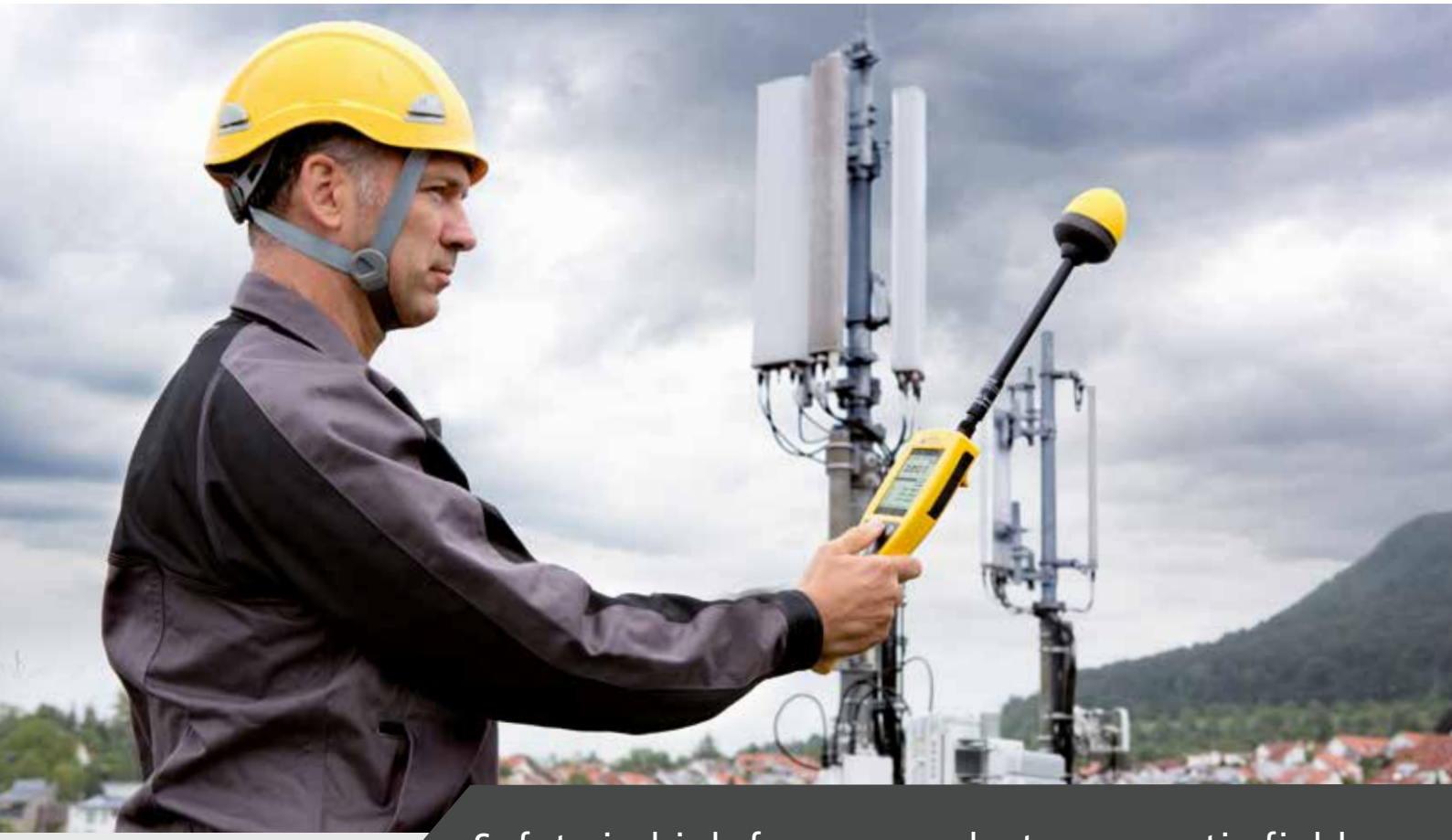
narda
Safety Test Solutions



Safety in high frequency electromagnetic fields

NBM-500

Narda Broadband Field Meter Series NBM-500

Safety only from reliable measurement results

The subject of protecting humans and the environment from harmful effects usually involves self-induced problems such as noise, dangerous substances, and electromagnetic or radioactive radiation. Manufacturers, plant operators, employers, safety representatives and health and safety organizations as well as public authorities all bear responsibility. The obligation to ensure safety covers all aspects from the workplace through to public and private areas – in short, the entire environment.

