Keysight 85106A/B/C Network Analyzer System

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KEYSIGHT TECHNOLOGIES

Service Quick Reference Guide

Notices

Manual Part Number

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Service Quick Reference Guide

HP 85106A/B/C Network Analyzer System

HP Part No. 85106-90058
Printed in USA April 1994

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Table 1-1. HP 85106C Frequency Bands

45 MHz to 50 GHz Coaxial	33 to 50 GHz Q-Band WR-22	40 to 60 GHz U-band WR-19	50 to 75 GHz V-band WR-15	75 to 110 GHz W-band WR-10
HP 8517A/B Test Set	HP Q85104A[1]	HP U85104A[1]	HP V85104A[1]	HP W85104[1]
HP 85056 Cal Kit	HP Q11644A[2].	HP U11644A[2]	HP V11664A[2]	HP W11644A[2]
HP 85057 Ver Kit	HP Q11645A[3]	HP U11645A[3]	HP V11645A[3]	HP W11645A[3]

1 Two required for S-Parameter measurements.

2 Required for calibration.

3 Needed for Performance Verification.

Table 1-2. HP 85106B/C System Dimensions

Height	Width	Depth
63 inches	23.6 inches	31.4 inches

Table 1-3. HP 85106B/C Weight/Power Consumption

HP Model	Weight	Power
85109C STD	576 lbs	1,505 VA/5117 BTU's
85109C Opt 001/002	624 lbs	1,675 VA/5525 BTU's

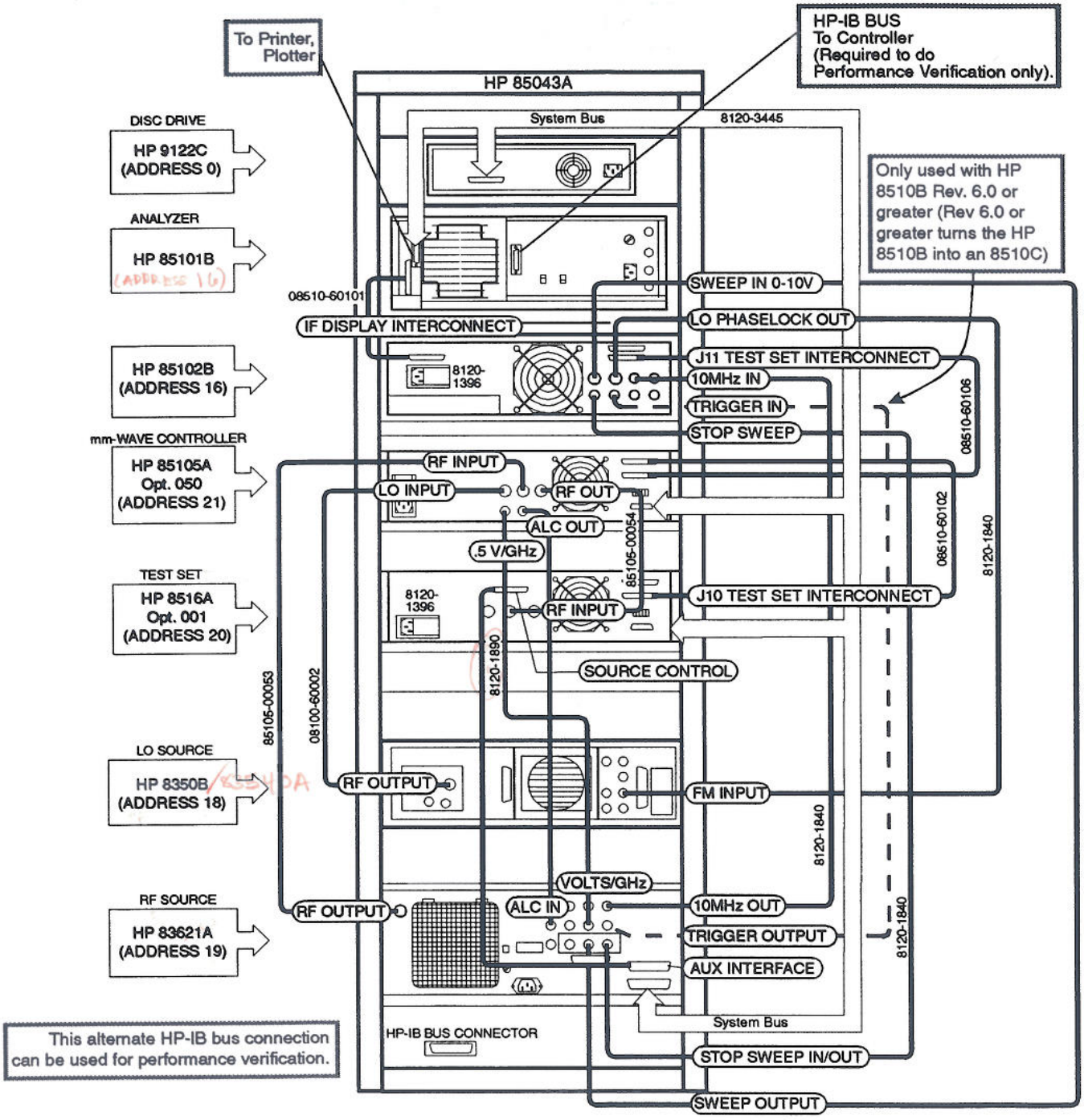
Table 1-4. ESD Safety Equipment

EQUIPMENT	HP PART NO.
Anti Static Mat	9300-0797
Wrist Strap	9300-1367
Wrist Strap Cord	9033-0980

Note

- H69 for HP 8360's is a very clean 100 ohms sweep ramp of 0-10 Volts. (by passes the sweep circuity to keep it clean and change from high to low impedence)= LO drive H69 for HP 8350's is Sweep in/out this is driven by LO drive. YIG Oscillator has small filter cap to narrow the band to stay in Phase Lock range (switch on rear panel).
- Hewlett-Packard strongly recommends that the HP 85106C System Cabinent HP 85043C be used with the HP 85106C mm-Wave System. Hewlett-Packard is not obligated to support user-configured mm-wave rack systems other than the HP 85106C 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 85106C System.
- Option 010 adds adds Time Domain
- Option 230 adds 220/240 Volts
- When looking at user parameters always turn averaging off, for division by zero is undefined and causes a noisy trace.

HP 85106B Cabling Diagram
(Standard/Option 001 Configuration)



106betd.cdr

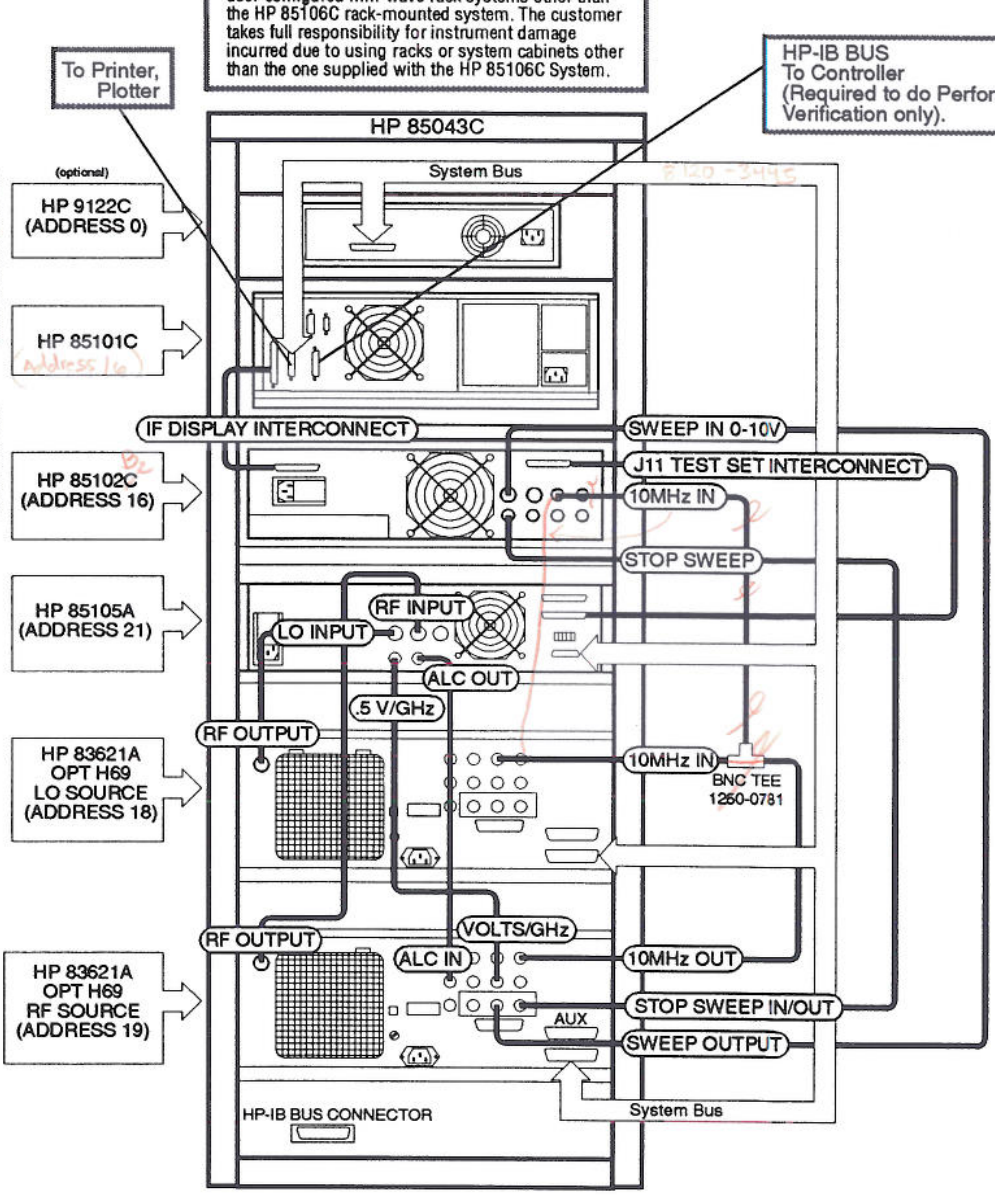
HP 85106C Cabling Diagram
(Option 002 Configuration)

Hewlett-Packard strongly recommends that the HP 85106C System cabinet be used with the HP 85106C mm-Wave System. HP is not obligated to support user-configured mm-wave rack systems other than the HP 85106C 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 85106C System.

