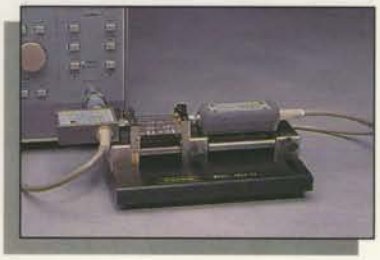
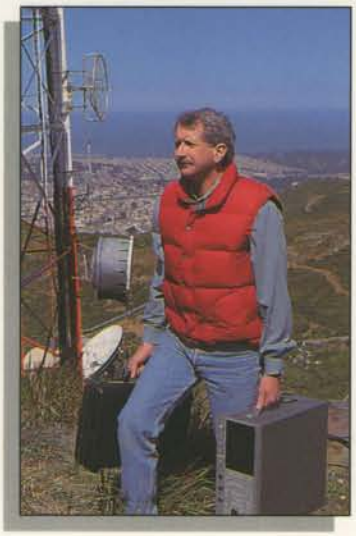
WILTRON

1992 Catalog





Vector Network Analyzers

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Company Overview

You Benefit From Wiltron's Focused Approach

More Than 30 Years of Dedication

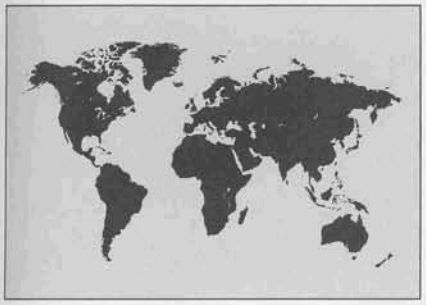
For more than 30 years, Wiltron has dedicated itself to research, design, and manufacture of the finest, most advanced microwave test and measurement instrumentation available. Users worldwide, in R&D labs, calibration labs, manufacturing areas, maintenance areas and universities benefit from Wiltron's focus on microwave test equipment products. Wiltron continues to be successful by answering the current needs of the microwave industry with state of the art solutions.

Continuous Innovation

Many of the features and capability that you have come to expect of todays microwave test instrumentation were Wiltron "Firsts", and were often available many years ahead of our competition. We are proud of our leadership position and we commit to continuing this tradition of being first with even more advanced products.

- *Wiltron's first landmark was a phase-measuring Microwave Network Analyzer in 1962*
- *Introduced first solid state Sweep Generator with internal leveling in 1966*
- *First 10 MHz to 18.5 GHz solid state microwave sweep generator in 1975*
- *In mid-70s Wiltron increased the Sweep Generator range to 40 GHz and was first to add GPIB programmability*
- *First high directivity (40 dB) Bridge/Autotester in 1977*
- *In 1983, Wiltron introduced the first SMA compatible coaxial connector, the K-Connector with 40 GHz capability along with a complete 10 MHz to 40 GHz Network Analyzer System*
- *In 1987, the first 40 GHz Vector Network Analyzer, the Wiltron 360 pioneered many widely accepted advances, including color display, MS-DOS disk drive, fast synthesized sweep, and simultaneous display of all 4 S-parameters*
- *In 1989, Wiltron introduced the first coaxial connector with 60 GHz capability. The Wiltron V-connector is supported by the 360 Series of Vector Network Analyzers*

Company Overview



Wiltron Takes Unusual Care to Assure Your Success

You get unsurpassed quality and reliability with Wiltron products.

Wiltron designs and manufactures the microwave components critical to the performance and reliability you expect. We offer 2 year warranty on all microwave YIG oscillator components to both protect you and to demonstrate our confidence in our reliability.

Wiltron machine shops produce most major assemblies and all precision hardware including our leading edge 60 GHz connector products and instruments.

Serviceability is designed into our products to minimize down time. For example our 6700B family of microwave synthesizers has only 5 potentiometer adjustments.

You Get Total Customer Support

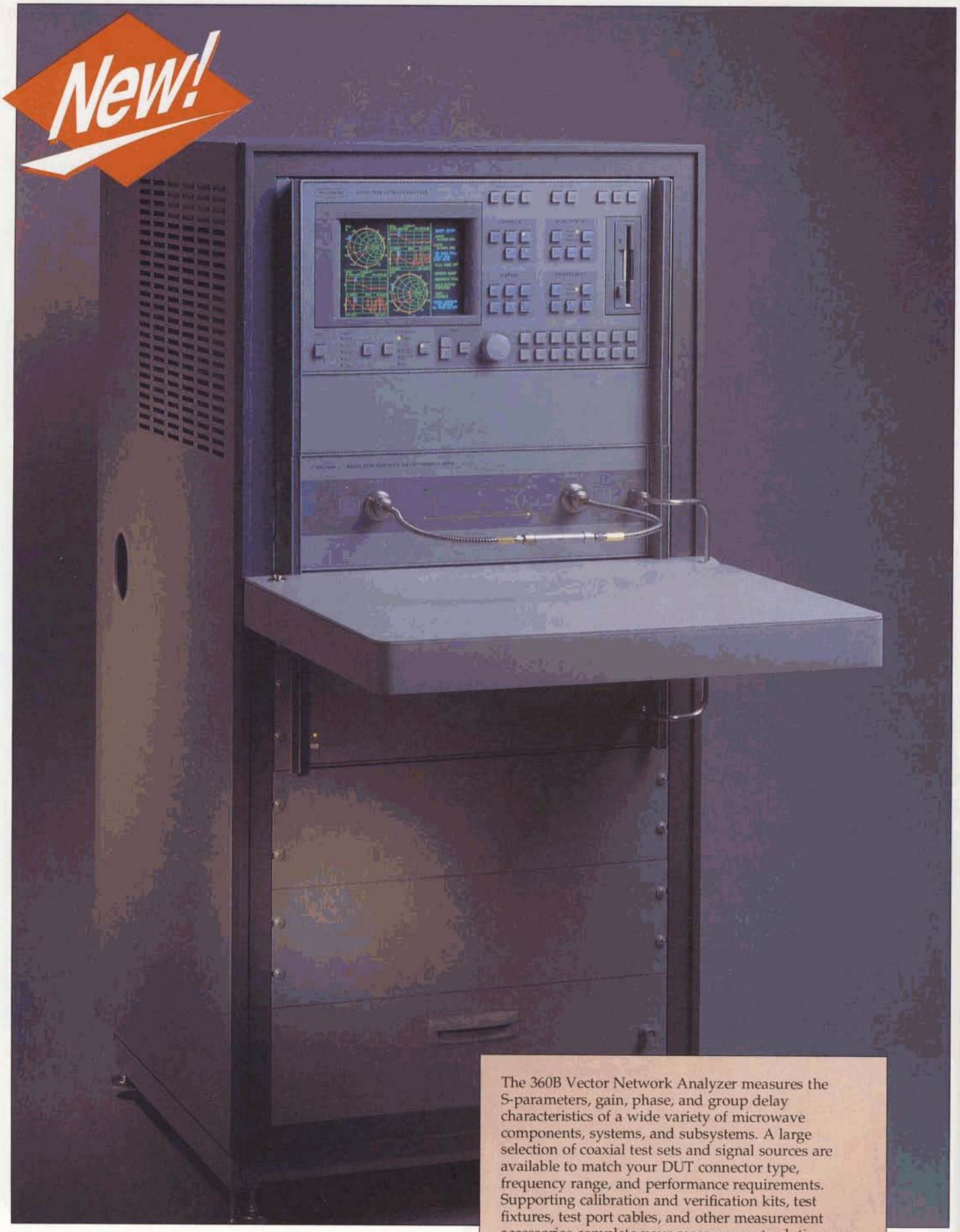
We have equipped, stocked, and staffed service centers around the world to keep your down time to a minimum. Exchange assemblies are available for most instruments to minimize repair costs. Most of our instruments have built-in diagnostics to give you confidence in your results and to help locate problems. Our service centers utilize the latest computer aided repair methods.

Stability from Wiltron's Microwave Focus and International Presence

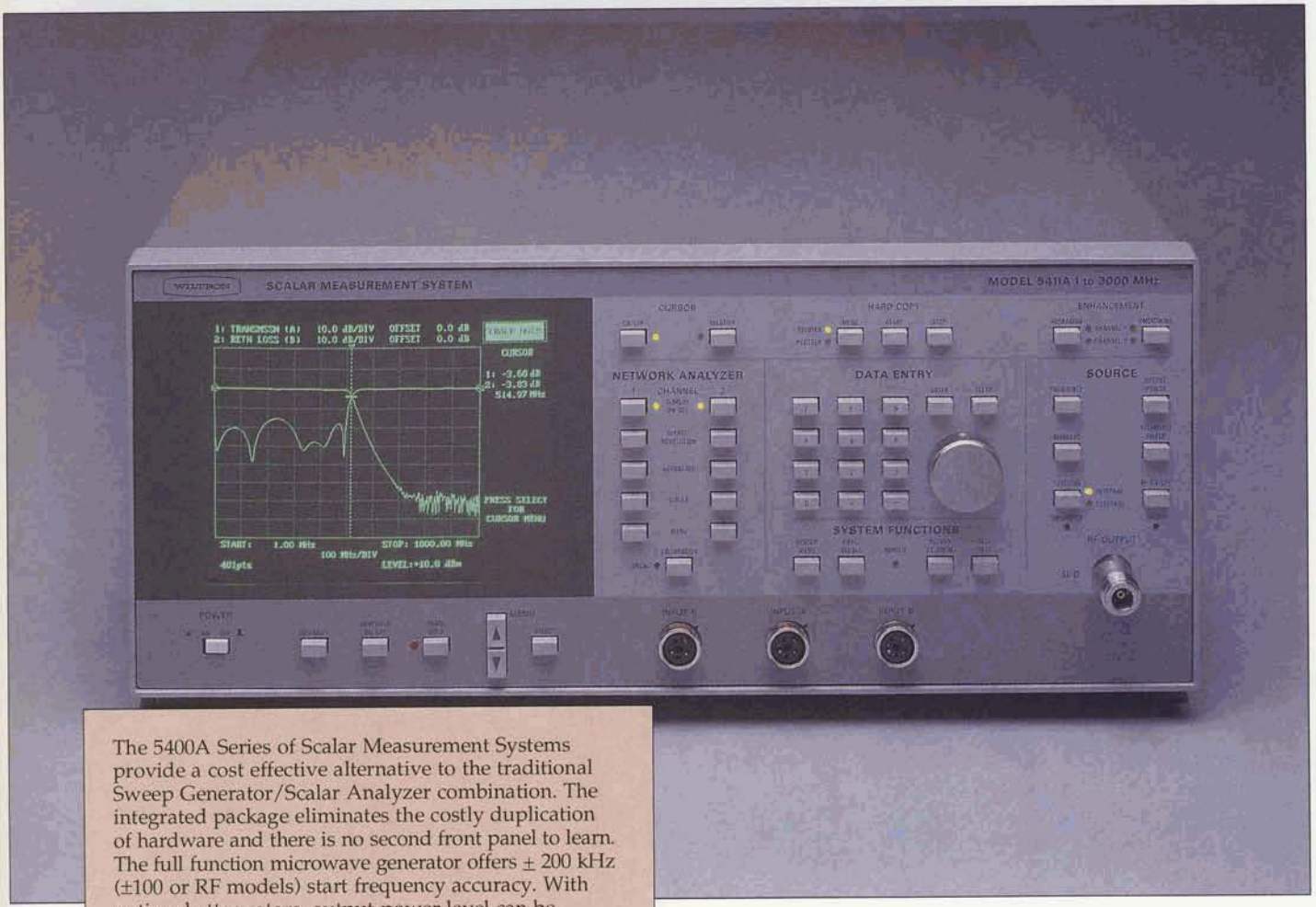
Since 1960, Wiltron has grown at an average rate of 30% per year. Wiltron's international customer base assures continued growth. Wiltron has manufacturing sites in Morgan Hill, California and Stevenage, England. Wiltron was acquired in 1990 by Anritsu Corporation, one of Japan's leading manufacturers of complimentary RF, microwave and optical test equipment. Anritsu Corporation has over $700 million in worldwide sales. Wiltron will remain a separate entity dedicated as it has always been to the microwave industry. Where possible, the two companies hope to combine capabilities to offer advanced microwave products.

Wiltron Continues to Invest in Excellence

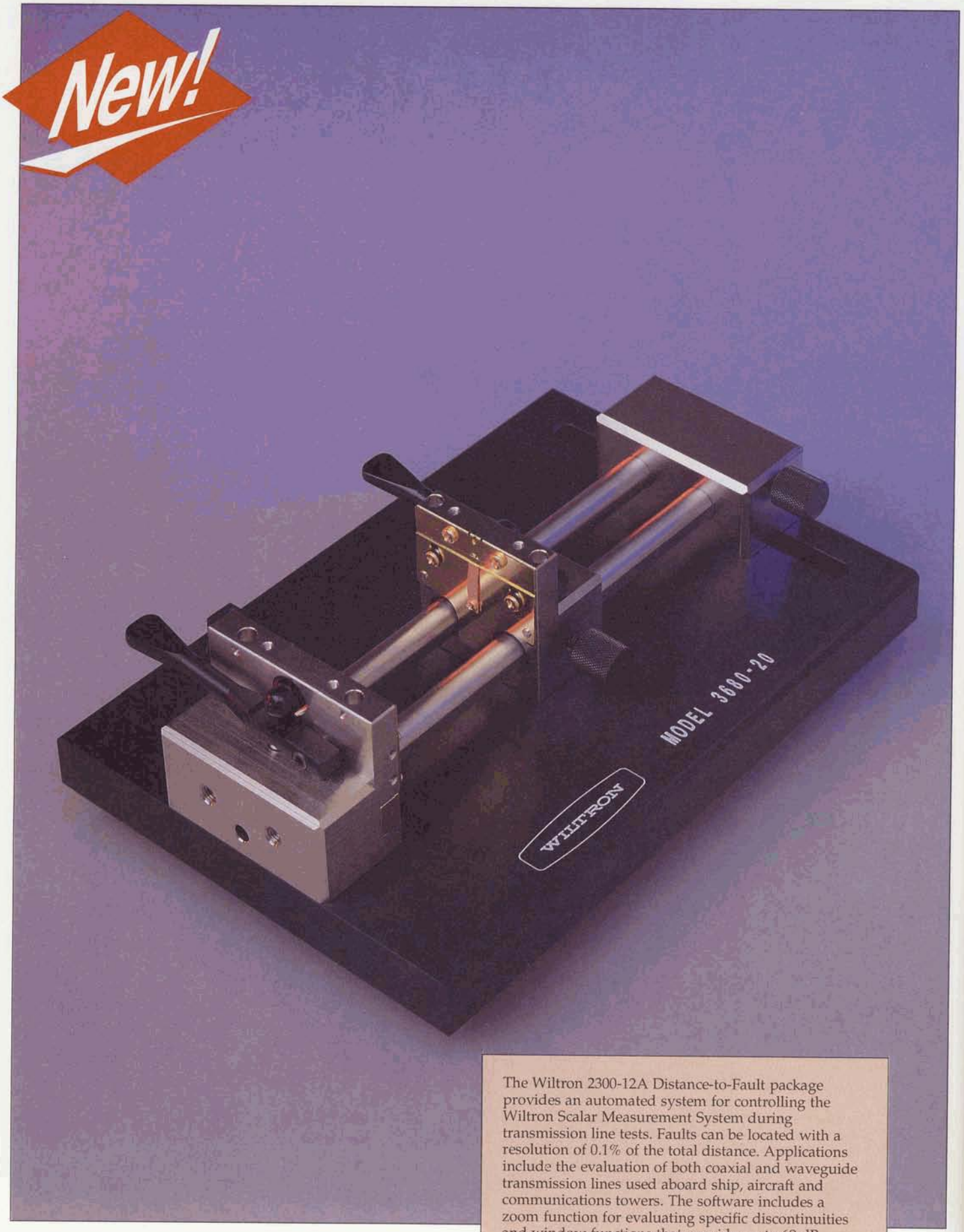
More than 15% of every sales dollar is invested into new designs to assure our leadership position. Our design and manufacturing facilities are divided up into small-company "teams" with a product focus to promote a creative environment and to reduce time for new products to appear. Wiltron believes in the protege system (experienced training novices) to quickly get new employees producing and to improve morale and reduce turnover.



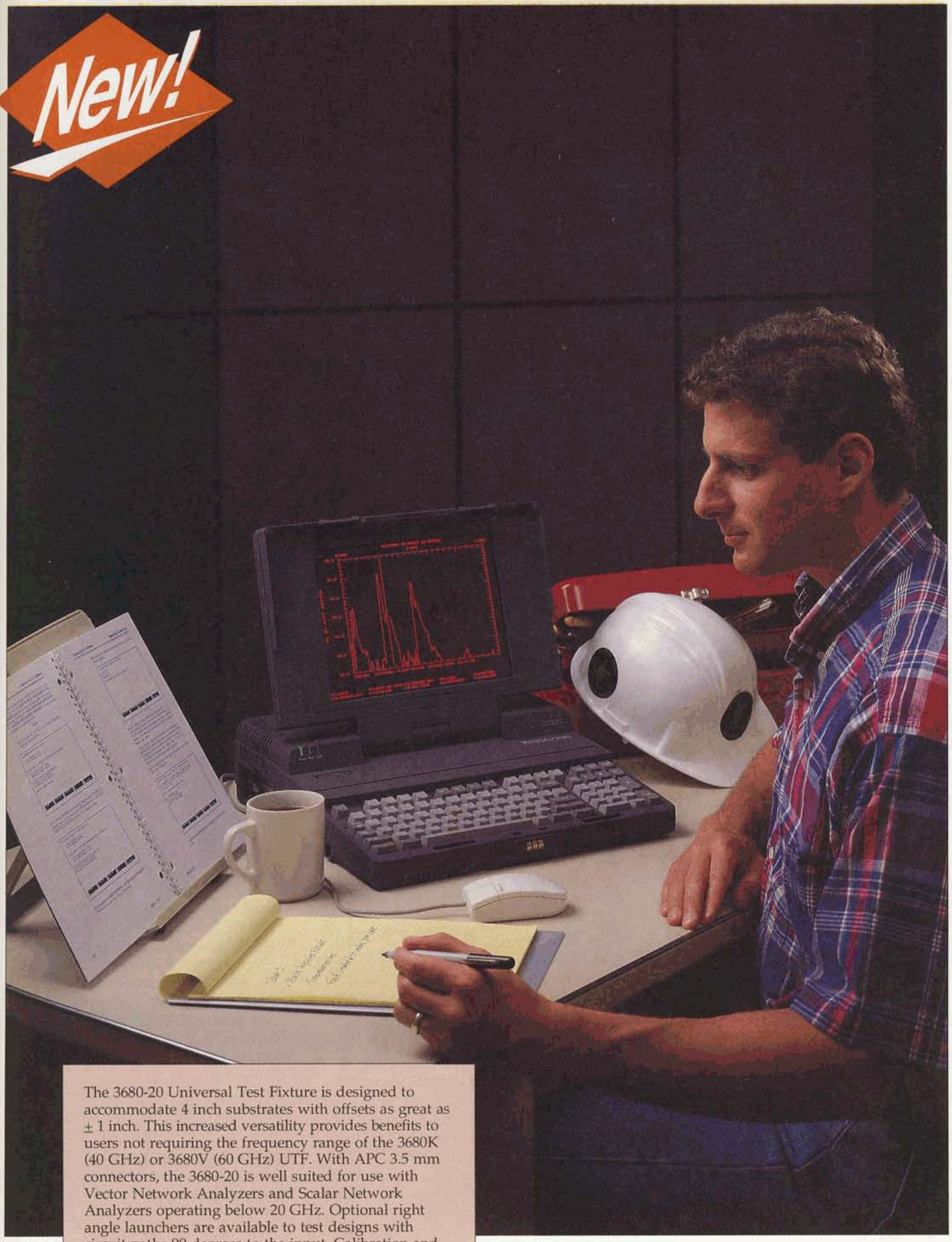
The 360B Vector Network Analyzer measures the S-parameters, gain, phase, and group delay characteristics of a wide variety of microwave components, systems, and subsystems. A large selection of coaxial test sets and signal sources are available to match your DUT connector type, frequency range, and performance requirements. Supporting calibration and verification kits, test fixtures, test port cables, and other measurement accessories complete your measurement solution over the 10 MHz to 110 GHz frequency range.



The 5400A Series of Scalar Measurement Systems provide a cost effective alternative to the traditional Sweep Generator/Scalar Analyzer combination. The integrated package eliminates the costly duplication of hardware and there is no second front panel to learn. The full function microwave generator offers ± 200 kHz (±100 or RF models) start frequency accuracy. With optional attenuators, output power level can be controlled from -70 dBm to maximum leveled power.



The Wiltron 2300-12A Distance-to-Fault package provides an automated system for controlling the Wiltron Scalar Measurement System during transmission line tests. Faults can be located with a resolution of 0.1% of the total distance. Applications include the evaluation of both coaxial and waveguide transmission lines used aboard ship, aircraft and communications towers. The software includes a zoom function for evaluating specific discontinuities and window functions that provide up to 60 dB dynamic range.



The 3680-20 Universal Test Fixture is designed to accommodate 4 inch substrates with offsets as great as ± 1 inch. This increased versatility provides benefits to users not requiring the frequency range of the 3680K (40 GHz) or 3680V (60 GHz) UTF. With APC 3.5 mm connectors, the 3680-20 is well suited for use with Vector Network Analyzers and Scalar Network Analyzers operating below 20 GHz. Optional right angle launchers are available to test designs with circuit paths 90 degrees to the input. Calibration and Verification kits ensure quality measurements.

Alphabetical Index

Model Number Index

Wiltron Application Notes and Data Sheets

Use the reply card in the back of this catalog to order your free literature.

Application Notes

Vector Network Analyzers

Flat Test Port Power Correction **AN360B-1**
A 12-page application note details a highly accurate, automated procedure for "flattening" power at all measured frequencies using the 360B VNA and an external power meter.

On-Wafer Measurements to 62.5GHz. **AN360B-2**
A 12-page application note details how the Wiltron 360B is used to make accurate and high speed on-wafer measurements in R&D and production environments.

Waveguide Measurements **AN360-3**
A 4-page application note describes a unique approach to waveguide measurements using the Wiltron 360 VNA.

Using Option 02, Time (Distance) Domain **AN360-6**
A 16-page data sheet describes the power and benefits of Wiltron's Time Domain Option for the 360 VNA. Lowpass, bandpass and phasor impulse processing are described.

Microstrip Measurements **AN360-7**
An 8-page application note describes how the Wiltron 360 VNA addresses microstrip measurements. Calibration, dispersion compensation and fixturing and discussed.

Programming the 360 Using Microsoft C **AN360-8**
A 4-page application note details program development using Microsoft C to control the 360 VNA. A sample program is included.

Programming the 360 Using HP Basic **AN360-9**
A 4-page application note details program development using HP Basic to control the 360 VNA. A sample program is included.

Antenna Measurements **AN360-10**
An 8-page application note details the characterization of various antenna setups. Near field and far field techniques are discussed.

Measuring Frequency Conversion Devices **AN360-11**
A 16-page application note shows how Wiltron's Dual Source Control capability for the 360 VNA addresses the characterization of frequency conversion devices.

Programming the 360PS20A for Pulsed Measurements Using Microsoft C **AN360-12**
An 8-page application note to aid the development of controller software for the Wiltron Model 360PS20A Pulse/CW VNA. A sample Microsoft C program is included.

Scalar Network Analyzers

Testing Microwave Amplifiers **AN5400A-1**
An 8-page application note shows a fast way to thoroughly characterize amplifiers from 10 MHz to 26.5 GHz.

Testing Microwave Mixers **AN5400A-2**
An 8-page application note shows a fast way to thoroughly characterize mixers from 10 MHz to 26.5 GHz.

Programming the 5400A system Using Microsoft QuickBASIC **AN5400A-3**
An 8-page application note provides a useful and easily-adaptable example program for automating the save/recall functions of the Wiltron Model 5400A Scalar Measurement System using its GPIB interface.

Data Sheets

Vector Network Analyzers

Model 360B VNA Coaxial Systems **DS360B-1**
A 12-page data sheet describes the new productivity features of the 360B VNA. Trace overlay, flexible calibration, Automated Flat Test Port Power Correction and more.

Model 2300-11A Materials Measurement Package **DS360-5**
A 4-page data sheet describes this software package and its ability to analyze complex permitivity and permeability at microwave frequencies in conjunction with the Wiltron 360B VNA.

Millimeter-Wave Systems **DS360-7**
An 8-page data sheet describes the unmatched dynamic range, exceptional stability and flexible configuration of the Wiltron 360 millimeter-wave VNA.

360PS20A Pulse/CW Systems **DS360-8**
An 8-page data sheet describes the unsurpassed pulsed RF plus full performance CW measurement capability built into the 360PS20A.

360NF20A Noise Figure Module **DS360-9**
An 8-page data sheet details how easily you can measure S-parameters and mismatch-converted noise figures of low noise devices, receivers and more - from 2 to 20 GHz.

Scalar Network Analyzers

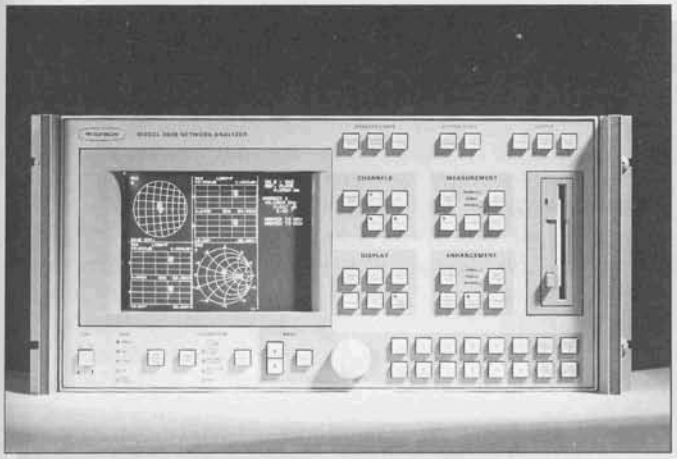
5400A Series Scalar Measurement Systems **DS5400A-2**
A 20-page data sheet shows how this easy-to-use scalar analyzer allows users unfamiliar with microwave measurements to run complex tests from 1 MHz to 26.5GHz.

2300-12A Distance-to-Fault Software **DSDTF-1**
A 2-page data sheet describes software that locates mismatches to within 0.1% of the total distance and displays return loss amplitude for a single mismatch to an accuracy of $\pm$ 2.5 dB

Synthesizers/Signal Generators

6700B Series Swept Frequency Synthesizers **DS6700B-1**
A 16-page data sheet describes the performance, versatility and features of Wiltron's family of high-performance synthesizers.

Vector Network Analyzer – Overview



The 360B builds upon a foundation of exceptional measurement accuracy, capability, and ease-of-use introduced in the original 360 Vector Network Analyzer. Flat Test Port Power, S-parameter overlay capability and more flexible calibration modes provide powerful benefits in many vector measurement applications.

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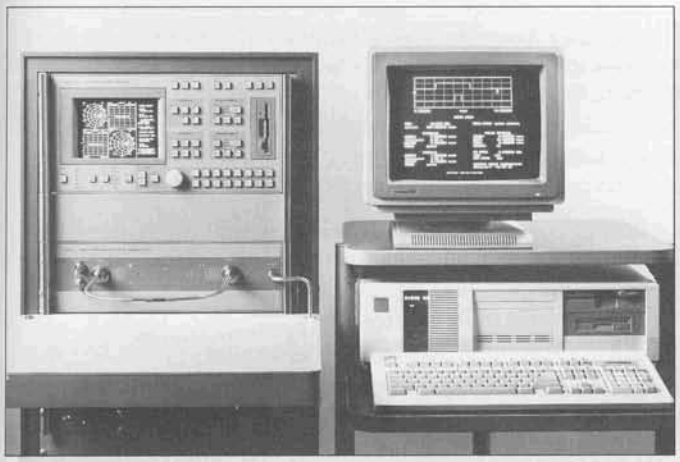

The 360PS20A Pulse/CW Vector Network Analyzer system combines full-performance CW measurements with the most powerful pulsed RF measurement capability available today. Pulse profiling, the measurement of magnitude and phase across the pulse, is possible with profile windows as narrow as 20 ns.

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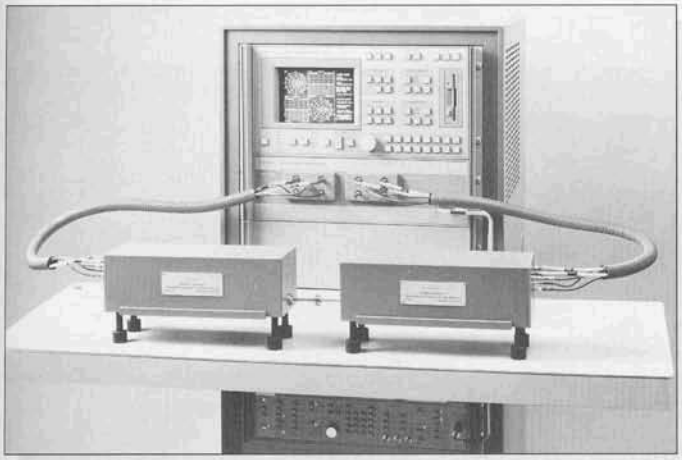

The Wiltron millimeter-wave system extends the exceptional performance of the 360B VNA family to 110 GHz. This system is based upon the 3635B Millimeter-Wave Test Set and 3640B/41B Series Module(s). Transmisssion/Reflection and Transmission-Only modules are available in four millimeter-wave bands: Q (33 to 50 GHz), U (40 to 60 GHz), V (50 to 75 GHz), and W (75 to 110 GHz).

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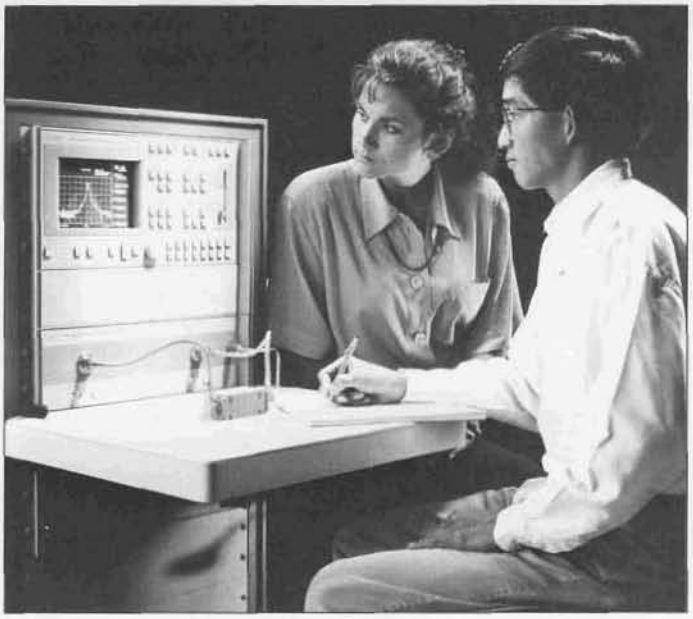
Vector Network Analyzers

General Information



Vector Network Analysis

A Vector Network Analyzer (VNA) measures the complex transmission and reflection characteristics of microwave devices as a function of frequency. It does so by comparing the signal incident to the device with the signal transmitted through or reflected from the device.

A scattering matrix that describes the device is derived by ratioing these signals. The four coefficients contained in this matrix are called scattering or "S" parameters. Each S-parameter is a complex quantity (consisting of magnitude and phase information) representing the device's input reflection (S11), forward transmission (S21), output reflection (S22), and reverse transmission (S12).

The 360B Vector Network Analyer

The Wiltron 360B VNA system is composed of three main elements: a microwave signal source, a signal routing and receiving unit, and a signal processing and data display unit. Wiltron provides several instrument choices for each of these elements in order to satisfy the vast majority of VNA applications.

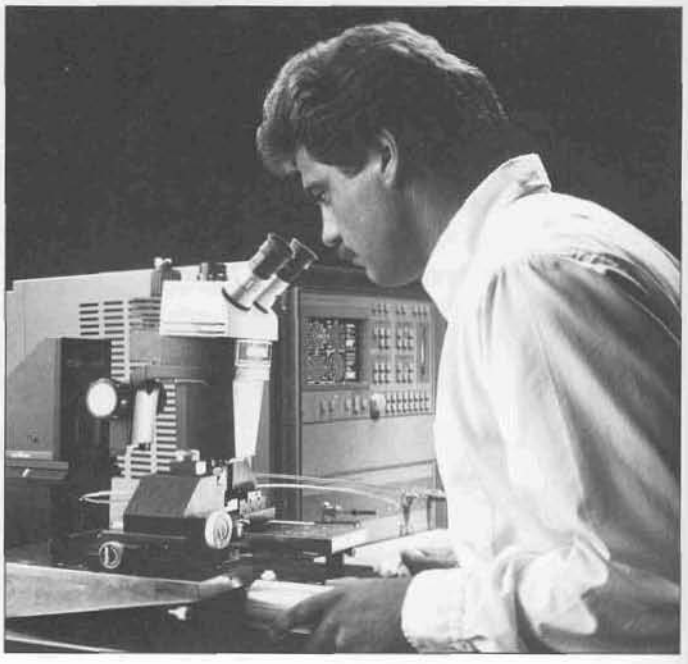
Network Analyzer. The Wiltron 360B Network Analyzer was designed for general purpose applications. It operates with system software loaded from a 1.44 Mbyte MS-DOS® compatible front-panel disk drive. Since its introduction in 1987, the system software has been adapted to meet the measurement needs of new applications such as waveguide, on-wafer, antenna, radar cross section, and microstrip measurements.

The 360B supports several dot matrix and laser printers as well as full-color plotters for either tabular or graphical hardcopy output. An extensive set of GPIB commands enable automation of all 360B functions by an external computer/controller.

Auto Reversing Test Sets. The Model 3600A Series test sets contain all the switching components required to make forward and reverse measurements of transmission and reflection parameters. Wiltron's active device test sets include bias tees for active device biasing and step attenuators for setting test port power level. An exclusive third step attenuator allows the direct measurement of active devices with up to 1 Watt output power. A summary of the test sets is shown in Table 2. Several connector types can be accommodated including the popular GPC-7, SMA, 3.5 mm, K®, and V® Connectors.

Fast *and* Accurate Signal Sources. The 360SS Series Signal Sources are recommended for use with the 360B VNA. The 360SS sources are phase locked by the 360B to provide unmatched frequency accuracy **and** step sweep speed. The outstanding frequency accuracy is based on an internal ovenized crystal reference for nearly zero frequency drift.

Vector Error Correction. Measurement information provided by the 360B VNA includes compensation for many error signals. Six error signals can be characterized during calibration: transmission frequency response, reflection frequency response, source match, load match, directivity, and isolation. Each of these six error signals can be measured in both the forward and reverse direction, thus forming a 12-term error model. The key factors in vector measurement accuracy are test set dynamic range and calibration kit accuracy. Wiltron offers unmatched performance in both areas.



140 dB Dynamic Range Up to 20 GHz. Whichever your choice of display, you will appreciate the 360B's exceptional receiver dynamic range: 140 dB up to 20 GHz (Model 3620A), 133 dB up to 40 GHz (Model 3621A), and 116 dB up to 60 GHz (Model 3622A). At very low signal levels, test data accuracy may be improved by using two different methods of signal enhancement: averaging and video IF bandwidth reduction. At all signal levels and at all measurement speeds, automatic 12-term vector error correction with a synthesized microwave test signal removes system residual errors to produce accurate phase and magnitude measurements. You make measurements with a new level of confidence.

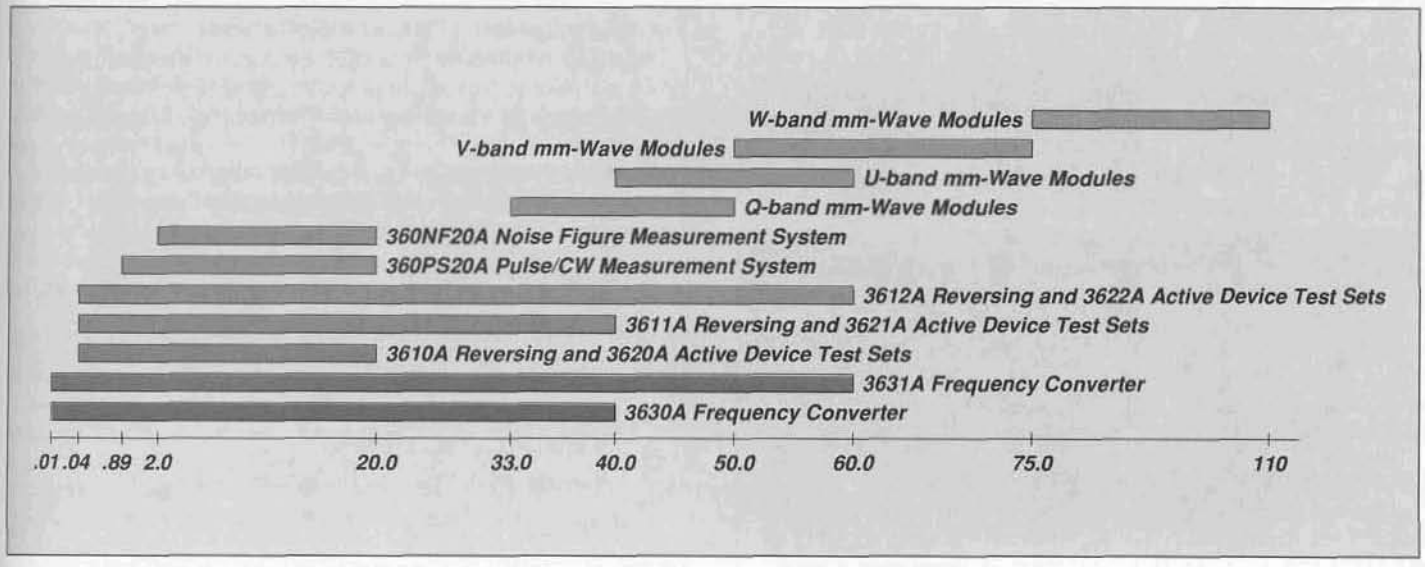
Calibration Kits. Wiltron supports a wide variety of calibration methods to give accurate measurements in almost any situation (see Table 1). For coaxial measurements, calibration kits are offered for SMA, 3.5 mm, GPC–7, Type N, K Connectors, and V Connectors. For microstrip measurements, calibration kits are offered in a wide range of substrate thicknesses. Waveguide calibration kits are also available for measurements in four millimeter-wave bands - Q, U, V, and W.

Time Domain Capabilities. The 360B Option 2A High Speed Time (Distance) Domain measurement capability for the 360B VNA converts frequency domain data to time domain. Low pass or bandpass processing allows characterization of microwave circuit impedance discontinuities. Wiltron's proprietary phasor impulse processing allows an analysis of the type of impedance discontinuity (capacitive, inductive, etc.) using bandpass processing that is required for band-limited microwave circuits.

Table 1. Vector Network Analyzer Calibration Methods

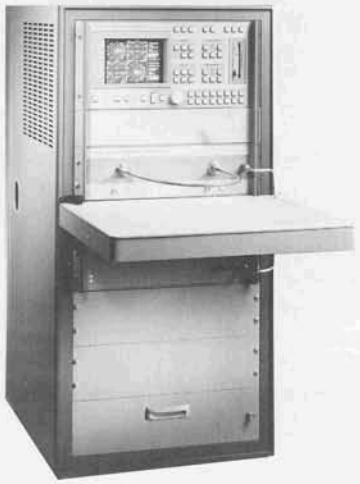
Model	Components Provided	Application
Traditional (OSL)	Open, Short, Thruline, Broadband Load or Sliding Load	Traditional method used for general purpose measurements capability. Model of open fringing capacitance is held in network analyzer memory. Measured fringing capacitance coefficients for a specific open can be loaded via the front panel disk drive.
Traditional With Offset Short	Short, Offset Short, Thruline, Broadband Load or Sliding Load	Offset short is substituted for open. Used for measurements, such as waveguide, where an open cannot be defined. Calibration bandwidth is limited.
LRL	Two Line Lengths Plus Known Reflection (LRL) or One Line, One Match, and a Known Reflection (LRM)) or Concatenated Calibration with optional Third Standard (LRLL, LRLM, LRML, LRMM)	LRL is used for measurements, such as microstrip, where opens and loads are difficult to fabricate. Two or three line lengths and a short are common calibration standards. TRL (through-reflection-line) and TSD (through-short-delay) are subsets of LRL. Calibration bandwidth is limited. The LRM calibration is a variation of the LRL technique that uses a precision termination rather than a second line length. A third optional standard, either Line or Match, may be measured in order to extend the frequency range of the calibration. This extended calibration range is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s).
LRM		

Table 2. Vector Network Analyzer Test Set Summary

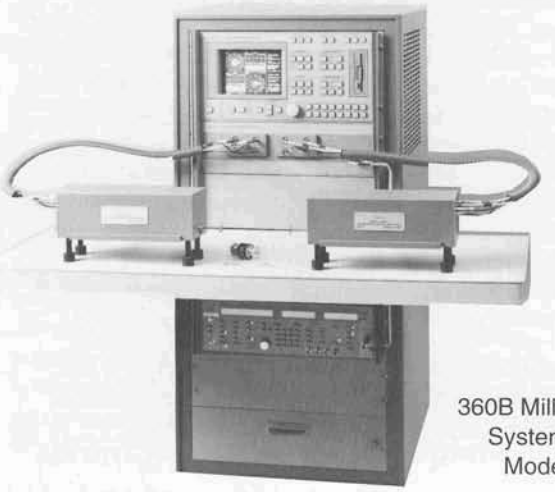


Vector Network Analyzer

Model 360B: Coaxial—10 MHz to 62.5 GHz; Waveguide—33 GHz to 110 GHz



360B
System Console
Model 360C1



360B Millimeter-Wave
System Console
Model 360C3

360B Vector Network Analyzer Highlights

- *40 MHz to 62.5 GHz Continuous Coaxial Coverage*
- *Full-Reversing Waveguide Test Solution From 33 to 110 GHz*
- *Full Color Four S-parameter Display*
- *High Denisty 1.44 Mbyte MS–DOS® Compatible Front-Panel Disk Drive*
- *Time Domain, Group Delay, and Frequency Domain Test Capabilities*

Wiltron continues its tradition of responding to customer needs with the new 360B Vector Network Analyzer (VNA). The 360B VNA builds upon a strong foundation of exceptional measurement accuracy, capability, and ease-of-use. New and improved features and capabilities provide powerful benefits in any vector measurement application.

The 360B VNA is recognized as the leader for performance, accuracy, and versatility. Wiltron's modern approach makes it easy to upgrade or convert a 360B system to new capability. Since its introduction in 1987, Wiltron has continued to expand its VNA family of products to solve new requirements. Several innovative products are available to expand the selection of 360B measurement solutions.

A Pulse/CW system offers unique 20 ns pulsed RF and CW S-parameter measurement capability in one package. Noise figure measurement accuracy takes a step ahead with the 3642A Noise Figure module and the addition of the 360B's vector error correction. The 360TSM test set multiplexer allows the 360B to control multiple test sets and sources. Now, from one interface you can measure from 10 MHz to 110 GHz using both waveguide and coaxial test sets.

Continuous Coaxial Coverage to 62.5 GHz

The coaxial frequency coverage of the 360B Series is unmatched. Continuous coverage is available from 40 MHz to 60 GHz (62.5 GHz with Test Set Option 5). Engineers in both commercial and defense sectors can benefit from designing in coax to 60 GHz - reducing systems size and weight. 60 GHz coverage also significantly increases the resolution of time domain measurements, allowing more accurate designs. Extensive OSL, offset short, and LRL/LRM calibration software with dispersion compensation let you accurately measure your coaxial, microstrip, waveguide, and on-wafer devices.

Waveguide Measurements to 110 GHz

Over the 33 to 110 GHz range, waveguide measurements can be made more easily and more accurately with Wiltron's full-reversing waveguide test solution. Wiltron also offers you a choice with economical One-Path Two-Port and Reflection-Only measurement configurations. The 360B VNA's exceptional dynamic range, over all four mm-wave bands, allows you to measure devices with greater precision and confidence. Also, the high-speed time/distance domain capability allows compensation for waveguide dispersion.

Turn-Key System: Console or Cabinet

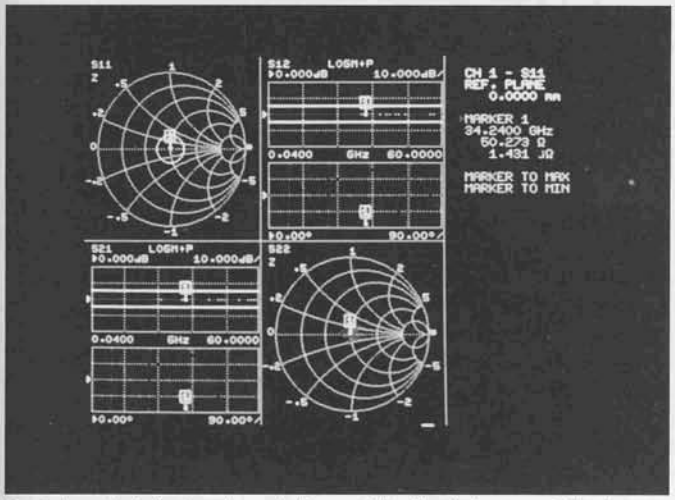
Whether you choose your 360B system for production, R&D, metrology, service, field testing, or QA, there is a system console or system cabinet configuration to meet your exact needs.

Coaxial systems consist of the following three units (an additional 6700B Series synthesizer is required for some specialized measurements):

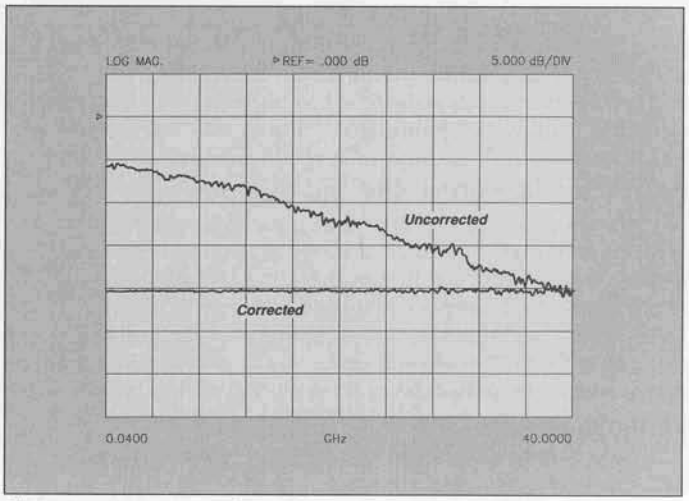
1) 360B Network Analyzer
2) 3600A Series Test Set
3) System Signal Source (Wiltron 360SS, 6600B, or 6700B Series)

Waveguide systems consist of five units:

1) 360B Network Analyzer
2) 3635B Millimeter-Wave Test Set
3) 3640B Series Transmission/Reflection Module(s)
   or
   3641B Series Transmission Module
4) 360SS47 System Source (or equivalent 6700B Series)
5) 6729B Microwave Synthesizer



Four independent display channels let you tailor the data presentation for your measurement application.



Flat test port power correction provides constant input power for active device testing.

Four-Channel Display on Large Color Screen

The 360B displays four channels simultaneously in any combination of Smith chart, rectilinear, or polar coordinates - and in frequency or time domain. Adding to the convenience, all displays are in four colors. With color, markers and limit lines are easily distinguished from the test data and graticule grid. The ease with which data are viewed and interpreted is incomparable.

Data Trace Overlay

Device evaluation and comparison is now easier than ever before with the new trace overlay capability. Superimpose an amplifier's gain data trace onto its input match data trace on a single graph. Overlaid data is displayed in yellow while the primary channel's data is shown in red. Vertical graticule lines have been added to all rectilinear graphs for enhanced data interpretation.

New Front Panel

A molded bezel exposes the 360B's color VGA display for improved brightness and clarity. Test data is now easier to read and interpret. Rubberized front panel buttons improve reliability and tactile feedback. Tinted keycaps distinguish frequenctly used functions.

Microstrip and Coplanar Waveguide Measurements

By combining the 360B with a Wiltron 3680 Series Universal Test Fixture, you can measure microstrip and coplanar waveguide devices, on-substrate. Wiltron provides the complete measurement solution, with a wide selection of VNAs, test fixtures, on-substrate calibration kits, and accessories. Three models of test fixtures are available covering dc to 20 GHz, 40 GHz and 60 GHz, respectively. See page 102 for more information.

Measurement Stability

Accurate measurements depend on a VNA's ability to maintain its calibrated state. Over time, significant factors such as temperature change, cable flexure, and frequency drift contribute to random measurement errors. The 360B VNA counters these effects with temperature-stable components, minimized cabling, fewer interconnections, and a unique phase-locking scheme. With the 360B VNA, your measurements are repeatable several days after calibration.

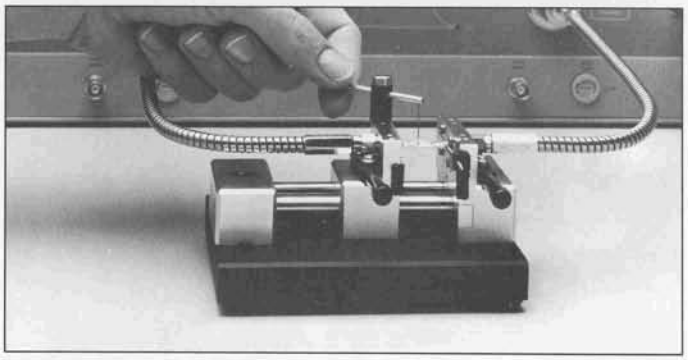
Flat Test Port Power Correction

For device measurements requiring constant input power levels, the 360B offers automated Flat Test Port Power Correction. Using an external power meter, test port power measurements are made at each frequency, or to save time, interpolated between user-defined frequencies. The correction data is then fed back to the signal source's level loop to provide a constant test port power. Flat Test Port Power Correction capability is compatible with Wiltron signal sources - 360SS, 6600B, and 6700B Series.

High-Speed Time (Distance) Domain Measurements

When identification of discontinuities within a test device is required or the distance to an impedance discontinuity must be measured, the 360B's Option 2A, High Speed Time (Distance) Domain measurement capability is the solution. This option adds a near real-time display of any S-parameter as a function of time or distance from the reference plane, as well as a display of frequency domain data preconditioned by a gate in the time domain.

The time domain displays are fully mixable with other display modes. Using a four-channel display, you can observe a normal frequency domain display on channel one, time domain response on channel two, time domain with gate on channel three, and frequency domain with gate on channel four. Wiltron's time domain digital signal processing decreases the processing time for a 401-point FFT to less than 350 ms.



The Wiltron 3680 Series Universal Test Fixture measures microstrip and CPW devices.

Vector Network Analyzer

Model 360B

The 360B also features an exclusive "Phasor Impulse" mode, which displays the absolute impedance characteristics of a discontinuity without the need for data at low RF frequencies. For testing amplifiers or high-pass devices, where conventional low-pass impulse response measurement would be impossible, this feature is of special value.

Precision Calibration Kits and Components

Accurate operation of your 360B system is ensured by Wiltron precision calibration and verification kits. The kits include components for direct calibration and performance verification of measurements on SMA/3.5 mm, GPC–7, Type N, K Connector®, and V Connector® (1.85 mm) test devices. Waveguide calibration kits are also available for four mm-wave bands: Q (WR-22), U (WR-19), V (WR-15), W (WR-10).

Verification Kits

In addition to calibration kits, Wiltron offers verification kits. The verification kit consists of components with characteristics that are traceable to NIST. This kit is usually kept in the metrology laboratory where it provides the most dependable means of checking system accuracy.

Reversing Test Sets

Reversing Test Sets make full S-parameter measurements on passive devices. Models 3610A, 3611A and 3612A cover the 40 MHz to 20 GHz, 40 MHz to 40 GHz, and 40 MHz to 60 GHz ranges, respectively, with K Connector or V Connector test ports.

Active Device Test Sets

The Active Device Test Sets contain step attenuators and bias tees, required for active device testing. Models 3620A, 3621A, and 3622A cover the 40 MHz to 20 GHz, 40 MHz to 40 GHz ranges, and 40 MHz to 60 GHz respectively, with K Connector and V Connector test ports.

Frequency Converter Test Sets

For testing mixers, multipliers, dividers—any frequency translation device—the 360B has the 3630A and 3631A Frequency Converter test sets with 10 MHz to 40 GHz and 10 MHz to 60 GHz coverage, respectively. These four-channel receivers can operate with two signal sources and the receiver signal, all at different frequencies. With its internal 70 dB step attenuator, the 3630A or 3631A are also an excellent choice for antenna measurements.

Waveguide Test Sets to 110 GHz

Measurements to 110 GHz are supported by the 3635B Millimeter Test Set and 3640B and 3641B Series Modules. The 3635B controls companion 3640B/41B Series modules and supplies necessary DC, RF, and IF signals. 3640B/41B Series modules are available in four waveguide bands to cover the 33 to 110 GHz range. The 3640B Series modules include a mm-wave source. A pair of 3640B modules allows measurement of all four S-parameters on a two port device without reversal of the test device. A 3640B module combined with a 3641B module allows for simultaneous measurement of S_{11} (input reflection) and S_{21} (forward transmission) characteristics.

Precision calibration kits are available.

Test Set Multiplexer

The new 360TSM Test Set Multiplexer allows the use of two test sets and two sources with a single 360B Network Analyzer. From the front panel, an operator can select a different test set or source. Sources or test sets may be located up to 30 meters from the 360B. The 360TSM brings a new level of versatility to the 360B family. Systems can be configured with different connector-type test ports or even a combination of coaxial and waveguide test ports. One test set can be located with a probe station and another can be located in the 360B cabinet. For production use, multiple test sets can improve productivity by allowing measurements on one test set while another device is being connected to the second test set.

Speed and Accuracy, Simultaneously

The 360B VNA offers the fastest step sweep available for real-time measurements of your devices. A 360SS Series Signal Source is phase locked in less than 2ms to provide synthesized frequency accuracy. Only the Wiltron system maintains synthesizer accuracy at "real time" measurement speeds for enhanced throughput.

Automatic Reference Delay

Auto-Reference Delay automatically sets the correct electrical delay compensation. Furthermore, the reference delay can be entered and displayed in distance, as well as in time, by entering the test device's dielectric constant.

High Density MS-DOS Disk Drive

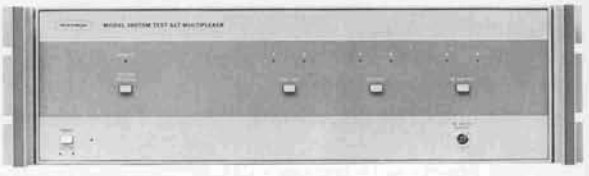
The built-in 3.5-inch disk with 1.44 Mbytes of memory is standard on the 360B. Data files are MS–DOS® formatted for easy interfacing with IBM and IBM-compatible computers and software.

Broadband, Narrow-Band Tests—No Recalibration

The 360B calibration is maintained as the number of data points is changed or a reduced frequency range is selected. Here is one more feature that improves productivity.

Set-On Mode

The 360B offers a "Set-On" mode making it possible to use the 360B as a tuned receiver over the 10 MHz to 60 GHz frequency range. The IF bandwidth is selectable between 10 kHz, 1 kHz, and 100 Hz. This mode significantly increases the versatility of the 360B in ATE applications that check for harmonics and spurious signals and for signals whose frequency is known.



The 360TSM allows (2) test sets and (2) sources to be controlled from a single 360B.

Complete Characterization of Test Devices

It is often desired to observe the effect of adjusting one S-parameter on the other three. In gain and phase matching applications, it is necessary to simultaneously view the input and output impedances. The 360B provides simultaneous viewing of 4 characteristics, in color, on a large screen. The color is employed to simplify interpretation of simultaneously displayed data.

Four S-parameters can be displayed simultaneously. In gain and phase matching applications, you not only observe the effect of matching on input and output impedances, but on gain and phase as well.

Solution to SMA Measurement Problems

Wiltron is keenly aware of the handicap under which engineers using SMA connectors have had to work. Since previous systems offered no SMA calibration or verification kits, error-correction could not be applied accurately to correct for the 3.5 mm-to-SMA interface mismatch. Measurement uncertainty was high. This problem persisted in spite of the widespread use of SMA devices. The Wiltron 360B has SMA Calibration Kits with which accurate, 12-term error-corrected test data can be taken on SMA test devices.

Easy-to-Use, Flexible Calibration Procedure

The 360B incorporates a more flexible error-correction process that now better addresses on-wafer and other single-standard calibration applications. Measure one standard at a time or two standards simultaneously. The ordering of reflection standards may be modified to suit a variety of calibrations. The system reference impedance (Z0) may also be modified to other than 50 ohms.

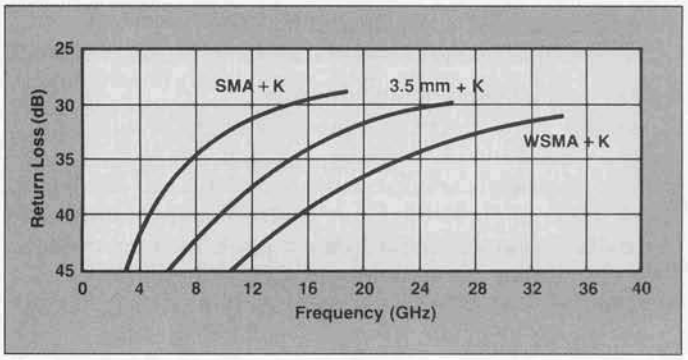
On the 360B, once the calibration has been completed, error-correction is automatically applied. Since all Wiltron test sets are auto-reversing, 12-term error correction is now always practical. Maximum accuracy is readily attained. The 360B also maintains its calibration when the number of data points is changed or a reduced frequency range is selected.

The 360B offers three types of calibration:

1) A standard calibration using an open circuit, short circuit, termination, and thru line.
2) A waveguide calibration using two different offset short circuits, a termination, and a thru line.
3) An LRL/LRM calibration for microstrip and mixed connector devices using three lengths of thru line (or a match device) and a reflective device.

Hands-Off Test Procedures

Wiltron's S-parameter test sets include automatic signal reversing so that measurement of all parameters proceeds without interruption or loss of accuracy. In addition, the Active Device Test Sets have 70 dB level-set attenuators in both port lines with which the drive signal can be adjusted to the proper test level. Furthermore, a step attenuator within the forward transmission measurement path permits measurements on devices with an output power level of up to one Watt. Full S-parameter measurements on active devices are now possible—even output match—while using a power-limiting pad on the output port of the test device.



Return loss characteristics (uncorrected) of K connector ensure excellent electrical compatability with SMA and 3.5 mm connectors.

Dual Source Control

Dual Source Control capability allows the 360B to independently control two sources and a receiver directly, without the need for an external computer/controller. Mixers, up/down converters, and other devices requiring two-tone stimulus are easily tested with the 360B, Dual Source Control capability, and two of Wiltron's compatible sources. Antennas may be tested on a far-field range with one source remote from the 360B. Any 3600 Series test set may be used with the Dual Source Control.

N-Discrete Frequencies Mode

To take the tedium out of collecting data at many specific frequencies, the 360B includes the "N Discrete Frequencies" mode. You select from 2 to 501 discrete frequencies, arranged in any sequence.

Unique Marker Sweep

Unique to the 360B is its capability to sweep between any two markers. You simply select the number of the markers positioned at the desired start and stop frequencies. Once the system is calibrated, you can select marker sweep limits anywhere within the calibrated range without recalibration. Some measurements are as simple as viewing a broadband sweep, setting the markers to bracket the characteristics of interest, then initiating the data-taking process.

Intuitive front panel operation eases complex measurements.

Model 360B

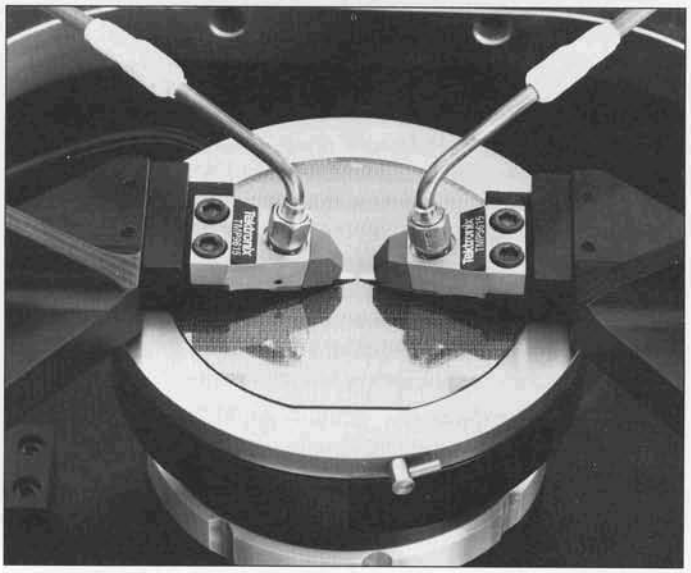
Measurement Applications

Active and Passive Components

Measure active and passive microwave components with real-time speed and phase-locked accuracy. The 360B displays all four S-parameters simultaneously or overlays two data traces onto a single graph. Flat test port power correction allows for easier gain compression and absolute power measurements. View the complete characterization of amplifiers, filters, switches, isolators, cables — whatever you are testing.

On-Wafer Devices

Make fully error-corrected measurements of your on-wafer devices to 62.5 GHz with the Wiltron 360B VNA and a wafer probing station. Air dielectric test port couplers offer excellent uncorrected directivity and test port match over the entire 40 MHz to 62.5 GHz frequency range. For best performance, every coaxial test set contains all necessary measurement components in a single, compact unit that can be easily located next to your wafer probing station. The 360B supports flexible OSL, LRL, and LRM calibration methods for optimal on-wafer accuracy.



The 360B VNA supports on-wafer measurements to 62.5 GHz.

Time Domain Analysis

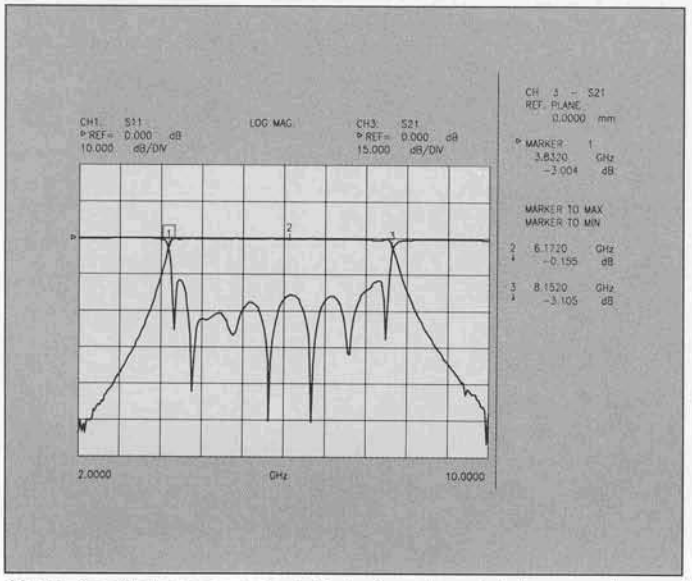
With the addition of Option 2A, High Speed Time (Distance) Domain Measurement Capability, your system displays discrete discontinuities as a function of time or distance. Unwanted reflections can be removed in the frequency domain by windowing and gating. The software provides four different windowing functions to reduce side lobes without compromising resolution. The exclusive Phasor Impulse mode enables you to measure the true impedance characteristics of a discontinuity in a dispersive or band-limited media such as waveguide.

Frequency Conversion Devices

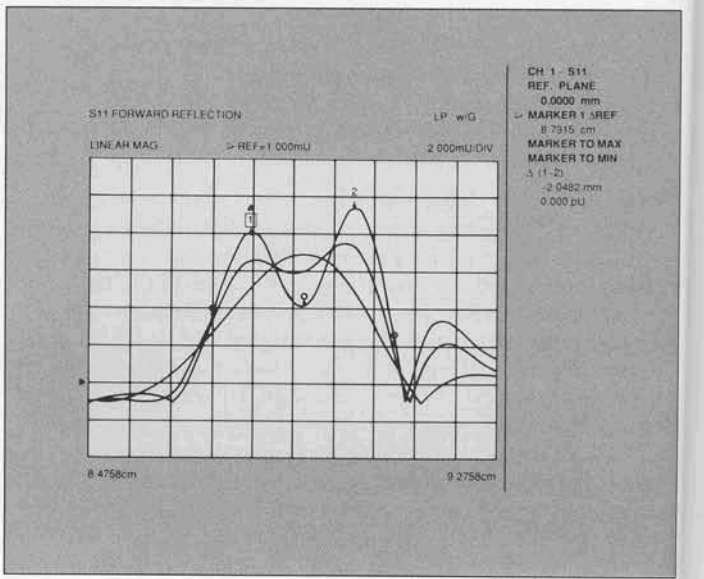
The Wiltron 3630A and 3631A Frequency Converter Test Sets provide three simultaneous measurement channels for convenient measurement of multi-port devices. The 360B VNA's multiple source control capability allows separate control of two sources and a receiver (test set) without an external controller. You can specify the frequency ranges and output powers of the sources and the frequency range and reference channel of the receiver. Test mixers, multipliers, diplexers, triplexers, and other frequency conversion devices with ease.

Fixtured Microstrip & Coplanar Waveguide

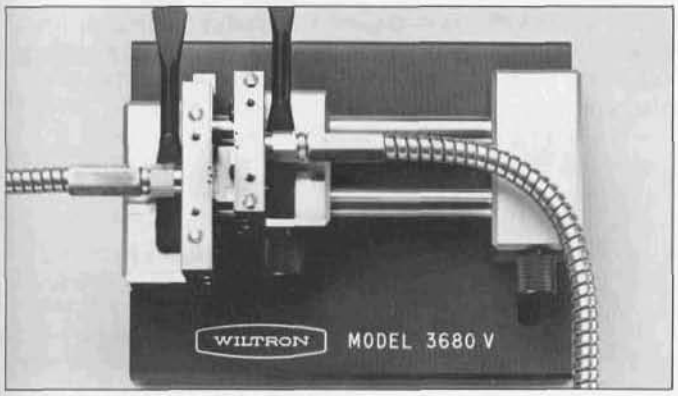
The Wiltron 3680 Series Universal Test Fixtures (UTF) allow you to adapt your coaxial system to measure virtually any microstrip or coplanar waveguide device. Three versions of the UTF are available: the 3680-20 covers dc to 20 GHz, the 3680K covers dc to 40 GHz, and the 3680V covers dc to 60 GHz.



Overlay two data traces on a single display for enhanced device comparison and evaluation.



Discontinuities 2 mm apart (top trace) can easily be distinguished with High-Speed Time (Distance) Domain capability and 60 GHz coverage.



The Wiltron 3680 Series Universal Test Fixture.

The 360B VNA's ability to compensate for non-linear dispersion can dramatically improve vector measurement accuracy. Wiltron also offers a complete line of microstrip calibration kits which include all the components necessary for OSL, LRL, and LRM calibration of the 3680 Series UTF.

Antenna Pattern and RCS

The 3630A and 3631A Frequency Converter Test Sets simplify antenna pattern and radar cross-section measurements. In the "CW Draw" mode, a CW measurement can be triggered at as many as 501 equal intervals to provide a data plot as a function of time or antenna position.

Dual source control capability provides flexibility to use either harmonic or fundamental mixing for optimizing sensitivity and other measurement parameters. Option 5, Receiver Mode Capability allows you to locate the signal source a great distance away from the 360B VNA and/or test set as high level reference and phase lock signals are not needed.

Materials Measurement

Measure the complex permittivity (ε_r) and permeability (μ_r) of electronic materials with Wiltron's Model 2300-11A Materials Measurement Software Package. The unique reflection-only approach allows for easy sample preparation and non-destructive measurement of high loss, high $\varepsilon_r\mu_r$ product materials. A room temperature calibration plane can be accurately extended into a temperature chamber for extreme temperature measurements.

Harmonic Level Tests

The 360B VNA can be configured to measure the relative harmonic level of your test devices with the addition of Option 5, Receiver Mode Capability. The 360B VNA's unique phase locking scheme allows it to operate as a tuned receiver by locking all of its local oscillators to its internal crystal reference oscillator. Option 5, Receiver Mode Capability significantly increases the versatility of the 360B VNA in applications that check for harmonics, intermodulation products, spurious signals, and signals of known frequency.

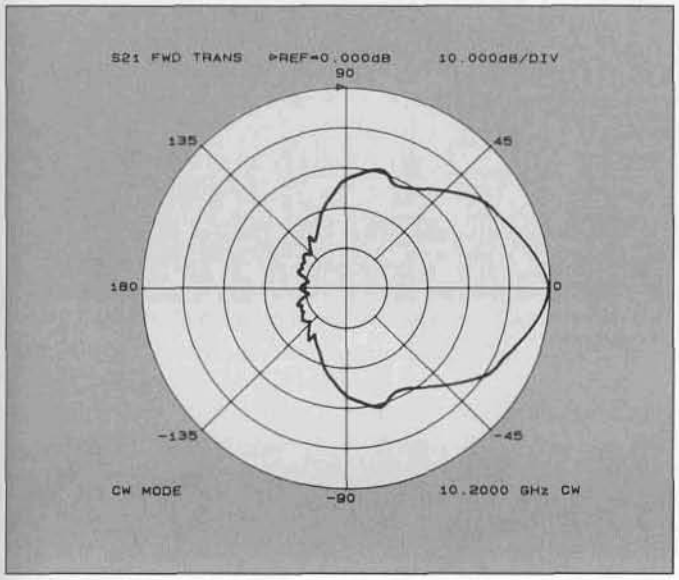
Waveguide Measurements with Adapters

The 360B system includes waveguide calibration and measurement capability up to 110 GHz. Direct waveguide measurements can be made using Wiltron V Connector-to-waveguide transitions and calibrating the system with two offset waveguide short circuits, a termination, and a thru connector. The reference delay includes compensation for the waveguide dispersion. You enter only the waveguide cutoff frequency.

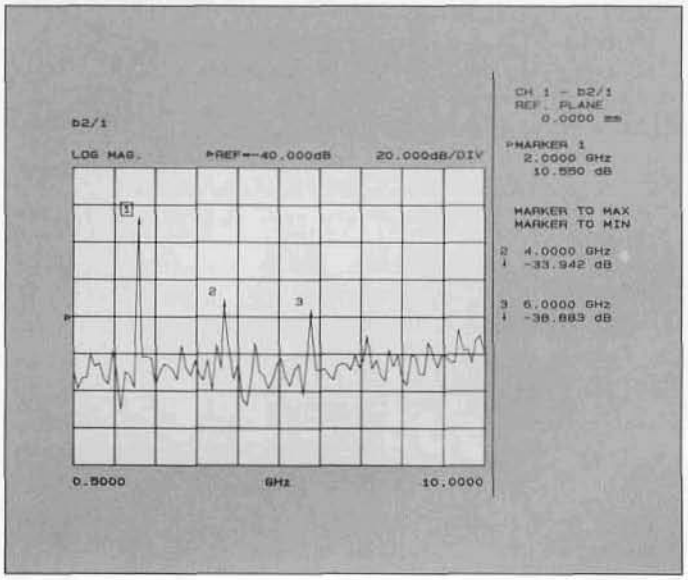
Millimeter-Wave Capability

The 360C3 Millimeter-Wave System Console provides full measurement coverage to 110 GHz. The 360B Millimeter-Wave system contains the 3635B Millimeter test set and companion 3640B/41B Series Modules for simple and direct measurement of waveguide networks to 110 GHz in four waveguide bands (Q, U, V, and W bands).

Millimeter-wave capability may be added to existing 360 systems with the addition of a 3635B, appropriate 3640/3641 Series Modules, and a 6729B Microwave Synthesizer.



A typical antenna radiation pattern shown in polar format using the 360B VNA's CW Draw capability.



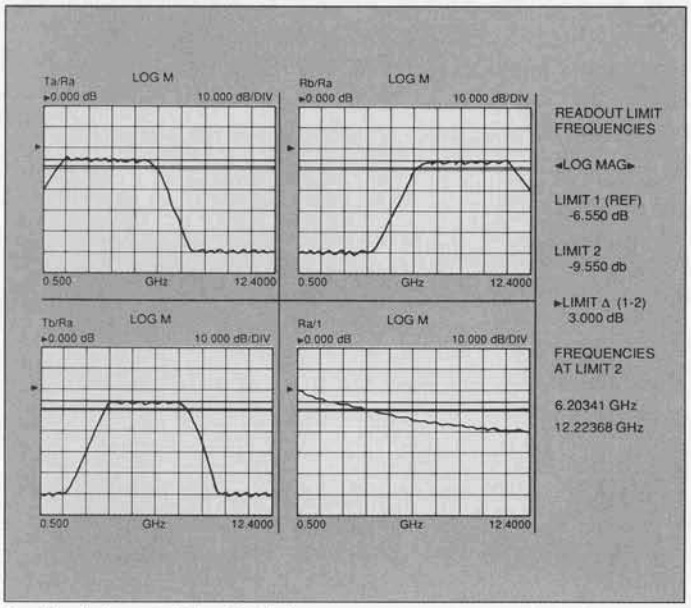
The harmonic response of your test devices can be measured by the 360B VNA.

