

NBM-520

Narda Broadband Field Meter

Operating Manual



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Order no.: 2403/98.21

Edition: 05/01.2022, A...

Previous edition: 04/09.08, A...

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Printed in Germany

Contents

1	Useful information	1
1.1	Measuring electromagnetic fields	2
1.2	About this instrument	2
	Applications	3
1.3	About this operating manual	4
	Characters and symbols used	4
	Terminology	5
2	Safety instructions	7
2.1	Using this operating manual	8
2.2	Proper use	8
2.3	Improper use	8
2.4	Dangers from electromagnetic fields	9
	Strong Fields	9
	Measurement Errors	9
	Probe is not operating properly	9
2.5	Dangers when handling rechargeable batteries	10
2.6	Dangers from AC adapter/charger	10
3	Preparing the NBM-520 for use	11
3.1	Unpacking	12
	Packaging	12
	Items included	12
	Transport damage	13
	Equipping the case	14
	After transport and storage	14
3.2	Instrument overview	15

3.3	Power supply	17
	Operation from rechargeable batteries	17
	Charge state and power source indicator	19
3.4	Connecting the probe.	20
	Probe with “Push-Pull” connector	21
	Probe with threaded coupling connector	21
4	Measuring with the NBM-520	23
4.1	Avoiding measurement errors	24
	Electrostatic charges	24
	Changes in temperature	24
	Strong low frequency fields	25
4.2	Switching on.	26
4.3	Displaying the instrument settings	26
4.4	Self test	29
4.5	Setting the contrast	29
4.6	Overview of the display	30
4.7	Selecting the result type.	30
	ACT (Actual)	31
	MAX (Maximum)	31
	AVG (Average).	31
	SPATIAL (spatial average).	32
4.8	Selecting the units	33
4.9	Freezing a result	34
4.10	Changing the field type measurement.	34
4.11	Using the alarm function	35
4.12	Remote control.	36
	Instrument settings during remote control operation with NBM-TS or with NBM-550 as the controller	37
4.13	Switching off.	37

5	PC software	39
5.1	Using the PC software	40
	Minimum system requirements	40
5.2	Connecting the NBM-520	40
5.3	Working with the PC software	40
5.4	Changing the instrument settings	41
5.5	Updating the firmware	41
6	Instrument maintenance	43
6.1	Cleaning the instrument	44
6.2	Replacing / removing the batteries	44
6.3	Disposal	47
6.4	Checking for proper operation	48
	Appropriate test sources	50
7	Specifications	51
7.1	Display	52
7.2	Measurement functions	52
7.3	Interfaces	52
7.4	General specifications	53
7.5	Standards compliance	53
7.6	AC Adapter / Charger Unit	54
7.7	CE Declaration of Conformity	54
7.8	Declaration of origin	54
8	Ordering information	55
8.1	NBM-520	56
8.2	Probes	56
8.3	Accessories	57
	Index	59

1

Useful information

This chapter contains basic information about measuring electromagnetic fields and about using the NBM-520.

- 1.1 [Measuring electromagnetic fields \(page 2\)](#)**
- 1.2 [About this instrument \(page 2\)](#)**
- 1.3 [About this operating manual \(page 4\)](#)**

1.1 Measuring electromagnetic fields

In today's world, practically everyone lives and works in an environment surrounded by technical equipment that generates electromagnetic fields. Our recognition of the problems associated with such fields and our depth of information in this area has increased as the effects of such fields on the human body have been examined more closely. Various authorities have long defined limit values designed to protect users from the dangers of exposure to such emissions.

1.2 About this instrument

The Narda Broadband Field Meter NBM-520 provides virtually everyone concerned with this subject with an instrument for measuring non-ionizing radiation with utmost accuracy within the frequency range from 100 kHz to 100 GHz (depending on the probe used). The instrument features very simple operation, a handy design in a robust casing, long battery life, and high measurement accuracy.

Probes for various measurement applications are connected to the NBM-520 basic unit. Flat frequency response probes are available, as well as so-called shaped probes that evaluate the field according to a specific human safety standard. These probes are calibrated separately from the measuring instrument, and include a non-volatile memory containing the probe parameters and calibration data. They can therefore be used with any instrument in the NBM-500 family without any loss in calibration accuracy.

The PC software supplied with the instrument allows you to remote control the NBM-520 and to configure the instrument settings.

Applications

The NBM-520 makes precision measurements for human safety purposes, particularly in workplace environments where high electric or magnetic field strengths are likely. It can also be used to demonstrate the electromagnetic compatibility (EMC) of devices and equipment.

Examples:

- Measuring field strengths as part of general safety regulations
- Measuring the field strengths around transmitting and radar equipment to establish safety zones and for monitoring during operations
- Measuring the field strength emanating from mobile phone repeaters and satellite communications systems to ensure compliance with human safety limit values
- Measuring the field strength in the industrial workplace environment, such as plastics welding equipment, RF heating, tempering, and drying equipment
- Measurements to ensure the safety of persons using diathermy equipment and other medical equipment that generates high frequency radiation
- Field strength measurements in TEM cells and absorber chambers

1.3 About this operating manual

Characters and symbols used

Various elements are used in this operating manual to indicate special meanings or particularly important passages in the text.

Symbols and terms used in warnings

According to the American National Standard ANSI Z535.6-2006, the following warnings, symbols, and terms are used in this document:

	<p>The general danger symbol warns of risk of serious injury when used with the signal words CAUTION, WARNING, and DANGER. Follow all the instructions in order to avoid injuries or death.</p>
<p>NOTICE</p>	<p>Indicates a danger that results in damage to or destruction of the instrument.</p>
<p>CAUTION</p>	<p>Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
<p>WARNING</p>	<p>Indicates a hazardous situation which, if not avoided, could result in death or serious injury.</p>
<p>DANGER</p>	<p>Indicates a hazardous situation which, if not avoided, will result in death or serious injury.</p>

Structure of warnings

All warnings are structured as follows:

<p> SIGNAL WORD</p>
<p>Type and source of danger Consequences of failure to observe warning ⇒ Instructions for preventing danger</p>

Symbols and marks used in this document

!	Important instruction Indicates an instruction that must be followed to avoid danger.
✓	Requirement Indicates a requirement that must be met before the next instruction can be carried out, e.g. ✓ The instrument is switched off.
⇒	Instruction Indicates a single instruction, e.g. ⇒ Switch the instrument on.
1. 2. 3.	Sequence of instructions Indicates a sequence of instructions that must be carried out in the order given.
↪	Result Indicates the result of carrying out an instruction, e.g. ↪ The instrument starts a self test.
Bold type	Control element Indicates a control element on the instrument, e.g. ⇒ Press the MODE key
Blue type	Cross reference (in PDF document only) Indicates a cross reference to another part of the document. Click on the blue type in the PDF document to jump directly to the cross reference.

Terminology

Item	Meaning
Battery	Rechargeable battery
Dry battery	Non-rechargeable battery

2

Safety instructions



This chapter contains important instructions on how to use the NBM-520 safely. Please therefore read this chapter carefully and follow the instructions closely.

