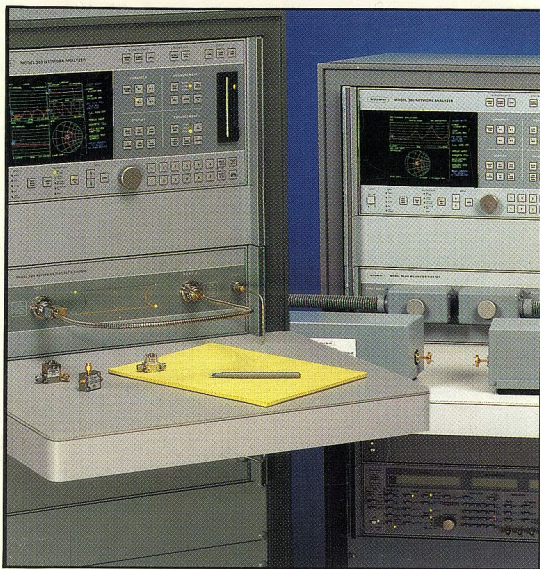


WILTRON

1990 Catalog



VECTOR NETWORK ANALYZERS

WAVEGUIDE 33 TO 110 GHz

COAXIAL 40 MHz TO 60 GHz

PULSED OR CW

NOISE FIGURE

PERFORMANCE CUTS DESIGN TIME WITH CONFIDENCE



SCALAR NETWORK ANALYZERS RF AND MICROWAVE

1 MHz TO 40 GHz

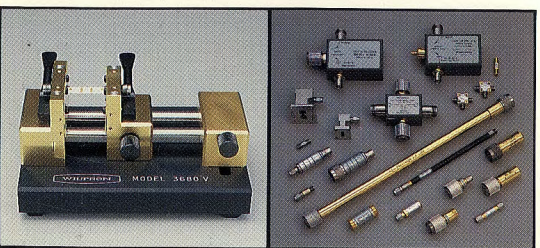
VERSATILITY FOR DESIGN AND PRODUCTION



SWEPT FREQUENCY SYNTHESIZERS AND SWEEP GENERATORS

10 MHz TO 60 GHz

PERFORMANCE AND FEATURES IMPROVE PRODUCTIVITY



MEASUREMENT COMPONENTS AND CONNECTORS

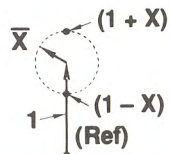
DC TO 60 GHz

PRECISION TOOLS FOR ALL MICROWAVE
MEASUREMENTS

30 years

RF Measurement Chart

Conversion tables for return loss, reflection coefficient, and SWR with values for interactions of a small phasor X with a large phasor (unity reference) expressed in dB related to reference.



Phasor Interaction

Relative to Unity Reference

SWR	Reflection Coefficient	Return Loss (dB)	X dB Below Ref + X Reference	Ref + X (dB)	Ref - X (dB)	Ref ± X Pk to Pk Ripple (dB)
17.3910	.8913	1	1	5.5350	-19.2715	24.8065
8.7242	.7943	2	2	5.0780	-13.7365	18.8145
5.8480	.7079	3	3	4.6495	-10.6907	15.3402
4.4194	.6310	4	4	4.2489	- 8.6585	12.9073
3.5698	.5623	5	5	3.8755	- 7.1773	11.0528
3.0095	.5012	6	6	3.5287	- 6.0412	9.5699
2.6146	.4467	7	7	3.2075	- 5.1405	8.3480
2.3229	.3981	8	8	2.9108	- 4.4096	7.3204
2.0999	.3548	9	9	2.6376	- 3.8063	6.4439
1.9250	.3162	10	10	2.3866	- 3.3018	5.6884
1.7849	.2818	11	11	2.1567	- 2.8756	5.0322
1.6709	.2512	12	12	1.9465	- 2.5126	4.4590
1.5769	.2239	13	13	1.7547	- 2.2013	3.9561
1.4985	.1995	14	14	1.5802	- 1.9331	3.5133
1.4326	.1778	15	15	1.4216	- 1.7007	3.1224
1.3767	.1585	16	16	1.2778	- 1.4988	2.7766
1.3290	.1413	17	17	1.1476	- 1.3227	2.4703
1.2880	.1259	18	18	1.0299	- 1.1687	2.1986
1.2528	.1122	19	19	.9237	- 1.0337	1.9574
1.2222	.1000	20	20	.8279	- .9151	1.7430
1.1957	.0891	21	21	.7416	- .8108	1.5524
1.1726	.0794	22	22	.6639	- .7189	1.3828
1.1524	.0708	23	23	.5941	- .6378	1.2319
1.1347	.0631	24	24	.5314	- .5661	1.0975
1.1192	.0562	25	25	.4752	- .5027	.9779
1.1055	.0501	26	26	.4248	- .4466	.8714
1.0935	.0447	27	27	.3796	- .3969	.7765
1.0829	.0398	28	28	.3391	- .3529	.6919
1.0736	.0355	29	29	.3028	- .3138	.6166
1.0653	.0316	30	30	.2704	- .2791	.5495
1.0580	.0282	31	31	.2414	- .2483	.4897
1.0515	.0251	32	32	.2155	- .2210	.4365
1.0458	.0224	33	33	.1923	- .1967	.3890
1.0407	.0200	34	34	.1716	- .1751	.3467
1.0362	.0178	35	35	.1531	- .1558	.3090
1.0322	.0158	36	36	.1366	- .1388	.2753
1.0287	.0141	37	37	.1218	- .1236	.2454
1.0255	.0126	38	38	.1087	- .1100	.2187
1.0227	.0112	39	39	.0969	- .0980	.1949
1.0202	.0100	40	40	.0864	- .0873	.1737
1.0180	.0089	41	41	.0771	- .0778	.1548
1.0160	.0079	42	42	.0687	- .0693	.1380
1.0143	.0071	43	43	.0613	- .0617	.1230
1.0127	.0063	44	44	.0546	- .0550	.1096
1.0113	.0056	45	45	.0487	- .0490	.0977
1.0101	.0050	46	46	.0434	- .0436	.0871
1.0090	.0045	47	47	.0387	- .0389	.0776
1.0080	.0040	48	48	.0345	- .0346	.0692
1.0071	.0035	49	49	.0308	- .0309	.0616
1.0063	.0032	50	50	.0274	- .0275	.0549
1.0057	.0028	51	51	.0244	- .0245	.0490
1.0050	.0025	52	52	.0218	- .0218	.0436
1.0045	.0022	53	53	.0194	- .0195	.0389
1.0040	.0020	54	54	.0173	- .0173	.0347
1.0036	.0018	55	55	.0154	- .0155	.0309
1.0032	.0016	56	56	.0138	- .0138	.0275
1.0028	.0014	57	57	.0123	- .0123	.0245
1.0025	.0013	58	58	.0109	- .0109	.0219
1.0022	.0011	59	59	.0097	- .0098	.0195
1.0020	.0010	60	60	.0087	- .0087	.0174

Dear Customer:

You will notice that this year's new products are specifically aimed at measurement applications where WILTRON offers a technical advantage. In this catalog are new and better solutions for:

1. Radar Cross Section (RCS) and antenna measurements;
2. The characterization of microstrip and coplanar waveguide circuits at both microwave and millimeter-wave frequencies;
3. Noise figure measurements and power measurements as a part of an integrated test station up to at least 20 GHz; and
4. Pulsed microwave measurements as narrow as 20 ns without degradation of CW measurement capability.

WILTRON marks its 30th anniversary this year and becomes an independently-operating division of ANRITSU which, by the way, will mark its own 60th anniversary next year. WILTRON still has only one philosophy — to single-mindedly provide measurement solutions with better measuring instruments. With this philosophy we have progressed to annual sales of \$85 million. In the process we have found ourselves to be an "international" company selling primarily to the export market. The influence of the U.S. military has been important in our industry and will continue to be. However, it is only one of many influences now.

WILTRON's \$85 million sales, although important to us, is dwarfed by the world communications market in which we find ourselves. This world market is, in the meantime, undergoing an almost-unprecedented revolution into new technologies that will soon be touching the lives of almost every person in the world. With our merger with ANRITSU, we can more fully participate in the world communications market. As a part of ANRITSU we are now an \$800 million-a-year company — a company that is known worldwide as a maker of better measuring instruments.

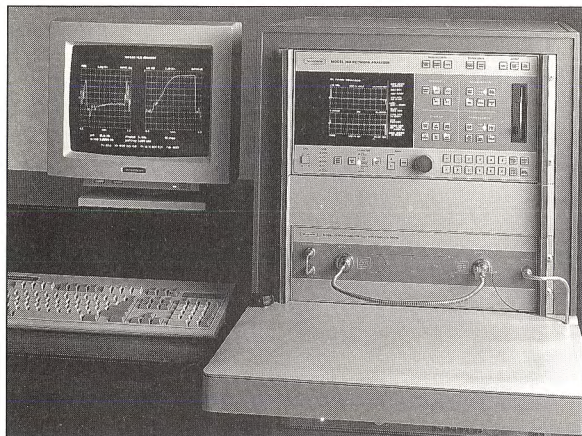
With our continuing philosophy and this added strength, now more than ever, you can count on WILTRON. You will see many new instruments in this catalog that I hope will serve you well. Continue to watch WILTRON in the coming years for other new products that will knock your socks off.

