

## NBM-500 – Frequently Asked Questions

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## 1. How do NBM broadband probes work?

The sensors consist of three orthogonally arranged dipoles that allow you to make isotropic (non-directional) measurements. The received signals are rectified by the diode sensors, whereas the DC signal is generated directly by the thermocouple sensors. The DC signals are fed to the connector and the basic instrument unit via a high-impedance circuit. Depending on the probe type, the signals are output separately for each spatial axis or they are output as a summed signal. The signals are integrated in the basic instrument in order to make RMS measurements. The integration time is 270 ms (for a 5 Hz sampling rate), 40 ms (for a 50 Hz sampling rate) or 36 ms (for a 60 Hz sampling rate). The integrated signals are sampled, digitized, and then further processed. Probe-specific parameters such as sensitivity, linearity corrections, and calibration values are stored in the probe itself. These parameters are uploaded when you connect the probe to the basic unit, and are applied to the input signal to produce the measurement result which is then displayed.

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## 2. What is the sampling rate used for recording measured values?

The sampling rate for manual measurements is always 5 Hz. Measurements are made continuously and without any dead time, so no signals are lost. You can set the sampling rate using remote control commands when the instrument is used in remote mode. Sampling rates of 5 Hz, 50 Hz and 60 Hz are provided. Faster sampling rates have the disadvantages of a reduced dynamic range and an increased noise level. The NBM-TS software only supports the 5 Hz sampling rate in measurement operation.

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## 3. Why does my instrument not display zero after a zero adjustment?

The zero adjustment compensates for the effects of offset voltages and therefore increases measurement accuracy. Since these voltages are temperature-dependent, it is a good idea to regularly perform auto-zeroing every 15 minutes. The NBM instruments allow auto zeroing even under conditions of high field strength. The reason that the display does not show zero after such adjustment is because the intrinsic noise cannot be compensated for and that any probe offset voltages present are not detected by the zero adjustment. This is of no consequence for accurate measurements as long as the indicated value in a zero field is less than the specified measurement range limit of the probe.

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## 4. How is the “true RMS” range of a probe defined?

Diode-based dipole sensors behave almost as true RMS detectors at low signal levels. The data sheet specifications for the true RMS range are defined as follows: The measurement range is designated as “true RMS” when the signal-dependent deviation between the displayed value and the actual RMS value is less than 0.5 dB (for a two tone test signal) and less than 1 dB (for an 8 tone test signal). The frequencies of the test signal are separated by  $\Delta f = 10$  MHz in each case.

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### 5. What's the difference between thermocouple and diode-based probes?

Both types of probe use dipoles to detect the electric field. The dipoles in the thermocouple probes are formed by thermocouples connected in series, which generate a DC voltage proportional to the power density. In the diode-based probes, the dipoles are formed by two equal lengths of wire with a detector diode as rectifier between them. Both these techniques can be used to develop broadband sensors.

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Thermocouple probes	Diode-based probes
+ True RMS detection (full range)	- Restricted True RMS range (upper limit 10-60 V/m)
+ Sensitivity does not vary with temperature	- Sensitivity varies with temperature
- For high frequencies only (above 300 MHz)	+ Also suitable for low frequencies (above 100 kHz)
- Restricted dynamic range (30 to 40 dB)	+ High dynamic range (55 to 65 dB)
- Affected by thermal gradients	+ Barely affected by thermal gradients

### 6. What is a shaped probe?

The traditionally-used flat frequency response probes have been developed with the aim of providing a probe having as constant sensitivity to magnetic field strength as possible over the usable frequency range. In contrast, Narda's patented Shaped Probes are constructed in a completely different way. The sensitivity of these probes is designed to match a particular directive or standard. The sensitivity versus frequency (frequency response) of the probe is as closely as possible in inverse proportion to the limit value curve. The measured values are not displayed in V/m or W/m<sup>2</sup>, but are shown as "% of standard" instead. This makes it very easy to assess the results, particularly in multi-frequency environments as there is no need to worry about the predominant frequencies in the field. A result of less than 100% always means that the limit values are not exceeded anywhere within the entire frequency range of the probe. The "% of standard" display is referred to the power density of the electromagnetic field. The high bandwidth of 300 kHz to 50 GHz of a Narda "Shaped Probe" is unique.

