HP References in this Manual

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Agilent Technologies

Quick Start Guide

HP 71500A and HP 70820A

Microwave Transition Analyzer

HEWLETT PACKARD

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General Safety Considerations

WARNING   *Before this instrument is switched on*, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

WARNING   There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

CAUTION   *Before this instrument is switched on,* make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

CAUTION   Total input signal power to the HP 71500A's front-panel channel inputs must not exceed 16 dBm. Because there is no RF input attenuator, power in excess of 16 dBm may damage the instrument.

HP 71500A Microwave Transition

Analyzer - At A Glance

This quick start guide contains two tutorials that introduce you to the microwave transition analyzer. You'll need about 20 minutes to complete the steps. After completing the tutorial, refer to the *HP 71500A and HP 70820A User's Guide* for a complete discussion of product features.

Why are there two tutorials

For optimum performance as a stimulus-response test system, your microwave transition analyzer is designed to control a signal source. This is referred to as a configured system. Operation in an unconfigured system offers additional measurement capability.
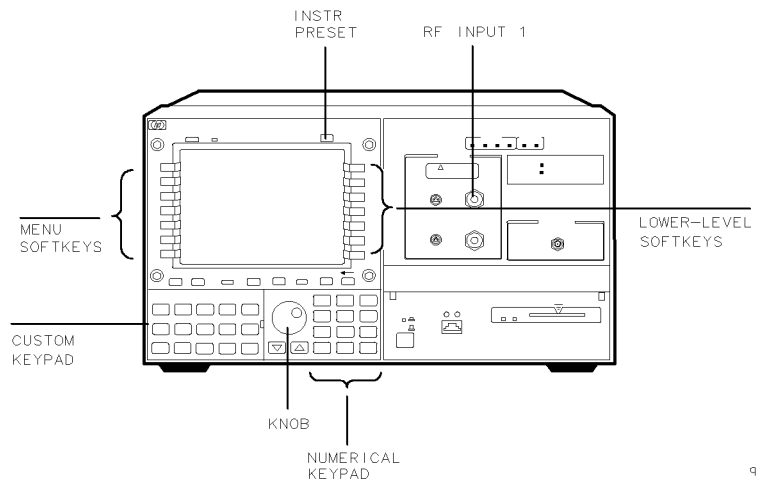
- Tutorial 1 shows operation of a configured system.
- Tutorial 2 shows operation of an unconfigured system.

If your system is configured, you can also perform tutorial 2.

Refer to the *HP 71500A Series Installation and Verification* for information on installing and configuring your instrument.

Understanding the basic controls

The HP 71500A microwave transition analyzer consists of the HP 70820A microwave transition analyzer module, the HP 70004A color display and mainframe, and a custom keypad that snaps into the front panel of the HP 70004A display. The figure on the following page shows the main controls for using the instrument.

INSTR
PRESET   RF INPUT 1

MENU
SOFTKEYS

LOWER—LEVEL
SOFTKEYS

CUSTOM
KEYPAD

KNOB

NUMERICAL
KEYPAD

qta3a

- *The INST PRESET key* (instrument preset key) sets the microwave transition analyzer to a preset condition.

- *The RF Input 1 Connector* is one of the two inputs to the HP 71500A.

- *The menu softkeys* allow access to two pages of primary functions. To access the second page, press the bottom softkey.

- *The lower-level softkeys* give users a wide range of choices in most menus.

- *The numerical keypad and knob* are used to manually enter data.

- *The custom keypad* supplies quick access to common instrument functions. (Each of these functions can also be accessed using the softkey menus.)

In the text of this quick start guide,

- ◼ ⬡boxed⬡ letters indicate normal front-panel keys.
- ◼ `shadow` letters indicate softkeys.

