

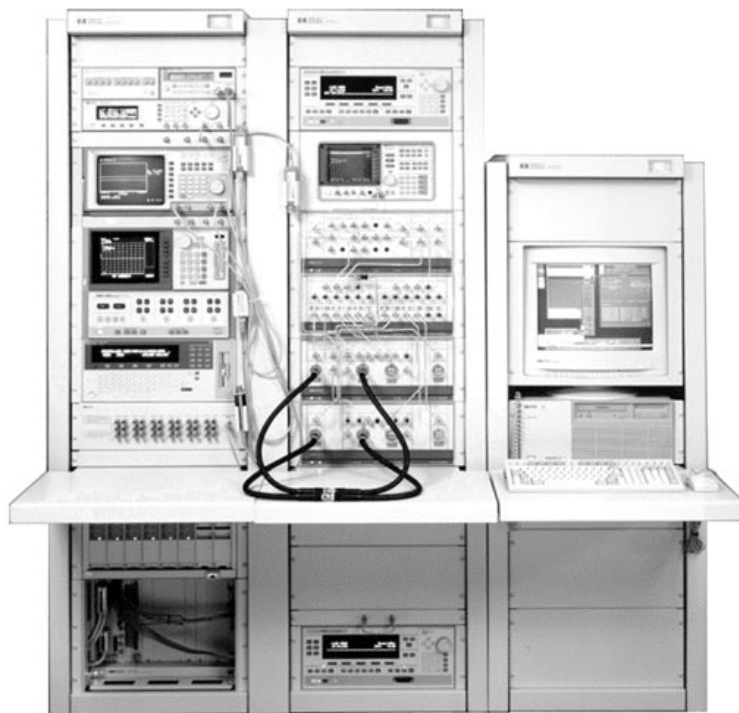
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# HP 85120A Series T/R Module Automated Test Systems

## Product Overview

**A system tailored  
for your application**

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**HP 85120A series  
Transmit/Receive  
module test system**

*An automated test system tailored to the measurement of phased-array T/R Modules and related components, combining high-speed multi-state device control and single connection multiple measurement (SCMM) capability for maximum test throughput.*

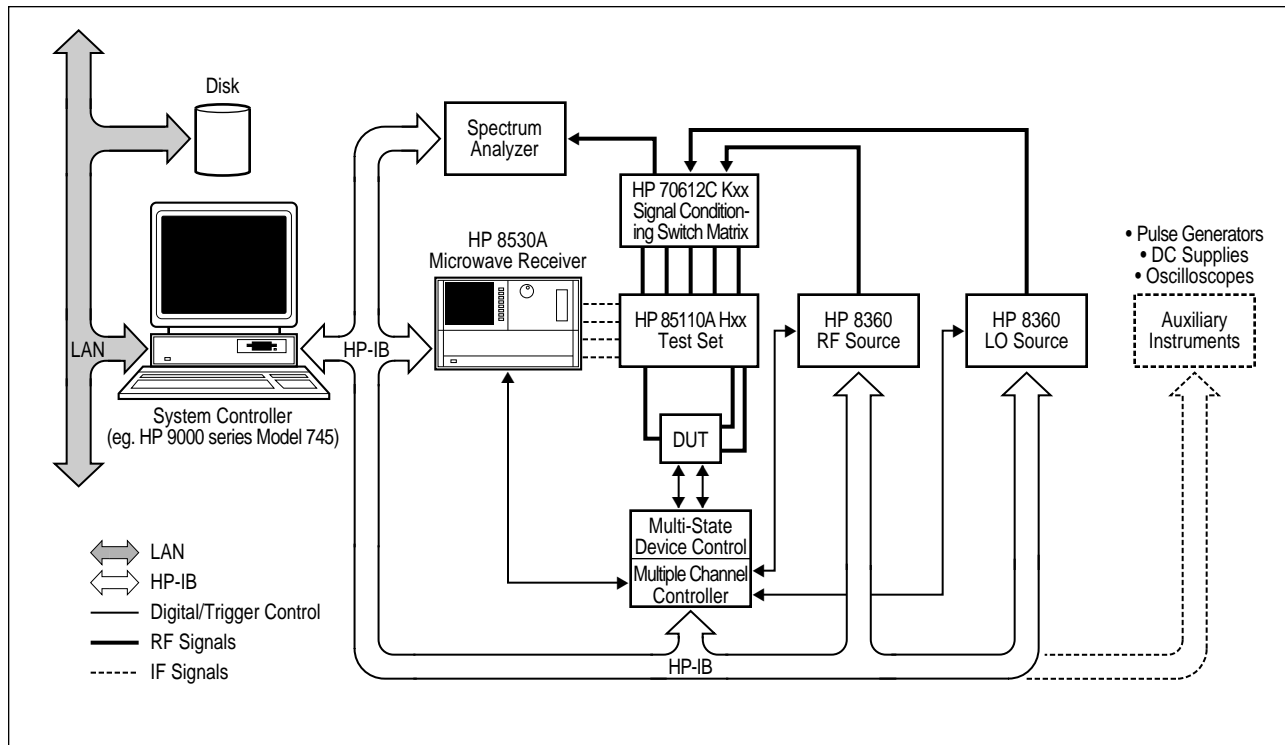
### System overview

HP 85120A series T/R module test systems are designed expressly for complete RF characterization of T/R modules and related MMIC devices. A single-connection multiple-measurement (SCMM) system architecture combines multi-state device control with high-speed measurement software for maximum test throughput. Standard and customized HP instruments and automated test software provide a complete measurement solution for device development or production test.