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### 7. What's the reason for the extremely wide bandwidth of Narda's shaped probes?

When compared with conventional broadband probes, Narda's Shaped Probes have a much wider frequency range (e.g. 300 kHz – 50 GHz). The reason for this is the use of a diode-based probe section for the lower frequency range (approx. 300 kHz – 2 GHz) and a thermocouple probe section for the upper frequency range (approx. 300 MHz – 50 GHz). Both parts of the probe have suitable frequency responses which are superimposed after adjustment of the sensitivity and which correspond as closely as possible to the limit value curve of a particular safety standard (e.g. ICNIRP).

Although the transition region is continuous, Shaped Probes can be considered simply as diode probes below 1.5 GHz and as thermocouple probes above 1.5 GHz.

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**8. How do I make measurements according to the ICNIRP General Public standard?**

The ED5091 probe for the NBM-500 is a Shaped Probe, i.e. it has a weighted frequency response. It takes account of the limit values specified in the ICNIRP Occupational standard. It can also be used to show conformance to the ICNIRP General Public limit values in the frequency range 10 MHz to 50 GHz, because the Occupational limit value curves in this frequency range are exactly five times higher than the General public limit value curves in terms of power density. You simply have to multiply the displayed value in "% of STD" by five to obtain the value for the General Public standard.

Example: Display reading "20% of STD" for ICNIRP Occupational corresponds to 100% of STD for ICNIRP General Public in the range 10 MHz to 50 GHz.

**Caution: This result can only be used if you are certain that there are no relevant fields with frequencies outside this frequency range!**

What about the other standards? Here's a summary:

Probe	Factor	Usable for "General Public" measurement in the frequency range
EA5091 Shaped Probe, FCC 96-326	5	3 MHz - 50 GHz
EB5091 Shaped Probe, IEEE C95-2005	5	3 MHz - 300 MHz only (!)
EC5091 Shaped Probe, Canada SC 6	5	300 kHz - 50 GHz (complete measurement range)
ED5091 Shaped Probe, ICNIRP 98	5	10 MHz - 50 GHz

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**9. Why are there no H-field probes available for frequencies above 1 GHz?**

High frequency electromagnetic fields have an electrical and a magnetic field component, known as the E-field and H-field respectively. These two components have a fixed relationship to each other at a significant distance from the source, the far field. It is thus only necessary to measure one component (e.g. E-field in V/m). The other field strength component (e.g. H-field in A/m) or the power density (e.g. in W/m<sup>2</sup>) can be calculated from this. This does not apply in the near field, so the E-field and H-field need to be measured separately here.

At frequencies above 1 GHz, the far field condition already applies at a distance of just 1 m from the source of the field. Since only one component needs to be measured here, there is no need for H-field probes. E-field probes for very high frequencies are technically easier to produce with greater precision and wider bandwidths than H-field probes.

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### 10. What temperatures can be withstood by the foam probe heads?

Applications involving semiconductor production require increased thermal resilience. The probe heads are produced from a special foam material that has excellent RF characteristics and which withstands temperatures between -40°C and +100°C. The thermal time constants are such that the probes can be briefly (< 10 minutes) subjected to temperatures higher than the specified temperature range without causing damage to the probe.

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### 11. Why is there no XYZ display mode available (NBM-550 only)?

XYZ mode is not available for all probes. Thermocouple probes and Shaped Probes do not generally support output of individual axis results. The data sheet for your probe will indicate whether this mode is supported or not.

The sum of the individual axis values corresponds to the isotropic result value when displayed in the units  $\text{mW}/\text{cm}^2$  or  $\text{W}/\text{m}^2$  in XYZ mode. The values must be added quadratically (square root of the sum of the squares, RSS) to obtain the isotropic result if displayed in the units V/m or A/m.

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### 12. How high is the immunity to radiated fields of NBM devices?

Electronic devices must function without impairment in field strengths of up to 3 V/m to fulfill the CE conformance declaration. The NBM instruments will operate in much higher field strengths because of additional screening (e.g. of the display screen) and suitable circuit design. Type testing has demonstrated that these instruments have immunity against RF field strength in excess of 200 V/m. Practically no suitable test equipment exists to prove immunity for higher field strengths. Further information is found in the Annex of the CE conformance declaration (included in the operating manual).