Sincerely,

A handwritten signature in black ink that reads "Bill Jarvis". The signature is written in a cursive, flowing style. The first name "Bill" is written in a larger, more prominent script, and the last name "Jarvis" follows it in a similar but slightly more compact script.

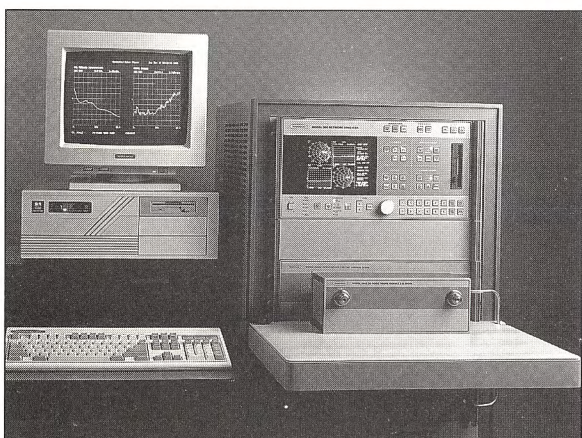
William E. Jarvis
President

New Product Summary



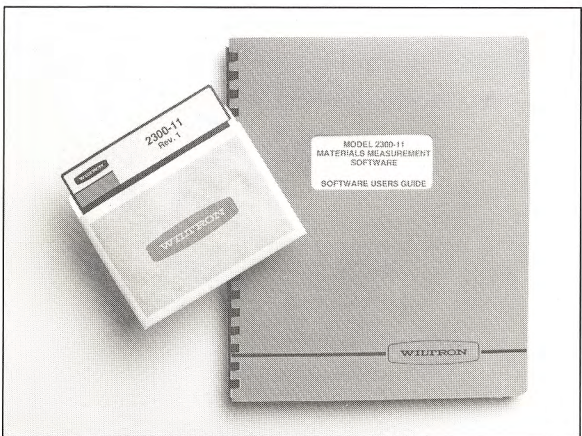
Pulsed or CW Vector Network Analyzer **NEW**

Wiltron's Pulsed or CW Network Analyzer combines full-performance CW measurements with the most powerful pulsed RF measurement capability available today. Pulse widths from 20 ns to CW can be characterized. Designers of GaAs FETs and MMIC devices can now fully evaluate device performance on the wafer. EW and radar systems engineers can now characterize components under actual-use pulsed RF conditions, thereby reducing problems at the systems level. See page 36.



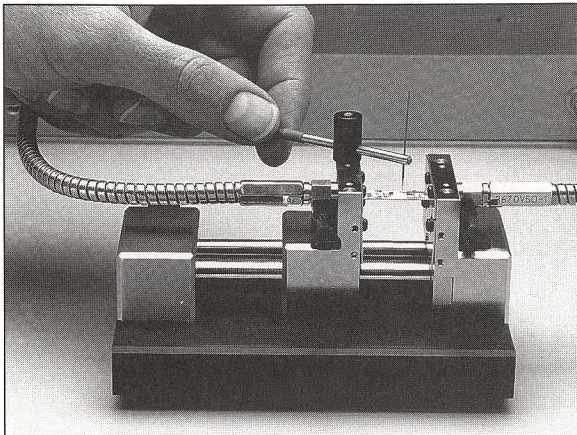
Noise Figure/Vector Network Analyzer **NEW**

Wiltron's new Noise Figure/Vector Network Analyzer is a key addition to Wiltron's new Single-Connection Multi-Measurement (SCMM) philosophy and brings a new level of ease in accurately characterizing and optimizing low noise microwave devices. The addition of vector error correction to noise figure measurements significantly adds to measurement accuracy. See page 34.



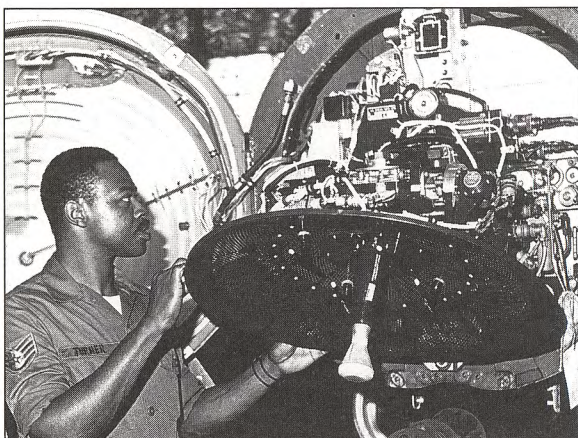
Materials Measurement Software **NEW**

Wiltron's new materials measurement software computes the complex permittivity and permeability of materials based on one-port 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 32.



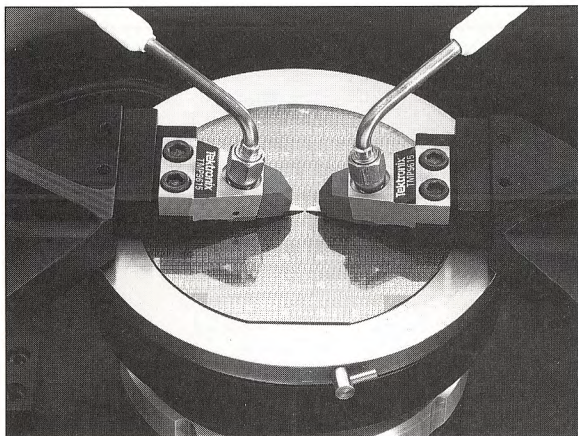
Universal Test Fixtures **NEW**

The new Wiltron universal test fixtures provide an accurate, repeatable solution for measuring microstrip and coplanar substrate devices. Wiltron provides everything you need to make accurate vector and scalar measurements on substrate devices, including dc to 40 and dc to 60 GHz test fixtures, substrate calibration/verification kits, and accessories. Wiltron's complete solution makes it easy for you to characterize devices at the substrate level — saving the time and expense of packaging devices for measurement. The exceptional accuracy gives you confidence that on-substrate measurements are correct. See page 76.



Antenna and RCS Measurements **NEW**

Antenna and Radar Cross Section (RCS) measurements are used to characterize antennas and illuminate targets so that their reflected power can be measured. The 360 Vector Network Analyzer offers significant advantages over other VNAs as it is able to perform "Hard Gating" of the received signal to provide up to 80 dB rejection of undesired responses. Exceptional dynamic range gives greater sensitivity and accuracy. Wiltron's VNA has two full test channels plus a reference channel so that both horizontally- and vertically-polarized signals can be measured simultaneously. Other VNAs contain just a single reference and test channel so time-consuming and error-producing switching between antennas is involved. See page 32.



MMIC Measurement System **NEW**

Wiltron's new MMIC Measurement System is a specially-configured 360 Vector Network Analyzer for characterizing MMIC devices. It is a key addition to Wiltron's new Single-Connection Multi-Measurement (SCMM) philosophy. The system quickly measures S-parameters, absolute power, noise figure, and (optionally) pulsed RF characteristics. With Wiltron's MMIC Calibration software, accurate measurements can be made with user-defined, on-wafer calibration components. Turn-on characteristics of pulsed devices can be measured with 20 ns resolution. Power devices can be characterized on-wafer with a low-duty cycle, pulsed RF stimulus. See page 31.

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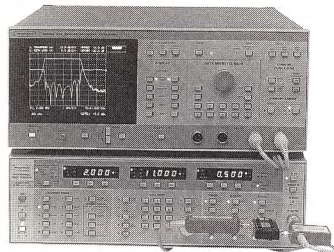
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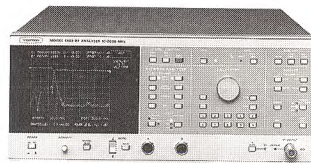
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Network Analyzers

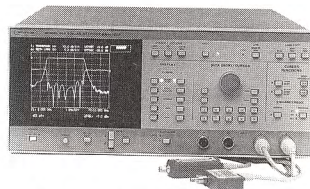
General Information



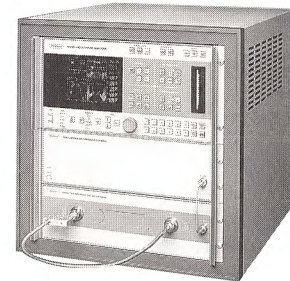
Scalar Network Analyzer Systems
5600B and 5700B Series



RF Analyzer
6400 Series



Scalar Network Analyzer
Model 562



Vector Network Analyzer
Model 360

Network Analysis

Network analysis includes the characterization of microwave devices through the measurement of their transmission and impedance characteristics as a function of frequency. It includes the measurement of input match, output match, forward transmission, and reverse transmission. Each parameter is a complex quantity consisting of magnitude and phase.