1

Quick Start Guide

Contents

Tutorial 1.
Using a Configured System

Perform the tasks in this tutorial in the order given. Doing them out of sequence may require extra steps. The time needed to finish all of these tasks is usually less than 20 minutes.
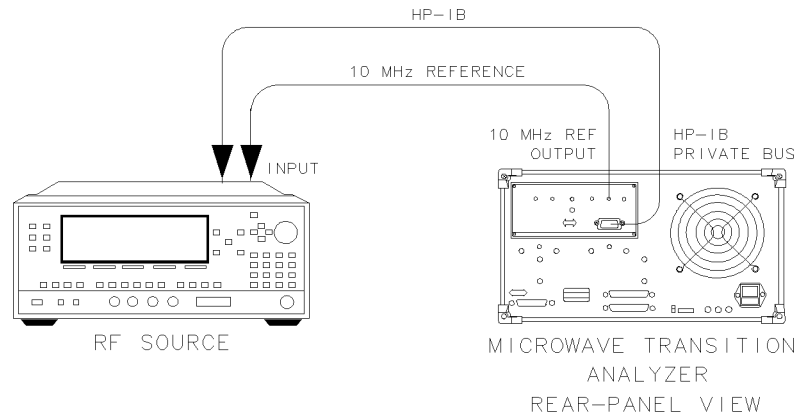
Cable connections in a configured system.

Step 1. Display a continuous wave signal

1. Connect a cable between your signal source output and the input to the microwave transition analyzer's RF INPUT 1.

2. Connect a cable between the rear-panel MOD OUTPUT of the HP 70820A module and the signal source's pulse modulation input.

3. Press INSTR PRESET.

4. Press RF out ON|OFF until ON is underlined.

You should now have a continuous wave (CW) signal on the screen. The display should look similar to the following figure.
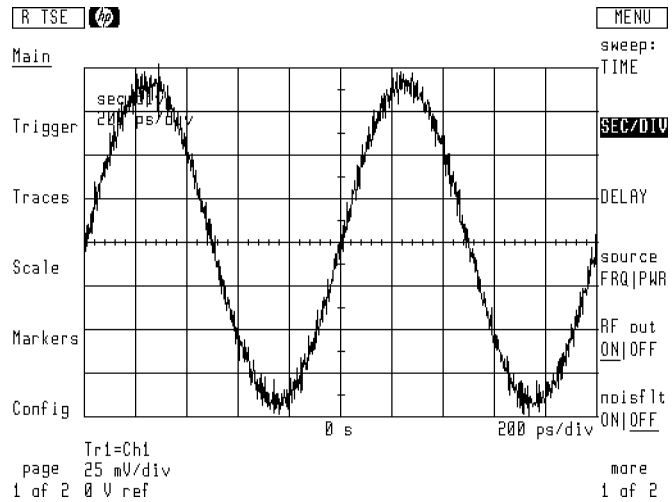
Step 2. Save a trace

1. Press `Traces` to enter the Traces menu.

2. Press the following softkeys:

    `store trace`

    `TO MEM1`

    This saves the trace on the screen in memory block number 1.

Step 3. Use the noise filter

1. Press `Main` to enter the Main menu.

2. Press `noisflt ON|OFF` until `ON` is underlined.

    This filters the noise on the signal.

Step 4. Use the markers menu

1. Press `Markers` to enter the Markers menu.

2. Press the `mkr →` and then `HIGHEST PEAK`.

    This is one example of how the options in the Markers menu can help you to interpret measurements.

Step 5. Recall a trace

1. Press `Traces` to enter the Traces menu.

2. Press the following softkeys:

    `input: Ch1`

    `MEMx`

    `MEM1`

    You now have the CW signal that you saved earlier back on the screen.

