occasionally it may become temporarily conductive due to condense on it.

The information contained in this document is subject to change without notice.

KEY TO THE ELECTRIC AND SAFETY SYMBOLS:

You now own a high-quality instrument that will give you many years of reliable service. Nevertheless, even this product will eventually become obsolete. When that time comes, please remember that electronic equipment must be disposed of in accordance with local regulations. This product conforms to the WEEE Directive of the European Union (2002/96/EC) and belongs to Category 9 (Monitoring and Control Instruments). You can return the instrument to us free of charge for proper environment friendly disposal. You can obtain further information from your local Narda Sales Partner or by visiting our website at www.narda-sts.it .

Warning, danger of electric shock **Earth**

Read carefully the Operating Manual and its instructions, pay attention to the safety symbols. **Unit Earth Connection**

Earth Protection **Equipotential**

KEY TO THE SYMBOLS USED IN THIS DOCUMENT:

DANGER — **The DANGER sign draws attention to a potential risk to a person's safety. All the precautions must be fully understood and applied before proceeding.**

WARNING — **The WARNING sign draws attention to a potential risk of damage to the apparatus or loss of data. All the precautions must be fully understood and applied before proceeding.**

CAUTION — **The CAUTION sign draws attention against unsafe practices for the apparatus functionality.**

NOTE: — **The NOTE draw attention to important information.**

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SAFETY RECOMMENDATIONS AND INSTRUCTIONS

This product has been designed, produced and tested in Italy, and it left the factory in conditions fully complying with the current safety standards. To maintain it in safe conditions and ensure correct use, these general instructions must be fully understood and applied before the product is used.

- When the device must be connected permanently, first provide effective grounding;
- If the device must be connected to other equipment or accessories, make sure they are all safely grounded;
- In case of devices permanently connected to the power supply, and lacking any fuses or other devices of mains protection, the power line must be equipped with adequate protection commensurate to the consumption of all the devices connected to it;
- In case of connection of the device to the power mains, make sure before connection that the voltage selected on the voltage switch and the fuses are adequate for the voltage of the actual mains;
- Devices in Safety Class I, equipped with connection to the power mains by means of cord and plug, can only be plugged into a socket equipped with a ground wire;
- Any interruption or loosening of the ground wire or of a connecting power cable, inside or outside the device, will cause a potential risk for the safety of the personnel;
- Ground connections must not be interrupted intentionally;
- To prevent the possible danger of electrocution, do not remove any covers, panels or guards installed on the device, and refer only to NARDA Service Centers if maintenance should be necessary;
- To maintain adequate protection from fire hazards, replace fuses only with others of the same type and rating;
- Follow the safety regulations and any additional instructions in this manual to prevent accidents and damages.

EC Conformity Certificate

(in accordance with the ISO/IEC standard 17050-1 and 17050-2**)**

This is to certify that the product: EHP-50C Electric and Magnetic field Probe - Analyzer

   Produced by: Narda Safety Test Solutions
                Via Benessea 29/B
                17035 Cisano sul Neva (SV) – ITALY

complies with the following European Standards:
Safety: CEI EN 61010-1 (2001)
EMC: EN 61326-1 (2007)

This product complies with the requirements of the Low Voltage Directive 2006/95/EC and with the EMC Directive 2004/108/EC.

Narda Safety Test Solutions

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1 - General information

1.1 Documentation

The following documents are included in this Manual:
- A questionnaire to be sent to NARDA together with the apparatus should service be required.
- A checklist of the Accessories included in the shipment.

This Manual includes description of EHP-50C standard and optional accessories.

1.2 Introduction

This section provides a general overview of EHP-50C Electric and Magnetic Field Analyzer.

EHP-50C is a low frequency electric and magnetic isotropic field probe-analyzer. It provides an advanced technology solution for field measurements ranging from a few V/m (or nT) to thousands V/m (or mT), in the 5 Hz to 100 kHz frequency range. It includes X, Y and Z axes measurements with a powerful, built in, spectrum analyzer.

EHP-50C can be used either connected to 8053-DISPLAY, SB04 switching control box or PC. Additionally, stand alone operation mode is provided for up to 24 hours continuous data collection.

EHP-50C includes an E^2PROM which stores frequency and level calibration tables and an internal optical repeater which allows connection to external devices through the optical fibre.

Spectral analysis, obtained through a powerful DSP (Digital Signal Processor), is performed on seven different frequency Span values and is displayed on the PC monitor or 8053-Display.
Marker function is available to provide accurate field strength and frequency measurement.

EHP-50C is managed internally with a microprocessor (CPU module) that controls all main functions, from battery charging to the serial communication with the DSP unit.
Electric or Magnetic field is picked up by three sensors on the X, Y and Z orthogonal axes. A Digital/Analog conversion follows which transforms the signal into numeric information processed by a Digital Signal Processing unit.

EHP-50C is housed in a small cubic container. The bottom side panel includes an optical fibre connector, extension rod screw, battery charger connector, ON/OFF button and Status LED.
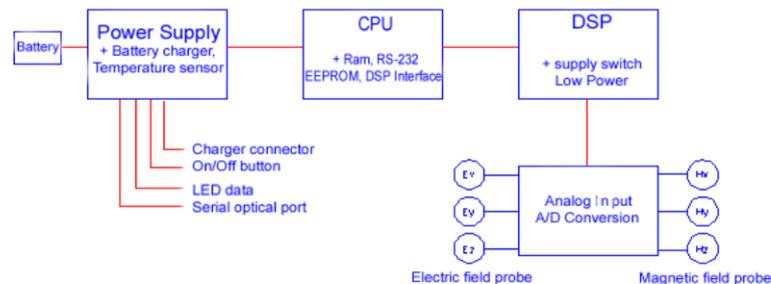
Fig. 1-1 Block diagram of the EHP-50C Analyzer

The magnetic sensor system is composed by three magnetic loops positioned orthogonal each other. The electric sensor system is composed by three orthogonal parallel capacitors and installed on opposite side of the magnetic loops.

1.3 Standard Accessories

- 8053-SC Soft carrying case, holds basic unit and accessories including 8053-Display;
- AC/DC battery charger;
- International AC plug adapter;
- FO-8053/10 Cable, fibre optic 10m
- FO-10USB Cable, fibre optic 10m;
- USB-OC Optical to USB converter;
- Optical bridge connector;
- Plastic rod support, 50cm;
- Mini tripod, bench top;
- EHP-TS software, CD-ROM;
- Operating manual EHP-50C;
- Certificate of calibration;
- Return for Repair Form

1.4 Optional Accessories The following accessories may be ordered as options:

- 8053-Display display unit;
- SB-04 Switching Control Box;
- FO-20USB Cable, fiber optic 20m;
- FO-40USB Cable, fiber optic 40m;
- FO-8053/20 Cable, fiber optic 20m;
- FO-8053/40 Cable, fiber optic 40m;
- FO-8053/80 Cable, fiber optic 80m;
- 8053-OC Optical to RS232 converter;
- 8053-OC-PS Power Supply;
- TR-02A wooden tripod 1-2m with soft carrying bag;
- TT-01 telescopic mast (120-420 cm) with carrying bag;
- 8053-CC Rigid case;
- 8053-CA Car Adapter.

1.5 EHP-50C Main specifications

The following conditions apply to all specifications:
- The ambient temperature for use must be between -10°C and 50° C.

Table 1-1 Technical specifications of the EHP-50C Electric and Magnetic Field Analyzer

	Electric field	Magnetic field
Frequency range	5 Hz – 100 kHz	
Level range	0.01 V/m – 100 kV/m	1 nT – 10 mT
Overload	200 kV/m @ 50 Hz	20 mT @ 50 Hz
Dynamic	> 140 dB	
Resolution	0.001 V/m on 8053 Display 0.1 V/m with 8053 Data logger	1 nT on 8053 display or internal data logger 10 nT with 8053 Data logger
Sensitivity	0.01 V/m	1 nT
Flatness (40 Hz – 10 kHz)	$\pm$ 0.5 dB	$\pm$ 0.5 dB
Anisotropy	**(see § 1.7)**	
Linearity @ 50 Hz	$\pm$ 0.2 dB (1 V/m – 100 kV/m)	$\pm$ 0.2 dB (200 nT – 10 mT)
Internal memory	1440 data with 1 minute storing; 2880 data with 30 sec storing. The data can be transferred only to PC	
Internal data logger	1 measurement every 30 or 60 seconds	
FFT	Real time FFT analysis	
SPAN	100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 10 kHz, 100 kHz (500Hz to 100kHz in Stand Alone mode)	
Start frequency	1.2 % of the SPAN	
Stop frequency	Equal to the SPAN	
E-field rejection	---	> 20 dB
H-field rejection	> 20 dB	---
Calibration	Internal into E²PROM	
Temperature deviation (referred to 23°C)	+/- 0.05 dB between -10 and +23°C, at 40% of relative humidity + 0.01 dB/°C between +23 and +50°C, at 40% of relative humidity	
Humidity deviation (referred to 40%)	+/- 0.05 dB between 20% and 50%, at the temperature of +23°C + 0.05 dB/% between 50% and 80%, at the temperature of +23°C	
Size	92 x 92 x 109 mm	
Weight	525 g	
Tripod support	Threaded insert ¼"	
Internal battery	Rechargeable NiMH batteries (5 x 1.2 V)	
Operating time	>10 hours in normal mode >150 hours in low-power mode 24 hours with internal data logger	
Recharging time	< 4 hours	
External DC supply	DC, 10 - 15 V, I = about 200 mA	
Fiber optic connection	Up to 40 meters via fiber optic (USB-OC) Up to 80 meters via fiber optic (8053-OC)	
Firmware update	Update available through the USB or RS232 port	
Autocheck	Automatically when switched on	
Operational temperature	-10°C to +50°C	
Storage temperature	-20°C to +70°C	

1.6 Isotropic E&H field analyzer EHP50C typical uncertainty and anisotropy

1.6.1 Typical uncertainty of EHP50C

The uncertainties stated in this document have been determined according to EA-4/2 [4].

They were estimated as expanded uncertainty obtained multiplying the standard by the coverage factor k=2, corresponding to a confidence level of about 95%.

The total uncertainty of the probe derived from typical contributions of linearity, anisotropy, frequency response, temperature, relative humidity and with/without contribution of uncertainty of calibration.

Magnetic probe [1]	Magnetic flux density range	Total expanded uncertainty (k=2)	
		Without contribution of uncertainty of calibration U_{EHP50C} (%)	With contribution of uncertainty of calibration U_T (%)
Frequency at 50Hz	0.1µT to < 0.3µT	4.1	4.2 [2]
	0.3µT to < 10.0µT	3.3	3.5 [2]
	10.0µT to < 100µT	3.7	4.3 [3]
	100µT to 500µT	4.1	4.8 [4]
Frequency from 40 to 10kHz	0.1µT to < 0.3µT	6.5	6.7 [5]
	0.3µT to > 10.0µT	6.1	6.3 [5]

(1) The temperature range is from -10°C to 23 °C and relative humidity is from 20% to 50%
(2) (5) The uncertainty of calibration used is 1,5%
(3) The uncertainty of calibration used is 2,0%
(4) The uncertainty of calibration used is 2,7%

Electric probe [6]	Electric field range	Total expanded uncertainty (k=2)	
		Without contribution of uncertainty of calibration U_{EHP50C} (%)	With contribution of uncertainty of calibration U_T (%)
Frequency at 50Hz	10 V/m to 500 V/m	7.8	8.2 [7]
	10 V/m to < 100 kV/m	8.4	8.8 [8]
Frequency from 40 to 10kHz	10 V/m to < 500 V/m	9.5	9.9 [8]

(6) The temperature range is from -10°C to 23 °C and relative humidity is from 20% to 50%
(7) The uncertainty of calibration used is 2,0%
(8) The uncertainty of calibration used is 2,5%

1.6.2 Explication Notes

a) If we have the certificate with different values of the uncertainty of calibration, in order to calculate the total expanded uncertainty U_T , the uncertainty of calibration has to be taken into account::

$$U_T = \sqrt{\left(U_{EHP50C}\right)^2 + \left(U_{Cal}\right)^2}$$

b) When the environmental temperature is higher than 23 °C the contribute due to the temperature must be added quadratically to the uncertainty.

Example: if the temperature is 38°C we get a variation of 15°C in comparison to 23°C, corresponding to a variation of 0.15 dB (0.01dB/°C) equivalent to 1,74% and therefore the standard uncertainty is 1% (=0,0174/ $\sqrt{3}$).

Assuming an expanded uncertainty U_T =4.2%,

$$U_{TOT} = \sqrt{\left(\frac{0.042}{2}\right)^2 + \left(0.01\right)^2} = 0.0465 \text{ is obtained.}$$

A similar calculation can be made in case the relative humidity overcomes 50%.

1.7 Anisotropy

1) The IEEE 1309-2005 [3] defined the anisotropy (A) as the maximum deviation from the geometric mean of the maximum response and minimum response when the probe is rotated around the ortho-axis (e.g. "virtual handle") as shown in the example in figure below.

$$A = 20 \cdot \log_{10} \left(\frac{S_{max}}{\sqrt{S_{max} \cdot S_{min}}} \right) \text{dB}$$ equation (1)
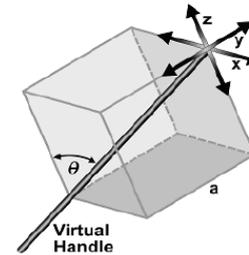
where S is the measured amplitude in field strength units.

$$\theta = \sin^{-1} \left(\frac{\sqrt{2}\, a}{\sqrt{3}\, a} \right) = 54.7°$$

2) The IEC 61786 [2] "Measurement of low-frequency magnetic and electric fields with regards to exposure of human beings - special requirements for instruments and guidance for measurements" don't define the anisotropy and suggest, for three-axis probes, the calibration of each axis when each element is aligned with the incident field.
The calibration should also be checked for a specific orientation where approximately there is the same indication for each one of the three axis (XYZ measurement).
Following this suggestion some laboratories find the minimum and the maximum values of the X,Y,Z and XYZ measure and calculate the anisotropy using equation (1).

3) We calculated the anisotropy with equation (1) but with 3D mesh measurements to cover 4π steradian.
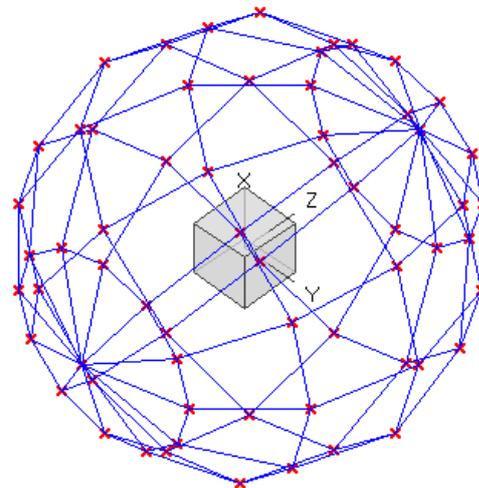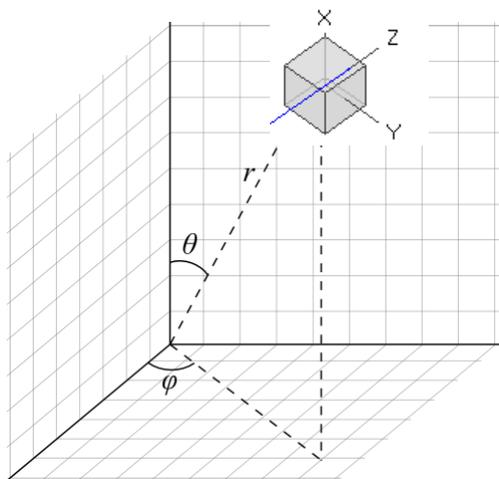
Fig. 1-2 3D mesh measurements of magnetic probe

Each x marker in the fig.1 indicates the coordinates surface of the spherical coordinates (r, θ, φ).
The anisotropy is evaluated with 30 degree steps for θ and φ, and r shows the calibration factor at each position.
The typical value of anisotropy is 1,4% (0.12 dB) for magnetic probe and 6,5% (0,54 dB) for electric probe.
The anisotropy calculated in this way is worse respect to other cases above described and it is more representative of the reality.

1.8 EHP-50C Panel
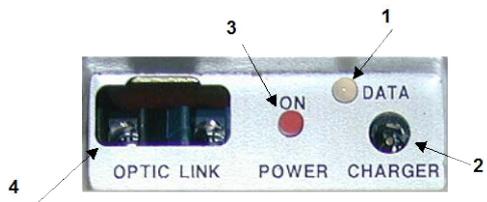
Fig. 1-3 Panel of EHP-50C

Key:

1. Led
2. Battery charger connector
3. ON/OFF button
4. Fiber optic connector

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2 - Installation and use

2.1 Introduction

This section provides the information required for installing and using the EHP-50C Analyzer.
Information is included regarding initial inspection, power requirements, interconnections, work environment, assembly, cleaning, storage and shipment.

2.2 Preliminary inspection

Inspect the packaging for any damage.

![WARNING hand symbol] **WARNING**

If the packaging or anti-shock material have been damaged, check that the contents are complete and that the meter has not suffered electric or mechanical damage.
Check that all the Accessories are there against the checklist found with the apparatus.
Inform the carrier and NARDA of any damage that has occurred.

2.3 Work environment

The work environment of the Accessories, must come within the following conditions:
- Temperature   From -10°C to +50°C
- Humidity   < 90% relative

The meter must be stored in a clean and dry environment, free from acid dusts and humidity.
The storage environment must come within the range of the following conditions:
- Temperature   From -20°C to + 70°C
- Humidity   < 95% relative

2.4 To return for repair

When the meter needs to be returned to NARDA for repair, please complete the questionnaire appended to this User's Manual, filling in all the data that will be useful for the service you have requested.
For reducing the period of time required for the repairs, it is necessary to be as specific as possible in describing the problem. If the problem only occurs in certain circumstances, please describe in detail how it happens.
If possible it is better to reuse the original packaging; making sure that the apparatus is wrapped in thick paper or plastic.
Otherwise, use strong packaging by using a sufficient quantity of shock absorbent material around all sides of the meter to ensure that it is compact and does not move around inside the package.
In particular, take every precaution to protect the front panels.
Finish the package by sealing it up tightly.
Apply a FRAGILE label to the package to encourage greater care in its handling.