Scalar Versus Vector Network Analyzers. A network analyzer system consists of three main elements: the signal source, the measurement components, and the network analyzer or signal processing element. There are two basic types of network analyzers: scalar and vector. Scalar network analyzers measure only the magnitude of the transmission or reflection signal. Vector network analyzers measure the magnitude and the phase of the transmission or reflection parameter.

Vector Network Analysis

The thrust of Wiltron's VNA product line is to satisfy *all* VNA applications. Accordingly, the Wiltron 360 display instrument was designed for general purpose applications. It operates with software loaded from a front-panel disk drive via an MS-DOS® compatible file structure. Therefore, it has been easy to adapt Wiltron software to new applications, including

waveguide, active device de-embedding, antennas, and radar cross sections.

Test Sets. The measurement components for Wiltron vector network analyzers are located in test sets. These test sets contain all measuring and switching components required to make forward and reverse measurements of transmission and impedance. 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 microwave test sets is shown in Table 1. Several connector types can be accommodated including the popular SMA, K Connectors and V Connectors.

Error Correction. Measurement information provided by the 360 Vector Network Analyzer 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. The key factors in vector measurement accuracy are test set dynamic range and calibration kit accuracy. Wiltron offers unmatched performance in both areas.

Table 1. 360 Vector Network Analyzer Test Sets

Model	Frequency Range	Supplied Connector ^①	Test Set Type	Application
3610A 3611A 3612A	40 MHz to 20 GHz 40 MHz to 40 GHz 40 MHz to 60 GHz	K Male K Male V Male	Reversing	General purpose test sets. Internal reversing switch allows measurement of any network parameter (forward/reverse transmission and reflection) so test devices can be fully characterized. Also, the reversing switch allows 12-term error corrections to always be applied.
3620A 3621A 3622A	40 MHz to 20 GHz 40 MHz to 40 GHz 40 MHz to 60 GHz	K Male K Male V Male	Active Device	All the features of reversing test sets plus internal bias tees for biasing of active test devices. Also, step attenuators for control of test port power levels. A third step attenuator enables testing of all four parameters of active devices with up to 1 Watt output power. Increases dynamic range to >140 dB.
3630A 3631A	10 MHz to 40 GHz 10 MHz to 60 GHz	K Male V Male	Frequency Conversion	Direct input to all four microwave samplers for specialized measurement setups.
3635A	33 GHz to 110 GHz (in bands)	Waveguide	Reversing or Single Direction	Millimeter-wave coverage in bands to 110 GHz. 3640/3641 Series Modules define frequency range (Q, U, V, or W band).
3637A	270 MHz to 20 GHz	K Male	High Power Reversing	Incorporates couplers instead of resistive power splitters to accommodate up to 20 Watts average power. Ports are available for the addition of high power terminations and bias tees.

^①Coaxial test sets can be converted to APC-7, 2.4 mm, APC-3.5™, Type N, and K Connector using the 34U and 34Y Series Test Port Converters. Therefore, the test sets can be customized for the measurement application.

Table 2. 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	Used for measurements, such as microstrip, where opens and loads are difficult to fabricate. Two 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.

Calibration Kits. Wiltron supports a wide variety of calibration methods to give accurate measurements in almost any situation (see Table 2). For coaxial measurements, calibration kits are offered for SMA/APC-3.5™, GPC-7, Type N, K Connectors, and V Connectors. For microstrip measurements, calibration kits are offered in a wide range of substrate thicknesses. For on-wafer MMIC measurements, Wiltron offers MMIC Calibration software which allows the use of user designed calibration components.

Direct Phase-Locked Signal Source. The 360SS Series Signal Sources are recommended for use with the 360 Vector Network Analyzer. The 360SS sources are phase locked by the 360, ensuring accurate, fully specified measurements. Frequency accuracy is based on an ovenized crystal reference for nearly zero frequency drift.

No External Computers Required. The 360 contains internal microprocessing capability that exceeds that available in most external computer/controllers. Therefore, an external computer/controller is not required for automated measurements or for printing hard copies of test data. An external computer/controller is required only when a special-purpose automated test system is used or when the test data must be externally manipulated or archived.

Time Domain Capabilities. The 360 Option 2A High Speed Time (Distance) Domain measurement capability for the 360 Vector Network Analyzer 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.

Scalar Network Analysis

For measuring the magnitude of attenuation and impedance characteristics, such as SWR and return loss, the scalar network analyzer performs several of the measurements made on a vector network analyzer, but at a lower cost. See Table 3. The

scalar network analyzer offers 76 dB dynamic range compared to the greater than 105 dB range of the vector network analyzer. In some ways the scalar analyzer is easier to use. For example, calibration of scalar network analyzers consists only of compensating for transmission and reflection frequency response.

Because of the extensive use of microprocessors in the Wiltron 562 Scalar Network Analyzer and the 6400 Series RF Analyzers, they do not require the use of an external controller. However, they are IEEE-488 compatible and can be used in special purpose automated systems.

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 multiplied-up frequencies. This multiplication process produces signals rich in harmonics and (more worrisome) in subharmonics, which cannot be readily filtered out.

A complete scalar network analyzer system package, the 5600B Series, includes the 562 Scalar Network Analyzer, 6600B Sweep Generator, and all required measurement components. The 5700B Series substitutes a 6700B Swept Frequency Synthesizer instead of the 6600B Sweep Generator.

The Wiltron 6400 Series RF Analyzers are scalar network analyzers with built-in RF sources. No external source is required. Housing the network analyzer and RF source in a single package reduces cost and provides excellent portability, especially important for field use. A patented frequency correction scheme produces a hundredfold improvement in frequency accuracy compared to that of stand-alone sweep generators. The 6400 has virtually no frequency drift with time or temperature.

Automated Test Stations. Wiltron's new scalar network analyzers are aimed at inexpensive, automated test stations. Many new features such as complex limit lines, automated location of 1 dB, 3 dB, or other dB-down points, and limit points are effective time-saving aids.

Table 3. Scalar Network Analyzer Selection Guide

Model	Frequency Range	Signal Source	Application
562	10 MHz to 40 GHz ^①	6600B Sweep Generators, 6700B Synthesizers	The industry's newest scalar network analyzer, ideal for general purpose production and R&D applications. Fully compatible with both Wiltron and Hewlett-Packard sweepers and synthesizers. Complex limit lines, Intelligent Cursor, and up to nine markers enhance production testing. Built-in printer buffer eliminates long waits while printing data. Full-capability GPIB for ATE applications.
6407 6409	1 MHz to 1 GHz 10 MHz to 2 GHz	Built-in	A complete system for RF measurements. Ideal for field testing, as the network analyzer contains its own precision signal source with a hundredfold-better frequency accuracy than stand-alone sweep generators and almost zero drift with time or temperature. Direct hard copy of tabular or graphic data to a dot-matrix printer.

^①Waveguide detectors can be used to extend the 562 frequency range to 110 GHz or higher.

Vector Network Analyzer

Model 360: Coaxial—40 MHz to 60 GHz; Waveguide—33 GHz to 110 GHz



360 System Console
Model 360C1



360 Millimeter-Wave
System Console
Model 360C3



360 System Cabinet
Model 360C2

360 Vector Network Analyzer Highlights

- 40 MHz to 60 GHz Continuous Coaxial Coverage
- Full Reversing Waveguide Test Solution From 33 to 110 GHz
- Four S-parameter Display on Color Screen
- MS-DOS® Compatible Front-Panel Disk Drive
- Time Domain, Group Delay, and Frequency Domain Test Capabilities

The 360 Vector Network Analyzer is recognized as the leader for performance, accuracy, and versatility. Wiltron's modern approach makes it easy to upgrade or convert a 360 system to new capability. Since its introduction in 1987, Wiltron has continued to expand the 360 family of products to solve new requirements. You now have an unparalleled selection of solutions to choose from. This year, we have added a new Pulsed or CW test set, a new noise figure measurement module, two new application-specific measurement solutions, and a new test set multiplexer. The test set multiplexer allows multiple sources and test sets to be used with the 360. Now, from one 360 interface you can measure from 10 MHz to 110 GHz using both waveguide and coaxial test sets.

Continuous Coaxial Coverage to 60 GHz

The coaxial frequency coverage of the 360 Series is unmatched. Continuous coverage is available from 40 MHz to 60 GHz. EW and ECM engineers can design with 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 calibration software with dispersion compensation let you accurately measure in coax, microstrip, and waveguide.

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. You don't have to turn a test device around to characterize it completely. Also, the high-speed time/distance domain capability allows compensation for waveguide dispersion.

