



Operating  
and  
Service  
Manual

HP 85053A  
3.5 mm Verification Kit

**TestEquity Inc. 1-800-732-3457**

# MANUAL CHANGES

## NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

## MANUAL IDENTIFICATION

HP Number: HP 85053A  
Date Printed: November 1986  
Part Number: 85053-90008

This supplement contains important information for correcting manual errors and for adapting the manual to products containing improvements made after the printing of the manual.

Two types of information are included:

**UPDATES - APPLY TO ALL SERIAL NUMBERS.**

**NUMBERED CHANGES - UPDATES THAT ARE SERIAL NUMBER PREFIX RELATED.**

The information is in the following order: UPDATES, NUMBERED CHANGES in sequential order with applicable illustrations as close as possible to each numbered change.

To use this supplement, make all UPDATES and all appropriate serial number related CHANGES indicated in the following tables.

■ = NEW ITEM

11 FEBRUARY 1987



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**UPDATES**

## ■ Page 2-4, Figure 2-2:

The length of the 25-ohm section of the stepped impedance line,  $l_2$ , should read:

$l_2$ (25-ohm section)	$1.966 \pm 0.0006$ in
	$49.94 \pm 0.015$ mm

## ■ Page 2-5/2-6, Figure 2-3:

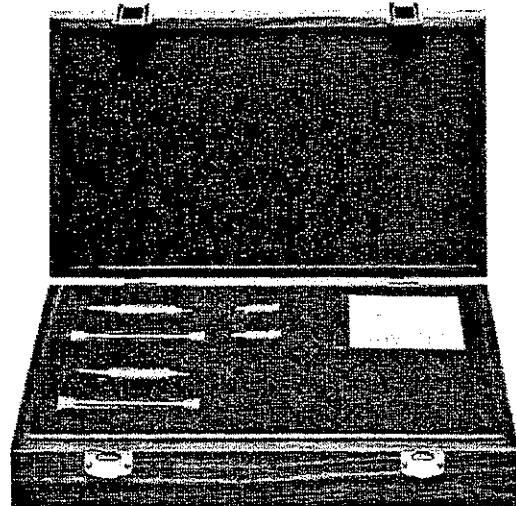
The length of the outer conductor listed in Figure 2-3 should read:

L (outer conductor)	$2.950 \pm 0.003$ in
	$74.93 \pm 0.08$ mm

## Page 4-1

The photograph of the airline and center conductor shows the center conductor backward from the text. The text is correct; reverse the center conductor to match the text.

# HP 85053A 3.5 mm VERIFICATION KIT



## **CERTIFICATION**

*Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.*

## **WARRANTY**

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

### **LIMITATION OF WARRANTY**

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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### **EXCLUSIVE REMEDIES**

**THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.**

## **ASSISTANCE**

*Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.*

*For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.*

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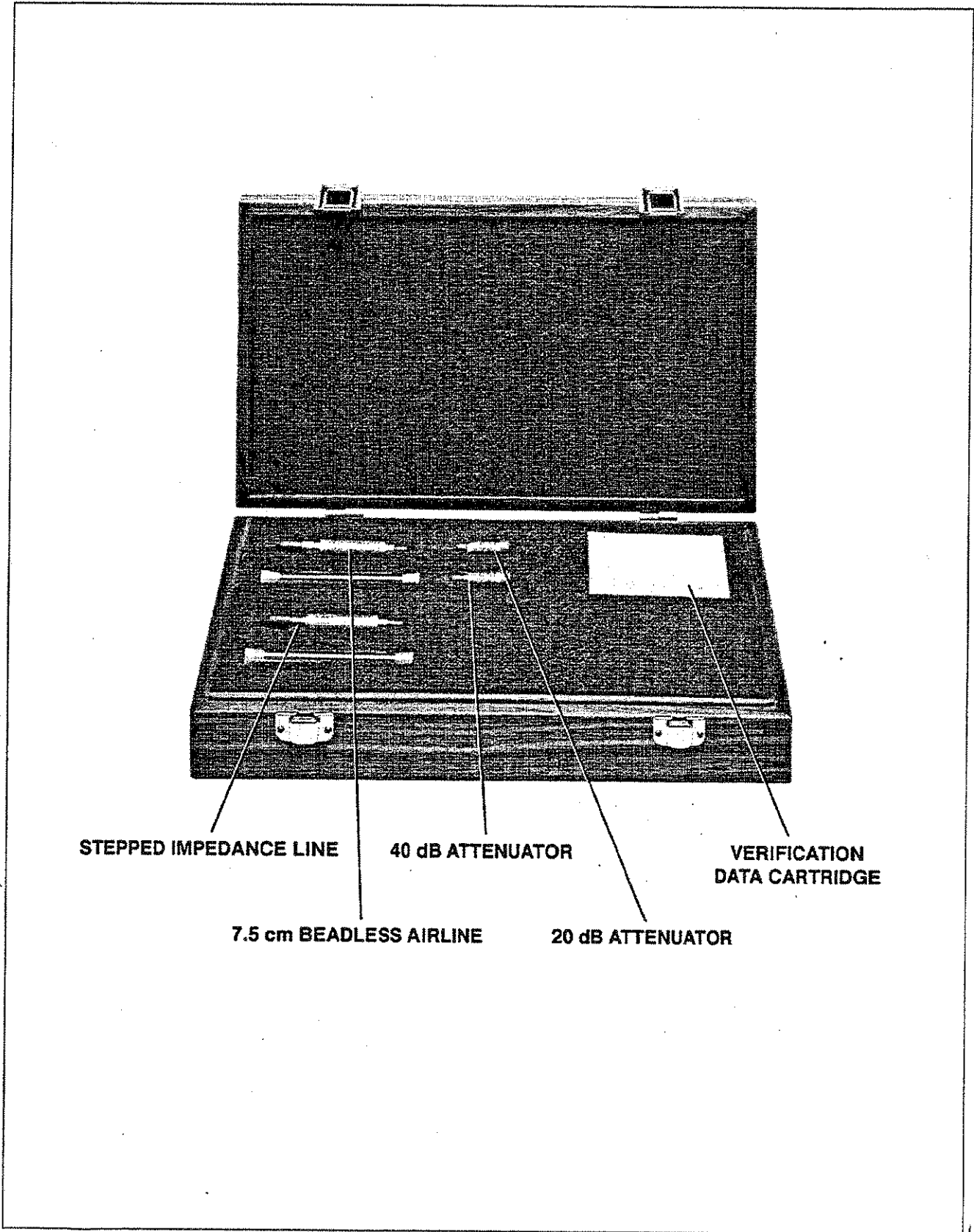


Figure 1-1. HP 85053A 3.5 mm Verification Kit

# Section 1. General Information

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## INTRODUCTION

The Hewlett-Packard 85053A 3.5 mm verification kit (Figure 1-1) is designed to be used with the HP 85052A 3.5 mm calibration kit and the HP 8510 network analyzer system. It consists of two attenuators, a stepped impedance line, a 7.5 cm airline, a data tape containing the factory measured verification data and factory uncertainties, and a data print out sheet for the devices in the kit.

The purpose of the HP 85053A 3.5 mm verification kit is to verify that your network analyzer system is working properly and that you have performed a good measurement calibration.

This manual describes the devices in the HP 85053A 3.5 mm verification kit and gives their mechanical and environmental specifications. It also shows how to connect the airlines.

The complete performance verification procedure is in section IV (Performance Tests) of the HP 8510 Operating and Service Manual.

**IMPORTANT NOTE:** The content of this manual is limited. It is assumed that proper cleaning, gaging and connection skills are known by the operator. There are two Hewlett-Packard publications available to help you learn these skills:

*Microwave Connector Care* (HP part number 08510-90064) explains in detail how to care for, inspect, clean, gage and make connections with coaxial microwave connectors. It is designed to be helpful regardless of the application or the kind of measurement being made.

HP Application Note 326, *Principles of microwave connector care*, summarizes the key points in *Microwave Connector Care*. A copy of this publication is included with each verification kit.

## EQUIPMENT REQUIRED BUT NOT SUPPLIED

The following items are required but not supplied with this kit:

- 3.5 mm connector gage kit (HP part number 1250-1862) supplied with the HP 85052A 3.5 mm calibration kit.
- $\frac{5}{16}$ " torque wrench, 8 lb-in (HP part number 1250-1863) supplied with the HP 85052A 3.5 mm calibration kit.
- $\frac{5}{16}$ " open end wrench for the 3.5 mm airline wrench flats (HP part number 8720-0015)
- Spanner wrench for the test port connectors (HP part number 08513-20014)



## SERIAL NUMBERS

A serial number label is attached to this verification kit. A typical serial number label is shown in Figure 1-2. The serial number is in two parts: the first four digits followed by a letter comprise the serial number prefix; the last five digits are the sequential suffix unique to each verification kit. In addition, each verification device in this kit also has a Hewlett-Packard serial number label attached to it.