Model 360B

Measurement Applications

Diplexers and Triplexers

With three simultaneous measurement channels the 360B can quickly characterize multi-port devices. The 3630A and 3631A Frequency Converter Test Sets have four input ports and programmable source power control. The transmission characteristics of diplexers and triplexers can be completely characterized without time-consuming reconnections. The 3630A provides coverage from 10 MHz to 40 GHz and the 3631A provides coverage from 10 MHz to 60 GHz.



Passband characteristics of a triplexer.

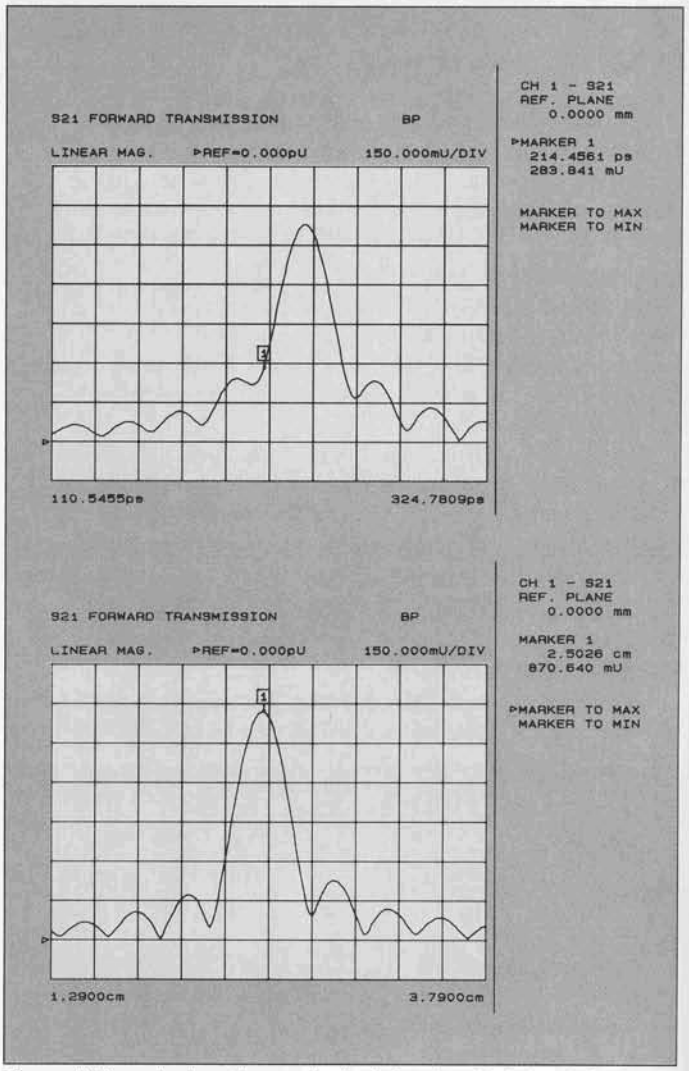
LRL/LRM Calibration

LRL/LRM calibration capability for making measurements in coaxial, microstrip, and waveguide transmission media. LRL/LRM calibration allows you to:

- Measure the S-parameters of chip-level devices in the medium in which the devices will be used (e.g., coplanar microstrip, etc.).
- De-embed the S-parameters of the device from the test fixture.
- Make S-parameter error-corrected measurements on noncoaxial transmission lines and move the reference planes.

With the use of the generic LRL/LRM calibration, and an external controller, you can perform multilevel de-embedding. In this mode, any noncoaxial transmission media, including mixed media inter-connects, can be accommodated. For example, a test device with a waveguide input and a coplanar microstrip output can be measured. Software automatically compensates for the microstrip dispersion. The versatility of this mode is limited only by your ingenuity and the availability of calibration devices.

Through the use of LRL/LRM calibration and an external computer, in conjunction with ANACAT® software, multiple-level de-embedding is possible. This calibration allows you to make semiconductor chip measurements with a single test fixture up to 60 GHz.



Phase shift through microstrip meander line before (top display) and after (bottom display) dispersion compensation.

Service Support

Built-In Diagnostics

Whenever the 360B VNA system is powered up, an extensive internal diagnostic routine makes 60 separate performance verification tests. Once in operation, a firmware-resident Self Test program is constantly running in a "background" mode, making over 50 additional system checks to ensure proper operation. It will even alert the user to certain system configuration and setup problems.

Should the diagnostics indicate a problem, the process of identifying the cause is facilitated through an extensive library of "on-screen" error messages and the use of 48 built-in status-indicating LEDs strategically located throughout the system.

Service Support

If a problem should occur, your 360B VNA system can be returned quickly to proper working order via one of the following:

- **On-Site Service:** If your system is covered under an On-Site Service Agreement (see the On-Site Support section on this page), just phone your nearest Wiltron Service Center and a Service Engineer will be sent to your site within the time frame specified on your agreement (typically, within 24 hours).
- **Return-to-Factory Service:** Simply return the faulty system or major subassembly to the closest Wiltron Factory Authorized Service Center with a description of the problem.
- **Assembly Exchange Service:** After determining the faulty assembly, contact the nearest Wiltron Service Center and order the exchange assembly you need. The exchange assembly is sent directly to you and, upon return of the replaced assembly, you receive a significant credit toward the cost of the exchange assembly. In the case of warranty service, full credit is issued.

On-site Support

A variety of on-site support services are available to help maximize 360B system up-time. These include:

- **On-Site Installation:** Available upon request with each 360B VNA system. A Wiltron Customer Service Representative will help set up and check out your 360B Network Analyzer System when it arrives at your plant. The Customer Service Representative will also provide a brief user orientation on 360B system operation.
- **On-Site Verification:** Ordered as 360MS Option 11, this service provides on-site verification of the 360B system performance by a Wiltron Customer Service Engineer. Broadband performance is verified via comparison measurements on K Connector®, V Connector®, GPC-3.5, or GPC-7® standards. A printout of verification data is provided for comparison with past and future results. (Required repairs discovered during the calibration process are extra to this service and will be billed separately unless the system is under warranty or covered by an on-site service agreement).
- **On-Site Service:** Ordered as 360MS Option 12, this service provides for repair service performed at the customer site within a specified time (typically 24 hours) after customer notification of a problem.

For a complete on-site support solution, both Option 11, On-Site Calibration and Option 12, On-Site Service should be ordered.

Warranty

The 360B system is covered by Wiltron's standard one-year, return-to-factory warranty (two-years on YIG-tuned oscillators, 90 days on 3670 Series Test Port Cables). In most cases, by taking advantage of Wiltron's Exchange Assembly Service, repair can be accomplished without actually returning the system to the factory.

Warranty Conversion

For those customers preferring on-site warranty coverage, the one-year, return-to-factory warranty may be converted to a 90-day, on-site service warranty at no additional charge by ordering 360MS Option 13 at the time of purchase. For a continuation of on-site service after the 90-day warranty period, 360MS Option 11, On-Site Calibration and 360MS Option 12, On-Site Service are recommended.

On-site service is available in 29 countries.

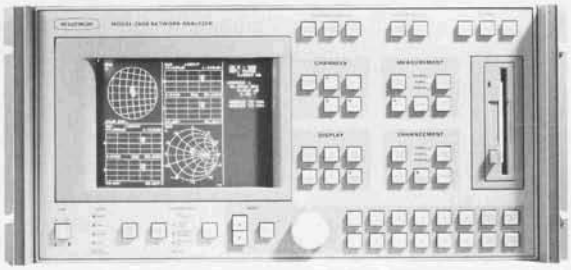
Vector Network Analyzers

Model 360B

System Composition

Network Analyzer

The 360B Network Analyzer is the control and display unit for all versions of the network analyzer system. Selected from its front panel are menu items, test functions, test parameters, measurement enhancements, and frequencies. Frequency information is provided to the system signal source over a dedicated GPIB system interface bus. Test parameters, system status, and measurement data are displayed on the large color screen and hard copied on a printer or plotter.



Model 360B Network Analyzer

Test Sets and Modules

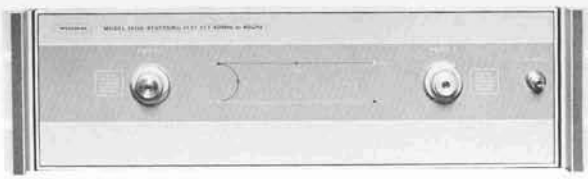
There are several test sets from which to choose, depending upon your application. Most test set types include multiple models covering differing frequency ranges and corresponding connectors. Reversing and Active Device test sets include automatic signal reversing with which full S-parameter tests can be made without manually reversing the test device. The 3635B Millimeter-Wave Test Set is the interface for the 3640B and 3641B Series (waveguide-band) Modules.

Model	Frequency Range	Test Port Connectors[1]
3610A Reversing Test Set 3611A Reversing Test Set 3612A Reversing Test Set	40 MHz to 20 GHz 40 MHz to 40 GHz 40 MHz to 60 GHz	K Connector (m) K Connector (m) V Connector (m)
3636A Pulse/CW Test Set	890 MHz to 20 GHz	K Connector (m)
3620A Active Device Test Set 3621A Active Device Test Set 3622A Active Device Test Set	40 MHz to 20 GHz 40 MHz to 40 GHz 40 MHz to 60 GHz	K Connector (m) K Connector (m) V Connector (m)
3630A Frequency Converter 3631A Frequency Converter	10 MHz to 40 GHz 10 MHz to 60 GHz	K Connector (f) V Connector (f)
3635B mm-Wave Test Set	33 to 110 GHz	Waveguide (Q, U, V, W Bands)

[1]Test port connectors can be converted to GPC–7, 3.5 mm, or Type N with the use of the 34U and 34Y Series Test Port Converters.

Reversing Test Sets

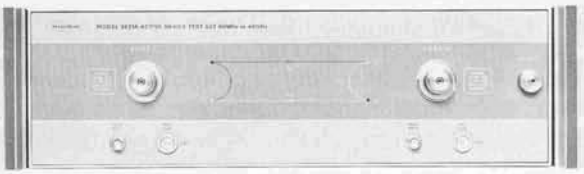
Reversing test sets provide basic S-parameter measurement capability. There are three coaxial models: 3610A (40 MHz to 20 GHz), 3611A (40 MHz to 40 GHz), and 3612A (40 MHz to 60 GHz).



Model 3611A Reversing Test Set

Active Device Test Sets

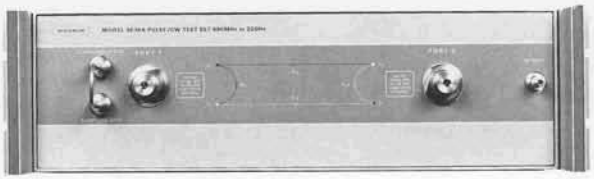
Models 3620A, 3621A, and 3622A include 70 dB step attenuators in both port lines for adjusting the test signal level. A step attenuator in the forward transmission line attenuates the test device output power up to one Watt. Bias tees are included to superimpose dc bias upon each test port center conductor.



Model 3621A Active Device Test Set

Pulse/CW Test Set

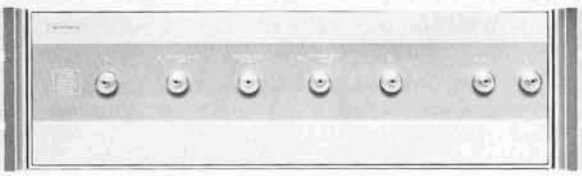
The 3636A is the heart of the 360PS20A Pulse/CW VNA System. It can be configured in a wide variety of ways to offer maximum flexibility. The test set incorporates couplers capable of 20 Watts peak (10 Watts) average forward power. An additional coupler in Port 2 allows high-power forward measurements and low-power reverse measurements. Key nodes on the test set are available to allow addition of bias tees, high-power amplifiers, and terminations.



Model 3636A Pulse/CW Test Set

Frequency Converters

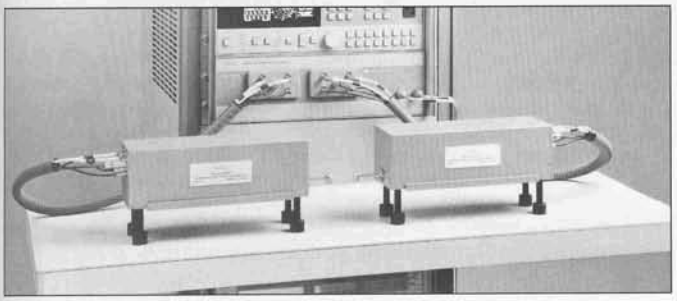
The 3630A and 3631A Frequency Converters are four-channel receivers that measure magnitude and phase of frequency conversion devices. Two different input frequencies (RF and LO) and the receiver frequency (IF) are controlled from the 360B front panel. With its exceptional versatility, the unit is also well suited to measuring multiple-output devices, high power TWTs, QPSK modulators, antenna patterns, and radar cross sections.



Model 3630A Frequency Converter

Millimeter-Wave Test Sets

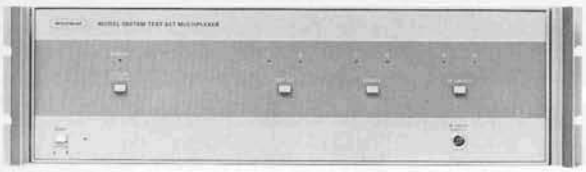
The 3635B Millimeter-Wave Test Set and 3640B and 3641B Series modules provide full test capability to 110 GHz in four waveguide bands. The 3635B interfaces with the 360 Network Analyzer and provides necessary DC, RF, and IF signals for the 3640B Series modules. 3640B Series Transmission/Reflection Modules provide RF stimulus to the device under test and measures relative forward and reflected power. A pair of 3640B modules allows measurement of all four S-parameters on a two- port device without reversal of the test device. A 3640B module combined with a 3641B module allows measurement of S_{11} (input reflection) and S_{21} (forward transmission) characteristics.



Model 3635B Millimeter-Wave Test Set

Test Set Multiplexer

The 360TSM Test Set Multiplexer allows the use of two test sets and two sources with a single 360B Network Analyzer. From the 360TSM front panel, or from a 360B menu, an operator can select a different test set or source. Sources or test sets may be located up to 30 meters from the 360B. All IF and control circuitry is switched automatically. An output is provided for switching microwave signals through an external coaxial switch.



Model 360TSM Test Set Multiplexer

Signal Sources

Wiltron offers three different families of microwave sources that are compatible with the 360B. The System Signal Sources are designed specifically for use with the 360B and have no front panel control. Wiltron's 6700B Series Swept Frequency Synthesizers and 6600B Sweep Generators are also compatible with the 360B.

System Signal Sources

There are two System Signal Sources: The 360SS47 and the 360SS69, covering the 10 MHz to 20 GHz and 40 GHz ranges respectively. Both are controlled and phase-locked by the 360B Network Analyzer to provide clean, phase-locked stimulus signals. Frequency resolution is 100 kHz. 60 GHz coverage is provided by using a standard 360SS69 with a 3612A, 3622A, or 3631A Test Set that includes a frequency tripler.

Model 360SS69 System Signal Source

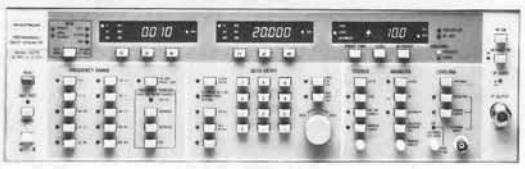
6700B Series Swept Frequency Synthesizers

The 360B controls the 6700B over it's GPIB interface. The 6700B Series offers 1 kHz resolution and internal pulse capability.

6700B Series Synthesizers

6600B Series Sweep Generators

Also compatible with the 360B are the 6600B Sweep Generators (with Option 14, 360 compatibility). The 360B controls the 6600B over its GPIB interface and phase locks the 6600B to 100 kHz resolution via the phase lock input.



6600B Series Sweep Generators

Cabinets

360B VNA systems, consisting of a 360B, test set(s), and source(s) are available either in the 360C2 System Console, 360C1 System Cabinet, or 360C3 Millimeter-Wave System Console.

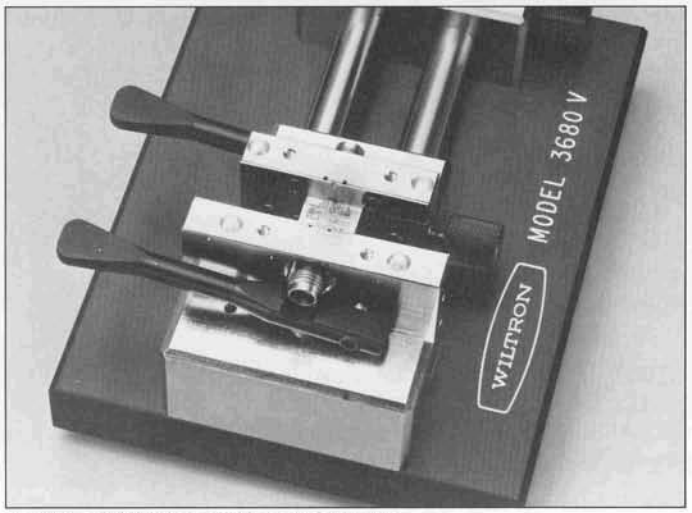
Vector Network Analyzers

Measurement Accessories

Wiltron offers a complete line of accessories to accommodate measurement of a wide variety of test devices.

3680 Series Universal Test Fixture (UTF)

Wiltron's UTF provides an accurate, repeatable solution for measuring microstrip and coplanar waveguide devices.



The Wiltron 3680 Series Universal Test Fixture

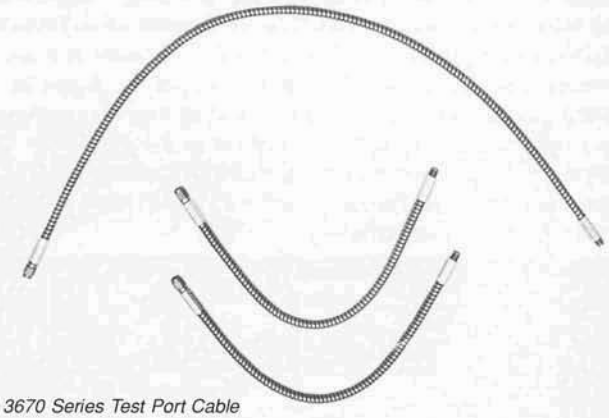
Gore Next Generation Test Port Cables

Gore Next Generation flexible test port cables are available for use with the Wiltron 360B VNA. These test assemblies ensure precise, repeatable, broadband measurements to 62.5 GHz and can be configured for test sets covering 40 MHz to 20 GHz, 40 GHz, and 62.5 GHz. Standard lengths are 25 and 38 inches. The excellent phase and amplitude stability of Gore test assemblies helps maintain calibration to ensure test accuracy and productivity. For more information on Next Generation Series test port cables for use with the 360B VNA, contact your local Anritsu-Wiltron Sales Center or W.L. Gore & Associates at 800-356-4622.

Gore Next Generation Test Port Cables

3670 Series Test Port Cables

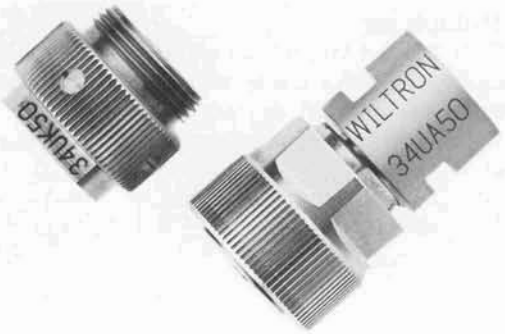
Wiltron offers 1- and 2-foot lengths of these laboratory quality cables with GPC-7, K, or V connectors. Most applications require one 1-foot cable and one 2-foot cable.



Model 3670 Series Test Port Cable

34U & 34Y Series Test Port Converters

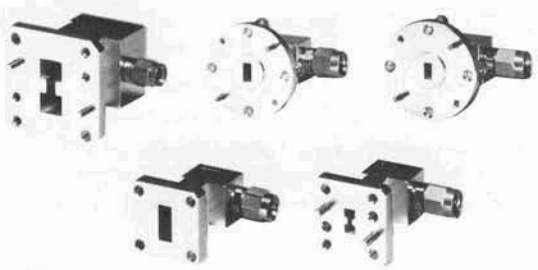
Test port converters allow you to change the test port connectors on a 3600A Series test set. Converters are available with Type N, 2.4 mm, 3.5 mm, GPC-7, K, and V connectors.



Model 34U and 34Y Series Test Port Converters

35 Series Waveguide-to-Coaxial Adapters

The 35 Series precision waveguide-to-coaxial adapters transform standard or double-ridge waveguide to coaxial K or V connectors. Sixteen different models cover the 7.5 to 60 GHz frequency range.



The 35 Series Waveguide-to-Coax Adapters include standard and double-ridge models

Specifications

MEASUREMENT CAPABILITIES

Number of Channels: Four measurement channels.
Parameters: S_{11}, S_{21}, S_{22}, S_{12}; or user defined, complex input and output impedance; complex input or output admittance; and complex forward and reverse transmission. All measurements are made without the need to manually reverse the test device.
Domains: Frequency Domain, CW Draw, and optional High Speed Time (Distance) Domain.
Formats: Log Magnitude, Phase, Log Magnitude and Phase, Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, Log Polar, Group Delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real and Imaginary, SWR.
Data Points: 501 (MAXIMUM). Can be switched to a value of 168 (NORMAL) or 85 (MINIMUM) data (frequency) points without recalibration. In addition, the system accepts an arbitrary set of N discrete data points where: $2 \leq N \leq 501$. CW mode permits selection of a single data point without recalibration.
Reference Delay: Can be entered in time or in distance (when the dielectric constant is entered). Automatic reference delay feature adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between reference and test is always accurate and stable since measurement frequencies are always synthesized. In addition, Wiltron offers compensated reference phase delay for dispersive transmission media, such as waveguide and microstrip.
Markers: Six independent markers can be used to read out measurement data. In delta-reference mode, any one marker can be selected as the reference for the other five. Markers can be directed automatically to the minimum or maximum of a data trace.
Marker Sweep: Sweeps upward in frequency between any two markers. Recalibration is not required during the marker sweep.
Limits: Two limit lines per data trace to indicate test limits.
Limit Frequency: Identifies the ±X dB bandwidth of amplifiers, filters and other frequency sensitive devices. Interpolation algorithm determines the exact intersection frequencies of test data and limit lines.
Measurement Frequency Range: Frequency range of measurement can be narrowed within calibration range without recalibration. CW mode permits single frequency measurements, also without recalibration. In addition, the system accepts N discrete frequency points where $2 \leq N \leq 501$.
Dynamic Range: Table 1, on page 27, gives dynamic range in two manners. "Receiver Dynamic Range" is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the noise floor at Port 2. "System Dynamic Range" is defined as the ratio of the power incident on Port 2 in a through line connection to the noise floor at Port 2 (forward measurements only). In preparing the table, minimum IF bandwidth and 1024 averages were used in calibration and measurement.

DISPLAY CAPABILITIES

Display Channels: Four, each of which can display any S-parameter or user defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously. A single channel, two channels (1 and 3, or 2 and 4), or all four channels can be displayed simultaneously.
CRT: Color, 7.5" diagonal, VGA display. Graticules are displayed in green, measurement data in red, markers and limits in blue, and overlaid trace data in yellow. Trace data stored in memory are displayed in green.
Trace Overlay: Displays two traces on the active channel's graticule simultaneously. The overlaid trace is displayed in yellow and the primary trace is displayed in red.
Trace Memory: A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data.
Scale Resolution (minimum):

Log Magnitude: 0.001 dB/div
Phase: 0.01 degrees/div
Time: 0.001 µs
SWR: 1 pU
Linear Magnitude: 1 pU
Group Delay: 0.001 ps
Distance: 0.001 µm

Autoscale: Automatically sets Resolution and Offset to fully display measurement data.
Reference Position: Can be set at any graticule line.
Annotation: Type of measurement, vertical and horizontal scale resolution, start and stop frequencies, and reference position.

MEASUREMENT ENHANCEMENT

Data Averaging: Averaging of 1 to 4095 averages can be selected. Averaging can be toggled on/off with front-panel button. Front-panel LED indicates when averaging is active.
Video IF Bandwidth: Front-panel switch selects three levels of video IF bandwidth. NORMAL, REDUCED, and MINIMUM selections correspond to approximately 10 kHz, 1 kHz, and 100 Hz, respectively.
Trace Smoothing: Functions similarly to Data Averaging but computes an average over a percentage range of the data trace. The percentage of trace to be smoothed can be selected from 0 to 20% of trace. Front-panel button turns smoothing on/off, and front-panel LED indicates when smoothing is active.

SOURCE CONTROL

Compatibility: The 360B is compatible with the Wiltron 360SS System Sources and the 6600B Sweep Generators. The output frequency of both is phase locked by the 360B to the internal 10 MHz crystal standard, providing synthesizer stability. Phase-lock time is typically 2 ms. Frequency resolution is 100 kHz. The 360B is also compatible with the 6700B Series Swept Frequency Synthesizers which offer 1 kHz frequency resolution.
Source Power Level: The source power (dBm) may be set from a 360B front panel menu. For active device test sets, the signal level at Port 1 or Port 2 can be controlled using the test set's internal step attenuators.
Power Flatness Correction: The 360B corrects for test port power variations and slope using an external Hewlett-Packard 437B power meter. The 360B measures the power level at the test port, calculates the flatness correction offset at each frequency, and then passes the offset array to the 360B signal source. Once the test port power has been flattened, its level may be changed within the remaining power adjustment range of the signal source.
Dual Source Control Capability: Dual Source Control capability allows a user to separately control the frequency of up to two sources and a receiver without the need for an external controller. The frequency ranges and output powers of the two sources may be specified. A frequency sweep may be comprised of up to five separate bands, each with independent source and receiver settings, for convenient testing of frequency translation devices such as mixers. Up to five sub-bands may be tested in one sweep. Option 4 enables users to easily test mixers, up/down converters, multipliers, and other frequency conversion devices.

Source #1: Any one of Wiltron's family of 360SS signal sources or any one of Wiltron's family of 6700B synthesizers
Source #2: Any of Wiltron's family of 6700B synthesizers
Receiver: Any one of Wiltron's family of 3600A Series VNA test sets.

SOURCE FREQUENCY ACCURACY

Time Base Freq. Accuracy: Same as internal or external time base.
Internal 10 MHz Time Base Stability:
With Aging: $<\pm 1 \times 10^{-9}$/day
With Temperature: $<\pm 5 \times 10^{-9}$ over 0° to +55°C range

TEST PORT CHARACTERISTICS

The specifications in Table 2 apply when the proper Model 34U or 34Y Universal Adapters are connected, with or without phase-equal insertables, to the test set ports and calibrated with the appropriate Wiltron or other designated calibration kit at 23°C ±3°C using the OSL calibration method with a sliding load to achieve 12-Term error correction.

GROUP DELAY CHARACTERISTICS

Group Delay is measured by computing the phase change in degrees across a frequency step by applying the formula:

$$\tau_g = -1/360\ d\phi/df$$

Aperture: Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range without recalibration. The frequency width of the aperture and the percent of the frequency range are displayed automatically.

Range: The maximum delay range is limited to measuring no more than ±180 degrees of phase change within the aperture set by the number of frequency points. A frequency step size of 100 kHz corresponds to 10 μs.

Measurement Repeatability (sweep to sweep): For continuous measurement of a through connection, RSS fluctuations due to phase and FM noise are:

$$\frac{1.41\ \{(\text{Phase Noise}^* \text{ in deg})^2 + (\tau_g \times \text{Residual FM Noise in Hz})^2\}^{1/2}}{360\ (\text{Aperture in Hz})}$$

* Signal source phase noise specification.

Accuracy:

$$\text{Error in } \tau_g = \frac{\frac{\text{Error in phase (deg)}}{360} + (\tau_g \times \text{Aperture Freq. Error (Hz)}}{\text{Aperture (Hz)}}$$

VECTOR ERROR CORRECTION

There are three methods of calibration:

1) a standard Open-Short-Load (OSL) calibration method using short circuits, open circuits, and terminations (fixed or sliding);
2) Offset-Short (waveguide) calibration; and
3) LRL/LRM — Line-Reflect-Line or Line-Reflect-Match calibration.

There are four vector error correction models available:

1) Full 12-Term
2) One Path/Two Port
3) Frequency Response (Transmission/Reflection)
4) Reflection Only

Full 12-Term can always be used, if desired, since all S-parameter test sets automatically reverse the test signal. Front-panel LEDs indicate the type of calibration that is stored in memory. Front-panel button selects whether calibration is to be applied, and an LED lights when error correction data are being applied.

Calibration Sequence: Prompts the user to connect the appropriate calibration standard to Port 1 and/or Port 2. Calibration standards may be measured simultaneously or one at a time.

Calibration Standards: For coaxial calibrations the user selects SMA, GPC–3.5, GPC–7, Type N, 2.4 mm, TNC, K Connector, or V Connector from a calibration menu. Use of fixed or sliding load can be selected for each connector type. Open circuit offset length and capacitance coefficients can be modified. Short circuit offset length may be modified. Throughline parameters may be modified by entering an offset length and/or by entering the dc coefficient (A), frequency coefficient (B), and frequency exponent (C) for a throughline loss equation as follows: $(A + B \times \text{Frequency}^C)$. In general, all calibration parameters may be modified manually or through the GPIB interface.

Reference Impedance: Modify the reference impedance of the measurement to other than 50Ω.

LRL/LRM Calibration Capability: The LRL calibration technique uses the characteristic impedance of a length of transmission line as the calibration standard. A full LRL calibration consists merely of two transmission line measurements, a high reflection measurement, and an isolation measurement. The LRM calibration technique is a variation of the LRL technique that utilizes a precision termination rather than a second length of transmission line. A third optional standard, either Line or Match, may be measured in order to extend the frequency range of the calibration. This extended calibration range is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s). Using these techniques, full 12-term error correction can be performed on the 360B VNA.

LRL/LRM Calibration Performance:

Calibration Performed: LRL + Isolation, or LRM + Isolation; two-line, one-line/one-match, or concatenated calibration (LRLL, LRLM, LRML, or LRMM).

Dispesion Compensation: Selectable as Coaxial (non-dispersive), Waveguide, or Microstrip.

Reference Plane: Selectable as Middle of line 1 or Ends of line 1.

Corrected Impedance: Determined by Calibration Standards.

Accuracy: Determined by calibration components. For a GPC–7 calibration, when properly calibrated with an appropriate Maury Microwave LRL calibration kit, the specifications in Table 2 on page 28 apply.

HARD COPY

Printer: Menu selects full screen, graphical, tabular data, and printer type. The number of data points of tabular data can be selected as well as data at markers only. Compatible with the 2225C Ink Jet, HP QuietJet, HP DeskJet, HP LaserJet, and Epson compatible printers with Parallel (Centronics) interfaces.

GPIB Plotter: The 360B is compatible with HP Models 7440A, 7470A, 7475A, and 7550A and Tektronix Model HC100 plotters. Menu selects plotting of full or user-selected portions of graphical data. Plotter is connected to the dedicated system bus, which also controls the system signal source.

Buffer: Hard-copy printed data are loaded into buffer memory in approximately 12 seconds. Full front-panel operation and measurement capability is then restored to the user during the remainder of the hard-copy generation.

STORAGE

Internal Memory: Up to four front panel states (setup/calibration) can be stored and recalled from non-volatile memory locations. The current front panel setup is automatically stored in non-volatile memory at instrument power-down. When power is applied, the instrument returns to its last front panel setup (with no calibration or normalization data applied).

Internal Disk Drive: A 3.5-inch microdiskette drive with 1.44 Mbytes formatted capacity is used to load measurement programs and to store and recall measurement and calibration data and front-panel setups. This disk drive will also read from and write to 720 kbyte MS–DOS formatted disks. All files are MS–DOS compatible. File names can be 1 to 8 characters long.

Disk Drive File Size:

Measurement Data: 25.6K bytes per 501 point S-parameter data file.

Calibration Data: 61K bytes per 501 point (12-term cal+setup).

Trace Memory File: 4K bytes per 501 point channel.

Table 1. Test Set Dynamic Range Summary

Test Set Model	Frequency (GHz)	Max. Signal Into Port 2 (dBm)	Noise Floor (dBm)	Receiver Dynamic Range (dB)	Port 1 Power (dBm, typical)	System Dynamic Range (dB)
3610A Reversing Test Set	0.04	+20	–95	115	–4	91
	1	0	–113	113	–5	108
	20	0	–108	108	–7	101
3611A Reversing Test Set	0.04	+20	–92	112	–6	86
	1	+3	–109	112	–7	102
	20	+3	–105	108	–9	96
	40	+3	–101	104	–15	86
3612A Reversing Test Set	0.04	+20	–95	115	–10	85
	1	+3	–112	115	–11	101
	20	+3	–108	111	–17	91
	40	+3	–105	108	–22	83
	50	+3	–90	93	–15	75
	60	+3	–87	90	–17	70
	62.5①	+3	–85	88	–18	67
3620A Active Device Test Set	0.04	+30	–98	128	–4	94
	1	+30	–115	145	–5	110
	20	+30	–110	140	–8	102
3621A Active Device Test Set	0.04	+30	–95	125	–6	89
	1	+30	–112	142	–7	105
	20	+30	–107	137	–10	97
	40	+30	–103	133	–18	85
3622A Active Device Test Set	0.04	+30	–95	125	–10	85
	1	+30	–112	142	–11	101
	20	+30	–107	137	–18	89
	40	+30	–103	133	–24	79
	50	+30	–89	119	–19	70
	60	+30	–86	116	–21	65
	62.5①	+30	–84	114	–22	62
3630A Frequency Converter	0.01	–10	–112	102	n/a	n/a
	1	–10	–112	102		
	20	–15	–108	98		
	40	–7	–97	87		
3631A Frequency Converter	0.01	–10	–117	107	n/a	n/a
	1	–10	–117	107		
	20	–10	–115	105		
	40	–10	–107	97		
	50	–10	–95	85		
	60	–10	–90	80		
3640B-Q & 3641B-Q (WR-22) mm-Wave Modules②	33 to 50	–1	–102	101	–4	98
3640B-U & 3641B-U (WR-19) mm-Wave Modules②	40 to 60	+1	–101	102	–4	97
3640B-V & 3641B-V (WR-15) mm-Wave Modules②	50 to 75	–7	–100	93	–10	90
3640B-W & 3641B-W (WR-10) mm-Wave Modules②	75 to 110	–4	–95	91	–15	80

① Available with Test Set Option 5, 62.5 GHz Frequency Coverage.
② 364XB Series mm-Wave Modules are used with the 3635B mm-Wave Test Set.

Table 2. Test Port Characteristics

Connector	Frequency (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB)
GPC–7	0.04 1.0 18	>52 >52 >52	>44 >44 >42	>52 >52 >52	±0.003 ±0.003 ±0.004	±0.004 ±0.004 ±0.012	>105 >115 >112
GPC–7[1] LRL Calibration	2 18	>60 >60	>60 >60	>60 >60	±0.001 ±0.001	±0.001 ±0.001	>115 >112
3.5 mm	0.04 1.0 20 26.5	>44 >44 >44 >44	>40 >40 >38 >34	>44 >44 >44 >44	±0.005 ±0.005 ±0.006 ±0.006	±0.030 ±0.030 ±0.050 ±0.070	>105 >115 >110 >102
K	0.04 1.0 20 40	>42 >42 >42 >38	>40 >40 >38 >33	>42 >42 >42 >38	±0.005 ±0.005 ±0.006 ±0.006	±0.030 ±0.050 ±0.070 ±0.080	>105 >115 >110 >100
V	0.04 1.0 20 40 50 60 62.5[2]	>40 >40 >40 >36 >34 >34 >34	>38 >38 >36 >32 >28 >28 >26	>40 >40 >40 >36 >34 >34 >34	±0.005 ±0.005 ±0.008 ±0.008 ±0.015 ±0.015 ±0.015	±0.030 ±0.050 ±0.050 ±0.080 ±0.100 ±0.100 ±0.100	>105 >115 >110 >97 >85 >77 >75
WR-22 Waveguide (LRL Calibration)	33 to 50	>50	>50	>50	±0.002	±0.002	>100
WR-22 Waveguide (Offset Short Cal.)		>50	>45	>50	±0.010	±0.030	>100
WR-19 Waveguide (LRL Calibration)	40 to 60	>50	>50	>50	±0.002	±0.002	>100
WR-19 Waveguide (Offset Short Cal.)		>50	>40	>50	±0.010	±0.040	>100
WR-15 Waveguide (LRL Calibration)	50 to 75	>50	>50	>50	±0.002	±0.002	>90
WR-15 Waveguide (Offset Short Cal.)		>50	>37	>50	±0.030	±0.060	>90
WR-10 Waveguide (LRL Calibration)	75 to 110	>46	>46	>46	±0.002	±0.002	>90
WR-10 Waveguide (Offset Short Cal.)		>46	>36	>46	±0.040	±0.070	>90

[1] When used with an appropriate Maury Microwave Calibration Kit (or equivalent).
[2] Available with Test Set Option 5, 62.5 GHz Frequency Coverage.

REMOTE PROGRAMMING

Interface: GPIB (IEEE–488)
Addressing: Address can be set from the front panel and can range from 0 to 30. Defaults to address 6.
Transfer Formats: ASCII, 32-bit floating point, or 64-bit floating point.
Speed: 40K bytes/s
Interface Function Codes: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC1, C0.

MEASUREMENT ACCURACY

The graphs on the following pages give measurement accuracy after 12-term vector error correction. The errors are worst case contributions of residual directivity, load and source match, frequency response, isolation, network analyzer dynamic accuracy, and connector repeatability. In preparing the following graphs, minimum video/IF bandwidth and averaging of 1024 points were used. Changes in the video IF bandwidth or averaging can result in variations at low levels.

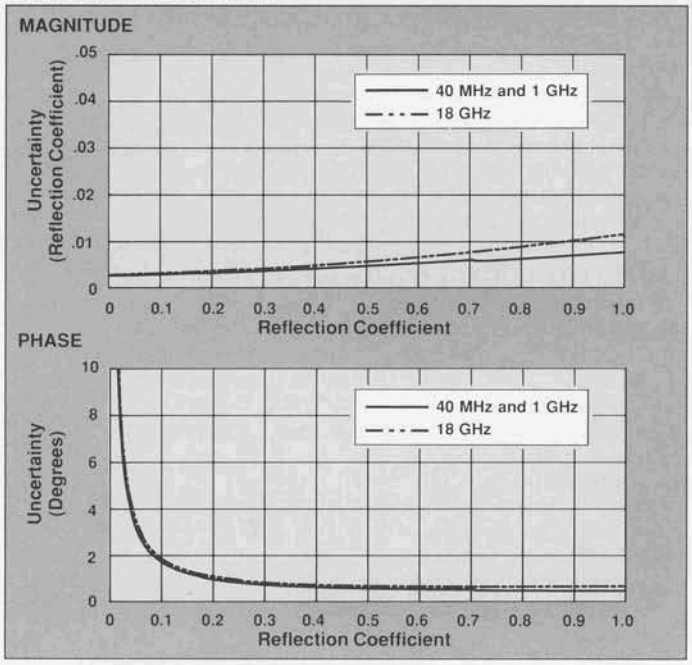
GENERAL

360B Rear Panel Connectors and Controls:
CRT INTEN: Continuous control of CRT intensity.
CRT DEGAUSS: Pushbutton control degausses CRT.
PRINTER: Centronics interface for an external printer.
VGA IN: Accepts standard 15-pin external VGA signal input.
VGA OUT: Provides VGA output of 360B video display.
10 MHz REF IN: Connects to external reference frequency standard, 10 MHz, +5 to –5 dBm, 50Ω, BNC female.
10 MHz REF OUT: Connects to internal reference frequency standard, 10 MHz, 0 dBm, 50Ω, BNC female.
EXT ANALOG OUT: –10V to +10V with 5 mV resolution, varying in proportion to user-selected data (e.g., frequency, amplitude, phase). BNC female.
LINE SELECTION: Sets 110V, 120V, 220V, or 240V operation.
EXTERNAL DIGITAL CONTROL: External triggering for 360B measurement, BNC female. ±1V trigger. 10 kΩ input impedance.
EXT FM PHASE LOCK OUTPUT: Connects to 6600B Series or 360SS signal source for phase locking.
SYSTEM BUS: Dedicated IEEE–488 interface for the system signal source, plotter, and power meter.
TEST SET SIGNAL: Interconnects system components.
TEST SET CONTROL: Interconnects system components.
360B GPIB: IEEE-488 interface

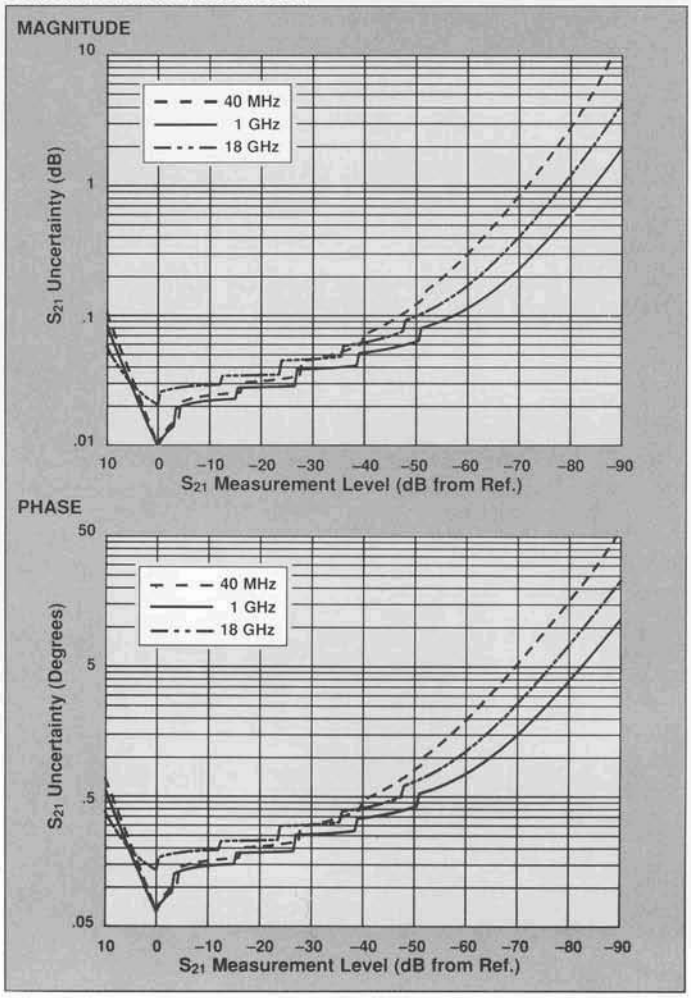
Test Set Rear Panel Connectors and Controls:
BIAS INPUTS, Ports 1 and 2: 0.5 A maximum. BNCs on test set front and rear panels.
REFERENCE EXTENSION: Provides access to reference samplers, K Connector, female.
360B SIGNAL: Interconnects system components.
360B CONTROL: Interconnects system components.
OPTION I/O: Dedicated I/O port for 360B module support.
Frequency Converter Rear Panel Connectors and Controls:
PORT 2 SOURCE ATTENUATOR: 14-pin DIP socket, used to control external Wiltron Step Attenuator.
PORT 2 TEST ATTENUATOR: 14-pin DIP socket, used to control external Wiltron Step Attenuator.
TRANSFER SWITCH: Connector used to control an external Wiltron transfer switch.
360B SIGNAL: Interconnects system components.
360B CONTROL: Interconnects system components.
OPTION I/O: Dedicated I/O port for 360B module support.
Temperature Range:
Operating: 0°C to 50°C (45°C maximum for disk drive)
Storage: –40°C to 75°C
Power Requirements:
Network Analyzer: 100V/120V/220V/240V +5%, –10%, 48–63 Hz, 350 VA maximum
System Sources: 100V/120V/220V/240V +5%, –10%, 48–63 Hz, 250 VA maximum
Test Sets & Freq. Converter: None; power supplied by 360.
Dimensions:
360B VNA: 222H x 432W x 603D mm (8.75x17x23.75 in.)
System Sources: 133H x 432W x 476D mm (5.25x17x18.75 in.)
Test Sets and Frequency Converter: 133H x 432W x 603D mm (5.25x17x23.75 in.)
Printer: 89H x 292W x 203D mm (3.5x11.5x8 in.)
System Cabinet: 572H x 559W x 699D mm (22.5x22x27.5 in.)
System Console: 1245H x 559W x 699D mm (49x22x27.5 in.)
Weight:
Network Analyzer: 25 kg (55 lb.)
System Sources: 16 kg (35.4 lb.)
Test Sets and Frequency Converter: 14.3 kg (31.5 lb.)
Printer: 3.2 kg (7 lb.)
System Cabinet (empty): 40.8 kg (90 lb.)
System Console (empty): 88.4 kg (195 lb.)

UNCERTAINTY CURVES

Models 3610A and 3620A Test Sets (GPC–7 Connectors)
Reflection Measurements:

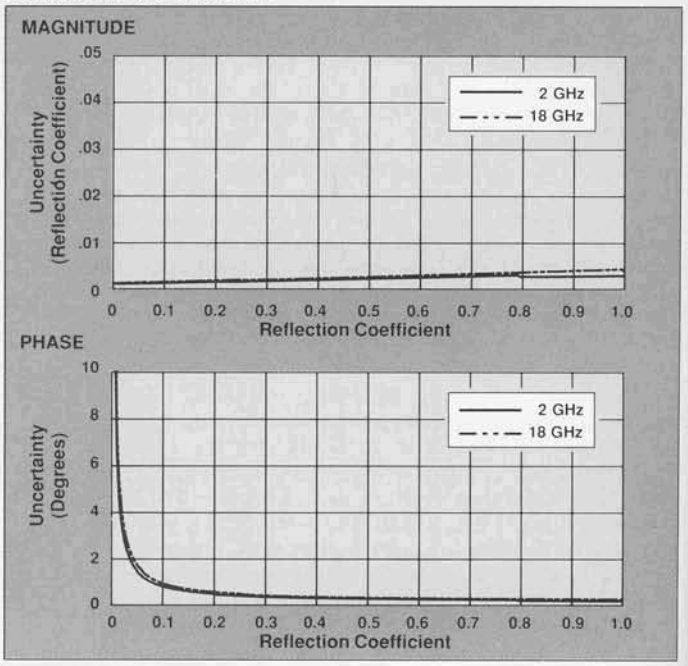


Transmission Measurements:

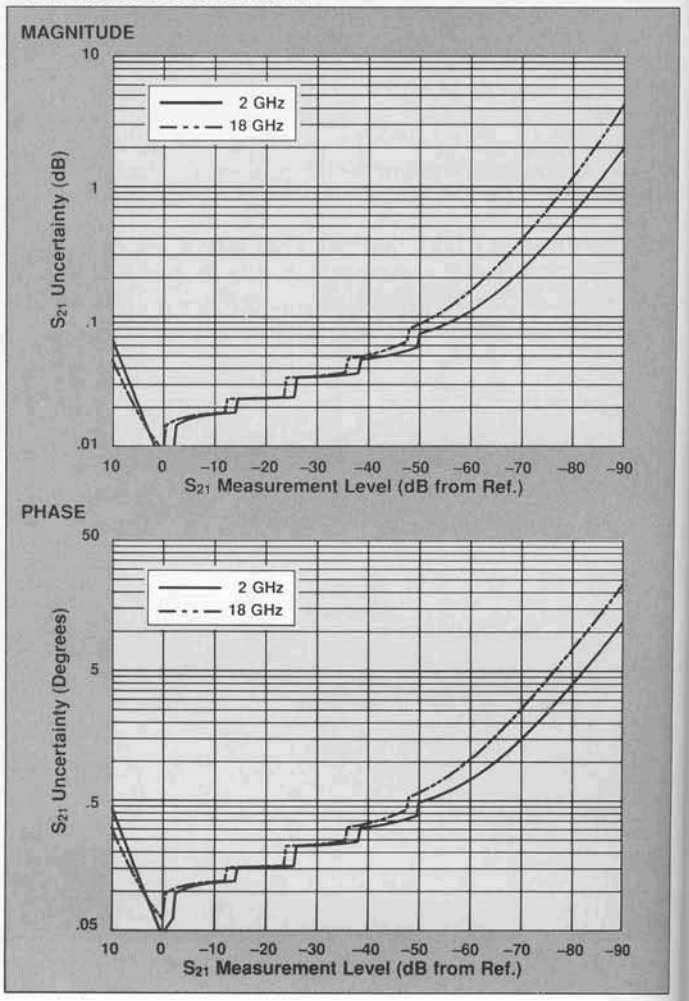


UNCERTAINTY CURVES

Models 3610A and 3620A (LRL Calibration; GPC-7 Connectors)
Reflection Measurements:



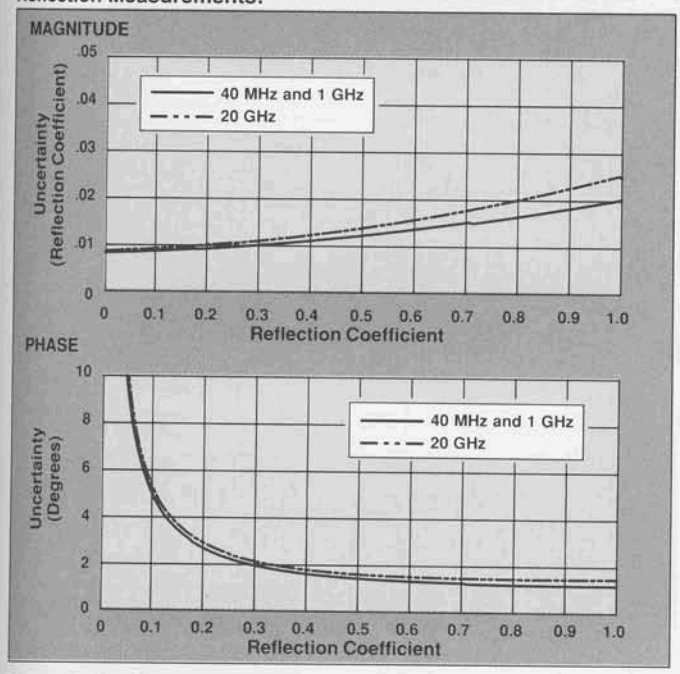
Transmission Measurements:



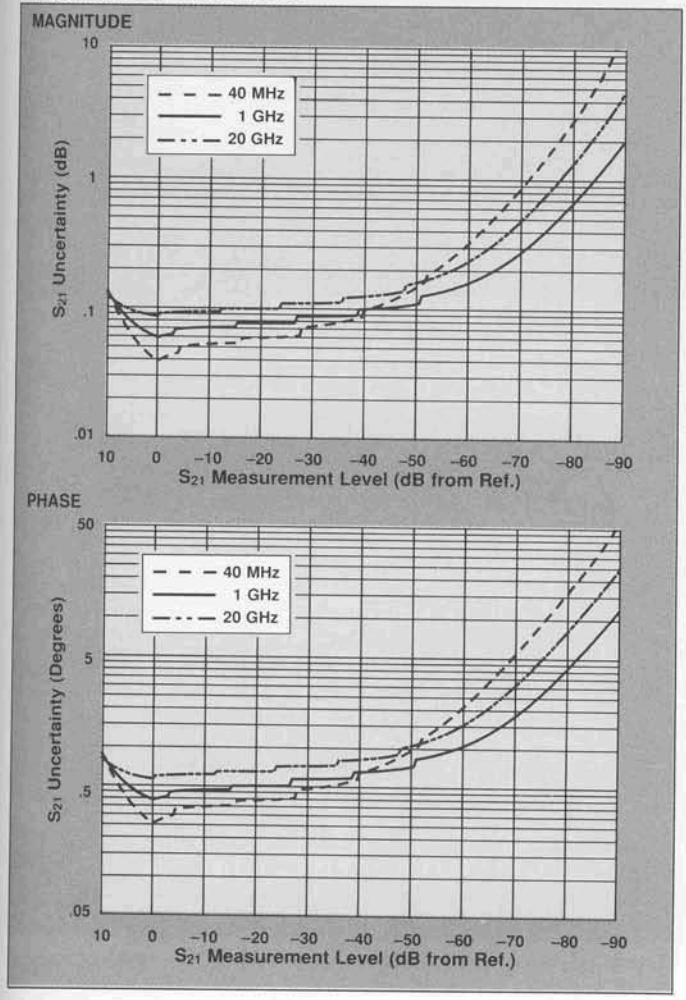
UNCERTAINTY CURVES

Models 3610A and 3620A Test Sets (K Connectors)

Reflection Measurements:



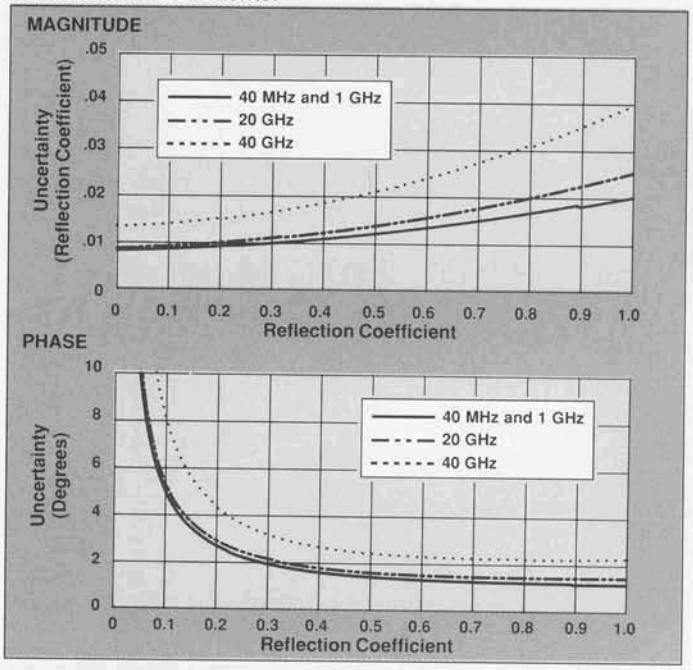
Transmission Measurements:



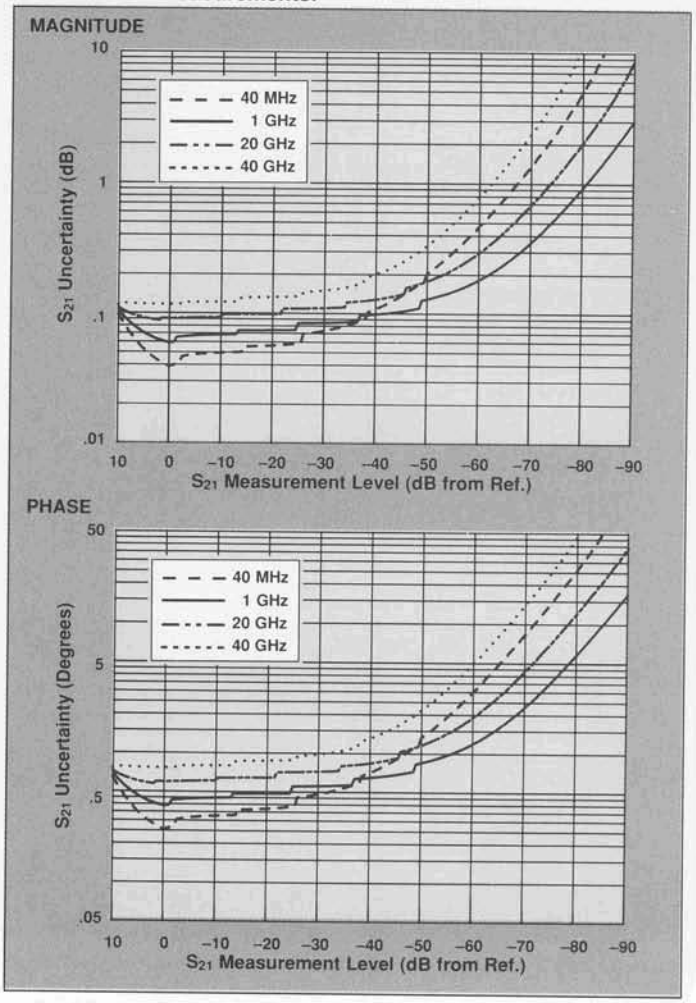
UNCERTAINTY CURVES

Models 3611A and 3621A Test Sets (K Connectors)

Reflection Measurements:

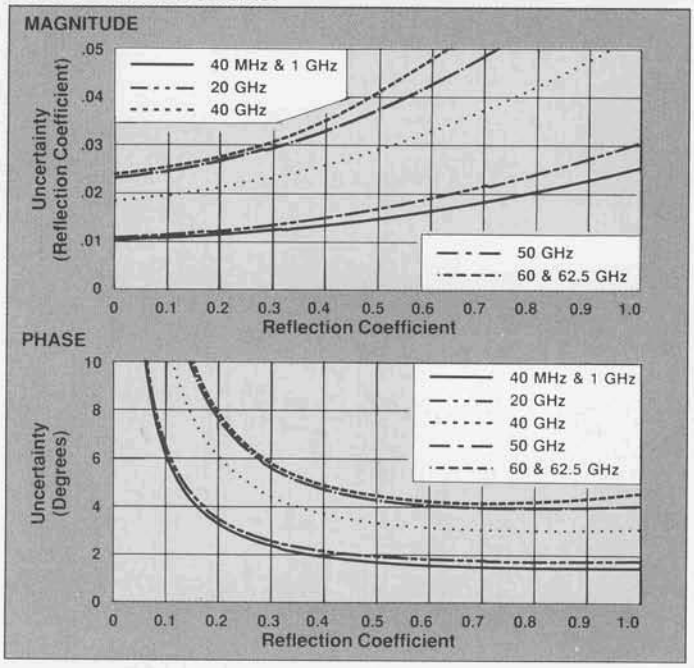


Transmission Measurements:

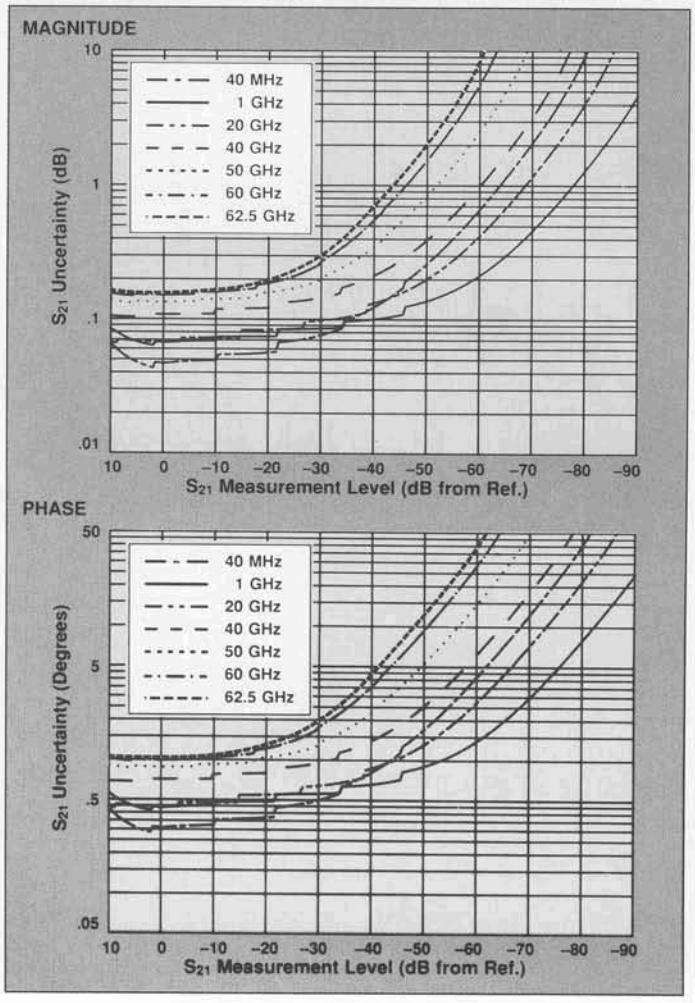


UNCERTAINTY CURVES

Models 3612A and 3622A Test Sets (V Connectors)
Reflection Measurements:

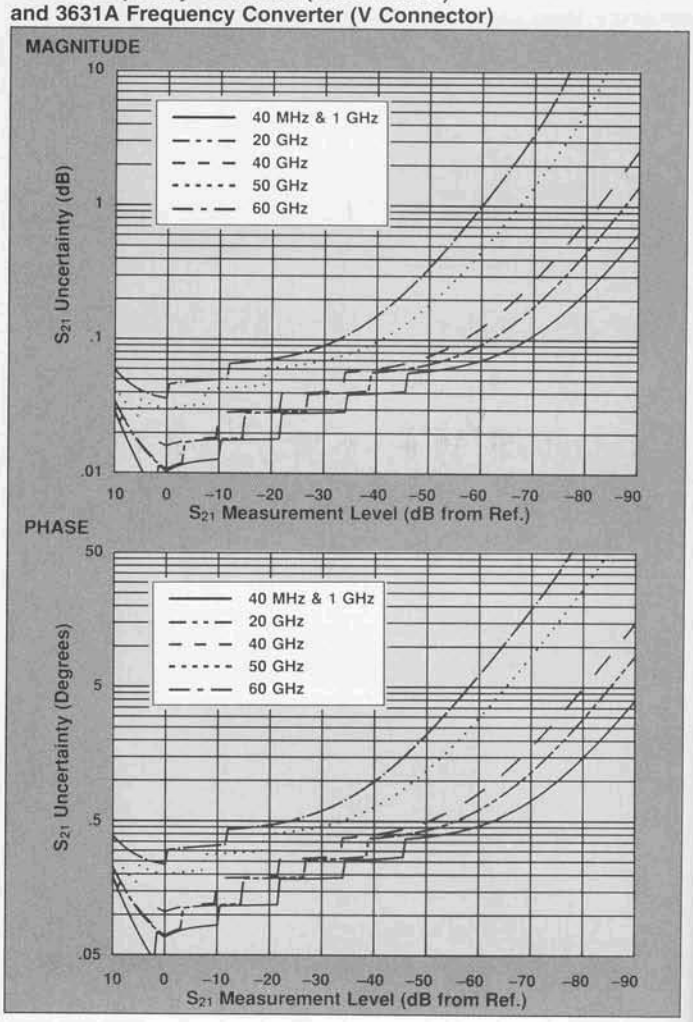


Transmission Measurements:



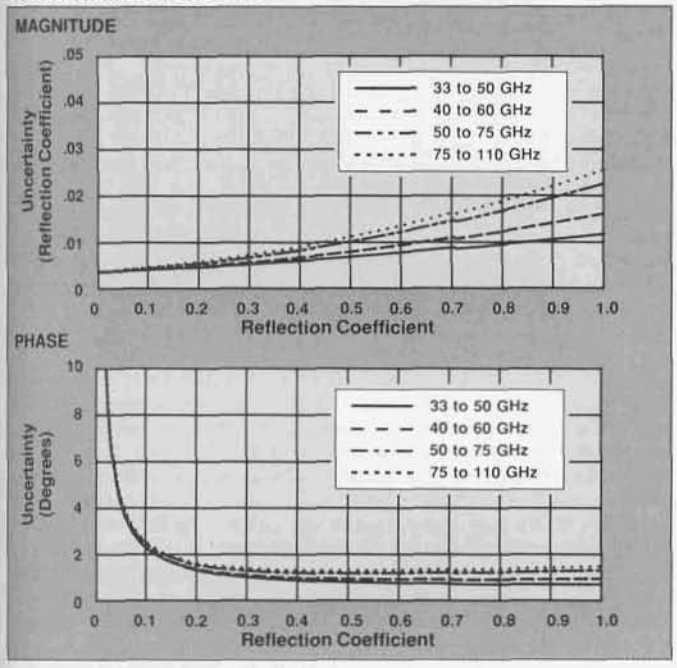
DYNAMIC ACCURACY CURVES

3630A Frequency Converter (K Connector)
and 3631A Frequency Converter (V Connector)

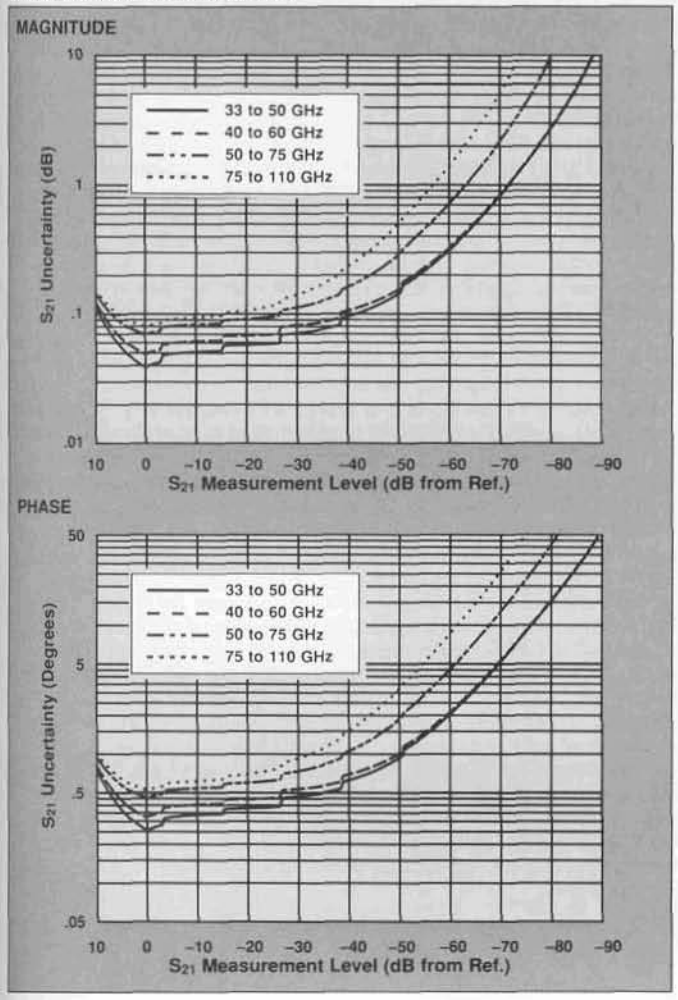


UNCERTAINTY CURVES

3640B and 3641B Series mm-Wave Modules (Q, U, V, W Bands)
Using Offset Short Calibration Method
Reflection Measurements:

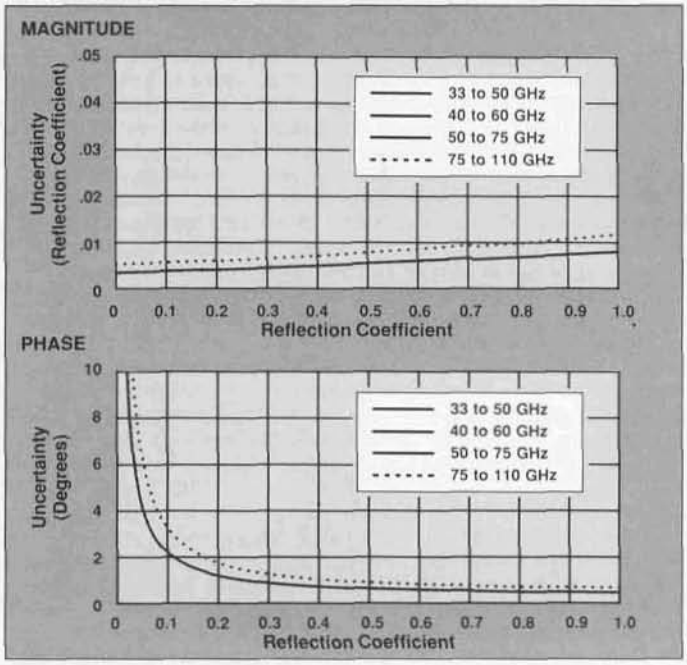


Transmission Measurements:

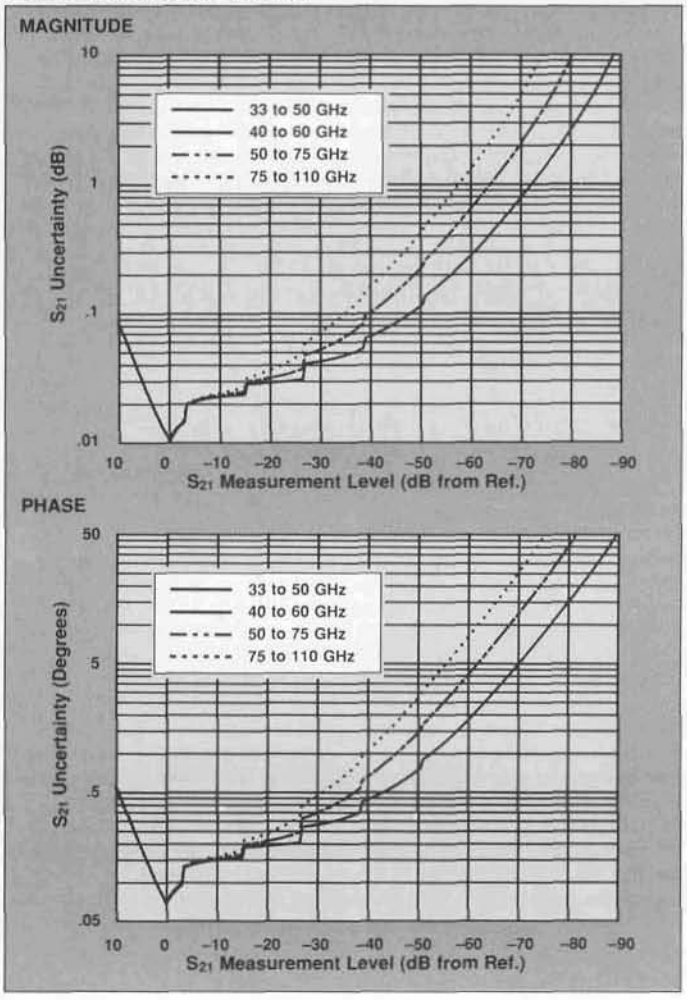


UNCERTAINTY CURVES

3640B and 3641B Series mm-Wave Modules (Q, U, V, W Bands)
Using LRL Calibration Method
Reflection Measurements:



Transmission Measurements:



360B Options

OPTION 2A — HIGH SPEED TIME (DISTANCE) DOMAIN MEASUREMENT CAPABILITY

Option 2A, High Speed Time (Distance) Domain software allows the conversion of reflection or transmission measurements from the frequency domain to the time domain. Measured S-parameter data is converted to the time domain by application of a Fast Fourier Transform (FFT) using the Chirp Z-Transform technique. Prior to conversion any one of several selectable windowing functions may be applied. Once the data is converted to the time domain, a gating function may be applied to select the data of interest. The processed data may then be displayed in the time domain with display start and stop times selected by the user, or in the distance domain with display start and stop distance selected by the user. The data may also be converted back to the frequency domain with a time gate to view the frequency response of the gated data.

Lowpass Mode: This mode displays a response equivalent to the classic "TDR" (Time Domain Reflectometer) response of the device under test. Lowpass response may be displayed in either the impulse or step mode. This type of processing requires a sweep over a harmonic series of frequencies and an extrapolated or user-entered dc value.

Bandpass Mode: This mode displays a response equivalent to the time response of the device under test to a band limited impulse. This type of processing may be used with any arbitrary frequency sweep range, limited only by the test set range or device under test response.

Phasor Impulse Mode: This mode displays a response similar to the Lowpass impulse response, using data taken over an arbitrary (band limited) sweep range. Detailed information, similar to that contained in the lowpass impulse response may be used to identify the nature of impedance discontinuities in the device under test. Now, with Phasor Impulse, it is possible to characterize complex impedances on band-limited devices.

Windowing: Any one of four window functions may be applied to the initial frequency data, to counteract the effects of processing data with a finite bandwidth. These windows provide a range of tradeoffs of main lobe width versus sidelobe level (ringing). The general type of function used is the Blackman-Harris window, with the number of terms being varied from one to four. Typical performance follows:

Type of Window (Number of Terms)	First Side Lobe Relative to Peak	Impulse Width[1]
Rectangular (1)	–13 dB	1.2 W
Nominal-Hamming (2)	–43 dB	1.8 W
Low Side Lobe, Blackman-Harris (3)	–67 dB	2.1 W
Minimum Side Lobe, Blackman-Harris (4)	–92 dB	2.7 W

[1] W(Bin Width) = 1/2Δf sweep width.
Example: when Δf = 40 MHz to 40 GHz, W = 12.5 ps.