Turn-Key System: Console or Cabinet

Whether you choose your 360 system for production, R&D, metrology, service, 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):

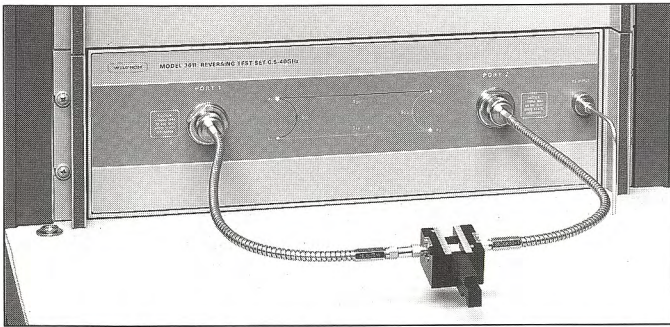
- 1) 360 Network Analyzer
- 2) 3600A Series Test Set
- 3) 360SS Series System Source

Waveguide systems consist of five units:

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

Four-Channel Display on Large Color Screen

The 360 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 three 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.



With the SMA Calibration Kit, 12-term error-corrected test data can be taken on SMA test devices.

Microstrip and Coplanar Waveguide Measurements

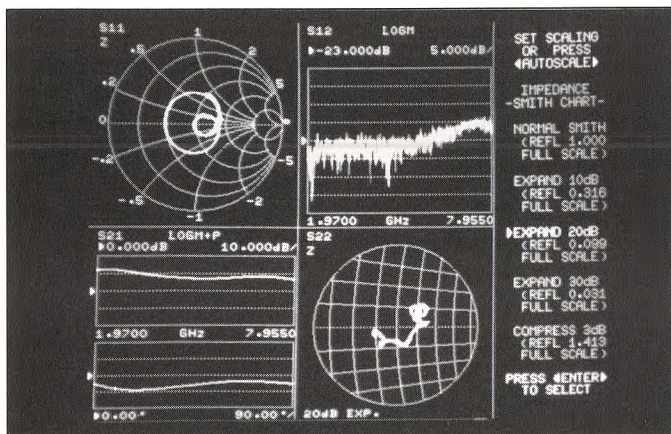
By combining the 360 with a new Wiltron 3680 Series Universal Test Fixture, you can measure microstrip and coplanar waveguide devices, on-substrate. Wiltron provides the complete measurement solution, with a wide selection of VNAs, test fixtures, on-substrate calibration kits, and accessories. Two models of test fixtures are available covering dc to 40 GHz and dc to 60 GHz. See page 76 for more information.

High-Speed Time (Distance) Domain Measurements

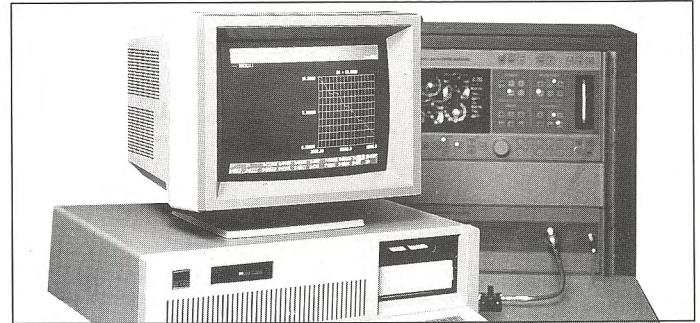
When identification of discontinuities within a test device is required or the distance to an impedance discontinuity must be measured, the 360's Option 2A, High Speed Time (Distance) Domain measurement capability is the solution. This option adds a real-time display of any S-parameter as a function 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 360 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.



The 360 simultaneously displays four S-parameters on a large, color screen.



IBM AT-compatible software permits calibration of test fixtures for real-time de-embedding.

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 360 system is ensured by Wiltron precision calibration and verification kits. The kits include components for direct calibration and performance verification of measurements on GPC-7, K Connector®, Type N, SMA/3.5 mm, and V Connector® (1.85 mm) test devices.

Full-Front Panel Control

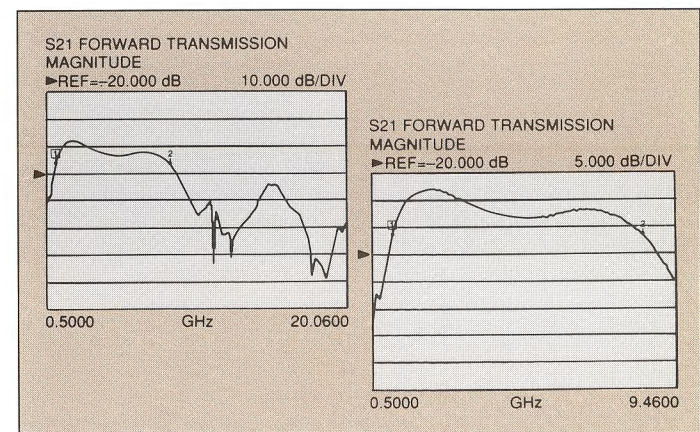
The 360 provides, from its front panel, complete system control and display of test data. GPIB is an alternative control for ATE applications.

Verification Kits

In addition to calibration kits, Wiltron offers verification kits. The verification kit consists of components with characteristics that are traceable to NBS. 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.



The frequency range of the 360 can be changed from broadband to narrow-band without recalibration.

Vector Network Analyzer (Cont.)

Model 360

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 Conversion Test Sets

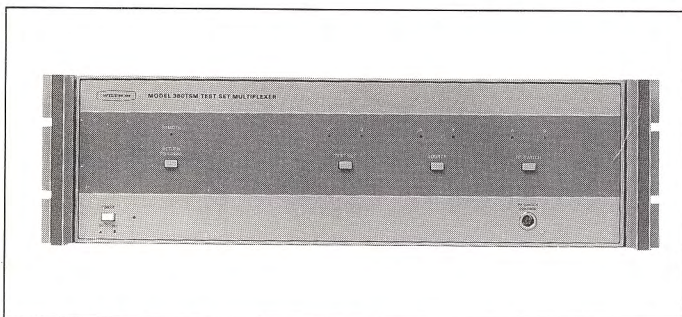
For testing mixers, multipliers, dividers—any frequency translation device—the 360 has the 3630A and 3631A Frequency Converter test sets with 10 MHz to 40 GHz and 10 MHz to 60 GHz coverage respectively. These four-channel receivers can operate with two signal sources and the receiver signal, all at different 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 new 3635A Millimeter Test Set and 3640 and 3641 Series Modules. The 3635A controls companion 3640/41 Series modules and supplies necessary DC, RF, and IF signals. 3640/41 Series modules are available in four waveguide bands to cover the 33 to 110 GHz range. The 3640 Series modules include a mm-wave source. A pair of 3640 modules allows measurement of all four S-parameters on a two port device without reversal of the test device. A 3640 module combined with a 3641 module allows for simultaneous measurement of S_{11} (input reflection) and S_{21} (forward transmission) characteristics.

Test Set Multiplexer

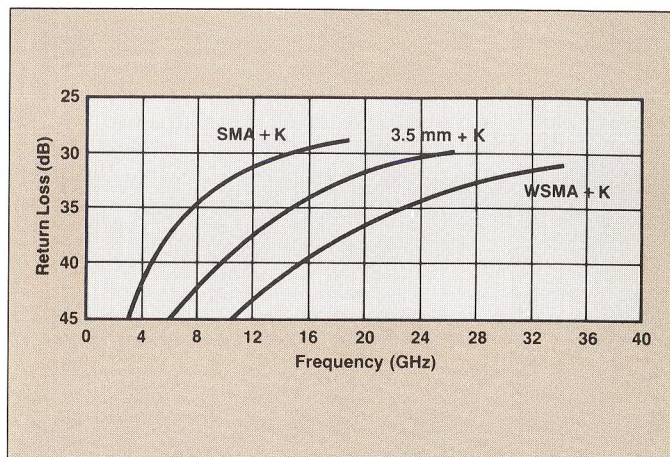
The new 360TSM Test Set Multiplexer allows the use of two test sets and two sources with a single 360 Network Analyzer. From the front panel, an operator can select a different test set or source. Sources or test sets may be located up to 20 meters from the 360. The 360TSM brings a new level of versatility to the 360 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 360 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.



The 360TSM allows the operator to select from the 360 front panel either of two test sets and two sources.

Computer-Aided Test Software

For improved data archiving and enhanced calibration flexibility, Wiltron offers, as an accessory, the ANACAT[®] computer-aided test software.



Return loss characteristics (uncorrected) of K Connector[®] ensure excellent electrical compatibility with SMA and 3.5 mm connectors.

Speed and Accuracy, Simultaneously

Compared to other systems, the 360 improves by twentyfold, from 40 ms to 2 ms, the time required to phase lock the system source at each test frequency. Only the Wiltron system maintains synthesizer accuracy at "real time" fast-measurement speeds.

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.

Unique Direct SMA Calibration and Measurements

The 360 is the first vector network analyzer to offer an SMA Calibration Kit with which accurate, 12-term error-corrected test data can be taken on SMA test devices.

Front-Panel Disk Drive

The built-in 3.5-inch disk with 720K bytes of memory is standard on the 360. Data files are MS-DOS[®] formatted for easy interfacing with IBM and IBM-compatible computers and software.

Broadband, Narrow-Band Tests—No Recalibration

The 360 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 360 offers a "Set-On" mode making it possible to use the 360 as 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 360 in ATE applications that check for harmonics and spurious signals and for signals whose frequency is known.