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### 13. Which cables are used for the optical interface?

The optical duplex cable (1 forward and 1 return fiber) Type RP-02 uses a new connector system that has been specially developed for Narda and which has been used for the first time for the NBM. Other Narda products will also be fitted with this connector system in future. The RS-232 protocol is used. Suitable cables in lengths of 2m and 20m are available as accessories.

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### 14. Which interface should be used for which remote operating mode?

In Controller operation, the NBM-550 controls a second NBM device (520 or 550). The optical interface is always used for this purpose. In contrast, remote controlled operation can be via either the optical interface or the USB interface (if available).

An NBM-550 in Controller mode can also be remote-controlled at the same time. Only the USB interface can be used in this case. As a result, the Interface is set to USB automatically as soon as Controller mode is activated. The Interface setting is not changed automatically when Controller mode is deactivated.

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### 15. How does the external trigger input work (NBM-550 only)?

The trigger input can be used to connect an external device that can trigger store to memory operations (e.g. zero-voltage switches, rotary counters, or TTL signals). Connection is made using the 2 pole trigger cable with BNC plug (available as an optional accessory). The action of pressing the Store button is simulated each time the BNC plug contacts are shorted together, triggering a store operation. The trigger function is activated or deactivated from the INTERFACE menu.

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### 16. What is the difference between “CLEAR” and “RESET”?

When you press the CLEAR (ESC) button, the uninterrupted values to be updated for MIN, MAX, AVG and MAXAVG are reset to zero. The history memory content (HISTORY) is always retained as long as you do not change any relevant parameters. In contrast, a RESET restarts the device and is intended for use when the instrument no longer responds due to a fault or error. Pressing function key 1 and the power key at the same time triggers a RESET. The NBM-520 does not have a RESET function. Stored measurement results are retained in either case.

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### 17. How do I reset the history graph (NBM-550 only)?

Whereas the Timer Logging function is intended for recording planned measurements starting at a particular point in time (future), the History memory records the past measurements and operates continuously in the background. The history memory is only cleared if basic settings have been changed. This is the case, for example, if you change the probe, alter the correction frequency, or change the displayed time period. There is no provision for directly clearing the history memory manually.

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### 18. How should the results for a measurement interval be interpreted in History mode?

You can select a recording time (span) between 2 minutes and 8 hours in History mode. Earlier records are automatically overwritten in the ring memory. The time axis is divided into 4 segments (divisions) and is labeled Time / div. The recording time or span is divided into 200 measurement intervals. In physical terms, one interval corresponds to the time period represented by a single pixel in the graphical display. The complete measurement trace therefore consists of exactly 200 pixels.

Span = time duration / div x 4  
Interval = span / 200

Sampled measurements are not made, but rather the measurement is made continuously and the maximum, minimum and average value of each measurement interval is displayed and stored.

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### 19. How do I adjust the volume (NBM-550 only)?

You can set the AUDIO OUTPUT LEVEL parameter in the INTERFACE menu of the NBM-550. The setting is intended to allow adjustment for external earphones and is only used when a Voice Recorder is present (optional feature). The setting has no effect on the volume of the internal beeper that is used for example to generate the alarm tone. The volume level of the beeper cannot be altered. Alarm signals are not output via the headphone output either.

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### 20. What happens when the device switches off due to low battery power?

The battery indicator flashes to give ample warning when the battery capacity drops below 5%. The device powers down in a controlled manner when the capacity drops further to about 2%. All the results saved up till then are retained, including those made in a series of measurements such as in Timer Logging or Conditional Logging modes.

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### 21. Could the GPS receiver module adversely affect measurements (NBM-550 only)?

A connected GPS module mainly affects the battery life, because GPS receivers require relatively high power levels. The effect on anisotropy due to increased signal reflections is typically below +/- 0.5 dB and can be ignored for the most part.

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### 22. Why is no position shown although the GPS receiver is connected (NBM-550 only)?

The technology used requires that the GPS receiver is in a direct line of sight to the geostationary satellites. As a result, the function is generally unavailable within buildings because strong reflections occur and the received signals are usually too weak. Even outdoors, reception can be affected by shadowing (due to buildings or trees). When a signal can be received, it can take up to 5 minutes from the time the receiver is switched on or plugged in before the position information is available.

