NARDA BROADBAND FIELD METER

NBM-520

# Measuring electric and magnetic fields

ranging from high frequency
to microwaves

- **Non-directional measurement using isotropic probes for applications in the frequency range 100 kHz to 60 GHz**
- **Intelligent probe interface with automatic detection of probe parameters for simple operation**
- **Extra small and lightweight**
- **Unbeatably easy 4-button operation**
- **Auto zero ensures precision measurements**

## DESCRIPTION

The Narda Broadband Field Meter NBM-520 is part of the NBM-500 family of test instruments. It measures non-ionizing radiation with utmost accuracy and incorporates all the major basic measurement modes. In contrast with the larger NBM-550, a memory for measurement results has been deliberately left out of the NBM-520. The result is unbeatably easy operation using just 4 buttons, so referring to the operating manual is all but unnecessary.

Suitable measuring probes for electric and magnetic field strengths are available for the frequency range from about 100 kHz up to 60 GHz. So-called *shaped probes* which have frequency responses that weight the results according to specific human safety standards are available in addition to *flat probes* with flat frequency responses. All probes are calibrated independently from the measuring instrument. They include a non-volatile memory containing the probe parameters and calibration data, so they can be used with any instrument in the NBM-500 family.

***Small, lightweight and rugged design – ideal for use in rough environments***

## APPLICATIONS

The NBM-520 is used to make precision measurements to establish human safety, particularly in workplace environments where high electric or magnetic field strengths are likely to occur. Some examples are:

- **Measuring field strengths to comply with general safety regulations**
- **Establishing safe zones**
- **Measuring field strengths in the industrial environment, such as plastics welding equipment, RF heating, tempering, and drying equipment**
- **Measuring and monitoring field strengths around broadcasting and radar equipment**
- **Measuring field strengths of cell phone transmitters and satellite communications systems to demonstrate compliance with human safety standard limit values**
- **Measurements for protecting users of diathermy equipment and other medical devices that generate high-frequency radiation**
- **Measuring field strength in TEM cells and absorber chambers to demonstrate electromagnetic compatibility (EMC)**

***Changing the probe is quick and easy, with no need to reconfigure the device***

## FEATURES

The Narda Broadband Meter NBM-520 is designed for on-site use. The concept focuses on simple operation and the range of functions has been deliberately kept to the main features necessary for performing precision field measurements.

**Display and operation**

- Operated by weatherproof foil keypad using just 4 buttons with perceptible click point
- Backlit monochrome LCD with selectable illumination time, easy to read even in bright daylight

**Result display and evaluation**

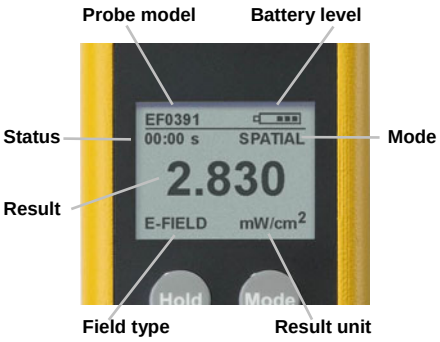
- 4 measurement modes selectable using the Mode button:
  Instantaneous value (ACT)
  Maximum (MAX)
  Time average (AVG)
  Spatial average (SPATIAL)
- Display units selectable using the Units button:
  V/m, A/m, mW/cm$^2$, W/m$^2$ when using flat probes,
  % of limit value when using shaped probes
- Hold button for “freezing” the display value

**Automatic adjustment, application of calibration data**

- Intelligent probe interface recognizes the NBM probe type and automatically imports and applies the correction values stored in the probe during calibration
- Fully automatic zero point adjustment with user definable time interval

**Warning functions**

- Audible and visible warning signals for high field strengths:
  Alarm threshold can be set from a PC




***Everything at a glance. The clearly arranged display is easy to read.***

***The optical interface connector and AC adapter / charger connector compartment is sealed with a rubber cap. The tilt stand provided in addition to the tripod bush can be used to place the instrument securely on a flat surface.***

**Operating features**

- Standard rechargeable batteries provide long operating life and can be recharged rapidly as needed
- Batteries protected by auto-off function with programmable timer
- Instrument configuration easy to set using the PC software supplied

**Remote control**

- PC software NBM-TS allows remote controlled measurements
- PC connected via optical interface to avoid field interference effects
- Optical cable extension allows additional freedom of movement for probes. The NBM-550 controller function enables data communication with the smaller NBM-520 so it can be used as an “extended probe handle”. This means that probes can be situated remotely from the NBM-550 without any metallic cables to adversely affect the measurements

***The battery compartment is opened easily using a coin. Two replaceable NiMH rechargeable batteries (AA size) are used to power the device.***

