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# 8700 SERIES PROBES

## *PROBE SELECTION*

The 8700 series system has the most extensive selection of probes available from any source in the world. The factors that you should consider in selecting the probe, or probes, best suited for your task are:

**Frequency Range**

The probe frequency range should include the frequencies of all the emitters to be surveyed at one time.

**Power Density or Field Strength**

The measurement range of the probe should be adequate for the field levels that you anticipate, i.e., Do you expect strong fields or weak fields? Probes give more accurate and more stable readings when they are not used at the extreme low end of their sensitivity range. Therefore, if you anticipate measuring very weak fields, select a probe with a lower power full-scale measurement range to get greater sensitivity. In contrast, higher power probes give additional safety margins, especially at microwave frequencies where field strength can change rapidly with a small change in distance to the source. Select a probe with a higher power full-scale measurement range if you anticipate measuring high level fields.

**Electric Field versus Magnetic Field**

Most standards recommend that you measure both electric (E) and magnetic (H) fields below 300 MHz (due to the possibility that measurements may be made in the near field). Since most experts agree that the electric field poses a greater danger at lower frequencies due to induced and contact currents that can occur, the electric field is normally measured first. Higher frequency measurements are normally made only of the electric field since measurements will invariably be made in the far field.

**Flat Response or Shaped Frequency Response**

Flat response probes are the most common. Narda's patented shaped frequency response probes read out in Percent of Standard and are particularly useful in complex, multi-signal environments where exposure limits are different for the various emitter frequencies and in classified environments.

**Size and Minimum Measurement Distance**

The majority of the 8700D series probes have four inch (10 cm) diameter heads. The minimum measurement distance for these probes is about 4 in (10 cm) from the outside surface of the probe. Measurements made at closer distances can result in inaccurate readings due to capacitive coupling. The Models 8721D, 8723D, 8725D and 8783D have two-inch (5 cm) diameter heads that can be used as close as 2 in (5 cm) from the source to the outside of the probe. These probes are ideal for the measurement of ***waveguide leaks***. Similarly, the Model 8781D has a one-inch (2.5 cm) diameter head with a flexible shaft that is designed for locating leaks in densely packaged microwave systems. The 8783D also has a flexible shaft.

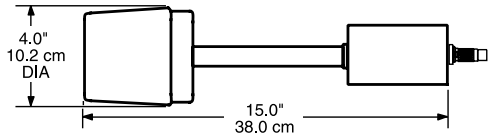
# Electric and Magnetic Field Measurement

## ENVIRONMENTAL SPECIFICATIONS

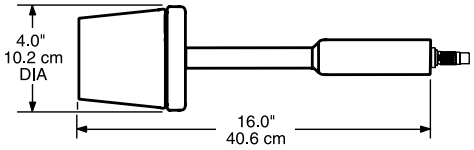
| | |
|---|---|
| Temperature | |
| Operating | -10°C to +55°C |
| Non-Operating | -40°C to +75°C |
| Humidity | 0% to 95%, non-condensing |

## OUTLINE DRAWINGS

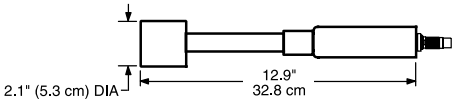
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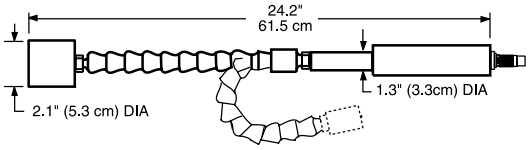

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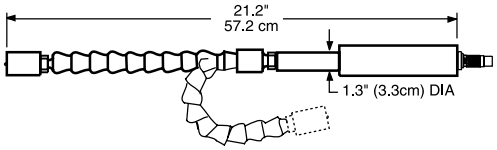

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4




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## SHAPED FREQUENCY RESPONSE 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 as closely as possible. For example, many of the major standards in the world set limits for maximum exposure at the lowest frequencies to 100 mW/cm$^2$. These same standards typically limit exposure in the VHF region to 1 mW/cm$^2$ and to 5-10 mW/cm$^2$ in the microwave region. A shaped frequency response probe designed for such a standard is 100 times more sensitive in the VHF region than at the lowest frequencies. The result is that energy from all sources within the probe's rated frequency range are not only summed in terms of RMS power but are also weighted in direct proportion to a particular standard.