Step 6. Display a pulsed RF signal

1. Press `INSTR PRESET`.

2. Get into the States menu by pressing the following softkeys:

    `page 1 of 2`

    `States`

3. Press the following softkeys:

    `more 1 of 2`

    `PULSED TIME`

4. Get into the Pulsgen menu by pressing the following softkeys:

    `page 1 of 2`

    `Pulsgen`

5. Press `RF src PUL|CW` until `PUL` (pulse), is underlined.

6. Get into the Main menu by pressing the following softkeys:

   `page 2 of 2`

   `Main`

7. Press `RF out ON|OFF` until `ON` is underlined.

The signal should look similar to the following figure. The top trace (Tr1) shows the real input data. The burst of RF is used only for visual effect. The bottom trace (Tr3) shows the demodulated signal from the input at channel 1.

```
 R TSE  (hp)                                      MENU
Main                                           sweep:
                                               TIME

Trigger                                        SEC/DIV

Traces                                         DELAY

Scale                                          carrier
                                               FRQ|PWR

Markers                                        RF out
                                               ON|OFF

Config                                         noisflt
                   0 s              1 us/div   ON|OFF

          Tr1=Ch1       Tr3=Ch1
   page   50 mV/div     50 mV/div              more
   1 of 2 0 V ref       0 V ref                1 of 2
```
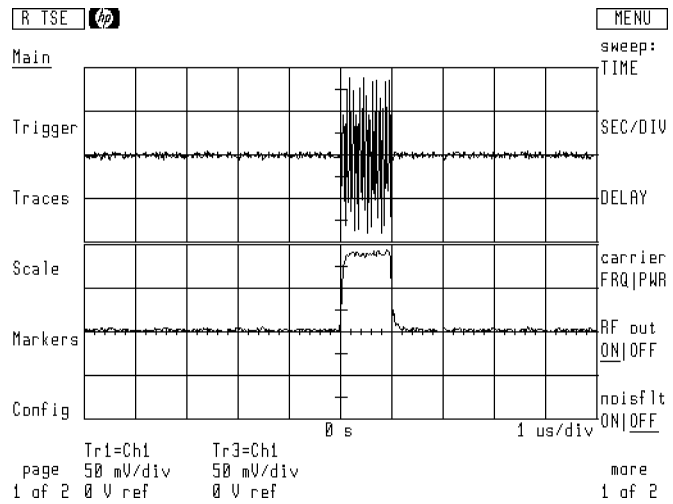
Step 7. Store internal settings (states)

1. Get into the States menu by pressing the following softkeys:

   `page 1 of 2`

   `States`

2. Press the following softkeys:

   `save state`

   `SAVE STATE 1`

The instrument will save the state in memory even if power is cycled. We will recall this state later.

Step 8. Use the automatic measurements table

1. Get into the Pulsegen menu by pressing `Pulsegen`.

2. Press the following softkeys to put more than one duty cycle on the screen:

   `WIDTH | DUT CYC` until `DUT CYC` is highlighted.

