Notice

Hewlett-Packard to Agilent Technologies Transition

This documentation supports a product that previously shipped under the Hewlett-Packard company brand name. The brand name has now been changed to Agilent Technologies. The two products are functionally identical, only our name has changed. The document still includes references to Hewlett-Packard products, some of which have been transitioned to Agilent Technologies.

Agilent Technologies

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Service Quick Reference Guide

Agilent Technologies
85109C
On-Wafer Network Analyzer
Measurement System

Agilent Technologies

85109-90024

Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP 85109C is now model number Agilent 85109C.

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DFARS/Restricted Rights Notice

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NOTE   In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine whether your product is still within its warranty period.

Service Quick Reference Guide

HP 85109C On-Wafer Network Analyzer Measurement System

HEWLETT PACKARD

Contents

Figures

Tables

1

Installation "Preflight" Checkout

HP85109C Standard

SYSTEM BUS

HP 85101
(ADDRESS 16)
Network
Analyzer

HP 85102
(ADDRESS 16)
Network
Analyzer

HP 83651A
RF SOURCE
(ADDRESS 19)
(Analyzer)
(Language)
Opt 004

HP 8517A
(ADDRESS 20)
Test Set

1" Cooling Space Required

HP V85104A
K09
mm wave test
set/modules

HP 85105A
Opt 050 & 04
(ADDRESS 21)
mm wave test
set/controller

HP 8350B
LO SOURCE
(ADDRESS 18)
Opt 004

IF DISPLAY
INTERCONNECT

HP-IB   TO CONTROLLER

J1

10MHz IN
TRIGGER IN

See Table 1

10MHz OUT
TRIGGER OUT
STOP SWEEP IN/OUT

RF OUTPUT

ALC IN

RF INPUT

J11

.5V/GHz
ALC OUT

PORT 2   PORT 1

LO

RF INPUT

SWITCH BIAS

LO

RF

RF

LO INPUT
FUSES

J10
J11

RF OUTPUT

SWITCHES IN SP MODE

TEST SET INTERCONNECT   08510-60102

TEST SET INTERCONNECT   08510-60102

LO PHASELOCK OUT

FM INPUT

To change HP 836XXA sources to
.5V/6GHz, locate A12 Multiplier/Filter
Board; brown one on left and red one
on right. Set S1 located under brown tab
to position 3 and 4 closed, and 1, 2 and
5 open. HP836XXA sources come set for
.25V/GHz and will cause several dB of
power slope and output power inaccuracy
if not changed.

Table 1

1		000=TMSL/SCPI
0		010=MATE LANG
		001=NA LANG ADDRESS=19

L, L, L,   A, A, A, A, A,

You will need to cycle power to accept new settings.

cablestd

Figure 1-1.

Addresses	
Plotter	5
Printer	1
Disc	0
Pass Thru	31
RF Switch	31

HP85109C Option 002

SYSTEM BUS

HP-IB   TO CONTROLLER

HP 85101
(ADDRESS 16)
Network
Analyzer

IF DISPLAY INTERCONNECT

HP 85102
(ADDRESS 16)
Network
Analyzer

1" Cooling Space Required

HP 83651A
RF SOURCE 1
(ADDRESS 19)
(Analyzer)
(Language)
Opt 004

RF OUTPUT

J1

10MHz IN
10MHz IN
TRIGGER IN
10MHz OUT
TRIGGER OUT
STOP SWEEP IN/OUT

ALC IN

TEST SET INTERCONNECT

08510-60102

HP 8517A
(ADDRESS 20)
Test Set

RF INPUT

NC1

C

J11

0955-0603

CON

SWITCH BIAS

.5V/GHz

ALC OUT

TEST SET INTERCONNECT

08510-60102

HP V85104A
KO9
mm wave test
set/modules

RF INPUT

PORT 2   PORT 1

LO

LO

RF

HP 85105A
Opt 050 & 04
(ADDRESS 21)
mm wave test
set/controller

RF

LO INPUT

FUSES

J10
J11

10MHz OUT

SWITCHES IN SP MODE

RF OUTPUT

HP 83621A
LO SOURCE 2
(ADDRESS 18)
(Analyzer)
(Language)

HP 85043C Cabinet

In Drawer of System Cabinet:
HP V281A adapters (2)
Test port combiners (2)

Software required to run HP85109C.

1. HP 8510C operating System Disk (must be revision C.06.00 or later. HP part number 085101—80113)

2. HP 85109C on—wafer Automation software disk Rev.C.01.00 loaded into Controller disk drive. (HP part number 85109—10009).

3. HP 9000 Series 200 or 300 computer to do Per—formance Verification and System Configuration/control.

4. Basic 5.00 or higher.

5. Bin files: Graph, 10, Mat, Ms Err, C580, HP—IB,CRTA, CRTB, and Complex.

6. 3 mega bytes of memory.

CAUTION

The cabinet fans may be permanently damaged if a 120V system is plugged into a 230V ac power outlet. The cabinet fans are wired for either 120V or 230V, but not both, therefore, a system wired for 120V operation cannot be switched to 230V operation simply by changing individual instrument voltage selection switches, because in this case the fans are only 120V.

WARRANTY

The HP 85109 On—wafer Network Analyzer system carries a one year on—site warranty. If instruments are ordered separately, such as the HP 85104A and 85105A, they carry the same warranty as long as they are used in an HP 8510 system.

cable002

Figure 1-2.

Multiple Source Operating Frequencies

Table 1-1. *Multiple Source Operating Frequencies for Highband Operation*

	Values		Frequency		Values		Frequency	
	Multi.	Offset Freq. (GHz)	Start (GHz)	Stop[1] (GHz)	Multi.	Offset Freq. GHz	Start GHz	Stop GHz
Source #1	1/4	0.000000000	50.0	65	1/6	0.00000000	75	110
Source #2	1/14	0.020000000	50.0	65	1/18	0.0200000	75	110

1 The stop frequency is 75 GHz without the combiner attached.

Receiver: Constant Frequency = 0.020000000 GHz.

Hardware States

Table 1-2. *Hardware States Specific to the HP 85109C System*

System Parameter	Frequency Range 45 MHz to 50 GHz	Frequency Range 50 to 75 GHz or with Option 110, 75 GHz to 110 GHz
System Phaselock	Int.	None[1]
Multi. Source	Off	On
Leveling Source #1	Int.	Ext.
Leveling Source #2	Int.	Int.

1 System must be set to "external" if the source is an HP 8350B.

Instrument States

Table 1-3. *Instrument States Specific to the HP 85109C System*

System Parameter	Frequency Range 45 MHz to 50 GHz	Frequency Range 50 to 75 GHz	or with Option 110, 75 tp 110 GHz	Unit
Power Source #1[1,2]	+10	−25	−30	dBm
Power Source #2[1,2]	N/A	+3	+3	dBm
Z_0	50	50[3]	1	Ohm
Delay	Coaxial Delay	Coaxial Delay	Waveguide Delay	

1 Leave the power levels at the default settings unless an "IF overload" error is displayed. Reduce the RF power in the affected band to correct the "IF overload".

2 HP 85109C in stepmode always.

3 Z_0 set to one Ohm during any waveguide test port connector measurements.

Note

Do not press (PRESET) key on the HP 8510 for instrument states may be changed.

Some general hardware states required for HP 85109C.

(STIMULAS) (STEP), (FORMAT) (Log Mag), (RESPONSE) (Averaging on/restart) 16, (SYSTEM) (MORE) (System PhaseLock) (Step type normal) (Lock Speed Normal)

(CAL) CAL1 WR-15 (CAL2) 2.4 mm A.2

(DOMAIN) FREQUENCY (DISPLAY) DATA & MEMORIES DISPLAY DATA

(MARKER) (MARKER1)

Hint

After loading all the previous hardware and instrument states please save them by doing a machine dump to a disk.

Load and Run the System Software

If you have not already done so, do the following procedure:

1. Load HP BASIC 5.0 or higher into the external controller prior to running the HP 85109C system software.

2. Operating System (HP part number 85101-80113) Rev. C.06.00 or later must be loaded into the HP 8510C disc drive.

3. Insert the HP 85109C system software disk (HP part number 85109-10009) in the external default disk drive.

4. Type:*load "HP 85109C"*, then press (RETURN/ENTER). The program takes about 45 seconds to load. This program provides configuration, calibration and operating system software for the HP 85109C.

5. Type:*run* press (RETURN/ENTER). The program displays a copyright screen.

6. Press (RETURN/ENTER) to clear this screen and enter the HP 85109C software program after initializing the system; about one minute.

```
                    HP 85109C System Software Main Menu
    Config        :    Choose measurement configuration.

    Stimulus      :    Enter HP 85109C source setup parameters.

    Calibrate     :    Calibrate the measurement system over the current freq. range.

    Bias          :    Set bias supply choice and bias settings for measurement.

    Lowband       :    Set the HP 85109C to the Lowband portion (below 50 GHz)
                       of the current frequency range.

    Highband      :    Set the HP 85109C to the Highband portion (above 50 GHz)
                       of the current frequency range.

    Measure       :    Trigger a measurement over the current frequency range.

         Make selection from softkeys below

  | Config | Stimulus | Cali-  | Bias |   | Lowband | Highband |   | Measure |
  |        |          | brate  |      |   |         |          |   |         |
```

menscrn_d

Figure 1-3. HP 85109C Main Menu Screen

Config Softkey and Menu Organization

Use the config softkey to select the desired configuration for your system. The Config Menu has four selections.

Using the Config Menu

Note	After making your choice you must select the frequency range under the stimulus menu and also calibrate over this range. (ie) combind and require you to change the frequency to 45 MHz - 65 GHz.

- *Lowband* allows you to calibrate and test from 0.045 GHz to 50 GHz.
- *Combined* allows you to calibrate and test from 0.045 GHz to 62.5 GHz, on-wafer. For device measurements, no probes used, you can test from 0.045 GHz to 65 GHz.
- *V-Band* allows you to calibrate and test from 50 GHz to 75 GHz.
- *W-Band* allows you to calibrate and test from 75 to 110 GHz, provided you have installed the HP W85104A test set modules.
- Press OK to accept the choices made. Select Cancel to cancel changes made to the configuration settings.

Stimulus Softkey and Menu Organization

- Use the `Stimulus` softkey to select the desired power level, frequency range, step attenuation, and number of points of your system. The Stimulus Menu has five sections. Instructions are listed on the left-hand side of the screen. They explain how to operate the sofware within the Stimulus Screen.
- For 45 MHz to 62.5 GHz, on-wafer, or 65 GHz for device testing, use the combined coaxial configuration.
- For 50 GHz to 75 GHz, use the waveguide configuration.
- Or with Option 110 for 75 GHz to 110 GHz, use the waveguide configuraiton.

HP 85109C On-Wafer System Options

Option 002, deletes the HP 8350B/83540A sweep oscillator, and adds on HP 83621Asynthesized source as the LO source. Option 110 adds W85104A/W85104 Option K10.

Combined coaxial waveguide configuraiton (Frequencies 45 MHz to 65 GHz): Use this configuraiton to make measurements over the 45 MHz to 65 GHz frequency range. The system uses two test sets to cover this broad range. A coaxial test set for 45 MHz to 50 GHz and a waveguide test set for 50 GHz to 75 GHz coverage. Low loss test port combiners combine the signals from each test set to provide a single connection (through wafer probes) to on-wafer devices, up to 65 GHz.

The system software (program: HP 85109C) automatically switches test sets, downloads combined calibration error corrections, and sends measurement data back to the network analyzer to be displayed over the full 45 MHz to 62.5 GHz frequency range.

HP 8510

HP 83651A

HP 8517A/B

HP 85104A K09

HP 85105A

HP 8350B/
HP 83540A

V85104A K10
1mm Adapter
Kit (V—Band)*

HP 92214C System Table

*Opt 110 adds W85104A K10
1mm Adapter Kit (W—Band)
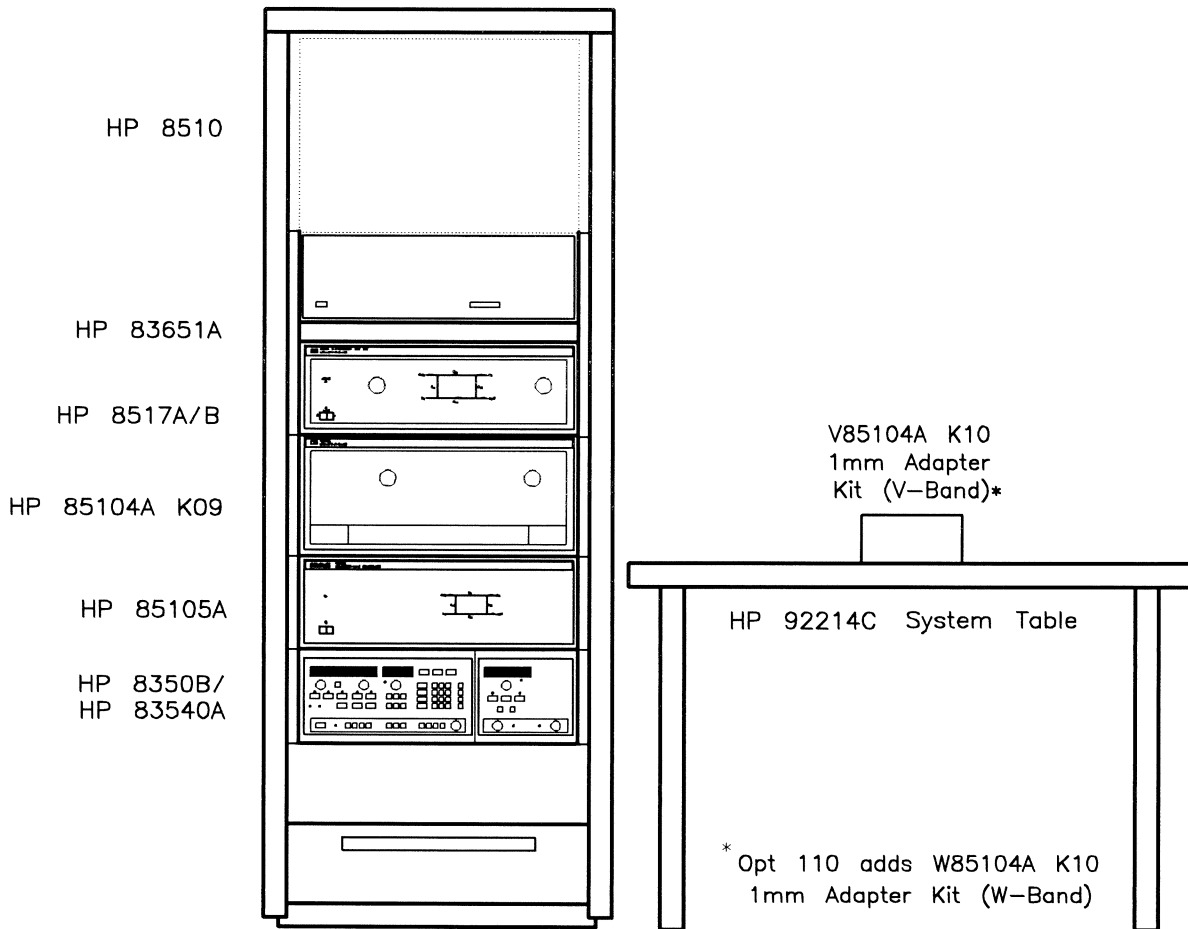
onwafer_d
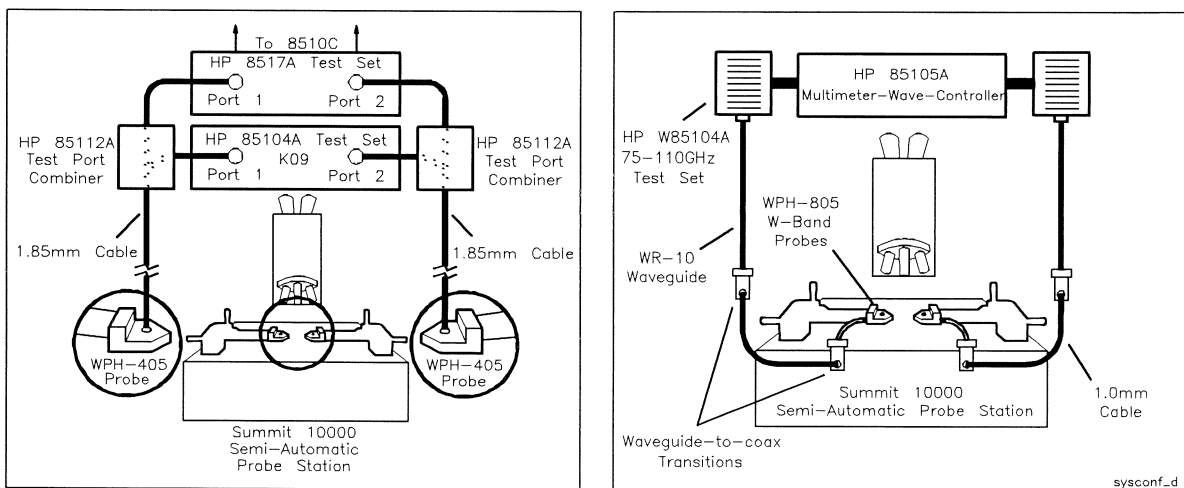
Figure 1-4.

Figure 1-5. System Configuration for wafer probing to 62.5 GHz

HP 85112A Test Port combiner
HP V281A adapter (2 ea. shipped in the drawer of system cabinet).

CONNECT TEST PORT CABLES TO PORT 3 OF THE COMBINERS.

It is important that these test port cables be bent as little as possible.
18" 85109-20003 (2)
22" 85109-20004 (2)

TEST PORT CABLES (TO PROBE HEADS)
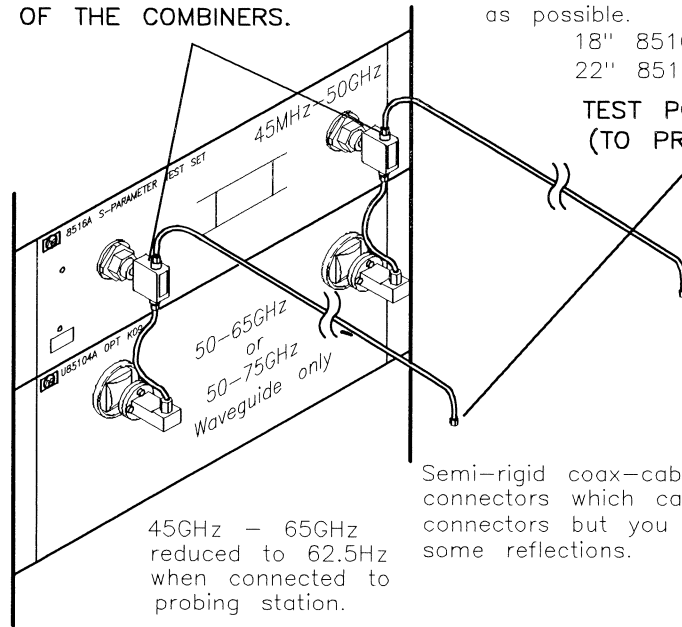
Semi-rigid coax-cables have 1.85mm connectors which can mate to 2.4mm connectors but you will experience some reflections.

45GHz — 65GHz reduced to 62.5Hz when connected to probing station.

50-65GHz or 50-75GHz Waveguide only

tpretcab_d

Figure 1-6. System configuration for wafer probing in W-Band

System Overview

The HP 85109C on-wafer network analyzer system allows you to make s-parameter measurements over the 45 MHz to 110 GHz frequency range. The system can be configured in two configurations. One is called the combined coxial configuration and the other is the wave-guide configuration.