Gating: A selective gating function may be applied to the time domain data to remove the responses of all but one desired time range. This gating function may be chosen as the convolution of any of the above window types with a rectangular gate of user defined position and width. The gate may be specified by entering start and stop times or center and span. The gated data may be displayed in the time domain, or converted back to the frequency domain.

Time Domain Display: Data processed to time domain may be displayed as a function of time or as a function of distance, provided the dielectric constant of the transmission media is entered correctly. In the case of dispersive media such as waveguide or microstrip, the true distance to a discontinuity is displayed in the distance mode. The time display may be set to any arbitrary range by specifying either the start and stop times or the center time and span.

The unaliased (non-repeating) time range is given by the formula:

$$\text{Unaliased Range (ns)} = \frac{\text{Number of Frequency Data Points}}{\text{Frequency Sweep Range (GHz)}}$$

The resolution is given by the formula:

$$\text{Main Lobe Width (null–null) in ns} = \frac{\text{Kw}}{\text{Freq. Sweep Range (GHz)}}$$

where Kw is two times the number of window terms, (for example, four for a two-term window)

For a 40 GHz sweep range with 501 data points, the unaliased range is 12.525 nanoseconds.

Frequency with Time Gate: Data that has been converted to time domain and selected by the application of gating function may be converted back to the frequency domain. This allows the display of the frequency response of a single element contained in the device under test. Frequency response accuracy is a function of window and gate type, and gate width. For a full reflection, minimum gate and window accuracy is within 0.2 dB of the ungated response over a 40 GHz range.

OPTION 5 — RECEIVER MODE CAPABILITY

Option 5 for the Wiltron 360B VNA allows a user to select the mode in which an incoming signal is coherently detected. A user may select one of three modes of phase-lock operation:

Source Lock Mode: In this mode, the 360B can phase lock any frequency source capable of being controlled by an analog output. The 360B detects the frequency error of the source, and sends a dc correction voltage to the External Phase Lock Input of the 360B System Signal Source. The constraints imposed on the signal source analog output are 1) >10 kΩ input impedance, 2) <100 pF input capacitance, 3) >500 kHz 3 dB Bandwidth, 4) –6 MHz/volt sensitivity. The absolute accuracy of the signal source must also be better than ±25 MHz. Source lock can only be achieved if the source frequency is available to one of the reference receive channels. The power level needed at the sampler input is –10 to –30 dBm. All other receive channels will operate over their full dynamic range. Due to the inherent resolution of the 360's synthesized local oscillators, frequency resolution is limited to 100 kHz intervals over the full frequency range of the test set.

Tracking Mode: This mode is used to phase lock the 360B receivers to a known frequency source. Specifically, The 360B steers its local oscillator frequencies to phase lock itself to a reference signal from the signal source. Typically, the signal source is a swept frequency synthesizer. The accuracy of the source must be within ±10 MHz of the desired receive frequency to achieve 360B phase lock. The source frequency must be available to one of the reference receive channels for phase lock to occur. The power level needed at the sampler input is –10 to –30 dBm. All other receive channels will operate over their full dynamic range. Frequency resolution is determined by the resolution of the signal source. This resolution is available over the full frequency range of the test set.

Set-On Mode: In this mode, the source lock circuitry of the 360B is completely disabled, allowing all four samplers to operate over their full dynamic range. All of the 360's internal local oscillators are locked to its internal ovenized crystal reference oscillator. A reference signal from the signal source is no longer necessary for system operation. Only synthesized sources may be used in this mode. The lack of a reference signal to derive frequency correction prevents the use of the 360SS Series signal source. The 360B 10 MHz time base must be common to the synthesized source's time base for coherent detection to occur. The inherent resolution of the 360B's synthesized local oscillators limit the receiver resolution to 100 kHz. This resolution is available over the full frequency range of the test set. Transmission Frequency Tracking is typically degraded by 0.1 dB (see Table 2 on page 28). This feature is valuable for applications in which the signal source must be located a great distance away from the 360B Network Analyzer. Additionally, the 360B receivers can be tuned to measure the harmonic content of a test device at a known source frequency. When used in conjunction with Option 4, Dual Source Control Capability, the 360B receivers can be set at a fixed offset from the source frequency to provide swept harmonic level measurement.

Calibration Kits

These Wiltron Calibration Kits contain all the precision components and tools required to calibrate for 12-term error-corrected measurements in the connector style of your choice. Components are included for calibrating male and female test ports as required. The kit supports calibration with broadband loads. Option 1 adds sliding loads and a pin depth guage when required.

3650 SMA/3.5 mm Calibration Kit

Consisting of:

23S50	Short, SMA Male
23SF50	Short, SMA Female
24S50	Open, SMA Male
24SF50	Open, SMA Female
28S50-2	Termination, SMA Male (dc–26.5 GHz) (2 each)
28SF50-2	Termination, SMA Female (dc–26.5 GHz) (2 each)
33SFSF50	Insertable, SMA Female/Female (2 each)
33SS50	Insertable, SMA Male/Male
33SSF50	Insertable, SMA Male/Female (2 each)
34AS50-2	Adapter, GPC–7/SMA Male (2 each)
34ASF50-2	Adapter, GPC–7/SMA Female (2 each)
01-201	Torque Wrench
01-210	Reference Flat
01-222	Connector Gauge
01-223	Gauge Kit Adapter

Option 1: Add the following.

17S50	Sliding Load, SMA Male
17SF50	Sliding Load, SMA Female
01-211	Female Flush Short
01-212	Male Flush Short

3651 GPC–7 Calibration Kit

Consisting of:

23A50	Short, GPC–7
24A50	Open, GPC–7
28A50-2	Termination, GPC–7 (dc–18 GHz) (2 each)
01-200	Torque Wrench
01-221	Collet Extractor Tool and Vial of 4 Collets

Option 1: Add the following.

17A50	Sliding Load, GPC–7
01-210	Reference Flat
01-220	GPC–7 Connector Gauge

3652 K Connector® Calibration Kit

Consisting of:

23K50	Short, K Male
23KF50	Short, K Female
24K50	Open, K Male
24KF50	Open, K Female
28K50	Termination, K Male (dc-40 GHz) (2 each)
28KF50	Termination, K Female (dc-40 GHz) (2 each)
33KK50	Insertable, K Male/Male
33KFKF50	Insertable, K Female/Female (2 each)
33KKF50	Insertable, K Male/Female (2 each)
34AK50	Adapter, GPC–7/K Male (2 each)
34AKF50	Adapter, GPC–7/K Female (2 each)
01-201	Torque Wrench
01-210	Reference Flat
01-222	Connector Gauge
01-223	Gauge Kit Adapter

Option 1: Add the following.

17K50	Sliding Load, K Male
17KF50	Sliding Load, K Female
01-211	Female Flush Short
01-212	Male Flush Short

3653 Type N Calibration Kit

Consisting of:

23N50	Short, N Male
23NF50	Short, N Female
24N50	Open, N Male
24NF50	Open, N Female
28N50-2	Termination, N Male (dc–18 GHz) (2 each)
28NF50-2	Termination, N Female (dc–18 GHz) (2 each)
34AN50-2	Adapter, GPC–7/N Male (2 each)
34ANF50-2	Adapter, GPC–7/N Female (2 each)
01-213	Type N Reference Gauge
01-224	Type N Connector Gauge

3654 V Connector® Calibration Kit

Consisting of:

23V50	Short, V Male
23VF50	Short, V Female
24V50	Open, V Male
24VF50	Open, V Female
28V50	Termination, V Male (dc–60 GHz) (2 each)
28VF50	Termination, V Female (dc–60 GHz) (2 each)
33VV50	Insertable, V Male/Male
33VFVF50	Insertable, V Female/Female (2 each)
33VVF50	Insertable, V Male/Female (2 each)
01-201	Torque Wrench
01-210	Reference Flat
01-322	Connector Gauge
01-323	Gauge Kit Adapter
17V50	Sliding Load, V Male
17VF50	Sliding Load, V Female
01-311	Female Flush Short
01-312	Male Flush Short

3655 Waveguide Calibration Kit

The 3655 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of test devices with the appropriate waveguide designation. Components are included for calibrating both module ports. The kit supports calibration with broadband loads. Option 1 adds a sliding termination.

Consisting of:

Short, Fixed, 2 each
Offset, 1/4-Wavelength
Termination, Fixed (2 each)
Test Port Section (2 each)

Option 1: Add the following.
Sliding Termination

Vector Network Analyzers

Verification Kits

These Wiltron Verification Kits contain precision components with characteristics that are traceable to NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining system accuracy. A disk containing factory-measured test data for all components is supplied for comparison with customer-measured data by Wiltron Service personnel.

3665 Waveguide Verification Kit

Consisting of:

Attenuator, 20 dB
Attenuator, 40 dB
Section, Precision Straight
Mismatch Section

3666 3.5 mm Verification Kit

Consisting of:

19S50-7	7.5 cm Air Line
19S50-7B	7.5 cm Stepped Impedance Air Line (Beatty Standard)
42S-20	20 dB Attenuator
42S-50	50 dB Attenuator

3667 GPC–7 Verification Kit

Consisting of:

18A50-10	10 cm Stepped Impedance Air Line (Beatty Standard)
18A50-10B	10 cm Air Line
42A-20	20 dB Attenuator
42A-50	50 dB Attenuator

3668 K Connector® Verification Kit

Consisting of:

19K50-7	7.5 cm Air Line
19K50-7B	7.5 cm Stepped Impedance Air Line (Beatty Standard)
42K-20	20 dB Attenuator
42K-50	50 dB Attenuator

3669 V Connector® Verification Kit

Consisting of:

19V50-5	5 cm Air Line
19V50-5B	5 cm Stepped Impedance Air Line (Beatty Standard)
42V-20	20 dB Attenuator
42V-40	40 dB Attenuator

Ordering Information

NETWORK ANALYZER (One Required)

360B Vector Network Analyzer
360B Option 1: The 360B instrument is supplied with rack-mount slides and ears.
360B Option 2A: High Speed Time (Distance) Domain Measurement Capability.
360B Option 5: Receiver Mode Capability.
360C1 System Console, including support rails, component storage drawer, and power distribution.
360C2 System Cabinet, including support rails and power distribution.
360C3 Millimeter-Wave System Console, including support rails and power distribution.

TEST SETS (One Required)

Model	Frequency Range	Test Port Connectors
3610A Reversing Test Set	40 MHz to 20 GHz	K Male
3611A Reversing Test Set	40 MHz to 40 GHz	K Male
3612A Reversing Test Set	40 MHz to 60 GHz	V Male
3620A Active Device Test Set	40 MHz to 20 GHz	K Male
3621A Active Device Test Set	40 MHz to 40 GHz	K Male
3622A Active Device Test Set	40 MHz to 60 GHz	V Male
3630A Frequency Converter	10 MHz to 40 GHz	K Female
3631A Frequency Converter	10 MHz to 60 GHz	V Female

Test Set Options:
Option 1: Supplied with rack-mount slides and ears.
Option 3: Asymmetrical configuration, optimizes dynamic range and performance for the forward parameters (Not available for the 3630A and 3631A Test Sets).
Option 4: 10 MHz Frequency Coverage (Available for Models 3610A and 3611A only).
Option 5: 62.5 GHz Frequency Coverage (Available for Model 3612A and 3622A only).

MILLIMETER TEST SETS and MODULES

3635B Millimeter Test Set, Interfaces with 360B Network Analyzer to provide necessary DC, RF, and IF signals for 3640B and 3641B Series modules

3640B Series Transmission/Reflection Modules (One Required), Provide RF stimulus to device under test and measures relative forward and reflected power.
3640B-Q Transmission/Reflection Module, (33-50 GHz)
3640B-U Transmission/Reflection Module, (40-60 GHz)
3640B-V Transmission/Reflection Module, (50-75 GHz)
3640B-W Transmission/Reflection Module, (75-110 GHz)
3641B Series Transmission Modules Measure relative forward power.
3641B-Q Transmission Module, (33-50 GHz)
3641B-U Transmission Module, (40-60 GHz)
3641B-V Transmission Module, (50-75 GHz)
3641B-W Transmission Module, (75-110 GHz)

TEST SET MULTIPLEXER

360TSM Test Set Multiplexer, Enables a 360B Network Analyzer to control two test sets and two signal sources.

SYSTEM SOURCES (One Required)

360SS47 Signal Source, 10 MHz to 20 GHz, 100 kHz frequency resolution, +10 dBm output power.
360SS69 Signal Source, 10 MHz to 40 GHz, 100 kHz frequency resolution, +5 dBm output power.

System Source Options:
Option 1S: Configured for Wiltron 360C1 System Console, 360C2 System Cabinet, or 360C3 Millimeter System Console.
Option 1: Supplied with rack-mount slides and ears.
Wiltron Swept Frequency Synthesizers and Sweep Generators: The Wiltron 6700B Series Swept Frequency Synthesizers (see page 82) with 1 kHz resolution for high resolution measurements and the 6600B Series Sweep Generators (see page 92) are also compatible with the 360B. Please consult your local representative for additional information.

CALIBRATION KITS

3650 SMA/3.5 mm Calibration Kit
Option 1: Male and female Sliding Terminations
3651 GPC-7 Calibration Kit
Option 1: Sliding Termination, Connector Gauge, and Reference Flat
3652 K Connector Calibration Kit
Option 1: Male and female Sliding Terminations
3653 Type N Calibration Kit
3654 V Connector Calibration Kit Includes male and female Sliding Terminations
3655Q WR-22 Calibration Kit (33-50 GHz)
Option 1: Sliding Termination
3655U WR-19 Calibration Kit (40-60 GHz)
Option 1: Sliding Termination
3655V WR-15 Calibration Kit (50-75 GHz)
Option 1: Sliding Termination
3655W WR-10 Calibration Kit (75-110 GHz)
Option 1: Sliding Termination

Vector Network Analyzers

VERIFICATION KITS

3666 3.5 mm Verification Kit
3667 GPC-7 Verification Kit
3668 K Connector Verification Kit
3669 V Connector Verification Kit
3665Q WR-22 Verification Kit (33-50 GHz)
3665U WR-19 Verification Kit (40-60 GHz)
3665V WR-15 Verification Kit (50-75 GHz)
3665W WR-10 Verification Kit (75-110 GHz)

TEST PORT CABLES

3670A50-1 Test Port Cable, dc to 18 GHz, GPC-7 connectors, 1 foot long, two required.
3670A50-2 Test Port Cable, dc to 18 GHz, GPC-7 connectors, 2 feet long.
3670K50-1 Test Port Cable, dc to 40 GHz, K Connectors, 1 foot long, male/female, two required.
3670K50-2 Test Port Cable, dc to 40 GHz, K Connectors, 2 feet long, male/female.
3670V50-1 Test Port Cable, dc to 60 GHz, V Connectors, 1 foot long, male/female, two required.
3670V50-2 Test Port Cable, dc to 60 GHz, V Connectors, 2 feet long, male/female.

TEST PORT CONVERTERS

Test port converters for 3610A, 3611A, 3620A, and 3621A Test Sets.
34UA50 Test Port Converter, Universal/GPC-7
34UK50 Test Port Converter, Universal/K Connector, male
34UN50 Test Port Converter, Universal/N, male
34UNF50 Test Port Converter, Universal/N, female
34UQ50 Test Port Converter, Universal/2.4 mm, male
34US50 Test Port Converter, Universal/3.5 mm, male

Test port converters for 3612A and 3622A Test Sets
34YA50 Test Port Converter, Universal/GPC-7
34YK50 Test Port Converter, Universal/K Connector, male.
34YSS50 Test Port Converter, Universal/SSMA, male
34YV50 Test Port Converter, Universal/V Connector, male

01-202 Wrench for changing test set Test Port Converters

SOFTWARE

2300-10 ANACAT® Software
2300-11A Materials Measurement Package

REPLACEMENT GPIB CABLES

2100-1 GPIB Cable, 1 m (3.3 ft.)
2100-2 GPIB Cable, 2 m (6.6 ft.)
2100-4 GPIB Cable, 4 m (13.2 ft.)
2100-5 GPIB Cable, 0.5 m (1.65 ft.)

ACCESSORIES

2225C Ink Jet Dot-Matrix Printer, including 2225-1 Interface Cable, 1 Ink Jet Cartridge, and 500 sheets of Ink Jet Printer Paper
2225-1 Spare Printer Interface Cable
2225-2 Replacement Ink Jet Cartridge
2225-3 Fan-Fold Ink Jet Printer Paper (500 sheets)
2000-209 3.5-inch Blank Diskettes (Box of 10)

TRAINING

360MS Option 10: Two-Day Training Course, A two-day user training course covering basic 360B features, operation and measurements. Enrollment for two operators is provided at no charge with the purchase of each 360B system.

ON-SITE SUPPORT

360MS Option 11: On-Site Verification, On-site 360B system verification performed by a Wiltron service engineer using traceable devices from a Wiltron Verification Kit. Includes both tabular and graphic hardcopy data output.
360MS Option 12: On-Site Service, One year on-site service support for the 360B, test set, and system signal source. Includes all labor and material. Available throughout the USA and in most international areas. Please check availability with your local representative.

EXTENDED SERVICE OPTIONS

Additional, one year and two year "return to Wiltron" service is available, as an option for 360B systems and components. Prices and details are available from your Anritsu-Wiltron Sales Representative or by contacting the factory.

VNA Measurement Solutions

Photo courtesy of Hughes Aircraft Company, Missile Systems Group

Measurement Solutions for Specific Needs

- *Permittivity and Permeability of Materials*
- *Q-Measurements of High Temperature Superconductors*
- *Pulsed RF Measurements with 20 ns Pulse Widths*
- *Error-Corrected Noise Figure Measurements*
- *Antenna and Radar Cross Section Measurements*

The 360B family of vector network analyzers offers unmatched performance, accuracy, and versatility. In addition to a number of test sets and test modules, we offer a number of measurement system solutions. These systems focus the power of the 360B family on specific applications. You benefit with a turn-key solution to difficult measurement problems.

Materials Measurement Software

The Wiltron Materials Measurement Software computes the complex permittivity and permeability of materials based on 360B S-parameter measurements. EW and communications systems engineers can minimize the reflectivity of coatings. Materials scientists can analyze the chemical composition of materials. See page 40 for more information.

High Temperature Superconductor Measurement Systems

The capability to control the atmosphere surrounding the Wiltron 3680 series of Universal Test Fixtures enhances this products versatility. The ATM-77K CryoUTF was designed for making accurate microwave measurements at 77 degrees Kelvin. Tests of HTSC circuits are now easily made with an off-the-shelf fixture suitable for broadband passive and active components. See page 41 for more information.

General Information

Pulse/CW Vector Network Analyzer System

The Wiltron 360PS20A Pulse/CW Vector Network Analyzer System combines full-performance CW measurements with the most powerful pulsed RF measurement capability available today. Observe the phase and magnitude performance during pulse operation with as narrow as 20 ns resolution. Designers of MMIC devices can now evaluate high power performance on-wafer. EW system designers can characterize most EW system components under actual use conditions, reducing problems at the system level. The 20 ns resolution and minimum pulse width capability is 50 times narrower than that offered by any competitor. See page 42 for more information.

Noise Figure/Vector Network Analyzer System

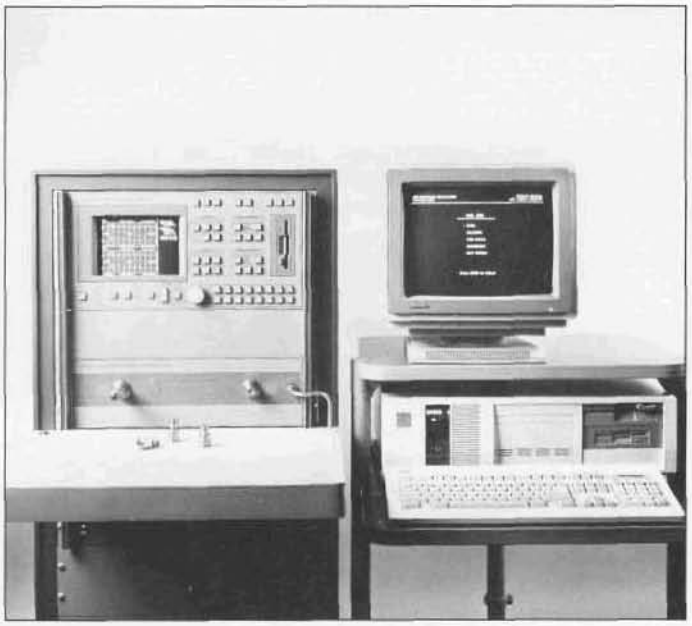
Wiltron's 360NF20A Noise Figure/Vector Network Analyzer System brings a new level of accuracy to the characterization and optimization of low noise microwave devices. The capabilities of a high performance VNA and noise figure meter have been integrated into one system. It is now possible to make error-corrected S-parameter and noise figure measurements to 20 GHz with a single connection. See page 44 for more information.

RCS Measurement Systems

The 360B Vector Network Analyzer is ideal for use in Radar Cross Section (RCS) measurements. RCS measurements often require both horizontally polarized and vertically polarized data from separate antennas. The 360B is the only vector network analyzer which can make these three measurements simultaneously as the 360B has three complete measurement channels — one reference and two test. Also, in making RCS measurements, it is important to remove unwanted reflections such as antenna leakage and background reflections. The most accurate approach to eliminating unwanted reflections is called "hard gating." The 360B is the only VNA with this capability. The VNA receiver's range gate is opened only during the time that the desired signal is expected at the antenna. At other times, it is closed so that unwanted reflections are reduced by 80 dB. See page 46 for more information.

Materials Measurement Software

Model 2300-11A



2300-11A Materials Measurement Package Highlights

- *Complex Permittivity*
- *Complex Permeability*
- *Requires Only Reflection Measurements*
- *Simple Fixturing Requirements*

The new Wiltron 2300-11A Materials Measurement Package operates with any 360 or 360B Vector Network Analyzer system to compute the complex permittivity and permeability of materials based on one port S-parameter measurements. The complex loss tangent (tanΔ) and magnetic loss tandgent (tanΔm) for the material are also calculated. This software provides a method to measure and analyze the basic properties of materials. EW and communications systems engineers can minimize the reflectivity of coatings. Materials scientists can analyze the chemical composition of materials.

Unique One-Port Approach

Wiltron's approach offers significant advantages over other solutions that require both transmission and reflection measurements. For high loss $\varepsilon_r\mu_r$ product materials, samples must be made very thin. Solutions that need both transmission and reflection measurements require suspension of a thin web of material in the transmission line (fixture). Support windows interfere with the measurements. With Wiltron's reflection-only approach, samples are backed by a short circuit that provides support and alignment within the tranmission line.

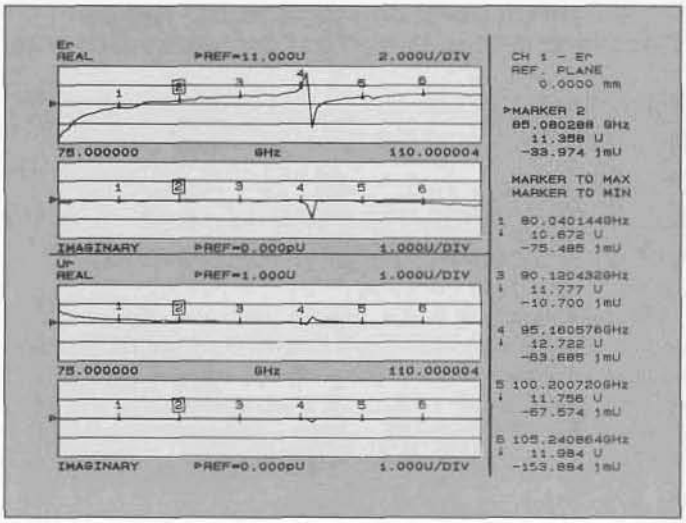
A Versatile Solution

Wiltron's Materials Measurement software works in conjunction with Wiltron's High Speed Time (Distance) Domain software and phasor impulse processing to allow gating of fixture effects and compensation for fixture dispersion. Since the 2300-11A software only requires reflection data, analysis of materials at high temperatures is greatly simplified, compared with solutions that require both reflection and transmission measurement data.

Accommodates a Wide Variety of Test Fixtures

The analysis is based on measurements of two small, but different size, samples of material. Either coaxial or waveguide fixtures are supported. This approach simplifies the task of characterizing a wide variety of materials.

The 2300-11A Materials Measurement Software comes on one 3.5-inch microfloppy diskette, and runs on MS-DOS® compatible computers with a minimum of 2 Mbytes RAM. The Wiltron 360CC MS-DOS® Computer/Controller is the ideal hardware environment for this sofware. If both the Materials Measurement software and 360CC MS-DOS® Computer/Controller are ordered at the same time, the software comes fully-resident on the hard disk and operates through straightforward menu selection.



A measurement of the complex material parameters ε_r and μ_r of GaAs (110).

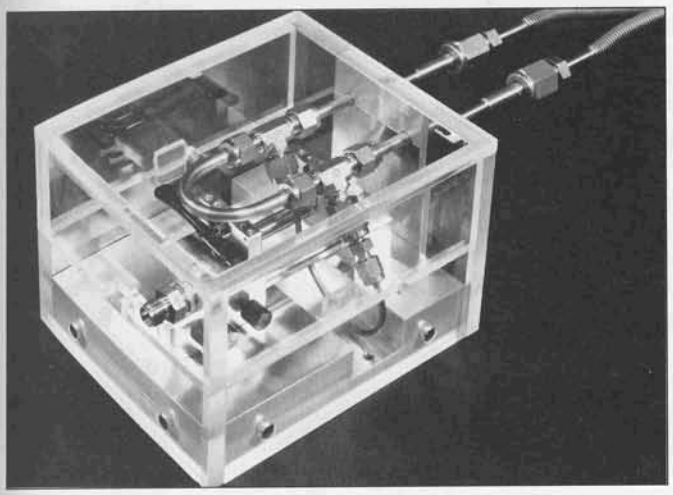
Ordering Information

2300-11A Materials Measurement Package includes:

360CC Computer/Controller
Materials Measurement Software
GPIB Interface Cable, 2 meters

Option 1: Delete 360CC MS–DOS® Computer/Controller
Option 2: Portable MS–DOS® Computer/Controller

Cryogenic Universal Test Fixture



Cryogenic Universal Test Fixture Highlights

- *Accurate Microwave Measurements at 77K*
- *Simple Operation Reduces Measurement Time*
- *Suitable for Hybrid Circuits and MMICs*
- *LRL, LRM, and OSL Microstrip Calibration/Verification Kits*

Substrate Measurement Capability

The ATM-77K series Cryogenic Universal Test Fixture (CryoUTF) is uniquely designed for fast and accurate dc-40 GHz microwave measurements under controlled atmosphere. Available from Advanced Technology Materials, Inc. (ATM), the unit provides microwave circuit designers with a reliable off-the-shelf test fixture suitable for broadband passive or active components. The test fixture is suitable for a wide range of circuits needing evaluation at 77K, including: HTSC resonators, filters, and similar 2 port devices made on Al_2O_3, $LaAlO_3$ or similar substrates. The fixture also provides an excellent test environment for accurate measurements of active GaAs Microwave Monolithic Circuits, GaAs devices and hybrid ICs at cryogenic temperatures.

The system has a reproducible cooling rate of about 40 degrees C/min. Input and output connections are made to the DUT by two spring-loaded jaws that include coax-to-microstrip launchers. The jaws accommodate substrates from 5 to 75 mils in thickness. One jaw is moveable in two dimensions to accommodate substrates up to 1 inch long and line offsets of up to 1/2 inch.

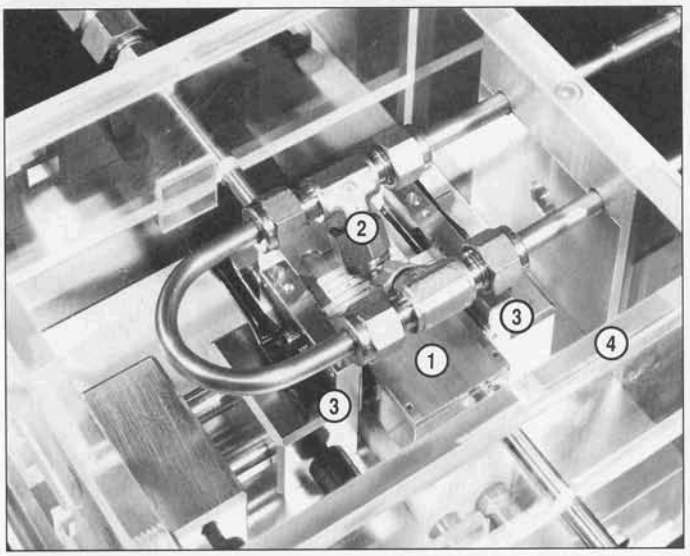
Exceptional Performance and Reproducibility

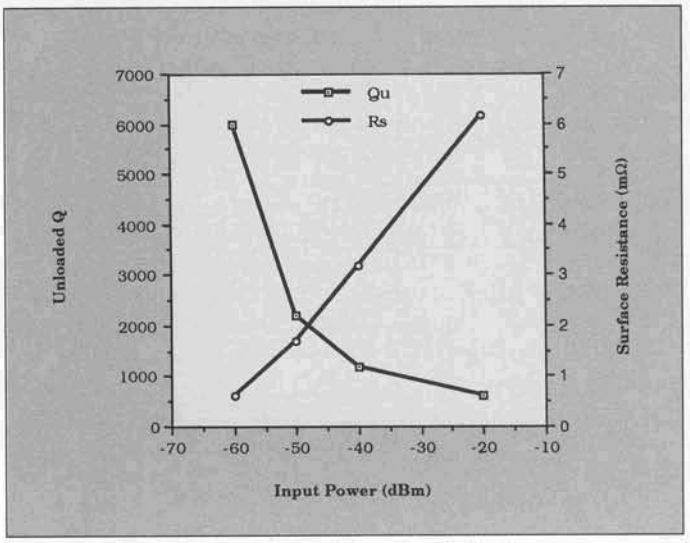
For accurate calibration or measurement, the DUT is directly placed between spring-loaded jaws. This allows the fixture to accommodate different devices without requiring a metal carrier. The unique jaw action ensures solid, repeatable electrical contact. For substrate sizes of less than 1 cm or GaAs chips, it is recommended that the DUT be mounted on a thin metal carrier between two Model A103-3S microstrip launchers. The opposite ends of the launchers are then clamped into the CryoUTF jaws. Support for the metal carrier is provided by a metal block provided with the CryoUTF.

In addition to the performance of the ATM-77K CryoUTF, the Wiltron 360B VNA provides unmatched dynamic range and directivity performance, significantly improving measurement accuracy, essential for most superconductor microwave components.

1. Flow-through liquid nitrogen cooled stage accommodates up to 1 inch substrates and maintains an isothermal platform for the DUT.
2. Liquid nitrogen shower eliminates temperature gradients between the surface of the DUT and the cold stage.
3. Adjustable launch measures substrates up to 1 inch long without requiring modification of the center stage.
4. Nitrogen purge shroud provides a controlled atmosphere for the DUT and allows easy access for minimum cycle times.

For more information on the ATM-77K CryoUTF, contact ATM at (203) 794-1100.

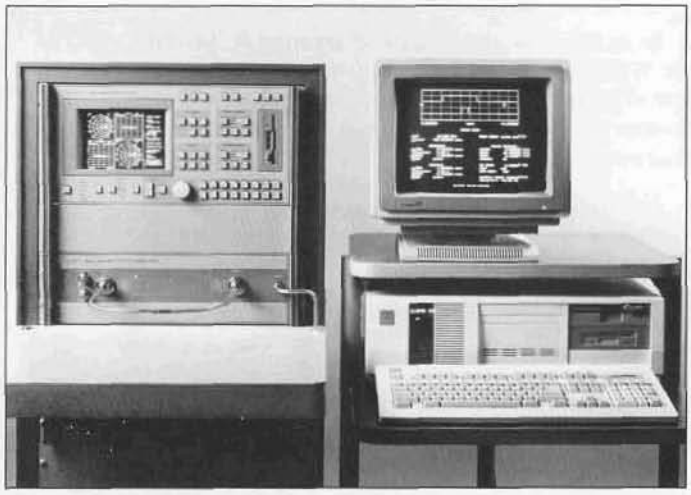




Unloaded Q and Surface Resistance Vs Input Power.

Pulse/CW/Vector Network Analyzer

Model 360PS20A, 890 MHz to 20 GHz



360PS20A Pulse/CW Vector Network Analyzer Highlights

- *20 ns Minimum Pulse Width* ‹AN›
- *105 dB Dynamic Range for CW Measurements*
- *Displays Phase and Magnitude Versus Time or Frequency*
- *Full Reversing S-parameter Measurements with Error Correction*

The Wiltron 360PS20A Pulse/CW Vector Network Analyzer System combines full-performance CW measurements with the most powerful pulsed RF measurement capability available today.

MMIC and GaAs FET Measurements

Designers of GaAs FETs and MMIC devices can now fully evaluate device performance both on wafer and microstrip. In CW mode, the system can be used to measure the small signal S-parameters. It can then be switched to measure the performance at full RF power output using a low-duty-cycle, pulsed RF stimulus. Heatsinking is not needed, as the device temperature does not rise as a result of the low-duty-cycle RF stimulus.

EW and Radar Component Measurements

EW and radar systems engineers can now characterize components under actual-use pulsed RF conditions, thereby reducing problems at the system level. Many microwave components exhibit gain and phase changes during RF turn-on and turn-off. Measurements of warm-up time are needed to know when the system is available after turn-on. System accuracy can be improved by predicting performance during pulses. The 360PS20A can profile the gain and phase performance of a device with as narrow as 20 ns resolution as the RF pulse or bias pulse is applied. Previous VNA systems only offered 1 µs pulse width resolution.

Pulse I V Testing

Methods for nonlinear modelling of transistors can be done with the 360PS20A. Based on pulse parameter measurements under pulsed bias conditions, the DUT's dynamic variations (without being subjected to its temperature variations) can be accounted for. Such methods have been successfully achieved with FET transistors and may be extended to high power bipolar transistors used in pulse Class C radar applications.

A Complete System

The 360PS20A includes installation, a one year on-site warranty, and all equipment needed for both pulsed RF and CW measurements. Pulsed RF capability can be easily added to existing 360B systems with the 3636A Test Set Package (TSP).

Exceptional Performance with Minimum Cost

Wiltron uses an advanced system architecture that provides a wide effective bandwidth (>50 MHz) with excellent sensitivity and dynamic range. Wiltron's approach requires only one RF source, giving significant savings over approaches requiring two microwave synthesizers.

Unmatched Versatility

The 360PS20A can be configured in a wide variety of ways to offer maximum flexibility. The test set incorporates couplers capable of 20 Watts peak (10 Watts average) forward power. An additional coupler in Port 2 allows high-power forward measurements and low-power reverse measurements. Key nodes on the test set are available to allow addition of bias tees, high-power amplifiers, and terminations.

The RF stimulus modulator and all four profile modulators can be externally triggered for time-coincident measurements. Three methods of developing the reference channel CW, Pulsed, and Set-on are available for accommodating a wide variety of measurement situations.

Odering Information

360PS20A PULSE/CW VECTOR NETWORK ANALYZER SYSTEM

Provides pulsed and CW measurement capability over the 890 MHz to 20 GHz frequency range.

The 360PS20A system consists of:

360 Network Analyzer (with Option 5, Receiver Mode Capability)
3636A Pulse/CW Test Set (890 MHz to 20 GHz)
6747B Swept Frequency Synthesizer
360CC MS–DOS® Computer/Controller
360ACM Auxiliary Control Module
360PSG Pulse Generator
360C1 System Console
360C4 Computer Console
2225C Ink Jet Dot-Matrix Printer
Pulsed Measurement Software
Two-Day Training Course for Two Operators

3636A PULSE/CW TEST SET PACKAGE (Upgrade for Existing 360 Systems)

This package adds pulsed and CW measurement capability to an existing 360 VNA system. It requires a Wiltron 360 Vector Network Analyzer with Option 5, Receiver Mode Capability and a 6700B Series Swept Frequency Synthesizer.

The 3636A Test Set Package (TSP) consists of:

3636A Pulse/CW Test Set (890 MHz to 20 GHz)
360CC MS–DOS® Computer/Controller
360ACM Auxiliary Control Module
360PSG Pulse Generator
360C4 Computer Console
Pulsed Measurement Software

OPTIONS

These options apply to either the 360PS20A system or the 3636A Test Set Package (TSP) described above.

Option 1: Delete 360CC MS–DOS® Computer/Controller and 360C4 Computer Console

Option 2: Portable 360CC MS–DOS® Computer/Controller

Specifications

Frequency Range: 890 MHz to 20 GHz
Pulse Width: 20 ns to CW
Duty Factor: 0.1% to CW
Pulse Repetition Frequency (PRF):
Minimum: 1 kHz
Maximum: 980 kHz (limited by system pulse generator)
Power Handling: 20 Watts, peak (10 Watts, average)
Equivalent Bandwidth: >50 MHz

Pulse Delay: 0 µs to $\left(\frac{1}{\text{PRF}} - 1\ \mu s - \text{Pulse Width}\right)$

External Trigger Width: ≥5 ns
External Trigger Delay: <85 ns

Dynamic Range Summary:[1]

Frequency	890 MHz	2 GHz	20 GHz
Maximum Signal[2] Into Port 2 (dBm)	+43	+43	+43
Noise Floor (dBm)	–105	–108	–91
Receiver Dynamic Range[3] (dB)	148	151	134
Port 1 Power[3] (dBm, typical)	–5	–5	–8
System Dynamic Range[3] (dB)	100	103	83

Test Port Characteristics (K Connectors):

Frequency		890 MHz	2 GHz	20 GHz
Directivity (dB)		>42	>42	>42
Source Match (dB)		>40	>40	>38
Load Match (dB)		>42	>42	>42
Frequency[4] Tracking (dB)	Reflection	±0.020	±0.020	±0.030
	Transmission	±0.050	±0.050	±0.070
Isolation (dB)		>105	>115	>110

[1] Dynamic Range is given in two manners. "Receiver Dynamic Range" is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the noise floor at Port 2. The "System Dynamic Range" is defined as the ratio of the power incident on Port 2 in a through line connection to the noise floor at Port 2 (forward measurements only). In preparing the Dynamic Range Summary table minimum IF Bandwidth and 1024 averages were used in calibration and measurement. Changes in the Video IF Bandwidth or averaging can result in variations at low levels.

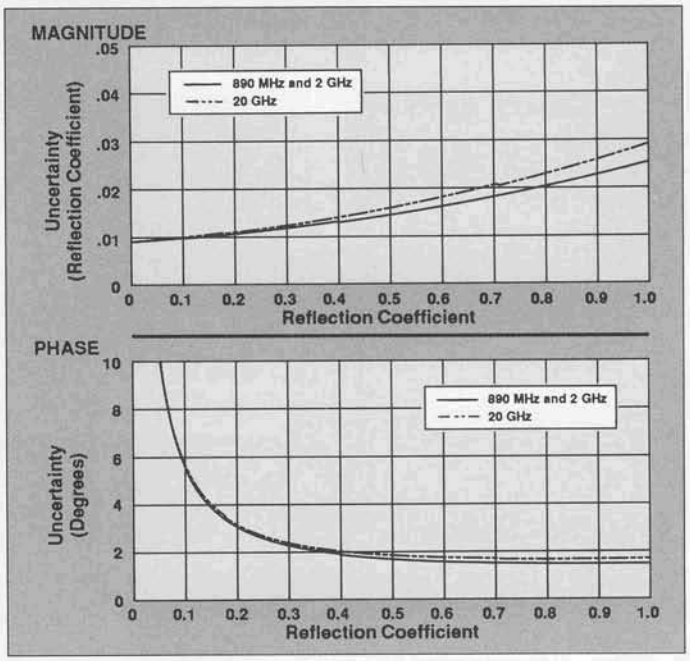
[2] With high power termination and using internal step attenuator.

[3] For pulsed measurements, average Port 1 power, receiver dynamic range, and system dynamic range are reduced by 20log(duty factor).

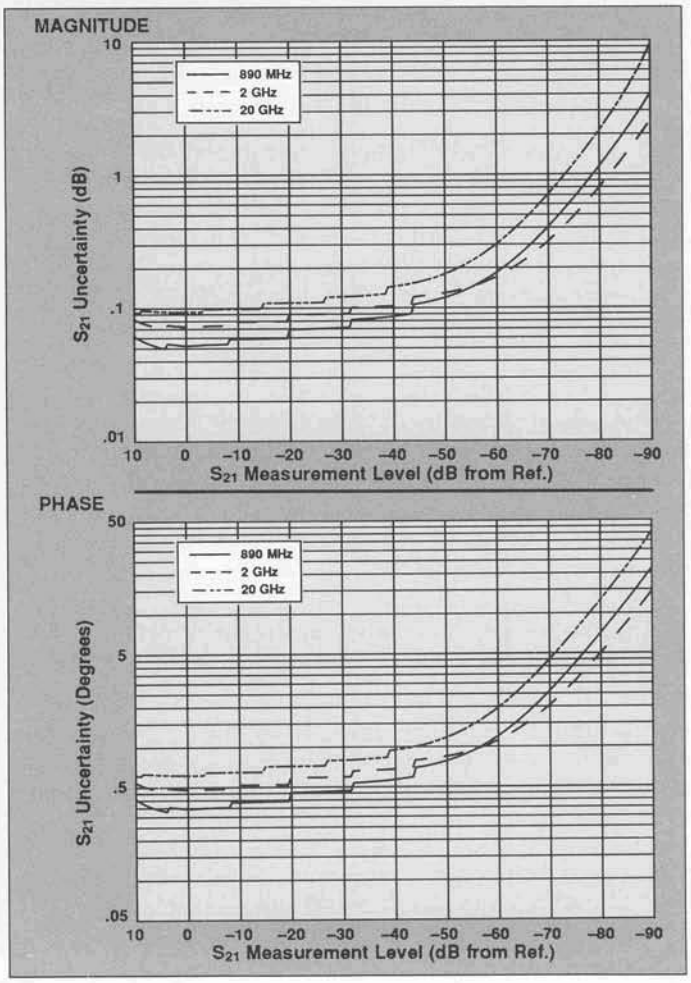
[4] For CW measurements, using the Tracking Mode.

[5] For pulsed measurements, transmission uncertainty curves are shifted to the left by 20log(duty factor).

MEASUREMENT UNCERTAINTY CURVES:
Model 3636A Test Set (K Connectors)
Reflection Measurements:

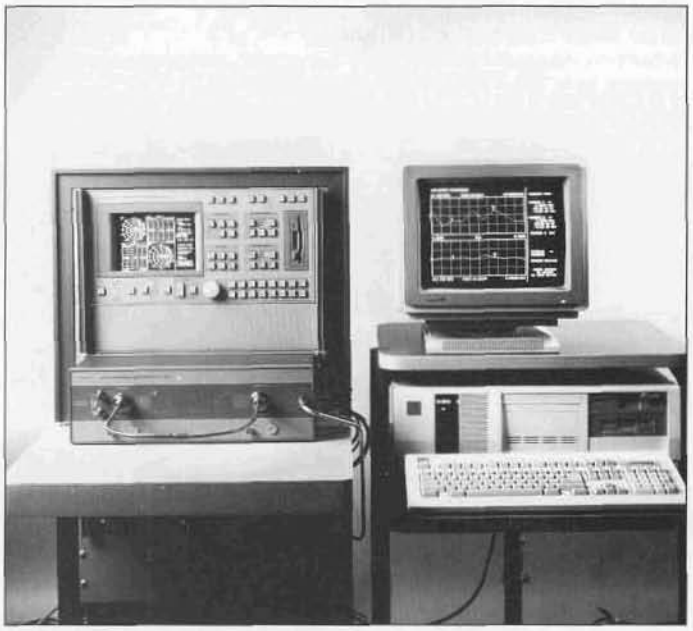


Transmission Measurements:[5]



Noise Figure/Vector Network Analyzer

Model 360NF20A, 2 to 20 GHz



360NF20A Noise Figure/VNA Highlights

- *Error-Corrected Noise Figure and S-parameter Measurements*
- *2 to 20 GHz Frequency Coverage*
- *Easy Upgrade for Existing 360 & 360B Systems*
- *Full-Reversing S-parameter Measurements*

Wiltron's new Noise Figure Module for the 360B Vector Network Analyzer brings a new level of ease in accurately characterizing and optimizing low noise microwave devices. Vector network measurements are often performed in conjunction with noise figure measurements to help arrive at matching structures that give optimum performance. Wiltron makes this job much easier by combining both measurements into one system.

GaAs FET Device Characterization

The noise performance of GaAs FET amplifiers depends on the matching structure surrounding each device. Together, the Wiltron Noise Figure Module and 360B Vector Network Analyzer make these measurements easily and with exceptional accuracy. With the use of the 360B and 3642A, mismatch uncertainties can be characterized between:

1) the noise source and DUT,
2) the DUT and the measurement system, and
3) the measurement system and the noise source.

Improved accuracy means greater yields and less rework.

Noise Figure Capability Easy to Add

Noise figure measurement capability can be easily added to existing Wiltron 360B systems. The 3642A quickly attaches to the K Connector® test ports of a 3610A, 3611A, 3620A or 3621A Test Set (with an Auxiliary I/O Connector). A Wiltron 360CC MS-DOS® Computer/Controller, 360ACM Auxiliary Control Module and noise figure measurement software complete the installation. No additional mixers or local oscillators are required.

The 3642A Noise Figure Module

The heart of the noise figure system is the 3642A Noise Figure Module. The 3642A includes a high performance noise source, superheterodyne receiver, and all the RF switching circuitry required to measure noise figure and pass S-parameter measurements through to the test set.

Ordering Information

360NF20A NOISE FIGURE/VNA SYSTEM

Provides single-sideband noise figure measurement capability (2 to 20 GHz) as well as S-parameter measurement capability (0.04 to 20 GHz).

The 360NF20A system consists of:

360 Network Analyzer
3642A Noise Figure Module
3610A Reversing Test Set
360SS47 Signal Source
360ACM Auxiliary Control Module
360YTC YIG Tracking Controller
360CC MS–DOS® Computer/Controller
360C1 System Console
360C4 Computer Console
2225C Ink Jet Dot-Matrix Printer
Noise Figure Software
Two-Day Training Course for Two Operators

3642A NOISE FIGURE MEASUREMENT PACKAGE (Upgrade for Existing 360 Systems)

This package adds single-sideband noise figure measurement capability to an existing 360 VNA system. It requires a 360 Network Analyzer, 3600A coaxial test set (with K Connector® test ports and auxiliary I/O connector), and either a 360SS, 6600B, or 6700B series signal source.

The 3642A Noise Figure Measurement Package (NFMP) consists of:

3642A Noise Figure Module
360ACM Auxiliary Control Module
360YTC YIG Tracking Controller
360CC MS–DOS® Computer/Controller
360C4 Computer Console
Noise Figure Software

OPTIONS

Option 1: Delete 360CC MS–DOS® Computer/Controller and 360C4 Computer Console

Option 2: Portable 360CC MS–DOS® Computer/Controller

Option 3: Double-Sideband Measurement Capability

Deletes the internal YIG Tracking Filter and 360YTC YIG Tracking Controller to allow double-sideband noise figure measurements.

Specifications

The following specifications apply to a 360 system incorporating the 3642A Noise Figure Measurement Package and 3620A Active Device Test Set.①

Noise Figure Frequency Range: 2 to 20 GHz

S-Parameter Frequency Range: 0.04 to 20 GHz

Noise Figure Measurement Range: 0 to 30 dB

Noise Figure Measurement Uncertainty:②
±0.25 dB @ 23°C
±1.5 dB @ 0 to 55°C

Noise Figure Measurement Resolution: 0.01 dB

Maximum Operating Power (Noise Figure Module):
-20 dBm; damage level, +3 dBm

Excess Noise Ratio (Port 1): 13.0 ±1 dB

Tracking Filter Drive: 1 to 10 Volts; 0.5 Volts/GHz

Receiver Noise Figure (@ 20 GHz):
SSB: 14.0 dB maximum
DSB: 12.5 dB maximum

S-Parameter Dynamic Range Summary:③

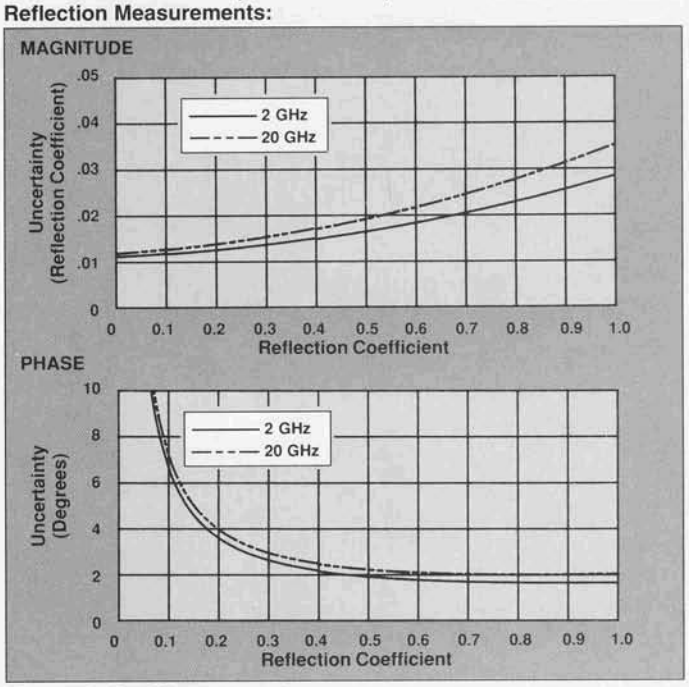
Frequency	2 GHz	20 GHz
Maximum Signal Into Port 2 (dBm)	+30	+30
Noise Floor (dBm)	–109	–99
Receiver Dynamic Range (dB)	139	129
Port 1 Power (dBm, typical)④	–9	–14
System Dynamic Range (dB)	100	85

Test Port Characteristics (K Connector):

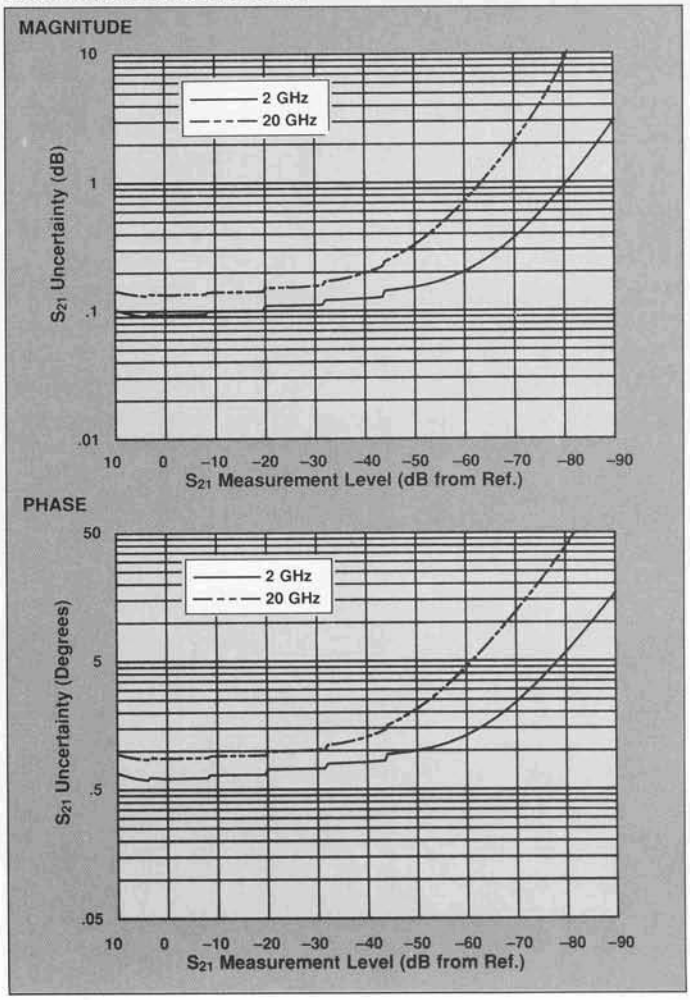
Frequency	2 GHz	20 GHz
Directivity (dB)	>40	>40
Source Match (dB)	>38	>36
Load Match (dB)	>40	>40
Reflection Frequency Tracking (dB)	±0.007	±0.010
Transmission Frequency Tracking (dB)	±0.07	±0.10
Isolation (dB)	>115	>110

① Test sets must have Auxiliary I/O Connector.
② Excluding Noise Source Error.
③ Dynamic Range is given two manners. "Receiver Dynamic Range" is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the noise floor at Port 2. The "System Dynamic Range" is defined as the ratio of the power incident on Port 2 in a through line connection to the noise floor at Port 2 (forward measurements only). In preparing the Dynamic Range Summary table minimum IF Bandwidth and 1024 averages were used in calibration and measurement. Changes in the Video IF Bandwidth or averaging can result in variations at low levels.
④ +10 dBm into 3620A Test Set.

UNCERTAINTY CURVES
Model 3620A Test Set (K Connectors) with 3642A
Reflection Measurements:



Transmission Measurements:



Antenna and RCS Measurements

Antenna & RCS Measurement Highlights

- *Hard Gating Removes Unwanted Responses*
- *Two Test Channels Allow Simultaneous Measurement of Vertically- and Horizontally-Polarized Antenna*
- *Direct Display of Antenna Pattern*

The 360B Vector Network Analyzer is ideal for use in Radar Cross Section (RCS) and antenna measurements as in the Systems Planning Corporation (SPC) MARS 100 System above. The high dynamic range of the 360B assures that small radar cross sections can be measured accurately and repeatably. The broad frequency coverage allows antenna pattern measurements anywhere from 40 MHz to 110 GHz.

Complete RCS and antenna pattern measurements require both horizontally-polarized and vertically-polarized data. This is accomplished by taking data from separate vertically-polarized and horizontally-polarized antennas. The 360B is the only vector network analyzer which can make these two measurements simultaneously as the 360B has three complete measurement channels - one reference and two test.

Other network analyzers have only a single reference and a single test channel so the signals from the two antennas must be multiplexed into the single test channel. Multiplexing takes time and, unless the antenna rotator or X-Y scanner is stopped for each measurement, the horizontal and vertical data is skewed as to position. This creates errors in both RCS and antenna measurements, regardless of whether the target or antenna is rotated or if the antenna is X-Y scanned in a near field measurement system. In either case, the 360B, with its dual test channels, is immune to such errors.

In making RCS measurements, it is important to remove unwanted reflections such as antenna leakage and background reflections. This can be done with software methods such as time domain processing but this technique is mathematically limited to approximately 40 dB of unwanted signal reduction.

The most accurate approach to eliminating unwanted reflections is called "hard gating." The 360B is the only VNA with this capability. The VNA receiver's range gate is opened only during the time that the desired signal is expected at the antenna. At other times, it is closed so that unwanted reflections are reduced by 80 dB.

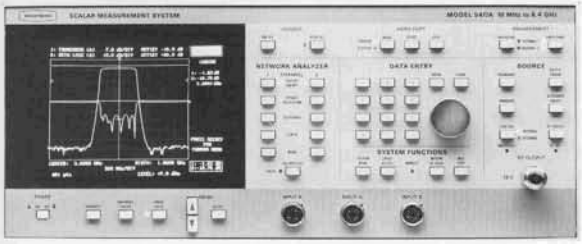
The 360B also has the capability to plot antenna pattern measurements in either rectangular or polar format directly on the front panel CRT display. No additional software or controller is required to enable this feature.

Many configurations are available to meet your measurement needs.

SPC, in cooperation with Wiltron, offers an integrated system for antenna and RCS measurements.

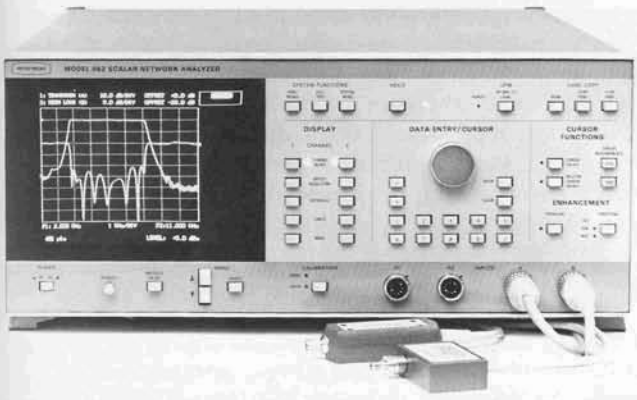
To learn more about the antenna pattern and RCS capabilities of the 360B, consult your Anritsu-Wiltron Sales Engineer or Product Specialist or contact System Planning Corporation directly at (703) 351-8719.

Scalar Network Analyzer – Overview



The 5400A family of Scalar Measurements Systems integrates a sophisticated scalar analyzer with a full-function microwave generator. The result is a low cost system with uncompromised performance in a compact package.

See page 50



The 562 is a high performance Scalar Network Analyzer. Great care has been placed of the front panel operation to make it straightforward and easy to use. Frequency coverage of the 562 is dependant on the source that provides the microwave stimulus. The 562 is compatible with a number of sources.

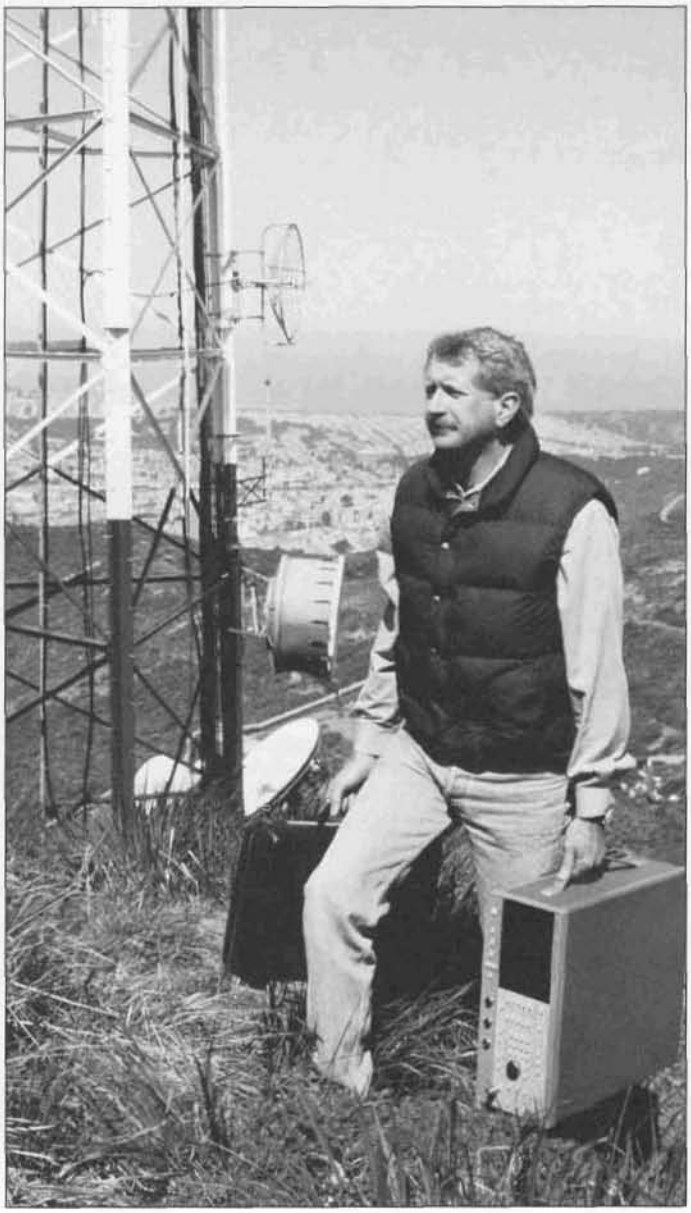
See page 64

The Wiltron 560A Scalar Network Analyzers analog display provides the speed necessary to tune microwave components in a real-time environment. A complete system using Wiltron high directivity SWR autotesters and signal sources provide simultaneous transmission and return loss measurements covering frequency ranges up to 40 GHz in coax.

See page 70

Scalar Network Analyzers

General Information



Introduction to Scalar Network Analysis

Scalar network analyzers offer an economical solution for measuring the magnitude only (scalar) characteristics of microwave devices. Most microwave components have only scalar specifications. Where vector analyzers are commonly used to aid design activities, scalar analyzers are used in manufacturing for adjustment and final test to specification.

Scalar analyzers use very wide bandwidth detector/log amplifier based receivers and a swept microwave source. Vector analyzers incorporate narrow bandwidth receivers tuned to the same frequency as the signal source. While detector based receivers offer less dynamic range than the narrow bandwidth receivers in vector analyzers, they allow easy measurement of nonlinear devices (mixers and frequency multipliers). Additionally, they allow absolute power measurement over a wide dynamic range, and easy measurement of multiple port devices. Scalar analyzers also offer very fast sweep update rate, improving tune times in applications where operators must make many adjustments.

Scalar analyzers present results in the same format as vector network analyzers in the rectangular/magnitude display mode. The horizontal axis is frequency range. Wiltron 562 scalar analyzers measure and display device match in SWR or return loss in dB, transmission gain or loss in dB, and absolute power in dBm. A Volts Mode is also available to display the response of a detector type test device. Calibration of scalar network analyzers consists only of compensating for transmission and reflection frequency response.

Built-in Automated Testing. Wiltron's scalar analyzers offer many built-in features to speed testing. Automated cursor features give quick and accurate identification of specific characteristics, including Min/Max, "X" dB and "X" dB bandwidth. Setups may be saved and recalled (with internal battery backed RAM) and quickly sequenced for production use. Trace memory features allow de-embedding of couplers or high power attenuators as well as saving and recalling of measurement results. Autoscaling speeds testing of new devices by automatically selecting scale values and positioning the trace for best viewing. Straight and complex limit lines with pass/fail testing provide easy comparison of results to specification.

Scalar Network Analyzers

Signal Sources. Recommended signal sources for the Wiltron 562 Network Analyzer are the 6600B Sweep Generators, and 6700B Swept Frequency Synthesizers. These instruments use Wiltron fundamental oscillators over the 2 to 26.5 GHz range. Sweepers and synthesizers offered by other leading manufacturers use multipliers to accomplish this frequency span. This multiplication process produces signals abundant in harmonics and (more worrisome) in subharmonics, which cannot be readily filtered out. The new 5400A Scalar Measurement Systems incorporate a built-in swept frequency source. A patented frequency correction scheme produces a hundredfold improvement in frequency accuracy compared to that of stand-alone sweep generators. The 5400A has virtually no frequency drift with time or temperature.

5400A Scalar Network Analyzer with Built-In Source

A complete system for both manufacturing and field use. The source has start frequency accuracy 100 times more accurate than stand-alone sweep generators. Many powerful automation features enhance production testing, including complex limit lines with pass/fail testing, intelligent cursors, up to nine markers, trace memory, and autoscaling. Built-in print and plot buffer eliminates long waits for hard copy output. Optional full-capability GPIB for ATE applications.

See page 50 for more information.

562 Scalar Network Analyzer

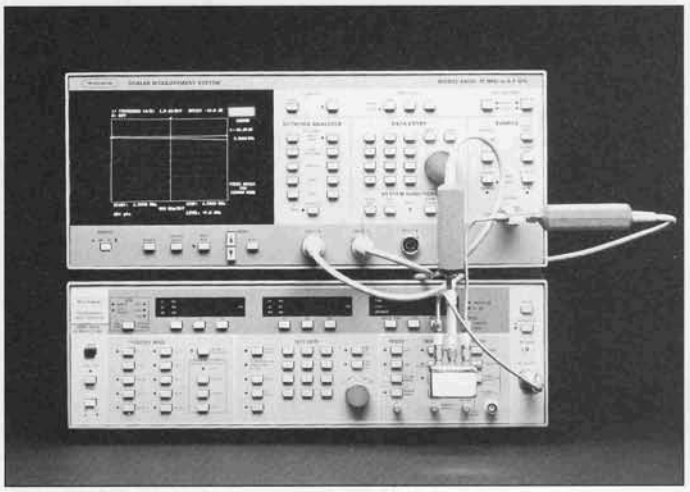
A powerful analyzer capable of interfacing with many different sources. The Model 562 contains application functions allowing improved productivity. 76 dB dynamic range from 10 MHz to 40 GHz provide measurements of transmission and reflection characteristics in an endless variety of applications.

See page 64 for more information.

560A Scalar Network Analyzer

The 560A real time display permits operators tuning filters and amplifiers to immediately see the results of any adjustments. The sweep speed of the microwave source controls the horizontal deflection of the 560A display. When the fastest update time is required, the 560A is the ideal choice.

See page 70 for more information.



P2FF

Designed for the rigors of military use, this system has many commercial applications. Transmission, refection and Distance-to-Fault measurements are easily accomplished via a menu driven, touch sensative screen. The unique Fault Finder module includes all the circuitry required to interface the test transmission line input to the test system. All components can be stored in the ruggedized, enviornmental proof case.

See page 72 for more information.

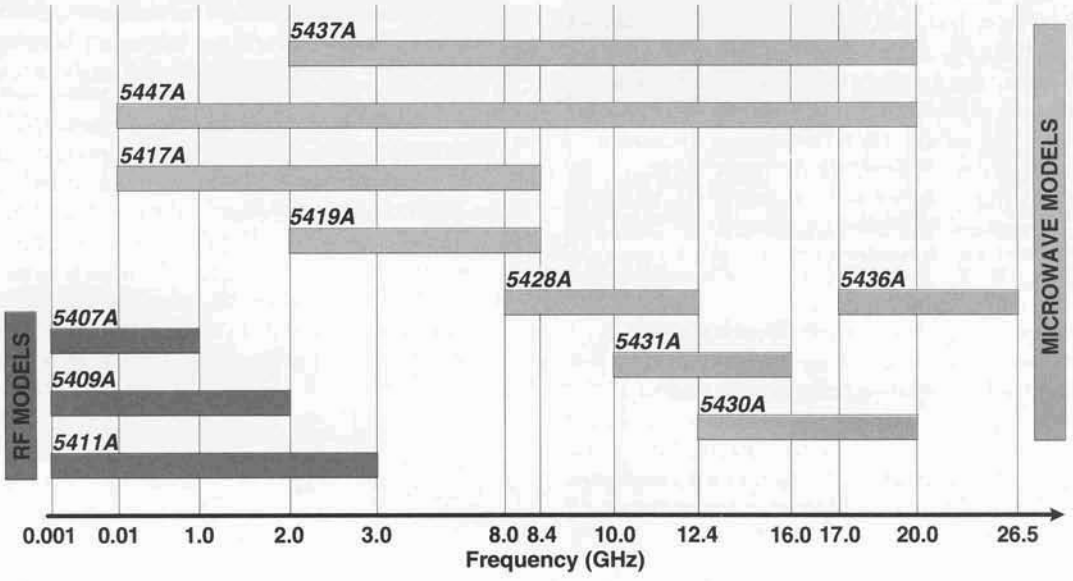
Distance-to-Fault

With simple hardware set-ups, this software package allows fast and easy measurements of impedance discontinuities versus distance (distance-to-fault). Running on an MS-DOS® laptop computer to control a Wiltron 5400A Scalar Measurement System, this unique combination provides a lightweight, portable system for field use.

See page 73 for more information.

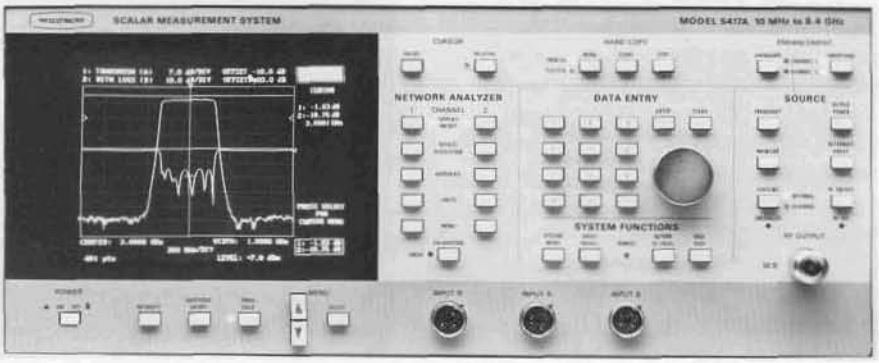
Measurement Accessories and Components

A quick reference summary of components for scalar based systems. See page 76 for more information.



5400A Scalar Network Analyzers

Model 5400A, 1 MHz to 26.5 GHz

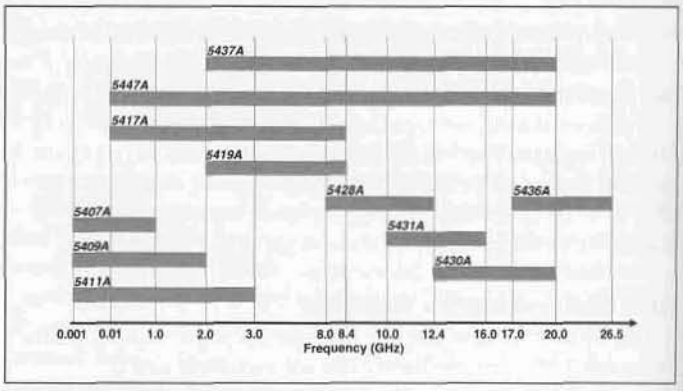


5400A Scalar Measurement System Highlights

- *Single, Easy-to Use Unit with an Affordable Price*
- *Fast, Accurate Measurement of Transmission, Return Loss, SWR, and Absolute Power*
- *Crystal-Based Source for Exceptional Stability and Accuracy*
- *10 kHz Frequency Resolution (RF Models); 100 kHz Resolution (Microwave Models)*
- *Built-In Automation Features Including Cursor Search and Save/Recall*

Complete, Self-Contained System

Wiltron 5400A Series Scalar Measurement Systems integrate a sophisticated scalar analyzer with a full-function microwave generator. The result is a low cost system with uncompromised performance in a compact package. Users in manufacturing, design, and field service will benefit from this unique combination of features. There are three RF models and eight microwave models (see chart) to allow matching frequency capability with budget. All models measure insertion loss or gain in dB, return loss in dB, match in SWR, or RF power in dBm with 71 dB dynamic range. Remote detectors and Autotesters minimize error from cable loss and facilitate measurements at remote points.

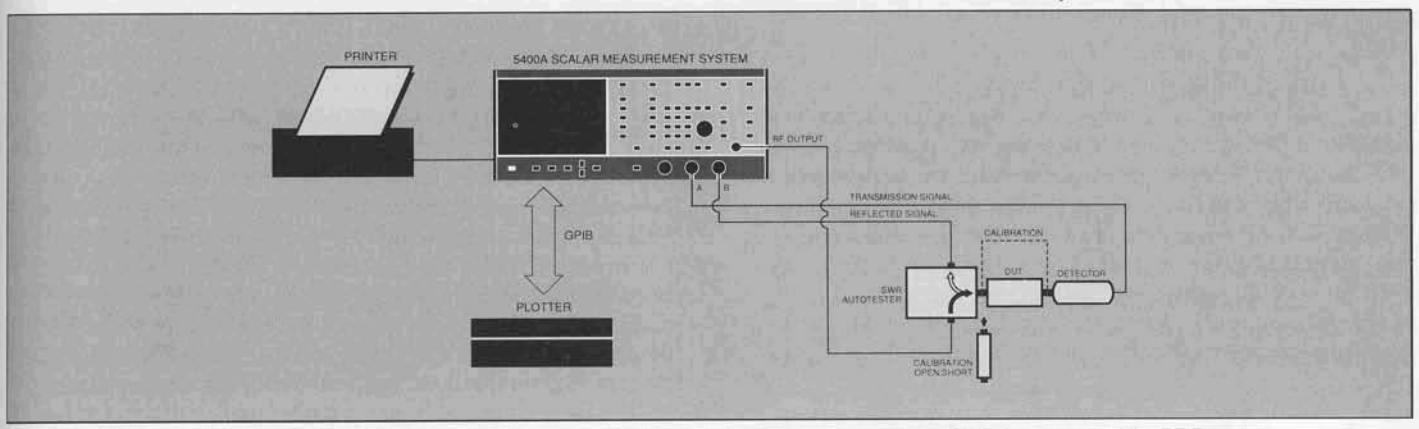


The Value of a Built-in Source

The integrated, proprietary signal source makes this system easier to learn and more convenient, not to mention compact and light enough for use in the field. Results are 100 times more accurate than a conventional microwave sweeper. You get synthesized sweeper frequency accuracy at a cost less than ordinary sweep generator and analyzer combinations.