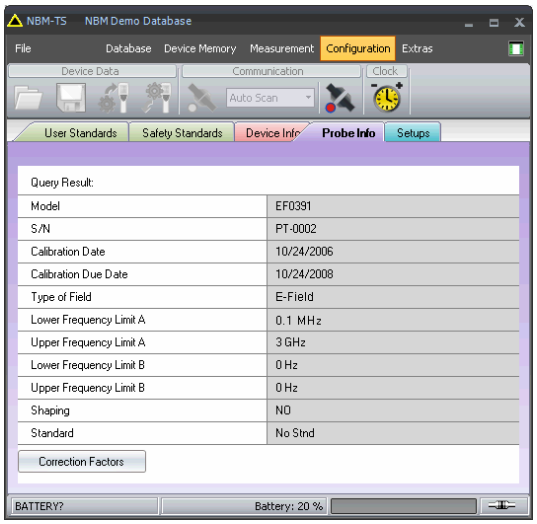
***Probe extension using an optical cable: The NBM-550 acts as controller and displays the results. The smaller NBM-520 acts as the optical probe interface. Both devices can also be used separately as measuring devices when fitted with probes.***

***A rugged transport case is included. This provides ideal protection for the instrument, together with up to two probes and all accessories.***

## PC SOFTWARE

The easy to use “NBM-TS” PC software (included) provides the following functions:

- Remote controlled measurements
- Device configuration management
- Firmware update control




***Compatible with the following operating systems: Microsoft® Windows® 2000 SP4, Windows® XP SP2, Windows Vista ™***

## PROBES

| Frequency range | 100 kHz – 3 GHz | 100 kHz – 6 GHz | 3 MHz -18 GHz | 300 MHz – 50 GHz | 100 MHz – 60 GHz | 300 kHz – 30 MHz | 27 MHz – 1 GHz | 300 kHz – 50 GHz EB5091: 3 MHz – 50 GHz |
|---|---|---|---|---|---|---|---|---|
| Field type | E | E | E | E | E | H | H | E Shaped |
| **Probe designation** | **EF0391 EF0392** | **EF0691** | **EF1891** | **EF5091 EF5092** | **EF6091** | **HF3061** | **HF0191** | **EA … ED5091** |
| Mobile radio / telecommunications | ● | ● | ● | | | ● | ● | ● |
| Radio / TV broadcasting | ● | ● | ● | | | ● | ● | ● |
| Satellite communications | | | ● | ● | ● | | | ○ |
| Radar | | | ○ | ● | ○ | | | ○ |
| Industry: Heating and tempering | ● | ● | | | | ● | | |
| Industry: Plastics welding | ● | ● | | | | ● | | |
| Industry: Semiconductor production | ● | ● | | | | ○ | | |
| Medicine: Diathermy, hyperthermy | ● | ● | | | | | | ○ |
| Leak detection | | | ● | ● | ● | | | ○ |
| Human safety (general public safety) | ● | ● | ● | ○ | ● | ● | ○ | ○ |
| Health and safety at work (occupational safety) | ● | ● | ● | ● | ● | ● | ● | ● |

● more important ○ variable importance

## SPECIFICATIONS

| NBM-520 | |
|---|---|
| **DISPLAY** | |
| Display type | Transflective LCD, monochrome |
| Display size | 4 cm (1.5”), 128 x 64 dots |
| Backlight | LEDs, selectable illumination time (OFF, 5s, 10s, 30s, 60s, PERMANENT) |
| Refresh rate | 400 ms |
| **MEASUREMENT FUNCTIONS** | |
| Result units | $mW/cm^2$, $W/m^2$, V/m, A/m (for flat probes)<br>% (for shaped probes) |
| Display range | 0.01 to 9999 V/m<br>0.0001 to 265.3 A/m<br>0.0001 to 9999 $W/m^2$<br>0.0001 to 9999 $mW/cm^2$<br>0.0001 to 9999 % |
| Result types (isotropic, RSS) | Actual (ACT), Maximum (MAX), Average (AVG), Spatial Averaging (SPATIAL) |
| Averaging time | 4 s to 30 min (2 s steps), selectable by PC software |
| Spatial averaging | discrete or continuously, selectable by PC software |
| Alarm function | 2 kHz audible signal (4 Hz repetition), threshold adjustable by PC software |
| **INTERFACES** | |
| Optical interface | Serial, full duplex, 115200 baud, no parity, 1 start and 1 stop bit |
| Probe interface | Plug-and-play auto detection, compatible with all NBM series probes<br><br>Integration time for measuring input approx. 270 ms<br>Measurement sampling rate 5 Hz (5/ 50/ 60 Hz for remote operation) |
| **GENERAL SPECIFICATIONS** | |
| Recommended calibration interval | 24 months (basic unit only, probes are specified separately) |
| Battery | NiMH rechargeable batteries, 2 x AA size (Mignon), 2500 mAh, included |
| Operation time | Approx. 22 hours (backlight off)<br>Approx. 16 hours (permanent backlight) |
| Charging time | 2 hours |
| Battery level display | 100%, 80%, 60%, 40%, 20%, 10%, low level (< 5%) |
| Temperature range<br>Operating<br>Non-operating (transport) | <br>-10 °C to +50 °C<br>-30 °C to +70°C |
| Humidity | 5 to 95%, non condensing<br>≤29 $g/m^3$ absolute humidity (IEC 60721-3-2 class 7K2) |
| Size (h x w x d) | 38 x 52 x 195 mm (without probe) |
| Weight | 300 g (without probe) |
| Accessories (included) | Hard case, power supply, rechargeable batteries, shoulder strap, NBM-TS software, operating manual, certificate of calibration |
| Country of origin | Germany |

