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Antenna Test Solutions

H P | **Antenna Test Solutions** | 1999/2000 Catalog

Microwave receiver
Frequency converters
Multiple-channel measurement accessories
Millimeter-wave systems
Synthesized sources
Amplifiers
Antenna systems cables

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Antenna Test Solutions

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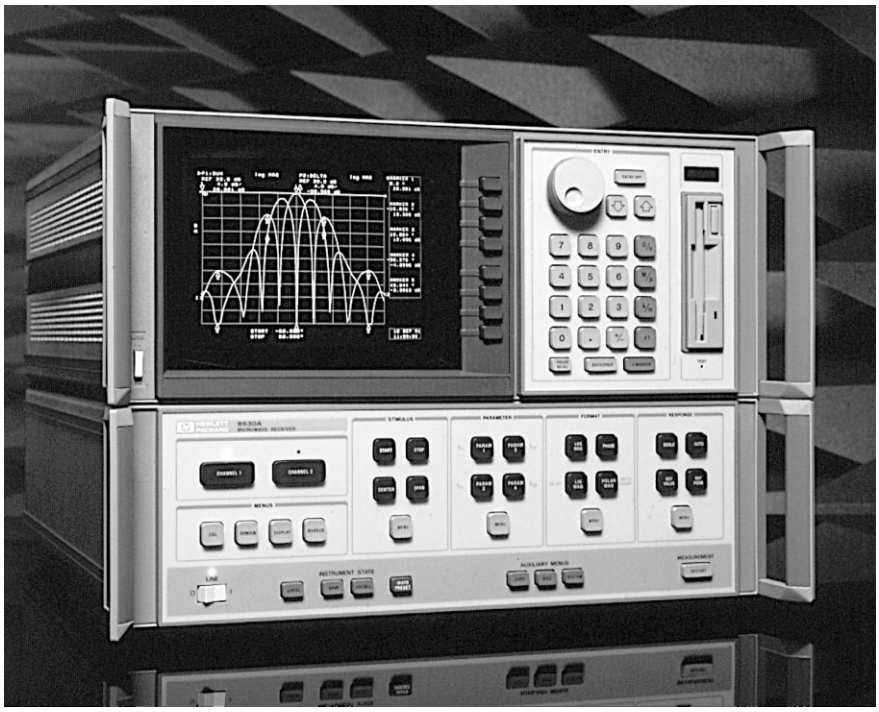
HP 8530A
microwave receiver



Overview

The HP 8530A is a fast and accurate microwave receiver designed for both manual and automated antenna measurement and Radar Cross-Section (RCS) measurement applications. It offers fast data acquisition speeds, excellent sensitivity, wide dynamic range, multiple test channels, and frequency agility—without compromising measurement accuracy. This receiver provides frequency coverage from 45 MHz to 26.5 GHz, with extensions to 110 GHz.

The HP 8530A can be a replacement receiver for existing antenna or RCS range receivers. With the HP 85370A antenna position encoder, the receiver can be interfaced to virtually any positioning system. Any HP 8510 network analyzer can be upgraded on-site to an HP 8530A microwave receiver with the HP 85395A/B/C kits. The HP 8530A is the basis for the HP 85301B/C custom antenna and RCS measurement systems.

Features

- High sensitivity for more accurate measurements in less time
- High measurement accuracy with linearity of better than 0.5° (phase) and 0.06 dB (magnitude) over a 70 dB range
- Fast measurements in both single- and multiple-frequency applications
- Optional time-domain measurement capability
- Multiple-channel capability allows fast measurements of multiple-output antennas
- Large data buffer holds 100,000 measurement points

HP 8530A specifications

Measurement speed

For measurement of a single test channel at a single frequency (FAST CW mode): 200 µs per data sample, or 5000 measurements per second.

For measurement of multiple test channels at a single frequency (FAST AD mode): 400 µs per data sample, or 2500 measurements per second.

Receiver linearity

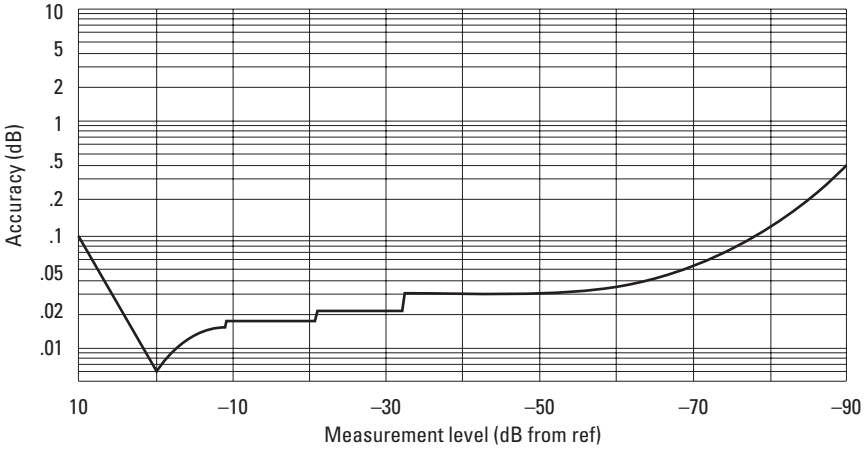


Figure 1. Dynamic amplitude accuracy

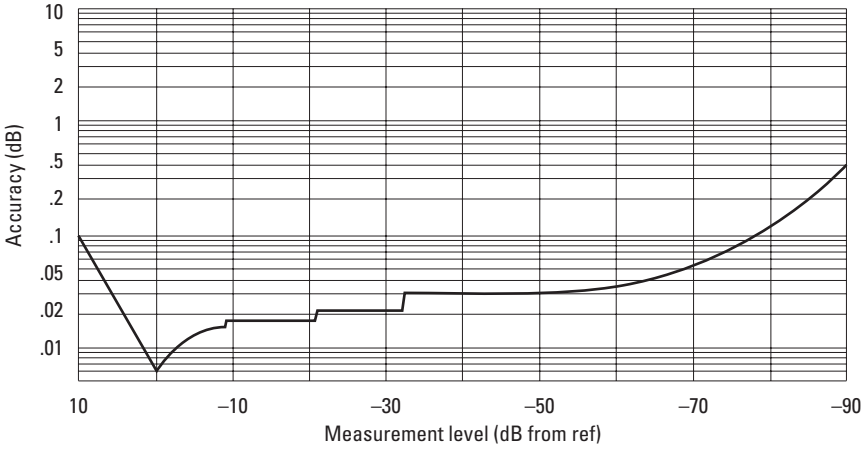


Figure 2. Dynamic phase accuracy

System performance specifications

The system performance specifications of the HP 8530A receiver depend upon the microwave converter used to downconvert the microwave signal to an IF signal for processing by the receiver. Three different converters are available for the HP 8530A receiver—the HP 85310A distributed frequency converter and the HP 8511A/B frequency converters. Typical system configurations are shown below for each converter, and the corresponding system performance specifications are provided.

HP 8530A/85310A system

The HP 8530A receiver in combination with the HP 85310A distributed frequency converter is a mixer-based system that provides excellent sensitivity and RFI immunity for outdoor ranges. It is also well suited to indoor applications. A 20 GHz microwave synthesized source is used as the local oscillator for the mixers. Depending on the RF source and mixers selected, this configuration will operate over the frequency range from 0.1 to 110 GHz. The available mixers for this configuration are as follows:

HP 85320A/B-H20	0.1 to 3 GHz
HP 85320A/B	1 to 26.5 GHz
HP 85320A/B-H50	2 to 50 GHz

Additionally, HP 85325A millimeter-wave subsystems are available to extend the frequency range of this system in waveguide bands as follows:

R85325A	26.5 to 40 GHz.
Q85325A	33 to 50 GHz
U85325A	40 to 60 GHz
V85325A	50 to 75 GHz
W85325A	75 to 110 GHz

System configuration

Figure 3 shows a typical configuration for an antenna measurement system that uses the HP 8530A microwave receiver with the HP 85310A distributed frequency converter.

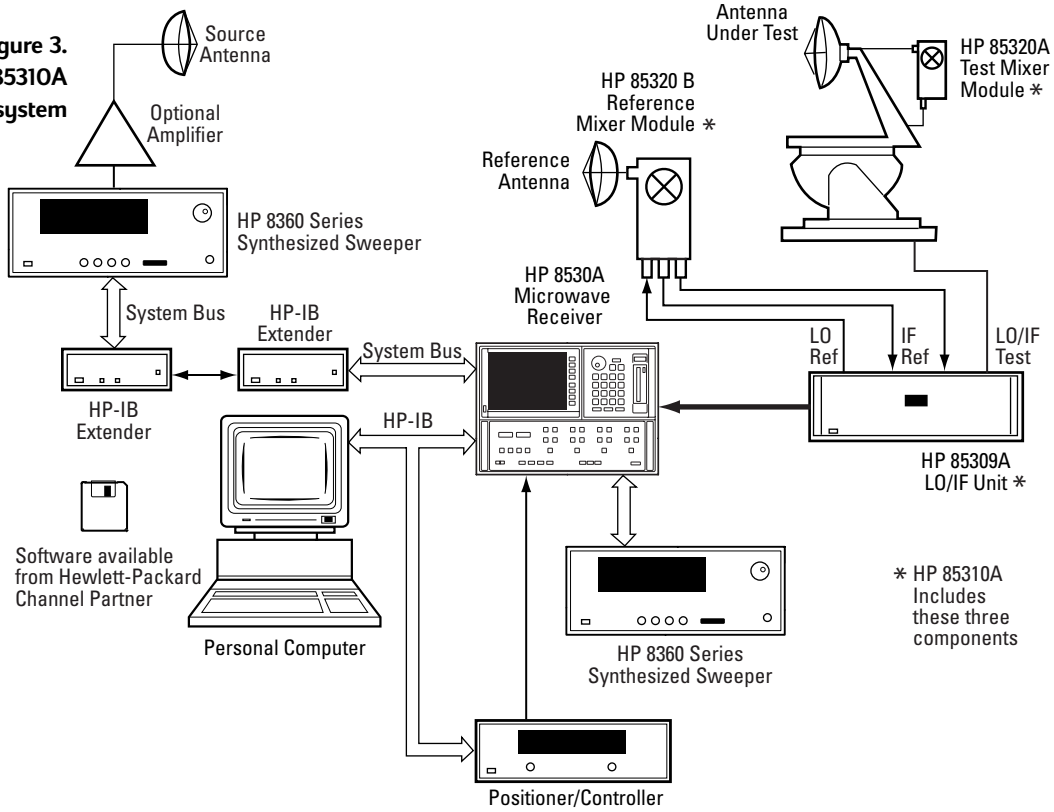


Figure 3. Typical HP 8530A/85310A antenna measurement system

System specifications

Table 1. HP 8530A/85310A system performance specifications

	Frequency (GHz)								
Specification	**1 to 3**	**2 to 18**	**6 to 20**	**20 to 26.5**	**26.5 to 40**	**33 to 50**	**40 to 60**	**50 to 75**	**75 to 110**
Max output power (dBm)	•	•	•	•	•	•	•	•	•
HP 83621B		10	+10	+10	•	•	•	•	•
HP 83621B + HP 8348A (Option 004)	+25	+25	+25	•	•	•	•	•	•
HP 83631B (Option 003)	+10	+10	+10	+3	•	•	•	•	•
HP 83631B + HP 8348A (Option 004)	25	+25	+25	+23	•	•	•	•	•
HP 83550 series	•	•	•	•	+7	+3	+3	+3	0
Sensitivity (dBm) (S/N=1;0 averages)	–107	–113	–96	–96	–88	–85	–86	–78	–71
Sensitivity (dBm) (S/N=1;128 averages)	–128	–134	–117	–117	–109	–106	–107	–99	–92
Dynamic range (dB,0 averages)	86	89	81	81	79	71	72	60	56
Compression level (dBm at 0.1 dB)	–21	–24	–15	–15	–19	–24	–24	–18	–15
Channel isolation (dB, ref.to test)	100	100	100	100	100	100	100	100	100
Return loss (dB, RF input)	8	8	8	8	15.5	15.5	15.5	9.5	9.5

HP 8530A/8511A/B systems

The HP 8511A frequency converter provides frequency coverage from 45 MHz to 26.5 GHz. The HP 8511B operates from 45 MHz to 50 GHz. Both frequency converters use a harmonic sampling technique with a built-in voltage-tuned oscillator for the downconversion source. This architecture provides the lowest-cost downconversion technique, but is more susceptible to Radio Frequency Interference (RFI). Because of the susceptibility to RFI, this frequency converter is well suited to indoor environments where RFI is usually minimal, and is not recommended for outdoor applications where interference signals may be present. The HP 8511A/B frequency converters provide broadband frequency coverage and fast-ramp frequency sweep capability, which make them ideal for Radar Cross-Section (RCS) applications. These converters are also used in antenna measurement applications.

System configuration

Figure 4 shows a typical configuration for an antenna measurement system that uses the HP 8530A microwave receiver with the HP 8511A/B distributed frequency converters.

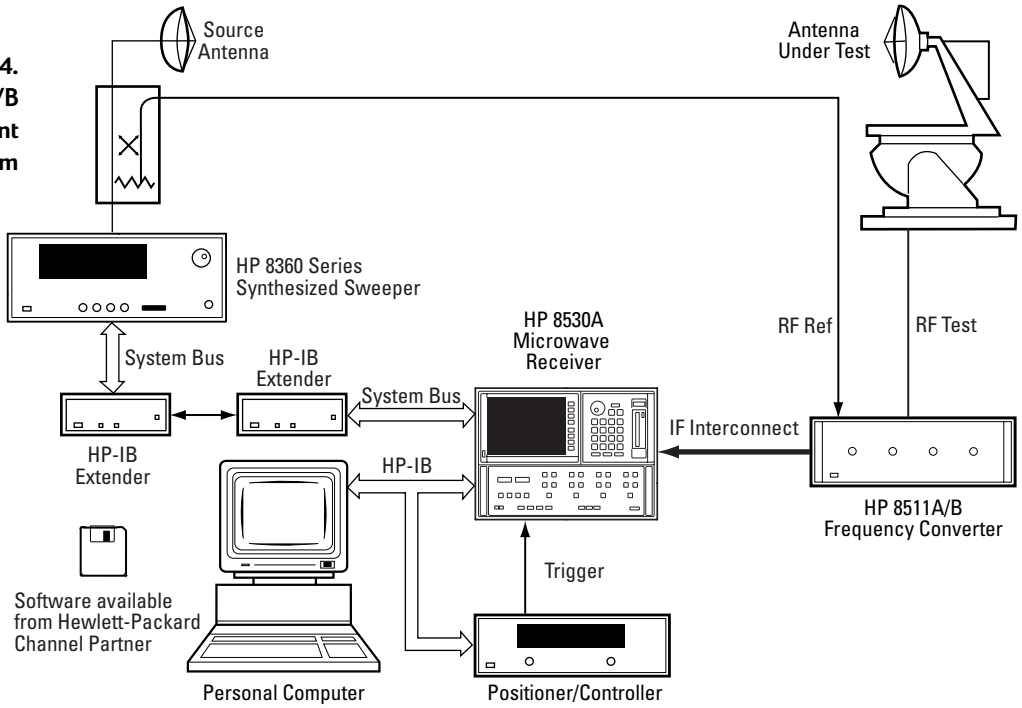
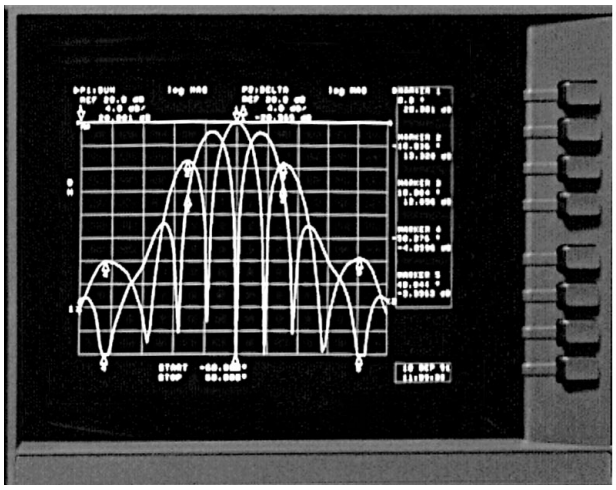


Figure 4. Typical HP 8530A/8511A/B antenna measurement system

System specifications

Table 2. HP 8530A/8511A/B system performance specifications

	Frequency (GHz)				
Specification	**0.045 to 8**	**8 to 20**	**20 to 26.5**	**26.5 to 40**	**40 to 50**
Max output power (dBm) [HP 83631B]	+10	+10	+3	•	•
Max output power (dBm) [HP 83651B]	+10	+10	+4	+3	0
Frequency converter	HP 8511A/B	HP 8511A/B	HP 8511A/B	HP 8511B	HP 8511B
Sensitivity (dBm) S/N=1;0 averages), HP 8511A [HP 8511B]	–98	–98	–94 [–89]	[–89]	[–87]
Sensitivity (dBm) S/N=1;128 averages), HP 8511A [HP 8511B]	–119	–119	–115 [–110]	[–110]	[–108]
Dynamic range (dB;0 averages), HP 8511A [HP 8511B]	88	88	79 [74]	[74]	[68]
Compression level (dBm at 0.1 dB)	–10	–10	–15	–15	–19
Channel isolation (dB, ref. to test), HP 8511A [HP 8511B]	80 [85]	80 [85]	80 [75]	[75]	[70]
Return loss (dB, RF input)	17	15	9	9	7
Minimum phase-lock power (dBm), HP 8511A [HP 8511B]	–40 [–41]	–38 [–39]	–35 [–32]	[–32]	[–30]



Manual measurements

The HP 8530A can be operated in a manual mode, allowing antenna patterns to be displayed directly on the receiver's large color display. The built-in marker functions allow easy on-screen pattern analysis. User-defined pattern scaling is quick and easy, and a variety of pattern formats are available. Up to three channels can be measured in a manual mode, and up to four patterns can be displayed simultaneously in overlaid or separate formats. For permanent archiving of antenna pattern data, either hard copy paper plots or storage to DOS disk is available to make your archiving tasks quick, easy, and reliable.