2.5 To clean the meter

Use a dry, clean and non-abrasive cloth for cleaning the meter.

![WARNING hand symbol] **WARNING**

Do not use solvents, acids, turpentine, acetone or other similar products for cleaning the meter in order to avoid damaging it.

2.6 Power supply and battery recharging

EHP-50C has an internal rechargeable NiMH battery that can be recharged with the battery charger supplied with it. (the battery charger is the same as that of 8053 DISPLAY).

Make a full charging cycle before using the Analyzer for longest battery operation time.

NOTE

ALWAYS connect the battery charger to the power supply BEFORE connecting it to the EHP-50C.
The battery charger has an internal protective circuit that will limit the output of current if there is any load when connecting to the mains.
Always remove the shorting loop connector when recharging EHP-50C.
Battery charger:
output: DC, 10 - 15 V, ~ 500 mA

Connector: - → ⊙ ← +

NOTE

In order to safeguard the features of the batteries, it is crucial to have a complete recharge before storing them for periods longer than 4 months. Therefore, it is warmly suggested recharging the batteries at least every 4 months even though the device has not been used.

NOTE

The minimum voltage level for operation is about 5.3 V. The batteries must be recharged for lower voltages. Below such voltage the analyzer will turn OFF automatically.

The time required for recharging the batteries is about 4-5 hours. When the recharge is complete, this is indicated by the Led of the EHP-50C, with a rapidly blinking Green light.

NOTE

To take measurements ALWAYS remove the battery charger from the EHP-50C Analyzer otherwise the system does not work.

6.20 V

Charging

The battery status is reported by the EHP-50 control program

When charging is in progress the operator is warned in the battery sub-window.

2.7 EHP-50C connected to a PC

Using the EHP-TS software spectrum analysis can be displayed on a PC

2.8 EHP-50C stand alone Mode

The EHP-50C offers a Stand-alone mode of operation and thanks to its internal memory is possible to perform a long term acquisition without connecting it to any external device.
With EHP-50C is possible to collect data every 1 minute or every 30 seconds for 24 hours. Later on, it is possible to download all collected data to any PC by using the provided NARDA software

2.9 EHP-50C with 8053 DISPLAY

EHP-50C is linked to 8053 DISPLAY via the fiber optic link.

NOTE

See 8053 DISPLAY Manual for further details

2.10 Battery management

EHP-50C has efficient battery management that allows measurements to be taken in **Logger** mode (when connected to 8053-Display accessory) with over one week's autonomy.
During the time the Data Logger - Low Power is being used, the Analyzer stays on for the minimum period necessary (Time ON) and correctly takes a measurement and transfers it to the internal non volatile memory of the 8053 DISPLAY, after which it goes into a state of low consumption until the next measuring point. The delay between measurements may be set between a minimum of 10 seconds and a maximum of 900 seconds (15 minutes).
The Table below illustrates the autonomy of the batteries with measurement settings every minute and every 5 minutes. The longer the delay between one measurement and the next, the longer the battery charge lasts.
The Table summaries the battery autonomy of the Analyzer depending on its mode of operation.

TABLE 2-1 Autonomy of the battery					
		LOW POWER MODE		**STAND ALONE MODE**	
Span	**Normal functioning Autonomy (hours)**	**Logger Mode 60s Autonomy (hours)**	**Logger Mode 300s Autonomy (hours)**	**30s Sample**	**60s Sample**
100 Hz	>11	>24	>72	---	---
200 Hz	>11	>36	>110	---	---
500 Hz	>10	>48	>130	>24	>24
1 kHz	>10	>72	>150	>24	>24
2 kHz	>9	>65	>150	>24	>24
10 kHz	>6	>60	>130	>24	>24
100 kHz	>9	>72	>150	>24	>24

2.11 Avoiding measurement errors

To avoid disturbing the measurements in progress, the user or other persons or mobile vehicles should stay at least 5 meters away from the Analyzers. We also recommend that the probe be set up a long way from metal objects or masses.

WARNING

To perform correct measurements, the tripod TR-02A to hold EHP-50C is mandatory. Using an unsuitable support could influence the measurements that have been taken and, therefore, determine incorrect results. We recommend always using the isolated extension support supplied with EHP-50C for supporting the Analyzer.
We also recommend that the TR-02A optional tripod be used for positioning EHP-50C at the height set out in the reference standards for the measurement in progress and that this configuration is always maintained so that the measurements taken can be repeated.

NOTE

The intensity of the measured field mainly depends on its voltage and the geometry of the system under examination as well as the distance between the conductors and the measurement points. In the vicinity of cables, the reading of the field value may be very high and vary with the location of the probe.
From the definition of the potential difference between to points:

$$V_{21} = -\int_{r_1}^{r_2} \overline{E}\, dr$$

It is evident that, keeping the potential difference constant as the distance between the two points under examination decreases, the intensity of the field necessarily increases.
For example: the intensity of the electric field between two armatures of a parallel-plate capacitor situated at a distance of 0.1 m and having a potential difference of 100 V is equal to:

$$E = \frac{100V}{0,1m} = 1\,KV\!\!\Big/\!\!m$$

It should be noted that a voltage of 100 V, in these conditions, generates a field of 1000 V/m. It is, therefore, possible, in the vicinity of 220 V conductors, that there may be a field, which is much higher than 220 V/m.

3 − EHP-TS installation

3.1 Introduction

EHP-TS is a useful software tool developed for remote PC control, through fibre optic link, of EHP family Electromagnetic field analyzers.

By means of the recently introduced USB-OC optical to USB converter, EHP-50C and EHP-200A can be connected to a PC USB port.

Using the former optical/RS232 adapter, the selected COM port should be assigned to the application software (see cap.5 EHP-TS applications).

EHP-TS software requires that at least one of the mentioned analyzers is connected to PC in order to run.

The EHP-TS installation program doesn't install any driver for USB-OC converter but makes the driver file available for its installation.

3.2 Hardware requirements

Minimum requirements:

- 486 Processor or Pentium
- 16 Mb RAM
- At least 2 Mb of free space on hard disk
- 1 free USB or RS232 port
- Windows Operating system™ XP/Vista/Win7

WARNING

The User might have the need of administrator privileges to install and run the software in Windows 7; for further information see the next paragraph.

WARNING

EHP-TS software does not work with EHP50A/B which can be anyway factory upgraded to the EHP-50C version (please contact your local Narda distributor for details).

1

3.3 Installing EHP-TS Software

Before connecting the EM field analyzer to PC the EHP-TS software installation should be performed:
Insert the EHP-TS CD into the driver of your PC and run the file "EHP-TS Setup.exe".

NOTE

The User must have administrator privileges to install the EHP-TS software in Windows 7; right click on the program .exe file and click on "Run as administrator" to temporarily run the program or application as an administrator until close it (Windows 7 also allows to mark an application so that it always runs with administrator rights).
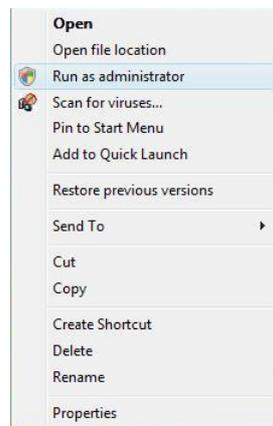
Follow set-up program instructions

Fig.3-1 EHP-TS installation
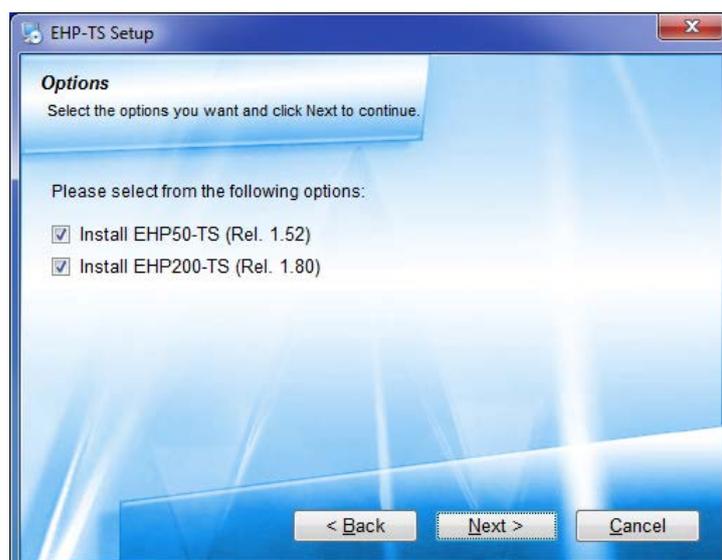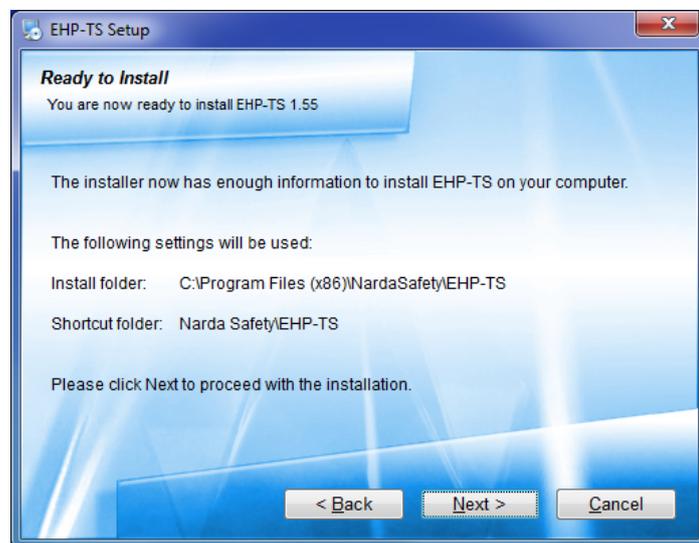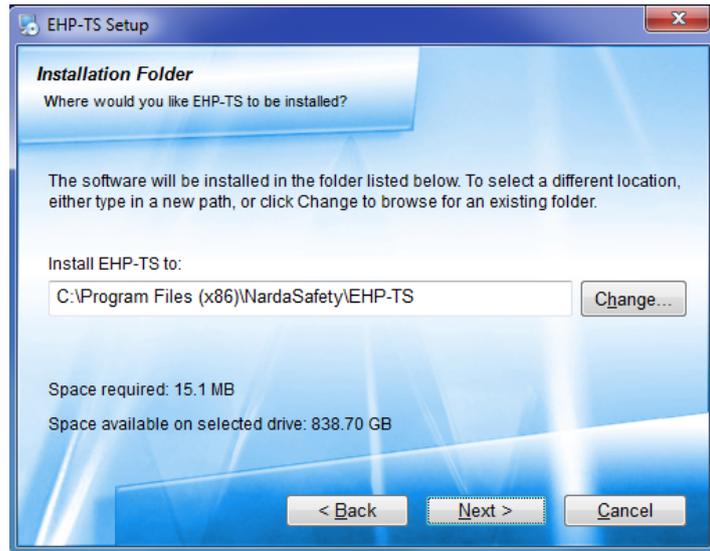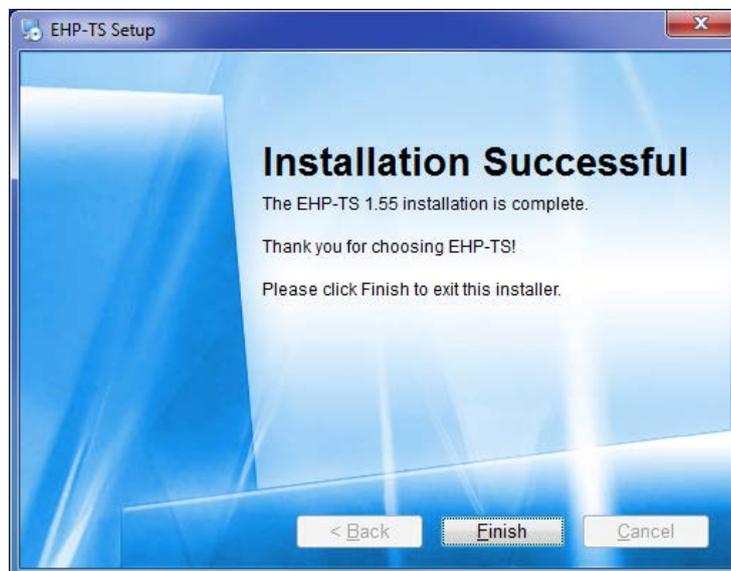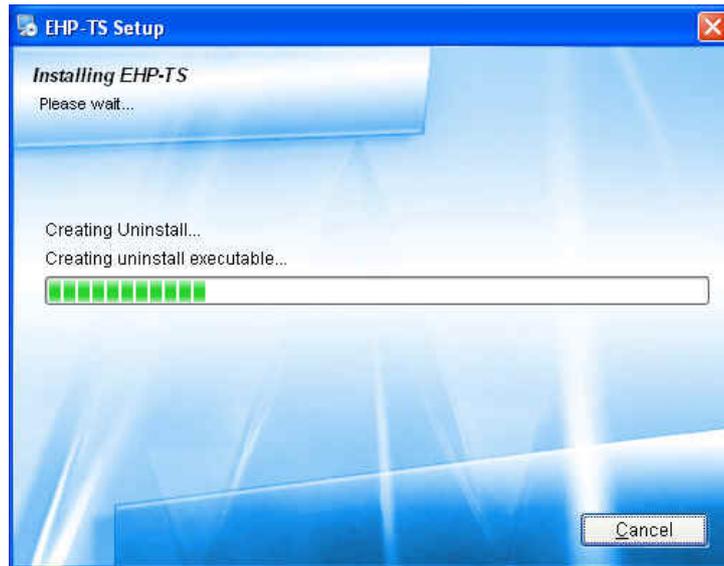
When asked for, reboot your system to complete installation
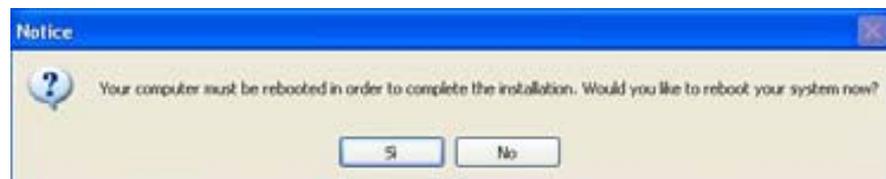
EHP-TS software is now installed in your PC, you can remove it, if needed, simply running the "Uninstall EHP-TS" application (see cap.8).

4 – USB-OC Installation

4.1 USB-OC optical to USB converter driver Installation

USB-OC optical to USB converter requires a driver program to be installed in your system. EHP-TS software create a folder including all files requested for the driver installation. Before running EHP-TS, please connect the USB-OC converter to a USB port of your PC.

Fig.4-1 USB-OC Converter

NOTE
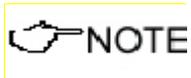
The following provides, as an example, USB converter installation instructions for Windows XP O.S. The procedure to select location of the driver directory will be different in case of different operating systems

In case the driver is not already installed, a message informing that new hardware has been found will be shown and a guided installation will start:
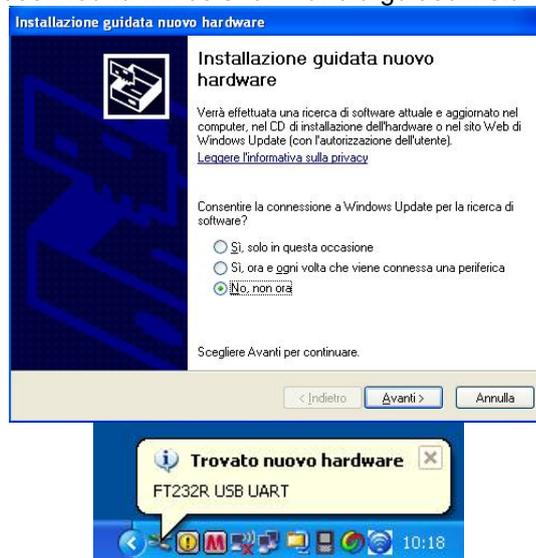
Do not allow connection to Windows Update but select "No, not now" and click "next"

Select "Install from a list or specific path" and click "next"
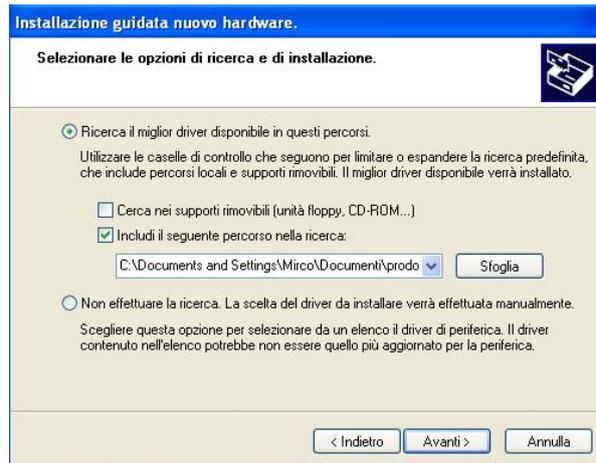
Select options as in the previous picture and click "browse" to select the directory containing the requested files:

The folder "USB-WIN-98" includes driver for Windows 98.
The folder "USB-WIN-XP" includes driver for Windows XP and Vista.
The folder "WIN-7" includes driver for Windows 7.

