

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER IH99390
	REVISION FINAL rev0
SUBJECT: Narda Model 8718B Electromagnetic Radiation Survey Meter INSTRUMENT OPERATION:	DATE 02/06/02
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1.0 Purpose/Scope

This procedure provides a standardized method for the operation of the Narda Model 8718B Electromagnetic Radiation Survey Meter. It should be used in conjunction with the ESH Standard 2.3.2 *Radio Frequency and Microwaves (RF/Microwave)* and IH SOP IH-99150 *Radiofrequency and Microwave Measurement Principles*.

This instrument covers the radiofrequency and microwave wavelengths of 300 kHz to 50 GHz (electric field) and 300 kHz to 200 MHz (magnetic field). The meter is used to:

- Determine the need for area warning posting,
- Determine the need for personnel exposure monitoring,
- Determine if inclusion in a medical surveillance program is required, and
- Measure the effectiveness of engineering controls.

2.0 Responsibilities

- 2.1 Use of this SOP is limited to persons who act under the direction of a competent hazard assessor and who have demonstrated the competency to satisfactorily use the procedures and meter, as evidenced by experience and training, to the satisfaction of the qualification criteria set by their organization.
- 2.2 Personnel that perform exposure monitoring with this procedure are responsible to follow all steps in this procedure.

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2.3 The data collected using this meter must have an appropriate evaluation of the hazard and risk by a skilled Industrial Hygiene professional.

3.0 **Definitions** see IH96150.

4.0 Prerequisites

4.1 Training prior to using this meter:

- 4.1.1 Demonstration of proper operation of the instrument to the satisfaction of the employee's supervision.
- 4.1.2 Review of the Radio Frequency /Microwave ESH Standard 2.3.2.

4.2 Area Access:

- 4.2.1 Contact the appropriate Facility Support Representative or FS Technician to obtain approval to enter radiological areas. Complete all training for hazards for the area to be entered.
- 4.2.2 Verify with the appropriate Facility Support Representative or FS Technician if a Work Permit or Radiological Permit is needed or is in effect. If so, review and sign the permit.
- 4.2.3 Use appropriate PPE for area.

5.0 Precautions

5.1 Hazard Determination:

- 5.1.1 The operation of this meter does not create exposure to any chemical, physical, or radiological hazards. The meter does not generate Hazardous Waste.
- 5.1.2 The meter is sensitive and can be burned by entry into fields above their capacity. Approach the source from a low background.
- 5.1.3 The primary hazard from rf/microwave is heating of the body. The eyes and genitals/reproductive organs are the most sensitive body parts. Prolonged exposure to very high sources can result in death to the individual.

5.2 Personal Protective Equipment:

- 5.2.1 If high fields are expected, the NARDA Alert alarming meter can be used as an alarming device to indicate high fields.

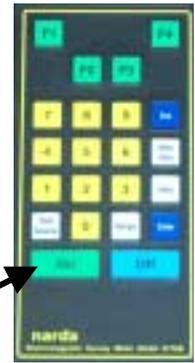
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- 5.2.2 Microwave protective clothing is not available. Rely on engineering and administrative controls such as remaining a safe distance from the source as indicated by this direct reading meter.
- 5.2.3 Additional PPE: Other appropriate PPE for hands, feet, skin, head, or eyes may be needed for the area being entered. Check with the FS Representative for the area.

6.0 Procedure

6.1 Follow all the decision logic and monitoring strategy design outlined in IH99150. Determine if the range of the source is within the range of this meter:

- 6.1.1 Electric probe B8722D - range 300 kHz – 50 GHz
- 6.1.2 Magnetic probe A8732D - range 300 kHz – 200 MHz



6.2 **Turn instrument on** by pressing the “Om” button. The LCD display will present the initial screen that contains the meter, model, serial and firmware version. The display will automatically move to the next screen to show the last calibration date, and calibration due date. *Note:* Calibration date of body of instrument that will flash on the screen and verify that meter is usable.

CAL DATE 07/06/01			
CAL DUE 07/06/02			
CONNECT PROBE NOW			
MEASURE		MENU	
F1	F2	F3	F4

6.3 **Check Battery:** Press F4 “Menu”, then press “4” for *Bat/Lite*: Check if the battery is >50% charged. If there is insufficient charge (<50%) do not use the meter as you may not be able to zero the probe.

1. DATA LOG	5. UNITS
2. TIME AVG	6. RS232
3. SPATIAL	7. PROBE
4. BAT/LITE	8. NEXT

6.4 **Connect the probe.**

6.4.1 Press F1 *Measure* then F4 “Menu”. Then select the correct probe from the list and enter the corresponding number. Select either (2) B8722D (Electric probe) or (5) A8732D (Magnetic probe). It is best to start with the E field probe. The display will show you the last probe that was selected. If this is the correct probe number press F1 *Yes*. You will get a confirmation with the details of the probe.