5400A Scalar Network Analyzers

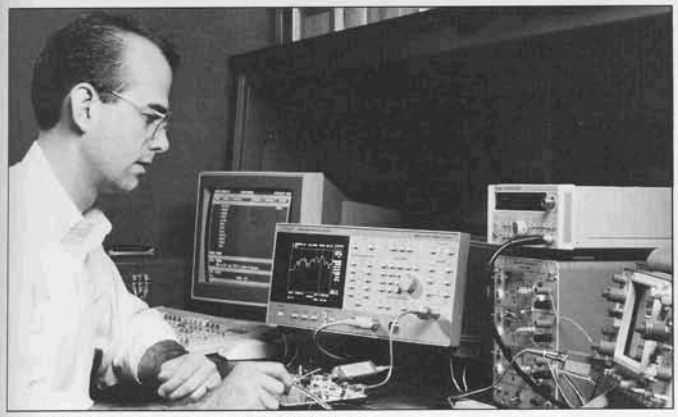
Model 5400A, 1 MHz to 26.5 GHz



In a typical 5400A transmission and return loss measurement setup, the device under test is inserted between the SWR Autotester and the RF Detector.

Accuracy and Versatility for R&D

Though the Wiltron 5400A scalar measurement system combines compact size and low cost, you sacrifice nothing in performance as compared with a separate source and analyzer setup. You'll realize far better results than you could with a sweep generator as the signal source. And you'll have them faster. The integrated, crystal-based microwave source is key to the Wiltron 5400A series' start frequency accuracy:
±100 kHz, 1 MHz–3 GHz (RF models);
±200 kHz, 10 MHz–26.5 GHz (Microwave models).



The 5400A has the performance for R&D use.

Transmission and reflection measurements can be viewed simultaneously. Both traces can be scaled independently in dB, dBm, or SWR. Measurement of the ratio of two detector inputs may be applied to either channel for enhancing accuracy or for viewing differences. Built-in calibration capability allows subtraction of the unwanted transmission frequency response or the average of open/short reflections from either trace. The use of dc detection eliminates uncertainty from RF modulation. And a detector low level calibration is made on every retrace providing sensitivity of greater than –55 dBm.

Optimized for Production

Ease-of-use, repeatability and low cost are keys to a cost-effective production testing program. The Wiltron 5400A series was built with these needs in mind. This system is so intuitive that, with little training, anyone can run high-speed production tests. Even complex tests are easy, because up to nine complete setups (including source settings) can be saved for later recall. Four of these can include calibration data and trace memory. A one-button recall mode speeds access to commonly-used production setups. And all can be previewed on the CRT prior to selection. The high-resolution monitor displays all pertinent test parameters. Ten display cursor functions help locate important frequencies, amplitudes, deltas, and bandwidths. Straight or complex limit lines are available with PASS/FAIL indication. Operators are guided step-by-step through measurement calibration. And the optional reference channel maintains calibration, even when the RF power changes.

The many automation features and low cost make the 5400A perfect for production use.

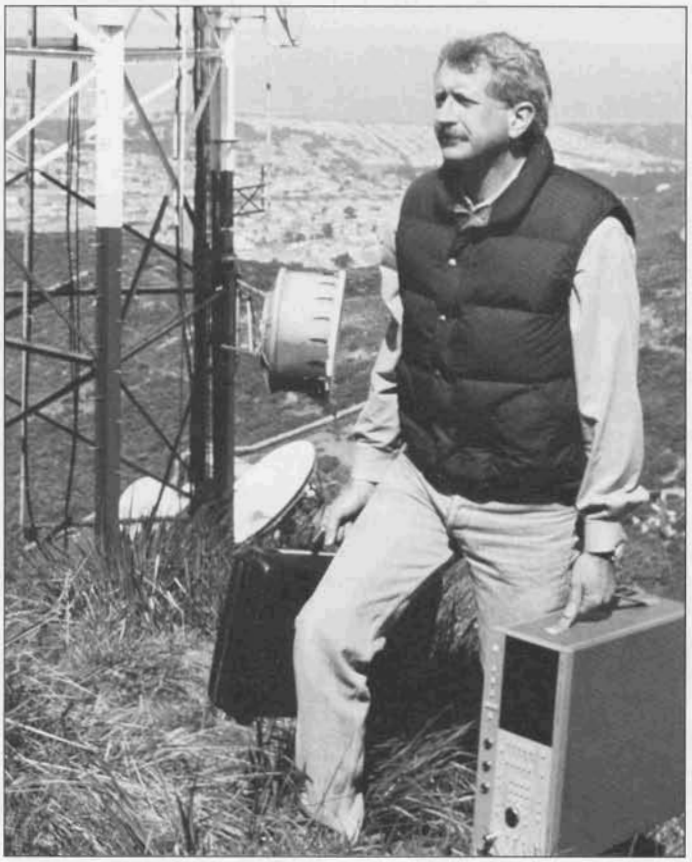
In short, production supervisors can set up sophisticated tests and go on to other things, confident that their operators can run the sequences properly and with repeatable results. The built-in signal source doesn't just save the cost of a synthesizer – it saves space on your workbench. The crisp, monochrome CRT also minimizes the cost and size. A built-in VGA output provides large-screen color capability at minimal cost.

5400A Scalar Network Analyzers

Model 5400A, 1 MHz to 26.5 GHz

Compact for Field Use

Whether your application is in radar, telecommunications relay stations, cellular telephone sites, any place that requires measurements away from your home base, you'll appreciate the Wiltron 5400A. A system that integrates the signal source with the analyzer saves significant weight. This also solves the problem of lugging two cases to the site instead of one. The Wiltron 5400A does both for you. Remote detection allows placement of the measurement sensors away from the instrument. Wiltron 5400 and 560 Series Detectors and Autotesters are highly accurate, yet rugged. Extender Cables allow measurements several hundred feet from the analyzer.



The 5400A is compact for field use.

Full GPIB for ATE Use

While integrated design assures consistent test results at all times, the built-in GPIB interface and VGA color output also make the Wiltron 5400A ideal for automated test environments. All front-panel capabilities of the Wiltron 5400A (except Power On/Off) can be controlled from your external computer through the rear-panel IEEE-488 GPIB port. Test and normalization data are transferred at high speed. The color VGA output allows viewing both the computer instructions and the measurement results on the same display. The display can prompt the operator to tune the device, then present the proper measurement display. After tuning, the computer can continue with automated testing.

The GPIB interface is compatible with a variety of HP plotters for copying display traces and markers, as well as cursor and graticule information. A parallel printer interface compatible with most Epson dot-matrix and HP Ink Jet printers is also provided. Hard copy can be selected in graphical or tabular format.

And the internal buffer allows you to do new tests while previously obtained data is being printed or plotted.

VGA output and full GPIB programmability (optional) for ATE use.

Applications

The compact and accurate Wiltron 5400A is an ideal solution for characterization of the microwave components in radar warning systems and other electronic warfare equipment, cellular repeaters, and most advanced telecommunications relay systems.

5400A Scalar Measurement System

5400A Applications

Amplifier Testing

The 5400A series offers many features for characterizing RF and microwave amplifiers. Broad frequency range, flat output power, wide dynamic range and a built-in step attenuator are typical instrument requirements for amplifier testing. Automated measurement routines combined with these features make for fast and accurate testing. Regardless of the amplifier, the 5400A and measurement components can be configured in a variety of ways to measure specific amplifier characteristics. The figure below shows a basic configuration for determining:

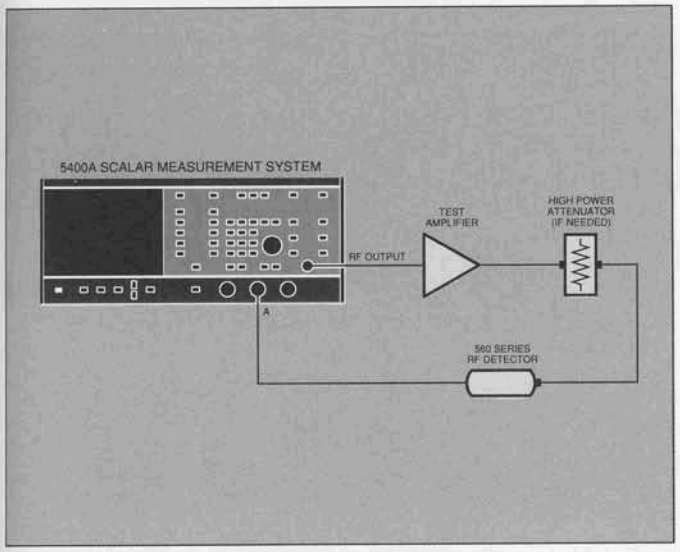
- Gain versus frequency
- Output power versus frequency
- Gain variation with bias change

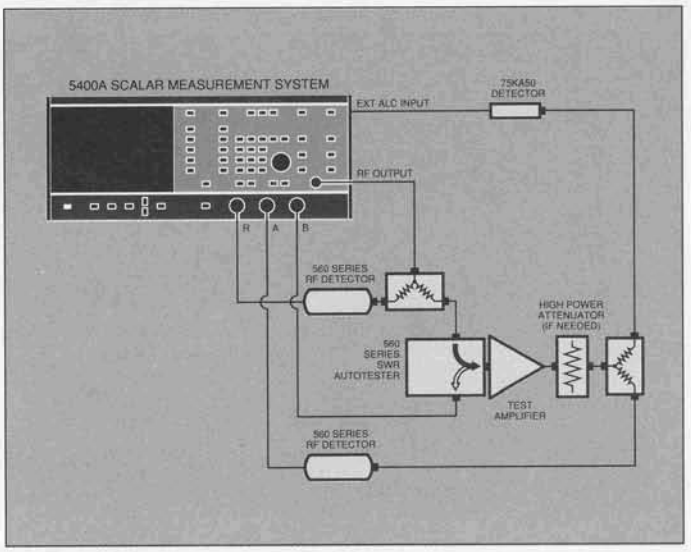
Cursors may be set to automatically search for key device parameters to expedite testing and reduce errors from misread displays. Despite their power, ease of use is maintained, enabling new users to quickly make accurate measurements.

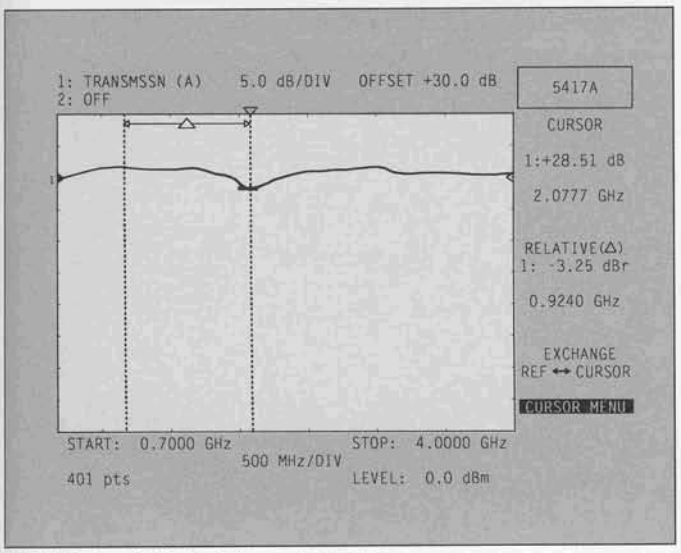
More sophisticated measurements are possible using external leveling and a ratio channel. Below is the setup for measuring:

- Input match versus frequency and power
- Output power at 1 dB gain compression

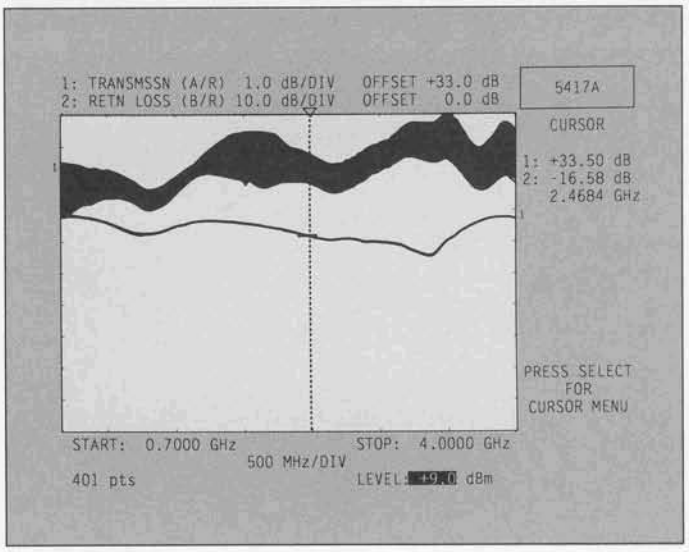
The optional external leveling feature makes amplifier gain compression a simple one-display measurement; previously these required a time consuming series of measurements at various power levels. Built-in limit lines and an amplifier test routine automate the test for manufacturing environments to maximize through-put.







5400A Display of Gain Variation vs. Frequency.



Gain Compression and Input Match vs. Frequency are easily made with the 5400A.

5400A Scalar Measurement System

5400A Applications

Mixer Measurements

Complete characterization of RF and microwave mixers is easier than before with the 5400A. The combination of broad frequency range, a built-in source and step attenuator plus the instrument's wide dynamic range make it ideal for most mixer applications. Below is a basic measurement setup for measuring:

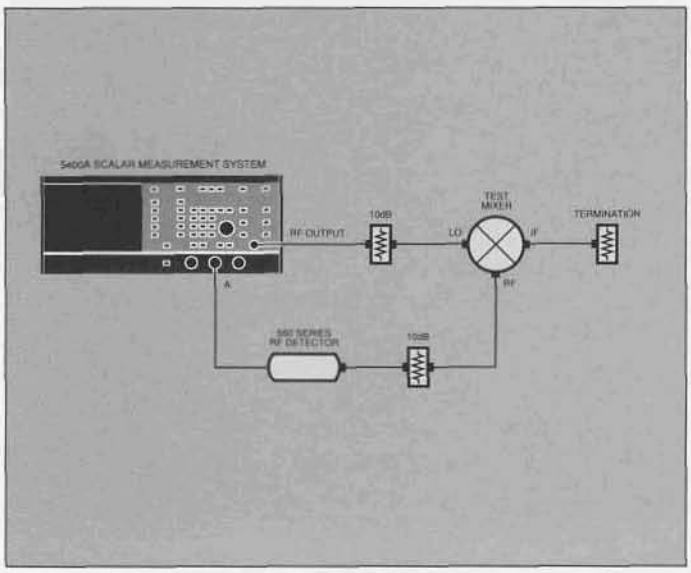
- LO to RF Isolation
- LO to IF Isolation
- RF to IF Isolation

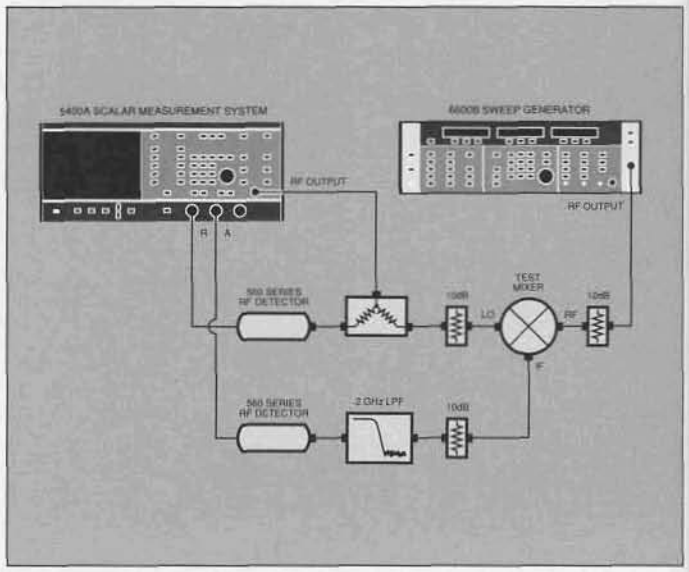
The 70 dB optional step attenuator allows source power to be controlled over a range up to 80 dB. Even low noise mixers are easily tested at a variety of source powers without the need for connecting external attenuators.

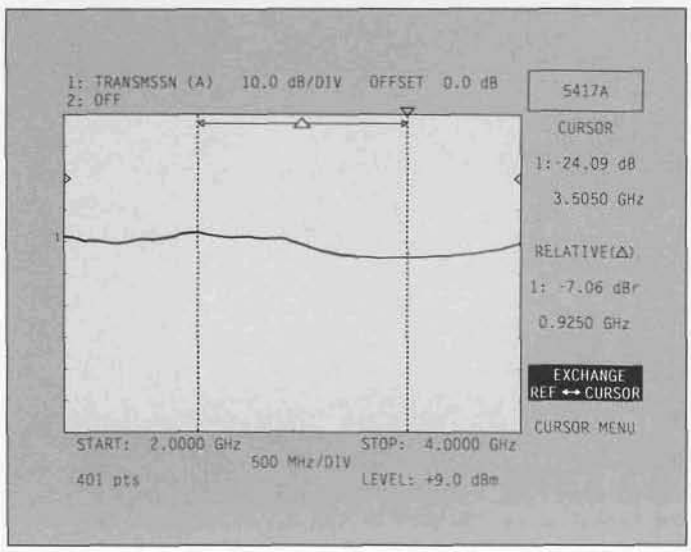
By adding a second signal source the 5400A can make a variety of conversion loss measurements. Complete mixer characterization is achieved when including the optional Ratio channel. The measurement setup below is ideal for evaluating:

- SSB Conversion Loss vs. Input Frequency (IF Fixed)
- SSB Conversion Loss vs. IF Frequency (RF Fixed)
- Conversion Loss vs. LO Power
- 1 dB Conversion Compression point

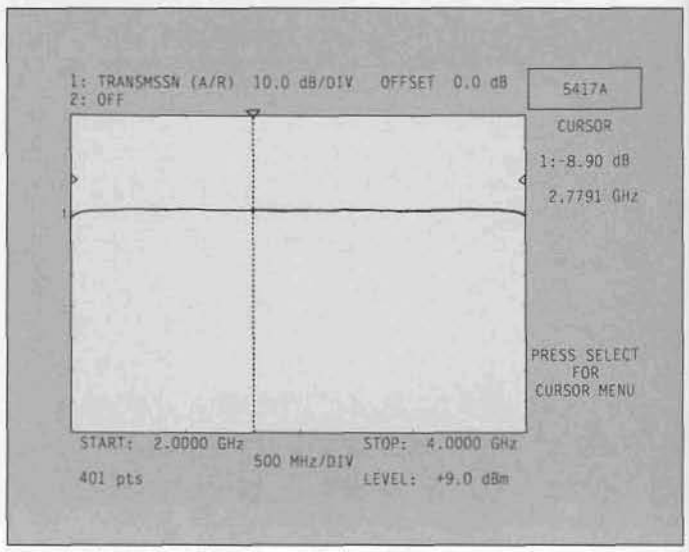
The 5400A offers extensive built-in functions to automate and simplify complex measurements providing more meaningful results. The display below demonstrates how easy variations in signal amplitude are captured using the MAX-MIN TRACE.







The relative cursor function allows the L.O. to RF isolation to be read directly on the display.



Trace math eases this SSB Conversion Loss Measurement.

5400A Scalar Measurement System

Filter

Filter measurements are a breeze with the 5400A. Whether your application centers around design, production or QA, the 5400A is packed with features to save you time. Automated cursor routines quickly locate broadband, passband, 3 dB and skirt characteristics. The high degree of frequency resolution allows filter characteristics to be measured down to 1 kHz (10 kHz in microwave models). Single and complex limit lines can further speed testing by displaying PASS/FAIL when comparing trace data.

Below is the basic setup for determining:

- Input Match
- Passband Insertion Loss
- 3 dB Bandwidth

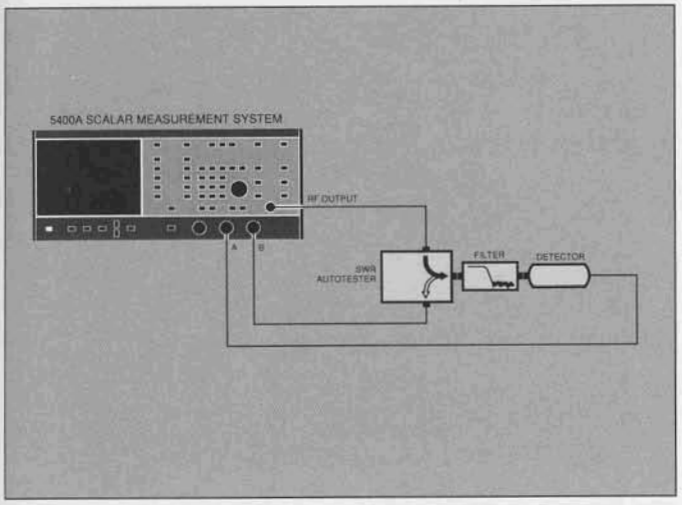
For some setups, productivity may be improved using the 5400A's Alternate Sweep mode. View both broadband and narrowband performance without having to recalibrate.

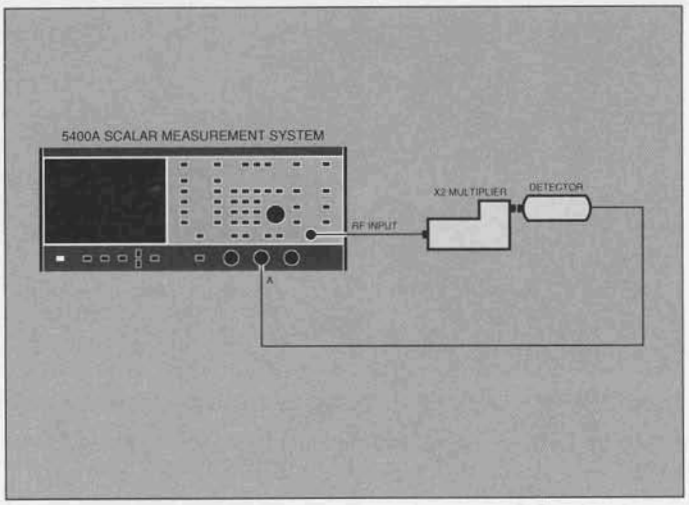
Multiplier Testing

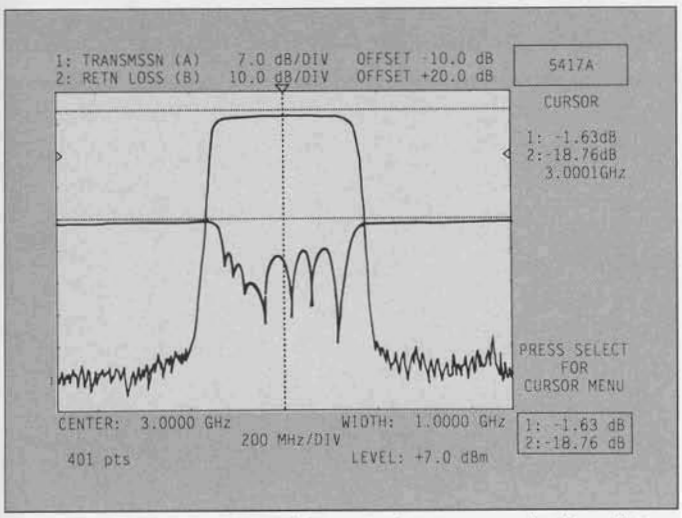
The 5400A series analyzers offer a new level of simplicity for multiplier evaluation. A frequency scalable axis allows users to directly read frequencies at the multiplied output. Frequency scaling also converts all cursor and marker readouts for easy viewing of specific frequency points. Output power can be displayed in dBm to immediately evaluate multiplier performance. Here is an example for measuring:

- Frequency Response
- Output Power

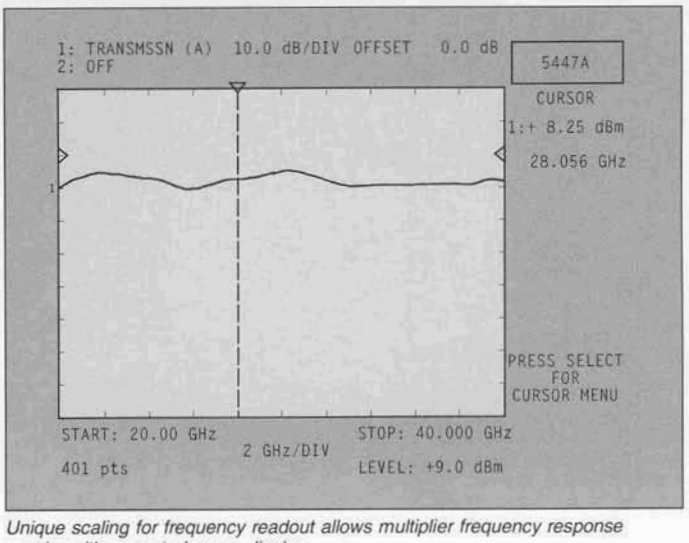
With optional external leveling the frequency range of any 5400A can actually be extended. Simply scale the frequency axis according to the multiplied output and switch to external level to achieve flat output power at the new frequencies.







The 5400A's frequency resolution allows accurate measurements at Insertion Loss and Input Match at any point on the display.



Unique scaling for frequency readout allows multiplier frequency response graphs with corrected range display.

5400A Scalar Measurement System

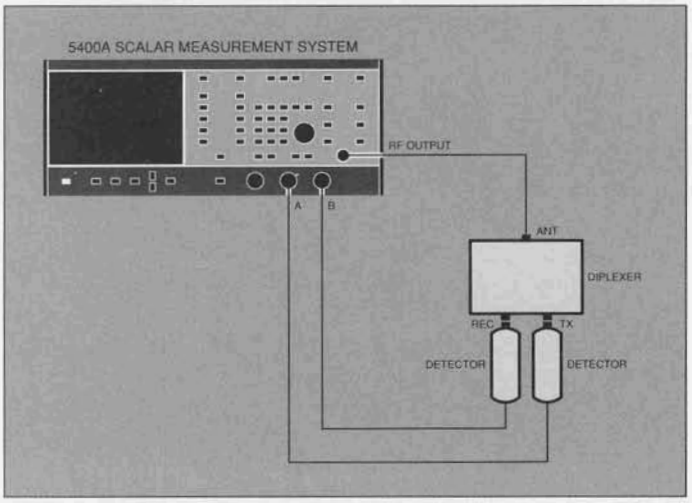
5400A Applications

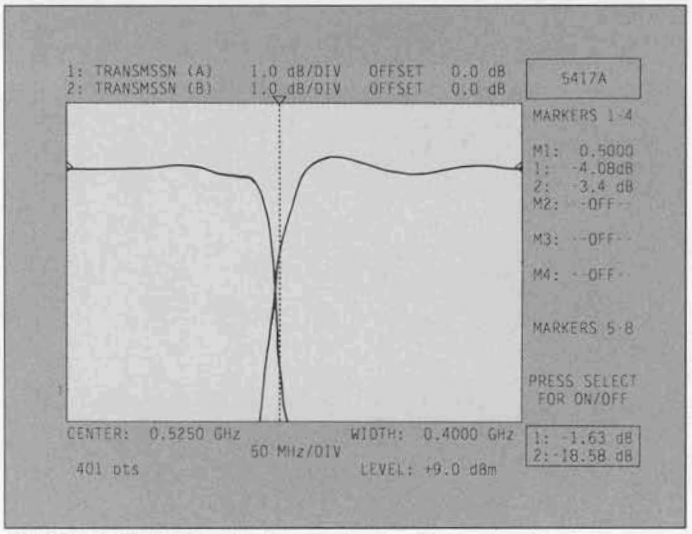
Diplexer and Multiplexer Measurements

The 5400A allows simultaneous viewing of both outputs on diplexer assemblies. By calibrating both channels for transmission only, users can view band-pass and band-reject characteristics of each signal path. To help speed testing, critical frequency points are constantly monitored using up to eight on-screen markers.

Here is one possible setup for quickly measuring diplexer performance.

For a more complete view of diplexer characteristics, use the Alternate Sweep feature to display both broadband and narrowband responses. Combine Limit Testing with Alternate Sweep and quickly evaluate diplexer performance with a simple PASS/FAIL indication.





Two input channels allow simultaneous viewing of transmit and receive characteristics of diplexers.

Low Cost Antenna Pattern Measurements

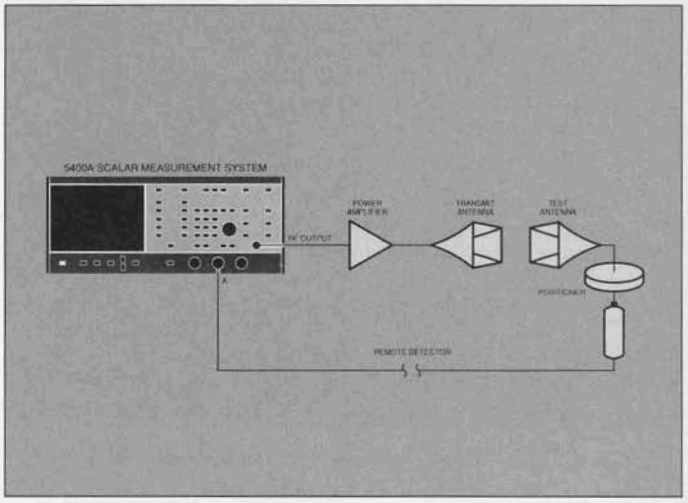
Rapidly determine antenna characteristics using the 5400A and an open loop positioner. This technique is especially valuable for those requiring antenna pattern measurements at minimal cost.

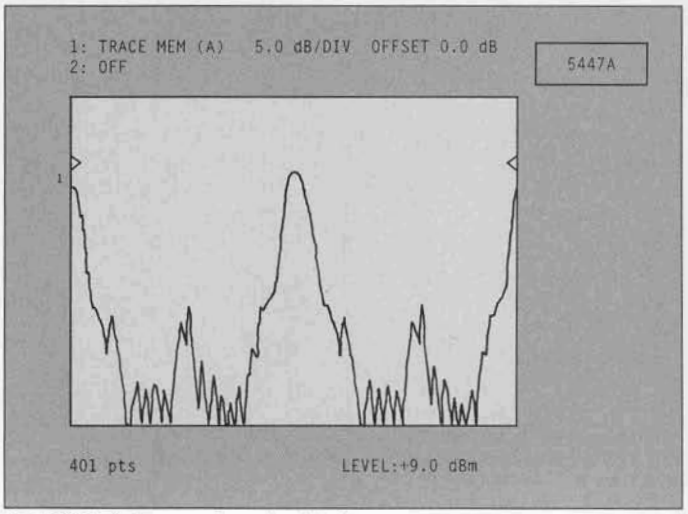
The basic setup is shown here for measuring:

- Main Lobe to Side Lobe Ratio
- Front To Back Ratio
- Pattern Anomalies

The wide 71 dB dynamic range of the 5400A provides for analysis of high gain as well as lower gain antennas. Extender cables allow receive antenna to be remotely located hundreds of feet from the transmit antenna.

The measurement procedure is straightforward. After calibration, the user adjusts the positioner rotation speed to achieve two or more revolutions on the instrument display. TRACE HOLD freezes the display for immediate evaluation of the antenna pattern. Zoom-in on stored patterns for closer analysis of pattern anomalies.





The 5400A displays a rectangular plot of antenna pattern measurements.

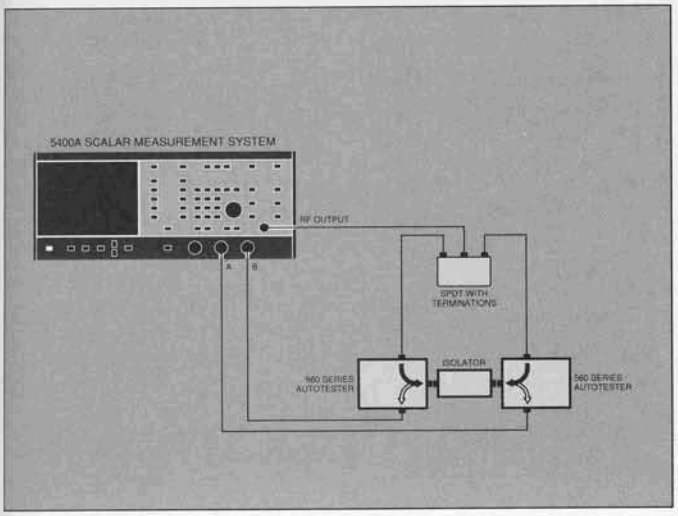
5400A Scalar Measurement System

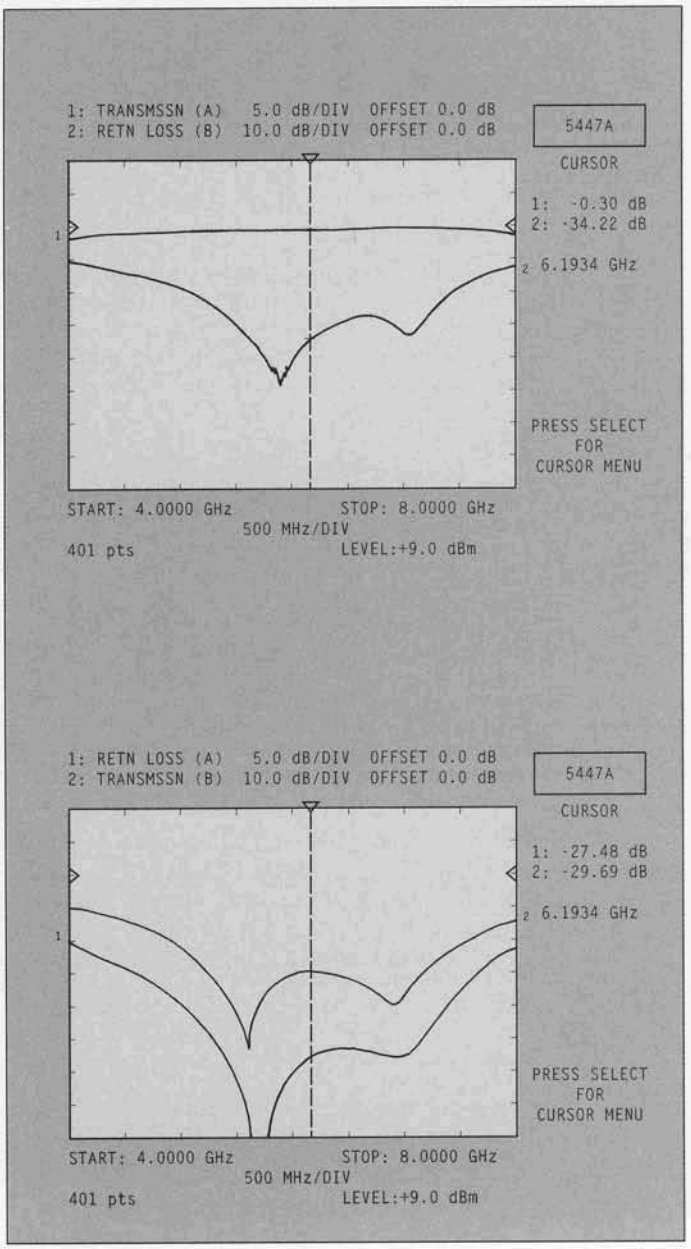
Isolators

Measuring forward and reverse characteristics of an isolator requires a system with wide dynamic range and high directivity. The 5400A, together with its external components, provides a cost effective solution for rapid and accurate testing. Below is a unique single-connection setup for measuring an isolator's:

- Forward Transmission
- Input Match
- Reverse Transmission
- Output Match

The 5400A's Single Key Recall feature reduces test time and increases throughput. The four isolator tests are quickly executed with the press of a single key after calibration and setup information has been stored for both RF paths.





The versatility of the 5400A allows Forward and Reverse measurements to be made without removing the D.U.T.

5400A Scalar Measurement System

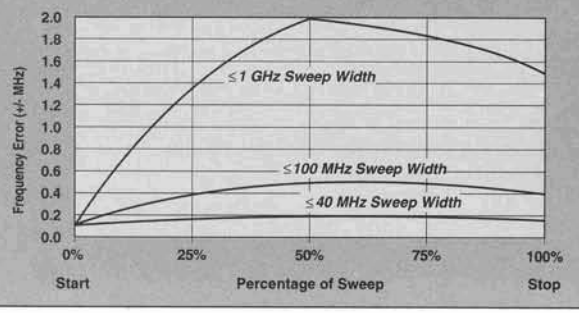
General Specifications

MODEL/SPECIFICATION[1]		Units	RF MODELS			MICROWAVE MODELS							
			5407A	5409A	5411A	5417A	5447A	5419A	5437A	5428A	5431A	5430A	5436A
Frequency Range		GHz	0.001 to 1.0	0.001 to 2.0	0.001 to 3.0	0.01 to 8.4	0.01 to 20.0	2.0 to 8.4	2.0 to 20.0	8.0 to 12.4	10.0 to 16.0	12.4 to 20.0	17.0 to 26.5
Output Power (@25°C)	Internally Leveled, Maximum	dBm	+12[2]	+12[2]	+12[2]	+10	+10	+10	+10	+10	+10	+10	+7
	With Option 2, 2A, or 2B; 70 dB Step Attenuator (10 dB Steps)	dBm	+10[2]	+10[2]	+10[2]	+7	+7	+7	+7	+7	+7	+7	+4
Power Level Accuracy	With Leveled Power	dB	±1.0[3]	±1.0[3]	±1.0[3]	±1.0	±1.0	±1.0	±1.0	±1.0	±1.0	±1.0	±1.0
	With Option 2, 2A, or 2B; 70 dB Step Attenuator (10 dB Steps)	Add dB	±1.0[3]	±1.0[3]	±1.5[3]	±1.5	±1.9	±1.5	±1.9	±1.5	±1.5	±1.5	±3.0
	Step Attenuator Accuracy, Between 10 dB Steps	dB	±0.4	±0.4	±0.4	±0.4	±0.5	±0.4	±0.4	±0.4	±0.5	±0.4	±0.7
Leveled Power Variation	With Frequency	dB	±0.3[3]	±0.4[3]	±0.6[3]	±0.5	±0.75	±0.4	±0.5	±0.4	±0.4	±0.5	±1.0
	With Frequency; With Option 2, 2A, or 2B; 70 dB Step Attenuator (10 dB Steps)	dB	±1.0[3]	±1.1[3]	±1.3[3]	±1.0	±1.0	±0.9	±1.0	±0.9	±0.9	±1.0	±2.5
Source SWR	With Leveled Power	SWR	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.7
	With Leveled Power; 70 dB Step Attenuator (10 dB Steps)	SWR	<1.5	<1.5	<1.5	<1.5	<1.8	<1.5	<1.8	<1.5	<1.5	<1.5	<2.0
Signal Purity	Harmonics	dBc	<–40	<–40	<–40	<–40 (≤2 GHz) <–50 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<–50	<–60	<–50	<–50	<–50	<–50
	Non-Harmonics	dBc	<–60	<–60	<–60	<–50 (≤2 GHz) <–60 (>2 GHz)	<–50 (≤2 GHz) <–60 (>2 GHz)	<–60	<–60	<–60	<–60	<–60	<–60
	Residual FM (Measured in 30 Hz to 15 kHz post-detection BW)	kHz peak	<10	<10	<10	<7	<10	<7	<10	<10	<10	<10	<30
Frequency Accuracy (See Sweep Width Error Charts below)	Start Frequency Error	kHz	±100	±100	±100	±200	±200	±200	±200	±200	±200	±200	±200
RF Output Connector (50Ω Standard, 75Ω Optional[4])			Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	Type N (f)	K (f)

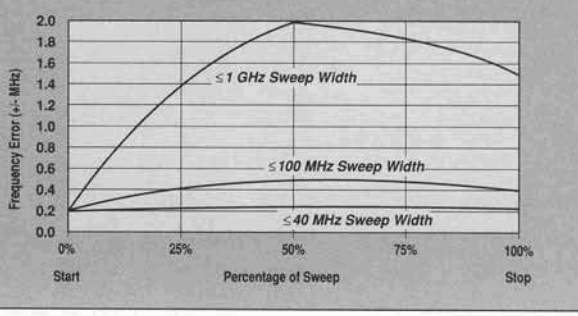
① At maximum specified output power. ② For Option 4, 75Ω output, subtract 2.0 dB. ③ For Option 4, 75Ω output, add 0.2 dB.
④ Option 4, 75Ω available on RF Models 5407A, 5409A, and 5411A only.

Frequency Error with Sweep Width (In Swept Frequency Mode):

RF Models —
5407A, 5409A, 5411A:



Microwave Models —
5417A, 5419A, 5428A, 5430A, 5431A, 5436A, 5437A, 5447A:



5400A Scalar Measurement System

MEASUREMENTS

Function: The 5400A Series measures the swept frequency transmission, reflection and power characteristics of microwave devices using a built-in microwave source, remote detectors, and SWR Autotesters.

There are eleven models, each covering a different frequency range (see table on page 58). Measurements are displayed on two independent channels in dB, dBm, or SWR.

Measurement Modes: Transmission (dB), Return Loss (dB), SWR (linear SWR), and power (dBm)

Frequency Range: Depends on model, see table on page 58.

ANALYZER

Dynamic Range: 71 dB (–55 to +16 dBm) with Wiltron 560 Series or 5400 Series Detectors and SWR Autotesters.

Inputs: Two inputs (three optionally) — A, B, and R (Option 5) — accept detected outputs from Wiltron 560 Series or 5400 Series Detectors and SWR Autotesters, remote from the instrument.

Channels: Two channels are used to select and simultaneously display any two inputs from A, B, or R (Option 5). The inputs can also be displayed as ratios A/R or B/R.

Display Resolution:
Horizontal: 101, 201, or 401 points over selected frequency range
Vertical: 0.025 dB

Graticule: Ten vertical divisions. Horizontal axis is automatically scaled in frequency increments of 1, 2, 5. Graticule On/Off button turns all graticule lines off. Tick marks remain on axis to indicate graticule position.

Scaling:
Resolution: 0.1 dB(m) to 10 dB(m) per division in 0.1 dB steps with independent control for each channel.
Offset range: –99.9 dB to +99.9 dB in 0.1 dB steps.
Autoscale: Automatically selects offset and resolution to provide optimum display of test data.

Trace Update Time: Typically less than 130 ms for single-channel, 101 point resolution, depending on frequency range and the averaging and smoothing settings.

CRT Intensity: Both the graticule and the data are independently adjustable from off to bright.

External VGA Monitor Output: Rear panel connection is provided to drive a VGA color display. Colors are selectable via a menu.

Cursor: The numerical amplitude of the test data and frequency are displayed for both channels. The frequency is continuously variable with the tuning knob over the displayed range. Cursor position remains fixed on the display as the sweep frequency range is changed.

Relative Cursor: Displays the amplitude and frequency difference between the Cursor and Relative Cursor for both channels. A menu selection reverses the position of the two cursors.

Cursor Functions: Automatic cursor searches for trace Maximum, Minimum, dB Level, dB Bandwidth, Next Marker, and Active Marker may be performed.

Data Correction: System frequency response errors are removed for transmission measurements with a through line calibration and for reflection measurements with an open-short calibration. Calibration data is stored at 0.002 dB resolution over the selected frequency range. Calibration is maintained at all resolutions. At narrower frequency ranges, interpolation is used to maintain the chosen number of frequency data points.

Smoothing: Analog filtering, adjustable in five levels, individually settable for each channel to reduce noise on low-level traces.

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces may be averaged together to remove unwanted noise. Channels may be independently set.

Limit Lines: Two lines, either straight or complex, for each trace for comparison of trace data with predetermined values. Complex lines may be made from up to 10 individually-editable segments. Trace data may be compared with limit lines for Pass/Fail testing.

Save/Recall: Nine sets of front-panel set-ups and four sets of calibrations can be stored for later recall. Stored set-ups may be previewed on the CRT or printed prior to selection. Four setups may include calibration data and trace memory.

SOURCE

Frequency Range: 1 MHz to 26.5 GHz in eleven models. See table on page 58.

Start-Stop: Sweeps upward from start frequency to stop frequency. Start frequency must be less than stop frequency.

Center-Width: Sweeps upward from CENTER – (WIDTH/2) to CENTER + (WIDTH/2).

Alternate Sweep: Sweeps alternately between frequency ranges set differently for Channel 1 and Channel 2.

CW: Provides single frequency entered as start frequency as above (both channels turned off).

Frequency Resolution:
RF Models (5407A, 5409A, 5411A): ±10 kHz
Microwave Models (5417A, 5419A, 5428A, 5430A, 5431A, 5436A, 5437A, and 5447A: ±100 kHz

Start Frequency Accuracy:
RF Models (5407A, 5409A, 5411A): ±100 kHz
Microwave Models (5417A, 5419A, 5428A, 5430A, 5431A, 5436A, 5437A, and 5447A: ±200 kHz

Output Power: Depends on model; see table on page 58.

Power Level Control, Internally Leveled: Front panel control adjusts power over a 10 dB range (standard) or from –70.0 dBm to maximum leveled power when Option 2, 2A, or 2B 70 dB Step Attenuator is installed.

Power Level Control, Externally Leveled (Option 6): Front panel control adjusts power over a 10 dB range determined by external leveling detector output.

Leveling (With External Detector): Levels output power at remote test position where directional detector samples RF power and provides a positive or negative polarity detected signal of 30 to 200 mV to rear panel BNC connector.

Attenuator: Option 2 (RF Models), 2A (20 GHz models) or 2B (26.5 GHz model) adds a 70 dB Step Attenuator (10 dB steps). See table on page 58 for accuracy specifications.

Markers: The numerical amplitude of the test data and frequency are displayed for both channels. The frequency is continuously variable with the keypad or tuning knob over the entire instrument frequency range. Markers remain fixed at the set frequency, independent of sweep frequency range.

Horizontal Output: Rear panel BNC connector, 0 to +10V ramp coincident with sweep in all sweep modes.

Reverse Power Protection: Up to 1 Watt RF.

APPLICATION FUNCTIONS

Applications functions speed and ease the task of characterizing antennas, filters, amplifiers, and other microwave devices.

Trace Functions: Save the minimum and maximum values of successive sweeps or the combination of the two. Ideal for acquiring data on drift or gain variation against temperature.

Cursor Functions: Supplement the cursors by adding an automatic search to find the minimum and maximum levels of the displayed trace, "X" dB above or below the min/max point, or a selected bandwidth. This function can be set to repeat continuously.

Amplifier Testing: Determines the gain compression point over the operating frequency range of an amplifier by successively incrementing the source power and measuring the amount of compression until a preset limit is exceeded.

5400A Scalar Measurement System

RF Model Specifications

SYSTEM ACCURACY FOR 5400A RF MODELS WHEN USED WITH 5400 SERIES COMPONENTS (≤3 GHz)

Transmission Loss or Gain Accuracy

Uncertainties from frequency response of components are automatically subtracted from test data during the normalization procedure. Overall accuracy is then:

Transmission Loss or Gain Accuracy	=	Channel Accuracy	+	Mismatch Uncertainty*

* Effects of source, test device, SWR Autotester, and detector mismatch can be significant. This mismatch uncertainty is minimized by Wiltron's exceptionally low reflection characterisitics of the detector, source, and SWR Autotester.

Overall Coaxial Return Loss Measurement Accuracy

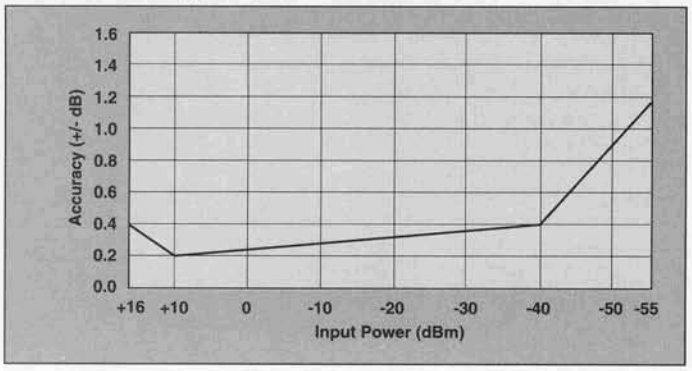
Uncertainties resulting from SWR Autotester and source frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Return Loss Accuracy	=	Channel Accuracy	+	SWR Autotester Accuracy

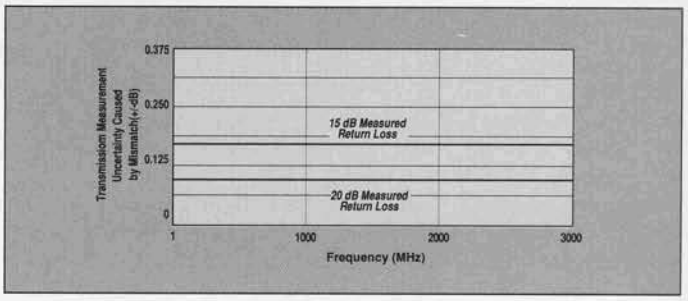
Power Measurement Accuracy

Absolute Power Accuracy	=	Channel Accuracy	+	Detector Frequency Response

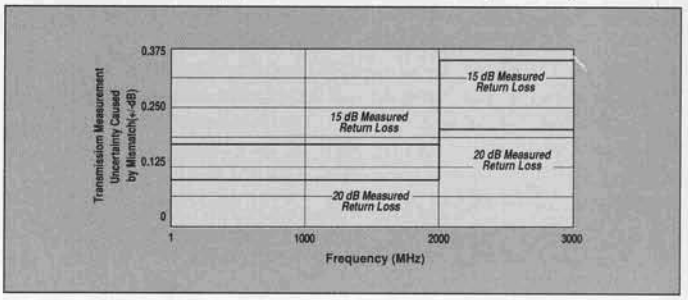
Channel Accuracy (25°C):



Mismatch Uncertainty (50Ω Measurement Components)*:



Mismatch Uncertainty (75Ω Measurement Components)*:



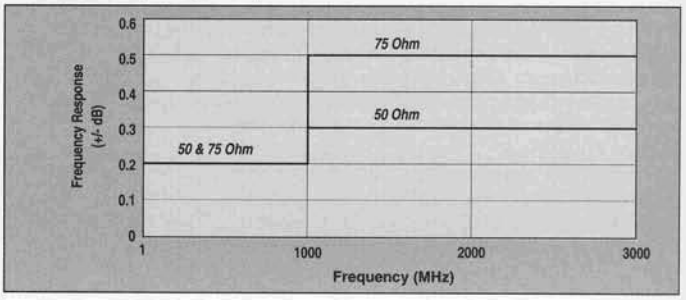
* Based on worst-case analysis of uncertainties due to return loss of the detector, SWR Autotester, (N-type) connecting cables, and the return loss of the measured reflection.

SWR Autotester Accuracy:

Model	Accuracy of Measured Reflection Coefficient (ρ)①		
	1 to 1000 MHz	1 to 2000 MHz	2000 to 3000 MHz
5400-6B75	$0.010 \pm 0.10\rho^2$	N/A	N/A
5400-6N50 5400-6NF50	$0.010+0.05\rho^2$ $0.010+.05\rho^2$	$0.010+0.05\rho^2$ $0.010+0.05\rho^2$	$0.010+0.05\rho^2$ $0.010+0.05\rho^2$
5400-6N75 5400-6NF75	$0.010+0.05\rho^2$ $0.010+0.05\rho^2$	$0.010+0.05\rho^2$ $0.010+0.05\rho^2$	$0.010+0.08\rho^2$ $0.010+0.08\rho^2$

① Accuracy includes the effects of directivity (first term) and test port reflection (second term) over the frequency range.

Detector Frequency Response:



5400A Scalar Measurement System

Microwave Model Specifications

SYSTEM ACCURACY FOR 5400A MICROWAVE MODELS WHEN USED WITH 560 SERIES COMPONENTS (≤26.5 GHz)

Transmission Loss or Gain Accuracy

Uncertainties from frequency response of components are automatically subtracted from test data during the normalization procedure. Overall accuracy is then:

Transmission Loss or Gain Accuracy = Channel Accuracy + Mismatch Uncertainty*

* Effects of source, test device, SWR Autotester, and detector mismatch can be significant. This mismatch uncertainty is minimized by Wiltron's exceptionally low reflection characterisitics of the detector, source, and SWR Autotester.

Overall Coaxial Return Loss Measurement Accuracy

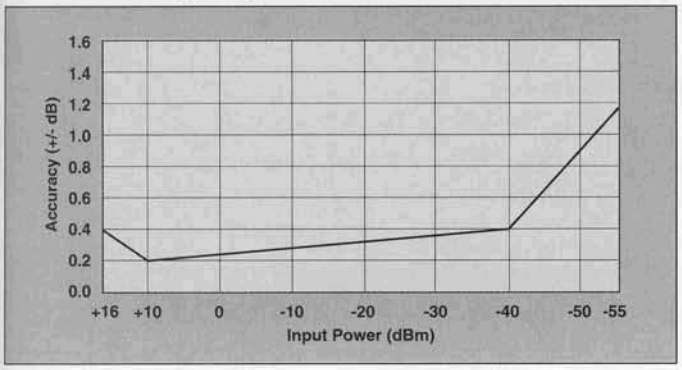
Uncertainties resulting from SWR Autotester and source frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Return Loss Accuracy = Channel Accuracy + SWR Autotester Accuracy

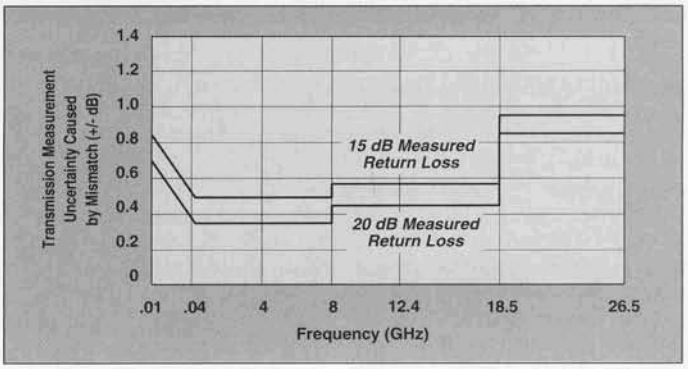
Power Measurement Accuracy

Absolute Power Accuracy = Channel Accuracy + Detector Frequency Response

Channel Accuracy (25°C):



Mismatch Uncertainty*:



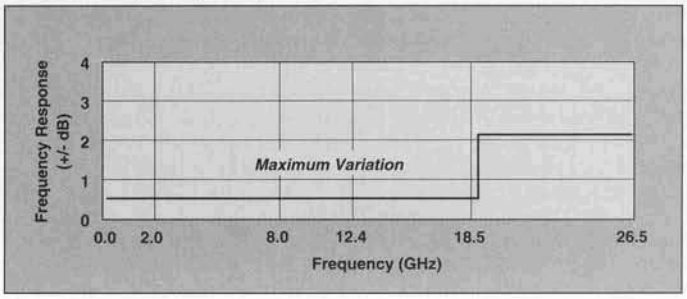
* Based on worst-case analysis of uncertainties due to return loss of the detector, SWR Autotester, (N-type) connecting cables, and the return loss of the measured reflection.

SWR Autotester Accuracy:

Model	Accuracy of Measured Reflection Coefficient (ρ)①		
	10 MHz – 8 GHz	8 – 18 GHz	18 – 26.5 GHz
560-97A50 560-97A50-1	$0.016+0.06\rho^2$ $0.010+0.06\rho^2$	$0.016+0.10\rho^2$ $0.010+0.10\rho^2$	N/A
560-97N50 560-97N50-1	$0.018+0.08\rho^2$ $0.013+0.08\rho^2$	$0.018+0.12\rho^2$ $0.013+0.12\rho^2$	N/A
560-97NF50 560-97NF50-1	$0.018+0.08\rho^2$ $0.013+0.08\rho^2$	$0.018+0.12\rho^2$ $0.013+0.12\rho^2$	N/A
560-98S50 560-98S50-1	$0.014+0.10\rho^2$ $0.010+0.10\rho^2$	$0.014+0.10\rho^2$ $0.010+0.10\rho^2$	$0.016+0.12\rho^2$ $0.013+0.12\rho^2$
560-98SF50 560-98SF50-1	$0.014+0.10\rho^2$ $0.010+0.10\rho^2$	$0.014+0.10\rho^2$ $0.010+0.10\rho^2$	$0.016+0.12\rho^2$ $0.013+0.12\rho^2$
560-98K50② 560-98KF50②	$0.018+0.15\rho^2$	$0.018+0.15\rho^2$	$0.025+0.15\rho^2$

① Accuracy includes the effects of directivity (first term) and test port reflection (second term) over the frequency range.
② Operation to 40 GHz is available with the Wiltron 562 Network Analyzer.

Detector Frequency Response:



5400A Scalar Measurement System

General Specifications

GPIB

Interface: IEEE–488 Interface/GPIB Plotter Control is optional on all instruments (Option 3). All front panel controls are GPIB-controllable except power on/off. Configurable for instrument control or for control of GPIB plotter.

Data Transfer The 5400A Series does not require an external controller; nevertheless, it is capable of providing high speed data transfer of test data and normalization data to an external GPIB controller.

GPIB Indicators: The following conditions are indicated:
Remote: Operating on GPIB
Talk: Talking on GPIB
Listen: Listening on GPIB
SRQ: Sending a service request
Local Lockout: Disabling the RETURN TO LOCAL pushbutton. The instrument can then be placed in local mode only via GPIB.

PRINTER/PLOTTER

Plotter: The GPIB interface is compatible with HP 7440A, HP 7470A, and HP 7475A plotters. Display traces, markers, cursor, and graticule information are copied. When overlay traces are desired, data traces only can be plotted. Output may be scaled using P1 and P2 controls.

Printer: Parallel printer interface is compatible with most Epson FX-compatible dot-matrix printers and the HP 2225C Ink Jet Printer. Hard copy output in graphical or tabular format can be selected. Selections include graphics with measurement parameters, test data tabulated for 26, 51, 101, 201, or 401 points, marker parameters only, stored setup parameters, or a listing of the complex limit lines.

Internal Print and Plot Buffer: After approximately 5 seconds of formatting, a new test can be conducted while previously taken test data are being printed or plotted out from an internal printer buffer.

INPUT/OUTPUT CONNECTIONS

Horizontal Sweep Ramp Output: 0 to +10V nominal

GPIB: Connects 5400A to controller or plotter. Rear panel GPIB connector (Option 3).

Parallel Printer (Centronics): Connects 5400A to printer. Rear panel.

VGA Output: Connects 5400A to external VGA color display (not supplied). Rear panel connector.

External Leveling: Option 6 adds external leveling capability. Levels output power at remote test position where directional detector samples RF power and provides a positive or negative polarity detected signal of 30 to 200 mV to rear panel BNC connector.

GENERAL

Nonvolatile Memory: Retains front-panel control settings in memory for up to 10 years. Whenever instrument is turned on, control settings come on at the same functions and values existing when power was removed.

Self Test: Performs a self test every time power is applied or when SELF TEST pushbutton is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.

Temperature Range:
Operating: 0°C to +50°C
Storage: –40°C to +70°C

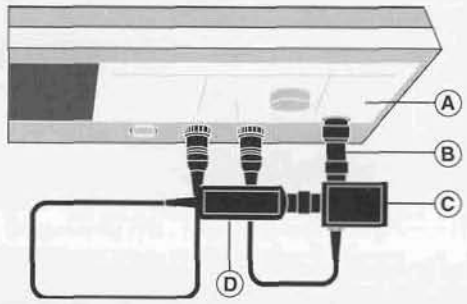
Power: 115V +10%/–20%, 230V +10%/–20%, 48–440 Hz, 300 VA maximum

Dimensions: 177 H x 432 W x 476 D mm + 10 mm for feet
(7 H x 17 W x 18.75 D in. + 0.375 in. for feet)

Weight: 16 kg (35 lb.)
Transit Case 760-75

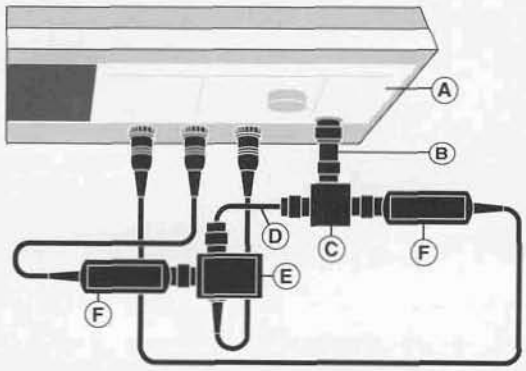
Recommended Accessories

Non-Ratio Measurements



TYPE N TEST PORT (50 Ohms)		
Ref	**Accessory**	**Model No.**
Ⓐ	5400A Scalar Network Measurement System: 5407A: 1 to 1000 MHz 5409A: 1 to 2000 MHz 5411A: 1 to 3000 MHz	
Ⓑ	Adapter: DC to 20 GHz, N (m) to N (m), SWR: 1.1	34NN50A
Ⓒ	SWR Autotester: 1 to 3000 MHz (Includes a Model 22N50 Open/Short)	5400-6NF50
Ⓓ	Detector: 1 to 3000 MHz, N (m)	5400-71N50

Ratio Measurements

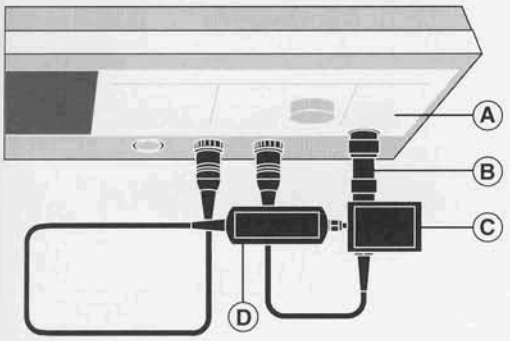


TYPE N TEST PORT (50 Ohms)		
Ref	**Accessory**	**Model No.**
Ⓐ	5400A Scalar Network Measurement System: 5407A: 1 to 1000 MHz 5409A: 1 to 2000 MHz 5411A: 1 to 3000 MHz	
Ⓑ	Adapter: N (m) to N (m)	34NN50A
Ⓒ	Signal Divider: DC to 3000 MHz, Input: N (f), Outputs: N (f)	11N50B
Ⓓ	Cable Assembly: N (m) to N (m), 2 feet long	10N50-2
Ⓔ	SWR Autotester: 1 to 3000 MHz (Includes a Model 22N50 Open/Short)	5400-6NF50
Ⓕ	Detectors (2): 1 to 3000 MHz, N (m)	5400-71N50

5400A Scalar Measurement System

Recommended Accessories

Non-Ratio Measurements

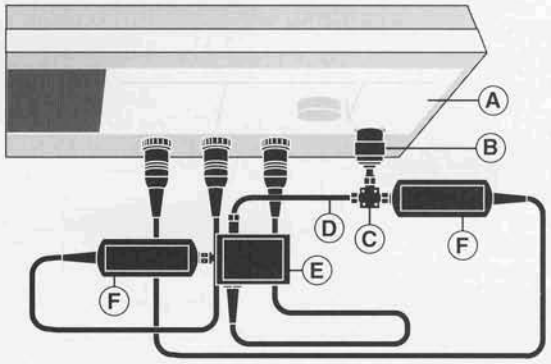


Ref	Accessory	Model No.
Ⓐ	5400A Scalar Network Measurement System: 5417A: 0.01–8.4 GHz 5419A: 2.0–8.4 GHz 5428A: 8.0–12.4 GHz 5431A: 10.0–16.0 GHz 5430A: 12.4–20.0 GHz 5436A: 17–26.5 GHz[1] 5437A: 2.0–20.0 GHz 5447A: 0.01–20.0 GHz	
	SMA TEST PORT	
Ref	**Accessory**	**Model No.**
Ⓑ	Adapter: DC to 20 GHz RS (m) to N (m) SWR: 1.25	34RSN50
Ⓒ	SWR Autotester: 0.01–26.5 GHz (Includes a Model 22S50 Open/Short)	560-98SF50-1
Ⓓ	Detector: 0.01–20.0 GHz WSMA (m)	560-7S50B
	TYPE N TEST PORT	
Ref	**Accessory**	**Model No.**
Ⓑ	Adapter: DC to 20 GHz N (m) to N (m) SWR: 1.1	34NN50A
Ⓒ	SWR Autotester: 0.01–18 GHz (Includes a Model 22N50 Open/Short)	560-97NF50
Ⓓ	Detector: 0.01–20.0 GHz N (m)	560-7N50B

[1] For Non-Ratio Measurements, use (B) RSN50 Adapter and (D) 560-7S50-2 Detector.

System Options

Ratio Measurements



Ref	Accessory	Model No.
Ⓐ	5400A Scalar Network Measurement System (Add Option 5 Reference (R) Channel): 5417A: 0.01–8.4 GHz 5419A: 2.0–8.4 GHz 5428A: 8.0–12.4 GHz 5431A: 10.0–16.0 GHz 5430A: 12.4–20.0 GHz 5436A: 17–26.5 GHz[1] 5437A: 2.0–20.0 GHz 5447A: 0.01–20.0 GHz	
	SMA TEST PORT	
Ref	**Accessory**	**Model No.**
Ⓑ	Adapter N (m) to SMA (f)	1091-79
Ⓒ	Power Splitter DC–26.5 GHz Input: K (m) Outputs: K (f)	K241B
Ⓓ	Cable Assembly K (m) to K (m) 1 foot long	K120-12
Ⓔ	SWR Autotester: 0.01–26.5 GHz (Includes a Model 22S50 Open/Short)	560-98SF50-1
Ⓕ	Detectors (2): 0.01–20.0 GHz WSMA (m)	560-7S50B

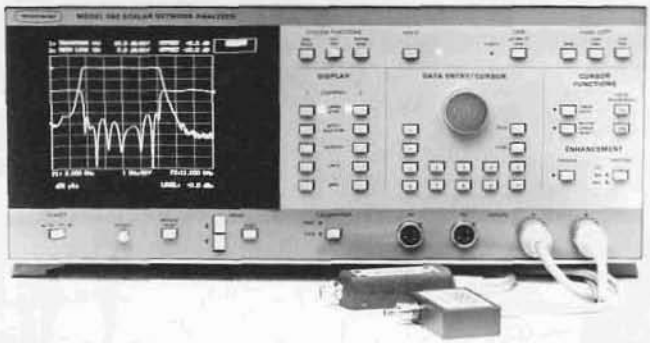
[1] For Ratio Measurements, delete (B) Adapter and use (D) 560-7S50-2 Detector.

5400 SYSTEM OPTIONS

Option 1 **Rack Mounting Unit** supplied with mounting ears and chassis track slide (90° tilt) installed.
Option 2 **70 dB Step Attenuator** (For Models 5407A, 5409A, and 5411A)
Option 2A **70 dB Step Attenuator** (For Models 5417A, 5419A, 5428A, 5430A, 5431A, 5437A, and 5447A)
Option 2B **70 dB Step Attenuator** (For Model 5436A)
Option 3 **Add GPIB Programmability/GPIB Plotter Control**
Option 4 **75Ω Output** (RF Models 5407A, 5409A, and 5411A only)
Option 5 **Add Reference (R) Channel**
Option 6 **Add External Leveling Capability**

Scalar Network Analyzers

Model 562, 10 MHz to 40 GHz

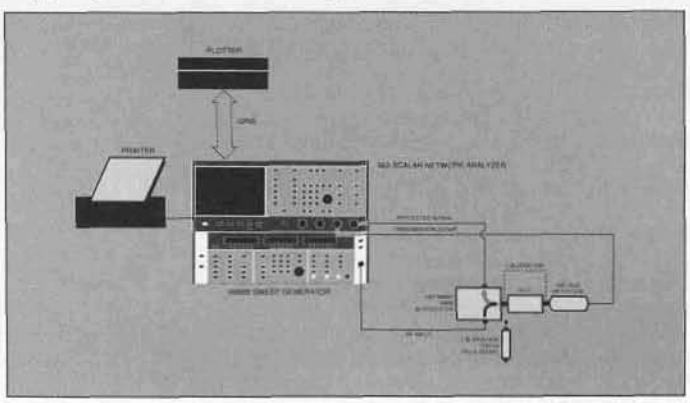


562 Scalar Network Analyzer Highlights

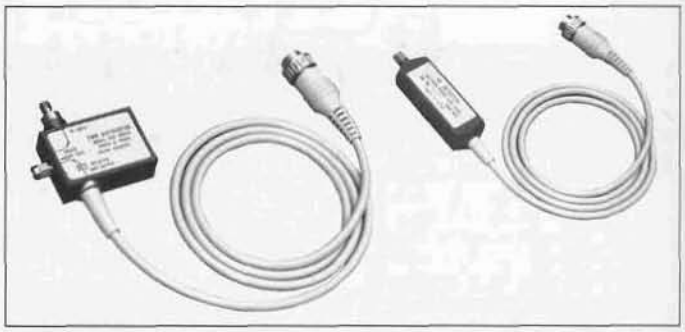
- *Full Compatibility with Wiltron Sources*
- *76 dB Dynamic Range, –60 dBm Sensitivity*
- *10 MHz to 40 GHz Coverage*
- *Four Input Channels*
- *Extensive Cursors, Markers, and Limit Lines*
- *Nine Setups and Four Independent Trace Memories, With Battery Backup*
- *Applications Functions for Improved Productivity*
- *Synthesized Step Sweep with Wiltron 6700B*

High Performance Scalar Measurements

The Wiltron 562 Scalar Network Analyzer combined with a Wiltron 6600B Series Sweep Generator or 6700B Series Synthesizer, forms a powerful swept frequency measurement system for both production and design applications. Measure insertion loss, insertion gain, or RF power with 76 dB dynamic range over the 10 MHz to 40 GHz frequency range—the widest frequency range available in coax. Measure device match as return loss in dB or as SWR. Separate detectors can be used on all four inputs for multiple transmission measurements on duplexers or matched amplifiers. Direct detection allows simultaneous RF power measurement at different frequencies, for example, at the RF, IF, and LO frequencies of mixers and converters. Wiltron offers a complete line of precision accessories including detectors and directional bridges to support your measurement requirements.



The 562 test setup includes direct connection to a printer or GPIB plotter. An external controller can be added but is not required for automated measurements.



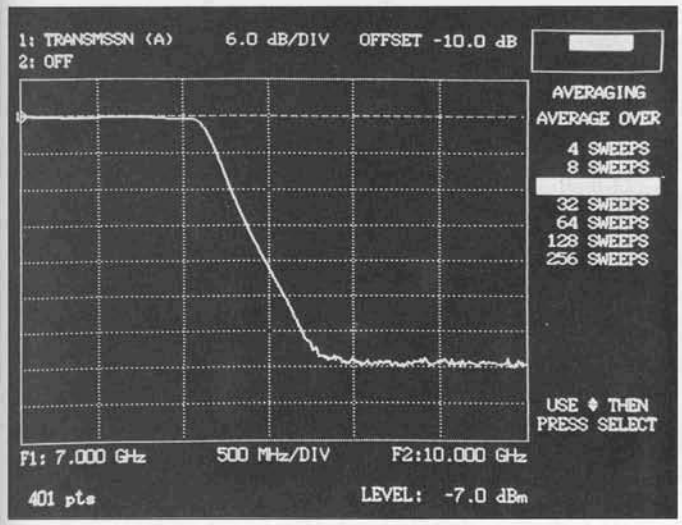
Wiltron SWR Autotesters have 40 dB directivity up to 18 GHz, 30 dB to 40 GHz. The 560-7 Series Detectors also contribute to accuracy with their excellent source match and compensated frequency range.

Superior Accuracy

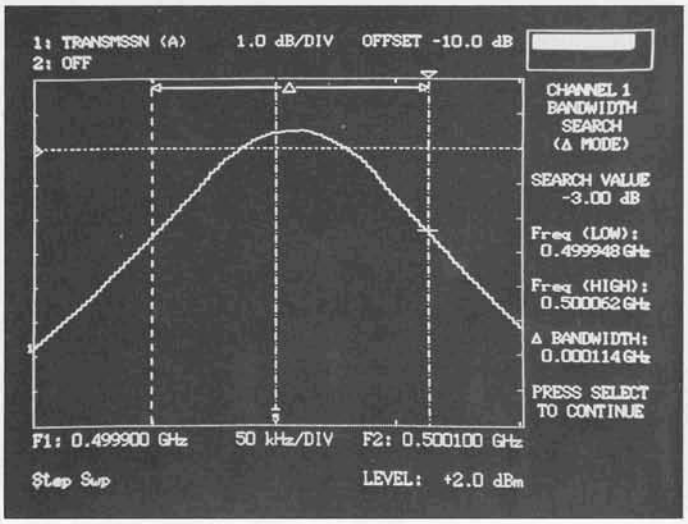
The 562 is designed to provide superior accuracy over the 10 MHz to 40 GHz frequency range. The 562 uses DC detection, which eliminates uncertainty from RF modulation. A detector low level calibration is made on every retrace giving sensitivity of –60 dBm.

When used with the 6700B Swept Frequency Synthesizer, in Step Sweep Mode, all measurement frequencies, including markers and cursors, have synthesizer accuracy. The exceptional return-loss accuracy is attributable to the high directivity and exceptional test port match of the Wiltron SWR Autotesters. To avoid the use of error-producing adapters, SWR Autotesters are available with GPC–7, Type N, WSMA, or K Connector test ports, all with high directivity. The accuracy of a transmission loss or gain measurement is affected by reflections from the test port, the device under test, the detector, and the signal source. These errors are minimized by the very low reflections from the Wiltron SWR Autotesters, Detectors, and 6600B or 6700B source.