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 360 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 360 has SMA Calibration Kits with which accurate, 12-term error-corrected test data can be taken on SMA test devices. Because the K Connector is directly compatible with SMA, there is no need for adapters.

Convenient and Versatile Calibration

In addition to solving the SMA measurement problem, the Wiltron 360 offers four other important design features.

On the 360, once the calibration has been completed, error-correction automatically takes place. Since all Wiltron test sets are auto-reversing, 12-term error correction is now always practical. Maximum accuracy is readily attained. Also, the original calibration still applies, even when the number of data points is changed or a reduced frequency range is selected. This is measurement convenience at its best.

The 360 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 calibration for microstrip and mixed connector devices using two lengths of thru line and a reflective device.

The 360 uses a 3.5-inch disk drive with faster-than-tape cassette loading speed and greater memory. The files are MS-DOS® compatible for easy transfer to most popular PCs.

Hands-Off Test Procedures On the 360

There is no need to waste time or degrade accuracy by having to physically reverse the test device. 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.

Dual Source Control

Dual Source Control software, allows the 360 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 360, Dual Source Control software, and two of Wiltron's 360 compatible sources. Antennas may be tested on a far-field range with one source remote from the 360. Any 3600 Series test set may be used with the Dual Source Control software.

140 dB Dynamic Range Up to 20 GHz

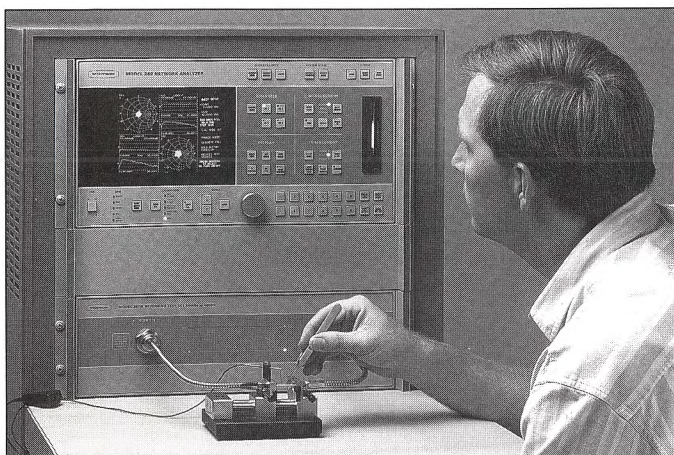
Whichever your choice of display, you will appreciate the 360's exceptional dynamic range: 140 dB up to 20 GHz (Model 3620A), 133 dB up to 40 GHz (Model 3621A), and 113 dB up to 60 GHz (Model 3622A). At very low signal levels, test data accuracy may be improved by using two different methods of signal 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.

"N Discrete Frequencies" Mode

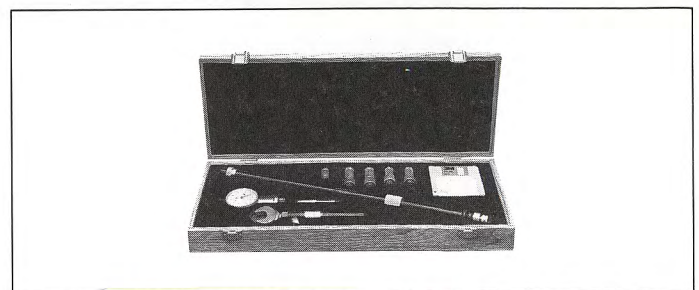
To take the tedium out of collecting data at many specific frequencies, the 360 includes the "N Discrete Frequencies" mode. You select from 2 to 501 discrete frequencies, arranged in any sequence.

Unique Marker Sweep

Unique to the 360 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.



Measure microstrip and coplanar devices on-substrate with the 360 and Wiltron's new 3680 Series Universal Test Fixture.



Calibration Kits are available for K Connector, V Connector, Type N, GPC-7, APC-3.5", and SMA test devices.

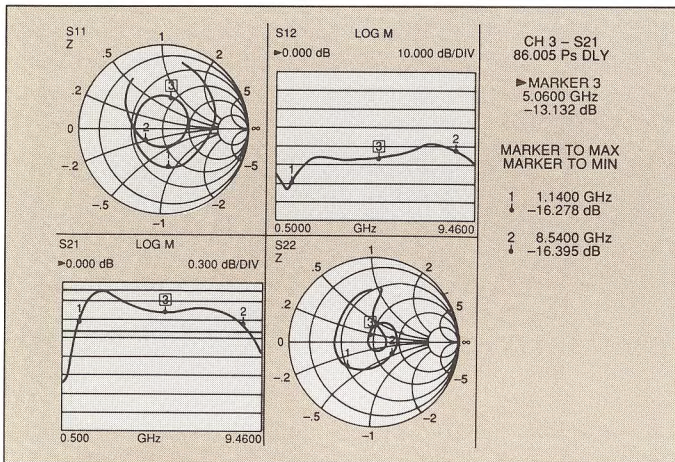
Vector Network Analyzer (Cont.)

Model 360

Measurement Applications

Impedance and Transmission Characteristics

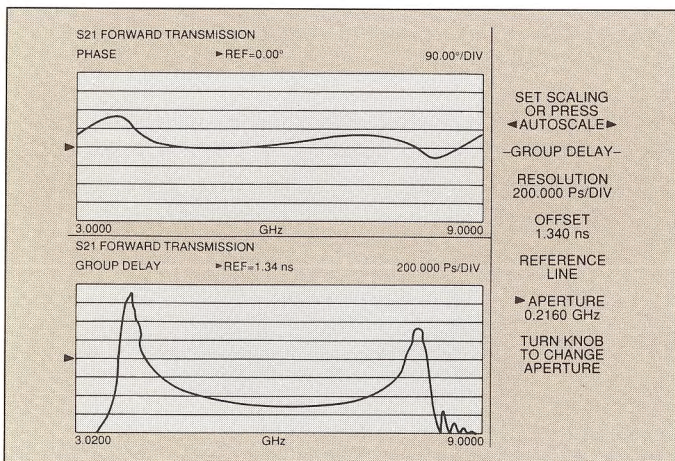
The 360 tests two-port devices in both directions without disconnecting, applies 12-term vector error correction to the test data, and displays all four S-parameters simultaneously in "real time" with phase-locked accuracy. On one display you see the complete characterization of amplifiers, isolators, directional couplers, cables—whatever you are testing. A color display with six markers, data limit lines, and complete annotation enhances data interpretation directly from the screen. Below, you see the forward and reverse transfer characteristics as well as the input and output Smith chart impedance of a two-stage S and C band FET amplifier over the 0.5 to 9.46 GHz range.



The 360 can display up to four device characteristics simultaneously.

Group Delay

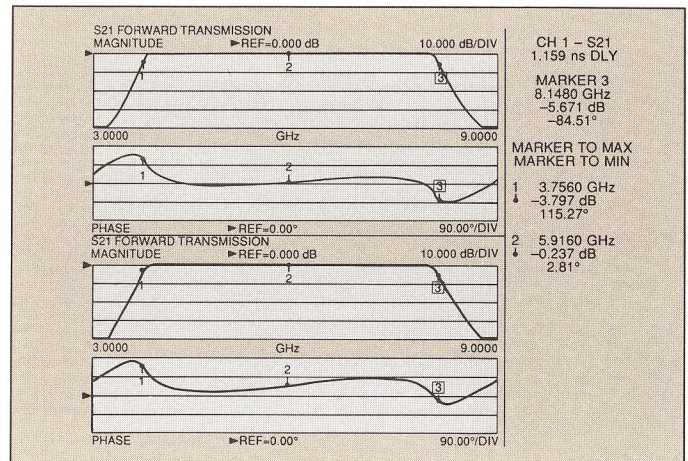
With a "real time" display of signal transit time, you can easily adjust your test device to optimize group delay characteristics. Variable frequency aperture settings can be made without recalibrating. Group delay and deviations from linear phase can be displayed simultaneously on separate graphs. As a result, your products will perform with improved signal fidelity. The display below shows both the deviation from linear phase and group delay for a 4 to 8 GHz bandpass filter.



Simultaneous display of deviation from linear phase and group delay.

Amplitude and Phase Matching

To match the amplitude and phase of a test device to a standard or to a known device, the characteristics of one can be placed in memory and compared automatically to that of the second, using the "Trace Memory" feature. Differences between the two units can be directly measured and compared. In addition, by using normalization, the differences can be indicated as deviations from a straight line. When both data and memory are displayed on the same graph, the use of a different color for each trace enhances analysis. In the display below, the characteristics of two bandpass filters are shown. Two standard filter traces are shown above two test filter traces.