The readout on the meter is shown in terms of Percent of Standard. The full scale of Narda's shaped probes is typically either 300% or 600% of a standard. This permits measurements of exposure environments where the weighted field strengths range from as high as three to six times the maximum permissible exposure1 (MPE) level to environments where the levels are less than one percent of the MPE. For a more complete description of how shaped probes are used in complex, multi-signal environments, refer to the application note Measuring RF Levels at Multi-Signal Sites that begins on page 609.

[1] Maximum Persmissible Exposure (MPE) level is only one of several terms used to designate the limits imposed by various standards. Other common terms are: Threshold Limit Value (TLV), Permissible Exposure Level (PEL), action limit, and reference level.

## SELECTING A SHAPED PROBE

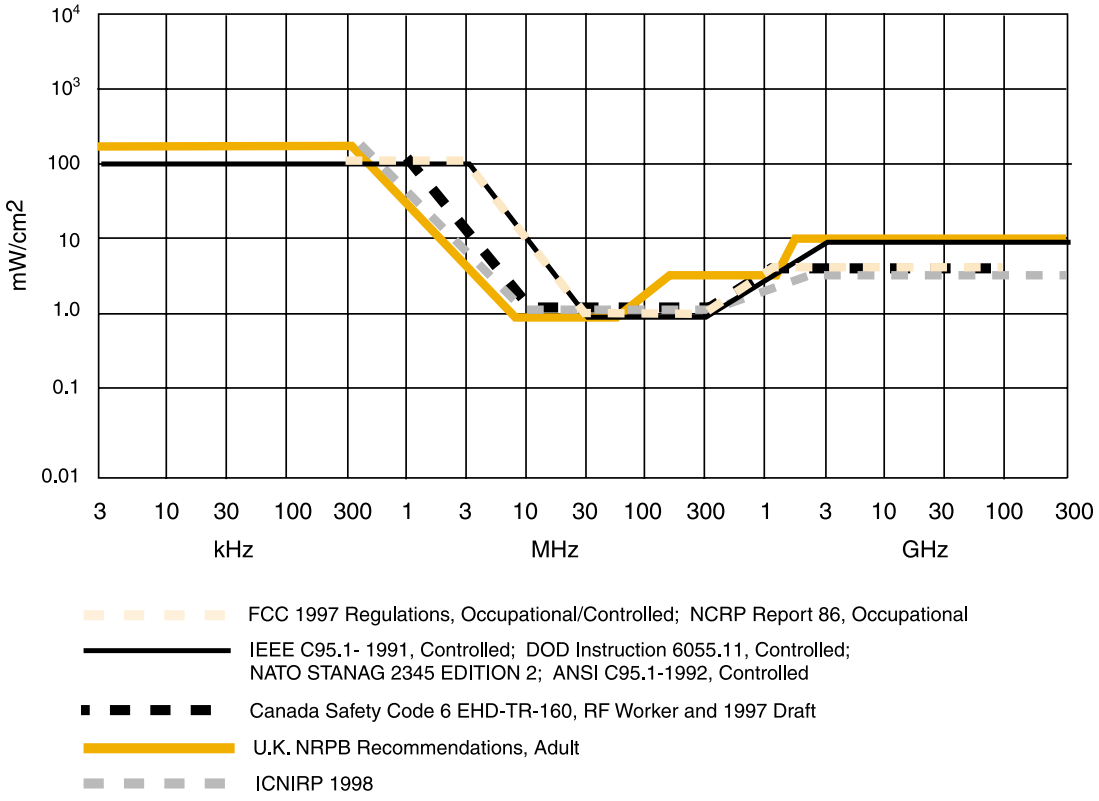
1. Determine the standard that you will be using.
2. Determine which tier of the standard will be used, i.e., Occupational Environment or General Population Environment.
3. Determine whether you must measure the magnetic field as well as the electric field.
4. Select a probe model from the table on the next page.