Additional capabilities

A closer look at the HP 8530A microwave receiver reveals additional features and capabilities specifically tailored to antenna/RCS measurement applications. Built-in antenna and RCS calibrations can be performed and stored, and with the stability of this receiver, calibrations remain valid for days. Several different domains are available; in addition to the standard angle domain for measuring antenna patterns, frequency domain is available for measuring the frequency response of an antenna, and optional time domain is available for evaluating reflections in an antenna chamber.

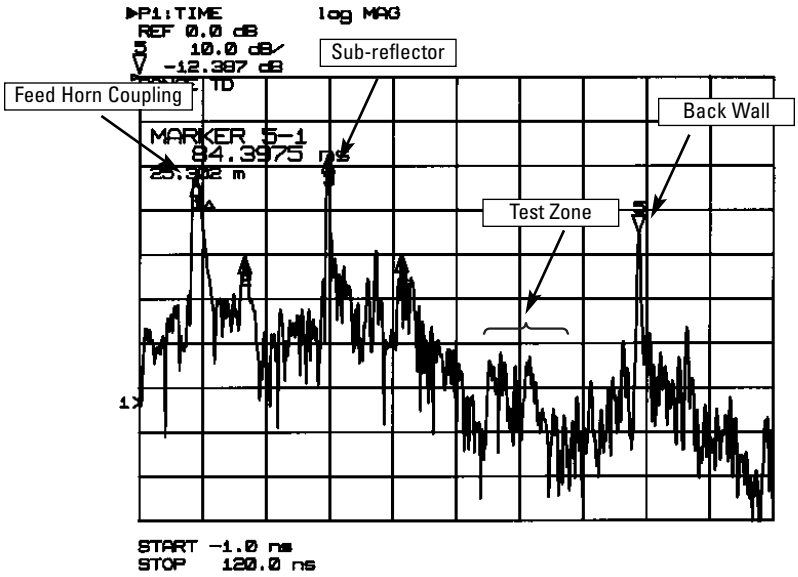


Figure 5. Time-domain plot

Time domain

Optional time-domain capability is available with the HP 8530A microwave receiver. Time domain is most often used for locating reflections inside of anechoic chambers. The time domain displays reflections versus time or distance inside an anechoic chamber. Knowing the distance of a reflection from the source antenna helps the operator locate the reflection source, and helps to identify and mitigate the reflection. The above data plot shows the time-domain response of HP's compact antenna test range; the various reflection sources are identified.

Network analysis

By loading in optional network analyzer firmware, which takes about a minute, the HP 8530A microwave receiver is transformed to an HP 8510C vector network analyzer, allowing return loss, transmission, and impedance-matching measurements to be performed on components. A complete network measurement system requires the addition of a signal separation device such as an S-parameter test set, and a microwave source to provide a stimulus signal.

Multiple-channel measurements

For applications that require measuring more than one test channel, HP offers multiple-channel measurement capability with the HP 8530A receiver. Described below are both an IF switching technique and an RF switching technique to illustrate the differences between the two architectures.

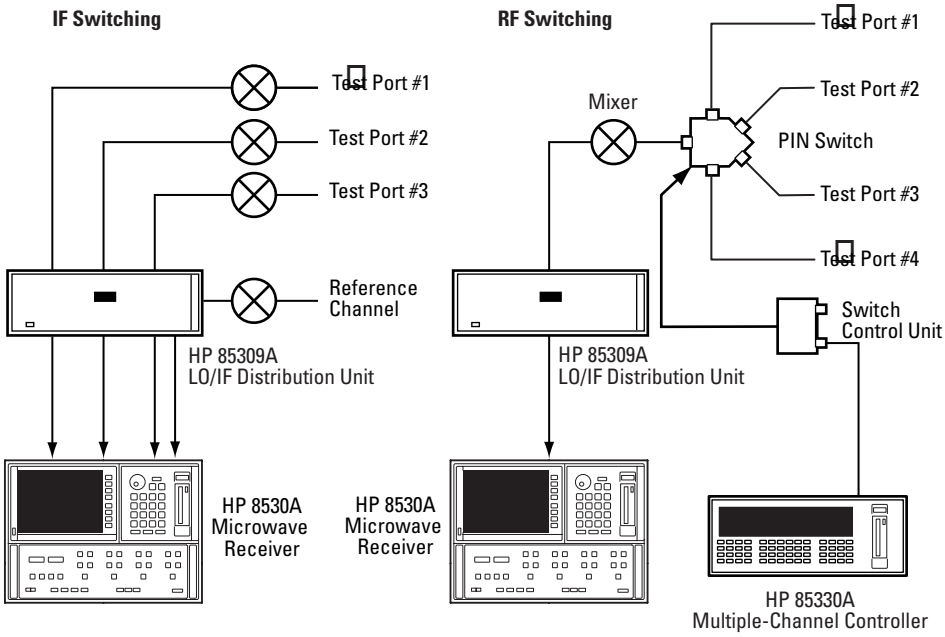


Figure 6. IF switching and RF switching architectures

IF switching

The HP 8530A microwave receiver offers internal IF switching. With this mode, up to three test channels (plus a fourth reference channel) can be measured. Each test channel has its own mixer. The three test IF signals are sent from the mixers to the HP 8530A receiver and downconverted to the final IF frequency. The receiver then switches its test channel between each of the test port IF signals. In this manner, up to three test ports can be measured at one time. The IF switching architecture has several advantages; one is very fast switching times of up to 4000 channel switches per second. A second advantage is the ability to measure multiple-channel millimeter-wave frequency antenna ports in one rotation of the antenna. Since PIN switches are not readily available above 50 GHz, the IF switching capability allows fast characterization of antennas such as millimeter-wave monopulse antennas.

RF switching

The RF switching architecture uses solid-state PIN switches (HP 85331/32A) to switch between multiple antenna test ports and route the signals to the test channel of the receiver. A separate PIN switch can also be used on the transmit source side of the antenna range to switch incident polarizations. RF switching has the advantage of allowing an almost unlimited number of test channels to measured. Switch trees of up to 64 inputs or more have been used. Refer to the HP 85330A and 85331/32A products for additional information on multiple-channel measurements using RF switching architecture.

Pulse measurements

The HP 8530A receiver has optional pulse measurement capability (Option H02). This capability adds wide-bandwidth detectors plus pulse synchronization timing circuitry to the receiver. With this option, two bandwidths are available for pulse measurements: 10 kHz and 3 MHz. The narrow bandwidth provides the best sensitivity and dynamic range, and is most useful for measuring narrow pulses with high pulse repetition frequencies. The wide-bandwidth detectors provide a fast risetime for the receiver, and are useful for fully characterizing pulses with pulse widths greater than 1 µs.

Pulse parameter chart

The pulse parameter chart shows all possible pulse widths and pulse periods that can be characterized with the HP 8530A Option H02 receiver.

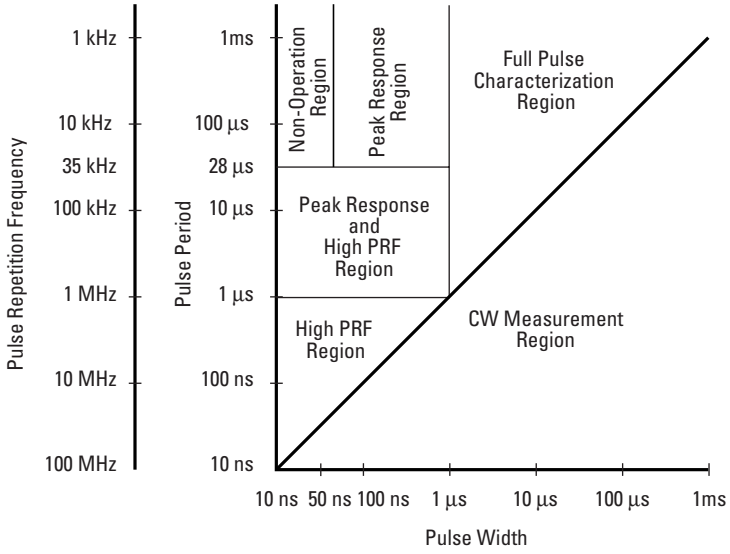


Figure 7. Pulse parameter chart

Full pulse characterization
For pulsewidths ≥ 1 µs, the pulse can be completely characterized. This allows the receiver to profile the pulse received by an antenna to look for distortion on the pulse such as overshoot, or pulse droop. Up to 801 points can be used to profile the pulse, providing excellent pulse resolution.

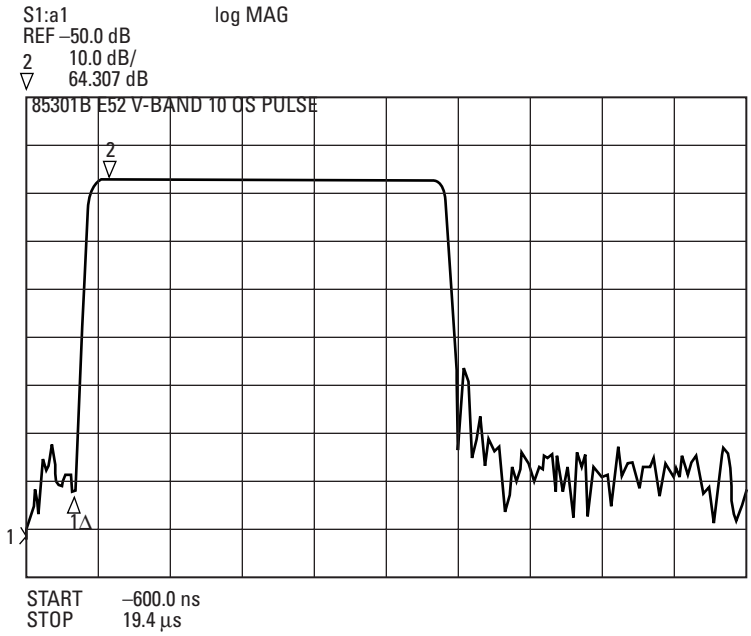


Figure 8.
Pulse profile

Point-on-pulse mode
In the point-on-pulse mode, available for pulse widths ≥ 1 µs, the user can select any point on the pulse to sample for an antenna pattern measurement. This allows pattern comparisons at different points within the pulse. For example, patterns can be measured at the beginning, middle, and end of the pulse, and compared to see changes in the patterns as a function of time within the pulse.

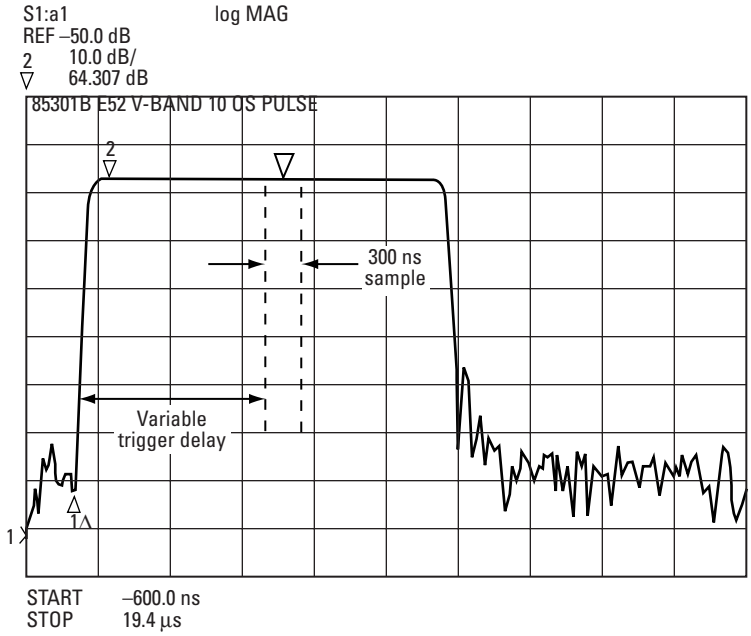


Figure 9.
Point-on-pulse plot

RCS measurements

The HP 8530A is a very popular receiver for Radar Cross-Section (RCS) measurements, and can be found in hundreds of RCS ranges worldwide. The HP 8530A with the HP 8511A/B frequency converters provides the broadband sweeps and fast frequency agility that are so important to RCS applications. Broadband sweeps from 45 MHz to either 26.5 or 50 GHz are available, with a frequency agility of 230 µs per frequency point.

Built-in RCS calibrations allow quick and easy manual RCS measurements to be performed, displayed on the receiver, and analyzed with built-in marker readouts. Built-in time-domain capability allows manual RCS down-range measurements to be performed, displayed, and analyzed. Also, the time-domain feature allows range clutter to be identified in terms of time or distance, and the amplitudes of each clutter source to be measured. This can be of tremendous benefit to anyone who needs to measure RCS and understand the effects of clutter on the accuracy of their measurements. All of these measurements can be sent to a printer, or stored to a floppy disk for archiving purposes.

For automated measurements, the HP 8530A is easily programmed, and has the measurement speed and accuracy so important for productive and precise RCS measurements.

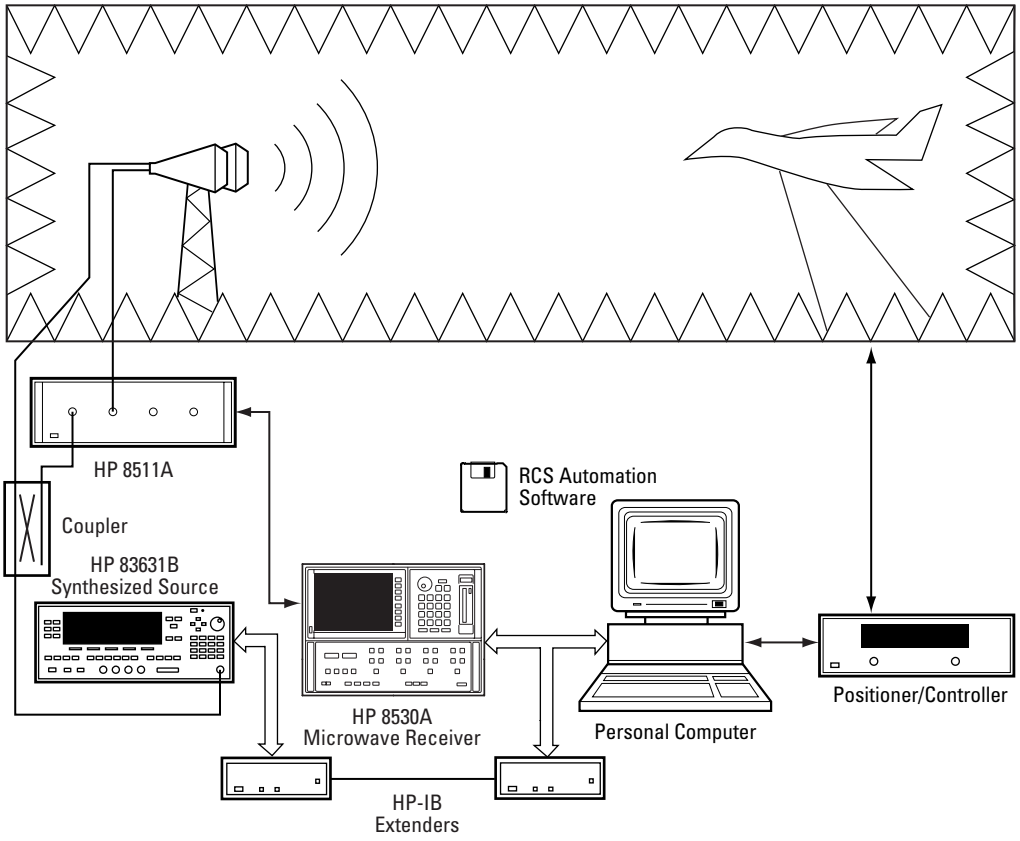
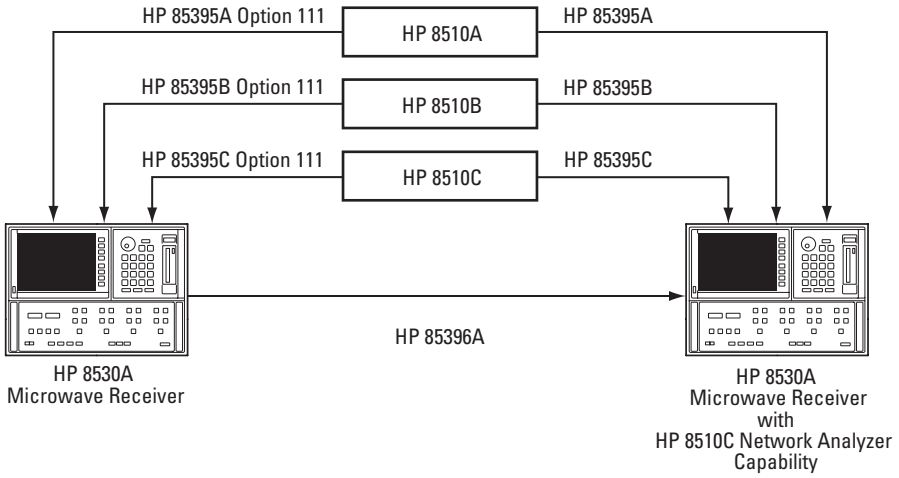


Figure 10.
RCS configuration

Upgrade an HP 8510 to an HP 8530A

If you own an HP 8510 network analyzer, you already have a significant portion of an antenna measurement receiver. Any HP 8510 network analyzer can be upgraded to an HP 8530A microwave receiver and still retain HP 8510C network analyzer capability (see Figure 11). Switching between the receiver mode and network analyzer mode is as easy as loading a single firmware disk, which takes only a few minutes. Of course, network analysis requires a signal source, and a signal separation device such as an S-parameter test set.