- 2.1 Using this operating manual (page 8)**
- 2.2 Proper use (page 8)**
- 2.3 Improper use (page 8)**
- 2.4 Dangers from electromagnetic fields (page 9)**
- 2.5 Dangers when handling rechargeable batteries (page 10)**
- 2.6 Dangers from AC adapter/charger (page 10)**

2.1 Using this operating manual

- ! Carefully read this entire operating manual before you start using the instrument.
- ! Keep this operating manual so that it is available to everyone who uses the instrument, and ensure that this operating manual is with the instrument if you pass it on to a third party.

2.2 Proper use

The NBM-520 is designed to measure and evaluate electromagnetic fields.

- ! Only use the instrument for the purpose and under the conditions for which it has been designed.
- ! In particular, observe the technical data given in the **“Specifications”** on page 51.

Proper use also includes:

- ! observing any national accident prevention regulations at the place of use,
- ! ensuring that the instrument is used only by appropriately qualified and trained persons.

2.3 Improper use

The NBM-520 is not a warning device that gives active notice of the existence of dangerous fields by means of a visible or audible warning signal.

- ! Remember that this instrument is a measuring device, not a warning device.
- ! Carefully observe the actual measurement displayed when you are approaching an unknown field source.
- ! If in doubt, use an additional warning device such as “RadMan” or “Nardalert XT”, available from Narda Safety Test Solutions.

2.4 Dangers from electromagnetic fields

Strong Fields

Very high field strengths can occur in the vicinity of some radiation sources.

- ⇒ Do not cross or ignore safety barriers or markings.
- ⇒ Persons with electronic implants (e.g. heart pacemakers) must avoid danger zones.

Measurement Errors

Metallic labels (stickers) affixed to the yellow sensor area of the probe can lead to measurement errors, usually an underestimation of the electromagnetic field strength.

- ⇒ Affix labels of any type only to the black probe shaft.
- ⇒ If the instrument malfunctions, take it out of service and contact your Narda Service Center. The addresses are listed at the end of this operating manual and on the Internet at <http://www.narda-sts.com>.

Probe is not operating properly

Possibly present high radiation values are not recognized.

- ⇒ Check probes for proper operation with a signal source before using this measuring instrument. This is especially important for thermocouples because the sensors can be affected by various mechanical and environmental stressors.
Narda offers portable sources to accomplish this important step (see “**Accessories**” on page 57).
- ⇒ Before beginning any RF radiation measurement, always inform yourself of the frequencies and field strengths that you could expect to encounter.

2.5 Dangers when handling rechargeable batteries

When handled improperly, rechargeable batteries can overheat, explode, or ignite.

- ⇒ Only use the NBM-520 with NiMH rechargeable batteries (AA, Mignon).
- ⇒ Do not use dry batteries.
- ⇒ Do not replace individual batteries; always replace the entire set.
- ⇒ Always use identical batteries.
- ⇒ Never touch both poles of the batteries simultaneously with a metal object.
- ⇒ Make sure you insert the batteries correctly as shown on the base of the battery compartment.
- ⇒ Always close the battery compartment immediately after replacing batteries.
- ⇒ Never use the NBM-520 with the battery compartment open.

2.6 Dangers from AC adapter/charger

You could experience electric shock from the AC adapter/charger.

- ⇒ Do not use the instrument when the casing is damaged because parts carrying dangerous voltages could be exposed.
- ⇒ Do not use an AC adapter/charger that has been moved from a cold to a warm room, thereby forming condensation.
- ⇒ Only use the AC adapter/charger indoors and at temperatures between 0 °C and +40 °C.

The AC adapter/charger could be destroyed if the voltage specification on the AC adapter/charger does not match the AC line voltage.

- ⇒ Only use the AC adapter/charger if the voltage specification on the AC adapter/charger matches the AC line voltage.

3

Preparing the NBM-520 for use

This chapter describes all you need to do before starting to use the NBM-520.

- 3.1 Unpacking (page 12)**
- 3.2 Instrument overview (page 15)**
- 3.3 Power supply (page 17)**
- 3.4 Connecting the probe (page 20)**

3.1 Unpacking

Packaging

The packaging is designed to be re-used as long as it has not been damaged.

⇒ Keep the original packaging and use it whenever the instrument needs to be shipped or transported.

Items included

- ⇒ Check that all the following items have been delivered:
- NBM-520
 - 2 x NiMH Mignon/AA batteries (packaged separately)
 - Case
 - Probe (type and quantity as ordered)
 - AC Adapter / Charger
 - Shoulder strap
 - NBM-TS PC software (free download at www.narda-sts.com)
 - Safety Instructions
 - Operating manual
 - Calibration certificate
 - O/E converter
 - Cable, fiber optic duplex (1000 µm) RP-02, 2m

Transport damage

NOTICE

Instrument/accessories damaged during transportation

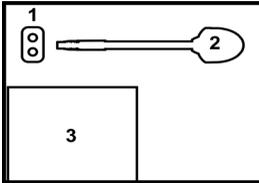
Using damaged instrument/accessories can lead to subsequent damage.

- ⇒ Check the instrument and all accessories for damage when you have unpacked them.
- ⇒ If the instrument is damaged, contact your Narda Service Center.

The addresses of your Narda Service Center are listed at the end of this operating manual and on the Internet at <http://www.narda-sts.com>.

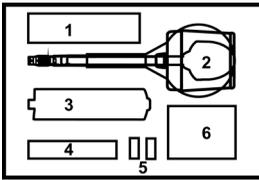
Equipping the case

You can use the case provided to store a wide range of optional accessories in addition to the items supplied. The figures below show the compartments in the case lid and case base.



Case lid

1	Rechargeable batteries	3	Compartment for cables, operating manual, and safety instructions
2	Probe		



Case base

1	Table top tripod	4	Shoulder strap
2	Probe	5	O/E converter
3	NBM-520 basic unit	6	AC Adapter / Charger

After transport and storage

NOTICE

Condensation on an instrument can lead to damage

Condensation can form on an instrument that has been stored at a low temperature when it is brought into a warm room. It may be damaged if used.

⇒ Wait until all visible condensation has evaporated from the instrument surface to avoid damaging the instrument.

Note: The instrument is not ready for use until it has reached a temperature within the operating range of -10 to +50 °C.

3.2 Instrument overview



3 Preparing the NBM-520 for use

1 Probe connector socket

2 Display

3 Operating panel



Hold or Start / Stop button

Freezes the display value, or start / stop measurement for spatial measurements



Mode button

Selects the display mode for the measured values



Units button

Selects the display units



ON / OFF or Clear button

Switches the instrument on or off

Charge Charge state

Indicates the charge state (red = rapid charging, green = trickle charging)

Status Operating status

Indicates the instrument operating status:

- Green = normal operation
 - Red = remote operation
 - Flashing red =
 - Firmware update
 - Alarm limit exceeded
-

4 Rubber cover

5 Tripod bush

6 Electrical and optical connectors

6a AC Adapter / Charger

6b Optical connector

7 Battery compartment (on back of instrument)

8 Stand

Probe (various models available)

9 Probe head

10 Probe plug

3.3 Power supply

The power supply is normally taken from the batteries provided. You can use the AC Adapter / Charger supplied as an alternative power source.