   `25`

   `%`

   `page 2 of 2`

   `Main`

   `50`

   `us`

3. Get into the Measure menu by pressing the following softkeys:

   `page 1 of 2`

   `Measure`

4. Press the following softkeys to select trace 3 (the bottom trace) as the trace to be measured:

   `MsrTrc: TR1`

   `TR3`

5. Press `MEASURE ALL`.

This provides quick access to multiple measurements that the microwave transition analyzer system performs automatically.
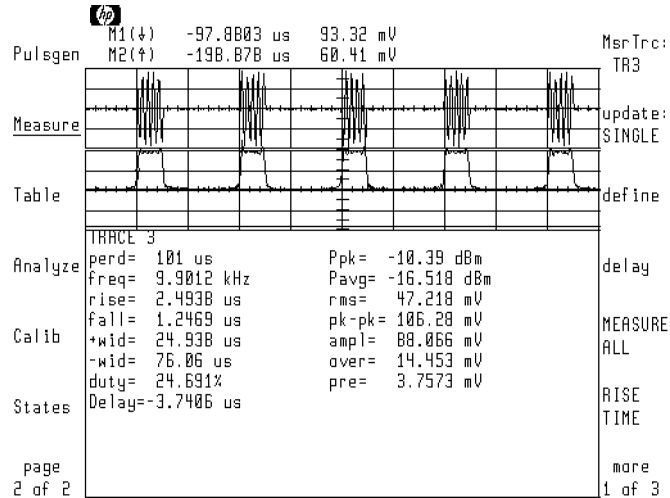
```
                              hp
                              M1(↓)    -97.8B03 us    93.32 mV
          Pulsgen            M2(↑)   -19B.B7B us    60.41 mV                    MsrTrc:
                                                                                TR3

          Measure                                                               update:
                                                                                SINGLE

          Table                                                                 define

                        TRACE 3
          Analyze       perd=   101 us           Ppk=   -10.39 dBm              delay
                        freq=   9.9012 kHz       Pavg=  -16.518 dBm
                        rise=   2.493B us        rms=    47.218 mV
                        fall=   1.2469 us        pk-pk= 106.28 mV               MEASURE
          Calib         +wid=   24.93B us        ampl=  B8.066 mV               ALL
                        -wid=   76.06 us         over=  14.453 mV
                        duty=   24.691%          pre=    3.7573 mV
          States        Delay=-3.7406 us                                        RISE
                                                                                TIME

              page                                                                more
             2 of 2                                                              1 of 3
```

Step 9. Remove the automatic measurements table from the screen

1. Press the following softkeys:

   update: SINGLE

   OFF

2. Get into the Markers menu by pressing the following softkeys:

   page 2 of 2

   Markers

3. Press MARKERS OFF.

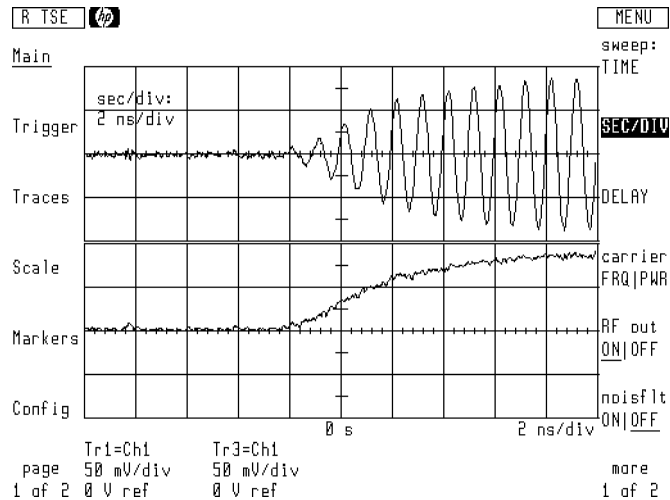You have just deleted the automatic measurements table and the markers from the screen.

Step 10. Display video feedthrough

1. Press Main to get into the Main menu.

2. Change the displayed time per division by pressing the following keys:

   (2)

   ns

3. If necessary, press DELAY and adjust with the front-panel knob until the leading edge of the pulse is displayed as shown below.

```
┌──────┐  ┌──┐                                              ┌────┐
│R TSE │  │hp│                                              │MENU│
└──────┘  └──┘                                              └────┘
 Main                                                        sweep:
                                                             TIME
           sec/div:        ╷                 ╭╮ ╭╮ ╭╮ ╭╮ ╭╮
 Trigger   2 ns/div        ┤           ╭╮   ╱  ╲╱  ╲╱  ╲╱  ╲   SEC/DIV
          ~~~╱╲~~~~~~~~~~~~~┤      ╱╲  ╱  ╲  │
                           ┤  ╭╮ ╱  ╲╱    ╲╱                  DELAY
 Traces                    ┤  ╲╱
                           ┤                    ╭──────────   carrier
 Scale                     ┤       ╭────────────               FRQ|PWR
                      _____╱──────╯
 Markers  ~~~~~~~~~~~~┤      +++++++++++++++++++++++++++++++   RF out
                      ┤                                        ON|OFF
                      ┤
 Config               ┤                                       noisflt
                      ┤                                       ON|OFF
                          0 s                    2 ns/div
          Tr1=Ch1      Tr3=Ch1
   page   50 mV/div    50 mV/div                              more
   1 of 2 0 V ref      0 V ref                                1 of 2
```