Accuracy-enhanced (error corrected) measurements require the ambient temperature of the HP 85106C System to be maintained within ±1 degree C of the ambient temperature at calibration.

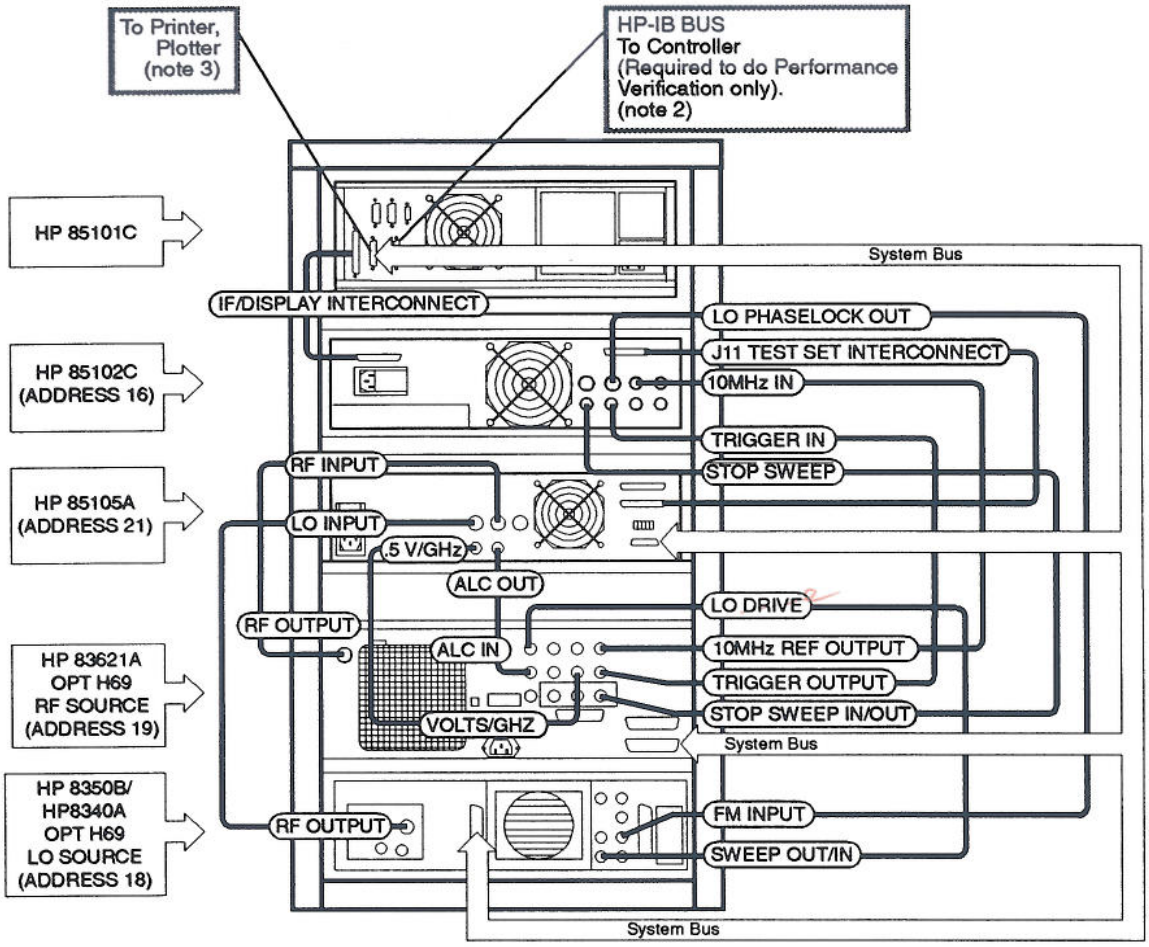
Environmental Requirements:
Temperature: +5 degrees C to 40 degrees C
(41 degrees F to 104 degrees F)
Relative Humidity: 5% to 95% at +40 degrees C (or less non-condensing)
Altitude: Up to 4600 metres (approximately 15,000 feet)

Power Consumtion
Standard: 1,505VA / 5,117 BTU
Opt. 001/002: 1,675VA / 5,525 BTU



106c002.cdr

HP 85106C Cabling Diagram
(Standard Configuration)



Notes:

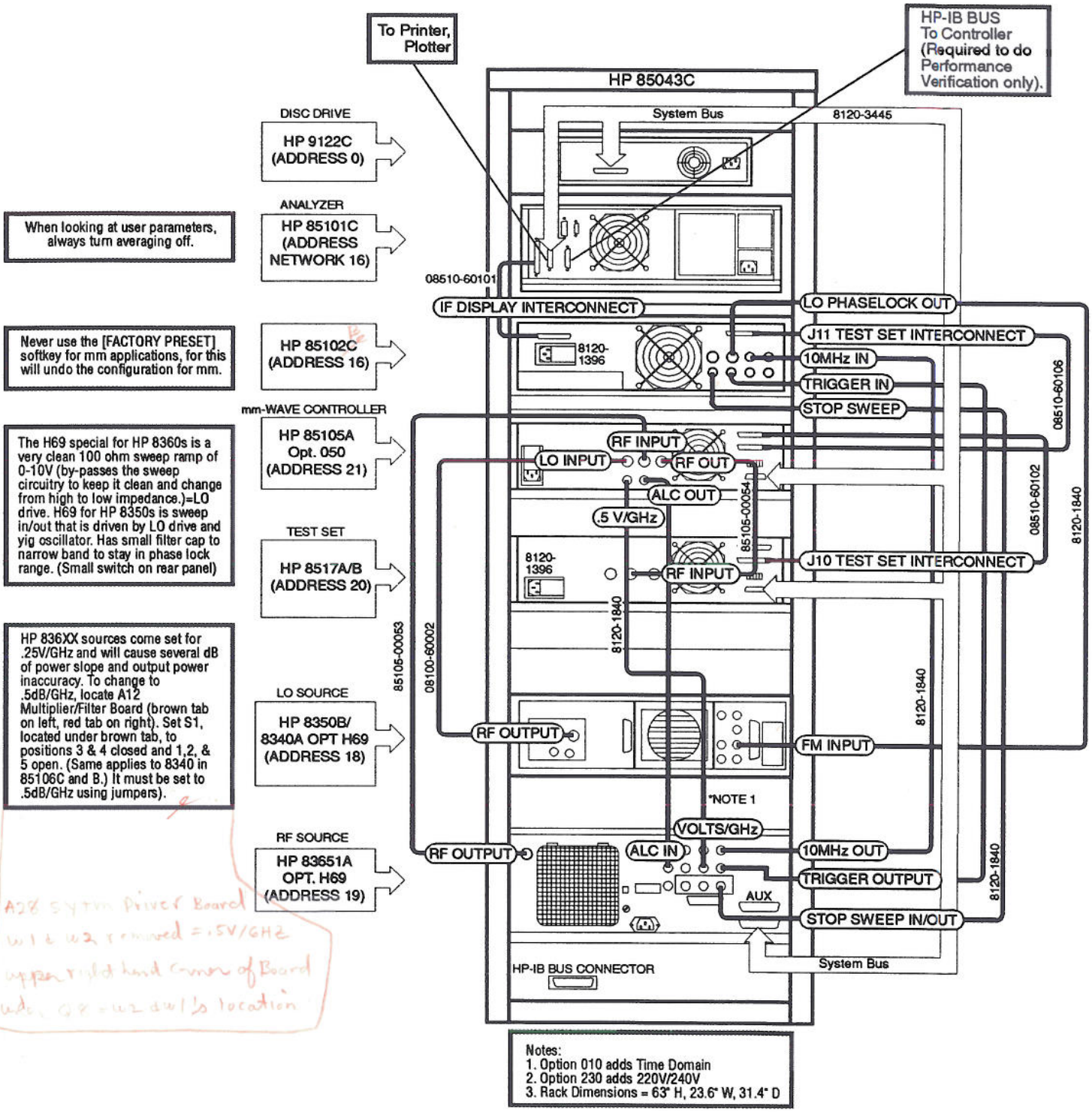
1. Site Prep:
   To ensure adequate cooling and reliable operation in a benchtop configuration ,follow these guidelines:
   Keep all instrument feet on to maintain 12 mm (1/2 inch) vertical clearance between stacked instruments.
   Keep instrument covers on during operation.
   Maintain 75 mm (3 inches) side separation between instruments.