## ORDERING INFORMATION

| NBM-520 | Part Number (P/N) |
|---|---|
| NBM-500 Set 2, Narda Broadband Field Meter<br>Includes:<br>- NBM-520 Basic unit (2403/01)<br>- Hard case, holds field meter and up to 2 probes (2400/90.07)<br>- Power supply, 9VDC, 100V-240VAC (2259/92.06)<br>- Shoulder strap, 1 m (2244/90.49)<br>- O/E converter USB (2260/90.07)<br>- Cable, fiber optic, duplex (1000 m), RP-02, 2 m (2260/91.02)<br>- Software, NBM-TS, PC transfer (2400/93.01)<br>- Operating manual<br>- Certificate of calibration<br>*Probes are not included* | **2400/102** |
| NBM-500 Set 4, Narda Broadband Field Meter<br>*- identical to NBM-500 Set 2 (2400/102) but with a larger case (2400/90.06) for up to 4 probes* | **2400/104** |
| **PROBES** | |
| Probe EF0391, E-field for NBM, 100 kHz - 3 GHz, isotropic | **2402/01** |
| Probe EF1891, E-field for NBM, 3 MHz - 18 GHz, isotropic | **2402/02** |
| Probe EF5091, E-field for NBM, thermocouple, 300 MHz - 50 GHz, isotropic | **2402/03** |
| Probe EF6091, E-field for NBM, 100 MHz - 60 GHz, isotropic | **2402/04** |
| Probe HF3061, H-field for NBM, 300 kHz - 30 MHz, isotropic | **2402/05** |
| Probe HF0191, H-field for NBM, 27 MHz - 1 GHz, isotropic | **2402/06** |
| Probe EA5091, Shaped E-field, FCC for NBM, 300 kHz - 50 GHz, isotropic | **2402/07** |
| Probe EB5091, Shaped E-field, IEEE for NBM, 3 MHz - 50 GHz, isotropic | **2402/08** |
| Probe EC5091, Shaped E-field, SC6 Canada for NBM, 300 kHz - 50 GHz, isotropic | **2402/09** |
| Probe ED5091, Shaped E-field, ICNIRP for NBM, 300 kHz - 50 GHz, isotropic | **2402/10** |
| Probe EF5092, E-field for NBM, thermocouple, 300 MHz - 50 GHz, high power, isotropic | **2402/11** |
| Probe EF0392, E-field for NBM, 100 kHz - 3 GHz, high power, isotropic | **2402/12** |
| Probe EF0691, E-field for NBM, 100 kHz - 6 GHz, isotropic | **2402/14** |
| **ACCESSORIES** | |
| Test generator, 27 MHz, hand-held | **2244/90.38** |
| Tripod, non-conductive, 1.65 m with carrying bag | **2244/90.31** |
| Tripod extension, 0.50 m, non-conductive (for 2244/90.31) | **2244/90.45** |
| Handle, non-conductive extension, 0.42 m | **2250/92.02** |
| Carrying Strap for Hardcase SRM/ NBM | **3001/90.04** |
| Cable, Probe Extension 1.25m | **2244/90.35** |
| Cable, fiber optic, duplex, F-SMA to RP-02, 0.3 m | **2260/91.01** |
| Cable, fiber optic, duplex (1000 m), RP-02, 2 m | **2260/91.02** |
| Cable, fiber optic, duplex (1000 m) ,RP-02, 20 m | **2260/91.03** |
| O/E converter, RS232, RP-02 / DB9 | **2260/90.06** |
| Protective pouch for NBM-520 | **2403/90.01** |
| Protective pouch for NBM probe (compatible with all NBM probes except 2402/05) | **2402/90.01** |