4. Change the channel of measurement to channel 1 by pressing the following softkeys:

> page 1 of 2
>
> Measure
>
> MsrTrc: TR3
>
> TR1

5. Separate the RF from the video feedthrough and display the RF by pressing the following softkeys:

> page 2 of 2
>
> noisflt ON|OFF until ON is underlined.
>
> more 1 of 2
>
> sweep options
>
> CH1 = VID/RF until VID (video) is underlined.

The pulse modulator in this signal source (an HP 83640A is being used in this example) is of such a high quality that video feedthrough is minimal and both traces appear to be straight lines.

If a message is displayed

If the screen displays Synchronous modulation not allowed for profile. Can't find proper carrier mix, then the two signals are synchronous. The source frequency needs to be adjusted slightly. The microwave transition analyzer system can do this automatically. To fix this problem, press the following softkeys: Pulsgen, more 1 of 2, modify: SYNTH, and then SYNTH.

---

6. Autoscale the video feedthrough by pressing the following softkeys:

> Scale

`AUTO-SCALE`

The following figure has an example of what you might expect to find on the screen for this signal source or another of its quality.

7. Take an automatic peak-to-peak measurement of the video feedthrough by pressing the following softkeys:
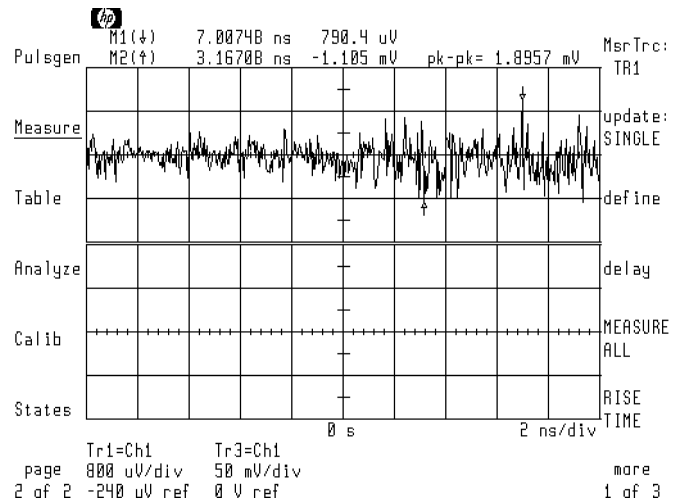
`page 1 of 2`

`Measure`

`more 1 of 3`

`more 2 of 3`

`PK-PK`

The following figure shows the video feedthrough of a pulse originating from an HP 83640A.

Step 11. Recall states

1. Press `States` to access the States menu.

2. Press the following softkeys:

`recall state`

`RECAL STATE 1`

You should have the pulse display that you saved earlier in Step 6 back on the screen.

Step 12. Measure the risetime of an RF pulse

1. Press the following keys to change the time per division shown on the screen:

   SEC/DIV

   ②

   ns

2. If necessary, press delay and adjust the delay with the front-panel knob until the leading edge of the pulse is displayed.