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6.4.2 Attach the probe to the meter body.

Information for Electric Field Probe	Information for Magnetic Field Probe
B8722D	A8732D
300 kHz-50 GHz E-Fld	300 kHz – 200 MHz G-Fld
300 % Std Shaped	300%Std Shaped

6.5 **Zero the meter:** The meter will prompt to place the meter into a zero density field. Place probe into the *zero bag* or in the case. Press **Enter**. The display will read “Zeroing...” during the setup.

Zeroing....

6.5.1 If zero is successful the meter will beep in about 15 seconds after zeroing is complete. The menu will reappear with information on the % Std detected, the maximum value. The top line will be a graphic indicator of the value. The meter will then automatically advance to the measuring mode.

nnn% STD
 nnn MAX CF 1.00
 ALT MAXR MENU FREQ

6.5.2 If the meter cannot zero itself, the display will prompt for recalibration.

6.6 **Testing the Probe**

6.6.1 The Model 9718B is equipped with two RF sources for testing probes. When **TEST SOURCE** is pressed both sources will stay on for approximately 20 seconds. A contact on the right side of the unit is used for testing low frequency probes and the low frequency section of the ultra-broadband probes.



6.6.2 The magnetic probe has three test points around the head of the probe. Position the probe so that one of the test points touches the contact on the meter and is parallel to the meter body. The meter reading should show an increased reading (amount of deflection is not important). Repeat for the other two test points to insure that the probe is working correctly. A probe that does not show a movement of the bar graph display for all tests may be damaged and should not be used to make measurements.



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6.6.3 A microwave window on the right side of the probe is used for testing high frequency electric probes. The B8722D 300 KHz -50 GHz *electric field* probe is an ultra- broadband probe that contains both high frequency and low frequency sensors. These probe require six checks – three high frequency and three low frequency. Position the probe so that one of the test points touches the window on the meter and is parallel to the meter body. The meter reading should show an increased reading (amount of deflection is not important). Repeat for the other five test points to insure that the probe is working correctly. A probe that does not show a movement of the bar graph display for all tests may be damaged and should not be used to make measurements.



6.7 Sampling Strategy:

6.7.1 Start with the E field measurement.

6.7.2 Spatially averaged levels are specified in the BNL Occupational Exposure Limits (OELs). Take at least 10 measurements along the vertical plane from floor to about 6.5 feet high. Measurements should be at a maximum 20 cm (~8 inches) apart. Determine the point of highest concentration. The 8718B can perform spatial averaging so this will simplify the calculations. See Section 6.9.

6.7.3 It is also recommended to take single point measurements at the following locations:

- Source measurement: however no closer than 8 inches from the surface of the source. (If personnel are never in close proximity to the source, then it is not necessary to measure surface levels.) Additional measurements at equal distance away from the centerline, repeated along all surfaces of source.
- Shielding: determine if there are any leaks in the barriers.
- Typical operating position: (sitting, standing or bending) to estimate personal exposures.
- Locations where maximum employee exposures are possible.

6.8 Taking Measurements

6.8.1 **Operator Position:** The meter operator should be further from the source than the probe. If readings exceed 100% of Standard, stop field sampling and seek a professional evaluation of exposure potential.

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6.8.2 Approach source from a low background. Make sure the probe does not get overloaded. Overloading could result in burning out the probe. The probes will readout in Percent of Standard. The permitted exposure for these probes is 300% of standard.

6.8.3 Keep the probe away from reflective surfaces.

6.9 Spatial Averaging by Data logging

6.9.1 Press **F3 Menu**, then select **3 Spatial Average**

1. DATA LOG	5. UNITS
2. TIME AVG	6. RS232
3. SPATIAL	7. PROBE
4. BAT/LITE	8. NEXT

6.9.2 Press **F1 On** to accept the mode

SPATIAL AVG MODE			
MODE IS ___			
ON			
F1	F2	F3	F4

6.9.3 Press **F1 Start** while slowly moving the probe vertically at a constant rate of movement. (Meter beeps at 1 second intervals) The meter will log the values and average them. Strive for an interval of about 10 seconds between starting and stopping the time. When the probe reaches the height equal to the top of an adult's head (about 6 Ft) press **F1 Stop** to stop.

nnn % STD			
Nnn MAX CF 1.00			
START	MAXR	MENU	QUIT
F1	F2	F3	F4

The meter will show the average value on the second line of the display and the maximum value on the left side of the third line of the display. The bar graph will be indicating the instantaneous field magnitude in real time. The averaging interval will be shown on the right side of the third line.