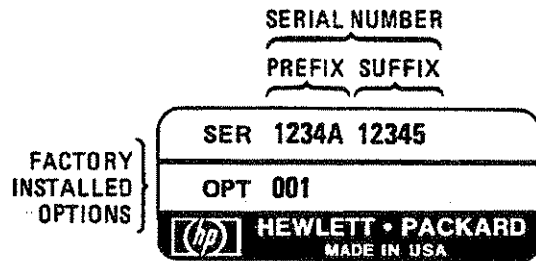


Figure 1-2. Typical Serial Number Label

## INCOMING INSPECTION

Use Table 1-1 and Figure 1-3 to verify that your shipment is complete.

The foam-lined storage case provides protection for the verification kit devices during shipping. If the case or devices are damaged, set aside the verification kit and all packaging materials and contact the nearest Hewlett-Packard office listed inside the back cover of this manual.

Hewlett-Packard will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company.

## REPLACEABLE PARTS

Table 1-1 gives the individual Hewlett-Packard replacement part numbers for all of the devices in the HP 85053A 3.5 mm verification kit. Maury Microwave Corporation is the original manufacturer of some of the items in this verification kit but replacement parts must be ordered from Hewlett-Packard to assure valid characterization data. See *Device Replacement Kit* in section one of this manual for replacement information.

When ordering replacement parts use the numbers given in Table 1-1. This will expedite your order and assure that you receive the correct replacement part.

To order an HP part, list the description, HP part number and quantity desired. Send your order to the nearest Hewlett-Packard office listed inside the back cover of this manual.

*Table 1-1. HP 85053A 3.5 mm Verification Kit Replaceable Parts*

Description	Quantity Per Kit	HP Replacement Part Number
<b>Airlines</b>		
7.5 cm Beadless Airline	1	85053-60003
Stepped Impedance Line	1	85053-60004
<b>Attenuators</b>		
20 dB Attenuator	1	85053-60001
40 dB Attenuator	1	85053-60002
<b>Miscellaneous Items</b>		
Verification Data Tape	1	none*
Blank tape (for data backup)	0	9164-0166
Verification Kit Storage Case	1	85053-80009
Data Envelope	1	85053-80006
3.5 mm Protective End Cap, Male	4	1401-0208
3.5 mm Protective End Cap, Female	4	1401-0202
Foam Swabs	0	9300-1270
* See <i>Verification Data Replacement</i> in section one of this manual.		



7.5 cm Beadless Airline



Stepped Impedance Line



20 dB Attenuator



40 dB Attenuator

**NOT SHOWN**  
Device Data Envelope  
Operating and Service Manual  
Verification Kit Storage Case  
Verification Data Tape

Figure 1-3. HP 85053A 3.5 mm Verification Kit Replaceable Parts

## PERIODIC RECERTIFICATION

Hewlett-Packard suggests an initial one year interval for sending your verification kit to the HP Service Center for recertification. The actual need for the recertification service depends on the usage of the kit. After the initial one year recertification, it will be up to you to determine what interval is best for your needs. Contact your nearest Hewlett-Packard sales office for more information.

## VERIFICATION DATA REPLACEMENT

A file containing the verification data for your kit is maintained for one year from the time of initial factory measurement or recertification measurement. If you lose the original verification data contact:

Network Measurements Division  
1400 Fountaingrove Parkway  
Santa Rosa, CA 95401

Attn: Factory Repair Coordinator  
Telephone: (707) 577-1400

If you lose the recertification data contact:

Mountain View Service Center  
333 Logue Ave.  
Mountain View, CA 94043

Telephone: (415) 968-9200

## DEVICE REPLACEMENT KIT

If you have ordered a replacement verification device, you should have received the verification device, a data print out sheet(s) and a verification data cartridge that contains the S-parameter data and calculated uncertainties for your new device. Attach the new data print out to the data print out of the device that was replaced.

Below are instructions on how to load the data from the replacement device data cartridge into the HP 8510 memory, and then onto the original verification data cartridge that came with the verification kit. This procedure writes the "new" data (for the replacement device) over the "old" data on the original verification data cartridge. Note: Once you write over the data, the "old" data can *not* be recovered. Therefore, it is recommended that you make a backup copy of the verification data *before* you perform the following procedure (see *3.5 mm Verification Data Tape* in section three of this manual for the backup procedure). Also, save the new data cartridge for a backup.

1. Insert the new verification data cartridge containing the data for your new device into the HP 85101A tape drive. Press the following keys:

[TAPE],

LOAD softkey,

MEMORY ALL softkey,

FILE #\_ softkey. File # depends on the device; see the list below.