3. Get into the Measure menu by pressing the following softkeys:
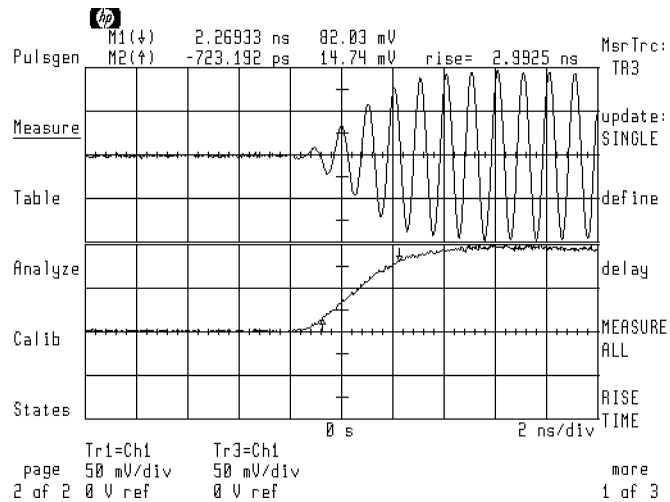
   page 1 of 2

   Measure

4. Press the following softkeys to change the trace to be measured to trace 3:

   Msr Trc: TR1

   TR3

5. Press RISE TIME.
   Note the automatic measurement results that appear at the top of the screen.

Step 13. Measure the falltime of an RF pulse

1. Press `States` to access the States menu.

2. Press the following softkeys to get the RF pulse that you saved states for earlier, back on the screen:

   `recall state`

   `RECALL STATE 1`

3. Adjust delay by pressing the following keys:

   `DELAY`

   ①

   `us`

4. Adjust the time per division shown on the screen by pressing the following keys:

   `SEC/DIV`

   ②

   `ns`

   The trailing edge of the pulse should now appear on the screen as shown in the following figure.
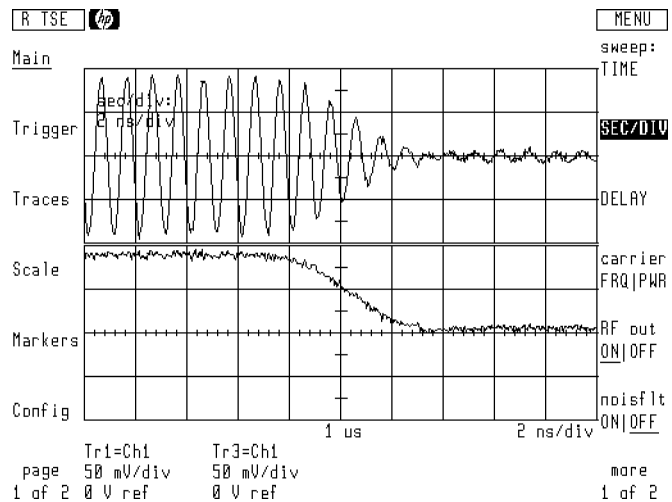
5. Get into the Measure menu by pressing the following softkeys:

   `page 1 of 2`

   `Measure`

6. Press the following softkeys to make trace 3 the trace to be measured:

   `Msr Trc: TR1`

   `TR3`

7. Press `more 1 of 3` and then `FALLTIME`. Note the automatic measurements that appear at the top of the screen.


Tutorial 2. Using an Unconfigured System

Perform the tasks in this tutorial in the order given. Doing them out of sequence may require extra steps. The time needed to finish all of these tasks (excluding calibration) is usually less than 20 minutes.

You do not need to configure a signal source to the HP 71500A microwave transition analyzer system to do the tasks in this chapter. You will, however, need the following equipment:

- An HP 71500A microwave transition analyzer system

- A signal source

- Two 2.4 mm (f) bulkhead to APC-3.5 mm (f) adapters

- Two SMA cables

- A power splitter

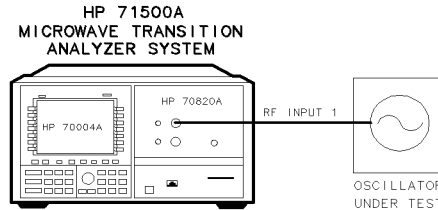- A device to test vector voltage transmission (for example, a limiter or a filter)
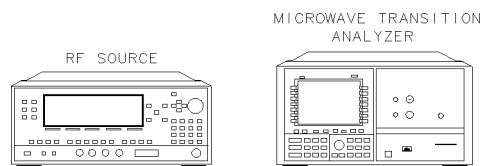
No connecting cables are needed in an unconfigured system.