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## MAJOR INTERNATIONAL STANDARDS AND GUIDANCES




## SHAPED PROBE SELECTION GUIDE

| STANDARD OR GUIDANCE | TIER | MODEL | FREQUENCY RANGE | FULL SCALE RANGE | FIELD |
|---|---|---|---|---|---|
| FCC 1997<br>Japan RCR-38 | Occupational / Controlled<br>Controlled | A8722D | 300 kHz - 50 GHz | 300% of Std | E |
| | | A8742D | 300 kHz - 3 GHz | 600% of Std | E |
| FCC 1997 | General Population | B8742D | 300 kHz - 3 GHz | 600% of Std | E |
| IEEE C95.1-1991<br>NATO STANAG 2345<br>ACGIH | Controlled<br>—<br>— | B8722D | 300 kHz - 50 GHz | 300% of Std | E |
| | | A8732D | 300 kHz - 200 MHz | 300% of Std | H |
| Canada Safety Code 6 | RF Workers | C8722D | 300 kHz - 50 GHz | 300% of Std | E |
| ICNIRP 1998 | Occupational | D8722D | 300 kHz - 50 GHz | 300% of Std | E |

# Electric and Magnetic Field Measurement

## ELECTRIC FIELD PROBES

| MODEL NO. | FREQUENCY RANGE | MEASUREMENT RANGE | | | FREQUENCY RESPONSE | SENSOR TYPE |
|---|---|---|---|---|---|---|
| | | Rated | V/m | $V^2/m^2$ | | |
| 8782D[a] | 3 kHz to 1 MHz | 0.1μW/cm² to 200mW/cm² | 0.61 to 868 | 0.376 to 753,000 | Flat | Active Antenna |
| 8764D | 100 kHz to 300 MHz | 100μW/cm² to 200mW/cm² | 19.4 to 868 | 376 to 753,000 | Flat | Compensated Diode |
| 8760D | 300 kHz to 3.0 GHz | 0.05μW/cm² to 100μW/cm² | 0.5 to 19.4 | 0.2 to 377 | | |
| 8761D | | 10μW/cm² to 20mW/cm² | 6.13 to 274 | 37.6 to 75,300 | | |
| 8762D | | 100μW/cm² to 200mW/cm² | 19.4 to 868 | 376 to 753,000 | | |
| A8742D | | 0.6 to 600% of Standard | — | — | Shaped[g] | |
| B8742D | | | | | Shaped[g] | |
| 8741D | 300 kHz to 50 GHz | 50μW/cm² to 20mW/cm² | 13 to 274 | 169 to 75,300 | Flat | Compensated Diode and Thermocouple |
| A8722D | | 0.3% to 300% of Standard | — | — | Shaped[g] | |
| B8722D | | | | | | |
| C8722D | | | | | | |
| D8722D | | | | | | |
| 8721D | 300 MHz to 50 GHz[e] | 10μW/cm² to 20mW/cm² | 6.13 to 274 | 37.6 to 75,300 | Flat | Thermocouple |
| 8723D | | 50μW/cm² 100mW/cm² | 13.7 to 614 | 188 to 376,000 | | |
| 8783D | | | | | | |
| 8725D | 1 to 40 GHz[e] | 0.5 mW/cm² to 1000mW/cm² | 43.4 to 1940 | 1880 to 3,760,000 | | |
| 8781D | 2 to 18 GHz | 20μW/cm² to 20mW/cm² | 8.67 to 274 | 75.3 to 75,300 | | |

[a] Model 8782D probe must be used with fiber optic interface Model 8747. Specifications guaranteed for high power range only.
[b] Frequency sensitivity can be compensated for by the use of calibration factors marked on the handle of each probe
[c] In power ($10 \log_{10}$) units
[d] The fields generated to calibrate the probes are accurate within ±0.5 dB
[e] This model can be used up to 100 GHz. Refer to the application note on pages 618
[f] Isotropic response ±1 dB from 300 kHz to 3 MHz
[g] See Shaped Probe Selection Guide on previous page