You can find the folders in the following path: C:\Programs\NardaSafety\EHP-TS, select it and click "OK"
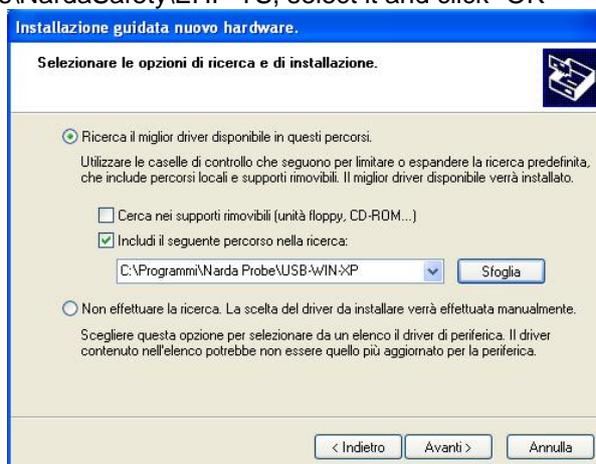
Click "next" to start installation.

Click "continue"

It may happen that a more recent version of a requested file is already present in your system.
In this case do not replace it but answer "No" to the confirmation request:
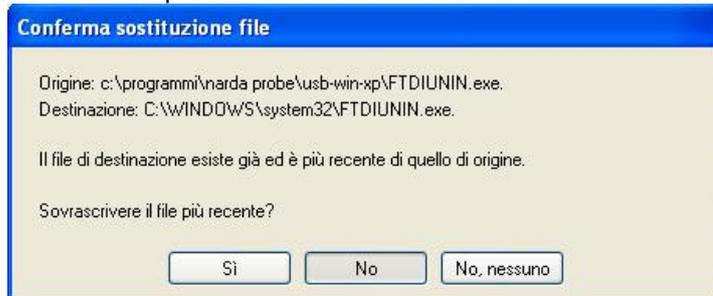
In case of Windows XP operating system the entire procedure will be executed twice as two different drivers will be installed. Same steps as above should be followed and same path C:\Programs\NardaSafety\EHP-TS must be selected.

NOTE

Click "Finish" to complete driver installation, the new hardware is now ready to be used.

USB-OC converter driver is now installed in your PC, you can remove it, if needed, following instructions in cap.9.

4.2 Hardware installation

Connect the USB-OC supplied with EHP-50C to a USB port of the PC, and the optic fiber cable to the EHP-50C. Instead if you connect the probe to the RS232 port, you must use the optional accessories 8053-OC.

WARNING

Do not pull the optic fiber by holding onto the cable but use the connector so that the head does not get damaged.
Avoid dirt and other particles getting into the transducers of the optic fiber.

Fig. 4-2 EHP-50C link with USB-OC

Fig. 4-3 EHP-50C link with 8053-OC

NOTE

EHP-50C should be OFF.

4.3 COM Port setting with 8053-OC

The optional accessory 8053-OC optical/RS232 adapter can be used to connect EHP-50C to PC allowing thus 80 m maximum fibre length.
With 8053-OC the program automatically establishes the connection on the first RS232 port that is not in use at that time, in the following order: COM1, COM2, COM3, etc.

NOTE

The energy available on the DB9 connector of some PC model could be not sufficient to guarantee a good link with 80 meter fibre.

NOTE

The energy available on the DB9 connector of some PC model could be not sufficient to guarantee a link with 8053-OC. In this case, it is necessary to use 8053-OC-PS between the converter and PC. (for more information see Accessories).

Whenever a port is tied up by a device (e.g. modem) which is not active or turned off at that time, the program recognises it as free and will therefore attempt to connect EHP-50C to that port. In this case, it is necessary to "force" the next serial port by the following procedure:

- Click right the requested program icon and select "properties".
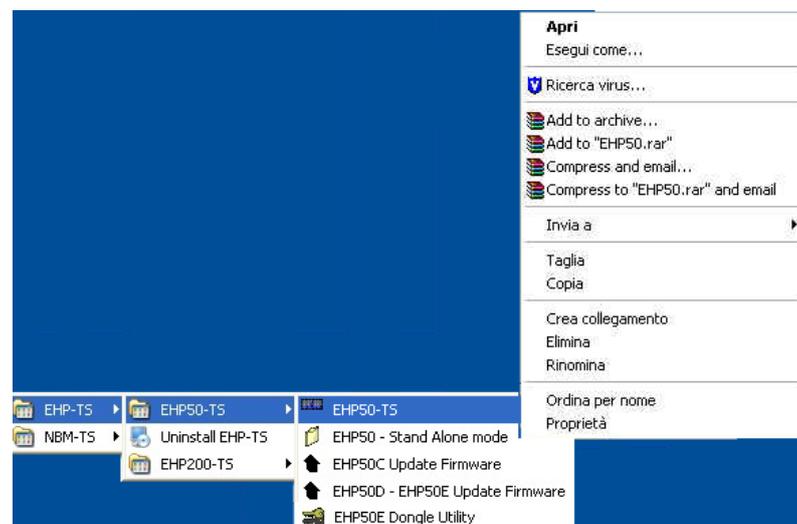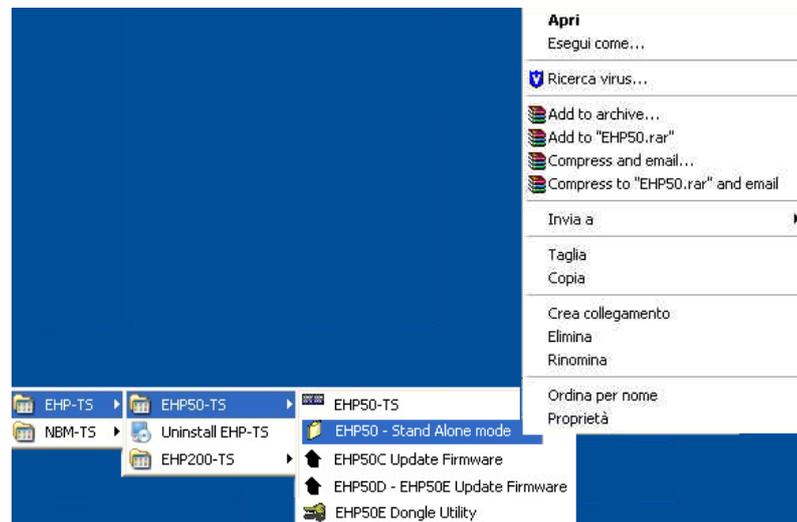
- Add the command COMM=N preceded by a space (in capital letters) at the end of the Destination field where N indicates the serial port to be used; for example, if the EHP-50C is connected to port 2, add the command COMM=2.

The assigned COM port nr. must be between 1 and 9.
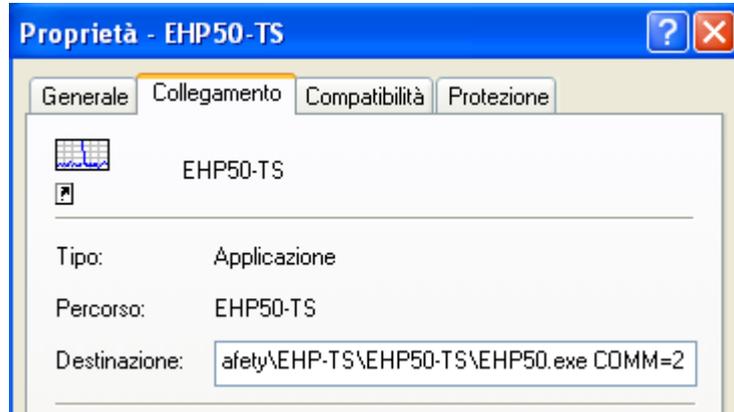
- **In some operating system the Destination field is enclosed in double quotation marks ("); in this case, the command COMM=N, preceded by a space must be outside as in the example below;**

- Then confirm by selecting Apply
- After switching the analyzer ON, run the control software.

⟲NOTE   **EHP-50C must be ON before running EHP-50 control software.**
EHP-50C may not be correctly recognized if switched ON when the control software is already running.

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5 – EHP-TS software

5.1 EHP-TS applications

EHP-TS software includes different applications to be used with EHP family analyzers. Shortcuts are shown, selecting "all programs" from the windows XP "start" button or, using Windows Vista or 7, by clicking **Windows (🏁)** and **Programs:**
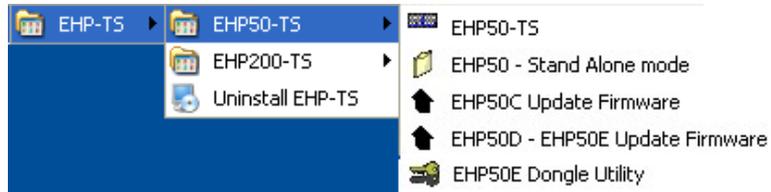
The EHP-50 section includes three different applications:

EHP50 – Stand Alone Mode: main task of this program is to set up EHP-50C for standalone mode. The analyzer will take and log E or H field measurements (according to the setting) for up to 24 hours, when switched on without any connection to external devices (see operating manual for details). Using EHP-50C-Stand Alone mode program is then possible to download measurement results and store them as a text file.

EHP50-TS: this program is used to perform live Spectrum Analysis measurements when an EHP-50C analyzer is connected to PC

EHP-50C Update Firmware: this is a tool to update EHP-50C firmware.

EHP-50D – EHP50E Update Firmware: this is a tool to update the firmware of EHP-50D and EHP50E firmware.

EHP-50E Dongle Utility: this is a tool to allows to enable the function WP10 ordered such Options.

This document describes applications for EHP-50C analyzer only

NOTE

The User might have the need of administrator privileges to install and run the software in Windows 7; for further information see the paragraphs in Chapter 3.

WARNING

EHP-TS software does not work with EHP50A/B which can be anyway factory upgraded to the EHP-50C version (please contact your local Narda distributor for details).

NOTE

If the battery charger is plugged to EHP-50C while the software is running, the analyzer will be disconnected.

NOTE

During the charging process, always remove the bridge connector from the EHP-50C

1

5.2 EHP50-TS Application	This chapter describes controls and function provided by EHP50-TS application for spectrum analysis included in EHP-TS software package. Connect EHP-50C to the USB port of your PC using provided optical fibre and USB-OC optical to USB converter. Optional 8053-OC optical to RS232 converter can be used, as an alternative, to connect the analyzer to the PC RS232 connector.
5.3 Main menu	Switch the analyzer ON and run EHP50-TS application.

After the welcome screenshot appears for few seconds the program main window will be shown:
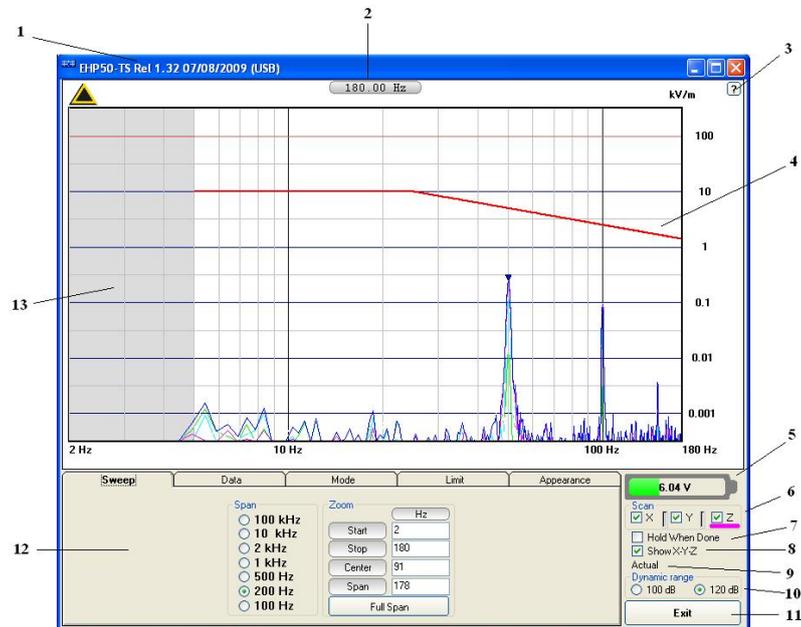
Fig.5-1 EHP50-TS Main Window

Description:
1 - EHP50-TS software release, (communication port)
2 - Shows frequency while scanning
3 - Click **"?"** to display EHP-50C analyzer **Firmware** release
4 - Trace of selected Limit
5 - EHP-50C analyzer battery status
6 - **Scan** activation for each axis (default setting: all axis activated)
7 - **Hold When Done:** stops scan to allow data analysis as soon as all axis have been measured
8 - **Show X-Y-Z**: to display or not the traces of single axis.
9 - Acquisition mode selected (see **Mode** section)
10 - **Dynamic range** (chosen between 100 and 120dB)
11 - **Exit** button to terminate application
12 - Control panel
13 – Display for spectrum analysis

Commands are grouped in the control panel in 5 different sections:

Sweep: to select a specific frequency span and, within the selected span, to set zoom function

Data: to display measurement results and save data

Mode: to set different operating modes

Limit: to create and save limit traces, to activate a specific limit

Appearance: to change colour and button aspect

Each section can be activated with a mouse click.

5.3.1 Sweep section
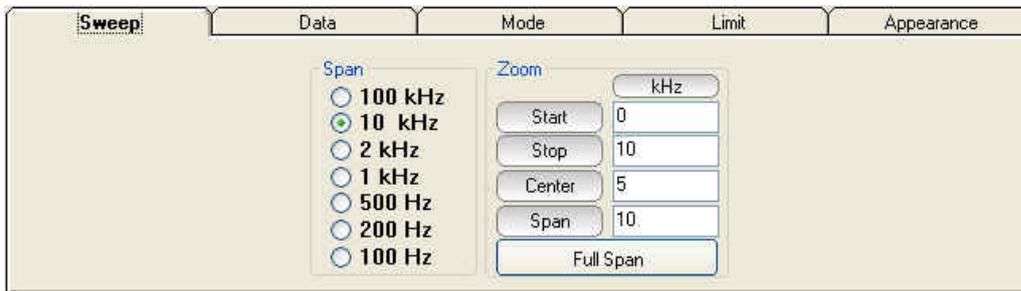
EHP-50C includes an FFT analyzer to show frequency spectrum of measured field. The sweep section includes the following:

Span: select one of the 7 available **span** keeping in mind that beside the EHP-50C minimum operating frequency of 5 Hz, the minimum **start** frequency of each Span is 1,2% of Span. For example, selecting 1kHz span the minimum start frequency should be 12Hz (automatically adjusted to the nearer step available of 12.5Hz).This to avoid that the 0Hz signal, common to every spectrum analyzer, is included in the measurement result.
Start frequency of 100Hz and 200Hz span is therefore 5Hz (minimum operating frequency).

Zoom: EHP-50C performs selective measurement over the entire frequency range defined by the Span setting. EHP50-TS is able to select data in order to display a user specified frequency band within the selected span. For this purpose the Zoom function can be set by typing the relevant parameters through the PC keyboard or, graphically, by means of the PC mouse.
Within the selected frequency **span**, you can operate a zoom function to define a specific frequency range over which perform your measurement. For this purpose **Start, Stop, Center** and **Span** can be set to easily define frequencies to be displayed. The **Full Span** button deactivate the Zoom function showing the whole Span selected.

NOTE

Right click and drag on the graph window to define graphically the Zoom frequency range.
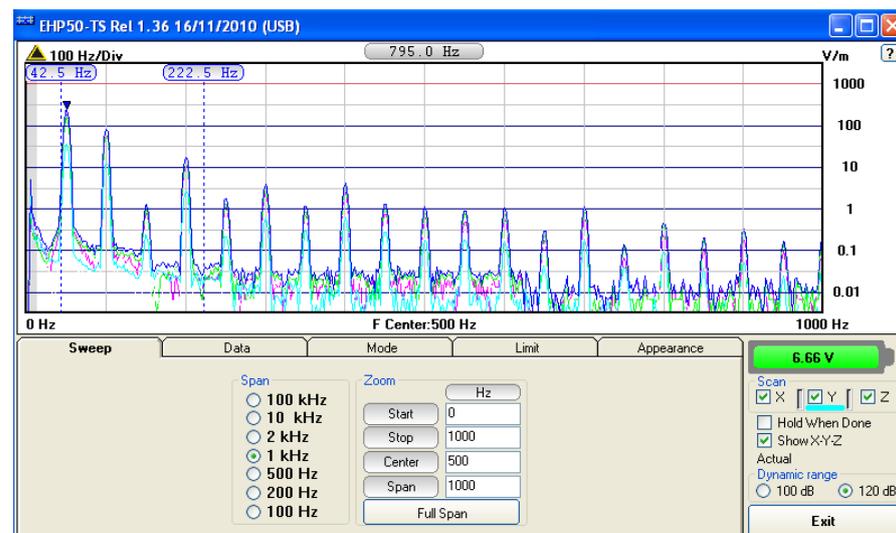
Fig.5-2 Defining frequency band through the PC mouse
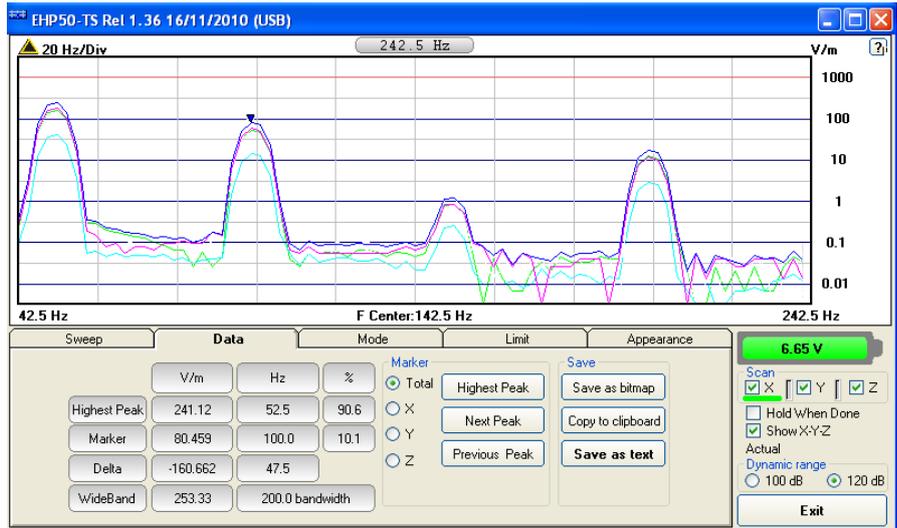
Fig.5-3 Zoom window