The HP 85120A series T/R module test systems provide:

- Broad frequency coverage from 2 to 20 GHz, extendable to 50 GHz
- High internal data-acquisition rates of up to 5,000 points per second
- Fully error-corrected S-parameter measurements under CW or pulsed-RF conditions
- Synchronized module or device-state control during data acquisition
- Independent DC, RF, and device-state control for maximum system efficiency
- Industry-standard instrument and computer platforms

## System description



### HP 85120A series T/R module test system architecture

The HP 85120A series combines the high-speed measurement capabilities of an HP 8530A microwave receiver with the 85110A Hxx S-parameter test set to provide error-corrected noise figure and CW or pulsed-RF S-parameter measurements. A customized HP 70612C series switch matrix, a high-performance HP spectrum analyzer, and accessory instruments allow a system to be tailored to the specific measurement requirements of T/R modules at the wafer, module, or tray assembly level. These flexible systems permit spectrum analysis, measurement of S-parameters, noise figure, power, and gain compression as a function of frequency, power, bias, device state, or other programmable condition.

### Single-connection multiple-measurement architecture

The HP 85110A test set allows high-performance S-parameter measurements of multiport T/R modules. The test set provides a low-loss RF access path to a customized HP 70612C series switch matrix. This allows a full complement of RF tests to be performed with a single connection to the device under test (DUT). In addition to housing RF cabling and switching, the switch matrix accommodates RF power amplification and signal-conditioning hardware.

### Error-corrected noise figure

For testing low-noise amplifiers that are incorporated in T/R modules, a high-sensitivity RF path through the S-parameter test set permits measurement of DUT noise figure using the HP 8530A microwave receiver. As a result, the system utilizes S-parameter error-correction to enhance the accuracy of a noise-figure measurement.

### Multi-state device control

Central to the system is an HP 85330A multiple-channel controller, which orchestrates the measurement process and permits synchronized control of the state of the T/R module under test. Through the HP-IB programming interface of the controller, a system-controlling computer provides the desired measurement sequence and conditions, including the state of the DUT.

The HP 85330A multiple-channel controller provides a parallel interface and optional serial interface for T/R module state control. The control system allows flexibility in control parameters and conditions, and Hewlett-Packard can provide a custom-designed serial control card to your specifications. Alternatively, a 64-bit parallel output bus allows you to design a parallel-to-serial control scheme and circuitry. The multiple-channel controller pre-loads the next device state during a measurement to maximize data throughput. TTL- and GaAs-compatible outputs are available.

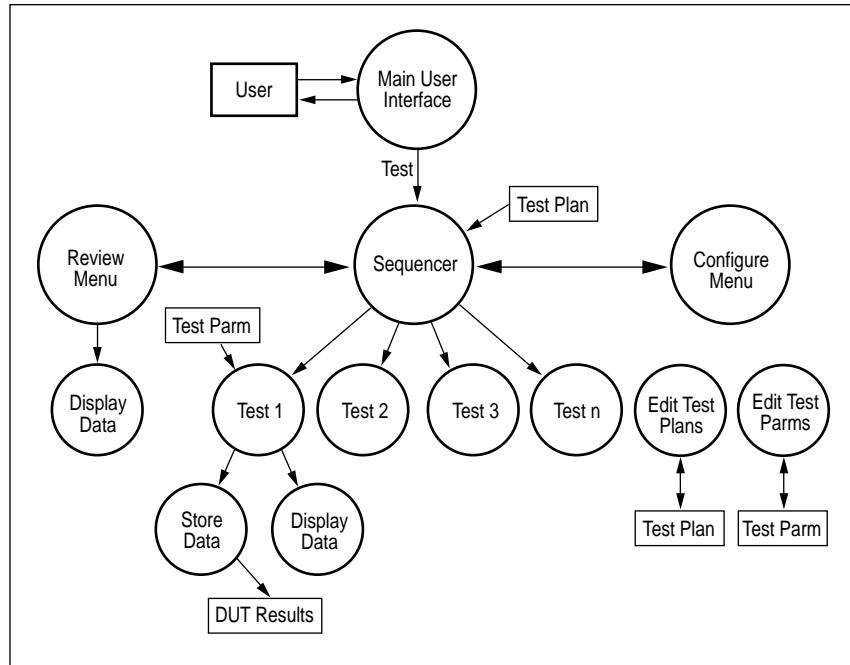
## Complete solutions to your test problems

When you choose an HP test system, you will be able to improve your business results through savings in reduced system development and lifecycle cost which impact the effective test cost of your products. HP system engineers work with your engineering staff to develop a system that meets your development and production test requirements. These systems incorporate the necessary hardware, software, and on-going support to form a complete single-source solution to your measurement problems.