Accuracy is also improved because modulation of the input signal is not required. The need for modulation is avoided by using self-balancing amplifiers, which are stable at low signal levels. As a result, errors from modulation asymmetry and modulation-sensitive test devices are nonexistent. Without the insertion loss of a modulator, measurements can be made at higher input levels, increasing the measurement dynamic range.



The 5600B displays frequencies, differences in frequencies, amplitudes, and differences in amplitudes on the large, easy-to-read screen.



Cursor "X" dB Bandwidth automatically displays frequencies of 3 dB over selected bandwidth amplitudes.

Versatile

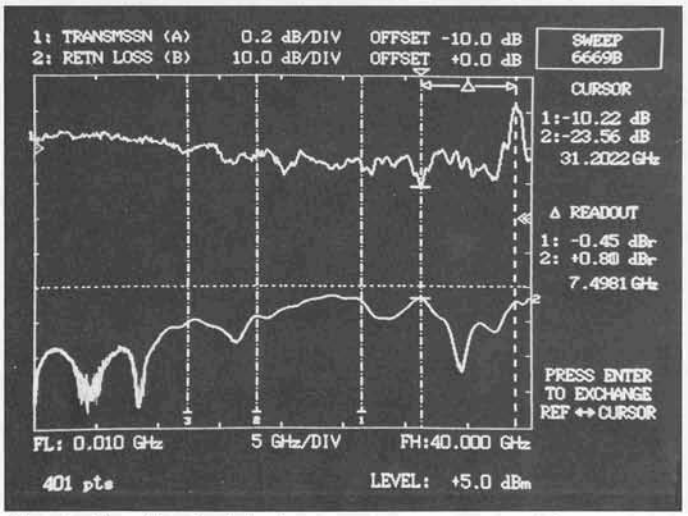
Transmission and reflection measurements can be viewed simultaneously. Both traces can be scaled independently in dB, dBm or SWR. Measurement of the ratio of two detector inputs may be applied to either channel for enhancing accuracy or for viewing differences. Built-in calibration allows subtraction of the unwanted transmission frequency response or the average of open/short reflections from either trace. A Volt Mode is available for displaying voltage (with Volt Mode Adapter Cable). A 0 to 10 Volt Sweep Ramp Output Mode is also available. These modes, combined with a versatile Trace Memory Mode, allow easy testing of VCOs, PIN diodes, and detectors.

Easy to Use

Great care was placed on the 562 front panel operation to make it straightforward and easy to use; the extra crisp high resolution display allows easy viewing over long hours of use. At each step, the instrument provides a comprehensive display of all pertinent parameters. Ten display cursor functions are available to locate important frequencies, amplitudes, deltas, or bandwidths. During calibration, clear, concise procedural guidance is provided for transmission and return loss measurements. For return loss tests, a 0 dB reference is established by connecting an open and then a short to the 560 Series SWR Autotester test port. The calibration data are taken independent of sensitivity settings and stored in memory for correction of test data or for recall. Therefore, once the 562 has been normalized across a user-selected frequency range, measurements can be made over any portion of the range without recalibration. Set-up time is minimized by storing parameters for up to nine test setups. Four may include calibration data.

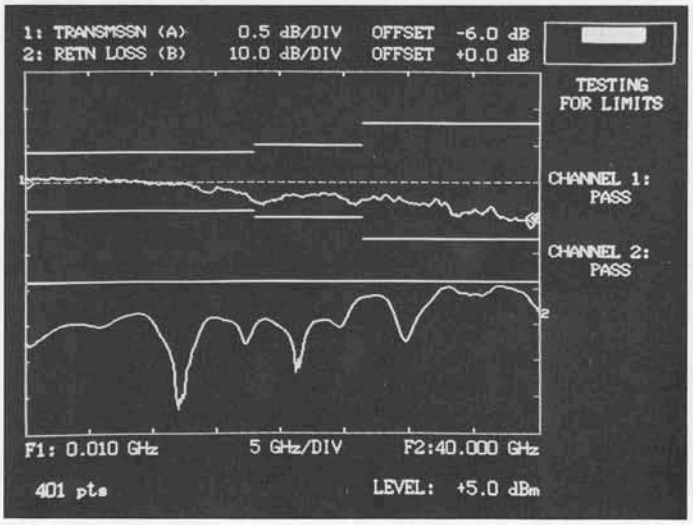
Measurements can be made at 101, 201, or 401 points (user selected) with 0.025 dB vertical resolution on both channels. Since the data-update time is typically less than 150 ms, the test device can be adjusted while viewing a "real time" display. Straight or complex limit lines are available with Pass/Fail indication for high speed production testing. Four user-assignable trace memories improve measurement accuracy and provide an additional level of de-embedding. Nine complete system setups (including source settings) may be saved for later recall — four may include calibration data and trace memory. All can be previewed on the CRT prior to selection.

Selections may be made on both the network analyzer and source front panels. The 562 has a dedicated port for source and plotter interface. It interfaces with all frequency models of Wiltron 6600A/B Series and 6700A/B Series sources to provide complete interaction during measurements: Full band, start-stop, and CW ΔF sweep ranges are displayed. All marker functions from the source may be viewed. Save/Recall also saves and recalls the source settings. The dedicated interface may be turned off to allow control of the source by another instrument such as a noise figure meter. After automatic normalization, the systems display any two inputs on channels A, B, R1, or R2. The same inputs can be displayed as ratios of A/R1, A/R2, B/R1, or B/R2. Compatible with several plotters and dot-matrix printers, the systems feature a buffer memory that allows tests to proceed while previously taken data are being printed out.



Characteristics of low-level signals are easy to measure accurately with the 562 trace averaging.

Scalar Network Analyzers



Both straight or complex limit lines with Pass/Fail indication are available to speed production testing.

5600B and 5700B Series Systems

5600B and 5700B Series Systems are pre-configured systems including a 562 Scalar Network Analyzer, a Wiltron source, and components for reflection and transmission measurements. Each series consist of eight models, depending on the source frequency coverage. 5600B Series Systems include a Wiltron 6600B Sweep Generator. 5700B Series Systems include a Wiltron 6700B Swept Frequency Synthesizer. Each system includes a 560 Series Detector, 560 Series Autotester, and measurement accessories matching the source frequency coverage and connector type. The 5669B and 5769B Systems have a coaxial frequency range of 10 MHz to 40 GHz. The dynamic range for each of the four channels is 76 dB (–60 dBm to +16 dBm). The 6700B Swept Frequency Synthesizer provides the ultimate in frequency measurement accuracy for both CW and swept frequency measurements. When used in Step Sweep mode, all measurement frequencies, including markers and cursors, have synthesizer accuracy at every measurement point.

See page 78 for pre-configured systems synopsis.

Cursors and Markers

The 562 has an extensive set of cursor functions:

- **Cursor:** Position of the cursor is continuously variable with the tuning knob. The frequency and amplitude of the test data at the cursor on both traces are digitally displayed.
- **Relative Cursor:** The difference in amplitude and frequency between the main Cursor and the Relative Cursor positions on the test data are displayed for both traces. To establish a new reference, the position of the two cursors can be reversed through a menu selection.
- **Cursor Min/Max: Cursor "X" dB, Cursor "X" Bandwidth:** The 562 moves the cursors, in absolute or relative mode, to the positions requested by the user, quickly and accurately. The frequency and amplitude is digitally displayed in dB or dBm, along with the difference frequency.
- **Cursor Next Marker, Cursor Active Marker:** The cursor moves to the position of the markers set on the sweeper or synthesizer, retaining the frequency precision of the source.

These cursor functions supplement the eight markers available with the Wiltron 6600B Sweep Generator or 6700B Synthesizer. The 562 displays full identification of all markers used.

Applications Functions

Applications functions speed and ease the task of characterizing antennas, filters, amplifiers, and other microwave devices.

- **Trace Functions:** Will save the minimum and maximum values of successive sweeps, or the combination of the two. Ideal for acquiring data on drift or gain variation against temperature.
- **Cursor Functions:** Supplement the cursors by adding an automatic search from the minimum/maximum of the displayed trace to either X dB or selected bandwidth. This function can be set to repeat continuously.
- **Labelling:** Custom nomenclature can be created for testing VCOs, PIN diodes, and other devices.
- **Gain Compression:** Determines the gain compression point of an amplifer by successively incrementing the source power and measuring the amount of compression until a preset limit is exceeded.

Stored Test Setups

Set-up time is reduced substantially by storing up to nine front-panel setups, four of which include their own calibration data and trace memories. A unique preview feature allows stored setup parameters to be reviewed before recalling or storing a new setup in the memory location. The stored data are backed by a battery with an estimated 10-year life.

Averaging and Smoothing

Even when characteristics of the test device vary rapidly with frequency at very low signal levels, the trace can be smoothed without loosing detail. Smoothing is true band width reduction filtering which improves dynamic range. The sweep time is adjusted automatically. When averaging is selected, 4 to 256 successive traces can be averaged to remove any low periodicity variations.

Hard Copy Output is Fast and Easy

A hard copy of test data can then be plotted on an HP 7440A, 7470A, or 7475A Plotter or printed on an Epson FX or Wiltron 2225C Ink Jet Printer. Printing is done quickly since the 562 requires only about 10 seconds for print formatting. The next measurement can proceed while data from the last are being printed out.

Waveguide Detectors Extend Coverage to Above 100 GHz

Measurements in waveguide are made following the same general normalization and test procedures. Wiltron 560-10BX-1 Adapter Cables provide the 562 interface with the waveguide detectors.

Trace Memory

Trace Memory is available for each channel for subtracting any trace, measurement, or limit line from subsequent measurements. This allows de-embedding scalar responses in addition to normal calibration or comparison of devices.

GPIB Compatibility

An IEEE–488 (GPIB) interface is standard, providing remote control of all front-panel functions except power on/off and CRT intensity. A high speed data transfer can be used to transfer measurement data to the host computer. This capability is especially useful in manufacturing environments where archiving of data is required.

Measurement Accuracy

The return-loss accuracy of the 562 is largely attributable to the high directivity of the Wiltron SWR Autotesters. For example, the 560-97A50-1 with its GPC-7 test port connector has a directivity of better than 40 dB from 10 MHz to 18 GHz. On the 560-98K50, the directivity exceeds 35 dB up to 18 GHz, 32 dB up to 26.5 GHz, and 30 dB up to 40 GHz. The same unit has a test port match of better than 23 dB up to 26.5 GHz and 15 dB up to 40 GHz.

To avoid the use of error-producing adapters, SWR Autotesters are available with either male or female test ports in Type N, WSMA, or K Connectors all with high directivity. When the GPC-7 test port is selected, the lowest reflection adapters obtainable are offered in Type N and WSMA, which is optimized for testing SMA devices.

Transmission loss, gain, or power measurement accuracy is affected by reflections from the test port, the device under test, and the detector. These errors are minimized by the very low reflections from the Wiltron SWR Autotesters and detectors.

All detectors use zero-biased Schottky diodes to minimize drift and circuit complexity. All diode modules are field-replaceable, eliminating the expense and inconvenience of returning detectors to service centers for repair.

The accuracy of the 562 is high also because modulation of the input signal is not required. The need for modulation is avoided by using self-balancing amplifiers, which are stable at low signal levels. As a result, errors from modulation asymmetry and modulation-sensitive test devices are nonexistent. Without the insertion loss of a modulator, measurements can be made at higher input levels, increasing measurement dynamic range.

Wiltron Signal Sources

Both the 6600B Sweep Generators and 6700B Swept Frequency Synthesizers use fundamental oscillators over the 2 to 26.5 GHz range because they deliver the purest, most accurate signals. Four aspects of their performance contribute to accurate measurements:

- **Harmonic Content:** The troublesome subharmonics of multiplier-type sweep generators don't exist.
- **Residual FM:** Below 26.5 GHz, the 6600B Series does not use a multiplier, therefore residual FM is not degraded by the multiplication factor. Residual FM in CW or narrow-band mode is less than 10 kHz peak up to 20 GHz.

Available sources include the Wiltron 6700B Swept Frequency Synthesizer or the Wiltron 6600B Sweep Generator.

- **Frequency Accuracy:** In the 6600B, by using ROM to correct for residual nonlinearities of YIG-tuned oscillators, CW accuracy is ±10 MHz over the 10 MHz to 20 GHz range. In CW and Step Sweep Mode with the 6700B, the frequency accuracy is determined by the crystal reference oscillator which has less than $5x10^{-10}$ aging per day.
- **Output Flatness:** The output level does not vary with sweep speed since there is no tracking filter required to take out unwanted multiplier responses.

Five Sweep Modes

The 6600B and 6700B have five sweep modes as well as five CW frequencies and eight markers. With a single keystroke, you switch from Full Range, F1 to F2, or M1 to M2 to the symmetrical sweep about CF or marker M1. The CW frequencies are also selected directly without having to use the shift key or to remember frequencies stored in memory. Sweep frequencies and the test power level are shown on the 562 display.

In addition to the versatile frequency sweep modes, the 6600B and 6700B have a power sweep with which the output is swept over a 15 dB range. Furthermore, with the addition of the Option 2 Series Attenuator, a 120 dB power sweep may be made with the 6700 Series. Amplifier and semiconductor characteristics, such as gain compression and saturation, can be measured rapidly over a continuously variable input power range.

In the Alternate Stored Setup mode, a set of power sweep and a set of frequency sweep parameters stored in memory can be recalled to provide a simultaneous two-trace display of test device power and frequency characterisitics.

Frequency Vernier

The Frequency Vernier controls on the 6600B can be used to increase frequency accuracy and achieve 100 kHz resolution in the CW and ΔF modes. While monitoring the output with a counter, you simply tune with the increase/decrease control until the desired frequency is obtained. Subsequent requests for this frequency include the correction.

562 Scalar Network Analyzer

Specifications

MEASUREMENTS

Function: The 562 has four detector inputs and two independent channels for measurement and display of detected RF power from Wiltron 560 Series Detectors and SWR Autotesters. Two independent traces may be viewed as the logarithmn of RF power (in dB, dBm) or linear reflected power (in SWR). Voltage may also be displayed (with optional Volt Mode Adapter Cable).
Measurement Modes: Measures and displays in dB swept transmission and return loss characteristics. Power is displayed in dBm. Complete measurement parameters for all modes are displayed.
Frequency Range: 10 MHz to 40 GHz in coax using Wiltron 560 Series Detectors and SWR Autotesters. Measurements can be made at higher frequencies with user-supplied waveguide detectors and Wiltron 560-10BX-1 Adapter Cables.
Frequency Accuracy:
5600B: Same as 6600B Sweep Generator Frequency Accuracy specification; see page 96.
5700B: Same as 6700B Swept Frequency Synthesizer Frequency Accuracy specification; see page 87.
Inputs: Four inputs, A, B, R1, and R2 accept detected outputs from Wiltron 560 Series Detectors and SWR Autotesters.
Dynamic Range: 76 dB (–60 dBm to +16 dBm) on all channels, useable to –65 dBm.
Data Correction: System residuals, including the average of open and short reflections, are stored during normalization for automatic subtraction from test data.
Normalization: During the normalization sequence, each trace is stored with 0.002 dB resolution over any user-selected frequency range. Normalization data are automatically interpolated for ranges less than the original normalized range.
Save/Recall: Nine sets of front-panel settings can be stored for later recall. All stored data can be previewed on the CRT or printer output prior to selection. Four of the setups include their own calibration data.

DISPLAY

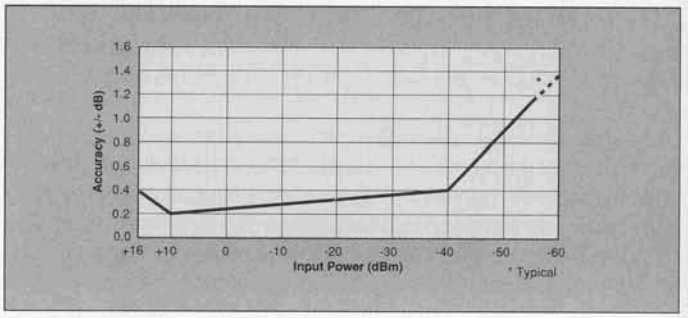
Channels: Two channels are used to select and simultaneously display any two inputs from A, B, R1, or R2. The same inputs can be displayed as ratios of A/R1, A/R2, B/R1, or B/R2.
Alternate Sweep: Displays alternate sweeps between the current front-panel setup and any of nine stored setups.
Graticule: Ten vertical divisions. Horizontal divisions are set automatically in frequency increments of a 1, 2, 5 sequence. Graticule On/Off control turns all graticule lines off. Tick marks remain on axis to indicate graticule position.
Display Resolution:
Horizontal: 101, 201, or 401 points over selected frequency range.
Vertical: 0.005 dB
Limit Lines: Two lines, either straight or complex, for each trace. Complex lines may be made from up to 10 segments. Measurement data may be compared with limit lines for Pass/Fail testing.
Scaling:
Resolution: 0.1 dB to 10 dB per division in 0.1 dB steps with independent control for each channel.
Offset Range: –99 dB to +99 dB in 0.1 dB steps.
Autoscale: Automatically selects offset and resolution to provide optimum display of test data.
Trace Update Time: Typically less than 100 ms, varying with frequency range and the averaging and smoothing settings.
Smoothing: Off, Minimum, and Maximum selections use analog techniques to reduce noise on low-level traces. Trace update time is automatically adjusted for any combination of averaging and smoothing.
Averaging: 4, 8, 16, 32, 64, 128, or 256 successive traces can be averaged to smooth the trace display.
CRT Intensity: Continuously adjustable from off to bright.

MARKERS AND CURSOR

Markers: Displays up to eight numerically identified markers generated by the 6600B Sweep Generator; nine are numerically identified with the 6700B Synthesizer. When a marker is selected as "Active," the cursor can be moved directly to the marker. The cursor can also be moved sequentially through markers until the desired marker is reached.
Cursor: Continuously variable with the tuning knob. The frequency and amplitude of test data at the cursor on both traces are digitally displayed.
Relative Cursor Displays the frequency and amplitude difference between the main Cursor and the Relative Cursor for both traces. A menu selection reverses the position of the two cursors.
Cursor Min/Max: Automatically moves the cursor to the minimum or maximum value of test data on either trace.
Cursor "X" dB: Automatically moves cursor on either trace to an amplitude that is equal to the entered value of "X" dB or dBm.
Cursor "X" Bandwidth: Automatically displays cursors to the right and left of the cursor at the frequencies where the test data are equal to the entered value of "X" dB. The frequencies of the low and high cursors and the bandwidth between them are displayed.
Cursor Next Marker: Moves cursor to next highest frequency marker.
Cursor Active Marker: Moves cursor to the frequency of the active marker.

ACCURACY

Channel Accuracy (25°C):

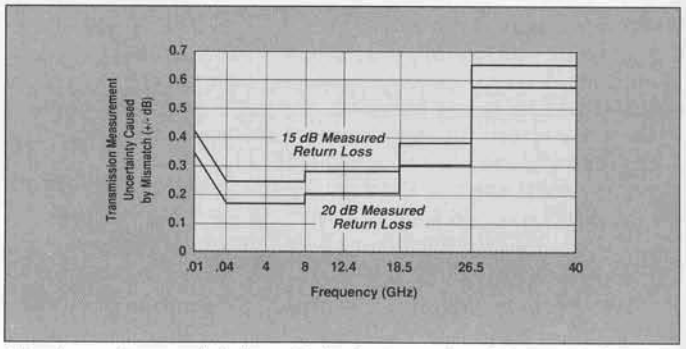


Transmission Loss or Gain Accuracy: Uncertainties from frequency response of components are automatically subtracted from test data during the normalization procedure. Overall accuracy is then:

Transmission Loss or Gain = Channel Accuracy + Mismatch Uncertainty*

* Effects of sweep generator, test device, SWR Autotester and detector mismatch can be significant. This mismatch uncertainty is minimized by Wiltron's exceptionally low reflection characterisitics of the detector, sweep generator and SWR Autotester.

Mismatch Uncertainty **:



**Based on worst-case analysis of uncertainties due to return loss of the detector, SWR Autotester, (N-type) connecting cables, and the return loss of the measured reflection.

562 Scalar Network Analyzer

Overall Coaxial Return Loss Measurement Accuracy:
Uncertainties resulting from SWR Autotester and sweep generator frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Return Loss Accuracy = Channel Accuracy + SWR Autotester Accuracy

SWR Autotester Accuracy:

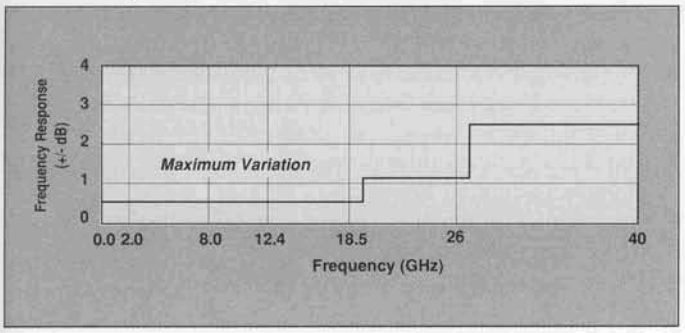
Model	Accuracy of Measured Reflection Coefficient (ρ)[1]			
	10 MHz-8 GHz	8-18 GHz	18-26.5 GHz	26.5-40 GHz
560-97A50 560-97A50-1	$0.016 + 0.06\rho^2$ $0.010 + 0.06\rho^2$	$0.016 + 0.10\rho^2$ $0.010 + 0.10\rho^2$	N/A	N/A
560-97N50 560-97N50-1	$0.018 + 0.08\rho^2$ $0.013 + 0.08\rho^2$	$0.018 + 0.12\rho^2$ $0.013 + 0.12\rho^2$	N/A	N/A
560-97NF50 560-97NF50-1	$0.018 + 0.08\rho^2$ $0.013 + 0.08\rho^2$	$0.018 + 0.12\rho^2$ $0.013 + 0.12\rho^2$	N/A	N/A
560-98S50 560-98S50-1	$0.018 + 0.10\rho^2$ $0.013 + 0.10\rho^2$	$0.018 + 0.10\rho^2$ $0.013 + 0.10\rho^2$	$0.025 + 0.12\rho^2$ $0.018 + 0.12\rho^2$	N/A
560-98SF50 560-98SF50-1	$0.014 + 0.10\rho^2$ $0.010 + 0.10\rho^2$	$0.014 + 0.10\rho^2$ $0.010 + 0.10\rho^2$	$0.016 + 0.12\rho^2$ $0.013 + 0.12\rho^2$	N/A
560-98K50 560-98KF50	$0.018 + 0.15\rho^2$	$0.018 + 0.15\rho^2$	$0.025 + 0.15\rho^2$	$0.032 + 0.18\rho^2$

[1] Accuracy includes the effects of directivity (first term) and test port reflection (second term) over the frequency range.

Power Measurement Accuracy:

Absolute Power Accuracy = Channel Accuracy + Detector Frequency Response

Detector Frequency Response:



Overall Waveguide Return Loss Measurement Accuracy:

Return Loss Accuracy = Channel Accuracy + User-Selected Coupler Accuracy

In addition, mismatch uncertainties introduced by the detectors used in a waveguide reflectometer setup can be significant.

GPIB

Interface: IEEE-488 interface is standard on all instruments. All front-panel controls are GPIB controllable except power on/off and CRT intensity. Pass-through commands allow control of the microwave signal source through the 562 GPIB port.
Data Transfer: The 562 does not require an external controller; nevertheless, it is capable of providing high speed data transfer of test data and normalization data to an external GPIB controller.

PRINTER/PLOTTER

Plotter: Dedicated GPIB interface is compatible with HP 7440A, HP 7470A, and HP 7475A Plotters. Display traces, markers, cursor, and graticule information are copied. When overlay traces are desired, data traces only can be plotted.
Printer: Parallel printer interface is compatible with most dot-matrix printers, including Epson FX and the optional 2225C Ink Jet Printer. Hard copy output in graphical or tabular format can be selected. Selections include graphics with measurement parameters, test data tabulated for 26, 51, 101, 201, or 401 points, marker parameters only, or stored setup parameters.

Internal Print Buffer: After approximately 10 seconds of print formatting, a new test can be conducted while previously taken test data are being printed out from an internal printer buffer.

INPUT/OUTPUT CONNECTIONS

Horizontal Sweep Ramp Input: 0 to +10V nominal, +12V maximum
Sequential Sync Input: +3.5V to +10V blanks trace during retrace or bandswitching. –3.5V to –10V defines a marker which when in the range of –8V to –10V is an active marker. Rear panel BNC connector, 10 KΩ impedance.
Sweep Dwell Input: TTL-low signal stops sweep. Sweep continues when signal is removed. Rear panel BNC connector.
Bandswitching Blanking Input: Accepts ±5V signal coincident with bandswitching points. Rear panel BNC connector.
Retrace Blanking Input: +5V blanks traces during retrace. Rear panel BNC connector.
Video Marker Input: ±1V to ±10V peak input. Rear panel BNC connector.
System GPIB: Connects 562 to GPIB. Rear panel GPIB connector.
Dedicated GPIB: Connects 562 to signal source and plotter. Rear panel GPIB connector.
Parallel Printer (Centronics): Connects 562 to printer. Rear panel.
AUX I/O: Connects 562 to compatible source. Rear panel.

GENERAL

Temperature Range:
Operating: 0°C to +50°C
Storage: –40°C to +70°C
Power: 100V/120V/220V/240V ±10%, 48–63 Hz, 130 VA maximum
Dimensions: 177 H x 432 W x 476 D mm + 10 mm for feet
(7 H x 17 W x 18-3/4 D in. + 3/8 in. for feet)
Weight: 16 kg (35 lb.)
Transit Case 760-75

MEASUREMENT COMPONENTS

SWR Autotester: The 560 Series SWR Autotesters integrate in one small package a broadband, high directivity bridge, a detector, a low reflection test port, a reference termination, and a connecting cable. The output is a detected signal, varying in proportion to reflections from the test device connected to the test port. Optional extender cables don't degrade performance. A mating Open/Short is shipped with the 560 Autotester.

Model	Freq. Range (GHz)	Directivity (dB)	Freq. Sensitivity (dB)	Test Port Connector	Input Connector
560-97A50	0.01-18	36	±1.2	GPC-7	N Female
560-97A50-1	0.01-18	40	±1.2		
560-97N50	0.01-18	35	±1.5	N Male	N Female
560-97N50-1	0.01-18	38	±1.5		
560-97NF50	0.01-18	35	±1.5	N Female	N Female
560-97NF50-1	0.01-18	38	±1.5		
560-98S50	0.01-26.5	37 (<18 GHz) 36 (≥18 GHz)	±2.0	WSMA Male	Ruggedized K Female
560-98SF50	0.01-26.5	37 (<18 GHz) 36 (≥18 GHz)	±2.0	WSMA Female	Ruggedized K Female
560-98S50-1	0.01-26.5	40 (<18 GHz) 38 (≥18 GHz)	±2.0	WSMA Male	Ruggedized K Female
560-98SF50-1	0.01-26.5	40 (<18 GHz) 38 (≥18 GHz)	±2.0	WSMA Female	Ruggedized K Female
560-98K50	0.01-40	35 (<18 GHz) 32 (18-26.5 GHz)	±3.0	K Male	Ruggedized K Female
560-98KF50	0.01-40	30 (≥26.5 GHz)	±3.0	K Female	

Maximum Input Power: 0.5 W
Cable Length: 122 cm (4 ft.)
Insertion Loss: 6.5 dB nominal from input port to test port
Dimensions and Weight:

Model	Dimensions[1]	Weight
560-97A50,-1 560-97N50,-97NF50,-1	7.6 x 5 x 2.8 cm (3 x 2 x 1-1/8 in.)	340 g (12 oz.)
560-98K50,-98KF50 560-98S50,-98SF50,-1	1.9 x 3.8 x 2.9 cm (3/4 x 1-1/2 x 2-1/8 in.)	198 g (7 oz.)

[1] Plus connectors and cable.

Scalar Network Analyzers

Model 560A, 10 MHz to 40 GHz

Vertical Configuration
Model 560A-2

Horizontal Configuration
Model 560A

560A Scalar Network Analyzer Highlights

- *Simultaneous Transmission and Return Loss or Power Measurements*
- *10 MHz to 40 GHz Range from Single Coaxial Test Port*
- *40 dB Directivity to 18 GHz, 30 dB to 40 GHz*
- *GPIB Programmability*
- *Memory-Enhanced Accuracy*
- *71 dB Dynamic Range (+16 dBm to -55 dBm)*

Highest Return Loss Accuracy

The accuracy with which return loss measurements are made result largely from the high directivity of the Wiltron SWR Autotesters. With directivities of 40 dB up to 18 GHz, 32 dB up to 26.5 GHz, and 30 dB up to 40 GHz, these SWR Autotesters are available with GPC-7, WSMA, Type N, and K Connector test ports. To eliminate the errors that would be introduced by adapters, the detectors are also available with the same selection of test ports. Detector return loss specifications of 22 dB from 0.04 to 8 GHz, 17 dB up to 20 GHz, 13 dB up to 26.5 GHz and 12 dB up to 40 GHz contribute significantly to the 560A's exceptional accuracy. The substantial errors introduced by multiplier-type oscillators are eliminated when a 6600B Sweep Generator is used as the signal source.

Memory-Enhanced Performance

High accuracy is also ensured by the use of memory which stores and automatically subtracts system residual errors from the test data. The normalization procedure applies to power measurement as well, allowing direct measurements over the +16 dBm to -55 dBm range.

Memory Operation

Many measurements do not require the use of the R channel. In conventional analyzers, R is used to detect the input signal. The effects of variations in the input signal amplitude are then removed by taking the ratio of A/R and B/R. The 560A memory accomplishes the same thing and a lot more:

- Stored system residuals are automatically subtracted from test data.
- One detector is used to measure each parameter—no errors resulting from lack of tracking between A and R or B and R Detectors.
- The R channel amplifier is not used—no errors from lack of perfect amplifier linearity.
- Only two detectors are used for dual trace display—no unnecessary costs or setup complexity.
- Memory automatically averages open/short reflections—no need for cumbersome, inaccurate estimates.
- The memory is an integral and dedicated part of the 560A — no inconvenience of an external normalizer box that was designed for general purpose use. Should an application require an R channel, the 560A has pushbutton selection of A, B, R, A-R, and B-R.

A Display Mode For Every Operation

Four modes are available to display the characteristics of the many components, sub-assemblies, and systems that can be tested with the 560A.

Real Time Display Mode—The horizontal sweep is synchronized with the ramp from the sweep generator and may be varied from approximately 50 msec to 100 sec per sweep.

Refresh Display Mode—The ramp from the sweep generator is digitized and stored in a 1024 point memory (512 points for dual trace). To provide a flicker-free display, the stored data is continuously updated at the sweep generator sweep rate while the refreshed display is swept at a 14 msec per sweep rate. Even though the sweep generator may sweep at a slow rate, the 560A presents a steady, non-flickering display.

Refresh Hold Display Mode—The updating of the display is stopped, and the display is frozen for analysis or photography.

X-Y Plot Display Mode—The refresh sweep rate is slowed to approximately 30 sec per sweep for making plots on an analog recorder. A hard copy of any display, single or dual trace, may be made. Dual trace recordings are made automatically by sequentially plotting the A and B channels.

Bus Operation Independent Of Controls

The 560A meets the requirements of automatic test systems. Bus operation is completely independent of front panel settings, permitting the user to adjust controls for an optimum CRT display without disrupting the automatic test operation.

Detected power levels are digitized in dBm and then transferred across the bus. This is true automated operation. Because the data in the Wiltron system is in dBm, the processing for hard-copy recordings on printers and plotters is performed much more rapidly, while maintaining measurement accuracy.

Bus-Controlled Autozero

In the autotest mode, the 560A calibrates out thermal effects and residual dc error voltages that would degrade measurement accuracy. It is enabled by a calibration command (LC or EC) and is performed automatically. The External Calibrate (EC) capability is particularly useful during mixer tests to cancel the effect of local oscillator leakage. For best accuracy when using External Calibrate, the signal source output must be below -60 dBm, a task that is easily achieved with the Model 6600B Series Sweep Generators.

Bus Control Of Smoothing And Test Time Interval

To maintain accuracy and minimize test time at all signal levels, the 560A automatically adjusts the time interval during which data is taken at each frequency. Measurements at low levels are programmed to take more time than those at high levels, but never more than necessary. With bus controlled test time intervals, the 560A makes rapid measurements above -30 dBm. The smoothing level is also programmable to allow the user to minimize the uncertainties characteristic of low signal levels.

Alternative Data Transfer Modes

Three data transfer modes are available to meet virtually all measurement requirements and to assure compatibility with most system controllers.

Normal Mode: Each data point is converted to a dBm value and transferred to the bus. The transfer is completed with a GPIB handshake.

Interrupt Mode: The smoothing and test time interval functions operate as in the normal mode. When data is ready for transfer to the bus, a service request (SRQ) message is sent to the controller. The user is free to design a data transfer sequence that is optimal for the system.

Fast Mode: When very rapid data acquisition is needed, this mode is used to bypass the test time interval routine. There is no degradation in accuracy when used with averaging algorithms.

Specifications

Frequency Range: 10 MHz to 40 GHz, determined by selection of SWR Autotester and detector. The 560-10BX and 560-10BX-1 Adapter Cables provide interface to waveguide detectors.

Channels: Three, with selection of A, B, R, A-R, and B-R. Two channels are displayed simultaneously.

Dynamic Range: 71 dB (+16 dBm to -55 dBm) on channels A and B. 46 dB (+16 dBm to -30 dBm) on channel R.

Amplitude Resolution: 0.01 dB

Temperature Range: Operating: 0°C to +50°C
Storage: -40°C to +70°C
Power: 100V/120V/220V/240V +5%, -10%, 50-60 Hz, 85 VA max.

Dimensions:
560A Horizontal Model: 133 H x 429 W x 500 D mm
(5.25 H x 16.9 W x 19.7 in. + 3/8 in. for feet)
560A-2 Vertical Model: 267 H x 213 W x 500 D mm
(10.5 H x 8.4 W x 19.7 D in. + 3/8 in. for feet)
560A Option 1 Rack Mount: 133 H x 483 W x 500 D mm
(5.25 H x 19 W x 19.7 D in.)

Weight:
560A and 560A-2: 11 kg (24.5 lb)
560A Option 1: 13.5 kg (30 lb)

Ordering Information

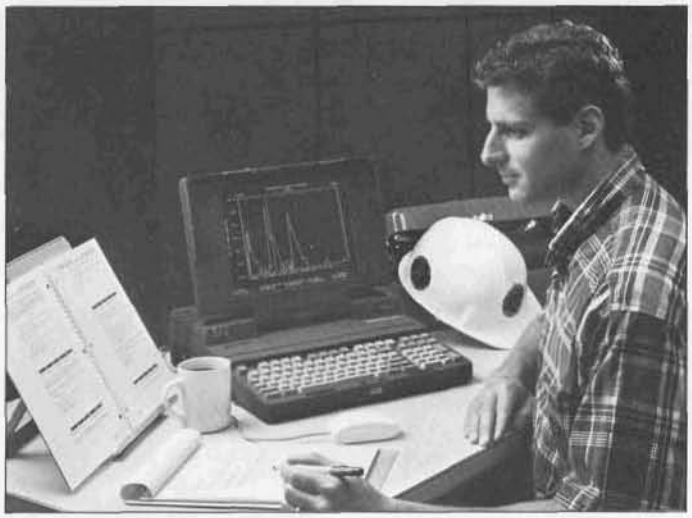
560A Scalar Network Analyzer, Horizontal Configuration
560A-2 Scalar Network Analyzer, Vertical Configuration

Options:
Option 1: Rack Mounting for 560A
Option 3: GPIB Programming
Option 4: Operation from 50-400 Hz Power Source

GPIB Field Installation Kit, P/N 560-A-7094
Adapter to Connect 560A to HP 8620C, P/N 560-B-8208
Adapter to Connect 560A to HP 8350A, P/N 560-B-9658
Transit Case 760-115 for 560A
Transit Case 760-56 for RF Components

Distance-to-Fault Measurements

Model 2300-12A Distance-to-Fault Software



2300-12A Highlights

- *MS-DOS® Compatible*
- *60 dB Dynamic Range*
- *10 MHz to 40 GHz in Coax*
- *Corrects for Dispersion in Waveguide*

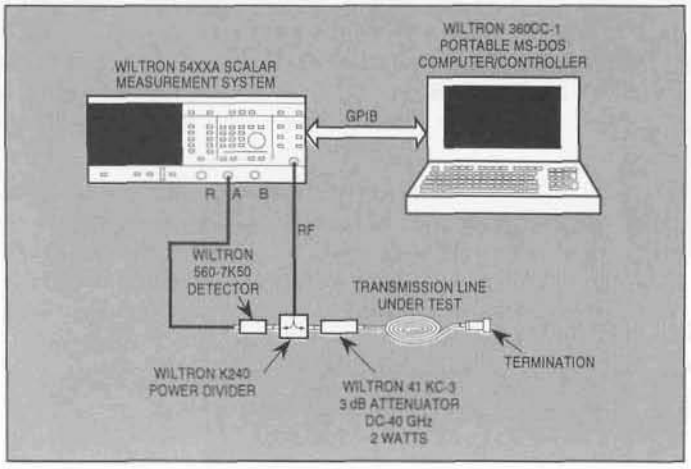
Fast, Accurate Measurements for Transmission Lines

The 2300-12A Distance-to-Fault Software displays impedance discontinuities versus distance based on a swept frequency scalar measurement of transmission line mismatch. The software runs on an MS-DOS® computer and operates with 5400A Scalar Measurement Systems or 562 Scalar Network Analyzer Systems with 6600B or 6700B sources.

Measurements are made of Distance-to-Fault and Return loss of fault for both coax and waveguide transmission lines.

Utilizing readily available components, a typical setup for distance-to-fault measurements would include a power divider, 3 dB attenuator, detector and termination as shown in the adjacent diagram.

If you already have an MS-DOS® computer, the 2300-12A Distance-to-Fault Software may be ordered separately. Or, you can order a fully configured solution, ready to connect to your Wiltron 5400A Series Scalar Measurement System or 562-based Scalar Network Analyzer System via GPIB.



Specifications

Frequency Range: 0.01 to 40 GHz. Determined by 5400A model or 562 and source frequency range.

Frequency Sampling: 256, 512, or 1024 frequency points.

Window Functions:
Hamming, 2-term, –42 dB sidelobes.
Blackman-Harris, 3-term, –67 dB sidelobes.

Dynamic Range: 60 dB

Return Loss Amplitude Accuracy (typical): ±2.5 dB for a single mismatch.

Distance Range: 1 to 500 meters depending on measurement frequency range and hardware configuration

Distance Resolution (for one fault):
0.4% of total distance (256 frequency measurement points).
0.2% of total distance (512 frequency measurement points).
0.1% of total distance (1024 frequency measurement points).

Transmission Lines Supported: Transmission line loss and velocity factor are corrected for by the software. Waveguide dispersion is corrected based on the cutoff frequency F_c.

Graph Controls: Cursor On/Off, Zoom In/Out, Return Loss Scaling, Limit Line.

Cursor Modes: Cursor display of mismatch amplitude at a specific distance.

Data Storage: 99 each of waveguide data, measurement set-ups, and measurement results. May be stored on the computer's fixed or removable disk drives.

Hard Copy Output: Printer attaches to LPT1 (computer parallel port); HPGL plotter connects to GPIB port. Print waveguide data, results graph, and results tabular data on Epson-emulated printer; results graph on HPGL plotter.

Ordering Information

The 2300-12A, Fully-configured System consists of the following items:
- Wiltron 360CC MS–DOS® Computer/Controller
- Distance-to-Fault software, installed and ready to operate
- Power cables and monitor-to-computer cable
- MS–DOS® manual and disks
- National Instruments GPIB-PCII Card (installed), GPIB cable, manual, and disk
- 3-1/2" disk containing the Distance-to-Fault Software
- Wiltron Distance-to-Fault Software User's Guide

The 2300-12A/2, Fully-configured System consists of the following items:
- Wiltron 360CC-1 MS–DOS® Computer/Controller (Toshiba T5200 Laptop)
- Distance-to-Fault software, installed and ready to operate
- Power cable
- MS–DOS® manual and disks
- National Instruments GPIB-PCII Card (installed), GPIB cable, manual, and disk
- 3-1/2" disk containing the Distance-to-Fault Software
- Wiltron Distance-to-Fault Software User's Guide

The 2300-12A/1, Software Only includes:
- 3-1/2" disk containing the Distance-to-Fault Software
- Wiltron Distance-to-Fault Software User's Guide.

Distance-to-Fault Measurements

Model 5600 P2FF Series, 10 MHz to 18 GHz

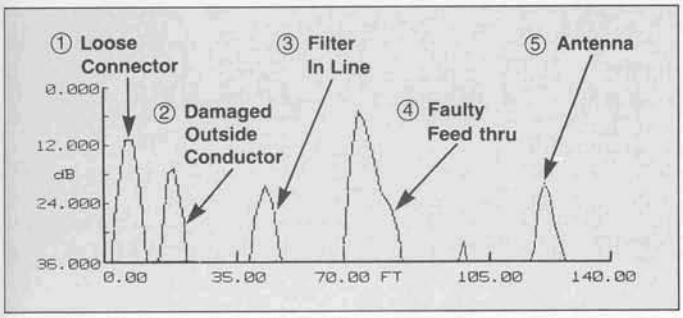
5600 P2FF Fault-Location System Highlights

- *Single-Setup Test Procedures*
- *Accurate, Reliable Operation In Hostile Environments*
- *Fault Location On Aircraft, Surface Ships, Submarines, Antenna Range, or Production Line*
- *Coaxial and Waveguide Measurement Capability*

A Wiltron Solution to a Serious Problem

The consequences of faulty transmission lines on airplanes, helicopters, ships, submarines, and ground-based antenna towers can jeopardize success of a mission or program.

The best insurance against faulty transmission lines is a 5600 P2FF Series Transmission Line Test and Fault-Location System. In one compact enclosure—suitable for use on the flight line, in the shipyard, at an antenna site, or on the production line—this system automatically measures transmission lines (coaxial or waveguide) over the 10 MHz to 18 GHz range. When performance falls outside specifications, the system pinpoints the location of the fault on lines up to 500 feet long to 1% resolution.



This typical distance-to-fault display identifies the location and amplitude of discontinuities from one end of the transmission path to the other without tedious test-and-try procedures or removal of the line.

Easy to Use

A 5600 P2FF Fault-Location System is delivered ready for operation. Almost instantly after turn-on, the software guides the operator through return loss, transmission loss, or distance-to-fault test procedures. On-screen block diagrams show how to connect the test setup. These are followed by unambiguous, step-by-step procedures for the chosen measurement. In a typical test sequence, the operator first measures return loss (or SWR) and/or transmission loss. When the results reveal a potential fault, a distance-to-fault measurement is made. Digital data processing and computation using a Fast Fourier Transform provide the operator with a visual display of the location and magnitude of the individual fault(s).

Fault Finder Measurement Component

The Wiltron Fault Finder includes all the circuitry required to interface the test transmission line input to the test system. The line to be tested is connected to one test port for the transmission and return loss measurements. Should the line be faulty, it can then be connected to an adjacent test port for the distance-to-fault measurement.

The Wiltron Fault Finder includes all circuitry required for return loss, transmission, and distance-to-fault measurements.

Specifications

SYSTEM ELEMENTS

Network Analyzer: 560A Scalar Network Analyzer
Source: 6600B Series Sweep Generator or 6700B Series Swept Frequency Synthesizer
Faultfinder: 560-95NF50
Controller: Included, contact your Anritsu Wiltron sales representative for details.
Enclosure: Included, contact your Anritsu Wiltron sales representative for details.

Accessories:
560-7N50 Detector
800-109 Detector Extender Cable, 7.6 m (25 ft.), (3)
800-110 Detector Extender Cable, 15.2 m (50 ft.)
800-195 RF Cable, 2.44 m (8 ft.) N Male/N Female
34NFNF50 N Female/N /Female Adapter
34NN50A N Male/N Male Adapter
22N50 Male Open/Short
26N50 N Male Terminations (2)
2300 Series P2FF Software

Ordering Information

5600 P2FF Series Automated Transmission Line Test and Fault-Location System Contact your Anritsu Wiltron sales representative for details.

RF Measurement Accessories

SWR AUTOTESTER

The 5400 Series SWR Autotesters integrate in one small package a broadband, high directivity bridge, a detector, a low reflection stainless steel test port, a reference termination, and a connecting cable. The output is a detected signal, varying in proportion to reflections from the test device connected to the test port. Optional extender cables don't degrade performance. A mating Open/Short is shipped with each SWR Autotester.

Maximum Input Power: +27 dBm
Cable Length: 122 cm (4 ft.)
Insertion Loss: 7 dB nominal from input port to test port
Frequency Sensitivity: ±1.0 dB, max.

Model	Freq. Range (MHz)	Directivity (dB)	Impedance (Ohms)	Test Port Connector	Input Connector
5400-6B75	1 to 1000	40	75	BNC (m)	N (f)
5400-6N50 5400-6NF50	1 to 3000	40	50	N (m) N (f)	N (f) N (f)
5400-6N75 5400-6NF75	1 to 3000	40	75	N (m) N (f)	N (f) N (f)

Model	Test Port Match		
	1 to 1000 MHz	1000 to 2000 MHz	2000 to 3000 MHz
5400-6B75	20 dB	N/A	N/A
5400-6N50 5400-6NF50	26 dB	26 dB	26 dB
5400-6N75 5400-6NF75	26 dB	26 dB	22 dB

Dimensions and Weight:

SWR Autotester Model	Dimensions①	Weight
5400-6B75	6.4 x 3.8 x 3.2 cm (2-1/2 x 1-1/2 x 1-1/4 in.)	200 g (7 oz.)
5400-6N50, 5400-6NF50, 5400-6N75, 5400-6NF75	2.5 x 5.1 x 7.0 cm (1 x 2 x 2-3/4 in.)	255 g (9 oz.)

① Plus connectors and cable.

OPEN/SHORTS

An Open/Short is used to establish a 0 dB return loss reference during the normalization procedure.

Model	Frequency Range (MHz)	Impedance (Ohms)	Test Port Connector
22BF75	DC to 1000	75	BNC (f)
22N50 22NF50	DC to 18000	50	N (m) N (f)
22N75 22NF75	DC to 3000	75	N (m) N (f)

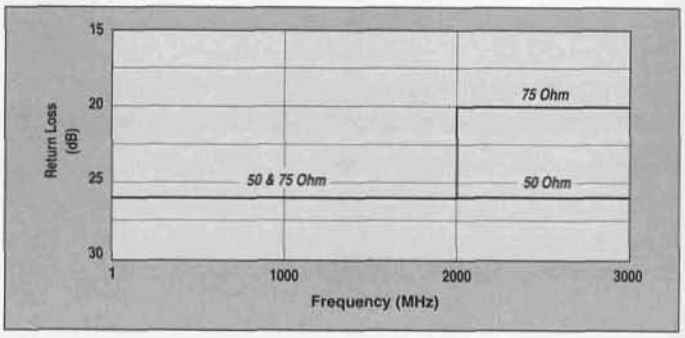
DETECTORS

The 5400 Series Detectors are for absolute power and relative transmission measurements. The 5400 Series Detectors use zero-biased Schottky diodes. Measurement range is –55 dBm to +16 dBm. Optional extender cables can be used without degradation in performance.

Maximum Input Power: +20 dBm
Cable Length: 122 cm (4 ft.)
Dimensions: 7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.)
Weight: 170 g (6 oz.)

Model	Freq. Range (MHz)	Impedance (Ohms)	Return Loss (dB)	Input Connector
5400-71B75	1 to 1000	75	20	BNC (m)
5400-71N50	1 to 3000	50	26	N (m)
5400-71N75	1 to 3000	75	26 (≤2 GHz) 20 (>2 GHz)	N (m)

Detector Return Loss:



Service Center Replaceable Diodes:

Detector Model	Diode Part Number
5400-71B75	10-88
5400-71N50, 5400-71N75	Service Center Replaceable

PRECISION ADAPTERS

These are used for calibration or measurement of non-insertable devices by adapting various test device connectors to the system test port connector without degrading calibration parameters.

Model/ Part Number	Frequency Range (MHz)	Impedance (Ohms)	SWR	Connectors
34NN50A	DC to 18000	50	1.1	N (m) to N (m)
34NFNF50	DC to 18000	50	1.1	N (f) to N (f)
34NN75B	DC to 3000	75	1.1	N (m) to N (m)
34NFNF75B	DC to 3000	75	1.1	N (f) to N (f)
1091-136	DC to 1500	75	1.1	F (f) to F (f)
1091-137	DC to 1500	75	1.1	N (f) to F (m)

RF LIMITERS

These RF limiters protect the 5400A detectors against damage from:
1) DC Voltage — blocks up to 50 Vdc
2) AC Voltage — filters 50/60 Hz up to 100 Vac and impulse currents of 500 mA
3) RF Power — provides protection up to 1.5 W over their frequency range

Model	Frequency Range (MHz)	Impedance (Ohms)	SWR	Connectors
1B75	1 to 1000	75	1.5	BNC (m) to BNC (f)
1N50B	1 to 3000	50	1.25	N (m) to N (f)
1N75B	1 to 3000	75	1.25	N (m) to N (f)

MATCHING PAD AND MINIMUM LOSS ADAPTER

The 12N50/75B pad matches 50Ω to 75Ω or 75Ω to 50Ω circuits. The 12N75B converts 50Ω to 75Ω with less than 3 dB loss.

Model	Frequency Range (MHz)	SWR	Insertion Loss (dB)	Connectors
12N50/75B	DC to 3000	1.25	7.5 max.	N (m) 50Ω to N (f) 75Ω
12N75B	DC to 3000	1.25	3.0 max.	N (m) 50Ω to N (m) 75Ω

TERMINATIONS

These Precision Terminations are used to terminate the output of a two-port device for the most accurate return loss measurements.

Model	Freq. Range (MHz)	Impedance (Ohms)	SWR (F = Freq. in GHz)	Connector
26N50 26NF50	DC to 18000	50	1.004 + 0.0026F	N (m) N (f)
26N75 26NF75	DC to 4000	75	1.004 + 0.0025F	N (m) N (f)
1015-29	DC to 1500	75	1.04	F (f)

LEVELING DETECTOR

Model 73N50: This negative output polarity microwave detector can be used to externally level 5400A power by sampling power at a remote test position. Connection is made to the 5400A rear panel (Option 6) via a BNC cable.

Model	Freq. Range (MHz)	Impedance (Ohms)	SWR (max.)	Flatness (dB)	Connector
73N50	0.100 to 4000	50	1.2	±0.5	Input: N (m) Output: BNC (f)

Max. Input: +20 dBm **Output Capacitance:** 500 pF
Low Level Sensitivity at –30 dBm 0.35 mV/μW
High Level Sensitivity at +13 dBm 1V, minimum

SIGNAL DIVIDER

These signal dividers are symmetrical, three-resistor tee designs that can be used in applications where signals from dc to 3000 MHz must be accurately divided. They provide excellent amplitude and phase tracking.

Maximum Input Power: +30 dBm
Dimensions (without connectors):
14.73 mm x 14.73 mm x 9.40 mm
(0.58 x 0.58 x 0.37 in.)
Weight: 43 g (1.5 oz.)

Model	Frequency Range (MHz)	Input SWR	Effective Output SWR	Insertion Loss (dB, max.)	Impedance (Ohms)	Connectors	
						Input	Outputs
11B75	DC to 1000	≤1.25	≤1.25	7	75	BNC (f)	BNC (f)
11N50B 11N75B	DC to 3000	≤1.25	≤1.25	7	50 75	N (f)	N (f)

RF CABLES

These RF Cables are used to extend the source RF Output to the device under test input port.

Model	Freq. Range (MHz)	Impedance (Ohms)	Length	Connectors
10B75-2	DC to 1500	75	61 cm (2 ft.)	BNC (m)
10N50-2	DC to 1500	50	61 cm (2 ft.)	N (m)
10N75-2	DC to 1500	75	61 cm (2 ft.)	N (m)

Interface Cables: Allows the 562 to operate with the following sources.

Model	Signal Source
806-7 806-7 806-13 806-14	Wiltron 6600A/B Wiltron 6700A/B HP 8350B, 8340/1 HP 8620C

Microwave Measurement Accessories

SWR AUTOTESTER

The 560 Series SWR Autotesters integrate in one small package a broadband, high directivity bridge, a detector, a low reflection test port, a reference termination, and a connecting cable. The output is a detected signal, varying in proportion to reflections from the test device connected to the test port. Optional extender cables don't degrade performance. A mating Open/Short is shipped with each 560 Series Autotester.

Impedance: 50 Ohms
Maximum Input Power: +27 dBm
Cable Length: 122 cm (4 ft.)
Insertion Loss: 6.5 dB nominal from input port to test port

Model	Freq. Range (GHz)	Directivity (dB)	Freq. Sensitivity (dB)	Test Port Connector	Input Connector
560-97A50 560-97A50-1	0.01-18 0.01-18	36 40	±1.2 ±1.2	GPC-7	N (f)
560-97N50 560-97N50-1	0.01-18 0.01-18	35 38	±1.5 ±1.5	N (m)	N (f)
560-97NF50 560-97NF50-1	0.01-18 0.01-18	35 38	±1.5 ±1.5	N (f)	N (f)
560-98S50	0.01-26.5	37 (<18 GHz) 36 (≥18 GHz)	±2.0	WSMA (m)	Ruggedized K (f)
560-98SF50	0.01-26.5	37 (<18 GHz) 36 (≥18 GHz)	±2.0	WSMA (f)	Ruggedized K (f)
560-98S50-1	0.01-26.5	40 (<18 GHz) 38 (≥18 GHz)	±2.0	WSMA (m)	Ruggedized K (f)
560-98SF50-1	0.01-26.5	40 (<18 GHz) 38 (≥18 GHz)	±2.0	WSMA (f)	Ruggedized K (f)
560-98K50① 560-98KF50①	0.01-26.5 0.01-26.5	35 (<18 GHz) 32 (18-26.5 GHz)	±3.0 ±3.0	K (m) K (f)	Ruggedized K (f)

① Operation to 40 GHz is available with the Wiltron 562 Network Analyzer.

Dimensions and Weight:

SWR Autotester Model	Dimensions①	Weight
560-97A50, -1 560-97N50, -97NF50, -1	7.6 x 5 x 2.8 cm (3 x 2 x 1-1/8 in.)	340 g (12 oz.)
560-98K50, -98KF50, 560-98S50, -98SF50, -1	1.9 x 3.8 x 2.9 cm (3/4 x 1-1/2 x 2-1/8 in.)	198 g (7 oz.)

① Plus connectors and cable.

OPEN/SHORTS

An Open/Short is used to establish a 0 dB return loss reference during the normalization procedure.

Model	Frequency Range (MHz)	Impedance (Ohms)	Test Port Connector
22A50	DC to 18000	50	GPC-7
22N50 22NF50	DC to 18000	50	N (m) N (f)
22S50 22SF50	DC to 26500	50	WSMA (m) WSMA (f)
22K50 22KF50	DC to 40000	50	K (m) K (f)

DETECTORS

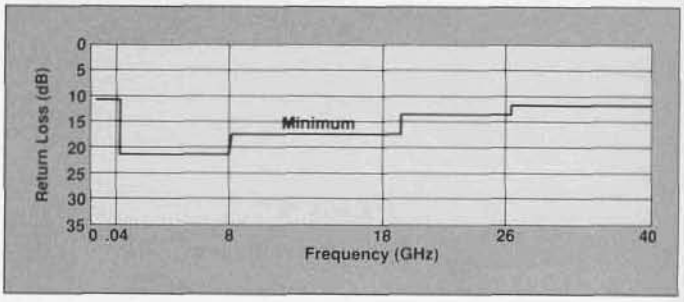
The 560 Series Detectors are for absolute power and relative transmission measurements. The 560 Series Detectors use zero-biased, field-replaceable Schottky diodes. Measurement range is –55 dBm to +16 dBm. Optional extender cables can be used without degradation in performance.

Maximum Input Power: +20 dBm
Cable Length: 122 cm (4 ft.)
Dimensions: 7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.)
Weight: 170 g (6 oz.)

Detector Model	Frequency Range	Input Connector
560-7A50	10 MHz to 18 GHz	GPC–7
560-7N50B	10 MHz to 20 GHz	N (m)
560-7S50B	10 MHz to 20 GHz	WSMA (m)
560-7S50-2	10 MHz to 26.5 GHz	WSMA (m)
560-7K50①	10 MHz to 26.5 GHz	K (m)

① Operation to 40 GHz is available with the Wiltron 562 Network Analyzer.

Detector Return Loss:



Replaceable Diode Modules:

Detector Model	Diode Module Model
560-7A50 560-7N50B, 560-7S50B 560-7S50-2 560-7K50	560-A-7219-A (To 18 GHz) 560-C-24441 (To 20 GHz) 560-A-7219-B (To 26.5 GHz) ND19393

MICROWAVE DETECTOR

Model 75KA50: This microwave detector can be used to externally level 5400A power by sampling power at a remote test position. Connection is made to the 5400A rear panel via a BNC cable.

Frequency Range: 0.01 to 20 GHz
Output Polarity: Negative **Flatness:** ±0.5 dB
Impedance: 50Ω **SWR:** 1.33
Max. Input: +20 dBm **Output Capacitance:** 30 pF
Low Level Sensitivity at –30 dBm 0.4 mV/μW
High Level Sensitivity at +13 dBm 1 V, minimum
Connectors: K (m) Input; BNC (f) Output

POWER DIVIDER

These power dividers are symmetrical, three-resistor tee designs that can be used in applications where signals from dc to 40 GHz must be accurately divided to externally level the 5400A or the signal source. They provide excellent amplitude and phase tracking. K Connectors are compatible with APC–3.5® and SMA.

Impedance: 50Ω **Maximum Input Power:** +30 dBm
Dimensions (without connectors):
14.73 mm x 14.73 mm x 9.40 mm (0.58 x 0.58 x 0.37 in.)
Weight: 43 g (1.5 oz.)

Model	Frequency Range	Connectors
K240B	DC to 26.5 GHz	Input: K Connector (f) Outputs: K Connector (f)
K240C	DC to 40 GHz	

	Frequency Range (GHz)			
	DC to 6	6 to 18	18 to 26.5	26.5 to 40
Tracking of Outputs (Amplitude/Phase)	±0.3 dB/ ±2°	±0.3 dB/ ±2°	±0.3 dB/ ±2°	±0.3 dB/ ±2°
Insertion Loss (max)	7.0 dB	7.5 dB	8.0 dB	8.5 dB
SWR	1.2	1.4	1.5	1.7

POWER SPLITTER

These power splitters are symmetrical, two-resistor tee designs that can be used in applications where signals from dc to 40 GHz must be accurately divided for ratio measurement. They provide excellent flatness and effective output SWR. K Connectors are compatible with APC–3.5® and SMA.

Impedance: 50Ω **Maximum Input Power:** +30 dBm
Dimensions (without connectors):
14.73 mm x 14.73 mm x 9.40 mm (0.58 x 0.58 x 0.37 in.)
Weight: 43 g (1.5 oz.)

Model	K241B	K241C
Frequency Range	DC to 26.5 GHz	DC to 40 GHz
Connectors	Input: K Connector (m) Outputs: K Connector (f)	
Input SWR	≤2.0	
Effective Output SWR	≤1.7	
Flatness	≤2.0 dB	
Insertion Loss	6 dB (nominal)	

EXTENDER CABLES

These cables can be installed between the SWR Autotester or Detectors and the Scalar Analyzer, thereby permitting measurements up to 200 feet away.

Model	Cable Length
800-109	7.6 m (25 ft.)
800-110	15.2 m (50 ft.)
800-111	30.5 m (100 ft.
800-112	61 m (200 ft.)

GPIB CABLES

These cables connect the Scalar Analyzer to a GPIB plotter or controller on the GPIB (IEEE–488 bus).

Model	Cable Length
2100-1	1 m (3.3 ft.)
2100-2	2 m (6.6 ft.)
2100-4	4 m (13.2 ft.
2100-5	0.5 m (1.65 ft.)

ADAPTER CABLES

These adapter cables allow the Scalar Analyzer to be used with waveguide or other detectors having an SMA or BNC female output connector. Contact factory for more information.

Model	Cable Length	Connector Type
560-10BX	122 cm (4 ft.)	BNC (f)
560-10BX-1	122 cm (4 ft.)	SMA (f)

TRANSIT CASE & PROTECTIVE COVER

760-75 Transit Case: Hard shell case with custom foam inserts and carrying handle for maximum protection of the 5400A.

PRINTER & ACCESSORIES

2225C Ink Jet Printer, including 2225-1 Interface Cable, 1 ink cartridge, and 50 sheets of Ink Jet paper.
2225-1 Printer Interface Cable
2225-2 Ink Cartridge
2225-3 Fan-Fold Ink Jet Paper (500 sheets)

UNIVERSAL TEST FIXTURE

The Wiltron Universal Test Fixture (UTF) provides an accurate, repeatable solution for measuring microstrip and coplanar substrate devices at the substrate level — saving the time and expense of packaging devices for measurement. The complete solution includes substrate calibration/verification kits, bias probes, a MMIC attachment, and right-angle launchers for designs incorporating right-angle connections.

Universal Test Fixtures Models:

Model	Frequency Range	Connector Type
3680-20	DC to 20 GHz	3.5 mm (f)
3680K	DC to 40 GHz	K Connector (f)
3680V	DC to 60 GHz	V Connector (f)

UTF Accessories & Calibration/Verification Kits:

Model	Accessory
36801K 36801V	Right-Angle Launcher
36802	MMIC Attachment (requires 36805-XXM; see below)
36803	Bias Probe
36805-10M 36805-15M 36805-25M	Four Substrate Launchers for the MMIC Attachment: 10 mil 15 mil 25 mil
36804-10M 36804-15M 36804-25M	Microstrip Cal./Ver. Kits: DC to 60 GHz DC to 40 GHz DC to 20 GHz
36804-25C	Coplanar Waveguide (CPW) Cal./Ver. Kit (Includes CPW jaws for UTF); DC to 40 GHz

562-15BX Volt Mode Adapter Cable: Allows the 562 to be used in Volt Mode. BNC Male Connector.

Scalar Network Analyzers

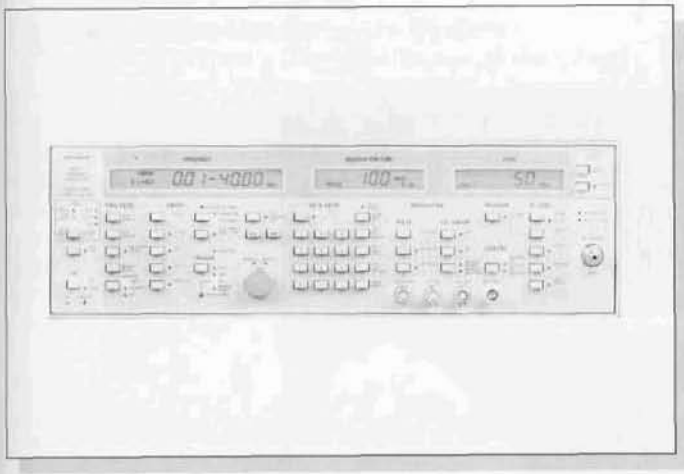
Complete 5700B/5600B Systems:

	Frequency Range							
	10 MHz to 8 GHz	18 to 26.5 GHz	26.5 to 40 GHz	10 MHz to 20 GHz	2 to 26.5 GHz	10 MHz to 26.5 GHz	2 to 40 GHz	10 MHz to 40 GHz
5700 Series, Order Model Number	**5717B**	**5736B**	**5740B**	**5747B**	**5753B**	**5759B**	**5763B**	**5769B**
5600 Series, Order Model Number	**5617B**	**5636B**	**5640B**	**5647B**	**5653B**	**5659B**	**5663B**	**5669B**
Your system includes:								
Network Analyzer 562 Scalar Network Analyzer	●	●	●	●	●	●	●	●
Swept Frequency Synthesizer (5700B Series) or **Sweep Generator** (5600B Series; GPIB included)	6717B 6617B	6737B 6636B	6740B 6640B	6747B 6647B	6753B 6653B	6759B 6659B	6763B 6663B	6769B 6669B
SWR Autotester								
560-97A50-1 SWR Autotester, GPC–7	●							
560-98S50-1 SWR Autotester, WSMA Male		●		●	●	●		
560-98K50 SWR Autotester, K Male							●	●
Detector								
560-7A50 Detector, GPC–7	●							
560-7S50-2 Detector, WSMA Male		●		●	●	●		
560-7K50 Detector, K Male							●	●
Open/Short								
22A50 Open/Short, GPC–7	●							
22SF50 Open/Short, WSMA Female		●		●	●	●		
22KF50 Open/Short, K Female							●	●
Accessories								
34SFSF50 Adapter, WSMA Female/WSMA Female		●		●	●	●		
34KFKF50 Adapter, K Female/K Female							●	●
34NN50A Adapter, N Male/N Male	●							
34RKRK50 Adapter, Ruggedized K Male/K Male		●			●	●	●	●
34RSN50 Adapter, Ruggedized WSMA Male/N Male				●				
806-7 Interconnect Cable (562 to Source)	●	●	●	●	●	●	●	●
2100-1 GPIB Cable, 1 m (3.3 ft.)	●	●	●	●	●	●	●	●

Options:

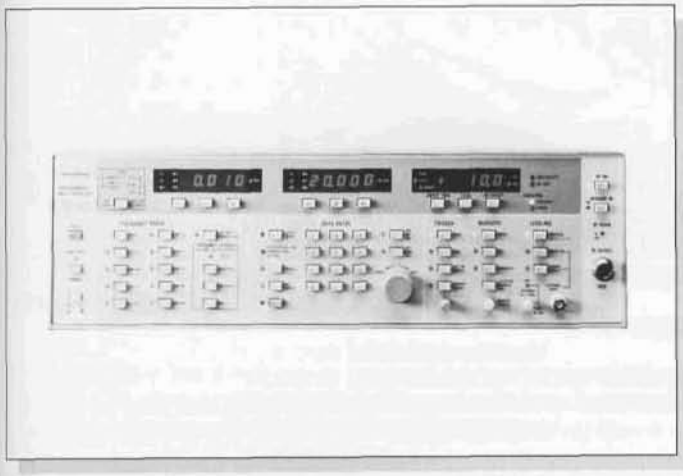
Description	Option		
Rack mounting for 562 Network Analyzer and Source (6700B or 6600B); track slide (90° tilt) included.	1		
Adds to 6700B Series Synthesizer a 110 dB Step Attenuator (10 dB steps)	2A 2B 2C	For 5717B, or 5747B For 5736B, 5753B, or 5759B For 5769B	
Adds to 6600B Series Synthesizer a 70 dB Step Attenuator (10 dB steps)	2A 2B 2C	For 5617B, or 5647B For 5636B, 5653B, or 5659B For 5669B	
		Adds	**Deletes**
Adapters supplied to convert the existing SWR Autotester, Detector, and Open/Short GPC–7 test port connectors to Type N or WSMA. Available on: 5717B, 5617B	4	34AN50 Adapter, GPC–7/N Male 34ANF50 Adapter, GPC–7/N Female 34AS50 Adapter, GPC–7/WSMA Male 34ASF50 Adapter, GPC–7/WSMA Female	Nothing
Replaces existing SWR Autotester, Detector, and Open/Short GPC–7 test port connectors with WSMA test ports. Available on: 5717B, 5617B	5	560-98S50-1 SWR Autotester with WSMA Male test port connector with Option 1, 38 dB directivity. 560-7S50 Detector, WSMA Male 34SFSF50 Adapter, WSMA Female/Female 22SF Open/Short 34RSN50 Adapter, Ruggedized WSMA Male/N Male	560-97A50-1 SWR Autotester 560-7A50 Detector, GPC–7 22A50 Open/Short 34NN50 Adapter, Type N Male/Male
Replaces existing SWR Autotester, Detector, and Open/Short GPC–7 test port connectors with Type N test ports. Available on: 5717B, 5617B	6	560-97N50-1 SWR Autotester with Type N Male test port connector with Option 1, 38 dB directivity. 560-7N50 Detector, Type N Male 34NFNF50 Adapter, Type N Female/Female 22NF50 Open/Short	560-97A50-1 SWR Autotester 560-7A50 Detector, GPC–7 22A50 Open/Short

Frequency Sources – Overview



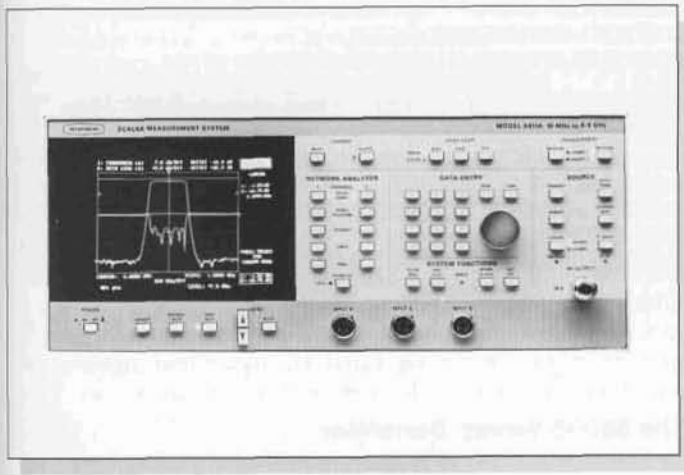
The Wiltron 6700B series of Swept Frequency Synthesizers provide unparalleled versatility. Frequency accuracy of 5×10^{-10}/day, built-in power meter, and high performance pulse generator are just a few of the features that make this series an exceptional value.

See page 82



The 6600B series of Sweep Generators offers an extremely reliable, feature laden instrument that meets the needs of the majority of sweeper requirements. The fundamental oscillator design over the 2 to 26.5 GHz. range means a pure, subharmonic free signal with little residual FM and superior output flatness.

See page 92

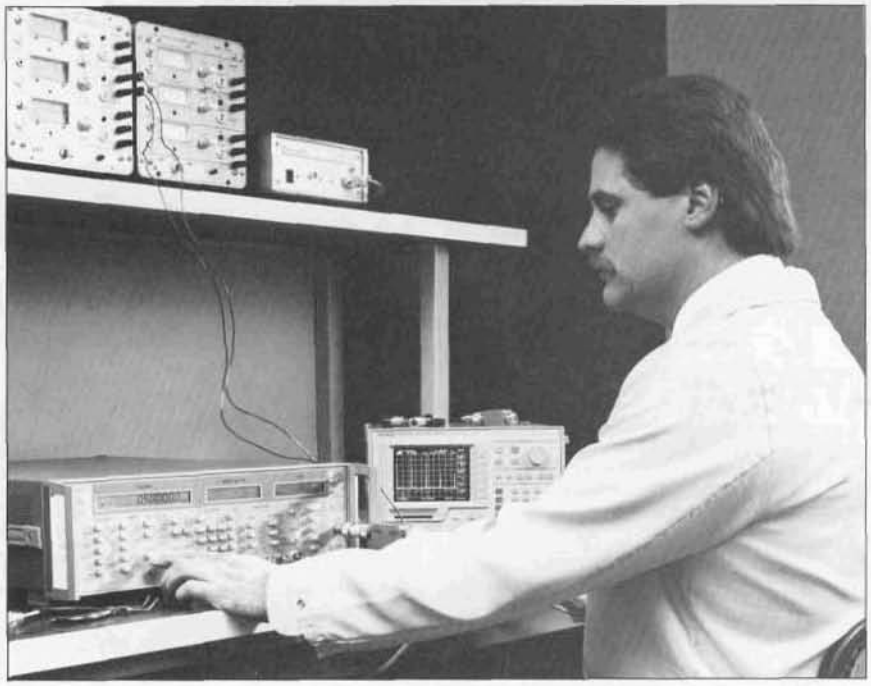


The 5400A family of Scalar Measurements Systems integrate a sophisticated scalar analyzer with a full-function microwave generator. The result is a low cost system with uncompromised performance in a compact package.

See page 50

Signal Sources

General Information



Introduction to Signal Sources

Signal sources (commonly known as Sources) are a primary stimulus used for the test and measurement of RF and Microwave apparatus. They can be used as a stand-alone instrument or be an integral part of a network analysis system. Sources provide a test signal for characterization of devices, subsystems or transmission lines.

RF and Microwave stimulus typically fall into one of three categories:

- Signal Generators - provide a constant, single-frequency RF output. Typically, the output can be manually varied over the range of the source.
- Sweep Generators - permit the RF output to be automatically varied (swept) over a diverse range of frequencies allowing the rapid characterization of broader band devices.
- Synthesizers - provide very accurate generation of RF frequencies by "phase locking" the signal from a RF source to a highly stable, very precise frequency standard.

Wiltron sources combine the advantages of all of these aspects into full feature instruments. For those applications requiring CW and swept frequency operation without the superior frequency accuracy of a synthesizer, the Wiltron 6600B series sweepers are the right choice. If the application demands the performance of a synthesizer, the Wiltron 6700B series fills the requirement by providing CW operation as well as a synthesized step sweep and true analog sweep that is ten fold better than that of a conventional sweep generator.