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# Electric and Magnetic Field Measurement

| FREQUENCY SENSITIVITY[b,c] | ISOTROPIC[c] RESPONSE | CW OVERLOAD ($mW/cm^2$) | PEAK OVERLOAD ($W/cm^2$) | CALIBRATION[d] FREQUENCIES | APPROX WEIGHT oz/kg | OUTLINE DRAWING |
|---|---|---|---|---|---|---|
| 1dB | 0.75dB | 1000 | 1000 | 3, 10, 14, 30, 100, 300, 540, 700, 1000 kHz | 25/0.71 | 1 |
| ±2 dB | ±0.75 dB | 600 | 600 | 0.3, 0.5, 1.0, 3.0, 6.78, 13.56, 27.12, 40.68, 100, 200, 300 MHz | 12/0.34 | 2 |
| ±1 dB(3 MHz to 300 MHz)<br>±2 dB (300 kHz to 3 GHz) | ±0.75 dB[f] | 10 | 10 | 0.3, 0.5, 1.0, 3.0, 6.78 13.56, 27.12, 40.68, 100, 200, 300, 750, 915, 1800, 2450, 2700, 3000 MHz | 12/0.34 | 2 |
| | | 60 | 60 | | | |
| | | 600 | 600 | | | |
| ±2 dB from Standard | ±0.75 dB | 3000% of Standard | 32 dB above Standard | 0.3, 1, 3, 13.56, 27.12, 100, 300, 500, 750, 915, 1800, 2450, 2700, 3000 MHz | 12/0.34 | 2 |
| ±3.0/-1.5 dB(0.3 MHz to 50 GHz)<br>±1.5 dB(3 MHz to 50 GHz) | ±0.75 dB | 200 | 15 | 0.3, 3, 10, 30, 100, 300, 750 MHz<br>1, 1.8, 2.45, 4, 8.2, 10, 18, 26.5 40, 45.5 GHz | 12/0.34 | 2 |
| ±2 dB from standard | ±0.75 dB | 3000% of Standard | 32 dB above Standard | | | |
| +1.25/-3.0 dB (0.3 GHz to 50 GHz)<br>±1.25 dB (1 GHz to 50 GHz) | ±1.0 dB | 600 | 200 | 0.3, 0.75, 1.8, 2.45 4, 5, 6, 7, 8.2, 9.3, 10, 11, 18, 26.5, 40, 45.5 GHz | 10/.028 | 3 |
| | | 1500 | 600 | | | 4 |
| ±1.25 dB | ±1.0 dB | 3000 | 1000 | 1.0, 1.8, 2.45, 4, 5, 6, 7, 8.2, 9.3, 10, 11, 18, 26.5, 40 GHz | 10/0.28 | 3 |
| +1.25/-3.0 dB (2 GHz to 4 GHz)<br>±1.25 dB (4 GHz to 18 GHz) | ±1.0 dB | 300 | 60 | 2, 2.45, 4, 5, 6, 7, 8.2, 9.3, 10, 11, 18 GHz | 10/0.28 | 5 |

# Electric and Magnetic Field Measurement

## MAGNETIC FIELD PROBES

| MODEL NO. | FREQUENCY RANGE | MEASUREMENT RANGE | | | SHAPE | SENSOR TYPE |
|---|---|---|---|---|---|---|
| | | RATED | A/M | $A^2/m^2$ | | |
| 8752D | 300 kHz to 10 MHz | 100μW/cm² to 200mW/cm² | 0.0515 to 2.31 | 0.00265 to 5.31 | FLAT | Thermocouple |
| 8754D | | 1μW/cm² to 2 W/cm² | 0.163 to 7.29 | 0.0275 to 53.1 | | |
| A8732D | 300 kHz to 200 MHz | 0.3% to 300% of Standard | —— | —— | Shape 5[d] | Thermocouple |
| 8731D | 10 MHz to 300 MHz | 10μW/cm² to 20mW/cm² | 0.0163 to 0.729 | 0.000265 to 0.667 | FLAT | Thermocouple |
| 8733D | | 50μW/cm² to 100mW/cm² | 0.0364 to 1.64 | 0.00167 to 2.66 | | |