Figure 11. Upgrade diagram



HP 8530A options

Option 005 antenna positioner encoder interface
Option 010 add time-domain capability
Option 011 add HP 8510C network analyzer capability
Option 908 rack flange kit, without front handles
Option 910 extra set of operating and service manuals
Option 913 rack flange kit, with front handles
Option 916 extra set of operating and programming manuals

HP 8511A/B frequency converters

Overview

The HP 8511A and 8511B are frequency converters used in the HP 85301C antenna measurement system. They cover the frequency ranges of 45 MHz to 26.5 GHz and 45 MHz to 50 GHz, respectively. They are self-contained, with built-in voltage-tuned oscillators (VTOs) for the LO source. The HP 8511A/B use a harmonic sampling technique, which is susceptible to detection of undesired signals; hence, these converters are best suited for indoor environments with relatively few spurious signals.

Features

Since the HP 8511A/B use a low-cost internal VTO instead of an external LO source, they are the lowest-cost frequency converters available. They operate over a broad frequency range—from 0.045 to 26.5 or 50 GHz. Additionally, these converters allow fast broadband swept-frequency measurements. This permits swept-frequency measurements over the full frequency band at speeds of 230 microseconds per data point. Their ability to make fast, broadband, swept-frequency measurements makes the HP 8511A/B frequency converters ideally suited to Radar Cross-Section (RCS) applications.

Specifications

Frequency of operation

HP 8511A	0.045 to 26.5 GHz
HP 8511B	0.045 to 50 GHz

Connector type

HP 8511A	3.5 mm female
HP 8511B	2.4 mm female

Input port match

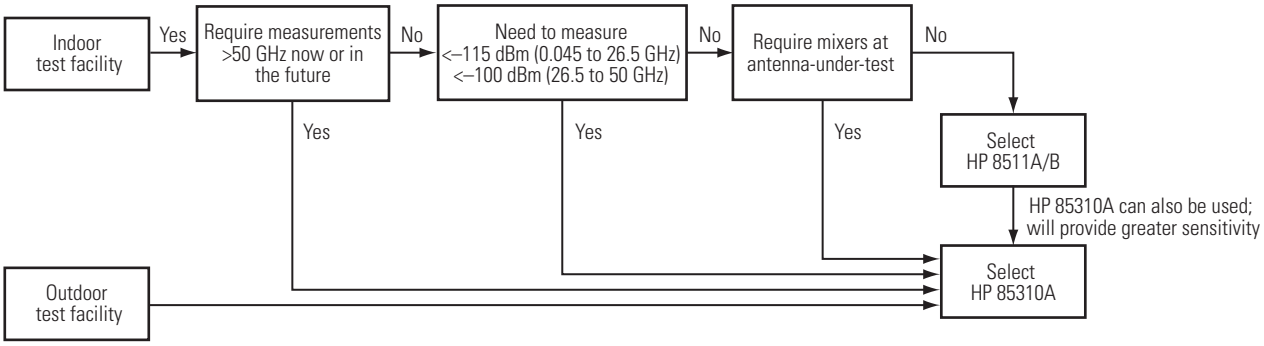
Frequency (GHz)	Impedance match (dB)
0.045 to 8	17
8 to 20	15
20 to 26.5	9
26.5 to 40	9
40 to 50	7

For system performance specifications of HP 8511A/B frequency converters used in an antenna or RCS system, refer to the HP 8530A/8511A/B system performance specifications in the HP 8530A microwave receiver section.

Selection criteria

The following selection chart can help you determine which applications are best suited for the HP 8511A/B frequency converters. As the chart shows, they are ideal for indoor measurement applications. They are particularly well suited to RCS applications because of their ability to do fast broadband frequency sweeps. Near-field applications also often use the HP 8511A/B frequency converters because of their short coupled-signal path distance and lower requirements on measurement sensitivity. Unlike the mixer-based converter (HP 85310A), the HP 8511A/B require a phase-lock signal to the reference channel. This can be a cabled or transmitted signal.

Figure 12. Frequency converter selection chart



Other information

Static warning

Damage to the HP 8511A/B frequency converters can result from electrostatic discharge. The input connectors provide direct access to the harmonic samplers, which are very susceptible to electrostatic damage. Static-safe work procedures should be followed with these units. In antenna applications, gradual static buildup has been observed. Therefore, it is recommended that 3 dB attenuators be placed on all four input ports to minimize static electricity buildup.

IF interconnect cables

In antenna applications, it is often desirable to remote the HP 8511 away from the receiver and closer to the antenna under test. An IF interconnect cable routes the signals between the HP 8511 and the HP 8530A receiver. The standard length IF interconnect cable supplied with the HP 8511 is 1 meter in length. Other available lengths are as follows:

Part number	IF interconnect cable length
08510-60106	5 ft
08510-60107	10 ft
08510-60103	20 ft
08510-60104	40 ft

For applications requiring distances greater than 40 feet, special option kit HP 8510B-K41(with 70 ft. cable) is available. This kit contains an amplifier, replaces a circuit board in the receiver, and requires installation by an HP customer engineer. Seventy feet is the longest distance an HP 8511A/B can be remotely located from the HP 8530A receiver.

Options

Option 001 adds IF switching capability for switching between multiple frequency converters from the front panel of the receiver. This option is for applications in which two or more frequency converters will be frequently used, and convenient switching between them is desired. Option 001 places an IF switch within the HP 8511A and degrades the channel-to-channel isolation from 100 dB to 80 dB. For occasional switching between test sets, manually connecting the IF interconnect cable to the desired test set is usually satisfactory.

HP 85310A distributed frequency converter

Overview

The HP 85310A distributed frequency converter is part of the HP 85301B antenna measurement system. It is used to downconvert a microwave signal to a 20 MHz signal that can be measured by the HP 8530A microwave receiver. The distributed frequency converter uses external mixers for microwave downconversion. These mixers can be located directly at the antenna under test. The frequency of operation of the HP 85310A depends upon the frequency range of the external mixers selected. Mixers that cover the frequency range from 300 MHz to 110 GHz are available.

The HP 85310A provides high immunity to interference signals and excellent microwave sensitivity.

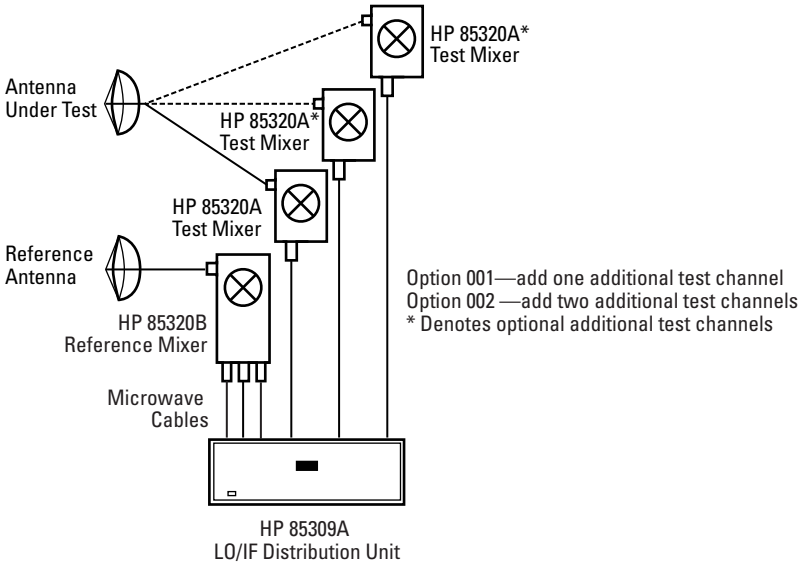


Figure 13.
HP 85310A distributed frequency converter

The HP 85310A distributed frequency converter consists of an HP 85309A LO/IF distribution unit an HP 85320A test mixer, and an HP 85320B reference mixer. HP 85381A and 85381C microwave cables are required to interconnect the mixers (which are usually placed at the antenna under test) to the HP 85309A.

Specifications

The specifications in Table 2 are for the HP 85310A with standard HP 85320A/B mixers and the HP 8530A microwave receiver.

Table 2. HP 85310A specifications

Specification	1 to 2 GHz[1]	2 to 18 GHz	6 to 26.5 GHz
Sensitivity[2] (dBm)	–80	–113	–96
Compression level[3] (dB)	–24	–24	–15
Dynamic range[4] (dB)	56	89	81
Crosstalk[5] (dB)	–100	–100	–100
Minimum phase lock power[6] (dBm)	–35	–55	–40
RF input match[7] (dB)	6	8	8
Conversion gain[8] (±2 dB)	4.5	9.5	–2

Maximum input to mixers

Do not exceed the following levels at either mixer input:

Maximum DC voltage at input 10 volts
Maximum RF signal at input +26 dBm

For system performance specifications of an HP 85310A distributed frequency converter used with other mixers in an antenna or RCS system, refer to the HP 8530A /85310A system performance specifications in the HP 8530A microwave receiver section.

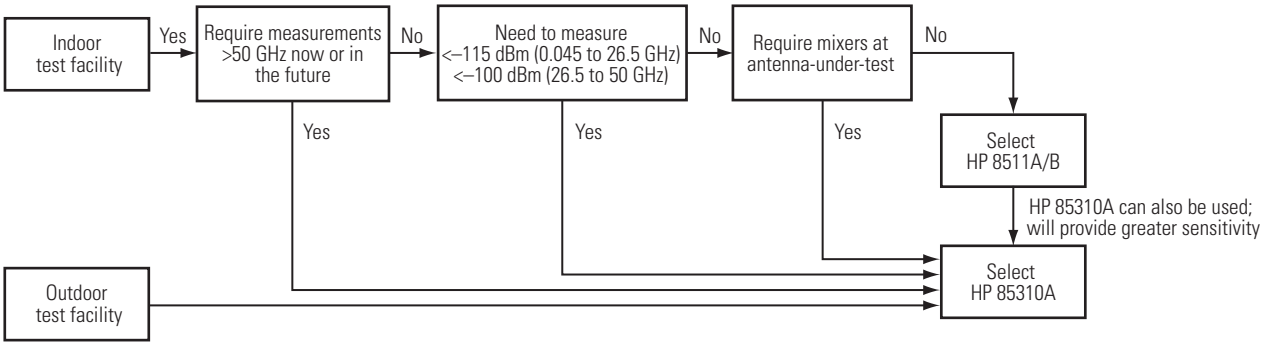
1. For the frequency range of 1 to 2 GHz, these are typical specifications.
2. Sensitivity is defined as the average noise floor (with IF bandwidth = 10 kHz, and 0 averages). Averaging will improve sensitivity by 10 log (number of averages).
3. RF level for 0.1 dB compression.
4. Dynamic range is compression level minus sensitivity.
5. Crosstalk is the coherent RF leakage from the reference channel to the test channel with 1024 averages.
6. Refers to systems that use an HP 8350 LO source only. Minimum phase lock power is the minimum RF power into the reference mixer to achieve phase lock. This does not apply to systems with a synthesized LO.
7. Typical values, not guaranteed.
8. Typical RF to IF conversion gain through the mixer and HP 85309A LO/IF distribution unit.

Selection criteria

The microwave receiver selection chart in Figure 14 shows the best applications for the HP 85310A distributed frequency converter. The HP 85310A is recommended in the following situations:

- Outdoor environments where interference signals are present.
- When the best possible microwave sensitivity is required.
- Frequency coverage beyond 50 GHz is required now or in the future.

Figure 14. Frequency converter selection criteria



Options

Option 001 adds one additional test channel and test mixer, providing a total of two test channels and one reference channel.

Option 002 adds two additional test channels and two additional test mixers, providing a total of three test channels and one reference channel.

HP 85309A LO/IF distribution unit

Overview

The HP 85309A LO/IF distribution unit is part of a remote-mixer frequency downconversion system. The HP 85309A plus the HP 85320A/B mixers form the HP 85310A distributed frequency converter, and serve to downconvert a microwave signal to an IF signal that can be measured by the HP 8530A microwave receiver. Refer to the HP 85310A section in this catalog for additional information on system specifications and configurations.

Features

- Allows mixers to be located at the antenna under test, minimizing RF cable loss
- Allows fundamental mixing to 18 GHz for best sensitivity
- Provides best rejection of unwanted spurious signals

Description

The HP 85309A contains LO signal amplifiers, which provide LO drive power through RF cables to the mixers. The high output power allows the mixers to be located up to seven meters (or more) from the HP 85309A. By using a separate LO amplifier for each channel, channel-to-channel isolation of 100 dB is achieved, minimizing signal leakage from the reference to the test channel and improving the accuracy of the measurement. There are also IF amplifiers located in the HP 85309A, which serve as a preamplifier for the receiver, reducing the overall system noise figure significantly.

Specifications

Absolute maximum ratings

LO input power (CW) +23 dBm
IF input power (CW) +13 dBm

Table 4.
HP 85309A specifications

Characteristics	Minimum	Typical	Maximum	Unit	Conditions
Frequency range	0.3		18	GHz	
Power output		19		dBm	
RF output tracing			±2	dB	
Input return loss		9		dB	
Output return loss		7		dB	
IF amplifier gain	21		25	dB	20 MHz, –35 dBm input
IF amplifier input return loss	12			dB	20 MHz
IF amplifier output return loss	10			dB	20 MHz

Remote mixer distances

Refer to the *Antenna Measurement Systems Configuration Guide* (HP literature number 5967-6042E) for assistance in calculating the distances that mixers can be remotely located from the HP 85309A LO/IF distribution unit.

Options

Option 001 adds second test channel; provides a total of two test channels and one reference channel.
Option 002 adds two additional test channels; provides a total of three test channels and one reference channel.
Option 908 rack mount kit without handles.
Option 913 rack mount kit with handles.
Option 910 additional manual.
Option W30 extended return-to-HP warranty.
Option W31 extended on-site warranty.

Special options

Occasionally an application requires locating the mixers at a distance greater than provided by a standard HP 85309A. The greater distance requires additional LO output power from the HP 85309A. Several special options that increase the output power of the HP 85309A are available. Refer to the HP 85309A-H30 section in this catalog.

Other information

Connectors type-N female
Environmental operating conditions: 0° to 55°C
Non-operating conditions –40° to 75°C; 5 to 90% relative humidity, non-condensing.
Power consumption 47.5 to 66 Hz, 100-120 or 220-240 VAC (±10%); 125 VA maximum.
Weight 15.5 kg (34 lb)
Size 460 mm (18.1 in) W x 133 mm (5.25 in) H x 533 mm (21 in) D

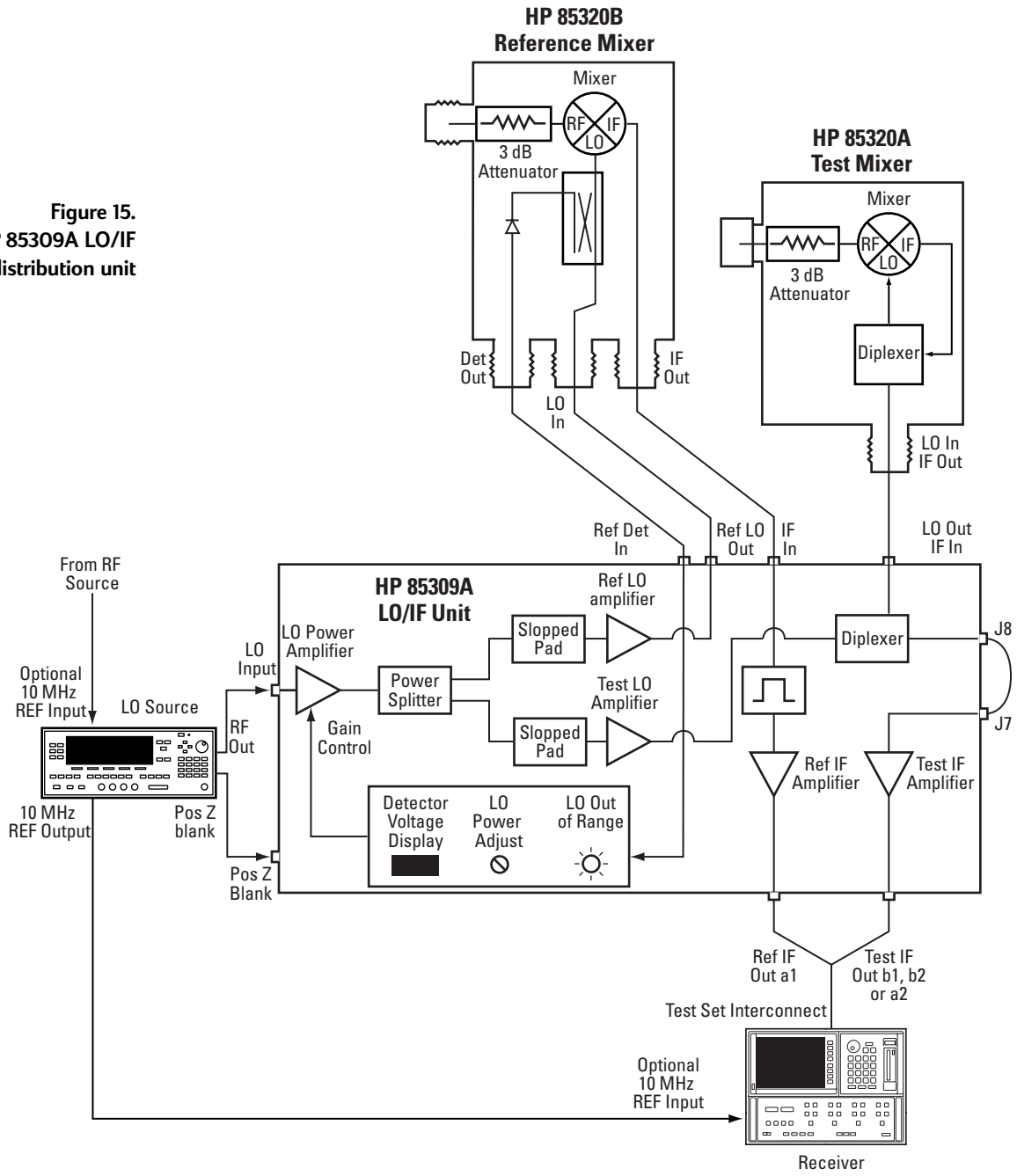


Figure 15.
HP 85309A LO/IF distribution unit

HP 85309A-H20 and -H21 low-frequency LO/IF distribution units

The HP 85309A-H20 and -H21 add 100 to 300 MHz operation to the standard HP 85309A LO/IF distribution unit. The standard HP 85309A provides frequency downconversion of signals from 300 MHz to 110 GHz with the appropriate external mixers.