In addition to worldwide system support, HP provides professional program and project management and access to HP personnel with in-depth experience in microwave test and information management. HP also provides registration or certification for expanding quality standards such as MIL-Standard 45662, and ISO 9000. Complete HP test system solutions let you focus your engineering and management resources and competencies on the successful development of your business.

### System software

HP has a full complement of software for HP 85120A system operation that can be specified for completely automated testing. Whether you need software development tools, measurement drivers or a complete test executive, Hewlett-Packard provides tailored software development and consulting services to ensure that your system performs to your requirements.



**HP 85120A series  
test software  
architecture**

### Additional engineering services

The HP 85120A series test systems are designed to allow flexibility in customizing instrument, hardware, and overall system configuration. Hewlett-Packard system engineers work with you to specify a HP 85120A series test system to provide a complete solution to your specific measurement needs. HP also develops or procures specialized test fixtures, part handlers and power supplies to suit your requirements.

### Main system instruments

The HP 85120A series test system includes the following instruments:

- HP 8530A microwave receiver with Option 011 (full HP 8510C compatibility)
- HP 85330A multiple-channel controller
- HP 85110A S-parameter test set
- HP 8360 series synthesized sweepers
- HP 71000 series or HP 8563E spectrum analyzers
- HP 70612C series switch matrix
- HP pulse/function generators
- HP DC system power supplies

## System functional characteristics

### Measurement capabilities

- Error-corrected S-parameters (pulsed-RF or CW)
- Input/output VSWR
- High-power gain
- Error-corrected noise figure
- Spectrum analysis (harmonic distortion and spur measurement)
- Absolute power
- Power-added efficiency

### Operating characteristics

<b>Frequency range:</b>	2 to 20 GHz	Up to 50 GHz for spectrum analysis
Optional ranges:	1 to 18 and 2 to 50 GHz	
<b>RF power range:</b>	-30 to +20 dBm up to 43 dBm (20 W)	Supplied to DUT Received from DUT
<b>RF pulse widths:</b>	1 $\mu$ s to 400 ms	
<b>Receiver dynamic range:</b> <sup>1</sup>	90 dB 70 dB >100 dB	CW S-parameters Pulsed S-parameters Spectrum analysis
<b>Acquisition Speed:</b> <sup>2</sup>		
S-parameters	0.25 msec/point (CW operation) 0.56 msec/point (pulsed operation)	
Noise figure	5 seconds/point to $\pm 0.3$ dB accuracy 2 second/point to $\pm 0.35$ dB accuracy 0.3 sec/point to $\pm 0.6$ dB accuracy	

<sup>1</sup> Receiver dynamic range is measured from system 0.1 dB compression point to system noise floor, S/N = 1.

<sup>2</sup> Spectrum analysis measurement time is a function of sensitivity and spur search requirements.

### System throughput example

The following cases are typical throughput calculation examples for automated S-parameter and noise figure measurements at five test frequencies. Excluded in the calculation of these measurement times is any overhead related to software operations except data transfer to the system-controlling computer. Module-state programming time is dependent on the number of bits and the clock frequency, and should not add significantly to the overall measurement time.

#### CASE 1

Measurement time for 128 gain states at one phase state and 128 phase states at one gain state repeated at 5 frequencies, including noise figure at  $\pm 0.6$  dB accuracy:

##### Under CW operating conditions:

$[(128 \text{ states} \times 2 \times 0.25 \text{ msec/point} \times 4 \text{ s-parameters}) + 0.3 \text{ sec/noise figure} + 12 \text{ msec/freq}] \times 5 \text{ frequencies} = \mathbf{2.84 \text{ seconds}}$

##### Under pulsed-RF conditions:

$[(128 \text{ states} \times 2 \times 0.56 \text{ msec/point} \times 4 \text{ s-parameters}) + 0.3 \text{ sec/noise figure} + 12 \text{ msec/freq}] \times 5 \text{ frequencies} = \mathbf{4.43 \text{ seconds}}$

#### CASE 2

Measurement time for 256 gain states at one phase state and 256 phase states at one gain state, repeated at 5 frequencies, including noise figure at  $\pm 0.35$  dB accuracy:

##### Under CW operating conditions:

$[(256 \text{ states} \times 2 \times 0.25 \text{ msec/point} \times 4 \text{ s-parameters}) + 2.0 \text{ sec/noise figure} + 12 \text{ msec/freq}] \times 5 \text{ frequencies} = \mathbf{12.62 \text{ seconds}}$

##### Under pulsed-RF conditions:

$[(256 \text{ states} \times 2 \times 0.56 \text{ msec/point} \times 4 \text{ s-parameters}) + 2.0 \text{ sec/noise figure} + 12 \text{ msec/freq}] \times 5 \text{ frequencies} = \mathbf{15.79 \text{ seconds}}$

**Please contact your local HP sales representative for more information on this and other tailored microwave test system solutions available from Hewlett-Packard.**

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