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### 23. How can I use the increased accuracy (DGPS via EGNOS/ WAAS)?

The public services of EGNOS (Europe), WAAS (USA) and MSAS (Japan) are compatible with each other and provide enhanced DGPS positional accuracy of 1 to 3 m where they are available. EGNOS is offered by ESSP (European Satellite Service Provider), can be used free of charge and does not require any special equipment other than a compatible receiver. The GPS receiver included in the NBM Option Set is EGNOS/WAAS/MSAS compatible. The NBM basic unit displays the enhanced accuracy if a signal from any of these services is received.

ESSP does not currently guarantee continuous availability and interference free operation.

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### 24. What functions are provided by the GPS option with the NBM-550?

The basic function provided when the GPS receiver module is fitted is the display of the latitude and longitude of your current location. When you save measurement results this data is recorded along with the height information. When you upload the results to a PC, you can use the intelligent functions of the NBM-TS software which make documentation much easier. The learning function allows you to assign addresses to the location data. The address is automatically recognized and displayed the next time a result is recorded at the same location. You can set the capture range for automatic address detection in three stages (search radius of 30 m, 300 m, or 3000 m).

You can also show a measurement location on a map at the press of a button. Simply select your preferred Internet map server. NBM-TS will transmit the location coordinates and the geographic representation is then displayed in your web browser window.

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### 25. How do I record the variation over time of an averaged measurement value?

You can record the variation of measurement values versus time using HISTORY mode or using TIMER LOGGING operating mode. In each case, the measurement is made continuously except for a brief interruption each time a zero adjustment is performed. The entire measurement time is subdivided into intervals, and the maximum, minimum, and average values for each interval are saved. The averaging time over one measurement interval is often not the same as the desired averaging time (e.g. 6-minute average value). NBM-TS includes a POST averaging function that allows you to subsequently vary the averaging time, saving you the trouble of converting the results to a different average value. The POST averaging function can be used when the results have been saved in the database.

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### 26. How do I analyze a time interval within a series of measurements?

Often only a section of a series of measurements is of interest and needs to be analyzed or recorded. The ZOOM function of NBM-TS allows you to do this by using the mouse to simply mark the area of interest in the graphical display of results. The graphical display and the table of values then only show the zoomed section. All the documentation and export functions then only apply to the zoomed section so there is no need for any subsequent editing of the results.

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### 27. Where are my exported results (CSV files) located?

A message indicating that the data was exported successfully is displayed after the selected data has been exported in CSV format. The files are saved in the export folder that you specify under EXTRAS/ PREFERENCES.

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**28. How do I export several results in one file?**

You must first select all the desired measurement results by placing a check mark against them. You must also specify under EXTRAS/ PREFERENCES/ EXPORT that the results are to be exported in a common file. Once this is done, click on the CSV icon to export the results in one file to the export folder.

In contrast, exporting to MS-Excel generates a separate table sheet in the workbook for each data set. Creating a report in MS-Word generates a separate file for each data set.

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**29. What's the difference between NBM-520 and NBM-550 when running measurements with NBM-TS?**

Both devices behave identically and have the same measurement functions. You can also use correction frequencies with an NBM-520 when it is remote controlled using NBM-TS.

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**30. Does Narda supply drivers that I can incorporate into my own control programs?**

Descriptions of the remote control commands for the NBM-520 and NBM-550 are found on the NBM-TS CD. You can usually write your own programs using just a few commands. Because the instruments are primarily designed for use in mobile field measurements, Narda does not currently offer drivers for third-party products (such as LabView).

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**31. Can I control several instruments simultaneously using the NBM-TS software?**

You can start and run multiple instances of the NBM-TS application at the same time. Remember, though, that you need to open a separate exclusive database for each instance of NBM-TS, and you can only control one instrument from each instance. The program can be started using a batch program and you can use parameters in the command line. NBM-TS is optimized to use minimal processor resources so at least 8 instances can be run at the same time.

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**32. Where can I find operating instructions for the NBM-TS software?**

NBM-TS includes comprehensive on-line help in English and German. The search function helps you find what you are looking for quickly. You can also find a complete description in the form of a PDF file on the NBM-TS CD in the "Operating Manuals\ NBM-TS" folder.

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