## Device File Number

20 dB attenuator .....	File #1
40 dB attenuator .....	File #2
Beadless airline .....	File #3
Stepped impedance airline .....	File #4

2. Remove the data cartridge.
3. Push the RECORD tab on the original verification data cartridge (the one that came with the verification kit) into the record position, as shown by the arrow on the tab. Insert this tape into the HP 85101A tape drive.

Press the following keys:

STORE softkey,  
MEMORY ALL softkey,  
FILE #\_ softkey. File # depends on the device; see the list above.

4. Remove the data cartridge.
5. Reinsert the new verification data cartridge containing the data for your new device into the HP 85101A tape drive. Press the following keys:

LOAD softkey,  
MEMORY 1-4 softkey,  
MEMORY \*1 softkey,  
FILE #\_ softkey. File # depends on the device; see the list above.

6. Remove the data cartridge.
7. Reinsert the original tape into the HP 85101A tape drive.

Press the following keys:

STORE softkey,  
MEMORY 1-4 softkey,  
MEMORY \*1 softkey  
FILE #\_ softkey. File # depends on the device; see the list above.

8. Remove the data cartridge.
9. Push the RECORD tab to the non-record position.
10. The original data cartridge now has the data for the replacement device. On the data cartridge label, cross out the serial number of the old device and write the serial number of the new device.

If you need further assistance, please call your local Hewlett-Packard representative.

## Section 2. Specifications

This section gives the mechanical and environmental specifications for the devices in the HP 85053A 3.5 mm verification kit.

### ENVIRONMENT

Table 2-1 lists the environmental specifications for the devices in the HP 85053A 3.5 mm verification kit.

Table 2-1. Environmental Specifications

Accuracy Enhanced Operating Temperature	Calibration Temperature $\pm 1^{\circ}\text{C}$ ( $1.8^{\circ}\text{F}$ )
Calibration Temperature	20° to 26°C (68° to 79°F)
Barometric Pressure Operation Storage	<4,500 metres (15,000 feet) <15,000 metres (50,000 feet)
Relative Humidity Operation Storage	Non-Condensing at All Times 20 to 80% (26°C maximum dry bulb temperature) 5 to 95%

### Temperature

Temperature of the verification devices is critical because device dimensions (and therefore electrical characteristics) change with temperature. The temperature of the verification devices and all connectors must be stable before use.

Performance verification and actual device measurements must be made within the accuracy enhanced operating temperature specification. This is true even if the accuracy enhanced operating temperature falls outside of the calibration temperature window.

Example. If measurement calibration is performed at +20°C (+68°F), verification and measurements must be made between +19°C (+66.2°F) and +21°C (+69.8°F). Also, if the accuracy enhanced operating temperature deviates from the allowable range a new measurement calibration must be performed to assure optimum accuracy.

Remember that your fingers are a heat source, so avoid unnecessary handling of the devices during verification.

## Barometric Pressure and Relative Humidity

Barometric pressure and relative humidity also affect device performance, although to a lesser extent than temperature. Air exists between the inner and outer conductors of these devices and the dielectric constant of air depends on pressure and humidity.

## MECHANICAL SPECIFICATIONS

Table 2-2 lists and Figure 2-1 shows the allowable center conductor recessions for the devices in the HP 85053A 3.5 mm verification kit.

Table 2-2. Allowable Center Conductor Recession

3.5 mm Connectors	Allowable Recession
Attenuators	0.0000 to +0.003 in 0.000 to +0.08 mm
Airlines*	0.0000 to +0.0005 in 0.000 to +0.013 mm

\* The recession of the airlines is predetermined from the relationship between the length of the outer conductor to the length of the inner conductor.

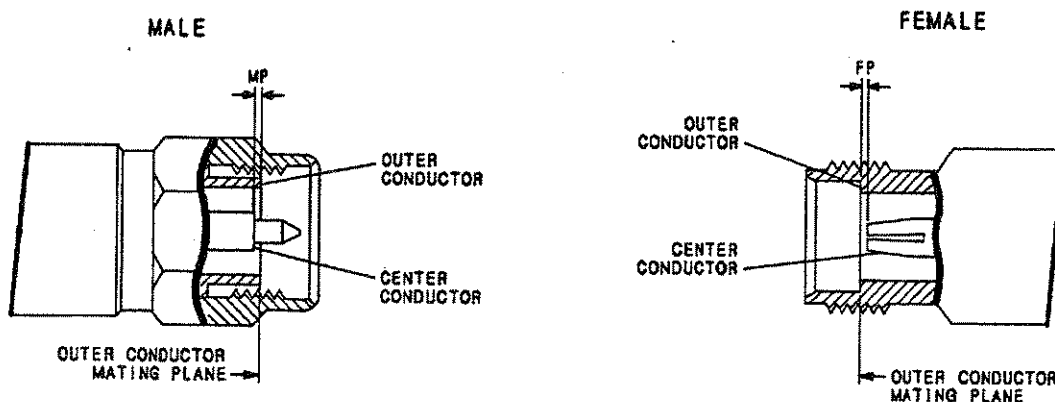


Figure 2-1. 3.5 mm Attenuators

MP = recession of the male contact pin shoulder behind the outer conductor mating plane.