Combined Coaxial Waveguide Configuration (frequencies 45 MHz to 65 GHz)

This configuration is capable of making measurements over the 45 MHz to 62.5 GHz frequency range. The system uses two test sets to cover this broad range. A coaxial test set for 45 MHz to 50 GHz and a waveguide test set for 50 to 75 GHz coverage. Low loss test port combiners combine the signals from each test set to provide a single connection (through wafer probes) to on-wafer devices up to 62.5 GHz.
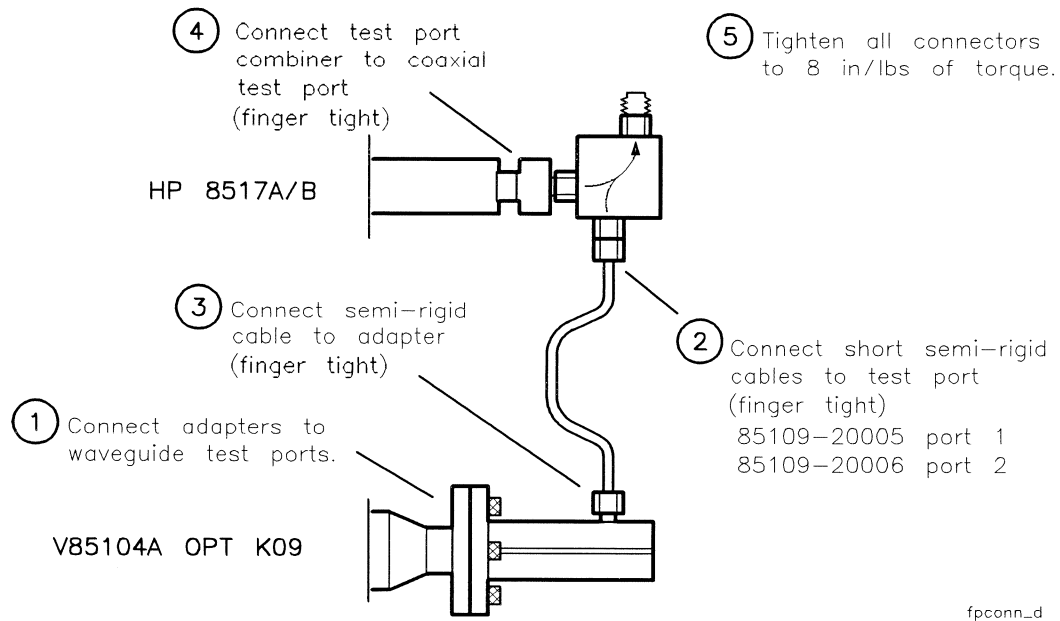
Figure 1-7.

Waveguide Configuration

The HP 85109C uses its waveguide test set modules connected to the probes through a V-band 1 mm adapter kit. The adapter kit consists of four V-band to 1 mm adapters and two cables with 1mm connector on each end(V85104A K10 1 mm adapter kit (V-band). There is a similar W-band kit.

This configuration is capable of making measurements over the 50 to 110 GHz frequency range. The system was the waveguide test set modules V and W bands connected to the probes through WR-15 or WR-10 waveguide.

The system software (program: HP 85109C on-wafer automation software disk (HP part number 85109-10009 Rev.C.01.00) is used to configure and control the HP 85109C system via controller. This software is used in conjunction with the HP 85101C operating system firmware. This system software cordinates the operation of the measurement system by controlling the stimulas.

The test port combiner enables an HP 8510 System to provide a single RF connection to a device under test from 0.045 to 65 GHz. In the HP 85109 On-wafer system, for example, the test port combiner combines the RF test ports from the two test sets used in the system. Through its DC-to-50 GHz input, the combiner also provides a DC path for biasing on-wafer devices.

PORT 1

DC-50 GHz

1.0W MAX
Made in U.S.A

50-65 GHz

PORT 2

DC-65 GHz

PORT 3

hp HEWLETT
PACKARD

85112A
TEST PORT COMBINER
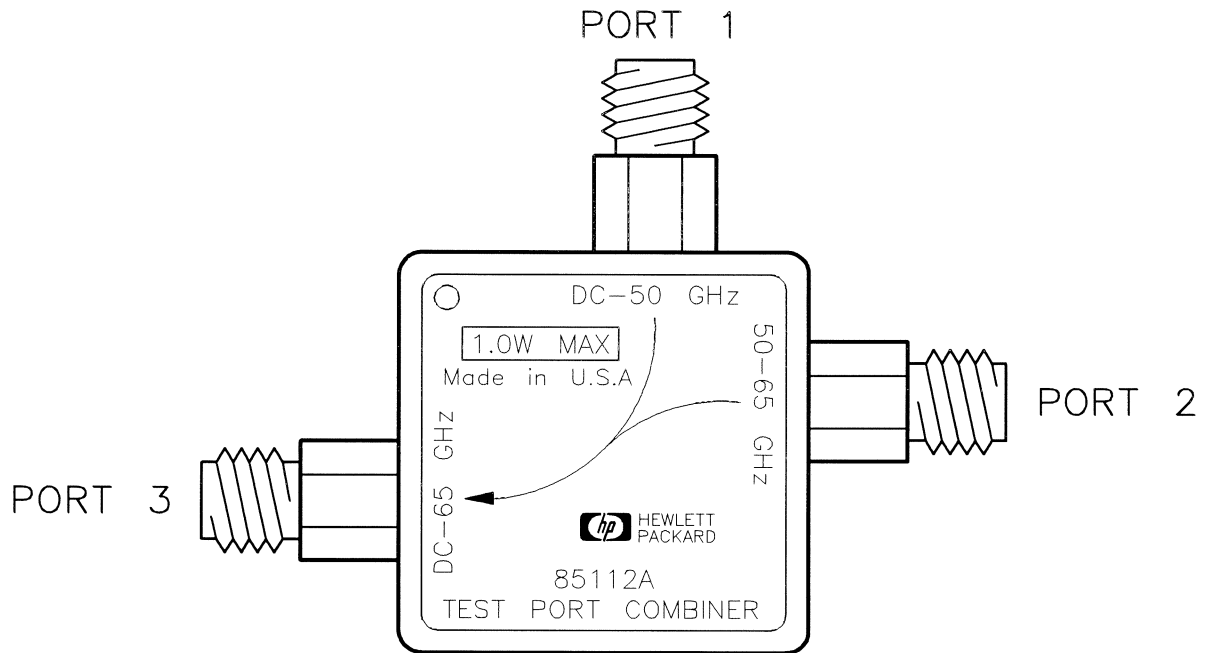
tpcomb_d

Figure 1-8. Test Port Combiner

Typical Performance Characteristics

The characteristics below are intended to provide information useful in applying the combiner by giving typical but non-warranted performance parameters. They are not specifications.

Table 1-4.

Port Number	Frequency Range (GHz)	Connector Type	Port Match		Insertion Loss to Port 3	
			DC to 50 GHz	40 MHz to 65 GHz	DC to 50 GHz	40 MHz to 65 GHz
1	DC to 50 Input	2.4 mm(f)	9.7 dB	—	3.5 dB	—
2	40 to 65 Input	1.85 mm (f)	—	6.8 dB	—	5.5 dB
3	DC to 65 Output	1.85 mm (f)	14.0 dB	10.0 dB	—	—

Pin Depth (all three ports)	0.0001 to 0.00022 inch (0.0025 to 0.0056 mm)
Maximum Power	1W
DC Current Limit	2A
DC Voltage Limit	100V
DC Series Resistance of Bias Path	Typically 1Ω
Dimensions	2.5 cm x 3.0 cm x 1.3 cm
Weight	71g (2.5 oz)

Service

Return all test port combiners to Hewlett-Packard for service or replacement. The replacement part number for the HP 85112A Test Port Combiner is 85109-60002.

Hint   Hewlett-Packard 2.4 mm gauges are compatible with 1.85 mm connectors.

Install/Remove Test Setup Modules

HP V85104A K09 (Cabinet with 2 V Band Source Modules)=Garage

HP 85104A H09 mm Wave Test Set

③ Connect 2 HP V896B 5cm WR-15 waveguide precision sections.

HP 85104A K09 50-75GHz S-Parameter Test Set

Port 1 +27dBm Max

Port 2 +27dBm Max

① To remove front panel, use fingers to loosen 6 fasteners.

teflon slides

Module stop plate

Retainer Brackets (2)

④ Remove or install the two module retaining brackets using #10 torx driver

RF/LO CABLE PORT 2

HP 8517A (ADDRESS 20) Test Set

HP V85104A K09 mm wave test set/modules

HP 85105A Opt Q50 & 04 (ADDRESS 21) mm wave test set/controller

HP 83621A LO SOURCE (ADDRESS 18) (Analyzer) (Language)

RF INPUT

.5V/GHz ALC OUT

PORT 2 PORT 1

LO RF

LO INPUT

RF OUTPUT

10MHz OUT

SWITCH BUS RF INPUT TEST SET INTERCONNECT TEST SET INTERCONNECT

⑤ Connect module interface cables to the port 1 & 2 module interface connectors on rear of HP 85105A as shown.

Note: RF/LO cable radius must be > 4cm (1.5 in) to avoid damage.

Retaining brackets for cables

⑥ Leveling screws raised enough to allow modules to rest on there teflon slides shown in above drawing. 4 places.

② Connect or remove cables (8 in/lbs of torque).

⑦ Gently route the module RF/LO cables as shown. Loosen or tighten retaining bracket hardware and right angle RF/LO connectors etc. as needed to assemble as shown. Tighten all RF connectors to 8 in/1bs

LO

RF

PORT 1

nylon cable clamp

Port 1 cable

nylon cable clamp

LO

RF

PORT 2

instrem_d

Figure 1-9.

Waveguide Configuration

1. Remove Front Panel of V85104A—K09

2. Guide the W band Module Interface cables (Lo/RF and IF Cables through space between the top of the V band modules.

3. Connect module interconnect cables to the port 1 & 2 module connector on rear panel of HP 85105A mm wave controller.

4. Connect Lo and RF cables as shown.

HP W85104A H08 or Standard   (c) Waveguide Configurations   HP W85104A H08 or Standard
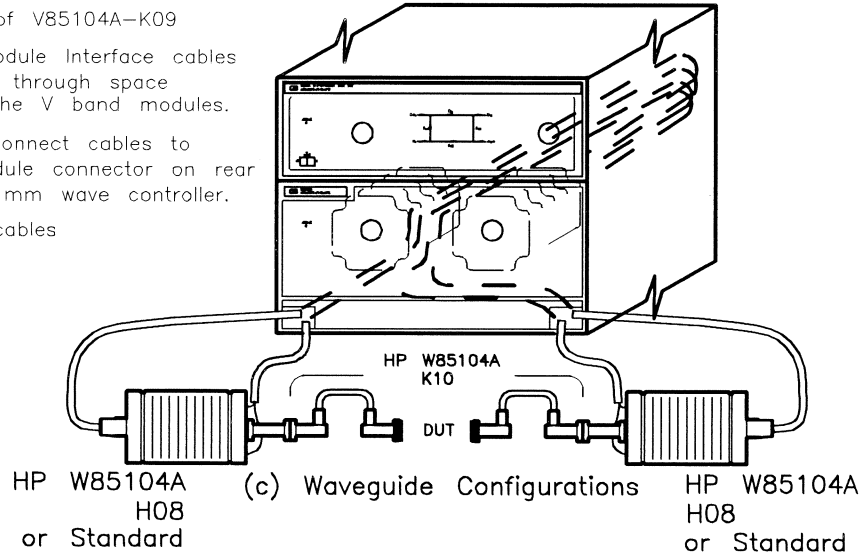
wgconfig_d

Figure 1-10. Waveguide Configurations
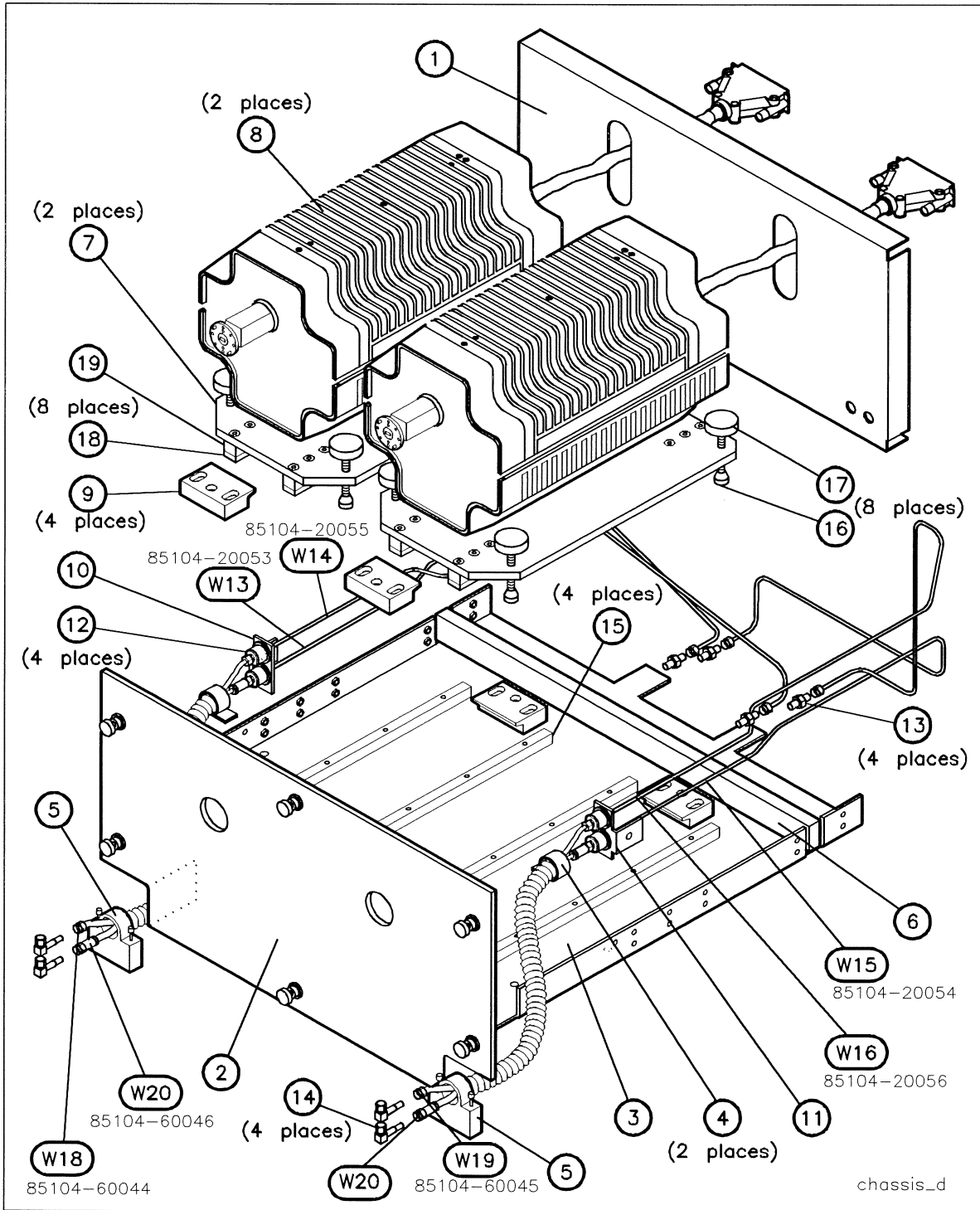
Figure 1-11. HP V85104A Option K09 Replaceable Parts - Instrument Chassis

Install the Bias Supply (for the combined coaxial configuration)

This section covers installation of the HP 414X series bias supplies and the HP 6626A bias supply. Refer to the instructions that apply to your bias supply.

Using the HP 414X Series Bias Supplies

Connections for all the HP 414x-series instruments are similar. Bias power is supplied to the test set from source monitor units (SMUs) 1 and 2 on the bias supply. Computer control is over the HP-IB bus.

The HP-IB address of these supplies should be set to 12.

If the bias supply is an HP 4145B semiconductor parameter analyzer, you must install the shorting connector (HP part number 04145-61623) shipped with the instrument.

Cables

You need two triaxial-tocoaxial BNC cables, HP part number 85014-60002, to connect the bias supply to the coaxial test set. The SMUs on the 414x-series instruments have triaxial connectors. The bias inputs on the test sets (and the HP 11635A bias decoupling network) have coaxial BNC connectors.

If you are using an HP 11635A bias decoupling netowrk, you need one BNC-to-BNC cable to connect the output of the decoupling network to the Port 1 Bias input on the test set. The HP 11635A is connected in the line that supplies bias power to the port 1 bias input on the rear panel of the test set.

REAR VIEW
HP 4145B
SEMICONDUCTOR
PARAMETER ANALYZER

SMU1 ①

SMU2 ③

To 16058A ⑥
Test Fixture

HP 11635A
BIAS DECOUPLING
NETWORK

Bias Input ④

Bias Output ⑤

HP 11635 BIAS DECOUPLING NETWORK

BIAS MONITOR   BIAS MONITOR   BIAS OUTPUT

BIAS INPUT   BIAS OUTPUT   BIAS INPUT   BIAS INPUT

LOW CAPACITANCE   HIGH CAPACITANCE
SUPPLY   SUPPLY

BIPOLAR TRANSISTOR BASE ONLY
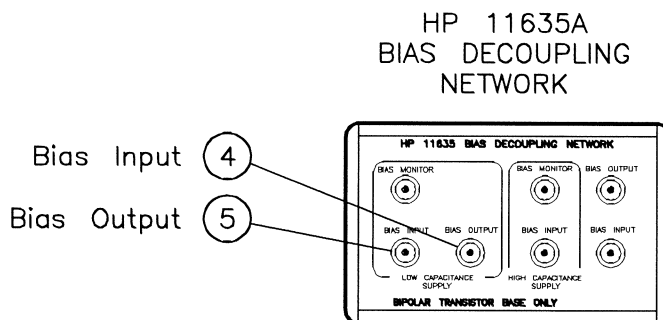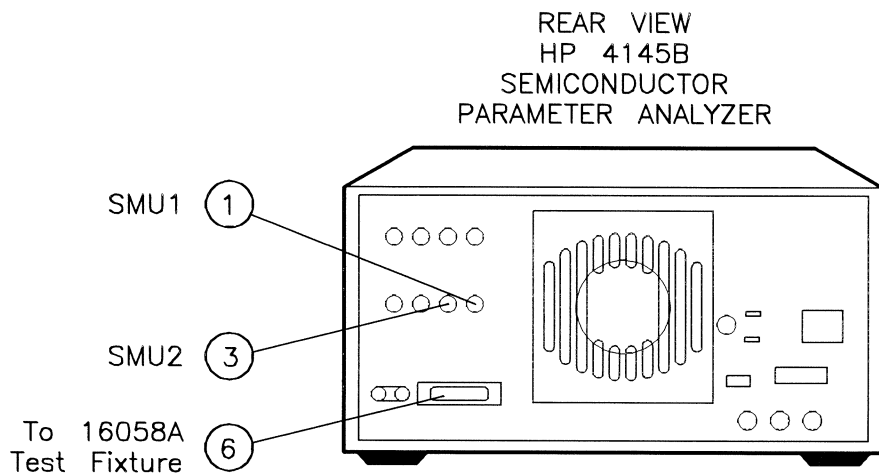
rview_d

Figure 1-12.

Using the HP 6626A bias Supply

You will need an HP 14852A bias cable to connect the HP 6626A bias supply to the microwave test set.

Install the HP 14852A Bias Cable

Warning	The outer connection on each BNC is not connected to ground. Be careful that this point does not reach more than 50 volts DC. Failure to do so can result in damage to the equipment and personal shock hazard.

1. Remove the sense jumpers shipped installed on the HP 6626A terminals before you install the HP 14852A bias cable.
2. Connect the bias cable to the power supply as follows:
   a. Attach each RED wire to the corresponding output's "+" (plus) OUT.
   b. Attach each RED/WHITE wire to the corresponding output's "+")plus) SENSE.
   c. Attach each BLUE wire tothe corresponding output's "−" (minus) OUT.
   d. Attach each BLUE/WHITE wire to the corresponding output's "−" (minus) SENSE.

Figure 1-13 shows a schematic of the HP 14852A bias cable.