Note: We do not recommend that you operate the instrument with the AC Adapter / Charger connected, as this can significantly degrade the measurement performance of the NBM-520. The measurement accuracy figures given in the specifications cannot then be guaranteed.

Operation from rechargeable batteries

The rechargeable NiMH batteries for this device are packaged separately. You must insert the batteries into the device and then charge them up fully before using the device. The charging cycle takes about 2 hours. Do not use dry batteries in this device.

Notice

Improper pole positions

The batteries can explode and damage the instrument if you put the batteries in the wrong way round.

⇒ Observe the positions of the positive and negative poles marked in the battery compartment.

Inserting the batteries

1. Open the battery compartment cover underneath the device by undoing the two screws with a screwdriver or the edge of a coin.
2. Take the NiMH batteries provided out of their protective foil and insert them into the battery compartment. Make sure you put them in the right way round. The positions of the positive and negative poles are marked in the battery compartment by "+" and "-" respectively. Match the markings to the markings on the batteries.
3. Close the battery compartment cover and do up the two screws again to secure it.

Charging the batteries

If the device is probably not going to be used for several weeks, it should be recharged before being stored to avoid the possibility of deep discharge of the batteries. If storage is likely to be for a period of more than two months, remove the batteries from the device after recharging them.

Note: Deep discharge can significantly reduce the battery capacity. This is indicated by unusually short charging cycles. If this happens, the nominal capacity can be restored by discharging and recharging the batteries several times. Regeneration usually takes four to five recharging cycles.

WARNING

Charging the batteries with wrong AC Adapter / Charger

Overheating, explosion, or ignition of rechargeable batteries/batteries or their surroundings

⇒ You must use only the AC Adapter / Charger supplied to charge the batteries.

Note: A complete charge cycle takes about 2 hours (with the instrument switched off).

Starting the charge cycle

✓ The AC line voltage must match the operating voltage of the AC Adapter / Charger.

1. Connect the AC Adapter / Charger to the charging socket of the NBM-520.
2. Connect the AC Adapter / Charger to the AC line.
 - ↪ The charge cycle starts.
 - ↪ The **Charge** LED glows red during the entire charge cycle.

As soon as the batteries are fully charged, the AC Adapter / Charger switches to trickle charge mode and the **Charge** LED glows green.

Proper handling of rechargeable batteries

- ⇒ Observe the following precautions when handling rechargeable batteries:
- Always handle the batteries with care.
 - Do not drop or damage the batteries or expose them to excessively high temperatures.
 - Do not leave the batteries inside or outside the instrument for more than one or two days in a very warm place (e.g. in an automobile).
 - Do not leave the discharged batteries in the unused instrument for a long period of time.
 - Do not store the batteries for more than six months without discharging and recharging them in the meantime.
 - Avoid deep discharging the batteries as this could cause the cells to reverse polarity and make them useless.

Charge state and power source indicator

The battery charge state and the power source used are indicated at the top right of the display:

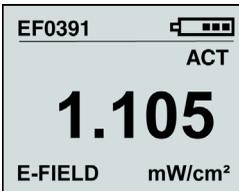


Table 1 Charge state and power source indication

	<p>Power is supplied by the rechargeable batteries.</p> <ul style="list-style-type: none"> • Continuous display: Charge level = 10% • Flashing display: Charge level \leq 5% <p>If the charge level drops to \leq 5%, the instrument will switch off automatically within a few minutes.</p>
	<p>Power is supplied by the rechargeable batteries.</p> <p>The charge level is indicated in 20% steps by black bars within the battery symbol. The batteries are fully charged when all five bars are shown.</p>
	<p>Power is supplied by the AC Adapter / Charger.</p> <p>The batteries are charged at the same time.</p>

3.4 Connecting the probe

WARNING

Probe is not operating properly

Possibly present high radiation values can not be recognized when a probe is defective.

⇒ Check probes for proper operation with a signal source before using this measuring instrument. This is especially important for thermocouples because the sensors can be affected by various mechanical and environmental stressors.

Narda offers portable sources to accomplish this important step (see “**Accessories**” on page 57).

⇒ Before beginning any RF radiation measurement, always advise yourself of the frequencies and field strengths that you could expect to encounter.

There are many different probes available for different applications for the NBM-520. You can find more information about the order numbers and specifications of the probes under “**Ordering information**” on page 55, as well as in the data sheets of the NBM-520 and NBM probes. These documents can also be downloaded from the Narda web site on the Internet at <http://www.narda-sts.com>.

NOTICE

Wrong handling of the probe

Damage of the probe head

⇒ Always hold the probe at the metal plug end.

Probe with “Push-Pull” connector

Connecting the probe

- ✓ The red mark on the probe plug **(10)** is pointing towards the front of the instrument.
- ⇒ Push the probe plug **(10)** straight down into the probe socket **(1)** until it clicks into place.
 - ↳ The NBM-520 detects the probe type automatically. The probe type is displayed top left when you switch on the instrument.

Disconnecting the probe

- ⇒ Slide the sleeve on the probe plug **(10)** upwards and pull the probe upwards to remove it.

Probe with threaded coupling connector

Threaded connectors are now being used for the link between the probe and the basic unit. For this purpose, the basic unit is fitted with a longer socket which can be recognized by the approximately 1 cm long threaded section. Probes fitted with "push-pull" connectors can still be used with this connector. Probes with threaded coupling connectors can only be used with this new, longer connecting socket.

Connecting the probe

- ✓ Make sure the guide lug on the probe plug **(10)** is pointing towards the front of the instrument.
- ⇒ Push the probe plug **(10)** straight down into the probe socket **(1)** and tighten the threaded coupling using your thumb and forefinger. Never tighten the coupling using pliers or other tools.

Disconnecting the probe

- ⇒ Undo the threaded coupling using your thumb and forefinger and then pull the probe upwards to release it.

4

Measuring with the NBM-520

This chapter describes how to make measurements using the NBM-520.

- [4.1 Avoiding measurement errors \(page 24\)](#)
- [4.2 Switching on \(page 26\)](#)
- [4.3 Displaying the instrument settings \(page 26\)](#)
- [4.4 Self test \(page 29\)](#)
- [4.5 Setting the contrast \(page 29\)](#)
- [4.6 Overview of the display \(page 30\)](#)
- [4.7 Selecting the result type \(page 30\)](#)
- [4.8 Selecting the units \(page 33\)](#)
- [4.9 Freezing a result \(page 34\)](#)
- [4.10 Changing the field type measurement \(page 34\)](#)
- [4.11 Using the alarm function \(page 35\)](#)
- [4.12 Remote control \(page 36\)](#)
- [4.13 Switching off \(page 37\)](#)

4.1 Avoiding measurement errors

The measurement result can be falsified by external influences when measuring electromagnetic fields. Considerable measurement deviations can occur under certain circumstances, particularly when measuring low field strengths. The following tips may be of assistance in recognizing sources of interference so as to avoid measurement errors. The following factors can affect the measurement result:

- Electrostatic charges
- Changes in temperature
- Strong low frequency fields (e.g. due to high tension lines)

Electrostatic charges

The following effect will be noted with all field strength meters: If you move the probe quickly, excessive field strength values will be displayed which do not reflect the actual field conditions. This effect is caused by electrostatic charges.