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| Frequency Range | 100 kHz – 3 GHz | | 100 kHz – 6 GHz | 100 kHz – 6 GHz | 3 MHz -18 GHz | 300 MHz – 50 GHz | | 27 MHz – 60 GHz | 300 kHz – 30 MHz | 27 MHz – 1 GHz | 300 kHz – 50 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Field Type** | E | E | E | E | E | E | E | E | H | H | E Shaped |
| **Probe Model** | EF 0391 | EF 0392 | EF 0691 | EF 0691 | EF 1891 | EF 5091 | EF 5092 | EF 6091 | HF 3061 | HF 0191 | EX 5091 |
| Mobile Phone and Telecom Transmitters | ● | | ● | | ● | | | | ● | ● | ● |
| Broadcasting (TV, Radio) | ○ | ● | ● | | ● | | | | ● | ● | ● |
| Satellite Communication | | | | | | ● | ○ | ● | | | ○ |
| Radar Signals | | | | | | ○ | ● | ● | | | ○ |
| Metal (Induction) Heating and Hardening | ● | | ○ | | | | | | ● | | |
| Plastic (or High Frequency) Welding Machines | ○ | ● | ○ | | | | | | ● | | |
| Industry Semiconductor Production | ● | | ● | | | | | | ● | | |
| Medical Diathermy / Hyperthermia | ○ | ● | ○ | | | | | | | | ○ |
| Leak Detection | | | ○ | | ● | ● | | ● | | | ○ |
| General Public (or Action) Exposure Levels | ● | | ● | | ● | ● | ○ | ● | ● | ○ | ○ |
| Controlled or Occupational Exposure Levels | | ● | ○ | | ● | ● | ● | ● | ● | ● | ● |

● Best Use For ○ Partially Suited For

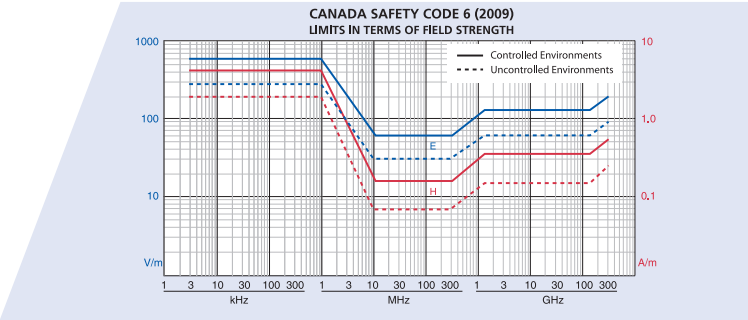
## Shaped Probes

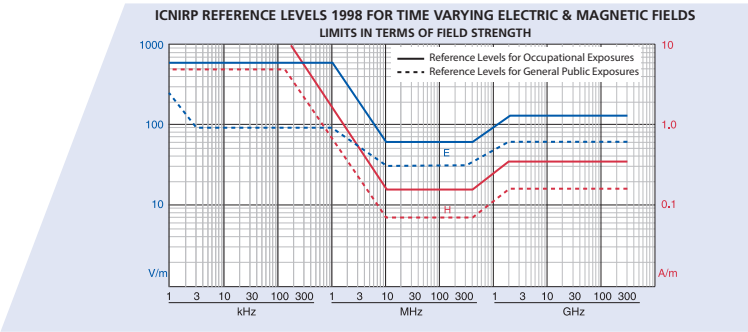
The goal in designing and manufacturing a traditional, "flat" frequency response probe is to make the probe equally responsive to energy at every frequency within its rated frequency range. In contrast, Narda's patented shaped frequency response probes are designed and manufactured so that their sensitivity mirrors a particular standard (or guidance) as closely as possible. For example, many of the major guidances and standards in the world set E-field limits for maximum human exposure at 614 V/m (1000 W/m$^2$) at lower frequencies (~1 MHz). At frequencies of 10 to 400 MHz the limits are typically much less, 61.4 V/m (10 W/m$^2$), a difference of 20 dB (100 times the power). A shaped frequency response probe designed for such limits is 100 times more sensitive in the 100 MHz region, than at 1 MHz.

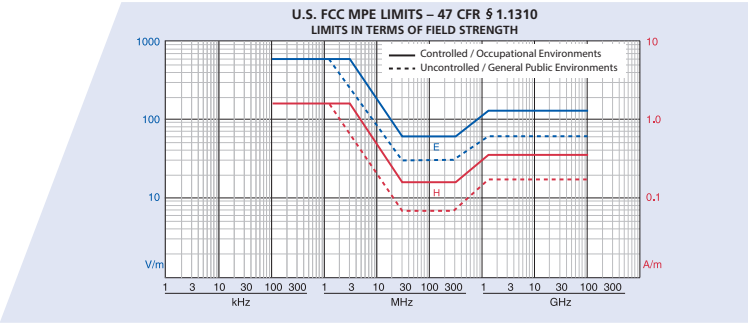
If you were performing a survey of a site with a flat frequency response probe that has both of the above frequency ranges and your survey indicated 137 V/m (or 50 W/m²), it would be difficult to determine if the site was out of compliance without turning one of the emitters off. Again, given the example above, the site could be generating anywhere from 5% to 500% of the human exposure limit. There are many sites with multiple emissions (rooftops, flight lines, broadcast towers) that have emitters at different exposure limits.