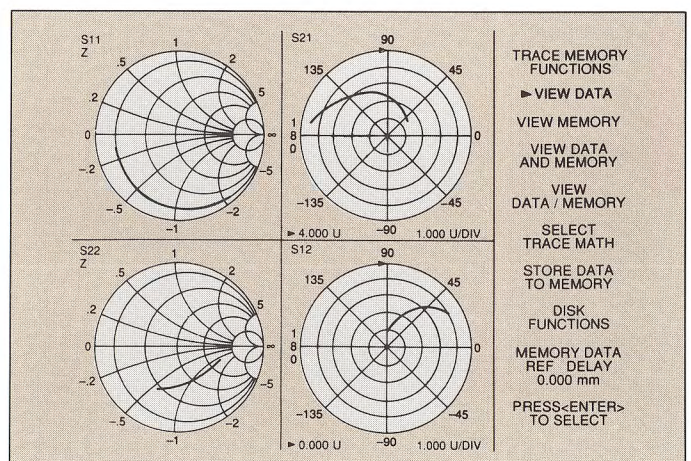


The magnitude and phase characteristics of two devices can easily be compared.

Semiconductor Characteristics

There are at least three 360 features that could change the way you test semiconductors:

- Active Device Test Sets include bias tees and step attenuators for adjusting signal levels at the measurement ports. A unique third attenuator allows direct measurement of devices up to one Watt output power.
- All four S-parameters can be displayed simultaneously.
- Software is available that implements de-embedding and customizes output formats. In the display below, the four S-parameters of an NEC700 GaAs FET over the 2 to 18 GHz range are shown.



Simultaneous display of four S-parameters.

Time (Distance) Domain

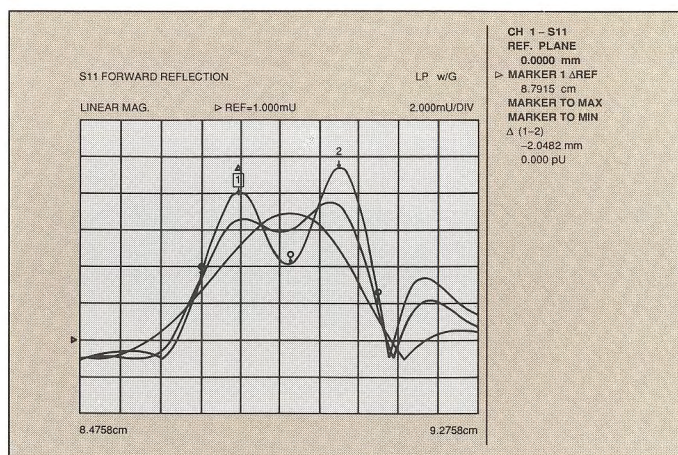
With the addition of Option 2A, High-Speed Time (Distance) Domain measurement capability, your system displays discrete discontinuities as a function of time or distance. Unwanted reflections can be removed from the display by gating. For complete characterization, data can be shown in frequency and time domains simultaneously. The trace at right shows a distance domain display of two discontinuities 2.048 mm apart in a microwave structure measured at 40, 50, and 60 GHz. Note the dramatic improvement in resolution at 60 GHz.

High-Speed Phasor Impulse Processing

In the past, it was never possible to measure the true impedance characteristics of a discontinuity by using time domain measurements in a dispersive or band-limited medium such as waveguide. The exclusive "Phasor Impulse" mode in the Option 2A High-Speed Time (Distance) Domain measurement capability now makes this possible by removing response distortions inherent to these media, and allowing the measurement of the true mid-band conductance and susceptance of a circuit element.

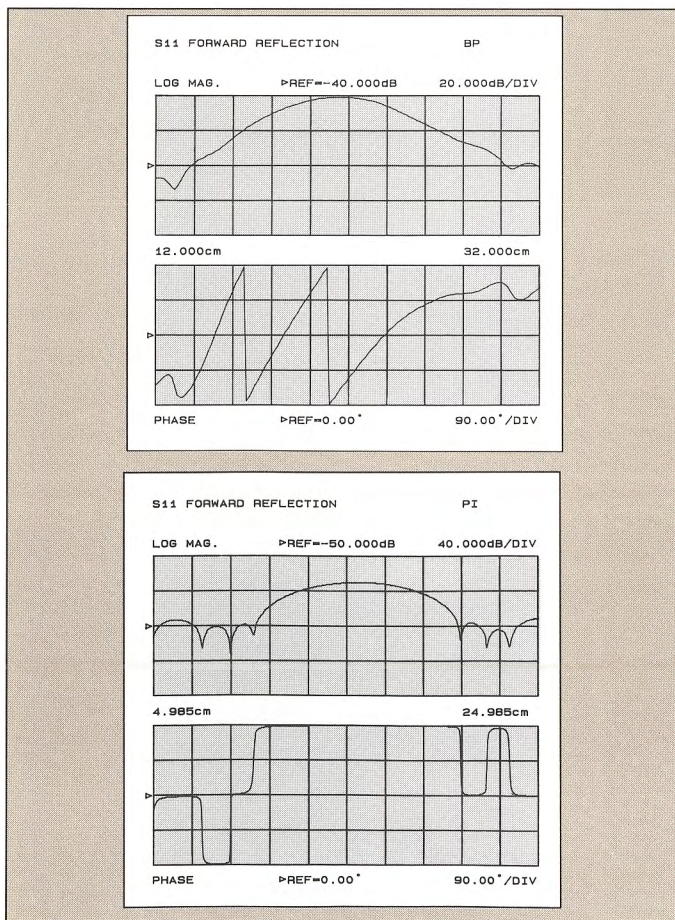
Insertion Loss/Gain and Phase

Low noise floor, 0.001 dB resolution, video IF bandwidth reduction, averaging, and automatic scaling make the 360 system stand alone for transmission measurements of attenuators, high-isolation switches, and high-rejection filters.

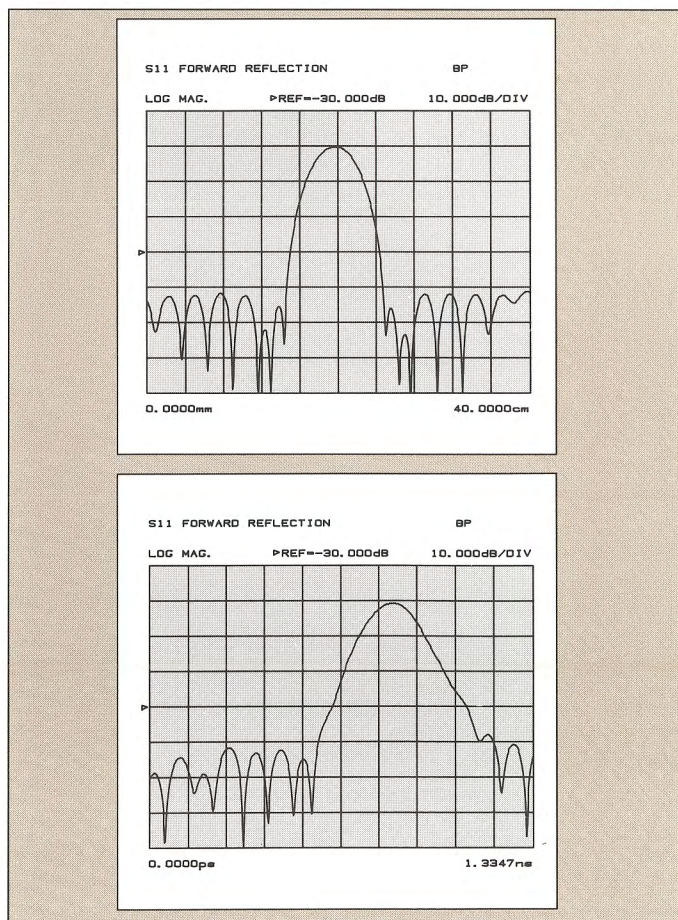


Discontinuities 2 mm apart (top trace) can easily be distinguished with High-Speed Time (Distance) Domain capability and 60 GHz coverage.

While making insertion loss or gain measurements in the "Limit Frequency Readout" mode, one limit line can be placed at any reference value, then a second limit line can be set to any dB-down point. The 3-dB-down frequency points are displayed on the screen, thereby simplifying and improving the accuracy of frequency response, loss, and gain measurements.



Time domain response of a short in a section of waveguide shown without Phasor Impulse Processing (top) and on bottom with Phasor Impulse Processing applied (bottom). Note the clarity with which response impedance characteristics of individual circuit elements can be distinguished.



Time domain response, with (top) and without (bottom) dispersion compensation.

Vector Network Analyzer (Cont.)

Model 360

Measurement Applications (Cont.)

Waveguide Measurements with Adapters

The 360 system includes waveguide calibration and measurement capability up to 60 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.