2. 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.

3. The HP 8510C 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.

106cstd.cdr

HP 85106C Cabling Diagram
(Option 001 Configuration)



A28 Sytm Driver Board
W1 & W2 removed = .5V/GHz
upper right hand corner of Board
W1, W2 = W1 and W2's location

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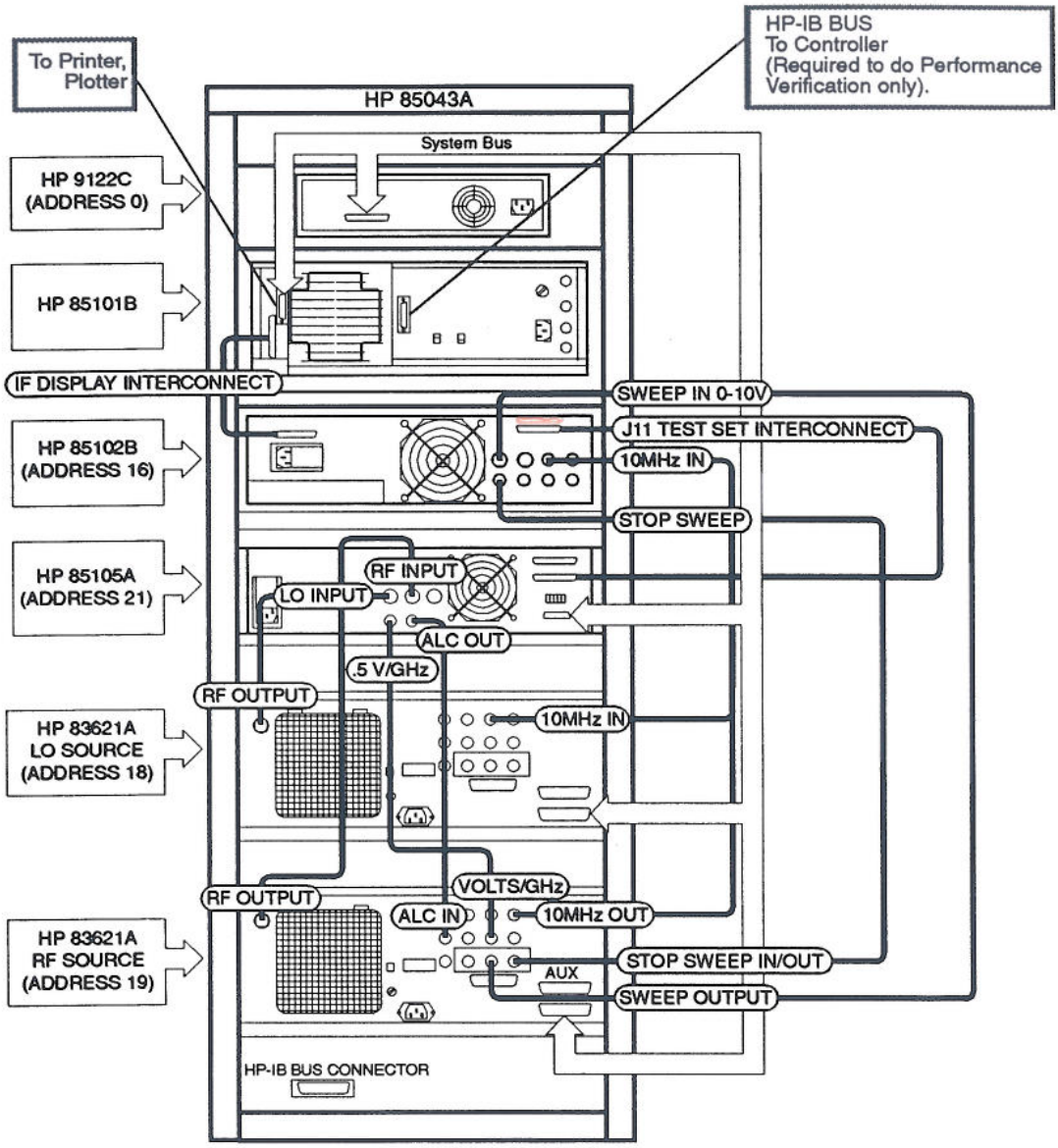
HP 85106B Cabling Diagram
(Option 002 Configuration)



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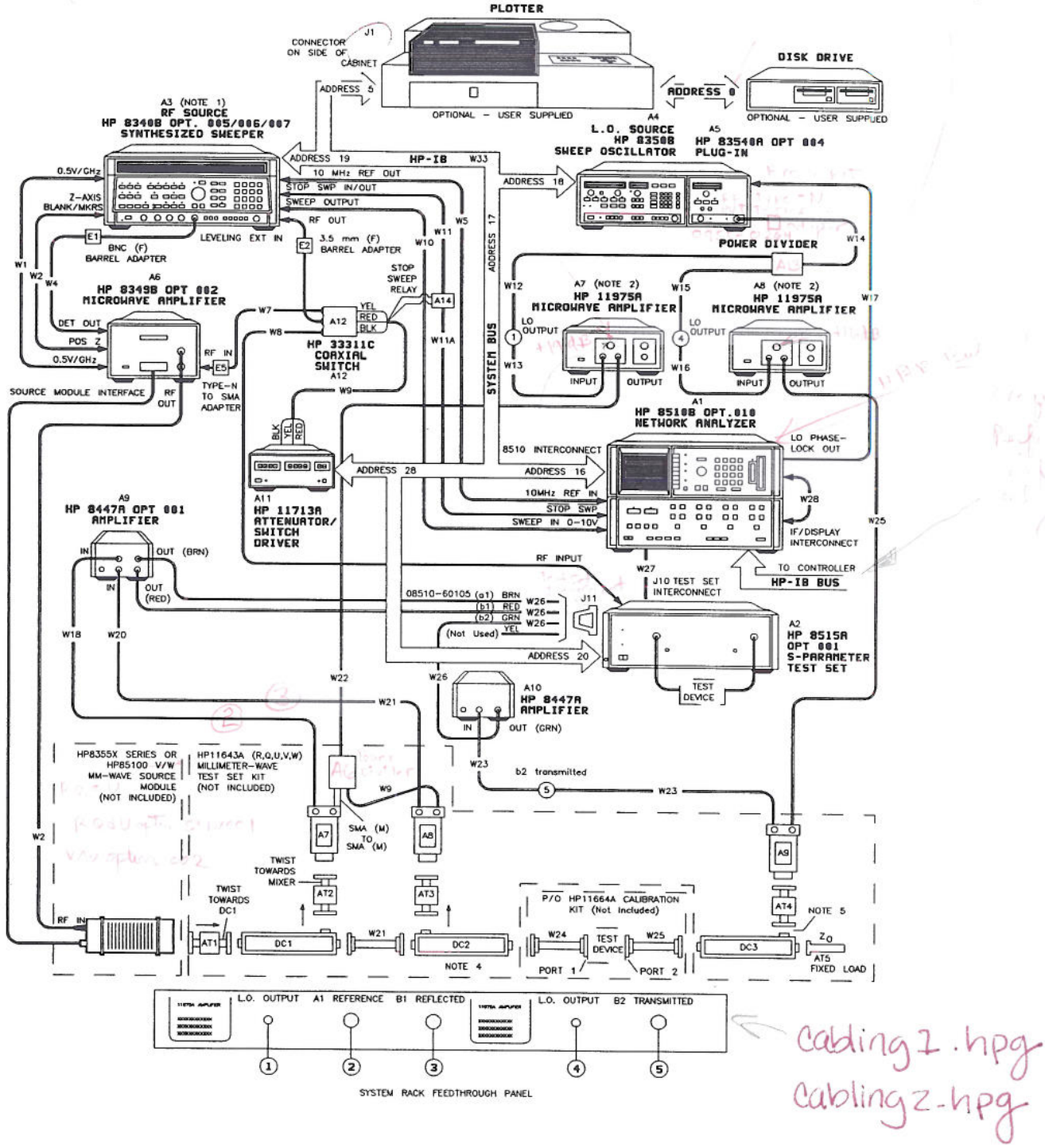


Figure 1-6.
HP 85106A Option 001 (Coax test set)/002 (synthesizer LO) Cabling diagram 45 MHz to 100 GHz

Figure FIG1-5 here.