6.9.4 To make another spatially averaged measurement, press **F1 Start** again.

6.9.5 To temporarily suspend the spatial average mode and make real time measurements press **F2 Clr**. To resume spatially averaged measurements, press **F1 Start** again.

6.9.6 To end spatial averaging, press **F4 Quit**.

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6.10 **Monitoring for a specific frequency.** If you know the specific frequency of operation of equipment, then this information can be entered into the meter. During this process, a correction factor should be applied to the data. See the Narda 8718B instrument manual for operating instructions.

6.11 **Data Logging:** The 8718B has data logging capabilities. It permits the data to be stored and downloaded at a later time. See the Narda 8718B instrument manual and Attachment 8.3 for more information.

6.12 **Recording readings:**

6.12.1 Record values by writing down the findings or logging the data (See section 6.9 and Attachment 8.3). Use a *BNL IH Group Direct Reading Sampling Instrument Form* or equivalent to record the electric and magnetic field readings and additional required information.

6.12.2 Return meter and original sampling form to the SHSD IH Laboratory. Copy goes to the ESH Coordinator.

6.13 **Calculations**

6.13.1 Determine the spatial average (manually or by the meter logging mode). If the spatially averaged mode was not used, average the values across the vertical range (take the square root of the average of the squares of the values of the vertical range) or visually identify the highest value as the worst-case incident.

6.13.2 Compare values with numbers in OEL standard.

6.13.3 If values are greater than or equal to 50% of the standard, then individuals are referred to the occupational medicine clinic for inclusion in the RF protocol. Further review should be made to determine what additional controls or procedures should be instituted.

6.13.4 Ensure that a copy of any hazard evaluation report written by a competent person on the survey is sent to the IH Laboratory and the Occupational Medicine Clinic, the department ESH coordinator, and the individuals surveyed.

7.0 **References**

7.1 ESH Standard 2.3.2 RF and Microwaves.

7.2 Model 8718B Electromagnetic Radiation Survey Meter User's Guide. Narda Communication P/N 42983600 Rev A.

7.3 Narda Safety Products and Services Handbook.

The only official copy is on-line at the SHSD IH Group website.
 Before using a printed copy, verify that it is current by checking the document issue date on the website.

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8.0 Attachments

- 8.1 Photo of meter
- 8.2 Short Operating Instructions
- 8.3 Using Data Logging features

9.0 Documentation

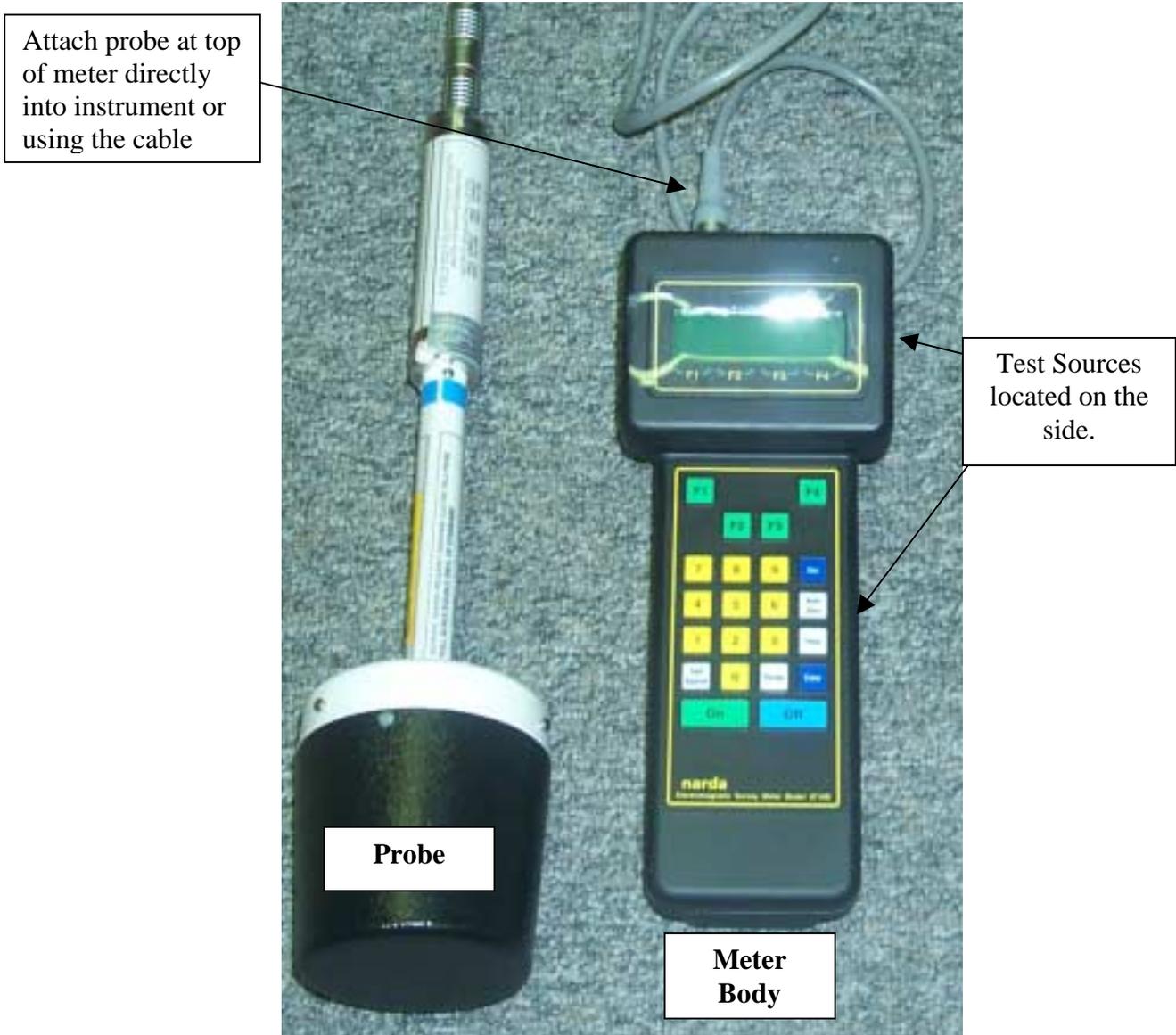
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Attachment 8.1