Description

The special option numbers designate the following:

HP 85309A-H20: low-frequency operation; from 0.1 to 110 GHz with the appropriate mixers. Unit has one test channel and one reference channel.

HP 85309A-H21: low-frequency operation; from 0.1 to 110 GHz with the appropriate mixers. Unit has two test channels and one reference channel.

Specifications

Absolute maximum ratings

LO input power (CW)	+23 dBm
IF input power (CW)	+13 dBm
Storage temperature	–40 to 85°C
Operating temperature	0 to 50°C

Table 5. HP 85309A-H20 and -H21 specifications

Characteristics	Minimum	Typical	Maximum	Unit	Conditions
Frequency range	0.1		18	GHz	
Power output		16		dBm	
RF output tracing			±2	dB	
Input return loss		9		dB	
Output return loss		7		dB	
IF amplifier gain	21		25	dB	20 MHz, –35 dBm input
IF amplifier input return loss	12			dB	20 MHz
IF amplifier output return loss	10			dB	20 MHz

Remote mixer distances

The distances that the remote mixers can be located from the HP 85309A-H20 or -H21 LO/IF distribution unit are the same distances as for the standard HP 85309A. Refer to the *Antenna Measurement Systems Configuration Guide* (HP literature number 5969-6042E) for assistance in calculating the distances that mixers can be remotely located from the HP 85309A.

Other information

Connectors: type-N female

HP 85309A-H30, -H31 and -H32 high-power LO/IF distribution units

The HP 85309A-H30, -H31, and -H32 are the high-power versions of the HP 85309A LO/IF distribution unit. H30, H31, and H32 designate special high-power options for the HP 85309A:

HP 85309A-H30: high output power; one test channel and one reference channel.
HP 85309A-H31: high output power; two test channels and one reference channel.
HP 85309A-H32: high output power; three test channels and one reference channel.

Specifications

Absolute maximum ratings

LO input power (CW)	+23 dBm
IF input power (CW)	+13 dBm
Storage temperature	–40 to 85°C
Operating temperature	0 to 50°C

Table 6. HP 85309A-H30, -H31 and -H32 specifications

Characteristics	Minimum	Typical	Maximum	Unit	Conditions
Frequency range	0.3		18	GHz	
Power output	+21.5	>+24.5[1] >+25[1]		dBm	0.3 to 0.5 GHz, 0dBm Input +6 dBm Input
Power output	+24	>+25[1] >+27[1]		dBm	0.5 to 3 GHz, 0dBm Input +6 dBm Input
Power output	+26	>+27[1] >+30[1]		dBm	3 to 6.2 GHz, 0dBm Input +6 dBm Input
Power output	+23	>+26[2] >+25[1] >+28[1]		dBm	6.2 to 18 GHz, 0dBm Input +6 dBm Input
RF output tracing			±2	dB	0.3 to 18 GHz 0 or +6dBm input
Input return loss		9		dB	0.3 to 18 GHz 0 or +6dBm input
Output return loss		7		dB	0.3 to 18 GHz 0 or +6dBm input
IF amplifier gain	21		25	dB	20 MHz, –35 dBm input
IF amplifier input return loss	12			dB	20 MHz
IF amplifier output return loss	10			dB	20 MHz

Remote mixer distances

Refer to the *Antenna Measurement Systems Configuration Guide* (HP literature number 5967-6042E) for assistance in calculating the distances that mixers can be remotely located from the HP 85309A-H30/31/32 LO/IF distribution unit.

Other information

Connectors: type-N female

1. Typical measurement on HP 85309A-H32 test channel #3.
2. Typical measurement on HP 85309A-H32 test channel #3, 6 to 9 GHz, 0 dBm input.

HP 85320A/B mixer modules

Overview

The HP 85320A/B mixer modules are designed for use with the HP 85309A LO/IF distribution unit. Together, they function to downconvert microwave frequencies to a 20 MHz signal for measurement by the HP 8530A microwave receiver.

Features

The mixer modules are broadband, operating from 1 to 26.5 GHz. They operate in fundamental mode from 1 to 18 GHz, providing the lowest conversion loss and best sensitivity. Third-harmonic mixing is used for the frequency range of 6 to 26.5 GHz.

HP 85320A test mixer

The HP 85320A contains a diplexer that combines the LO input and IF output onto a single coaxial connector, which is useful for rotary joint applications.

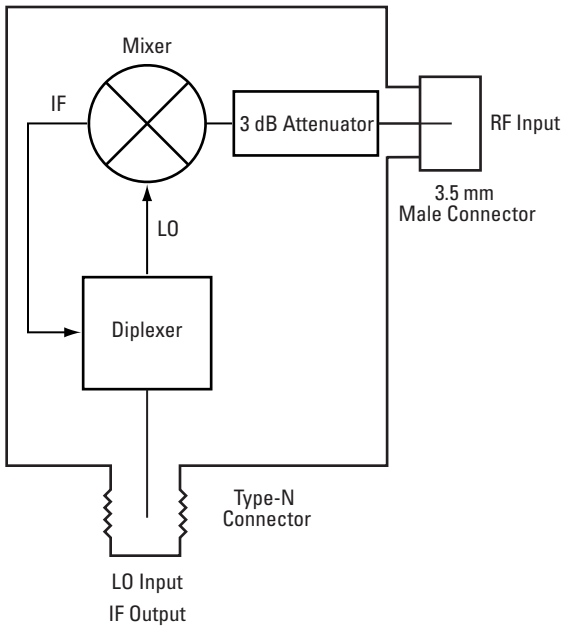


Figure 16. HP 85320A test mixer

HP 85320B reference mixer

The HP 85320B contains a leveling coupler/detector that provides a leveling signal to the HP 85309A LO/IF distribution unit, ensuring leveled LO drive power to the mixer.

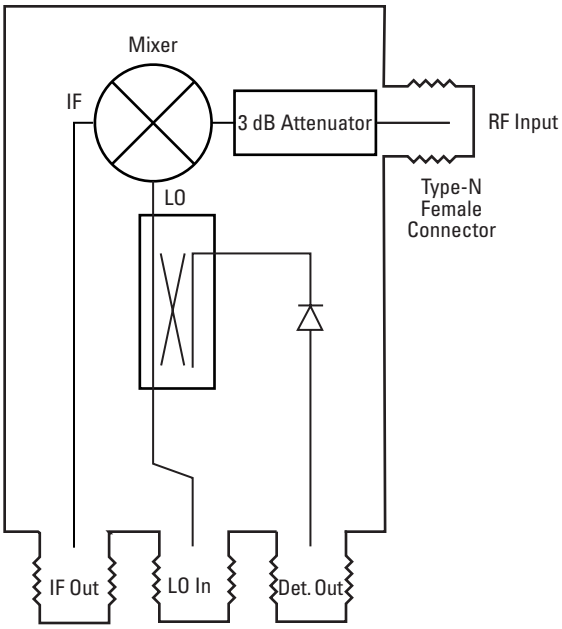


Figure 17. HP 85320B reference mixer

Specifications

Frequency range

Fundamental mode	1 to 18 GHz

Maximum input levels

Maximum DC voltage at input	10 volts
Maximum signal level at RF or LO inputs	+26 dBm

LO signal power

LO frequency	Minimum power	Typical power	Maximum power
1 to 18 GHz	+7.5 dBm	+11 dBm	+16 dBM

Conversion loss

Table 7. Conversion loss of HP 85320A/B mixer modules

Frequency range	LO harmonic	Typical loss	Maximum loss
1 to 2 GHz	1	18.0 dB	22 dB
2 to 3 GHz	1	12.0 dB	16 dB
3 to 5 GHz	1	11.0 dB	15 dB
5 to 18 GHz	1	14.7 dB	17 dB
6 to 8 GHz	3	23.8 dB	26 dB
8 to 16 GHz	3	26.5 dB	28 dB
16 to 26.5 GHz	3	28.5 dB	33 dB

Connector types

RF input	3.5 mm male
All other connectors	type-N female

Environmental characteristics

Operating conditions	0 to +55°C
Non-operating conditions	–40 to +75°C; 5 to 90% relative humidity, non-condensing.

Size

HP 85320A (excluding connectors)	83 mm (3.25 in) W x 122 mm (4.8 in) L x 33 mm (1.3 in) D
HP 85320B (excluding connectors)	92 mm (3.6 in) W x 185 mm (7.3 in) L x 25 mm (1.0 in) D

Weight

HP 85320A	615 g (1.35 lb)
HP 85320B	840 g (1.85 lb)

System performance specifications

For system performance specifications, refer to the HP 8530A/85310A system performance specifications in the HP 8530A microwave receiver section.

HP 85320A/B-H20 low-frequency mixer modules

Overview

The HP 85320A/B-H20 are low-frequency mixer modules designed for use with the HP 85309A LO/IF distribution unit. They downconvert microwave frequencies to a 20 MHz signal for measurement by the HP 8530A microwave receiver.

Features

The mixer modules are broadband, operating from 100 MHz to 3 GHz in fundamental mode, which provides the lowest conversion loss and best sensitivity. The mixer modules operate with a standard HP 85309A from 300 MHz to 3 GHz. Operation from 100 to 300 MHz requires an HP 85309A-H20.

HP 85320A-H20 test mixer

The HP 85320A-H20 contains a diplexer that combines the LO input and IF output onto a single coaxial connector, which is useful for rotary joint applications.

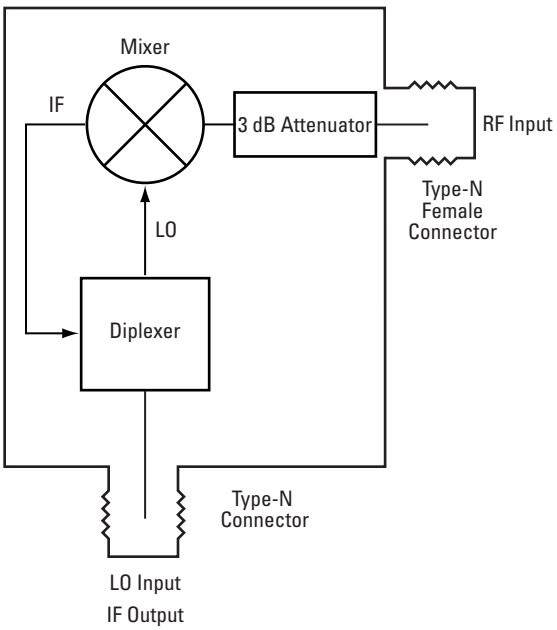


Figure 18. HP 85320A-H20 test mixer

HP 85320B-H20 reference mixer

The HP 85320B-H20 contains a leveling coupler/detector that provides a leveling signal to the HP 85309A LO/IF distribution unit, ensuring leveled LO drive power to the mixer.

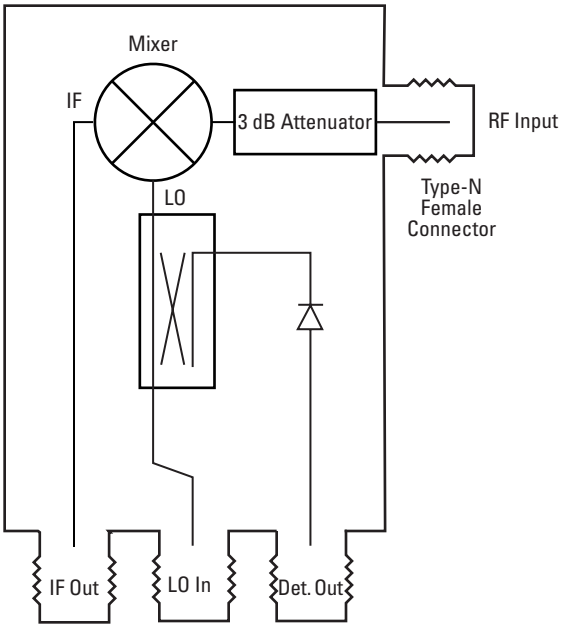


Figure 19.
HP 85320B-H20 reference mixer

Specifications

Frequency range

Fundamental mixing mode	100 MHz to 3 GHz

Maximum input levels

Maximum DC voltage at input	10 volts
Maximum signal level at RF or LO inputs	+20 dBm

LO signal power

LO frequency	Minimum power	Typical power	Maximum power
0.1 to 3 GHz	+8 dBm	+10 dBm	+16 dBm

Conversion loss

Frequency range	LO harmonics	Typical loss	Maximum loss
100 MHz to 3 GHz	1	–10 dB	–14 dB

Connector types

RF input	type-N female
All other connectors	type-N female

Environmental characteristics

Operating conditions	0 to +55°C
Non-operating conditions	–40 to +75°C; 5 to 90% relative humidity, non-condensing.

Size

HP 85320A-H20 (excluding connectors)	97 mm (3.8 in) W x 122 mm (4.8 in) L x 34 mm (1.3 in) D
HP 85320B-H20 (excluding connectors)	97 mm (3.8 in) W x 186 mm (7.3 in) L x 31 mm (1.2 in) D

Weight

HP 85320A-H20	700 g (1.52 lb)
HP 85320B-H20	840 g (1.85 lb)

System performance specifications

A measurement system consists of HP 85320A/B-H20 mixers, an HP 85309A LO/IF distribution unit, and an HP 8530A microwave receiver. The HP 85320A/B-H20 mixer operates from 0.3 to 3 GHz with a standard HP 85309A. If system operation is desired from 100 to 300 MHz, the HP 85309A requires a special low-frequency option, H20, which adds low-frequency amplifiers.

Performance specifications for a system using HP 85320A/B-H20 mixers are shown in Table 8.

Table 8. System specifications with HP 85309A/B-H20 mixers

Specification	0.1 to 3 GHz	0.3 to 3 GHz
Sensitivity[1] (dBm)	–107	–107
Compression level[2] (dB)	–21	–21
Dynamic range[3] (dB)	86	86
Crosstalk[4] (dB)	100	80
RF input match (dB)	8	8
Conversion gain (dB)	–10	–10

1. Sensitivity is defined as signal = noise, or S/N=1. Averaging will improve sensitivity by 10 log (averaging factor).
2. Specified at 0.1 dB RF compression level.
3. Dynamic range is calculated from compression level minus RMS noise floor.
4. Crosstalk is the coherent leakage from the reference channel to the test channel; measured with 1024 averages.

HP 85320A/B-H50 broadband mixer modules

Overview

The HP 85320A/B-H50 are broadband mixer modules designed for use with the HP 85309A LO/IF distribution unit. They downconvert microwave frequencies to a 20 MHz signal for measurement by the HP 8530A microwave receiver.

Features

The mixer modules are broadband, operating from 2 to 50 GHz. They operate in fundamental mode from 2 to 18 GHz, which provides the lowest conversion loss and best sensitivity. From 18 to 50 GHz, the mixers operate in third-harmonic mode.

HP 85320A-H50 test mixer

The HP 85320A-H50 contains a diplexer that combines the LO input and IF output onto a single coaxial connector which is useful for rotary joint applications.

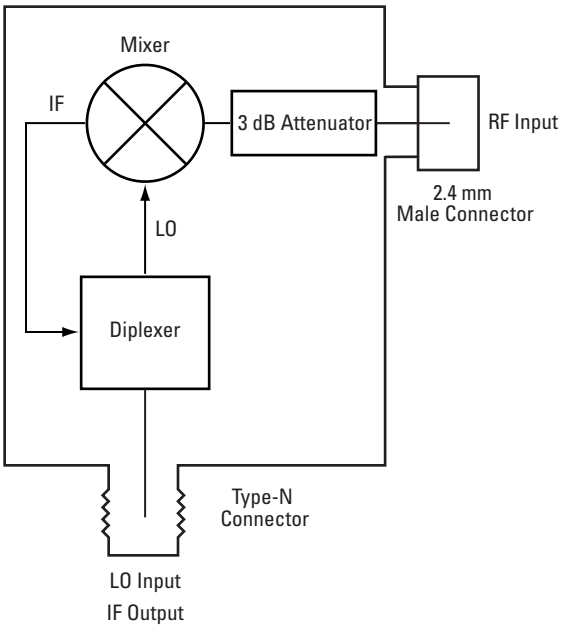


Figure 19. HP 85320A/B-H50 test mixer

HP 85320B-H50 reference mixer

The HP 85320B-H50 contains a leveling coupler/detector that provides a leveling signal to the HP 85309A LO/IF distribution unit, ensuring leveled LO drive power to the mixer.