Figure 1-5. HP 85106B Cabling Diagram (Option 002 configuration)

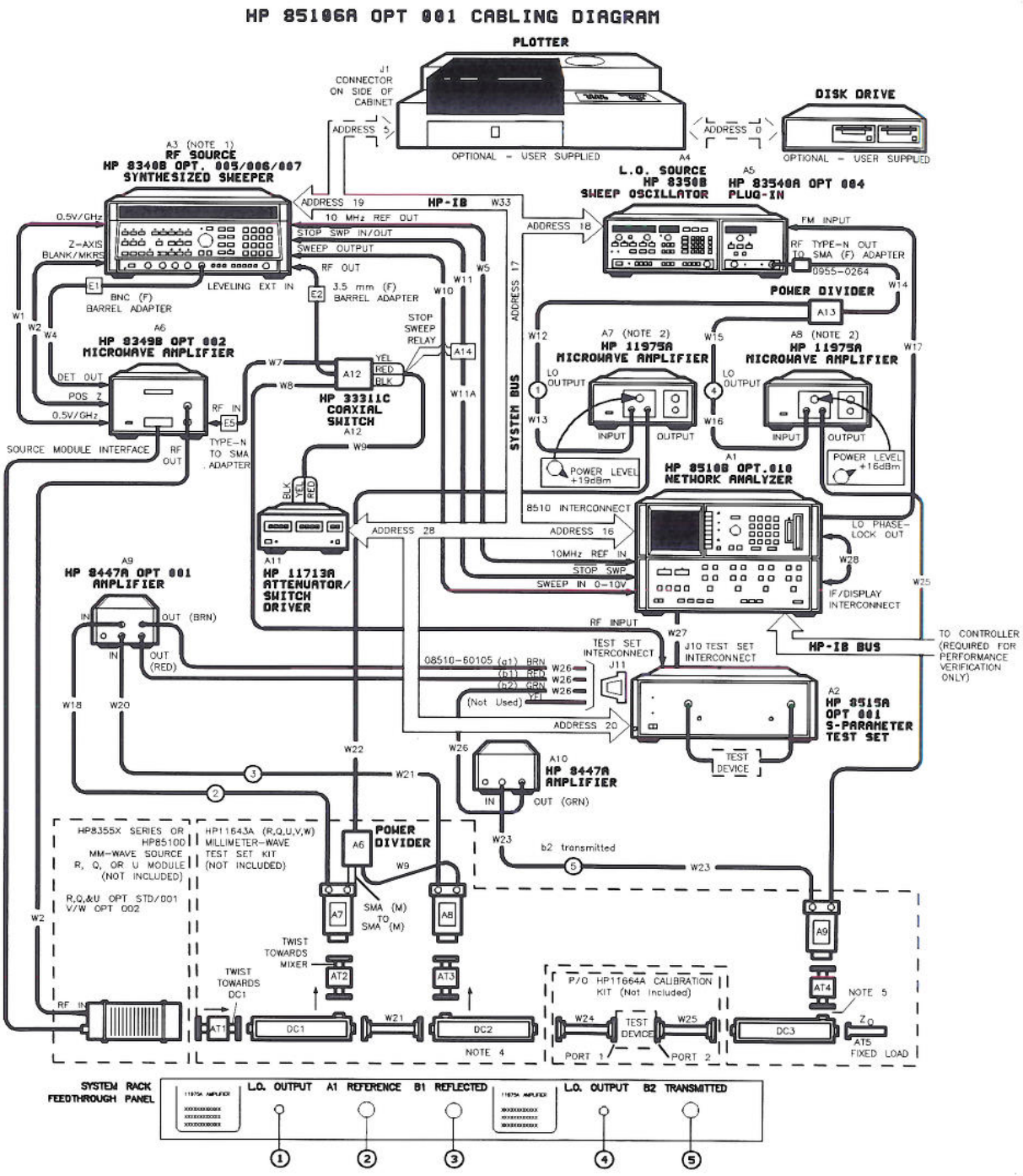


Figure 1-6. HP 85106A Option 001 (Coax test set) Cabling Diagram 45 MHz to 60 GHz

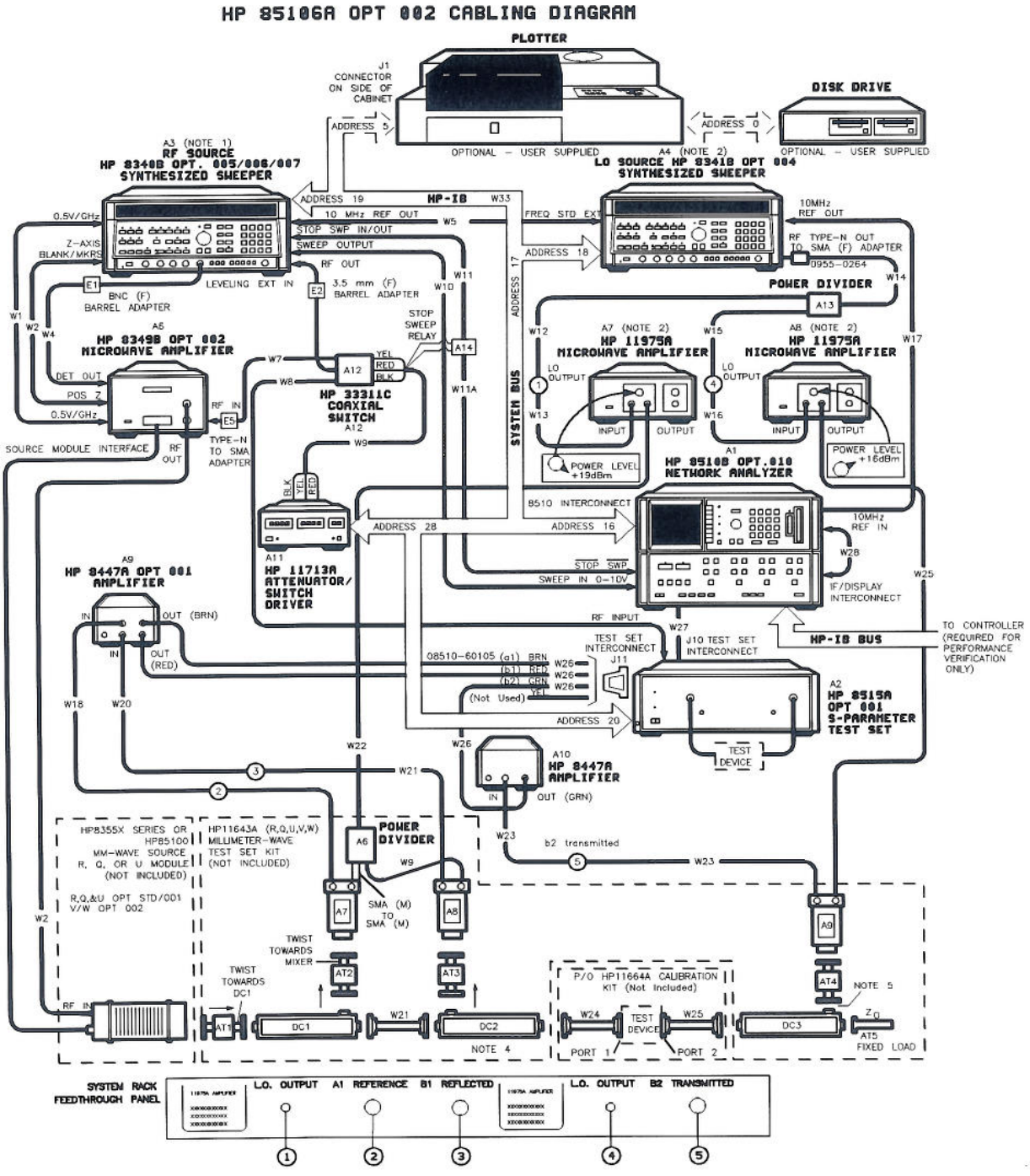


Figure 1-7. HP 85106A option 002 (synthesizer LO) Cabling Diagram 45 MHz to 100 GHz

Note

1. Set the Frequency Standard switch on the A3 (RF source) rear panel to INT.
2. Set the Frequency Standard switch on the A4 (LO source) rear panel to EXT.
3. Turn ON the ALC switches on the rear panels of A7 and A8. Set the output power level knob on A7 to +19dB (pull knob and turn fully clockwise to limit). Set the output power level know on A8 to +16dBm.
4. This diagram refers to components in the Q- and U-band test set kits. The R-, V-, and W-band kit components look differnet, but are connected the same way. Refer to your test set kit manual for details. Four stands are inlcuded in the HP 85106A. Put them under AT2, AT4, DC2, and DC3.
5. For R-band, use filter FL1 (refer to your R-band test set kit manual for details). Goes between AT4 & DC3.
6. The HP 8340/41A/B 1.0V GHz must be changed to .5v GHz by clipping or removing jumpers (W1, W2) on A28 SYTM board.