Step 1. Measure frequency and power

1. Press `Config`, `RF Source`, `RF src:`, and then `NONE` to ensure your source is unconfigured.

2. Connect the oscillator under test to the channel 1 input as shown below.

3. Set the oscillator frequency to 3.1 GHz and its output power level to −2.1 dBm. Turn the oscillator power on.

4. Press (INSTR PRESET).

5. Press `more 1 of 2`.

6. Press `sig trk ON | OFF` until `ON` is underlined.

7. Access the States menu by pressing the following softkeys:

   `page 1 of 2`

   `States`

8. Press `FREQ & POWER`.

The results of this measurement are displayed on the screen as shown
below.

The displayed measurement reads −3.82 dBm when the input is −2.1
dBm because the cable loss is fairly heavy for this particular setup.

This procedure is for a frequency and power measurement of one
input. The microwave transition analyzer system can, however,
determine the frequency and power of up to five signals at one time.

```
                        (hp)
                                                              sweep:
Main                                                          TIME

                # cycle span:
Trigger         6.2 cycles                                    # CYCLE

Traces                                                        DELAY

         source: CHAN1
Scale    3.099999884 GHz      -3.82 dBm                       signal
                                                              FREQ

Markers

Config                                                        noisflt
                                                              ON|OFF

 page                                                          more
1 of 2                                                        1 of 2
```

Step 2. Normalize the system for a vector voltage measurement

1. Connect the signal source to a power splitter and the microwave transition analyzer system as shown below.
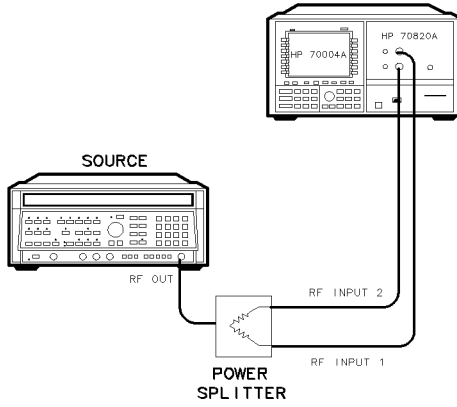
2. Set the frequency of the signal source to 1 GHz and the power level to −10.0 dBm.

3. Press INSTR PRESET.

4. Access the States menu by pressing the following softkeys:

   page 1 of 2

   States

5. Press VECTOR VOLTAGE.
   You should now have only a table on the screen. The source signal is no longer visible on the screen.

6. Access the Table menu by pressing the following softkeys:

   page 1 of 2

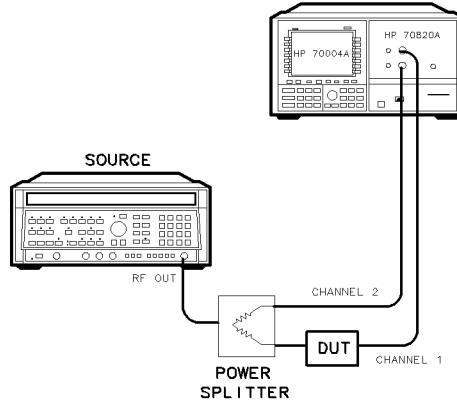   Table

7. Set the reference to zero by pressing the following softkeys:

   delta (off)

   SET REF.

You have just normalized the system (adjusted for the losses of the system) to make an accurate vector voltage measurement.

Step 3. Make a vector voltage measurement

1. Connect the device under test (DUT) to the normalized measurement setup as shown below.

2. Read the results at the top of the screen as shown below.

The example shows the measurements for a 1.5 GHz low-pass filter. The left number in the table shown on the screen is the input frequency. The center number shows the insertion loss of the DUT. The right number shows the phase shift caused by the DUT.