Subjective perceptions can be a protection. For example, you can hear noise, and feel vibration. Some chemicals have distinctive odors. So it is easy to avoid or remove such hazards. Electromagnetic radiation is different. Our senses cannot detect it. There is only one way to make an objective assessment: with measured values.

National and international bodies have specified frequency-dependent limit values for electromagnetic radiation to protect us from harmful exposure. Generally, the field strength limits for the workplace (occupational) are higher than those for the general public. This is because people who work where there are electromagnetic fields present are usually properly trained, know the dangers, and know what to do. On the other hand, employers must ensure safety, demonstrate that the limit values are not exceeded, clearly indicate safety areas, and specify rules of conduct.

Narda Safety Test Solutions has developed the Broadband Field Meters in the NBM-500 series for these tasks. These devices detect high frequency electric and magnetic fields* and have been specially designed for personal safety measurements. They give you precise, reproducible and calibrated measurements, so they can be traced back to national and international standards. The results are therefore authoritative and conclusive.

The NBM devices really show their strength when used on site, in any surroundings. Their accuracy and reliability makes them just as suitable for making measurements in the laboratory as for detecting leaks in high frequency lines or devices.

* High frequency electric and magnetic fields with frequencies of up to 300 GHz are classified as non-ionizing radiation (NIR), which is not the same as ionizing or "radioactive" radiation.

Narda Safety Test Solutions is the global leader in developing and producing equipment for measuring electric, magnetic and electromagnetic fields. Our expertise is based on many years of experience in high frequency and microwave technology, know-how that means we have around 95% of all published patents for measuring these fields. The result of all this: High quality, application tailored measurement solutions, permanently assured by our management system that covers all aspects and implements the requirements of the ISO 9001 and ISO/IEC 17025 standards.

Mobile communications, broadcasting, radar, and other wireless services

We live in a mobile society, with an emphasis on mobile communications. Basically, we can be reached anywhere and at any time. Our Smartphones or Tablets let us use Internet services and exchange data, and give us access to information and controls from almost anywhere in the world, as well as being useful as telephones.

This gigantic amount of data being exchanged means data networks have to be expanded to cope: WLAN and other wireless communications systems for local areas, cellular networks such as GSM, UMTS, CDMA and LTE for coverage of wider areas from any point, and fixed networks for long distance communications. Even fixed networks do not rely on cables, as radio links transmit thousands of channels over 50 km or more, and satellite links cover the globe.

As our use of mobile communications increases, so does the number and density of the antennas needed. Space is at a premium on transmitter towers and masts as well as on rooftops. Antenna locations have to be approved by the authorities, who sometimes also specify safety zones. Operators are responsible for sticking to these zones and the field strength limits, as well as for protecting staff working on or near the antennas, and for protecting the general public. Those responsible need measuring equipment with a big enough bandwidth to cover the existing frequency spectrum and sensitive enough to measure even low field strengths from a greater distance. Accurate enough to deliver authoritative results, too, because only reliable, reproducible measured values can be communicated clearly.

Radio listeners and TV viewers expect high quality reception wherever they are, even if they are a long way from the transmitter. Cabled connections are not available everywhere, and even the cable network needs a header station that receives all the channels cleanly.
You need high powered transmissions to achieve quality and range, regardless of the modulation method used. This applies to non-public wireless services, too: police, emergency services, in-house communications, air traffic control. It also applies when the signal is used for location rather than transmitting data, such as for radar. This uses high frequency impulses. The radar set evaluates the impulse echoes, so the higher the impulse power and shorter the impulse, the better the resolution. Here again, humans and the environment must be protected from excessive exposure. Safety zones must be classified and indicated, and the permitted length of time specified that you can stay in the direct vicinity of the antenna. Appropriate measurements will tell you if the limit values are being kept to near the equipment and in the wider area. So the measuring device must not only withstand high field strengths and short impulses, it must also measure them precisely.