2

HP 85106C/B/A Making Adjustments

The following provides the adjustments most frequently needed for HP 85106C system service. Table 2-1 Most of the HP 85106C is self adjusting except for the following:

Table 2-1. Typically Used HP 85106C Adjustments

Title	Adjustment Function	Assembly Adjusted
Vertical Alignment Adjustment[1,2]	Aligns softkey labels and mechanical softkey buttons	A11
Degausing the Display (Demagnetizing HP 85101 Display)[1,2]	Demagnetize the display	A11/CRT
HP 8350A Plug-ins Front Panel FREQ CAL[2]	RF frequency calibration	HP 8350B plug-in
HP 8360 Serires Sources Full User Cal[2]	Full user calibration	HP 836XX Series Sources
Trim Sweep (sweep ADC gain adjust)[2]	Compensates for component tolerances in staircase generator	A20

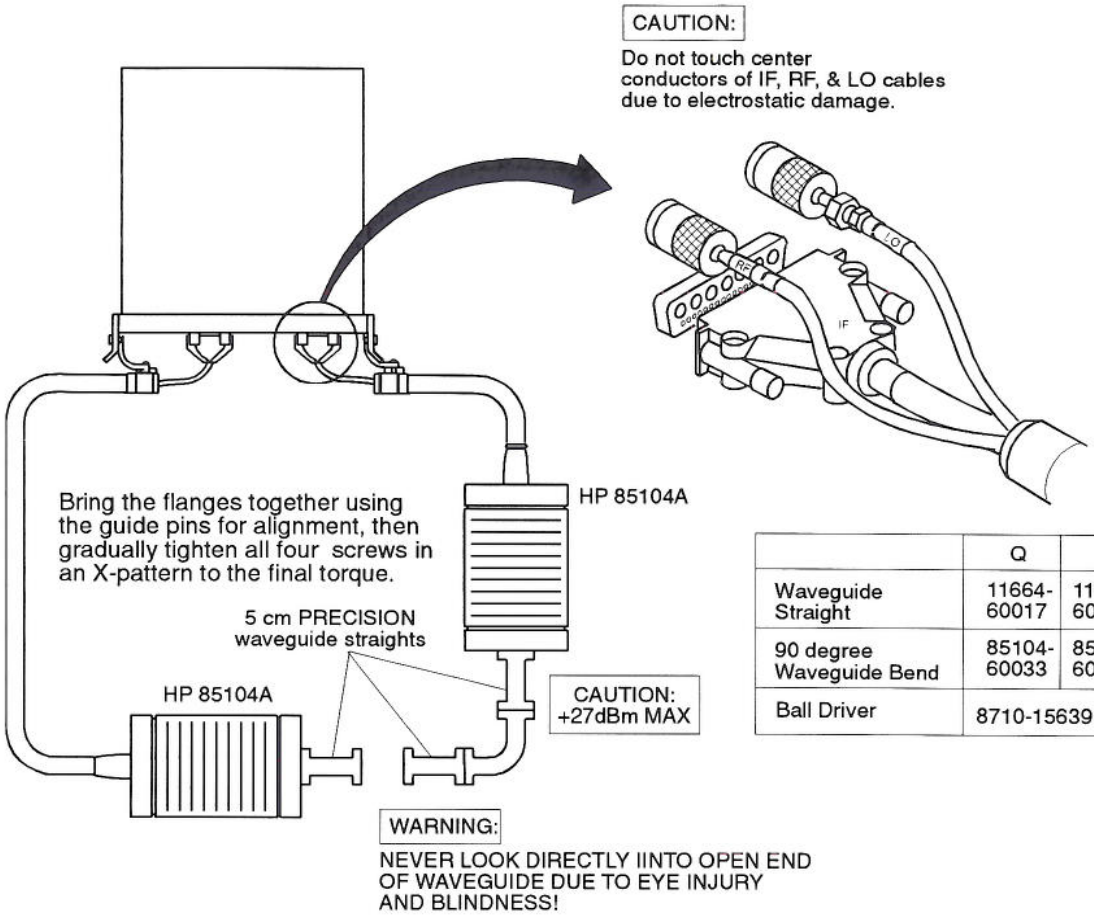
1 Not required for HP 8510B; for details about these, see HP 8510B/C Quick Reference Guides.

2 For details about these adjustments, see HP 8510C Quick Reference Guides.

Note HP 85106A HP 11975A Microwave Power Amp A8 set to +16 dBm, A7 set to +19dBm. See HP 85106A Installation diagram for details.

Connecting the Test Set Modules to the HP 85105A (used in HP 85106B/C)

Be sure the power to the HP 85105A is OFF. Then connect the test set modules to the HP 85105A mm-Wave Controller as shown.



	Q	U	V	W
Waveguide Straight	11664-60017	11664-60018	11664-60012	11664-60013
90 degree Waveguide Bend	85104-60033	85104-60034	85104-60035	85104-60036
Ball Driver	8710-15639		8710-1539	

Figure 2-1. Installing the Test Port Extensions

Each test set module is shipped with 2 or 3 straight extensions (depending on the wave guide band) and one 90° bend. These extensions should be connected to the test port of your module before you perform a calibration and performance verification (refer to Figure 2-1). The striaght extensions have precision flanges and the 90° extension has standard flanges. Use a straight extension for the actual test port.

Caution Do not use the 90° bend as the test port since it does not have precision flanges.

Do not exceed +27 dBm incident at Port 2 or Port 1.

Waveguide Connections

Inspect each flange for damage, then clean the mating surfaces using Isopropyl alcohol and a non-abrasive foam swab. Always support both components being assembled and never allow bending or twisting force to be applied to the flange connections.

There are two types of flanges used (figure 2-2). All connections except the test ports use the standard flange. The test ports use the precision flange.

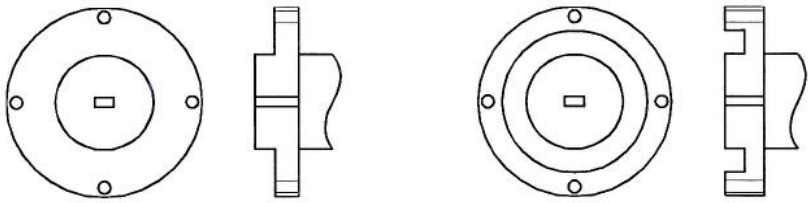


Figure 2-2. Standard and Precision Waveguide Flanges (Q, U, V, and W bands)

While making the connection you may inspect the mating surfaces for proper alignment by placing a lamp or white paper behind the connection to see that there is no gap.

Configure Network Analyzer Memory

The system turn on procedure is greatly simplified by loading the appropriate Machine Dump file from the mm-Wave System Configuration Disk (HP part number 85106-10006).

1. Load the desired Machine Dump file from the system configuration disk by inserting the disk into the internal drive of the HP 8510C. Press the following HP 8510C keys:
   - DISC
   - STORAGE IS INTERNAL
   - LOAD MORE
   - MACHINE DUMP
   - Use the RPG knob to select the file for the desired frequency band (see table 2-2).
   - LOAD FILE

Table 2-2. *Machine Dump Files Stored on the mm-Wave System Disk*

Frequency Range	33 GHz to 50 GHz	40 GHz to 60 GHz	50 GHz to 75 GHz	75 GHz to 110 GHz	0.045 GHz to 50 GHz
Band	Q (WR-22)	U (WR-19)	V (WR-15)	W (WR-10)	Coaxial
Source 1	−20	−20	−25	−30	+10
Source 2	+3	+3	+3	+3	N/A
Sweeper is LO	MD_SWPWR22	MD_SWPWR19	MD_SWPWR15	MD_SWPWR10	MD_COAX
Synthesizer is LO	MD_SYNWR22	MD_SYNWR19	MD_SYNWR15	MD_SYNWR10	MD_COAX

Note If your system contains an extra test set (HP 85106 option 001), verify that only the desired test set is active (active light ON). If unselected test sets are active, deactivate the test set temporarily by pressing LOCAL test set. Then return to the desired address.

2. After the Machine Dump file is loaded, the system will begin sweeping over the full frequency range of the current band.

Once the mm-Wave system has been configured according to the preceding instructions, the system is ready for normal operation. The HP 8510C front panel behaves the same for microwave measurements with the following exceptions.

Use of Ramp Sweep

Standard configuration and option 001 HP 85106C systems have the capability for ramp sweep, provided the two sources in the system (HP 83621A or HP 83651A and HP 8350B/83540A) have option H69 installed. Two synthesizers cannot be used in ramp mode.

For Ramp mode to work properly, the sweeptime must be greater than 500 msec. Change the sweeptime by pressing: STIMULUS (MENU), Ramp (if not in it already). Sweeptime, 501 (K/m).

Note If you are looking at unratioed user parameters (a1, b1, a2, b2) you may see a discontinuity at the beginning and end of the trace, and frequencies where source 1 is going through a band change (i.e. 40.5 GHz in Q and U-band, 54 GHz in V-band and 81 GHz in W-band).

Ramp sweep is best used for real time applications such as turning filters and oscillators. For best measurement accuracy, calibrate the HP 85106C millimeter system in step mode, then go to ramp mode for realtime applications. Ignore the CAUTION: Calibrations may be invalid message. Refer to the HP 85106C Operating and Programming Manual for more information on this and other caution messages.

Instrument State and Hardware State Settings

The following is a complete list of Hardware and Instrument state settings for the system when using the HP 85105 test set controller, the HP 85104 test set modules, and for a system using a coaxial test set. These are the settings the configuration disk (HP part number 85106-10006) will set the HP 85106C to. You may also use the following list to check settings or to set them manually if the disk is missing, or factory preset was pushed by accident.

HP-IB Addresses

Source #1 (RF)	19
Source #2 (LO)	18
Test set	21 (HP 85105) 20 (Coaxial)
RF switch	31

System Phaslock

Lock Type:	NONE (two synthesizers)
Lock Type:	EXTERNAL (Sweeper LO)
Lock Type:	INTERNAL (Single source)

Power Leveling

(mm-Wave):
Source 1 (RF) EXTERNAL
Source 2 (LO) INTERNAL
(Coaxial):
Source 1 (RF) INTERNAL
Source 2 (LO) not used

Sweep Mode

- (HP 85105, two synthesizers) FREQUENCY LIST OR SINGLE POINT or STEP.
- (HP 85105, RF synthesizer, LO sweeper) Any sweep mode (RAMP sweep not fully specified).
- Sweep speed ≥501 lms QuickSTEP does not work when in multiple source mode.
- (Coaxial) any sweep mode.