5.3.2 Data section

Even if EHP-50C takes measurement over the entire selected span, shown results are related to the displayed spectrum only, allowing thus detailed evaluation of user defineable frequency range through the zoom function.
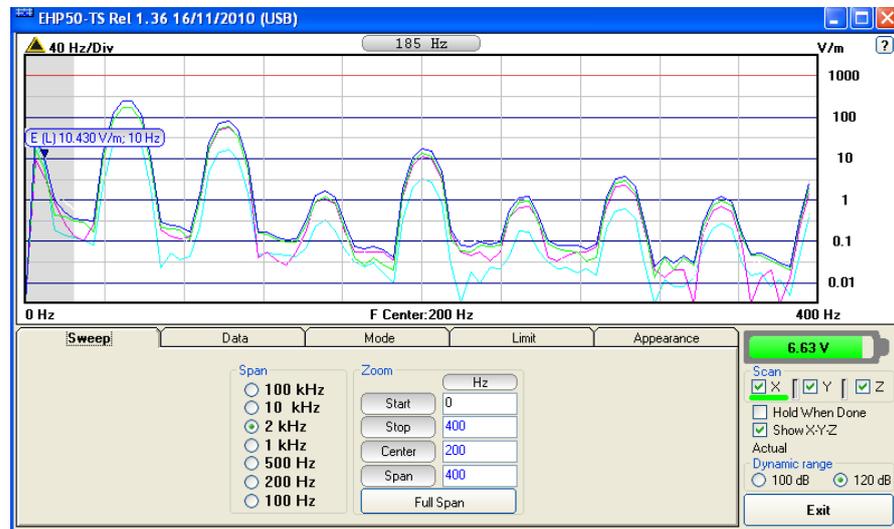
The gray band on the left side of the graph highlights signals below the minimum start frequency (1,2 % of Span) which are affected by residual 0Hz peak. Calculation of Wideband result (see below) does not include any spectral line within the gray band.
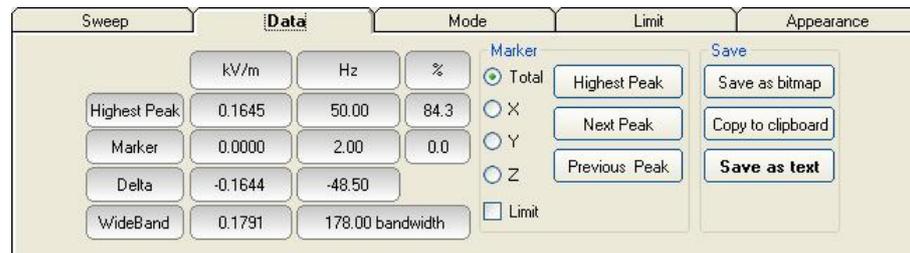
Fig.5-4 Data section

Measurement result: the following values are shown in a table form:

Highest Peak: Maximum value within the displayed spectrum.
Showed parameters:
Highest Peak field strength in the selected Unit (kV/m in the above picture)
Highest Peak frequency (Hz)
% of contribution to the WideBand result

Marker: you can place a marker anywhere on the spectrum display with a mouse click
Showed parameters:
Field strength at Marker frequency in the selected Unit (kV/m in the above picture)
Marker frequency (Hz)
% of contribution to the WideBand result

Delta: Difference in Field strength and frequency (Hz) between Highest Peak and Marker

WideBand: integration over the displayed frequency band
It is the square sum of all contributions within the displayed spectrum. Result of calculation is the field strength expressed in the selected unit while "Bandwidth" is the difference between Stop and Start frequency.

Two additional frames, Marker and Save, are included in the Data section:

Marker: in this area you can select on which trace to place the Marker: specific axis (X,Y,Z) or Total result.
Three dedicated buttons, Highest Peak, Next Peak and Previous Peak, allow Marker positioning over peaks shown by the graph.
If activated, Limit checkbox allows displaying the Limit value corresponding to the Marker frequency.

Save: three buttons in this area to save spectrum as a picture file (.bmp), as a text file (.txt) or to copy the spectrum picture to the Windows Clipboard.

5.3.3 Mode section

Mode section allows setting different acquisition modes, including Max and Average result, as well as defining Electric, Magnetic field, or both in the same graph, and preferred Unit. Logarithmic or Linear frequency axis can be set in this section too.
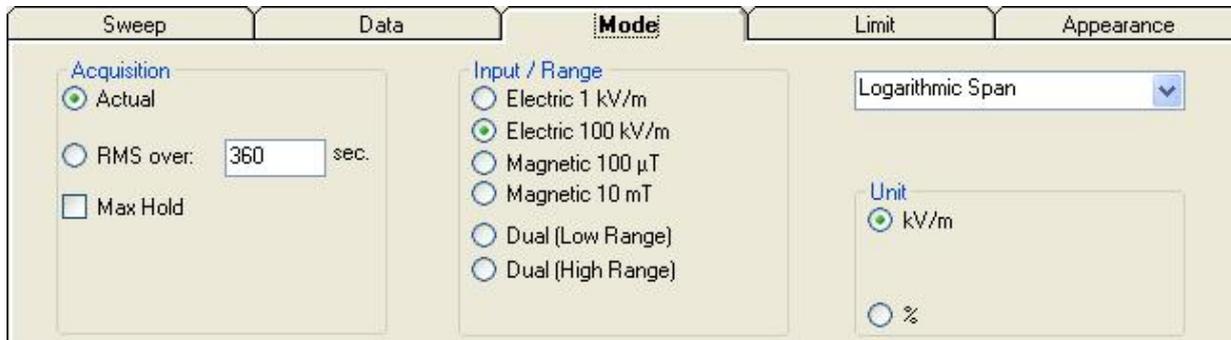
Acquisition: spectrum is displayed in different acquisition modes:

Actual: instantaneous values are shown, display is continuously updated with new instantaneous reading.

RMS over: square average calculated over the specified time period (sec) is shown. This is a moving average. Ones the first time period has been completed, oldest data is discarded to be replaced by the newest one showing thus the average value of the latest time period as specified.

Max Hold: the maximum field strength value of each frequency step is retained and displayed since the Max Hold function has been activated. Every spectral line is therefore updated only if the new value is grater than the previously dislayed one showing thus the Maximum of each spectral line since the Max hold function was activated.

Input/Range: to select electric, magnetic or dual mode field (contemporary displaying of both Electric and Magnetic fields) in two different ranges. Dual (Low Range) shows Electric and Magnetic field which full range values are 1kV/m and 100μT respectively. Full scale ranges of Dual (High Range) are therefore 100kV/m and 10mT.

Linear Span or Logarithmic Span: this is used to chose between linear or logarithmic frequency scale. Logarithmic scale is used to emphathise and clearly display low frequencies even thow high ones are included in the graph. High frequencies are therefore compressed to the high side of displayed range.

Unit: to select unit according to the Input setting. Electric field can be expressed in V/m and % of the limit only while Magnetic field can be expressed in A/m, μT (magnetic induction), mG or % of selected limit. Dual mode units are always V/m and A/m.

The unit "%" can be selected only if a Limit has been activated. Each spectrum line will then represent the field strength expressed as percent of the selected limit.

☞NOTE
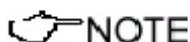
5.3.4 Limit section

Limit section allows the user to select standard ICNIRP and IEEE limits, already included by the software installation, as well as user's limits which can be created through the "Make Limit" function provided by this section.
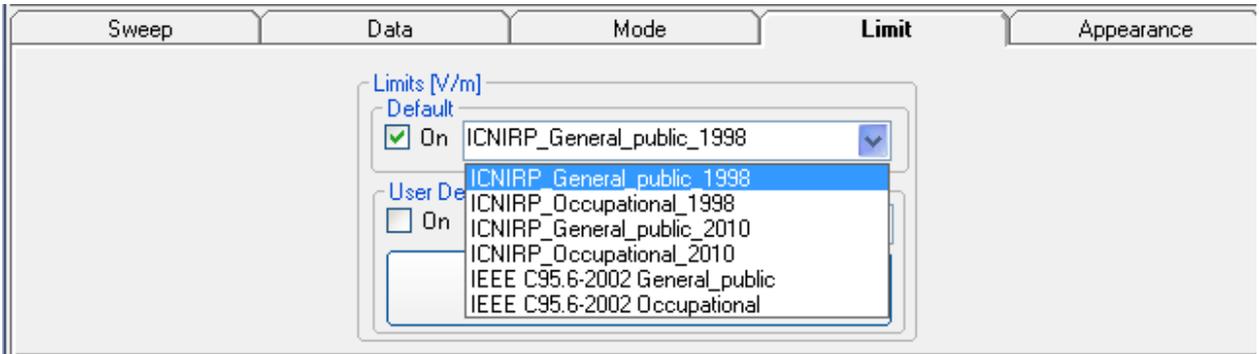
Default: The default limit section can be used to load a default standard limit saved into the memory at the factory. Default limit list shows limits which are compatible to the actual setting only. If Electric field was selected in the Mode section, electric field limits only are displayed by the limit list. No default limit is shown in case mG unit was selected.

User Defined: This limit section allows to select and activate a specific limit among limits created and saved by the user.

The **Make Limit** button opens a window to edit limits and create new ones:
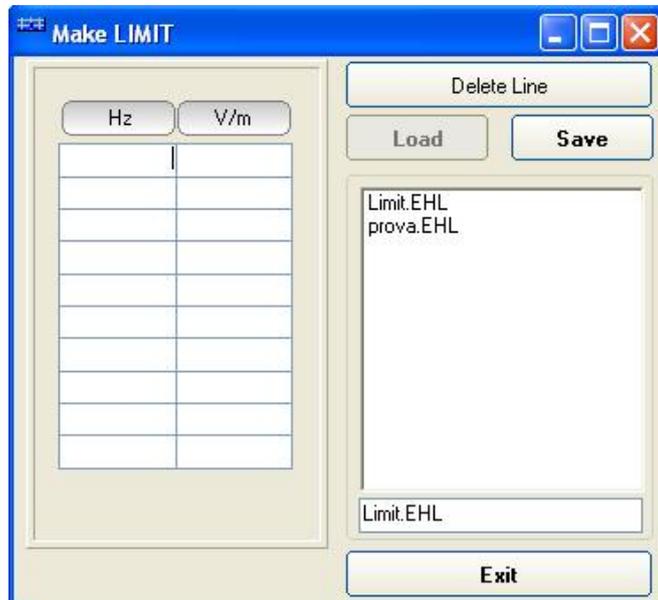
Type frequency and field strength for each point of the required limit and click save to save it under the program directory. The limit file will be created as a linear interpolation between specified points.

☞NOTE

When the ICNIRP or IEEE limit is selected, the software automatically calculates the corresponding total integration of the measured signals, and compares the result with the threshold set by the standard, considering whether it is or is not exceeded.

5.3.5 Appearance section
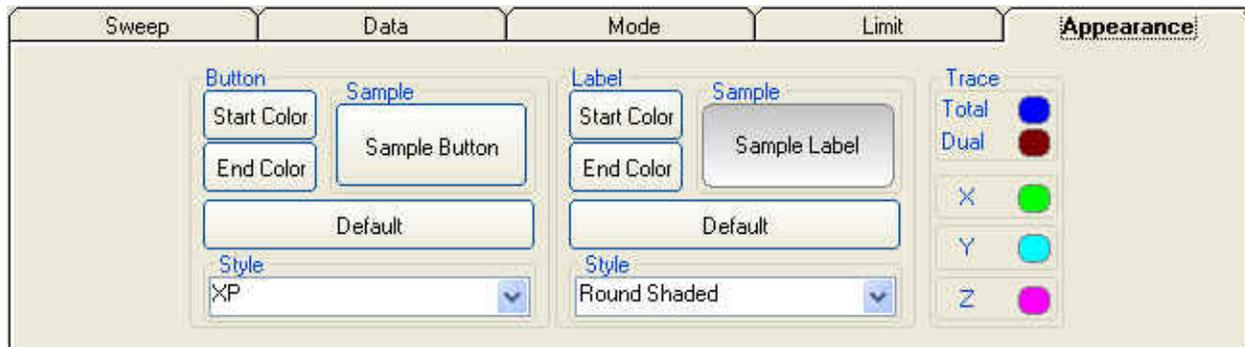
Button and label style can be selected from a **Style** list

Start and **End Color** button allow selection from a color palette

Sample Button and **Sample Label** show the appearance preview

Default button to set appearance to the default parameters

Trace to set trace colours by means of the colour palette

5.4 ICNIRP

One of the purposes of the **International Commission on Non-Ionizing Radiation Protection** is to establish guidelines for limiting EMF exposure that could affect human health.

Limit section allows the user to select **standard ICNIRP limits**, already included by the software installation.
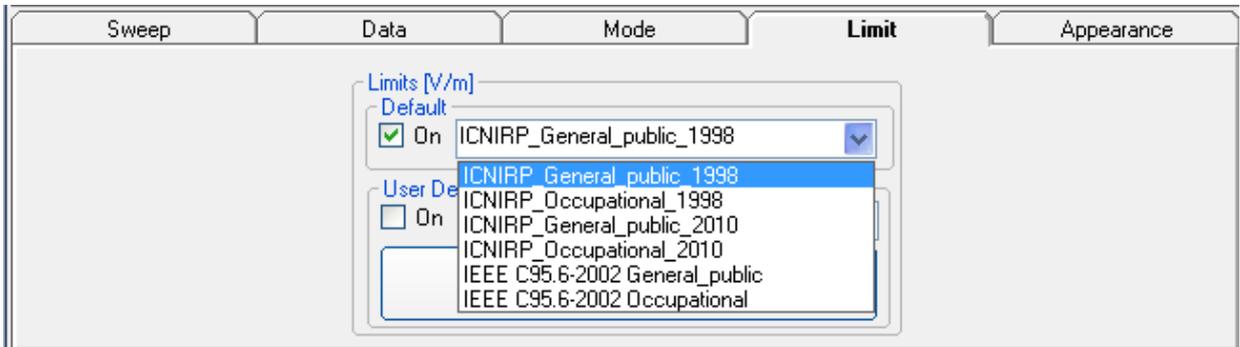
☞NOTE

When the **ICNIRP limit** is selected, the software automatically calculates the corresponding total integration of the measured signals, and compares the result with the threshold set by the standard, considering whether it is or is not exceeded.
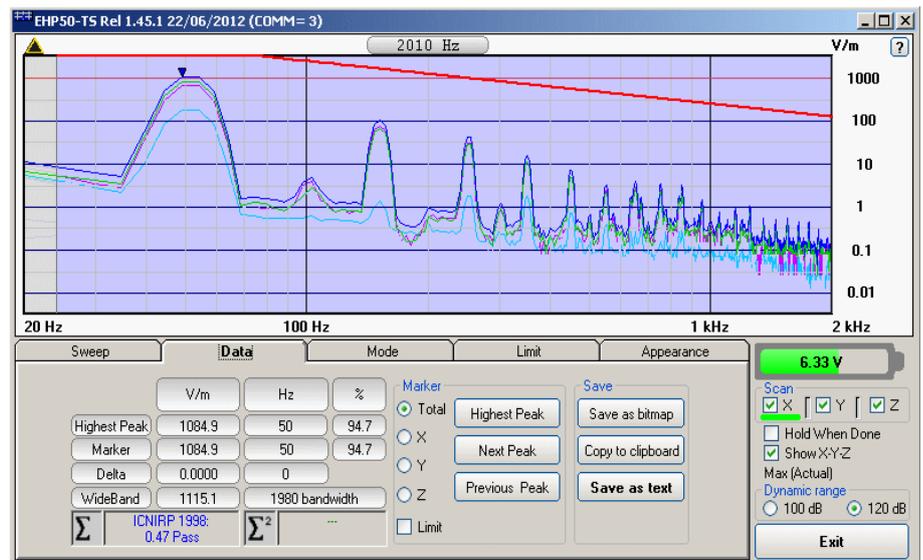
☞NOTE

The calculation of the ICNIRP value is performed if all three axes are enabled
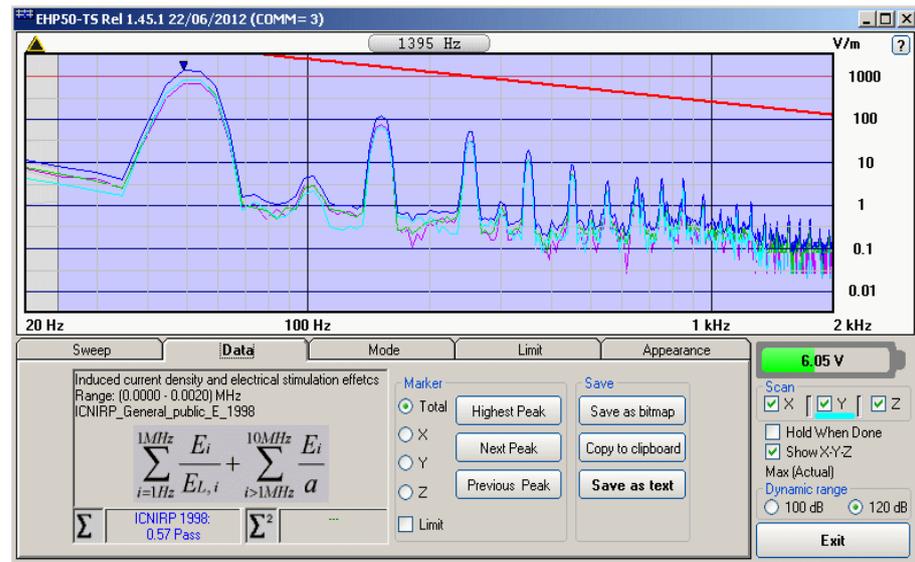
In the screenshot above it is depicted an example how the software shows the calculation of the ICNIRP value for the Electric Field measurement.
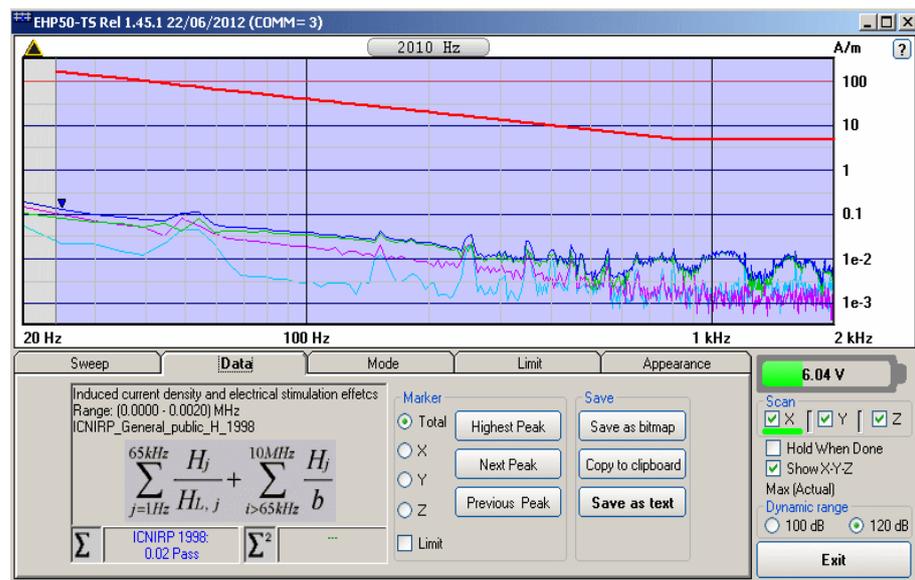
In the screenshot above it is depicted an example how the software shows the calculation of the ICNIRP value for the Magnetic Field measurement.