Connect the Bias Supply to the S-parameter Test Set

1. Place the power supply near the system.
2. Connect the bias cable to the coaxial S-parameter test.

You need two BNC male-to-male cables (HP 10502A, 9 inches long) to make this connection.
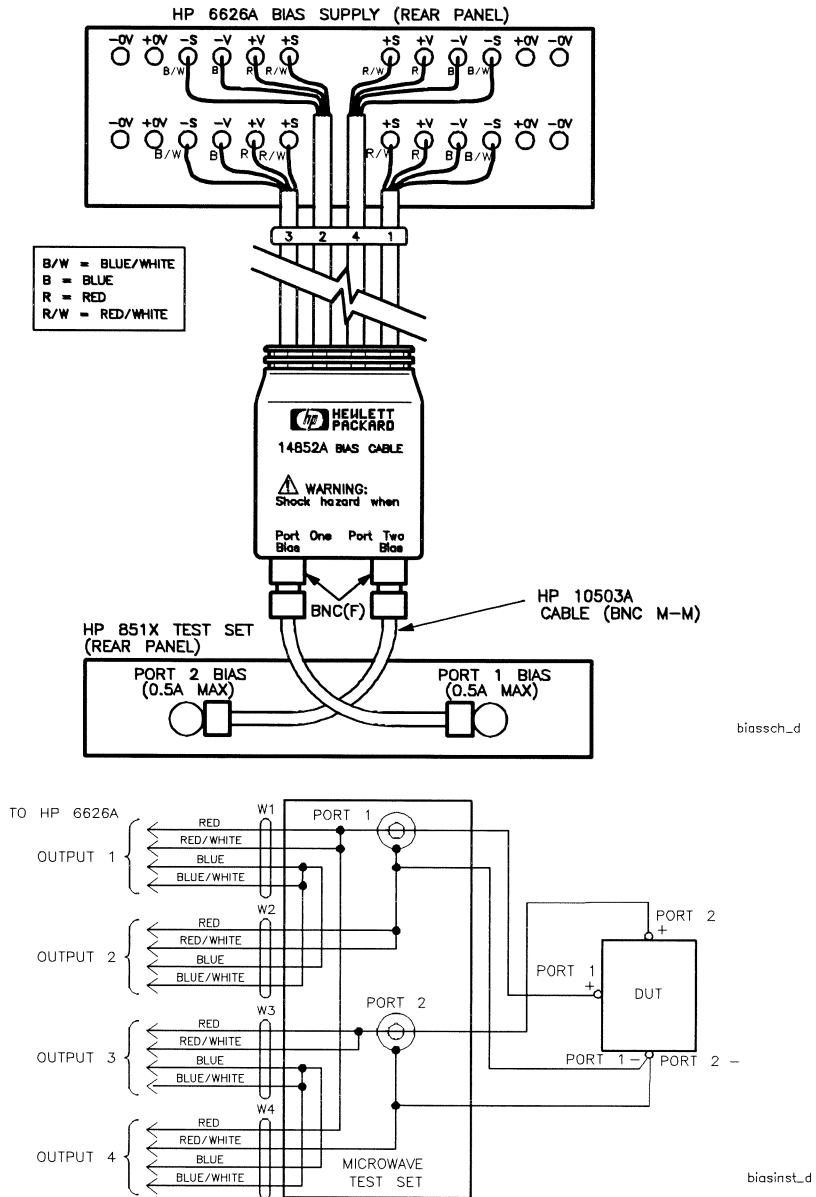
Figure 1-13. Bias Cable Schematic
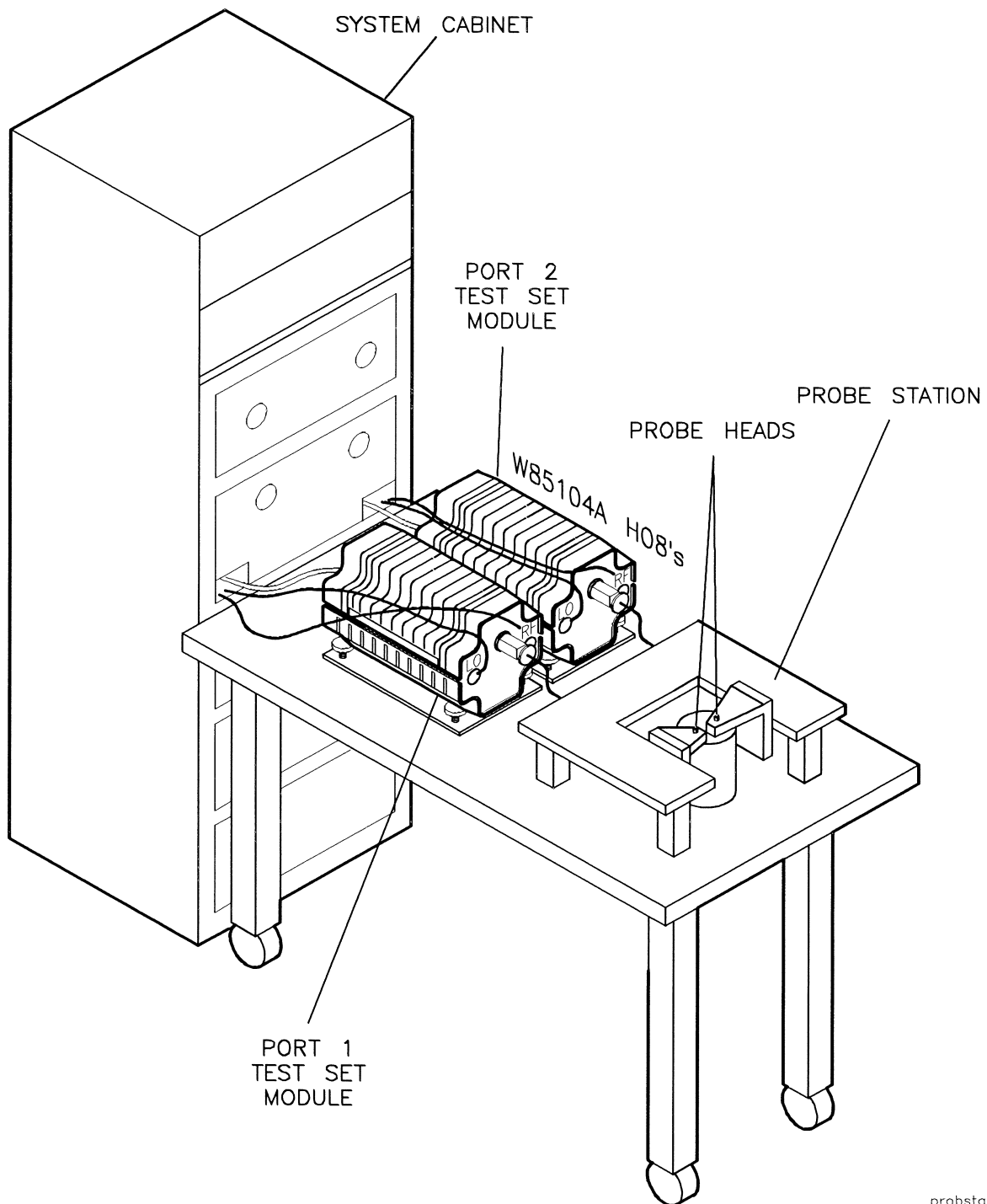
Figure 1-14. Probe Station Installation for Waveguide Configuration

SYSTEM CABINET

PORT 2
TEST SET
MODULE

PROBE STATION

PROBE HEADS

W85104A H08's

PORT 1
TEST SET
MODULE

probsta_d

PORT 1
MODULE

PORT 2
MODULE

TOP VIEW

WR—15 WAVEGUIDE (2)
30cm (12 inch) MINIMUM LENGTH

1mm Cables

V85104A K10

CASCADE MICROTECH
WPH—505
50—75 GHz PROBE (2)
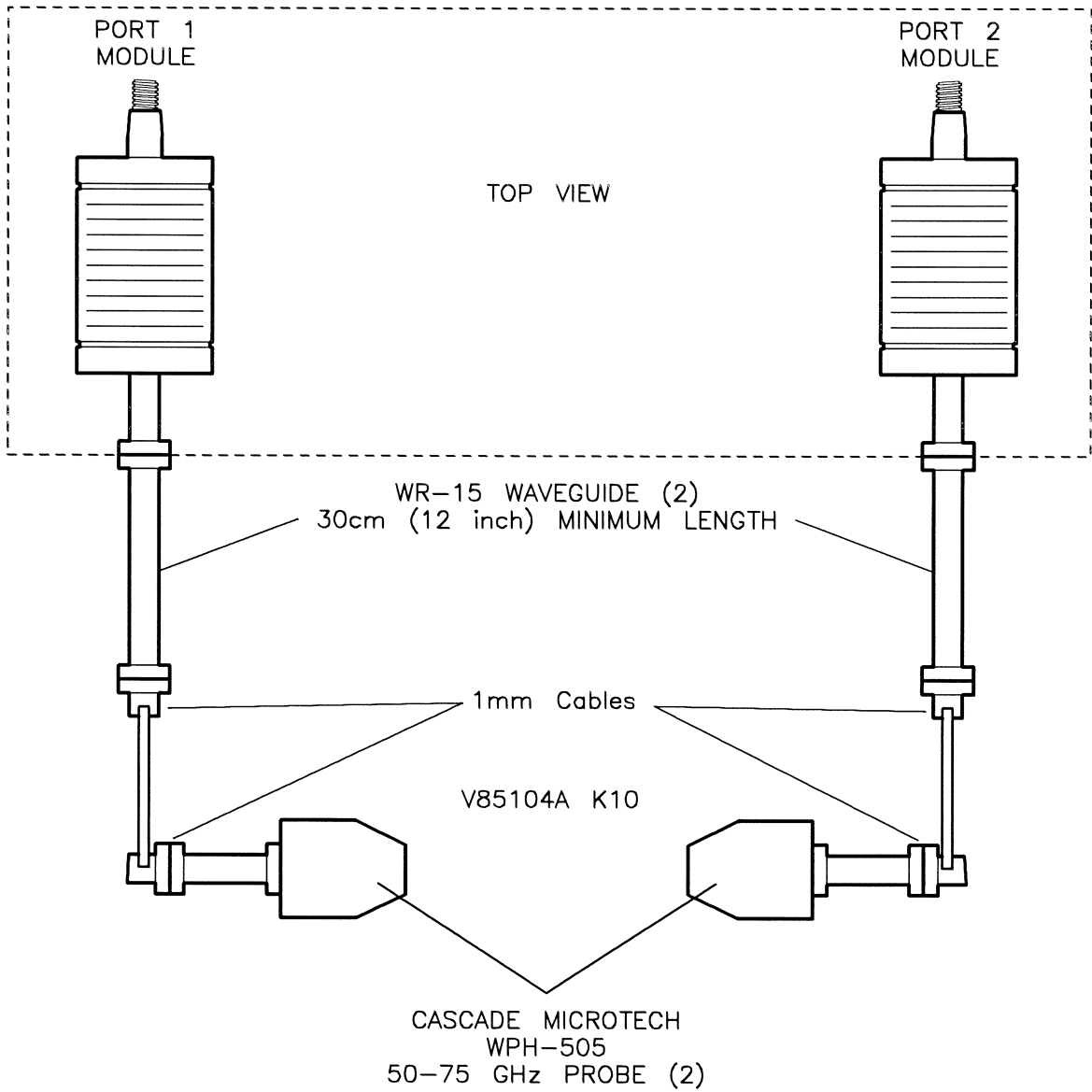
wgconn_d

Figure 1-15. Waveguide Connections for Test Points to Probes

Operator's Check

The operators check *must* be done before doing performance verification.

A quick operational check may be performed by measuring the power levels of the HP 8510 User parameters a_1, b_1, a_2, and b_2. Observing the appropriate levels listed in Table 1-5 gives the user a high level of confidence that the system is operating properly, and will pass the system performance verification.

The following measurements show the approximate RF signal levels incident at the first frequency conversion stage in dBm.

Do not increase source #1 power or connect a device with gain such that greater the -13 dBm is shown in these measurements. Greater than about -10 dBm will result in mixer compression errors, and greater than $+27$ dBm will probably damage the first frequency conversion stage. System specifications apply only when the source #1 power is set as listed in Table 1-5.

1. Turn Averaging off (if not you will be dividing by zero, which is undefined).
2. Press PARAMETER (MENU) then USER 1 a1 . The forward reference signal path power level is displayed. The power level should be approximately as indicated in Table 1-5.
3. Connect a short to test port 1. Select USER 4 b1 . The forward reflection signal path power level is displayed. The power level should be approximately as indicated in Table 1-5.
4. In order to measure the reverse reference signal paths the parameter must be redefined.

For a2 press:

a. PARAMETER (MENU)
b. USER 3 a2
c. REDEFINE PARAMETERS
d. DRIVE DRIVE:PORT2
e. PHASE LOCK LOCK TO a2
f. REDEFINE DONE

For b2 press:

a. PARAMETER (MENU)
b. USER 2 b2
c. REDEFINE PARAMETERS
d. DRIVE DRIVE:PORT2
e. PHASE LOCK LOCK TO a2
f. REDEFINE DONE

Note   For both a2 and b2 procedures connect a short to test port 2 for best results.

Table 1-5. *Typical Power Levels for Operational Check of the mm-wave System*

		Raw Channel Power ±5 dB	Coax System
Freq Range Ghz	50 to 75	75 to 110	045 to 50 GHz
Band	V (WR-15)	W (WR-10)	Coax
a_1	−26	−27	−15 to −35
b_1	−27	−28	−15 to −35
a_2	−26	−27	−15 to −35
b_2	−27	−28	−15 to −35
Source 1 RF	−25	−30	+10
Source 2 LO	+3	+3	N/A

Note   0.1 dB compression, −10 dBm; typical, −13 dBm maximum; damage, +27 dBm.

The maximum power level must not activate the IF OVERLOAD running error message.

The reverse reference signal path signal level is displayed. The power level should be approximately as indicated in Table 1-5.

5. Connect Port 1 and Port 2 together. Select USER 2 b2 REDEFINE PARAMETERS DRIVE DRIVE:PORT1 PHASE LOCK LOCK TO a1 . The forward transmission signal path power level is displayed. The power level should be approximately 2 dB less than what was measured with a short on each test port.

If any of the power levels shown in Table 1-5 are not observed (approximately ±5 dB), consult the "Service and Troubleshooting" paragraphs in this Quick Reference Guide. See the following for a graphic representation of Table 1-5.

HP 85109C User Channel Traces with Shorts Connected to port 1 and port 2.
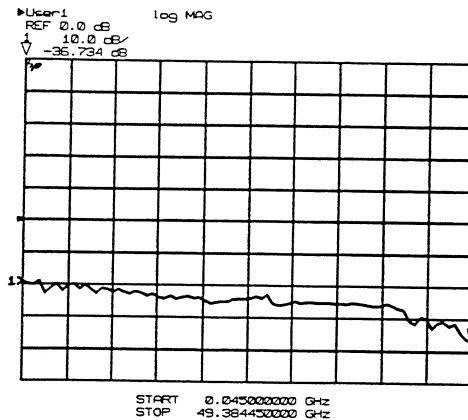
Figure 1-16. *Lowband a1/a2 Combined*
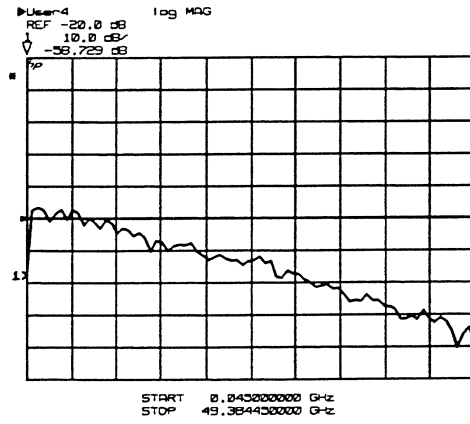
Figure 1-17. *Lowband b1/b2 Combined*
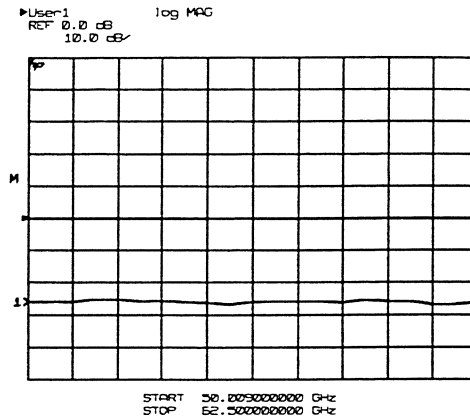
Figure 1-18. *Highband a1/a2 Combined*
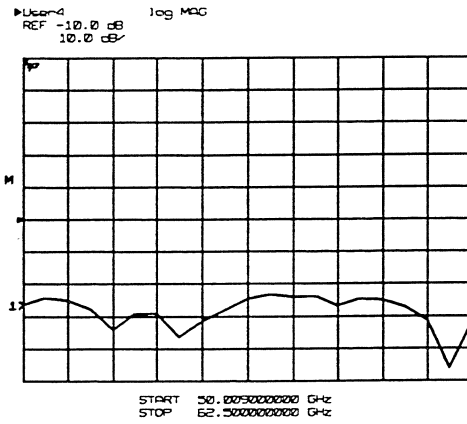
Figure 1-19. *Highband b1/b2 Combined*
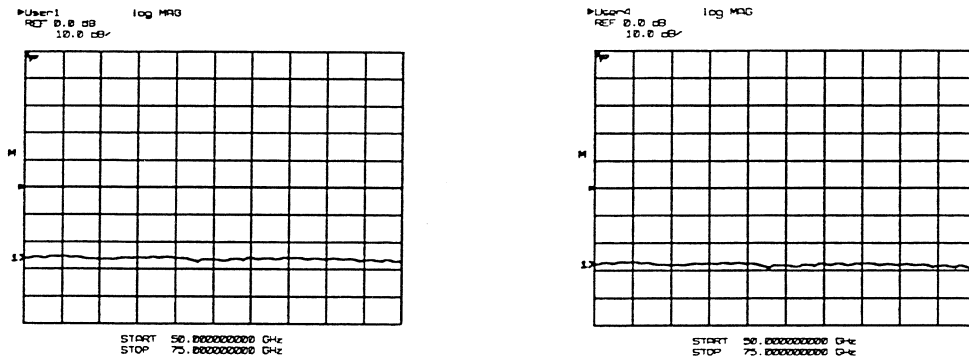
Figure 1-20. *V-Band Waveguide a1/a2 and b1/b2*
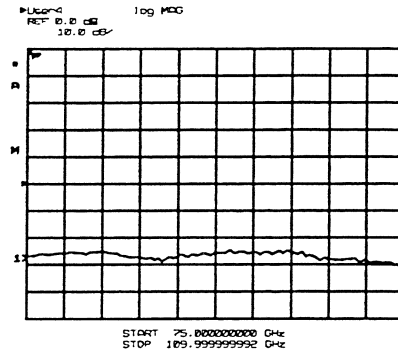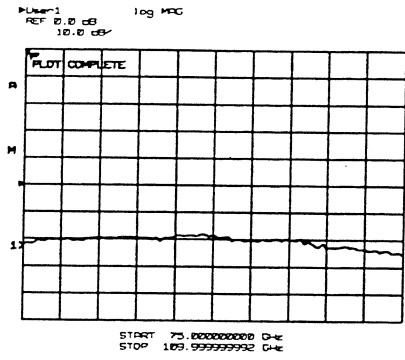
Figure 1-21. *W-Band Waveguide a1/a2 and b1/b2*

2

Making Adjustments

See the HP 8510C *Quick Reference Guide*(part number 08510-90317) for the procedure for these adjustments if needed.

1. Vertical Alignment Adjustment

2. Degaussing (Demagnetizing) the Display

3. HP 8350B/Plug-ins Front Panel FREQ CAL

4. HP 8360 Series Sources Full User CAL

5. Trim Sweep

Performance Verification

Recommended Performance Verification Cycle

The recommended performance verification cycle for the HP 85109 system is once a year initially, or always after the system is repaired or installed (the Performace verification is included as part of the HP 85109C installation). You can very the once a year cycle time depending on the results of your performance verification. Additionally, perform a frequency test every year (or after repair) on all HP 8340 series and HP 8360 series sources. Refer to this section for the frequency test procedures.

Note   Performance Verification is included as part of the HP 85109C installation.