Table 2-3. Waveguide Cutoff

Frequency Range	33 to 50 GHz	40 to 60 GHz	50 to 75 GHz	75 to 110 GHz	0.045 to 50 GHz
Band	Q (WR-22)	U (WR-19)	V (WR-15)	W (WR-10)	coaxial
Frequency	26.338 GHz	31.386 GHz	39.873 GHz	59.024 GHz	0[1]

1 Selected by Factory Preset.

WAVEGUIDE DELAY — Factory Preset selects coaxial. For mm-Wave you must select Waveguide, or else use the configuration disk that automatically chooses waveguide.

Impedeance

Set Z_0 to

1 for (85105)

50 for (coaxial)

Press these keys for impedeance:

(CAL) MORE SET Z0 (1) (X1).

Multiple Source

ON (HP 85105)

OFF (Coaxial)

Multiple Source Definitions are required for each band. These multiple source settings are shown in Figure 2-3 for all the mm-wave bands. These difinitions are loaded automatically when the hardware state is loaded. These are examined by pressing (SYSTEM) MORE EDIT MLT.SRC.. QuickSTEP will not work when in multiple source mode.

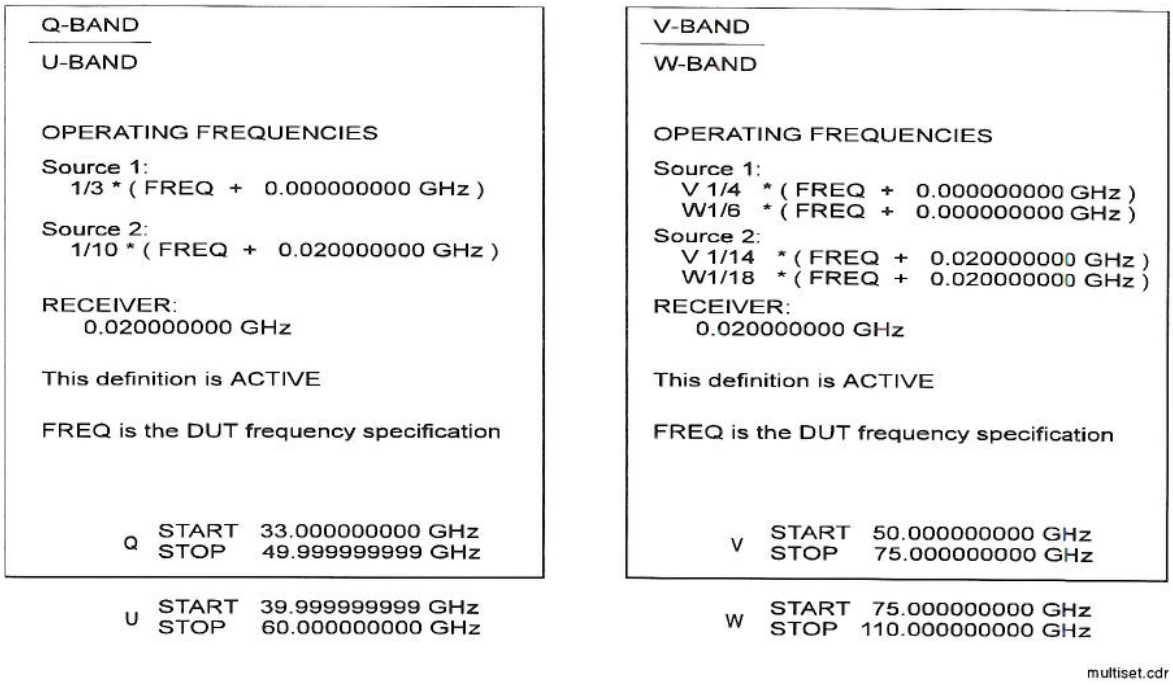


Figure 2-3. Multiple Source Settings

Operator's Check for HP 85106B/C

A quick operational check may be performed by measuring the power levels of the HP 8510 User parameters a_1, b_1, a_2, and b_2. Observing the appropriate levels (listed in table 2-4) gives the user a high level of confidence that the system is operating properly. For complete system verification, see "Performance Verification" in this Guide.

The following measurements show the approximate RF signal levels incident at the first frequency conversion stage and are given in dBm even though the market value is read out in dB. During this procedure you may adjust the RF source #1 power level, changing the available power at the test port, and thus the IF signal level.

Do not increase source #1 power or connect a device with gain such that greater than −13 dBm is shown in these measurements. Greater than about −10 dBm will result in mixer compression errors, and greater than +27 dBm will probably damage the first frequency conversion stage. System specifications apply when the source #1 power is set as listed in Table 2-4.

1. Turn Averaging off, if not you will be dividing by zero which is undefined.
2. Press PARAMETER (MENU) then `user 1 a1`. The forward reference signal path power level is displayed. The power level should be approximately as indicated in Table 2-4.
3. Connect a flush short to test port1. Select `USER 4 b1`. The forward reflection signal path power level is displayed. The power level should be approximately as indicated in Table 2-4.

4. In order to measure the recerse reference signal path the parameter must be redefined. Press the following keys:
   - PARAMETER (MENU)
   - USER 3 a2
   - REDEFINE PARAMETERS
   - DRIVE DRIVE:PORT2
   - PHASE LOCK LOCK TO a2
   - NUMERATOR NUMERATOR a2
   - DENOMINATOR NO RATIO
   - CONVERSION CONVERT to S
   - REDEFINE DOME

Table 2-4.

Typical Power Levels for Operational Check of the mm-Wave System/Coax System

Frequency Range	33 to 50 GHz	40 to 60 GHz	50 to 75 GHz	75 to 100 GHz	.045 to 50 GHz
Band	Q (WR-22)	U (WR-19)	V (WR-15)	W (WR-10)	COAX
a_1	−13	−13	−26	−27	−15 to −35
b_1	−15	−15	−27	−28	−15 to −35
a_2	−13	−13	−26	−27	−15 to −35
b_2	−15	−15	−27	−28	−15 to −35
Source #1 RF	−20	−20	−25	−30	+10
Source #2 LO	+3	+3	+3	+3	N/A

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

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

The reverse reference signal path signal level is displayed. The power level should be approximately as indicated in Table 2-4.

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

If any of the power levels shown above are not observed (approximately ±4 dB), consult the "Service and troubleshooting" paragraphs in the Quick Reference Guide.

TRL 2-Port Calibration

The TRL 2-Port calibration procedure is required when performing the complete performance verification procedure.

1. Set the averaging factor to 128 by pressing: RESPONSE (MENU) AVERAGING ON/restart (128) (x1). Leave the AVERAGING FACTOR as the Active Function to allow changing the averaging factor for the different calibration standards during the calibration procedure.

Note If System Performance Verification is being done, the averaging factor is set to 1024 by the performance verification program and should not be changed.

2. Start the calibration procedure by pressing: (CAL) CAL KIT 1 WR-xx CALIBRATE TRL 2-PORT
3. Connect Port 1 directly to Port 2. Press THRU. The HP 8510 makes 6 measurements.
4. Connect the short to Port 1. Press S11 REFLECT. The HP 8510 measures S_{11}.
5. Connect the short to Port 2. Press S22 REFLECT. The HP 8510 measures S_{22}.
6. Press ISOLATION. The isolation calibration is recommended for wide dynamic range measurements, but it is not required. The isolation measurement is made with both Port 1 and Port 2 terminated with an appropriate one-port device. Since there is only one load in the standard calibration kit, the measurement is performed with a load on one port and a short circuit on the other. To omit the isolation part of the calibration, press OMIT ISOLATION, then procede to step 7.

   To perform the isolation cal, connect the load to Port 1 and a short circuit to Port 2. Press FWD ISOL'N ISOL'N STD. The Hp 8510 measures S_{11} and S_{21}.

   Next connect the load to Port 2 and the short circuit to Port 2, then press REV ISOL'N ISOL'N STD. The HP 8510 measures S_{22} and S_{12}.
7. Connect the waveguide shim between Port 1 and Port 2. Press LINE. The HP 8510 makes 6 measurements.
8. Press SAVE TRL 2-PORT. The error coefficients are computed and the Cal Set selection menu is displayed. Press a CAL SET key to store the error coefficients and turn correction on. The HP 8510 will begin to measure all four S-Parameters, automatically switching between Forward and Reverse parameters.
9. To measure a device, connect it between the test ports, and select a parameter to measure by pressing (S11), (S21), (S12), or (S22). Any of the four S-parameters may now be selected for display. To restart the measurement, press (MEASUREMENT RESTART).

3

Performance Verification

After installation of the HP 85106C a performance verification is needed and is included as part of the HP 85106C installation. Performance Verification for the HP 85106C, is the same as the standard HP 8510C.

The following procedure is provided to show the slight variations from the standard HP 8510C performance verification.