NOTE

The limit cannot be activated when using Dual Mode.

5.5 IEEE

One of the purposes of the **Institute of Electrical and Electronic Engineers, Inc. ("IEEE")** is to establish exposure standards.

Limit section allows the user to select **standard IEEE limits**, already included by the software installation.
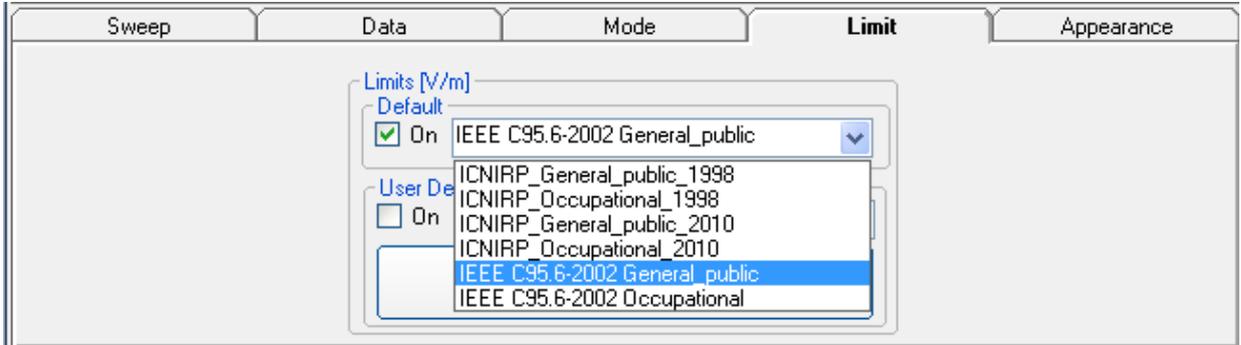
NOTE

When the **IEEE limit** is selected, the software automatically calculates the corresponding total integration of the measured signals, and compares the result with the threshold set by the standard, considering whether it is or is not exceeded.

NOTE

With coherent signals the result can be overestimated
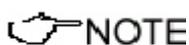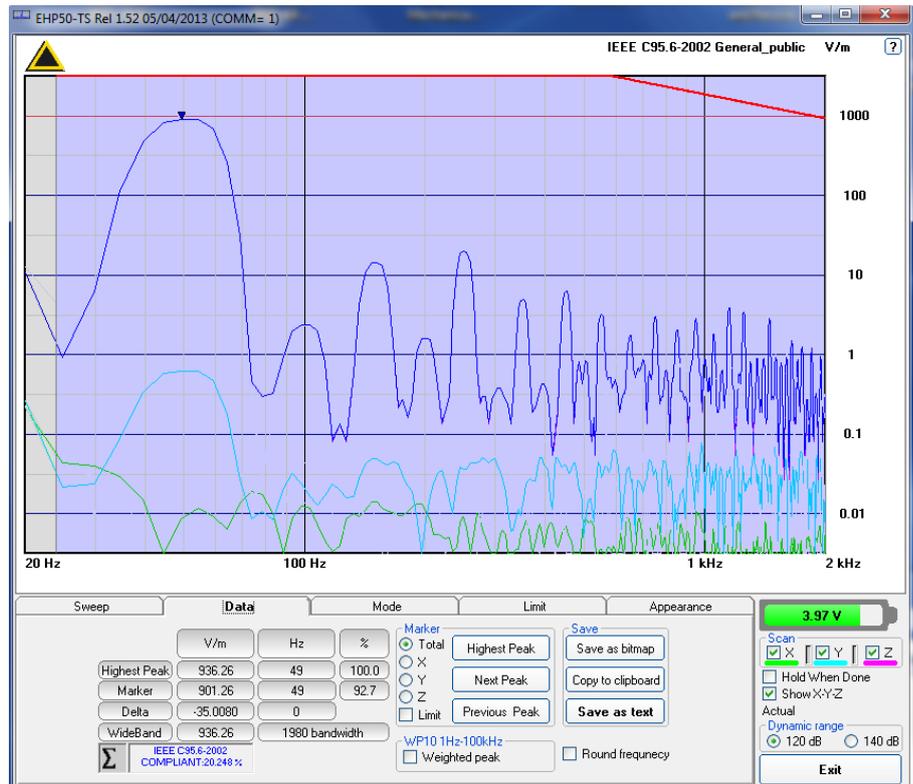
NOTE

The calculation of the IEEE value is performed if all three axes are enabled
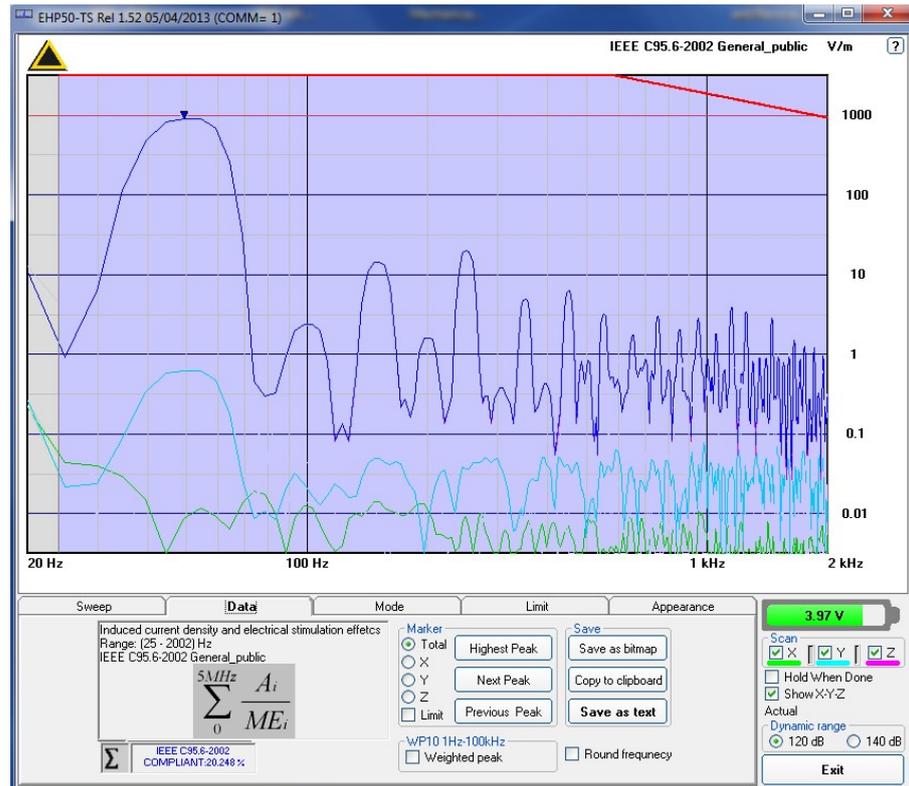
In the screenshot above it is depicted an example how the software shows the calculation of the IEEE value for the Electric Field measurement.

NOTE **The limit cannot be activated when using Dual Mode.**

5.6 Additional functions provided by EHP200-TS

EHP-200A electromagnetic field analyzer provides Electric and Magnetic field selective measurement in the 9kHz – 30MHz frequency range.
Even though there is no difference from EHP-50C regarding minimal physical overall dimensions and sensor positioning, a high frequency selective receiver is housed within this product.
Additional settings and functions are therefore available.

Regarding settings, Span can be set as desired within the entire frequency range and required RBW filter can be selected down to 1kHz allowing thus optimum selectivity.

As requested by reference standards, Average value can be automatically calculated over 6 minutes as well as over customer defineable time periods.

An important advantage, which is provided thanks to the Dual (E and H), Tri-axial sensor technology implemented in EHP-200A is the new concept of power density calculation which, unlike common practice, makes use of both E and H real measurements providing thus accurate results which are still valid in both Near and Far Field conditions.
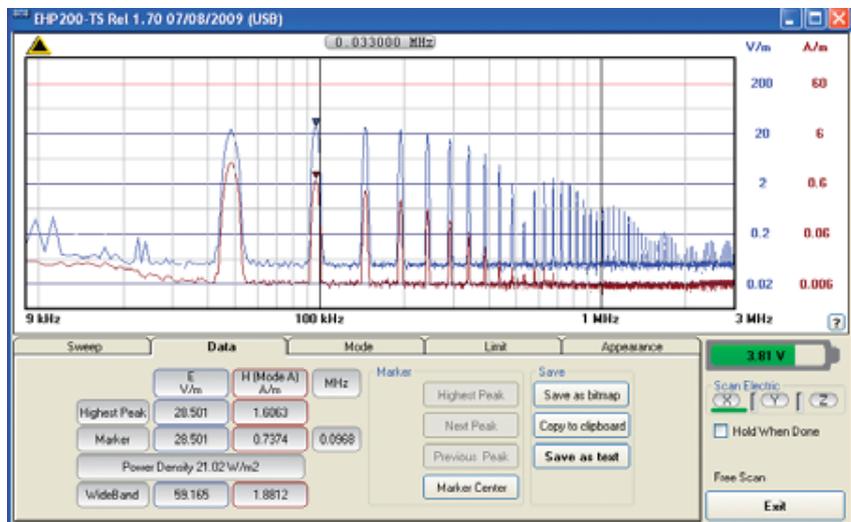
Fig.5-5 Both electric and magnetic fields can be displayed on the same graph.
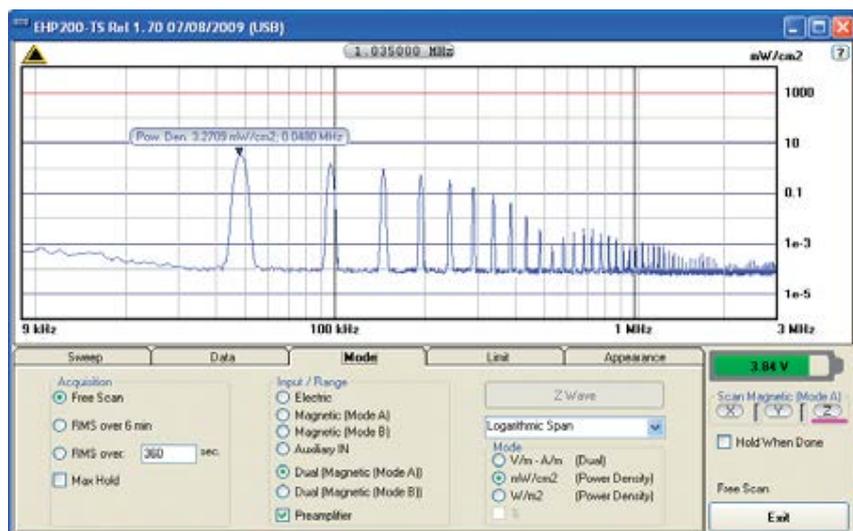
Fig.5-6 Power density spectrum is calculated over real electric and magnetic field measurement and therefore applicable to both far and near field conditions.

Description   **5-15**

New wave impedance function is provided too by selecting the Ohm unit.
This function automatically searches and displays result at frequencies
showing effective fied ratio calculation.
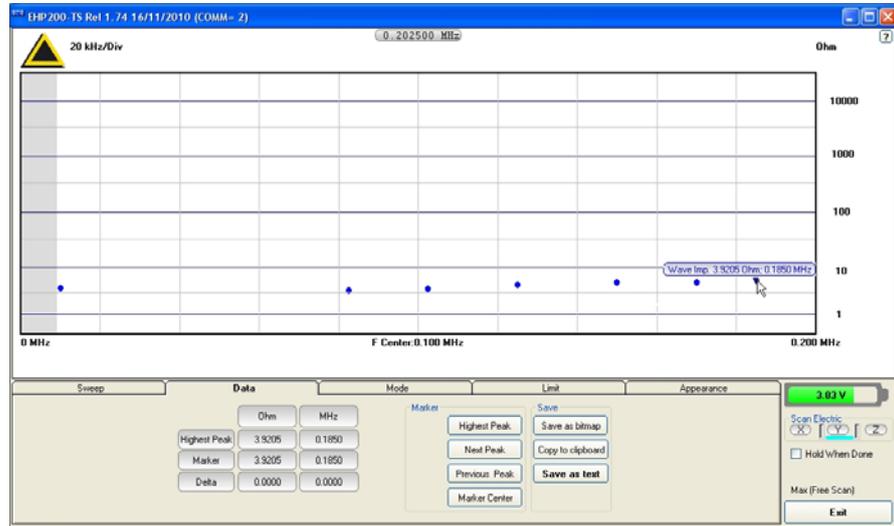
Fig.5-7 New wave impedance function

⟲NOTE

Please refer to EHP-200A user's manual for detailed informations regarding EHP200-TS application software.

6 - EHP-50C Stand alone mode

6.1 Stand alone mode description

EHP-50C has been designed to be used also in stand-alone mode. This mode is useful because no external devices is connected to the analyzer during measurements. Once the measurement parameters have been programmed through a PC, the EHP-50C analyzer can start its acquisition by storing the data over 24 hours in a stand-alone mode. It is necessary to position it over the TR-02A tripod and to activate the start. After 24 hours it will stop automatically and later it would be possible to download all data to the PC by using the provided NARDA software. From PC it is possible to select to measure the electric or magnetic field, to select the range, the Highest or Wideband mode, the SPAN whished and the sampling rate of one minute or 30 seconds.

Some typical applications are:
- Magnetic fields near high, medium and low voltage transformers
- Measurements in proximity of power line towers
- Safety measurement at worker's site
- Measurements close to machines, air conditioning systems, home appliances etc.
- Development of new products

Fig. 6-1 Shorting loop

To start the stand-alone acquisition it is necessary to follow this procedure:
- Turn OFF the EHP-50C
- Remove the fiber optic connected to PC
- Insert the small optical bridge connector into the fiber receptacle of EHP-50C
- Position it on TR-02A tripod or use the small tripod supplied with EHP-50C
- Turn ON the EHP-50C and you will see the led flashing red and green for about one minute
- Go away from the analyzer in order to non influence the measurement
- Wait 24 hours for the completion of the one day measurement
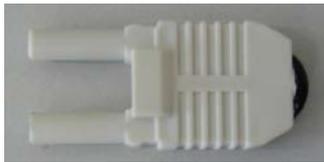
The led of EHP-50C will flash every second to inform that it is ON with red light. After every minute (or 30 sec) the led will become green for the time requested by the analyzer to perform one measurement. The time that the led remain green will depend by the selected SPAN. Lower Span requires longer measurement time.

NOTE

The acquisition can be terminated earlier than 24 hours. Just turn off the EHP-50C and run EHP50C application to download the data to the PC.

6.2 EHP-50C Data Logger

Once the data has been collected by EHP-50C, you should connect it to the PC to download all measurement results.

6.2.1 Run EHP-50C-Stand Alone mode software

Run "EHP-50C Stan Alone mode" application
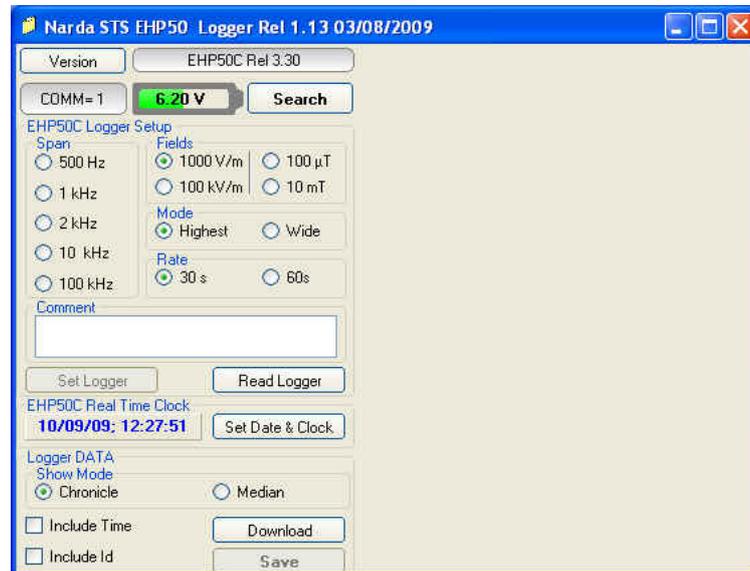
During the communication process for searching the analyzer EHP-50C, the following messages will appear in sequence for a few seconds:

To define measurement parameters for a new stand alone acquisition you may need to select:

- **(SPAN)** The Span
- **(FIELD)** The electric or magnetic field with the proper range
- **(MODE)** The Wide or Highest mode
- **(RATE)** The Storing Rate
- **(COMMENT)** To Insert the comments
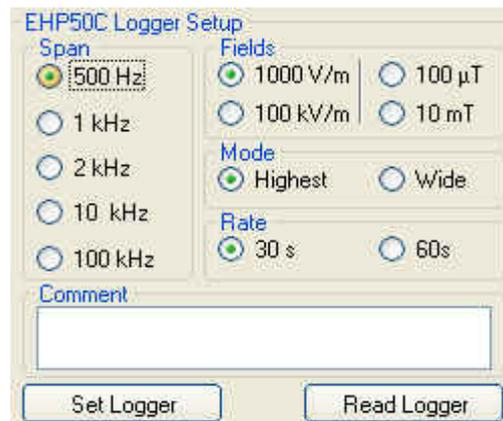
The **Read Logger** will not be available unless the communication between the PC and the analyzer has been established. Click this button to read the actual EHP-50C setup.