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Attachment 8.2 Short Operating Instructions

Step	User Action	Meter Response
Turn meter on	Press " ON " membrane button	Meter display activates and meter cycles through <i>start up</i> and <i>main</i> menus.
Select Probe	Attach probe to meter body	The model and serial number of the last probe used will be displayed on the second line of the display.
	Verify that the information on the screen matches the probe you are using. If yes, press " Enter "	Meter display information on the probe.
	If the right probe model is not displayed, enter the number for the correct model numbers in the F1 and F2 legends. Verify information that appears on next screen by pressing " F1 " <i>yes</i>	Meter display information on the probe.
Zero Probe	Place probe in the protective case or in the zero bag. Press " Enter " when ready	The meter will beep and the main measurement screen will appear in about 15 seconds after zeroing is completed.
Test the probe with an internal test source.	Place the meter probe head marked " L " to the source site on the side of meter and press " Test Source ".	Meter detects source. Acceptable reading is any increase above background. Typically increase is 5% of Standard.
Measure field source	Proceed to perform measurements using either the direct reading mode or data logging. Take spatially averaged readings from floor to 6'5". Take measurements across the surface of the instrument. Survey the operator positions and close to source (>8").	Meter reads in % of OEL Standard. Record reading on data sheet.

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Appendix 8.3 Using Datalogging Features

1.0 Go to menu and select **“1” Data Log**. (If you want to log averaged data, the spatial average mode must have been previously turned on).

1. DATA LOG	5. UNITS
2. TIME AVG	6. RS232
3. SPATIAL	7. PROBE
4. BAT/LITE	8. NEXT

2.0 Then select **“2” Log AVG with Ref#**.

1. Log with Ref#			
2. Log AVG with Ref#			
3. Continuous Logging			
MEM		QUIT	
F1	F2	F3	F4

3.0 The screen will prompt you for a reference number for this series of data.

New Logging Run:			
Enter New Ref No:			
OK	CLR	MENU	QUIT
F1	F2	F3	F4

4.0 Press **F1 OK**. Make note of the number so you can later associate this survey number with the data points collected.

nnn % STD			
Nnn MAX CF 1.00			
START	MAXR	END	QUIT
F1	F2	F3	F4

5.0 PRESS **F1 Start**. You will hear the machine beep each time it takes a measurement. It will show how many seconds you have been running.

nnn % STD			
Nnn MAX CF 1.00			
STOP			
F1	F2	F3	F4

6.0 You will be shown the information collected and you will have a choice to discard or save. Press **F1 Save** or **F3 Discard**

DATA POINT NO. 001			
0.0562% STD AVG			
0.0812 % STD MAX _____ sec			
SAVE		DISCARD	
F1	F2	F3	F4