The NBM has been designed in a way that minimizes this effect. However, if you move the probe very quickly, field strengths on the order of a few V/m can be displayed.

Recommendation: Hold the device steady during the measurement. Delete the stored maximum values and average values by pressing **Clear** before using the **MAX** or **AVG** result types. Do not touch the probe at any time during the measurement.

Changes in temperature

Ambient temperature changes as well as warming by direct sunlight will create offset voltages that may impact the measurement result. Zeroing eliminates offset voltages within the instrument only. Offset voltages caused by the probe or the probe connector can not be eliminated. Particularly probes with thermocouple sensors are affected by offset voltages until stable temperature conditions are achieved.

Recommendation: Try to avoid heating caused by direct sunlight during measurements with thermocouple probes. Consider an adequate settling time for stabilization of the probe in case of temperature changes. A settling time of about 15 minutes will ensure stabilized conditions. Extremely high steps of the environmental temperature changes may require longer settling times.

Strong low frequency fields

The result display when measuring high frequency electromagnetic fields can be falsified by low frequency fields. Wideband probes will detect signals even if the frequency is well outside the specified measurement range (out-of-band attenuation is 20 dB/decade). A probe specified to measure from 100 kHz to 3 GHz would therefore attenuate signals down to 100 Hz by at least 60 dB (= field strength / 1000). However, very high field strengths of several thousand V/m can occur in the vicinity of high tension lines. An RF wideband probe would therefore register several V/m.

Recommendation: Thoroughly inspect every measurement location before any measurement and make a note of any possible sources of interference, such as high tension lines in the vicinity. Keep a critical eye on any possible increase in the minimum display value (noise floor) which may indicate interfering factors. Increase the distance from the source of low frequency interference or use a probe that has a higher frequency cutoff point at the lower end of its range.

Further useful information can be found under FAQ at www.narda-sts.com

4.2 Switching on

You can switch the instrument on as soon as you have prepared it for use.

- ⇒ Press the **ON/OFF** button to switch the instrument on.
 - ↳ The instrument displays the instrument settings and performs a self test.

4.3 Displaying the instrument settings

AUTO-ZERO	15:00
AUTO-OFF	30:00
BACKLIGHT	00:30
AVG TIME	06:00
SPATIAL	DISCRETE

The preset instrument settings are displayed after the instrument is turned on. You can change these settings with the aid of the PC software (see **“PC software”** on page 39).

- ⇒ Press the **Hold** button to “freeze” the display of settings or to resume measurements.
 - ↳ After a few seconds, the self test starts.

UNIT	mW/cm ²
LIMIT FLAT	2.00
LIMIT SHAP	200%
ALARM	ON

The settings are explained briefly below.

AUTO-ZERO This value determines how often automatic zeroing is performed.

The following settings are possible:

- **6 minutes**: auto zero every 6 minutes
- **15 minutes**: auto zero every 15 minutes
- **30 minutes**: auto zero every 30 minutes
- **60 minutes**: auto zero every 60 minutes
- **off**: auto zero function disabled

The default setting is **15 minutes**.

AUTO-OFF To prevent discharging the batteries unnecessarily, the instrument can be switched off automatically after a specified time without activity. This time is set by the **AUTO-OFF** value.

The following settings are possible:

- **6 minutes**: auto off after 6 minutes
- **15 minutes**: auto off after 15 minutes
- **30 minutes**: auto off after 30 minutes
- **60 minutes**: auto off after 60 minutes
- **off**: auto off function disabled

The default setting is **15 minutes**.

BACKLIGHT The display backlight is activated each time you press a button and switches off after a specified time to prevent discharging the batteries unnecessarily. This time is set by the **BACKLIGHT** value.

The following settings are possible:

- **off**: backlight is switched off permanently
- **5 s**: auto off after 5 seconds
- **10 s**: auto off after 10 seconds
- **30 s**: auto off after 30 seconds
- **60 s**: auto off after 60 seconds
- **permanent**: backlight is switched on permanently

The default setting is **10 seconds**.

AVG TIME This value specifies the time period over which the results are averaged.

You can use the PC software to set this time period between 4 s and 30 min in steps of 2 s.

The default setting is **6 minutes**.

SPATIAL This item displays the measurement method currently selected for determining the spatial average.

The following settings are possible:

- **Spatial Discrete**
Individual measurement values are recorded and averaged.
- **Spatial Continuous**
The measurement values are recorded and averaged continuously.

The default setting is **Spatial Continuous**.

More information on spatial averaging is found under **“SPATIAL (spatial average)”** on page 32.

UNIT The UNIT item displays the last unit used. This unit is also used for the limit value of the alarm function.

**LIMIT FLAT/
LIMIT SHAP** These items show the limit value settings for the audible and visible alarm function.

- **LIMIT FLAT**
Limit value for normal (flat) probes
- **LIMIT SHAP**
Limit value for shaped probes

More information on the alarm function is found under **“Using the alarm function”** on page 35.

ALARM This item shows whether the alarm function is switched on or off.

The following settings are possible:

- **ON**
The alarm function is switched on.
- **OFF**
The alarm function is switched off.

The default setting is **OFF**.

4.4 Self test



The self test takes a few seconds. During this time, the firmware version is also displayed. If the test is successful, the message **OK** is displayed on the screen.

If an error message is displayed:

⇒ Press the **ON/OFF** button again to switch the instrument off and then switch it on again.

If an error message is displayed again:

⇒ Switch the instrument off and contact your nearest Narda Service Center.

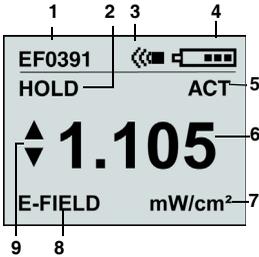
4.5 Setting the contrast

You can change the display contrast dependent of the environment lighting in order to achieve optimal instrument read-out.

- ✓ The instrument is turned on and the self test is finished.
 - ⇒ Press the **ON/OFF** button and **Mode** button simultaneously to increase the contrast.
 - ⇒ Press the **ON/OFF** button and **Units** button simultaneously to decrease the contrast.

4.6 Overview of the display

The image below shows the items that can be displayed during a measurement.



-
- | | |
|---|--|
| 1 | Probe used |
| 2 | Measured value "frozen" (hold) / Zero displays during zeroing / Elapsed time counter in SPATIAL mode |
| 3 | Alarm function is switched on |
| 4 | Battery charge status |
| 5 | Result type |
| 6 | Measured value |
| 7 | Measured value units |
| 8 | Field type / REMOTE displays during a remote controlled measurement |
| 9 | Value is outside probe measurement range |
-

4.7 Selecting the result type

The NBM-520 can display the results in various ways:

- [ACT \(Actual\) \(page 31\)](#)
- [MAX \(Maximum\) \(page 31\)](#)
- [AVG \(Average\) \(page 31\)](#)
- [SPATIAL \(spatial average\) \(page 32\)](#)

These different result display modes are described in the sections indicated above.

