

## E-FIELD PROBES

EA5091 EB5091 EC5091 ED5091

# Measuring electric fields with shaped frequency response up to 50 GHz

using instruments in the NBM-500 family

- ▲ **Frequency shaping to match the ICNIRP, FCC, IEEE or Safety Code 6 standard for occupational/ controlled environment**
- ▲ **Results are directly displayed in “% of Standard“**
- ▲ **Precise results without the need to know the emitted frequency**
- ▲ **Isotropic (non-directional) measurements**

The probes contain 6 dipoles, three diode based and three thermocouple based dipoles. The correctly tuned overlap of two dipoles, one acting as a high pass filter the other as a low pass filter, provides a frequency sensitivity that mirrors a particular standard. Testing for compliance to that standard is very easy to perform, since you no longer have the need to know the emitted frequency.

## APPLICATIONS

Electric fields from 300 kHz to 50 GHz (3 MHz to 50 GHz with EB5091) can be detected. The probes are particularly suitable for measuring human safety limit values in mobile phone, telecom transmitter and broadcasting environment.

## CALIBRATION

The probes are calibrated at several frequencies. The correction values are stored in an EPROM in the probe and are automatically taken into account by the NBM instrument. Calibrated accuracy is thus obtained regardless of the combination of probe and instrument.



## DESCRIPTION - 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.

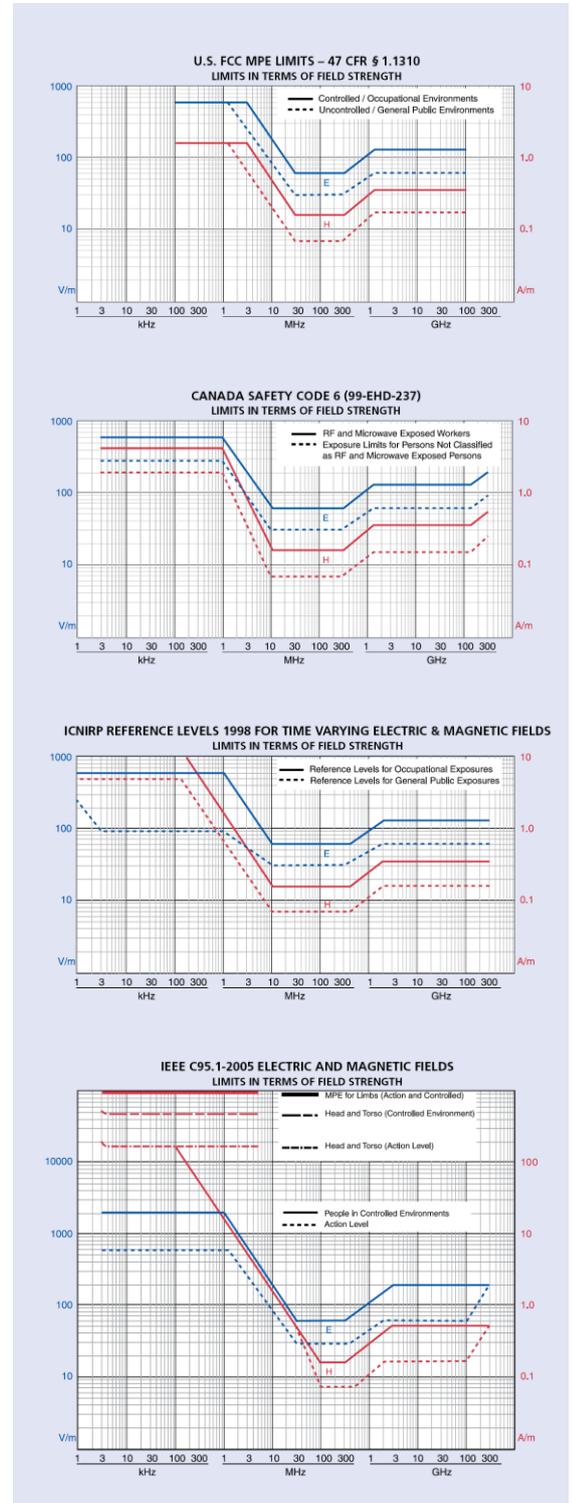
For example, many of the major guidances and standards in the world set E-field limits for maximum human exposure at 614 V/m (1000 W/m<sup>2</sup>) at lower frequencies (~1 MHz). At frequencies of 30 to 300 MHz the limits are typically much less, 61.4 V/m (10 W/m<sup>2</sup>), a difference of 20 dB (100 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/m<sup>2</sup>), 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/m<sup>2</sup>, 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%. Besides the ease of use, the main advantage is that you no longer have the “need to know” the frequency when using a shaped probe.