WLAN Wireless Local Area Network
GSM GSM Global System for Mobile Communications, second generation mobile communications standard (2G)
UMTS Universal Mobile Telecommunications System, third generation mobile communications standard (3G)
CDMA Code-Division Multiple Access, modulation method and name for mobile networks that use this method
LTE Long Term Evolution, fourth generation mobile communications standard (4G)

Applications in the workplace – Health and safety at work

Welding, hardening, heating, drying

High frequency electromagnetic radiation is useful for many things. High frequencies can weld plastics, harden metallic surfaces, dry coatings, wood and leather, heat up materials for industrial processes – and your dinner in the microwave. The so-called ISM frequencies are reserved for these applications (Industry, Science, Medicine), for example 13.56 MHz, 27.12 MHz or 2.45 GHz – which is the frequency used by your microwave oven.

Diagnosis and treatment

High frequencies are useful to science and medicine for non-invasive investigations of materials and of the human body. For example, modern nuclear magnetic resonance tomography (NMR or MRI) uses overlapping high frequency fields. Diathermy and hyperthermy, penetrative heating of body tissues by means of electromagnetic fields, can produce healing or speed up the healing process.

Keeping a check on the electromagnetic field strengths is part of workplace health and safety. After all, the industrial process is designed to process materials, not cook the workers! In medical applications, too, the patient should receive the right amount of radiation without exposing the staff to uncontrolled high field strength levels. Suitable test equipment can prove that the permitted field strengths are not being exceeded. It can also help you to detect any faults, even if this is only a missing bit of screening or a door that doesn't seal properly.

Tailor made measurements

The places where field strengths need to be measured are often not the most convenient. The Narda Broadband Field Meters in the NBM-500 series are therefore designed to be used anywhere. The casings are impact resistant, the probes are robust. The monochrome displays – backlit LCDs – can be read in darkness and in bright sunlight. Even under difficult working conditions, you will immediately get reliable results. Narda offers two device types with a wide range of probes, tailor made for each particular application.

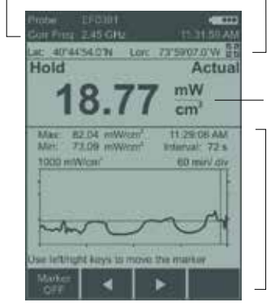
Strength in the family

The devices in the NBM-500 series are members of a family. They share the same probes, so you can swap these from one device to another as you want. The smaller NBM-520 can be controlled from its bigger brother the NBM-550, so it can be used as an extended probe handle, for example. With the probe on the NBM-520, you can reach awkward places, while the results can be read off from the convenient display of the NBM-550 held comfortably in your hand.

Accuracy behind the scenes

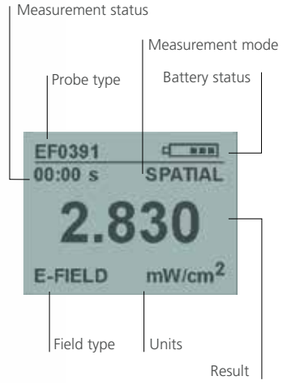
All NBM devices automatically perform zero point adjustment to eliminate the effects of temperature on the results. You don't need to put them in a screened chamber for this, and you won't notice the process any more than you can see the device detecting the individual probe parameters stored in an EPROM in the probe itself. The NBM basic unit calls up the parameters through the intelligent probe interface and automatically takes them into account. This guarantees maximum measurement accuracy in any situation. The NBM will even tell you when the next calibration of the basic unit or the probe is due, if you want it to.

NBM-550:
Get the details easily
The NBM-550 conveniently offers additional on-site evaluation facilities as well as storage for up to 5,000 results so you can process them and document them later. The device can be hand held or fixed to a tripod, and can be programmed for long term measurements or remote controlled from a PC.



Brief summary of result history: NBM-550 shows a graph versus time. You can use the markers to read off the numerical values.

NBM-520:
Four buttons find the target
The particularly handy NBM-520 straightaway indicates the field strength in V/m, A/m, mW/cm², or W/m² – or directly as a percentage of the permitted limit value if you are using a Shaped Probe. You can remote control the device or pre-configure it from a PC via its optical interface.