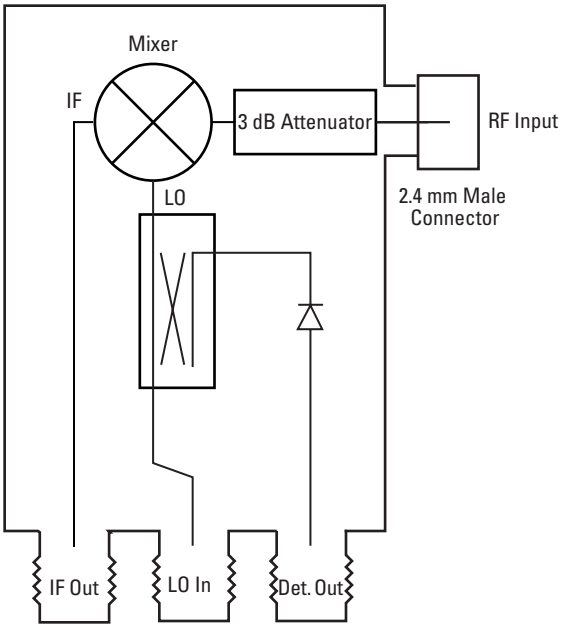


Figure 20. HP 85320A/B-H50 reference mixer

Specifications

Frequency range

Fundamental mixing mode	2 to 18 GHz
Third-harmonic mode	18 to 50 GHz

Maximum input levels

Maximum DC voltage at input	10 volts
Maximum signal level at RF or LO inputs	+26 dBm

LO signal power

LO frequency	Minimum power	Typical power	Maximum power
2 to 18 GHz	+12 dBm	+14 dBm	+17 dBm

Conversion loss

Frequency range	LO harmonics	Typical loss
2 to 18 GHz	1	–12 dB
18 to 50 GHz	3	–28 dB

Port match

RF input port match, 2 to 50 GHz	3.5:1 maximum (typical)
LO port match (2 to 18 GHz)	2.7:1 maximum (typical)

Connector types

RF input	2.4 mm male
All other connectors	type-N female

Environmental characteristics

Operating conditions	0 to +45°C
Non-operating conditions	–40 to +75°C; 5 to 90% relative humidity, non-condensing.

Size

HP 85320A-H50 (excluding connectors)	97 mm (3.8 in) W x 122 mm (4.8 in) L x 34 mm (1.3 in) D
HP 85320B-H50 (excluding connectors)	97 mm (3.8 in) W x 186 mm (7.3 in) L x 31 mm (1.2 in) D

Weight

HP 85320A-H50	794 g (1.75 lb)
HP 85320B-H50	1021 g (2.25 lb)

System performance specifications

A measurement system consists of HP 85320A/B-H50 mixers, an HP 85309A LO/IF distribution unit, and an HP 8530A microwave receiver. Performance specifications for this system are shown in Table 9.

Table 9. System specifications with HP 85320A/B-H50 mixers

Specification	2 to 18 GHz	18 to 40 GHz	40 to 50 GHz
Sensitivity[1] (dBm)	–110	–95	–95
Compression level[2] (dB)	–24	–24	–27
Dynamic range[3] (dB)	86	71	68
Crosstalk[4] (dB)	100	100	100
RF port match[5] (dB)	5	5	5
Conversion loss[6] (dB)	–12	–28	–28

1. Sensitivity is defined as signal = noise, or S/N=1. Averaging will improve sensitivity by 10 log (averaging factor).
2. Specified at 0.1 dB RF compression level.
3. Dynamic range is calculated from compression level minus RMS noise floor.
4. Crosstalk is the coherent leakage from the reference channel to the test channel; measured with 1024 averages.
5. Typical worst-case port match.
6. Typical conversion loss.

Microwave synthesized sources

HP antenna measurement systems use HP 8360 series synthesized microwave sources for precise frequency resolution and accuracy. An antenna measurement system that includes the HP 8511A/B frequency converter requires only a transmit source. No LO source is required, since it is internal to the HP 8511A/B. An antenna measurement system that uses the HP 85310A frequency converter requires two synthesized sources. Option 008 is recommended for all synthesized sources to provide a system frequency resolution of 1 Hz instead of 1 kHz. Option 004, rear-panel RF output, is popular for antenna measurement systems that are to be mounted into instrument racks.

Front-panel controls

HP synthesized sources are available with or without front-panel controls. Front-panel controls provide easy manual operation for diagnostic capability on an antenna range, and also allow the source to be used in other stand-alone applications. If your antenna or RCS system will be operated in a pulsed mode, high-performance pulse modulators (Option 006) will be required, and these are only available in sources with front-panel controls. Sources without front-panel controls and modulation capabilities are available at lower cost.

Transmit sources

When selecting a transmit source for an antenna range, frequency range and output power are the primary concerns. Future frequency requirements should also be considered. A variety of synthesized sources with different frequency ranges and output powers are available. Depending on individual preference, select a transmit source from Tables 10 and 11. If the system is to be used for measuring antennas in a pulsed mode of operation, fast pulse modulation (Option 006) should be ordered for the transmit source.

Table 10. Transmit sources with front-panel controls

HP model	Description	Output power (dBm)
HP 83620B	10 MHz to 20 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+13 dBm
HP 83622B	2 GHz to 20 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+13 dBm
HP 83623B	10 MHz to 20 GHz synthesized sweeper with high output power and front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+17 dBm
HP 83624B	2 GHz to 20 GHz synthesized sweeper with high output power and front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+20 dBm
HP 83630B	10 MHz to 26.5 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+13 dBm (<20 GHz) +10 dBm (20 to 26.5 GHz)
HP 83640B	10 MHz to 40 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+10 dBm (26.5 GHz) +6 (26.5 to 40 GHz)
HP 83650B	10 MHz to 50 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1 Hz frequency resolution.	+10 dBm (<26.5 GHz) +5 dBm (26.5 to 40 GHz) +2.5 dBm (40-50 GHz)

Table 11. Transmit sources without front-panel controls

HP model	Description	Output power (dBm)
HP 83621B	45 MHz to 20 GHz synthesized sweeper with rear-panel RF output and 1-Hz frequency resolution. No front-panel controls or modulation capability.	+13 dBm
HP 83631B	45 MHz to 26.5 GHz synthesized sweeper with rear-panel RF output and 1-Hz frequency resolution. No front-panel controls or modulation capability.	13 dBm (<20GHz) 10 dBm (20 to 26.5 GHz)
HP 83651B	45 MHz to 50 GHz synthesized sweeper with rear-panel RF output and 1-Hz frequency resolution. No front-panel controls or modulation capability.	10 dBm (<26.5 GHz) 5 dBm (26.5 to 40 GHz) 2.5 dBm (40 to 50 GHz)

Millimeter-wave source modules

Source modules are available for waveguide bands from 26.5 to 110 GHz (see Table 12). Normally these modules are ordered as part of an HP 85325A millimeter-wave subsystem kit, which contains all the additional components necessary to upgrade a standard antenna measurement system to millimeter-wave frequencies. Refer to the section on HP 85325A millimeter-wave subsystem kits for additional information.

Source drive power requirements

Source multiplier modules are part of the HP 85325A kits, and multiply a signal from a 20 GHz synthesized source up to the desired millimeter-wave frequency. These modules require high input drive power. The HP 83623B and 83624B synthesized sources have adequate output power to drive the source modules directly. All other synthesizer sources require an HP 8349B microwave amplifier to provide sufficient RF drive power to the millimeter-wave source modules.

Table 12. Millimeter source module specifications

Millimeter source module	Output frequency	Millimeter-wave output	Harmonic number	Input frequency	RF input level
HP 83554A	26.5 to 40 GHz	7 dBm	2	13.25 to 20.0 GHz	+17 dBm
HP 83555A	33 to 50 GHz	3 dBm	3	11.0 to 16.7 GHz	+17 dBm
HP 83556A	40 to 60 GHz	3 dBm	3	13.3 to 20.0 GHz	+17 dBm
HP 83557A	50 to75 GHz	3 dBm	4	12.5 to 18.75 GHz	+17 dBm
HP 83558A	75 to 110 GHz	0 dBm	6	12.5 to 18.33 GHz	+17 dBm

Local oscillator sources

An antenna measurement system that uses the HP 85310A frequency converter requires a synthesized local oscillator (LO) source. Since the RF and LO signals are synthesized, phase locking of the receiver is unnecessary. By using synthesized sources for both the transmit and the local oscillator source, it eliminates the need (and the time) to phase lock the receiver. Both sources can be set to the exact frequency required to downconvert the AUT frequency to the 20 MHz IF required by the HP 8530A microwave receiver.

Frequency range

Microwave mixers used with the HP 85310A frequency converter use fundamental mixing from 100 MHz to 18 GHz, and harmonic mixing for frequencies above 18 GHz. Thus, an LO source that operates over the frequency range of 0.1 to 18 GHz will be adequate for measuring antennas in the 0.1 to 110 GHz frequency range with the HP 85310A.

All HP 8360 series synthesized sources will function as LO sources. However, because the LO source only operates over the frequency range of 0.1 to 18 GHz, LO source selection can be limited to the synthesizers listed in Table 13.

Table 13. LO sources

HP model	Description	Output pwer (dBm)
HP 83621B	10 MHz to 20 GHz synthesized sweeper without front-panel controls. Standard unit includes rear-panel and 1-Hz frequency resolution.	+13 dBm
HP 83623L	10 MHz to 20 GHz synthesized sweeper without front-panel controls. No source modulation capability is available. Recommended: Option 004, rear-panel RF output; Option 008, 1-Hz frequency resolution.	+15 dBm
HP 83620B	10 MHz to 20 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1-Hz frequency resolution.	+13 dBm
HP 83622B	2 GHz to 20 GHz synthesized sweeper with front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1-Hz frequency resolution.	+13 dBm
HP 83623B	10 MHz to 20 GHz synthesized sweeper with high output power and front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1-Hz frequency resolution.	+17 dBm
HP 83624B	2 GHz to 20 GHz synthesized sweeper with high output power and front panel controls. Recommended options: Option 004, rear-panel RF output; Option 008, 1-Hz frequency resolution.	+20 dBm

Select a source that meets your individual preference and needs. The higher-output power sources are useful when the RF cable distance between the LO source and the HP 85309A LO/IF distribution unit must be longer than allowed by the standard +13 dBm output power. Refer to the *Antenna Measurement Systems Configuration Guide* (HP literature number 5967-6042E) for guidance on calculating cable lengths.

HP 8347A

HP 8348A

HP 8349B

HP 8347A **100 kHz to 3 GHz**
HP 8348A **2 to 26.5 GHz**
HP 8349B **2 to 20 GHz**

The HP 8347A, 8348A, and 8349B are general purpose broadband instrumentation amplifiers capable of producing power and gain to overcome systematic RF path losses and improve measurement system performance. These amplifiers are self contained, featuring internal power supplies and bias networks to ensure simple system integration. They are packaged for rack mount or benchtop applications.

Millimeter-wave signal sources are easily configured using new or existing microwave sources with the HP 8349B as a driver for the HP 83550 series millimeter-wave source modules. The built-in source module interface on the HP 8349B ensures that proper DC bias and control signals are maintained.

Specifications

Table 14. General purpose amplifier specifications

HP model	Frequency range	Output power	Gain	Harmonics	Input SWR (typ)	Output SWR (typ)
8347A	Unleveled: 100 kHz to 2 GHz 2 GHz to 3 GHz	—	≥ 25 dB ≥ 25 dB	≤ 25 dBc ≤ 25 dBc	2.0 2.0	2.0 3.0
	Leveled: 100 kHz to 3 GHz	≥ 20 dBm	≥ 25 dB	≤ 20 dBc	2.0	1.5
8348A	Unleveled: 2 to 20 GHz 20 to 26.5 GHz	≥ 25 dBm ≥ 23 dBm	≥ 25 dB ≥ 23 dB	< –15 dBc (typ) < –15 dBc (typ)	3.0 3.0	4.5 2.0
8349B	Unleveled: 2 to 18.6 GHz 18.6 to 20 GHz	≥ 20 dBm ≥ 18 dBm	≥ 15 dB ≥ 13 dB	≤ 20 dBc ≤ 20 dBc	2.8 2.8	≤ 4.8 ≤ 3.2
	Leveled: 2 to 18.6 GHz 18.6 to 20 GHz	≥ 19 dBm ≥ 17 dBm	≥ 15 dB ≥ 13 dB	≤ 20 dBc ≤ 20 dBc	2.8 2.8	2.5 2.5

HP 83020A

HP 83017A

HP 83018A

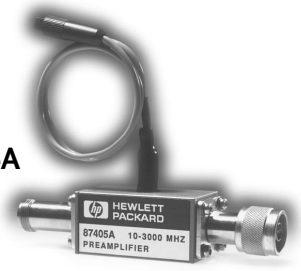
HP 83060A

HP 83051A

HP 83050A

HP 87415A

HP 87405A



HP 83060A	**0.01 to 26.5 GHz**
HP 83017A	**0.5 to 26.5 GHz**
HP 83018A	**2 to 26.5 GHz**
HP 83020A	**2 to 26.5 GHz**
HP 83050A	**2 to 50 GHz**
HP 83051A	**0.045 to 50 GHz**
HP 87405A	**0.01 to 3 GHz**
HP 87415A	**2 to 8 GHz**

Hewlett-Packard has a variety of amplifiers that find applications on antenna and RCS ranges. These amplifiers are small and compact, with high gain and output power. An external power supply (available from HP) is required for these amplifiers. Refer to Hewlett-Packard's *RF & Microwave Test Accessories Catalog* (literature number 5968-4314EUS) for complete information (including outline drawings) on HP amplifiers.

Table 15.
Amplifier specifications

HP model	Frequency (GHz)	Output power at P_{sat} (dBm/mW)	Output power at P_{1dB} (dBm/mW) (min)	Gain (dB) (min)	Noise figure (dB) (typ)	Detector[1] output/dc connector	RF bias (nom)	Connectors (input/output)
83006A	0.01 to 26.5	+18/64 typ. to 10 GHz +16/40 typ. to 20 GHz +14/25 typ. to 26.5 GHz	+13/20 to 20 GHz +10/10 to 26.5 GHz	20	13 to 0.1 GHz 8 to 18 GHz 13 to 26.5 GHz	No	+12 V @ 450 mA –12 V @ 50 mA	3.5 mm (f)
83017A	0.5 to 26.5	+20/100 typ. to 20 GHz +15/32 typ. to 26.5 GHz	+18/64 to 20 GHz $(18 – 0.75\Delta f)$ dBm^2 $(64 – 7.8\Delta f)$ mw^2 $(20 \leq f \leq 26.5$ GHz)	25	8 to 20 GHz 13 to 26.5 GHz	Yes/BNC (f)	+12 V @ 700 mA –12 V @ 50 mA	3.5 mm (f)
83018A	2 to 26.5	+24/250 min to 20 GHz +21/125 min to 26.5 GHz	+22/160 to 20 GHz +17/50 to 26.5 GHz	27 to 20 GHz 23 to 26.5 GHz	10 to 20 GHz 13 to 26.5 GHz	Yes/BNC (f)	+12 V @ 2 A –12 V @ 50 mA	3.5 mm (f)
83020A	2 to 26.5	+30/1000 min to 20 GHz $(30 – 0.7\Delta f)$ dBm min^2 $(1000 – 65\Delta f)$ mw min^2 $(20 \leq f \leq 26.5$ GHz)	+27/500 to 20 GHz +23/200 to 26.5 GHz	30 to 20 GHz 27 to 26.5 GHz	10 to 20 GHz 13 to 26.5 GHz	Yes/BNC (f)	+15 V @ –15 V @ 50 mA	3.2 A 3.5 mm (f)
83050A	2 to 50	+20/100 min to 40 GHz $(19 – 0.2\Delta f)$ dBm^3 $(80 – 3.1\Delta f)$ mw^3 $(40 < f \leq 50$ GHz)	+15/32 to 40 GHz +13/20 to 50 GHz	23	6 to 26.5 GHz 10 to 50 GHz	No	+12 V @ 830 mA –12 V @ 50 mA	2.4 mm (f)
83051A	0.045 to 50	+12/16 min to 45 GHz min +10/10 min to 50 GHz min	+8/6 to 45 GHz +6/4 to 50 GHz	23	12 to 2 GHz 6 to 26.5 GHz 10 to 50 GHz	No	+12 V @ 425 mA –12 V @ 50 mA	2.4 mm (f)
87405A	0.01 to 3	+26/400 typ.	+4/2.5	22 min 27 max	6.5 to 2 GHz 7.5 to 3 GHz	No	+15 V @ 80 mA	N (f) N (m)
87415A	2 to 8	+26/400 typ.	+23/200	25	13	No	+12 V @ 900 mA	SMA (f)

A 2-meter power cable with a connector on one end and bare wires on the other is shipped with all amplifiers.