FP = recession of the end of female center pin behind the outer conductor mating plane.

The devices in this kit have been measured electrically at the factory. The actual recession of each device is accounted for in the characterization data.

Figures 2-2 and 2-3 illustrate the mechanical dimensions of the stepped impedance line and the 7.5 cm beadless airline that are included in the HP 85053A 3.5 mm verification kit.

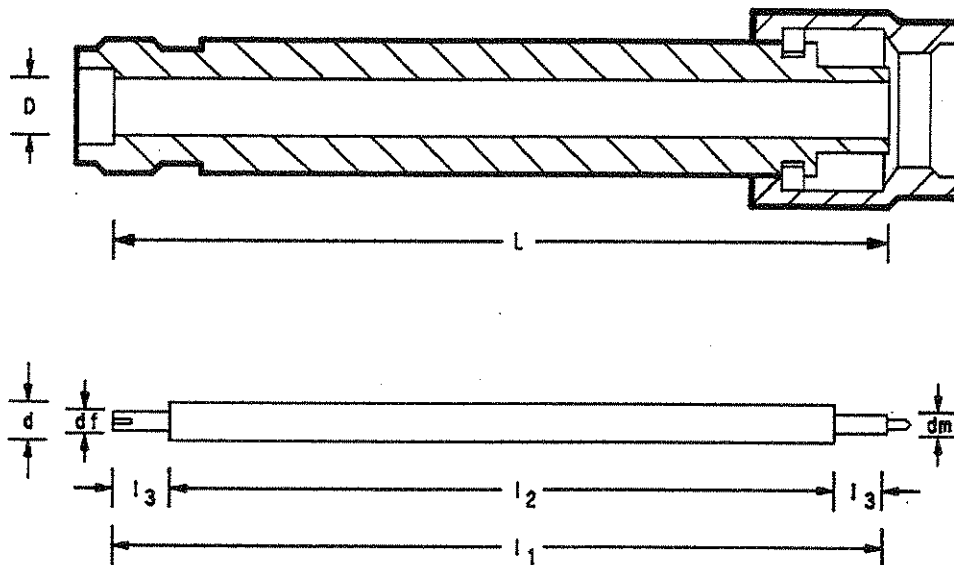
If you wish to make the measurements shown in Figures 2-2 or 2-3, the expected electrical performance of the devices can be calculated from the equations in these two publications:

Nelson, Robert E., and Marlene R. Coryell, "Electrical Parameters of Precision, Coaxial, Air-Dielectric Transmission Lines", U.S. National Bureau of Standards Monograph No. 96.

Somlo, P.I., "The Computation of Coaxial Line Step Capacitances", IEEE Transactions on Microwave Theory and Techniques, Volume MTT-15, No. 1, January, 1967.

This measurement method may be used for a general idea of the expected device characteristic impedance. Variations in connector interfaces can have a large effect on your actual electrical measurements.





**Diameters**

D (outer conductor)	$0.1378 \pm 0.00035$ in	
	$3.500 \pm 0.009$ mm	
d (25-ohm section)	$0.0908 \pm 0.0003$ in	
	$2.306 \pm 0.008$ mm	
$d_m$ (50-ohm section, male connector end)	$0.5984 \pm 0.0003$ in	
	$1.520 \pm 0.008$ mm	
$d_f$ (50-ohm section, female connector end)	$0.0603 \pm 0.0006$ in	
	$1.532 \pm 0.015$ mm	