To select a result type:

- ⇒ Press the **Mode** button repeatedly until the desired result type is displayed.

ACT (Actual)

The actual field strength value measured at the moment is displayed.

If the measured value is outside the instrument's measurement range or if it cannot be shown correctly on the display, appropriate symbols are displayed on the left to indicate this.

Table 2 Symbols indicating value outside range limits.

▼.0001	The measured value is below the measurement range of the probe.
^380.2	The measured value is above the measurement range of the probe.
>9999	The measured value is above the instrument display range.

MAX (Maximum)

The maximum value measured during the current measurement is always displayed. Measurement of the maximum value starts as soon as you switch on the instrument. The measured value memory is cleared if you change the probe or press the **Clear** button.

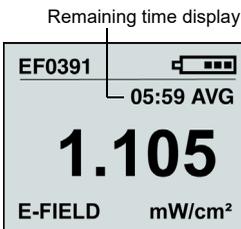
⇒ Press the **Clear** button to reset the maximum value and restart the measurement.

AVG (Average)

The following averages are determined:

- Linear average of power values (e.g. W/m^2 or mW/cm^2)
- Root mean square (RMS) of field strength values (e.g. V/m or A/m)

Both types of average give the same result. The averaging process conforms to current safety standards for high frequency fields and normally takes place over a period of 6 minutes. The units of the measured value can be switched at any time without affecting the results already averaged.



The period of time over which the average is taken can be set using the PC software. The progress of forming the average is shown by the remaining time display. The time counts down to 0. When the averaging time has elapsed, the remaining time display is no longer shown.

⇒ Press the **Clear** button to reset the average value and restart the measurement.

SPATIAL (spatial average)

The spatial average function allows you to determine the spatial average value of the field strength. This measurement mode is used, for example, to determine the degree to which the human body is exposed to electromagnetic radiation.

Two measurement methods are provided:

- **Discrete**

Individual (discrete) measurement values are recorded and averaged. This allows you to measure at specific locations.

- **Continuous**

Measurement values are recorded and averaged continuously while the probe is moved through the area of interest. This allows you to measure the field strength affecting an entire room.

You can set the measurement method using the PC software.

To measure discrete values

✓ You have set the **Measurement method** to **Discrete** using the PC software.

1. Press the **Mode** button repeatedly until the result type **SPATIAL** is displayed.

2. Press the **Hold** button.

↳ The first measurement value is displayed, #1 indicates that one value has been measured so far.

3. Press the **Hold** button again for each further measurement you want to make.
 - ↳ The average value of all the measurements made so far is displayed,
#... indicates the number of measurements made so far.
4. If necessary press the **Clear** button to reset the average value.

To measure values continuously

- ✓ You have set the **Measurement method** to **Continuous** using the PC software.
1. Press the **Mode** button repeatedly until the result type **SPATIAL** is displayed.
 2. Press the **Hold** button to start the measurement.
 - ↳ The elapsed measurement time is shown top left in the display.
 3. Move the NBM-520 smoothly through the volume to be measured and then press the **Hold** button again to end the measurement.
 - ↳ The spatial average value is shown on the display.
 4. To perform a further measurement, press the **Hold** button again. This automatically resets the last average value.

Note: To help you move the NBM-520 smoothly, an audible signal is output once every second.

4.8 Selecting the units

The NBM-520 can display the results in several different measurement units.

The following units can be displayed for normal (flat) probes:

- V/m
- A/m
- W/m²
- mW/cm²

The results from shaped probes are always displayed in %. A shaped probe provides a frequency sensitivity that mirrors a particular standard, such as ICNIRP. Values in % (of standard) are related to the equivalent power density limit, not to the field strength.

To select the units

⇒ Press the **Units** button repeatedly until the desired units are displayed.

Note: If the unit is changed, the limit value setting of the alarm function will be automatically adjusted.

4.9 Freezing a result

1. Press the **Hold** button to hold the measurement value that is currently displayed.
2. Press the **Hold** button again to resume measuring.

4.10 Changing the field type measurement

The E-field and H-field probes can only measure the field type for which they were designed. The field type is selected automatically according to the probe used.

Combination probes can measure electric as well as magnetic fields. You will need to select the field type on the instrument. The field type is shown at the bottom left of the display.

To change the field type

⇒ Press the **Hold** and **Mode** buttons simultaneously (toggle function).

4.11 Using the alarm function

The alarm function allows you to enter a limit value. The instrument outputs an audible signal and the Status LED flashes red when this limit value is exceeded.

This function is useful for checking limit values or for early detection of dangerous field strengths, for example.

To activate the alarm function

⇒ Set the parameter **ALARM** to **ON** using the PC software.

To set the alarm limit

For normal (flat) probes:

⇒ Select the desired limit value for **LIMIT FLAT** using the PC software.

↳ The symbol  is shown in the display when the alarm function is activated (see “[Overview of the display](#)” on page 30).

Table 3 Setting ranges of the limit values (in 1 dB steps)

Measuring range	Minimum	Maximum
V/m	100 mV/m	100 kV/m
A/m	250 μ A/m	250 A/m
W/m ²	25 μ W/m ²	25 MW/m ²
mW/cm ²	2.5 nW/cm ²	2.5 kW/cm ²

For shaped probes:

⇒ Select the desired limit value (percentage of the standard value) for **LIMIT SHAP** using the PC software.

Setting range: 0.1% to 10,000% (in 1 dB steps)

↳ The symbol  is shown in the display when the alarm function is activated (see “[Overview of the display](#)” on page 30).

To deactivate the alarm function

⇒ Set the parameter **ALARM** to **OFF** using the PC software.

4.12 Remote control

The NBM-520 can be remote controlled using the NBM-TS software or from an NBM-550 measuring set. This allows you to use the NBM-520 in places that are difficult to reach and read the results without needing to see the actual display on the NBM-520. While the NBM-520 is remote controlled, **REMOTE** appears in the display instead of field type (E-Field or H-Field).

To remote control the NBM-520 from an NBM-550 measuring set

1. Set the NBM-550 to controller operating mode (see NBM-550 operating manual).
2. Switch on the NBM-520 and connect it to the NBM-550 using a fiber optic cable.
 - ↳ The NBM-520 can be used as an extended probe handle.
 - ↳ All the measurement functions of the NBM-550 can be used.

Note: The probe must be connected to the NBM-520. Probes connected to the NBM-550 will be ignored. The display of the used probe type on the controller (NBM-550) changes from **Probe:** to **Remote:** in order to indicate an external probe (for example, **Remote: EF0391**).

To remote control the NBM-520 using the NBM-TS software

1. Connect the NBM-520 to the PC (see [“Connecting the NBM-520”](#) on page 40).
2. Use the NBM-TS software to control the instrument (see [“Working with the PC software”](#) on page 40).

