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 EB 5091) 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.

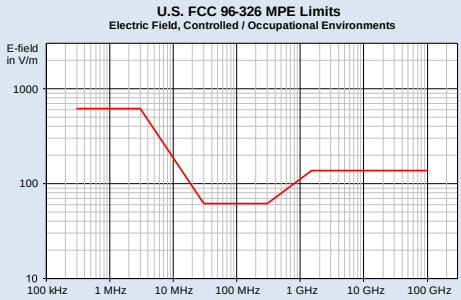
DESCRIPTION - Shaped Probes

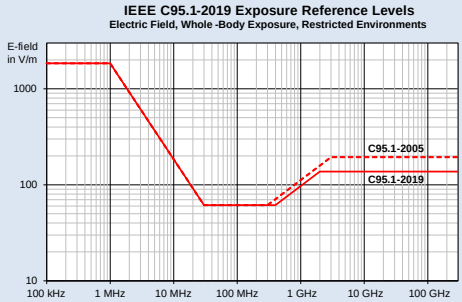
The goal in designing and manufacturing a traditional, “flat” frequency response probe is to make the probe equally responsive to energy at every frequency within its rated frequency range. In contrast, Narda’s patented shaped frequency response probes are designed and manufactured so that their sensitivity mirrors a particular standard (or guidance) as closely as possible.

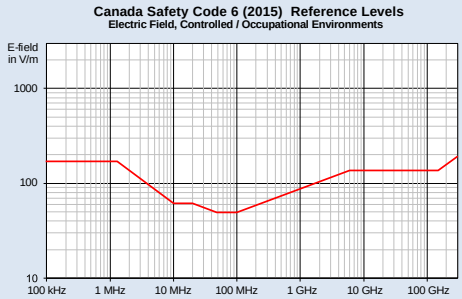
For example, many of the major guidances and standards in the world set E-field limits for maximum human exposure at 614 V/m (1000 W/m^2) at lower frequencies (~1 MHz). At frequencies of 30 to 300 MHz the limits are typically much less, 61.4 V/m (10 W/m^2), a difference of 20 dB (100 times the power). 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/m^2), 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^2, 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.







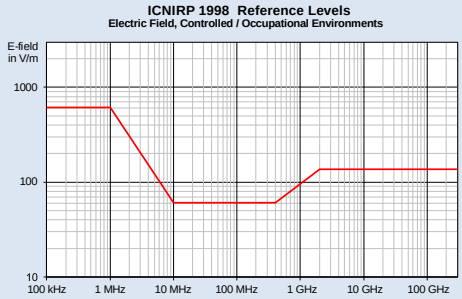


Table: Standards and matching probe models

Standard or Guidance	Level	Model
U.S. FCC, 1997	Occupational/ Controlled	**EA 5091**
IEEE C95.1-2019	Controlled Environments	**EB 5091**
Canada Safety Code 6, 2015	Controlled Environments	**EC 5091**
ICNIRP 1998 Guidelines compliant with ICNIRP 2020 above 30 MHz	Occupational	**ED 5091**

SPECIFICATIONS [a]

Probe EA … ED 5091	Electric (E-)Field	
Frequency range [b]	300 kHz to 50 GHz (IEEE Model: 3 MHz to 50 GHz)	
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/cm²
Peak damage level [c]	32 dB above Standard	
Sensor type	Combined diodes/ thermocouples	
Directivity	Isotropic (Tri-axial)	
Readout mode / spatial assessment	Combined 3-axis (RSS)	
UNCERTAINTY		
Flatness of frequency response [d] Calibration uncertainty not included	±2 dB from Standard	
Linearity 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 [e]	±1 dB (10 MHz to 5 GHz) typ. ±1.5 dB (> 5 GHz)	
Temperature response	typ. ±0 dB (≥ 2 GHz)	
GENERAL SPECIFICATIONS		
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	0 °C to +50 °C	
Temperature range — Non-operating	-40 °C to +70 °C	
Humidity	5 to 95 % RH @ ≤25 °C	≤23 g/m³ absolute humidity
Size	350 mm x 104 mm Ø	
Weight	240 g	
Compatibility	NBM-500 series meters	
Country of origin	Germany	

(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) Results are calculated from the maximum and minimum response obtained during the full revolution about the stem of the probe, oriented 54.7° to the electric field vector.

ORDERING INFORMATION

	Part number P/N
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**
Probe ED 5091, ICNIRP 1998 Occ Shaped, ACC - with accredited (DAkkS) calibration up to 18 GHz, basic unit required	**2402/10D/ACC**

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