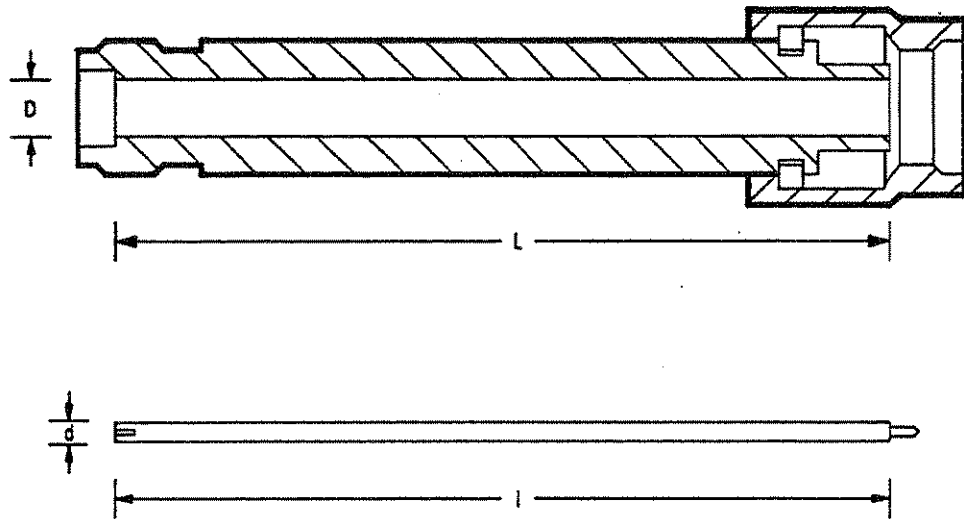
**Lengths**

L (outer conductor)	$2.950 \pm 0.003$ in	
	$74.93 \pm 0.08$ mm	
$l_1$ (center conductor)	$L + 0.0000 / -0.0005$ in	
	$+0.000 / -0.013$ mm	
$l_2$ (25-ohm section)	$1.966 + 0.0006$ in	
	$49.94 + 0.013$ mm	
$l_3$ (50-ohm section)	$0.492 \pm 0.005$ in	
	$12.49 \pm 0.13$ mm	

**Straightness**

D (outer conductor)	$0.0002/\text{in}$	$0.002$ mm/cm
d (center conductor)	$0.0003/\text{in}$	$0.003$ mm/cm

Figure 2-2. Mechanical Dimensions: Stepped Impedance Line



**Diameters**

<b>D</b> (outer conductor)	$0.1378 \pm 0.00025$ in
	$3.50 \pm 0.006$ mm
<b>d</b> (center conductor)	$0.05984 \pm 0.0002$ in
	$1.520 \pm 0.005$ mm

**Lengths**

<b>L</b> (outer conductor)	$2.950 \pm 0.0005$ in
	$74.93 \pm 0.013$ mm
<b>l</b> (center conductor)	$L + 0.0000 / -0.0005$ in
	$+0.000 / -0.013$ mm

**Straightness**

<b>D</b> (outer conductor)	0.0002/in	0.002 mm/cm
<b>d</b> (center conductor)	0.0003/in	0.003 mm/cm

Figure 2-3. Mechanical Dimensions: 7.5 cm Beadless Airline

## Section 3. Preparation for Use

This section provides some of the information necessary to verify the performance of your HP 8510 network analyzer. Refer to Section IV (Performance Tests) in the HP 8510 Operating and Service Manual for the complete performance verification procedure.

### OPERATING PRECAUTIONS

There are several precautions that must be observed to protect the devices in this kit and the instruments being used.

#### Handling and Storage

Handle and store these verification devices with great care; their continued performance and accuracy depend on maintaining very precise mechanical tolerances.

When not in use, replace the protective end caps and store the verification devices in their foam lined storage case. As shown in Figure 3-1, the storage case lid is detachable so that the case can be stored in a shallow drawer.