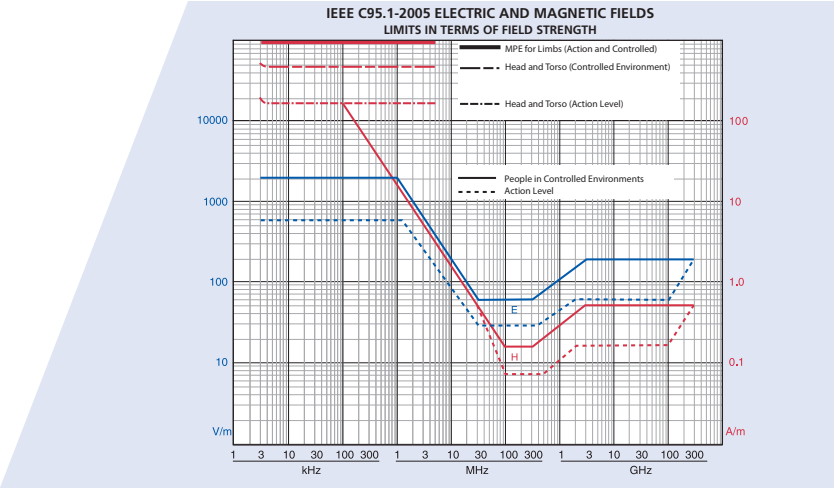
If your interest is general safety measurements, to know if you comply with an exposure limit or not, you will find shaped probes easy to use in any environment. The display of total field strength with shaped probes is not in terms of V/m or W/m², it is "% of Std." So at a multiple emitter site, a result of 15% is simple to understand. The total detected field strength of each emitter (to its limit, at its frequency) has added up to 15%. An additional use of these probes is for Military (classified) environments, since you no longer have the "need to know" the frequency when using a shaped probe.

| Standard or Guidance | Level | Model |
|---|---|---|
| US FCC 1997 | Occupational / Controlled | EA 5091 |
| IEEE C95.1-2005 | Controlled | EB 5091 |
| Canada Safety Code 6 | Controlled | EC 5091 |
| ICNIRP Recommendations | Occupational | ED 5091 |



# Probe Specifications

| Probe Model No. | Probe Ordering No. | Frequency Range [a] | Measurement Range | Linearity | Frequency Sensitivity [c, d] |
|---|---|---|---|---|---|
| **Probe EF 0391, E-Field, Flat** | 2402/01B | 100 kHz to 3 GHz | 0.2 to 320 V/m | ±0.5 dB (1.2 to 200 V/m)<br>±0.7dB (200 to 320 V/m) | ±0.5 dB (100 kHz to 100 MHz)<br>±1.4 dB (100 MHz to 3 GHz) |
| **Probe EF 0392, E-Field, Flat** | 2402/12B | 100 kHz to 3 GHz | 0.8 to 1300 V/m | +2/-3 dB (1 to 2 V/m)<br>±1 dB (2 to 4 V/m)<br>±0.5 dB (4 to 400 V/m)<br>±1 dB (400 to 1300 V/m) | ±1 dB (1 MHz to 1 GHz)<br>±1.25 dB (1 to 2.45 GHz) |
| **Probe EF 0691, E-Field Flat** | 2402/14B | 100 kHz to 6 GHz | 0.35 to 650 V/m | ±0.5 dB (2 to 400 V/m) | ±1.5 dB (1 MHz to 4 GHz) |
| **Probe EF 1891, E-Field, Flat** | 2402/02B | 3 MHz to 18 GHz | 0.8 to 1000 V/m | ±3 dB (0.8 to 1.65 V/m)<br>±1 dB (1.65 to 3.3 V/m)<br>±0.5 dB (3.3 to 300 V/m)<br>±0.8 dB (300 to 1000 V/m) | ±1.5 dB (10 to 100 MHz)<br>±2.4 dB (100 MHz to 8 GHz)<br>±3.0 dB (8.0 to 18 GHz) |
| **Probe EF 5091, E-Field, Flat** | 2402/03B | 300 MHz to 50 GHz | 8 to 614 V/m | ±1 dB (8 to 27 V/m)<br>±0.3 dB ( > 27 V/m) | +1.25 / -3 dB (0.3 to 1.0 GHz)<br>±1.25 dB (1 to 50 GHz) |
| **Probe EF 5092, E-Field, Flat** | 2402/11B | 300 MHz to 50 GHz | 18 to 1370 V/m | ±1 dB (18 to 61.4 V/m)<br>±0.3 dB ( > 61.4 V/m) | +1.25 / -3 dB (0.3 to 1.0 GHz)<br>±1.25 dB (1 to 50 GHz) |
| **Probe HF 3061, H-Field, Flat** | 2402/05B | 300 kHz to 30 MHz | 0.017 to 16 A/m | ±3 dB (0.017 to 0.033 A/m)<br>±1 dB (0.033 to 0.068 A/m)<br>±0.5 dB (0.068 to 3 A/m)<br>±1 dB (3 to 16 A/m) | ±0.5 dB (500 kHz to 30 MHz) |
| **Probe HF 0191, H-Field, Flat** | 2402/06B | 27 MHz to 1 GHz | 0.026 to 16 A/m | ±3 dB (0.026 to 0.05 A/m)<br>±1 dB (0.05 to 0.1 A/m)<br>±0.5 dB (0.1 to 3 A/m)<br>±1dB (3 to 16 A/m) | ±0.5 dB (27 to 300 MHz)<br>±0.65 dB (300 to 750 MHz)<br>±1.2 dB (750 MHz to 1 GHz) |
| **Probe EA 5091, E-Field, Shaped FCC** | 2402/07B | 300 kHz to 50 GHz | 0.5 to 600% of FCC "Occupational / Controlled" limits | ±3 dB (0.5 to 6%)<br>±1 dB (6 to 100%)<br>±2 dB (100 to 600%) | ±2.0 dB from Standard |
| **Probe EB 5091, E-Field, Shaped IEEE** | 2402/08B | 3 MHz to 50 GHz | 0.5 to 600% of IEEE C95.1-2005 for People in Controlled Environments | | |
| **Probe EC 5091, E-Field, Shaped SC 6 Canada** | 2402/09B | 300 kHz to 50 GHz | 0.5 to 600% of Safety Code 6 for People in Controlled Environments | | |
| **Probe ED 5091, E-Field, Shaped ICNIRP** | 2402/10B | 300 kHz to 50 GHz | 0.5 to 600% of ICNIRP Recommendations for Occupational Exposures | | |
| **Probe EF 6092, E-Field, Flat** | 2402/17B | 100 MHz to 60 GHz | 0.7 to 400 V/m | ±3 dB (.7 to 2 V/m)<br>±1 dB (2 to 250 V/m)<br>±2 dB (250 to 400 V/m) | +3.0 / -7.0 dB (100 MHz to 60 GHz)<br>±3 dB (300 MHz to 40 GHz) |