To set the NBM-520 from REMOTE operation back to manual operation:

⇒ Briefly press the **ON/OFF** button.

Instrument settings during remote control operation with NBM-TS or with NBM-550 as the controller

NBM-520 instrument settings are not changed in either of these remote control modes. While operating remotely, the instrument also displays the results in the measurement mode and the unit that were set before activating remote control operation. This ensures that the NBM-520 always remains correctly configured.

Example: The NBM-520 is remotely controlled via the NBM-550. On NBM-550, the result type **Average** with 6 min. averaging time was set. The measuring results are correctly displayed in V/m.

The NBM-520 simultaneously displays completely different values because it was set to **MAXimum** and **W/m²**. Both displays are correct - there are no errors.

Note: Normal remote control via NBM remote control commands differs from the behavior described above. All settings that are active in the instrument and in the display will be shown then.

4.13 Switching off

To switch the instrument off

⇒ Press and hold down the **ON/OFF** button for about three seconds.

↳ The instrument switches off.

5

PC software

This chapter gives you some basic information about the NBM-TS PC software. It explains the possible applications of the software, how to connect the NBM-520 to the PC and the settings you need to make on the NBM-520. It also describes how to update the NBM-520 software using the PC software.

You can find detailed information about the PC software itself in the on-line help for the PC software.

- 5.1 [Using the PC software \(page 40\)](#)**
- 5.2 [Connecting the NBM-520 \(page 40\)](#)**
- 5.3 [Working with the PC software \(page 40\)](#)**
- 5.4 [Changing the instrument settings \(page 41\)](#)**
- 5.5 [Updating the firmware \(page 41\)](#)**

5.1 Using the PC software

The NBM-TS PC software can be downloaded for free at www.narda-sts.com.

The software provides the following functions:

- Changing the instrument settings
- Remote control of the NBM-520 (including live signals on the PC)

The PC software is essential for performing a firmware update.

Minimum system requirements

The following minimum system requirements must be met:

- Windows 2000 SP4 or later
- Microsoft.NET Framework 2.0 (installed automatically if needed)
- USB driver (installed with the software)

5.2 Connecting the NBM-520

You can connect the NBM-520 to the PC using the optical interface and the O/E converter. Use the 2 m long optical data cable supplied with the NBM-520 for this purpose. Longer cables are available as accessories.

5.3 Working with the PC software

The following conditions must be fulfilled before you can work with the PC software:

- ✓ The PC is ready to use and the PC software has been installed successfully.
- ✓ The NBM-520 is ready to use.
- ✓ NBM-520 and PC are connected together by an optical cable.

Start the PC software and use it to operate the NBM-520. Information on using the PC software is found in the on-line help for the PC software.

5.4 Changing the instrument settings

Changing the instrument settings

1. Establish a connection between the instrument and PC (see “[Working with the PC software](#)” on page 40).
2. Start the software.
3. Select the **Configuration** tab and activate the connection via the **Connect** icon.
4. Select the **Setups** tab.
5. Set the values as required.

You can alter the following values (see “[Displaying the instrument settings](#)” on page 26):

- AUTO-ZERO
- AUTO-OFF
- BACKLIGHT
- AVG TIME
- SPATIAL
- UNIT
- LIMIT FLAT
- LIMIT SHAPED
- ALARM

5.5 Updating the firmware

You can update the firmware of the NBM-520 in order to make use of new or improved functions.

You can only update the firmware using a PC on which the NBM-TS PC software has been installed.

Note: The NBM-520 must be supplied with power via the mains adapter while updating. This prevents the update from being interrupted due to discharged batteries. The PC software checks whether an adapter is connected and, if not, displays a warning.

Updating the firmware



1. Save the latest firmware for the NBM-520 on the PC. The latest firmware is available from the Narda web site at <http://www.narda-sts.com>.

The NBM-TS software automatically directs you with a simple mouse click to the corresponding web site in order to search for a newer version of both the NBM-520 firmware as well as the NBM-TS software.

Always use the most recent NBM-TS version to perform a firmware update.

2. Establish a connection between the instrument and PC (see “**Working with the PC software**” on page 40).
3. Start the NBM-TS software.
4. Activate the connection in the **Extras** menu via the **Connect** icon.
5. Click on the **Firmware Update** icon and follow the instructions displayed on the screen.
 - ↳ The NBM-520 is initially switched off via remote control and you will be prompted to switch it on.
 - ↳ The firmware transfer is indicated by the flashing status LED.
 - ↳ After a successful transfer, a PC software notice appears.
6. Switch the NBM-520 on.
 - ↳ The self test with the new firmware starts.



Note:

A firmware update takes about 5 minutes.
The NBM-520 display remains blank during update.

6

Instrument maintenance

This chapter describes how to clean the instrument, replace the batteries, dispose the instrument and check the instrument for proper operation.

- 6.1 [Cleaning the instrument \(page 44\)](#)**
- 6.2 [Replacing / removing the batteries \(page 44\)](#)**
- 6.3 [Disposal \(page 47\)](#)**
- 6.4 [Checking for proper operation \(page 48\)](#)**

6.1 Cleaning the instrument

NOTICE

Damage to the instrument from liquids

The instrument may be damaged or destroyed if liquids are allowed to get inside the casing.

⇒ Make sure that no liquid gets inside the instrument.

NOTICE

Solvents

Solvents can corrode the surfaces of basic unit, probe and AC Adapter / Charger.

⇒ You must not use solvents to clean the basic unit, probe, and AC Adapter / Charger.

Cleaning the instrument:

1. Use a soft cloth to clean the instrument. You can use lukewarm water to which a little detergent solution has been added as a cleansing agent.
2. To prevent streaks and spots, wipe off the instrument with a dry cloth while it is still damp.

6.2 Replacing / removing the batteries

The rechargeable batteries have a useful life of about 1000 charge cycles or 3 years (whichever occurs soonest).

Replace the batteries if the operating time is significantly reduced although the batteries are fully charged.

 **WARNING**

Improper replacement of batteries

Overheating, explosion, or ignition of rechargeable batteries/batteries or their surroundings

- ⇒ Only use the NBM-520 with NiMH rechargeable batteries (AA, Mignon).
- ⇒ Do not use dry batteries.
- ⇒ Do not replace individual batteries; always replace the entire set.
- ⇒ Always use identical batteries.

 **WARNING**

Short circuiting the batteries

Overheating, explosion, or ignition of rechargeable batteries or their surroundings

- ⇒ Never touch both poles of the batteries simultaneously with a metal object.
- ⇒ Always close the battery compartment immediately after replacing batteries.
- ⇒ Never use the NBM-520 with the battery compartment open.

 **WARNING**

Reverse charging of rechargeable batteries

NiMH batteries can explode if you charge them with reversed poles.

- ⇒ Make sure you insert the batteries correctly as shown on the base of the battery compartment.