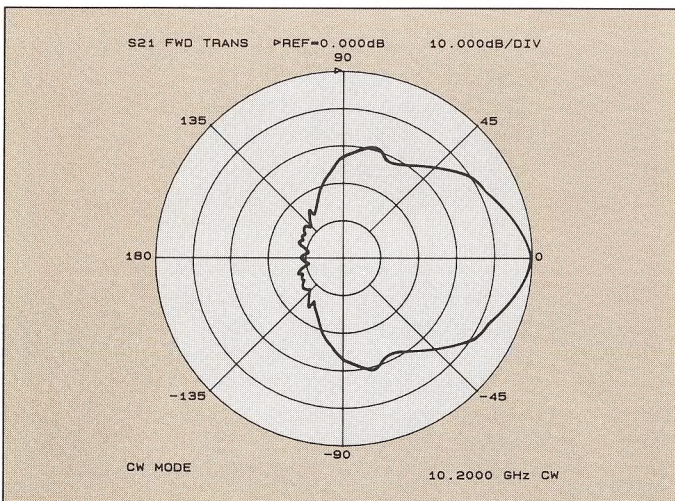
Millimeter-Wave Capability

The 360C3 Millimeter-Wave System Console provides full measurement coverage to 110 GHz. The 360 Millimeter-Wave system contains the new 3635A Millimeter test set and companion 3640 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 3635A, appropriate 3640/3641 Series Modules, and a 6729B Microwave Synthesizer.

Antennas

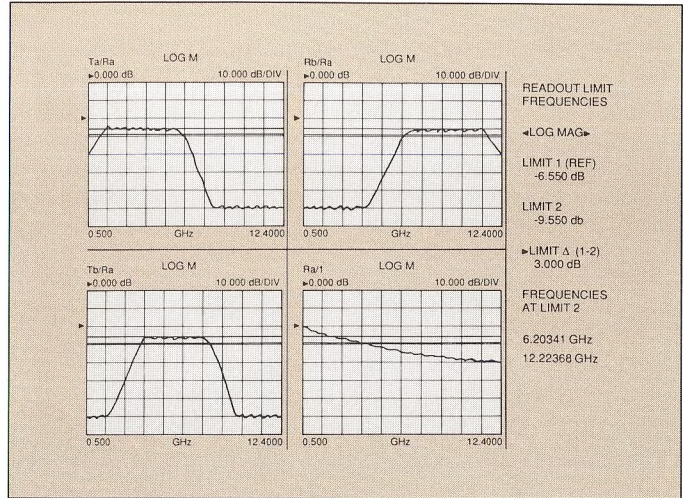
On the antenna range, the 3630A or 3631A simplifies antenna pattern and radar cross-section measurements. In the "CW Draw" mode, a CW signal can be triggered at equal intervals at up to 501 points to provide a data plot as a function of time or antenna position. Dual Source Control software gives flexibility to use either harmonic or fundamental mixing for optimizing sensitivity and other measurement parameters.



Radiation pattern shown in a polar format using "CW Draw."

Diplexers and Triplexers

With three simultaneous measurement channels the 360 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.

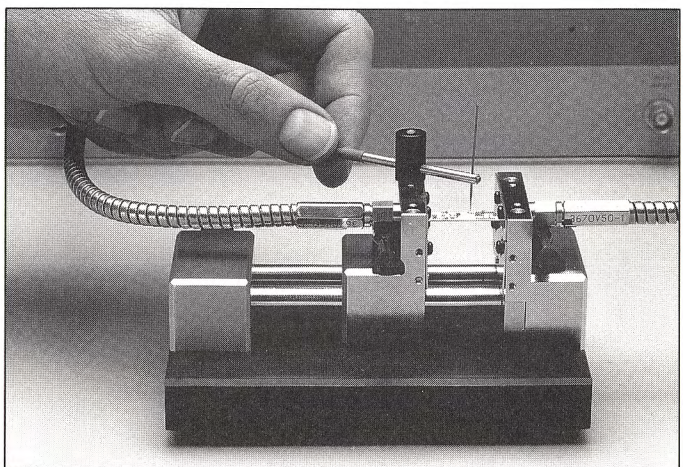
Mixers

Mixers and other frequency conversion devices can easily be characterized with the 360 and 3630A or 3631A Frequency Converter Test Sets and Dual Source Control software. The Frequency Converter Test Sets can be configured in many different ways to support the multiple source requirements of mixer testing. With the dual source control capability, all three frequencies (RF, LO, and IF) can be controlled from the 360 front panel.

Microstrip and Coplanar Waveguide

The 360 combined with a new Wiltron 3680 Series Universal Test Fixture provides unparalleled accuracy for measurements on substrate devices. The 360's 60 GHz frequency coverage provides exceptional resolution for locating discontinuities and dispersion compensation software significantly improves the accuracy of measurements on dispersive substrate media.

The Universal Test Fixture can easily adapt to a wide variety of substrate devices and the 36804 substrate calibration/verification components extends accuracy to the substrate level. Wiltron even specifies the accuracy of measurements made with the 360 and 3680 combined together.



Wiltron's new Universal Test Fixture.

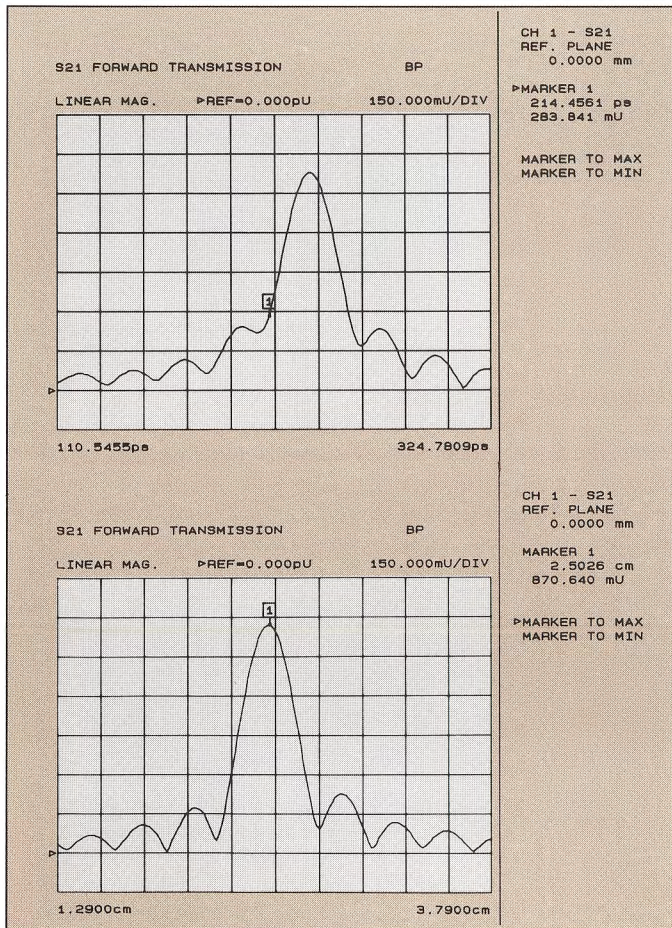
LRL Calibration

The 360 Option 3 adds an LRL calibration capability for making measurements in coaxial, microstrip, and waveguide transmission media. LRL 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 calibration scheme, internal adapter removal software, and an external controller, you can perform multilevel de-embedding. In this mode, any noncoaxial transmission media, including mixed media interconnects, 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 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

Installation

There is no charge for installation and start-up instructions for your 360 Network Analyzer. Operation is very straightforward, so you can immediately start making measurements with your system.

Wilton specialists make certain that you are pleased with your system and that it is performing to your satisfaction.

Hardware Documentation Support

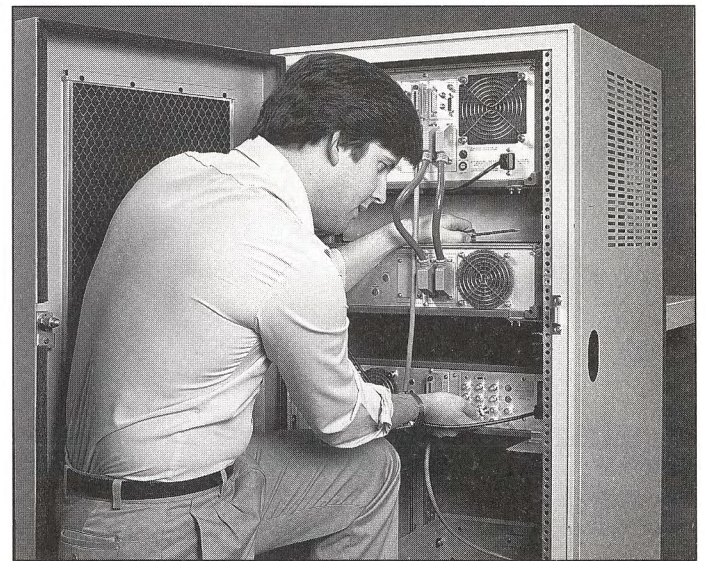
Your system is delivered with a complete set of operation, maintenance, and software manuals. To keep your documentation current, you receive manual updates.

You will appreciate the clarity and thoroughness with which Wiltron support documentation is prepared.

Maintenance, Repair, and Calibration

Wilton provides worldwide support for the 360 Network Analyzer. Service centers are staffed by skilled personnel who welcome telephone consultation calls.

On-site service and calibration (performed with NIST-traceable devices) keeps your system performing reliably and accurately. In many areas, annual service agreements are available.



On-site service is available in 29 countries.