The following materials are required to run the tests:

- HP 85106C system with accessories.
- Model HP 9000, 200 and 300 Series controller (except HP 9826) with 2.5 Mb of memory before loading HP BASIC and is attached to the HP 8510 HP-IB BUSS as shown in the Installation Diagram.
- HP BASIC 5.0 or higher, drivers, and language extensions disks.
- HP 85106C Specifications and Performance Verification Software (HP part number 08510-10033). (Revision A.03.02 unsecured and Revision A.02.00 secured, both work and are the latest software).
- HP 5343 Option 001, 10 Hz to 26.5 GHz frequency counter.

Prepare for performance verification by completing the following steps:

1. Measure the environment temperature and humidity. The temperature must be between +20°C and +26°C. The temperature cannot vary more than ±1°C after calibration.
2. Do a good installation "preflight" checkout on the HP 85106C system.
3. Turn on the system components in the following order:
   - Sources, first
   - Test set, second
   - HP 8510C, HP 85105A, HP 85104A third
   - Controller last
   - Or throw masters system connectr switch
   - Allow 1 hour of warm-up time

Note

This same procedure is used for the HP 85106B!

This step-by-step verification procedure works for almost any HP 85106 hardware configuration by substituting the proper HP 85106 sources, test set, accessories, and controller.

For HP 8516, use only HP 834X016 or HP 8360X016. Older HP 8340 sources may require modification before they work on the HP 8516. (Use upgrade kit 11875A if firmware is earlier than May 11, 1988.)

Compatible controllers for HP 85106C performance verification software include: HP Vectra 386 with HP 82300C BASIC language processor card or UNIX-based workstation with Rocky Mountain BASIC (RMB).

CW Frequency Accuracy Test

Source frequency accuracy is tested across the entire sweep range for HP 8340/8360 sources only. Measure CW frequency accuracy with a frequency counter. The HP 8350 source frequency accuracy is tested during the total system uncertainty test.

Front panel emulation software, included in the HP 8510 operating system disk, is required to test an HP 83621/31/51. The emulator kit (HP part number 08516-60022) contains the analyzer keypad overlay, the operating system disk or tape, and instructions.

Note If the source and test set operate below 500 MHz, connect the test set output to the 10 Hz – 500 MHz BNC connector on the frequency counter. The input switch on the frequency counter must also be in the 10 Hz – 500 MHz position.

1. Connect the equipment as shown in Figure 3-1.

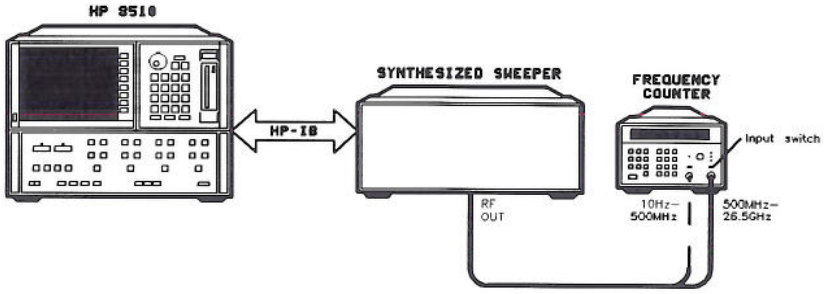


Figure 3-1. CW Frequency Accuracy Equipment Setup

2. To preset the instruments, press INSTRUMENT STATE (RECALL) MORE FACTORY PRESET.
3. To set the frequency using the analyzer front panel, press STIMULUS (CENTER) (MENU) SINGLE POINT. Enter the start frequency of the source or test set, whichever is higher.
4. Measure the frequency with the counter, then record this value on the test record at the end of this section.
5. From the analyzer front panel, enter the stop frequency of the source or test set, whichever is lower. (For an HP 83640 or 83651, refer to the HP 8510C On-Site Service Manual, Chapter 8, pages 8-19 and 8-20 for specific instructions about disabling the sources doubler.)

Note Be sure to connect the test set output to the 500 MHz – 26.5 GHz input on the frequency counter. Also set the input switch to the 500 MHz – 26.5 GHz position.

6. Measure the frequency with the counter, then record the value on the test record at the end of this section.

In Case of Difficulty

If the measured values do not meet the specifications listed on the test record, refer to your source manual for adjustment and troubleshooting instructions.

Table 3-1. Performance Test Record for CW Frequency Accuracy Test

Instrument Model		Report Number		Date
Frequency	Minimum Specification	Recorded Results	Maximum Specification	Uncertainty[1]
45 MHz[2]	44.999955 MHz	_____	45.000045MHz	±10 Hz
2 MHz[3]	1.999998 GHz	_____	2.000002 GHz	±10 Hz
20 GHz[4]	19.99998 GHz	_____	20.00002 GHz	±4 kHz
26.5 GHz[5]	26.4999735 GHz	_____	26.5000256 GHz	±5 kHz
40 GHz[6]	39.999996 GHz	_____	40.00004 GHz	±5 kHz
50 GHz[7]	49.9999756 GHz	_____	50.0000256 GHz	±5kHz

1 The measurement uncertainty is quoted for these performance tests using only the recommended models specified in Table 8-1 of the "Equipment Required" chapter of the "On-Site Service" manual. The quoted uncertainty represents limits of ±3 times the equivalent standard dreviation (3σ) and is intended to represent a 90% confidence level.

2 For all sources except the HP 83622A/24A.

3 For HP 83622A/24A only.

4 For HP 83620A/21A/22A/23A/24A only.

5 For HP 83631A/40A/51A and HP8340 only.

6 For HP 83640A only.

7 For HP 83650A/51A only.

Automated Performance Tests

This test requires the following disks:

- BASIC 5.0 or greater
- Language extension disks (Clock, MAT, Graph and I/O)
- Drivers disk (HP-IB)
- Performance Verifications Software, Revision A.03.01 or A.02.00 (HP part number 08510-10033)

Loading the Language Disks and Software

1. Load BASIC 5.0 or higher into the disk drive for autostart on your controller. Press [SHIFT] [PAUSE] or cycle the power of controller to activate autostart.

Note

You must have 2.5 Mb of memory for the program to run. Check by typing `SYSTEM $ (AVAILABLE MEMORY)`. Press [RETURN].

If necessary, clear controller memory: type `SCRATCH A`, press [EXECUTE]. Then type `SCRATCH C`. Press [EXECUTE].

Be sure the disk is in the proper drive for the autostart on your controller.

2. After BASIC is loaded, the disc drive LED goes off and a `BASIC READY` prompt appears on the controller CRT. Remove the disk.
3. Insert the language extensions disk in the right-hand drive and load the following files one at a time using the HP 9836A keyboard. Type:
   - `LOAD BIN ERR`, then press (EXECUTE). Repeat to load the remaining language extension and drivers.
   - `LOAD BIN CLOCK`, press (EXECUTE).
   - `LOAD BIN GRAPH`, press (EXECUTE).
   - `LOAD BIN MAT`, press (EXECUTE).
   - `LOAD BIN I/O`, press (EXECUTE).
4. Remove the language extensions disk and insert the drivers disk into the right-hand drive. Type: LOAD BIN HPIB. Press (EXECUTE), then remove the drivers disk.
5. Type `MSI:, 700,0`. Press (EXECUTE) to specify mass storage device on external disk drive or external controller's drive.
6. Insert the performance verification disk (HP part number 08510-10033) into right-hand drive 0. Type: `LOAD SPECS-8510`, press (EXECUTE).

Note There is no need to connect the HP 85106 to generate system specification; therefore, ignore any CRT prompts about connecting the HP 85106.

Running the Program

When the LED turns off, the program disk loading is completed. Note the HP part number and software revision number appear on the display. Confirm that the number represents the latest version.

1. Set the date and time as instructed by the CRT. Type `YES` when the settings are correct.
2. From the Hardware Configuration Menu file, select the equipment you plan to use.
3. Use `Next` and `Previous`, and the up and down arrow keys to select equipment. Refer to the example equipment list below:

Network Analyzer	Test Set	Source	Cal Kit	Test Type	Cables	Ver Kit
HP 8510C-Color Model	HP 85105A R,Q,U,V,W Band S-Parameter	HP 83621A Synthesizer	HP 11644A R,Q,U,V, or W Band	TL-Thru-Reflect-Line (TRL)	mm Cables R,Q,U,V,W Band mm LO Cables	HP 11645A R,Q,U,V,W Band

4. Press `done` when equipment selection is completed. Wait for the files to load for each piece of equipment.
5. After you select `VERIFY SYSTEM` the Performance Verification Software is menu driven. Continue with the procedure by carefully reading the CRT step-by-step instructions.
   - Be sure the controller is connected to the HP 8510 rear panel HP-IB connector. Also, the HP 8510 must be warmed-up for one hour before verification.
   - Press (SYSTEM) `HP-IB Configure` `HP-IB uses USR PRESET` to set the Preset command over HP-IB to USER PRESET.
6. Press `VERIFY SYSTEM`. If the program acknowledges the system over the HP-IB, it will display the System Performance Verificatin Menu on the controller CRT.

7. Press SERIAL NUMBERS. Enter the serial numbers and the NIST numbers only if you want them to appear on the printout of your performance tesst results for each verification device. The serial numbers are usually located on the rear panels. NIST test numbers are on the Certificate of Calibration that accompanies your verification kit. Press DONE when finished.
8. You should be back in the System Performance Verificaiton Menu. Press SYSTEM CAL. The configuration infromation is displayed. Be sure it agrees with the system you are going to verify. If it does press RESUME to continue. If not, return to the Hardware Configuration Menu to correct it.