The **Set Logger** window will not be available unless you change some parameters. The **Set Logger** will be active and available for the user to transfer all measurement parameters to the EHP-50C internal memory.

It is possible to set the date & clock inside the EHP-50C by transferring the actual date & time of your PC. Pushing the button **Set Date & Clock** you will get the following window:

Answering YES, the date & time of your PC will be transferred inside the analyzer.

The measurement results can be shown in two modes:
Chronicle: the data are ordered by increasing time like in the following example:

Logger Started 11/07/08; 09:58:27   Rate: 30s.

Time	V/m
9.58.30	221.564
9.59.00	181.761
9.59.30	192.088
10.00.00	192.531
10.00.30	183.231
10.01.00	184.502
10.01.30	184.927
10.02.00	184.077
10.02.30	184.714
10.03.00	183.654
10.03.30	183.865
10.04.00	184.289
10.04.30	184.502
10.05.00	183.654
10.05.30	184.077
10.06.00	183.231
10.06.30	181.552
10.07.00	183.443

Median: the data are ordered from the lowest value to the highest like in the following example:

Logger Started 24/06/09; 15:56:02   Rate: 30s.

Time	V/m
03:58:00	1,756
17:10:30	5,702
17:11:30	5,708
17:12:00	5,721
17:25:30	5,721
17:38:00	5,721
17:41:00	5,721
17:46:30	5,721
18:00:00	5,721
17:13:30	5,728
17:26:30	5,728
17:38:30	5,728
17:16:00	5,735
17:18:30	5,735
17:26:00	5,735
17:27:30	5,735
17:30:30	5,735
17:34:00	5,735

☑ Include Time   Download
☐ Include Id   Save

If the checkbox **Include Time** is activated, the absolute time will be shown togher with the collected data

If the checkbox **Include Id** is activated, a number representing the position of the data inside the EHP-50C memory will be shown, like in the following example.

```
Id     Time           µT
 1    18.31        0.010
 2    18.32        0.012
 3    18.33        0.015
 4    18.34        0.011
 5    18.35        0.012
 6    18.36        0.009
 7    18.37        0.010
 8    18.38        0.042
 9    18.39        0.043
10    18.40        0.042
11    18.41        0.042
12    18.42        0.043
13    18.43        0.043
14    18.44        0.041
15    18.45        0.043
16    18.46        0.043
17    18.47        0.043
```

Download

Push the button **Download** to transfer all data from the analyzer to the PC

Save

To save the data into your own PC directory, it is necessary to activate the button **Save**.
Data will be saved in TXT format according to the following window:

Save EHP50C LOGGER DATA

Salva in: EHP50C

Recent

Desktop

Documenti

Risorse del computer

Risorse di rete

Nome file: DEF_50C   Salva

Salva come: Draft (Diagram)   Annulla
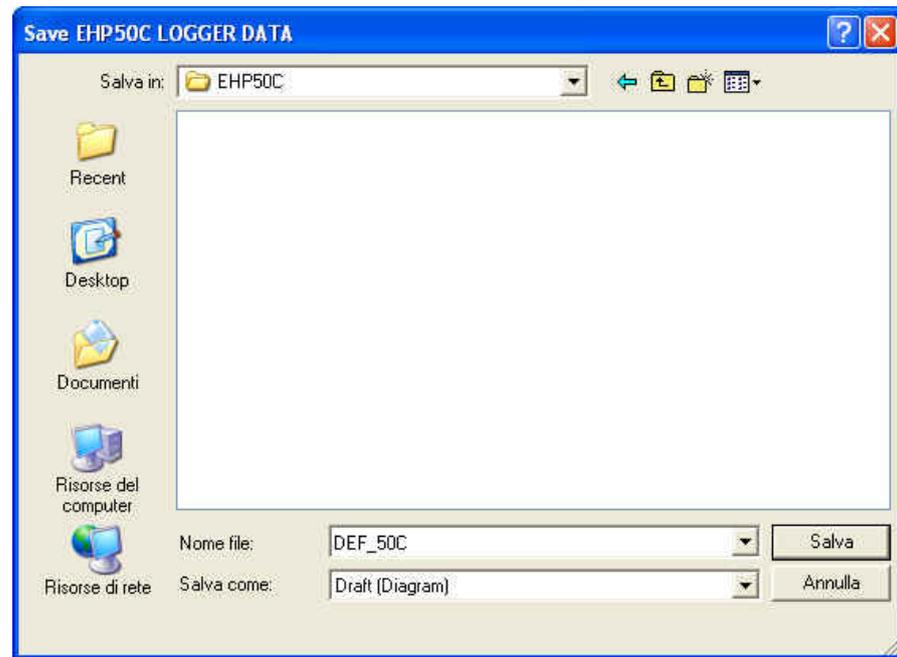
6.2.2 Use EHP-50C Logger

When the communication between the PC and the analyzer has been established, push the button **Download** to transfer all data from the analyzer to the PC.
To use such data you must save them into a file.

A typical display will be:
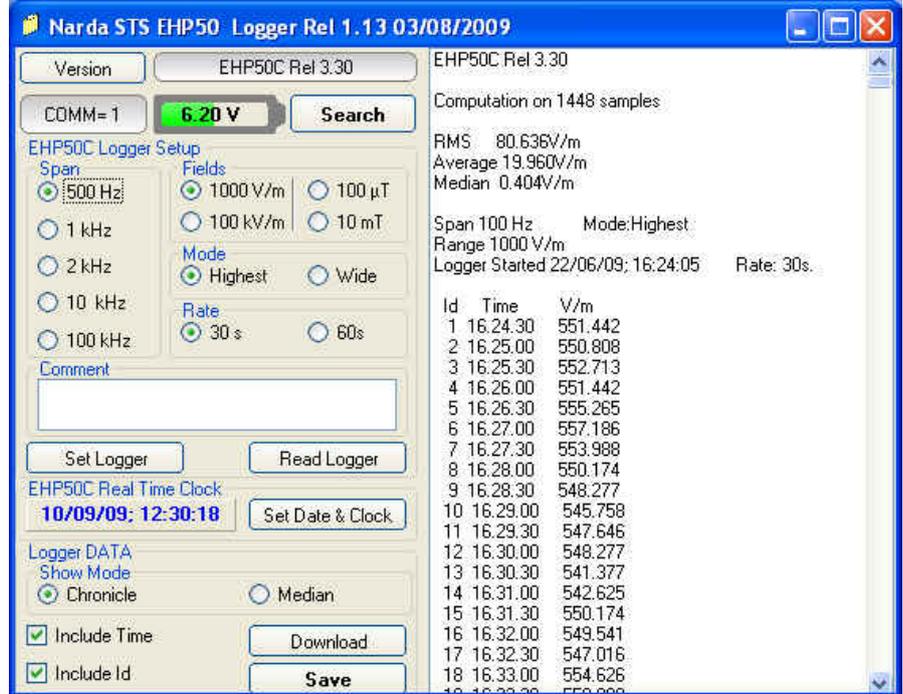
On the right side of the display, the software shows:
- Firmware release of EHP-50C
- The comment that you wrote inside the memory of EHP-50C typing few words in the **Comment** window
- Number of samples stored
- RMS, Average and Median values
- Span and Mode used during the acquisition
- Range
- Starting date and time
- All values collected

6.2.3 EHP-50C battery charging

While EHP-50C is connected to the PC and the battery charger is plugged to the analyzer, the software will display:

and the led is flashing quickly.

NOTE
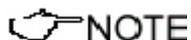
During the charging process, always remove the bridge connector from the EHP-50C

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7 – Update Firmware

7.1 Update firmware

The EHP-50C internal firmware can be updated easily by the user itself.

This section provides all the information required for firmware updating.

The Update Firmware Program is available after EHP-TS package installation.

7.2 To run the update software

Turn off the EHP-50C and connect it to a free USB or RS232 port of the PC.
Run **EHP-50C Update Firmware** to start the update program.
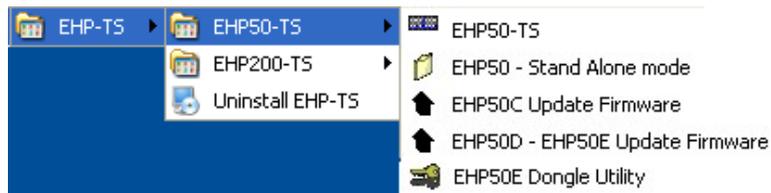
7.3 To transfer data

Main window displayed after the updating program **EHP-50C Update Firmware** has been run:

Fig.7-1 EHP-50C Upgrading Utility Main Window

Select USB or RS232 communication port.
Before selecting RS232 port, choose the COM port used.

In case the software doesn't detect any EHP-50C in the USB port, the following message will be displayed.

☞NOTE

As soon the connection is established, the program is ready to update EHP-50C firmware.
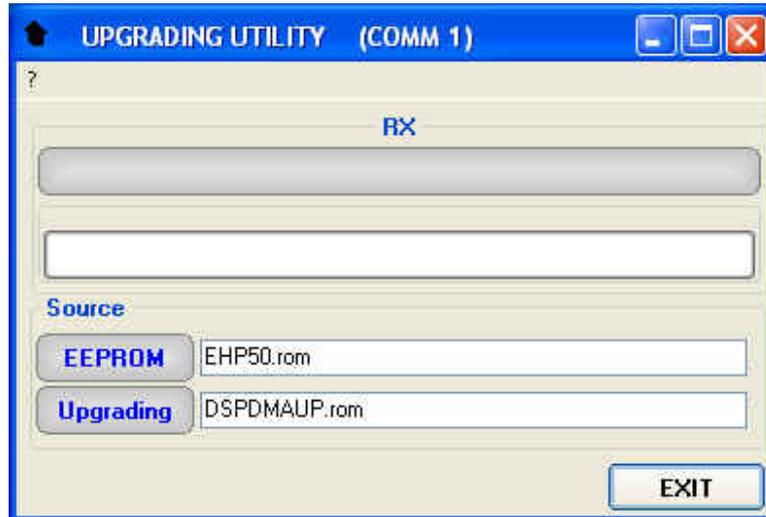
To start the process simply switch EHP-50C on and wait (few minutes) until the automatic transfer is completed.
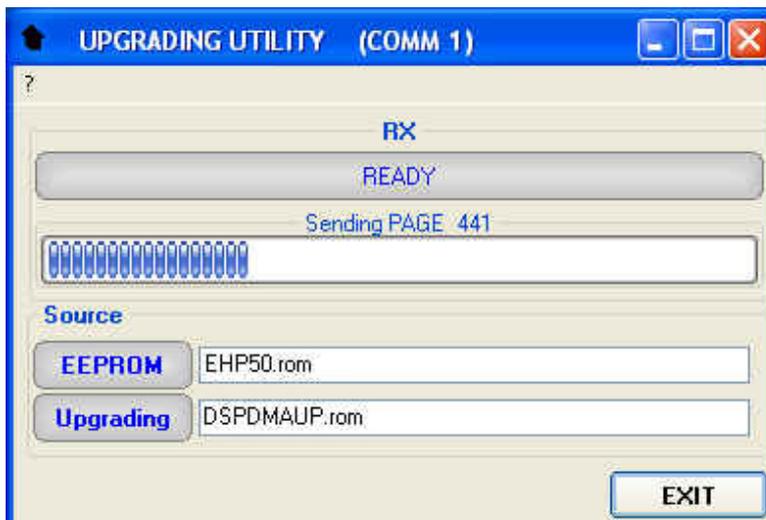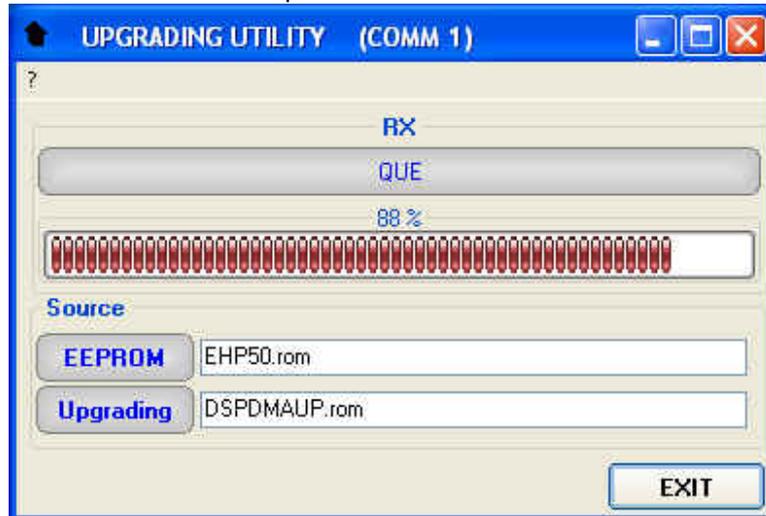
At the end, a message informs if the update has been successfully performed.

Turn the EHP-50C **OFF** (it seems already OFF but it is not) and turn it **ON** again.

The EHP-50C is now updated with the new version of the internal firmware.

It is now possible to disconnect the cable connected to the PC, with the EHP-50C meter either switched on or off.

Subsequently, when the meter is switched on again, the new version of the firmware will be displayed in the 8053-Display, EHP50-TS or EHP-50C Stand Alone Mode application software.

NOTE **To obtain firmware or programs updates for EHP-50C, please contact your NARDA agent or download it directly from the NARDA Web site: www.narda-sts.it**

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![narda Safety Test Solutions logo]

8 − Uninstalling Software

8.1 Uninstalling EHP-TS Software

It is possible to remove the EHP-TS software from the PC according to the following procedure:

Run the Uninstall EHP-TS utility.

Follow the uninstaller instructions.
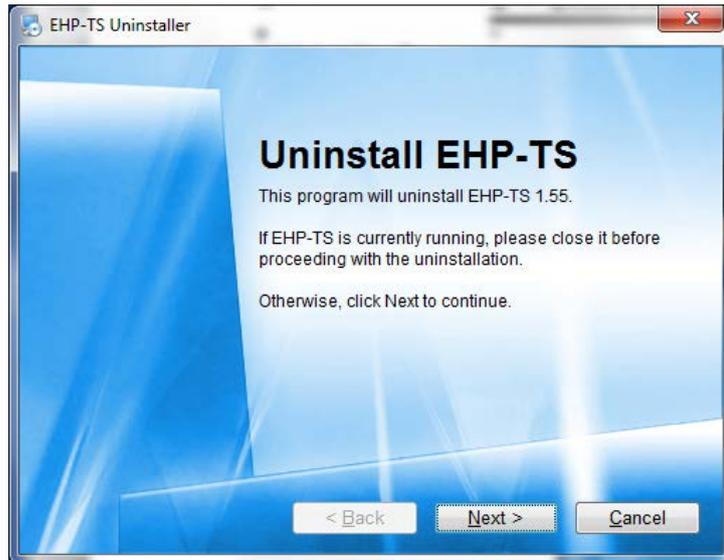
Fig.8-1 Uninstalling EHP-TS

Before removing any shared system file, the uninstaller will ask for a confirmation.
Answer "NO" in case you are not sure whether the showed system file is required for other applications.

1

EHP-TS software is now removed from the system, click "Finish" to close uninstaller utility

9 – Uninstalling USB-OC

9.1 Uninstalling driver for USB-OC

It is possible to remove the USB-OC driver from the PC according to the following procedure:

☞ **NOTE**

The following procedure shows how to remove the driver in Windows XP environment. It may be different depending on the operating system in use.

Open the Windows Control Panel.

Double click "Application Installation".