Table 16.
Power supply specifications

HP model	ac input voltage	dc output (nom)	Output power	Size (H,W,D)
87421A	100 to 240 VAC 50/60 Hz	+12 V @ 2.0 A, -12 V @ 200 mA	25 W max	57, 114, 176 mm 2.3, 4.5, 6.9 in
87422A[4]	100 to 240 VAC 50/60 Hz	+15 V @ 3.3 A, -15 V @ 50 mA +12 V @ 2.0 A, -12 V @ 200 mA	70 W max	86, 202, 276 mm 3.4, 8.0, 10.9 in

A 2-meter power cable with connectors to connect between amplifier and power supply is provided with all power supplies.

1. Detector output can be used for leveling output power at the test port.
2. Δf=f (GHz)–20.
3. Δf=f (GHz)–40.
4. The ±15V output is designed to power the HP 83020A; the ±12V output can be used to power an additional amplifier.

Table 17. Power supply and cable cross reference[1]

HP model	HP cable part number[2] (supplied with ampifier)	HP power supply recommended	HP cable part number[3] (supplied with power supply)
83006A	83006-60004	87421A	83006-60005
83017A	83006-60004	87421A	83006-60005
83018A	83006-60004	87421A	83006-60005
83050A	83006-60004	87421A	83006-60005
83051A	83006-60004	87421A	83006-60005
87415A	83006-60004	87421A	83006-60005
83020A	83020-60004	87422A[2]	83006-60001
			83006-60005
87405A	Integral cable	HP 11899A power supply or spectrum analyzer	

1. Connectors on cables are compatible with power supplies and amplifiers. Refer to the *HP RF & Microwave Test Accessories Catalog* (literature number 5968-4314EUS) for information on connector types.
2. For use with available power supply.
3. For use with power supply for direct connection.

HP 85370A antenna position encoder

The HP 85370A antenna position encoder allows manual antenna patterns to be measured easily using the HP 8530A microwave receiver and any antenna positioning system. The antenna position encoder provides information to the HP 8530A microwave receiver. The encoder monitors the synchro lines from the antenna positioner, decodes the synchro signals, and sends the positioning information to the receiver through an encoder interface cable.

When the positioner is manually moved through the desired angles, the receiver measures and displays the antenna pattern. Antenna pattern parameters such as start and stop angles, as well as angular sampling increment, can be selected from the front panel of the microwave receiver.

Interface a modern receiver to older antenna ranges

The antenna position encoder allows existing manual antenna ranges to be upgraded with a modern microwave receiver without upgrading the positioning system. Manual pattern measurement capability is retained.

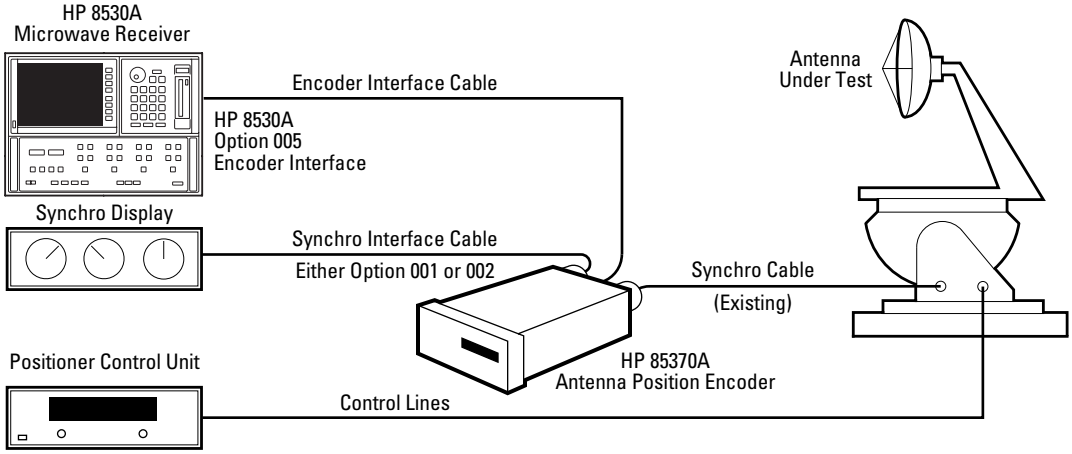
Versatile features

The antenna position encoder has several versatile features that make it easy to use. A positioner offset angle can be entered from the receiver, making it easy to boresight the antenna. The positioner angle for the active axis (corrected for the offset angle) is displayed continuously. A switch is provided that reverses the direction of the synchros. This allows the user to determine which direction (clockwise or counterclockwise) produces increasing rotation angles.

Easy operation

Encoder setup is accomplished from the microwave receiver. Axis select, offset angle, triggering increment, and measurement start/stop angles are all chosen through the firmware of the HP 8530A microwave receiver. Measurement messages appear on the receiver's display to inform the user of measurement status. The receiver warns the user when the positioner is being rotated too fast for the selected sampling increment angle.

Figure 21. Antenna position encoder interconnect diagram



Specifications

Electrical

Any one of three axes
Single or dual (36:1) synchros

Resolution

Single synchro	0.1 degree
Dual synchro	0.01 degree

Accuracy

Single synchro	±0.5 degree
Dual synchro	±0.01 degree

Acquisition speed

The maximum positioner speed for antenna pattern acquisition depends on the size of the sampling increment angle and the number of parameters being acquired. As shown in Figure 22, very small sampling increments can be used for normal positioner speeds.

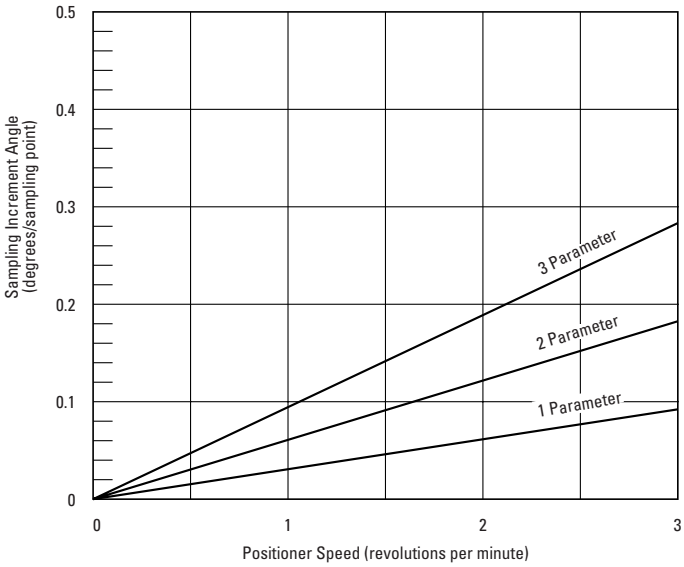


Figure 22. Maximum positioner speeds for antenna pattern acquisition

Supplemental characteristics

Active axis indicator
Five-digit active angle display
Selectable ±180°, or 0° to 360° display
Selectable sense of rotation (CW or CCW)
Industry-standard connectors
Requires HP 8530A Option 005 (encoder interface) for operation with the HP 8530A microwave receiver

Required option

Synchro interface cables are required to interface the antenna position encoder to the existing positioning system. Option 001 interfaces to Scientific-Atlanta position indicator model numbers SA 1842, SA 1843, SA 1844, and SA 4400. Option 002 interfaces to Flam & Russell 8502 and Orbit AL-4706-3A, AL-4806-3A, and AL-4906-3A positioner controllers. For interfaces to other positioner controllers, consult your HP representative.

Dimensions

Height	102 mm (4 inches including feet)
Rack height	89 mm (3.5 inches; half-width module)
Width	213 mm (8.38 inches)
Depth	290 mm (11.4 inches)
Net weight	2.7 kg (5.9 lb)

Environmental

Operating	0°C to 50°C
Storage	–20°C to 70°C
	15 to 95% relative humidity

Power from the HP 8530A through the interface cable

Supplied accessories

Encoder interface cable	1.82 m (6 ft)
Synchro cable	1.82 m (6 ft)

HP 85325A millimeter-wave subsystems

R/Q/U/V/W millimeter-wave bands

Description

The HP 85325A millimeter-wave subsystems extend the frequency of operation of the HP 85310A frequency converter into the millimeter-wave frequency range. The standard HP 85309A LO/IF distribution unit with the HP 85320A/B-H50 mixers (single coaxial connector) provides frequency downconversion from 2 to 50 GHz. The millimeter-wave subsystems extend frequency downconversion to higher frequencies in waveguide bands as follows:

R85325A	26.5 to 40 GHz
Q85325A	33 to 50 GHz
U85325A	40 to 60 GHz
V85325A	50 to 75 GHz
W85325A	75 to 110 GHz

Features

- Extends frequency downconversion up to 110 GHz.
- Upgrade to additional frequency coverage when needed.

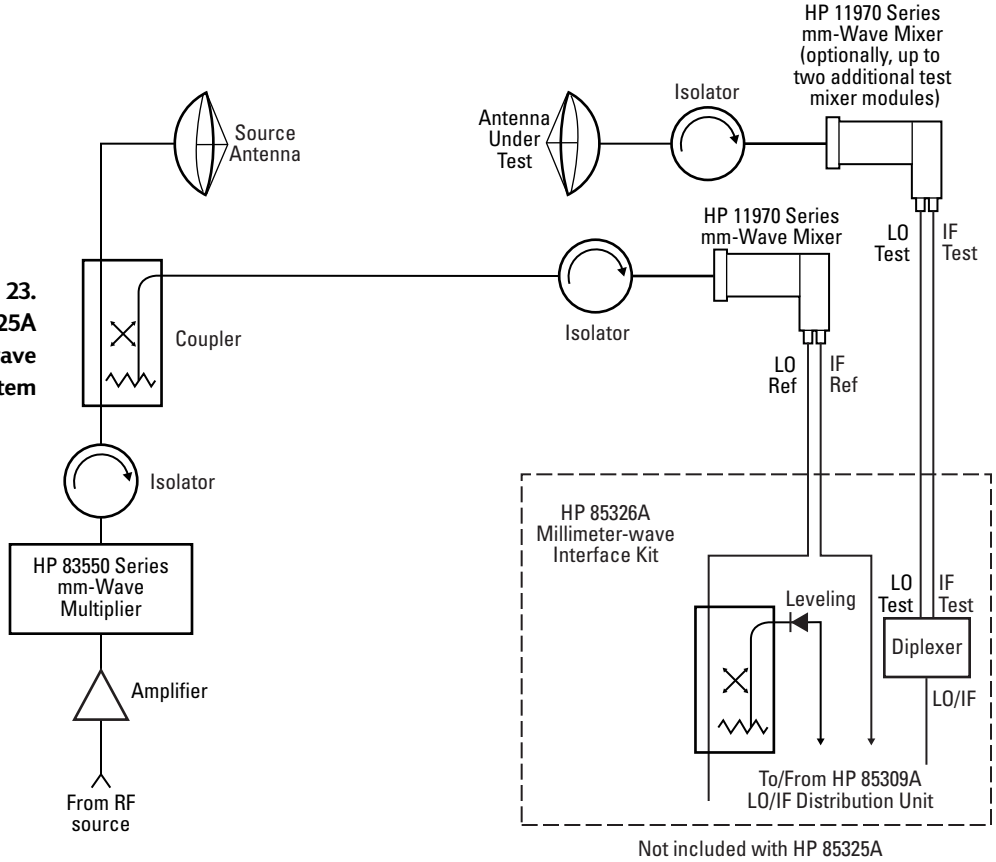
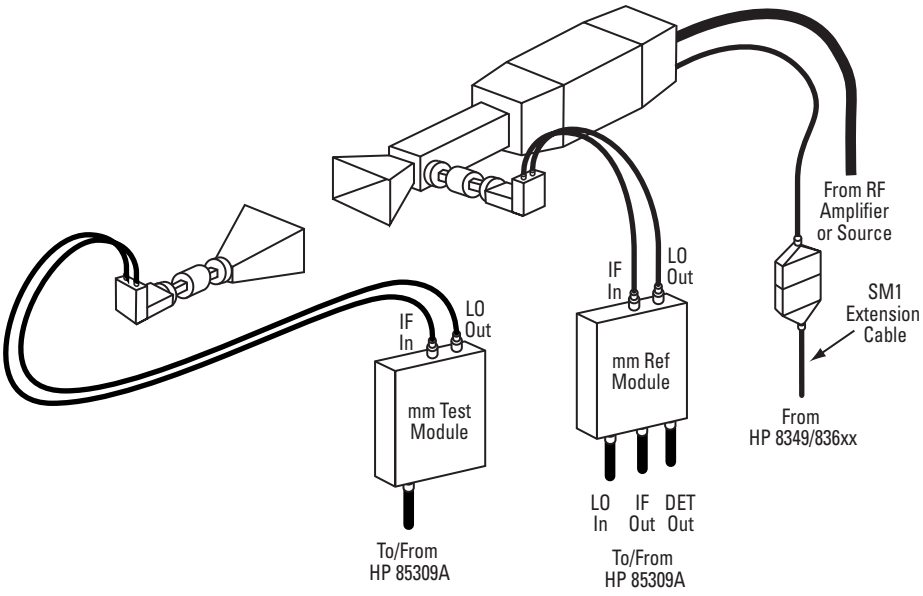


Figure 23. HP 85325A millimeter-wave subsystem

Figure 24. HP 85325A/85326A interconnections



Description

The block diagram in Figure 23 illustrates all the components in a millimeter-wave subsystem. An HP 83550 series millimeter-wave multiplier takes a high-power signal from a microwave synthesizer and multiplies it up to the appropriate frequency band. An HP 752D series waveguide coupler provides a signal to the reference mixer. Two HP 11970 series waveguide mixers are provided; one for the reference channel and one for the test channel. Three HP 365A series waveguide isolators are provided to improve source match and reduce mixer mismatch uncertainty.

An HP 85326A millimeter-wave interface kit is required to interface an HP 85325A millimeter-wave subsystem to an HP 85309A. The HP 85326A provides all the band-independent hardware necessary for the interface. See Figure 24.

Specifications

Table 18. HP 85325A specifications

	Frequency range (GHz)				
Specification	**R band 26.5 to 40**	**Q band 33 to 55**	**U band 40 to 60**	**V band 50 to 75**	**W band 75 to 110**
Max output power (dBm)[1]	7	3	3	3	0
Sensitivity (dBm) [2]	–88	–85	–86	–72 [–82]	–71 [–74]
Sensitivity (dBm) (S/N=1;128 averages)	–109	–106	–107	–99 [–103]	–92 [–95]
Dynamic range	79	71	72	60 [64]	56 [59]
Compression level (dBm)	–19	–24	–24	–18	–15
Channel isolation (dB)[3]	100	100	100	100	100
Typical match[4]	15.5	15.5	15.5	9.5	9.5

Values in brackets indicate typical performance

1. Minimum power at output of HP 83550 series source modules.
2. Sensitivity is defined as signal = noise. Averaging will improve sensitivity by 10 log (averaging factor).
3. Channel isolation is the coherent leakage from the reference channel to the test channel.
4. At the input of test and reference isolators in front of the mixers.

Maximum inputs

Maximum RF input power to mixers	+20 dBm (CW)
	+24 dBm (pulsed at ≤ 1 µs)
Maximum LO input power to mixers	+20 dBm
Required LO power	+14 to +18 dBm

Remote mixer distances

Refer to the *Antenna Measurement Systems Configuration Guide* (HP literature number 5967-6042E) for assistance in calculating the distances that mixers can be remotely located from the HP 85309A LO/IF distribution unit.

Millimeter-wave frequency source and mixer characteristics

Tables 19 and 20 identify the input and output characteristics of the HP 83550 series millimeter-wave source modules and HP 11970 series mixers.

Table 19. Millimeter-wave source module input/output characteristics

Millimeter source module	Output frequency	Millimeter-wave output	Harmonic number	Input frequency	RF input level
HP 83554A	26.5 to 40 GHz	7 dBm	2	13.25 to 20.0 GHz	+17 dBm
HP 83555A	33 to 50 GHz	3 dBm	3	11.0 to 16.7 GHz	+17 dBm
HP 83556A	40 to 60 GHz	3 dBm	3	13.3 to 20.0 GHz	+17 dBm
HP 83557A	50 to75 GHz	3 dBm	4	12.5 to 18.75 GHz	+17 dBm
HP 83558A	75 to 110 GHz	0 dBm	6	12.5 to 18.33 GHz	+17 dBm

Table 20. Input/output characteristics of HP 11970 series mixers

Mixer	RF frequency range (GHz)	Max input at 1 dB[1] compression (dBm)	Harmonic number	LO frequency range (GHz)	LO power level (dBm)
HP 11970A	26.5 to 40	–5	8	3.27 to 4.96	+16 ±2
HP 11970Q	33 to 50	–7	10	3.27 to 4.97	+16 ±2
HP 11970U	40 to 60	–7	10	3.97 to 5.97	+16 ±2
HP 11970V	50 to 75	–3	14	3.55 to 5.33	+16 ±2
HP 11970W	75 to 110	–1	18	4.15 to 6.09	+16 ±2

Options

Option 001 adds a second test channel, providing a total of two test channels and one reference channel.

Option 002 adds two additional test channels, providing a total of three test channels and one reference channel.

1. Refer to the HP 8530A/85310A specifications for the 0.1 dB compression level.

HP 85326A millimeter-wave interface kit

Description

The HP 85326A millimeter-wave interface kit contains all the frequency band-independent hardware necessary to interface an HP 85325A millimeter-wave subsystem to an HP 85309A LO/IF distribution unit. Together these items comprise a millimeter-wave frequency downconverter, which will provide a 20 MHz IF signal that can be measured by the HP 8530A microwave receiver. The HP 85326A consists of a test module, a reference module, and four SMA male-to-male cables (HP part number 5061-5458).

The test module contains a slope pad in the LO path, and a signal diplexer. The slope pad compensates for variations in LO signal generator power with frequency, and the diplexer combines the IF signal onto the LO signal path to facilitate passing both signals through a rotary joint.