Wiltron's newest offering is a sweep generator with built-in Scalar Network Analyzer. The 5400A provides the features of a sweep generator that includes a patented frequency correction scheme to produce a hundredfold improvement in frequency accuracy as compared to a stand-alone sweep generator.

The 6700B Swept Frequency Synthesizer

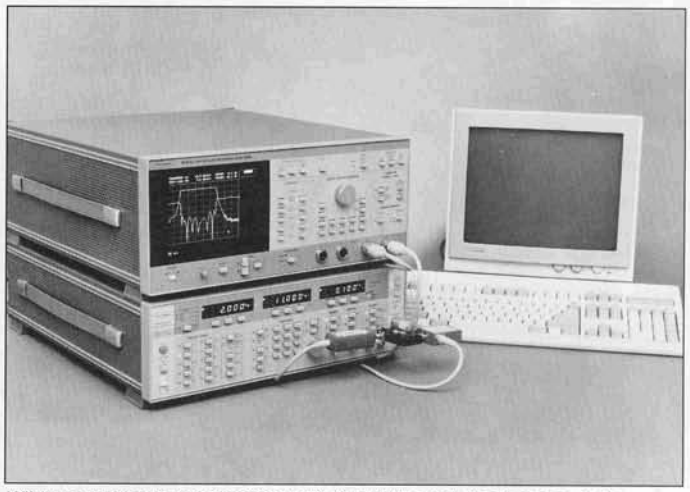
This family of synthesizers includes 30 different models covering the frequency range of 10 MHz to 60 GHz. All of these instruments employ a fundamental oscillator design from 2 to 26.5 GHz that reduces the harmonic and subharmonic generation plaguing multiplier type sources. Many features have been incorporated that enhance performance and versatility. The step sweep mode consists of 1800 synthesized steps spaced by as little as 1 kHz. The true analog sweep mode phase locks the sweep at the start/stop and bandswitch points to provide drift-free, repeatable frequency accuracy. Built in features include a power meter with +16 to -35 dBm range and a high performance pulse generator and modulator that provides an on/off ratio of 80 dB with a rise time of less than 10 ns.

The 6600B Sweep Generator

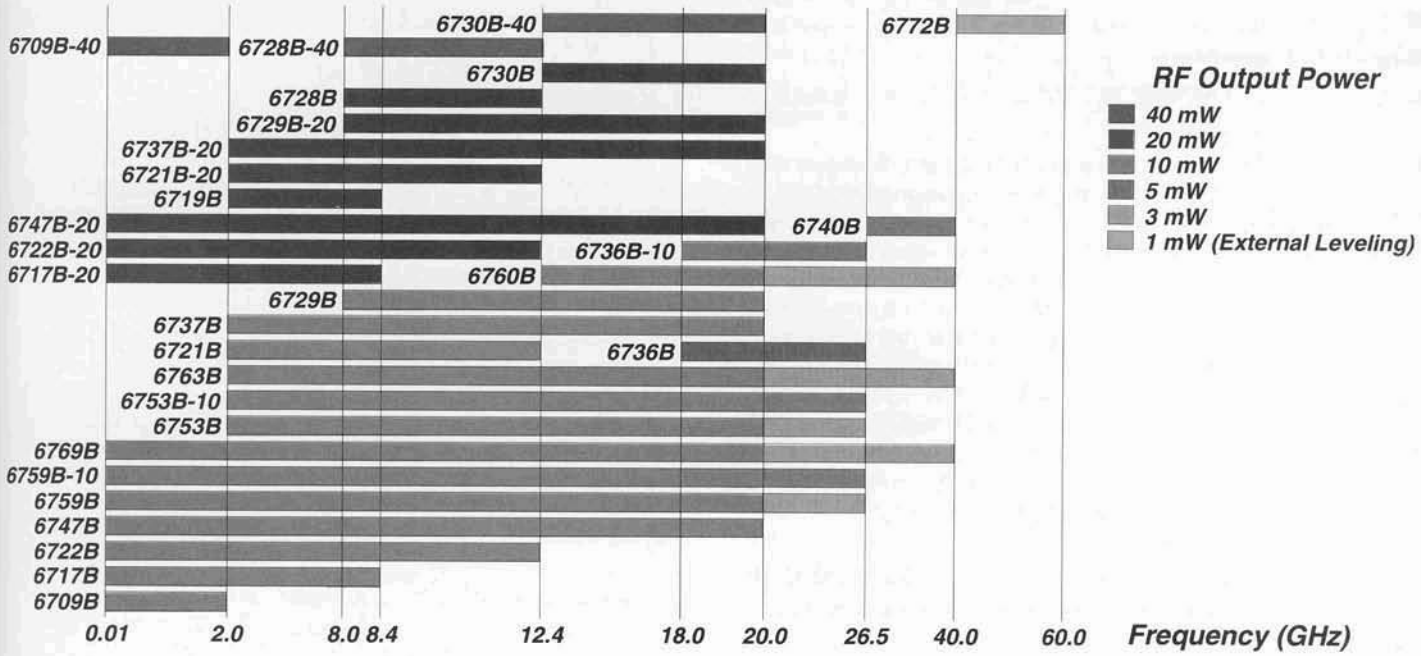
The 6600B family of generators includes 30 different models that cover the frequency range of 10 MHz. to 60 GHz. As with the 6700B series of sources, the 6600B family utilizes the fundamental oscillator approach to avoid error-producing harmonics and subharmonics. All 6600B models provide an abundance of user friendly features including versatile sweep modes, eight available markers, power sweep, the ability to store setups in memory and a front panel security function that blanks the displayed frequency information.

The 5400A Scalar Measurement System

The 5400A is Wiltron's latest contribution to the RF and Microwave industry. This system supplies the benefits of a frequency corrected source with the advantage of a built-in scalar network analyzer. In applications where testing is to be done on a scalar system, the 5400A provides a compact all-in-one package at a price less than the cost of buying two separate instruments. And with built-in automated testing features, the 5400A is a powerful system for both manufacturing and field use.



Wiltron sources can be combined with Scalar Network Analyzers as in the Wiltron 5600B System.



Swept Frequency Synthesizers

6700B Series, 10 MHz to 60 GHz

6700B Swept Frequency Synthesizer Highlights

- *25 ms Switching Speed Over Any Frequency Step Size*
- *20 mW Output Power Up to 20 GHz*
- *1 kHz Resolution up to 26.5 GHz*
- *Built-In Power Measuring Capability*
- *Simultaneous FM, AM, and Pulse Modulation, Including a Built-In Pulse Generator*
- *Continuous Analog Sweep and Phase-Locked Step Sweep Capability*

Performance and Versatility

The Wiltron 6700B Series covers the 10 MHz to 60 GHz range with 30 models. The series offers many features: 25 ms frequency switching speeds over any step size, up to 20 mW output to 20 GHz (10 mW to 40 GHz; 1 mW to 60 GHz), 1 kHz resolution up to 26.5 GHz, wideband FM, ac- and dc-coupled AM, and pulse modulation with an internal high-performance pulse generator. In every aspect of synthesizer performance— accuracy, stability, signal purity, close-in phase noise, EMI, modulation—this series is exceptional. To add further to its value, the 6700B includes a continuous analog sweep capability, as well as a phase-locked step sweep.

Clean Signals

The 6700B uses fundamental YIG-tuned oscillators from 2 to 26.5 GHz because they produce the cleanest signals. Completely free of the error-producing subharmonics of frequency multipliers, these signals can be applied to your test device with confidence that the test data will be accurate. Harmonic and spurious are less than –60 dBc from 2 to 26.5 GHz. The phase-locked stability and low phase noise of the 6700B make it an ideal signal source for simulation and test of narrow-band devices and communications systems. Noise characteristics compare very favorably with those of much more expensive, less versatile instruments.

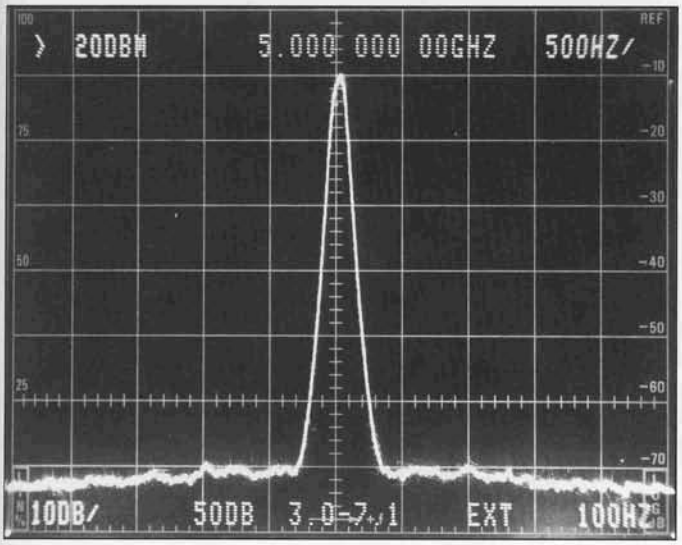
Broadest Selection

Model	Range	Output Power[1] (Minimum)
6709B	10 MHz to 2 GHz	10 mW
6709B-40	10 MHz to 2 GHz	40 mW
6717B	10 MHz to 8.4 GHz	10 mW
6717B-20	10 MHz to 8.4 GHz	20 mW
6722B	10 MHz to 12.4 GHz	10 mW
6722B-20	10 MHz to 12.4 GHz	20 mW
6747B	10 MHz to 20 GHz	10 mW
6747B-20	10 MHz to 20 GHz	20 mW
6759B	10 MHz to 26.5 GHz	3 mW
6759B-10	10 MHz to 26.5 GHz	10 mW
6769B	10 MHz to 40 GHz	3 mW
6719B	2 to 8.4 GHz	20 mW
6721B	2 to 12.4 GHz	10 mW
6721B-20	2 to 12.4 GHz	20 mW
6737B	2 to 20 GHz	10 mW
6737B-20	2 to 20 GHz	20 mW
6753B	2 to 26.5 GHz	3 mW
6753B-10	2 to 26.5 GHz	10 mW
6763B	2 to 40 GHz	3 mW
6728B	8 to 12.4 GHz	20 mW
6728B-40	8 to 12.4 GHz	40 mW
6729B	8 to 20 GHz	10 mW
6729B-20	8 to 20 GHz	20 mW
6730B	12.4 to 20 GHz	20 mW
6730B-40	12.4 to 20 GHz	40 mW
6760B	12.4 to 40 GHz	3 mW
6736B	18 to 26.5 GHz	5 mW
6736B-10	18 to 26.5 GHz	10 mW
6740B	26.5 to 40 GHz	10 mW
6772B[2]	40 to 60 GHz	1 mW

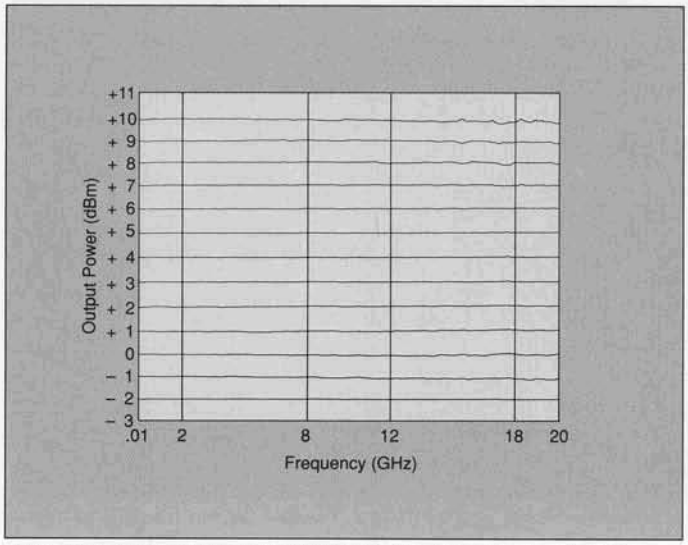
[1]Without optional attenuator. [2]External leveling only.

Built-In Pulse Generator

Because pulse performance is often critical in synthesizer applications, every model includes as standard equipment an internal pulse generator and modulator. Specifications include an on/off ratio of 80 dB and a rise time of less than 10 ns (typically <5 ns). The internal pulse generator provides repetition rates from 10 Hz to 1 MHz and pulse widths of 25 ns to 99 ms, both parameters being crystal derived.



Typical 5 GHz signal shows low SSB noise and absence of spurious signals.



In the Power Sweep mode, the 6700B can sweep frequency at each power level, simplifying gain compression measurements.

For additional pulse modulation capability, you can apply externally generated pulses to the 6700B. The pulse width range then becomes 10 ns to CW at repetition rates from 10 Hz to 10 MHz. Furthermore, an applied TTL signal can be used to gate the internal generator to produce pulse bursts. This pulse burst capability, combined with the 6700B's programmable frequency hopping, saves time and simplifies tests in complex radar simulation applications.

Wide Dynamic Range From Built-in Attenuator Option

With a greater than 120 dB dynamic range, the 6700B eliminates the need for external attenuators when testing filters, attenuators, tuners, isolators, mixers, and receivers. For your convenience, power levels can be selected on the keypad, control knob, Increase/Decrease key, or GPIB—all with 0.01 dB resolution. Wiltron's optional built-in attenuators work to 60 GHz, compared to only 26.5 GHz for competing units.

AM, FM, and Pulse Modulation

The 6700B produces simultaneous AM, FM, and pulse modulation. Sensitivity levels for FM and AM input signals are adjustable and calibrated so that modulation values may be read directly from an LCD display. For AM, the modulation range is 0 to 90% at rates of dc to 100 kHz. For FM, the deviation range is up to 20 times the modulation rate from 100 Hz to 250 kHz. In addition, an "unlocked FM" mode can be enabled from the front panel for deviation up to ±25 MHz and modulation rates down to dc. The modulation versatility of the 6700B allows you to use this single instrument in almost all applications.

Step Sweep and Analog Sweep

The 6700B has two sweep modes. The first is the Step Sweep Mode which consists of up to 1800 synthesized steps, spaced by as little as 1 kHz. The dwell time per step can be adjusted to allow an adequate settling time for the test device or other instruments.

The second sweep mode is a true analog sweep with frequency accuracy that is at least tenfold better than that of a conventional sweep generator. Because the start/stop and bandswitching frequencies are phase-lock-corrected during each sweep, the analog sweep is drift-free and repeatable.

Frequency parameters for four sweep ranges (F1–F2, F3–F4, ΔF F5, ΔF F6) in the step or analog sweep can be stored and recalled as needed to save set-up time and simplify measurements.

Alternate Sweep

In the Alternate Sweep mode, you sweep alternately between any two of the F1–F2, F3–F4, ΔF F5, and ΔF F6 ranges. You improve productivity by measuring filter rejection outside the passband while simultaneously viewing response within the passband.

Power Sweep

The Power Sweep might be considered a third sweep mode. In this mode, the output power can be automatically stepped over your selected range. In addition a frequency sweep can be made at each power level, thereby generating a family of curves which greatly simplify gain compression measurements.

Nine Markers

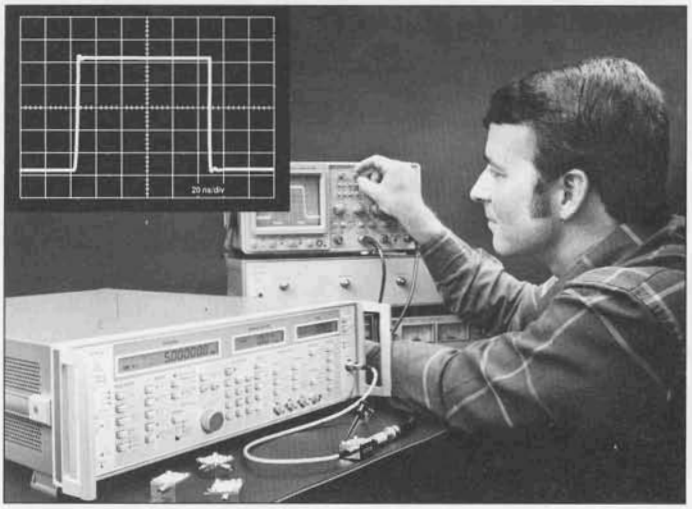
In both the step and analog sweep modes, you have up to nine markers for precise frequency identification. These can be saved with other sweep parameters for recall, reducing set-up time when changing from one test device to another.

Integral Power Meter

The built-in power meter eliminates the expense and inconvenience of an external power meter. By connecting one of the Wiltron detectors listed on page 76, you measure over the +16 dBm to −35 dBm range from 10 MHz to 40 GHz. For remote power measurements, extension cables up to 61 m (200 ft) long can be used with negligible effect on accuracy.

Swept Frequency Synthesizers

6700B Series



Built-in pulse generator typically has less than 5 ns rise time over a 25 ns to 99 ms pulse width range.

High Fidelity Radar Simulation

The 6700B generates pulsed signals in three ways:

- By controlling the built-in pulse modulator with the internal pulse generator, you avoid the inconvenience and expense of an external pulse generator.
- By externally "gating" the internal pulse generator, you can easily create complex pulse bursts.
- By externally controlling the internal pulse generator/modulator, you obtain high pulse fidelity with no droop, minimal overshoot, video feedthrough of less than ±5 mVpk, and constant peak power with changing pulse widths.

Accurate rotating antenna simulation is achieved with 0 to 90% modulation depths, ac- or dc-coupled AM, fast frequency agility, and amplitude-modulated pulse envelopes.

Doppler simulation is enhanced with phase-locked and unlocked, dc-coupled FM.

Receiver Measurement Capability

The growing demand for greater sensitivity and selectivity in EW/ECM, navigation, and communication receivers can be fulfilled only with performance like that of the 6700B. Exceptional EMI and RFI shielding takes the guesswork out of low signal level tests. The broad frequency range of this one instrument permits measurements at all receiver frequencies—from baseband to microwave. Virtually every receiver characteristic can be measured with ease: sensitivity, selectivity, discriminator alignment, audio noise and distortion, AM reflection, intermodulation, distortion, SINAD, audio hum, and AGC response.

Wiltron Quality Components

When you consider overall measurement accuracy, the 6700B is superb. Wiltron fundamental oscillators avoid the errors introduced by the subharmonics of multiplier-type oscillators. Wiltron-designed PIN switches hold harmonic levels to better than −60 dBc above 2 GHz, while spurious are typically less than −70 dBc.

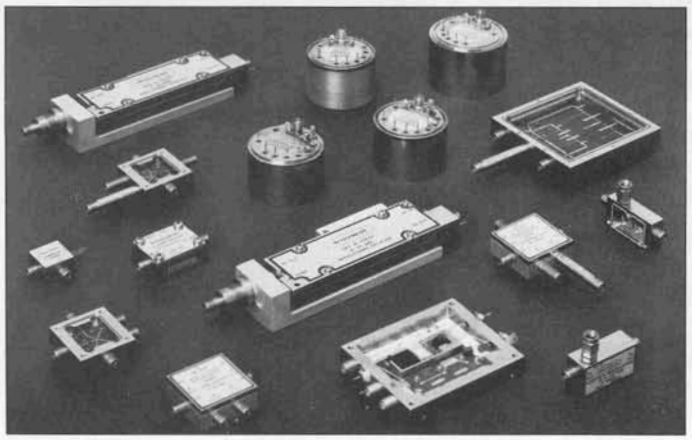
Source match is better than 13 dB return loss (1.6 SWR), a result of the excellent directivity of the Wiltron-designed leveling loop coupler. The addition of external components to improve match is unnecessary.

Also contributing to accuracy is the diode detector in the leveling loop. This component, also Wiltron designed, is digitally calibrated to compensate for variations in the temperature response and linearity. The result is a more accurate RF level.

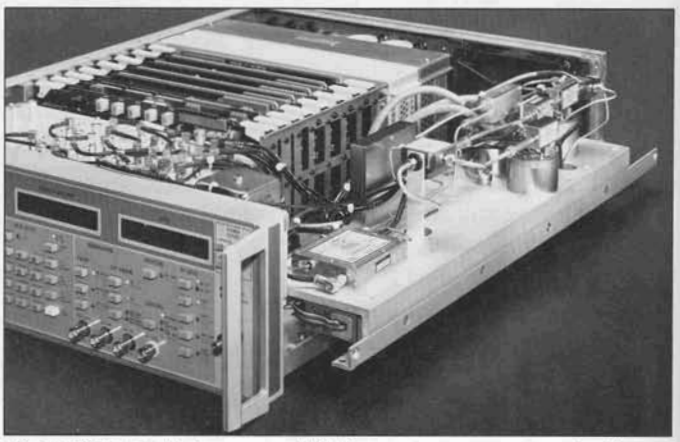
Serviceability

An inside view of the 6700B provides convincing evidence of the care given to making it serviceable. For instance, a major competitor has 109 potentiometer adjustments in its 26.5 GHz synthesizer—the 6700B has five! Precision voltage regulators and microprocessor-controlled, digital-to-analog converters are used throughout to eliminate manual adjustments, to improve stability and reliability, and to reduce calibration time. Major functions can be tested and recalibrated from the front panel without an external controller. Internal firmware makes it easy.

To enhance serviceability further, circuitry is divided into readily accessible modules, including one each for the entire front and rear panels. A tilt-out RF deck exposes all microwave components for easy inspection or replacement. Access to the components while the instrument is in operation contributes to efficient troubleshooting.



Precision components manufactured in the Wiltron microelectronics facility contribute greatly to the exceptional performance of the 6700B.



Tilt-out microwave deck exposes all high-frequency components and cabling.

6700B Series

Versatility Yields Usefulness

The broad range of 6700B performance characteristics makes it ever more useful in today's complex production and laboratory environments.

The 6700B's clean signal output and superior modulation capabilies provide many application oriented uses.

Component & Subsystem Testing

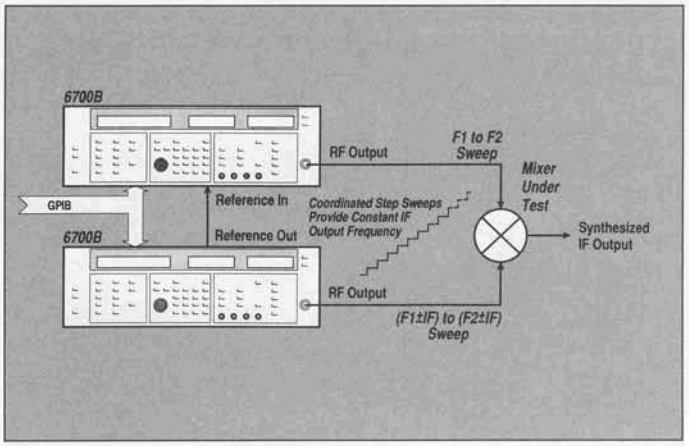
Component and subsystem tests often require a test signal input as well as a local oscillator input. To test over a frequency band, the two input signals should track. This type of test is readily automated using a pair of 6700B synthesizers. A single "GET" command results in incrementing both synthesizers simultaneously. If a small amount of IF variation can be tolerated, a Wiltron Model 6600B Sweep Generator can be used with the 6700B in its Analog Sweep Mode to permit faster sweeps for tuning applications.

ATE System Source

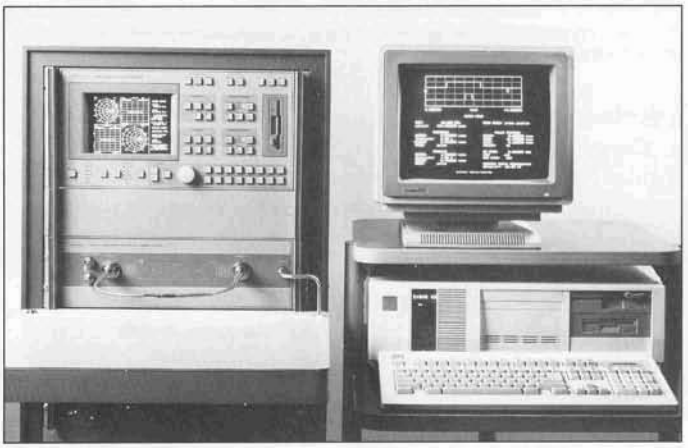
Automatic test systems place a high premium on rack space, computer-memory capacity, and controller software. That's why the 6700B is the ideal signal source for ATE applications. In some systems, this single 133 mm (5-1/4") high instrument replaces a sweep generator, a frequency counter or synchronizer, a power meter, MATE translators, switches, and modulators.

Complex test routines requiring power sweep, step sweep, frequency agility, and power correction are easily completed using standard 6700B functions. Straightforward functions reduce software overhead.

For ATE, the 6700B wins two ways — performance and cost savings.



The 6700B can be used as a precision source, local oscillator, or both for production component and subsystem testing.



The 6700B is the ideal source for automated test setups such as this Wiltron 360PS20A Pulsed or CW Vector Network Analyzer.

6700B Applications

6700B Series

Photo courtesy of Raytheon Company.

Electronic countermeasures systems require the exceptional pulse performance of the 6700B.

EW/Radar Simulation

Electronic warfare and radar simulation applications require high performance pulse capabilities and exceptional versatility. Some considerations are:

The ability to provide a high power pulse signal with low leakage during the RF Off periods;

- Enough modulation depth to allow wide dynamic range measurements;
- Excellent pulse definition — even during very narrow pulse widths;
- Fast, clean rise and fall times during pulse operation; and
- The ability to perform random frequency generation in computer-driven setups.

Every 6700B Series model satisfies all of these requirements. Its built-in pulse generator and ability to provide AM and FM while simultaneously pulsing the RF provide unequalled flexibility and value.

Communications

Network Analyzer Measurements At A New Level of Convenience — The quality of the signal used to make measurements on scalar or vector network analyzers has a significant impact on measurement accuracy. Only with a phase-locked signal can you test narrowband communication filters and sharply-tuned receivers with confidence. Then you know that the frequency identification is precise and repeatable. The analog sweep not only provides a continuous display of test parameters, it reduces sweep time as well. Since the analog sweep start and stop frequencies are corrected through phase locking, accuracy is considerably better than that of conventional sweepers.

The 6700B Series' outstanding performance, features, and versatility offer numerous measurement solutions for the demanding needs of today's communications industry.

Intermodulation Measurements — Intermodulation measurements are becoming more demanding. Two precision signals are required and the test system approach must be careful to determine the IM performance of the UUT, independent of the measuring system. Stability of amplitude and phase can be critical. The 6700B provides excellent performance for these applications, which may involve frequency conversion, due primarily to the fundamental oscillator design. This approach eliminates the need for tuned YTFs which introduce both amplitude and phase instabilities.

6700B Swept Frequency Synthesizers

General Specifications

MODEL SUMMARY

Model	Frequency Range	Output Power[1] (Minimum)	RF OUTPUT Connector
6709B 6709B-40	10 MHz to 2 GHz	10 mW 40 mW	Type N female
6717B 6717B-20	10 MHz to 8.4 GHz	10 mW 20 mW	Type N female
6719B	2 to 8.4 GHz	20 mW	Type N female
6721B 6721B-20	2 to 12.4 GHz	10 mW 20 mW	Type N female
6722B 6722B-20	10 MHz to 12.4 GHz	10 mW 20 mW	Type N female
6728B 6728B-40	8 to 12.4 GHz	20 mW 40 mW	Type N female
6729B 6729B-20	8 to 20 GHz	10 mW 20 mW	Type N female
6730B 6730B-40	12.4 to 20 GHz	20 mW 40 mW	Type N female
6736B 6736B-10	18 to 26.5 GHz	5 mW 10 mW	K female
6737B 6737B-20	2 to 20 GHz	10 mW 20 mW	Type N female
6740B	26.5 to 40 GHz	10 mW	K female
6747B 6747B-20	10 MHz to 20 GHz	10 mW 20 mW	Type N female
6753B	2 to 26.5 GHz	10 mW, ≤20 GHz 3 mW, >20 GHz	K female
6753B-10		10 mW	
6759B	10 MHz to 26.5 GHz	10 mW, ≤20 GHz 3 mW, >20 GHz	K female
6759B-10		10 mW	
6760B	12.4 to 40 GHz	10 mW, ≤20 GHz 3 mW, >20 GHz	K female
6763B	2 to 40 GHz	10 mW, ≤20 GHz 3 mW, >20 GHz	K female
6769B	10 MHz to 40 GHz	10 mW, ≤20 GHz 3 mW, >20 GHz	K female
6772B	40 GHz to 60 GHz	1 mW (External Leveling only)	WR19 Waveguide UG–383/U Flange

[1] Without optional attenuator.

CW MODE

Output: Nine independent, presettable CW frequencies.
Accuracy: Same as internal or external time base.
Internal 10 MHz Time Base Stability:
With Aging: $<5 \times 10^{-10}$/day
With Temperature: $<\pm 5 \times 10^{-9}$/°C over 0° to +55°C
Resolution:
0.01 to 26.5 GHz: 1 kHz
>26.5 to 40 GHz: 2 kHz
>40 to 60 GHz: 3 kHz
10 MHz Reference Output: 2 Vp-p into 50Ω. AC coupled. Rear panel BNC; 50Ω impedance.
External 10 MHz Reference Input: Accepts external 10 MHz ±100 Hz, 0 to +10 dBm time base signal. Automatically disconnects internal time base. Rear panel BNC; 50Ω impedance.
High Resolution Input: Accepts 20–32.1 MHz external synthesizer signal to improve resolution to equal that of external instrument. Rear panel BNC; 50Ω impedance. Requires 0 dBm input level.
Switching Time (for any step size): <15 ms typical to be within 1 kHz.
Lock Output: Rear panel BNC. Provides TTL-high signal when frequency is phase locked.

SWEEP MODES

ANALOG SWEEP MODE
Provides an accurate, repeatable continuous sweep.
Sweep Modes: Four sweep modes are independently selected: F1–F2, F3–F4, ΔF F5, and ΔF F6.
Sweep Width Range: 1 MHz to full range of instrument (continuous sweep).
For sweep widths >50 MHz, start/stop and bandswitching frequencies are phase-lock-corrected during every sweep.
For sweep widths ≤50 MHz, the center frequency is phase-lock-corrected.
Accuracy: The lesser of:
±30 MHz or ±(2 MHz + 0.25% of sweep width)
for sweep speeds of ≤50 GHz/s
Resolution: 1 MHz
Sweep Time Range: 30 ms to 99 s

PHASE-LOCKED STEP SWEEP MODE
Provides a sweep consisting of up to 1800 synthesized steps. Each step may be spaced by as little as 1 kHz. The dwell time per step may be adjusted to allow an adequate settling time for the test device or other instruments.
Sweep Modes: Four sweep modes are independently selected: F1–F2, F3–F4, ΔF F5, and ΔF F6.
Sweep Width Range: 1 kHz to full range of instrument. Every frequency point in sweep range is phase locked.
Accuracy: Same as internal or external time base.
Resolution (Minimum Step Size):
0.01 to 26.5 GHz: 1 kHz
>26.5 to 40 GHz: 2 kHz
>40 to 60 GHz: 3 kHz
Number of Steps: Variable from 1 to 1800
Dwell Time Per Step: Variable from 1 ms to 99s
Switching Time (for any step size): <15 ms typical, 25 ms max. to be within 1 kHz

ALTERNATE SWEEP MODE
Sweeps alternately in analog or step sweep between any two of the sweep ranges: F1–F2, F3–F4, ΔF F5, and ΔF F6.

MANUAL SWEEP MODE
Provides stepped, phase-locked adjustment of frequencies between sweep limits.

6700B Swept Frequency Synsthesizers

General Specifications

PROGRAMMABLE FREQUENCY AGILITY

Under GPIB control, up to 512 nonsequential frequencies can be stored and then addressed as a phase-locked step sweep.
Switching Time (for any step size): <15 ms typical, 25 ms max. to be within 1 kHz

MARKERS

Up to nine independent, presettable markers.
Video Markers: TTL compatible, high true. Rear panel BNC.
Intensity Markers (Available in Analog Sweep Mode only): Intensified dot on trace. Obtained by momentary dwell in sweep.
Marker Accuracy: Same as sweep frequency accuracy.
Marker Resolution (Step Sweep):
0.01 to 26.5 GHz: 1 kHz
>26.5 to 40 GHz: 2 kHz
>40 to 60 GHz: 3 kHz
Resolution (Analog Sweep): Sweep width/4096 or 1 MHz, whichever is greater.

SWEEP TRIGGERING

Auto: Triggers sweep automatically.
Line: Triggers sweep from power line frequency.
External: Accepts TTL-high signal of >1 µs width to trigger, abort, or reset analog sweep. Rear panel BNC.
Single: Triggers, aborts, and resets a single sweep. Front-panel pushbutton.

REAR PANEL I/O CONNECTORS

Sweep Dwell Input: Accepts TTL-low signal to stop sweep. Sweep continues when signal is removed. Rear panel BNC.
Horizontal Sweep Output: Provides 0V at beginning to 10V at end of sweep for all sweep modes, regardless of sweep width. Rear panel BNC.
In CW mode, voltage is proportional to frequency between 0V at low end and 10V at high end of range.
In CW mode, CW RAMP provides a repetitive, 30 ms, 0V to 10V ramp.
V/GHz Output (Rear panel BNC):
0.01 to ≤20 GHz: 1V/GHz
>20 to ≤40 GHz: 0.5V/GHz
>40 to ≤60 GHz: 0.33V/GHz
Bandswitch Blanking Output: +5V or −5V signal coincident with bandswitching points. Signal present at rear panel BNC and AUX I/O (Cannon 25-pin D-style) connectors. 100Ω impedance.
Retrace Blanking Output: +5V or −5V output signal coincident with sweep retrace. Signal present at rear panel BNC and AUX I/O (Cannon 25-pin D-style) connectors.
Pen Lift Output: Normally-open or normally-closed internal relay contacts during sweep retrace. Rear panel BNC.
Sequential Sync Output: Provides TTL-high signal during retrace and at bandswitching points for interface to scalar network analyzers, −5V during marker and −10V during selected marker. Signal present at rear panel BNC and AUX I/O (Cannon 25-pin D-style) connectors.

All specifications apply to the phase-locked CW and Step Sweep Modes.

SPURIOUS SIGNALS

Subharmonics: None
Harmonics:
0.01 to 2.0 GHz: −40 dBc
(−30 dBc for 6709B-40, 6717B-20, 6722B-40, and 6747B-20)
>2.0 to ≤40 GHz: −60 dBc
>40 to 60 GHz: −20 dBc
Harmonically Related:
26.5 to 28 GHz: −20 dBc
>28 to ≤40 GHz: −40 dBc
>40 to 60 GHz: −20 dBc
Nonharmonics: −60 dBc, typically −70 dBc
−50 dBc ≤2 GHz for 20 mW and 40 mW models)

SINGLE-SIDEBAND PHASE NOISE
(CW Mode, maximum)

Frequency Range (GHz)	Offset From Carrier (dBc/Hz; 1 Hz BW)				
	30 Hz	100 Hz	1 kHz	10 kHz	100 kHz
0.01 to 8	−67	−72	−76	−80	−98
>8 to 12.4	−64	−69	−73	−77	−100
>12.4 to 20	−60	−65	−69	−73	−100
>20 to 26.5	−58	−63	−67	−71	−97
>26.5 to 40	−54	−59	−63	−67	−95
>40 to 60	−50	−55	−59	−63	−90

POWER LINE AND FAN ROTATION SPURIOUS
(CW Mode, maximum)

Frequency Range (GHz)	Offset From Carrier (dBc)		
	<300 Hz	300 Hz to 1 kHz	1 kHz
0.01 to 8	−50	−60	−65
>8 to 12.4	−46	−53	−58
>12.4 to 20	−41	−48	−53
>20 to 26.5	−40	−47	−52
>26.5 to 40	−35	−42	−47
>40 to 60	−40	−47	−52

RESIDUAL FM
(CW Mode, 50 Hz–15 kHz BW, typical)

Frequency Range (GHz)	Residual FM (Hz RMS)
0.01 to 2	80
>2 to 8	90
>8 to 12.4	190
>12.4 to 20	240
>20 to 26.5	280
>26.5 to 40	480
>40 to 60	720

RESIDUAL FM
(Analog Sweep Mode, 50 Hz–15 kHz BW)

Frequency Range (GHz)	Residual FM (kHz RMS)
0.01 to 8	5
>8 to 12.4	7
>12.4 to 20	10
>20 to 26.5	15
>26.5 to 40	20
>40 to 60	30

Power level specifications apply at 25 ±10°C.
See Model Summary Table for power ratings.

OUTPUT POWER

Leveled Output Power Range:
Without Attenuator: 12 dB
With Option 2A, 2B, or 2C: 122 dB

Attenuator Insertion Loss: Reduces rated power (See Options on page 91).

Output Power Resolution:
Entry Resolution: 0.01 dB
Display Resolution: 0.1 dB

Power Level Stability with Temperature: 0.02 dB/°C, typical

Power Level Switching Time (to within specified accuracy):
Without Change in Step Attenuator (Pulse Off): <50 µs
With Change in Step Attenuator (Pulse Off): <20 ms

ACCURACY AND FLATNESS

Step Sweep and CW Modes:

Attenuation Below Maximum Power	Frequency (GHz)			
	0.01 to 20	20 to 26.5	26.5 to 40	40 to 60[3]
Accuracy[1]				
0 to 12 dB[4]	±0.6 dB	±0.6 dB	±0.8 dB	N/A
0 to 30 dB[2][4]	±1.4 dB	±2.0 dB	±3.0 dB	N/A
30 to 60 dB[2]	±2.6 dB	±2.6 dB	±4.6 dB	N/A
>60 dB[2]	±3.1 dB	±4.0 dB	±5.0 dB	N/A
Flatness				
0 to 12 dB[4]	±0.4 dB	±0.4 dB	±0.6 dB	N/A
0 to 30 dB[2][4]	±0.8 dB	±1.0 dB	±2.0 dB	N/A
30 to 60 dB[2]	±2.0 dB	±2.0 dB	±3.0 dB	N/A
>60 dB[2]	±2.5 dB	±3.0 dB	±4.0 dB	N/A

[1] Includes flatness variations. [2] For models with attenuator.
[3] External leveling performance is a function of the coupler and detector used.
[4] ±2.0 dB from 10 to 25 MHz.

Analog Sweep Modes (typical):

Attenuation Below Maximum Power	Frequency (GHz)			
	0.01 to 20	20 to 26.5	26.5 to 40	40 to 60[3]
Accuracy[1]				
0 to 12 dB	±1.0 dB	±1.5 dB	±2.0 dB	N/A
0 to 30 dB[2]	±3.5 dB	±3.6 dB	±4.6 dB	N/A
30 to 60 dB[2]	±4.0 dB	±4.2 dB	±5.2 dB	N/A
>60 dB[2]	±5.0 dB	±5.2 dB	±6.2 dB	N/A
Flatness				
0 to 12 dB	±1.0 dB	±1.5 dB	±2.0 dB	N/A
0 to 30 dB[2]	±3.0 dB	±3.1 dB	±4.1 dB	N/A
30 to 60 dB[2]	±3.5 dB	±3.6 dB	±4.6 dB	N/A
>60 dB[2]	±4.0 dB	±4.2 dB	±5.2 dB	N/A

[1] Includes flatness variations. [2] For models with attenuator.
[3] External leveling performance is a function of the coupler and detector used.

OTHER POWER LEVEL SPECIFICATIONS

Source Impedance: 50Ω
Source SWR (Internal Leveling):
Without Attenuator: <1.7 at <2 GHz
<1.6 at 2 to 20 GHz
<2.0 at >20 GHz
With Attenuator: <2.0, typical

Level Offset: Offsets displayed power level to establish a new reference level.

RF On/Off Between Frequency Steps: Shift-plus-Trigger key routines select RF On or Off during frequency switching in CW Mode or Step Sweep Mode.
Retrace RF On/Off: Shift-plusTrigger key routines select RF On or Off during retrace.
RF Off: With RF control in Off position, oscillators are turned fully off.

Internal Leveling: Power is leveled at output connector in all modes.

External Leveling:
External Detector: Levels power at remote detector location. Front panel BNC connector, positive or negative polarity, 0.5 mV to 500 mV.
EXT GAIN CAL adjusts input gain to optimum value.

External Power Meter: Levels output power at remote power sensor location. Front panel BNC connector, ±1V full scale.
EXT GAIN CAL adjusts input gain to optimum value.

External Leveling Bandwidth (Pulse Off):
30 kHz typical in Detector Mode
>0.7 Hz typical in Power Meter Mode.

Unleveled Indicator: Lights when output power is unleveled.

POWER SWEEP

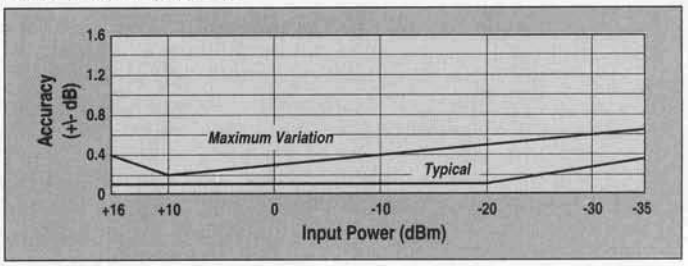
Range: Sweeps between any two power levels.
Resolution: 0.01 dB/step
Accuracy: Same as output accuracy.
Number of Steps: Variable from 1 to 1000
Dwell Time per Step: Variable from 50 ms to 10s

POWER METER

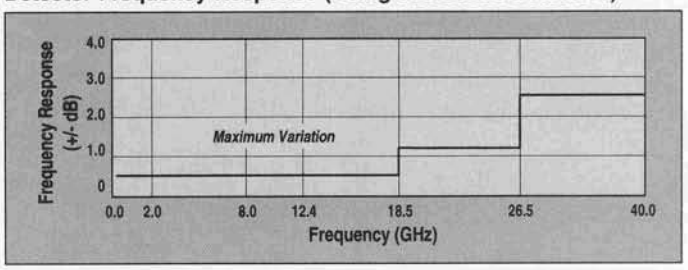
Built-In Power Meter Range: +16 dBm to –35 dBm. Compatible with Wiltron 560-7 and 5400-71 Series Detectors.
Rear panel input.

Power Measurement Accuracy:
Power Measurement Accuracy = Meter Accuracy + Detector Frequency Response (Refer to the following charts.)

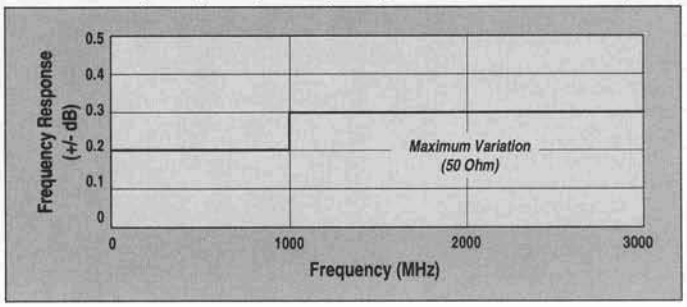
Meter Accuracy (25°C):



Detector Frequency Response (Using 560 Series Detectors):



Detector Frequency Response (Using 5400 Series Detectors):



6700B Swept Frequency Synsthesizers

General Specifications

AM, FM, and pulse modulation can be applied simultaneously.

PULSE MODULATION

On/Off Ratio: >80 dB for all pulse widths, 25 ns to 99 ms
Pulse Rise and Fall Time: <5 ns typical, 10 ns max.
Pulse Overshoot and Ringing: <10% maximum
Pulse Width Compression: ±5 ns max.
Video Feedthrough:
≤2 GHz, With Output Power (listed in Model Summary Table) ≤10 dBm: 2%
≤2 GHz, With Output Power (listed in Model Summary Table) >10 dBm: 5%
>2 to 26.5 GHz: <±5 mVpk, typical; ±10 mVpk, max.
>26.5 GHz: <±2 mVpk, typical; ±5 mVpk, max.

Accuracy of Peak Pulse Power (Output at Rated Power): (Relative to CW Level[1], 100 Hz ≤ PRF ≤ 1 MHz):

Pulse Width	Frequency	
	<2 GHz[3]	≥2 GHz
<100 ns	[2]	[2]
100 ns to <200 ns	[2]	±1.5 dB
200 ns to <500 ns	[2]	±1.5 dB
500 ns to <1 µs	[2]	±0.8 dB
1 µs to <2 µs	±1.4 dB	±0.5 dB
2 µs to <5 µs	±0.9 dB	±0.3 dB
≥5 µs	±0.6 dB	±0.3 dB

[1] Specifications are typical if RF level is not at Rated Power.
[2] RF Power is controllable, but not automatically leveled for very narrow pulses.
[3] Specifications are typical at <100 MHz.

INTERNAL PULSE GENERATOR

Pulse Width Range: 25 ns to 99 ms
Pulse Width Control Resolution:
Up to 100 ms Width: 25 ns
>100 ms to 1 ms Width: 1 µs
>1 ms to 10 ms Width: 10 µs
>10 ms to 99 ms Width: 100 µs
NOTE: Specified resolution may exceed the 3-digit display resolution.
Pulse Width Accuracy: ±10 ns, typical
Pulse Period: 1 µs to 100 ms
Pulse Period Resolution:
1 µs to 99.9 µs: 0.1 µs
100 µs to 999 µs: 1 µs
1 ms to 9.99 ms: 10 µs
10 ms to 100 ms: 100 µs
Pulse Period Accuracy: ±10 ns, typical

Gate Width Range: 100 ns to infinity

REAR PANEL I/O CONNECTORS

Pulse Input: Shift-plus-Trigger key routines select TTL-high or TTL-low signal for triggering or gating internal pulse generator. Rear panel BNC.

Pulse Sync Output: TTL-high signal, 100 ns minimum pulse width, preceding RF pulse by 100 ns. Rear panel BNC.

External Pulse Input:
Pulse Width Range: 10 ns to CW
Repetition Rate: 10 Hz to 10 MHz
External Trigger: TTL
Delay Time: 50 ns typical
External Triggered Pulse with Delay:
Delay Range: 200 ns to 100 ms
Delay Resolution:
200 ns to 99.9 µs: 100 ns
100 µs to 999 µs: 1µs
1 ms to 9.9 ms: 10 µs
10 ms to 100 ms: 100 µs

AMPLITUDE MODULATION

Specifications are measured at 1 kHz rate, 30% AM depth, with internally leveled RF at 4 dB below maximum rated output, unless otherwise noted.

AM Input: AC or DC coupling. Front and rear panel BNCs, 600Ω impedance.

Sensitivity: 1%/V to 100%/V, selectable
Sensitivity Accuracy: ±10% of displayed value ±1% AM plus AM flatness

Depth: With RF level at 6 dB below maximum rated output:
≤26.5 GHz: 0–90%, typical
>26.5 GHz: 0–80%, typical
AM Depth Metering Accuracy: Same as Sensitivity Accuracy

AM Bandwidth (3 dB, Pulse Off):
≤2 GHz: DC to 50 kHz or 50 Hz to 100 kHz, selectable
>2 GHz: DC to 100 kHz or 50 Hz to 100 kHz, selectable
AM Bandwidth with Pulse Modulation (typical):
10 kHz for pulse widths of ≥16 µs
10 kHz times the duty factor for pulse widths of <16 µs

Flatness (Relative to 1 kHz Rate, Pulse Off): ±0.3 dB from dc to 10 kHz

Distortion: <5% typical
Incidental Phase Modulation (100 Hz–10 kHz Modulation Rates): <0.4 radians, typical
Incidental FM: Incidental phase modulation times modulation frequency.

FREQUENCY MODULATION

FM Input: ±1 Vpk provides full range frequency deviation. Front and rear panel BNCs, 600Ω impedance.

Sensitivity:
Phase-Locked Mode: 10 kHz/V to 5 MHz/V, selectable to 3 digits
Unlocked Mode: 10 kHz/V to 25 MHz/V, selectable to 3 digits
Accuracy: ±5% at 40 kHz modulation rate

Maximum Deviation:
Phase-Locked Mode: ±20 times the modulation rate
Unlocked Mode: ±25 MHz
Deviation Meter Accuracy: ±5% of full range plus FM flatness

Modulation Rates (3 dB BW):
Phase-Locked Mode:
100 Hz–250 kHz
at ≤300 kHz/V sensitivity
2–250 kHz (500 kHz typical)
at >300 kHz/V sensitivity
Unlocked Mode: DC to 250 kHz (500 kHz typical) rate

Flatness (Relative to 40 kHz Rate):
Phase-Locked Mode:
±1 dB from 200 Hz to 200 kHz (500 kHz typical)
at ≤300 kHz/V sensitivity
±1 dB from 3 kHz to 200 kHz (500 kHz typical)
at >300 kHz/V sensitivity
Unlocked Mode: ±1 dB from dc to 200 kHz

Distortion at 1 kHz: <10%
Incidental AM: ±0.2% per MHz deviation

6700B Swept Frequency Synsthesizers

INSTRUMENT STATUS (IEEE-488)

GPIB Indicators: LED lights indicate the following conditions:
Remote: Operating on GPIB
Talk: Talking on GPIB
Listen: Listening on GPIB
SRQ: Sending a service request
Local Lockout: Disables the RETURN TO LOCAL pushbutton. Instrument can be placed in local mode only via GPIB.
Remote Operation: All front-panel functions except line power and GPIB address are programmable via GPIB (IEEE–488). Additional programmable commands include:
Front-Panel Settings, Stored Setups, Error/Malfunction Messages, Operational Status, and Self-Test Diagnostics.
GPIB Speed: 15K bytes/s
GPIB Address: Selectable from front panel.
IEEE–488 Interface Functions:

Source: SH1	**Acceptor Handshake:** AH1
Talker: T6	**Listener:** L4
Service Request: SR1	**Remote Local:** RL1
Parallel Poll: PP1	**Device Clear:** DC1
Device Trigger: DT1	

GENERAL

Stored Setups: Saves front-panel settings and nine additional stored setups for approximately ten years. Setups can be recovered directly by using the RECALL function or sequentially by using the SCAN function. Whenever the instrument is turned on, control settings come on at the same functions and values existing when power was removed.
Memory Sequencing Input: Accepts TTL-low signal to sequence through nine stored setups. Rear panel BNC.
Self-Test: Self-test is performed when power is applied or SELF TEST key is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.
Secure Mode: Front-panel readouts are blanked to protect confidential test parameters.
Parameter Entry: Instrument-controlled parameters may be entered in 3 ways: keypad, control knob, or step DECR/INCR keys (the step size of which is variable via the keypad).

Controlled parameters are: frequency, power level, sweep speed, dwell time, pulse width, pulse repetition rate, AM % depth, AM sensitivity, and FM sensitivity.

Entry is terminated by pressing appropriate unit key (i.e., GHz, MHz, dBm, ms, %, etc.). Values of each are displayed on LCD readout.
Reset Control: Returns test parameters to preset default values.

Warm-Up Time:
From Standby: 30 minutes
From AC Power Application: 72 hours to achieve 5×10^{-10} per day frequency accuracy and stability.

WEIGHT AND DIMENSIONS

Weight: 25 kg (55 lb.) maximum
Dimensions: 133 H x 429 W x 584 D mm
(5-1/4 H x 16-7/8 W x 23 D in.)
Power: 90–130V or 180–240V, 50–400 Hz, 220 VA (30 VA in Standby)
Standby: With ac line power connected, unit is placed in standby when power switch is released from the On position.

ENVIRONMENTAL

Operating Temperature Range: 0°C to 55°C
Relative Humidity: 95%
EMI: Meets the conducted and radiated emission requirements of MIL–STD–461B, CE03, RE02 Part 4 Class A3 and VDE 0871/1978, Level B. Tested for conducted and radiated susceptibility per MIL–STD–462, CS02, CS06, and RS03 with no functional failures.

ACCESSORIES

Power Meter Extender Cables:
800–109 Extender Cable, 7.6 m (25 ft.)
800–110 Extender Cable, 15.2 m (50 ft.)
800–111 Extender Cable, 30.5 m (100 ft.)
800–112 Extender Cable, 61.0 m (200 ft.)
GPIB Cables:
2100–1 GPIB Cable, 1 m (3.3 ft.)
2100–2 GPIB Cable, 2 m (6.6 ft.)
2100–4 GPIB Cable, 4 m (13.2 ft.)
2100–5 GPIB Cable, 0.5 m (1.65 ft.)
Transit Case 760–81 for 6700B

OPTIONS

NOTE: GPIB and Pulse Modulation are standard on all models.

Option 1 — Rack Mounting: Rack mount kit with chassis track slides and mounting ears. Weight is 2.3 kg (5 lb).

Option 2 — Attenuator: Adds 110 dB step attenuator to increase the RF output range.
Option 2A: For models with an Upper Frequency Limit of ≤20 GHz. Reduces rated power by 1.5 dB.
Option 2B: For models with an Upper Frequency Limit of 26.5 GHz. Reduces rated power by 2.0 dB.
Option 2C: For models with an Upper Frequency Limit of 40 GHz. Reduces rated power by 3.0 dB.

Option 9K — Rear Panel RF Output: Adds rear panel K Connector® ror a CW frequency output range of 2-26.5 GHz max, or the frequency coverage of the instrument, whichever is less. Retains the front panel RF output connector without any performance degradation. -30 dBm output power, typical.

Option 10 — Auxiliary Rear Panel RF Output: Adds rear panel K Connector® for a CW frequency output range of 2-26.5 GHz max, or the frequency coverage of the instrument, whichever is less. Retains the front panel RF output connector with no performance degradation. -30 dBm output power, typical.

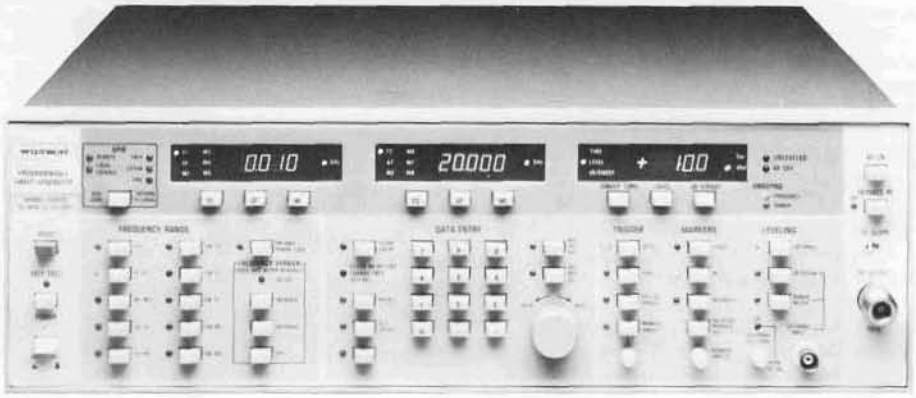
Option 14 — Wiltron 360 VNA Compatibility: Upgrade is No Charge if 360 VNA and 6700B are ordered at the same time.

AVAILABLE POWER METER DETECTORS

Detector Model	Frequency Range	Input Connector
560-7A50	10 MHz to 18 GHz	GPC–7 (50Ω)
560-7S50B	10 MHz to 20 GHz	WSMA male (50Ω)
560-7N50B	10 MHz to 20 GHz	N male (50Ω)
560-7S50-2	10 MHz to 26.5 GHz	WSMA male (50Ω)
560-7K50	10 MHz to 40 GHz	K male (50Ω)
5400-71N50	1 to 3000 MHz	N male (50Ω)

Sweep Generators

6600B Series, 10 MHz to 60 GHz



6600B Sweep Generator Highlights

- *40 mW Leveled Power from 10 MHz to 20 GHz*
- *10 MHz to 40 GHz Sweep from a Single Connector*
- *Subharmonic-Free Signals from Fundamental Oscillators*
- *15 dB Power Sweep Range Plus Optional 70 dB Attenuator*
- *Eight RF, Video, or Intensity Modulated Markers*
- *GPIB Interface Standard*

Measurement Accuracy and Convenience

The 6600B Sweep Generators combine proven microwave and microprocessor technology to produce a general-purpose swept signal source that makes the most accurate microwave measurements—in automated or manual systems. From a selection of 30 models, you choose the exact combination of capabilities you need: wideband sweep, narrowband sweep, and high power. All models feature exceptional source match, signal purity, frequency accuracy, resolution, and output flatness to improve the accuracy of your microwave measurements.

Innovative Design Philosophy

In designing the 6600B Series, Wiltron recognized that the great majority of a sweeper's cost is in the microwave components. Rather than mount these components in a plug-in, Wiltron engineers made each model a stand-alone, self-contained instrument. Every model is optimized to avoid the pick-up, interference, and over-heating that can plague plug-in sweeper designs. Each microwave module achieves the highest possible performance level, giving the 6600B distinct advantages over other sweepers.

Wide Selection

Model	Range	Output Power[1] (Minimum)
6609B	0.01 to 2 GHz	20 mW
6609B-50	0.01 to 2 GHz	50 mW
6617B	0.01 to 8 GHz	10 mW
6617B-40	0.01 to 8 GHz	40 mW
6622B	0.01 to 12.4 GHz	10 mW
6622B-40	0.01 to 12.4 GHz	40 mW
6647B	0.01 to 20 GHz	10 mW
6647B-40	0.01 to 20 GHz	40 mW
6659B	0.01 to 26.5 GHz	5 mW
6669B	0.01 to 40 GHz	3 mW
6616B	1.7 to 4.3 GHz	10 mW
6619B	2 to 8 GHz	10 mW
6619B-40	2 to 8 GHz	40 mW
6621B	2 to 12.4 GHz	10 mW
6621B-40	2 to 12.4 GHz	40 mW
6637B	2 to 20 GHz	10 mW
6637B-40	2 to 20 GHz	40 mW
6653B	2 to 26.5 GHz	5 mW
6663B	2 to 40 GHz	3 mW
6628B	8 to 12.4 GHz	10 mW
6628B-50	8 to 12.4 GHz	50 mW
6629B	8 to 20 GHz	10 mW
6629B-40	8 to 20 GHz	40 mW
6631B	10 to 15.5 GHz	10 mW
6630B	12.4 to 20 GHz	10 mW
6630B-50	12.4 to 20 GHz	50 mW
6660B	12.4 to 40 GHz	3 mW
6636B	18 to 26.5 GHz	3 mW
6640B-10	26.5 to 40 GHz	10 mW
6672B[2]	40 to 60 GHz	1 mW

[1]Without optional attenuator. [2]External leveling only.

6600B Series

Versatile Sweep Modes and Eight Markers

The 6600B Series has five sweep modes, as well as five CW frequencies and eight markers, to enhance your network analyzer display of test data. With a single keystroke, you switch from broadband sweep (Full Range, F1 to F2, or M1 to M2) to narrow-band symmetrical sweep about center frequency CF or marker M1. The CW frequencies are also selected directly without use of a shift key or having to remember frequencies stored in memory, both required by a major competitor. The exceptional attention given to all aspects of front-panel layout make the 6600B a pleasure to use.

Power Sweep

In addition to the versatile frequency sweep modes, the 6600B has a power sweep with which the output is swept over a 15 dB range. Furthermore, with the addition of the Option 2 Attenuator, the 15 dB power sweep can be offset in 10 dB steps over a 70 dB range. Amplifier and semiconductor characteristics, such as gain compression and saturation, can be measured rapidly over a continuously variable input power range. In the Alternate Stored Setup mode, a set of power sweep and a set of frequency sweep parameters stored in memory can be recalled to provide a "simultaneous" two-trace display of test device power *and* frequency characteristics.

ROM Frequency Accuracy

The accuracy with which frequencies can be selected is especially important when measuring devices with rapidly changing frequency characteristics. By using ROM to correct for residual nonlinearities of YIG-tuned oscillators, Wiltron holds accuracy to ±10 MHz from 10 MHz to 20 GHz. In addition, there is no degradation of accuracy when tuning from one band to the next, as is the case with multiplier techniques.

Nine Stored Setups

Because the 6600B has memory for nine independent test setups, operation of the Alternate Stored Setup mode is as simple as recalling the test parameters from memory. Set-up time is virtually eliminated.

Front Panel Security

When test parameters must be kept secret, an instruction to blank the digital displays is stored with the other test setup information by activating the security mode. Also, the secure information can be easily cleared to reduce protection problems.

Fundamental Oscillators

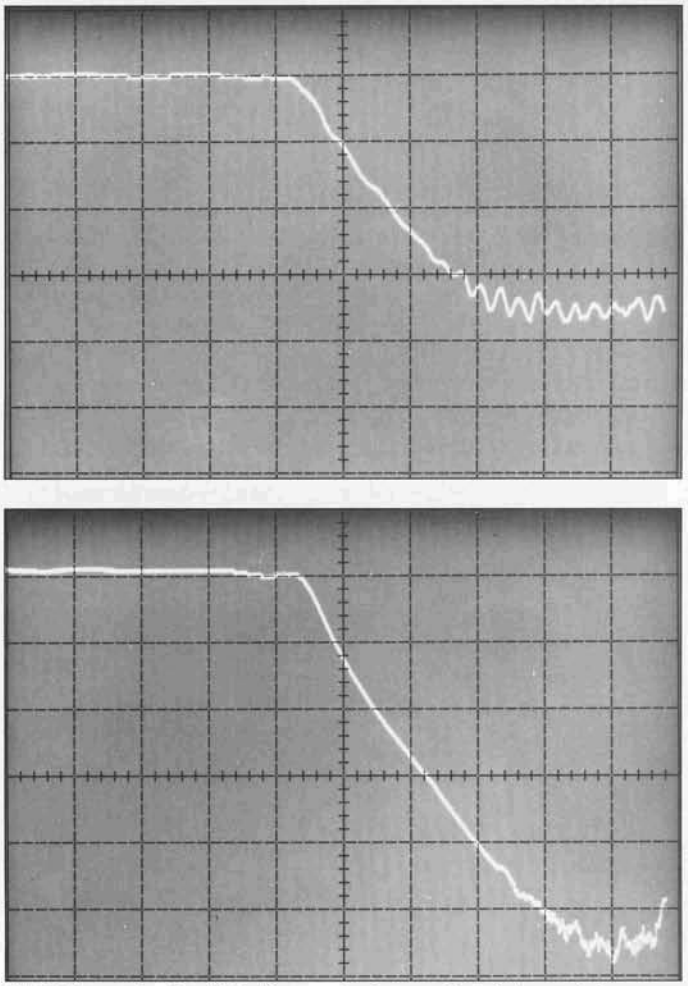
The 6600B Series uses fundamental oscillators over the 2 to 26.5 GHz range because they deliver the purest, most accurate signals. Four aspects of their performance contribute to accurate measurements:

- **Harmonic Content.** The troublesome subharmonics of multiplier-type sweep generators don't exist.
- **Residual FM.** Without a multiplier, residual FM is not degraded by the multiplication factor. Residual FM in CW or narrow-band mode is less than 10 kHz peak up to 20 GHz.
- **Frequency Accuracy.** CW accuracy is ±10 MHz over the full 10 MHz to 20 GHz range.
- **Output Flatness.** Since there is no tracking filter required to take out unwanted multiplier responses, the output level does not vary with sweep speed.

Low Harmonics

Harmonic content can cause large errors in the measurement of reflection and transmission. The photographs below show test results when a competitor's multiplier-type sweeper (A) and a Wiltron fundamental oscillator sweeper (B) are used to make the same measurement. Photograph (A) shows the effect of multiplier subharmonics from a 2–7 GHz oscillator on test results above 7 GHz. With a clean signal from its fundamental oscillator, the Wiltron 6659B shows in (B) a 20 dB improvement in dynamic range. This is a result of the 40 dB (typically 55 dB above 4 GHz) harmonic suppression of the 6659B, a vast improvement over the 25 dB specification of the sweeper shown in (A). Spurious signals are better than –60 dBc for all models between 2 and 60 GHz—one more reason why the 6600B is the preferred signal source for precise microwave measurements.

Harmonics can also introduce significant uncertainty when measuring power levels. For example, with the Wiltron specified harmonic level of <–40 dBc, the measurement uncertainty due to detection of harmonics is less than ±0.2 dB. In contrast, multplier-type sweepers with a specification of <–25 dBc can have as much as ±0.7 dB uncertainty.



(A) Subharmonics of multiplied frequencies in competitor's instrument give erroneous indication of response outside filter passband. (B) Clean signals from fundamental oscillators of 6600B Sweep Generator show that actual response of the filter is 20 dB better than that measured in (A).

Sweep Generators

Alternate Stored-Setup Sweep

In some applications, test times can be cut in half by simultaneously displaying two traces of characteristics over different frequency and/or power ranges. For example, with a simultaneous display of amplifier reflection and output power, you can adjust the amplifier for optimum balance of the two without changing the test setup. Similarly, the broadband rejection characteristics and the narrow passband response of a filter can be observed simultaneously. The time saved in avoiding sequential tests with two sets of test parameters is substantial.

Phase Lock

When resolution greater than 100 kHz is required, the 6600B can be phase locked to an external source. When phase locked to a frequency counter, accuracies of ±10 Hz or better can be achieved. Here is one more way the 6600B Series improves measurement accuracy and meets the needs of applications which formerly required a signal generator or synthesizer.

Exceptional Source Match

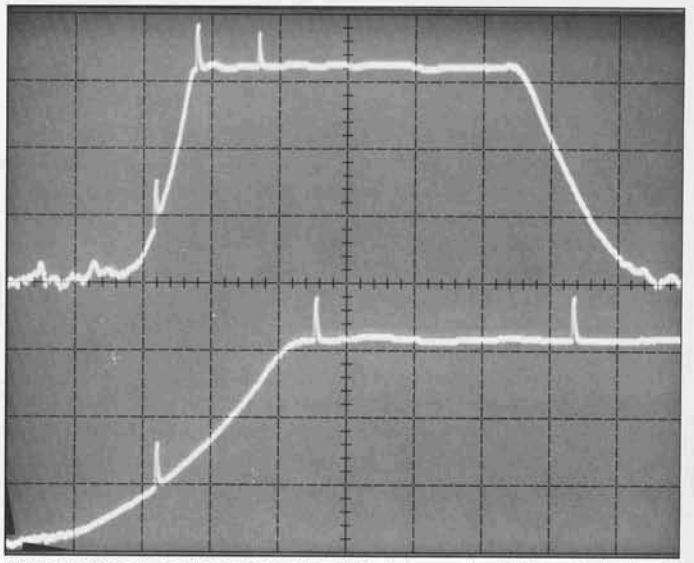
A poor source impedance match can introduce significant errors in test results. Energy reflected from the mismatch causes uncertainty in return loss and transmission measurements. This error is minimized by the exceptionally good source match of the 6600B. In the 6637B, for example, source SWR is 1.5 from 2 to 20 GHz. These values compare very favorably to the 1.9 SWR above 2 GHz specified for a competitor's unit. When a 10 dB return loss measurement is made on the competitor's unit, the uncertainty is 1.7 dB. In contrast, the 6600B sweeper with a source match of 1.5 SWR holds uncertainty to 1 dB, an improvement of 0.7 dB.

Frequency Vernier

The FREQUENCY VERNIER controls can be used to increase frequency accuracy in the CW and ΔF mode. While monitoring the output with a counter, you simply press the INCREASE and DECREASE buttons until the desired frequency is obtained. Subsequent requests for frequency include the correction.

Complete Programmability

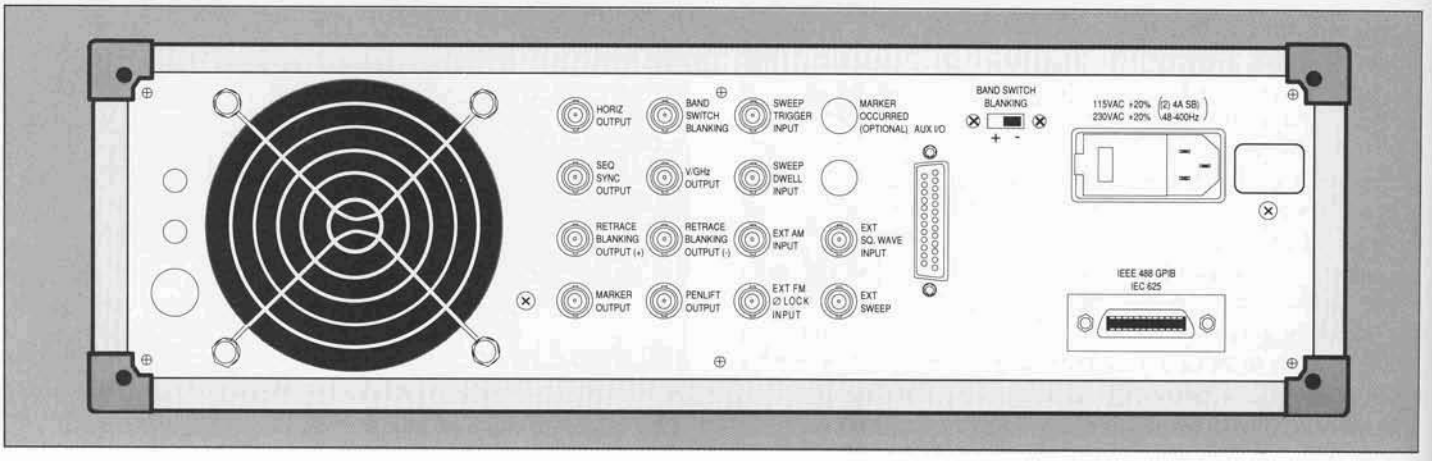
Every measurement parameter can be controlled over the standard GPIB (IEEE–488) by descriptive commands that make the 6600B compatible with every computer or controller. In addition, special interfaces are included to ensure compatibility with every available network analyzer. With complete programmability, the 6600B works smoothly in interactive, real-time systems. Parallel poll, serial poll, service request (SRQ), and group execute trigger provide programming flexibility to achieve optimum test sequencing, timing, and control. A local lock-out command protects the system against errors that might be inadvertently introduced by operating the front-panel controls.



Alternate Sweep mode sweeps alternately between two independent selected frequency ranges: 2–12.4 GHz for the top trace, 3–5 GHz for the bottom trace.

Self-Test

The 6600B Series features a self-test that allows you to diagnose problems and return the unit to service with a minimum of down-time. When the self-test is initiated, remotely or from the front panel, up to 25 error codes are available on the front panel LED readouts. The error codes direct the repair technician to the module(s) that needs service. These error codes are completely documented in the 6600B Service Manual so that the repair technician can proceed from an error code to at least a board level solution, often to component level. When self-test is initiated remotely, the 6600B supplies a pass or fail indication over the bus. The self-test is an independent function and does not disrupt previous front-panel settings.



Sweep Generators

General Specifications

FREQUENCY

Frequency Range: 10 MHz to 60 GHz in 30 models. Please see pages 96 and 97.

Frequency Control:

Full: Sweeps upward across the complete frequency range.
F1–F2: Sweeps from F1 to F2, entered independently on keypad or control knob. F2 must be greater than F1.
M1–M2: Sweeps from M1 to M2 markers, entered independently on keypad or control knob. M2 must be greater than M1.
ΔF: Sweeps upward symmetrically about CF or M1. Sweep width is adjustable on keypad or control knob in MHz or GHz.
CW: Single frequency at CF, F1, F2, M1, and M2, entered independently on keypad or control knob.
Frequency Vernier: Fine adjustment of frequency in CW and ΔF modes up to ±12.7 MHz for models with specified frequency accuracies of <±10 MHz. A new correction in frequency can be made with the control knob. Correction applies until released with Off button or the frequency is changed. ACTIVE light is on whenever a vernier adjustment is in use.
Manual: Continuous manual adjustment of frequency between sweep limits in every sweep mode. Can be used to set recorder.

CW Filter Enable/Disable:

Enabled: Filter inserted for CW mode and sweep widths ≤50 MHz. Shift key function.
Disabled: Filter removed for all modes of operation.

Frequency Stability:

For Models With Upper Frequency Limit (GHz)	With Time (10 Minutes, Typical[1]) (kHz)	With 10% Line Voltage Change (kHz)
≤26.5	±200	±100
26.5 to 40	±400	±200
40 to 60	±600	±300

[1]After 30 minutes warmup at selected CW frequency.

Frequency Resolution:

Normal: 1 MHz
Frequency Vernier: 100 kHz on ±12.7 MHz range, 200 kHz on ±25 MHz range, 300 kHz on ±37.5 MHz range.
Step Sweep: 4096 programmable points

Frequency Accuracy: Please see pages 96 and 97.

MARKERS

Marker Selection: Eight markers at M1 through M8, entered independently on keypad or control knob in MHz or GHz.
Accuracy: Same as frequency accuracy. Please see page 96.
Resolution: 0.4% of sweep width
Display: Front-panel pushbuttons select one of three marker modes:
Video:* Positive video pulse, 0 to +5 volts, TTL-compatible, adjustable with MARKER CONTROL. 1KΩ impedance, rear panel BNC connector.
RF:* Up to 5 dB attenuated RF level at marker frequency, adjustable with MARKER CONTROL.
Intensity: Intensified dot on trace, obtained by momentary dwell in sweep.
*Amplitude of video and RF marker increases twofold when single marker is selected.