Specifications (part of the performance verification software)

Note   No system or HP 85109C system software required for specifications.

The HP 8510 Specifications and Performance Verification software (HP part number 08510-10033 Rev.03.02 or greater) allows you to generate system specifications and measurement uncertainties after the system configuration and type of calibration kit have been entered into the above program. Generating system specifications and uncertainties is optional.

Performance Verification

You can verify your system in any of the following configurations.

Figure 3-1, through Figure 3-3, illustrate the different configurations.

- **Lowband** from 45 MHz to 50 GHz (not illustrated).
- **Combined** From 45 MHz to 62.5 GHz, on-wafer (or 65 GHz for device measurements), see Figure 3-1.
- **V-Band** from 50 to 75 GHz, see Figure 3-2 (which is using the V85104A H08 module).
- **W-Band** from 75 to 110 GHz, see Figure 3-2 (which is using the W85104A H08 module).

For a complete performance verification done upon installation you must perform verification on all the bands, (an example is combined V and W configurations for option 110). Hewlett–Packard gives 8 hours as part of your installation.

Performance Verification Procedure

1. Disconnecting the probe station, leaving the test port combiners HP 85112A attached.
2. Supporting the calibration and verification standards (using table).
3. Connect the computer and warm up the system (one hour).
4. Loading BASIC and BIN files. (BASIC 5.0 or greater. 5.0 has BIN files; type List Bin to see them)
5. Load/run the HP 85109C system software (HP part number 85109-10009)
6. Load/run the performance verification software (HP part number 08510-10033 Rev 03.02 or greater).
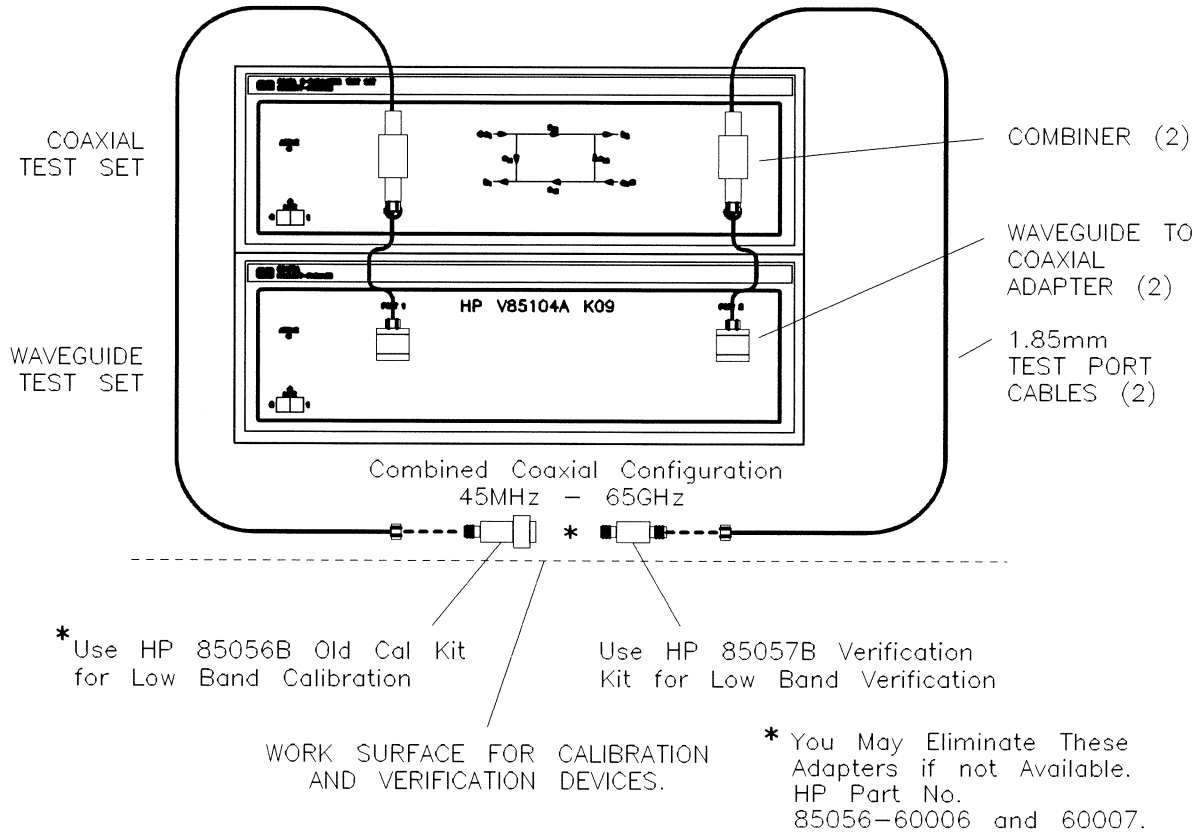
Figure 3-1. Combined Coaxial Configuration for 45 MHz to 50 GHz Lowband Calibrations

(c) Waveguide Configurations
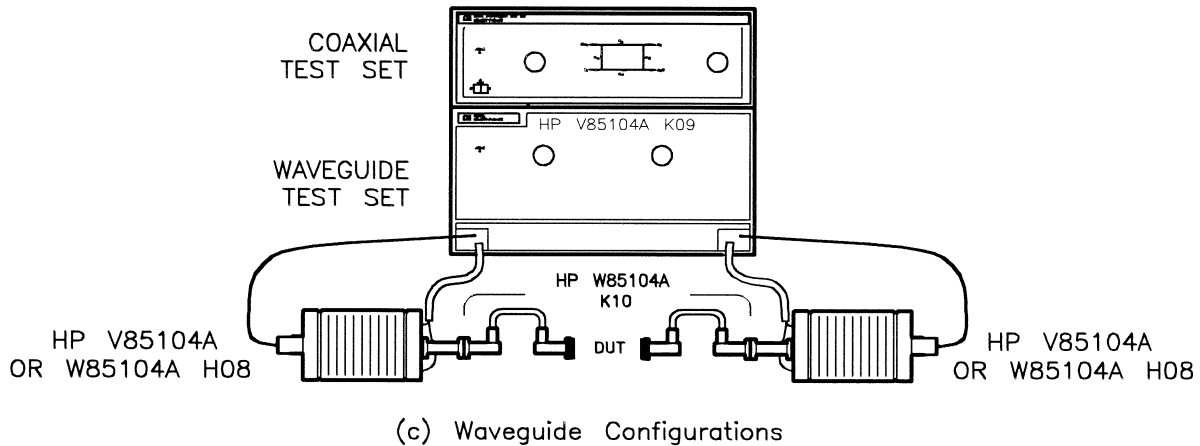
wcforvw_d

Figure 3-2. Combined Coaxial Configuration for 50 GHz to 75 GHz Highband Calibrations

Combined coaxial

Figure 3-1 and Figure 3-2 do this performance verification at the ends of the semi-rigid test port return cables using *coaxial* and *waveguide* calibration kits, along with characterized verification standards. This method is valid from 45 MHz to 65 GHz, but is a 2–step process that requires a lowband calibration and verification. This will result in two separate low and high band verification print–outs. The measurement results will be combined in later measurements.

(c) Waveguide Configurations
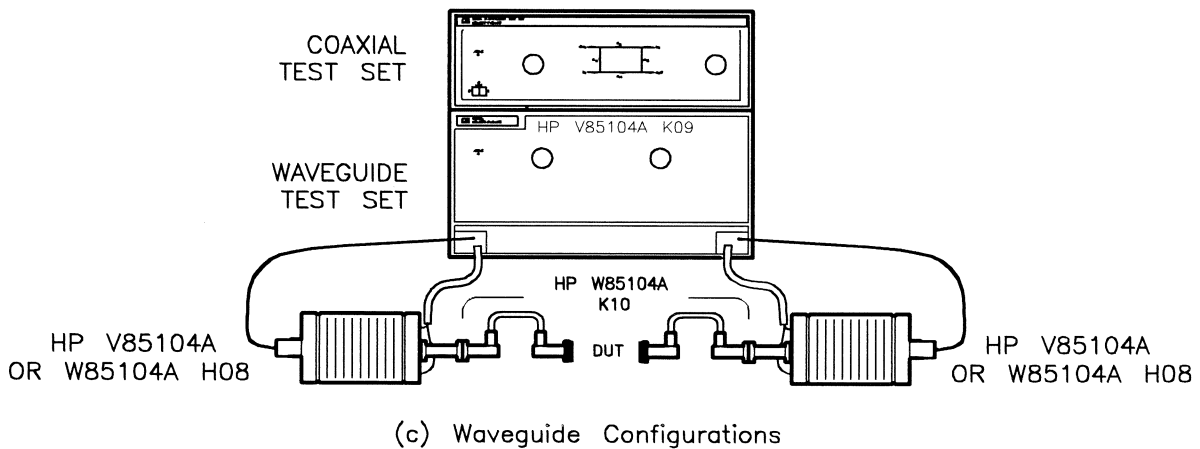
wcforvw_d

Figure 3-3. Waveguide Configurations

V-band or W-Band

Do this performance verification at the end of the 1 mm cables, and adapters in the HP V85104A or HP W85104A K10 kits. The V-band or W-band modules sit on the work table during the procedure. This method verifies the system from 75 to 110 GHz in waveguide (see Figure 3-3.

Using Work-Surface Support

Plane that work surface
must support

DUT

mm—MODULE   V or W   85104A   K10
              1 mm ADAPTER   SET

wsforvw2_d

TEST PORT CABLE

SIDE VIEW OF
SYSTEM CABINET

PLANE THAT WORK SURFACE ≥ 40cm WIDE BY 30cm DEEP
MUST SUPPORT, CABLES, CAL AND VERIFICATION STANDARDS.

wsforvw_d
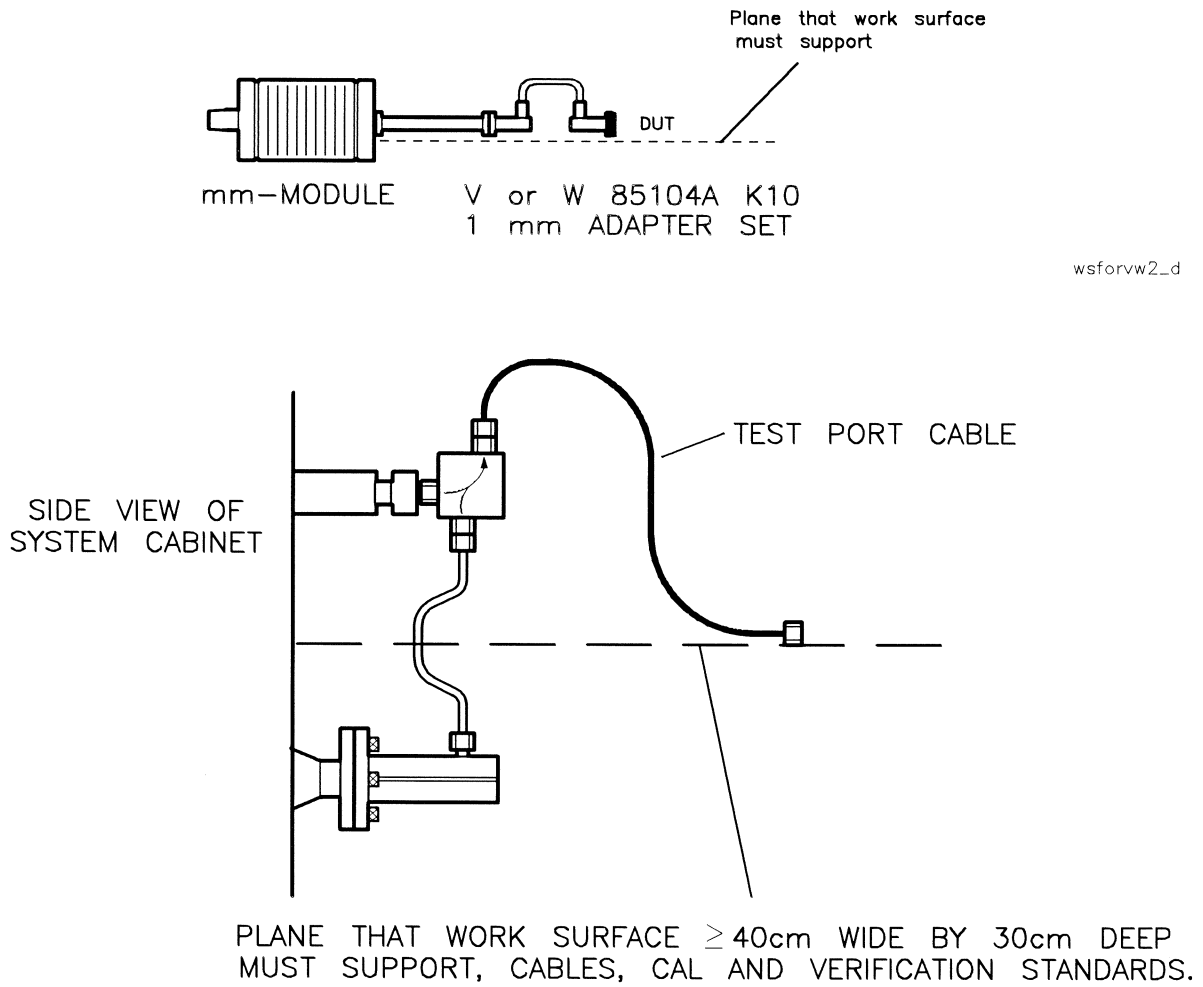
Figure 3-4. Work Surface

Required Equipment

You need the following items to verify the performance of your on-wafer system.

Table 3-1.

Required Equipment	HP Part/Model No.
Computer 3 meg. of memory	HP 9000 series 200 or 300[1,2]
2.4 mm to 2.4 mm Adapters	HP 85056-60006 (85056A)
	HP 85056-60007 (85056A)
Waveguide to coaxial adapter (2 more required) (2 included with HP 85109C)	HP V281A[3]
2.4 mm Calibration Kit	HP 85056A/D
2.4 mm Verification Kit[4]	HP 85057B
WR-15 Calibration Kit	HP V11644A
WR-15 Verification Kit	HP V11645A
WR-10 Calibration Kit	HP W11644A
WR-10 Verification Kit	HP W11645A
WR-15 Verification Kit (for V-Band 50 to 75 GHz)	HP V85104A K10
WR-10 Verificatin Kit (for W-band 75 to 110 GHz)	HP W85104A K10
HP 8510 Specifications and Performance Verification Software (revision A.03.02 or higher)	08510-10033
HP 85109C System Software (revision C.01.00 or higher)	85109-10009
HP BASIC 5.0 or higher (with Language extensions/drivers)	order by name

1 With the addition of either the HP 82300C Measurement Coprocessor or the HP 82324A High Performance Measurement Coprocessor, you can run the specifications and verification software on an HP Vectra personal computer or any AT-compatible computer.

2 The computer or measurement coprocessor must have 3 megabytes of available memory (after HP BASIC has been loaded) to run the performance verification program.

3 Two HP V281A waveguide to coaxial adapters are required to complete the WR-15 portions of the performance verification procedure from 50 to 75 GHz. These adapters are required in addition to the two HP V281A adapters that come as part of the HP 85109 system.

4 The verification kit must be certified to 50 GHz, *not* 40 GHz. If it is not, return it to Hewlett-Packard for recertification.

Generating system Specifications

Specifications for the on-wafer system are generated using the HP 8510 Specification and Performance Verification Software, which is supplied with your system, HP part number 08510-10033 (Rev A.03.02 or higher). To generate specifications for your system, continue with the performance verification procedure and, at the designated time, select SYSTEM SPECS .

Performance Verification Procedure

The following steps apply to both verification procedures; the combined procedure method and waveguide procedure method, using V-band, W-band or both.

Connect the Computer and Warm Up the System

1. Connect the computer HP-IB to the network analyzer HP-IB. Connect a 3.5 inch floppy disk drive to the computer HP-IB and set the disk drive HP-IB address to 0.

2. Turn on the instruments in the network analyzer system (network analyzer last).

3. On the HP 8510, press (SYSTEM) HP-IB CONFIGURE HP-IB use USRS PRESET to reduce the network analyzer preset time and prevent program timeout errors.
   Sources are not continuosly re-preset each time the program presets the HP8510 Instrument and Hardware states.

4. The system requires approximately one hour to stabilize at its operating temperature. Perform the next two steps (load BASIC and BIN files).

Load BASIC and BIN Files

The performance verifications program will run on most HP 9000 series 200 and 300 computers, except for a 9826 because of its limited CRT display. To load HP BASIC, use the following procedure:

1. While the computer is OFF, insert the HP BASIC language system disk in the default drive (typically 0). Then turn the computer ON (Auto start should automatically load the BASIC Software).

2. When BASIC is loaded, the drive LED will go off and a prompt will appear on the computer display: BASIC Ready. Remove the disk.

Note   Later versions of BASIC automatically load the Language Extension and Driver files so you do not have to load them seperately. To see if this has happened you can type "List Bin" to see if these files were loaded.

Load the HP 85109C System Software

Ignore any "beeping" or running error messages on the network analyzer at this time. Insert the HP 85109C System software disk into the default disk drive of the computer.

1. Load the system software:

   Type: LOAD "HP 85109C"

   Press (RETURN/ENTER).

2. To run the program:

   Type: "RUN"

   Press (RETURN/ENTER).

   The copyright screen displays when the program executes.

Press (RETURN/ENTER) to clear the copyright screen and enter the HP 85109C software Main Menu.

3. Select the measurement configuration:

Press `Config`

Press `Lowband` 45 MHz to 50 GHz coax test set configuration.

Press `Combined` 45 MHz to 62.5 GHz on-wafer configuratin, (65 GHz for non-on wafer device measurements).

Press `V-band` 50 to 75 GHz operation, V-band source modules are used.

Press `W-band` 75 GHz to 110 GHz operation W-band source modules are used.

Press `Lowband` for measurements below 50 GHz or `Highband` for measurements above 50 GHz.

Press `OK`

Press `STIMULUS` softkey and select the frequency range, number of points, RF and LO power, attenuator settings, and averaging as instructed on CRT menu. (for example V-band is 50 to 75 GHz, 101 points. RF-25 dBm high LO +3 dBm port 1, 2 atten 0,0 averaging 16).

Press `OK`

4. When the program completes switching to the selected band, press the following keys on the network analyzer to save the instrument state in the "power up" register:

(LOCAL) INSTRUMENT STATE (SAVE)

INST STATE `USER PRESET #8` and "INST STATE SAVED" is displayed.

5. Set the network analyzer to use "user preset" when it receives a preset command over the HP-IB bus, by pressing:

(SYSTEM) `HP-IB configure`

`HP-IB uses USR PRESET`

The network analyzer underlines USR PRESET.

6. To stop the program:

Press (STOP) on the computer keyboard. (Hint: you may want to save these settings on a disk by doing a machine dump).

Type: scratch a

Press (RETURN/ENTER) or (EXECUTE)

The system is now configured for the performance test.

Run the Specifications and Performance Verifications Software

Insert the HP 8510C Specification and Performance Verification Software disk (HP part number 08510-10033 Rev.03.02 or greater) into the default drive or the drive you specify as the MSI (Mass Storage Is). Type "LOAD" and enter the literal filename lable as shown below then press (RETURN/ENTER).

Type: LOAD "SPECS_8510"

Press (RETURN/ENTER)

Type: RUN or press the RUN softkey

Press (RETURN/ENTER)
The program shows the title banner information on the computer display.

Press the RESUME softkey (takes several minutes to load).

Set the time and date.

Press the computer Y key and the program will continue, or press the computer N key for NO and set the date and time.

When your entries are complete, press (RETURN/ENTER).

The program displays the System Hardward Configuration Menu. This menu allows you to select the type of system equipment you will be using during the calibration and performance verification. If your system is in the waveguide configuration, skip ahead to the "Measurement Configuration Performance Verification" section in this manual.

Verifying the Combined Coaxial Configuration HP 85109C 2–Step Process

After you have configured your system, follow the procedure below to verify your system from .045 to 62.5 GHz, through the test port combiner for on-wafer operation (up to 65 GHz for device measurements). This is a 2–step procedure. You must verify 45 MHz to 50 GHz first. Then 50 GHz to 65 GHz second. There is no combined verification mode that covers 45 MHz to 65 GHz.

Coaxial Hardware Configuration

The following list of equipment is used in a typical on-wafer system. The equipment is for the lowband (45 MHz to 50 GHz) portion of the frequency range is as follows:

Network Analyzer:	HP 8510C - Color Model
Test Set:	HP 8517A/B - 2.4 mm S-parameter (45 MHz-50 GHz)
Source:	HP 83651A - Synthesizer (45 MHz-50 GHz)
Calibration Kit:	HP 85056A - 2.4 mm Slotless Standard (Grade)
or	HP 85056D - 2.4 mm Slotless Economy (Grade)
Calibration Technique:	SL - Sliding Load Cal, or BL - Broadband Load Cal (for HP 85056D)
Test Port Cables:	HP 85109C1 - 85112A Combiner and 8517
Verification Kit:	HP 85057B - 2.4 mm

Select the equipment according to the system you plan to verify. The active selection is denoted by a highlighted field on the CRT. Use the NEXT and PREVIOUS keys to change

the selection in the highlighted area, if required. Use the $\boxed{\text{TAB}}$ key to move to the next highlighted field.

Make all the selections necessary until the hardware configuration is correct for your system. Press the softkey labeled DONE } and the program will load the files from the disk (HP part number 08510–10033 Rev.3.02 or greater). The program will remember the last system configuration you select and, when you run it again (without turning the computer off), the same configuration will appear on the display. You can reset the configuration by using the PROGRAM RESET softkey, found in the SYSTEM CONFIGURATION menu. The main menu appears on the computer display. Be sure to have the following items ready to use:

- Calibration kit and its disk. The model number of the calibration kit must match the one you select in the Hardware Configuration menu.

- Verification kit and its disk. The model number of the cerification kit must match the one you select in the Hardware Configuration menu. Be sure the computer is connected to the HP 8510.

- Press VERIFY SYSTEM. If the program acknowledges the system over the HP-IB, it will display the System Performance Verification Menu on the computer.

- Press SERIAL NUMBERS. Enter the serial numbers and the National Institute of Standards and Technology (NIST) numbers only if you want them to appear on the printout of your performance test results for each verification device. The serial numbers of the instruments are usually located on the rear panels. NIST test numbers are on the Certificate of Calibration that accompanies your verification kit.

- When you are finished with this menu, press DONE.

- You should now be back in the System Performance Verification Menu. Press SYSTEM CAL. The configuration information will be displayed; make sure it agrees with the system you are going to verify. If it does, press RESUME to continue. If it does not, return to the Hardware Configuration Menu to correct it.

Measuring the Coaxial Calibration Devices 45 MHz to 50 GHz Step 1 Lowband Verification

Do not follow the *Test Set Cable Connections* instructions on the computer display. Instead, do the following:

Do calibration on HP 85101C display *not* the computer display.

- If test port cables are not connected, select the best length of semi-rigid cable for your configuration and connect the semi-rigid cables to port 1 and port 2 of the test set. Combiner DC-65 GHz, 18 inch 85109–20003 or 22 inch 85109–20004.

- Connect the 2.4 mm female to 2.4 mm male adapter to the end of the port 1 semi-rigid cable, and the 2.4 mm female to 2.4 mm female adapter to the end of the port 2 simi-rigid cable. Both adapters are supplied in the 2.4 mm calibration kit.

- Use an 8 mm (5/16 inch) wrench to hold the adapter stable and use the 8 mm (90 N-cm) torque wrench to tighten the cable nut.

- Gently bend the semi-rigid test port cables so the 2.4 mm adapters face each other and the standards can be connected between them as required (see Figure 3-5.

- Press RESUME once and follow the screen prompts to load the verification disk.

COAXIAL
TEST SET

COMBINER (2)

WAVEGUIDE TO
COAXIAL
ADAPTER (2)

HP V85104A K09

1.85mm
TEST PORT
CABLES (2)

WAVEGUIDE
TEST SET

Combined Coaxial Configuration
45MHz — 65GHz

*Use HP 85056B Old Cal Kit
for Low Band Calibration

Use HP 85057B Verification
Kit for Low Band Verification

WORK SURFACE FOR CALIBRATION
AND VERIFICATION DEVICES.

* You May Eliminate These
Adapters if not Available.
HP Part No.
85056—60006 and 60007.

mcabcon_d

Figure 3-5. 2.4 mm Cable Configuration

■ Press YES to indicate that you want to perform a 45 MHz verification.

■ Press Bypass to skip this operation. It is normal to skip this step.

■ Load the Cal Kit Disk as follows:

Insert the standards definition disk and press:

(TAPE/DISK), LOAD, Cal Kit 1-2

CAL kit *1 Use the RPG knob to move the highlighted area to CK_24MMAx (for HP 85056A) or CK_24MMDx (for HP 85056D).

LOAD FILE After the disk is loaded, remove it from the disk drive.

Press (CAL) to verify that the proper files were loaded into Cal Kit 1 or 2. The HP 8510 softkey field should display the type of calibration and the revision number of the cal kit disk.

Press RESUME on the computer keyboard.

At this point the verification program initializes the system and changes some instrument states. Set the following instrument state before you continue with the calibration procedure.

Note   Your verification will be invalid if Z0 is not correctly set.

System Z0

Press (CAL) `MORE` `SET Z0` (5) (0) (x1) on the network analyzer.

These conditions will be recalled automatically during the verification.

Source Power Level

Press STIMULUS (MENU) `POWER MENU`

`POWER SOURCE 1` (1) (0) (x1)

The prompt Initalizing System Prior to Calibration will be displayed on the computer.

Perform the calibration (the measurement system must be warmed up and stabilized before you continue).

A Full 2-port calibration for S-parameter test set is required for verification.

Calibrate the HP 85109C Network Analyzer Press:

`LOCAL`

(CAL) Select the cal kit you loaded above.

`FULL 2-PORT` .

Next, a series of softkeys will appear on the network analyzer display: `REFLECT'N`, `TRANSMISSION`, and `ISOLATION`. When you press one of these keys another set of softkeys will appear.

Connect each device as directed; the network analyzer will underline each device label as a measurement is completed. Refer to your calibration kit manual for additional information.

After all the devices are measured (for S11 and S22), press `DONE`.

For greatest measurement accuracy, minimize bending the semi-rigid test port cables, and minimize cable flexing or stressing when you are connecting the standards.

Store the calibration is a Cal Set Register (1 through 6) by pressing the accompanying softkey.

As asterisk (*) next to one of the cal set registers means that a calibration is already stored there. If all the registers are full, press a key to respond to the prompts. The present calibration will be stored over the calibration that was already in the cal set register.

Press `RESUME` .

If you indicated earlier in this procedure that you want a 45 MHz verification, the system will intialize again and prompt you to perform another calibration. For the 45 MHz calibration it is necessary to measure only a short, and open, and a lowband load. Store the calibration in a Cal Set register (1 through 6).

When the 45 MHz calibration is complete, press `RESUME` . The program will reset the network analyzer to REMOTE operation and return to the *System Performance Verification Menu*.

Measuring the Coaxial Verification Standards

A complete verification requires that you measure all devices in the kit. However, you must select the devices, one at a time, from the Verify Standard menu.

Select the verification standard.

Press SELECT STANDARD .
The program will display the *Verification Kit Device Selection Menu*. This menu is a form that allows you to select the standard you want to measure, enter its serial number, change the averaging factor for measurement, select the Cal Set register, and enter any comments.

When this form is complete, press DONE .

Insert the Verification Kit data disk into the HP 8510 disk drive.

Press RESUME
The program will read the disk and compare device serial numbers. If the numbers do not match, you can change them by responding to the program prompts.

Measure the Standard and Display the Data.

Measure the device, press MEASURE DATA .
respond to the prompts on the computer display. The program will initalize the system and give you instructions for making the proper connections.

Press PRINT ALL .
The program will print a complete results sheet for each device. If the device fails at any frequency, the letter F will appear in the column and a failure notice will appear at the bottom of the sheet.

Disconnect the 2.4 mm adapters from the test port cables.

This completes the lowband portion of the performance verification for the combined coaxial configuration. Continue with the next section for the highband portion, 50 to 65 GHz.

Measurement Configuration Performance Verification

The following performance verification procedures are for waveguide (WR-15, V-band , or WR-10, W-band) and Combined Coaxial configuration (highband 50 GHz to 62.5 GHz, on-wafer, and 50 GHz to 65 GHz, for device measurements.

IF you are testing the combined coaxial configuration, be sure to select the Highband ,
V-band or W-band softkey instead of Lowband :

Set start to 50 GHz, stop to 65 GHz

Set Start to 75 GHz, stop to 110 GHz

HP 85109 system disk can not be accessed if you start with Lowband, you must set manually.

Note	To verify highband performance in the combined system configuration, set up the equipment as shown in Figure 3-6. Calibrate and verify the system between the two V281A adapters at the end of the semi-rigid cable, connected to the two combiners. To verify the waveguide system configuration, calibrate and verify between the 1 mm adapter set as shown in Figure 3-7.

Waveguide Hardware Configuration

Press the PRIOR MENU or previous softkeys on the computer until you return to the Main Menu.

Press SYSTEM CONFIGURATION HARDWARE CONFIG

Equipment Used in V-Band (highband) or W-Band Mode:

Network Analyzer:	HP 8510C	Color Model
Test Set:	V85105A	V-Band S-Parameter (50 to 75 GHz) used also for (combined mode)
	W85105A	W-Band S-Parameter (75 to 110 GHz)
Source:	V85104A	V-Band Synthesizer (50 to 75 GHz) used also for (combined mode)
	W85104A	W-Band Synthesizer (75 to 110 GHz)
Calibration Kit:	V11644A	V-Band (50 to 75 GHz) used for (combined mode) also
	W16644A	W-Band (75 to 110 GHz)
Calibration Technique:	TL	Thru-reflect-Line (TRL) Cal
Test Port Cables		
Combined:	HP 85109C2	85112A combiner and V85104,5 V85104/5 with 1.85 mm cables
Waveguide:	HP 85109C3	V,W 85104A K10 Cable and V,W 85104,5
Verification Kit:	V11645A	V-Band (50 GHz to 75 GHz)
	W11645A	W-Band (75 GHz to 110 GHz)
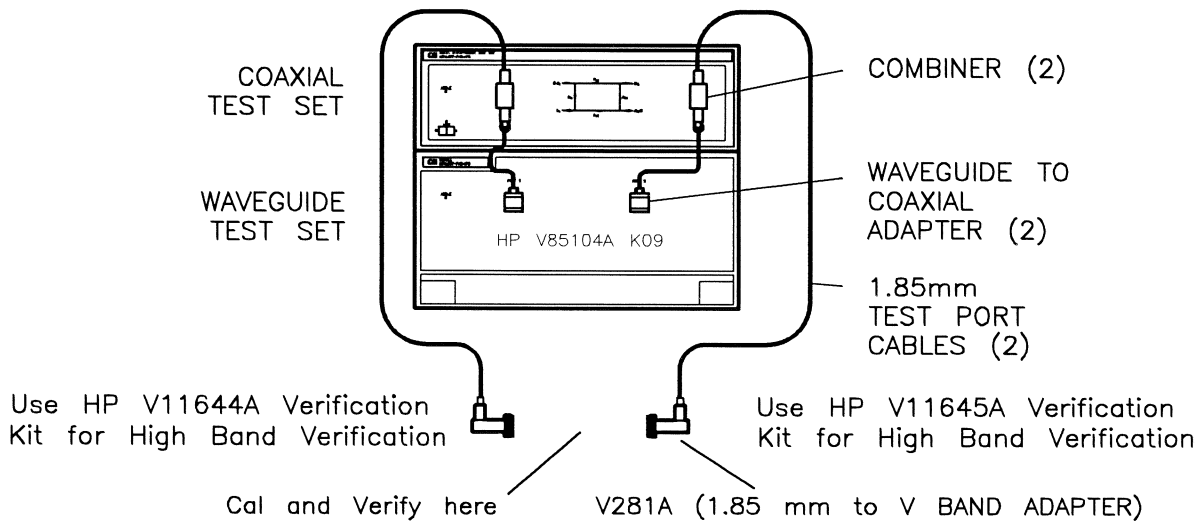
Figure 3-6. Combined Coaxial Configuration for 50 GHz to 65 GHz Calibrations
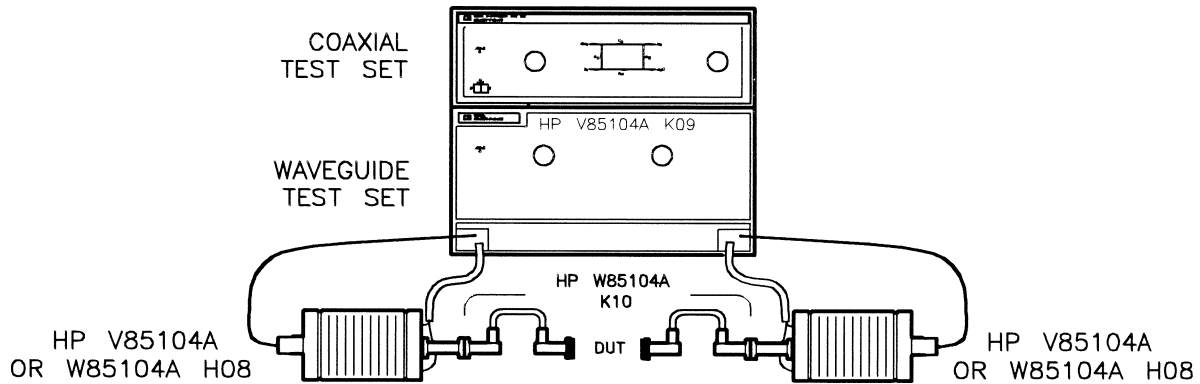
(c) Waveguide Configurations

wcforvw_d

Figure 3-7. Waveguide Configuration for V-Band or W-Band Calibrations

Note   If you are testing the combined coaxial configuration, make the following substitutions:

Test Set:	V85105A - V-Band S-Parmeter (50 to 75 GHz)
Source:	V85104A - V-Band Synthesizer (50 to 75 GHz)
Test Port Cables:	HP 85109C2 - 85112A Combiner, and V85104/5
Waveguide Adapters:	HP V281A - not part of configuration menu but needed to do Performance Verification

1. Select the appropriate equipment, then press `DONE` to load the data files.

2. Press `PRIOR MENU` to return to the Main Menu.

   At this point, be sure you have the following items ready for use:

   ■ Calibration kit and its calibration constants disk. The model number of the calibration kit must match the one you selected in the configuration menu.

   ■ Verification kit and its data disk. The model number of the kit must match the one you selected in the configuration menu.

Note   If you want to generate system specifications press `SYSTEM SPECS` under the Main Menu and follow the program prompts.

3. Press `VERIFY SYSTEM`. If the program acknowledges the system over the HP-IB bus, it will display the *System Performance Verification Menu* on the computer display.

4. Press `SERIAL NUMBERS`. Enter or change the serial numbers and the NBS numbers. The serial numbers are usually located on the rear panels. NBS test numbers are located on the Certificate of Calibration that accompanies your verification kit.

5. Press `DONE` when you are finished with this menu

You should now be back in the *System Performance Verificaiton Menu*. Press `SYSTEM CAL`. The configuration information will be displayed: make sure it agrees with the system you are

going to verify. If it does, press RESUME to continue. If it does not, return to the Hardware Configuration Menu to correct it.

Measuring the Waveguide Calibration Devices

Do not follow the "Test Set Cable connections instructions". Instead perform the following for your system configuraiton:

Waveguide Configuration

Connect the calibration devices directly to the waveguide test ports of the modules. Align the modules so the test ports face each other.

Combined Coaxial Configuration

Connect HP V281A WR-15 waveguide-to-1.85-mm coaxial adapters to the ends of the semi-rigid test port return cables. Align the adapters so the waveguide ends face each other.

Note	After bending the semi-rigid cables, allow them to relax in this position for 15 minutes before continuing.

1. Press RESUME

2. Load the cal kit disk as follows:

3. Insert the Calibration Constants disk in the network analyzer disk drive.

    Press (LOCAL) (TAPE/DISK) LOAD Cal Kit 1-2 .

    Press CAL KIT *1 or CAL KIT *2 .

   The directory of all the files on the disk will load.

4. Use the RPG knob to move the highlighted area to CK_WR15A3.

    Press LOAD FILE .

    Press (CAL) to verify that the proper file was loaded.

   The HP 8510 softkey field should display the type of calibration and the cal kit disk constants revision number. Remove the disk from the drive and return it to the calibraiton kit.

5. Before you proceed, check the HP 8510 hardware states as follows. Your verification will be invalid if these states are not correct.

TEST SET ADDRESS

    Press (SYSTEM) HP-IB ADDRESS TEST SET (2) (1) (x1).

MULTIPLE SOURCES

    Press (SYSTEM) MORE EDIT MLT.SRC MULT.SRC:ON/SAVE

SYSTEM PHASELOCK

1. Press (SYSTEM) `MORE` `SYSTEM PHAESLOCK` `NONE`.

2. Set Phaselock to `EXTERNAL` if you have an HP 8350B source.

POWER LEVELING

1. Press (SYSTEM) `MORE` `POWER LEVELING` `SOURCE 1:EXT LEVEL` `SOURCE 2:INTERNAL`.

2. Press `RESUME` on the computer, if you have not already done so.

3. The verificaiton program initalizes the system. For WR-15, these values must be set to their required values. The prompt `Intializing System Prior to Calibration` will be displayed on the network analyzer. Check the following:

SOURCE POWER LEVEL

1. Press STIMULUS (MENU) `POWER MENU`

2. `POWER SOURCE 1` (−) (2) (5) (X1).

3. `POWER SOURCE 2` (3) (x1).

4. The beeping and running error messages should be gone.

SYSTEM Z$_0$

1. Press (CAL) `MORE` `SET Z0` (1) (x1) for waveguide; (50) (X1) for coax or combined using coax standards and cables 1.85 mm..

2. Perform the Calibration

3. (SAVE) `USER PRESET 8`

4. On the network analyzer press (CAL).

5. Select the WR-15 cal kit in `CAL 1` or `CAL 2`.

6. Press `TRL 2-PORT`.

The network analyzer displays the TRL calibration menu. Connect the calibration standards as directed in steps (a) through (g) below.

To achieve the greatest measurement accuracy, minimize bending of the semi-rigid test port return cables (combined coaxial configuration).

When making waveguide connections, first tighten the screws equally finger-tight, then equally tighten them to a final torque.

For the waveguide configuration, substitute the words "waveguide test port" for "adapter."

a. Connect the 1/4 wavelength section between the adapters on ports 1 and 2 as shown in Figure 3-8.

   Press `LINE/MATCH LINE`.

   The network analyzer takes six measurement sweeps.

b. Connect the waveguide short standard to the port 1 adapter as shown in Figure 3-8.

Press `S11 REFLECT SHORT`

The network analyzer takes one measurement sweep.

c. Press `ISOLATION`. Connect the termination to the port 2 adapter as shown in Figure 3-8.

Press `FWD ISOL'N ISOL'N STD`.

The network analyzer takes one measurement sweep.

d. Leave the short on the port 1 adapter and the termination on the port 2 adapter.

Press `REV ISOL'N ISOL'N STD`.

The network analyzer takes one measurement sweep.

e. Connect the waveguide short standard to the port 2 adapter as shown in Figure 3-8.

Press `S22 REFELCT SHORT`.

The network analyzer takes one measurement sweep.

f. Connect the adapters directly together as shown in Figure 3-8.

Press `THRU THRU` on the network analyzer.

The network analyzer takes six measurement sweeps.

g. Press `SAVE TRL 2-PORT`. Save the calibraiton in a register (1 through 6). If an asterisk (*) is displayed next to one of the cal registers, a calibration is already stored there, and you will overwrite the existing data.

The WR-15, or WR-10 measurement calibarion is complete.

h. Press the program `RESUME` softkey and the program will reset the network analyzer to remote operation and return to the System Performance Verification Menu.

Note	`LOWBAND REFLECT'N` is not used for this calibration.
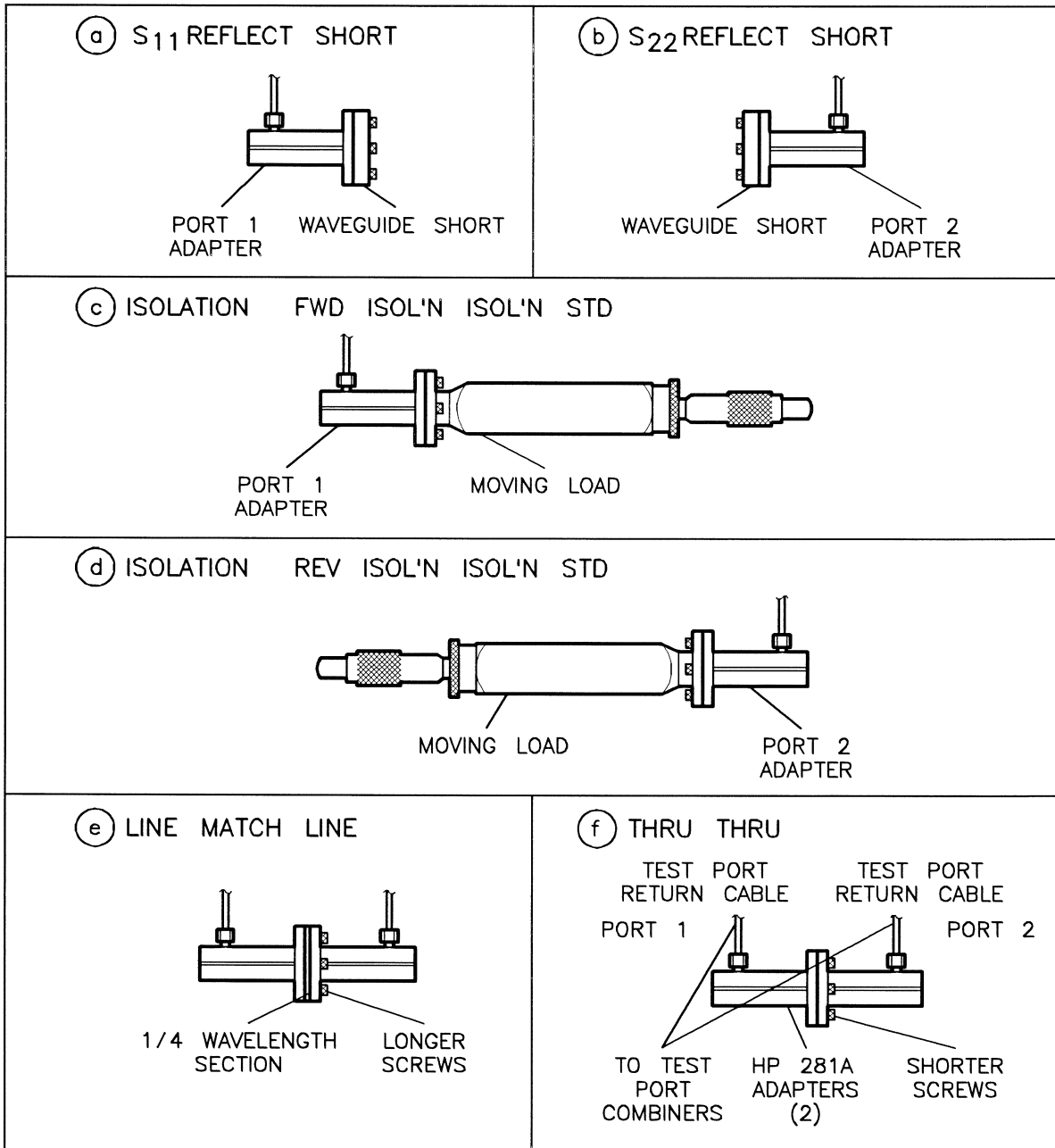
Figure 3-8. Waveguide TRL Connections

Measuring the Waveguide Verification Standards

Select the Verification Standard

Press SELECT STANDARD .

The program will display the *Verification Kit Standard Selection Menu*. This menu is a form that allows you to select the standard you want to measure.

Enter its serial number.

Change the averaging factor for measurement.

Select the Cal Set register, and enter comments.

When this form is complete, press `DONE`.

A complete verification requires that you measure all devices in the verification kit. However, you must select the devices, one at a time from the Verify Standard menu.

Insert the verification kit data disk into the network analyzer disk drive and press `RESUME`. The program will read the disk and compare device serial numbers. If the numbers do not match, you can change them by responding to the program prompts.

Measure the Standard and display the Data.

When you are ready to measure the device, press `MEASURE DATA` and respond to the prompts on the computer. The program will intialize the system and give you instructions for making the proper connections.

Note   The input and output ports of the attenuators are offset slightly. Place the metal plate under the port 1 module when you are measuring the attenuators to offset the test port height of V and W-bands only.

Press `PRINT ALL` and the program will print a complete results sheet for the measurement of the device. If the device fails at any frequency, the letter F will appear in the column and a failure notice will appear at the bottom of the sheet.

Repeat steps 3 and 4 for all the devices in your kit.

Disconnect the coaxial-to-waveguide adapters from the cable ends.

The waveguide portion of the system verification is complete and the performance verification is complete.

Figure 3-9.

prgflow_d

WHAT'S WRONG

1. Do you have any self test failures, running error messages (beeping) or raw channel power (unratioed power) problems? = MAGIC QUESTION

2. Failed performance tests?

3. Display or Front Panel abnormalities, measurement errors, or display hang-ups?

4. Low or no power symptoms?

DO A PRE-OPER
OF THE HP 8

Check front and rear panel
and HP-IB addresses. Check
configuration switch setting,
on the A5 processor board
firmware revisions for source
need to reload the operating
case). Check that HP 85100
greater.

First, turn on the sources,
HP 8510C, or the system
check all troubleshooting LED
level troubleshooting block di
installation for additional info
Pre Flight Checkout.
Load the appropriate Machin
System Configuration Disk, H
The system should be swee
current band. See Operators
on HP85109C proper operati

OBVIOUS CALIBRATION OR VERIFICATION PROBLEM.

Read the HP 8510 Calibration and Verification and Cable manuals on how to inspect, gage, clean, and use the calibration and verification devices, waveguide, and test port return cables. Make sure, if your HP 85057A Verification Kit has been re-certified to 50GHz, you must call it on HP 85057B when using the performance verification software.

Try the bo
operating s

It might be
report. Call
duplication
See Firmwa
for HP 851

WHAT'S WRONG

1. Do you have any self test failures, running error
    messages (beeping) or raw channel power
    (unratioed power) problems? = MAGIC QUESTION

2. Failed performance tests?

3. Display or Front Panel abnormalities,
    measurement errors, or display hang—ups?

4. Low or no power symptoms?

DO A PRE-OPERATIONAL CHECK
OF THE HP 85109 SYSTEM

Check front and rear panel control settings and cables
and HP—IB addresses. Check the HP 8510 test set
configuration switch setting, HP 85101 free run switch
on the A5 processor board (all zeroes), and proper
firmware revisions for source and HP 8510C (you may
need to reload the operating system in an extreme
case). Check that HP 8510C firmware is C.06.30 or
greater.

First, turn on the sources, then the test set, then the
HP 8510C, or the system cabinet power switch. Then
check all troubleshooting LED's. See the HP 85109 system
level troubleshooting block diagram for these LED's. See
installation for additional information in performing the
Pre Flight Checkout.
Load the appropriate Machine Dump file from the mm—wave
System Configuration Disk, HP Part Number 85109—10006.
The system should be sweeping over the full range of the
current band. See Operators Check for more information
on HP85109C proper operation.

Obvious Failure Type

Obvious Failure Type

Obv
tes
HP

OBVIOUS CALIBRATION OR VERIFICATION PROBLEM.

OBVIOUS SOFTWARE PROBLEM.

Read the HP 8510 Calibration and Verification and Cable
manuals on how to inspect, gage, clean, and use the
calibration and verification devices, waveguide, and test port
return cables. Make sure, if your HP 85057A Verification Kit
has been re—certified to 50GHz, you must call it an
HP 85057B when using the performance verification software.

Try the backup standard software by reloading the
operating system.

It might be a known software bug. See STARS bug
report. Call the factory with details for check out and
duplication of unknown and new bugs!
See Firmware Software Quick Reference Guide on bugs
for HP 8510 family.
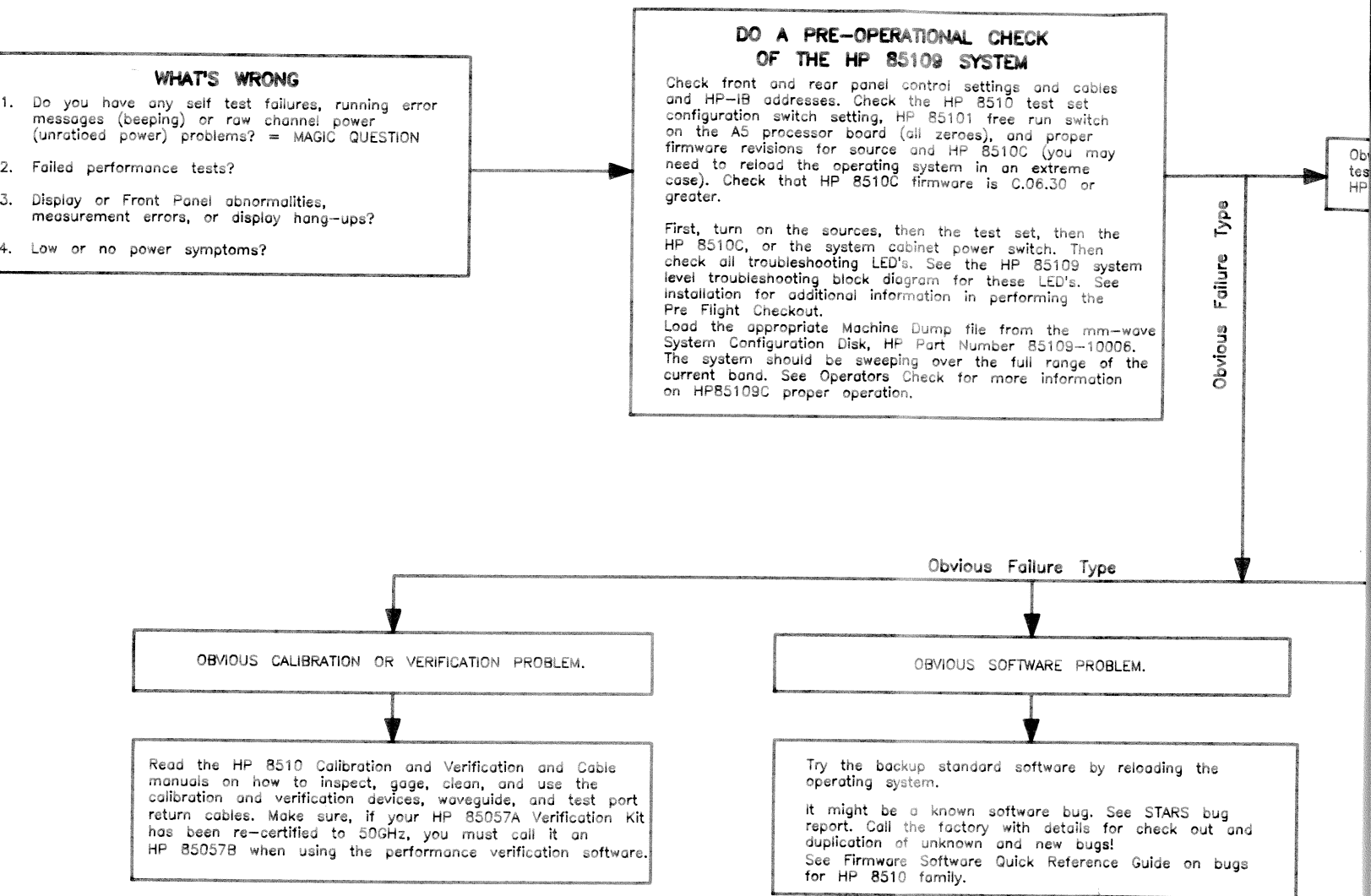
self—test, running error, or unratioed power
s. Refer to the HP 85106C Service Manual,
Number 85109—90039, Service and Troubleshooting

NO OBVIOUS FAILURE TYPE

The best approach to repair the HP 85106 at this point
is to verify that the HP 85101C is good. Once it is
known to be good, it will act as your diagnostic
controller.

Remove the external controller, printer, etc., and the
cables from the HP 85106C system.

Run the HP 8510C Service Program to verify that the
HP 85101C is OK to a 95% confidence level. To do
this, run all the service program tests in the "HP 85101C
Display/Processor Service Program menu (#1)". These tests
take about 10 minutes. Refer to the HP 8510C Service
Program Flowchart. See partial flowchart at right.

NOTE: the above tests can be skipped if the HP 85101C
passes the power up HP 85101 self test. The self
test has only a 70% confidence level, so use it
accordingly.

NOTE:
of the
set, H
controi

You co
running
channel
passed
the pro
diagnos
HP 85
to an
instrum
follows:

OBVIOUS POWER SUPPLY PROBLEM. FOR EXAMPLE
"VTO repetitive failure due to line spikes"

CHECK POWER SUPPLIES
Check all main (110V/220V) fuses and power switches.
Remove HP 85101 and HP 85102 instrument covers
and check LED power and service indicator lights.
Recheck by measuring each power supply voltage with
a DVM.

The HP 85102 power switch LED is supplied by the
+5V supply in the HP 85101.

WARNING: High Voltage — refer to qualified service
personel!

Note: If you are getting repetitive VTO failures,
suspect the old style power line module
or test set regulator board.

LO
SOURCE

Test Set (HP 85105A and HP 85104A)

RF
SOURCE

MULTIPLIER

a1

a2

b1

b2

HARMONIC MIXERS

Simplified Signal Path
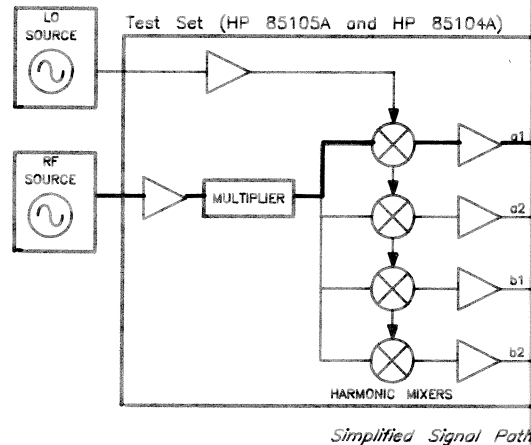
If all four channels fail the Unratioed P
RF or LO Sources, signal going to the
blue LO path and purple RF path). A P
Remove the HP—IB and RF power cables
appropriate source manual to troubleshoo
power levels out of the source and the
(For 8360 series sources use the front

NOTE: Do not try to measure the RF
disconnecting the RF cable. Mea
causes the source to supply mo
RF cable path and measure the
and cables for the suspected s

E: From this point, the problem is probably one
the remaining instruments; The HP 85102 test
HP 85105A mm-wave controller, the HP 85104A
roller, the source modules or their interfaces.

can use the HP 8510C, power-up self-tests,
ing error messages, a1, a2, b1, and b2 raw
nel power displays, troubleshooting LED's, and
ed installation data and displays to help pinpoint
problem to an instrument, but with the
nostic aids that are now available for the
8510C, the quickest way to isolate a problem
n instrument is using the technique of
ument substitution using the diagnostic aids as
ws:

Prove HP 85102 is OK

To prove that the HP 85102 is OK, run the
the built-in HP 85102 IF/Detector Service
Program Number 2. This verifies that the
HP 85102 is good to an 80% confidence level.
It takes less than a minute to run and pinpoint
failures to a board.

Partial Flowchart

Quick Reference

SYSTEM →

| TITLE |
| HP-IB ADDRESSES |
| CRT OFF |
| FREQUENCY OFF |
| BEEPER ON — OFF |
| RESET IF CORRECTION |
| MORE |

HP 85102

19.9MHz

a1 20MHz IF ⊗ 100KHz IF — REF

a2 ⊗

b1 ⊗ — TEST

b2 ⊗

th of Unratioed Power Level Test

The HP 85102 is OK

(20 min. Test)
To prove that the HP 851X A/B coax test set and source or HP 85105A mm-wave controller/HP 85104A
sources are at fault use the HP part number 85102-60210 5-way power splitter. This substitutes for the
coax test set or mm-wave controller and proves whether the coax test set/source or mm-wave controller/
HP85104A mm source modules are at fault. Also run the HP 8510C Service Program Menu Number 3
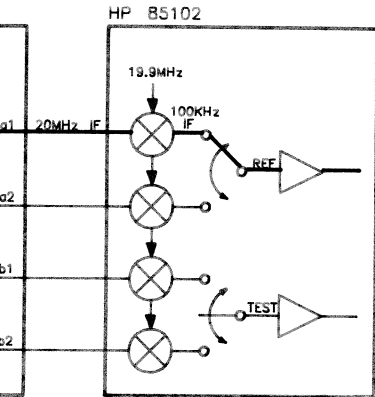
Finally, perform the coax test set RF Source or HP 85105A and HP 85104A's unratioed power troubleshooting.
Refer to the operator's check, and perform this check to troubleshoot the unratio power levels. This tests
the coax test set and RF Source mm-wave controller and source modules, HP-IB, and associated boards
and microcircuits. This verifies that the HP 851XA/B test set and RF source/HP 85105A mm-wave controller
and associated sources are operating to a 90% confidence level.

If all four channels are OK,
the HP 85109C is OK.

If all four channels fail the Unratioed Power Level Tests:

If one, two, or three channels fail the unratioed power tests

Power Level Tests, the most likely causes are a failure in the
HP 85104A by way of the HP 85105A and associated cables. (See
Power Supply can also cause these paths to fail.
es from the HP 85109C system to isolate the sources. Refer to the
oot the HP 8350B and 8360 series sources. Be sure to check the
e RF cables from the sources to the HP 85109C system.
t panel emulator 08510-60022).

F source power in source #1 in the HP 85109C system by
asuring the RF from the source breaks the leveling loop and
maximum power output. Instead, try placing a coupler in the
he power that way. Consider substituting known good sources
sources, if they are available.

If One, Two, or Three Channels Fail the Unratioed Power Test
If the power levels on at least one but not all of the four channels fail, the
failure is the HP 85104A Millimeter-Wave Test Set Module or HP 85105A Millimet
(See Test Set QRG for service prodedures).

Below describes how test set QRG works for the HP 85109.
To help narrow the problem to the faulty instrument, the service adapter and se
emulate the operation of the source and test set and check unratioed power lev
IF/Detector.
Run the Service Program using the Test Set HP-IB Commands tests. These test
15% of all HP 85105 Millimeter-Wave Controller failures and requires approximate
The digital functionality of the HP 85105 is checked with this test, not the RF
Finally, use the failed unratioed power test to find the bad path/s and assembly

NOTE: Do not perform Test number 5 "Increment Active Attenuator" in the
        "Test Set HP-IB Commands" menu. The HP 85105A does not contain
        any attenuators.

SYSTEM MENU

TITLE

HP-IB
ADDRESSES

CRT
OFF

FREQUENCY
OFF

BEEPER
ON
|
OFF

RESET IF
CORRECTION

MORE

SYSTEM
MORE MENU

PULSE
CONFIG

EDIT
MULT. SRC.

DATE/TIME
FUNCTIONS

SYSTEM
PHASELOCK

POWER
LEVELING

ANALOG OUT
ON
|
OFF

SERVICE
FUNCTIONS

SERVICE
FUNCTIONS
MENU

SERVICE
MENU

SYSTEM BUS
'LOCAL'
|
'REMOTE'

IF GAIN

PEEK/POKE
LOCATION
|
PEEK
|
POKE

SOFTWARE
REVISION

04A
the
lier/

ooting.
ts
ds
roller

---

ratioed power tests.

---

channels fail, the most likely cause of
HP 85105A Millimeter-Wave Controller.

ce adapter and service tools are used to
unratioed power levels into the HP 85102

tests. These tests can find approximately
quires approximately one minute to complete.
test, not the RF paths.
th/s and assembly.

uator" in the
oes not contain

MAIN SERVICE FUNCTIONS MENU

LOOPING SELF TESTS

1   A5 PROCESSOR EPROM
2   A5 PROCESSOR RAM
3   A7 DATA BUS
4   A4 DISPLAY PROCESSOR
5   A4 DISPLAY RAM
6   A7 TIMER/CLOCK/RS-232
7   A7 PUBLIC HP-IB
8   A7 SYSTEM BUS
9   INTERRUPT SYSTEM
10 A5 MULTIPLIER
11 A7 DISC CONTROLLER
12 A6 NON-VOLATILE MEMORY
13 IF DETECTOR DATA
14 KEYBOARD

SYSTEM COMMANDS

15 RUN MAIN PROGRAM
16 MEMORY OPERATIONS
17 RERUN SELF TEST
18 REPEAT TEST LOOP

DISC COMMANDS

19 LOAD PROGRAM DISC
20 RECORD PROGRAM DISC
21 INITIALIZE DISC

SERVICE COMMANDS

22 RUN SERVICE PROGRAM
23 DIAGNOSE A FAILURE

ENTER SELECTION, THEN PRESS =MARKER

HP 8510 SERVICE PROGRAM MENU

HP 85101 DISPLAY/PROCESSOR SERVICE PROGRAM   1
HP 85102 IF/DETECTOR SERVICE PROGRAM   2
TEST SET HP-IB SERVICE PROGRAM   3
RETURN TO MAIN SERVICE FUNCTIONS MENU   F[.]

NOTES: (1) Hex digits A thru F are assigned to [G/n], [M/u],
           [k/m], [X1], [+/-], and [.] respectively.

       (2) To make a selection, type the number indicated,
           then press =MARKER.

       (3) The default value on data entry is zero.

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HP 85101 DISPLAY/PROCESSOR SERVICE PROGRAM MENU

CPU BOARD TESTS (A5)   1

I/O BOARD AND FRONT PANEL TESTS (A1, A2, A7)   2

DISPLAY BOARD AND CRT TESTS (A4, A11)   3

NON-VOLATILE MEMORY BOARD TESTS (A6)   4

RETURN TO HP 8510 SERVICE PROGRAM MENU   F [.]

---

flowcht_d

HP 85109C System Service Flow Chart

HOW TO READ THIS BLOCK DIAGRAM:

THIS DIAGRAM SHOWS A TYPICAL HP85109C SYSTEM
CONFIGURATION. NOTE THAT THE CIRCUIT BOARDS
AND ASSEMBLIES HAVE NUMBERS PRECEDED BY THE
LETTER 'A'. THAT NUMBER IDENTIFIES THE ASSEMBLY.
THE OTHER NUMBERS REFER TO THE LIST
ON THE RIGHT OF THIS FOLDOUT.

USE THIS BLOCK DIAGRAM AS A QUICK REFERENCE
GUIDE TO SYSTEM FAILURES AS WELL AS A GUIDE
TO LED LOCATION AND MEANING. TEST SET
ADDRESS AND CONFIGURATION SWITCH SETTINGS
ARE ALSO SHOWN.

NUMBERS 1 — 14

THESE NUMBERS IDENTIFY THE SELF TEST THAT
EXERCISES THE PARTICULAR ASSEMBLY, MOSTLY
ON THE HP85101 DISPLAY/PROCESSOR. FOR
MORE INFORMATION, REFER TO 'SELF TEST
FAILURES' IN THE ON—SITE SERVICE MANUAL.

NUMBERS 15 — 36

THESE NUMBERS IDENTIFY THE BUILT—IN RUNNING
ERROR MESSAGE THAT WILL APPEAR ON THE HP85101
CRT IF A SYSTEM FAILURE IS DETECTED, MOSTLY
ON THE HP85102 IF/DETECTOR, TEST SET, AND
HP SOURCE. THE NUMBERS IDENTIFY THE ASSEMBLIES
WHERE THE ERROR IS DETECTED OR GENERATED.
FOR MORE INFORMATION, REFER TO 'RUNNING ERROR
MESSAGES' IN THE ON—SITE SERVICE MANUAL.

NUMBERS 37 — 41

THESE NUMBERS IDENTIFY RUNNING ERROR MESSAGES
ASSOCIATED WITH HP8360—SERIES SOURCES ONLY AND
APPEAR ON THE HP85101 CRT.

NUMBERS 42 — 44

THESE ARE EXTRA TROUBLESHOOTING SUGGESTIONS.

TEST SET CONFIGURATION SWITCH

LOCATED ON (A3) SUMMING AMP BOARD
INSIDE HP 8517A/B TEST SET.

MUST BE SET AS SHOWN BELOW:
NOTE: DARK SIDE OF SWITCH IS DEPRESSED.

HP 8517B OPT 007
=80

HP 8517B
=16
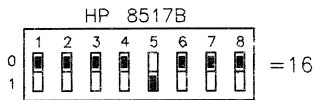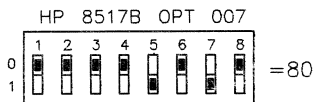
HP 8517A
=0

TEST SET DEFAULT SETTINGS:

THE DEFAULT STATE OF THE HP 8517A/B TEST SETS
(TURN POWER OFF, PULL A4 HPIB BOARD AND TURN
POWER BACK ON) IS TO HAVE ALL SAMPLERS
ENABLED, A14'S VTO BIASED ON, PORT 1 AND 2
ATTENUATORS AT 0dB, AND THE SWITCH SPLITTER
APPLYING RF POWER TO PORT 1.

UNIQUE TOOLS	
TORX DRIVER T—10 8710—1623 (For Chassis)	
TORX DRIVER T—15 8710—1622 (For Chassis)	
ALLEN WRENCH #6 = 1/16 IN. 5020—0289 (For RPG Knob)	

HP 85105A OPT. 050
mm—WAVE CONTROLLER
(ADDRESS 21)

HP 85105A Opt. 054 mm Wav

POWER DIVIDER

LO AMPLIFIER

LO AMPLIFIER

LO INPUT
(from HP83621A)

SWITCH   RF AMPLIFIER   RF SW

RF INPUT
(from HP836XX)

RF OUTPUT
(to coaxial test set)

LEVELING OUTPUT
to RF Source

ALC SW

20MHz IF INPUT
(from coaxial test set)

IF MUX   IF AMPLIFIER
a2
b2
b1
a1

20MHz IF OUTPUT
(to HP8510B/C)

HP—IB   A4   85105
.5V/GHz

To
Probe
Station

Test Port Cable 8
Test Port Cable 8

SYSTEM B

PORT 2

J11 TEST SE

RF INPUT

RF OUTPUT

ALC IN

VOLTS/GHz

HP 8517A/B
TEST SET
(ADDRESS 20)

HP 83651A
OPT 004
RF SOURCE
(ADDRESS 19)

RF OUTPUT

HP 83621A
OPT 004
LO SOURCE
(ADDRESS 18)

HP—IB LANG ADDRESS
0 0 1 1 0 0 1 0

OPEN
1
0

L3 L2 L1 A5 A4 A3 A2 A1
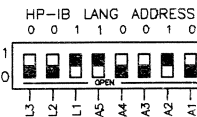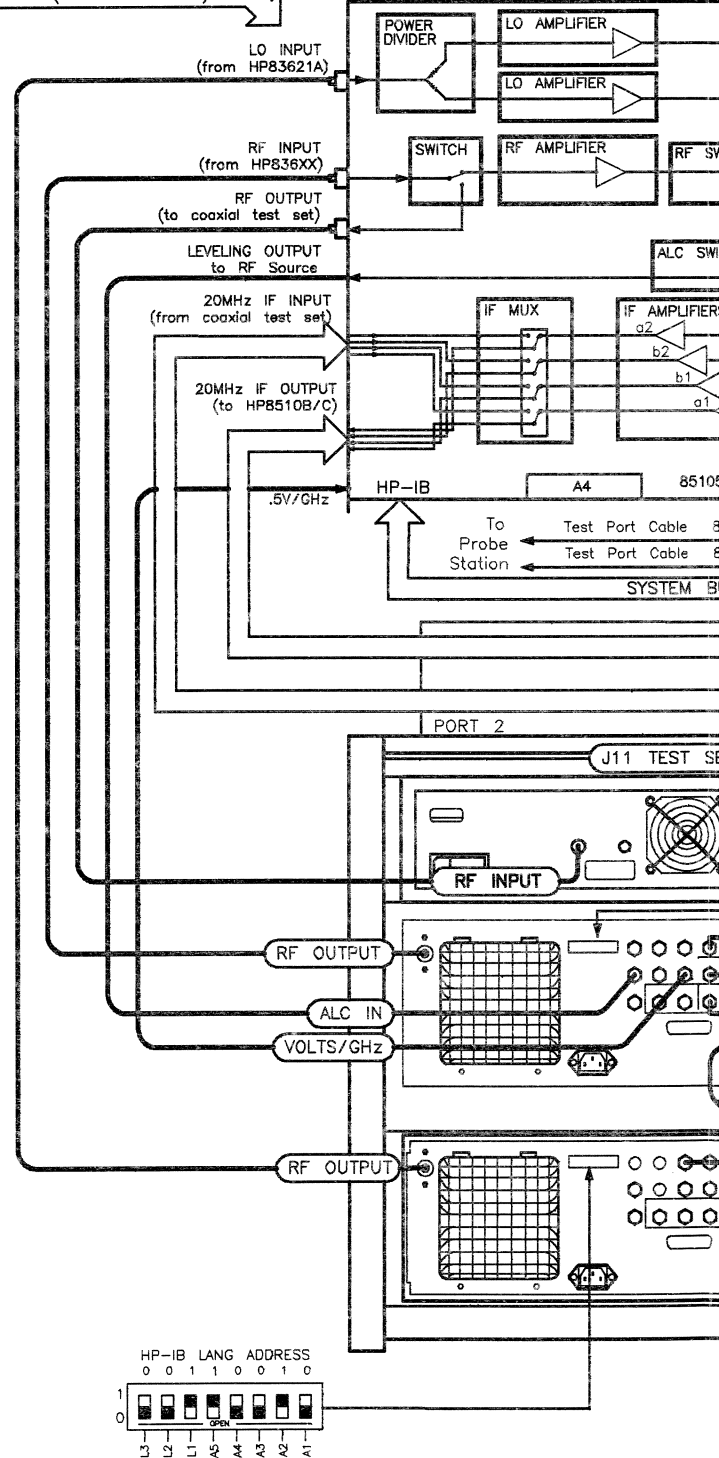
Frequency Range (GHz)	33 to 50	40 to 60	50 to 75	75 to 110	0.045 to 50
BAND	Q (WR—22)	U (WR—19)	V (WR—15)	W (WR—10)	Coaxial
SOURCE 1	−20	−25	−25	−20	+10
SOURCE 2	+3	+3	+3	+3	N/A
Sweeper is LO	MD_SWPWR22	MD_SWPWR19	MD_SWPWR15	MD_SWPWR10	MD_COAX
Synthesizer is LO	MD_SYNWR22	MD_SYNWR19	MD_SYNWR15	MD_SYNWR10	MD_COAX

HP 8510 SYST
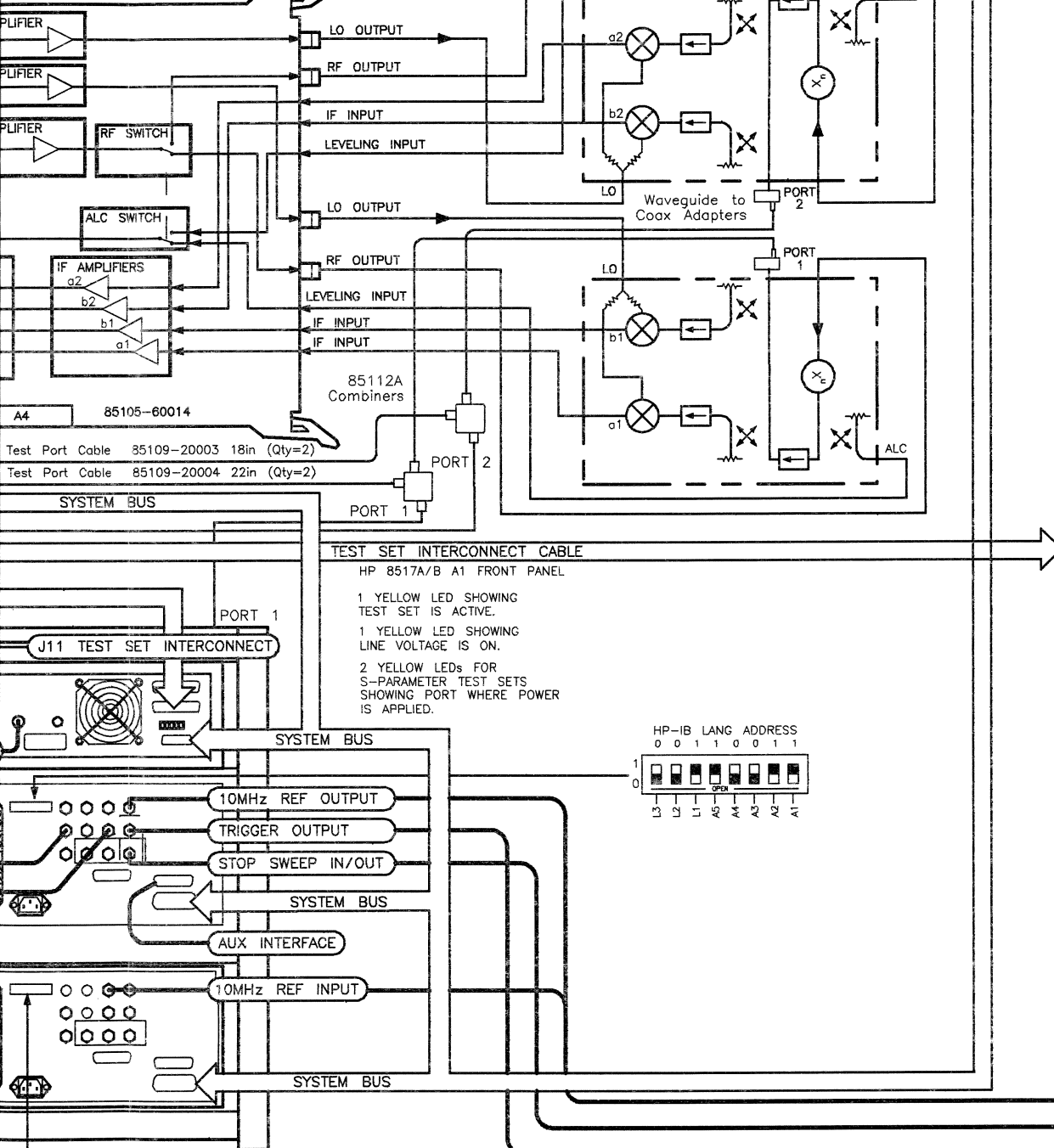
CABLE
08510—60106 (OPT 001, 5 FT.)
08510—60102 (STANDARD, 3 FT.)

HP 85102

054 mm Wave Controller

PLIFIER

PLIFIER

PLIFIER

RF SWITCH

ALC SWITCH

IF AMPLIFIERS
a2
b2
b1
a1

A4   85105—60014

Test Port Cable   85109—20003 18in (Qty=2)
Test Port Cable   85109—20004 22in (Qty=2)

SYSTEM BUS

85112A Combiners

PORT 2

PORT 1

HP 85104A SERIES TEST SET MODULES
Q, U, V, or W BANDS

LO OUTPUT

RF OUTPUT

IF INPUT

LEVELING INPUT

a2

b2

LO

Waveguide to
Coax Adapters

PORT 2

LO OUTPUT

RF OUTPUT

LEVELING INPUT

IF INPUT

IF INPUT

LO

PORT 1

b1

a1

ALC

ALC

ALC

×c

×c

TEST SET
INTERCONNECT

PORT 1

J11 TEST SET INTERCONNECT

SYSTEM BUS

10MHz REF OUTPUT

TRIGGER OUTPUT

STOP SWEEP IN/OUT

SYSTEM BUS

AUX INTERFACE

10MHz REF INPUT

SYSTEM BUS

TEST SET INTERCONNECT CABLE
HP 8517A/B A1 FRONT PANEL

1 YELLOW LED SHOWING
TEST SET IS ACTIVE.

1 YELLOW LED SHOWING
LINE VOLTAGE IS ON.

2 YELLOW LEDs FOR
S-PARAMETER TEST SETS
SHOWING PORT WHERE POWER
IS APPLIED.

HP-IB LANG ADDRESS
0 0 1 1 0 0 1 1

1
0
OPEN

L3 L2 L1 A5 A4 A3 A2 A1

VTUNE   VTUNE

LENDRA

A16 REMOTE
APPLICATIO
85102—6923

VTOSENSE

VPTUNE

LPTHLD

LO PHASE LOCK
(used with HP 8350B s
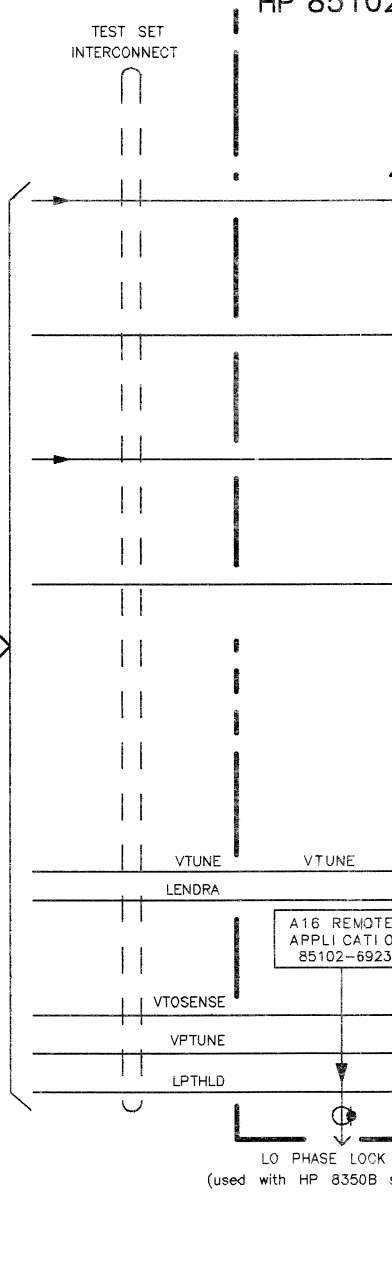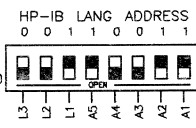
10MHz REF

USE WITH ALL SOURCES

USE ONLY WITH HP 8360-SERIES SOU

HP 8510 SYSTEM BUS   27,28,29

5 FT.)
3 FT.)

NOTE:
THE HP85102C HAS DUPLICATE BOARDS.
USE THEM AS A BUILT-IN BOARD KIT.
(A7/A5 REF DET., A10/A12 REF IF AMPL.,
A9/A11/A13/A14 IF MIXERS)

1. DEFE
   LINE
   OF T
   APPE

HP 85102 IF/DETECTOR

A14, A11, A9, A13 IF MIXERS
85102-69206
42
16,42

A12 REF IF AMPL
21,23, 24,42
85102-69010
R/W
J5   21   J3

A7 REF SYNC DET
21,42
85102-69023
R/W
J1   21   J4
J2   J3
21

A17 SAMPLE AND HOLD
20,21,42
85102-69212
R/W

A18 A/D CONVERTER
20,22,45
85102-69208
J5   20   J1

100kHz CAL

A10 TEST IF AMPL
21,23, 24,42
85102-69010
R/W
J5   21   J3

A5 TEST SYNC DET
21,42
85102-69023
R/W
J1 21 J2
J2   J1
21

100kHz CAL

A13J6 (a2)
A14J6 (a1)
16
16

21,24   21,24
J1 J2 J5

4MHz
J4   21

A6 CLOCK
31
13
85102-69006
J6   4MHz
J4   10MHz
J10
J11 J3 J7
R/W

22

A24 PROCESSOR INTERFACE
13,22
85102-69024
R/W

NOTE: SELF TEST FAILURE
CAN ALSO BE CAUSED BY
A25U1 (MOTHERBOARD),
DATA BITS 0-7. 13

FAN B1
85102-20056

POWER SUPPLIES
A15 85102-69015
A26 85102-69026

4
J2-J5 J1

A8
42
19.9MHz LO
85102-69008

17

A21 IF COUNTER
85102-69021
16,17,18
J1   J2
J3
J4

REMOTE
17
REMOTE

TRIM SWEEP CAN CAUSE NO IF FOUND.
ALSO A20 GAIN ADJUSTMENT, ESPECIALLY
AT 386Hz WITH HP 8516A.

VTUNE
DRA

A23 MAIN PHASELOCK
17,18,19
85102-69227
W/R
J1   J2

A16 REMOTE APPLICATION
85102-69235

NSE
UNE
HLD

A22 PRETUNE CONTROL
15,18
85102-69204
J3   J1
R/W

31

A20 SWEEP ADC
19,25,26
85102-69234
85102-60234
BUCKET PULSE INPUT

A1 PANEL
14
85102-69001

A1A1 BOARD
85102-69029

A19 ADC CONTROL
20,22,25,26
85102-69019
J1
R/W

4 GREEN LEDS THAT SHOW
-5V, +5V, -15V, +15V
REGULATED SUPPLIES ARE ON.

1 RED LED THAT SHOWS
THERMAL SHUTDOWN.
210VA / 714 BTU / HR

4 GREEN LEDS THAT SHOW
-5V, +5V, -15V, +15V
UNREGULATED SUPPLIES ARE ON.

LO PHASE LOCK OUT
(used with HP 8350B source only)

ANALOG 10MHz 20MHz
±10V   IN   OUT

STOP SWEEP
25

TRIGGER IN

3 YELLOW LEDS ON FRONT
PANEL. 2 FOR SHOWING ACTIVE
CHANNELS 1 & 2

1 FOR SHOWING LINE VOLTAGE
NOTE: THIS LED IS SUPPLIED
BY THE HP85101C +5V SUPPLY.

VOLTAGE REGULATORS ON CHASSIS
A25Q1 1854-0679
A25Q2 1853-0351
A25Q3 1854-0611
A25Q4 1853-0351
A25Q5 1854-0072

10MHz REF
WITH ALL SOURCES
H HP 8360-SERIES SOURCES

A21 IF COUNTER HAS 1 GREEN LED
THAT SHOWS SIGNAL (IF) POWER IS PRESENT
(APROXIMATELY 10MHz TO 30MHz)
IF GREEN LED IS LIT, RF SOURCE
IS PRODUCING RF POWER.

HP 85102 IF DETECTOR: 2			
Fuse	Name	Location	Va
AC Line	F1	Rear Panel	2A, 2
			1.5A,
			(220-
-15 VDC	F1	A26 Rectifier	2.5A,
+15 VDC	F2	A26 Rectifier	2.5A,
-5 VDC	F3	A26 Rectifier	1A, 25
+5 VDC	F4	A26 Rectifier	8A, 25
HPON to 85101	F1	A24 Interface	0.5A,

CABLE 8120-3445

CABLE 8120-3445
HP-IB

SERIES
200/300
CONTROLLER
USING BASIC

1. DEFECTIVE DATA OR ADDRESS
LINES ON BUS WILL CAUSE ANY
OF THE RUNNING ERRORS TO
APPEAR AT RANDOM.

6 RED LEDS THAT
SHOW SELF TEST
FAILURE AND
SUBTEST FAILUES

CABLE-25426
RS-232 RS-232
PORT 1 PORT 2

EXTERNAL DISPLAY
(VGA INTERFACE)

CABLE-D1191A

HP85101C DISPLAY/PROCESSOR

A8
SECURITY
KEY

32

CARD CAGE
EXTENDER BOARD
85101-60236

A7
I/O

27,28,29,30

85101-69240

A5
CPU **1,2,10**

85101-69245

Free Run A5S1
switch set closed
To all zeros.

6 Red Self-Test
LEDs:

● ● ● ● ● ●
32 16 8 4 2 1

3,6,7,8,9,11,44,32

A12
MOTHERBOARD
85101-60267

32

To turn beeper off
press [SYSTEM] [BEEPER OFF]

C1 0180-3017 .045F
C2 0180-0453 .0087F
C3 0180-2671 .012F
C4 0180-2671 .012F

IF DISPLAY
INTERCONNECT

A6 EEPROM
MEMORY

12

85101-69238
32K x 8 x 24
1818-4075

A24
PROCESSOR
INTERFACE
13,22
85102-69024

13,22

13,22

08510-60101

A4 GSP
GRAPHICS
SYSTEM
PROCESSOR

4,5

85101-69243

43

POWER SUPPLY
ASSEMBLIES

A10 PREREG
08753-60098
A3 POST-REG
85101-69244

ELF TEST FAILURE
SO BE CAUSED BY
(MOTHERBOARD),
TS 0-7. **13**

AN B1
102-20056

POWER
UPPLIES
85102-69015
85102-69026

MAIN PROCESSOR TEST
BUTTON LOCATED BEHIND
FRONT PANEL HOLE
UNDER THE DISK DRIVE.
IT RESETS THE PROCESSOR
ACTIVATES SELF-TESTS
1-14.

14 **33,34,35, 36,44**

85101-60234

(RPG) A1 FRONT
PANEL

85101-69249

A2
DISC
DRIVE
0950-2075

43

LINE
GEN

X
Y
Z

CRT

43

HIGH
VOLT

5180-8484
DISPLAY SECTION

FAN
08415-60036

EDS THAT SHOW
-15V, +15V
SUPPLIES ARE ON.

THAT SHOWS
HUTDOWN.
14 BTU / HR

EDS THAT SHOW
-15V, +15V
D SUPPLIES ARE ON.

PAPER
CLIP

1 YELLOW DISC DRIVE
LED ON FRONT PANEL

A LIT GREEN LED IS NORMAL.
A LIT RED LED ON A10 PREREG INDICATES A
POWER SUPPLY SHUTDOWN DUE TO FAILURE OF:

1. A10 PREREG
2. A3 POST-REG
3. +5V DIGITAL SUPPLY
4. ASSEMBLIES USING +5V DIGITAL SUPPLY

4 RED LED'S (#1, 2, 4, 8) THAT
SHOW SELF-TEST FAILURE
WHEN ADDED.

4 YELLOW LEDS THAT SHOW
HP-IB ACTIVITY R-L-T-S
R=REMOTE, L=LISTEN,
T=TALK, S=SERVICE REQUEST

A3 POST-REG GREEN LEDS SHOW
-15V, -12V, +5V, +12V, & +65V
POWER SUPPLIES ARE ON.
250 VA / 850 BTU/HR

85102 IF DETECTOR: 210VA/714BTU'S/HR

ame	Location	Value	HP Part Number
·1	Rear Panel	2A, 250V	2110-0002
		1.5A, 250V (220-225VAC)	2110-0043
1	A26 Rectifier	2.5A, 250V	2110-0083
2	A26 Rectifier	2.5A, 250V	2110-0083
3	A26 Rectifier	1A, 250V	2110-0001
4	A26 Rectifier	8A, 250V	2110-0342
1	A24 Interface	0.5A, 250V	2110-0269

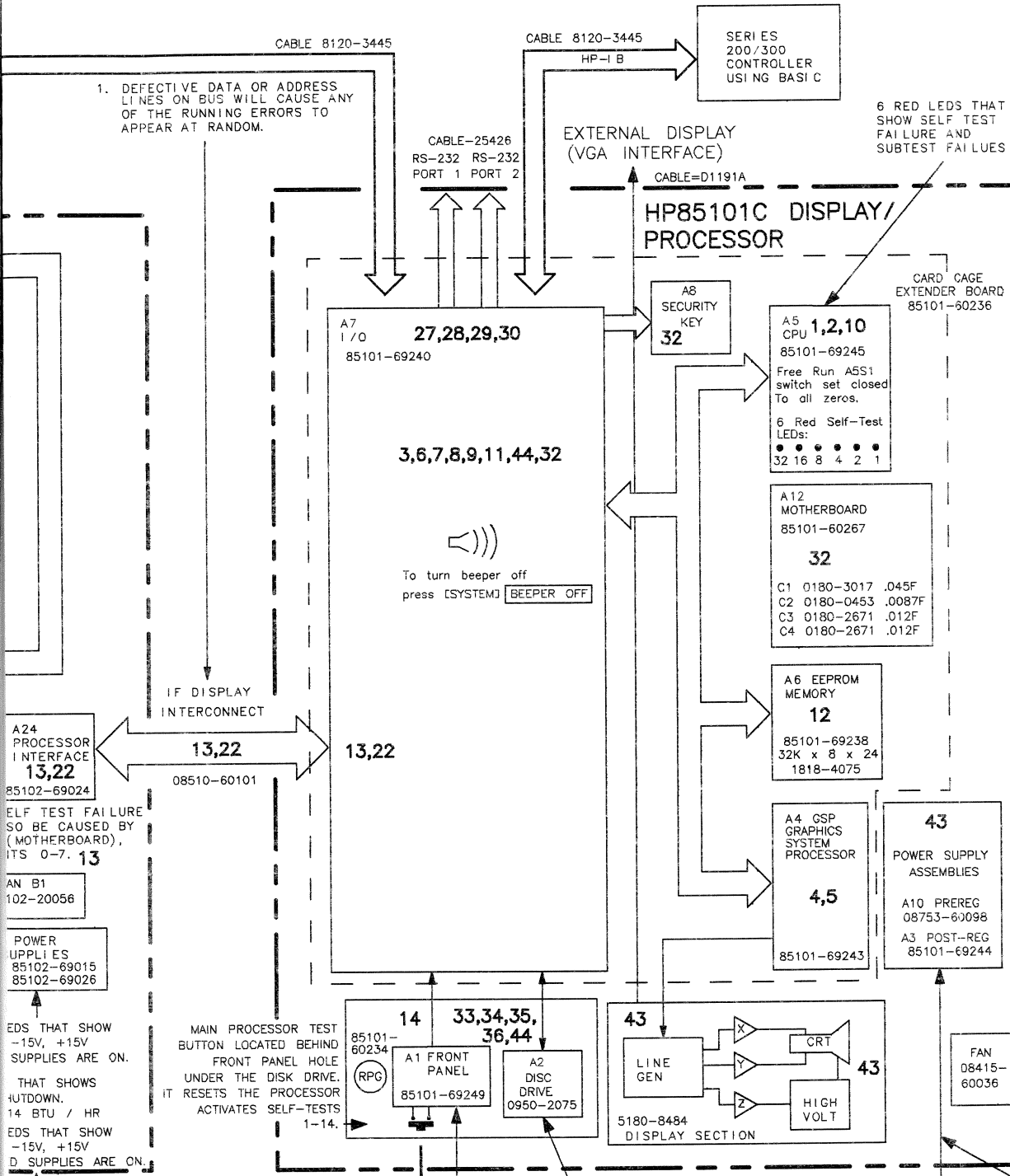## SELF TESTS

1. A5 PROCESSOR EPROM (self test and
2. A5 PROCESSOR RAM (test processor
3. A7 DATA BUS TEST (test I/O data bu
4. A4 DISPLAY PROCESSOR
5. A4 DISPLAY RAM
6. A7 TIMER/CLOCK/RS-232
7. A7 PUBLIC HP-IB (read-write test of
8. A7 SYSTEM BUS (read/write test of
9. INTERRUPT SYSTEM (test interrupts)
10. A5 MULTIPLIER (performs a complex
11. A7 DISC CONTROLLER
12. A6 NON-VOLATILE MEMORY TEST (read
13. IF DETECTOR DATA (read/write test
14. KEYBOARD (read HP 85101C keyboard

RUNNING ERROR MESSAGES

15. FAILED PRETUNE/LOST PRETUNE
16. NO IF FOUND (At high frequency 83
17. PHASE LOCK FAILURE
18. PHASE LOCK LOST
19. VTO OVER-RANGE
20. ADC CAL FAILED
21. IF CAL FAILED - REFERENCE
    IF CAL FAILED - TEST
    IF CAL FAILED - BOTH (channels)
22. ADC NOT RESPONDING
23. IF OVERLOAD (External level of 8360
24. AUTORANGE CAL FAILED
25. SOURCE SWEEP SYNC ERROR
26. SWEEP TIME TOO FAST
27. SOURCE (HP-IB) SYNTAX ERROR
28. TEST SET (HP-IB) SYNTAX ERROR
29. SYSTEM BUS ADDRESS ERROR
30. SYSTEM BUS SRQ ERROR
31. UNABLE TO LOCK TO EXT 10 MHz
32. ERROR: SYSTEM KEY NOT INSTALLED
    BAD A8 CONNECTOR, BAD MOTHERBOA
    CAUTION: OPTIONAL FUNCTION : NOT
    CAUTION: TIME DOMAIN KEY NOT INST
33. DISC HARDWARE PROBLEM
34. DISC COMMUNICATION ERROR
35. INITIALIZATION FAILED
36. DISC MEDIA WEARING OUT - REPLAC

HP 8360-SERIES SOURCES

37. FAILURE - FAULT INDICATOR ON
38. FAILURE - RF UNLOCKED
39. FAILURE - OVERMODULATION
40. FAILURE - SELF TEST FAILURE
41. INVALID SETUP - CHECK SYSTEM BU
    level flatness corr

OTHER TROUBLESHOOTING H

42. Perform the unratioed power test fo
    'Unratioed Power Failures' in the On

43. The A11 display must be working in

44. If self test 11 passes, try to initial
    the A2 disc drive.

45. A18 (HP 85102) ANALOG TO DIGITAL
    Whenever the noise on the trace is
    instrument ON, it means that the A

    If you cycle the AC power (Off, the
    there is probably a malfunction with
    symptoms are present. There may
    Failures, or Service Program test fo

    If this trace noise disappears when
    the A18 board should be replaced.

HP 85101 DISPLAY/PR		
Fuse	Name	Location
	A3F1	
	A3F2	
	A3F3	
	A10F1	

SERIES
200/300
CONTROLLER
USING BASIC

SPLAY
CE)
=D1191A

6 RED LEDS THAT
SHOW SELF TEST
FAILURE AND
SUBTEST FAILUES

5101C DISPLAY/
CESSOR

8
URITY
EY

CARD CAGE
EXTENDER BOARD
85101-60236

A5
CPU **1,2,10**
85101-69245
Free Run A5S1
switch set closed
To all zeros.

6 Red Self-Test
LEDs:
● ● ● ● ● ●
32 16 8 4 2 1

A12
MOTHERBOARD
85101-60267

32

C1 0180-3017 .045F
C2 0180-0453 .0087F
C3 0180-2671 .012F
C4 0180-2671 .012F

A6 EEPROM
MEMORY
12
85101-69238
32K x 8 x 24
1818-4075

A4 GSP
GRAPHICS
SYSTEM
PROCESSOR
4,5
85101-69243

43
POWER SUPPLY
ASSEMBLIES
A10 PREREG
08753-60098
A3 POST-REG
85101-69244

X
Y
Z
CRT
43
HIGH
VOLT
SECTION
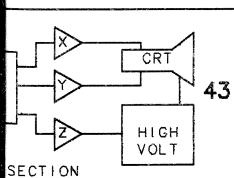
FAN
08415-
60036

A LIT GREEN LED IS NORMAL.
A LIT RED LED ON A10 PREREG INDICATES A
POWER SUPPLY SHUTDOWN DUE TO FAILURE OF:
1. A10 PREREG
2. A3 POST-REG
3. +5V DIGITAL SUPPLY
4. ASSEMBLIES USING +5V DIGITAL SUPPLY

A3 POST-REG GREEN LEDS SHOW
-15V, -12V, +5V, +12V, & +65V
POWER SUPPLIES ARE ON.
250 VA / 850 BTU/HR

SELF TESTS

1. A5 PROCESSOR EPROM (self test and service program PROM using checksum)
2. A5 PROCESSOR RAM (test processor memory using data complement technique)
3. A7 DATA BUS TEST (test I/O data bus)
4. A4 DISPLAY PROCESSOR
5. A4 DISPLAY RAM
6. A7 TIMER/CLOCK/RS-232
7. A7 PUBLIC HP-IB (read-write test of HP-IB register)
8. A7 SYSTEM BUS (read/write test of system bus register)
9. INTERRUPT SYSTEM (test interrupts)
10. A5 MULTIPLIER (performs a complex multiply)
11. A7 DISC CONTROLLER
12. A6 NON-VOLATILE MEMORY TEST (read/write test)
13. IF DETECTOR DATA (read/write test data and address lines)
14. KEYBOARD (read HP 85101C keyboard for a stuck key)

RUNNING ERROR MESSAGES

15. FAILED PRETUNE/LOST PRETUNE
16. NO IF FOUND (At high frequency 8340 squeg. will cause this (if you ask for +10dBm.)
17. PHASE LOCK FAILURE
18. PHASE LOCK LOST
19. VTO OVER-RANGE
20. ADC CAL FAILED
21. IF CAL FAILED — REFERENCE
    IF CAL FAILED — TEST
    IF CAL FAILED — BOTH (channels)
22. ADC NOT RESPONDING
23. IF OVERLOAD (External level of 8360 can cause this.)
24. AUTORANGE CAL FAILED
25. SOURCE SWEEP SYNC ERROR
26. SWEEP TIME TOO FAST
27. SOURCE (HP-IB) SYNTAX ERROR
28. TEST SET (HP-IB) SYNTAX ERROR
29. SYSTEM BUS ADDRESS ERROR
30. SYSTEM BUS SRQ ERROR
31. UNABLE TO LOCK TO EXT 10 MHz REF
32. ERROR: SYSTEM KEY NOT INSTALLED, CAUSED BY SECURITY KEY MISSING, BAD I/O,
    BAD A8 CONNECTOR, BAD MOTHERBOARD.
    CAUTION: OPTIONAL FUNCTION : NOT INSTALLED
    CAUTION: TIME DOMAIN KEY NOT INSTALLED
33. DISC HARDWARE PROBLEM
34. DISC COMMUNICATION ERROR
35. INITIALIZATION FAILED
36. DISC MEDIA WEARING OUT — REPLACE SOON

HP 8360-SERIES SOURCES RUNNING ERROR MESSAGES

37. FAILURE — FAULT INDICATOR ON
38. FAILURE — RF UNLOCKED
39. FAILURE — OVERMODULATION
40. FAILURE — SELF TEST FAILURE
41. INVALID SETUP — CHECK SYSTEM BUS CONFIGURATION (associated with incorrect power
    level flatness correction only)

OTHER TROUBLESHOOTING HINTS

42. Perform the unratioed power test for a1, a2, b1, and b2. Refer to
    'Unratioed Power Failures' in the On-Site Service Manual, 08510-90023

43. The A11 display must be working in order for a normal display to be on the CRT.

44. If self test 11 passes, try to initialize a blank disc to further test
    the A2 disc drive.

45. A18 (HP 85102) ANALOG TO DIGITAL CONVERTER TEST
    Whenever the noise on the trace is greater than 1 dB when you first turn the
    instrument ON, it means that the A18 board may be faulty.

    If you cycle the AC power (Off, then On), the noise may go away. If it does,
    there is probably a malfunction with the A18 A/D board although no apparent
    symptoms are present. There may also be no Running Error Messages, Self Test
    Failures, or Service Program test failures.

    If this trace noise disappears when the power is cycled, the test has failed and
    the A18 board should be replaced.

HP 85101 DISPLAY/PROCESSOR: 250VA/850BTU'S/HR				
Fuse	Name	Location	Value	HP Part Number
	A3F1		1.5A 125V	2110-0333
	A3F2		2A 125V	2110-0425
	A3F3		2A 125V	2110-0425
	A10F1		3.15 A 250V	2110-0655

trouble_d

HP 85109C System Level Troubleshooting Block Diagram