**NOTES:**

a Cutoff frequency at approximately -3 dB (-6 dB for EF 6092)

b Pulse Length 1 µsec., duty cycle 1:100 (1:1000 for EF5091 and EF 5092)

c Frequency Sensitivity can be compensated for by the use of correction factors stored in the probes' memory.

d Accuracy of the fields generated to calibrate the probes is ±1 dB.

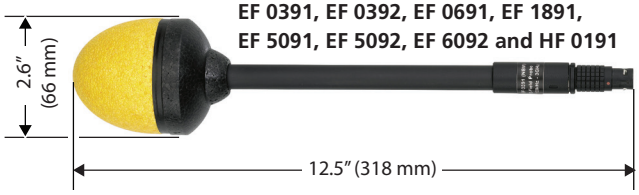
e Uncertainty due to varying polarization (verified by type approval test for meter with probe).
Ellipse ratio included and calibrated for each probe.

f Frequencies above 30 MHz.

**Unless otherwise noted, specifications apply at reference condition: device in the far-field of source, ambient temperature 23 ±3°C, relative humidity 25 - 75%, sinusoidal signal**

**Probe Model Numbers beginning with EF or HF are flat frequency response and employ diode sensors, except EF 5091 and EF 5092, which employ thermocouple sensors.**

**Probe Model Numbers:**
**EF 0391, EF 0392, EF 0691, EF 1891, EF 5091, EF 5092, EF 6092 and HF 0191**



Los puntos marcados con ($)
no están amparados por
la acreditación de ENAC

# CERTIFICADO DE CALIBRACIÓN
*Certificate of Calibration*

Número **16/02086**
*Number*



**LabCal - Wavecontrol**
Laboratorio de calibraciones radioeléctricas
C/ Pallars 65-71
08018 Barcelona

| | |
|---|---|
| OBJETO<br>*Item* | Medidor de campo electromagnético<br>+ Sonda isotrópica de campo eléctrico |
| MARCA<br>*Mark* | Narda |
| MODELO<br>*Model* | Medidor: NBM-520 2403/01<br>Sonda: EF-0391 2402/01 |
| IDENTIFICACIÓN<br>*Identification* | Medidor: B-0432<br>Sonda: A-0661 |
| SOLICITANTE<br>*Applicant* | AD INSTRUMENTS S.L.<br>C/ Cardeña 9, bajo 4, local<br>28054 Madrid |
| FECHA/S DE CALIBRACIÓN<br>*Date/s of calibration* | 14/09/2016 |

Signatario/s autorizado/s
*Autorized Signatory/ies*

Fecha de emisión: 15/09/2016
*Date of issue*

Àlex Clusa
Laboratory Manager

Laurent Derousseau
Technical Director

Este certificado se expide de acuerdo con las condiciones de la acreditación concedidas por ENAC, según norma ISO 17025, que ha comprobado las capacidades de medida del laboratorio y su trazabilidad a patrones nacionales e internacionales.
ENAC es firmante del Acuerdo de Reconocimiento Mutuo (MLA ) de certificados de calibración de European Cooperation for Accreditation (EA ) y de International Laboratories Accreditation Cooperation (ILAC).
Este certificado no podrá ser reproducido parcialmente sin la aprobación por escrito de Wavecontrol.