Everything at a glance: Even with the small NBM-520, you can average the measurement results over time as well as perform spatial averaging.

Capture what the situation demands

There are NBM probes for practically all applications in the frequency range from 0 Hz (DC) up to 100 GHz.
The E field probes, particularly the wideband models, capture electric field strengths in the long wave to microwave frequencies. The H field probes are used for making separate measurements of the magnetic field component in the near field region of transmitters or on industrial equipment where high currents are flowing. The so-called Shaped Probes automatically evaluate the field strength in accordance with a particular safety standard.
All the NBM probes are isotropic, so they are non-directional. This means that you don't have to worry about the direction that the radiation is coming from. Some examples:

E field probe Type EF 0391
Frequency range 100 kHz to 3 GHz

This probe captures electric fields as found in industry, broadcasting and telecommunications. It is particularly suitable for verifying human safety limit values for the general public, thanks to its high sensitivity of 0.2 V/m and its good linearity.

E field probe Type EF 5091
300 MHz to 50 GHz

This probe's thermocouple sensors deliver true RMS results, even for short impulses and where several frequencies are superimposed. The probe captures practically all the frequencies used in satellite communications and radar.

Calibration
All NBM probes are calibrated at several points in their frequency ranges. The data are stored in an EPROM within the probe itself and are taken into account automatically by the NBM basic unit. Separate factory calibration of the probes and the basic units means you can combine any NBM basic unit with any NBM probe. This multi-frequency calibration means that the NBM-550 offers additional accuracy: If the frequency of the field source is known, the correction value at this frequency can be specifically applied or interpolated from the neighboring correction values.

Narda Safety Test Solutions has three of the most modern calibration laboratories available for calibrations. All of them offer accredited calibrations in addition to the standard factory calibration. The labs are accredited by the relevant national accreditation agencies and also meet the general requirements for competence for calibration laboratories outlined in ISO/IEC 17025.

H field probe Type HF 3061
300 kHz to 30 MHz

This probe captures magnetic fields. It is particularly useful in the near field region of short and medium wave transmitters or of industrial plant. Its dynamic range from 0.012 A/m to 16 A/m (62 dB) makes it ideal for demonstrating compliance with limit values in occupational and general public areas.

E field probe Type EA/EB/EC/ED 5091
300 kHz to 50 GHz

This shaped probe measures and evaluates the electric field in the range from 300 kHz to 50 GHz automatically according to the latest safety standards, i.e. corresponding to the limit values for the workplace. Even if you do not know the frequencies, you can see immediately if the field exposure level is within the safe limits: The result is shown directly as a percentage of the permitted value.

Norms, standards, regulations

Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz). International Commission on Non-Ionizing Radiation Protection (ICNIRP). Health Physics 74(4): 494-522; April 1998

- Guidelines on Limiting Exposure to Non-Ionizing Radiation. International Commission on Non-Ionizing Radiation Protection (ICNIRP), July 1999; ISBN 3-9804789-6-3
- Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz -100 kHz). Health Physics 99(6): 818-836; 2010
- Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC
- Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). Official Journal of the European Communities L 199/59, 30.7.1999
- IEEE Std C95.1-2005: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
- Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz. Safety Code 6 (2015), ISBN: 978-0-660-02466-0
- Revised ECC Recommendation (02)04: Measuring non-ionising electromagnetic radiation (9 kHz - 300 GHz). Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT). Edition October, 2003
- Federal Communications Commission (FCC), „Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation", Report and Order, ET Docket 93-62, FCC 96-326, adopted August 1, 1996. 61 Federal Register 41006 (1996)

The perfect combination ideal for a wide range of applications

Narda has developed the Field Analyzer EHP-50F for measuring low frequency fields from 1 Hz up to 400 kHz. It makes isotropic (non-directional) measurements as a stand alone device or in combination with a PC. The optical interface allows you to position the device in places that are difficult to reach or where exposure levels are very high. Combination with the NBM-550 is a new feature. This controls the EHP-50F and displays the results. There are four operating modes for different applications: Wideband measurement over a selectable frequency range, measurement of only the highest level in a frequency band, spectrum measurement with marker function for individual evaluation, or wideband measurement using the Weighted Peak method.