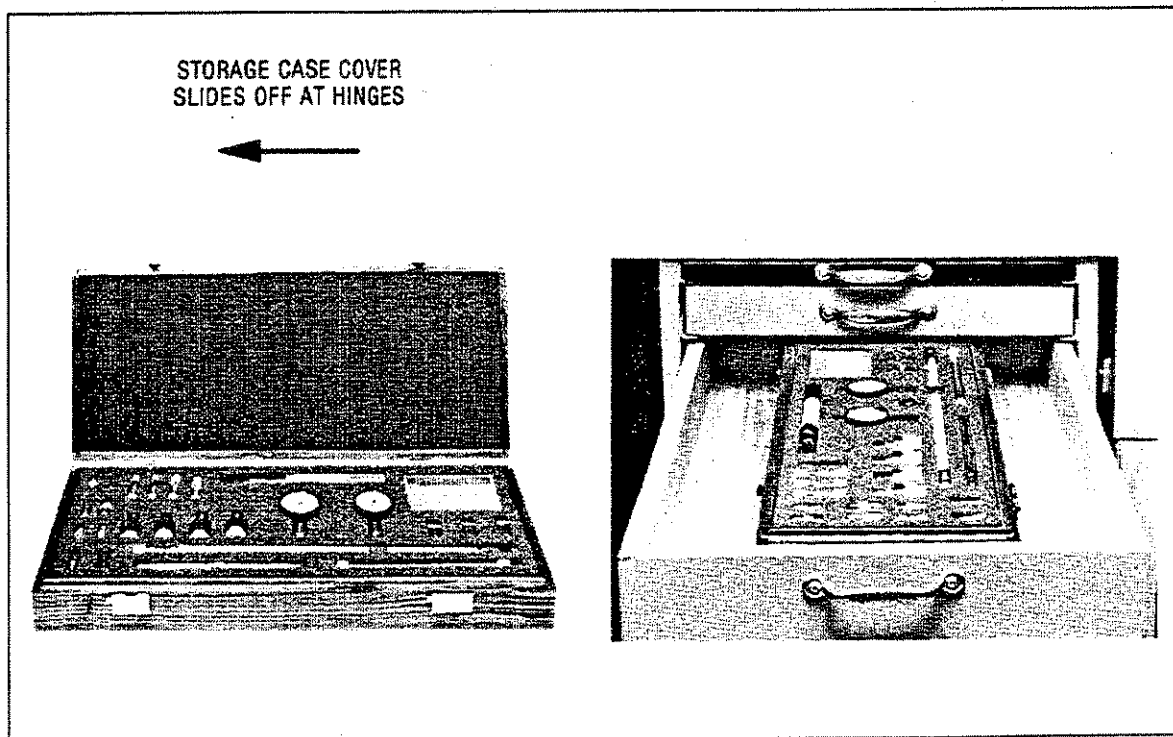


Figure 3-1. Removing Storage Case Cover

## **Electrostatic Discharge**

When you clean or inspect connectors attached to any static sensitive circuits (such as test port connectors), protect against electrostatic discharge (ESD).



**The human body almost always has some static charge. You are usually not aware of this charge because the human threshold for the perception of a static discharge shock is approximately 3,000 volts. ESD as low as 60 volts can destroy sensitive microcircuits. Always protect against ESD when working near sensitive equipment.**

## **Connection Techniques**

The mechanical tolerances of the connectors in this verification kit, and their electrical performance, are better than most other 3.5 mm connectors. Because of this, slight errors in technique that would not be noticeable with other connectors can appear when these precision connectors are used. Extreme care should be taken when making connections or disconnections with these precision devices.

### **Wear**

Connector wear eventually degrades performance. The verification devices, which may be used only a few times a month, should have a long life. The test port connectors on the network analyzer test set may have many connections each day, and are therefore more subject to wear.

## **VISUAL AND MECHANICAL INSPECTION**

Visually inspect and, if necessary, clean all connectors each time a connection is made. Metal and metal by-product particles from the connector threads often find their way onto the mating plane surfaces when a connection is disconnected. Do not use damaged connectors.

Inspect the end of the connector gage and the calibration block visually before any mechanical measurements of the connectors are made.

### 3.5 mm VERIFICATION DATA TAPE

The HP 85053A verification data tape contains the factory measured s-parameter data and the calculated factory uncertainties. This data is unique to each kit. It is recommended that a backup copy of the tape and the data printout sheet is made immediately upon receiving the verification kit. If your verification data is lost, refer to *Verification Data Replacement* in section one of this manual. Follow these steps to make a backup copy:

1. Obtain a blank tape cartridge. If the blank tape cartridge has not been initialized, insert the blank tape into the HP 85101A tape drive. Press [TAPE] the INITIALIZE TAPE softkey, then the Yes softkey. Remove the tape cartridge when initialization is complete.
2. Load the verification data tape cartridge into the HP 85101A tape drive. Press [TAPE], then the LOAD softkey.
3. Press the MEMORY ALL softkey, then the FILE 1 softkey.
4. When it has finished loading, remove the tape from the tape drive and insert the blank initialized tape.
5. Press the STORE softkey, the MEMORY ALL softkey, then the FILE 1 softkey.
6. Repeat steps 1 through 5 substituting FILE 1 with the remaining file numbers listed on the CRT that have an asterisk next to them (when the MEMORY ALL softkey is pressed).
7. Repeat steps 2 through 6 substituting the MEMORY ALL softkey with the MEMORY 1-4 then the MEMORY \* 1 softkeys.
8. Remove the tape from the HP85101A tape drive and label it.

This completes the procedure for making a backup copy of the verification tape.

## Section 4. Connecting the Verification Devices

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This section provides a step-by-step procedure for connecting the airline and the stepped impedance line.

Before making any connections to the test set, be sure that bias power to the test set is OFF and take care to avoid electrostatic discharge by wearing a grounded wrist strap. In addition, it is good practice to grasp the outer shell of the test port just before you make any connections to the test set. This discharges any static electricity on your body by providing a conductive path to an earth ground.