*This certificate is issued in accordance with the conditions of accreditation granted by ENAC, according to standard ISO 17025, which has assessed the measurement capability of the laboratory and its traceability to national standards.*
*ENAC is one of the signatories of the Multilateral Agreement of the European Cooperation for Accreditation (EA) and the International Laboratories Accreditation Cooperation (ILAC).*
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**Método de calibración:**

La calibración de sondas de campo se realiza mediante la generación de un valor de campo conocido con polarización lineal. La sonda a calibrar se sitúa en dicho campo, obteniéndose la diferencia entre el valor de campo generado y el campo medido por la sonda a calibrar.

En el margen de frecuencias de 0.1 – 800 MHz se emplea una celda TEM con absorbentes para generar el campo. La sonda a calibrar se coloca paralela al campo eléctrico y perpendicular a la dirección de propagación.

En el margen de frecuencias de 800 MHz – 3 GHz la sonda a calibrar se coloca en una cámara anecoica, utilizando un soporte de baja reflectividad. La sonda se sitúa en la dirección de máxima radiación de una antena de bocina polarizada linealmente, paralela al campo eléctrico y perpendicular a la dirección de propagación.

Los parámetros de calibración obtenidos son los siguientes:

1- *Factor de corrección (FC)*

El factor de corrección se ha obtenido utilizando la siguiente fórmula:

$$FC = \frac{Campo\ Aplicado}{Campo\ Medido\ por\ la\ Sonda} \qquad FC^2 = \frac{Densidad\ de\ potencia\ Aplicada}{Densidad\ de\ Potencia\ Medida\ por\ la\ Sonda}$$

Multiplicando el valor medido con la sonda calibrada por el factor de corrección correspondiente se obtiene el valor de campo real.

2- *Linealidad*

Es la variación del Factor de Corrección en función del nivel de campo aplicado para una misma frecuencia.

3- *Respuesta en frecuencia*

Es la variación del Factor de Corrección en función de la frecuencia para un mismo nivel de campo aplicado.

**Trazabilidad:**

DARE Calibrations
NPL (National Physical Laboratory)
Applus Metrología

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**Normas de referencia:**

IEEE Std 1309:2013 "Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9 kHz to 40 Ghz"

**Incertidumbre asociada a la medida:**

La incertidumbre asociada a la calibración de este equipo es la siguiente:

| | | |
|---|---|---|
| **0,1 MHz - 10 MHz:** | **±** | **1,19 dB** |
| **10 MHz - 300 MHz:** | **±** | **1,33 dB** |
| **300 MHz – 500 MHz:** | **±** | **1,08 dB** |
| **500 MHz - 800 MHz:** | **±** | **1,46 dB** |
| **800 MHz - 1 GHz:** | **±** | **1,02 dB** |
| **1 GHz - 2,5 GHz:** | **±** | **0,94 dB** |
| **2,5 GHz - 3 GHz:** | **±** | **0,91 dB** |

Esta incertidumbre solamente es aplicable si la sonda se coloca sobre un soporte de baja reflectividad y no hay ninguna interferencia sobre la medida por parte de objetos o personas.

La incertidumbre expandida de medida se ha obtenido multiplicando la incertidumbre típica de medición por el factor de cobertura k=2 que, para una distribución normal, corresponde a una probabilidad de cobertura de aproximadamente el 95 %. La incertidumbre típica de medida se ha determinado conforme al documento EA-4/02.

**Condiciones ambientales:**

| Humedad | Temperatura |
|---|---|
| (45,3 ± 2,5) % rH | (24,9 ± 0,1) ºC |

Los resultados son únicamente validos para los equipos calibrados en el momento y las condiciones de la medida.

**Procedimiento:**

"PC-1205 - Calibración de sondas de campo eléctrico en el margen 100 kHz – 800 MHz"
"PC-1206 - Calibración de sondas de campo eléctrico en el margen 800 MHz – 18 GHz"

Ambos métodos emplean el método de Sonda de referencia, en el que una sonda patrón es utilizada para generar el campo conocido con el que se calibran las sondas a calibrar.