Table: Standards and matching probe models

| Standard or Guidance       | Level                    | Model          |
|----------------------------|--------------------------|----------------|
| U.S. FCC, 1997             | Occupational/ Controlled | <b>EA 5091</b> |
| IEEE C95.1-2005            | Controlled Environment   | <b>EB 5091</b> |
| Canada Safety Code 6, 2015 | RF/Microwave Worker      | <b>EC 5091</b> |
| ICNIRP Rec. 1998           | Occupational             | <b>ED 5091</b> |



## SPECIFICATIONS <sup>a</sup>

| Probe EA ... ED5091   | Electric (E-)Field  |  |
|---|---|--|
| Frequency range <sup>(b)</sup>  | 300 kHz to 50 GHz (EA5091, EC5091, ED5091)  | 3 MHz to 50 GHz (EB5091)               |
| Type of frequency response  | Shaped, see table on page 2   |  |
| Measurement range   | 0.5 to 600 % of Standard (Power Density)  |  |
| Dynamic range   | 30 dB   |  |
| CW damage level   | 2000 % of Standard  | 700 mW/cm <sup>2</sup>                 |
| Peak damage level <sup>(c)</sup>  | 32 dB above Standard  |  |
| Sensor type   | Combined diodes/ thermocouples  |  |
| Directivity   | Isotropic (Tri-axial)   |  |
| Readout mode / spatial assessment   | Combined 3-axis (RSS)   |  |
| <b>UNCERTAINTY</b>  |   |  |
| Flatness of frequency response <sup>(d)</sup><br>Calibration uncertainty not included | ±2 dB from Standard   |  |
| Calibration uncertainty <sup>(e)</sup>  | ±1.5 dB (≤ 750 MHz)   |  |
|   | ±1.7 dB (750 MHz to 1.8 GHz)  |  |
|   | ±1.4 dB (≥ 1.8 GHz to 45.5 GHz)   |  |
| Linearity<br>Referred to 100 %  | ±3 dB (< 4 % of Standard)   |  |
|   | ±1 dB (4% to 12 % of Standard)  |  |
|   | ±0.5 dB (12 % to 600 % of Standard)   |  |
| Isotropic response <sup>(f)</sup>   | typ. ±1 dB (≥ 10 MHz)   |  |
| <b>GENERAL SPECIFICATIONS</b>   |   |  |
| Calibration frequencies   | 0.3/ 3/ 10/ 30/ 100/ 300/ 750 MHz    1/ 1.8/ 2.45/ 4/ 8.2/ 10/ 18/ 26.5/ 40/ 45.5 GHz |  |
| Recommended calibration interval  | 24 months   |  |
| Temperature range   | Operating   |  |
|   | Non-operating (transport)   |  |
| Humidity  | 5 to 95 % RH @ ≤25 °C   | ≤23 g/m <sup>3</sup> absolute humidity |
| Size  | 350 mm x 104 mm Ø   |  |
| Weight  | 240 g   |  |
| Compatibility   | NBM-500 series meters   |  |
| Country of origin   | USA   |  |

(a) Unless otherwise noted specifications apply at reference condition: device in far-field of source, ambient temperature 23±3 °C, relative air humidity 40% to 60%, sinusoidal signal

(b) Cutoff frequency at approx. -3 dB

(c) Pulse length 1µsec, duty cycle 1:1000

(d) Frequency response can be compensated for by the use of correction factors stored in the probe memory

(e) Accuracy of the fields generated to calibrate the probes

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

## ORDERING INFORMATION

|   | Part number P/N     |
|---|---------------------|
| Probe EA5091, Shaped E-field, FCC for NBM, 300 kHz - 50 GHz, isotropic                                    | <b>2402/07B</b>     |
| Probe EB5091, Shaped E-field, IEEE for NBM, 3 MHz - 50 GHz, isotropic                                     | <b>2402/08B</b>     |
| Probe EC5091, Shaped E-field, SC6 Canada for NBM, 300 kHz - 50 GHz, isotropic                             | <b>2402/16B</b>     |
| Probe ED5091, Shaped E-field, ICNIRP for NBM, 300 kHz - 50 GHz, isotropic                                 | <b>2402/10B</b>     |
| Probe ED5091, Shaped, ICNIRP, ACC - with accredited (DAkkS) calibration up to 18 GHz, basic unit required | <b>2402/10B/ACC</b> |

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