The frequency range of the NBM-550 is extended by the Field Analyzer EHP- 50F: Using appropriate probes, the NBM-550 covers the entire range from 0 Hz (DC) up to 100 GHz. This means that you can use the NBM-550 for anything from analyzing low frequency fields in the industrial environment to high frequency measurements on mobile communications antennas, transmitting equipment and radar installations.

Organize, comment, document

The NBM-550 makes it easy for you to keep track of large scale measurement programs, long term observations, or monitoring multiple locations. The device automatically adds a timestamp with the date and time to every measured value. The GPS option gives you the corresponding location coordinates.

You can record comments for each measurement, which can be replayed over headphones. Each comment is stored along with the measured values and is also available later when you have transferred the results to a PC.

NBM-TS, the PC software for the NBM family, is included with the device. This software is identical for the entire NBM family, so you only have to install it once, learn how to use it once, and then use it for everything. NBM-TS lets you

- Generate and manage device configurations
- Make firmware updates
- Make remote controlled measurements

Extra features for the NBM-550:

- Result transfer to a PC
- Database management
- Later evaluation and documentation

Fully equipped for every application

Frequency range	300 kHz - 30 MHz	27 MHz - 1 GHz	100 kHz - 3 GHz	[3] 100 kHz - 6 GHz [4] 600 kHz - 6 GHz	3 MHz - 18 GHz	40 MHz - 40 GHz	[5] 300 MHz - 50 GHz [6] 300 MHz - 100 GHz	100 MHz - 60 GHz	100 MHz - 90 GHz	300 kHz - 50 GHz
Field quantity	H	H	E	E	E	E	E	E	E	E, weighted
Measurement range	0.012 - 16 A/m	0.018 - 16 A/m	[1] 0,2 - 320 V/m [2] 0,8 - 1300 V/m	0.2 - 650 V/m	0.8 - 1000 V/m	0.7 - 400 V/m	8 - 614 V/m	0.7 - 400 V/m	0.7 (2) - 400 V/m (2) for f > 60 GHz	approx. 0.5 - 600% of standard
Sensor type	Coils with diodes	Coils with diodes	Dipoles with diodes	Dipoles with diodes	Dipoles with diodes	Dipoles with diodes	Dipoles with thermocouples	Dipoles with diodes	Dipoles with diodes	Dipoles with diodes and thermocouples
Model name										
	HF 3061	HF 0191	[1] EF 0391 [2] EF 0392	[3] EF 0691 [4] EF 0692	EF 1891	EF 4091	[5] EF 5091 [6] EF 5092	EF 6092	EF 9091	EA/EB/EC/ED 5091
Mobile communications / Telecommunications	●	●	●	●	●					●
Radio / TV broadcasting	●	●	●	●	●					●
Satellite communications					●	●	●	●	●	○
Radar					○	○	●	○	●	○
Industry: Heating and hardening	●		●	●						
Industry: Plastics welding	●		●	●						
Industry: Semiconductor production	○		●	●						
Medicine: Diathermy, hyperthermy			●	●						○
Leak detection					●	●	●	●	●	○
Human safety (general public)	●	○	●	●	●	●	○	●	●	○
Health and safety (occupational)	●	●	●	●	●	●	●	●	●	●

● Particularly suitable

○ Suitable

Leaders in EMF Measurement

narda
Safety Test Solutions

Narda Safety Test Solutions GmbH
Sandwiesenstraße 7
72793 Pfullingen, Germany
Phone +49 7121 97 32 0
info@narda-sts.com

Narda Safety Test Solutions
North America Representative Office
435 Moreland Road
Hauppauge, NY11788, USA
Phone +1 631 231 1700
info@narda-sts.com

Narda Safety Test Solutions S.r.l.
Via Rimini, 22
20142 Milano, Italy
Phone +39 0258188 1
nardait.support@narda-sts.it

Narda Safety Test Solutions GmbH
Beijing Representative Office
Xiyuan Hotel, No. 1 Sanlihe Road, Haidian
100044 Beijing, China
Phone +86 10 6830 5870
support@narda-sts.cn

www.narda-sts.com

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