Calibrating the System

1. Load the Cal Kit disk/tape as follows:
   - Insert the standards definition disk and press (DISK/TAPE), LOAD, Cal Kit 1-2. Then press CAL KIT *1, *File 1 and if an asterisk (*) appears next to file 2, press it after file 1 is loaded.
   - Press (CAL) agin to verify that the proper files were loaded. The HP 8510 softkey field should display the type of calibration and the cal kit disk constants revision number. After the disk is loaded, remove it from the drive.
2. Press RESUME twice if you are ready to calibrate. The program will set up the HP 8510 and put it into LOCAL operation so that you can calibrate the system using its front panel keys.
3. From this point on the Performance Verificaiton Software is menu driven. Continue with the calibration procedure by reading the CRT step-by-step instructions

Important Information for mm-Wave System Users

The verification program initalizes the system and may change the instrument state. For mm-Wave systems, these values must be checked, and may need to be reset to their initial values. The prompt *Intializing System Prior to Calibration* will be displayed on the HP 8510 CRT.

Check the following states before continuing with the calibration procedure. Your verification will be invalid if these states are not set correctly.

SYSTEM PHASELOCK	Press (SYSTEM) MORE SYSTEM PHASELOCK EXTERNAL. Set Phaselock to NONE for all sources except the HP 8350B, which is set to EXTERNAL.
POWER LEVELING	Press (SYSTEM) MORE POWER LEVELING SOURCE 1:EXT LEVEL SOURCE 2: INTERNAL.
SOURCE POWER LEVEL	Press STIMULUS (MENU) POWER MENU POWER SOURCE 1 (xx). Refer to table 3-2 for the correct power level. (x1) POWER SOURCE 2 (xx) (x1)

Table 3-2. *Recommended RF and LO Source Power Levels*

Frequency Range	33 to 50 GHz	40 to 60 GHz	50 to 75 GHz	75 to 110 GHz
Band	Q (WR-22)	U (WR-19)	V (WR-15)	W (WR-10)
Power Source #1 (RF)[1]	-20	-20	-25	-30
Power Source #2 (LO)	+3	+3	+3	+3
WAVEGUIDE DELAY Cutoff Frequency	26.338	31.396	39.873	59.024

1 Optimum power level may vary from system to system. Adjust the power level to the maximum level without an "IF overlaod" error message. (Refer to "RF Signal Power Control" in Chapter 2).

Optional Swept Frequency Accuracy Check

For Swept-Frequency/Mode Only

You must have HP85106C Option 001 or a coax test set that covers the RF Sources. Frequency range of use in substitute of the HP 85105A to perform this test.

If only step mode will be used, you may skip this check, and this procedure is *not* for HP 8350 instruments.

This procedure is not a part of Performance Verification. Performance Verification requires step-mode. As a result, do not perform this check for performance verification.

Measure swept frequency by observing phase. This check is helpful for systems that are primarily operated in *ramp mode*. Typically step mode is used.

The front panel emulation software, (part of the HP 8510 operating system disk) is required to test an HP 83621/31/51. The emulator kit (HP part number 08516-60022) contains the analyzer keypad overlay, the operating system disk/tape and instructions.

Note HP 8514/15 test sets must have the test and reference ports unbalanced. Connect long test port cables between the front panel ports. Connect short reference links between the back panel ports (or vice versa). To insure unbalancing you may use one short and one long reference link on the test set rear panel. If system is not unbalanced this test will not function properly.

1. Connect the equipment as shown in figure 3-2.

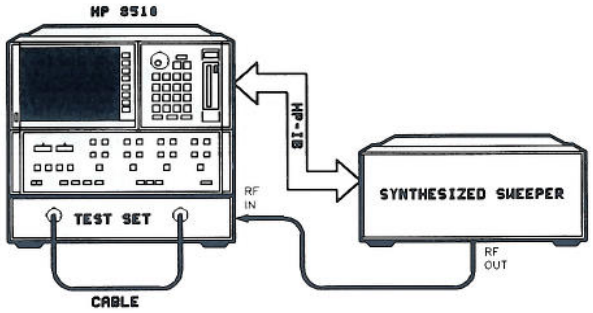


Figure 3-2. Swept Frequency Accuracy Test Set Up

2. Press INSTRUMENT STATE (RECALL) MORE FACTORY PRESET to preset the system.

For All HP 8360 Series Synthesizers

From the front panel or the emulator program, (use instructions from emulator kit), refer to the following procedure:

1. To initiate an auto track, press the following synthesizer keys:

   (PRESET) (USER CAL) Tracking Menu Auto Track Proceed

2. To initiate a sweep span calibration, press the following synthesizer keys:

   (PRESET) (USER CAL) (FREQ CAL MENU) Sweep Span Cal ONCE. *No visual response is dispalyed after pressing the* ONCE key.

For HP 8340/41 Series Synthesizers

Run the network analyzer program.

1. Press (=MARKER) (X1) (.) (=MARKER) (.) (=MARKER) (1s) (=MARKER).
2. To initiate an auto track, press the following synthesizer keys:

   (PRESET) (SHIFT) (PEAK)

For All Synthesizers

Run the network analyzer program.

1. Press (=MARKER) (X1) (.) (=MARKER) (.) (=MARKER) (1s) (=MARKER).
2. Press the following network analyzer keys:

   PARAMETER (S21) FORMAT (PHASE) STIMULUS (MENU) STEP

3. After the second or more sweeps the asterisk in the upper right-hand corner disappears.
4. To normalise the measurement, press the following synthesizer keys:

   MENUS (DISPLAY) DATA→MEMORY 2. Wait one sweep, then press MATH(/) to make a flat line from the phase-unbalanced trace.

5. To offset the center frequency by 5 MHz, press STIMULUS (CENTER) and increase the displayed value by 5 MHz.
6. To adjust the scale factor and shift the flat trace to the bottom or the top graticule (where trace variations are about halfway above and below the last graticule), press RESPONSE (SCALE) and then adjust position with the front-panel knob.
7. To place the trace on the opposite side of the CRT, press STIMULUS (CENTER) and change the display frequency by −10 MHz. The frequency shift value represents a vertical 1MHz per division scaling.
8. Return the frequency to the original setting (remove 5 MHz offset), press STIMULUS (CENTER). The phase measurement should return to 0°.
9. To display the difference between step and ramp mode, press STIMULUS (MENU) RAMP SWEEP TIME (.) (5) (X1). See Figure 3-3 for an example of a full band measurement at 1 MHz per division.
10. Measure the trace variation at 1MHz per division scale, then record the results on the test record at the end of this procedure.

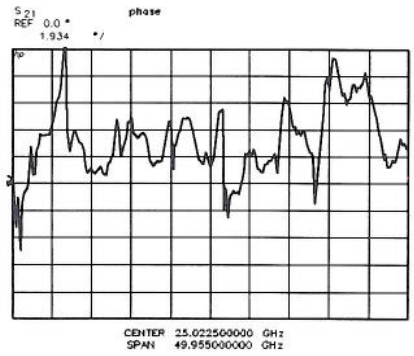


Figure 3-3. Full Span Response at 1 MHz per Division

For HP 8340/41 Series Synthesizers

Position the highest frequency bandswitch transition point on to the reference line. Press the following synthesizer keys:

(CAL) MORE TRIM SWEEP then adjust the front panel knob. Refer to Figure 3-4 for an example. Record the maximum trace variation on the test record.

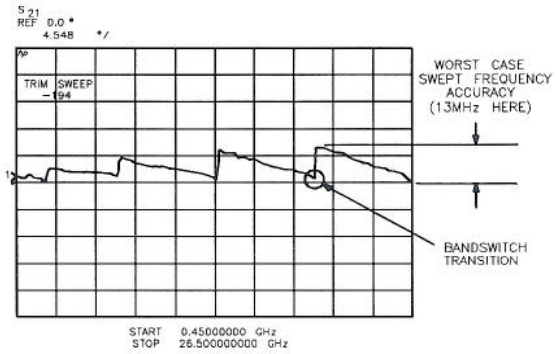


Figure 3-4. Trace Variation Display

In Case of Difficulty

If measured values do no meet the specifications listed on the test record, refer to the source manual for adjustment and troubleshooting instructions.

Table 3-3. Performance Test Record for Optional Test 5

Instrument Model _____	Report Number _____		Date _____
Test Description	Recorded Results	Maximum Specification	Measurement Uncertainty[1]
Swept Frequency Accuracy			
Start Frequency: _____	_____	0.1% of sweep (for 8360)	±150 kHz
Stop Frequency: _____	_____	1% of sweep	±150 kHz

1 The measurement uncertainty is quoted for these performance tests using only the recommended models specified in Table 8-1 of the Equipment Required chapter of the "On-Site Service" manual. The quoted uncertainty represents limits of ±3 times the equivalent standard dreviation (3σ) and is intended to represent a 90% confidence level.

Insert artwork here.

Figure 3-5. Abreviated HP 85106C system service Flow Chart

Insert artwork here.

Figure 3-6. HP 85106C System Level Troubleshooting Diagram