SWEEP AND TRIGGERING

Alternate Stored Setup: Sweeps alternately between the current front-panel setup and one of nine stored setups.
Sweep Triggering:
Auto: Triggers sweep automatically.
Line: Triggers sweep from power line frequency.
External: Triggers sweep from externally applied 4 to 25 Vpk or TTL-compatible pulse with >1 μs width and >5 μs fall time. Rear panel BNC connector.
Single: EXT OR SINGLE SWEEP selects mode, triggers, aborts, and resets single sweep.
Sweep Time: Adjustable from approximately 0.01 to 99 s. Entered on keypad or control knob in ms or s.

Retrace RF: Front panel pushbutton activates RF power during retrace.

Horizontal Output: 0 to 10V ramp coincident with sweep in all sweep modes. In CW mode, output voltage varies in proportion to frequency, 0V at 0 GHz and 10V at upper frequency limit. In shift key CW RAMP mode voltage varies from 0 to 10V between sweep limits. Rear panel BNC connector.

Sequential Sync Output: +5V TTL-compatible pulse occurring at oscillator bandswitching points and during sweep retrace. –5V occurring at markers, –10V at selected marker. Rear panel BNC connector.

Retrace Blanking (–) Output: –5V pulse occurring during sweep retrace. Rear panel BNC connector. <100Ω impedance.

Retrace Blanking (+) Output: +5V TTL-compatible pulse occurring during sweep retrace. Rear panel BNC connector.

Bandswitching Blanking Output: ±5V pulse occurring during oscillator bandswitching points. Polarity selected on rear panel switch. Rear panel BNC connector. <100Ω impedance.

V/GHz: Reference voltage varying in proportion to output frequency as shown in the table below. Rear panel BNC. 100Ω impedance.

For Models With Upper Frequency Limit (GHz)	V/GHz Output (V/GHz)
≤20	1.00
20 to 40	0.50
40 to 60	0.33

Penlift Output: Normally open relay contacts for lifting recorder pen during sweep retrace. Internal jumper can be installed to provide normally closed contacts. Rear panel BNC connector.

Sweep Dwell Input: Low true TTL-compatible pulse causes frequency sweep to stop. Can be used to count marker frequencies with an external counter and Frequency Counter Interface output, Option 13.

External Sweep Input: Externally applied 0 to 10V ramp sweeps frequency between selected sweep limits. Rear panel BNC connector. 10KΩ impedance. Front-panel control.

POWER SWEEP AND LEVELING

Leveling:

Internal: Levels output power at front-panel connector. Please see pages 96 and 97 for power variation specifications. Not available on 6672B.
External Detector: Levels output power at remote test position where directional detector samples RF power and provides a positive or negative polarity detected signal of 5 mV to 500 mV to front-panel BNC connector. Front-panel ALC control adjusts input signal level to optimum value.
Power Meter: Levels output power at remote test position where a power meter samples RF power and provides a ±1V full scale video signal to front-panel BNC connector. Front-panel ALC gain control adjusts input signal level to optimum value.
Unleveled Indicator: Lights when ouput is insufficient to maintain leveling across the selected sweep range.

Power Sweep: Sweeps over up to 15 dB range, entered on keypad or control knob. Option 2 Attenuator offsets sweep range in 10 dB steps over 70 dB range.

Attenuator: Option 2 adds a 10 dB attenuator with a 70 dB range. Please see pages 96 and 97 for accuracy specifications.

RF Slope Control: Adjusts slope of leveled output power by increasing power at the higher frequencies to compensate for frequency dependent cable losses in test setup.

6600B Sweep Generators

General Specifications

Model	Frequency Range (GHz)	Output Power (25°C ±5°C)		Power Level Accuracy			Leveled Power Variation		Source SWR (Leveled Power)
		Internally Leveled Maximum (mW)	With Opt. 2, 70 dB Attenuator (mW)	Leveled (dB)	With Opt. 2, 70 dB Attenuator (dB)	Attenuator Accuracy Per Step Add (dB)	With Frequency (dB)	With Frequency Opt. 2, 70 dB Attenuator (dB)	
6669B	0.01 to 40	>3.1	>1.5	±2	±2.5	±1	±1.5	±2	1.5 (≤20 GHz) 1.7 (>20 GHz) 2 (>26.5 GHz)
6659B	0.01 to 26.5	>10 (≤18 GHz) >5 (>18 GHz)	>5 (≤18 GHz) >2 (>18 GHz)	±1.5	±2.0	±0.7	±1.0	±1.5	1.5 (≤20 GHz) 1.7 (>20 GHz)
6647B 6647B-40	0.01 to 20	>10 >40	>6.6 >26.3	±1	±1.5	±0.4	±0.6	±1.5	1.5
6622B 6622B-40	0.01 to 12.4	>10 >40	>7.4 >29.5	±1	±1.5	±0.4	±0.5	±1.4	1.5
6617B 6617B-40	0.01 to 8	>10 >40	>7.9 >31.6	±0.9	±1	±0.4	±0.5	±1	1.5
6609B 6609B-50	0.01 to 2	>20 >50	>17.8 >44.5	±0.6	±0.8	±0.3	±0.3	±0.8	1.3
6616B	1.7 to 4.3	>10	>7.8	±1	±1.5	±0.4	±0.4	±0.7	1.2
6663B	2 to 40	>3.1	>1.5	±2	±2.5	±1	±1.5	±2	1.5 (≤20 GHz) 1.7 (>20 GHz) 2 (>26.5 GHz)
6653B	2 to 26.5	>10 (≤18 GHz) >5 (>18 GHz)	>5 (≤18 GHz) >2 (>18 GHz)	±1.5	±2.0	±0.7	±1.0	±1.5	1.5 (≤20 GHz) 1.7 (>20 GHz)
6637B 6637B-40	2 to 20	>10 >40	>6.6 >26.3	±1	±1.5	±0.4	±0.5	±1.5	1.5
6621B 6621B-40	2 to 12.4	>10 >40	>7.4 >29.5	±1	±1.5	±0.4	±0.5	±1.4	1.5
6619B 6619B-40	2 to 8	>10 >40	>7.9 >31.6	±1	±1.5	±0.4	±0.4	±0.9	1.5
6628B 6628B-50	8 to 12.4	>10 >50	>7.4 >37.2	±1	±1.5	±0.4	±0.4	±0.9	1.5
6629B 6629B-40	8 to 20	>10 >40	>6.6 >26.3	±1	±1.5	±0.4	±0.5	±1.5	1.5
6631B	10 to 15.5	>10	>7	±1	±1.5	±0.4	±0.4	±0.9	1.5
6630B 6630B-50	12.4 to 20	>10 >50	>6.6 >33.9	±1	±1.5	±0.4	±0.5	±1	1.5
6660B	12.4 to 40	>3.1	>2	±2	±2.5	±1	±1.5	±2	1.5 (≤20 GHz) 1.7 (20-26.5 GHz) 2 (>26.5 GHz)
6636B	18 to 26.5	>3.1	>1.2	±1	±3	±0.7	±1	±2.5	1.7
6640B-10	26.5 to 40	>10	>5	±1	±2	±1	±1	±2	2.0
6672B	40 to 60	>1①	N/A	N/A	N/A	N/A	N/A	N/A	N/A

①External leveling only ②Excluding 5% band edges where specification is >20 dBc ③Measured in 30 Hz-15 kHz bandwidth ④Subharmonics ⑤At 25°C

6600B Sweep Generators

Source SWR With Opt., 2 70 dB Attenuator	Signal Purity			Frequency Accuracy[3]		Frequency Stability			Model
	Harmonics[6] (dBc)	Non-Harmonics[6] (dBc)	Residual FM[2] (kHz peak)	Cw Mode (MHz)	Sweep Mode ≤50 MHz (MHz)	With Temperature (MHz/°C)	With 10 dB Power Level Change (kHz)	With 3:1 Load SWR (kHz)	
1.4 (≤18 GHz) 1.5 (>18-26.5 GHz) 2.0 (>26.5 GHz)	<–30 (<2 GHz) <–40 (2-26.5 GHz) <–30 (>26.5 GHz)[2]	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (<8 GHz) <10 (8-18 GHz) <15 (18-26.5 GHz <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±500	±300	6669B
1.4 (≤18 GHz) 1.5 (>18 GHz)	<–30 (≤2 GHz) <–40 (>2.0 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (<8 GHz) <10 (8-18 GHz) <15 (>18.0 GHz)	±20	±30	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300	6659B
1.4 (≤18 GHz) 1.5 (>18 GHz)	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (≤8 GHz) <10 (>8 GHz)	±10	±15	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300	6647B 6647B-40
1.5	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7 (≤8 GHz) <10 (>8 GHz)	±10	±15	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300	6622B 6622B-40
1.5	<–30 (≤2 GHz) <–40 (>2 GHz) <–20 (≤2 GHz) <–25 (>2 GHz)	<–40 (≤2 GHz) <–60 (>2 GHz)	<7	±5	±10	±1 (≤2 GHz) ±0.5 (>2 GHz)	±100	±100	6617B 6617B-40
1.5	<–30 <–20	<–40	<7	±5	±10	±1	±100	±100	6609B 6609B-50
1.5	<–20 (<2.26 GHz) <–30 (≥2.26 GHz)	<–60	<7	±10	±15	±0.5	±500	±300	6616B
1.4 (≤18 GHz) 1.5 (>18-26.5 GHz) 2.0 (>26.5 GHz)	<–40 (2-26.5 GHz) <–30 (>26.5 GHz)[2]	<–60	<7 (<8 GHz) <10 (8-18 GHz) <15 (18-26.5 GHz <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±500	±300	6663B
1.4 (≤18 GHz) 1.5 (>18 GHz)	<–40	<–60	<7 (<8 GHz) <10 (8-18 GHz) <15 (>18 GHz	±20	±30	±1	±500	±300	6653B
1.4 (≤18 GHz) 1.5 (>18 GHz)	<–40 <–25	<–60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300	6637B 6637B-40
1.4	<–40	<–60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300	6621B 6621B-40
1.5	<–40 <–25	<–60	<7	±10	±15	±0.5	±100	±100	6619B 6619B-40
1.5	<–40	<–60	<10	±10	±15	±0.5	±500	±300	6628B 6628B-50
1.4 (≤18 GHz) 1.5 (>18 GHz)	<–40 <–25	<–60	<10	±10	±15	±0.5	±500	±300	6629B 6629B-40
1.5	<–40	<–60	<10	±10	±15	±0.5	±500	±300	6631B
1.5	<40	<–60	<10	±10	±15	±0.5	±500	±300	6630B 6630B-50
1.4 (≤18 GHz) 1.5 (>18-26.5 GHz) 2.0 (>26.5 GHz)	<–40 (≤26.5 GHz) <–30 (>26.5 GHz)[2]	<–60	<10 (<18 GHz) <15 (18-26.5 GHz) <20 (>26.5 GHz)	±20	±30	±1 (≤26.5 GHz) ±2 (>26.5 GHz)	±300	±300	6660B
1.5	<–40	<–60	<20	±15	±25	±2	±500	±300	6636B
2.0	<–30[2]	<–60	<30	±20	±30	±2	±500	±300	6640B-10
N/A	<–20[4]	<–60	<50	±30	±45	±3	N/A	±300	6672B

[6] At rated power

Sweep Generators

General Specifications

MODULATION

External AM Input: Rear panel BNC connector. 10 KΩ impedance.
Sensitivity: 1 dB/V
Frequency Response (typical): DC–50 kHz
Input Impedance: 10 KΩ
Amplitude Control Range: 13 dB
Maximum Input: 20V
External FM and Phase-Lock Input: Rear panel BNC connector. 10 KΩ impedance.
Sensitivity: –6 MHz/V
Maximum Deviation for Modulation Frequency of:
DC–100 kHz: ±25 MHz
100–250 kHz: ±5 MHz
External Square Wave Input: Externally applied TTL-compatible square wave modulates output at dc to 50 kHz rate. Will accommodate ±6V square wave. On/Off ratio, typically 40 dB.
Maximum Input: ±20 volts.
Rear panel BNC connector.
Order Option 11 for 6616B, 6619B 6619B–40, 6628B, 6628B–50, 6630B, 6630B–50, 6631B, 6636B, 6640B-10, and 6672B. Standard on all others.

INSTRUMENT STATUS

GPIB Indicators: LED lights indicate the following conditions:
Remote: Operating on GPIB
Talk: Talking on GPIB
Listen: Listening on GPIB
SRQ: Sending a service request
Local Lockout: Disabling the RETURN TO LOCAL pushbutton. The instrument can be placed in local mode only via GPIB.
Nonvolatile Memory: Retains front-panel control settings in memory for up to 10 years. Whenever instrument is turned on, control settings come on at the same functions and values existing when power was removed.
Self-Test: Performs self-test every time power is applied or when SELF TEST pushbutton is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.

GENERAL

Test Setup Storage: Stores nine test setups for recall during normal or Alternate Stored Setup modes.
Continuous Control: Knob provides smooth, continuous control of frequency, sweep time, and power.
Front Panel Security: Blanks LEDs to secure test parameters.
Power Variation With Temperature: ±0.08 dB/°C. Not applicable to units with external leveling only.
Residual AM (30 kHz bandwidth): 50 dBc. Not applicable to units with external leveling only.
Output Connector: Type N female all models except:
Models 6636B, 6653B, 6659B, 6660B, 6663B, 6669B and 6640B-10: Ruggedized K Connector® female.
Model 6672B: WR19 Waveguide (UG–383/U Flange)
Test Parameter Data Entry: Frequency sweep time and power level are entered on keypad with up to 5 digit resolution or on continuous control knob. Entry is terminated by pressing appropriate unit (MHz, dB, mS, or GHz) pushbutton. Entry errors are cleared by pressing CLEAR ENTRY.
Reset Control: Returns controls to following conditions:
Frequency Range: Full
Trigger: Auto
Markers: M1 and M2 only on
RF: On
Level: Specified power level
Leveling: Internal
Sweep Time: 50 ms
CW, Marker, ΔF Frequencies: Varies with model number.
Shift Key: Activates dual function controls:

CW RAMP (horizontal output ramp)
CW FILTER (CW filter enable/disable)
DISPLAY OFF (blanks front-panel LEDs)
FULL (Blanks frequency display)
POWER SWEEP (sweeps output power)
EXTERNAL SWEEP (external sweep input)
RETURN TO LOCAL (address selection)
SELECTED MARKER OFF (removal of all markers).

Warranties: Two years on YIG oscillators, one year on instruments.
Dimensions: 133 H x 432 W x 476 D mm
(5.25 H x 17 W x 18.75 D in.)
Weight: 16 kg (35.4 lb.) maximum
Input Power: 90-130 V or 180-240 V, 50-400 Hz, 250 VA maximum
Operating Temperature Range: 0 to 55°C

Ordering Information

Frequency Ranges: Please see pages 96 and 97.
Options:
Rack Mounting, Option 1: Unit supplied with mounting ears and chassis track slide (90° tilt)
Attenuator, Option 2: Adds 10 dB step attenuator with 70 dB range. Output power is selected on keypad or control knob directly in dBm over an 82 dB range.

For Models With Upper Frequency Limit (GHz)	Order
≤20	Option 2A
26.5	Option 2B
40	Option 2C

Rear Panel RF Output, Option 9: Option 9S adds SMA female and Option 9N adds Type N female rear-panel RF output connector and deletes front-panel RF connector, degrading output power (typically 1 dB at 20 GHz), source SWR (typically 2 at >8 GHz), and power variation. Not available on units with upper frequency above 26.5 GHz
Auxiliary Rear Panel RF Connector, Option 10: Adds SMA female connector to rear panel, providing an attenuated (approximately –15 to –25 dB) sample of the reduced RF output signal (typically 1.5 dB ≤20 GHz; 2 dB, >20 GHz).
External Square Wave Input, Option 11: Adds rear-panel BNC connector for externally applied TTL-compatible signal which modulates RF at rates from dc to 50 kHz. On/Off ratio, typically 40 dB. Maximum input, ±20 volts. Accommodates ±6V square wave. Order for 6616B, 6619B, 6619B–40, 6628B, 6628B–50, 6630B, 6630B–50, 6631B, 6636B, 6640B-10, and 6672B. Standard on all others.
Auxiliary Rear Panel RF Connector, Option 12: Adds SMA female connector to rear panel, providing an RF sample that is approximately 10 dB below output power.

Frequency Range (GHz)	Order
2 to 20	Option 12A
2 to 26.5	Option 12B

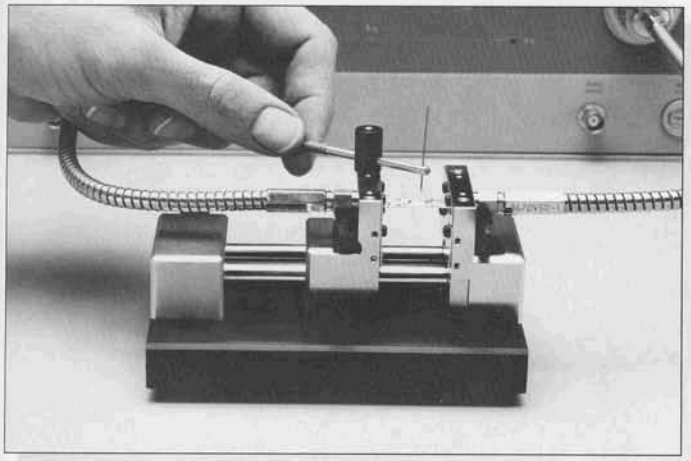
Frequency Counter Interface, Option 13: Adds rear panel BNC connector to provide interface with HP 5343A counter for counting marker frequencies

Extender Board 660-D-8062–3

Transit Case 760-115

6600B/3 GPIB Retrofit Kit Provides field upgrade of GPIB interface to Model 6600B units not originally equipped with GPIB

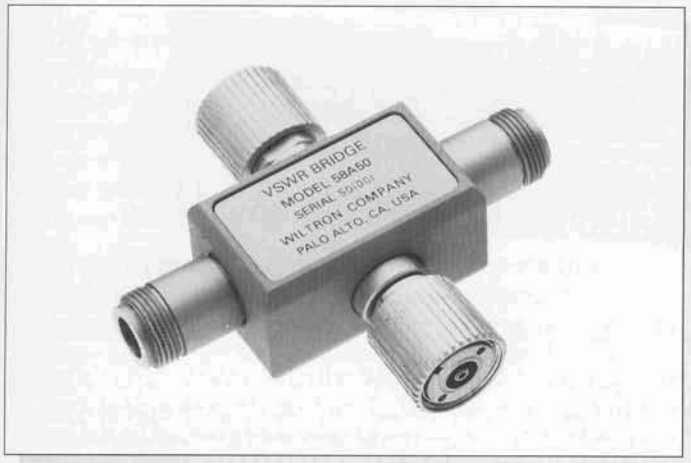
Precision Measurement Components – Overview



The Wiltron Universal Test Fixture (UTF) was designed to provide a solution to measurements of unconnectorized substrates. Accurate, repeatable measurements can be made on microstrip and coplanar waveguide with thicknesses up to 75 mils. Wiltron offers three models covering different frequency ranges:

DC to 20 GHz with APC 3.5 connectors,
DC to 40 GHz with the Wiltron K connector,
DC to 60 GHz with the Wiltron V connector

See page 102



Wiltron SWR Autotesters and Bridges offer high directivity over a broad range of frequencies. These precision components come with an assortment of test port connector options to allow maximum versatility. You get big performance in a small package.

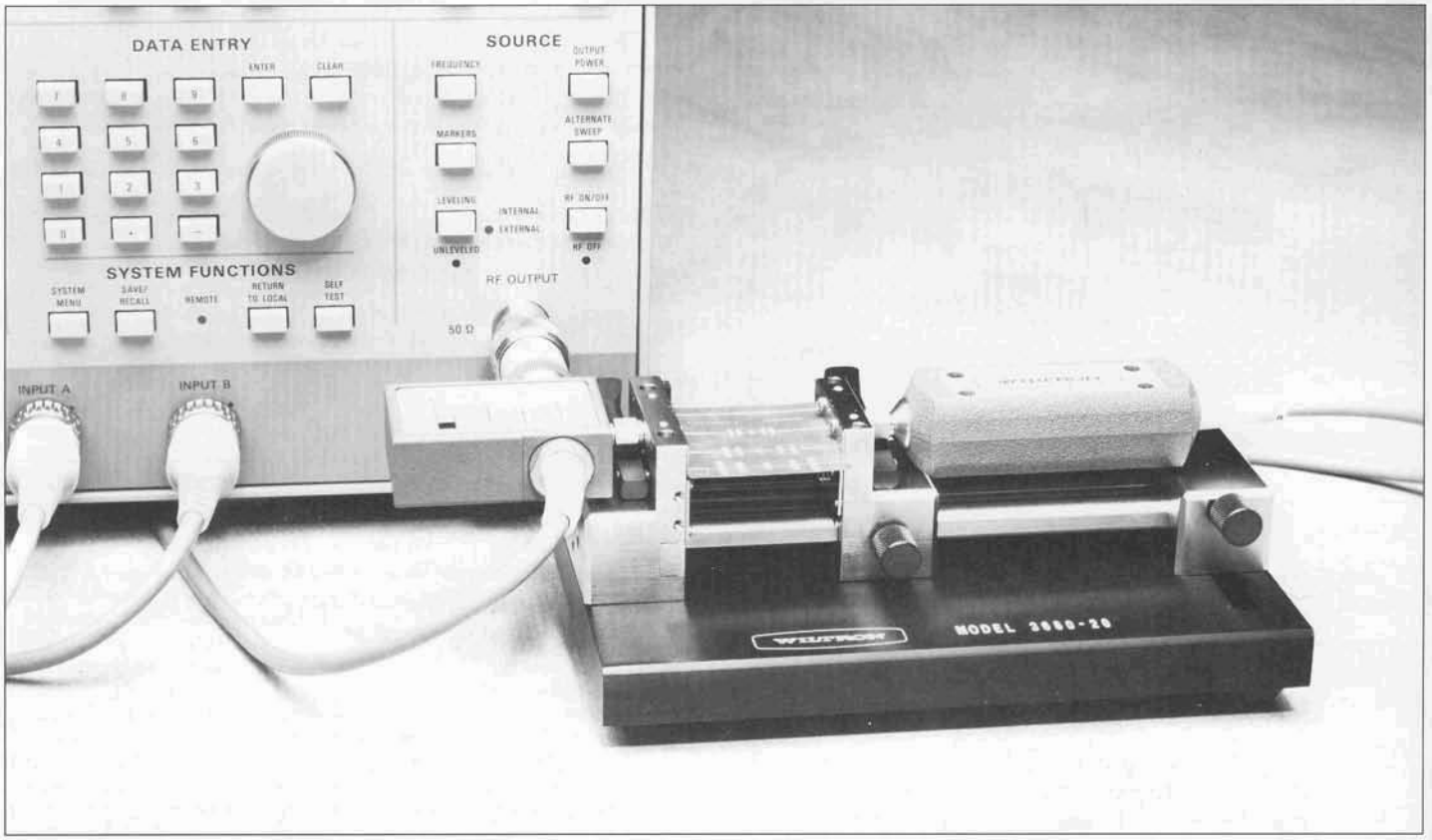
See page 104

Wiltron airlines are known throughout the world as a premier impedance standard. Many countries use them as their standard for 50 ohms. These airlines have a beadless end to provide a minimum reflection connection for the greatest test port return loss.

See page 106

Precision Measurement Components

General Information



Precision Components—Precision Measurements

This section of the catalog describes a complete line of precision components which can be used with the Model 562 Scalar Network Analyzer (page 64), 560A Scalar Network Analyzer (page 70) and the Model 5400 RF Analyzer (page 50) or other instruments to provide the most accurate measurements.

SWR Autotesters and Bridges

SWR Autotesters and SWR Bridges are directional measurement devices that separate the incident and the reflected signals of a device under test. The reflected component can then be compared to the incident signal to determine the difference between the device's impedance and its characteristic impedance.

The directivity of the SWR Autotester or bridge is the measure of how well the incident and reflected signals can be separated. For example, 40 dB directivity means that the error signal in the output is 40 dB below the reflected signal to be measured. This error signal is present regardless of the reflected signal magnitude; therefore, the smaller the reflected signal being measured, the greater the potential error introduced by directivity. When using a device with 40 dB directivity to make a 20 dB return loss measurement, the uncertainty, or possible error due to directivity, is +0.8279 dB to –0.9151 dB. If the measured return loss is 30 dB, the uncertainty increases to +2.3866 dB to –3.3018 dB or a total of 5.6884 dB.

The RF Measurement Chart inside the front cover can be used to determine the uncertainty due to directivity. The "X dB Below Reference" column represents the difference between the directivity and the measured reflection (return loss). The "1 + X dB" and "1 – X dB" values are the algebraic sum of the error signal and the measured reflected signal as their phase relationship varies over 360°. Therefore, the peak-to-peak ripple (1 ± X) is the total measurement uncertainty caused by the error signal. If the error and directivity signals are equal, 1 + X dB equals 6 dB (voltage doubled causes 6 dB change) and 1 – X dB becomes infinite, since the two signals are equal in amplitude and 180° out of phase (zero voltage). Uncertainty curves (next page) show the measurement uncertainty with a 35 dB directional device.

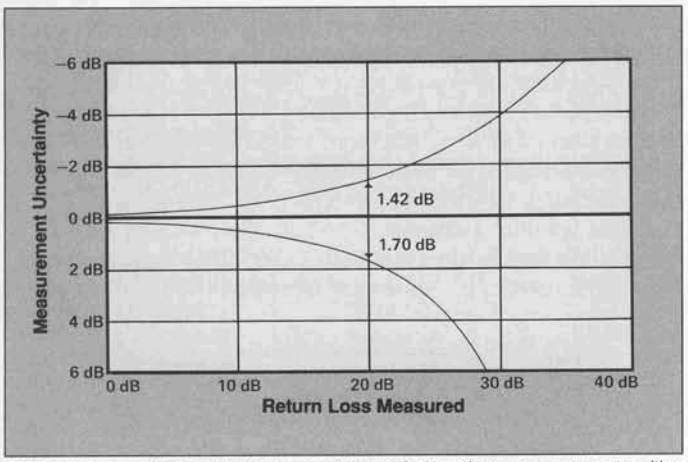
It is clear that high directivity is a very important consideration when selecting a directional device for reflection measurements. Equally important is that the device under test be connected directly to the test port of the SWR Autotester or bridge. An adapter inserted between the test device and the test port decreases the effective directivity.

To avoid the use of adapters, Wiltron offers SWR Autotesters and SWR Bridges with all common connector types, male and female interfaces.

RF Detectors

Just as directivity is the principal error contributor in reflection measurements, the impedance match of the signal source and RF detector is the largest error contributor in transmission measurements.

Wiltron offers a complete line of coaxial RF detectors covering from 100 kHz to 40 GHz with the lowest SWR available. The excellent impedance match of the detectors, along with that of the test port on the SWR Autotesters and bridges, minimize errors when making simultaneous transmission and reflection measurements.



These curves show measurement uncertainty of return loss measurements with a directional device having 35 dB directivity (test port match not included).

The principal error signals present in a transmission measurement are shown to the right. Typically, when Wiltron measurement components are used in transmission measurements, the uncertainty of a 20 dB to 30 dB insertion loss measurement is ±0.2 dB to ±0.4 dB. If RF detectors and sources with high SWR are substituted, the uncertainty can easily exceed ±1.0 dB.

Precision Terminations, Air Lines, and Adapters

Wiltron is recognized as the leader in the field of impedance standards. Our complete line of components includes terminations and air lines. Not only do these products increase measurement accuracy, they also provide the only method of certifying the performance of SWR Autotesters, bridges, directional couplers, terminations, and other devices.

A series of precision measurement adapters are available to adapt one connector type to another. Adapters can be a major source of measurement error and, therefore, must be carefully selected. Wiltron precision adapters typically have 6 dB better return loss than competitive units.

Our current 35K Series Waveguide-to-Coax Adapters use the Wiltron K Connector® for full SMA compatibility with extended coaxial frequency range to 46 GHz. The 35V Series V Connector® adapters extend the coaxial frequency range to 60 GHz with full 2.4 mm connector compatability.

Model 41K and 41V Series Precision Attenuators

As discussed above, the SWR of the source and RF detector is very important in minimizing transmission measurement errors. One of the simplest ways to improve impedance match is to insert a precision attenuator between the device under test and the source or RF detector. The 41K and 41V Series attenuators are specifically designed for such applications where accuracy is a basic requirement.

In addition to being available as individual units of 3, 6, 10, or 20 dB, the 41K and 41V Series Fixed Attenuators are also available in sets with calibration data. Available frequency ranges cover dc to 18 GHz, 26.5 GHz, 40 GHz, or 60 GHz.

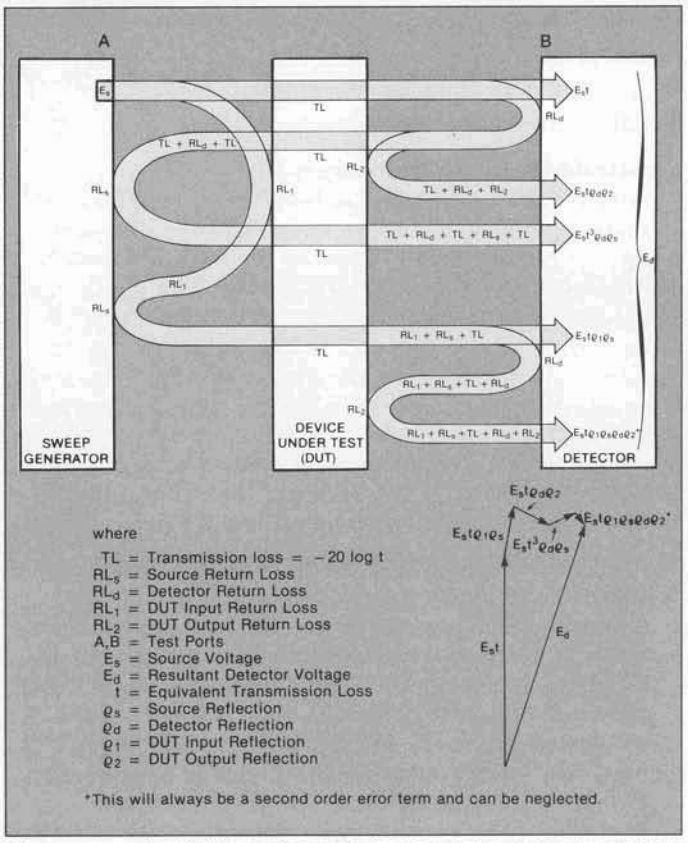
Model 43K Series Fixed Attenuators

Many other attenuator applications have as their principal objective the reduction of power. Since the attenuator might not be inserted at a measurement point, the measurement precision discussed earlier is not required. In such a power-reducing system application, attenuators are often required in large quantities, making price an important consideration. The 43K Series includes models covering dc to 18 GHz, dc to 26.5 GHz, and dc to 40 GHz. All are available with 3, 6, 10, or 20 dB attenuation values. All have the Wiltron K Connectors and are compatible with SMA connectors.

Whatever your fixed attenuator needs might be, Wiltron provides the solution.

Power Dividers

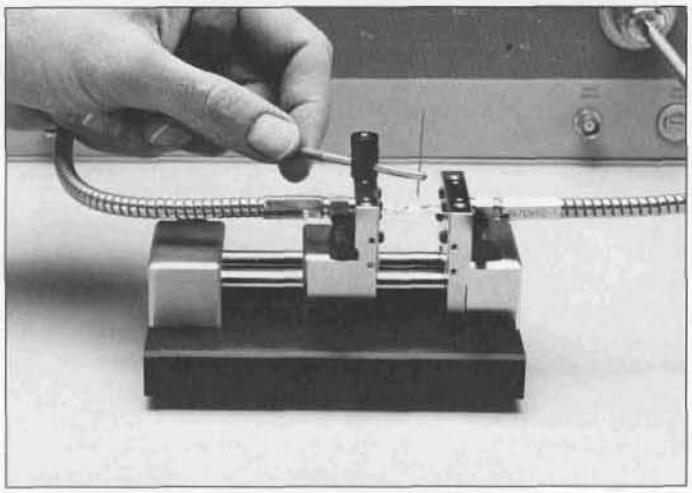
The Wiltron K240C is the first power divider to operate from dc to 40 GHz. In addition, there is the Model K240B for the dc to 26.5 GHz range. Both models use the Wiltron K Connector on all ports.



The accuracy with which transmission loss is measured is affected by reflections and re-reflections from the source, DUT input, DUT output, and detector mismatches. The value of the total measurement uncertainty is dependent on the magnitude and phase relationship of the signals shown.

Universal Test Fixtures

3680 Series, DC to 60 GHz



3680 Universal Test Fixture Highlights

- *DC to 60 GHz Coverage*
- *Microstrip and Coplanar Measurement Capability*
- *Accommodates Offset and Right-Angle Test Devices*
- *Calibration/Verification Kits (Optional)*

Substrate Measurement Capability

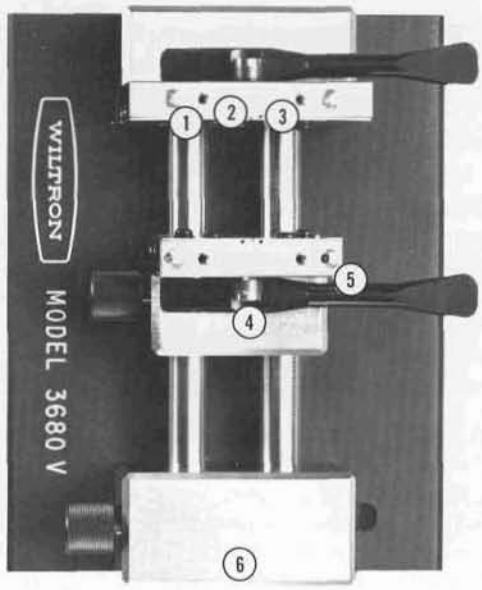
Wiltron 3680 Series Universal Test Fixtures provide an accurate, repeatable solution for measuring microstrip and coplanar substrate devices. Input and output connections are made to the substrate device by two spring-loaded jaws that include coax-to-microstrip/coplanar launchers. The jaws accommodate substrates from 5 to 75 mils in thickness. No center section is required. One jaw is movable in two dimensions to accommodate substrates up to 2 inches long (4 inches for 3680-20) and substrates with line offsets of up to 1/2 inch (1 inch for 3680-20). The 3680 Series includes three models: the 3680-20 covers DC to 20 GHz with APC-3.5™ connectors, the 3680K covers DC to 40 GHz with Wiltron's K Connector® and the 3680V covers DC to 60 GHz with Wiltron's V Connector®.

A Complete Measurement Solution

Wiltron provides everything you need to make accurate vector and scalar network measurements on substrate devices including the 3680 Series Universal Test Fixtures, 36804 Series Calibration/Verification Kits, and a wide range of scalar and vector network analyzers. The 3680 Series includes many optional accessories to allow measurements on a wide variety of devices including MMICs and right-angle substrates. Wiltron specifies the performance of substrate measurements made with the 3680 when it is used with a 360 Vector Network Analyzer or with a 562 Scalar Network Analyzer.

Exceptional Performance and Repeatability

Exceptional return loss of the 3680 launchers provides minimal degradation of measurements. To assure repeatable measurements, the 3680 Series incorporates unique substrate clamping jaws that provide solid, repeatable electrical contact. Repeatability is better than ±0.2 dB to 40 GHz. In addition to the performance of the 3680 Universal Test Fixture, Wiltron's 360B Vector Network Analyzer provides unmatched dynamic range and directivity performance. And, the 360B can compensate for the dispersion of microstrip devices, significantly improving measurement accuracy. This exceptional accuracy is easily transferred to the substrate level with the use of Wiltron's on-substrate Calibration/Verification Kits. These kits provide substrates for both OSL (Open-Short- Load) and LRL (Line-Reflect-Line) calibration techniques, plus a Beatty standard (standard mismatch) and 20 dB offset termination. Verification data is available with these kits to help you ensure the validity of your measurements.



1. *Solid ground contact on substrate top and bottom allow microstrip or coplanar waveguide measurements in the same fixture.*
2. *Spring-loaded jaws provide <0.1 dB repeatibility to 20 GHz on devices having 5 to 75 mil substrate thickness with no fixture modification.*
3. *Dielectric spacers reduce fringing capacitance for more accurate and repeatable measurements.*
4. *Device measurements over any coaxial frequency range can be made: DC to 20 GHz with APC-3.5, DC to 40 GHz with the K connector and DC to 60 GHz with the V connector.*
5. *Adjustible launch measures substrates up to 2 inches long (4 inches with the model 3680-20) without requiring custom center sections.*
6. *Line offset up to ±1/2 inch (1 inch for 3680-20) eliminates the need for custom fixtures.*

MMIC Measurements

With the optional MMIC attachment, you can easily test MMICs and other very small components. The MMIC attachment consists of a center carrier with microstrip lines for launching, and cam-operated pressure rods. The MMIC chip component (on a header) is placed on the center carrier between two microstrip lines. Contact is made with gold tabs pressed down upon the MMIC header by a pressure rod on the MMIC attachment. The cam-actuated pressure rod are progressive—the gold tabs are secured only after the launching substrate is held in place—for improved reliability and damage protection. The unique design of the MMIC attachment assures solid, repeatable measurements on any small device.

Specifications:

3680 Series Universal Test Fixture

Mechanical Specifications:

Substrate Types Supported: Microstrip or Coplanar Waveguide
Overall Size: 4 x 5 x 2.5"
Substrate Length:
0.2" (0.5 cm) min.
2.0" (5 cm) max. – 4.0' (10 cm) with 3680-20
Maximum Substrate Width: No limit
Substrate Thickness:
0.005" (0.012 cm) min.
0.075" (0.17 cm) max.
Maximum Line Offset: ±0.5" (1.2 cm) – ±1" (2.5 cm) with 3680-20
Input and Output Connectors:
3680-20: APC 3.5 Female
3680K: K Connector Female
3680V: V Connector Female

36801 K and V Right-Angle Launcher

Mechanical Specifications:

Distance from In-line Connector, Axial:
Minimum: 0.4" (1 cm)
Maximum: 1.6" (4 cm)
Distance from In-line Connector, Offset:
Minimum: 0.0"
Maximum: 0.8" (2 cm)

36802 MMIC Attachment

Mechanical Specifications:

Substrate Thickness: 0.010", 0.015", 0.025"
Minimum Test Substrate Length: 0.06" (1.5 mm)
Maximum Test Substrate Length: 0.46" (1.17 cm) with std. block
Maximum Line Offset: ±0.5" (1.2 cm)

Electrical Specifications

Model	Universal Test Fixture			Right-Angle Launcher		MMIC Attachment
	3680-20	3680K	3680V	36801K	36801V	36802
Frequency Range (GHz)	DC to 20	DC to 40	DC to 60	DC to 40	DC to 60	DC to 60
Return Loss (dB)						
DC to 20 GHz	>17	>17	>17	>16	>16	>12
20 to 40 GHz		>14	>14	>12	>12	>8
40 to 60 GHz			>8		>7	>6
Repeatability (dB)						
DC to 20 GHz	<±0.10	<±0.10	<±0.10	<±0.15	<±0.15	<±0.20
20 to 40 GHz		<±0.20	<±0.20	<±0.25	<±0.25	<±0.40
40 to 60 GHz			<±0.30		<±0.40	<±0.60

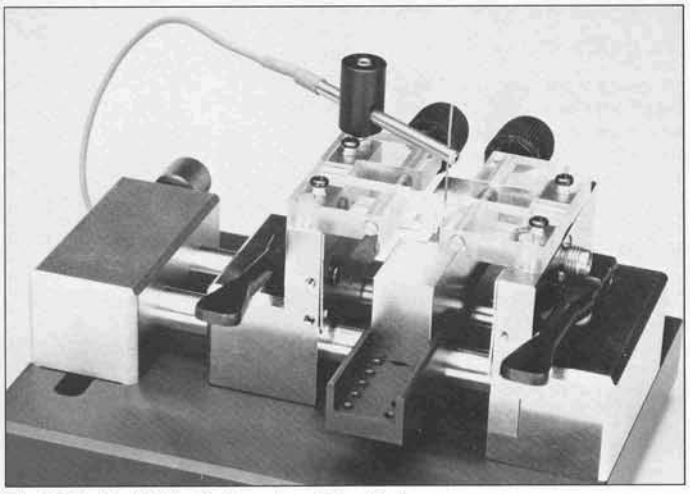
When Used with the Wiltron 360 Vector Network Analyzer

Test Port Characteristics

Test port characteristics apply after standard 12-term calibration, using a Wiltron 36804 cal kit*. (Optimum calibration for frequency.)

Frequency (GHz)	Directivity (dB)	Source Match (dB)	Load Match (dB)	Reflection Frequency Tracking (dB)	Transmission Frequency Tracking (dB)	Isolation (dB typical)
0.04	>36	>34	>36	±0.005	±0.030	>84
1.0	>36	>34	>36	±0.005	±0.050	>100
20	>36	>34	>36	±0.008	±0.050	>90
26.5	>30	>28	>30	±0.008	±0.070	>85
40	>30	>28	>30	±0.008	±0.080	>81
60	>26	>24	>26	±0.010	±0.100	>60

*36804-10M to 60 GHz; 36804-15M to 26.5 GHz; 36804-25M and 36804-25C to 20 GHz



The 3680 with MMIC attachment and Bias Probe

Ordering Information

Universal Test Fixtures:
3680-20 20 GHz Universal Test Fixture
3680K 40 GHz Universal Test Fixture
3680V 60 GHz Universal Test Fixture

Accessories:
36801K 40 GHz Right-Angle Launcher
36801V 60 GHz Right-Angle Launcher
36802 MMIC Attachment
36803 Bias Probe
36805 Series includes (4) Substrate Launchers for the 36802 MMIC Attachment
36805-10M 10 mil Launchers
36805-15M 15 mil Launchers
36805-25M 25 mil Launchers

36804 Calibration/Verification Kits:
36804-10M 10 mil Microstrip Cal/Verif. Kit
36804-15M 15 mil Microstrip Cal/Verif. Kit
36804-25M 25 mil Microstrip Cal/Verif. Kit
36804-25C 25 mil Coplanar Waveguide Cal/Verif. Kit

Verification Data, Option 1: Adds verification data to any of the above kits.

SWR Bridges

Model 58A50 and 87 Series, 2 to 18 GHz

58A50

87A50

58A50 Comparison SWR Bridge Highlights

- *Measurement Capability to 1.006 SWR*
- *Broad 2 to 18 GHz Frequency Range*
- *Compatibility with Ripple Extraction Technique for Accurate SWR Measurements with 57 dB Effective Directivity*
- *Precision GPC–7 Test Port Connector*

When used with an 18A50 Precision Air Line (page 106) and a 29A50–20 Reference Offset Termination (page 107) in the Ripple Extraction test setup described in *Wiltron Technical Review #8*, the 58A50 makes accurate SWR measurements down to 1.006 (50 dB return loss). With an effective directivity of 57 dB, this SWR Bridge is the best choice for accurate measurement of very small reflections over the 2 to 18 GHz range.

Specifications

Frequency Range: 2 to 18 GHz
Directivity: 35 dB
Accuracy:[①②] $0.0014 + 0.01\rho^2$, where ρ is the measured reflection coefficient
Insertion Loss: 6.5 dB nominal[③]
Maximum Input Power: 0.5 W
Test Port Connector: GPC–7
Input and Output Connector: Type N Female
Dimensions: 6.7 x 5.1 x 2.26 cm (2-5/8 x 2 x 7/8 in.) plus connectors
Weight: 340 g (12 oz.)
Model 58A50

Companion Equipment: 18A50 Air Line, 29A50–20 Reference Offset Termination, 560-7 Series Detector, 562 Network Analyzer and 6600B Sweep Generator.

① Including the effects of test port reflections and directivity.
② When used with the Ripple Extraction method *(Wiltron Technical Review #8)*.
③ Typically 9 dB at 18 GHz from input to test port.

87 Broadband SWR Bridge Highlights

- *Broadband 2 to 18 GHz Frequency Range*
- *High 38 dB Directivity*
- *Precise GPC–7 Test Port Connector*
- *Built–In Reference Termination*

The 87 Series SWR Bridges are precision, high directivity measurement components—ideal for SWR and return loss measurements. Both models include a built-in termination and are provided with an overall accuracy equation. These SWR Bridges can be used for making very low-level SWR measurements by amplifying the RF output prior to detection. Since both the phase and amplitude of the reflected signal are preserved in the RF output, these components can also be used to make accurate phase comparisons in a network analyzer system.

Model	Directivity (dB)	Accuracy[①]		
		2 to 3 GHz	3 to 4 GHz	4 to 18 GHz
87A50	35	$0.018 + 0.31\rho^2$	$0.018 + 0.2\rho^2$	$0.018 + 0.12\rho^2$
87A50-1	38	$0.013 + 0.31\rho^2$	$0.013 + 0.2\rho^2$	$0.013 + 0.12\rho^2$

Specifications

Frequency Range: 2 to 18 GHz
Insertion Loss: 6.5 dB nominal[②]
Maximum Input Power: 0.5 W
Test Port Connector: GPC–7
Input and Output Connector: Type N Female
Dimensions: 7.3 x 5.1 x 2.86 cm (2-7/8 x 2 x 1-1/8 in.) plus connectors
Weight: 340 g (12 oz.)

Companion Equipment: 70 or 75 Series Detector, 562 Network Analyzer and 6600B Sweep Generator.

① Where ρ is the measured reflection coefficient.
② Typically 9 dB at 18 GHz from input to test port.

SWR Bridges & Autotesters

Model 60, 62 Series, 5 to 2000 MHz and Model 97 Series, 10 MHz to 18 GHz


60N50


62NF50


97A50

60 and 62 Series RF SWR Bridge Highlights

- *5 to 2000 MHz Frequency Coverage*
- *Up to 46 dB Directivity*
- *Built-in Reference Termination*
- *GPC-7, Type N or BNC Test Port Connectors*

The 60 and 62 series RF SWR Bridges are precision devices designed to make very accurate measurement of SWR. All models contain a built-in reference termination and preserve phase and amplitude of the reflected signal. For extremely low values of SWR, the RF output can be amplified before detection. The 62 series are available with a choice of 50 or 75 impedence. For optimium performance, a 73 or 74 series RF Detector is recommended.

Model	Frequency Range (MHz)	Test Port Connector	Directivity (dB)	Input Impedance (Ohms)	Accuracy[1][2]
60A50 60A50-1	5-2000	GPC-7	40 46	50	$0.01 + 0.09\rho^2$
60N50 60N50-1	5-2000	N Male	40 46	50	$0.01 + 0.09\rho^2$
60NF50 60NF50-1	5-2000	N Female	40 46	50	$0.01 + 0.09\rho^2$
62B50 62BF50	10-1000	BNC Male BNC Female	40	50	$0.01 + 0.12\rho^2$
62B75 62BF75	10-1000	BNC Male BNC Female	40	75	$0.01 + 0.12\rho^2$
62FF75	10-1000	F Female	40	75	$0.01 + 0.12\rho^2$
62N50 62NF50	10-1000	N Male N Female	40	50	$0.01 + 0.12\rho^2$
62N75 62NF75	10-1000	N Male N Female	40	75	$0.01 + 0.12\rho^2$

Insertion Loss: 6.5 dB nominal from input to test port
Maximum Input Power: 0.5 W
Input and Output Connector:
Type N Female on 62N, 62NF and 60 Series
BNC Female on 62B, 62BF, and 62FF
Dimensions: 60 Series
6.7 x 5.1 x 2.54 cm (2-5/8 x 2 x 7/8 in.) plus connectors
62 Series
5.7 x 3.5 x 2.86 cm
(2-1/4 x 1-3/8 x 1-1/8 in.) plus connectors
Weight: 60 Series 340 g (12 oz.)
62 Series 170 g (6 oz.)
Companion Equipment: 5400-71N50, 562 Network Analyzer and 6600B Sweep Generator.

[1] Where ρ is the measured reflection coefficient.
[2] Includes the effects of test port reflections and directivity.

97 Broadband SWR Autotester Highlights

- *High 40 dB Directivity*
- *Low Test Port Reflections*
- *Broadband* 10 MHz to 18 GHz Frequency Range
- *Small Package Including Bridge, Termination, and Detector*
- *Selection of GPC-7, WSMA, or Type N Test Port Connector*

These precision SWR Autotesters integrate in one small package a broadband microwave bridge, a precision termination, a detector, and a GPC-7, Type N, or WSMA test port connector. With high directivity and low test port reflections, the 97 Series provides accurate return loss (SWR) measurements over the 10 MHz to 18 GHz range. An accuracy equation is provided for every model.

Model	Test Port Connector	Directivity (dB)	Accuracy[1][2]	
			10 MHz-8 GHz	8-18 GHz
97A50	GPC-7	36	$0.016 + 0.06\rho^2$	$0.016 + 0.10\rho^2$
97A50-1	GPC-7	40	$0.010 + 0.06\rho^2$	$0.010 + 0.10\rho^2$
97N50 97NF50	Type N Male Type N Female	37	$0.018 + 0.08\rho^2$	$0.018 + 0.08\rho^2$
97N50-1 97NF50-1	Type N Male Type N Female	38	$0.013 + 0.08\rho^2$	$0.013 + 0.12\rho^2$
97S50 97SF50	WSMA Male WSMA Female	35	$0.018 + 0.08\rho^2$	$0.018 + 0.08\rho^2$
97S50-1 97SF50-1	WSMA Male WSMA Female	38	$0.013 + 0.08\rho^2$	$0.013 + 0.12\rho^2$

Frequency Range: 10 MHz to 18 GHz
Frequency Sensitivity: ±1.5 dB maximum
Insertion Loss: 6.5 dB nominal[3]
Detector Polarity: Negative
SWR Output Time Constant: 2 µs
Maximum Input Power: 0.5 W
Input Connector: Type N Female stainless steel
Detector Output Connector: BNC Female
Dimensions: 7.6 x 5 x 2.8 cm (3 x 2 x 1-1/8 in.) plus connectors
Weight: 340 g (12 oz.)

Companion Equipment: 562 Network Analyzer, 6600B Sweep Generator, 28 Series Termination, and 18 Series Air Line

[1] Including effects of test port reflections and directivity.
[2] Where ρ is the measured reflection coefficient.
[3] Typically 8.5 dB at 18 GHz from RF input port to test port.

Air Lines and Open/Shorts

18, 19 Series, 2 to 26.5 GHz; 22 Series, DC to 40 GHz

18, 19 Air Line Highlights

- *Virtually Lossless Gold Over Silver Plating*
- *Impedance Traceable to NBS Through Mechanical Dimensions*
- *Measurements Down to 1.006 SWR to 18 GHz, 1.01 SWR to 26.5 GHz, 1.02 SWR to 40 GHz*

Precision Air Lines provide both a standard impedance and a time delay for use in the Error Averaging Measurement System and the Ripple Extraction Measurement System, both described in *Wiltron Technical Review #8*. Similarly, with these systems, measurements can be made down to 1.006 to 18 GHz and 1.01 SWR to 26.5 GHz.

A beadless connector is used at the measurement end to provide a minimum reflection connection. The other end is beaded to keep the center conductor captive, thus fixing the plane of reference at the beadless end.

Specifications

Model	Freq. Range (GHz)	Test Port Connector	Beaded Port Connector	SWR	Dia. (mm)	Length (cm)
18A50	2 to 18	GPC-7	GPC-7	1.003 (Test Port) 1.020 (Beaded End)	7	30
18N50 18NF50	2 to 18	N Male N Female	GPC-7	1.006	7	30
19S50 19SF50	2 to 26.5	WSMA Male WSMA Female	WSMA Male	1.006 to 18 GHz; 1.010 to 26.5 GHz	3.5	25
19K50 19KF50	2 to 40	K Male K Female	K Male	1.020	2.9	15

Companion Equipment: 21A-1 Short with collated GPC–7 for use with 18A50 in a 5600-P1 Accuracy Enhancement System as described in Application Note TN 5600-2, 58A50 SWR Bridge or 59A50 SWR Autotester, and 29A50-20 Offset Termination.

22 Precision Open/Short Highlights

- *Single Gold-Plated Component Providing Full Open and Short Reflections for Accurate SWR Measurements*
- *DC to 40 GHz Frequency Coverage*
- *GPC–7, K Connector,® Type N, WSMA, and BNC Connectors*
- *50Ω or 75Ω Impedance*

The 22 Series Open/Shorts are used on the test port of an SWR Autotester or SWR Bridge to establish a full reflection reference for accurate SWR measurements. When used with the 562 or 5600B Network Analyzers, the average of the open and short reflections over a swept frequency range can be automatically averaged to enhance measurement accuracy. Except for the 21A-1, which is a short only with a collet for mating with the beadless end of the 18A50 Air Line, all models consist of an open on one end and a short on the other.

Specifications

Model	Frequency Range (GHz)	Test Port Connector	Impedance (Ohms)
22BF50 22BF75	DC to 1	BNC Female	50 75
22N75 22NF75	DC to 2	N Male N Female	75
22N50 22NF50	DC to 18	N Male N Female	50
21A-1	DC to 18	GPC-7 with collet for mating with beadless end of 18A50 Air Line	50
22A50	DC to 18	GPC-7	50
22S50 22SF50	DC to 26.5	WSMA Male WSMA Female	50
22K50 22KF50	DC to 40	K Male K Female	50

Coaxial Terminations

26, 28, 29 Series and Model K210, DC to 40 GHz

26, 28 Precision Termination Highlights

- *Accurate Reference for SWR Measurements*
- *Precise Termination for Test Instrument or Device Under Test*
- *GPC–7, K Connector®, Type N, or WSMA Connectors*
- *Aged Termination for Long-Term Stability*

These precision, metrology-grade terminations are used in measurement systems where achieving the smallest possible reflections is critical.

Specifications

Model	Frequency Range (GHz)	Test Port Connector	Input Impedance (Ohms)	SWR (F in GHz)
26N75 26NF75	DC to 4	N Male N Female	75	1.004 + 0.0025F
26N50 26NF50	DC to 18	N Male N Female	50	1.004 + 0.0026F
28A50 28A50-1	DC to 18	GPC-7	50	1.010 + 0.001F, 1.020 Max.
28S50	DC to 26.5	WSMA Male	50	1.036 to 18.5 GHz 1.173 to 26.5 GHz
28S50-1	DC to 26.5	WSMA Male	50	1.020 to 18.5 GHz 1.135 to 26.5 GHz
28SF50	DC to 26.5	WSMA Female	50	1.036 to 18.5 GHz 1.173 to 26.5 GHz
28SF50-1	DC to 26.5	WSMA Female	50	1.020 to 18.5 GHz 1.135 to 26.5 GHz
28K50 28KF50	DC to 40	K Male K Female	50	1.040 to 18.5 GHz 1.070 to 26.5 GHz 1.135 to 40 GHz
K210	DC to 40	K Male	50	1.106 to 18 GHz 1.253 to 40 GHz

Maximum Input Power: 0.5 W

29 Offset Termination Highlights

- *50Ω Offset Terminations for Precise Measurement of Low SWR or High Directivity*
- *Measurements Down to 1.006 SWR Up to 18 GHz, 1.01 SWR to 26.5 GHz*

When used in the 5600-P1 Accuracy Enhancement System described in Application Note TN 5600-2, the 29 Series Offset Terminations permit measurements down to 1.006 SWR up to 18 GHz and 1.01 SWR up to 26.5 GHz.

Specifications

Model	Frequency Range (GHz)	Test Port Connector	Return Loss (dB)
29A50-20	DC to 18	GPC-7	20 ±0.5 to 1 GHz 20 ±1.0 to 4 GHz 20 ±1.5 to 18 GHz
29S50-20	DC to 26.5	WSMA Male	20 ±1.5 to 18.5 GHz 20 ±2.5 to 26.5 GHz
29SF50-20	DC to 26.5	WSMA Female	20 ±1.5 to 18.5 GHz 20 ±2.5 to 26.5 GHz
29K50-15	DC to 40	K Male	15 ±1.5 to 18.5 GHz 15 ±2.5 to 26.5 GHz 15 ±3.5 to 40 GHz
29KF50-15	DC to 40	K Female	15 ±1.5 to 18.5 GHz 15 ±2.5 to 26.5 GHz 15 ±3.5 to 40 GHz

Adapters

34, K220 and K230 Series, DC to 40 GHz


34KFKF50


34ASF50


34NN50A


34ANF50


K222


K224


K230


K232

34 Precision Adapter Highlights

- *Low SWR and Insertion Loss*
- *GPC–7, K Connector®, V Connector®, Type N, and WSMA Connectors*
- *Convenient Transition with Minimal Effect on Signal*
- *50Ω or 75Ω Impedance*

The 34 Series of adapters enables accurate measurements with GPC–7, K Connector, V Connector, Type N, or WSMA interfaces. Every adapter is fully specified and 100% tested to ensure low reflections and optimum phase performance over a broad frequency range.

Specifications

Model	Frequency Range (GHz)	Connectors	SWR
34NN75B 34NFNF75B	DC to 3	N Male to N Male N Female to N Female	1.1
34AN50 34ANF50	DC to 18	GPC-7 to N Male GPC-7 to N Female	1.02
34AS50 34ASF50	DC to 18	GPC-7 to WSMA Male GPC-7 to WSMA Female	1.033
34NN50A 34NFNF50	DC to20	N Male to N Male N Female to N Female	1.1
34SFSF50	DC to 26.5	WSMA Female to WSMA Female	1.100 to 18.5 GHz 1.170 to 26.5 GHz
34KFKF50	DC to 40	K Female to K Female	1.106 to 18.5 GHz 1.173 to 26.5 GHz 1.253 to 40 GHz
34VK50 34VFK50	DC to 46	V Male to K Male V Female to K Male	1.3
34VKF50 34VFKF50	DC to 46	V Male to K Female V Female to K Female	1.3

Impedance: 50Ω, except 34NN75B and 34FNF75B which are 75Ω.
Weight (typical): 92 g (3.25 oz.)

K220, K222, K224 Adapter Highlights

- *K Connector® DC to 40 GHz Frequency Range*
- *K Male/K Male, K Female/K Female, and K Male/K Female Models*
- *SMA and 3.5 mm Compatibility*
- *Quantity Discounts*

The K220 Series is a low-cost, yet precise set of K Connector®, SMA, and 3.5 mm adapters. With their low SWR and consistent phase length, the adapters are frequently used to adapt various test device connectors to the test port without degrading calibration parameters. Productivity is improved as adapters are installed without having to recalibrate the test system.

Specifications

Model	Frequency Range (GHz)	Connectors	SWR
K220 K222 K224	DC to 40	K Male to K Male K Female to K Female K Female to K Male	1.22

K230, K232, K234 Panel Adapter Highlights

- *Inexpensive, Panel-Mounted Feedthru Adapter*
- *Broad, DC to 40 GHz Frequency Range*
- *Compatible With SMA and APC–3.5™*

The K230 Series is the panel-mount version of the K220 Series Adapters. These units mount in a standard 3/8-inch "D" hole.

Specifications

Model	Frequency Range (GHz)	Connectors	SWR
K230 K232 K234	DC to 40	K Male to K Male K Female to K Female K Female to K Male	1.22

Ruggedized and W/G-to-Coaxial Adapters

34R Series, DC to 40 GHz; 35 Series, 7.5 to 60 GHz

34R Ruggedized Adapter Highlights

- *Enhanced Reliability of Microwave Test Setup*
- *Easy-to-Grasp Type N Outside Diameter*
- *Rigid Test Connections for Improved Test Data Repeatability*
- *Compatibility with WSMA and K Connectors®*

The 34RKRK50 and 34RSN50 Adapters provide a rugged, rigid connection between a 6600B Sweep Generator or 6700B Synthesizer that has a WSMA or K Connector output and Wiltron SWR Autotesters or SWR Bridges.

Both adapters have an outside diameter equal to that of a Type N connector, adding mechanical strength to the test setup and making installation convenient and fast.

Specifications

Model	Frequency Range (GHz)	Connectors	SWR
34RSN50	DC to 20	RS Male to N Male	1.25
34RKRK50	DC to 40	RK Male to RK Male	2

Impedance: 50Ω

35 Waveguide-to-Coaxial Adapter Highlights

- *7.5 to 60 GHz Frequency Coverage*
- *K Connector® Compatibility with SMA and APC-3.5™*
- *V Connector® Compatiblility with 2.4 mm*
- *Standard and Double-Ridge Designs*

The 35 Series precision adapters transform standard or double-ridge waveguide to coaxial K and V Connectors.

The 16 models listed below cover the 7.5 to 60 GHz range.

Specifications

Model	Frequency Range (GHz)	Connectors	W/G Flange UG-(__)U	SWR
35WRD750K 35WRD750KF	7.5 to 18	WRD750 to K Male WRD750 to K Female	1580	1.25
35WR42K 35WR42KF	18 to 26.5	WR42 to K Male WR42 to K Female	595	1.25
35WRD180K 35WRD180KF	18 to 40	WRD180 to K Male WRD180 to K Female	N/A	1.25
35WR28K 35WR28KF	26.5 to 40	WR28 to K Male WR28 to K Female	599	1.25
35WR22K 35WR22KF	33 to 50	WR22 to K Male WR22 to K Female	383	1.30
35WR22V 35WR22VF	33 to 50	WR22 to V Male WR22 to V Female	383	1.30
35WR19K 35WR19KF	40 to 50 Usable to 54	WR19 to K Male WR19 to K Female	383	1.30
35WR19V 35WR19VF	40 to 60	WR19 to V Male WRX19 to V Female	383	1.30

Impedance: 50Ω
Maximum Input Power: 1 W

Fixed Attenuators

41 and 43 Series, DC to 60 GHz

41KC-S

Fixed Attenuator Highlights

- *3, 6, 10, or 20 dB Attenuation Up to 60 GHz*
- *Low SWR, 1.28 Up to 40 GHz*
- *SMA and APC–3.5™ Compatibility*
- *Rugged and Reliable K Connector®*

Advanced Performance and Reliability

The Wiltron fixed attenuators consist of two series:

- The Gold Line (Series 41) for precision measurement applications covering dc to 60 GHz, and
- The Silver Line (Series 43) for use in systems and OEM equipment covering dc to 40 GHz.

Both series offer fixed attenuation values of 3, 6, 10, or 20 dB with models that span a frequency range of dc to 18 GHz, 26.5 GHz, 40 GHz, or 60 GHz.

With the addition of the new V Connector® attenuators to this product line, Wiltron further advances the accepted standards for fixed attenuator performance and reliability. But performance is not the only distinquishing feature. Attenuators that use the Wiltron K Connector® can be connected directly to SMA or APC–3.5 devices. And compared to SMA, the K Connectors offer a vast improvement in reliability. Attenuators that use the Wiltron V Connector can be connected directly to 2.4 mm devices.

For applications in metrology and calibration laboratories where precise characterization is essential, the Gold Line models are available in sets consisting of 3, 6, 10, and 20 dB units, each provided with attenuation and SWR calibration data. Calibration data are also optionally available for individual units, each of which is serialized.

Design Features

There are several design features that account for the exceptional performance of Wiltron attenuators:

- The geometry is small (2.9 mm), minimizing internal reflections and their adverse effect on frequency response and return loss.
- The use of sputtered resistors provides accurate control of attenuation values over a broad frequency range.
- The use of K Connectors improves reliability compared to SMA.

The new attenuators include the latest advances made in microwave thin-film technology. Miniaturization of the attenuator element is achieved by using sputtered tantalum nitride on both sides of a 0.127 mm (0.005 in.) Alumina circuit board. The board is mounted as an air dielectric suspended-substrate stripline. Tantalum nitride was selected as the resistive element for its exceptional stability with time and temperature. The relia- bility of the attenuator connectors is affected by insertion force, outer conductor mating area, and mating alignment. The K Connector is used on Wiltron attenuators because it has excellent performance in all of these areas. For example, a typical female SMA center conductor requires 1.36 kg (3 lb.) of insertion force compared to 0.23 kg (0.5 lb.) for the K Connector. In addition, the K Connector's outer conductor is four times thicker than that of SMA, resulting in a conservative order-of-magnitude improvement in the number of reliable connections.

To avoid a major cause of connector failure, the K Connector male pin is deliberately made shorter than the SMA pin. Therefore, the outer housing is properly aligned prior to center conductor mating, preventing destructive alignment.

Gold Line – Improved Measurement Accuracy

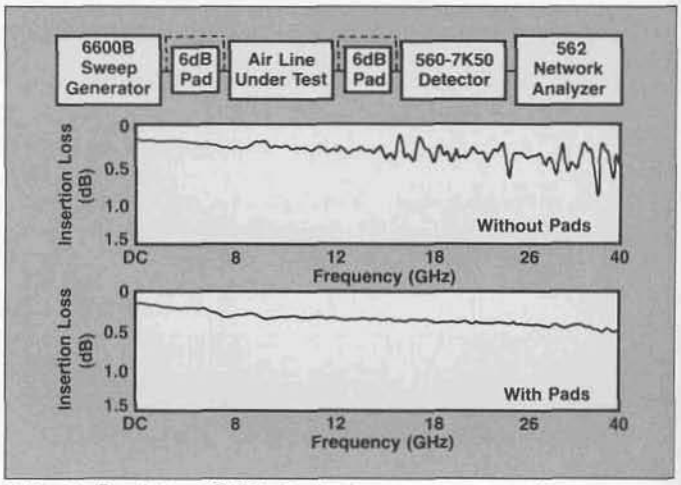
Adding Gold Line attenuators to your attenuation measurement setup will improve your measurement accuracy. In the test setup shown, the insertion loss of an air line was measured, first without and then with matching 6 dB pads. The difference in the accuracy of the two measurements is striking. By attenuating reflections and re-reflections that occur at the input and output of the air line, the pads reduce mismatch errors and allow the system to measure more accurately the actual insertion loss.

Silver Line – Improved System Reliability

Fixed attenuators used in systems or OEM equipment must be small, lightweight, economical, and reliable under severe environmental conditions. The Silver Line meets these requirements. K Connectors ensure well-seated, low-reflection connections that provide consistent operation year after year.

The Series 43 attenuator's small size, 8 mm dia. x 28.8 mm length (0.312 x 1.135 in.), and light weight, 8 g (0.28 oz.), make them an attractive choice for miniaturized, lightweight systems.

Discounts are available for OEM quantities.



Adding 6 dB pads to an SWR test setup improves measurement accuracy.

Common Specifications

Impedance: 50Ω
Power Rating (average): 2 W at 20°C; 1 W at 85°C
Temperature Coefficient: 0.001 dB/dB/°C
Connectors:
V Connector®, male and female, compatible with 2.4 mm;
K Connector®, male and female, compatible with SMA and APC–3.5™
Material: Passivated stainless steel housing
Size:
Length: 28.8 mm (1.135 in.) ±0.5 (0.020 in.)
Diameter: 8 mm (0.312 in.)
Weight: 8 g (0.28 oz.)
Temperature Range:
Operating: –55°C to +85°C
Nonoperating: –55°C to +125°C

Ordering Information

Single Fixed Attenuators: Select from tables below.

Option C Calibration Data: Attenuation and SWR test data are provided for attenuation and SWR for input and output ports at 500 MHz frequency intervals.

Precision Fixed Attenuator Sets: A set of 3, 6, 10, and 20 dB Gold Line (Series 41). Attenuators are supplied in a handsome hardwood case. Calibration data are included for each unit.

Order:
Model 41KA-S (DC to 18 GHz)
Model 41KB-S (DC to 26.5 GHz)
Model 41KC-S (DC to 40 GHz)
Model 41V-S (DC to 60 GHz)

Gold Line Specifications

Model	Attenuation① (dB)	Attenuation Accuracy				SWR				
		DC-18 GHz	18-26.5 GHz	26.5-40 GHz	40-60 GHz	DC-12 GHz	12-18 GHz	18-26.5 GHz	26.5-40 GHz	40-60 GHz
DC to 60 GHz										
41V-3	3	±0.5	±0.6	±0.9	±1.20	1.15	1.20	1.25	1.50	1.90
41V-6	6	±0.5	±0.6	±0.9	±1.20	1.15	1.20	1.25	1.40	1.70
41V-10	10	±0.5	±0.6	±0.9	±1.20	1.15	1.20	1.25	1.40	1.70
41V-20	20	±0.5	±0.6	±0.9	±1.20	1.15	1.20	1.25	1.40	1.70
DC to 40 GHz										
41KC-3	3	±0.4	±0.5	±0.8	–	1.10	1.15	1.25	1.43	–
41KC-6	6	±0.4	±0.5	±0.8	–	1.10	1.15	1.18	1.28	–
41KC-10	10	±0.4	±0.5	±0.8	–	1.10	1.15	1.18	1.28	–
41KC-20	20	±0.4	±0.5	±0.8	–	1.10	1.15	1.18	1.28	–
DC to 26.5 GHz										
41KB-3	3	±0.4	±0.5	–	–	1.10	1.15	1.25	–	–
41KB-6	6	±0.4	±0.5	–	–	1.10	1.15	1.18	–	–
41KB-10	10	±0.4	±0.5	–	–	1.10	1.15	1.18	–	–
41KB-20	20	±0.4	±0.5	–	–	1.10	1.15	1.18	–	
DC to 18 GHz										
41KA-3	3	±0.4	–	–	–	1.10	1.15	–	–	–
41KA-6	6	±0.4	–	–	–	1.10	1.15	–	–	–
41KA-10	10	±0.4	–	–	–	1.10	1.15	–	–	–
41KA-20	20	±0.4	–	–	–	1.10	1.15	–	–	–

① For traceability, all Gold Line units are serialized.

Silver Line Specifications

Model	Attenuation① (dB)	Attenuation Flatness				SWR				
		DC-18 GHz	18-26.5 GHz	26.5-40 GHz	40-60 GHz	DC-12 GHz	12-18 GHz	18-26.5 GHz	26.5-40 GHz	40-60 GHz
DC to 40 GHz										
43KC-3	3	±0.5	±0.6	±0.9	–	1.15	1.20	1.30	1.50	–
43KC-6	6	±0.5	±0.6	±0.9	–	1.15	1.20	1.30	1.40	–
43KC-10	10	±0.5	±0.6	±0.9	–	1.15	1.20	1.30	1.40	–
43KC-20	20	±0.5	±0.6	±0.9	–	1.15	1.20	1.30	1.40	–
DC to 26.5 GHz										
43KB-3	3	±0.5	±0.6	–	–	1.15	1.20	1.30	–	–
43KB-6	6	±0.5	±0.6	–	–	1.15	1.20	1.30	–	–
43KB-10	10	±0.5	±0.6	–	–	1.15	1.20	1.30	–	–
43KB-20	20	±0.5	±0.6	–	–	1.15	1.20	1.30	–	–

① ±1 dB from dc to 26.5 GHz; ±1.3 dB from >26.5 to 40 GHz, including frequency response and DC offset.

Microwave Detectors

70, 71, 73, 74, 75 Series 100 kHz to 40 GHz

71B50

74N50B

70KC50

73N75

75A50

75KC50

Detector Highlights

- *Broadband Coverage: 10 MHz to 40 GHz with a Single Detector*
- *K Connector® Compatibility with SMA and APC–3.5™*
- *Lowest SWR: 1.33 to 20 GHz, 1.5 to 40 GHz*
- *Flat Response:* ±0.5 dB to 20 GHz
  ±1.5 dB to 40 GHz
- *Best Value for Instrumentation, System, and OEM Applications*
- *Low Price and Availability from Stock*

Best Combination of Performance and Price

By using the latest design and microelectronics production technologies, Wiltron low-barrier Schottky-diode detectors outperform others and offer significant cost savings. Within this product line, you will find a model that matches your needs for instrumentation, system, or OEM applications. Eight frequency ranges varying from 100 kHz–2 GHz to 10 MHz–40 GHz allow you to select the exact coverage you need at the lowest possible cost. Input connector types include GPC–7, Type N, BNC, and K Connector®, the last being compatible with SMA and APC–3.5™ connectors. In addition to frequency coverage and price, these detectors are distinguished by their low SWR, flat frequency response, and close output-voltage tracking over a wide dynamic range.

Superior Performance

The degree to which a detector's output voltage accurately indicates the applied power is largely determined by the detector's impedance match, frequency response, and capability to produce a true logarithmic response. These detectors achieve superior performance by using specially designed Schottky diodes and Wiltron-developed, thin-film techniques for matching the diodes to the input transmission line. As a result, the broadband 70 and 75 Series hold SWR to less than 1.5 to 26.5 GHz and 1.9 to 40 GHz, compared to 2.2 up to 26.5 GHz of competitive units. By reducing the error signals that result from reflections, the excellent match improves measurement accuracy. (At this time, there are no other 40 GHz detectors available with which to compare the Wiltron designs.)