**Técnico de calibración:** Àlex Clusa

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**Montaje de Calibración:**

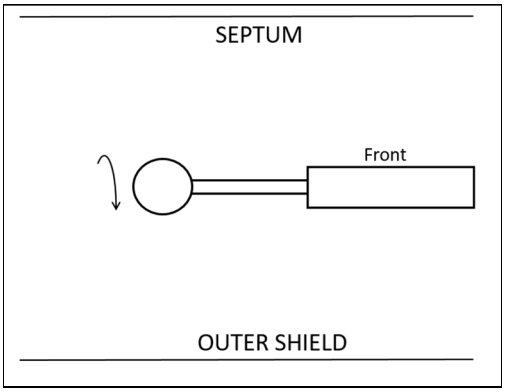


**Figura 1: Montaje de calibración en la celda TEM con absorbentes**

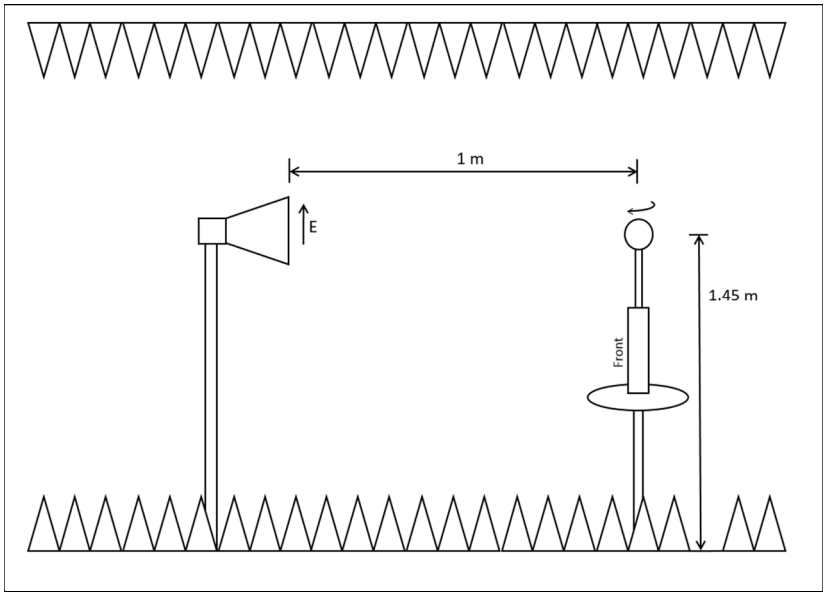


**Figura 2: Montaje de calibración en la cámara anecoica**

La sonda se ha situado en la celda TEM en la posición indicada en la Figura 1. El eje principal de la sonda se coloca paralelo a las paredes de la celda.

La sonda se ha posicionado en la cámara anecoica en la dirección de máxima radiación de la antena de bocina, a la distancia y altura especificadas en la Figura 2.

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**Resultados:**

A continuación se muestran los factores de corrección (FC) para los puntos de calibración solicitados.

Se proporcionan los factores de corrección de cada posición ejes y el factor de correción medio, que deberá aplicarse al valor de campo total. Este factor de corrección medio corresponde a la media aritmética de los factores de corrección de las dos posiciones.

Los factores de corrección indicados a continuación deben ser multiplicados por el valor de campo medido para obtener el valor de campo real:

| Linearity - 700 MHz | | | |
|---|---|---|---|
| E field (V/m) | 0º Position | 90º Position | Mean |
| | CF | CF | CF |
| 1 | 0,96 | 0,95 | **0,95** |
| 2,5 | 0,94 | 0,94 | **0,94** |
| 5 | 0,99 | 0,98 | **0,99** |
| 10 | 1,01 | 1,00 | **1,00** |
| 20 | 1,01 | 1,00 | **1,00** |
| 30 | 0,99 | 0,98 | **0,99** |
| 40 | 1,00 | 0,99 | **0,99** |
| 50 | 0,99 | 0,98 | **0,98** |
| 60 | 0,98 | 0,97 | **0,98** |
| 80 | 0,96 | 0,95 | **0,96** |
| 100 | 0,95 | 0,94 | **0,94** |

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| Frequency response - 10 V/m | | | |
|---|---|---|---|
| Freq. (MHz) | 0º Position | 90º Position | Mean |
| | CF | CF | CF |
| **0,1** | 1,34 | 1,33 | **1,33** |
| **0,3** | 1,10 | 1,09 | **1,10** |
| **0,5** | 1,09 | 1,08 | **1,09** |
| **1** | 1,06 | 1,05 | **1,06** |
| **10** | 1,07 | 1,06 | **1,06** |
| **30** | 1,08 | 1,07 | **1,07** |
| **100** | 1,07 | 1,06 | **1,06** |
| **200** | 1,00 | 1,00 | **1,00** |
| **400** | 0,94 | 0,94 | **0,94** |
| **600** | 0,92 | 0,93 | **0,92** |
| **700** | 1,01 | 1,00 | **1,00** |
| **800** | 0,85 | 0,82 | **0,84** |
| **1000** | 0,92 | 0,86 | **0,89** |
| **1200** | 0,84 | 0,83 | **0,83** |
| **1400** | 0,92 | 0,89 | **0,90** |
| **1600** | 0,86 | 0,83 | **0,85** |
| **1800** | 0,90 | 0,88 | **0,89** |
| **2000** | 0,89 | 0,87 | **0,88** |
| **2200** | 0,95 | 0,93 | **0,94** |
| **2400** | 1,05 | 1,01 | **1,03** |
| **2600** | 1,13 | 1,09 | **1,11** |
| **2800** | 1,27 | 1,22 | **1,24** |
| **3000** | 1,40 | 1,36 | **1,38** |

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