Document EHP50CEN-30514-1.52 - © NARDA 2013
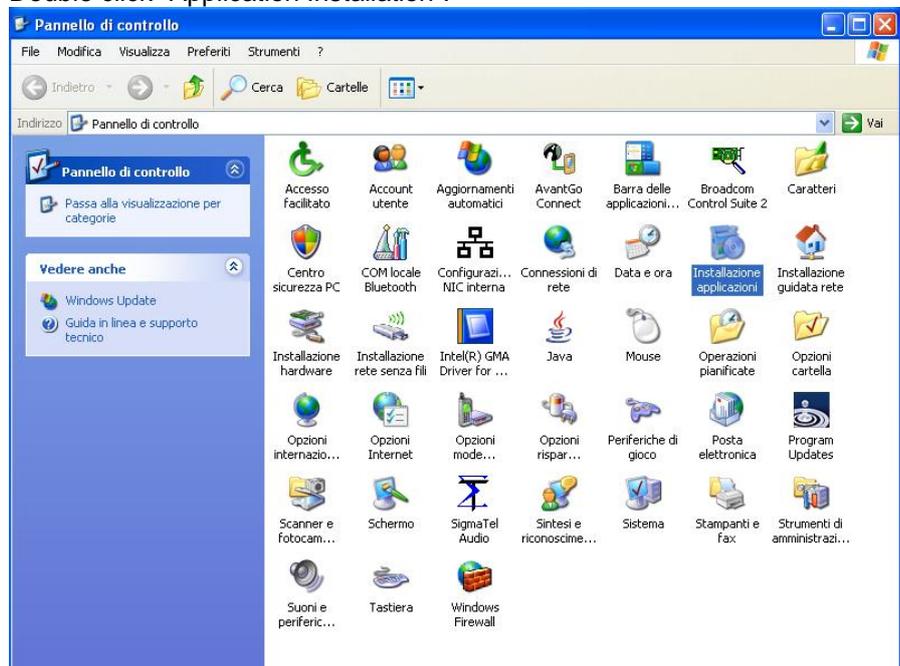
From the application list select "FTDI FTD2XX USB Drivers" and click "Change/Remove".
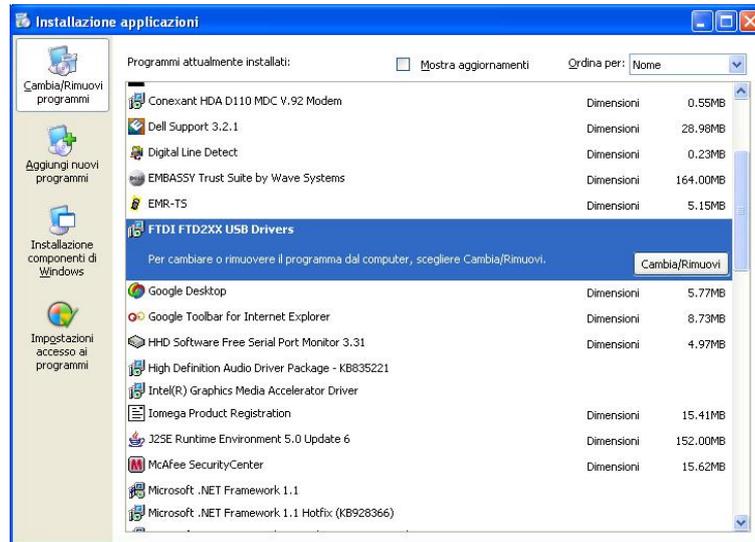
Fig.9-1 Uninstalling USB-OC

Unplug the USB-OC converter, if connected, and click "Continue".
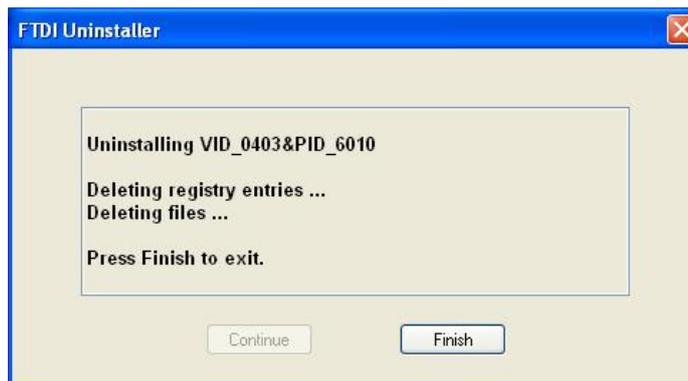
Click "finish" to exit the uninstaller, USB driver is now removed from your system.

10 - Accessories

10.1 Introduction

This section provides the information required for installing and using the accessories of the EHP-50C Analyzer.

Information is included regarding initial inspection, power requirements, interconnections, work environment, assembly, cleaning, storage and shipment.

The following general information is applicable to all accessories.

10.1.1 Preliminary inspection

Inspect the packaging for any damage.

WARNING

If the packaging or anti-shock material have been damaged, check that the contents are complete and that the product has not suffered electric or mechanical damage.

Check that all the Accessories are there against the checklist found with the apparatus.

Inform the carrier and NARDA of any damage that has occurred.

10.1.2 Work environment

Unless otherwise specified, the work environment of the Accessories, must come within the following conditions:

- Temperature   From -10°C to +50° C
- Humidity   < 90% relative

The Accessories must be stored in a clean and dry environment, free from dust, acids and humidity.

The storage environment must come within the range of the following conditions:

- Temperature   From -20°C to + 70° C
- Humidity   < 95% relative

10.1.3 Return for repair

When the Accessories need to be returned to NARDA for repair, please complete the questionnaire appended to this User's Manual, filling in all the data that will be useful for the service you have requested.

For reducing the period of time required for the repairs, it is necessary to be as specific as possible in describing the problem. If the problem only occurs in certain circumstances, please describe in detail how it happens.

If possible it is better to reuse the original packaging; making sure that the apparatus is wrapped in thick paper or plastic.

Otherwise, use strong packaging by using a sufficient quantity of shock absorbent material around all sides of the product to ensure that it is compact and does not move around inside the package.

In particular, take every precaution to protect the front panels.

Finish the package by sealing it up tightly.

Apply a FRAGILE label to the package to encourage greater care in its handling.

10.1.4 Cleaning

Use a dry, clean and non-abrasive cloth for cleaning the instruments.

WARNING

Do not use solvents, acids, turpentine, acetone or other similar products for cleaning the devices in order to avoid damaging them.

10.1.5 Power supply and battery chargers

EHP-50E accessories are powered by either internal rechargeable batteries or directly from other devices to which they are connected.

The AC/DC battery charger (650.000.036) can be used with a power frequency at either 50 Hz or 60 Hz with a supply voltage between 100 and 240 AC Volt. International AC plug adapters are provided according to the various national standards.

AC plug adapter can be easily removed from the battery charger to be replaced by a different one.

To have the greatest autonomy, a full recharging cycle should be carried out before using the Accessories.

NOTE

ALWAYS connect the battery charger to the power supply BEFORE connecting to the Charge input of the Accessories.
The battery charger has an internal protective circuit that will break the output of current if there is a charge in output when connecting to the mains.

Battery charger:
output: DC, 10 - 15 V, ~ 500 mA

Connector:

NOTE

In order to safeguard the features of the batteries, it is crucial to have a complete recharge before storing them for periods longer than 4 months. Therefore, it is warmly suggested recharging the batteries at least every 4 months even though the device has not been used.

NOTE
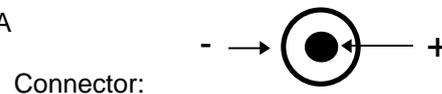
Updates of the software and firmware of the Accessories can be downloaded from the Web site http://narda-sts.it or requested directly from NARDA Sales Centres.

10.2   *USB-OC Optical USB Converter*

10.2.1 Introduction   USB-OC is an standard accessory of the EHP-50C Analyzer.
                           It converts the signals of some of the system's accessories, which are only connected via fiber optic, into USB-compatible signals. It, therefore, makes it possible to link the following items up to the USB port of any Personal Computer to operate them in conjunction with specific application software and for firmware updating:

- EHP-50C Electric and Magnetic Field Analyzers
- EHP-200A Electric and Magnetic Field Analyzers
- 8053-GPS Global Positioning System

Either USB-OC or 8053-OC is indispensable for updating the internal firmware of the above-mentioned items via a Personal Computer and the relative update software is available free-of-charge on NARDA's Web site at: http://narda-sts.it

10.2.2 Installation   Insert USB-OC in the connector of a free USB port of the PC, connect the fiber optic coming from the probe or other Accessories treating the locating key with care.
                           Considering the very low consumption of the device, the power required by USB-OC is taken directly from the USB port of the PC. This means no maintenance is needed.

Table 10-1 Technical specifications of the USB-OC Optical USB Converter	
Max. length of the fiber optic	40 m
USB Connector	Type A Male

NOTE

The link between USB-OC and a HUB USB device or USB cable extension could not work properly. Connect the USB-OC to the PC directly.

Front view

Key:

Fiber optic connector

Rear view

Key:

USB Type A Male

Fig. 10-1 USB-OC adapters

Power supply   USB-OC is powered directly from the USB port of the PC.

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10.3   *8053-OC Optical RS232 Converter*

10.3.1 Introduction

8053-OC is an optional accessory of the EHP-50C Analyzer.

It converts the signals of some of the system's accessories, which are only connected via fiber optic, into RS-232-compatible signals. It, therefore, makes it possible to link the following items up to the serial port of any Personal Computer to operate them in conjunction with specific application software and for firmware updating:

- EHP-50C Electric and Magnetic Field Analyzers
- EHP-200A Electric and Magnetic Field Analyzers
- 8053-GPS Global Positioning System

Either 8053-OC or USB-OC is indispensable for updating the internal firmware of the above-mentioned items via a Personal Computer and the relative update software is available free-of-charge on NARDA's Web site at: http://narda-sts.it

10.3.2 Installation

Insert 8053-OC in the connector of a free serial port of the PC, connect the fiber optic coming from the probe or other Accessories treating the locating key with care.

Considering the very low consumption of the device, the power required by 8053-OC is taken directly from the serial port of the PC. This means no maintenance is needed.

Table 10-2 Technical specifications of the 8053-OC Serial Optical Converter	
Max. length of the fiber optic	80 m
RS 232 Connector	9 pin DB9

NOTE   **The energy available on the DB9 connector of some PC model could be not sufficient to guarantee a good link with 80 meter fibre.**

NOTE   **The energy available on the DB9 connector of some PC model could be not sufficient to guarantee a link with 8053-OC. In this case, is necessary use 8053-OC-PS between the converter and PC.**

Front panel
Key:

1 – Fiber optic connector
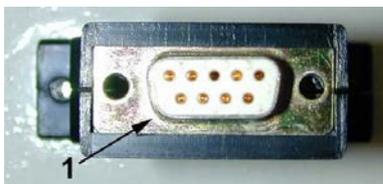
Rear panel
Key:

1 - RS232 female DB9 connector

Fig. 10-2 8053-OC Panels

Power supply   8053-OC is powered directly from the serial port of the PC.

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10.4 *8053-OC-PS Power Supply*

10.4.1 Introduction

8053-OC-PS is an optional accessory of the EHP-50C Analyzer.

8053-OC-PS is indispensable for some PC model don't have sufficient energy on the Serial Port to guarantee a link with 8053-OC.

10.4.2 Installation

Insert 8053-OC-PS in the connector of a free serial port of the PC or serial cable and connect the 8053-OC to 8053-OC-PS. To supply the 8053-OC-PS with 230Vac - 9Vdc Wall Adapter. Connect the fiber optic coming from the probe or other Accessories to 8053-OC.
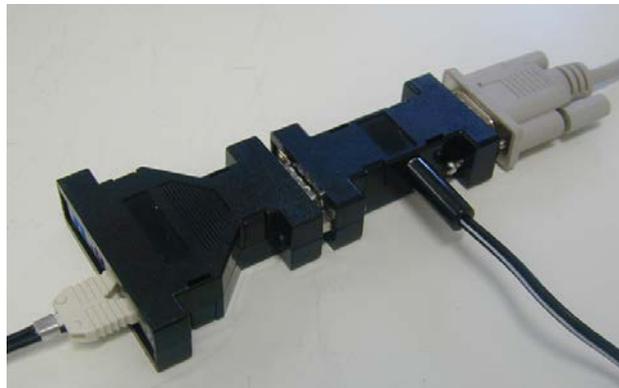
Table 10-3 Technical specifications of the 8053-OC-PS Power Supply	
RS 232 Connectors	9 pin DB9

Front panel

RS232 male DB9 connector

Rear panel

RS232 female DB9 connector

Side panel

Supply male connector

Fig. 10-3 8053-OC-PS Connectors

Power supply

8053-OC-PS is powered through 230Vac - 9Vdc Wall Adapter.

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10.5 *8053-Display*

10.5.1 Introduction

8053-Display is an Optional accessory of the EHP-50C Analyzer.
8053-Display is a versatile and expandable test system suitable for measuring electric and magnetic fields relating to electrosmog.
The system consists of various electric and magnetic field probes and of a compact and portable meter equipped with a wide LCD display, 4 simple function keys (which allow different actions and settings, in accordance with the selected menu), internal rechargeable batteries and RS232 and fiber optic interfaces. The system also has a wide range of Accessories, which have been designed for all the needs of the tests.

10.5.2 Standard accessories

The standard accessories included with 8053 DISPLAY are:
- 8053-SC Soft carrying case, holds basic unit and accessories (650.000.035);
- 8053-Serial Cable, 1.5m (210.500.002);
- AC/DC battery charger (650.000.036)
- Downloading & firmware update Program Disk;
- 8053SW-02 Data acquisition software
- User's Manual;
- Calibration Certificate;
- Return for Repair Form.

10.5.3 Optional accessories

The following accessories may be ordered separately:

- FO-8053/10 Fiber Optic Cable (10m);
- FO-8053/20 Fiber Optic Cable (20m);
- FO-8053/40 Fiber Optic Cable (40m);
- FO-8053/80 Fiber Optic Cable (80m);
- FO-10USB Fiber Optic Cable (10m);
- FO-20USB Fiber Optic Cable (20m);
- FO-40USB Fiber Optic Cable (40m);
- TR-02A Tripod with Swivel;
- TT-01 Fiber Glass Telescopic Support;
- SB-04 Switching Control Box;
- 8053-CC Rigid Carrying Case;
- 8053-CA Car Adapter;
- 8053-OC Optical Converter;
- USB-OC Optical Converter;
- 8053-GPS GPS Unit;
- 8053-RT Remote Trigger;

NOTE

Please refer to the device user's manual for any further indication.

10.5.4 Main specifications	Table 1-1 lists the specifications of 8053-Display. The specifications of all accessories are listed in the Chapter on Accessories. The following conditions apply to all specifications: • Temperature for use must be between -10°C and +40°C.

TABLE 10-4 Technical Specifications of 8053 DISPLAY	
Frequency range	Depending on the probe
Dynamic range	>140 dB (depending on the probe)
Operating range	|
Resolution	| Depending on the probe (See Table 1-2)
Sensitivity	|
Units	V/m, kV/m, μW/cm², mW/cm², W/m², A/m, nT, μT, mT;
LCD Display	
Field measured	X, Y, Z in absolute values, percent and total.
Time	Internal clock in real time
Probe	Display of the model and date of calibration
Graphic bar	The analog bar displays: - real time value with respect to full scale; - field versus time (in linear or logarithmic form) with automatic time scaling; - alarm threshold.
Measuring function	
Internal memory	Up to 32.700 measurements (up to 8.100 standard memory, up to 21.600 extended memory)
Alarm	Variable threshold from 0 to 100% of full scale. Internal sound and blinking symbol on the display when the level is greater than the alarm threshold
Functions	Minimum, Maximum and Averaging
Averaging mode	Arithmetic, quadratic (RMS), manual, rolling and spatial
Averaging time	Definable 30 sec, 1, 2, 3, 6,10,15, 30 min or manual
Data acquisition (Logger)	Sampling mode (1, 10-900 sec/sample), data change, over the limit, average on 6 min, manual, spectrum (with EHP-50C)
General specifications	
Output	LCD display 72x72mm 128x128 pixel, RS232 (with cable or fiber optic)
Input	Fiber optic connector
Internal battery	Rechargeable at NiMH (5 x 1.2 V)
Operational time	24 hours normal mode, 48 hours (in SAVE MODE function: display off)
Recharge time	< 4 hours (15 minutes charge for 1 hour of use)
External power supply	DC, 10 - 15 V, I = about 500 mA
Interfaces	RS232 (calibration and firmware update)
Software/Firmware	Upgrade available via Internet at the Web site: http://www.narda-sts.it
Autotest	Automatic during switch-on of all functions;
Calibration	Inside the built-in E²PROM of the probe
Conformity	With Directives 89/336 and 73/23 and the amendments to them CEI 211-6 and 211-7
Operating temperature	From -10 to +40°C
Storage temperature	From -20 to +70°C
Size (WxHxD)	108 x 240 x 50 mm
Weight	1.07 kg
Tripod support	Threaded insert ¼"

10.5.5 Field probes   Beside EHP-50C, other probes are available for using with 8053-Display as EHP-200A and other models to be launched in the near future.

<table>
<tr><th colspan="5">TABLE 10-5 Series of Electric and Magnetic field probes</th></tr>
<tr><th colspan="2">Field Probes</th><th>Frequency range</th><th>Level range</th></tr>
<tr><td rowspan="8">Electric and Magnetic Field Analyzer EHP200A</td><td>@10kHz RBW</td><td rowspan="2">9 kHz ÷ 30 MHz</td><td>0,1 ÷ 1000 V/m</td></tr>
<tr><td>with preamplifier ON</td><td>0,02 ÷ 200 V/m</td></tr>
<tr><td>@10kHz RBW</td><td rowspan="2">9 kHz ÷ 3 MHz</td><td>30 mA/m ÷ 300 A/m</td></tr>
<tr><td>with preamplifier ON</td><td>6 mA/m ÷ 60 A/m</td></tr>
<tr><td>@10kHz RBW</td><td rowspan="2">300 kHz ÷ 30 MHz</td><td>3 mA/m ÷ 30 A/m</td></tr>
<tr><td>with preamplifier ON</td><td>0.6 mA/m ÷ 6 A/m</td></tr>
<tr><td>@10kHz RBW</td><td rowspan="2">9 kHz ÷ 30 MHz</td><td>-80 ÷ 0 dBm</td></tr>
<tr><td>with preamplifier ON</td><td>-94 ÷ -14 dBm</td></tr>
</table>

10.5.6 Front panel

Fig. 10-4 Front panel

Key:

1. Display

2. Fiber optic Input/Output for additional probes, USB or RS232 interface via fiber optic link

3. RS232 interface

4. Battery charger input, from 10 to 15V DC, 500 mA

5. Securing screws to tripod

6. Alphanumeric keyboard

10.5.7 Side panel
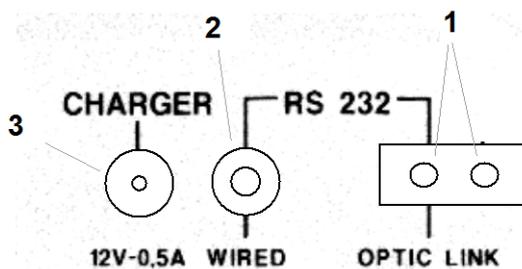
Fig. 10-5 Side panel

Key:

1. Connection EHP-50C or EHP200A fiber optic link

2. Wired RS232 interface for direct connection to the PC

3. Battery charger connector (12V, 0.5A)

10.5.8 Battery charger
The battery charger supplied with the meter can work at either 50 Hz or 60 Hz with a supply voltage range between 100 and 240 Volt.
It is supplied with different connectors to the supply mains in accordance with the various national standards.

10.5.9 To substitute the mains connector
To substitute the mains connector, simply remove the one installed on the battery charger and replace it with the one that is in compliance with its use.