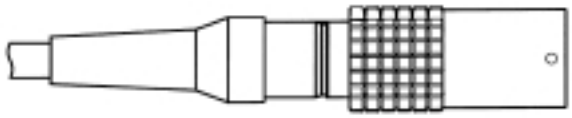
[a] Frequency sensitivity can be compensated for by the use of the calibration factors marked on the handle of each probe
[b] In power (10 $\log_{10}$ units)
[c] The fields generated to calibrated the probes are accurate within ±0.5dB.
[d] See probe selection guide on page 539

## 8700 SERIES CONNECTOR TYPES

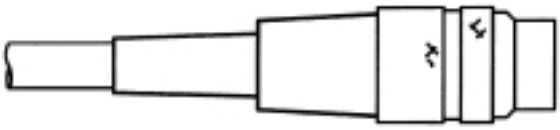
The latest 8700 system equipment uses a new, quick release style 8-pin connector, referred to as “Type L.” Older models and the 8700 series meters use a 7-pin, screw type connector, referred to as “Type A.”

Most older style 8700 series probes featured integral cables. The new D series probes require the use of a separate cable. One cable is required for each meter, regardless of the number of probes. A four foot long (1.2 m) quick-release cable (Model 8844-04) is supplied with every hand-held meter. The 8717 series meter requires the 8743-XX style cable which must be ordered separately. The 8740 style cables can be used to extend the length of the 8743 style cables.

**Type L Male Cable Connector**



**Type A Male Cable Connector**





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# Electric and Magnetic Field Measurement

| FREQUENCY SENSITIVITY[a,b] | ISOTROPIC[c] RESPONSE | CW OVERLOAD ($mW/cm^2$) | PEAK OVERLOAD ($W/cm^2$) | CALIBRATION[c] FREQUENCIES | APPROX WEIGHT oz/kg | OUTLINE DRAWING |
|---|---|---|---|---|---|---|
| ±0.75 dB | ±0.5 dB | 600 | 600 | 0.3, 0.5, 1, 3, 10 MHz | 12/0.34 | 2 |
| | | 6000 | 1000 | | | |
| ±1.5 dB from standard | ±0.5 dB | 900% of Standard | 30 dB above Standard | 0.3, 1, 3, 10, 30, 100, 200 MHz | 12/0.34 | 2 |
| ±0.5 dB (13 MHz to 200 MHz) 2 dB Max deviation (10 MHz to 300 MHz) | ±0.5 dB | 60 | 20 | 10, 13.56, 27.12, 40.68, 50, 75 100, 150, 200, 250, 300 MHz | 12/0.34 | 2 |
| | | 300 | 300 | | | |

## CONNECTOR USE

| EQUIPMENT MODEL | TYPE | GENDER |
|---|---|---|
| 8718B, 8715, 8712 Meters | L | Female |
| 8717 Series Meters | A | Female |
| 8700D Series Probes | L | Male |
| 8747 Fiber Optic Link | L | Female |
| 8718, 8716, 8711 Meters | A | Female |
| 8700 Series Probes (Except D Series) | A | Male |
| 8745, 8745T, 8746 Fiber Optic Links | A | Female |

## USE OF OLDER STYLE PROBES WITH NEW METERS

A special adaptor cable is required to connect older style 8700 probes with the type A connector and integral cable to the current hand-held meters that feqture the quick release type L connector. The part number of this 1 ft. (30 cm) type L male to type A female cable is **21787700.**

## PROBE EXTENSION CABLES

| MODEL | LENGTH | MALE CONNECTOR | FEMALE CONNECTOR |
|---|---|---|---|
| 8740-04 | 4 ft. (1.2 m) | Type A | Type A |
| 8740-06 | 6 ft. (1.8 m.) | Type A | Type A |
| 8740-12 | 12 ft. (3.7 m.) | Type A | Type A |
| 8740-24 | 24 ft. (7.3 m.) | Type A | Type A |
| 8740-40 | 40 ft. (12.2 m.) | Type A | Type A |
| 8743-04 | 4 ft. (1.2 m.) | Type A | Type L |
| 8744-04 | 4 ft. (1.2 m.) | Type L | Type L |
| 8744-12 | 12 ft. (3.7 m.) | Type L | Type L |

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