Replacing the batteries

1. Switch off the instrument and disconnect it from all other devices (AC Adapter / Charger, optical cable).
2. Open the battery compartment on the back of the instrument.
3. Remove the old batteries and dispose of them according to the waste disposal ordinances applicable in your country.
4. Insert the new batteries.
Make sure you insert them the right way round according to the diagram on the base of the battery compartment.
5. Close the battery compartment.
6. Connect the AC Adapter / Charger and charge the batteries (a complete charge cycle takes about 2 hours).



6.3 Disposal



Disposal of used equipment

The crossed-out wheeled garbage can symbol indicates that this product is subject to the European WEEE Directive 2012/19/EU on the disposal of waste electrical and electronic equipment and must be disposed of separately from household waste in accordance with your national regulations.

In the European Union, all electronic measuring systems purchased from Narda after August 13, 2005 can be returned at the end of their useful life.

⇒ For more information, please contact your Narda distributor.

Disposal of removable batteries

⇒ Batteries must not be disposed of in household waste, but must be disposed of separately from the product in accordance with the applicable regulations. They can be returned free of charge to the appropriate collection points, your dealer or directly via Narda.

⇒ Please discharge the batteries before disposal.

Disposal of permanently installed batteries

There are no permanently installed batteries in this device.

Deleting private data

⇒ Make sure that you delete any stored private data before passing on or disposing of the device.

6.4 Checking for proper operation

WARNING

Probe is not operating properly

Possibly present high radiation values are not recognized.

⇒ Check probes for proper operation with a signal source before using this measuring instrument. This is especially important for thermocouples because the sensors can be affected by various mechanical and environmental stressors.

Narda offers portable sources to accomplish this important step (see **“Accessories”** on page 57).

⇒ Before beginning any RF radiation measurement, always advise yourself of the frequencies and field strengths that you could expect to encounter.

Performing a function test:

1. Connect the probe to the instrument (see **“Connecting the probe”** on page 20).
2. Switch the instrument on and immediately thereafter press and hold down the **Units** key for 2-3 seconds to activate the probe function test.
 - ↪ After the self test the measured field strength will be displayed separately for all 3 input channels (Ch1...3).
3. Bring an appropriate signal source (see **“Appropriate test sources”** on page 50) near the probe head.
4. Switch the signal source on.
 - ↪ The Ch1...3 display increases: **Function test OK**
Briefly press the **ON/OFF** button to change to the measurement mode.
 - ↪ The Ch1...3 display does not increase: **Function test not OK.**
Do not use the probe any more. Contact the responsible service center.

Measures to be taken when function test is erroneous:

- ⇒ Repeat the test:
- move the signal source around the probe head to generate a signal for each of the 3 spatial axes,
- monitor the display while moving the signal source.

Note: Do not use this function test for measurements. This test is suitable only for checking probes. All 3 channels must respond to the field source. It is no fault if some channels display identical values. The meaning of the channels varies depending on the type of probe and is irrelevant for this test.

For more details about the probe, refer to the data sheet.

Appropriate test sources

The following table shows appropriate test sources for a function test.

Probe	Test Source: 27 MHz (2244/90.38)	Test-Source: 446 MHz PMR Pocket Radio ¹⁾
EF0391	✓	✓
EF0392	✓	✓
EF0691	✓	✓
EF1891	✓	✓
EF6091	✓	✓
HF3061	✓	✓
HF0191	✓	✓
EA5091	–	✓
EB5091	–	✓
EC5091	–	✓
ED5091	–	✓
EF5091	–	✓
EF5092	–	✓

1) PMR Pocket Radios are commonly available in electronics stores.

7

Specifications

This chapter lists the specifications of the NBM-520.

The technical specifications may change due to product developments. The latest technical specifications can be found in the datasheet of the product. The datasheet can be downloaded from the Narda website www.narda-sts.com under the corresponding product page.

- 7.1 Display (page 52)**
- 7.2 Measurement functions (page 52)**
- 7.3 Interfaces (page 52)**
- 7.4 General specifications (page 53)**
- 7.6 AC Adapter / Charger Unit (page 54)**
- 7.7 Declaration of Conformity (page 54)**
- 7.8 Declaration of origin (page 54)**

7.1 Display

Display type	Transflective LCD panel, monochrome
Display size	4 cm (1.5"), 128 x 64 pixels
Backlight	LEDs, selectable illumination time (OFF, 5 s, 10 s, 30 s, 60 s, PERMANENT)
Display refresh rate	every 400 ms

7.2 Measurement functions

Result units	mW/cm ² , W/m ² , V/m, A/m (for flat probes) % (for shaped probes, related to power density)
Display range	0.01 to 9999 V/m 0.0001 to 265.3 A/m 0.0001 to 9999 W/m ² 0.0001 to 9999 mW/cm ² 0.0001 to 9999 %
Measurement modes (RMS, isotropic)	Instantaneous (actual) value (ACT), maximum (MAX), average (AVG), spatial average (SPATIAL)
Averaging time (AVG)	4 s to 30 min (in 2 s steps) averaging time selectable using PC software
Spatial averaging (SPATIAL)	Single or continuous sampling selectable using PC software
Alarm function	2 kHz warning tone (4 Hz repetition rate) threshold selectable using PC software

7.3 Interfaces

Optical interface	For remote control and instrument configuration serial, full duplex, 115 kbaud, no parity, 1 start bit, 1 stop bit
Probe connection	Plug and play with automatic recognition, compatible with all NBM-series probes, integration time for measuring input approx. 270 ms, measurement sampling rate 5 Hz (5/50/60 Hz for remote operation)

7.4 General specifications

Recommended calibration interval	24 months ¹⁾	
MTBF	>10 years (basic unit with probe)	
Batteries	Standard rechargeable NiMH batteries, 2 x AA (Mignon) type, 2700 mAh	
Operating time	approx. 22 hours (without backlight) approx 16 hours (with permanent backlight)	
Charging time	2 hours	
Battery status indicator	100%, 80%, 60%, 40%, 20%, 10%, low (<5%)	
Temperature range	Operational: -10 °C to +50 °C Non-operational (transport): -30 °C to +70 °C	
Humidity	5 to 95% relative humidity, no condensation ≤29 g/m ³ absolute humidity (IEC 60721-3-2 class 7K2)	
Immunity to radiated electromagnetic fields	200 V/m (100 kHz to 60 GHz) Note: The immunity may be less than the specified measurement range of a probe	
Dimensions (H x W x D) basic unit	Series A to C: Series D...:	38 x 52 x 195 mm (without probe) 38 x 52 x 201 mm (without probe)
Dimensions (H x W x D) transport case	2400/90.07 2400/90.06	390 x 458 x 210 mm (outside dimensions) 470 x 545 x 230 mm (outside dimensions)
Weight basic unit	approx. 300 g (without probe)	
Weight transport case	2400/90.07 2400/90.06	3.1 kg (empty) 4.2 kg (empty)
Accessories (included in set)	rigid shell case, AC adapter/charger, shoulder strap, O/E converter, fiber optic cable (2 m), NBM-TS software (free download), operating manual, calibration certificate	

1) only for basic instrument; probes are specified separately

7.5 Standards compliance

Climatic	Storage	1K3 (IEC 60721-3) extended to -10 °C to +50 °C
	Transport	2K4 (IEC 60721-3) restricted to -30 °C to +70 °C
	Operating	7K2 (IEC 60721-3) for the basic unit extended to -10 °C to +50 °C
Mechanical	Storage	1M3 (IEC 60721-3)
	Transport	2M3 (IEC 60721-3)
	Operating	7M3 (IEC 60721-3)
Ingress Protection	IP 42 (IEC 60529)	

7.6 AC Adapter / Charger Unit

AC line voltage range	100 V to 240 V AC
Nominal AC line frequency range	50 Hz to 60 Hz
Output voltage	9 V DC
Maximum output current	1.5 A
Temperature range	
• Storage	-40 °C to +70 °C
• Operation	0 °C to +40 °C

7.7 Declaration of Conformity

Hereby, Narda STS declares that this device is in compliance with the directives 2014/30/EU, EN 61326-1:2013, 2014/35/EU, EN 61010-1:2010, and 2011/65/EU.