When connecting these devices, always turn the nut on the device. Do not turn the device. This rule also applies to torquing the devices. Hold the device stationary by placing an open end wrench on the wrench flats of the device and torque the nut of the attaching device.

### 7.5 CM BEADLESS AIRLINE AND STEPPED IMPEDANCE LINE

The following procedure applies to the 7.5 cm beadless airline and the stepped impedance line. Before proceeding with the connection procedure, verify that the center conductor is installed in the proper orientation. The male end of the center conductor should be installed at the end of the outer conductor which has the connector nut; the female end of the center conductor should be at the end without the nut.

Follow the exact sequence of steps when connecting the 7.5 cm airline or the stepped impedance line.

- I. Put the center conductor into the airline and verify that the female end of the center conductor emerges from the female end of the outer conductor. This end will be connected to the test set.

Connect the airline as follows (an active display is recommended):



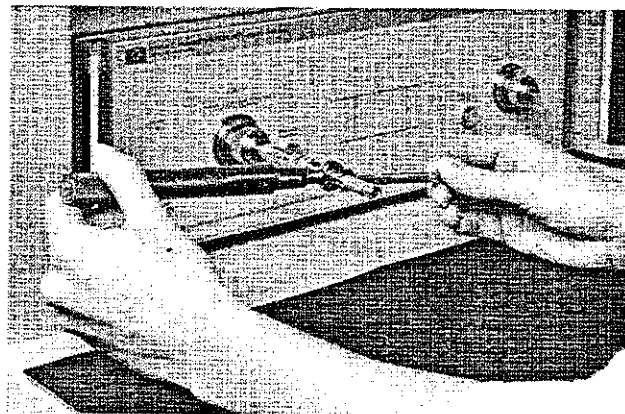
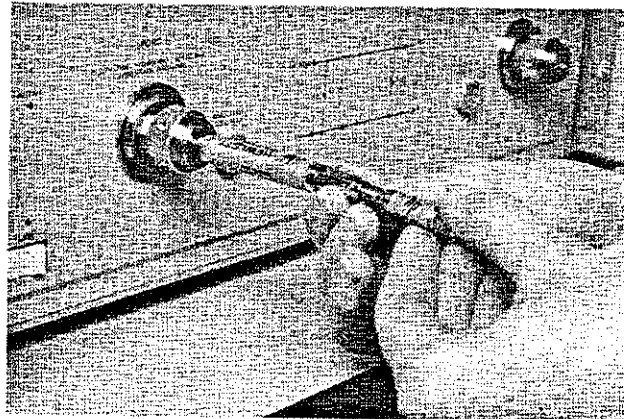
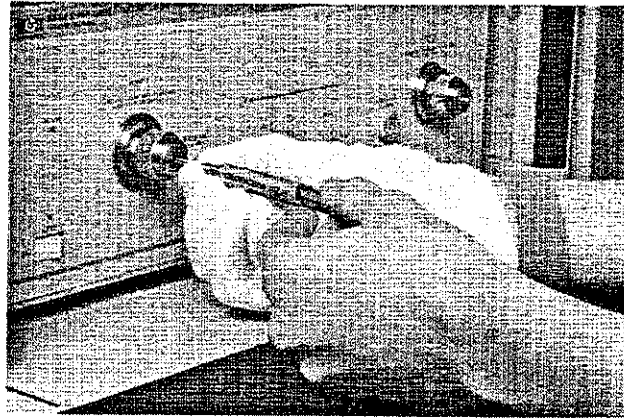
You are touching an exposed center conductor. Ground yourself to prevent electrostatic discharge (ESD).



For male test ports:

2. Hold the airline and center conductor as shown and bring both the airline and the center conductor to the test port connector. Mate the female end of the airline center conductor with the center conductor on the male test port of the test set.
3. Connect the outer conductor of the airline to the test port connector.
4. Align and mate the center conductor of the termination device with the center conductor at the end of the airline.
5. Mate the outer conductor of the airline with the outer conductor of the termination device by sliding the nut on the airline forward. Connect the outer conductors finger tight.
6. Leave the test port connection hand tight. Use a  $\frac{5}{16}$ " or  $\frac{7}{16}$ " open end wrench to hold the termination device and tighten the nut on the male end of the airline with the 3.5 mm torque wrench.

To disconnect the airline, reverse the above procedure. Always store the center conductor in the plastic case provided when it is not in use.



## FURTHER INFORMATION

This manual contains limited information about operating the HP 8510 system. For complete information, refer to the HP 8510 Operating and Service Manual.

If you need additional information, contact your local HP representative or the nearest HP office listed inside the back cover.