The reference module contains a slope pad, coupler, and detector. The slope pad compensates for variations in LO signal generator power with frequency. The coupler couples off a small portion of the LO signal, which is detected by the diode detector and fed back to the HP 85309A leveling loop to insure that leveled power is provided to the LO port of the mixer.

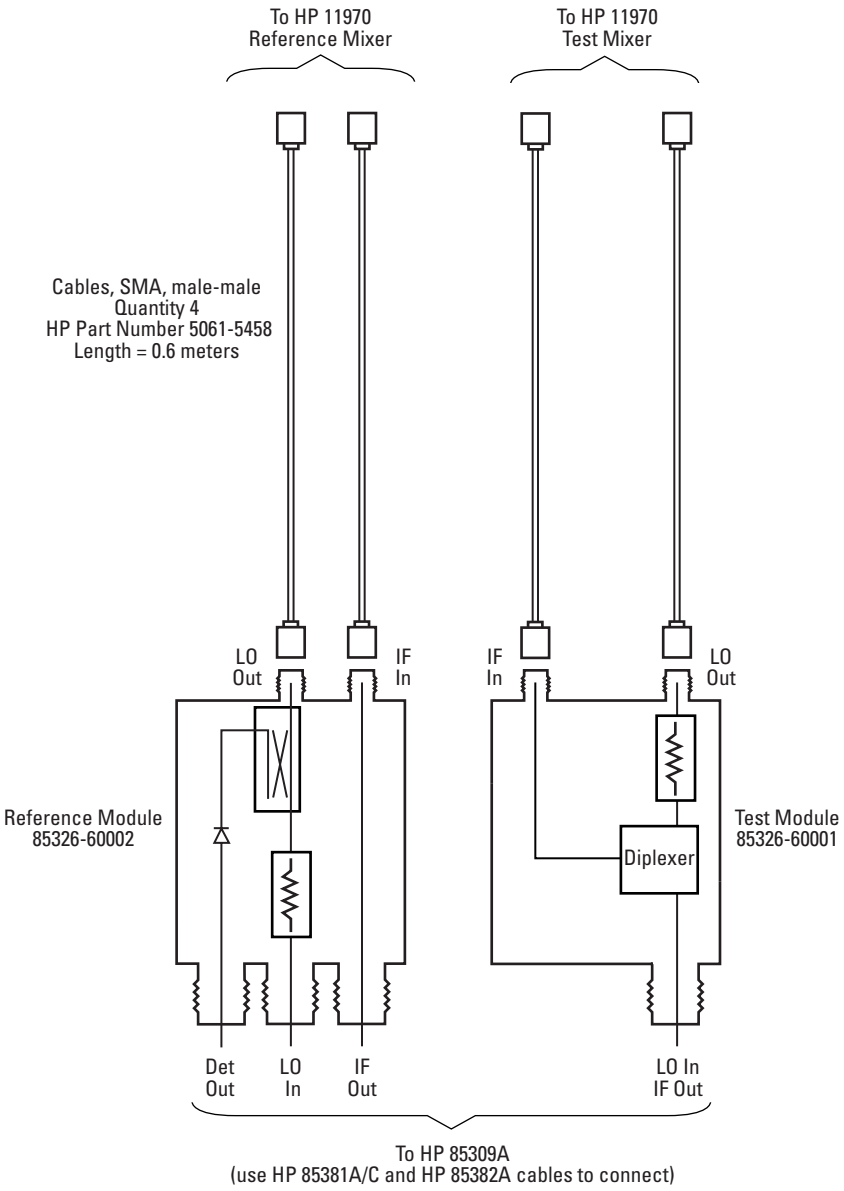
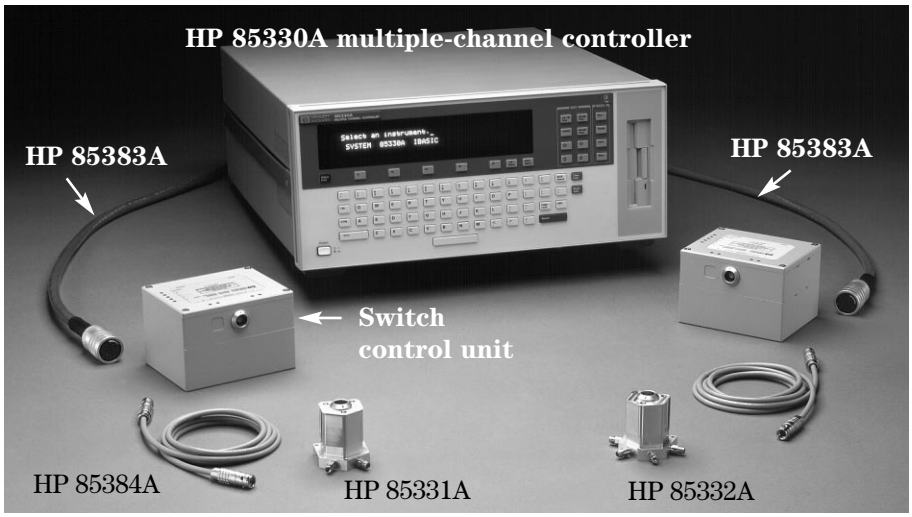


Figure 24.
HP 85326A millimeter-wave interface kit

HP 85330A multiple-channel controller



HP 85331A 1P2T PIN switch (0.045 to 40 GHz)
HP 85332A 1P4T PIN switch (0.045 to 40 GHz)

Multiple-channel measurements

The HP 85330A multiple-channel controller orchestrates the data acquisition of high-speed, multiple-channel, multiple-frequency measurements in fully automated systems. The multiple-channel controller provides sequencing control for the various PIN switch states and switching commands to the PIN switches (via the switch control units). When the positioning system triggers the multiple-channel controller, the controller synchronizes data flow from the PIN switches into the microwave receiver.

The HP 85331A and 85332A PIN switches offer the ability to switch between test channels quickly. These high-performance PIN switches have 90 dB of isolation, low loss, and a 45 MHz to 40 GHz bandwidth. They are absorptive, providing a good impedance match, which is key to achieving accurate measurements. The switches are small in size and weather resistant.

Application flexibility

Far-field antenna measurements

These products are ideally suited for antennas with multiple test ports, or applications that require measuring the co- and cross-polarization response. One PIN switch can switch transmit polarization, and a second PIN switch can switch between the separate test ports of the antenna. With this technique, the co- and cross-polarization response of each test port can be measured in one rotation of the antenna.

Near-field antenna measurements

For near-field applications, both the co- and cross-polarized response of an antenna can be measured at multiple frequencies in a single scan across the antenna. For the dual polarized response, a PIN switch can be used to rapidly switch between the two probe polarizations. The HP 85330A can optionally be configured to provide TTL control signals to change the phase states of the antenna being tested, eliminating the need for separate control.

Radar cross-section measurements

For Radar Cross-Section (RCS) applications, the ability to rapidly switch transmit and receive polarization allows full polarimetric RCS measurements to be made quickly and easily. The greater frequency agility provided by the HP 85330A improves measurement throughput.

Fast frequency switching

The HP 85330A multiple-channel controller maximizes the frequency agility of a measurement system by directly triggering the RF and LO sources with a hardware trigger, allowing the sources to switch at their fastest rate (see Figure 27).

System interconnection

A typical multiple-channel configuration is shown in Figure 25. The switch control unit can be separated from the HP 85330A by up to 50 meters using a local control cable. The PIN switches can be separated from the switch control units by up to 10 meters using a switch drive cable. The hardware trigger of the HP 85330A directly controls other instruments in the system, as illustrated in Figure 27. A single HP 85330A can provide control for a system length of 50 meters or less. Above 50 meters, two HP 85330A controllers are needed.

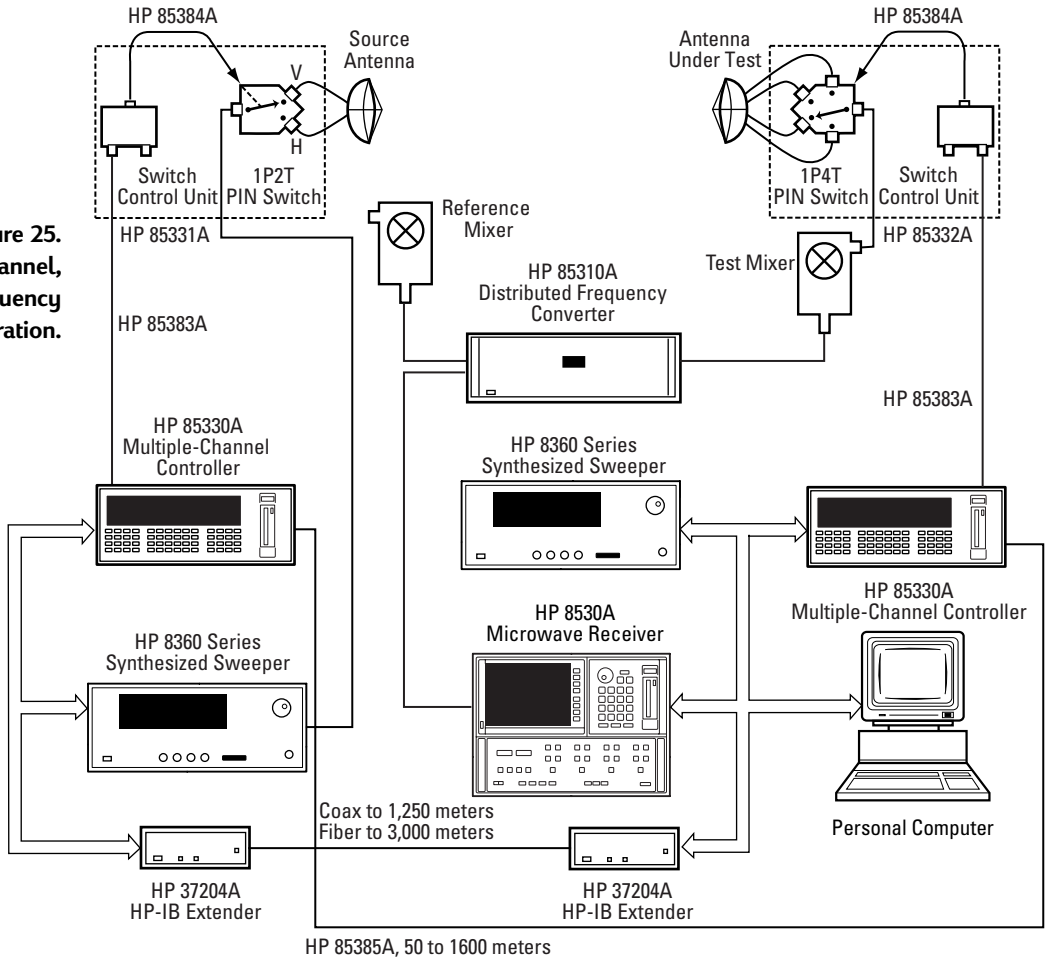


Figure 25.
A typical multiple-channel, multiple-frequency system configuration.

Complex switch configurations

Complex PIN switch trees with more than 128 outputs can be easily configured. Each switch control unit can be configured to control up to three PIN switches. The HP 85330A multiple-channel controller selects the appropriate switch states, controls the switches, and sequences the data into the receiver, simplifying the measurement of complex multiport devices.

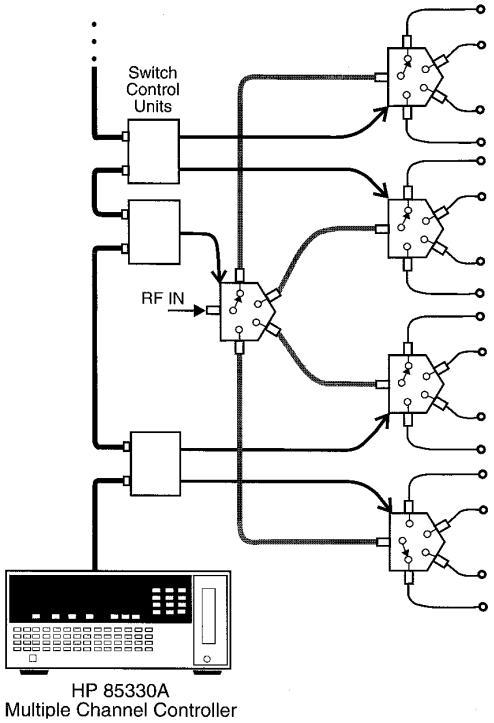


Figure 26. Example 1P16T switch configuration constructed from modular components

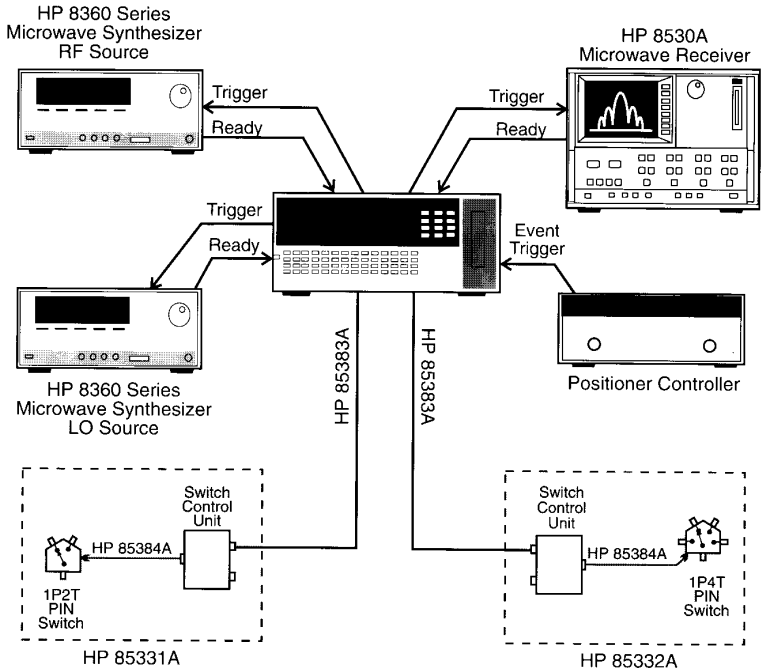


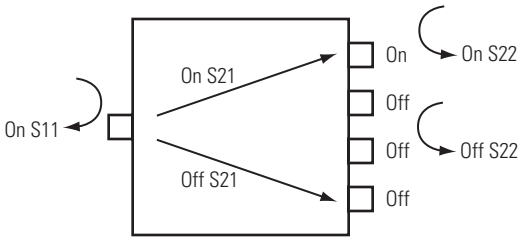
Figure 27. Typical interconnections between the HP 85330A multiple-channel controller and the other instruments in the system

Switch specifications

Table 21. HP 85331A/32A specifications

Model number	Frequency range (GHz)	ON S21 (db)	OFF S21 (db)	OFF S22 (db)	ON S22 (db)	ON S11 (db)	Max power (dBm)
HP 85331A 1P2T	0.045 to 0.5	–2.0	–85	–19.0	–10.0	–10.0	+27
	0.5 to 18	–4.5	–90	–19.0	–10.0	–10.0	+27
	18 to 26.5	–6.0	–90	–12.5	–6.0	–5.5	+27
	26.5 to 40	–10.0	–85	–10.0	–6.0	–4.5	+27
HP 85332A 1P4T	0.045 to 0.5	–2.0	–85	–19.0	–9.0	–10.0	+27
	0.5 to 18	–4.5	–90	–19.0	–9.0	–10.0	+27
	18 to 26.5	–7.0	–90	–12.5	–5.0	–5.5	+27
	26.5 to 40	–12.0	–85	–10.0	–4.5	–4.0	+27

Figure 28. Switch port match definitions for switch on/off states



Other information

HP 85330A multiple-channel controller

Environmental

Operating conditions

Temperature	0°C to 55° (32° to 131°F)
Humidity	5% to 95% at 40°C or less (non-condensing)

Non-operating conditions

Temperature	–40° to 70°C (–40° to 158°F)
Humidity	5% to 95% at 65°C or less (non-condensing)

Power

100, 120, 220, 240 VAC, ±10%, 47.5 to 66 Hz 78 - 107 VA

Size

42.6 cm (16.75 in) W x 17.7 cm (7.0 in) H x 51.0 cm (20.1 in) D

Weight

11.8 kg (26 lbs)

Other information
continued

HP 85331A 1P2T absorptive PIN switch
HP 85332A 1P4T absorptive PIN switch

Connectors on PIN switch
All RF ports are 2.4 mm female (a 2.4 mm male to 3.5 mm female adapter is provided for all RF ports)

Size and weight
PIN switch
65 mm (2.6 in) x 70 mm (2.75 in) x 70 mm (2.75 in)
Approximately 0.35 kg (0.7 lbs)
Switch control unit
122 mm (4.8 in) x 96 mm (3.8 in) x 80 mm (3.2 in)
Approximately 1.32 kg (2.9 lbs)

Environmental
Operating conditions
Temperature –20° to 55°C (–4° to 131°F)
Humidity 5% to 95% at 40°C or less (non-condensing)
Non-operating conditions
Temperature –40° to 70°C (–40° to 158°F)
Humidity 5% to 95% at 65°C or less (non-condensing)

Power
Supplied by the HP 85330A multiple-channel controller

HP 85383A control cable
HP 85383B expansion cable
HP 85384A PIN switch control cable
HP 85385A remote trigger cable

HP 85383A control cable

The HP 85383A control cable is used for RF switching applications in which multiple test channels need to be measured. In these applications, HP 85331A/32A solid-state PIN switches are used. The HP 85383A control cable carries TTL logic signals and DC power from the HP 85330A multiple-channel controller to the switch control unit. The cable is available in five optional lengths:

Option 002	2-meter length
Option 005	5-meter length
Option 010	10-meter length
Option 020	20-meter length
Option 050	50-meter length

The maximum length is 50 meters, since longer cables would have excessive voltage drop. If switches need to be remotely located greater than 50 meters away, the HP 85384A cable will provide an additional 20 meters of length. For greater distances, two HP 85330A multiple-channel controllers can be used in a master/slave configuration, with the HP 85385A cable providing synchronization between the two controllers.