The full text of the EU declaration of conformity is available at www.narda-sts.com.

7.8 Declaration of origin

Country of origin:	Germany
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8

Ordering information

This chapter lists the ordering information for the NBM-520, probes and accessories.

- 8.1** [NBM-520 \(page 56\)](#)
- 8.2** [Probes \(page 56\)](#)
- 8.3** [Accessories \(page 57\)](#)

8.1 NBM-520

NBM-500 Set 2, Narda Broadband Field Meter

2400/102B

contains:

- NBM-520 Basic Unit (2403/01B)
- Rigid shell case for basic unit and up to two probes (2400/90.07)
- Power supply, 9 VDC, 100 - 240 VAC (2259/92.06)
- Battery, Rechargeable AA-Size, NiMH (2pcs. 1001-0000-41)
- Shoulder strap, 1 m (2244/90.49)
- Cable, fiber optic, duplex (1000 μ m) RP-02, 2m (2260/91.02)
- O/E converter USB (2260/90.07)
- Software, NBM-TS, PC transfer (free download)
- Operating manual NBM-520
- Calibration certificate

Probes are not included in the set

NBM-500 Set 4, Narda Broadband Field Meter

2400/104B

Identical to NBM-500 Set 2 (2400/102),
but with a larger case (2400/90.06) for up to 5 probes.

Probes are not included in the set

8.2 Probes

Probe HF 3061, H-Field, for NBM, 300 kHz – 30 MHz	2402/05B
Probe HF 0191, H-Field, for NBM, 27 MHz – 1 GHz	2402/06B
Probe EF 0391, E-Field, for NBM, 100 kHz – 3 GHz	2402/01B
Probe EF 0392, E-Field, HiPow, for NBM, 100 kHz – 3 GHz	2402/12B
Probe EF 0691, E-Field, for NBM, 100 kHz – 6 GHz	2402/14B
Probe EF 0692, E-Field, for NBM, 600 MHz – 6 GHz	2402/20B
Probe EF 1891, E-Field, for NBM, 3 MHz – 18 GHz	2402/02B
Probe EF 4091, E-Field, for NBM, 40 MHz – 40 GHz	2402/19B
Probe EF 5091, E-Field, for NBM, 300 MHz – 50 GHz, Thermo	2402/03D
Probe EF 6092, E-Field, for NBM, 100 MHz – 60 GHz	2402/17B
Probe EF 9091, E-Field, for NBM, 100 MHz – 90 GHz	2402/18B
Probe EF 5092, E-Field, for NBM, 300 MHz – 100 GHz, Thermo	2402/11E
Probe EA 5091, FCC 1997 Controlled Shaped for NBM, 300 kHz – 50 GHz, E-Field	2402/07D
Probe EB 5091, IEEE 2019 Restricted Shaped for NBM, 3 MHz – 50 GHz, E-Field	2402/21B
Probe EC 5091, SC 6 2015 Controlled Shaped for NBM, 300 kHz – 50 GHz, E-Field	2402/16D
Probe ED 5091, ICNIRP 1998 Occ Shaped for NBM, 300 kHz – 50 GHz, E-Field (compliant with ICNIRP 2020 above 30 MHz)	2402/10D

8.3 Accessories

Test generator, 27 MHz	2244/90.38
Tripod (non-conducting), 1.65 m, with carrying bag	2244/90.31
Tripod extension (non-conducting), 0.50 m (for 2244/90.31)	2244/90.45
Extension handle (non-conducting), 0.42 m	2250/92.02
O/E converter, RS232, RP-02/DB9	2260/90.06
O/E Converter USB, RP-02/USB	2260/90.07
Cable, Adapter USB 2.0 – RS232, 0.8 m	2260/90.53
Cable, FO Duplex (1000 μ m) F-SMA to RP-02, 0.3 m	2260/91.01
Cable, FO Duplex (1000 μ m) RP-02, 2 m	2260/91.02
Cable, FO Duplex (1000 μ m) RP-02, 5 m	2260/91.09
Cable, FO Duplex (1000 μ m) RP-02, 10 m	2260/91.07
Cable, FO Duplex (1000 μ m) RP-02, 20 m	2260/91.03
Cable, FO Duplex (1000 μ m) RP-02, 50 m	2260/91.04

Index

A

AC adapter/charger 10
AC adapter/charger, Dangers from 10
ACT (Actual) 31
After transport and storage 14
ALARM 28
Audible signal 33
AUTO-OFF 27
AUTO-ZERO 27
AVG (Average) 31
AVG TIME 27

B

BACKLIGHT 27
Batteries
 Disposal of 47
 Replacing / removing 44

C

Case 14
CE Declaration of Conformity 54
Changing the field type 34
Charge state indicator 19
Checking for proper operation 48
Cleaning 44
Connecting the probe 20
Contrast setting 29

D

Dangers from 19
Declaration of origin 54
Discrete spatial measurement 32
Display backlight 27
Disposal 47

E

Electromagnetic fields, Dangers from 9
Error message 29

F

Firmware update 41
Freezing a result 34
Function testing 48

I

Improper use 8
Instrument overview 15
Instrument settings 26, 41
Items included 12

L

LIMIT FLAT 28
LIMIT SHAP(ED) 28

M

MAX (Maximum) 31
measuring discrete values 32
Measuring values continuously 33

O

Operation from rechargeable
 batteries 17
Ordering information 55
Overview of the display 30

P

Packaging 12
PC software 40
Probe testing 48
Proper use 8

R

Rechargeable batteries
 Proper handling of 19
Remote control 36

S

Safety instructions 7

- AC adapter/charger 10
- Electromagnetic fields 9
- Rechargeable batteries 10
- Selecting the result type 30
- Selecting the units 33
- Self test 29
- Setting contrast 29
- SPATIAL 28, 32
- Spatial average 32
- Specifications 51
- Switching off 37
- Switching on 26
- Symbols and marks 5

T

- Terminology 5
- Test sources 50
- Transport and storage 14
- Transport case 14
- Transport damage 13

U

- UNIT 28
- Unpacking 12
- Using the alarm function 35

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