10.5.10 To check the internal batteries
If the internal batteries are to have the greatest autonomy, we recommend that a full recharging cycle be carried out before using the meter.
To do this, go through the following procedure:
- Connect the battery charger to the power socket
- Link the output connector of the battery charger to the input **CHARGER** on the side panel of the meter
- 8053-Display will switch on automatically, after making a sound produced by the internal buzzer, the display will be activated and the meter will start its auto-check and begin the procedure for recognising the probes.
- The main window will therefore be activated and the status of the charge (**CHG**) of the battery will be displayed in the **STATUS** box

Indications of the battery in the STATUS box:
The status of the charge of the battery is displayed in the top left-hand corner of the **STATUS** box. The symbol of a small battery will be filled up proportion to the status of the battery charge.
The battery charger will be automatically stopped when one of the following occurs and a small connector will be displayed relating to a letter indicating the end of the recharging cycle.
Display of the following letters means:
V – The voltage of the batteries has reached 1.45 V/element (7.25 total), and therefore the recharging cycle is complete.
H – The recharging cycles has lasted for more than 4 hours.
T – The temperature of the batteries, compared to the temperature stored after ten minutes recharging, has increased more than 10 °C, or the temperature of the battery has reached 65 °C.

When the recharging cycle is finished, the 8053-Display is ready for use.

☞NOTE
To avoid damage to the batteries, when the T symbol appears, the recharging cycle is stopped automatically.
To finish the recharging cycle wait for about ten minutes for the batteries to cool down then reconnect the battery charger.
Battery charger: DC, 10 - 15 V, ~ 500 mA

- → (●)— +

Connector:
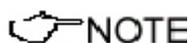
☞NOTE
ALWAYS connect the battery charger to the mains power BEFORE connecting the DC output to 8053 DISPLAY. The battery charger has an internal protective circuit that will not let it work if there is a load connected to the battery charger before the connection to the mains is activated.
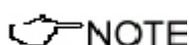
☞NOTE
In order to safeguard the features of the batteries, it is crucial to have a complete recharge before storing them for periods longer than 4 months. Therefore, it is warmly suggested recharging the batteries at least every 4 months even though the device has not been used.

10.6   *SB-04 Switching Control Box*

10.6.1 Introduction

SB-04 Switching Control Box is a versatile and expandable Accessory designed to operate with the EHP-50C for measuring electric and magnetic fields.

SB-04 allows the user to take field measurements with up to 16 probes connected at the same time, either placed in different measuring points and/or working on different frequencies and full scale ranges

Two internal microcontrollers check all operations interfacing the measured data with SW-02 Data Acquisition and Graphics Presentation Software, running on the user's PC.

A SB-04 enables the user to connect up to four devices via fiber optic to the PC by a single RS232 connection.

Up to four SB-04 can be interconnected for the purpose of acquiring and storing measurements coming from a maximum of 16 measuring devices.

☞NOTE

Every probe to be connected to SB-04 must be equipped with optional FO-8053/xx Fiber Optic Cable (xx required cable length).

10.6.2 Standard Accessories

The following are the standard Accessories supplied with the SB-04:
- RS232 serial cable with 9/25 pin adapter (2 m);
- SB-04 - SB-04 Expansion cable;
- 8053-BC Battery charger;
- 8053SW-02 Acquisition software, without hardware key;
- User's Manual;
- Certificate of Compliance;
- Return for Repair Form;
- Protective covers for the fiber optic ports;

10.6.3 Main specifications	The following Table lists the main specifications.

The following conditions apply to all specifications:
- The ambient temperature for use must be between -10°C and 40°C.

TABLE 10-6 Technical Specifications of SB-04	
Connections	Up to 4 devices via fiber optic. Connection with the RS232 serial port to a PC for remote operations and for updating the Firmware. Expandable up to 4 SB-04 through the integrated expansion port for a total of 16 connected devices.
General specifications	
Internal batteries	rechargeable NiMH batteries (5 x 1.2 V)
Autonomy	> 10 hours
Recharging time	< 12 hours
External DC supply	DC, 10 - 15 V, I = about 200 mA
Connections in fiber optic	up to 80 m.
Internal Firmware update	able to be loaded by the user through the serial port
Autocheck	automatically when switched on
Conformity	to Directives 89/336 and 72/23.
Operational temperature	from –10°C to +40°C
Storage temperature	from –20°C to +70°C
Size (H x W x D)	25 x 148 x 220 mm
Weight	900 g
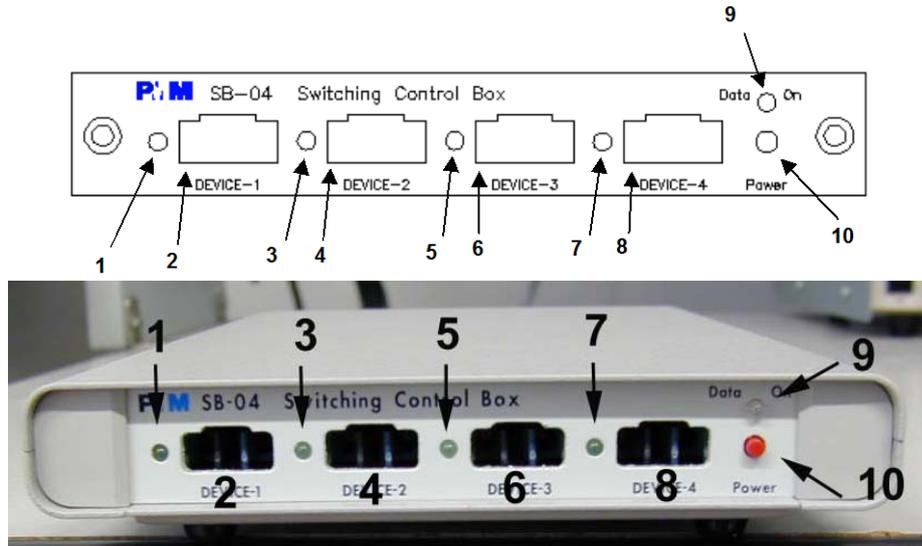
Fig. 10-6 Front panel

Key:

1. Device-1 Led;
2. Device-1 fiber optic connector;
3. Device-2 Led;
4. Device-2 fiber optic connector;
5. Device-3 Led;

6. Device-3 fiber optic connector;
7. Device-4 Led;
8. Device-4 fiber optic connector;
9. Data On Led;
10. On/Off button;
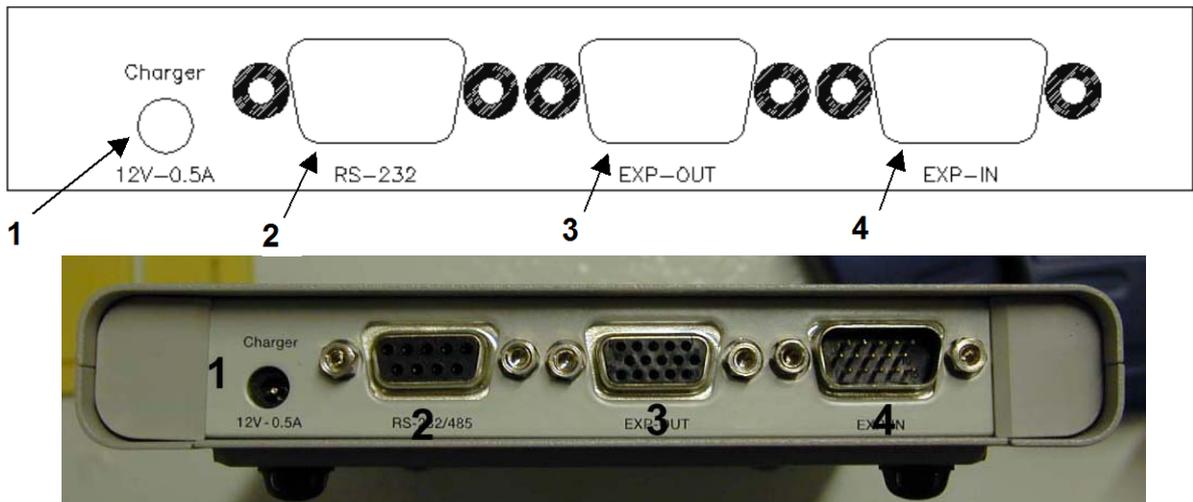
Fig. 10-7 Rear panel

Key:

1. Battery charger Connector (12V, 0,5A);
2. RS 232 Connector

3. Expansion out Connector;
4. Expansion in Connector.

10.6.4 System configuration

The SB-04 Switching Control Box can operate in conjunction with various sensors in a wide range of frequencies and levels. The EHP-50C meter can also be connected to it.
Up to four EHP-50C can be connected to each SB-04.

Power Supply/Charger

8053-GPS   EHP-50C   EHP-50C   EHP-50C

CHG
RS232

PC

SB-04

SW02

Optic Fibers

RS 232

CHG   SB-04

OUT

IN

Device 16
Device 15
Device 14
Device 13

Power Supply/Charger

SB-04

OUT

IN

Device 12
Device 11
Device 10
Device 9

Supplied Extension Cables

SB-04

OUT

IN

Device 8
Device 7
Device 6
Device 5

PC

RS232   SB-04

OUT

IN

SW02

Device 4
Device 3
Device 2
Device 1

OpticFibers

RS 232

10.6.5 Power supply and battery recharging of SB-04

SB-04 has an internal rechargeable NiMH battery that can be recharged with the battery charger supplied with it (the battery charger is the same as that of 8053 DISPLAY).

If the internal batteries are to have the greatest autonomy, we recommend that a full recharging cycle should be carried out before using the apparatus.

NOTE

ALWAYS connect the battery charger to the power supply BEFORE connecting it to the SB-04.
The battery charger has a internal protective circuit that will break the output of current if there is a charge in output when connecting to the mains.

Battery charger:
output: DC, 10 - 15 V, ~ 500 mA

Connector: $- \rightarrow \odot \leftarrow +$

NOTE

The SB-04, which may be used, without distinction, with both the battery charger connected or disconnected, will be respectively powered by the mains or internal batteries.

To switch SB-04 on or off, press the Red **POWER** button on the front panel of the apparatus.

NOTE

Pressing the POWER button down for more than 4 seconds forces the hardware of the apparatus to shut down. In this case, it is necessary to wait several seconds before switching it on again.

After being switched on, the two-colour LED labelled **ON DATA** will provide the following information about power supply:

TABLE 10-7 Led colour			
Power supply	**LED blinking**	**Colour**	**Indication of the LED DATA ON**
Batteries	Low speed	Green	The SB-04 is switched on and in normal use, the voltage of the battery exceeds 5.9 V.
Batteries	Low speed	Red	The voltage of the batteries is less than 5.9 V, the batteries need to be recharged.
Power supply	High speed	Green	The SB-04 is switched on and in normal use, the batteries are charged.
Power supply	High speed	Yellow	The SB-04 is switched on and in normal use, the batteries are being recharged.

NOTE

When SB-04 is connected to the Battery Charger, it switches on automatically and the POWER button to switch it off is disabled as long as the Battery Charger is connected.

NOTE

When the SB-04 is battery powered and no data transfer with the control software is in progress, it automatically switches itself off after 350 seconds (5 minutes) in order to keep the battery charged.

10.6.6 Installation

To install the SB-04 connect the optional FO-8053/xx Fiber Optic Cable to the **DEVICE-X** input on the front panel being careful to place the spigot in the right direction, then connect the other side of the fiber optic to the **OPTIC-LINK** connector of the EHP-50C measuring device.

NOTE

Every DEVICE-X connection has a LED diode near to it.
When the device is connected and switched on the LED blinks indicating that the connection has been made properly.

The following connections are to be found on the back panel:
- **Charger** of the Battery charger/Power supply connector – to recharge or supply power to SB-04;
- **RS 232/485** – to connect to a free serial port of a PC via the serial cable supplied;
- **EXP-OUT** – to connect to the **EXP-IN** connector of the next SB-04 (when required) with the extension cable supplied.

The battery charger can be connected or disconnected, depending on the type of power supply the user wishes to use.

NOTE

When more than one SB-04 is in use, up to 4 in all, each one can be charged or powered by a single power supply.
The battery charger can be connected, without distinction, to any SB-04.
The voltage of the power supply will be propagated to all the devices via the extension cable.

To switch SB-04 on or off press the Red **POWER** button on the front panel.

10.6.7 Use of PMM SB-04

On completion of the set-up of the desired measurement, start SW-02 Data Acquisition and Graphic Presentation Software on the control Personal Computer.

WARNING

To avoid damage to the connection ports of the fiber optics due to the accumulation of dust or dirt and to avoid disturbance to its operation through external luminous sources, always leave the protective covers on the ports that are not in use.

10.7   *TR-02A Tripod*

10.7.1 Introduction

TR02A is an Optional Accessory of the EHP-50C analyzer. It allows EHP-50C Analyzer to be easily supported during field measurements.

Each of these instruments has a securing screw, usually placed on the bottom part of its container, that enables it to be easily and quickly put into place through the 8053-SN swivel supplied with the tripod.

The design and materials of the TR-02A tripod have been specially selected to prevent it from disturbing the sensors and, therefore, the measurements taken.

The height of the tripod can be adjusted by means of its extendable legs and it is furnished with special feet that are able adapt to all surfaces thereby improving stability. The height of its central support can also be adjusted.

It is supplied with a small protective carrybag to make it easy to carry.

Table 10-8 Technical specifications of the TR-02A Tripod	
• **Legs**	3 legs x 3 extendable sections
• **Transport size:**	76 x 12 x 12 cm
• **Minimum height:**	60 cm
• **Maximum height:**	180 cm
• **Weight**	2.8 kg
• **Load capacity:**	10 kg
• **Tripod support**	Threaded insert ¼ "

Details of the mounting head of the central column of the support and its adjustments:
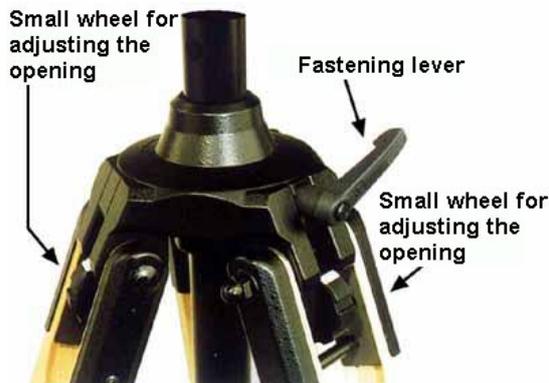
Fig. 10-8 TR-02A Tripod

The angle for opening each leg into three different positions can be adjusted by using special small adjustable wheels:

- fixed opening of 20°: White adjustment indicator is visible (as in the Figure);
- fixed opening of 45°: Red adjustment indicator is visible;
- variable opening: no indicator is visible.

The central support can be adjusted and blocked by means of a special fastening lever.

Details of the swivel for fastening to the **8053-SN**:

- full height: 8 cm
- weight: 160 g
- load capacity: 10 kg
- Threaded insert ¼ "

The adjustable swivel makes mounting and fastening the instrument easy as well as changing the angle in any directions via the locking knob.

10.8 ***TT-01 Fiber Glass Telescopic Support***

10.8.1 Introduction

TT-01 is an Optional Accessory of the EHP-50C Analyzer. It allows EHP-50C Analyzer to be easily supported during field measurements.

This device, on the top part of its container, has a screw to fix the relative apparatus.

The design and materials of the TT-01 have been specially selected to prevent it from disturbing the sensors and, therefore, the measurements taken.

Table 10-9 Technical specifications of the TT-01 Fiber Glass Telescopic Support	
• **Diameter**	32 mm
• **Minimum height:**	120 cm
• **Maximum height:**	420 cm
• **Weight**	500 g

TT-01 Fiber Glass Telescopic Support with soft carrying case

The height of the TT-01 can be adjusted.

Fig. 10-9 TT-01 Fiber Glass Telescopic Support

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10.9   *Other Accessories*

Other Accessories are available on request with the EHP50C, such as: car adapter, 12 V battery charger and Internal AC Plug Adapter.

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Nevertheless, even this product will eventually become obsolete. When that time comes, please remember that electronic equipment must be disposed of in accordance with local regulations. This product conforms to the WEEE Directive of the European Union (2002/96/EC) and belongs to Category 9 (Monitoring and Control Instruments). You can return the instrument to us free of charge for proper environment friendly disposal. You can obtain further information from your local NARDA Sales Partner or by visiting our website at www.narda-sts.it.

☑ **Servizio richiesto:** ☑ *Service needed*:

☐ **Solo taratura**   ☐ **Riparazione**   ☐ **Riparazione & Taratura**   ☐ **Taratura SIT**   ☐ **Altro:**
☐ Calibration only   ☐ Repair   ☐ Repair & Calibration   ☐ Certified Calibration   ☐ Other:

Ditta:
Company:

Indirizzo:
Address:

Persona da contattare: **Telefono:**
Technical contact person: *Phone n.*

Modello: **Numero di serie:**
Equipment model: *Serial n.*

☑ *Accessori ritornati con l'apparecchiatura:* ☐ **Nessuno**   ☐ **Cavo(i)**   ☐ **Cavo di alimentazione**   **Altro:**
☑ *Accessories returned with unit:*   ☐ None   ☐ Cable(s)   ☐ Power cable   Other:

☑ *Sintomi o problemi osservati:* ☑ *Observed symptoms / problems*:

☑ *Guasto*: ☐ **Fisso**   ☐ **Intermittente**   *Sensibile a* : ☐ **Freddo**   ☐ **Caldo**   ☐ **Vibrazioni**   ☐ **Altro**
☑ *Failure*: ☐ Continuous   ☐ Intermittent   *Sensitive to*: ☐ Cold   ☐ Heat   ☐ Vibration   ☐ Other

Descrizione del guasto/condizioni di funzionamento:
Failure symptoms/special control settings description:

Se l'unità è parte di un sistema descriverne la configurazione:
If unit is part of system please list other interconnected equipment and system set up:

Suggerimenti / Commenti / Note:
Suggestions / Comments / Note: