

System Manual

# **HP 85108A Pulsed-RF Network Analyzer System**



HP Part No. 85108-90023  
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This manual applies directly to all HP 8510Cs, or HP 8510Bs that have been upgraded to HP 8510Cs, with operating firmware revision 6.0 or higher.

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# System and Documentation Overview

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## Introduction

This manual contains information on the installation, operation, and repair of the HP 85108 Pulsed-RF Network Analyzer System. This manual may also be helpful for customer-configured pulsed-RF systems; the primary difference being the absence of the system cabinet in some customer-configured systems.

The HP 85108 system, shown in Figure 1-1, is a factory integrated pulsed-RF system which includes the following components.

- HP 8510C option 008 network analyzer.
- HP 83622A synthesized sweeper with options 001, 003, 004, and 008.
- HP 83624A synthesized sweeper with options 003, 004, and 008.
- HP 85110A S-parameter test set.
- System cabinet (all system instruments are installed in this cabinet at the factory).

## How to Use This Manual

Use this manual for installation, operation, calibration, performance verification, and troubleshooting of the pulsed-RF network analyzer system. Consult the manuals of the individual instruments and accessories in the system when necessary for reference.

This manual contains the following sections.

### System and Documentation Overview

Includes an overview of the pulsed-RF network analyzer system and its supporting documentation.

### System Installation

Includes information regarding site requirements prior to installation, and cabling/configuration diagrams.

### Operation

Includes several system operational tests, and instructions for using the pulsed-RF network analyzer system to make measurements.

### Specifications and Performance Verification

Includes instructions for obtaining the specifications of your pulsed-RF network analyzer system and procedures for running a performance verification of your system.

## **Adjustments**

Includes adjustments related to the pulsed-RF portion of the system. For other adjustments, refer to the service manual of the individual instrument in question.

## **System Service and Troubleshooting**

Includes information for troubleshooting the pulsed-RF portion of the system to the board level, and troubleshooting the rest of the system to the instrument level. System cabling diagrams are also included. When the faulty instrument is identified, refer to its manual for further troubleshooting information.

## **Replaceable Parts**

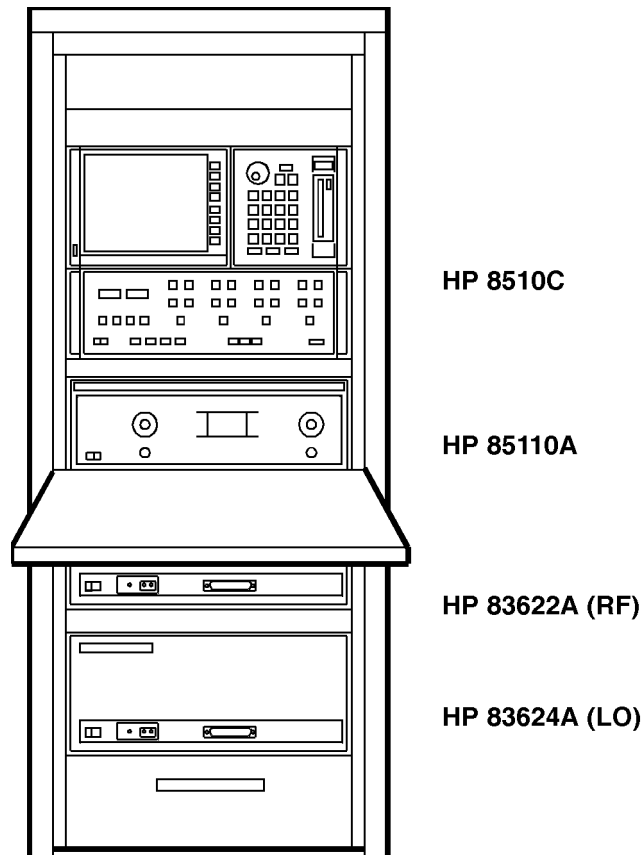
Includes a list of replaceable parts that pertain to the pulsed-RF portion of the system. Refer to the replaceable parts section of the individual instrument for a complete listing of replaceable parts.

## **Appendix**

Includes a glossary of pulsed-RF terms, information regarding system HP-IB addresses, power levels, and a procedure for loading the HP 85108 system configuration disk.

## **Index**

A subject index with alphabetized entries.



**Figure 1-1. HP 85108 Pulsed-RF Network Analyzer System**

## **System Overview**

The pulsed-RF network analyzer system provides you with the ability to measure and display the relative magnitude and phase shift of the component under test as a function of time with an equivalent bandwidth of 1.5 Mhz. this allows the evaluation of the dynamic pulsed-RF characteristics for pulse widths down to 1  $\mu$ second.

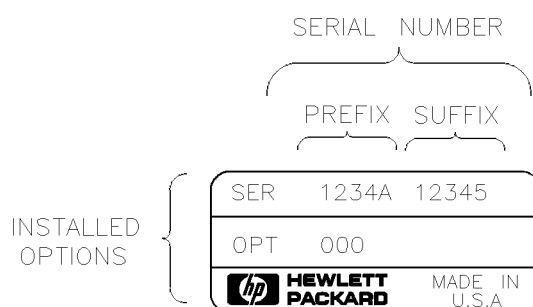
You can configure a pulsed-RF system using your existing HP 8510 network analyzer system by adding pulsed-RF capability (option 008) to your network analyzer. Refer to the paragraph titled Upgrade Paths in this chapter for more information.

---

## Systems Covered by This Manual

A serial number label is attached to each HP 85108 system cabinet. This label is located on the front of the cabinet in the lower left corner, and has the serial number of your system printed on it.

Figure 1-2 shows a typical serial number label. The serial number has two parts. The first four digits followed by a letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument (or system). The contents of this manual apply directly to systems having the same serial number prefix, or higher, as listed on the Title Page of this manual under the heading Serial Numbers.



**Figure 1-2. Typical Serial Number Label**

### HP 85108 Pulsed-RF System Options

The following options are available with the HP 85108 system.

#### Option 001

This test set option add IF switching capability to allow a total of four test sets to be connected to the HP 8510 at the same time. The test set in use is selectrd from the HP 8510 front panel. The 20 Mhz IF signal is transmitted from the selected test set through the option 001 test set(s) to the network analyzer. IF switching is performed automatically by the option 001 test set(s), without reconnections. For more information refer to Controlling Multiple Test Sets in the Operation chapter of this manual.

#### Option 010

This option adds time domain capability to the HP 8510 network analyzer.



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## Warranty

The HP 85108 system carries a one year on-site warranty.

Pulse upgrades (either the HP 85111A or 85111B) include a 90 day on-site warranty from the date of installation. This warranty covers the modified HP 85102 and is valid only if the upgrad package is installed by an HP Customer Engineer. Installation of the upgrade kits does not change an existing service contract in any way.

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## Upgrade Paths

### **HP 8510C Network Analyzer**

To add pulsed-RF capability to your HP 8510C, order the HP 85111B upgrade kit.

### **HP 8510B Network Analyzer**

To add pulsed-RF capability to your HP 8510B, order the HP 85111A upgrade kit.



## System Installation

---

### Introduction

This chapter contains the following information.

- Site preparation.
- System configuration.
- System turn on.

The pulsed-RF network analyzer system is rack-mounted, assembled, and has the cabling attached when it arrives from the factory.

During the installation, the HP customer engineer (CE) will do the following:

- Uncrate the system cabinet.
- Complete the receiving checklist.
- Turn on the system and verify that the HP-IB addresses of each instrument are set properly.
- Run a performance verification of the system, which includes a measurement calibration.

---

### System Arrival

The system will arrive with all rack components and instruments assembled and cabled in the system cabinet.

Keep the shipping containers in one area to help verify the receipt of all components ordered. Inspect all shipping containers. Keep the carton and packaging material until the entire shipment has been verified for completeness, and the system has been checked mechanically and electrically. Check all equipment received against the receiving checklist on the following page.

If the shipment is damaged or incomplete, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the packaging material shows signs of stress, notify the carrier as well as the HP office. Keep the shipping materials for the carrier's inspection. The Hewlett-Packard office will arrange for repair or replacement of damaged equipment without waiting for a claim settlement from the carrier.

## Receiving Checklist

When the entire shipment has arrived, contact the nearest HP office to arrange for installation of your system (if installation is available in your area). The HP customer engineer will perform the installation, beginning with the following receiving checklist.

Refer to your system while you review this checklist.

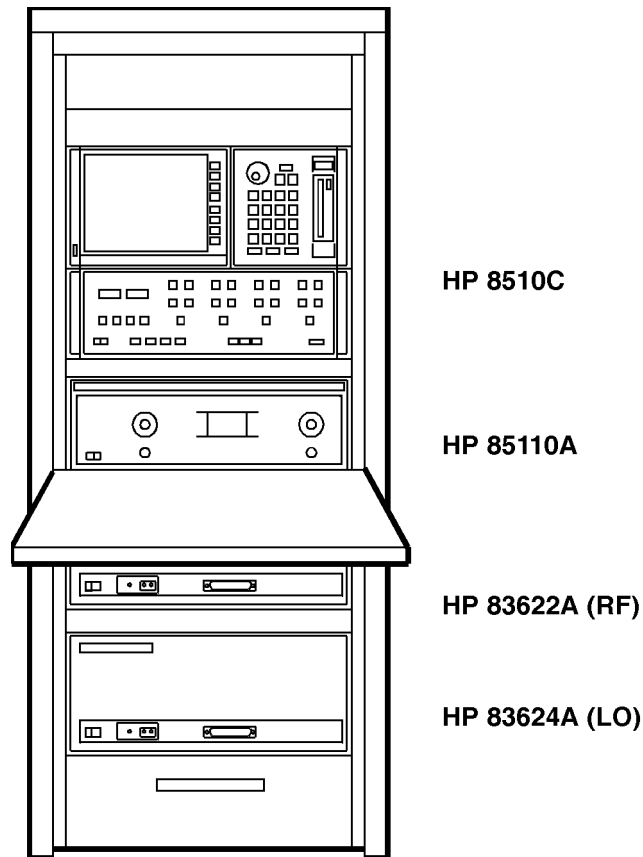
**Table 2-1. HP 85108 Receiving Checklist**

Instrument	Manual Part Number
HP 8510C Network Analyzer (option 008)	08510-90275
HP 85110 S-parameter Test Set	85110-90001
HP 83622A Synthesized Sweeper (with options 001, 003, 004, and 008)	83620-90007
HP 83624A Synthesized Sweeper (with options 003, 004, and 008)	83620-90007
<b>Software</b>	
HP 8510 Specifications and Performance Verification Software (Revision A.03.01 or higher)	08510-10033
HP 85108 System Configuration Disk	85108-10007

**Table 2-2. HP 85108 Option 010 - Adds Time Domain to the HP 8510**

Instrument	Manual Part Number
<b>HP 85108 Standard System</b> (has time domain capability)	85108-90048
<b>Miscellaneous Equipment</b> (not part of the system)	
Plotter	
Computer <sup>1</sup>	
Calibration Kits <sup>1</sup>	
Verification Kits <sup>1</sup>	

<sup>1</sup> Required for system performance verification.  
Refer to the Specification and Performance  
Verification chapter for more information.



**Figure 2-1. HP 85108 Pulsed-RF Network Analyzer System**

## Site Preparation

Site preparation includes the environmental and electrical requirements necessary for the HP 85108 system to operate within its specifications. Make sure your site meets these requirements before installing the system.

## Environmental Requirements

The environmental requirements of the HP 85108 system are listed in Table 2-3. Notice that these characteristics are the same as those for the HP 8510C network analyzer.

**Table 2-3. HP 85108 Environmental Requirements**

<b>Temperature</b>	+5°C to 40°C (+41°F to 104°F)
<b>Relative Humidity</b>	5% to 95% at +40°C or less (non-condensing)
<b>Altitude</b>	Up to 4600 meters (approximately 15,000 feet)

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<b>Note</b>	Note the accuracy-enhanced measurement requirements in the following paragraph.
-------------	---

---

## **Accuracy-Enhanced Measurement Requirements**

Accuracy-enhanced (error corrected) measurements require the ambient temperature of the pulsed-RF network analyzer system to be maintained within  $\pm 1^{\circ}\text{C}$  of the ambient temperature at measurement calibration. The measurement calibration temperature must be within the operating temperature range of the calibration kit (typically  $20^{\circ}$  to  $26^{\circ}\text{C}$ ). Refer to the appropriate calibration kit manual for the actual operating temperature of the calibration kit.

**Accuracy Enhanced Temp. = Measurement Calibration Temp.  $\pm 1^{\circ}\text{C}$**

## **Power Requirements**

Install the required AC power at all necessary locations. Place air conditioning equipment or other motor-operated equipment on a different AC line than that used for the system. Refer to Table 2-4 for a list of the maximum VA power ratings of the HP instruments used in the HP 85108 system.

Three-wire power cables must be used with all instruments. These cables provide the required ground when connected to an appropriate outlet.

## **System Heating and Cooling**

Install air conditioning and heating if required. Air conditioning requirements depend on the amount of heat produced by the instruments. Use the BTU/hour ratings from Table 2-4 to determine the total rating of your system. Each VA rating is multiplied by 3.4 to determine the BTU/hour rating of each instrument.

**Table 2-4. Maximum VA Ratings and BTU/hour Ratings of HP Instruments**

Instrument	Maximum VA Rating <sup>1</sup>	VA Subtotal	Maximum BTU/hour	BTU/hour Subtotal
<b>Standard Equipment</b>				
HP 85101 Display Processor	250	_____	850	_____
HP 85102 IF Detector	210	_____	714	_____
HP 85110A Test Set	110	_____	323	_____
HP 8360 Series Synthesized Source	400	_____	1360	_____
HP 8360 Series Synthesized Source	400	_____	1360	_____
<b>Totals:</b>				
Standard System	1355VA	_____	4607	_____
<b>Accessory Equipment</b>				
HP 9000 Series 300	250	_____	850	_____
HP 98751A 19 inch CRT	420	_____	1,430	_____
HP 98752A 19 inch CRT	420	_____	1,430	_____
HP 98753A 19 inch CRT	420	_____	1,430	_____
HP 98754A 19 inch CRT	420	_____	1,430	_____
HP 98785A 16 inch CRT	200	_____	680	_____
HP 98789A 16 inch CRT	200	_____	680	_____
Typical Hard Disk	65	_____	222	_____
HP Laser Jet II	170 to 800	_____	580 to 2,270	_____
HP PaintJet	20	_____	68	_____
HP 7550A Plotter	100	_____	340	_____
<b>Your System's Total:</b> <sup>2</sup>				

1 Values are based on 120 Vac supplied to each instrument at 60 Hz.

2 To convert the total BTU/hour value to "tons," divide the total BTU/hour value by 12,000.

## System Voltages

All instruments in the HP 85108 system must be set to the local voltage.

All system instruments are set to 120 Vac at the factory, except for Option 230 systems, which are set to 220 Vac.

---

**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.

---

Consult the individual instrument manuals to change the voltage selection switches.

## Weights and Dimensions

The approximate weight of the HP 85108 system cabinet (fully loaded) is listed below.

**Weight** (standard system): 295.5 kg (650 lbs)

The outside dimensions of the system cabinet and the system table are listed below.

**Height:** 160 cm (63 inches)

**Width:** 60 cm (23.6 inches)

**Depth:** 90 cm (31.4 inches)

## Anti-Static Precautions

---

<b>CAUTION</b>	<b>Handle only at static-safe workstations.</b> Beware of damage from electro-static discharge (ESD). The input connectors on the test set (test ports or cables or adapters connected to the test ports) are very sensitive to ESD. Use a grounded wrist strap when attaching devices to the input connectors.
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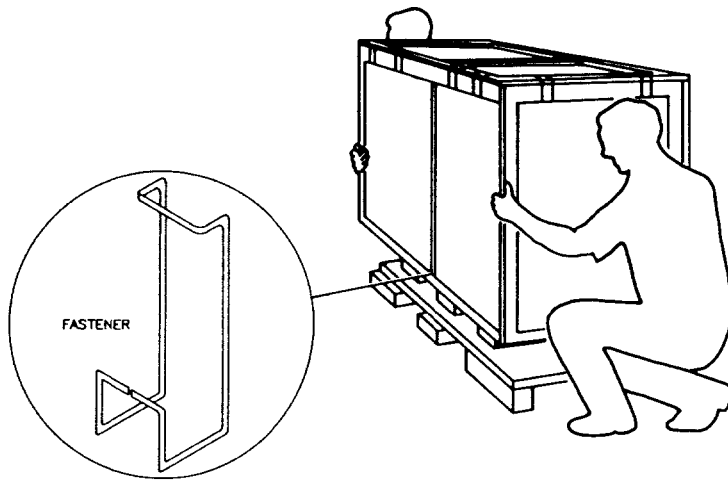
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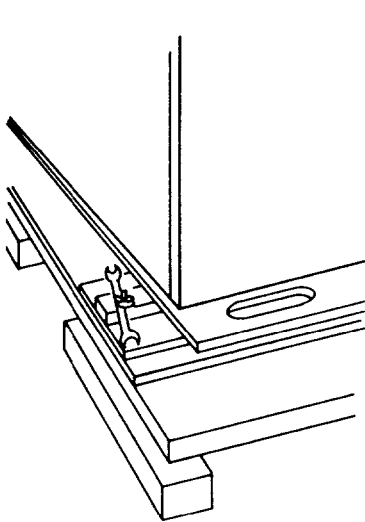
## Unpacking the System Cabinet

Figure 2-2 gives instructions for unpacking the system cabinet.

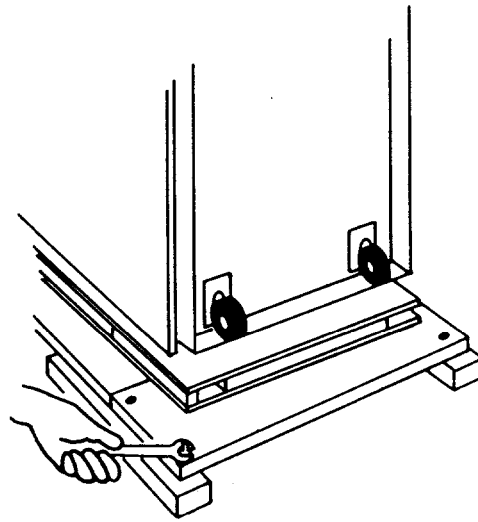




Remove 12 fasteners from the bottom edges using a hammer and screwdriver. Two people are required to remove the cover. Lift slowly and use safe lifting techniques. Remove the top cap, polyethylene cover, and work surface box and set them aside.

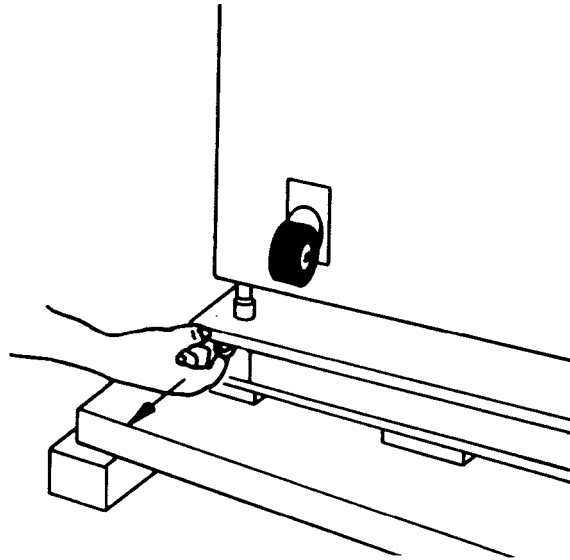


Remove the wrench and wing nut at the top right-hand corner of the crate. Remove the wing nut at the top left-hand corner also.

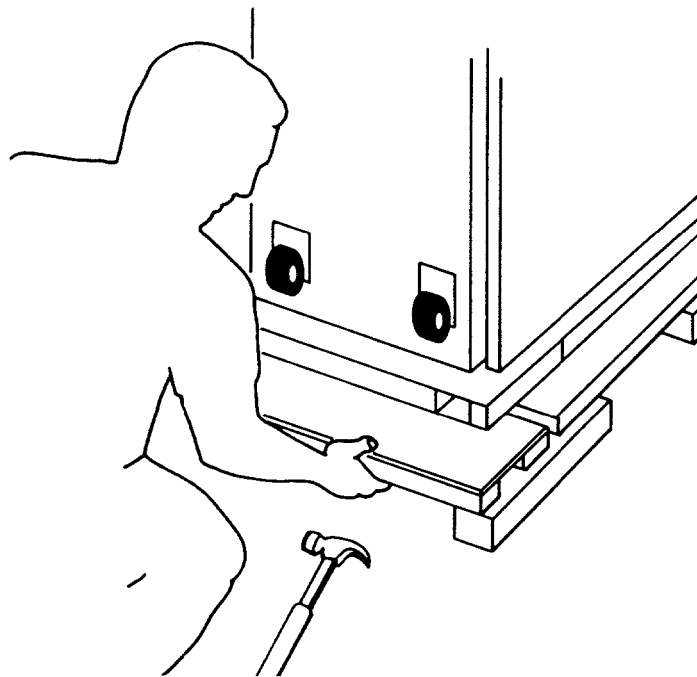


Use the wrench to remove the four bolts at the bottom end of the crate. Set them aside.

**Figure 2-2. Unpacking the HP 85108 System Cabinet in Air Carrier Style Packaging (1 of 4)**

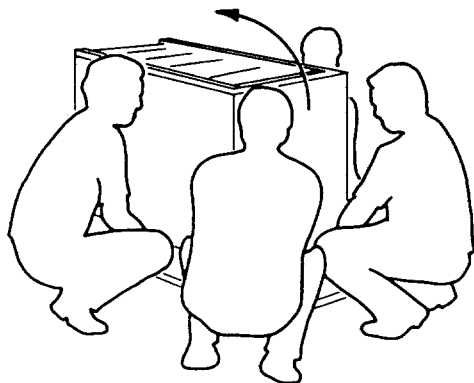


Remove the two metal pins and flat washers at the bottom end of the crate.

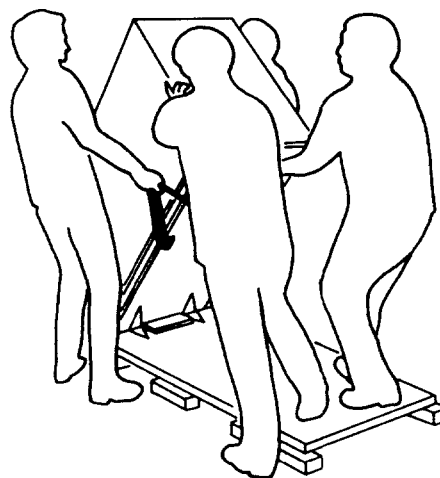


Remove the wooden pallet extender at the crate bottom using a hammer, if necessary. Set the extender aside.

**Figure 2-2. Unpacking the HP 85108 System Cabinet in Air Carrier Style Packaging (2 of 4)**



Move in close to the cabinet . Keep back straight.  
Crouch down and lift slowly with your legs.



Slowly rock cabinet forward using your legs,  
not your back.

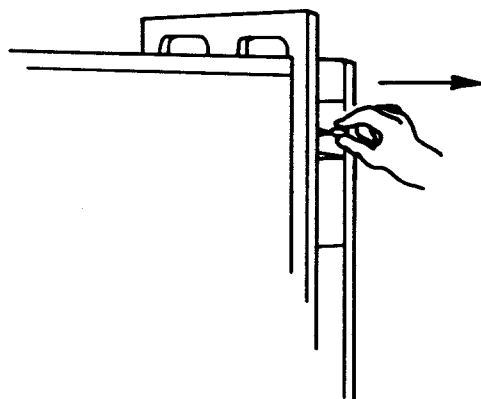


Do not allow anyone in front of the cabinet.

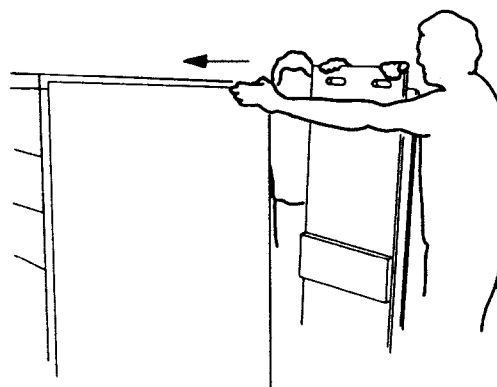


Be careful to avoid twisting your body.

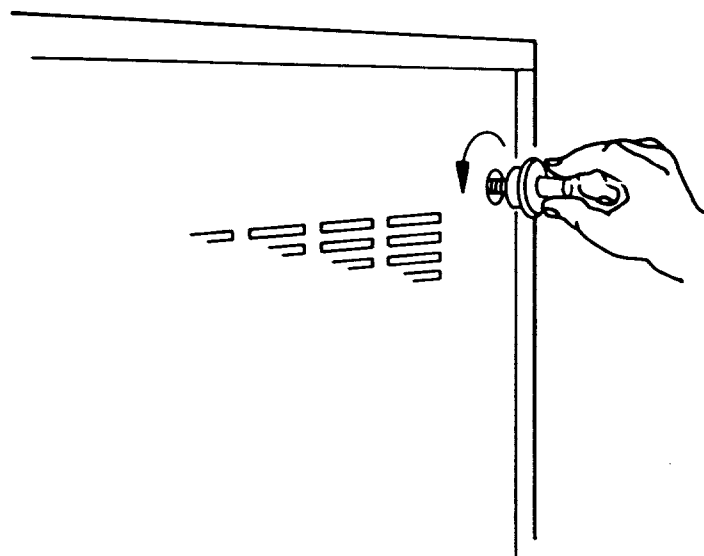
**Figure 2-2. Unpacking the HP 85108 System Cabinet in Air Carrier Style Packaging (3 of 4)**



Remove the two pins and flat washers on each side of the top of the crate.



Carefully push the cabinet away from the wooden pivot plate.



Remove the four shipping bolts from the back of the cabinet. Use the 12-inch adjustable open end wrench to loosen these bolts, if needed.

**Figure 2-2. Unpacking the HP 85108 System Cabinet in Air Carrier Style Packaging (4 of 4)**

---

## System Configuration

The configuration of the rack-mounted system is shown in Figure 2-1.

## Benchtop Configuration

The suggested configuration of the benchtop system is shown in Figure 2-4 of Figure 2-5.

You can configure your own pulsed-RF system using instruments you may already own. The pulsed-RF system consists of the following instruments:

Qty.	Item
1	HP 8510B,C option 008 Network Analyzer
1	HP 85110 S-parameter Test Set
1	HP source (RF)(select one from the table below)
1	HP source (LO) (select one from the table below)

**Table 2-5. Possible RF & LO Sources for Pulsed-RF Systems**

RF	LO	LO + HP 8349B Microwave amp <sup>1</sup>
HP 8340B	HP 83623A	HP 8340B
HP 8341B	HP 83624A	HP 8341B
HP 83620A		HP 83620A
HP 83622A		HP 83621A
HP 83623A		HP 83622A
HP 83624A		HP 83630A
HP 83630A		HP 83631A
HP 83640A		HP 83640A
HP 83642A		HP 83642A HP 83650A
HP 83650A		HP 83651A

<sup>1</sup> These sources can be used as LO sources if they are used with an HP 8349B microwave amplifier.

---

## System Cabling

Figure 2-3 shows the cabling of the rack-mounted pulsed-RF system. Figure 2-4 and Figure 2-5 show the cabling of the suggested benchtop systems. Notice that Figure 2-5 includes an amplifier in the setup, which is necessary with some LO sources.

---

## Installing a Computer

A computer must be connected to your system to run the performance verification software. The computer must be an HP 9000 series 300 computer with BASIC 5.0 or later and there must be 2 megabytes of available RAM after BASIC has been loaded. Refer to the Specifications and Performance Verification chapter of this manual for more information.

---

## Making Connections

There are two separate busses in this system:

- HP-IB Bus
- HP 8510 System Bus

Both busses use the same type of connector and cable, but the busses are not interchangeable.

### The HP-IB Bus

The computer retains full control of this bus, no other device can send commands unless the computer relinquishes control. Connect your peripheral equipment to this bus only if you want this equipment to be controlled by the computer.

### The HP 8510 System Bus

The HP 8510 must be able to send HP-IB commands to the other instruments in the system at any time, without waiting for “permission” from the computer. To facilitate this, a special HP-IB bus was created called the HP 8510 System Bus. Connect your peripheral equipment to this bus (via the 8510 Interconnect connector) only if you want this equipment to be controlled by the HP 8510.

## Connecting a Plotter

To connect a plotter to the system, connect one end of the HP-IB cable to the plotter (the plotter should have its own HP-IB cable). Connect the “free” end of the plotter cable to either the 8510 Interconnect connector (for system bus control) or to the HP-IB connector (for HP-IB bus control). Refer to Making Connections for more information regarding the busses. Set the plotter HP-IB address to 5.

Connect the plotter to an ac power source and turn it on. Refer to Accessory ac Power Outlet in this section for information about connecting the plotter to an ac power outlet inside the system cabinet.

## Accessory ac Power Outlet

All power connections for instruments in the system are located inside the cabinet via a multiple-outlet power strip. On some systems, an extra power outlet is provided on the power strip for accessories. Special “boot” ac power cables are included with your HP 85108 system for this purpose.

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<b>CAUTION</b>	Before connecting any equipment to the extra power outlet, refer to the paragraph entitled Environmental Characteristics earlier in this section for the maximum VA ratings for this outlet on your system.
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## The HP 85108 Installed In a Different Cabinet

Hewlett-Packard strongly recommends that the HP 85108 system cabinet be used with the HP 85108 pulsed-RF system. HP is not obligated to support user-configured pulsed-RF rack systems other than the HP 85108 rack-mounted system. The customer takes full responsibility for instrument damage incurred due to using racks or system cabinets other than the one supplied with the HP 85108 system.

Contact your nearest HP Office for more information about ordering a rack for your system.

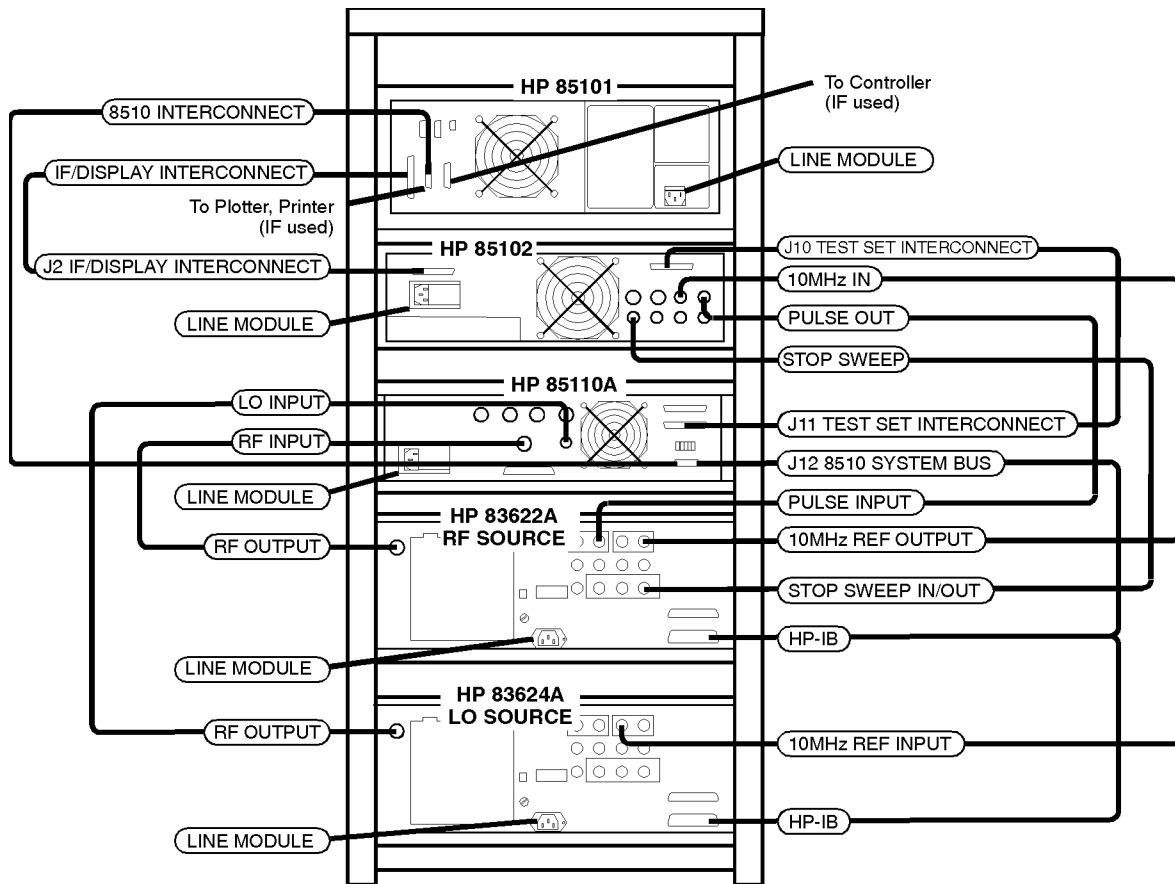
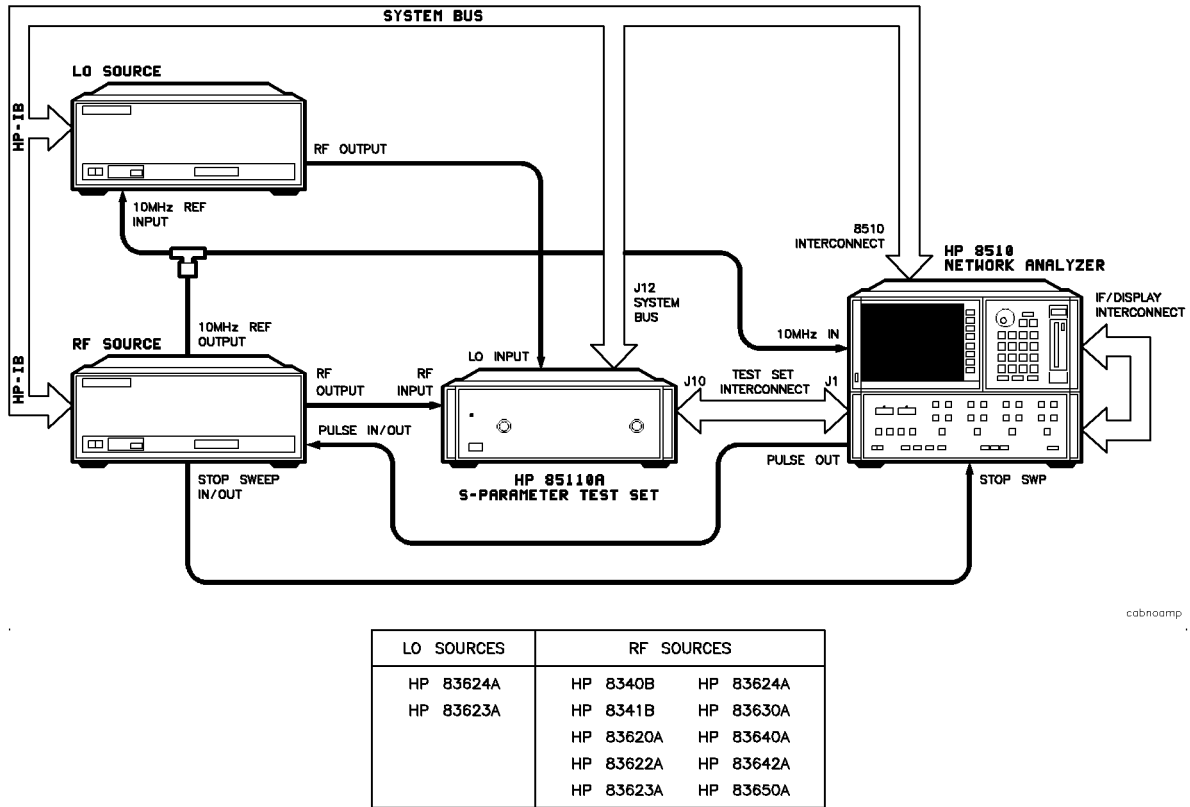


Figure 2-3. HP 85108 System Cabling Diagram (rack mounted system)





cabnoamp

Figure 2-4. HP 85108 System Cabling Diagram (benchtop configuration - without amplifier)

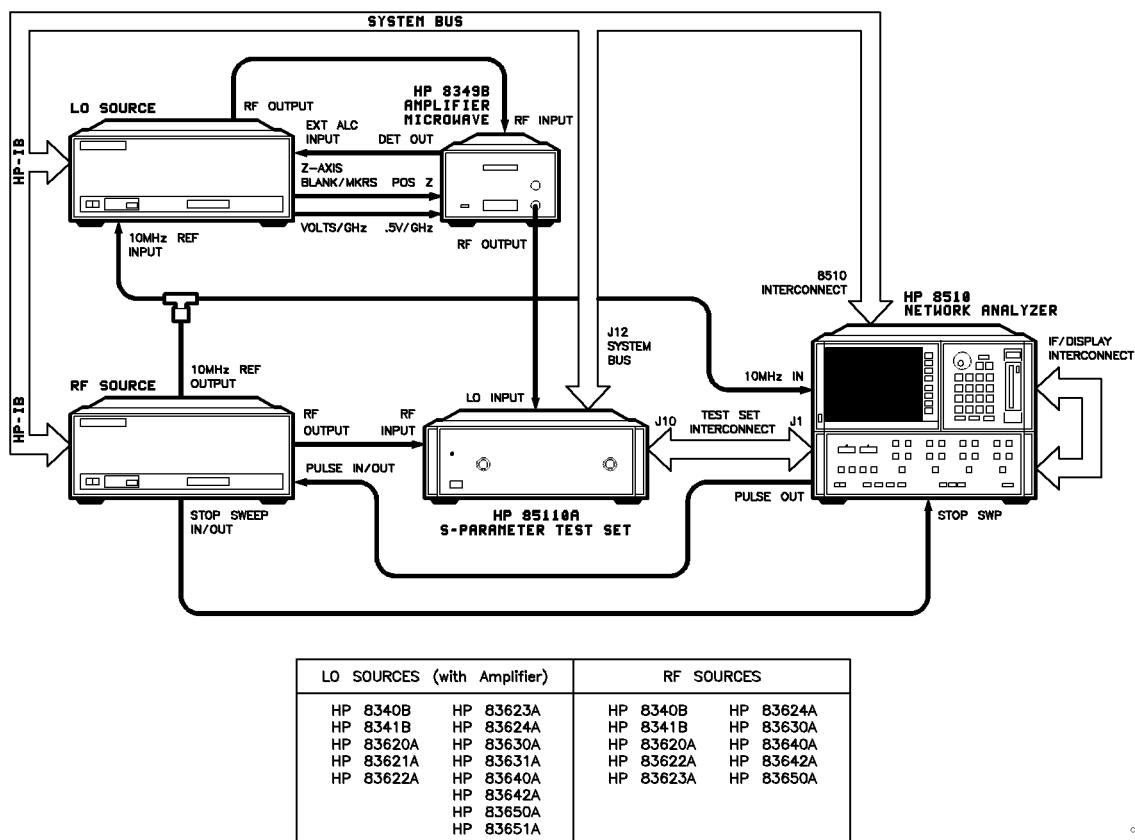


Figure 2-5. HP 85108 System Cabling Diagram (benchtop configuration - with amplifier)

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## System Turn On

Check the fuses of each instrument and verify that they match the local line voltage. Refer to the individual instrument manual to change the fuse or the fuse setting.

### Turn On System Power

1. Verify that all cables are connected properly (refer to Figure 2-3 or Figure 2-4).
2. Turn on power to the system rack and to all instruments except the HP 8510 Network Analyzer.
3. Once all the instruments are on, turn on the HP 8510.

### HP-IB Addresses

Verify that the instrument addresses are set correctly after system power on. On the network analyzer, press:

**SYSTEM** **HP-IB ADDRESSES**, then press the softkey that corresponds to each instrument in your system to check each address. Press **MORE** to show additional instrument choices.

Compare the addresses on the network analyzer display with the addresses listed in Table 2-6. To change an address, press the softkey corresponding to the desired instrument, then enter the correct address: **n** **n** **x1**.

**Table 2-6. HP 85108 System HP-IB Addresses**

Instrument	HP-IB Addresses
HP 8510	16
System Bus	17
Source #1 (RF)	19
Source #2 (LO)	18
HP 85110	20
RF Switch	31

### Initial Trace

Once the system is turned on, you should see a trace similar to Figure 2-6 on the network analyzer display. If your display is not similar to Figure 2-6 load the HP 85108 system configuration disk using the procedure in Appendix C.

If your display is similar to Figure 2-6, continue with the operator's tests in the Operation chapter of this manual.

## Firmware Revision

All property functioning systems display the firmware revision information illustrated in Figure 2-6 after system turn on.

HP 8510C-based systems must have firmware revision HP8510C.06.50 or greater.

HP 8510B-based systems must have firmware revision HP8510B.05.11 or greater. If your HP 8510B has firmware revision HP 8510B.06.00 or greater, and you are using an HP 836xx source, you must upgrade the firmware in each HP 836xx source you are using (must be March 08, 1991, or higher). Order HP part number 08360-60167 for the most current HP 836xx source firmware upgrade.

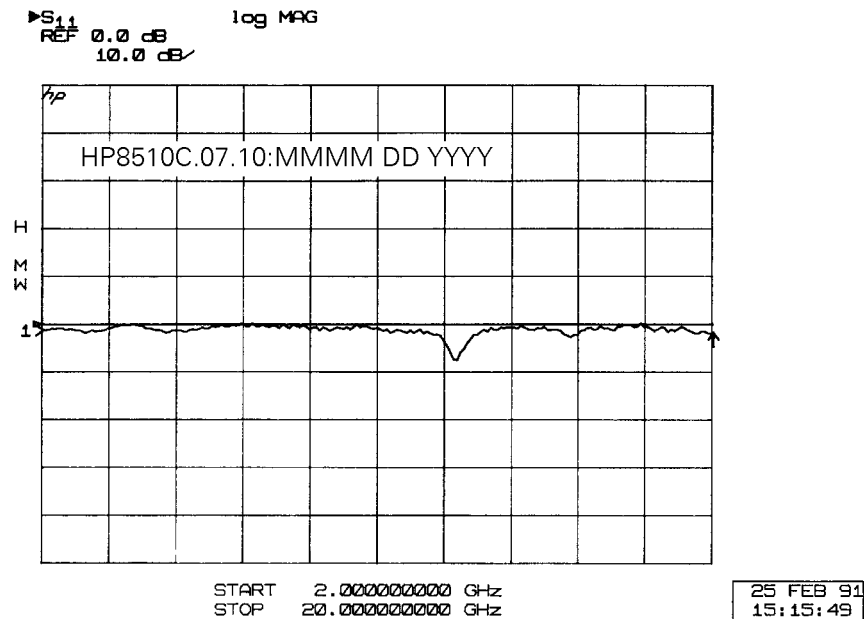


Figure 2-6. HP 85108 Initial Trace

## Operation

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### Introduction

This chapter contains the following information.

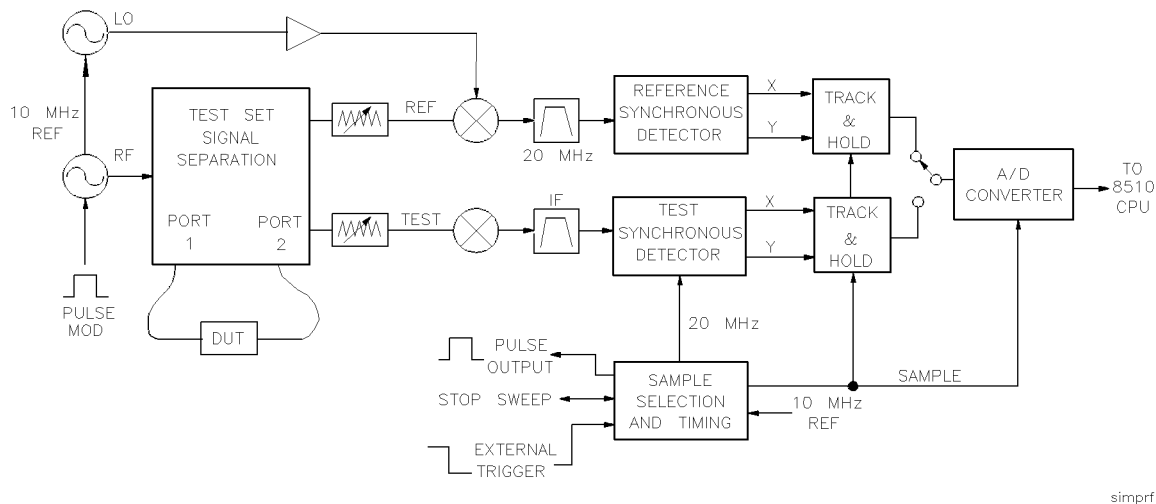
- A system description
- Operational tests
- Pulsed-RF measurement examples
- Pulsed-RF applications
  - Pulsed-RF timing information
  - External pulse modulation information
  - High power measurement considerations

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### System Description

Pulsed-RF stimulus may be required in cases where continuous application of the test signal could destroy the device, such as when testing occurs prior to packaging, or where the device must be tested using a PRF and duty cycle that accurately represents its final application. The HP 8510 pulsed-RF network analyzer configuration adds specialized hardware and an optimized firmware feature set to make fully error-corrected S-parameter measurements of pulsed-RF responses. For the first time, the combination of wideband IF and accurate timing circuits provides precise synchronization with the pulse, allowing S-parameters to be measured at a precisely known, repeatable time during the pulse. This extends the HP 8510 applications into two major areas: tests in which the stimulus signal to the device is pulsed, and tests of devices which accept a CW input and produce a pulsed output.

A simplified block diagram of the system is shown in Figure 3-1. One synthesizer provides the test signal stimulus to the RF input of the test set and the other provides the LO signal to the four frequency converters (only two are shown). The LO source is always tuned 20 MHz above the test signal source. The standard internal phaselock technique is not used; instead, a common 10 MHz frequency reference is used for both of these sources and the internal sample selection and timing logic in the HP 8510. These sources are considered to be coherent, thus generating the correct 20 MHz first IF and the correct clock frequency for the reference and test synchronous detectors. This eliminates the need to use the reference signal for receiver phaselock and allows all reference and test signals to be pulsed, thereby making fully error-corrected 2-port, pulsed-RF S-parameter measurements possible.



**Figure 3-1. Simplified Pulsed-RF Network Analyzer Block Diagram**

Using a wider bandwidth in both the reference and the test IF, synchronous detectors that operate at 20 MHz, and accurate measurement sample timing circuits allow flexible analysis of device response during the pulse. With the sources and test set controlled by the HP 8510 over the 8510 system bus, and with all necessary pulse generation and measurement timing signals generated internally from a common 10 MHz reference, the HP 85108 is a complete pulsed-RF stimulus/response test system. One pulse of a user-specified width is measured at each data point and the measurement is synchronized so that it is made at a certain known time in the pulse. The stimulus duty cycle can be predicted for a given instrument state, but the actual pulse repetition period depends upon the current domain, cal type, averaging, sweep time, and pulse width selections. For this reason, if your device is sensitive to duty cycle, refer to General Timing Information in this chapter.

Either the internal logic, the TTL Trigger Input, or the HP-IB Group Execute Trigger from an external controller can initiate a measurement cycle. When control of the pulse repetition period and duty cycle is required, the HP 8510 can use the trigger input to synchronize with the internal or an external pulse modulator. The HP 8510 Stop Sweep output can be used as a gating signal to tell when the analyzer is ready for the next measurement. The measurement is made with 100 nanosecond resolution and about 200 picosecond uncertainty with respect to the internally- or externally-generated measurement trigger.

## HP 85110 S-Parameter Test Set Operation

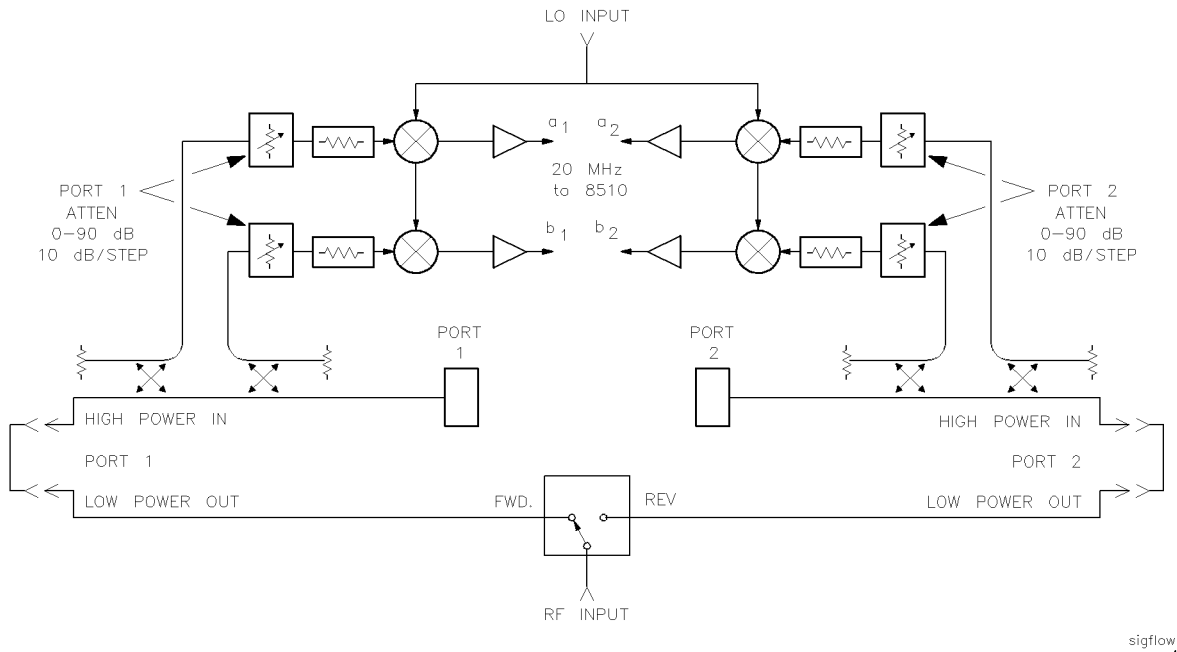
Figure 3-2 shows a detailed diagram of the HP 85110-series test set signal separation, signal routing, and frequency conversion. This is a fundamentally mixed test set, providing four 20 Mhz outputs to the network analyzer. Placement of a 0 to 90 db (10 dB/step) attenuator before each mixer provides control of the signal levels into the mixers while allowing operation at high PORT 1 and PORT 2 signal levels necessary in many pulsed-RF applications.

The test set has rear panel access links to allow integration of additional test and signal conditioning equipment in the low-loss main signal paths to the test ports. If your device exhibits more than about 20 dB of gain, or higher port signal levels are required, refer to the High Power Measurements section in this chapter.

## 3-2 Operation

Hewlett-Packard harmonic mixing test sets are designed to work with the normal 10 kHz IF and detectors. These include the HP 8514, 8515, and 8516 coaxial test sets; and the HP 11643-series millimeter waveguide test sets. This HP 85110 fundamental mixing test set is designed to work with the wideband IF and detectors. There are applications in which the HP 85110 can be used with normal IF and detectors. All HP 11643-series millimeter test sets can be configured to operate with the wideband IF and perform the pulse measurement functions described here.

All HP coaxial test sets can be equipped to include Option 001, IF Switching for Multiple Test Sets, so a system can be equipped for a wide range of applications by including up to four coaxial test sets and a millimeter-wave test set.



**Figure 3-2. HP 85110A S-Parameter Test Set Signal Flow**

## Controlling Multiple Test Sets

Option 001 for the HP 851X-series and 85110 test sets allows an HP 8510 to alternately control up to four test sets. While a measurement is proceeding on test set number 1, which is equipped with option 001, test device hookup can be accomplished on test set number 2, which does not have to be equipped with option 001, unless another test set is to be connected. When the measurement on test set number 1 is complete, the HP 8510 can control test set number 2.

---

## Operational Tests

Your system should be installed, turned on, and have the correct machine dump file from the HP 85108 system configuration disk loaded at this point. If it is, continue with this section. If it is not, return to the System Installation chapter of this manual.

Operational tests provide you with the assurance that your system is functioning. Operational tests do not indicate if the system is operating within its specifications. Perform these tests after the system is installed for the first time and when any part of the system is repaired.

If any of the operational tests fail, refer to the System Service and Troubleshooting chapter for more information.

The instrument and hardware states of each operational test are contained on the HP 85108 System Configuration disk. The configurations for these operator's tests are located in instrument states 1 through 8 of your network analyzer, provided you performed the system installation procedures. If not return to the System Installation chapter to load the machine dump file MD\_PULS or MD\_PULS\_A. MD\_PULS\_A should only be loaded for systems with the HP 8349B amplifier in the LO source path.



## Operational Test Procedure

1. The test ports are both “open” (nothing connected to them) for these tests.
2. Press **RECALL** **INSTRUMENT STATE 1**. Compare the network analyzer display to Figure 3-3.

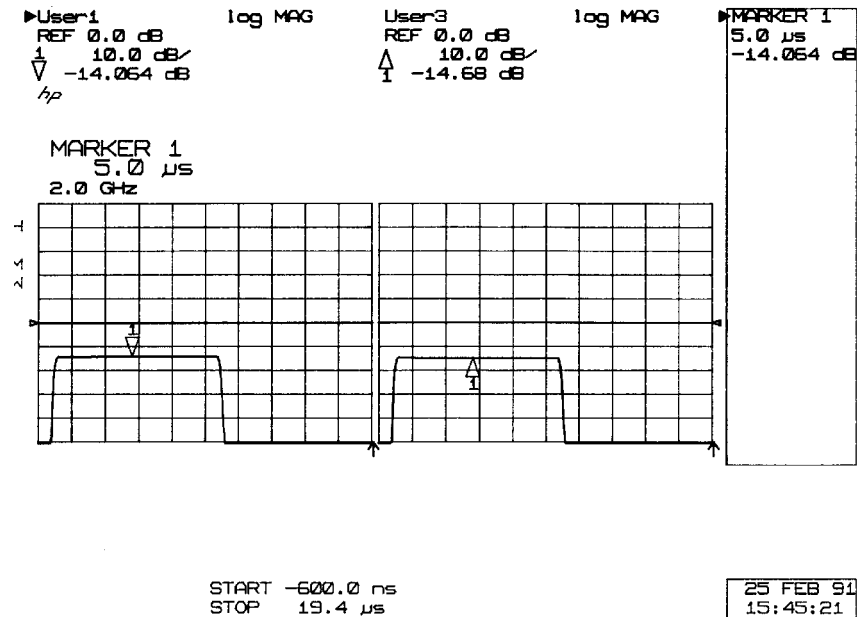
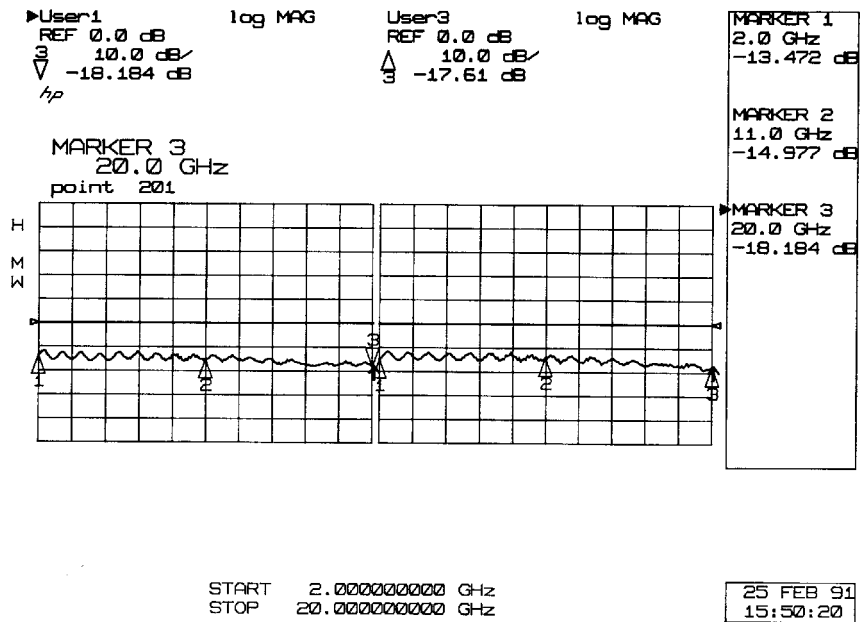


Figure 3-3. Instrument State 1

Check these items:

- Domain: Pulse profile
- Display Mode: Dual channel split
- Wide BW Detectors: On, indicated by the **W** to the left of the graticule.>
- Channel 1: log mag, USER 1 a1
- Channel 2: log mag, USER 3 a2

3. Repeat step 2 for the remaining instrument states and compare the results with Figure 3-4 through Figure 3-10.



**Figure 3-4. Instrument State 2**

Check these items:

Domain: Frequency

Display Mode: Dual channel split

Wide BW Detectors: On, indicated by the **W** to the left of the graticule.

Channel 1: log mag, USER 1 a1

Channel 2: log mag, USER 3 a2

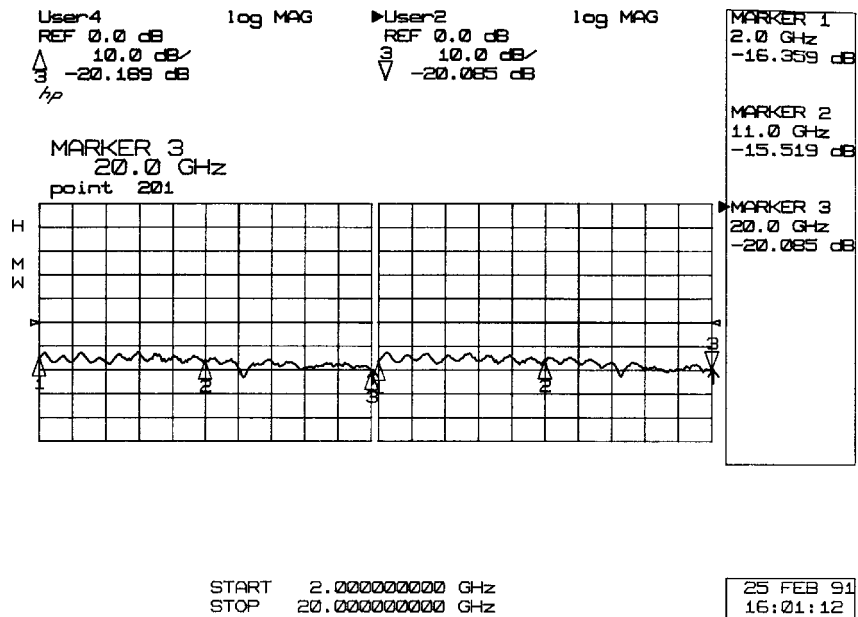


Figure 3-5. Instrument State 3

Check these items:

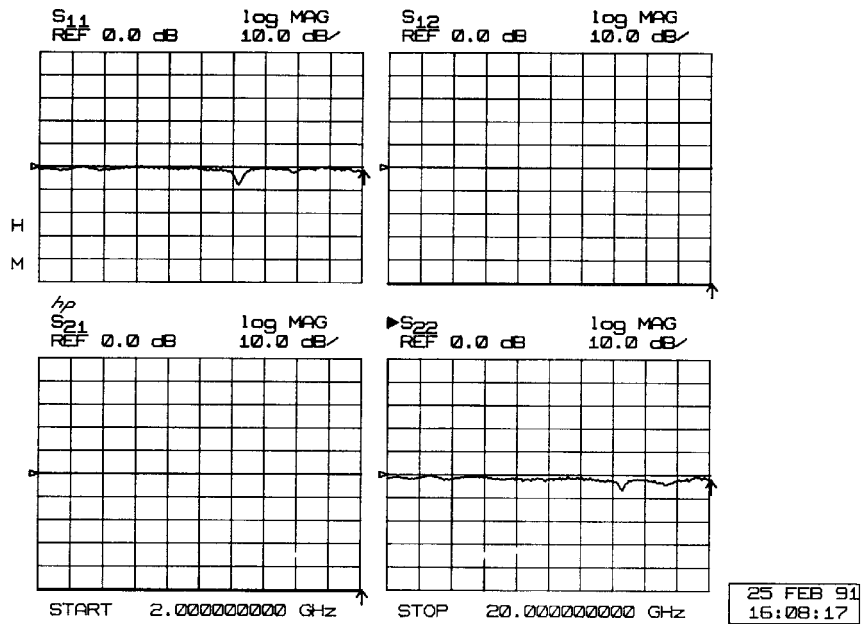
Domain: Frequency

Display Mode: Dual channel split

Wide BW Detectors: On, indicated by the **W** to the left of the graticule.

Channel 1: log mag, USER 4 b1

Channel 2: log mag, USER 2 b2



**Figure 3-6. Instrument State 4**

Check these items:

Domain: Frequency

Display Mode: Four parameter split

Normal BW Detectors: On, the **W** to the left of the graticule should disappear.

Channel 1: log mag,  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ ,  $S_{22}$

Channel 2: phase,  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ ,  $S_{22}$

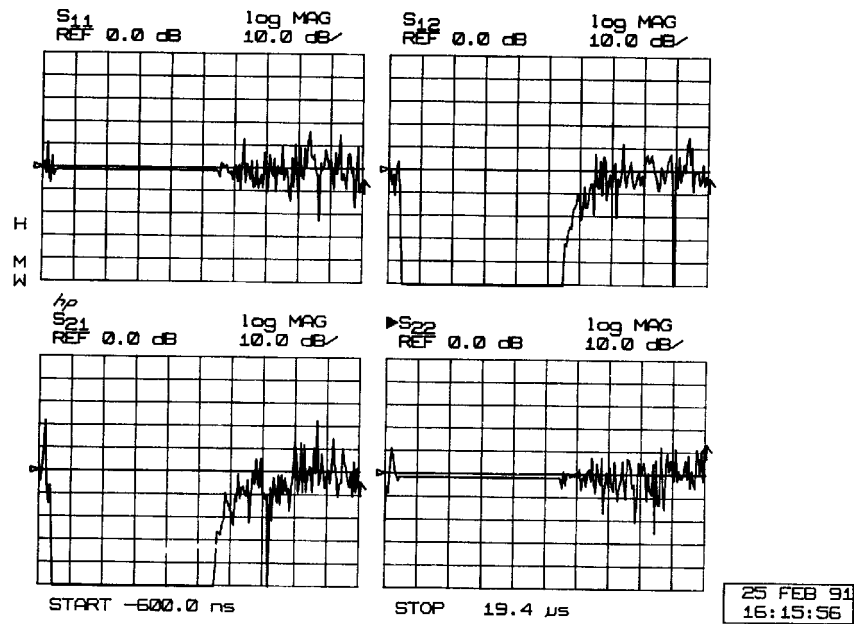


Figure 3-7. Instrument State 5

Check these items:

Domain: Pulse profile

Display Mode: Four parameter split

Wide BW Detectors: On, indicated by the **W** to the left of the graticule.

Channel 1: log mag, S<sub>11</sub>, S<sub>21</sub>, S<sub>12</sub>, S<sub>22</sub>

Channel 2: phase, S<sub>11</sub>, S<sub>21</sub>, S<sub>12</sub>, S<sub>22</sub>



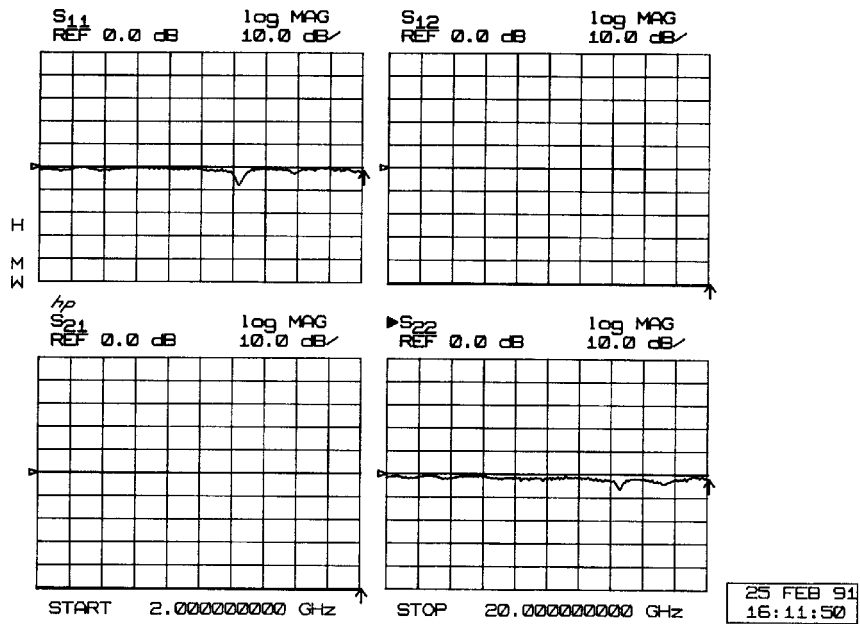


Figure 3-9. Instrument State 7

Check these items:

Domain: Frequency

Display Mode: Four parameter split

Wide BW Detectors: On, indicated by the **W** to the left of the graticule.

Channel 1: log mag,  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ ,  $S_{22}$

Channel 2: phase,  $S_{11}$ ,  $S_{21}$ ,  $S_{12}$ ,  $S_{22}$

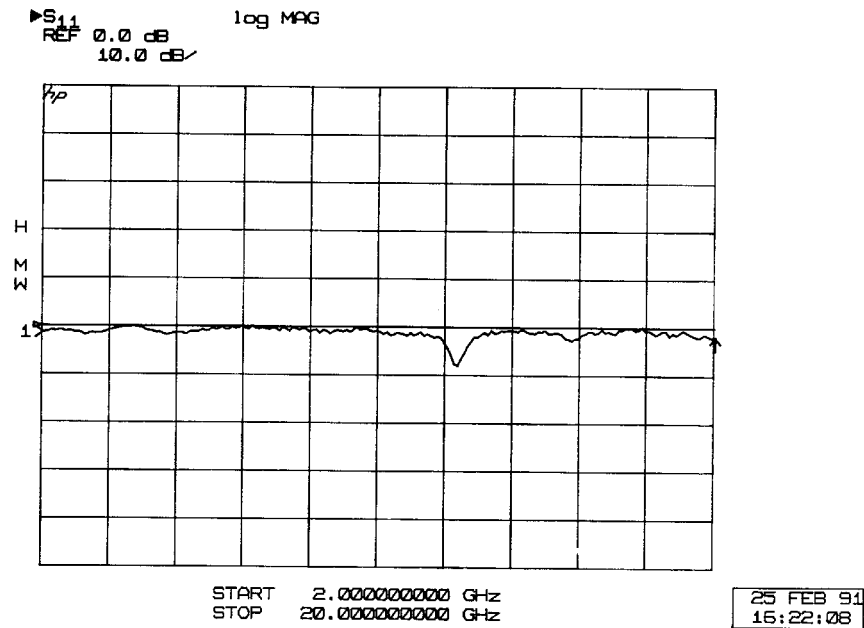


Figure 3-10. Instrument State 8

Check these items:

Domain: Frequency

Display Mode: Single parameter

Wide BW Detectors: On, indicated by the **W** to the left of the graticule.

Channel 1: log mag,  $S_{11}$

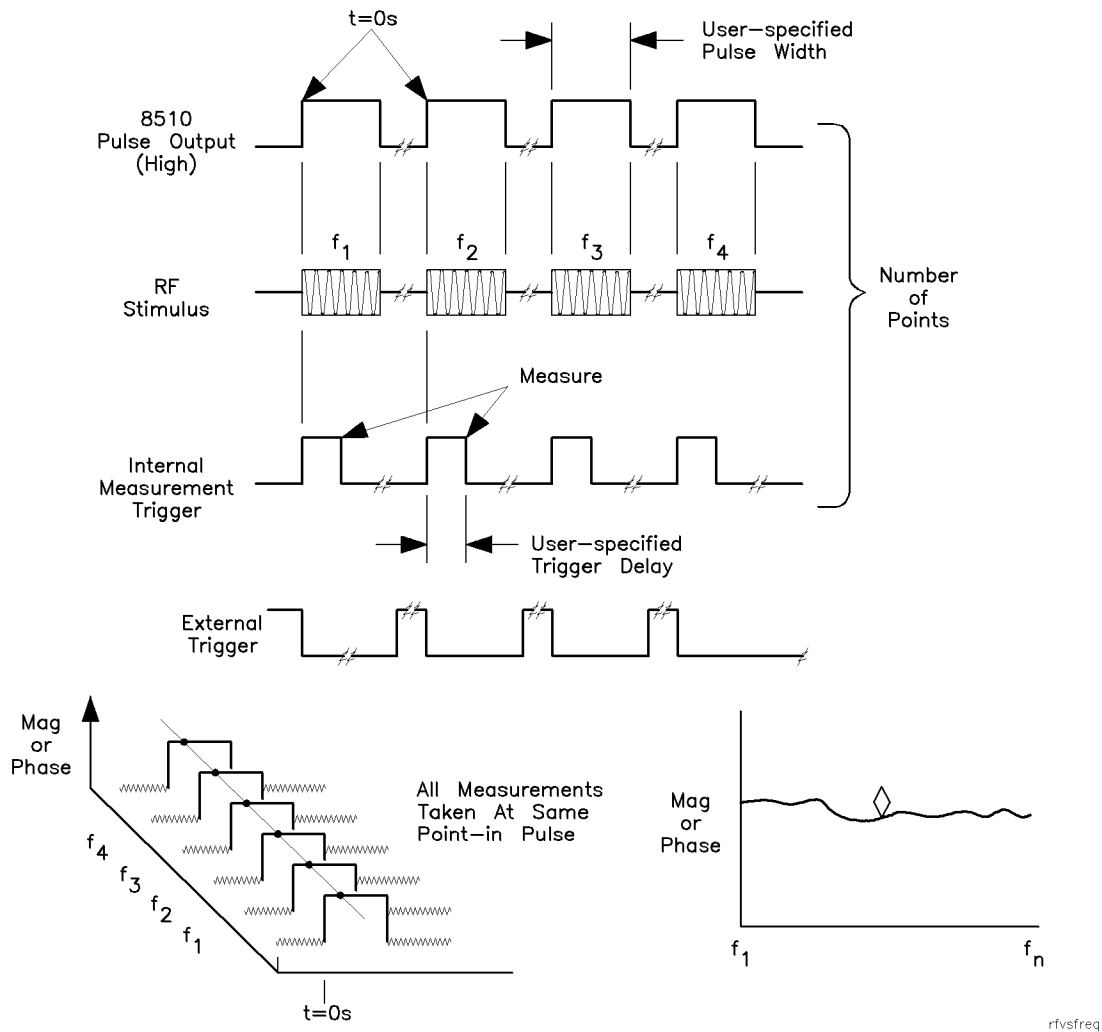
Channel 2: phase,  $S_{11}$

## Pulse Measurements Overview

Two types of measurements are available with the pulse configuration. Each type of measurement is described below.

1. **Pulsed-RF S-parameters versus Frequency.** Making pulsed-RF measurements in the frequency domain is accomplished by synchronizing the measurement process with the pulse so that the measurement is made at a single, user-specified time during the pulse. At each frequency, the sources are tuned, the RF is turned on, then the measurement is made after a certain delay. Figure 3-11 shows an example of this “frequency domain point-in-pulse” measurement using the internal pulse output and the internal measurement trigger. Each data point of the trace represents the response of the device to the pulsed stimulus at the same interval after the pulse is turned on.





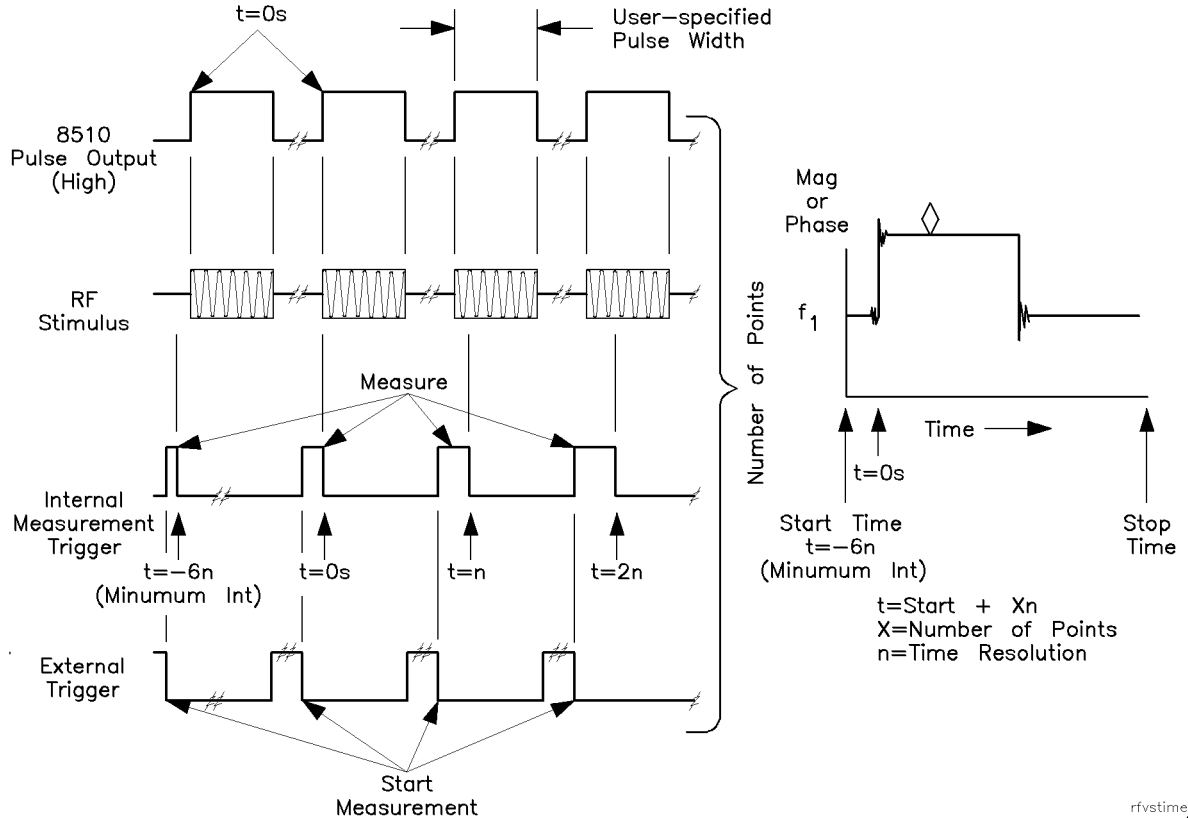
**Figure 3-11. Pulsed-RF S-Parameters versus Frequency (Frequency Domain Point-in-Pulse)**

2. **Pulse Profile Domain.** A repetitive sampling technique is used to make measurements in the pulse profile domain. Measurements are taken at a single frequency as determined by the start frequency setting. Data is reconstructed from samples taken from a series of pulses. For each pulse, a single point in the pulse is measured. A profile of the pulse is made by measuring the first pulse at the user-specified Start time, then increasing the measurement trigger delay by a certain time increment for each pulse until the specified number of points is measured. Refer to Figure 3-12 for an example of this process.

Time zero is the leading edge of the internally-generated pulse output waveform, or the falling edge of the externally-generated measurement trigger waveform. The network analyzer automatically controls the time increment between samples, called the measurement resolution period, using an algorithm that depends upon the greater of the user-specified pulse width or stop time. This automatic selection of the time resolution can be seen by changing the number of points and the time span. For narrow pulses and small time spans, the measurement resolution period can be as small as 100 nanoseconds; for wide pulses and large time spans, it can increase to multiples of 10 microseconds. With the internal measurement trigger, the first sample can be taken up to 6 resolution periods prior to time zero. When using

external triggering, the external trigger sets time zero and the first sample can be taken three resolution periods after time zero.

A method for making pulse profile measurements at multiple frequencies is described later, in the “Making Pulsed-RF Measurements” section.



**Figure 3-12.**  
**Pulsed-RF S-Parameters versus Time (Pulse Profile Domain) Measurement.**  
**Internal Pulse Output and Internal Measurement Trigger**

## Making Pulsed-RF Measurements

### Frequency Domain (Point-in-Pulse)

#### Calibration

Measurement calibration for frequency domain (point-in-pulse) is accomplished in exactly the same way as for the standard HP 8510 network analyzer.

1. Press **DOMAIN** **FREQUENCY** to select the frequency domain.
2. If the **W** annotation is not displayed, select the wideband detector by pressing **SYSTEM** **MORE PULSE CONFIG** **DETECTOR: WIDE BW**.

3. Select the maximum number of points required for the measurement, then perform the appropriate measurement calibration.

Note that when you press the key to measure the calibration standard, the HP 8510 pulse output signal is set to the active state (RF always On) during measurement of the standard. This assures that the calibration is made with respect to the On portion of the pulse independent of the trigger delay. If external pulse modulation is used, it is necessary that the RF is On during measurement of the calibration standard. Save a calibration in any one of the 8 registers.

## Measurement

1. Set Pulse Polarity. After factory preset, the pulse polarity is set to High for the On period of the pulse appearing at the HP 8510 rear panel PULSE OUTPUT connector. Use the following procedure to set the pulse polarity. Press: **SYSTEM** **MORE** **PULSE CONFIG** **PULSE OUT: HIGH** or **PULSE OUT: LOW**.
2. Set Pulse Width. After factory preset, the pulse width is set to 10 microseconds. Use the following procedure to set a different pulse width. Press **PULSE WIDTH**. Use the knob, step keys, or numeric entry to set the desired pulse width.
3. Set Duty Cycle Limit. After factory preset, the duty cycle limit is set to 10%. This means that the maximum duty cycle will never be allowed to be greater than 10 percent regardless of the pulse width.

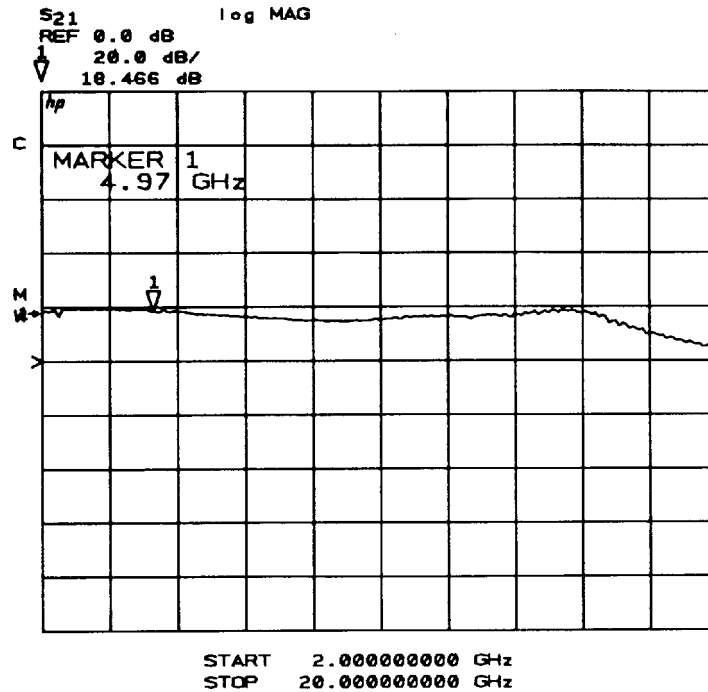
To set the duty cycle limit, press **DUTY CYCLE** on the Pulse Configuration menu. Use the knob, step keys, or numeric entry to set the desired maximum duty cycle limit. Note that the actual duty cycle may be less.

4. Set Trigger Delay. After factory preset, the trigger delay is set to 5 microseconds. This means that the measurement will take place 5 microseconds after time zero. Time equals zero seconds is when the HP 8510 pulse output goes to the active level turning on the pulse modulator. Use the following procedure to set the trigger delay.

Press **STIMULUS MENU** **MORE** **TRIGGER MODE** **TRIGGER DELAY**, then use the knob, step keys, or numeric entry to set the desired trigger delay.

Notice that if the trigger delay is set to outside the time interval that the pulse is On, the trace is noisy due to low signal levels.

5. Connect the Device Under Test. Figure 3-13 shows the response of the device to the pulsed-RF stimulus over the current frequency sweep.



**Figure 3-13. Amplifier Gain, Frequency Domain Point-in-Pulse**

The dynamic range can be increased using IF averaging, but, given the system noise floor with the wide IF bandwidth, an averaging factor of about 256 averages is the maximum value that should be used. In general, using an averaging factor greater than 256 will not result in any increase in visible dynamic range.

## Pulse Profile Domain

### Calibration

After selection of the pulse profile frequency, measurement calibration for pulse profile measurements is accomplished in exactly the same way as for the standard HP 8510. Following are two measurement calibration methods, one for calibration in the Pulse Profile domain, and the second for calibration using the Frequency List feature. Select the best one for your application.

The pulse profile domain calibration procedure is an easy way to familiarize yourself with the pulse profile domain and for general-purpose measurements using simple response-only correction.

Use the frequency list technique when more than one pulse profile frequency and 1-Port or 2-Port correction is required. Given adequate signal levels, accurate timing, and frequency stability, there is essentially no difference in the accuracy of the pulse profile measured data whether the calibration is performed in the pulse profile domain as described in the first procedure or in the frequency domain as described in the second procedure. The main advantage of calibration in the frequency domain is that you can calibrate at all frequencies in the list while only connecting the standards once.

**Pulse Profile Domain.** Perform measurement calibration in the pulse profile domain as follows.

1. Turn correction off by pressing **CAL** **CORRECTION OFF**.
2. Press **DOMAIN** **FREQUENCY** to select the frequency domain. Press **STIMULUS MENU** **STEP** to select the sweep mode.
3. Press **START** then set the start frequency to the desired pulse profile frequency. This will be the frequency measured when the pulse profile domain is selected.
4. Press **PULSE PROFILE** on the Domain menu. Press **MARKER** and notice that the active function readout shows both the time value at the marker position and the current measurement frequency.
5. Select the maximum number of points required for the measurement, then perform the appropriate measurement calibration.

Note that the HP 8510 pulse output is set to the active state (RF always On) during measurement of the calibration standards. If pulse modulation is operating during the calibration, the pulse width or time span cannot be changed after calibration.

Repeat this sequence for the next pulse profile frequency.

With several cal sets created in this way, you can select each pulse profile frequency in turn by simply recalling the corresponding cal set.

**Frequency Domain Using Frequency List.** In the above measurement calibration procedure it is necessary to perform a separate calibration for each pulse profile frequency. This is not a problem for simple response-only calibrations, but when accuracy considerations require the use of 1-Port or 2-Port calibrations, connecting the necessary sequence of standards repeatedly can be tedious. As an alternative, the frequency list feature allows the standards to be connected once for all pulse profile frequencies.

Perform the calibration as follows.

1. Press **DOMAIN** **FREQUENCY** to select the frequency domain.
2. If the **W** annotation is not displayed, the wideband detector must be selected before proceeding.  
Press **SYSTEM** **MORE** **PULSE CONFIG** **DETECTOR: WIDE BW**.
3. Press **STIMULUS MENU** **MORE** **EDIT LIST** to display the Edit List menu. Create a segment for each pulse profile frequency to be measured. Each segment is defined such that the start and stop frequencies are identical and the number of points in each segment is the number of points to be displayed in the pulse profile measurement. For example, the following sequence creates a frequency list to measure four pulse profile frequencies, of 51 points each.
  - a. Press **ADD** **START** **3** **G/n** **NUMBER of POINTS** **5** **1** **x1** **DONE**.
  - b. Press **ADD** **START** **4** **G/n** **x1** **DONE**.
  - c. Press **ADD** **START** **5** **G/n** **x1** **DONE**.
  - d. Press **ADD** **START** **6** **G/n** **x1** **DONE**.
4. Press **DONE** **FREQUENCY LIST**. The frequency list will be measured.

Figure 3-14 shows the resulting display. Proceed with the appropriate measurement calibration.

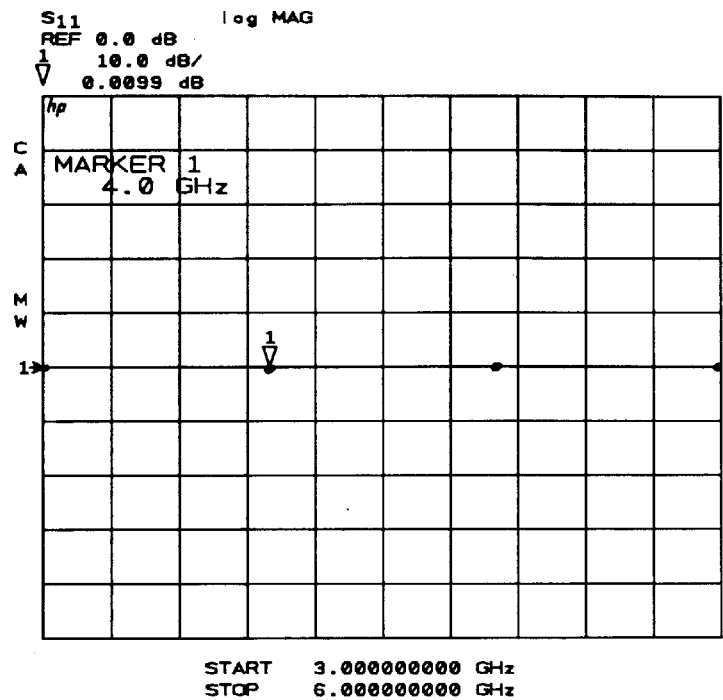
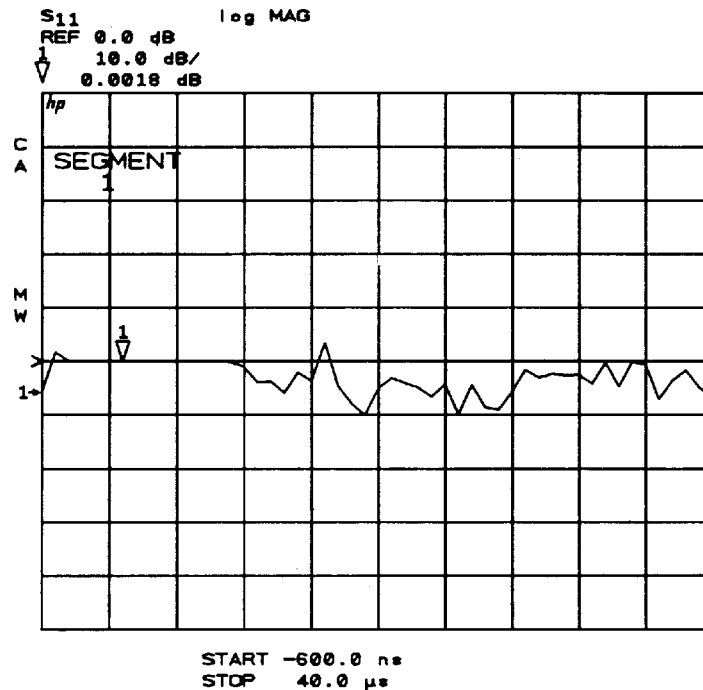


Figure 3-14. Frequency List Display During Measurement Calibration

- 5. Press **DOMAIN** **PULSE PROFILE**
- 6. Press **STIMULUS MENU** **FREQUENCY LIST** **SINGLE SEGMENT**.

The last selected segment will be active.



**Figure 3-15. Pulse Profile, Frequency List Segment Number 1**

To measure another frequency, select the appropriate active segment.

When either of these calibration procedures is complete, the device can be connected for measurement.

Again, in both of these procedures, note that when you press the key to measure the calibration standard, the HP 8510 pulse output is set to the active state (RF always On) during measurement of the standard. This ensures that the calibration data at every point is with respect to the On portion of the pulse. If external pulse modulation is used, it is necessary that the RF is On during measurement of the calibration standard.

### Measurement

After calibration, first view the response of one of the calibration standards. Figure 3-16 is typical: the trace is flat at 0 dB when the pulse is On, and noisy around 0 dB when the pulse is Off. The noise during pulse Off will vary depending upon the relative signal levels in the reference and test signal paths.

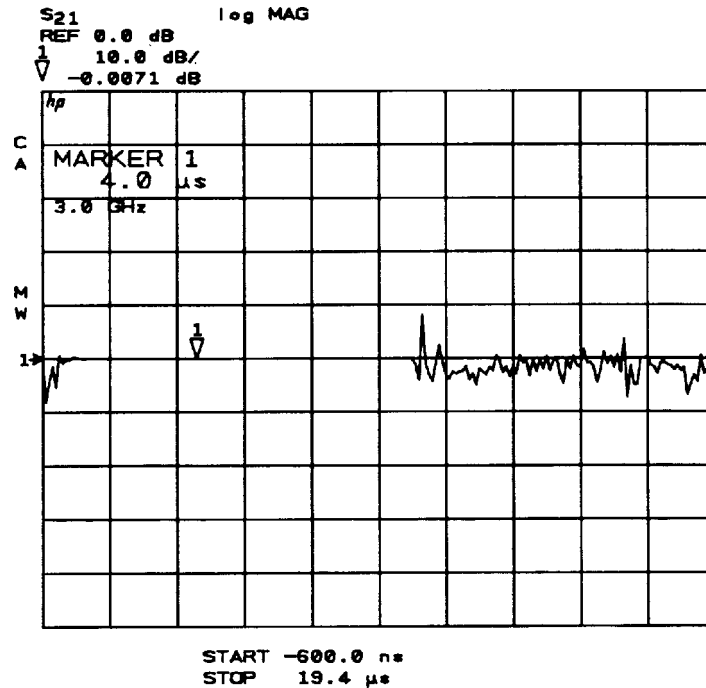


Figure 3-16. S<sub>21</sub>, Pulse Profile, Thru

1. Set Pulse Polarity. After instrument preset, the pulse polarity is set to High for the On period of the pulse appearing at the HP 8510 rear panel PULSE OUTPUT connector. Use the following procedure to set the pulse polarity.

Press **(SYSTEM) MORE PULSE CONFIG PULSE OUT: HIGH**.

For internal pulse modulation and internal triggering, time equals zero seconds is always the point where the pulse transitions to the active level. The internal pulse modulator in the RF source turns the RF pulse On when the analyzer output is positive, so the noisy part of the trace will change location depending on the pulse polarity.

2. Set Pulse Width. After instrument preset, the pulse width is set to 10 microseconds. Press the following keys to set a different pulse width.

Press **(SYSTEM) MORE PULSE CONFIG PULSE WIDTH**.

Use the knob, step keys, or numeric entry to set the desired pulse width.

3. Set Duty Cycle Limit. After instrument preset, the duty cycle limit is set to 10. This means that the maximum duty cycle will never be allowed to be greater than 10 percent regardless of the pulse width.

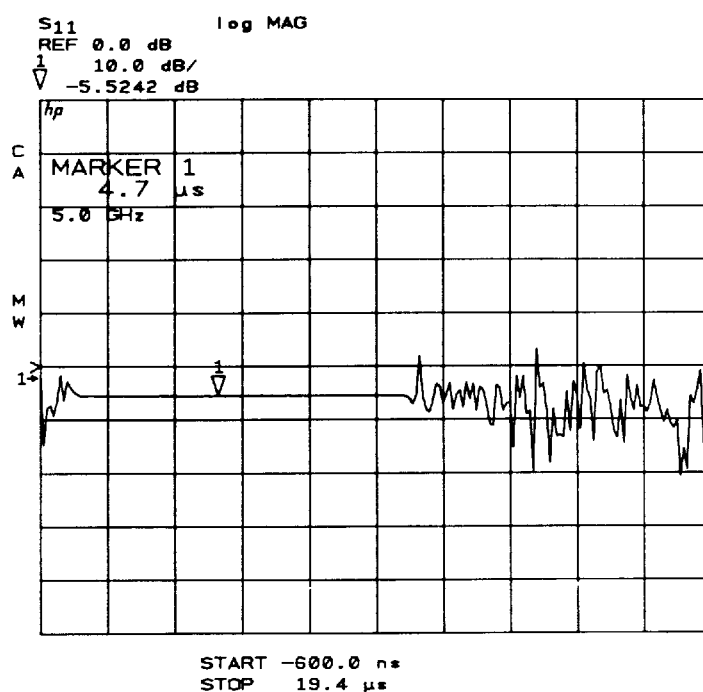
To set the duty cycle limit, press **DUTY CYCLE** on the Pulse Configuration menu. Use the knob, step keys, or numeric entry to set the desired maximum duty cycle limit. Note that the actual duty cycle may be less.

4. Set Measurement Time Span. The HP 8510 automatically chooses the minimum possible (given the HP 8510 hardware and firmware capabilities) time between samples, and thus the measurement resolution period, depending upon the larger of the pulse width time or the stop time. This results in a minimum possible span time which depends upon the current number of points.



To view the pulse with minimum sample resolution period and thus the best time resolution, press **(STOP)**, then repeatedly press the **▼** key until the time value at the bottom of the grid does not change (or enter **(STOP) 0 (x1)**). This also sets the start time to the minimum value. If the pulse is longer than this time span, increase the stop time to view the entire time period of interest.

5. Set Measurement Resolution Period. To find the resolution period, press **(MARKER)**, then move the marker one data point and see the time change in the Active Entry area. If necessary, adjust the resolution period to the value required for your measurement by changing the stop time, pulse width, and number of points.
6. Connect the Device under Test. With the pulse width set, connect the device under test. Figure 3-17 shows the response of the device to the pulsed-RF stimulus at the current frequency.



**Figure 3-17. Minimum Time Span, Resolution Period = 100 ns**

7. To measure another frequency, recall the appropriate cal set or frequency list segment, depending upon the calibration procedure used.

Figure 3-18 shows the  $S_{11}$  response using the Smith chart format. The marker is showing the input impedance during the On time of the pulsed-RF stimulus.

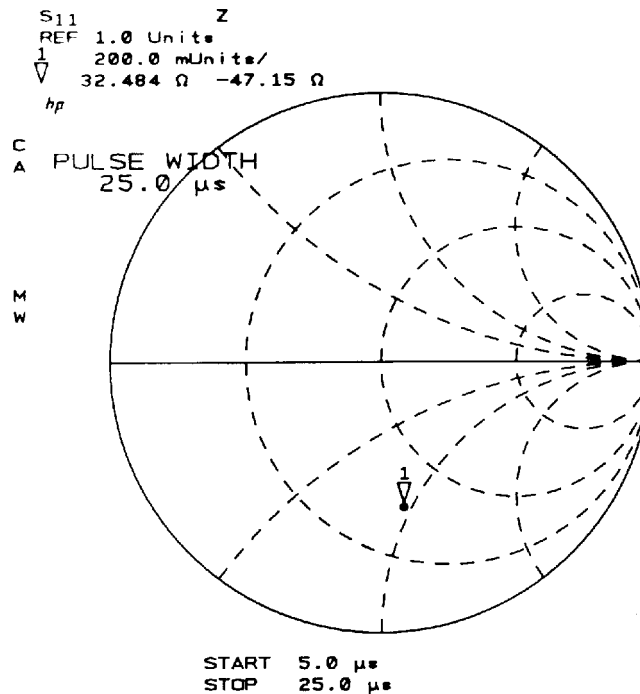


Figure 3-18.  $S_{11}$ , Smith Chart

### Switching Between Frequency Domain and Pulse Profile Domain

The domain in which the measurement calibration was performed is not part of the cal set limited instrument state. This means that, for example, a cal set created in the frequency domain could be turned on for a pulse profile domain measurement with no message to the operator. Except for the pulse profile calibration procedure in the frequency domain using Frequency List, a cal set should only be used in the domain in which it was created.

Press the following keys to switch between the frequency domain and the pulse profile domain.

- **CAL** **CORRECTION OFF** **DOMAIN** **FREQUENCY** or **PULSE PROFILE**
- **CAL** **CORRECTION ON** **CAL SET n**

This sequence makes certain that the cal set applies to the domain in which it was created. Another method is to save a number of instrument states, each with the appropriate domain and cal set, then simply recall the desired instrument state.

If a cal set created in the pulse profile domain is turned On while in the frequency domain, it is treated as if the calibration were performed using step sweep with the minimum frequency span. The pulse profile domain error coefficients are applied to different frequency points, resulting in trace errors.

Also, if a cal set created in the frequency domain is turned On while in the pulse profile domain, the frequency is set to the start frequency of the frequency domain cal set and the frequency domain error coefficients are applied to each corresponding point in the pulse profile domain. This also results in trace errors.

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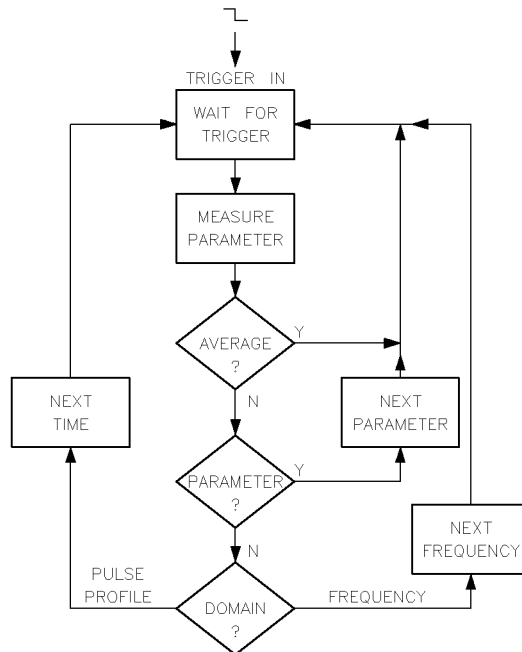
## Pulsed-RF Applications

### Pulsed-RF Timing Information

If your device is sensitive to pulse repetition period or duty cycle you will need to learn more about how these are affected by the instrument state. The following paragraphs provide information that can be used to predict the internal PRP for different instrument states.

#### Network Analyzer Measurement Cycle

Figure 3-19 shows the general measurement process flow of the network analyzer measurement cycle. For the frequency domain point-in-pulse measurement and the pulse profile domain measurement, the HP 8510 measurement cycle consists of making the measurement, setting up for the next measurement, then waiting for the next trigger.



meacycle

**Figure 3-19. Network Analyzer Measurement Cycle**

Each measurement cycle is initiated by the falling edge of the TTL signal at the rear panel external Trigger Input, or the internal 8510 logic, depending upon whether external or internal triggering is selected. At the appropriate time after the trigger, the measurement is made. If averaging is turned On but not completed, the process waits for the next trigger to make the next measurement for that data point. If averaging is complete but another parameter is required (2-Port correction is On), the next parameter is selected and the process waits for the next trigger. When all data for that point is acquired, then the process moves to the next point, changing the frequency if in the frequency domain, or the time if in the pulse profile domain, then waits for the next trigger.

These times are representative typical measurement cycle times using preset values for the analyzer controls.

Measurement Cycle Times	
1 ms	Next Average
4 to 8 ms	Next Parameter
30 to 40 ms	Next Frequency Point (Frequency Domain)
3-4 ms	Next Time Point (Pulse Profile Domain)

## Measurement Cycle Time

Controls that can effect the measurement cycle time are:

**Sweep Time.** When the analyzer is otherwise ready for the next measurement cycle, it ignores triggering for an interval equal to (Sweep Time (ms)/Number of Points).

**Pulse Width.** The pulse always remains On for the user-specified time.

**Duty Cycle Limit.** When the analyzer is otherwise ready for the next measurement cycle, if the duty cycle percent maximum limit would be exceeded, the process ignores triggering until the duty cycle limit is satisfied.

**Pulse Profile Domain Stop Time.** The time value of the current pulse profile data point determines the measurement cycle time when it is greater than the PRP set by the duty cycle limit.

**Frequency Domain Trigger Delay.** If the frequency domain trigger delay is greater than the duty cycle limit, trigger delay will control the minimum frequency domain measurement cycle time.

The only additional considerations are:

1. Pulse Output is set to the active level during measurement of any calibration standard.
2. Pulse Output is set to the inactive level during the sweep retrace.
3. Pulse Output is set to the active level for less than 30 microseconds immediately prior to the beginning of the sweep for the automatic periodic IF calibration sequence.
4. Pulse Output remains at the inactive level under all conditions when External Triggering is selected.

The automatic periodic IF calibration sequence is transparent to the operator except for the less than 30 microsecond pulse output immediately prior to the beginning of a sweep. To the operator, the IF calibration sequence will appear to occur at random times, more frequently just after the HP 8510 is turned on, then less often as the system temperature stabilizes.

## Pulse Repetition Period and Duty Cycle Considerations

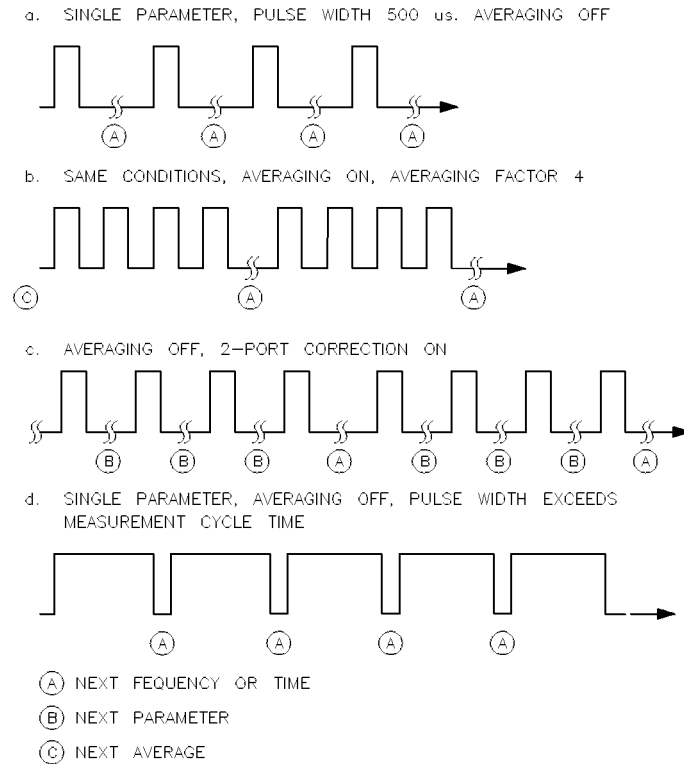
From the measurement cycle information you can see that the pulse repetition period and thus the duty cycle of the pulsed-RF signal applied to the DUT can vary depending upon the instrument state. For measurements in which the PRP or duty cycle is not important, simply set the pulse width and the duty cycle controls to an appropriate value and make the measurement. The specified duty cycle limit will not be exceeded, but the actual duty cycle may be less than expected.

For example, Figure 3-20 shows the pulse output waveform for various conditions.

Figure 3-20a shows the pulse output when the pulse width is 500 microseconds, the duty

## 3-24 Operation

cycle limit is 50 percent, and averaging is off. Under these conditions the measurement cycle time is about 3 milliseconds per trace data point in the pulse profile domain, or about 30 milliseconds in the frequency domain. Figure 3-20b shows the same conditions with averaging on and an averaging factor of four. Now four measurements are taken for each data point with the measurement cycle time alternating between 1 millisecond for each of the measurements required for the averaging, and the time to move to the next data point. Figure 3-20c shows the measurement when 2-Port correction is On. Here, the parameter switching time also affects the overall PRP and duty cycle.



prpcycle

**Figure 3-20. Example Internal Pulse Output PRP and Duty Cycle**

In Figure 3-20d, the pulse width is greater than the measurement cycle time, so the duty cycle could approach 100 percent. This is avoided by setting the duty cycle function to the maximum value allowed in the measurement. When the combination of the pulse width and the duty cycle limit approaches the measurement cycle time, the pulse off part of the measurement cycle time is increased to satisfy the duty cycle limit.

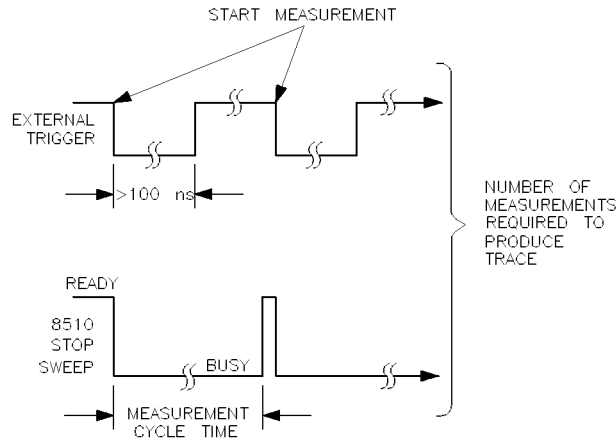
If you are viewing this with an oscilloscope, notice how the measurement cycle time varies according to the pulse profile stop time. If the stop time is greater than the pulse width, the measurement cycle time will extend past the end of the pulse depending upon the time value of the data point being measured. Depending upon the pulse width, this can result in a lower percent duty cycle toward the end of the time span.

### External Trigger and Stop Sweep Signals

Figure 3-21 shows the relationship between the external Trigger Input and the HP 8510 Stop Sweep output for frequency domain point-in-pulse measurements and for pulse profile domain measurements. For external triggering, Stop Sweep remains Busy (low) until the measurement

cycle is complete. This information is important for synchronizing the pulse modulation to the external trigger.

When a TTL pulse train is applied to the HP 8510 rear panel EXTERNAL TRIGGER INPUT the trigger should stay low for at least 100 nanoseconds. Excess triggers that occur while stop sweep is busy (low) are ignored. The next external trigger falling edge after stop sweep is ready will initiate the next measurement cycle and retrace is automatic.



timediag

**Figure 3-21. External Trigger and Stop Sweep Timing Diagram**

When internal triggering is selected, the stop sweep output does not operate (always in the ready state). Timing diagrams for the pulse output signal and development of the internal measurement trigger are shown in Figure 3-11 and Figure 3-12.

When external triggering is selected, the falling edge of the external trigger input defines time equals zero seconds for each measurement cycle. Stop sweep falls immediately and stays low until the HP 8510 completes the measurement cycle and is ready to accept the next trigger. The time period that stop sweep remains busy depends upon the next measurement function to be performed. Pulse output is turned Off for external triggering. As for internal triggering, the pulse profile measurement resolution period is set by the larger of pulse width and pulse profile domain stop time.

## Using External Triggering and Pulse Modulation

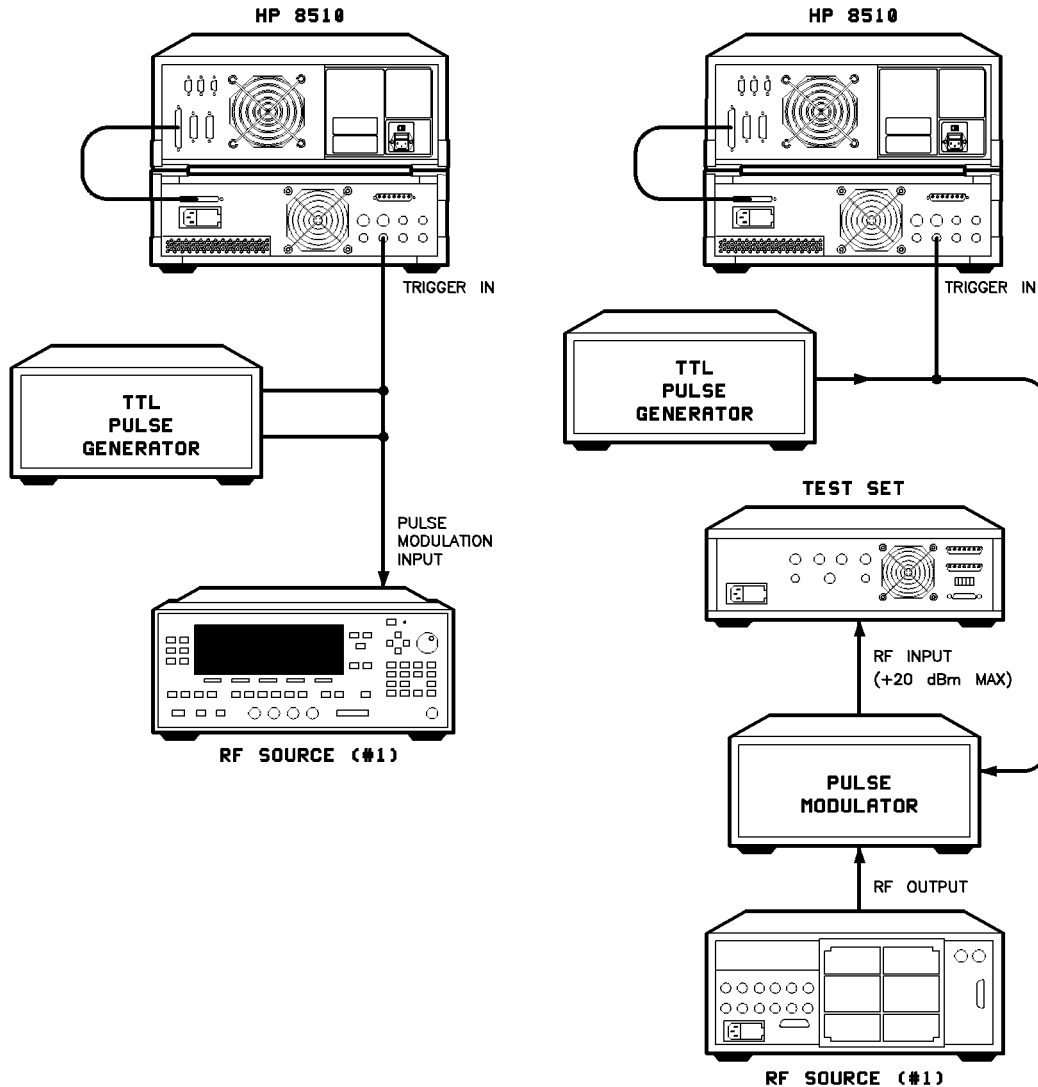
In applications where it is necessary to maintain close control over the PRP and duty cycle of the pulsed-RF stimulus, you can use external equipment to provide the TTL pulse modulation and external trigger signals. When using an external pulse modulation signal, it is necessary to synchronize the network analyzer with the pulse modulation signal so that the measurement is always made at the same time with respect to the stimulus. This synchronization is accomplished using the HP 8510 external trigger input.

### Connect the Pulse Generator

A simple method to control the PRP and duty cycle of the pulsed-RF stimulus is to use an external pulse generator to provide the pulse modulation input to the RF source. Figure 3-22 shows a simple setup that provides the same pulsed-RF stimulus to the DUT regardless of the

instrument state. The same TTL pulse train provides the pulse modulation input to the RF source and to the HP 8510 rear panel TRIGGER IN connector.

Please note that for internal triggering, a BNC short circuit is connected to the TRIGGER IN connector. When the pulse generator is connected to TRIGGER IN, move the BNC short to the SWEEP IN 0 to 10V connector. Otherwise, signals on the sweep in line could affect triggering.



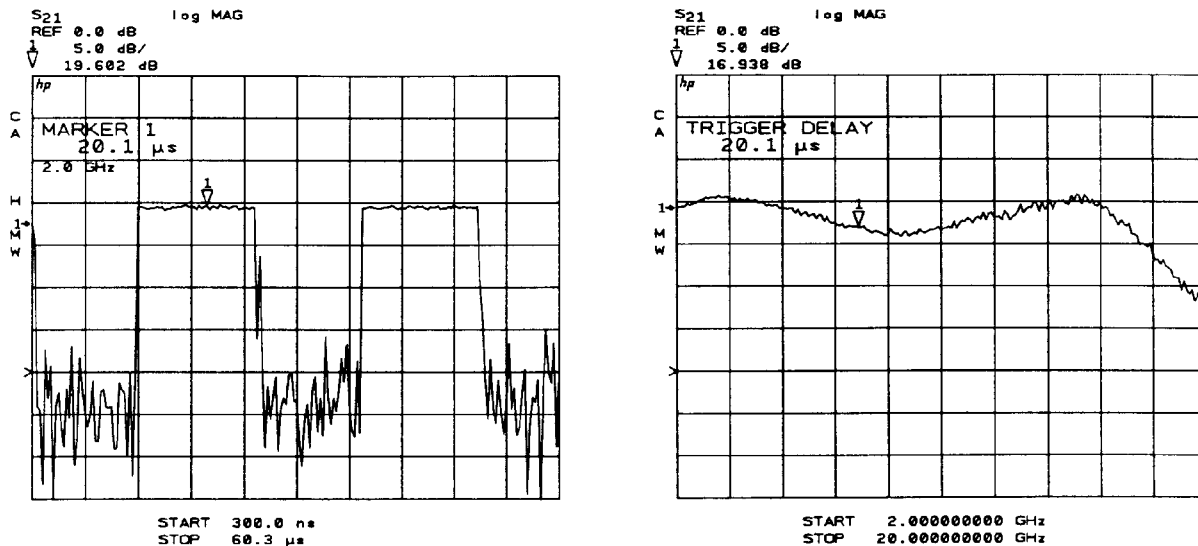
prpduty

**Figure 3-22. External Control of PRP and Duty Cycle**

Synchronization is assured because time equals zero seconds for each measurement cycle is defined as the first falling edge of the trigger input after stop sweep is ready (high). Figure 3-22b shows connection of an external pulse modulator instead of the internal modulator in the RF source.

Figure 3-23 shows results using this pulse modulation and triggering method when the pulse modulation input to the RF source is a continuous train of 10 microseconds PRP, 50

percent duty cycle pulses. The same input is applied to TRIGGER IN, and TRIGGERING EXTERNAL is selected.



**Figure 3-23.**  
**Using External Trigger and External Modulation**  
**PRP = 10 microseconds, Duty Cycle = 50%**

Figure 3-23a is the pulse profile domain response. Multiple pulses are visible because the stop time is greater than the stimulus PRP. Notice that for external triggering the minimum start time is about positive 3 measurement resolution periods with respect to the external trigger. Even though the internal pulse output is not used in this particular configuration, the pulse profile measurement resolution period is set by algorithm using the greater of the pulse width and stop time.

Figure 3-23b is the frequency domain response with the trigger delay set to measure during the On time of the pulse. One method used to set the trigger delay to an appropriate value is:

1. Press **[DOMAIN] PULSE PROFILE**, then set appropriate Start and Stop times.
2. Press **[MARKER]**, then move the marker to the point on the pulse you want the frequency domain measurement to be made.
3. Press **[STIMULUS MENU] MORE TRIGGER MODE TRIGGER DELAY**.

The current value of the trigger delay will be displayed. Now press **[=MARKER]**. The time value at the marker will be assigned to the trigger delay function.

4. Press **[DOMAIN] FREQUENCY**. The trace shows the response at the time after the TTL Trigger In signal falling edge as set by the trigger delay value.



## High Power Measurements

Use Figure 3-24 to examine the maximum power ratings and normal signal levels present in the test set. The signal levels are approximate, with signal path loss increasing with frequency. Note the following characteristics:

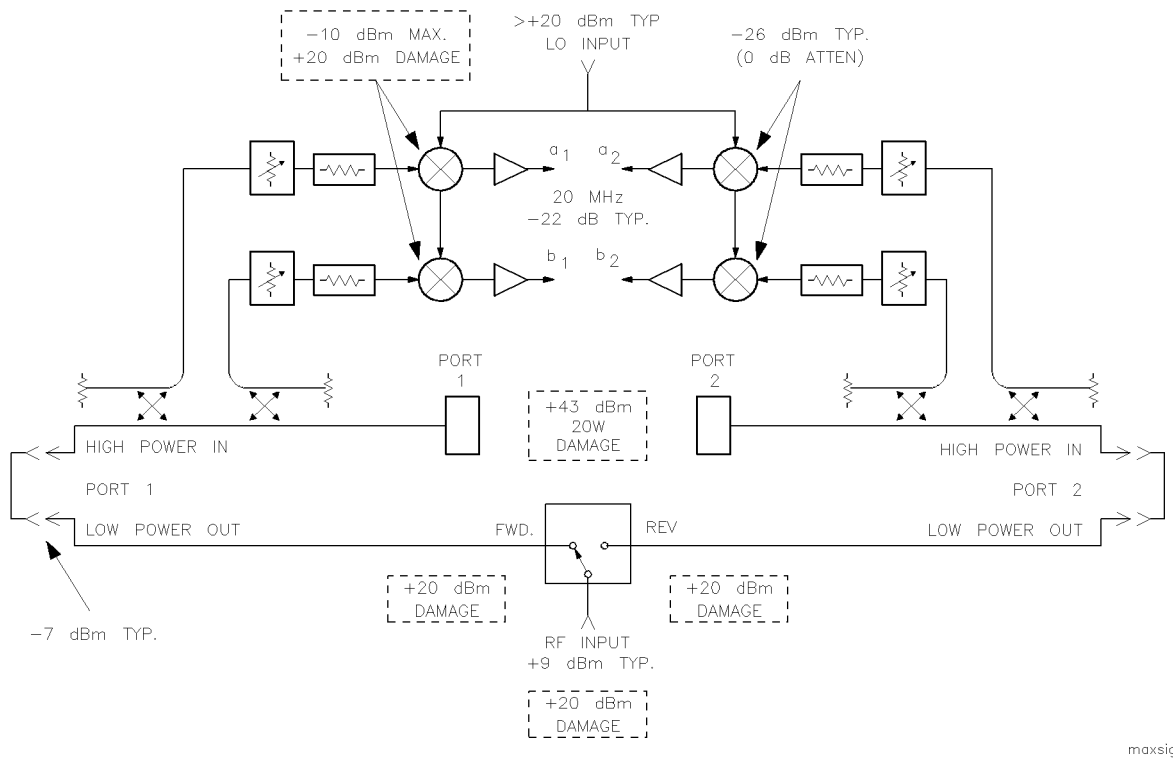
- a. Typically, the RF input is about 9 dBm and the loss to the selected test port is about 9 dB.
- b. With the step attenuators set to zero dB, the loss from the RF input to the a1 or the a2 mixer, and the loss from Port 1 or Port 2 to the b1 or the b2 mixer, are approximately equal at about 26 dB.
- c. Since each mixer includes a 20 MHz preamplifier to offset its conversion loss, measurement of the User Parameters will show the IF level to be about 22 dB less than the RF input or the signal level at the test port.
- d. For specified performance, the maximum IF signal level as measured by the user parameters is  $-10$  dBm. Higher signal levels cause errors due to compression, and lower signal levels produce greater uncertainty due to noise.

---

### Caution

Components in the test set will be damaged at certain signal levels. To avoid damage, observe the following operating precautions:

- Use the PORT 1 and PORT 2 attenuators (Stimulus Power menu) to protect the mixer input – the mixer damage level is  $+20$  dBm (1 watt, CW).
  - Install appropriate components in the rear panel extension links to protect the test set Forward/Reverse switch – the damage level is  $+20$  dBm applied at any input or output. This means that if the device output is greater than  $+20$  dB, the switch can be damaged by  $+20$  dBm present at either LOW POWER OUT connector.
  - If the device output is greater than  $+43$  dBm, use appropriate components to protect the test set ports (and the Forward/Reverse switch) – the damage level is  $+43$  dBm (20 watts) applied at PORT 1 or PORT 2.
-



**Figure 3-24. Test Set Maximum Signal Levels**

### Connecting External Signal Conditioning

The test set rear panel links labeled PORT 1 and PORT 2 can be used to install external equipment in the Port 1 and Port 2 signal paths. The connectors labeled LOW POWER OUT each connect to an output of the forward/reverse switch. The connectors labeled HIGH POWER IN connect to the front panel measurement PORT 1 or PORT 2.

Note the damage levels indicated in Figure 3-24. The maximum power rating of the forward/reverse switch is +20 dBm applied at the RF input, or applied to the forward/reverse poles via either LOW POWER OUT connector. The maximum signal level applied at either HIGH POWER IN connector, or to either of the front panel PORT 1 and PORT 2 connectors is +43 dBm.

### Example High Power Measurements

To set signal levels in the test set, estimate the input and output power levels of the device under test. When the test set is configured to handle these levels, the operating device is connected and the power estimates are verified by measuring the user parameters. If the estimates were inaccurate, the test set configuration is changed so that power levels at all points in the system are within limits. When this is accomplished, the device is removed, measurement calibration is performed, then the device is installed and its S-parameters are measured.

Following are two examples of measurements on high power devices. Use them as a guide for considerations that are special to your test setup.

**Measure a 30 dB Amplifier.** Figure 3-25 shows the setup for measurement of an amplifier having about 30 dB of gain. Using the standard RF source power setting of +9 dBm, the signal level at Port 1 is about +0 dBm, the level at the b2 mixer is about +5 dBm, and the signal level at the reverse pole of the forward/reverse switch is about +30 dBm. In order to avoid damage:

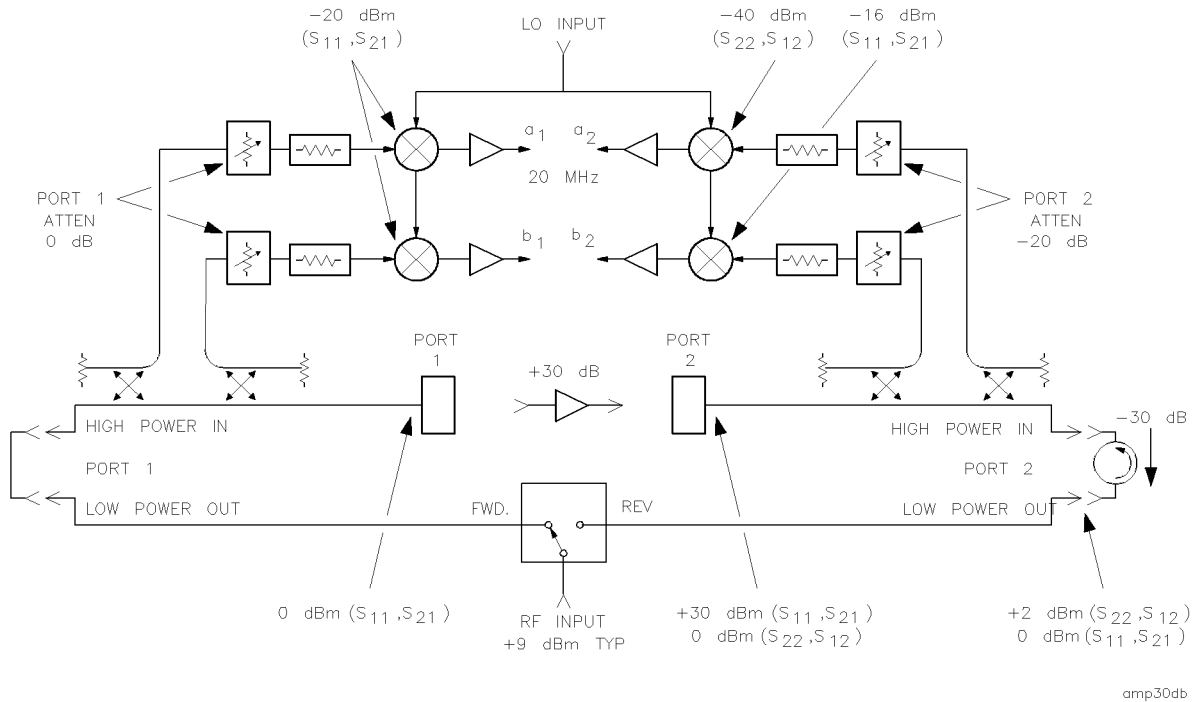
- The ATTENUATOR PORT: 2 step attenuator must be set to at least 20 dB to protect the b2 mixer; and,
- An attenuator or isolator must be added in the rear panel PORT 2 links to reduce the signal level at the reverse pole of the switch to below +20 dBm.
- If any IF OVERLOAD message or **O** annotation is displayed on the network analyzer when you are operating in the normal BW, non pulsed-RF mode, the RF power level must be lowered until the message no longer appears.

An isolator, providing about 30 dB of isolation between Port 2 and the switch, is the best choice because it can preserve the dynamic range for reverse measurements. Better performance for the reverse measurements will be obtained because the isolator will minimize the insertion loss from the reverse pole of the switch to Port 2, and to a2.

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**Note** The network analyzer can not sense IF Overload conditions in the pulsed-RF, wide BW mode of operation. Always check the user 1 through user 4 levels to be sure they are below -10 dB indicated on the display.

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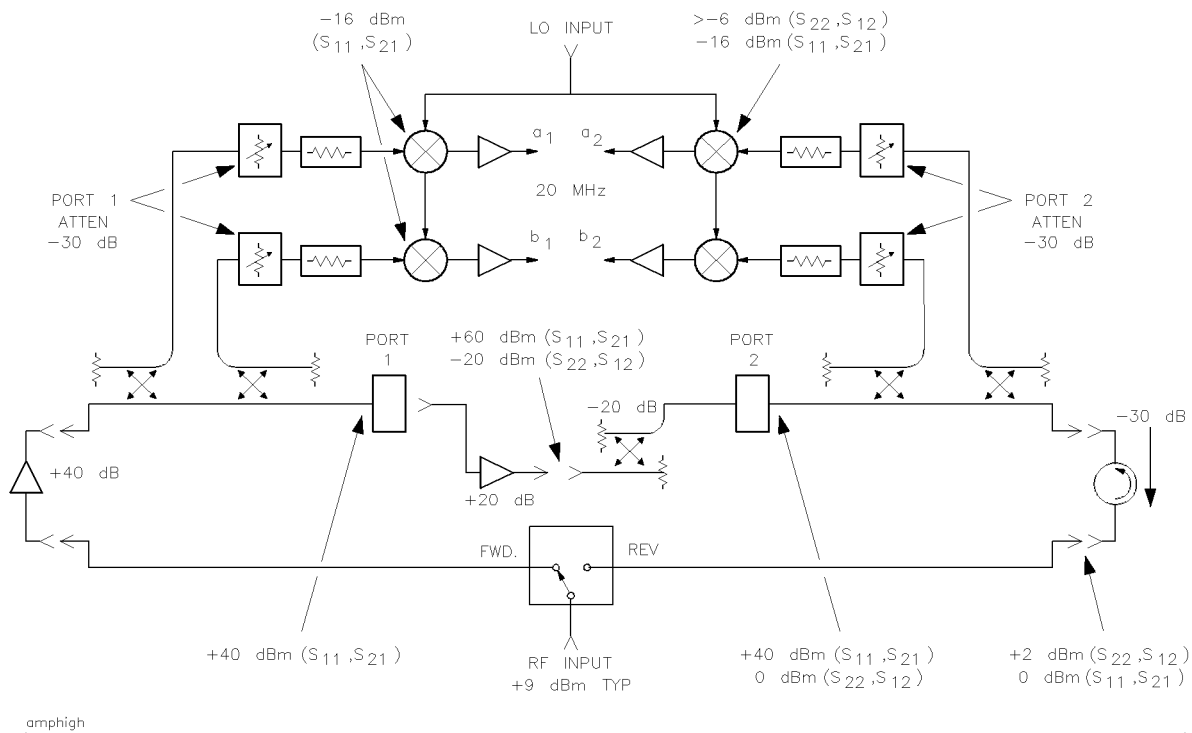
**Figure 3-25. Measuring a 30 dB gain Amplifier**

**Measure an Amplifier with High Input Levels.** Figure 3-26 shows the setup for measurement of an amplifier with about 20 dB of gain that needs an input level of about 40 dBm. A 40 dB gain amplifier is installed in the rear panel PORT 1 links to boost the signal level to the desired value without exceeding +43 dBm (20 watts). The signal level at the test port is

about +60 dBm, making the signal levels at the a1 mixer and the b1 mixer over +30 dBm. In order to avoid damage:

- The ATTENUATOR PORT: 1 attenuator must be set to 30 dB in order to reduce the a1 and b1 signal levels to below -10 dBm;
- On the transmission return side, the amplifier output is about 60 dBm, making it necessary to add 20 dB of loss between it and Port 2 in order to reduce the signal level incident at Port 2 to less than +43 dBm;
- The ATTENUATOR PORT: 2 step attenuator must be set to 30 dB in order to protect the b2 mixer; and
- The reverse pole of the forward/reverse switch must be protected by installing an attenuator or isolator in the rear panel PORT 2 links to reduce the signal level at the reverse pole of the switch to below +20 dBm.

The coupler is used in the transmission return signal path because it provides the necessary loss and will probably provide a more stable signal path than a high power attenuator that would otherwise be required. A high power termination is required to terminate the through arm of the coupler.



**Figure 3-26. Measuring an Amplifier with High Input Levels**

### Using the Port 1 and Port 2 Attenuators

The Port 1 and Port 2 step attenuators are used to adjust the signal level into the mixers and thus protect the mixers from excessively high signal levels. Note that the attenuators do not change the Port 1 or Port 2 signal levels.

**Controlling the Attenuators.** Set the step attenuators as follows.

- Press **STIMULUS MENU** **POWER MENU** **ATTENUATOR PORT: 1** or **ATTENUATOR PORT: 2**.

Use the knob, STEP keys, or numeric entry to set the attenuator from 0 dB to 90 dB in 10 dB steps. Familiarize yourself with operation of the step attenuators by measuring the user parameters.

**Measure User Parameters and Set Attenuators.** In order to maintain specified performance, the IF signal levels are less than  $-10$  dBm as measured by the user parameters. Connect an appropriate device at Port 1 or Port 2 for each measurement, turn on a measurement marker, then measure the user parameters in order to verify the IF signal levels as follows.

1. Press **PARAMETER MENU** **USER 1 a1** and observe the IF signal level in the LOG MAG format.
2. Press **USER 4 b1** and observe the IF signal level. If either a1 or b1 is greater than  $-10$  dBm at any point in the trace, increase the **ATTENUATOR PORT: 1** value.
3. Press **USER 3 a2**.
4. **REDEFINE PARAMETER DRIVE DRIVE: PORT 2**.

Observe the IF signal level.

5. Press **USER 2 b2** and observe the IF signal level. This shows the level with the signal applied to Port 1. If either a2 or b2 is greater than  $-10$  dBm at any point in the trace, increase the **ATTENUATOR PORT: 2** value.

In some applications it may be necessary to measure the signal at b2 with the signal applied to Port 2. For this measurement:

6. Press **USER 2 b2**.
7. **REDEFINE PARAMETER DRIVE DRIVE: PORT 2**.

Observe the IF signal level.

Before calibration, measure these user parameters with the calibration standards, then with the device under test connected and operating.

Generally, set the attenuators to obtain the maximum possible mixer input signal level (less than  $-10$  dBm) with the device connected and operating. This will provide the best signal-to-noise ratio for the measurement. Then remove the device and perform measurement calibration. For best accuracy, do not change either attenuator between calibration and measurement.

### Changing Signal Path After Calibration

If any attenuator or other external equipment is changed after calibration, the measurement results cannot be specified except by your own estimation of the error contribution of the change. For example, when the port attenuation is changed with correction On, the **CAUTION: CORRECTION MAY BE INVALID** is displayed. The operator must judge whether the error is tolerable in the particular application and how to compensate for the change.

The only reason to change the internal attenuators or external equipment between calibration and measurement is to maximize the levels under both conditions, thus minimizing uncertainty due to noise. Many factors will enter into the decision of whether it is more

accurate to calibrate at a low signal level without changing the setup, or change the setup to optimize levels for both calibration and measurement. Changing the Port 1 or the Port 2 attenuator does not seriously change the test set mismatch, directivity, or isolation characteristics, but will change the frequency response magnitude and phase. This difference in the frequency response between calibration and measurement can be normalized using the HP 8510 trace memories.

The following procedures can help minimize the errors due to changing the signal levels between calibration and measurements.

**Set the Attenuators.** If only the Port 1 or Port attenuators are changed, the following procedure can minimize the errors.

1. Connect a short or a thru and set the Port 1 and Port 2 attenuators for best IF signal levels during calibration.
2. Perform appropriate measurement calibration.
3. With an appropriate standard connected, set the Port 1 and Port 2 attenuators to the setting required for operating the test device.

If you view the response of a short circuit, notice that changing the Port 1 attenuators has negligible effect on the  $S_{11}$  marker reading, and that changing Port 2 attenuators has negligible effect on the  $S_{22}$  marker reading. This is due to the way that the attenuators are paired. Both the reference and the test signal are changed an approximately equal amount.

However, when viewing  $S_{21}$  or  $S_{12}$ , changing the Port 1 or Port 2 attenuators offsets the marker reading by the difference in the Port 1 and Port 2 values.

**Store Trace Memories.** The main frequency response effects of changing the attenuators can be compensated for by using the HP 8510 trace memories and trace mathematics as follows.

1. Connect the thru used for calibration. Set the port attenuators to the value used for measurement of the device. Recheck the user parameter levels then press  $S_{21}$ .
2. Press  $\text{[DISPLAY] DATA} \rightarrow \text{MEMORY}$  to store the  $S_{21}$  trace in default trace memory 1. This trace is the frequency response difference of the  $S_{21}$  signal path between calibration and measurement.
3. Press  $S_{12}$   $\text{[DISPLAY] DATA} \rightarrow \text{MEMORY}$  to store the  $S_{12}$  trace in trace memory 2. This trace is the frequency response difference of the  $S_{12}$  signal path between calibration and measurement.

Now that these traces are stored, they can be used to normalize the corrected data.

**View the Normalized Parameters.** Use these traces to normalize the corrected data to the new levels after the attenuation is changed. This example uses normalization only for  $S_{21}$  and  $S_{12}$ . Press the following keys to view the corrected parameters.

1. Press  $\text{[DISPLAY] DISPLAY: DATA}$ .
2. Press  $S_{11}$  and view the  $S_{11}$  measurement.
3. Press  $S_{22}$  and view the  $S_{22}$  measurement.
4. Press  $S_{21}$  and view the  $S_{21}$  measurement. If the thru is connected, the transmission coefficient should be  $1\angle 0^\circ$ .
5. Press  $S_{12}$   $\text{[SELECT DEFAULTS] DEFAULT to MEMORY: 2}$ .

### 3-34 Operation

View the  $S_{12}$  measurement. If the thru is connected, the transmission coefficient should be  $1\angle 0^\circ$ .

Normalization is turned off for the  $S_{11}$  and  $S_{22}$  measurements, then the appropriate memory is selected and normalization is turned on to view  $S_{21}$  and  $S_{12}$ .

Since these are accurate, repeatable attenuators, this sequence may be effective in your application. If it is necessary to change other parts of the test setup, especially components connected to the test ports or connected between the rear panel links, this procedure may require additional steps to adequately compensate for the changes.

### Selecting Appropriate Measurement Calibration

Selecting appropriate measurement calibration signal levels available for calibration and for measurement may also influence the decision of which error model to use for the measurement.

If appropriate signal levels can be achieved for all parameters during calibration and measurement, the HP 8510 2-Port accuracy enhancement error model, either the HP 8510 Full 2-Port or TRL 2-Port, provides best accuracy by providing best characterization and removal of the systematic errors in the test setup. If the device is noninsertable, the HP 8510 Adapter Removal calibration procedure can be implemented using the Full 2-Port and/or the TRL 2-Port calibration.

However, there are applications in which the 2-Port error model cannot be used. There are others in which better results are produced using other calibration techniques described later. These are the reasons that 2-Port correction cannot be used effectively:

1. Very low signal levels of the  $S_{22}$  and  $S_{12}$  measurement will probably reduce the accuracy of the  $S_{11}$  and  $S_{21}$  measurements.

Using 2-Port correction, the values of all four parameters are used to find the corrected value for the displayed parameter. If, for example, the reverse parameters are not representative of their actual values due to insufficient signal levels, then their contribution to the accuracy enhancement algorithm will cause errors. This leads to noisy, nonrepeatable data for the other parameters, even if their measured data is representative.

2. Equipment external to the HP test set must be switched depending upon the parameter being measured.

There is no means of automatically switching equipment external to the test set depending upon the S-parameter being measured.

Using 2-Port correction, all four S-parameters are automatically selected in sequence, and there is no signal available to indicate which parameter is being measured. If dynamic range considerations make it necessary to change the test set configuration for measurement of different parameters, the automatic switching used in the 2-Port error model cannot be used.

3. Test set configuration changes error terms other than frequency response between calibration and measurement.

If changes to the test set between calibration and measurement significantly change the directivity, isolation, source or load match, or frequency response error coefficients measured during the calibration, then the corrected data will be in error. If only the frequency response characteristics of the test set change, compensation can be provided using the display memory features of the HP 8510B. (See the Changing Signal Path After Calibration section in this chapter.)

In all of these situations the best choice will be to use a separate error model for each parameter. For example, use the Response or the Response & Isolation calibration for the  $S_{21}$  and  $S_{12}$  parameters, and 1-Port calibrations for the  $S_{11}$  and  $S_{22}$  parameters. Combining error models like this allows setup, calibration, and measurement for each parameter to be accomplished independently. After separate calibration for each parameter, the forward/reverse switch in the test set will respond to front panel parameter selections, and the cal set for the selected parameter will be recalled.

Combining error models is described in the HP 8510 Operating and Programming manual, Basic Network Measurements portion, with the Cal menu in the S-Parameter Test Set Calibration Error Models section.

### **General Calibration and Measurement Sequence**

- Specify device input/output requirements.
- Configure test set for these levels, plus guardband.
- Connect operating device and verify levels.
- Adjust levels for best dynamic range.
- Perform measurement calibration.
- Measure operating device S-parameters.

### **General Calibration and Measurement Sequence Using Display Math**

- Specify device input/output requirements.
- Configure test set for these levels, plus guardband.
- Connect operating device and verify levels.
- Configure setup for best dynamic range.
- Connect standards and verify levels.
- Change setup for best dynamic range during calibration.
- Perform measurement calibration. |(Before saving cal set, configure setup for operating device.)
- Connect appropriate standards and store reference traces.
- Connect operating device.
- Use normalization to view device parameters.



## Specifications and Performance Verification

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### Introduction

After installation of the system is complete, and the operator's tests have been successfully completed, a performance verification is necessary to assure that the system is operating within its expected measurement uncertainties. A performance verification (in either pulsed-RF mode or nonpulsed-RF mode, but not both) is included with the purchase of an HP 85108 System.

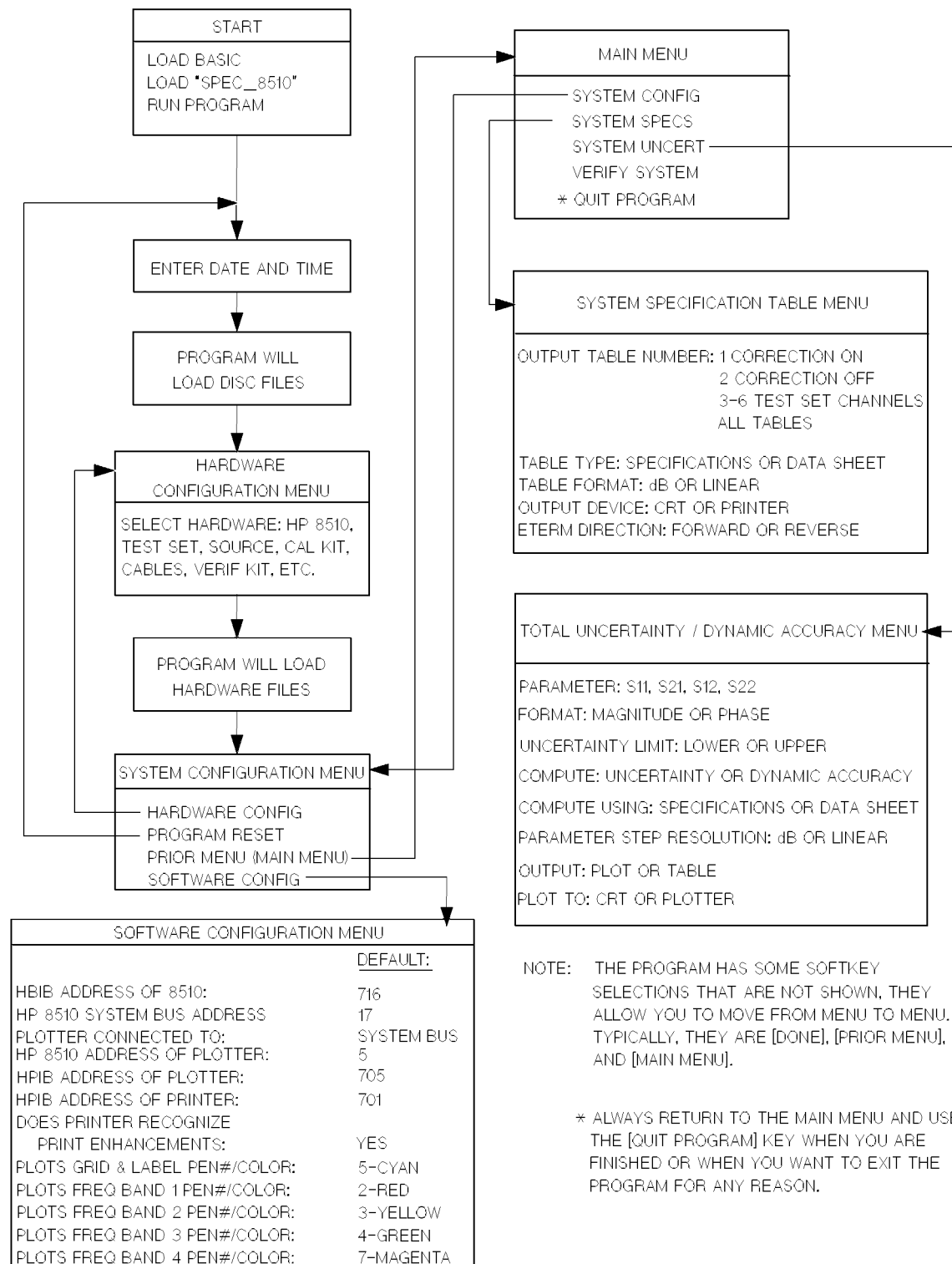
The verification procedure for the pulsed-RF system is summarized here. Refer to the Performance Verification and Specifications section of the HP 8510C On-Site Service Manual (HP part number 08510-90282) for an in-depth explanation of the procedure.

This procedure documents the verification with the system in pulsed-RF mode (wide BW detectors). Any changes to the setup for a nonpulsed-RF verification (normal BW detectors) are noted as they occur.

Performance verification of your pulsed-RF system consists of the following steps.

1. Connecting the computer and warming up the system.
2. Loading BASIC and BIN files.
3. Loading and running the performance verification software.
4. Performance testing in 7 mm.
  - a. Setting the configuration
  - b. Performing a measurement calibration
  - c. Measuring the verification standards

Figure 4-1 is a simplified flow diagram of the HP 8510 Specification and Performance Verification software program. The flow diagram shows the main menus and paths of the program.



specflow

**Figure 4-1. Specifications and Performance Verification Flow Diagram**

## 4-2 Specifications and Performance Verification

---

## Required Equipment

The following items are required to verify the performance of your pulsed-RF system.

Item	HP Part/Model Number
Computer	HP 9000 series 200 or 300 <sup>1, 2</sup>
3.5 mm Calibration Kit	HP 85052A/B/C/D/E
3.5 mm Verification Kit	HP 85053B
3.5 mm Cables (required for Full 2-port cal)	HP 85131C/D or E/F
HP 8510 Specifications and Performance Verification Software	08510-10033
HP BASIC 5.0 or higher (includes Language extensions and drivers)	order by name

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

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

## Verifying Non-Standard Systems

To verify systems that contain instruments additional to the standard system (network analyzer, two sources and the HP 85110 test set), disconnect all additional instruments from the system, configure the system as a pulsed-RF system Figure 2-3 then continue with this procedure.

Your verification may not be valid if any of your system instruments are equipped with a “special” option (usually denoted by an “H,” “E,” or “S,” on the serial number label). Refer to your special system documentation for additional information regarding performance verification.

---

## Recommended Performance Verification Cycle

The recommended performance verification cycle for the HP 85108 system is once a year, initially, and after the system is repaired. You can vary the cycle time of once a year depending on the results of your performance verification. Additionally, an operation verification (frequency tests) is required every year (or after repair) on all HP 8360 series and HP 8340 series sources. Refer to the HP 8510C On-Site Service Manual for the procedure.

---

## Generating System Specifications

Specifications for the pulsed-RF system are generated using the HP 8510 Specification and Performance Verification Software, which is supplied with your system. To generate specifications for your system, continue with the performance verification procedure and, at the designated time, select **SYSTEM SPECS**.

Table 4-1 lists the general characteristics of the HP 85108 pulsed-RF system. General characteristics are typical, non-warranted values.

---

## Performance Verification Procedure

### Connect the Computer and Warm Up the System

1. Connect the computer HP-IB to the network analyzer HP-IB. Connect a 3.5" floppy disk drive to the computer HP-IB and set the disk drive HP-IB address to 0.
2. Turn the system on.
  - a. Turn on the instruments in the pulsed-RF system (network analyzer last). The system requires approximately one hour to stabilize at its operating temperature. Perform the next two steps (load BASIC and BIN files, and run the performance verification software) while the system is stabilizing.
  - b. Set the network analyzer to use "USR PRESET" when it receives a preset command via the HP-IB bus by pressing **SYSTEM HP-IB CONFIGURE HP-IB USES USR PRESET**. "USR PRESET" should be underlined.

### Load BASIC and BIN Files

The performance verification program will run on most HP 9000 series 200 and 300 computers, except for a 9826 because of its limited CRT display.

1. BASIC loading procedure:
  - a. While the computer is OFF, insert the HP BASIC language system disk in the default drive (typically 0). Then turn the computer ON.
  - b. When BASIC is loaded, the drive LED will go off and a prompt will appear on the computer display: BASIC Ready. Remove the disk.

- c. Insert the Language Extensions disk in the drive and, one at a time, load the following files. For example:

Type: LOAD BIN "ERR"

Language Extension files: ERR, CLOCK, GRAPH, MAT, IO

Then press **CONTINUE** on the computer keyboard. When the file is loaded the drive LED will go OFF. After loading all the Extensions, remove the disk. Insert the Drivers disk and load the following files in the same manner as you loaded the Extension files.

Driver files: HPIB, (DISC and CS80 for stand alone drives)

After loading all the drivers, remove the disk.

## Run the Specifications and Performance Verification Software

1. Insert the HP 8510 Specification and Performance Verification software disk into the default drive or the drive you specify as the MSI (mass storage is). Type the load command and the filename as shown below then press **RETURN** or **ENTER**. Be sure to type the filename exactly as shown.

Type: load "SPECS\_8510" **RETURN/ENTER**

Type: run **RETURN/ENTER**

The program's title banner information and a **RESUME** softkey should be displayed on the computer.

*HP 8510 Specification and Performance Verification Software*

Press the [RESUME] softkey.

2. The program will load several more files. When it has finished loading the files, a menu will appear on the computer display to allow you to 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**.

3. The program will display the HARDWARE CONFIGURATION menu. This menu allows you to select the type of system equipment you will be using during the calibration and performance verification.

The following example shows the equipment used in a typical pulsed-RF system:

- a. Network Analyzer: HP 8510C008 - Wide BW Detectors
- b. Test Set: HP 85110—3.5 mm S-parameter (2 MHz to 20 GHz)
- c. Source: HP 83622A - Synthesizer (2 MHz - 20. GHz)
- d. Calibration Kit: HP 85052B—3.5 mm Slotless Standard Grade
- e. Calibration Technique: SL - Sliding Load Cal
- f. Test Port Cable: HP 85131B/D/F - pair short cables (3.5mm to 3.5mm)
- g. Verification Kit: HP 85053B - 3.5mm

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<b>Note</b>	Select “HP8510C Color Model” if you want to perform a nonpulsed-RF, normal BW system verification.
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4. Select the equipment above according to the system you are going 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 Tab key to move to the next highlighted field.

Make all the selections necessary until the hardware configuration is correct for your system.

5. Press the softkey labeled DONE and the program will load the files from the disk. 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 will now appear on the computer display.

Here is a brief explanation of the main menu choices:

**SYSTEM CONFIG** - Select this menu if you want to return to the Hardware Configuration menu or if you want to use the software configuration menu to set the addresses of your HP 8510 or your printer/plotter, or select plotter trace pens/colors. This menu will also allow you to reset the program - all menu choices will be returned to the program's default state and the program will begin again from the time and date setting.

**QUIT PROGRAM** - Always use this selection when you are finished using this program.

**VERIFY SYSTEM** - Select this menu when you want to verify system performance. Do not choose this selection until the Hardware and Software Configuration menus have been set.

**SYSTEM UNCERT** - Select this menu when you want to see the calculated uncertainty limits for each type of S-parameter measurement. Do not press this selection now.

**SYSTEM SPECS** - Select this menu to see the Specifications menu.

6. At this point, be sure you 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 verification kit must match the one you select in the Hardware Configuration menu.

7. Be sure the computer is connected to the HP 8510.
8. Press **VERIFY SYSTEM**. If the program acknowledges the system over the HP-IB, it will display the System Performance Verification Menu on the computer.
9. 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**.

10. 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, press **PRIOR MENU** to return to the Hardware Configuration Menu and correct it.

## Measurement Calibration

1. Connect the test port cables as directed by the software.
2. Load the HP 85108 system configuration disk.

---

### Note

**HP 8510B Network Analyzer** The configuration disk files are not compatible with the HP 8510B network analyzer. Instead, set the hardware and instrument states in Appendix B manually and then save in instrument state register number 8 by pressing **INSTRUMENT STATE SAVE USER PRESET \*8**.

---

Insert the disk into the disk drive on the network analyzer. Press **DISC LOAD MORE MACHINE DUMP**. Use RPG knob on the network analyzer to select file: MD\_PULS. Press **LOAD FILE**. The network analyzer will load file into the eight instrument state registers and one hardware state register, then set the hardware state and recall instrument state register eight.

3. Load the Cal Kit Disk as follows:

Insert the standards definition disk and press **(DISC)**, **LOAD**, **CAL KIT [1-2]**. Then press **CAL KIT\*1**. Move the knob to the desired file (to match the calibration kit you are using) and press **LOAD FILE**. After the disk is loaded, remove it from the disk drive.

4. Press **(CAL)** to verify that the proper files were loaded. The HP 8510 softkey field should display the type of calibration and the revision number of the cal kit disk.
5. Press **RESUME**.

6. The verification program initializes the system and can change some instrument states if the network analyzer was not set to use “USR PRESET” as instructed earlier in this procedure. For pulsed-RF system verification, these values must be reset to their initial values. The prompt Initializing System Prior to Calibration will be displayed on the network analyzer display. To check these values, press the following keys after the verification program has initialized the system.

---

**Note** Your verification will be invalid if you fail to set these states.

---

---

## Power Levels

### Source 1

Place the network analyzer in the normal BW, nonpulsed-RF mode by pressing:

1. **SYSTEM** **MORE** **PULSE CONFIG** **DETECTOR : NORMAL BW**.
2. On the network analyzer, press **STIMULUS MENU** **POWER MENU** **POWER SOURCE 1** **+8dBm**.

If an IF OVERLOAD error message appears on the display, decrease the power level in 0.5 dB increments until the IF OVERLOAD error message no longer appears on the network analyzer.

### Source 2

On the network analyzer, press **STIMULUS MENU** **POWER MENU** **POWER SOURCE 2** **+20 dBm**.

---

## Detectors

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**Note** Select **DETECTOR:NORMAL BW** for nonpulsed-RF verification.

---

On the network analyzer, press **SYSTEM** **MORE** **PULSE CONFIG** **DETECTOR:WIDE BW**. A **W** should appear to the left of the graticule for wide BW mode.



---

## Power Slope

On the network analyzer, press **STIMULUS MENU** **POWER MENU** **POWER SLOPE** **SLOPE SRC 1 ON** **2** **x1**.

---

## Frequency Offset

1. On the network analyzer, press **SYSTEM** **MORE** **EDIT MULT. SRC** **DEFINE: SOURCE 2** **OFFSET FREQUENCY** **2** **0** **.** **0** **0** **0** **0** **1** **7** **MHz** **x1**.

2. Press **DONE** **MULT. SRC: ON/SAVE**. Leave the receiver frequency set to 20.000000 MHz.

These selections will be recalled automatically during verification.

3. Press **RESUME**.

The program will set up the HP 8510 and put it into LOCAL operation so you can calibrate the system using its front panel keys.

Perform the calibration. The system must be warmed up for one hour before you continue.

You need a Full 2-port calibration for S-parameter test sets such as the HP 85110.

4. On the HP 8510 press **CAL**. Then select the Cal Kit type by pressing the appropriate softkey on the network analyzer display.

5. Select **Full 2-PORT**.

6. A series of softkey selections will appear on the CRT: **REFLECT'N**, **TRANSMISSION**, and **ISOLATION**. When you press one of these keys, another set of softkeys appears. Connect each device as directed; the HP 8510 will underline each device label when the measurement is complete. After all of the devices are measured (for  $S_{11}$  and  $S_{22}$ ), press **DONE**.

Press the appropriate **DONE** softkey when the last measurement is complete. Then store the calibration in a Cal Set Register (1 through 8) by pressing the accompanying softkey. If an asterisk (\*) appears alongside one of the cal set registers, it means that a calibration is already stored there. If all of the registers are full, go ahead and press a key and respond to the prompts. You will delete the contents of that register and store your calibration there.

When the calibration is complete, press the program **RESUME** key and the program will reset the HP 8510 to REMOTE operation and return you to the System Performance Verification Menu.

## Measure the Verification Standards

### 1. Selecting 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.

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.

### 2. When the form is complete, press **DONE**. 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.

### 3. Measuring the Standard and Displaying the Data

When you are ready to measure the verification device, press **MEASURE DATA** and respond to the prompts on the computer display. The program will initialize the system and give instructions for making the proper connections. Measure all of the devices in your kit.

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. A pass/fail notice will appear at the bottom of the sheet.

---

**Note**

The uncertainty limits are wider (larger) when operating in the pulsed-RF, wide BW mode than when operating in the nonpulsed-RF, normal BW mode. This is due to the wider bandwidth of the IF.

---

### 4. This completes the pulsed-RF system performance verification.

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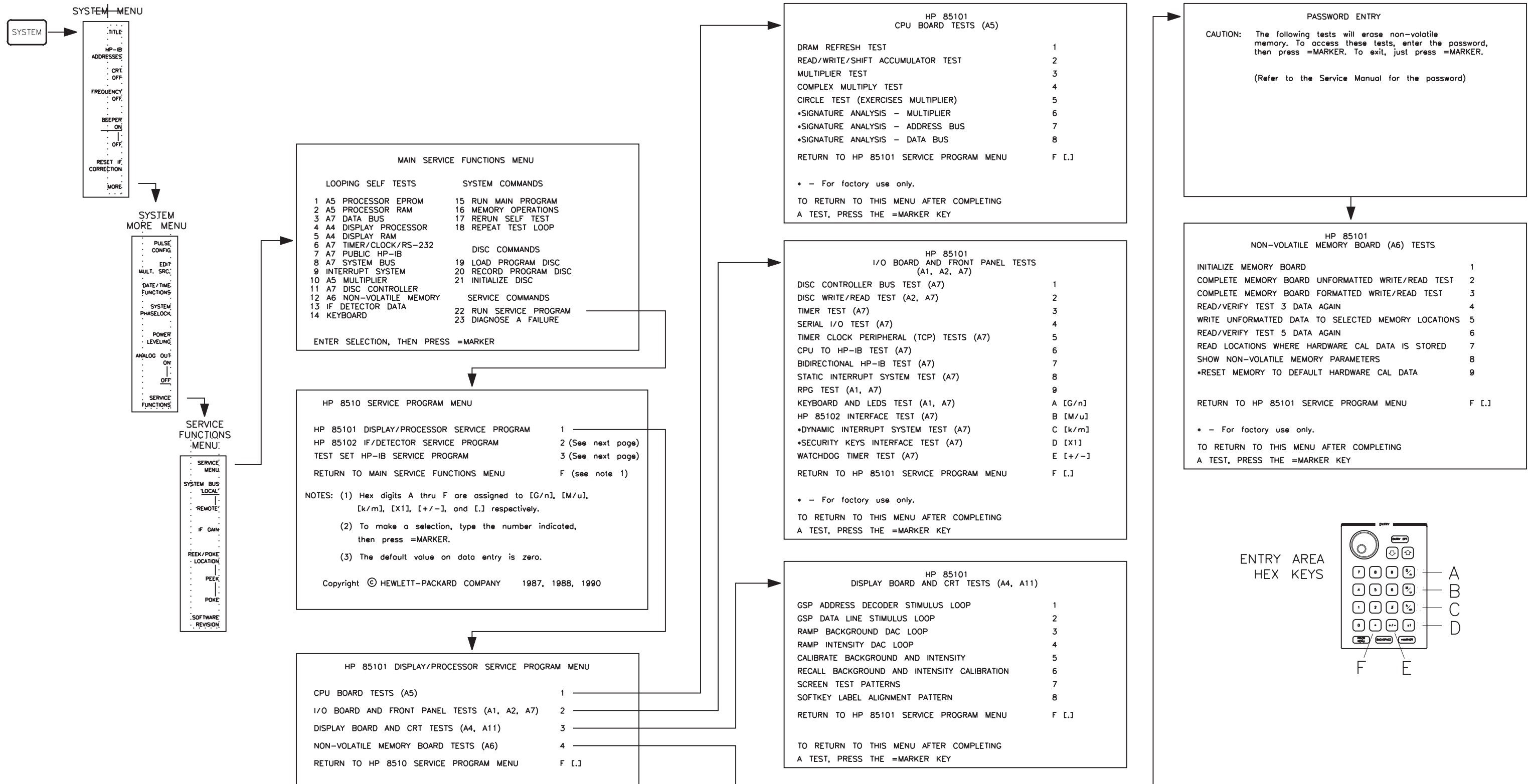
## General Characteristics

Table 4-1 lists the general characteristics of the HP 85108 pulsed-RF system. General characteristics are typical, non-warranted values and are included for user information.

**Table 4-1. General Characteristics**

<b>Rise Time</b>	10% to 90% of the test and reference channel detectors: 300 nanoseconds.
<b>Settling Time</b>	The time required for a ratioed, high-leveled measurement to reach within 0.1 dB of its final value when the system is in pulse profile mode.
<b>Equivalent Measurement Bandwidth</b>	The effective post-detection bandwidth of the test and reference detectors in the HP 8510.
<b>Trigger Level</b>	TTL.
<b>Trigger Width</b>	The minimum pulse width to be applied to the rear panel input of the HP 8510 for the HP 8510 to make a measurement. (External trigger mode: 100 nanoseconds).
<b>Minimum Time Delay</b>	The minimum time span of the x-axis of the HP 8510 display in pulse profile mode: 5 nanoseconds.
<b>Maximum Time Display</b>	The maximum time span of the x-axis of the HP 8510 display in pulse profile mode: 40 milliseconds.





HP 8510 SERVICE PROGRAM MENU

HP 85101 DISPLAY/PROCESSOR SERVICE PROGRAM

1 (See prev. page)

HP 85102 IF/DETECTOR SERVICE PROGRAM

2

TEST SET HP-IB SERVICE PROGRAM

3

RETURN TO MAIN SERVICE FUNCTIONS MENU

F (see note 1)

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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TEST SET HP-IB PROGRAM MENU

PRESET TEST SET

1

SWITCH ACTIVE LIGHT

2

\*SWITCH PORT 1,2 LIGHTS

3

\*ACTIVATE PORT 1,2 ATTENUATOR

4

\*INCREMENT ACTIVE ATTENUATOR

5

SELECT NEW HP-IB ADDRESS

6

RETURN TO HP 8510 SERVICE PROGRAM MENU

F [.]

\* - For test sets with appropriate feature.

NOTES: (1) To repeat a function, press =MARKER.

(2) The default Test Set HP-IB address is 20.

On the HP 85102 rear panel, connect '20MHz OUT' to 'J1 TEST SET INTERCONNECT' using the service adapter and a BNC cable. Also, connect 'ANALOG +-10V' to 'SWEEP IN 0-10V' using another BNC cable. Failure to do so will result in false error messages.

PRESS =MARKER TO CONTINUE . . .

HP 85102 IF/DETECTOR SERVICE PROGRAM MENU

ADC CONTROL TEST (A19)

1

SWEEP ADC TEST (A20)

2

ADC TEST (A18)

3

CAL DAC TEST (A17)

4

100 kHz IF AMPLIFIER TEST (A10, A12)

5

SYNCHRONOUS DETECTOR TEST (A5, A7)

6

20 MHz MIXER TEST (A9, A11, A13, A14)

7

PRETUNE PHASE LOCK TEST (A22)

8

MAIN PHASE LOCK TEST (A23)

9

IF COUNTER TEST (A21)

A [G/n]

RUN ALL THE ABOVE TESTS

B [M/u]

HP 85102 FRONT PANEL TEST

C [k/m]

RETURN TO HP 8510 SERVICE PROGRAM MENU

F [.]

NOTE: Always check cables leading to and from boards with suspected problems.

## Adjustments

---

### Introduction

This section contains the procedures for adjusting the pulse detector boards (A3 and A4) in the HP 85102 IF detector. These boards must be adjusted for minimum circularity error when they are replaced, swapped with each other, or when the HP 85102 IF detector is upgraded to include pulsed-RF capability (using the HP 8511B Upgrade kit).

---

### Equipment Required

The following equipment is required (in addition to the system instruments) to perform the pulse detector adjustments.

Item	HP Part/Model Number
RF Source (CW sinewave, 20.1 Mhz, -10 to -15 dBm)	HP 3324A, 3325, 8340/41B, 8360 series <sup>1</sup>
Test Cable (required for the adjustment procedure, included in the HP 85111A/B upgrade kits)	85111-60001
Adapters <sup>2</sup>	
Type-N (m) to BNC (f)	1250-0780
SMA (m) to BNC (m)	1250-1787
BNC (f) to BNC (f)	1250-0080
Type-N (m) to BNC (m)	1250-0077

<sup>1</sup> Only those that will provide 20.1 MHz.

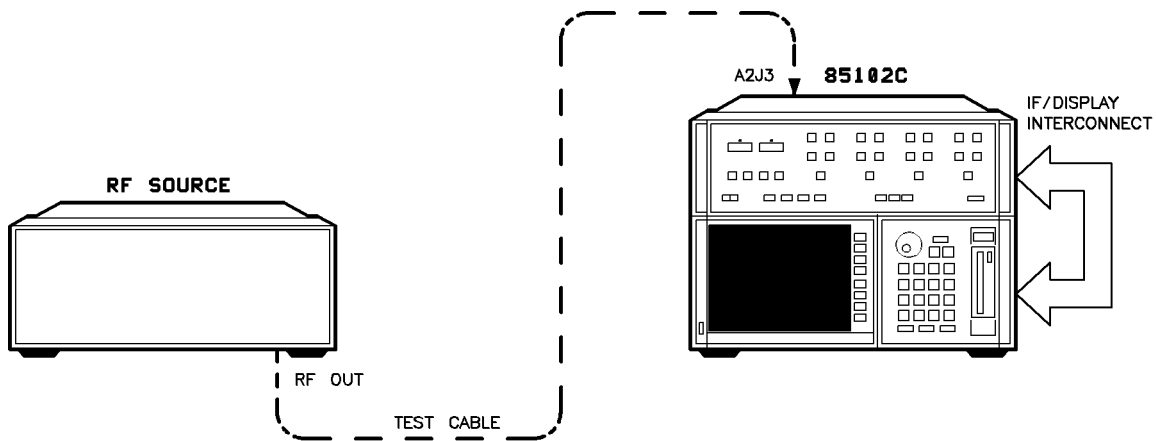
<sup>2</sup> Some combination of these adapters may be required to use the test cable with your source in the adjustment procedure.

---

## A3/A4 Pulse Detector Adjustment

The A3 and A4 pulse detector boards in the HP 85102 IF detector must be adjusted after installation for minimum circularity error. Follow the procedure below to make this adjustment.

Configure your system as shown in Figure 5-1. This is the standard pulsed-RF system configuration except that a connection is made from the RF source to the A2 assembly, and the RF source is disconnected from the system bus. For benchtop configurations, notice that the HP 85102 IF detector is placed on top of the HP 85101 display for the adjustment procedure. Use the test cable and the SMA to SMB adapter to make the connection from the source's output to the A2 board in the HP 85102.



adjuspro

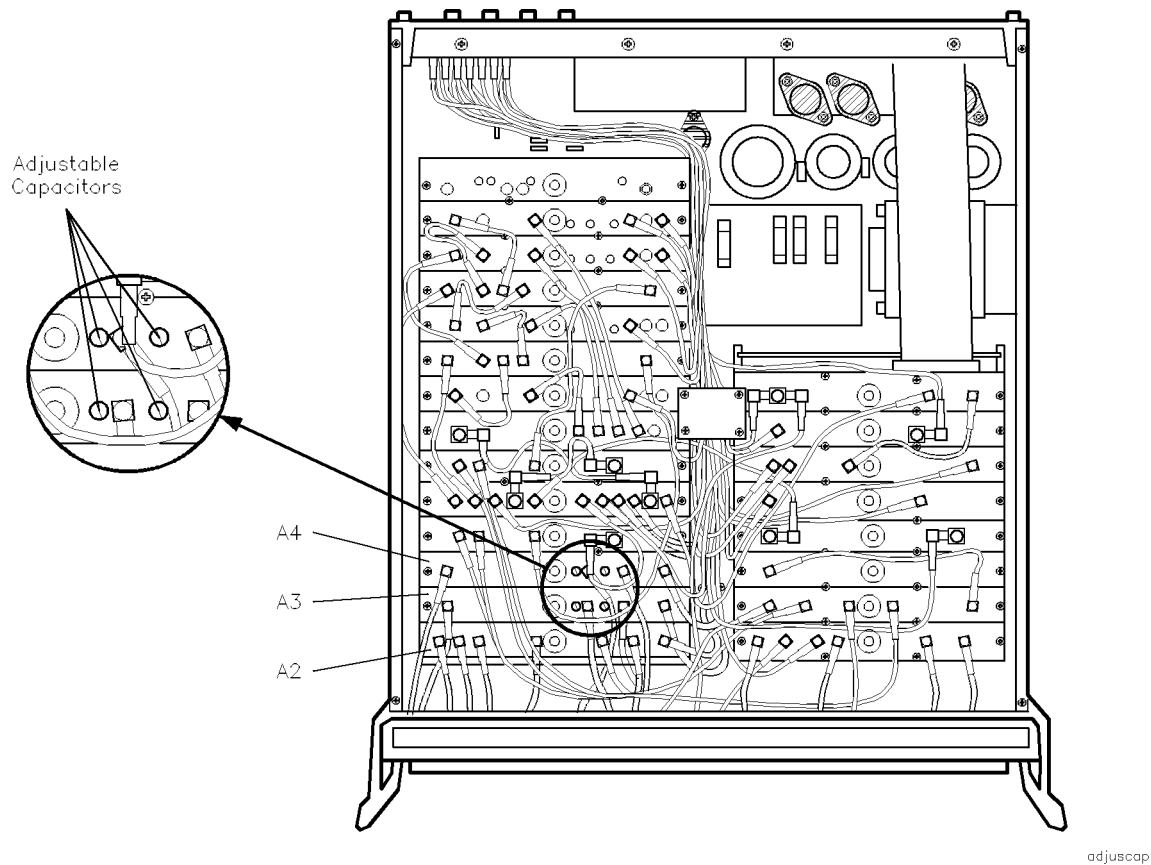
**Figure 5-1. Adjustment Procedure Setup**

---

**Note** All of the pulsed-RF system instruments can remain connected in the system during the adjustment procedure as long as they are powered OFF during the adjustment procedure. Only the instruments used in Figure 5-1 should be powered ON for the adjustment procedure.

---





**Figure 5-2. A2 IF MUX Board Connections**

1. For racked systems, remove the rack mounting screws from the front of the HP 85102. Slide the instrument forward slightly to give you access to the A2, A3, and A4 boards (refer to Figure 5-2).

---

**Note** For benchtop configurations, the HP 85102 is placed on top to the HP 85101 for easy access to the pulsed-RF boards.

---

2. Turn all the instruments off and move the top cover of the HP 85102 back to allow access to the A2, A3, and A4 boards only. The cover is only partially moved back to maintain the operating temperature of the HP 85102 as close to the operating temperature when its cover is fully on.
3. Turn on all the instruments in the adjustment setup and allow the equipment to warm up for at least one hour.
4. On the HP 8510, press **DOMAIN** **PULSE PROFILE**. Ignore the SYSTEM BUS ADDRESS ERROR message on the network analyzer display.
5. Set the source for a power level between  $-10$  and  $-15$  dBm, and a CW frequency of 20.1 MHz.

Use the test cable to connect the RF source output to A2J3 (disconnect the cable that is currently to A2J3.)

6. On the HP 8510, press **PARAMETER MENU** **USER 2 b2**

**RESPONSE REF VALUE** **MARKER**

**RESPONSE SCALE** **0** **2** **x1**

**SYSTEM** **RESET IF CORRECTION**

**STIMULUS MENU** **NUM PTS** **101**

7. Adjust the two variable ceramic capacitors, located on the A3 Pulse Detector board near J2 and J3, for minimum ripple (refer to Figure 5-2). Press **RESET IF CORRECTION** at the end of each sweep while adjusting these capacitors. The ripple should be <0.06 dB peak-to-peak after **RESET IF CORRECTION**. See Figure 5-3 and Figure 5-4 for typical network analyzer display traces.

Recenter the trace by changing the Reference Value if necessary.

---

**Note** Noise can sometimes make this adjustment appear temporarily out of specification. Ignore non-repeatable spikes.

---

8. Move the test cable to J5 on the A2 IF MUX board (refer to Figure 5-2) and replace the original cable on J3. Repeat this procedure from step 6 substituting **USER 3 a2** for **USER 2 b2**. Adjust the capacitors on the A4 Pulse Detector board instead of the board. The ripple should be <0.06 dB peak-to-peak after **RESET IF CORRECTION**.
9. When the A3 and A4 boards have been adjusted, turn the instrument OFF, remove the test cable and replace the original cable on J5. Replace the top cover on the IF/detector. Reconnect the system bus cables to the sources. Reconfigure the network analyzer with the display/processor on top of the IF/detector.

This completes the adjustment procedure, continue with the operator's tests in the operating section of this manual.

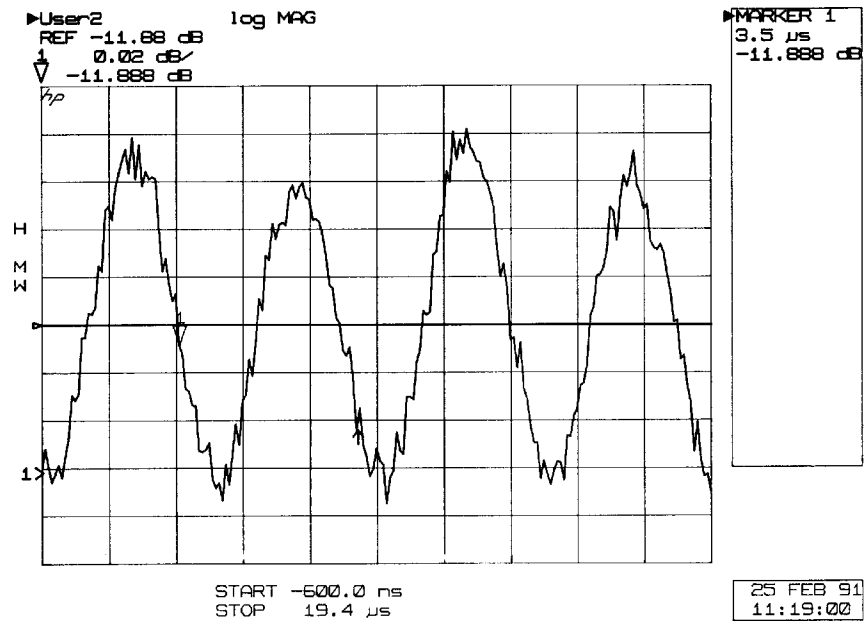


Figure 5-3. Misadjusted Pulse Detector Display Trace

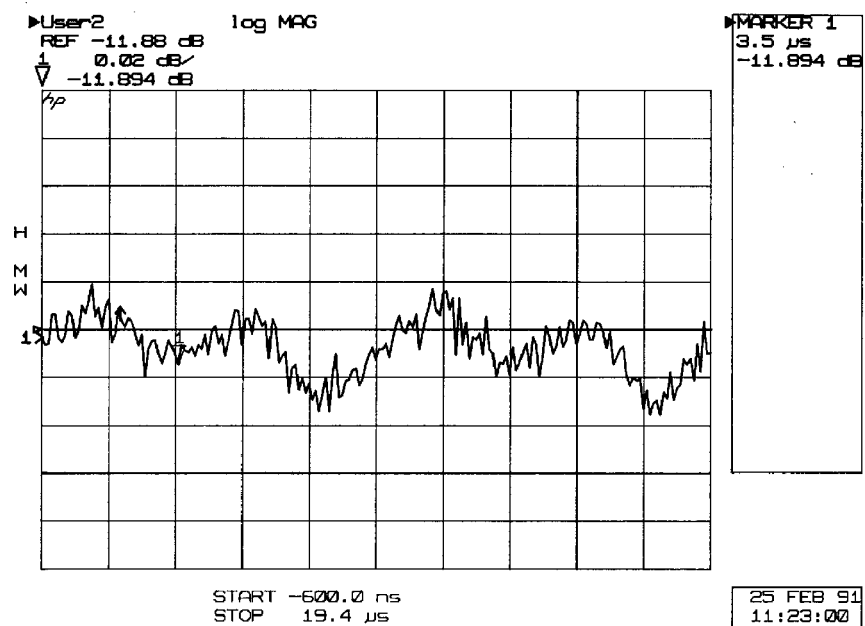


Figure 5-4. Adjusted Pulse Detector Display Trace



## System Service and Troubleshooting

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### Introduction

This section provides board/assembly level service for the features that are unique to wide BW, pulsed-RF operation and the HP 85102 option 008. Board/assembly level service for the system for operation in the normal BW, nonpulsed-RF mode is provided in the HP 8510C Service manual (part number given below).

### Getting Help

An HP Customer Engineer can provide service support for your pulsed-RF network analyzer system. Contact the nearest Hewlett-Packard Sales Office for service support. A list of sales offices is provided at the end of this manual.

---

### Troubleshooting

This section provides troubleshooting information for the racked, factory-configured pulsed-RF network analyzer system. This information may also be useful for similar user-configured systems.

For additional troubleshooting assistance, a block diagram of the system (Figure 6-7) and a block diagram of the IF detector, including the pulsed-RF portion (Figure 6-8), are included at the end of this section.

### Troubleshooting Strategy

The troubleshooting strategy for the pulsed-RF system is summarized below. Procedures for each item are given later in this section.

1. Note the symptoms of the failure.
2. Check the system setup.
3. Use error messages and internal diagnostics.
4. Use specific procedures for certain symptomatic failures.

## Documentation Required

Additional information and troubleshooting procedures are contained in the following manuals:

- HP 8510C Service manual (HP part number 08510-90282)
- HP 85110A Operating and Service manual (HP part number 85110-90001)
- HP 8360-series Troubleshooting manual

### 1. Note the Symptoms of the Failure

Write down the failure now while it is still fresh in your mind.

- What are the symptoms?
- Is the failure constant or intermittent?
- Does the failure always occur under a fixed set of conditions?

### 2. Check System Setup

The system setup check verifies that the system cabling, firmware revisions, HP-IB addresses, and operating languages are correct.

#### Procedure

This procedure is performed with the instruments turned off.

1. Use the cabling diagrams in the Installation section as you verify the system connections for correct location and tightness.
2. Use Table 6-1 as you verify the system settings.

**Table 6-1. System Setup Check Table**

Check		Should be:	Additional information
Rear panel settings:	Line voltage	Set to local line voltage	See rear panels of each instrument
	Fuse size	Appropriate for line voltage	See rear panels of each instrument
Operating system firmware revision:	HP 8510C	C.06.50 or higher	See the label on the operating system disk
	HP 8510B (if used)	B.05.11 or higher	See the label on the operating system tape
	HP 8360 series	08 Mar.91 or later	See HP 8360 series source check
HP 8510 system bus address:	RF source if HP 8360	LANG = 001 ADDRESS = 10010 (binary)	See HP 8360 series system bus
	LO source if HP 8360 series	LANG = 001 ADDRESS = 10010 (binary)	See HP 8360 series source check
	RF source if HP 8340B or HP 8341B	19 (decimal) address check	See HP 8340/41 source
	LO source if HP 8340B or HP 8341B	18 (decimal) address check	See HP 8340/41 source
Controller HP-IB bus addresses:	3.5 inch drive	700 (decimal)	See your disk drive manual for HP-IB address switch location
	HP 8510	716 (decimal)	Will be checked after the system is powered up

### HP 8360 Series Source Check Software Revision, Language, and HP-IB Address

When an HP 8360 series source is used with an HP 8510 based network analyzer system it must be set to the “Analyzer” Language.

The Language and HP-IB address of HP 8360 series sources can be set by two methods; Rear panel switches, and front panel keys. Either of these methods can be used. The procedure given below sets the HP-IB address to 19 (the address of RF source 1).

#### Front Panel Keys Method

1. Turn on the source.
2. On the network analyzer, press:

SYSTEM **MENU**

HP-IB MENU

**ANALYZER** (an \* will appear indicating the selection.)

**ADRS MENU** (top line of display shows the language and software revision:  
LANG: ANALYZER, ADRS=nn, REV dd mmm yy)

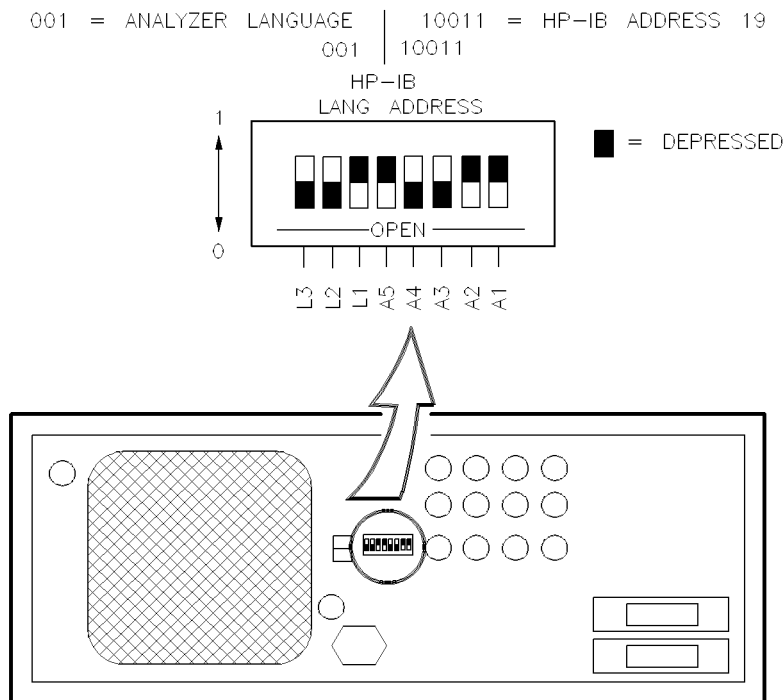
**8360 ADRS** (top line of display shows: HP-IB ADDRESS:nn SELECTED )

Entry **1** **9** **x1** (top line of display shows: HP-IB ADDRESS:19 SELECTED ).

3. Turn the source off.

### Rear Panel Switch Method

1. Set the rear panel switches on the source as shown in Figure 6-1.



**Figure 6-1. HP 8360 Series Source Rear Panel Switches**

### HP 8340/41 Source HP-IB Address Check

These sources are set by front panel keys. The procedure sets the source HP-IB address to 19 (the address of RF source 1).

#### Procedure

1. Turn on the source.
2. Press **SHIFT** **LOCAL** **1** **9** **Hz**
3. Turn the source off.



### 3. Use Error Messages and Internal Diagnostics

The network analyzer has built-in self tests that run automatically at power up. They can locate many problems in the system. If there is a failure of any of the self-tests, a message appears on the display. During normal operation, the network analyzer continually monitors its operation. When a failure or abnormal operation is detected, a 'running error' message is sent to the display.

The following procedure takes advantage of the network analyzer's built-in self-tests and monitoring to help locate a failure.

#### Procedure

This procedure assumes that the proper instrument states and hardware states have been loaded from the configuration disk into the network analyzer. If not, refer to Appendix C for instructions to load the proper machine dump configuration file.

1. Start with line power OFF to all instruments.
2. Switch the line power ON to the instruments in the following order:

- Microwave amplifier (if used)
- Sources
- Test set
- 85102
- 85101

As you turn on each instrument watch the front panel indicators for performance as shown in Table 6-2. If an instrument does not power up properly, refer to the service manual for that instrument for troubleshooting information.

3. If the HP 85101 does not complete the power on sequence, refer to 'Network Analyzer Startup Problems' later in this chapter.
4. If a "running error" message appears on the network analyzer display after the power on sequence is completed, note the error and then press the **ENTRY OFF** key. If the error message repeats, refer to the section Running Errors Specific to Pulsed-RF Systems later in this chapter.

**Table 6-2. Instrument Power On Sequence**

Instrument being powered on	At initial power on	After self-test is complete (approx. 5 seconds)	After HP 85101C is powered on <sup>1</sup>
<b>HP 8360 series</b>			
line power	ON	ON	ON
Instr Check	ON	OFF	OFF
<b>HP-IB status</b>			
R	ON	OFF	ON
S	ON	OFF	BLINKING
<b>HP 85110</b>			
line power	ON	ON	ON
a1	ON	ON	ON
a2	ON	OFF	OFF
<b>HP 85102</b>			
line power	OFF	OFF	ON
CHANNEL 1	ON	ON	ON
CHANNEL 2	ON	ON	OFF

<sup>1</sup> Refer to the HP 8510C power on sequence in the Network Analyzer Startup Problems section.

### Running Error Messages Specific to Pulsed-RF Systems

The following running error messages are specific to pulsed-RF systems. If your system shows a different running error message than is listed here, refer to the HP 8510C service manual for an explanation.

**PULSE CAL FAILURE ON TEST/REFERENCE CHANNEL(S).** This error message reports a failure detected in the pulsed-RF circuitry.

Probable cause of failure:

- HP 85102 A2 multiplexer board
- HP 85102 A3 and A4 test and reference channel detector boards
- HP 85102 A16 sample and hold board

**PULSE CAL FAILURE ON BOTH CHANNELS .** Probable cause of failure:

- HP 85102 A6 clock board
- HP 85102 A2 multiplexer board
- HP 85102 A16 sample and hold board

Troubleshooting:

- Remove W52 from A2J4 and check the output at A2J4 with an oscilloscope. The output should be about 0.6 volts peak to peak into the 1 M $\Omega$  input impedance of the oscilloscope.

## 6-6 System Service and Troubleshooting

If the output at A8J6 is missing or much lower than typical, replace the A8 Clock board.

**UNABLE TO LOCK TO EXT 10 MHZ REF.** Indicates the 10 MHz external input to the HP 85102 A6 clock assembly is more than +500 Hz off frequency. The level should be > 0 dBm. If the external input is off frequency or is less than 0 dBm, the A6 assembly sets the LIFSRQ low, alerting the CPU to the unlocked condition.

This message is not applicable unless you are locking to an external source such as in a multiple source network analyzer system.

If this error message occurs when the external 10 MHz input is not used, the probable causes of failure are:

- A6 clock assembly erroneously sets LIFSRQ low
- The A6 clock LIFSRQ signal is pulled low along the way to the HP 85101 A5 CPU
- +5V input to the HP 85102 A6 clock is intermittent

Troubleshooting:

- Run HP 85102 Service Program tests in the “run all” mode
- Check the 10 MHz input signal frequency and amplitude that you are applying to the rear panel of the HP 85102
- Refer to your source troubleshooting manual for the 10 MHz RF output level

#### 4. Use Specific Procedures for Certain Symptomatic Failures

If the symptoms of the failure are only present when the system is operating in the wide BW, pulsed-RF mode, the following procedures may help determine the failure. If the symptoms are present in both wide BW pulsed-RF and normal BW nonpulsed-RF operation, go to the troubleshooting section of the HP 8510C Service manual for troubleshooting information.

**Power loss, power holes, and frequency related problems.** Use the “Unratioed Power Levels check” in the HP 8510C Operating and Service Manual.

**Calibration and Verification problems.** Failure to pass verification of the 40 or 50 dB attenuators while passing the 20 dB attenuator, airline, and stepped impedance standard may be caused by incorrect setting of the offset frequency for source 2 in the multiple source setup. The correct offset frequency is 20.000017 MHz.

**Software/firmware problems.** If your hardware appears to be working properly but the system is not working the way you expect it to, reload the operating system software. If this does not correct the problem, you may have encountered a software “bug”. Determine the exact key sequence and/or setup that causes the failure and then contact HP for assistance.

## Network Analyzer Startup Problems

If the HP 85101C does not complete the power on sequence, turn it's power off for 10 seconds and then turn the power on. Note at what point in the power on sequence the procedure stops.

Power on sequence:

- a. RLTS8421 LED's all ON then OFF
- b. Same LED's light to indicate the number of the self-test being run.
- c. Display shows: TESTING
- d. Display shows: LOADING OPERATING SYSTEM
- e. Disk drive is briefly active
- f. Display shows: RECALLING INSTRUMENT STATE
- g. Display shows: graticule & trace

If one or more self-tests fail, the network analyzer will show an INTERNAL SELF TESTS HAVE REPORTED A FAILURE message. Refer to the Self Test Failure section of the HP 8510C manual.

If the hang-up failure occurs anywhere in steps a, b, or c of the sequence, check the power supplies (refer to the troubleshooting section of the HP 8510C Service manual for a procedure). If the power supplies are working properly, remove all instruments from the network analyzer system bus and HP-IB bus, and power on the network analyzer. If the network analyzer then completes the power on sequence and displays a graticule (disregarding any running error messages), one of the other instruments or an HP-IB cable is defective. If the network analyzer still does not complete it's power on sequence, call Hewlett-Packard for service support.

## Reloading the Operating System

If the failure occurs during steps d through g, the failure may be in the loaded operating system. Try reloading the operating system from disk using the following procedure:

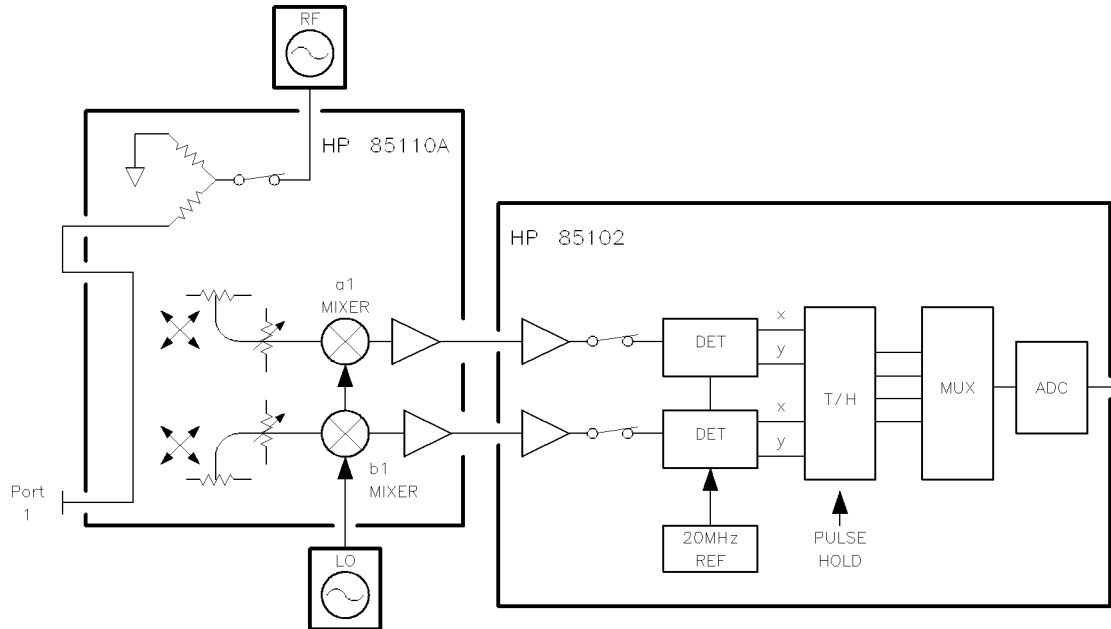
1. Turn on the HP 85101C while holding down a key in the entry key area of the HP 85101. This will force a self-test failure and bring up the error message display.
2. Press **[=MARKER]** to bring up the self-test menu.
3. Insert the operating system disk into the drive.
4. Press **[1] [9] [=MARKER]** and a disk directory will be shown.
5. Select the operating system file using the RPG knob and then press **LOAD FILE**. The network analyzer will then load the operating system from disk.

---

## Unratioed Power Level Check

This procedure allows you to check the power levels and frequency response of the four pulsed-RF signal paths. This test can give a good indication of the health of the sources, microwave paths, mixers, IF paths, amplifiers, detectors, track and hold, and A/D converter.

The a1 reference signal path and the b1 test signal path are shown in Figure 6-2. The a2 reference signal and the b2 test signal paths are similar to the a1 and b1 signal paths respectively.



**Figure 6-2. Simplified a1 and b1 Pulsed-RF Signal Paths**

### Procedure

Starting conditions:

- Test set test ports are “open”; nothing is connected to them.
- The system is powered ON.

---

<b>Note</b>	If you have any special instrument states loaded in the network analyzer, save them now in a machine dump disk file before continuing with this procedure. A single machine dump file holds all 8 instrument state files.
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Load the file MD\_PULS (or MD\_PULS\_A if you have an HP 8349B amplifier in the LO path):

1. Insert the HP 85108 Pulsed-RF configuration disk into the disk drive.
2. Press **DISC** or **TAPE/DISC** **LOAD MORE MACHINE DUMP**.
3. Use the RPG knob to select the desired file name.

4. Press **LOAD FILE**.
5. Remove the disk when the file is loaded.

## Setting Source 1 Power Level

The power level of source 1 is set to +7 dBm by Instrument State 8 of the system configuration disk (provided file MD\_PULS or MD\_PULS\_A has been loaded). This power level will not cause an IF OVERLOAD on most systems. For maximum dynamic range the power level of source 1 can sometimes be increased a few dB. To determine and set the maximum power level, perform the following procedure.

1. Press INSTRUMENT STATE **(RECALL) 4**. This will recall a four parameter split display and set the network analyzer to nonpulsed-RF operation.
2. Press STIMULUS **(MENU) MORE POWER MENU POWER SOURCE 1**.
3. Using the ENTRY **▲** key, increase the power level by 1 dB. Wait for one complete trace, and if an IF OVERLOAD message does not appear, increase the power by 1 dB again. Wait another complete trace.
4. Repeat the power increments until an IF OVERLOAD message appears, then decrease the power level by 1 dB.
5. Press INSTRUMENT STATE **(SAVE) 4** to save the maximum power level in register 4.
6. The maximum power level must be reset for the remaining instrument state registers: 1, 2, 3, 5, 6, 7, and 8.

Press INSTRUMENT STATE **(RECALL) n**. Press STIMULUS **(MENU) MORE POWER MENU POWER SOURCE 1** and set the power level to the value in step four.

7. Press INSTRUMENT STATE **(SAVE) n** (n=the register number selected in step 6).
8. Repeat steps 6 and 7 for the remaining instrument states.

## Signal Path Check

Look for the following items in the signal paths:

- Running errors – there should not be any.
- Power levels at the markers – should be within  $\pm 4$  dB of the traces shown.
- Power dips or power holes – none greater than 10 dB.

---

<b>Note</b>	The power level in wide BW, pulsed-RF mode is typically within 1 dB of the level for normal BW, nonpulsed-RF operation except at the bandcross points near 2.4, 7, and 13 GHz.
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---

## Checking a1 and a2 Signal Paths

### a1 path

1. Place a 3.5 mm 50  $\Omega$  termination on port 1.
2. Press INSTRUMENT STATE **(RECALL) 2**. This brings up a display similar to Figure 6-3.

## 6-10 System Service and Troubleshooting

3. Check for items mentioned in the Signal Path Check paragraph.

#### a2 path

1. Move the 3.5 mm 50  $\Omega$  termination to port 2.
2. Press **CHANNEL 2** to read the marker values on the a2 path.
3. Check for the items mentioned in the Signal Path Check paragraph.

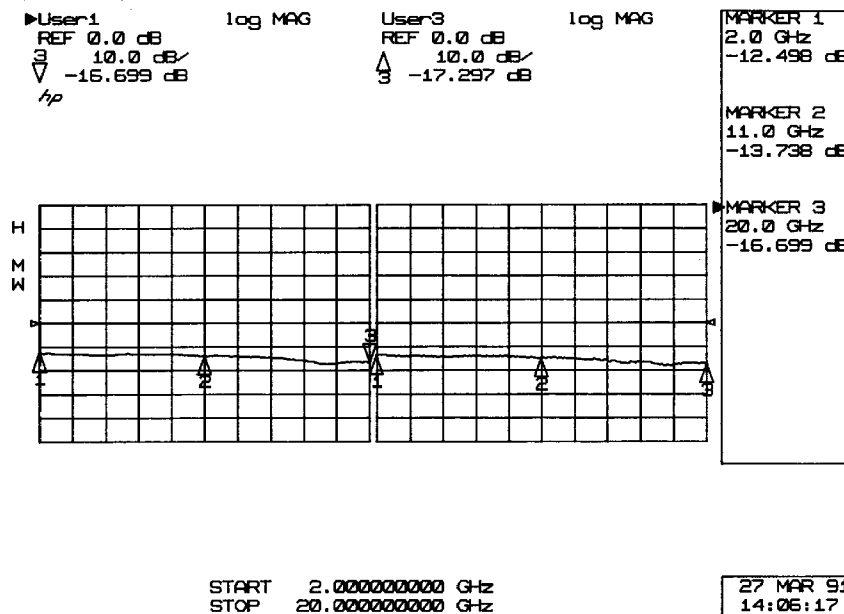


Figure 6-3. a1 and a2 Signal Paths

#### Checking b1 and b2 Signal Paths

##### b1 path

1. Place a 3.5 mm 50  $\Omega$  termination on port 1.
2. Press INSTRUMENT STATE **RECALL** 3. This brings up a display similar to Figure 6-4.
3. Check for items mentioned in the Signal Path Check paragraph.

##### b2 path

1. Move the 3.5 mm 50  $\Omega$  termination to port 2.
2. Press **CHANNEL 2** to read the marker values on the b2 path.
3. Check for the items mentioned in the Signal Path Check paragraph.

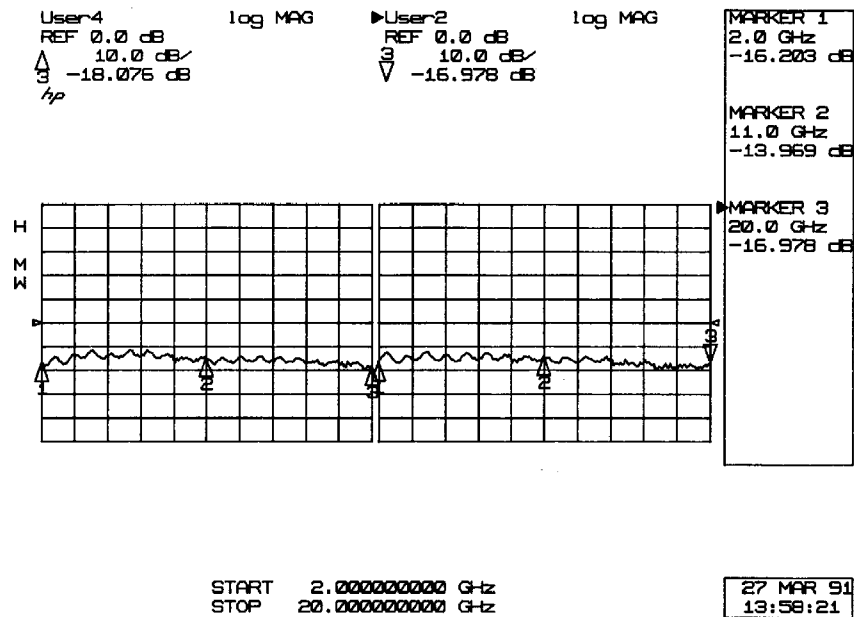


Figure 6-4. b1 and b2 Signal Paths

### Analyzing the Signal Path Check Results

**Power loss or power hole.** If the symptom is power loss or a power hole in all four signal paths, the failure must be at a point where it can affect all four paths.

Places to check:

- RF and LO sources.
- Source cables.
- Test set power supplies.

Refer to the source and test set manuals for troubleshooting help.

**Symptom in Wide BW Only.** If the symptom occurs only in wide BW, nonpulsed-RF mode or only in normal BW pulsed-RF mode, but not in both, then the failure is most likely in the HP 85102. If the symptom only occurs in the wide BW, pulsed-RF mode of operation, refer to Pulsed-RF IF Signal Path Description and then use the HP 85102 IF/Detector Option 008 Pulsed-RF IF Path Troubleshooting Flowchart.

**Symptom in Normal BW only.** If the symptom occurs only in the normal BW, nonpulsed-RF mode of operation, refer to the HP 8510C service manual.

### Pulsed-RF IF Signal Path Description

See Figure 6-5 as you read the following description.

**IF Mixer Boards (A9, A11, A13, A14).** The pulsed-RF IF path separates from the normal IF path on the IF mixer boards. On each IF mixer board the pulsed-RF IF signal flows through a buffer amplifier to the output connector J5.



**A2 Pulse IF Mux Board.** The pulsed-RF IF signals travel through coaxial cables to the input of the A2 Pulse IF Mux board. Firmware controlled switches select either b1 or b2 test IF signals for output at J2, and either a1 or a2 reference IF signal for output at J6. An additional function of the A2 pulse IF Mux board allows connection of a 19.9 MHz calibration signal into the test and reference IF signal paths during IF calibration.

**Pulse Detector Boards.** The test IF signal continues from A2J2 to A3J1 of the A3 Pulse detector board. The reference IF signal continues from A2J6 to A4J1 of the A4 Pulse detector board. The detectors on the A3 and A4 boards generate X and Y vector signals from the test and reference IF signals. A 20 MHz reference signal for the detectors is supplied by the A6 clock board. The X output is at J2 and the Y output at J3 on each board.

**A16 Remote Application / Pulse Track & Hold Board.** The X and Y test signals enter A16 at J3 and J4 respectively. The X and Y reference signals enter at J1 and J2 respectively. The signals are fed into track and hold circuits. The outputs of the T/H circuits are sent on to the A17 Sample/hold board multiplexer circuits. At the multiplexer circuits the signal paths converge to be the same as the normal BW, nonpulsed-RF paths.

---

## HP 85108 IF/Detector Option 008

### Pulsed-RF IF Path Troubleshooting Flowchart

The troubleshooting flowchart (Figure 6-6) is used when the problem has been isolated to the IF/Detector. If the problem is present during both normal BW and wide BW modes of operation, do not use this flowchart, instead refer to the troubleshooting section of the HP 8510C service manual. This flowchart addresses only the boards and cables unique to pulsed-RF operation.

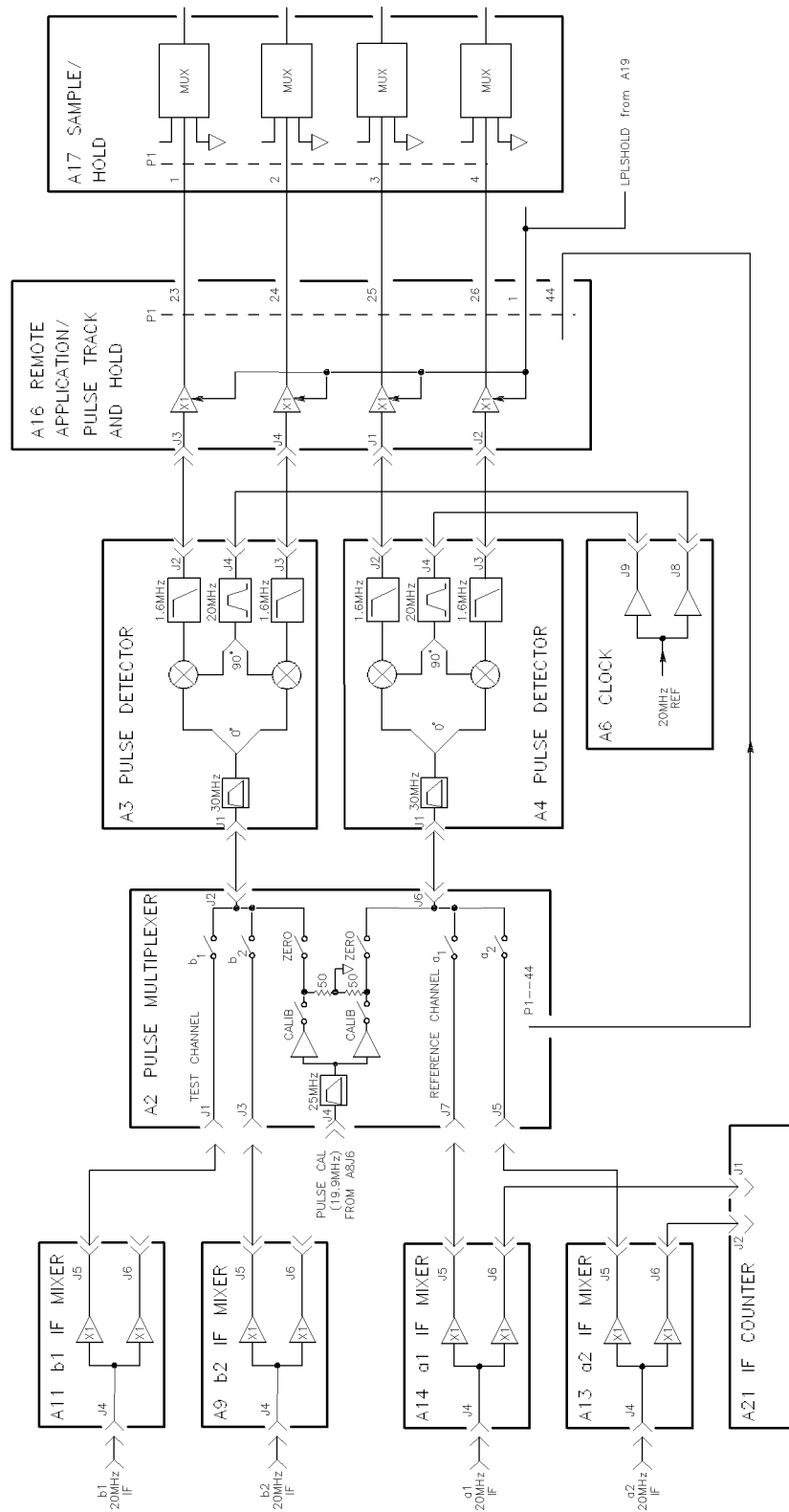
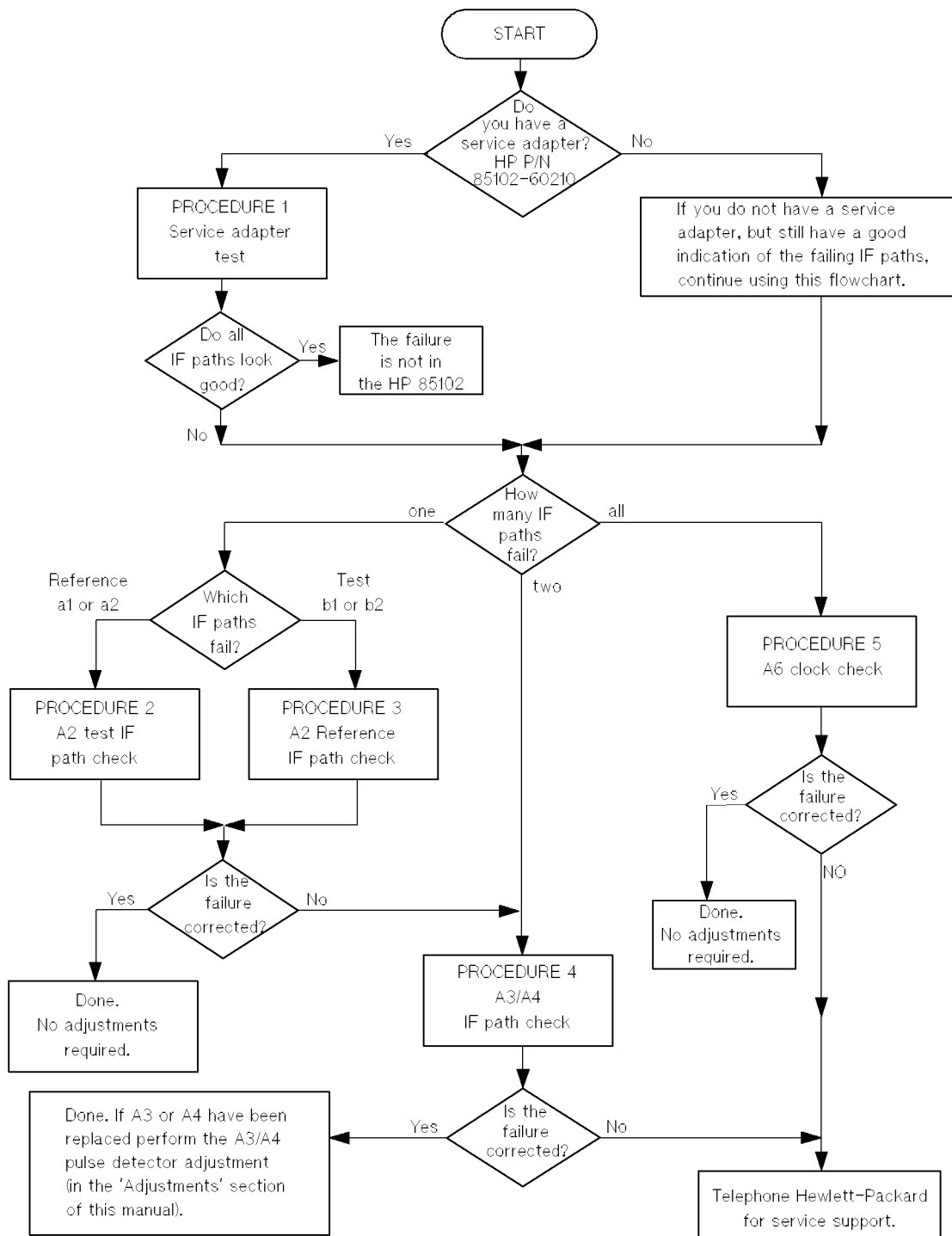


Figure 6-5. HP 85102 Pulsed-RF Signal Path

rfifpath



rfifpath

**Figure 6-6. Pulsed-RF IF Path Troubleshooting Flowchart**

## Procedure 1: Service Adapter Test

If one or more user channels appear faulty, the problem could be with the source, test set, or the HP 85102 IF/Detector. The service adapter is a source/test set emulator. It provides the same 20 MHz signal to the HP 85102 as the test set and source. Thus, it indicates whether or not the problem is in the HP 85102 IF/Detector.

### Equipment

- Service adapter (HP part number 85102-60210)
- BNC cable

### Service Adapter Procedure

1. Connect the HP 85102 service adapter to the HP 85102 rear panel 20 MHz OUT connector and the J2 IF-DISPLAY INTERCONNECT connector.
2. Press **[RECALL]** **[MORE]** **[FACTORY PRESET]** **[MARKER]** **[STIMULUS]** **[MENU]** **[STEP]**.
3. Press **[PARAMETER]** **[MENU]** and look at the unratiod power of each user channel (User1 through User4). The traces should be flat lines, and all four channels should look similar.

### Conclusions

If all of the channels look good (with the service adapter), and all looked bad in the unratiod power test, the HP 85101 and 85102 are working. The problem is likely source related. Refer to your source troubleshooting manual for further information.

- If all four User channels look bad (with the service adapter), suspect the 20 MHz signal from the A6 clock board assembly in the HP 85102.
- Single channel problems suggest the IF Mixer board corresponding to the User function (channel a1, b1, a2, or b2) is faulty. Refer to Figure 6-5.
- Multiple channel problems indicate the problem is most likely in the HP 85102 circuitry after the IF Mixer boards.

## Procedure 2: A2 Pulse IF Mux Test IF Path Check

Prerequisite for using this check: Only the b1 or the b2 pulsed-RF IF signal path looks bad.

In the two procedures below, always return any moved cables to their original connections before proceeding to the next step.

If the connections/setup correct the problem, carry out the instructions in the conclusion column. If the problem isn't corrected, go on to the next step.

### **b1 IF Signal Path Check**

<b>Step</b>	<b>Connections/setup</b>	<b>Conclusion (if the problem is corrected)</b>
1	Move W55 cable on A11J5 to A11J6.	replace A11 IF Mixer board
2	Move W46 cable on A2J7 to A2J1.	replace W55 (A11J5 to A2J1)
3	If b2 IF signal is okay.	replace A2 pulse IF Mux board
4	Return to the pulsed-RF troubleshooting flowchart.	

### **b2 IF Signal Path Check**

<b>Step</b>	<b>Connections/setup</b>	<b>Conclusion (if the problem is corrected)</b>
1	Move W53 cable on A9J5 to A9J6.	replace A9 IF Mixer board
2	Move W46 cable on A2J5 to A2J3.	replace W53 (A9J5 to A2J3)
3	If b1 IF signal is okay.	replace A2 pulse IF Mux board
4	Return to the pulsed-RF troubleshooting flowchart.	

### **Procedure 3: A2 Pulse IF Mux Reference IF Path Check**

Prerequisite for using this check: Only the a1 or the a2 pulsed-RF IF signal path looks bad.

In the two procedures below, always return any moved cables to their original connections before proceeding to the next step.

If the connections/setup correct the problem, carry out the instructions in the conclusion column. If the problem isn't corrected, go on to the next step.

### **a1 IF Signal Path Check**

<b>Step</b>	<b>Connections/setup</b>	<b>Conclusion (if the problem is corrected)</b>
1	Move W45 cable on A14J5 to A14J6.	replace A14 IF Mixer board
2	Move W46 cable on A2J5 to A2J7. Redefine a2 to: DRIVE:Port 1.	replace W45 (A14J5 to A2J7)
3	Redefine a2 to: DRIVE: Port 2. If a2 IF signal is okay.	replace A2 pulse IF Mux board
4	Return to the pulsed-RF troubleshooting flowchart.	

### a2 IF Signal Path Check

Step	Connections/setup	Conclusion (if the problem is corrected)
1	Move W46 cable on A13J5 to A13J6.	replace A13 IF Mixer board
2	Move W45 cable on A2J7 to A2J5. Redefine a1 to: DRIVE: Port 2.	replace W46 (A13J5 to A2J5)
3	Redefine a1 to: DRIVE: Port 1. If a1 IF signal is okay.	replace A2 pulse IF Mux board
4	Return to the pulsed-RF troubleshooting flowchart.	

### Procedure 4: A3/A4 Pulse Detector IF Path Check

Prerequisite for using this check:

1. Either both reference (a1 & a2) or both test (b1 & b2) pulsed-RF IF signal paths look bad.
2. Less than three IF paths are bad.

In the procedures below, always return any moved cables to their original connections before proceeding to the next step.

If the connections/setup correct the problem, carry out the instructions in the conclusion column. If the problem isn't corrected, go on to the next step.

### b1 IF Signal Path Check

Step	Connections/setup	Conclusion (if the problem is corrected)
1	Swap cables W50 & W51.	If the problem was in the ref. (a1 & a2) path, replace W50. If the problem was in the test (b1 & b2) path, replace W51.
2	Move W51 on A2J2 to A2J6. Move W50 on A2J6 to A2J2. Move W54 on A16J1 to A16J3. Move W47 on A16J3 to A16J1. Move W43 on A16J2 to A16J4. Move W48 on A16J4 to A16J2.	Go to step 3.
3	Do this step only if the problem was corrected in step 2.  Swap cables W47 & W54. Swap cables W48 & W43.	If the problem was in the ref. (a1 & a2) path, determine which cable is bad (W43 or W54) and replace it. If the problem was in the test (b1 & b2) path, determine which cable is bad (W47 or W48) and replace it.
4	Swap cables W5 & W49.	If the problem was in the ref. (a1 & a2) path, replace W5. If the problem was in the test (b1 & b2) path, replace W49.
5	Put in a known good A16 board.	replace A16.
6	Put in a known good A17 board.	replace A17.
7	Return to the pulsed-RF troubleshooting flowchart.	

### Procedure 5: A6 Clock 20 MHz Output Check

1. Disconnect the cable W5 or W54 at A6J9 or J8 and connect an oscilloscope to A6J8 or J9.

The output should typically be about 1.8 volts peak to peak into the 1 M $\Omega$  oscilloscope input impedance. The output voltage drops to about 1.2 volts peak to peak when connected to the pulse detector via W5 or W54.

A6J7 connects to the 20 MHz output on the rear panel and provides the same signal level.

2. If the signal is missing or greatly differs between J8, J9, and J7, replace the A6 Clock board.





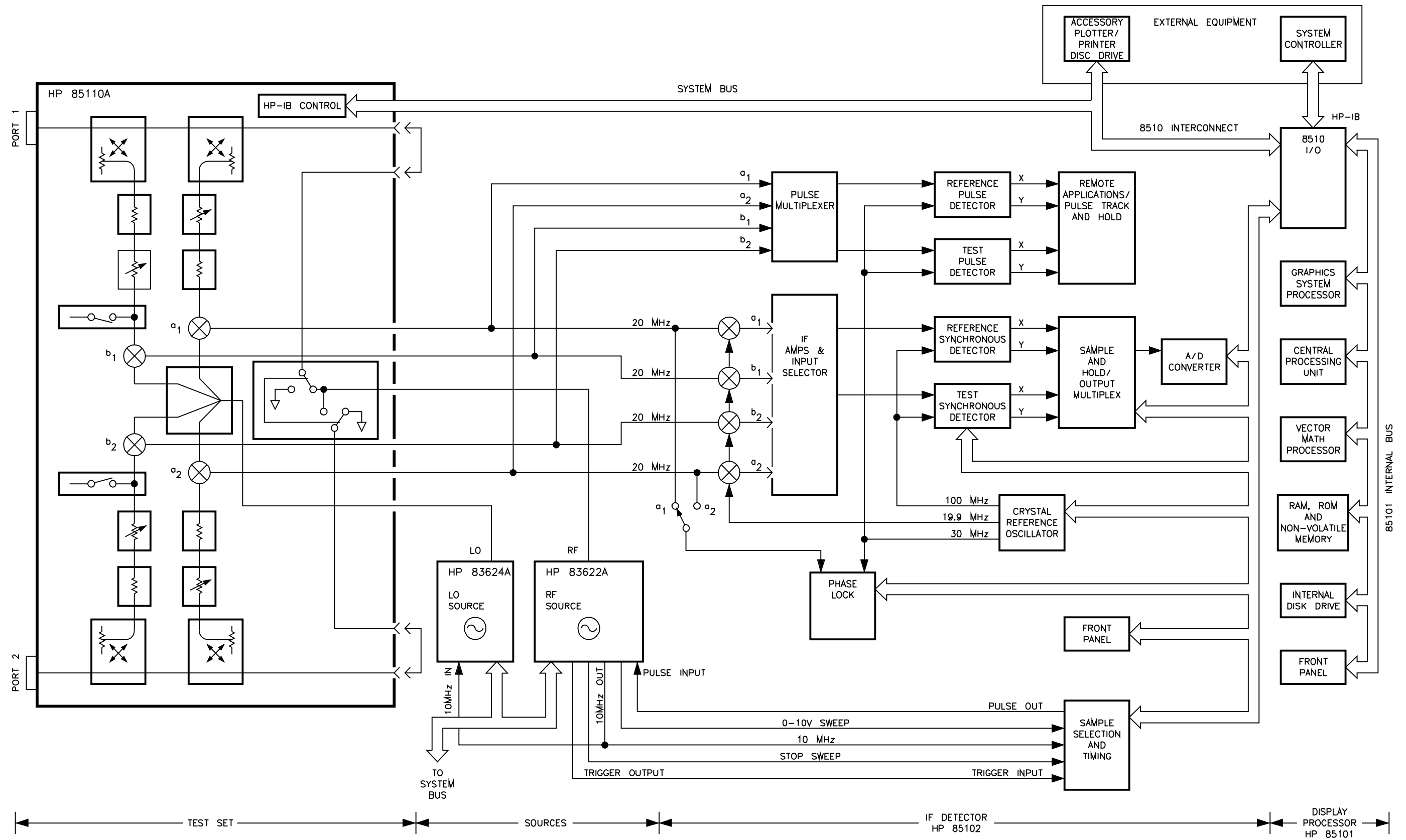


Figure 6-7. HP 85108A Block Diagram

## HP 85102C IF/DETECTOR OVERALL BLOCK DIAGRAM

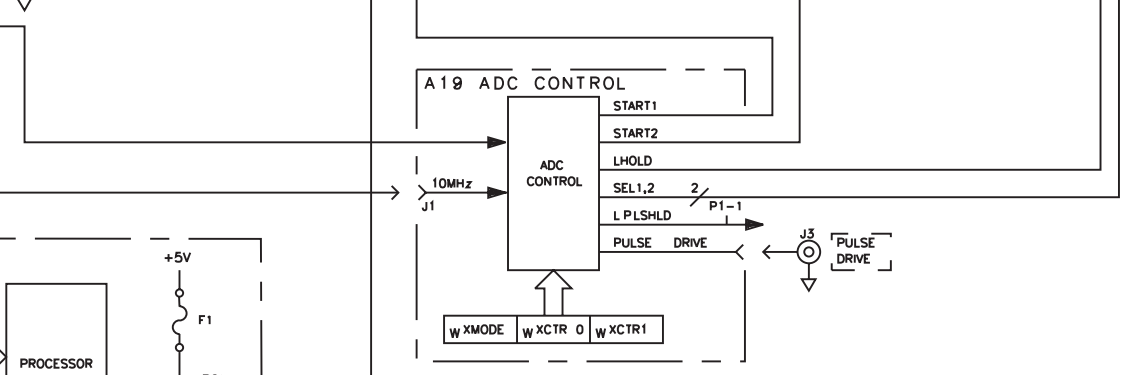
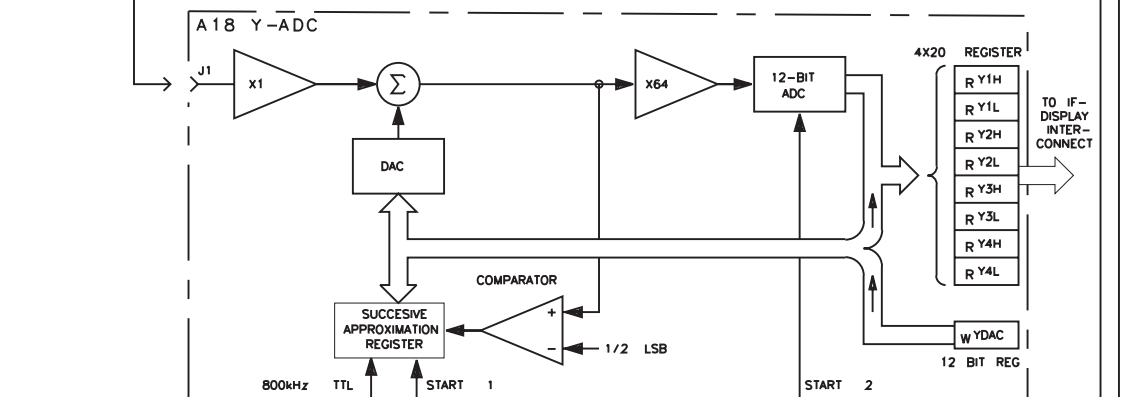
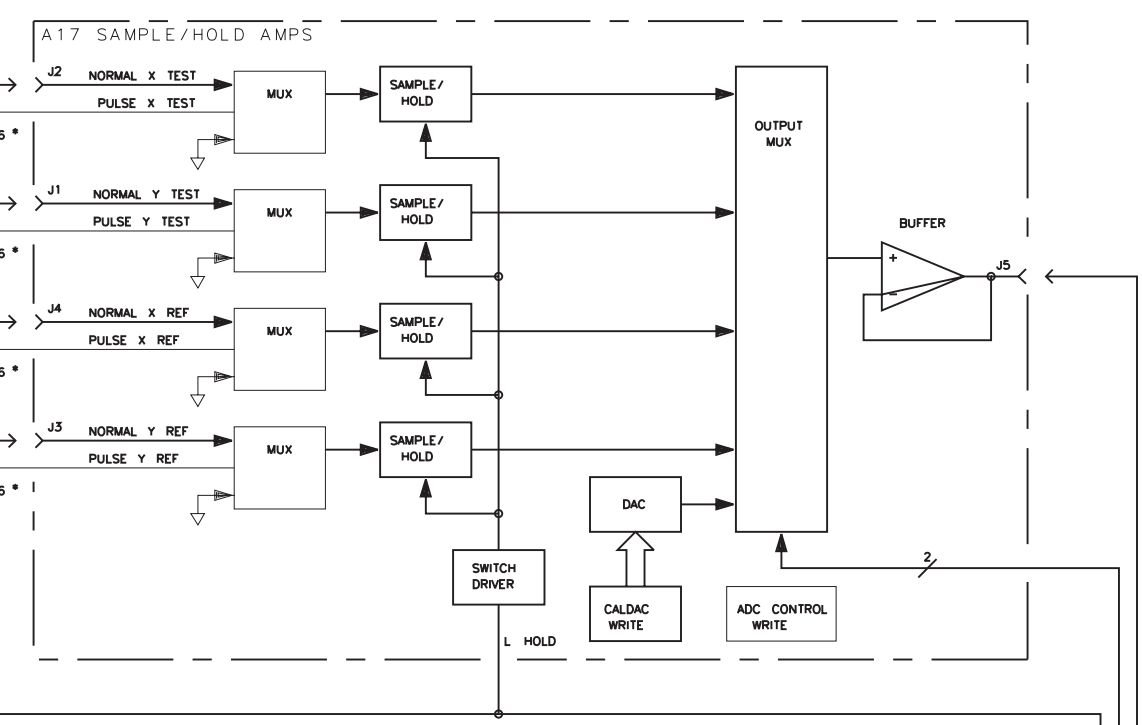
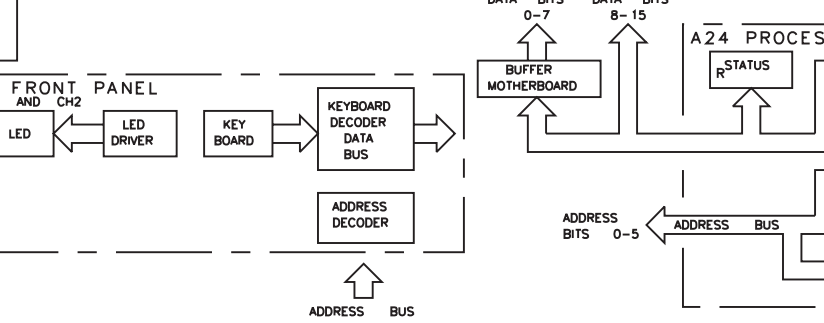
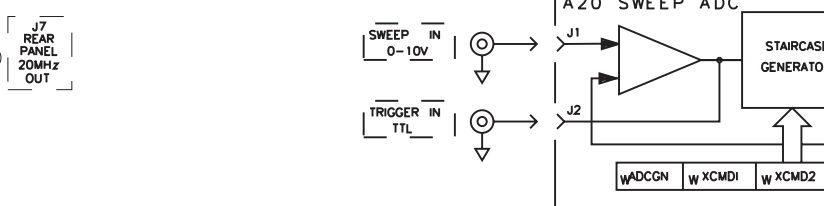
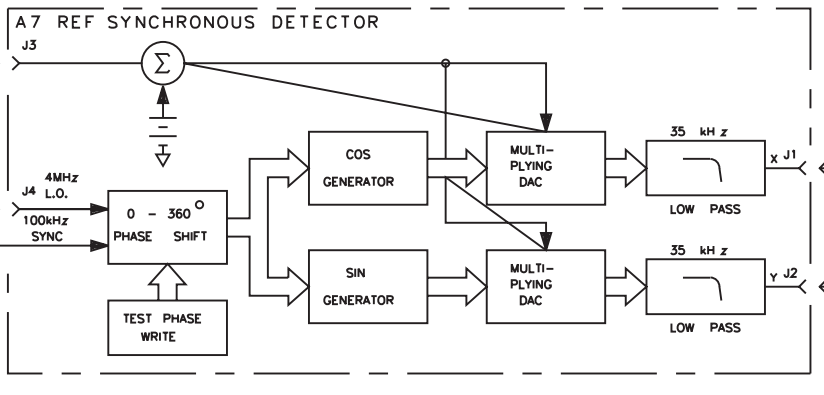
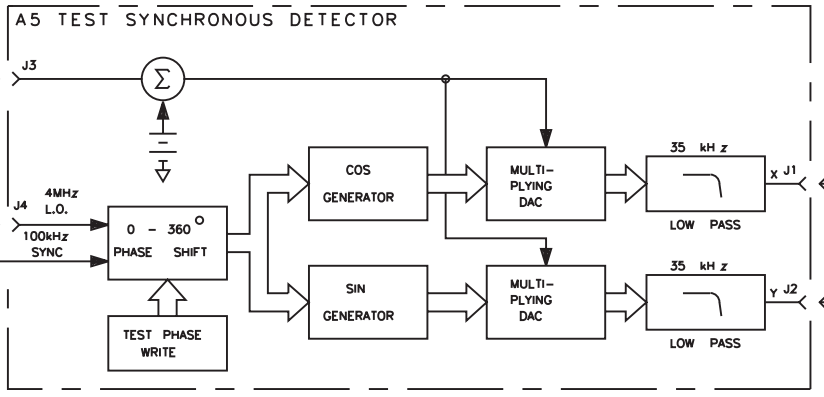
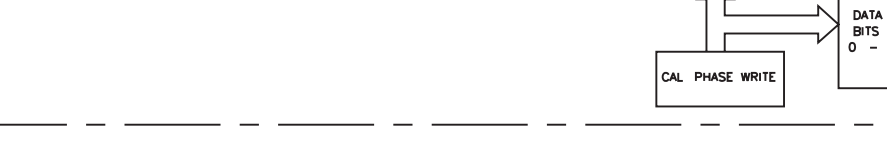
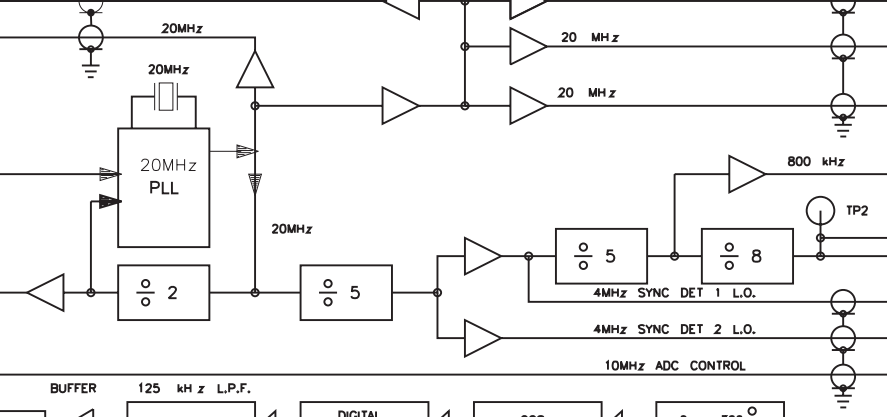
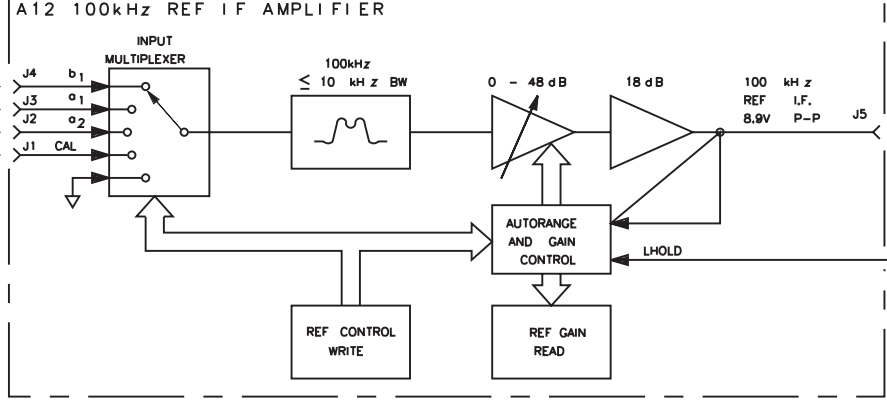
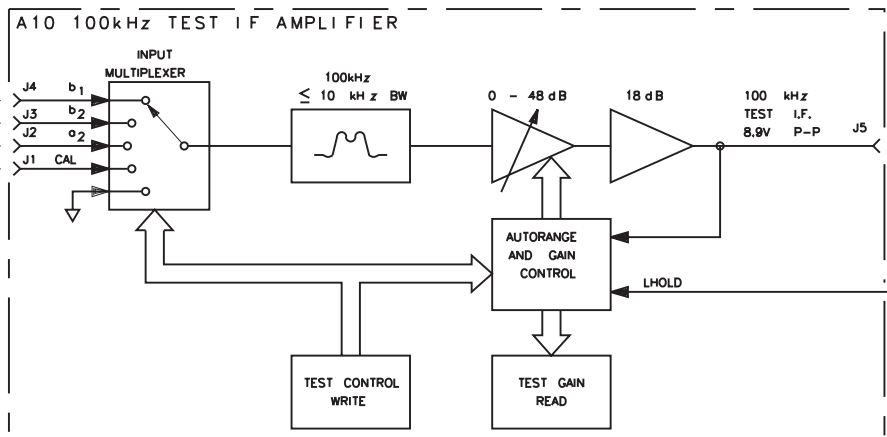
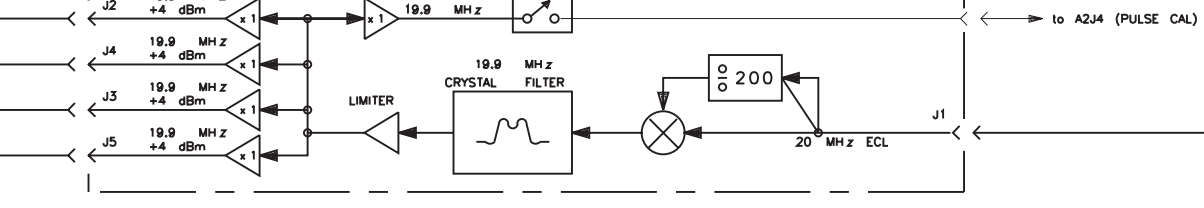
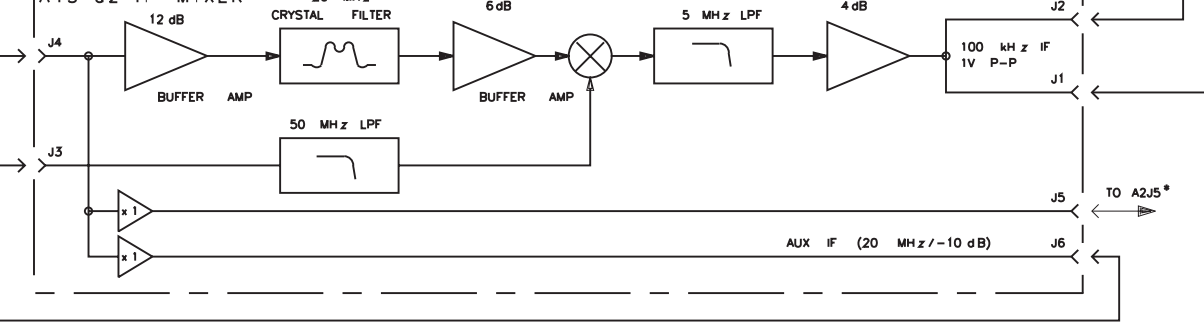
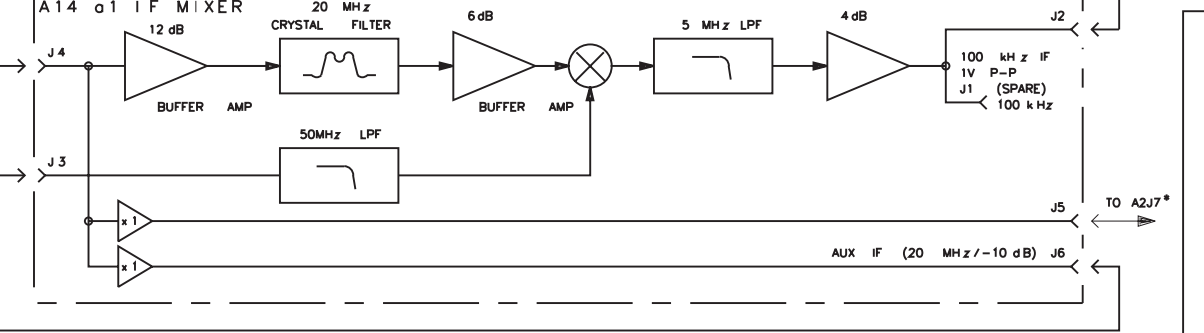
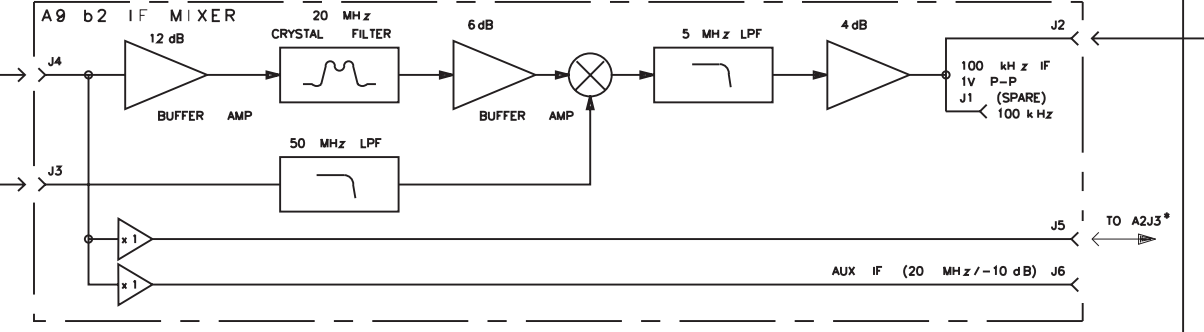
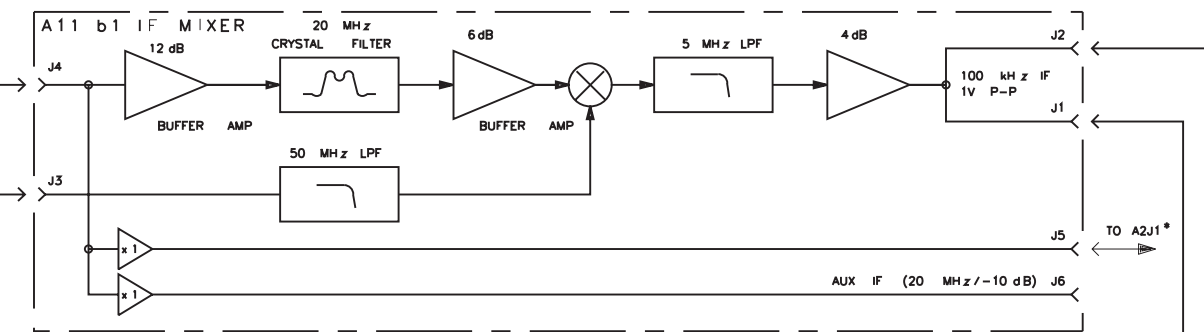
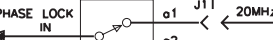
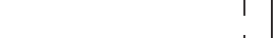
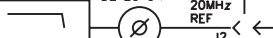
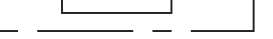
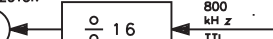
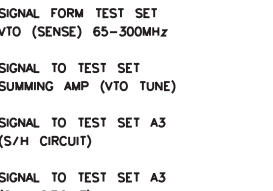


Figure 6-8. IF Detector with Pulse Option Block Diagram (1 of 2)

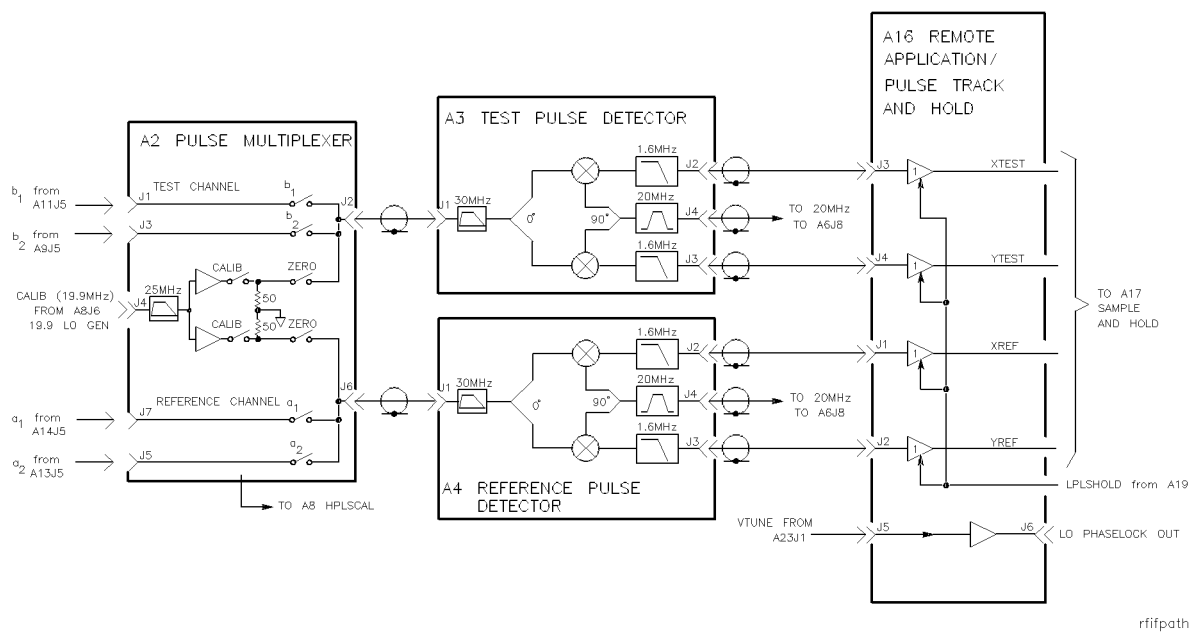


Figure 6-9. IF Detector with Pulse Option Block Diagram (2 of 2)



## Replaceable Parts

---

### Introduction

This chapter contains information for ordering replaceable parts that are unique to the pulsed-RF portion of the HP 85108 system. Refer to the individual instrument manuals for a complete replacement parts listing.

---

### Ordering Information

To order a part listed in the replaceable parts list, quote the Hewlett-Packard part number, indicate the quantity desired, and send the order to the nearest Hewlett-Packard office.

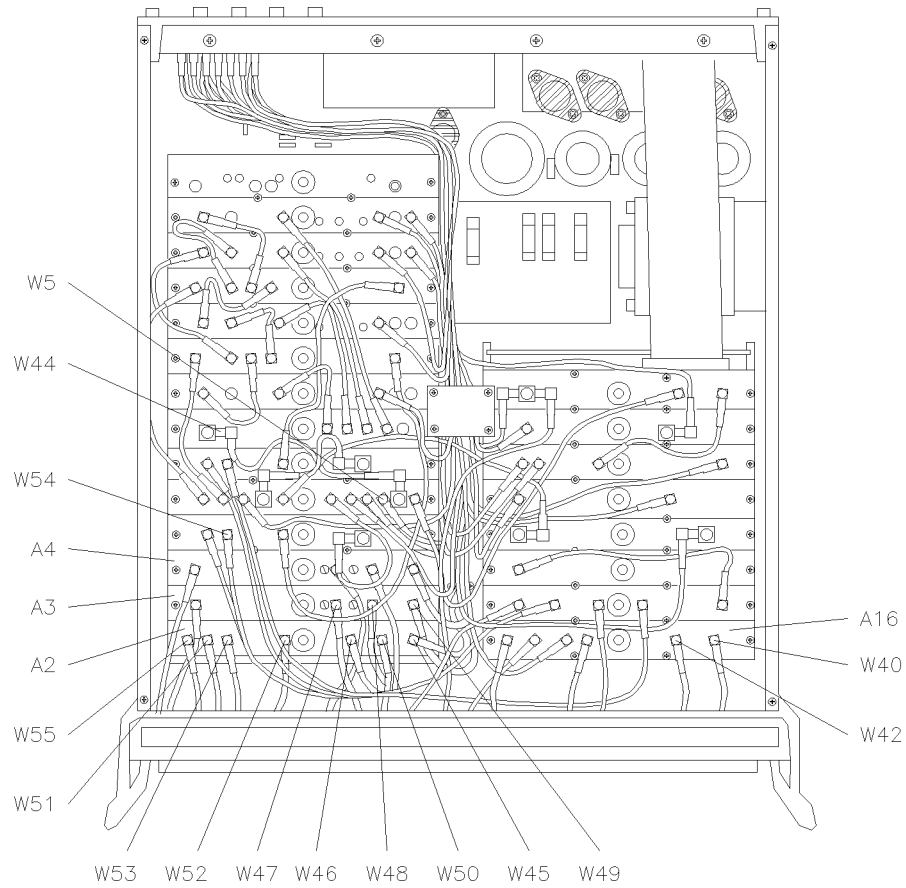
To order a part not listed in the replaceable parts list, include the instrument model number, complete instrument serial number, the description and function of the part, and the number of parts required. Send the order to the nearest Hewlett-Packard office.

### To Order Parts . . . fast!

(800)227-8164 Monday through Friday, 6 am to 5 pm (Pacific Standard Time)

The parts specialists have direct online access to replacement parts inventory corresponding to the replaceable parts list in this manual. There is a charge for hotline one day delivery, but four day delivery time is standard. After hours and holidays, call (415)968-2347.

This service applies to the United States only. Outside of the United States, contact your nearest HP office.



replpart

**Figure 7-1. HP 85108 Replaceable Parts**

## 7-2 Replaceable Parts

**Table 7-1. HP 85108 Replaceable Parts**

Ref Desig	HP Part Number	Qty	Description
<b>BOARD ASSEMBLIES</b>			
A2	85102-60002	1	Board Assembly, Pulse Mux
A3,A4	85102-60003	2	Board Assembly, Pulse Det
A16	85102-60016	1	Board Assembly, Remote App
<b>CABLE ASSEMBLIES</b>			
W5	85102-60135	1	Cable Assembly A6J9-A4J4
W40	85102-60249	1	Cable Assembly A16J6-RPJ9
W42	85102-60248	1	Cable Assembly A16J5-A23J1
W43	85102-60173	1	Cable Assembly A4J3-A16J2
W44	85102-60174	1	Cable Assembly A6J10-A8J1
W45	85102-60175	1	Cable Assembly A14J5-A2J7
W46	85102-60176	1	Cable Assembly A13J5-A2J5
W47	85102-60177	1	Cable Assembly A3J2-A16J3
W48	85102-60178	1	Cable Assembly A3J-A16J4
W49	85102-60179	1	Cable Assembly A6J8-A3J4
W50	85102-60180	1	Cable Assembly A2J6-A4J1
W51	85102-60181	1	Cable Assembly A2J2-A3J1
W52	85102-60182	1	Cable Assembly A8J6-A2J4
W53	85102-60171	1	Cable Assembly A9J5-A2J3
W54	85102-60172	1	Cable Assembly A4J2-A16J1
W55	85102-60170	1	Cable Assembly A11J5-A2J1
<b>DOCUMENTATION (NOT PICTURED)</b>			
	85108-90023	1	HP 85108 System Manual
	08510-90275	1	HP 8510 Operating & Service Manual
	83624-90001	1	HP 8360 Series Manual Set
	85110-90001	1	HP 85110 Test Set Manual

**Table 7-1. HP 85108 Replaceable Parts (continued)**

Ref Desig	HP Part Number	Qty	Description
<b>TOUCH-UP PAINT</b>			
	6010-1146	1	Dove Gray - Use on the frame around the front panel and painted portions of front handles.
	6010-1147	1	French Gray - Use on the side, top and bottom covers.
	6010-1148	1	Parchment Gray - Use on the rack mount flanges, rack support shelves and front panels.
<b>SYSTEM RACK PARTS</b>			
	85106-60002	1	System Cabinet Assembly
	85043-00028	1	Filler Panel - Right
	85043-00029	1	Filler Panel - Left
	85043-00030	1	Work Surface Assembly
	85043-00031	2	Support Rail
	85043-00046	1	Blank Panel 1.75 in
	85043-00048	2	Blank Panel 5.25 in
	85043-20001	1	Ground Stud
	85043-20002	2	Shoulder Screw
	85043-20003	1	Clip - Table Lock
	85043-80013	1	Mat Kit - Antistatic
	85043-00019	2	Fan Grill
	85043-00022	2	Plug - Painted
	85043-00026	2	Air Filter PF30PPI



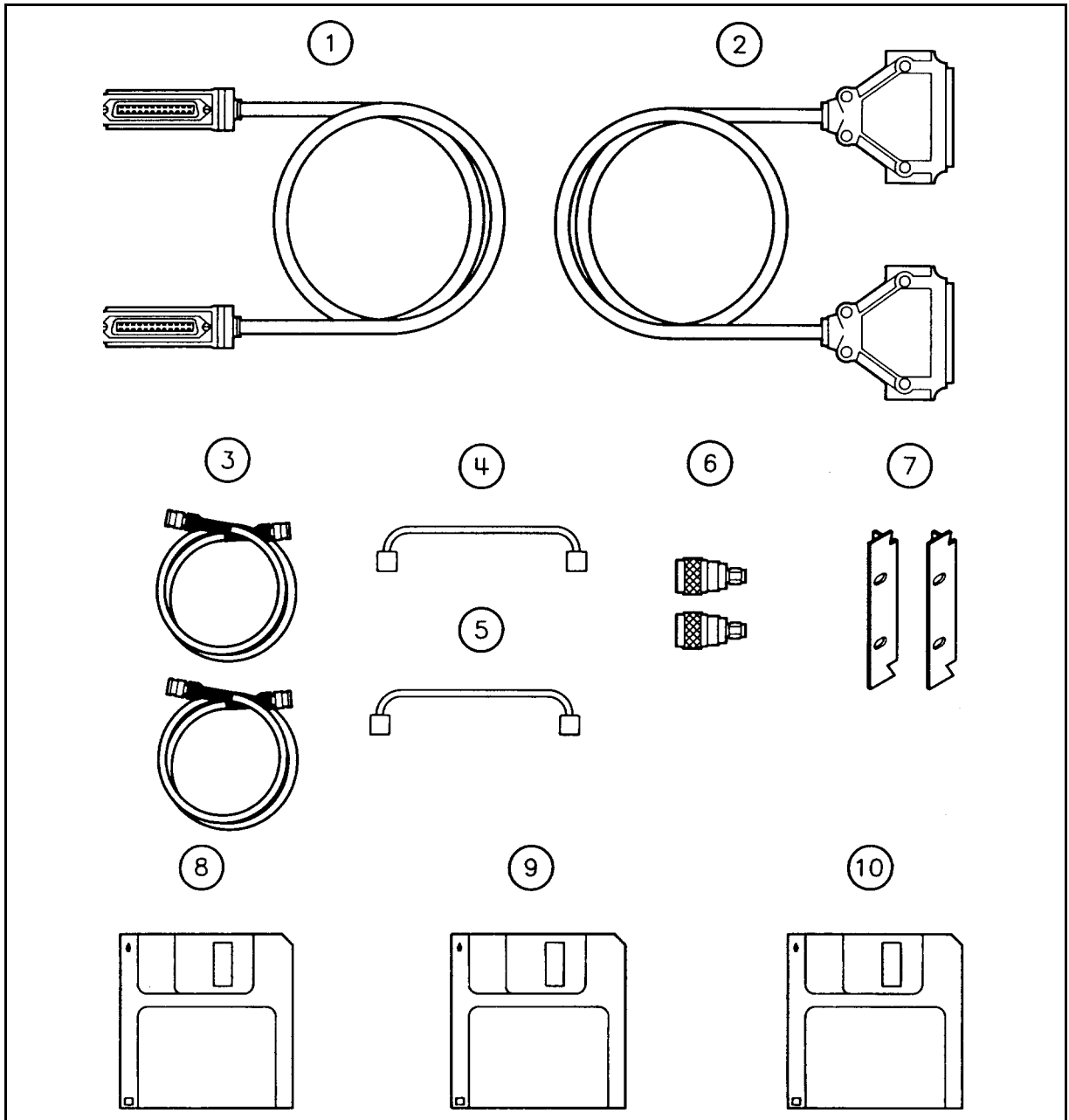


Figure 7-2. HP 85108 Replaceable Parts

**Table 7-2. HP 85108 Replaceable Parts**

Ref Desig	HP Part Number	Qty	Description
			<b>MISCELLANEOUS</b>
1	8120-3445	6	HP-IB Cable
2	08510-60106	1	Test Set Interface Cable
3	8120-1838	1	BNC Cables
	8120-1840	2	BNC Cable, 48 inch
4	85108-20028	1	Semi-Rigid RF Cable
5	85108-20029	1	Semi-Rigid RF Cable
6	1250-1894	2	Adapter Male N-Male SMA
7	5062-4071	3	Rack Mount Kit
8	85101-80098	1	HP 8510 Operating & Service Firmware
9	85108-10003	1	HP 85108 System Configuration Disk
10	08510-10033	1	HP 8510 Performance Verification Software

## Glossary of Pulsed-RF System Terms

---

### Introduction

This section contains a list of terms used to describe the pulsed-RF stimulus and response. Figure A-1 shows a typical envelope of the pulsed-RF waveform output by the RF signal source.

### Pulse Repetition Period, PRP

The time from the 50 percent point on the rising edge of one pulse to the 50 percent point on the rising edge of the next pulse.

For internal triggering operation the system PRP depends upon the instrument state. Typically there is one pulse per measurement. The pulse is turned ON for a user-specified time and the measurement is made at some user-specified time relative to the start of the pulse. The time until the next pulse consists first of the time required for the analyzer to set up for the next measurement and second, if necessary, waiting to satisfy the user-specified pulse width and duty cycle limit.

In the frequency domain, when the analyzer is tuned to the next frequency, the maximum PRP is about 30 milliseconds. In the Pulse Profile domain, the frequency does not change, making the maximum PRP about 3 milliseconds. With averaging, the PRP can be about 1 millisecond during part of the measurement. Other factors which affect the system PRP are calibration type, pulse width, duty cycle, and pulse profile domain stop time.

If the PRP is controlled externally, the HP 8510 external trigger input is used to synchronize the analyzer with the pulse.

### Pulse Repetition Frequency, PRF

$$PRF = \frac{1}{PRP}$$

### Duty Cycle

The ratio of the time that the pulse is ON to the total Pulse Repetition Period. If the pulse ON and OFF times are equal, the Duty Cycle is 50 percent.

For internal operation, the maximum duty cycle percent limit can be specified, but the actual duty cycle may be less, depending upon the user-specified pulse width and the time it takes for the analyzer to set up for the next measurement.

## **Pulse Width**

The ON time from the 50 percent point on the rising edge to the 50 percent point on the falling edge.

The internally-generated Pulse Width can be set from less than 100 nanoseconds to 40.88 milliseconds.

---

## **Rise/Fall Time**

The pulse transition time:

tr = pulse rise time

The time it takes for the pulse to rise from the 10 percent ON condition to the 90 percent ON condition.

tf = pulse fall time

The time it takes for the pulse to fall from the 90 percent ON condition to the 10 percent ON condition.

The normal IF responds to rise/fall times of about 75 microseconds; the wideband IF responds to rise/fall times of about 300 nanoseconds.

## **Trigger Delay**

The time after pulse ON that the measurement is actually made.

In the Frequency domain, the Trigger Delay can be set from down to -6 resolution periods (internal) or +3 resolution periods (external) and up to 40.88 milliseconds. In the Pulse Profile domain the trigger delay is automatic depending upon the display time span, pulse width, and number of points.

## **Pulse Profile Measurement Resolution Period**

The time between adjacent Pulse Profile domain data points. The minimum is 100 nanoseconds. This is set by an algorithm depending upon the Pulse Profile stop time, pulse width, and number of time points.

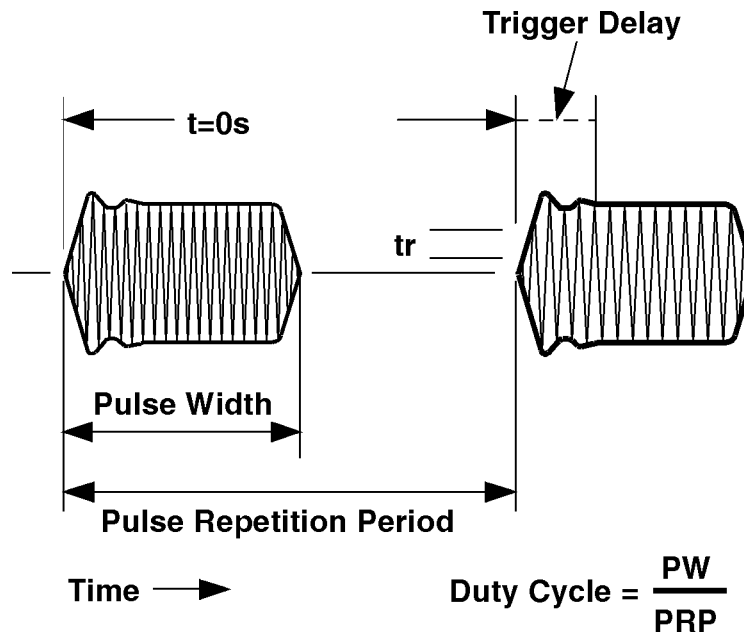


Figure A-1. Pulse Terms and Definitions



## Hardware and Instrument States

---

### Introduction

Appendix B contains the following information.

- HP-IB addresses of the pulsed-RF system instruments.
- Hardware states specific to the pulsed-RF system.
- Instrument states specific to the pulsed-RF system.
- Multiple source setup for the pulsed-RF system.

### HP-IB Addresses

Table B-1 lists the HP-IB address of each instrument in the pulsed-RF system.

**Table B-1. HP-IB Addresses Specific to Pulsed-RF Systems**

HP 8510 System Bus	HP-IB Address During Pulsed-RF Operation	HP-IB Address During 2nd Test Set Operation
Test Set	20	21
RF switch	31	28 <sup>1</sup>
Address of 8510	16	
System bus	17	
Source #1 (RF)	19	
Source #2 (LO)	18	
Plotter	5	
Printer	1	
Disk	0	
Pass-thru	31	

<sup>1</sup> If you have option 001 in your test set and a second test set connected, the RF switch address can be left at 28 for both pulsed-RF operation and second test set operation.

## Hardware States

Table B-2 lists the hardware states that are specific to the pulsed-RF system.

**Table B-2. Hardware States Specific to the Pulsed-RF System**

System Parameter	During pulsed-RF operation	During operation of 2nd test set
System Phaselock	None	Int.
Mult. Source	On/Save	Off
Leveling Source #1	Int.	Int.
Leveling Source #2	Int. <sup>1</sup>	N/A
Sweep Mode	STEP or FRQ LIST	Any

<sup>1</sup> Set source #2 power leveling to Ext. if an HP 8349B amplifier is used to amplify the LO signal.

## Instrument States

Table B-3 lists the instrument states that are specific to the pulsed-RF system.

**Table B-3. Instrument States Specific to the Pulsed-RF System**

System Parameter	Pulsed-RF	CW
Power Source #1	+8 dBm <sup>1</sup>	10 dBm
Power Slope src 1	OFF	OFF
Power Source #2	10 dBm <sup>2</sup>	N/A
Power Slope src 2	2.5 dB/GHz	N/A
Pulse config detector	wide BW <sup>3</sup>	normal BW

<sup>1</sup> Set source #1 power level to the highest level possible without IF overload. Power must be set in the 'normal BW' mode then changed to the 'wide BW' mode, if desired.

<sup>2</sup> Set source #2 power to -10 dBm if an HP 8349B amplifier is used to amplify the LO signal

<sup>3</sup> Set to normal BW for nonpulsed-RF operation

Table B-4 lists the multiple source settings for the pulsed-RF system.

**Table B-4. Multiple Source Settings for the Pulsed-RF System**

Define:	Settings:
Source 1	Mult. Numer. = 1 Mult. Denom. = 1 Offset Frequency = 0.000000000 GHz
Source 2	Mult. Numer. = 1 Mult. Denom. = 1 Offset Frequency = 0.020000017 GHz
Receiver	Constant Frequency = 0.020000000 GHz

## B-2 Hardware and Instrument States



---

## Examining Your Pulse Hardware and Instrument States

Use the following key sequence to examine the hardware and instrument states residing in your network analyzer. These are the settings for the file named MD\_PULS on the HP 85108 system configuration disk.

### Check HP-IB Addresses

- On the network analyzer, press **(SYSTEM) HP-IB ADDRESS**.
- Press the softkey of each instrument in your system. Refer to Table B-1 for the correct HP-IB address settings of the instruments in your system.

### Check Multiple Source Settings

Examine the Multiple Source configuration as follows.

- Press **(SYSTEM) MORE EDIT MULT.SRC**.
- Press **DEFINE SOURCE 1**
  - MULTIPLIER NUMER.** should be 1.
  - MULTIPLIER DENOM.** should be 1.
  - OFFSET FREQUENCY** should be 0.
- Press **DONE**
- Press **DEFINE SOURCE 2**
  - MULTIPLIER NUMER.** should be 1.
  - MULTIPLIER NUMER.** should be 1.
  - OFFSET FREQUENCY** should be 20.000017 MHz.
- Press **DONE**
- Press **DEFINE RECEIVER**
- **CONSTANT FREQUENCY** should be 20 MHz.
- Press **DONE MULT. SRC. ON/SAVE**. An M annotation should appear to the left of the graticule.

Other settings for pulsed-RF operation are as follows:

- Press **STIMULUS (MENU) POWER MENU**
- **POWER SOURCE 1** should be +8 dBm

---

**Note** Set source 1 power to the highest level possible without IF overload. Power must be set in the “normal BW” mode, then changed to the “wide BW” mode.

---

- **POWER SOURCE 2** should be +10 dBm

Check the sweep mode:

- Press **STIMULUS** **MENU** **STEP**
- **SYSTEM MORE PULSE CONFIG DETECTOR: WIDE BW**

A **W** annotation should appear to the left of the graticule.

- Press **PULSE OUT: HIGH**
- Press **SYSTEM** **MORE** **SYSTEM PHASELOCK NONE**
- Press **SYSTEM** **MORE** **POWER LEVELING**

**SOURCE1: INTERNAL**

**SOURCE2: INTERNAL**

---

**Note** Set source #2 power leveling to “Ext Level,” and set source #2 power level to -10 dBm if an HP 8349B amplifier is used to amplify the LO signal.

---

## Loading the System Configuration Disk

### Introduction

The HP 85108 system configuration disk contains files for two pulse configurations (MD\_PULS and MD\_PULS\_A) and three nonpulsed-RF configurations (MD\_NPULS, MD\_NPLS\_A, and MD\_SINGSRC). Refer to Table C-1 to select the appropriate file for your system.

If you use an HP 8349B microwave amplifier to amplify your LO source's signal, then select either MD\_PULS\_A, for a pulse configuration, or select MD\_NPULS\_A, for a nonpulsed-RF configuration.

**Table C-1. HP 85108 System Configuration Disk Files**

File Name	Description of Configuration		
	Source(s)	Detectors	LO Source + Amp?
MD_PULS	Multiple	Wide BW pulsed-RF mode	No
MD_PULS_A	Multiple	Normal BW nonpulsed- RF mode	Yes
MD_NPULS	Multiple	Normal BW nonpulsed-RF mode	No
MD_NPULS_A	Multiple	Normal BW nonpulsed-RF mode	Yes
MD_SINGSRC <sup>1</sup>	Single	Normal BW nonpulsed-RF mode	N/A

<sup>1</sup> This configuration requires a single source, and a test set that provides an LO signal such as the HP 8514, 8515, 8516, or 8517. Refer to the HP 8510C documentation for a configuration diagram.

### Procedure

1. Insert the HP 85108 System Configuration Disk into the disk drive of the network analyzer. On the network analyzer, press **TAPE/DISC** **LOAD** **MORE** **MACHINE DUMP**. Use the knob to select one of the files and press **LOAD FILE**.
2. Remove the disk when it has finished loading.

Instrument State 8 (the power up state) of the loaded file will be recalled automatically.



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