SMA and APC–3.5 Compatibility

Operation up to 40 GHz is made possible by the Wiltron-developed K Connector. Because it is compatible with SMA and APC–3.5 connectors, you can standardize on a single detector to cover the 10 MHz to 40 GHz range. As an extra bonus, K Connector performance is superior to that of SMA below 18 GHz. And it is more reliable. Having been qualified to MIL-C-39012C, the K Connector contributes to the detectors' capability to withstand rough treatment in harsh environments.

Pulse Response

The pulse response of a detector is determined by its resistance, capacitance, and load impedance. The achievable rise time is given by the following equation:

$$t_r = 2.2\left(\frac{R_V R_L}{R_V + R_L}\right)(C_O + C_L)$$

where: R_V = diode video resistance,
C_O = detector bypass capacitance, and
$R_L + C_L$ = load characteristics.
The standard detectors loaded with 1000Ω have typical rise times of less than 50 ns.

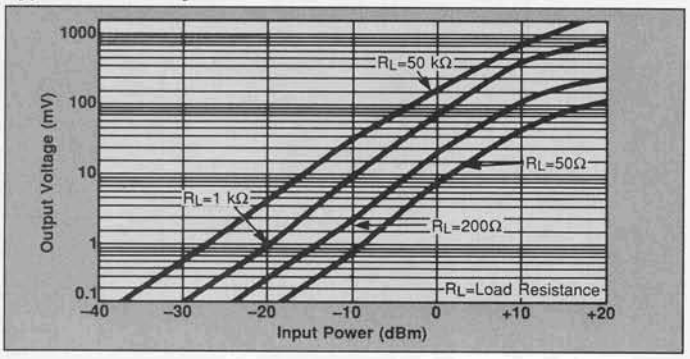
Field Replaceable Diodes

To avoid all degradation in performance when a diode is replaced in the field, Wiltron replacement modules include the thin-film matching circuit. Performance after replacement cannot be distinguished from that of a new detector.

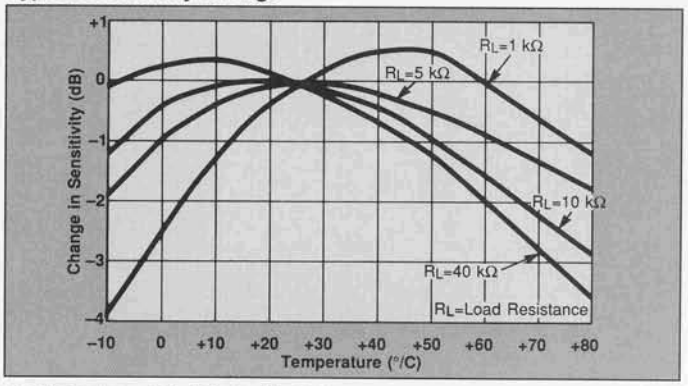
Specifications

Model	Polarity	Frequency Range	Flatness (dB)	Connectors		Impedance (Ohms)	SWR (Maximum)	Low Level Sensitivity at –30 dBm (mV/μW)	High Level Sensitivity at +13 dBm (Volts, Min.)	Input Max. (mW)	Output Capacitance (pF)
				In	Out						
70KA50 70KZ50P	Negative Positive	0.01 to 20 GHz	±0.5	K (m)	SMC (m)	50	1.33	0.5	1	100	30
70KB50 70KB50P	Negative Positive	0.01 to 26.5 GHz	±0.5 to 20 GHz	K (m)	SMC (m)	50	1.33 to 20 GHz 1.5 to 26.5 GHz	0.5	1	100	30
70KC50 70KC50P	Negative Positive	0.01 to 40 GHz	±0.5 to 20 GHz ±1 to 26.5 GHz ±1.5 to 40 GHz	K (m)	SMC (m)	50	1.33 to 20 GHz 1.5 to 26.5 GHz 1.9 to 40 GHz	0.5	1	100	30
71B50 71B50P	Negative Positive	100 kHz to 3 GHz	±0.5	BNC (m)	BNC (f)	50	1.2	0.35	1	100	500
71B75 71B75P	Negative Positive	100 kHz to 2 GHz	±0.5	BNC (m)	BNC (f)	75	1.25	0.35	1	100	500
73N50 73N50P	Negative Positive	100 kHz to 4 GHz	±0.5	N (m)	BNC (f)	50	1.2	0.35	1	100	500
73N75 73N75P	Negative Positive	100 kHz to 2 GHz	±0.5	N (m)	BNC (f)	75	1.2	0.35	1	100	500
74N50B 74N50BP	Negative Positive	0.01 to 12.4 GHz	±0.3	N (m)	BNC (f)	50	1.15 to 4.5 GHz 1.3 to 12.4 GHz	0.4	1	100	30
75A50 75A50P	Negative Positive	0.01 to 18.5 GHz	±0.5 to 12.4 GHz ±1 to 18.5 GHz	GPC–7	BNC (f)	50	1.25 to 4.5 GHz 1.35 to 7 GHz 1.5 to 12.4 GHz 1.6 to 18.5 GHz	0.4	1	100	30
75N50B 75N50BP	Negative Positive	0.01 to 18 GHz	±0.3 to 12.4 GHz ±0.6 to 18 GHz	N (m)	BNC (f)	50	1.15 to 4.5 GHz 1.30 to 15 GHz 1.39 to 18 GHz	0.4	1	100	30
75KA50 75KA50P	Negative Positive	0.01 to 20 GHz	±0.5	K (m)	BNC (f)	50	1.33	0.4	1	100	30
75KB50 75KB50P	Negative Positive	0.01 to 26.5 GHz	±0.5 to 20 GHz ±1 to 26.5 GHz	K (m)	BNC (f)	50	1.33 to 20 GHz 1.5 to 26.5 GHz	0.4	1	100	30
75KC50 75KC50P	Negative Positive	0.01 to 40 GHz	±0.5 to 20 GHz ±1 to 26.5 GHz ±1.5 to 40 GHz	K (m)	BNC (f)	50	1.33 to 20 GHz 1.5 to 26.5 GHz 1.9 to 40 GHz	0.4	1	100	30

Typical Sensitivity



Typical Sensitivity Change



Ordering Information

Negative or Positive Polarity Output: Please make selection from table above.

Option 2: Matches frequency response of two detectors.
Option 3: Matches frequency response of three detectors.

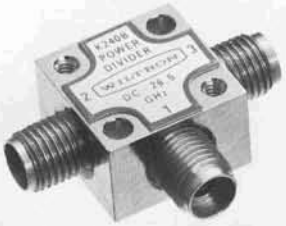
Upper Frequency Limit (GHz)	≤8	≤12.4	≤18	≤26.5	≤40
Frequency Response Tracking (dB)	±0.2	±0.3	±0.6	±0.8	±1.2

Field Replaceable Diode Modules:

Series	Negative Polarity	Positive Polarity
70K Series (≤20 GHz)	A16177	A18948
70K Series (>20 GHz)	A16176	A18873
71 and 73 Series	10-A2X985	10-A2X985
74N50B	A18735	A18736
75A50	10-75	10-75
75N50B	B16132	A18694
75K Series (≤20GHz)	A16177	A18948
75K Series (>20GHz)	A16176	A18873

Power Dividers and Bias Tees

K240 Series, DC to 40 GHz; K250 and V250 Series, DC to 60 GHz



K240B

K250

K240 Power Divider Highlights

- *DC to 40 GHz Frequency Range*
- *K Connector® Compatibility with SMA/APC–3.5™*
- *Excellent Amplitude and Phase Tracking*

These power dividers are symmetrical, three-resistor tee designs that can be used in applications where signals from dc to 40 GHz must be accurately divided or combined. K Connectors are compatible with APC–3.5 and SMA. All models have exceptional amplitude and tracking characteristics.

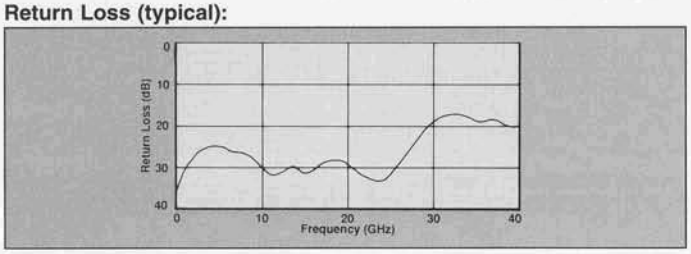
Specifications:

Model	Frequency Range (GHz)
K240B	DC to 26.5
K240C	DC to 40

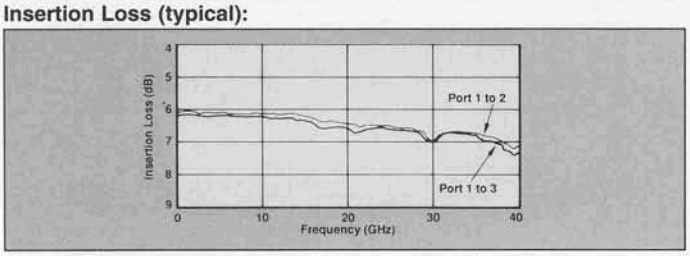
	Frequency Range (GHz)			
	DC to 6	6 to 18	18 to 26.5	26.5 to 40
Tracking of Outputs Amplitude / Phase:	±0.3 dB/±2°	±0.3 dB/±3°	±0.6 dB/±4°	±0.6 dB/±6°
Insertion Loss (max.):	7 dB	7.5 dB	8 dB	8.5 dB
SWR:	1.2	1.4	1.5	1.7

Impedance: 50 Ω **Connectors:** K Female
Maximum Input Power: 1 W **Weight:** 43 g (1.5 oz.)

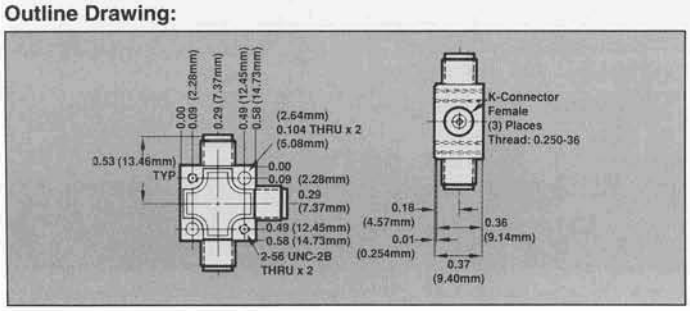
Return Loss (typical):



Insertion Loss (typical):



Outline Drawing:



K250 and V250 Bias Tee Highlights

- *Broadband, 0.1 to 60 GHz Coverage*
- *Low SWR, Low Insertion Loss*
- *K and V Connector Availability*

These bias tees were designed for applications where both DC and RF signals must be applied to a device under test. They are particularly suited for active device measurements. DC voltages of up to 30 volts at 0.5 amps may be applied to test devices with negligible effect on RF performance. Low RF throughline loss (<1 dB) and low return loss ensure negligible effect on measurements up to 60 GHz. An RF input DC block isolates the input port from the applied bias voltage.

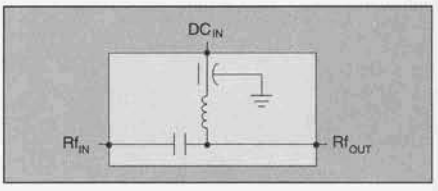
Specifications:

	K250	V250
Frequency Range:	0.1 to 40 GHz①	0.1 to 60 GHz①
Insertion Loss:	1.2 dB max.②	2.2 dB max.②
Return loss:	15 dB min. to 20 GHz 10 dB min. to 40 GHz	14 dB min. to 20 GHz 9 dB min. to 40 GHz 8 dB min. to 60 GHz
RF Power:	1 W max.	1 W max.
DC Voltage:	30 V max.	30 V max.
DC Current:	0.5 A	0.5 A
DC Port Isolation:	20 dB at 0.1 GHz 40 dB above 0.5 GHz	20 dB at 0.1 GHz 40 dB above 0.5 GHz
RF Connectors:	Input: K Male Output: K Female	Input: V Male Output: V Female
DC Connector:	SMC Male	SMC Male

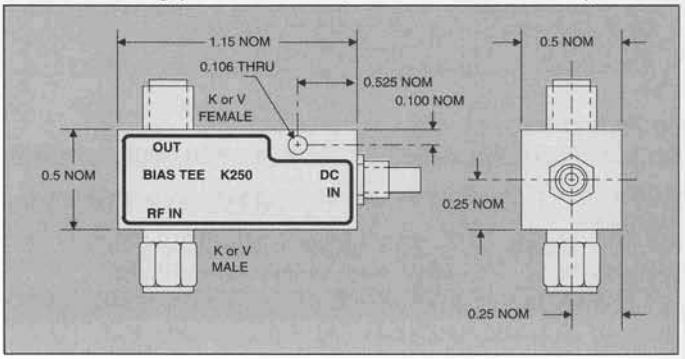
① Usable between 0.04 and 0.1 GHz with degraded performance. ② Typical.

Temperature: 0 to 60° C **Mounting Position:** Any
Weight: 57 g (2 oz.)

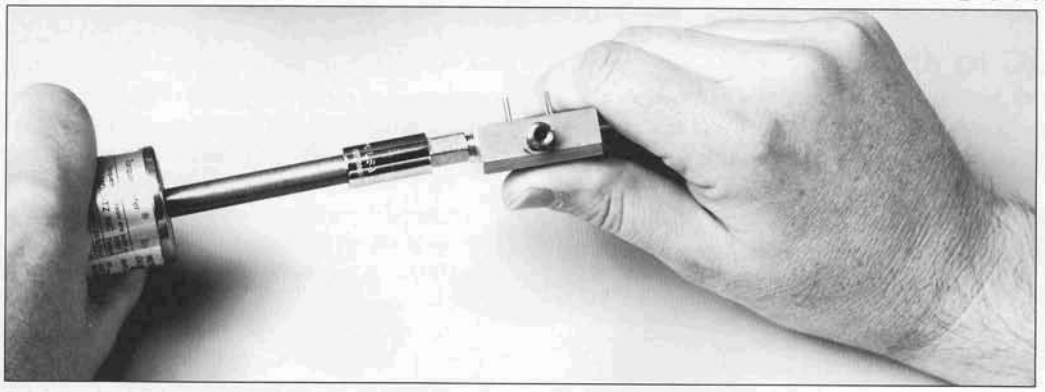
Schematic Diagram (K and V Connector Models):



Outline Drawing (K and V Models; Dimensions in Inches):



K and V Connectors



Connector Design Leadership

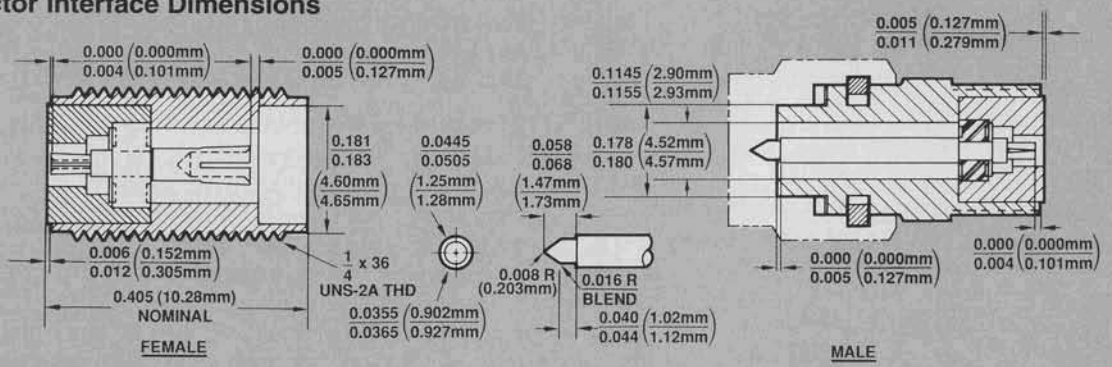
Wiltron has taken a leadership position in microwave connector design in order to support customer needs for higher frequency coverage and better reliability. In 1983, Wiltron introduced the K Connector® with coverage to 46 GHz, along with a complete family of 40 GHz test equipment. Wiltron designed the K Connector to mate with the popular SMA connector to support applications below 20 GHz. It was an immediate success and today is used on many commercial components, test fixtures, and military systems.

The V Connector®, introduced in 1989, offers coaxial coverage to 65 GHz and uses a 1.85 mm geometry endorsed by the International Electrotechnical Commission (IEC). It mates with commercially available 2.4 mm connectors. Wiltron is supporting the V Connector similarly to the K connector with complete test instrumentation (see the 360 Vector Network Analyzer, page 14) and an assortment of V Connector hardware.

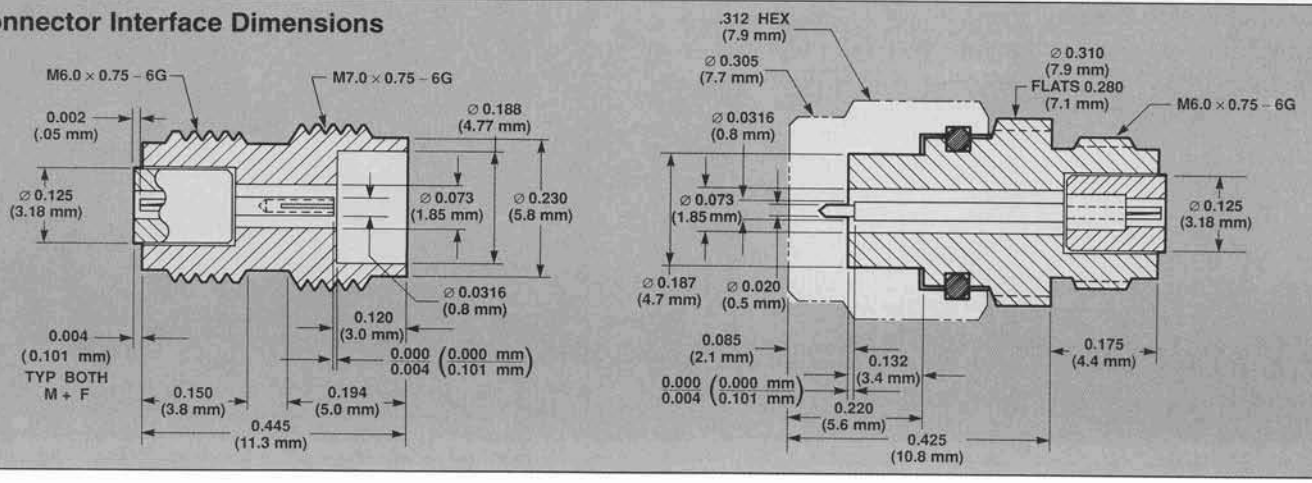
On the following pages, you will find everything you need—launchers, connectors, cables, adapters, tools, fixtures, an evaluation kit—to begin designing in coax up to 65 GHz.

Index

K Connector Interface Dimensions



V Connector Interface Dimensions



K and V Connectors

K Series; DC to 46 GHz

K Connector™ Highlights

- *Excellent Performance Up to 46 GHz*
- *Performance Exceeding SMA Below 18 GHz*
- *Superior Reliability*
- *Compatibility With SMA and APC–3.5™*
- *Familiar Assembly Procedures*
- *Complete Testability on Existing Network Analyzers*

Performance and Reliability at 46 GHz

The K Connector is a reliable, 2.92 mm device that operates up to 46 GHz and outperforms an SMA connector below 18 GHz. It is compatible with SMA, WSMA, and 3.5 mm connectors and is assembled using procedures that are similar to those used on SMA. It is well suited to applications in components, systems, or instrumentation.

Launcher Design

At the heart of the K Connector product line are the launchers. As their name implies, the launchers "launch" (make the transition) from a microwave circuit (microstrip, suspended substrate, stripline, or coplanar waveguide) to a coaxial connector and an outside transmission line. The key to making the transition without compromising electrical and mechanical objectives is the glass bead in the launcher assembly.

Low-Reflection Bead

The K Connector's standard glass bead has a unique .012 inch center conductor and readily connects to fragile devices. The bead is appropriate for most applications employing Duroid and ceramic (Alumina) microstrip, such as the .010 inch wide center conductor on a .010 inch thick Alumina substrate. Applications using suspended substrate geometries are equally well satisfied. The bead is constructed of Corning 7070 glass and has a gold-plated center conductor and a gold-plated Kovar collar.

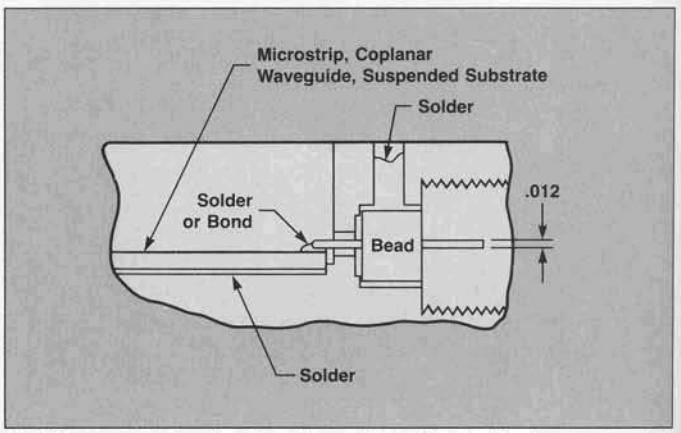
The outstanding design of the bead is largely accountable for the excellent performance of the K Connector launchers. Because the small .012 inch pin introduces minimal discontinuity, return loss is typically better than 20 dB at 40 GHz and better than 25 dB below 18 GHz. In addition, the design provides for soldering the bead to achieve a hermetic seal.

Both the sparkplug (screw-in) and the flange-mounted K Connector launchers offer an additional advantage over existing designs: These launchers do not use an epoxy pin to secure the center conductor, as used in some SMA designs. Without an epoxy pin, the outer conductor remains solid, and thereby eliminates the RF leakage path common to pin-captivated designs. Furthermore, the K launchers have a wall thickness which is four times that of SMA launchers (0.032 vs. 0.0088 inches). The heavier wall results in superior resistance to overtorquing. Finally, the K Connector launcher can be removed for repair without removal of the glass bead. This ensures that during removal the critical microcircuit-to-glass bead interface is not disturbed, that hermeticity is preserved, and that the microcircuit will not be subjected to the additional stress caused by heating to soldering temperature.

Exceptional Reliability and Repeatability

Microwave connector reliability is affected by insertion force, outer conductor strength, stress relief while mating, and mating alignment. The K Connector exhibits exceptional performance in all of these areas.

For proper seating, a standard SMA connector requires 3.0 pounds of insertion force. In contrast, the K Connector requires only 0.5 pounds. All other factors being equal, the reduced wear on the female center conductor equates to a



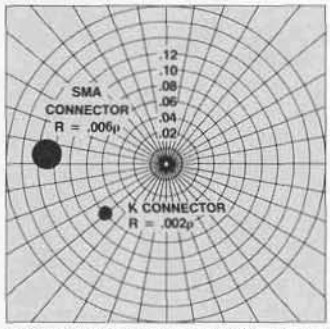
The K Connector's glass bead provides a high quality transition from a microcircuit to an outside transmission line.

12-fold improvement in reliability. However, other factors are not equal. For example, the K Connector's outer conductor is four times thicker than that of SMA. Taken together, the lower insertion force and the thicker wall offer a conservative 30-fold improvement in the number of reliable connections typically available from an SMA. This estimate is confirmed by life tests which show that the K Connector makes approximately 10,000 connections with negligible change in electrical characteristics.

All K Connectors, including the cable connectors, incorporate one other feature that eliminates a major cause of connector failure. This failure is caused by misalignment of the male pin with respect to the female contacts. To solve the problem, the K Connector male pin is deliberately made shorter than the SMA pin. With this arrangement, the outer housing is properly aligned prior to the mating of the center conductors. Thus a proper, non-destructive alignment before mating is ensured.

Threefold Improvement

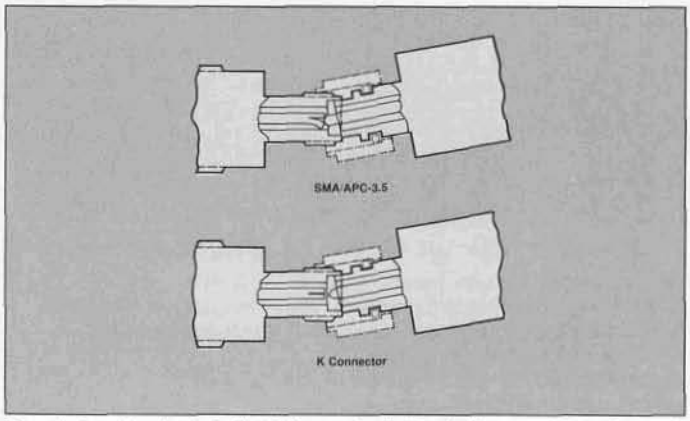
There are other advantages to the mating interface design. The K Connector female center conductor has four slots. Most SMA connectors have only two. With four slots, the pressure exerted by the male pin on the female is distributed more evenly, improving reliability and repeatability. A polar plot shows that the repeatability of the K Connector offers a more than threefold improvement over that of SMA, placing the K Connector on the same level as the considerably more expensive APC–3.5 connector.



K Connector's repeatability (R) is threefold better than SMA's.

Compatibility

With previous connectors that operated above 18 GHz, compatibility with existing lower-frequency connectors was often lost. This necessitated the stocking of adapters to change from one sex or type of connector to another. With the K Connector, the cost and inconvenience of stocking adapters are avoided. The K Connector interfaces electrically and mechanically with 3.5 mm connectors, including SMA, APC–3.5 and Wiltron's WSMA, without degradation in performance.



The shortened male pin in the K Connector (bottom) allows center conductors to be pre-aligned before contact, eliminating damage to the female connector.

Engineers benefit from the superiority of the K Connector launchers in lower frequency applications without worrying about compatibility with other connectors within the system.

Complete Family

Wiltron's family of K Connector products is large and growing. Virtually every interface need can be satisfied by one or more of the items offered. As a convenience to the design engineer, each item is completely specified with both guaranteed and typical performance.

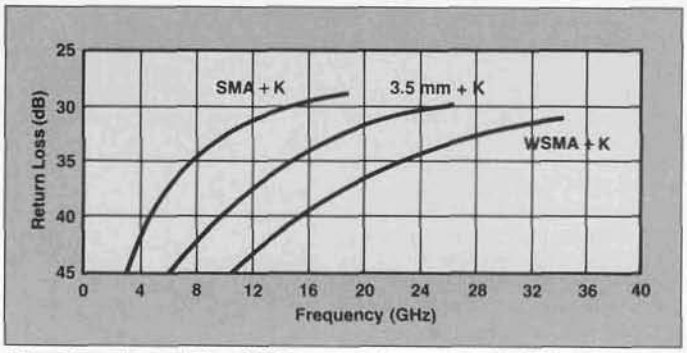
There are six different models of K Connector launchers. Two types of sparkplug (screw-in) launchers are available: the K102F female version and the K102M male version. Both screw into the housing that encloses the microwave circuit. And, like all Wiltron launchers, they can be easily removed for replacement or repair without unsoldering the glass bead and its interface to the microwave circuit.

When the housing that encloses the microwave circuit is not thick enough to support a threaded, screw-in launcher, flush- mounted (flange) launchers are required. Models with two mounting holes are available in both male and female version, K103F and K103M. Two other models, the K104F and K104M, have four mounting holes. The mounting hole spacing is identical to that of similar SMA flange launchers. The glass bead interface, of course, is the same design used for the sparkplug launcher.

Since the loss of 0.085-inch cable is too high and the high frequency limit of 0.141-inch cable is too low, a new semirigid cable has been designed. The new cable has an outside diameter of 0.118 inches and uses a microporous Teflon dielectric. Compared to solid Teflon, microporous Teflon has better mechanical and impedance stability, since it does not expand and contract with changing temperatures. The center conductor of the cable is soft copper with a 0.032-inch diameter, allowing a minimum bend radius of 0.25-inch with no displacement of the center conductor. The cable loss is typically 1.1 dB/ft at 40 GHz, which is one-half the loss of other cables operating in this frequency range. At lower frequencies, the loss is similar to that of 0.141-inch semirigid cable.

Cable Connectors

To complement this high performance cable, both male and female cable connectors are available. The cable connectors, K101M and K101F, use gold-plated, beryllium-copper center conductors for optimum performance and wear characteristics. Typical return loss at 40 GHz for finished cables exceeds 16 dB (1.35 SWR).



Return loss characteristics of K Connector when mated with SMA, APC–3.5, and WSMA ensure excellent electrical compatibility.

K and V Connectors

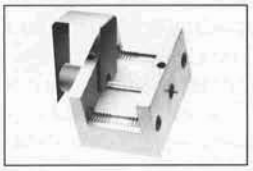
TOOLS AND FIXTURES

01–103 Soldering Fixture for sparkplug launcher glass beads, package of 10.

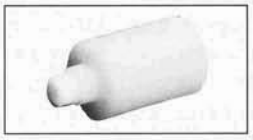
01–104 Drill and Tap Set for precision machining of concentric holes for mounting K Connector in microwave housing. (Drill Part No. B14094) (Tap Part No. 783-255)

01–105 Male and Female Sparkplug Torquing Kit

01–106 K Soldering Fixture for flange launcher glass bead, package of 5.

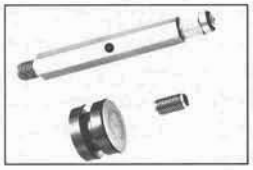


01–107M or 01–107F Cable Sleeve Soldering Fixture for K101M Male and K101F Female Cable Connectors, package of 10.



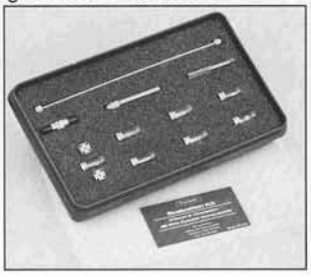
01–108 Drill and Tap Set for precision machining of concentric holes for mounting K Connector in microwave housing in applications where sliding contacts are used. (Drill Part No. B16526) (Tap Part No. 783-255)

01–118 K Connector Cable Assembling Fixture for 0.118 in. semirigid coaxial cable.



EVALUATION KIT

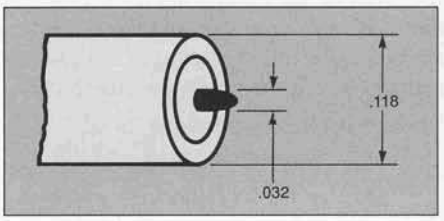
01–101A Evaluation Kit
Description: Kit contains one K120 10-inch Male/Male Cable Assembly, two K102F Female Sparkplug Launcher Connector Assemblies, two K104F Female Flange Launcher Connector Assemblies, five K100 Glass Beads, One 01-102A Test Fixture, one 01–104 Drill and Tap Set, five K110–1 Microstrip Sliding Contacts, five K110–2 Stripline Sliding Contacts, and all other parts and fixtures required to assemble launchers with or without sliding contacts.



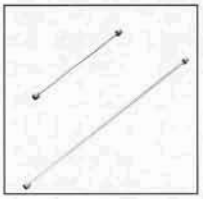
SEMIRIGID COAXIAL CABLE

Type: Semirigid coaxial, tin-plated copper outer conductor, silver-plated copper center conductor.
Impedance: 50 ±2 Ohms
Dielectric Type: Microporous Teflon, 0.241 cm (0.095 in.) diameter.
Dielectric Constant: 1.687 **Relative Velocity:** 0.77
Outside Diameter: 0.299 cm (0.32 in.)
Center Conductor Diameter: 0.081 cm (0.032 in.)
Minimum Bend Radius: 0.64 cm (0.25 in.)
Attenuation: 0.5 dB/ft at 10 GHz 0.7 dB/ft at 20 GHz
1.0 dB/ft at 30 GHz 1.4 dB/ft at 40 GHz

K118 Semirigid Coaxial Cable
Description: 1.52 m (5 ft) length of 0.118-inch semirigid cable for K101 series connector.



CABLE ASSEMBLIES

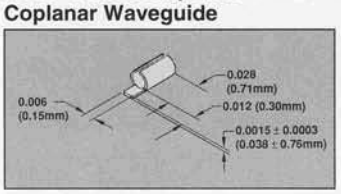


K120–6 or K120–12 Cable Assemblies
Description: Semirigid cable with K101M Male connector on each end.

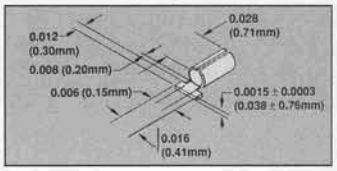
STRESS RELIEF CONTACTS

Wiltron's Stress Relief Contacts provide an elegant yet simple solution to relieving stress at the interface of the microcircuit and its connecting coaxial conductor. These contacts simply slide onto the standard glass bead pins. **Frequency Range:** DC to 46 GHz
Material: 0.001-in. heat-treated BeCu
Return Loss: 20 dB @ ≤26.5 GHz; 17 dB @ >26.5 GHz
Plating: min 200 µin. gold over 25 µin. nickle flash
Packaging: Lots of 25

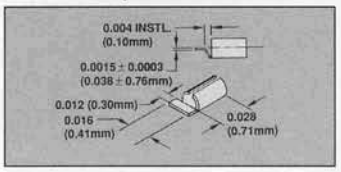
K110–1 Microstrip and Coplanar Waveguide



K110–3 Microstrip

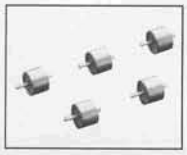


K110–2 Stripline



MICROSTRIP-TO-K LAUNCHERS & CABLE CONNECTORS

Return Loss (launchers only): 15 dB up to 40 GHz.
Coupling Nut Tightening Torque: 13.8 Kg-cm (12 in.-lb.) max.
Material: Passivated stainless steel with heat-treated beryllium copper center conductors.
Pin Depth: 0.000 to –0.127 mm (0.000 to –0.005 in.) for male and female connectors.
Temperature Range: –55°C to +125°C (200°C available; contact factory)



K100

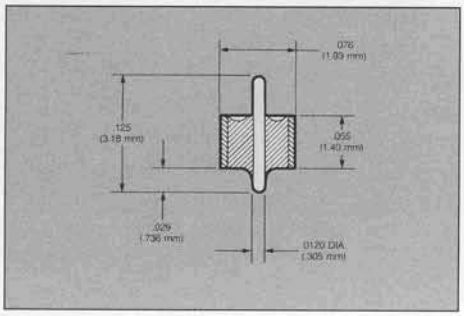
Description: Glass Beads for K102, K103, and K104 connectors (package of 5)

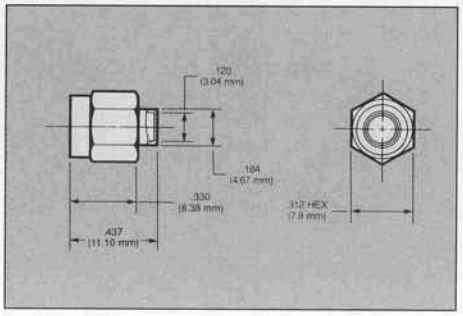
K101M

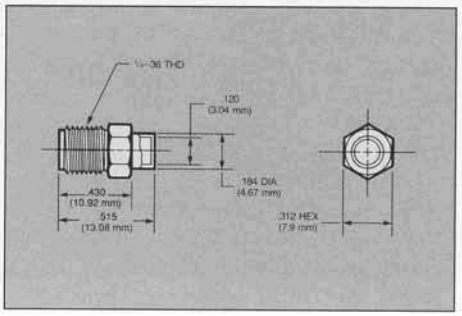
Description: K Male In-Line Cable Connector, DC-46 GHz for 0.118 cable

K101F

Description: K Female In-Line Cable Connector, DC-46 GHz for 0.118 cable







K102M

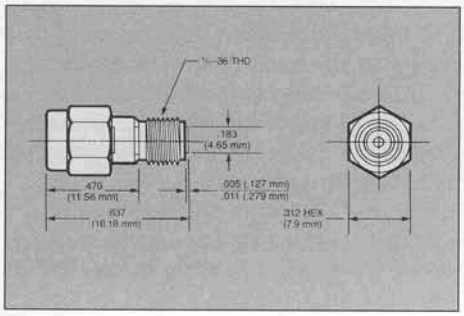
Description: K Male Sparkplug Launcher Connector, DC-46 GHz

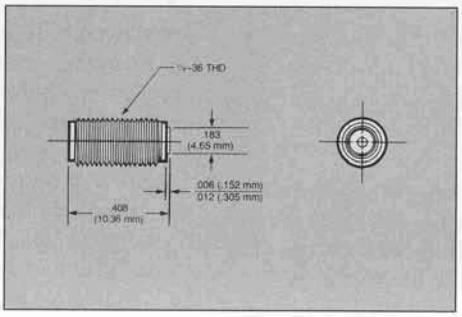
K102F

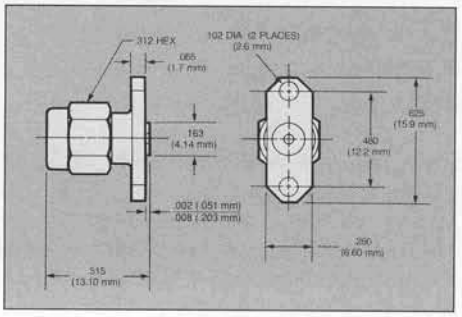
Description: K Female Sparkplug Launcher Connector, DC-46 GHz

K103M

Description: K Male Flange Launcher, two-hole, DC-46 GHz







K103F

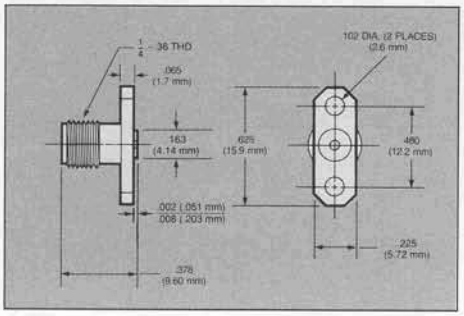
Description: K Female Flange Launcher, two-hole, DC-46 GHz

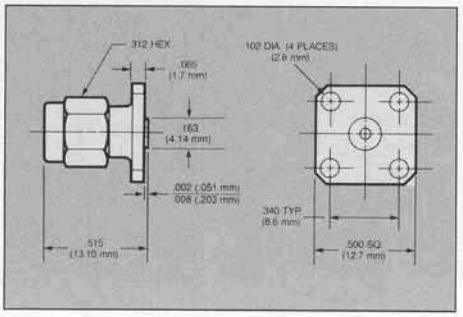
K104M

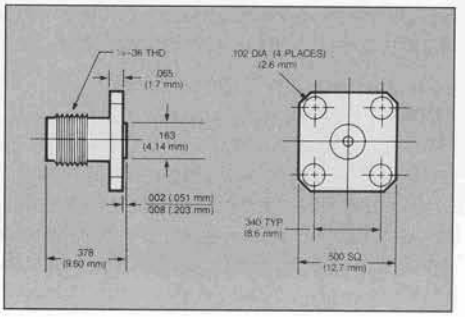
Description: K Male Flange Launcher, four-hole, DC-46 GHz

K104F

Description: K Female Flange Launcher, four-hole, DC-46 GHz







K and V Connectors

V Series; DC to 65 GHz

V Connector® Highlights

- *Excellent Performance Up to 65 GHz*
- *Performance Exceeding SMA Below 18 GHz*
- *Superior Reliability*
- *Compatibility With 2.4 mm*
- *Familiar Assembly Procedures*
- *Complete Testability on Existing Network Analyzers*

Performance and Reliability at 65 GHz

The V Connector is a reliable, 1.85 mm device that operates up to 65 GHz. It is compatible with 2.4 mm connectors and is assembled using procedures that are similar to those used on K Connectors. It is well suited to applications in components, systems, or instrumentation.

Launcher Design

At the heart of the V Connector product line are the launchers. As their name implies, the launchers "launch" (make the transition) from a microwave circuit (microstrip, suspended substrate, stripline, or coplanar waveguide) to a coaxial connector and an outside transmission line. The key to making the transition without compromising electrical and mechanical objectives is the glass bead in the launcher assembly.

Low-Reflection Glass Bead

The V Connector's standard glass bead has a unique .009 inch center conductor and readily connects to fragile devices. The bead is appropriate for most applications employing Duroid® and ceramic (Alumina) microstrip, such as the .010 inch wide center conductor on a .010 inch thick Alumina substrate. Applications using suspended substrate geometries are equally well satisfied. The bead is constructed of Corning 7070 glass and has a gold-plated center conductor and a gold-plated Kovar collar.

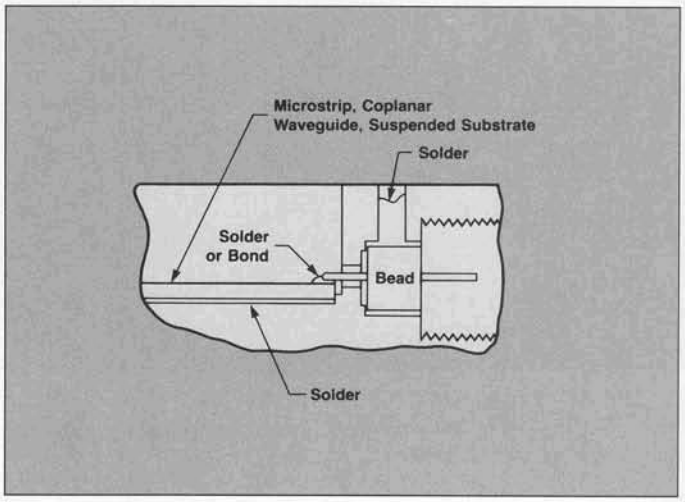
The outstanding design of the bead is largely accountable for the excellent performance of the V Connector launchers. In addition, the design provides for soldering the bead to achieve a hermetic seal.

The V Connector launchers can be removed for repair without removal of the glass bead. This ensures that during removal the critical microcircuit-to-glass bead interface is not disturbed, that hermeticity is preserved, and that the microcircuit will not be subjected to the additional stress caused by heating to soldering temperature.

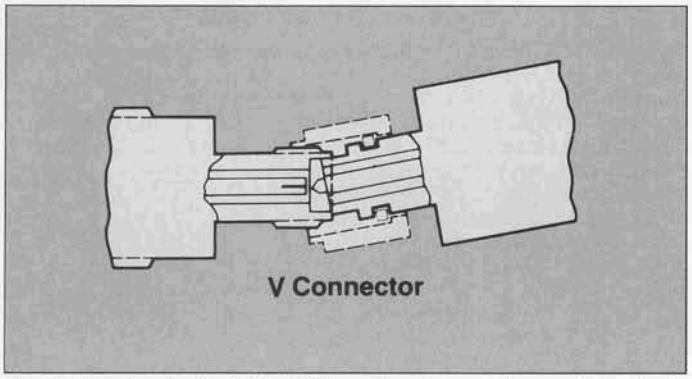
Exceptional Reliability and Repeatability

Microwave connector reliability is affected by insertion force, outer conductor strength, stress relief while mating, and mating alignment. The V Connector exhibits exceptional performance in all of these areas.

All V Connectors, including the cable connectors, incorporate another feature that eliminates a major cause of connector failure. This failure is caused by misalignment of the male pin with respect to the female. To solve the problem, the V Connector male pin is deliberately made sufficiently short to prevent damage to the female connector by misalignment. With this arrangement, the outer housing must be properly aligned prior to the mating of the center conductors. Thus a proper, non-destructive alignment before mating is ensured.



The V Connector's glass bead provides a high quality transition from a microcircuit to an outside transmission line.



The shortened male pin in the V Connector allows center conductors to be pre-aligned before contact, eliminating damage to the female connector.

Complete Family

Wiltron's family of V Connector products is large and growing. Virtually every interface need can be satisfied by one or more of the items offered. As a convenience to the design engineer, each item is completely specified with both guaranteed and typical performance.

There are four different models of V Connector launchers. Two types of sparkplug (screw-in) launchers are available: the V102F female version and the V102M male version. Both screw into the housing that encloses the microwave circuit. And, like all Wiltron launchers, they can be easily removed for replacement or repair without unsoldering the glass bead and its interface to the microwave circuit.

When the housing that encloses the microwave circuit is not thick enough to support a threaded, screw-in launcher, flush-mounted (flange) launchers are required. Models with two mounting holes are available in both male and female version, V103F and V103M. The mounting hole spacing is identical to that of similar SMA flange launchers. The glass bead interface, of course, is the same design used for the sparkplug launcher.

The V Connector coaxial cables use an 0.85-inch cable with a microporous Teflon dielectric and a copper center conductor. The cable assemblies use the center conducter of the coax as the male pin. This is similar to the UT–141 SMA-type assembly and the 2.4 mm cable assemblies. The microporous Teflon dielectric has maximum phase stability and minimum insertion loss. This type of cable assembly allows for easy assembly and maximum RF performance; however, since the male pin is copper, the cable assemblies are not suitable for repeated connections. In applications where the cable will be subject to more than 100 connections, it is recommended that a connector saver be used.

Cable Connectors

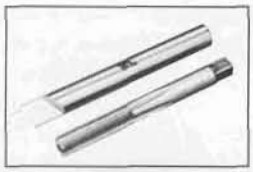
To complement this high performance cable, both male and female cable connectors are available. Typical return loss at 60 GHz for finished cables exceeds 16 dB (1.35 SWR).

K and V Connectors

TOOLS AND FIXTURES

01–303 Soldering Fixture for sparkplug launcher glass beads, package of 10.

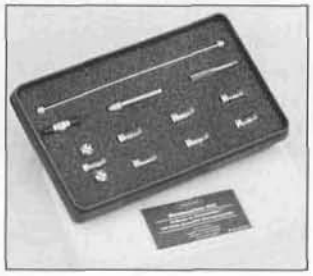
01–304 Drill and Tap Set for precision machining of concentric holes for mounting V Connector in microwave housing. (Step Drill Part No. 783-568) (Tap Part No. 783-569)



01–105A K and V Connector Male and Female Sparkplug Torquing Kit

EVALUATION KIT

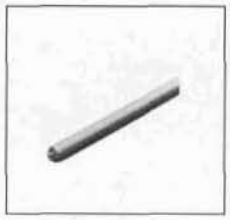
01–301 V Connector Evaluation Kit
Description: Kit contains one V120-10 10-inch Male/Male Cable Assembly, two V102F Female Sparkplug Launcher Connector Assemblies, two V103F Female Flange Launcher Connector Assemblies, two V101M Male In-line Cable Connector Assemblies, five V100 Glass Beads, one 01–304 Drill and Tap Set, one 01-302 Test Fixture, one 01-303 Soldering Fixture.

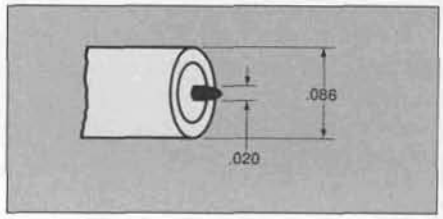


SEMIRIGID COAXIAL CABLE

Type: Semirigid coaxial, tin-plated copper outer conductor, silver-plated copper center conductor.
Impedance: 50 ±2 Ohms
Dielectric Type: Microporous Teflon, 0.150 cm (0.059 in.) diameter.
Dielectric Constant: 1.687
Relative Velocity: 0.77
Outside Diameter: 0.218 cm (0.086 in.)
Center Conductor Diameter: 0.051 cm (0.020 in.)
Minimum Bend Radius: 0.64 cm (0.25 in.)
Attenuation: 0.7 dB/ft at 10 GHz
1.1 dB/ft at 20 GHz
1.3 dB/ft at 30 GHz
1.6 dB/ft at 40 GHz
2.2 dB/ft at 60 GHz

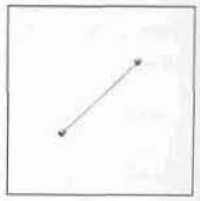
V085 Semirigid Coaxial Cable
Description: 1.52 m (5 ft.) length of 0.086-inch semirigid cable for V101 series connector.



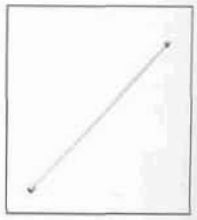


CABLE ASSEMBLIES

V120–6 Cable Assemblies
Description: Semirigid cable with V101M Male Connector on each end. Assembled length is 15.25 cm (6 in.).



V120–12 Cable Assemblies
Description: Semirigid cable with V101M Male Connector on each end. Assembled length is 30.5 cm (12 in.).



MICROSTRIP-TO-V LAUNCHERS & CABLE CONNECTORS

Return Loss (launchers only): 15 dB up to 60 GHz.
Coupling Nut Tightening Torque: 13.8 Kg-cm (12 in.-lb.) max.
Material: Passivated stainless steel with heat-treated beryllium copper center conductors.
Pin Depth: 0.000 to –0.076 mm (0.000 to –0.003 in.) for male and female connectors.
Temperature Range: –55°C to +125°C

V100

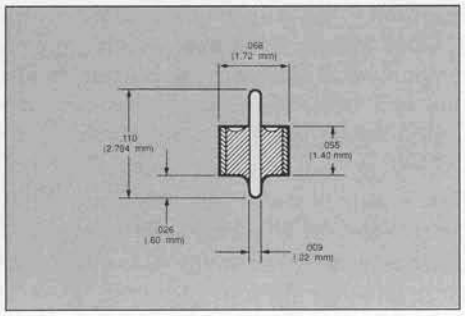
Description: Glass Beads for V102 and V103 connectors (package of 5)

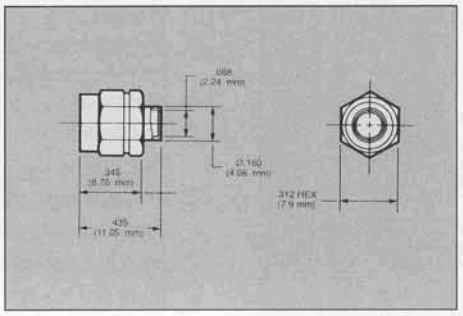
V101M

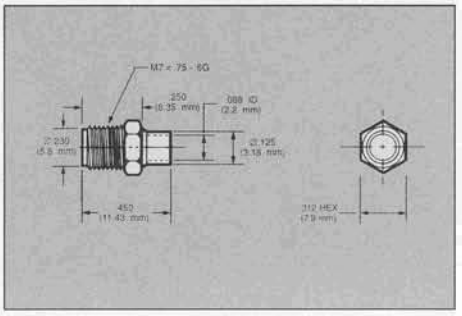
Description: V Male In-Line Cable Connector, DC-65 GHz for V085 cable

V101F

Description: V Female In-Line Cable Connector, DC-65 GHz for V085 cable







V102M

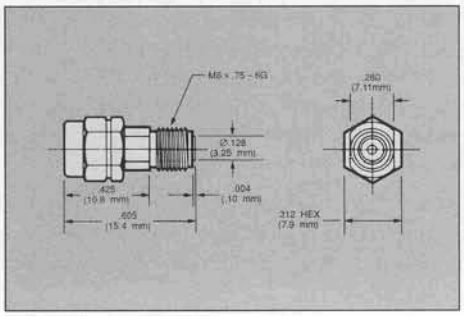
Description: V Male Sparkplug Launcher Connector, DC-65 GHz

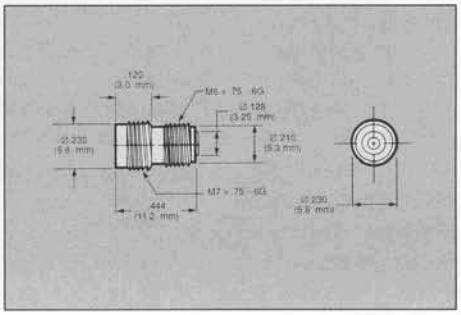
V102F

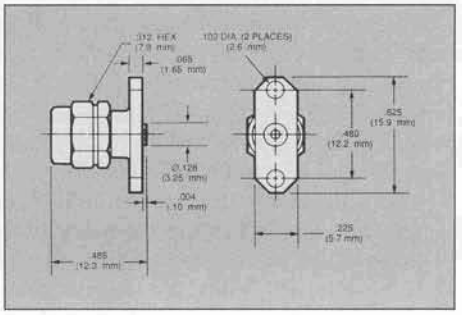
Description: V Female Sparkplug Launcher Connector, DC-65 GHz

V103M

Description: V Male Flange Launcher, two-hole, DC-65 GHz

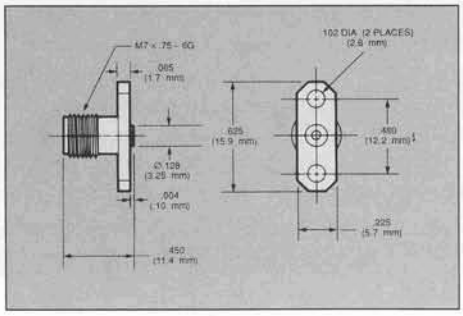






V103F

Description: V Female Flange Launcher, two-hole, DC-65 GHz



Ordering Information

Placing Purchase Orders

Orders may be placed through Wiltron Regional or Representative Sales Offices listed in the rear of this catalog.

Prices and Terms of Sale

The prices that may be included in this catalog are for USA customers only and were the prevailing net prices at the time of printing. These prices are useful for budgetary estimating purposes, but are subject to change without notice. Delivered prices can be obtained from Wiltron Regional or Representative Sales Offices.

- **USA Customers:** Prices are F.O.B. Morgan Hill, California. Standard credit terms are Net 30. Shipping charges may be prepaid or C.O.D, as specified on the purchase order.
- **International Customers:** Prices and terms of sale may be obtained from the Wiltron Regional and Representative Sales Offices or from the factory. For orders placed directly with the factory, the terms of sale is an irrevocable letter of credit. The beneficiary must be Wiltron Company, 490 Jarvis Drive, Morgan Hill, California 95037–2809, USA. Prices are F.O.B. origin. Prices for C.I.F. point of destination are available upon request. Export packaging for air shipments is provided at no charge.

OEM and Special Purchase Agreements

OEM and Special Purchase Agreements are available for multiple-unit requirements.

Minimum Order

There is a minimum order amount of $25 in USA currency or the equivalent in other currencies.

Rental or Leasing

In the USA, Wiltron instruments and systems are available for rental under a variety of convenient plans. For periods ranging from three to twelve months, rental at 6% of the selling price per month is available. For rental periods of 12, 24 or 36 months Wiltron's E-Z Rent program with a low monthly rental rate of 2.75% of the selling price is available. Under all rental plans sixty-five percent of the rent paid may be applied toward purchase. Three or five year attractive lease terms are also available; ask your Wiltron Sales Representative for details.

USA Government Sales

Many Wiltron products may be purchased on the following GSA Federal Supply Schedules:

- Contract GS-OOF-5994A, Section H, Instruments and Laboratory Equipment, August 1, 1991 through July 31, 1995
- Contract GS-OOF-2483A, Section J, Instruments and Laboratory Equipment, June 27,1990 through May 31, 1993
- National Stock Numbers for Wiltron products are available, please contact the factory. Wiltron's Federal Supply Code (FSC) is 20944.

Source Inspection

Source inspection is available for an additional charge.

Certificates of Conformance

Certificates of Conformance to published specifications and traceability to NIST are available upon request.

Warranty

All Wiltron products are warranted against defects in materials and workmanship for one year from the date of shipment. YIG-tuned oscillators are warranted for two years. All microwave components in the 6700B Series are warranted for 2 years. Wiltron's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Wiltron for warranty repair. Obligation is limited to the original purchaser. Wiltron is not liable for consequential damages.

Service Warranty

Wiltron warrants its service labor and replacement parts to be free from defects in material and workmanship for the greater of 90 days from the date of shipment or the remainder of the original product warranty.

Limitations of Warranty

The foregoing warranty does not apply to connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications for the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

Software Warranty

Wiltron software is warranted to operate in accordance with its programmed instructions for a period of one year from date of shipment. Wiltron does not warrant its software to be error-free or that all errors will be corrected. Wiltron assumes no responsibility and will not accept liability (consequential or otherwise) arising from the use of its software.

Special Products

Many Wiltron products can be modified to meet special requirements. Specifications for frequency range, output power, modulation capabilities, connectors, and spectral purity are typical of those that can be special ordered.

Application Engineers in your Wiltron Regional or Representative Sales Offices can help match a Wiltron solution to your application.

Service and Support

Our Commitment to You

Wiltron Company is committed to providing fast, professional customer service and support through a worldwide, computer-linked network of Customer Service Centers. Each Customer Service Center is staffed by factory-trained professionals and carries an extensive inventory of parts and replacement assemblies. A variety of flexible, comprehensive service and support products is available to help maximize your productivity and lower cost of ownership.

Support as a Product Option

Many Wiltron products are offered with Support Option "ES" which adds to product warranty to provide a total of three years of Return-to-Wiltron Repair Service from the time of delivery. This option, ordered with the product, locks in a competitive support cost at the time of purchase thus controlling cost of ownership for a specified time.

Service Agreements

Annual Repair and/or Calibration Service Agreements are also available on most Wiltron products. With a Wiltron Service Agreement you know in advance exactly what your support costs will be. You also have the assurance of knowing that your equipment will be serviced by qualified personnel using factory-approved procedures and instrumentation. Several Service Agreement options (detailed below) are available to meet your specific needs.

- **Repair Agreement:** Includes all labor and material required to maintain your product in good working condition. Should repair be required, the product is returned to the nearest Wiltron authorized Factory Service Center where it will be repaired and returned within the time span stated on the agreement (generally 5 days). Does not include calibrations (see Calibration and Full Service Agreements below).
- **Calibration Agreement:** Provides periodic calibrations at factory-recommended intervals. More economical than per incident calibrations and includes return freight.
- **Full Service Agreement:** Combines all the features of both the Repair Agreement and the Calibration Agreement in one convenient package.
- **Military Agreements:** Both the Calibration and Full Service Agreements are available in versions that comply with the requirements of MIL-STD-45662A.

Per-Incident Service

"Return-to-Wiltron" per-incident repair and/or calibration service is offered for most products on a Standard Service Price basis. A complete program description and price list is available from your Sales Representative or by contacting your Wiltron authorized Factory Service Center.

Exchange Assembly Service

Most Wiltron products are supported by an exchange assembly program. When using this service, you simply identify the defective assembly and order an exchange replacement from the closest Wiltron authorized Factory Service Center. Identifying the faulty assembly is facilitated by built-in diagnostic routines in most Wiltron products. The exchange assembly is sent directly to you. Upon return of the defective assembly you receive a significant credit towards the cost of

the exchange assembly. For more information on the Exchange Assembly Service and a list of products covered, please contact your Wiltron authorized Factory Service Center.

Replacement Parts

Wiltron supports customers who have their own maintenance facilities by providing an extensive inventory of repair parts at each service center. When ordering, simply notify the Service Center of the Wiltron part number and description as shown in the manual, along with the model and serial number of your instrument.

Special Services

The following special services are offered to meet special customer needs and to promote customer convenience:

- **Blanket Service Purchase Order:** Turnaround time can be reduced and customer documentation/order administration costs can be minimized through the use of a Blanket Service Purchase Order. Contact your local Wiltron authorized Factory Service Center for details.
- **Test Data:** Before and/or after test data is available at a nominal charge.
- **MIL-STD-45662A Calibration:** Wiltron can provide service and documentation meeting MIL-STD-45662A. There is an extra charge for the additional documentation and responsibilities associated with this service.
- **Telephone Consultation:** Our service engineers will gladly provide informal consultation over the telephone to customers with service questions.
- **On-Site Service:** On-site service is available as an option on certain Wiltron products and may be arranged on an "as-available" basis for others. Please contact your Wiltron authorized Factory Service Center for specifics.

Customer Training

Maintenance and service training are available on most Wiltron products. These courses, generally lasting one to two days per product, are designed to help maintenance personnel effectively troubleshoot and maintain Wiltron products. Courses may be scheduled either at a Wiltron Service Center or at the customer's site. Contact your local Wiltron authorized Factory Service Center for arrangements.

Wiltron Manufacturing Operations

Wiltron Facilities

The backbone of all test and measurement equipment suppliers is the manufacturing operation. Wiltron has two major manufacturing locations. The primary facility is in Morgan Hill, California in the U.S.A. The other is in Stevenage, U.K.

Wiltron People

Wiltron stands behind the people that build and test our products. Philosophies concerning quality and pride in workmanship are a match between both employee and employer. Many supervisors have previously worked in the departments that they now supervise. This makes them acutely aware of the need for proper training and development of their people. All manufacturing personnel receive a minimum one week training on the product and procedures concerning their job function prior to working on the product itself. Training continues throughout their career at Wiltron with technical and procedural updates being a primary focus.

Service to the Community

Concerns of the community are also a concern of Wiltron. Wiltron manufacturing is a pioneer in the usage of no-clean flux. These nonreactive, water based fluxes need not be removed from printed circuit cards. This eliminates the usage of chemicals containing chlorofluorocarbons (CFCs) which are known to damage the Earths' ozone layer. There are no CFCs used anywhere in Wiltron manufacturing.

Product Reliability

Of primary concern are our customers. Building reliable products has become a Wiltron trademark. Wiltron maintains a company-wide program to eliminate damage from Electrostatic Discharge (ESD). Beginning with grounded wrist straps in 1981, these procedures now encompass:

- Conductive wax on all manufacturing floors.
- Conductive heel straps worn by manufacturing employees.
- Conductive drag chains on all carts used to transport product.
- Anti-static smocks worn in all production areas.

Every employee that comes into contact with electronic components follows static procedures. This includes areas of receiving, stocking, quality assurance and shipping. Wiltron manufacturing engineers routinely visit vendors to educate and insure the use of proper ESD procedures.

To better control the reliability of our products, Wiltron manufactures the RF and microwave components used in our equipment. The micro-electronics facility produces substrates housed in our YIG oscillators and down converters. This emphasis begins with reliability and carries through to the end product.

Wiltron's Commitment

Wiltron manufacturing is committed to continuous improvement in our processes and products providing the most cost effective solutions to your measurement needs. When you purchase Wiltron equipment you receive the support and experience of people dedicated to making sure you are a repeat customer.

Wiltron Sales Offices

ARGENTINA

IOTA S.A.
Av. Avellaneda 1567
Capital Federal
1406 Buenos Aires
TEL: (01)-432-8520
FAX: (01)-432-8522

AUSTRALIA

WILTRON PTY LTD.
1/410 CHurch Street
North Parramatta
NSW 2151
TEL: (02)-630-8199
FAX: (02)-683-6884

AUSTRIA

TOMEK-ELECTRONICS GmbH
Kolpingstrasse 16
A-1232 Vienna
TEL: (01)-610030
FAX: (01)-610036

BELGIUM

HEYNEN N.V.
Industriepark Houthalen-Zuid
De Koelen 6
3530 Houthalen
TEL: (011)-52-5757
FAX: (011)-52-5777

BRAZIL

RIO DI JANEIRO

ANRITSU WILTRON
ELECTRONICA LTDA.
Praia de Botafogo
440-sala 2.401-Batafogo RJ Brazil
2225 Rio de Janeiro
TEL: (021)-286-9141
FAX: (021)-537-1456

SAO PAULO

ANRITSU WILTRON
ELECTRONICA LTDA.
Praca Amadeu Amaral
27-cjs. 101-Paraiso
01327 Sao Paulo SP Brazil
TEL: (011)-285-3091
FAX: (011)-288-6940

CANADA

WILTRON INSTRUMENTS LTD.
215 Stafford Rd. Unit 102
Nepean, Ontario K2H 9C1
TEL: (613) 726-8800
FAX: (613) 820-9525

CHINA

BEIJING

PROSTEN TECHNOLOGY CO. LTD.
Room 40527
Beijing Friendship Hotel
3 Jai Shi Qiaro Road
Beijing 100873
TEL: (01)-849888
FAX: (01) -849-8866
TELEX: 222362 FHBJCN

SCHMIDT & COMPANY LTD.
Room 801/802, 8/f.,Office Tower
Beijing New Century Hotel
6 Capital Gymnasium Southern Road
Beijing 100046
TEL: (01) 849-2108
FAX: (01) 849-2109
TELEX: 22860 SCHBJCN

SHANGHAI

PROSTEN TECHNOLOGY CO. LTD.
Hotel Equatorial Shanghai
64 Yanan Road West
Shanghai 200040
TEL: (021)-2791688 Ext. 7608
FAX: (021)-2581773

COSTA RICA

ELECTRO-IMPEX, S.A.
P.O. Box 620-1000
San Jose
TEL: (031)-5701
FAX: (031)-6531

CZECHOSLOVAKIA (CSFR)

TOMEK-ELECTRONICS GmbH
Kolpingstrasse 16
A-1232 Vienna
Austria
TEL: 43-(1)-610030
FAX: 43-(1)-610036

DENMARK

S.C. METRICK A/S
Skodsborgvej 305
DK-2850 Naerum
TEL: (042)-804200
FAX: (042)-804131

EGYPT

GIZA SYSTEMS ENGINEERING
2 El Mesaha Square
Dokki, A.R.E.
P.O. Box 1913
Cairo 11511
TEL: (02)-3490140
FAX: (02)-3609932

EUOROPEAN REGIONAL CENTER

ANRITSU WILTRON
Capability Green
Luton,Bedfordshire LU1 3LU
U.K.
TEL: 44-(582)-418853
FAX: 44-(582)-31303
TELEX: 826750 ANRSEU G

FINLAND

FINDIP OY
P.O. Box 64
Vitikka 1
SF-02631 ESPOO
TEL: (0)-5281
FAX: (0)-5021973

FRANCE

PARIS

ANRITSU WILTRON SA
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
TEL: (1)-64-466546
FAX: (1)-64-461065

TOULOUSE

ANRITSU WILTRON SA
Bureau de Tolouse
Region Sud-Ouest
TEL: (16)-62070484
FAX: (16)-62070668

GERMANY

DUSSELDORF

ANRITSU WILTRON GMBH
Grafenberger Allee 54-56
4000 Dusseldorf 1
TEL: (0211)-679760
FAX: (0211)-683353

MUNCHEN

ANRITSU WILTRON GMBH
Rudolf Diesel Str 17
8031 Gilching
TEL: (08105)-8055
FAX: (08105)-1700

STUTTGART

ANRTISU WILTRON GMBH
Zettachring 8A
7000 Stuttgart 80
TEL: (0711)-7280941
FAX: (0711)-727565

GREECE

SPACE HELLAS S.A.
302 Messagian Avenue
GR-155 62 Holargos
Athens
TEL: (01)-652-7008
FAX: (01)-651-6712

HONG KONG

SCHMIDT & COMPANY (H.K.) LTD.
18th Floor, Great Eagle Centre
23 Harbour Road
Wanchai
TEL: (5)-8330222
FAX: (5)-8275656
TELEX: 780-74766

HUNGARY

TOMEK-ELECTRONICS GmbH
Kolpingstrasse 16
A-1232 Vienna
Austria
TEL: 43-(1)-610030
FAX: 43-(1)-610036

INDIA

BANGALORE

ACCUTROL SYSTEMS PRIVATE LIMITED
No. 13 11th Main Raod
5th Block, Jayangar
Bangalore 560 041
TEL: (812)-644-556
FAX: (812)-647-982

BOMBAY

ACCUTROL SYSTEMS PRIVATE LIMITED
Express Towers
Nariman Point
Bombay 400 021
TEL: (22)-202-3218
FAX: (22)-202-9403
TELEX: 953-11-85514 ASPL IN

CALCUTTA

ACCUTROL SYSTEMS PRIVATE LIMITED
CG-243 Sector II
Salt Lake City
Calcutta 700 091
TEL: (33)-345-559
FAX: (33)-345-559

HYDERABAD

ACCUTROL SYSTEMS PRIVATE LIMITED
Plot No. 52
Siddarth Nagar
Vengairao Nagar P.O.
Hyderabad 500 890
TEL: (842)-363-837

NEW DELHI

ACCUTROL SYSTEMS PRIVATE LIMITED
N-195 Greater Kailash-I
New Delhi 110 048
TEL: (11)-641-3577
TELEX: 953-31-71297

INDONESIA

P.T. SUBUR SAKTI PUTERA
Jr. Musi No. 32
Jakarta 10150
TEL: (021)-3803644
FAX: (021)-3845043
TELEX: 44989

IRELAND

PEMA LTD.
Doromiskin
Dundalk
Co. Louth
TEL: (42)72899
FAX: (42)72376

ISRAEL

TECH-CENT LTD.
P.O. Box 43259
Tel-Aviv 81430
TEL: (03)-478563
FAX: (03)-478334

ITALY

MILAN

ANRITSU WILTRON Sp.A.
C.D. Colleoni, Via Paracelso, 14
20041 Agrate Brianza (MI)
TEL: (039)-639411
FAX: (039)-639419

ROME

ANRITSU WILTRON Sp.A.
Via Elio Vittorini, 129
00144 Rome
TEL: (06)-5022666
FAX: (06)-50224252

JAPAN

TOKYO

ANRITSU CORPORATION
5-10-27 Minami-Azabu
Minato-ku, 106
TEL: (03)-3446-1111
FAX: (03)-5420-0658

OSAKA

ANRITSU CORPORATION
Kansai Branch
4-1-14 Miyahara
Yodogawa-ku
Osaka 532
TEL: (06) 391-8813
FAX: (06) 391-8600

KOREA

WILTRON CORPORATION
1201 Singsong Bldg. 12F 25-4
Yeoeuido-Dong
Youngdeungpo-ku
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FAX: (02)-784-6409

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13066 Safat
TEL: (02) 436-100
FAX: (02) 437-700

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Industriepark Houthalen-Zuid
De Koelen 6
3530 Houthalen
Belgium
TEL: 32(11)-52-5757
FAX: 32(11)-52-5777
TELEX: 846-39047

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MECOMB MALAYSIA SDN BHD
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46700 Betaling Jaya
Selangor
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FAX: (03)-7743414
TELEX: 784-37764

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ELECTRONICA 2000
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FAX: (5) 548-34-53

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Mt. Eden, Auckland
TEL: (09)-601720
FAX: (09)-607871

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Post Box 63, NYE Vakasvei 80
N-1364 Hvalstad
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FAX: (02)-982066

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FAX: (02) 815-0986
TELEX: 66026 Rensal PN.

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TOMEK-ELECTRONICS GmbH
Kolpingstrasse 16
A-1232 Vienna
Austria
TEL: 43-(1)-610030
FAX: 43-(1)-610036

PORTUGAL

DECADA S.A.
Rua Margarida Palla No. 11-B
Miraflores/Alges
1492 Lisboa
TEL: (01)-410-3420
FAX: (01)-4101844

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TRADING AND AGENCY SERVICES
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Doha
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FAX: 422255

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1. Kozhuhovskii Proezd
dom 9, flat 32
Moscow, 109280
TEL: (095) 275-1257

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Riyadh, 11481
TEL: (01)-4771650
FAX: (01)-4785140
TELEX: 928-201120

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24 Ang Mo Kio Street 65
Industrial Park 3
Singapore 2056
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FAX: 4821079
TELEX: 786-21901

SLOVANIA

TOMEK-ELECTRONICS GmbH
Kolpingstrasse 16
A-1232 Vienna
Austria
TEL: 43-(1)-610030
FAX: 43-(1)-610036

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MADRID

UNITRONICS S.A.
Plaza Espana, 18
Torre de Madrid
Pl.12-ofc. 9
28008 Madrid
TEL: (01)-5425204
FAX: (01)-5427896

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S-127 25 Skarholmen
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Leasburg, MO 65535
TEL: (314) 245-6579

INDIANA

ANRITSU WILTRON SALES COMPANY
1816 Michigan Ave., Suite 104
Naperville, IL 60563
TEL: (708) 369-2424

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Naperville, IL 60563
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Norcross, GA 30071
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TEL: (201) 227-8999

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4166 Heatherton Place
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Naperville, IL 60563
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Richardson, TX 75081
TEL: (214) 644-5086

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20595 S.W. T.V. Hwy.,Suite 103B
Aloha, OR 97006
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ANRITSU WILTRON SALES COMPANY
3125 Poplarwood Ct. Suite 133
Raleigh, NC 27604
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FAX: (01) 5017553

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FAX: (03) 481958

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Via E. Vittorini, 129
00144 Roma EUR
TEL: (06) 5005171
FAX: (06) 5005273

JAPAN

ANRITSU CORPORATION
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
TEL: 0462-23-1111
FAX: 0462-25-8379

KOREA

WILTRON CORPORATION
1201 Sinsong Bldg. 12F,
25-4 Yeoeuido-Dong
Youngdeungpo-ku, Seoul
TEL: (02) 785-6407
FAX: (02) 784-6409

SWEDEN

WILTRON AB
Box 247
S-127 25 Skarholmen
TEL: (08) 7405840
TELEX: (854) 8135089
FAX: (08) 7109960

TAIWAN

WILTRON CO., LTD.
8F, No. 96, Section 3
Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
TEL: (02) 515-6050
FAX: (02) 505-5519

UNITED KINGDOM

ANRITSU EUROPE LTD.
Capability Green
Luton, Bedfordshire
LU1 3LU, England
TEL: (0582) 418853
TELEX: (851) 826750
FAX: (011) 582-31303

WEST GERMANY

WILTRON GmbH
Rudolf Diesel Str 17
8031 Gilching
TEL: (08105) 8055
TELEX: (841) 528523
FAX: (08105) 1700

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