Switch control unit

The switch control unit is included with the HP 85331A or 85332A PIN switch. It decodes control signals from the HP 85330A multiple-channel controller to determine if a switch is being addressed, and then provides drive current to close the appropriate PIN switch.

HP 85383B expansion cable for switch control unit

The expansion cable is used for interconnecting multiple switch control units. The cable serves to distribute the control signals from the HP 85330A multiple-channel controller to multiple switch control units. This is used in applications where switch trees of more than four switch positions are configured from multiple switches and switch control units. Refer to the HP 85330A section in this catalog for information on constructing large switch trees (up to 64 or more positions).

HP 85384A PIN switch control cable

This control cable is used for RF switching applications in which multiple test channels are measured. In these applications, HP 85331A/32A solid-state PIN switches are used. The HP 85384A control cable carries DC drive current from the switch control unit to the solid-state PIN switches. The cable also carries switch closure feedback information back to the switch control unit. The cable is available in four optional lengths:

Option 001 1-meter length
Option 002 2-meter length
Option 005 5-meter length
Option 010 10-meter length

The maximum length is 10 meters, since longer cables would have excessive voltage drop. Adequate current and voltage are required to drive the PIN switches. If switches need to be remotely located more than 10 meters away, a longer HP 85383A cable can be used. If this is not long enough, two HP 85330A multiple-channel controllers can be used in a master/slave configuration, with the HP 85385A cable providing synchronization between the two controllers.

HP 85385A remote trigger cable

This cable is used when two HP 85330A multiple-channel controllers are placed in a master/slave configuration. The cable provides synchronization between the two controllers. The cable is a shielded twisted pair of wires, used to transmit a differential TTL signal. Because the cable lengths for this type of cable vary widely, this product is not available as a standard product; it must be ordered as a special option. Contact your HP sales representative for ordering assistance.

HP 85381A/C/D and 85382A microwave cables

The HP 85381A/C/D/82A microwave cables are rugged, high-performance cables designed for antenna and RCS measurement applications. They are primarily used with the HP 85310A distributed frequency converter, but are also suitable for other applications as well. These cables can be used indoors or outdoors.

Available lengths

Cables are available in 1-meter increments from 1 to 20 meters. A 0.5-meter length is also available.

Specifications

HP 85381A microwave cable

This flexible cable is for applications that require the ability to bend easily. It is primarily used to route the LO signal from the HP 85309A LO/IF distribution unit to the test and reference mixers. It is also well suited as a general purpose DC to 18 GHz microwave cable.

Connectors available	type-N male and female, SMA male and female.
Frequency range	DC to 18 GHz
Insertion loss	refer to insertion loss curves
Typical return loss	12 dB
Dielectric	air-spaced teflon
Outer jacket	fluorinated ethylene propylene
Cable diameter[1]	8 mm (0.3 in)
Minimum bend radius	5 cm (2 in)

HP 85381C microwave cable

This flexible cable is for applications that require the ability to bend easily. It is primarily used to route DC to 26.5 GHz signals in antenna and RCS measurement systems. It can be used to carry the LO signal from the HP 85309A LO/IF distribution unit to the test and reference mixers. It is also well suited as a general purpose DC to 26.5 GHz microwave cable.

Connectors available	type-N male and female, 3.5 mm male and female, SMA male and female.
Frequency range	
Precision 3.5 mm	DC to 26.5 GHz
Precision type-N	DC to 18.0 GHz
Insertion loss	refer to insertion loss curves.
Typical return loss	
Precision 3.5 mm	18 dB
Precision type-N	17 dB
Dielectric	polytetra-floroethylene tape
Outer jacket	black polyurethane
Cable diameter[1]	7 mm (5/16 in)
Minimum bend radius	5 cm (2 in)

1. Excludes labels and connectors.

HP 85381D microwave cable

This flexible cable is for applications that require the ability to bend easily. It is primarily used in antenna and RCS measurement systems to route signals in the 26.5 to 50 GHz frequency range. Because of the higher loss characteristics (and cost) of this cable, it is not generally used to route signals below 26.5 GHz. It can be used as a general-purpose high-performance cable for signals in the 26.5 to 50 GHz range.

Connectors available	2.4 mm male, 2.4 mm female
Frequency range	DC to 50 GHz
Insertion loss	refer to insertion loss curves
Typical return loss	12 dB
Dielectric	air spaced teflon
Outer jacket	black polyolefin
Cable diameter[1]	4 mm (3/16 in)
Minimum bend radius	5 cm (2 in)

HP 85382A low-frequency cable

This is a general-purpose low-frequency flexible cable. On antenna ranges it is primarily used to route the 20 MHz IF signals from the test and reference mixers to the HP 85309A LO/IF distribution unit, and from this unit to the HP 8530A microwave receiver. The cable is also used to tie the 10 MHz reference signals of the RF and LO sources and the receiver together in applications where the distances are relatively short. It is not necessary to tie the reference signals together.

Connectors available	BNC female, BNC male, type-N male.
Frequency range	DC to 1.0 GHz
Typical insertion loss at 25°C	
At 10 MHz	<1.6 dB/100 feet (30.48 meters)
At 20 MHz	<2.7 dB/100 feet (30.48 meters)
Typical impedance at 25°C	50 ±1 ohms
Dielectric	solid polyethylene
Outer jacket	black polyethylene IIIA
Cable diameter[1]	6 mm (1.4 in)

Cable insertion loss curves

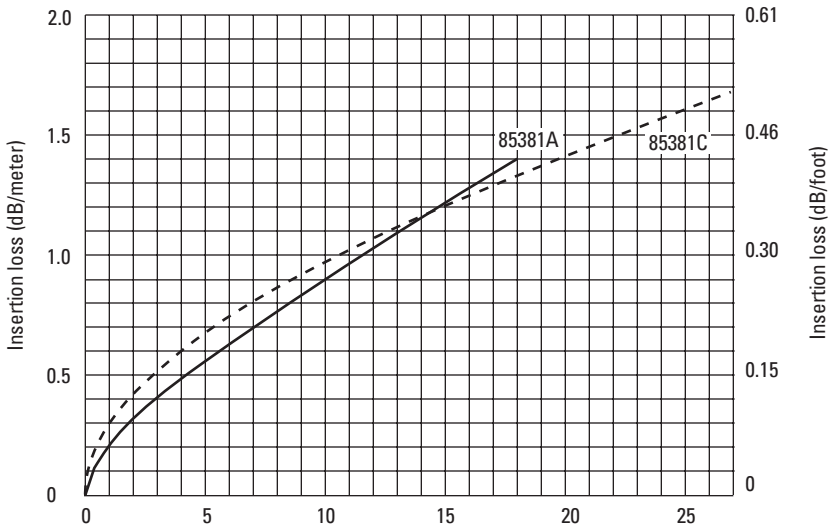


Figure 29. Typical insertion loss for HP 85381 series cables

1. Excludes labels and connectors.

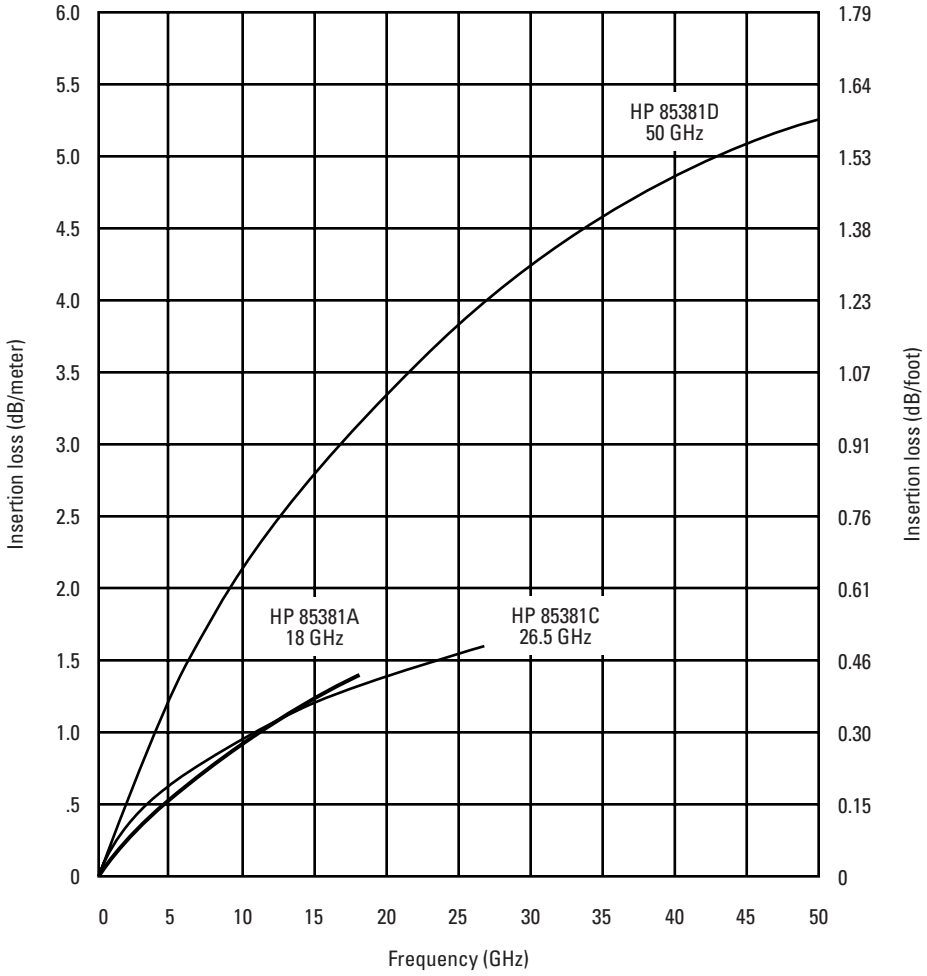


Figure 30. HP 85381A/C/D cables; typical insertion loss

Selecting the proper cable

Maximum frequency and flexibility are the two main criteria for selecting cables. If temperature and phase stability are important, buy cables that have the same length and model number. For example, the LO cables from the HP 85309A LO/IF distribution unit to the test and reference mixers should have the same model number and length.

When using a rotary joint

When using cables with a positioning system that has a rotary joint, care must be used to insure that the insertion losses of the LO signal to the test mixer and to the reference mixer are nearly equal. Rotary joints will introduce additional insertion loss, and often a microwave cable is used within the positioner in series with the rotary joint. This difference can be compensated by ordering additional cable length for the reference mixer LO cable to compensate for the additional loss of the rotary joint, and internal cable (if applicable) in the positioner.

Cable lengths

Determine the type and lengths (in meters) of cable required. Order the cable by type—either HP 85381A, C, D, or HP 85382A. Specify a length option as Cxx, where 'xx' specifies the length of the cable in meters. To convert feet to meters, multiply the number of feet by 0.3048. To order a one-half meter cable, specify Option C00.

Cable connectors

Table 22 illustrates the connectors available for each cable type, and the corresponding option to specify the connectors when ordering a cable.

Table 22. Cable connector options

	Connector option			
Connector type	**HP 85381A**	**HP 85381C**	**HP 85381D**	**HP 85382A**
Type-N male	CNM	CNM		CNM
Type-N female	CNF	CNF		
3.5 mm male		C3M		
3.5 mm female		C3F		
SMA male	CSM	CSM		
SMA female	CSF	CSF		
BNC male				CBM
BNC female				CBF
2.4 mm male			C2M	
2.4 mm female			C2F	

Ordering examples

Example 1

You wish to order a 7-meter (23-foot) cable for use up to 18 GHz. The cable must have a Type-N (male) connector on one end, and an SMA (male) on the other end. In this case, you would order HP 85381A Options C07, CNM, and CSM.

Example 2

You wish to order a 9-meter flexible cable. It will be used to 26.5 GHz and must have 3.5 mm (male) connectors on each end. In this case, you would order HP 85381C Options C09, C3M, and C3M.

Other manufacturers' cables

Other manufacturers have microwave cables that can be used in antenna and RCS applications. Selection considerations include frequency range, durability, ruggedness, microwave performance, and price.

HP 85395A/B/C & 85396A upgrade kits

You can upgrade your HP 8510 network analyzer to the HP 8530A microwave receiver with an upgrade kit.

Overview

If you have an HP 8510 network analyzer, you already have the heart of an antenna measurement receiver. Any HP 8510 network analyzer can be upgraded to the HP 8530A microwave receiver, and also retain network analyzer capability.

Features

The HP 8530A is optimized for antenna and RCS measurements. It has superb microwave performance, the ability to measure and display manual antenna patterns, and the ability to perform multiple-channel measurements.

Upgrade kit selection

The diagram in Figure 31 shows the upgrade paths provided by the HP 85395A/B/C and 85396A upgrade kits.

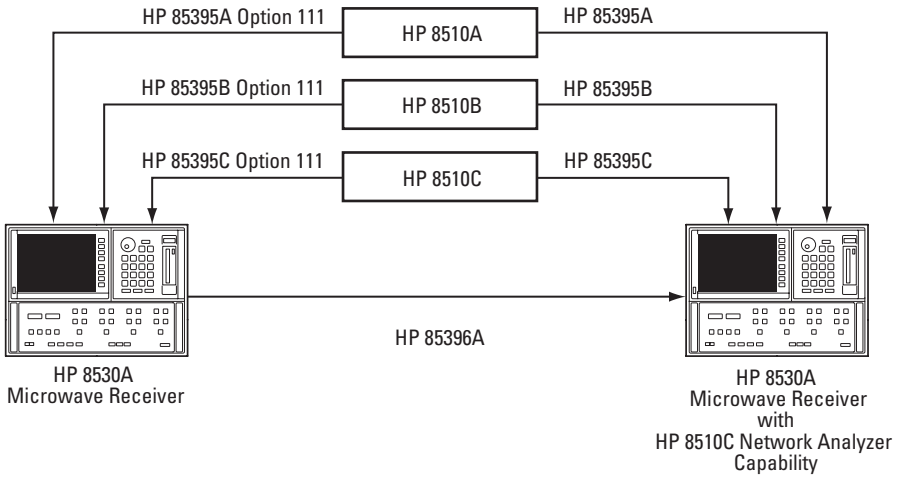


Figure 31. Upgrade paths

Ordering information

HP 85395A upgrade kit	Upgrade any HP 8510A to the HP 8530A. Retains network analyzer capability.
HP 85395B upgrade kit	Upgrades any HP 8510B to the HP 8530A. Retains network analyzer capability.
HP 85395C upgrade kit	Upgrades any HP 8510C to the HP 8530A. Retains network analyzer capability.
Option 010 (time domain)	For network analyzers with time domain; adds time-domain capability to the HP 8530A receiver.
Option 111 (delete network analyzer capability)	If the upgraded unit will be used exclusively as a receiver, this option deletes its network analyzer capabilities, reducing the cost of the upgrade.
HP 85396A upgrade kit	Adds HP 8510C network analyzer capability to any HP 8530A.
Option 010 (time domain)	Adds time-domain capability to the HP 85396A upgrade kit.

Other information

The serial number of the HP 8510 to be upgraded is required when submitting the order. For rack-mounted systems, allow 1.75 inches (4.5 cm) of additional rack space for HP 85395A/B upgrades.

Measurement automation software

HP's Channel Partner

Hewlett-Packard partners with Nearfield Systems, Inc. (NSI) to provide antenna measurement systems and solutions. Both companies have products and services that are complementary, and we work closely to insure our products will provide the best solutions to your antenna measurement needs. The two companies have worked together for over ten years, with many joint installations worldwide.

Far-field and near-field software

NSI provides far-field and near-field measurement automation software, which operates under Windows® 98 or NT® 4.0. The software is available in two different editions: Standard and Professional. Each edition provides various programming options.

The Standard edition provides the common features used in everyday far-field antenna measurements. The Professional edition adds a powerful scripting tool for making custom acquisition and processing scripts, which give the user complete and automated control of the NSI software. The Professional edition also exposes the script commands directly to any program through Microsoft®'s automation interface, allowing programming and control from another program.

For more information

Please contact NSI for complete information on software capabilities:

Nearfield Systems, Inc.
1330 E. 223rd Street, Bldg. 524
Carson, CA 90745
Phone: (310) 518-4277
FAX: (310) 518-4279
http://www.nearfield.com

Other software providers

Other antenna systems integrators have measurement automation software for Hewlett-Packard antenna test instrumentation. Contact these providers directly or Hewlett-Packard for additional information.

Related literature

HP 8530A Microwave Receiver (technical specifications), HP literature number 5091-0407E.

The Heart of Your Antenna/RCS Measurement System, HP literature number 5091-0699E.

Upgrade your HP 8510 to the receiver optimized for antenna and RCS measurements, HP literature number 5091-0948E.

HP 85330A Multiple Channel Controller, HP 85331A 1P2T PIN Switch 0.045-40 GHz, HP 85332A 1P4T PIN Switch 0.045-40 GHz (technical specifications), HP literature number 5091-9009E.

HP 85370A Antenna Position Encoder (technical specifications), HP literature number 5091-5668E.

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Printed in U.S.A. 10/99
5968-6759E

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