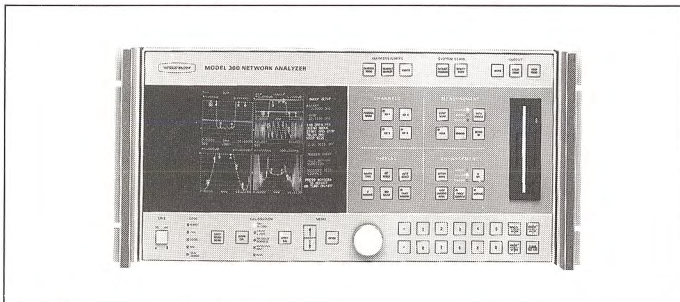
Vector Network Analyzer (Cont.)

Model 360

System Composition

Network Analyzer

The 360 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 360 Network Analyzer

Test Sets and Modules

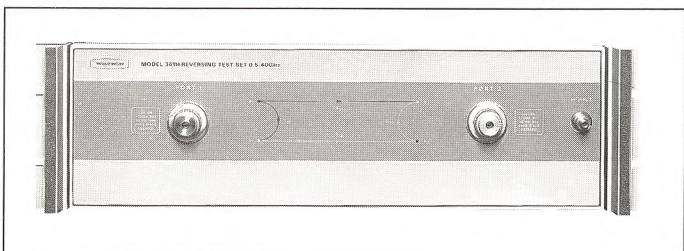
There are nine test sets from which to choose, depending upon your application. Most test set types include multiple models covering differing frequency ranges and corresponding connectors. Reversing and Active Device test sets include automatic signal reversing with which full S-parameter tests can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

Model	Frequency Range	Test Port Connectors ^①
3610A Reversing Test Set	40 MHz to 20 GHz	K Connector (m)
3611A Reversing Test Set	40 MHz to 40 GHz	K Connector (m)
3612A Reversing Test Set	40 MHz to 60 GHz	V Connector (m)
3637A High Power Reversing Test Set	270 MHz to 20 GHz	K Connector (m)
3620A Active Device Test Set	40 MHz to 20 GHz	K Connector (m)
3621A Active Device Test Set	40 MHz to 40 GHz	K Connector (m)
3622A Active Device Test Set	40 MHz to 60 GHz	V Connector (m)
3630A Frequency Converter	10 MHz to 40 GHz	K Connector (m)
3631A Frequency Converter	10 MHz to 60 GHz	V Connector (m)
3635A mm-Wave Test Set	33 to 110 GHz	Waveguide (Q, U, V, W Bands)

^①Test port connectors can be converted to GPC-7 or Type N with the use of the 34U and 34Y Series Test Port Converters.

Reversing Test Sets

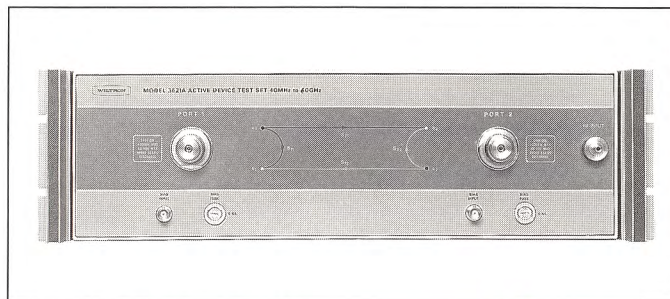
Reversing test sets provide basic S-parameter measurement capability. There are three coaxial models: 3610A (40 MHz to 20 GHz), 3611A (40 MHz to 40 GHz), and 3612A (40 MHz to 60 GHz).



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.

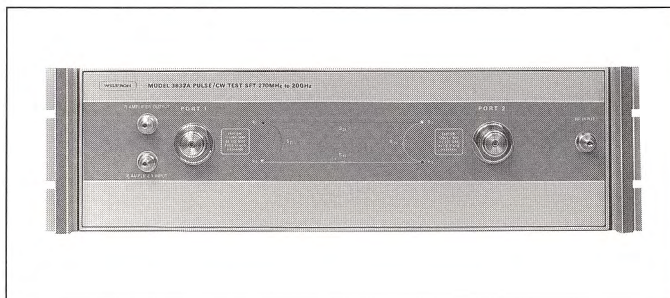


Model 3621A Active Device Test Set

High Power Reversing Test Set

NEW

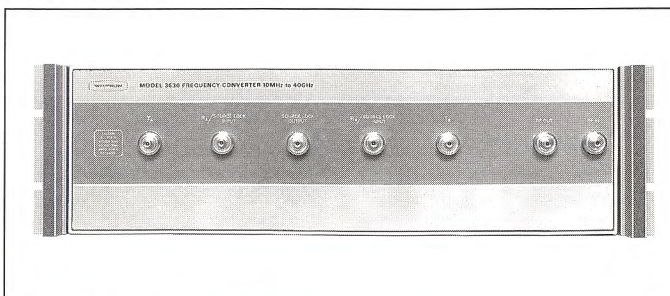
The Model 3637A High Power Reversing Test Set incorporates couplers instead of resistive power splitters to accommodate high RF powers. Ports are available for the addition of high power terminations and bias tees. The 70 dB step attenuators included in the 3637A, isolated by the 13 dB coupling factor of the internal couplers, can handle up to 20 Watts average RF power.



Model 3637A High Power Reversing Test Set

Frequency Converters

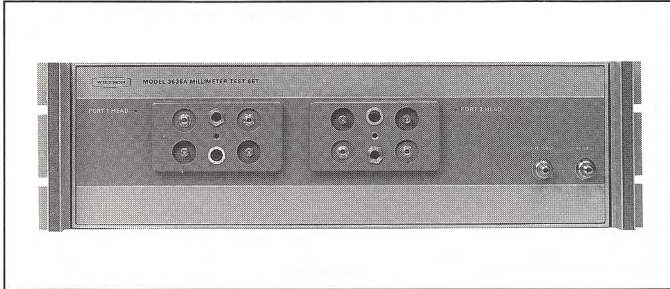
The 3630A and 3631A Frequency Converters are four-channel receivers that measure magnitude and phase of frequency conversion devices. Two different input frequencies (RF and LO) and the receiver frequency (IF) are controlled from the 360 front panel. With its exceptional versatility, the unit is also 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

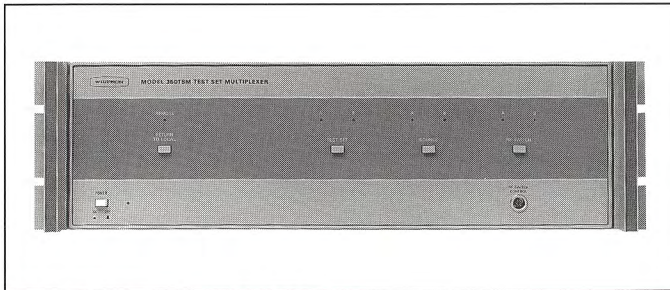
The 3635A Millimeter-Wave Test Set and 3640 and 3641 Series modules provide full test capability to 110 GHz in four waveguide bands. The 3635A interfaces with the 360 Network Analyzer and provides necessary DC, RF, and IF signals for the 3640 Series modules. 3640 Series Transmission/Reflection Modules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



Model 3635A Millimeter-Wave Test Set

Test Set Multiplexer

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



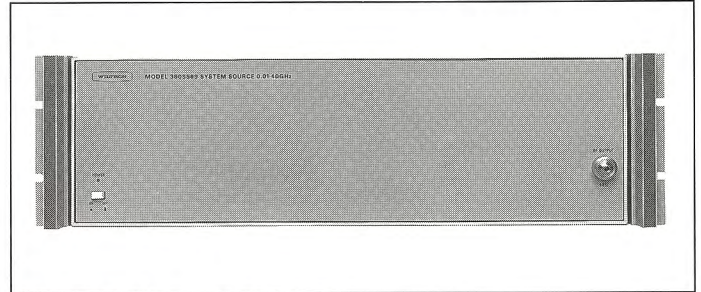
Model 360TSM Test Set Multiplexer

Signal Sources

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

System Signal Sources

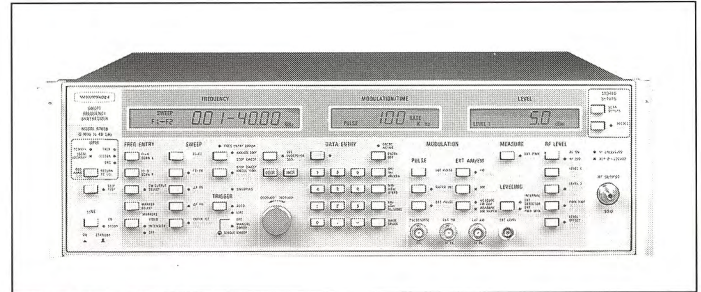
There are two System Signal Sources: The 360SS47 and the 360SS69, covering the 10 MHz to 20 GHz and 40 GHz ranges respectively. Both are controlled and phase-locked by 360 Network Analyzer and provide clean, phase-locked stimulus signals. Frequency resolution is 100 kHz. 60 GHz coverage is provided by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



Model 360SS69 System Signal Source

6700B Series Swept Frequency Synthesizers

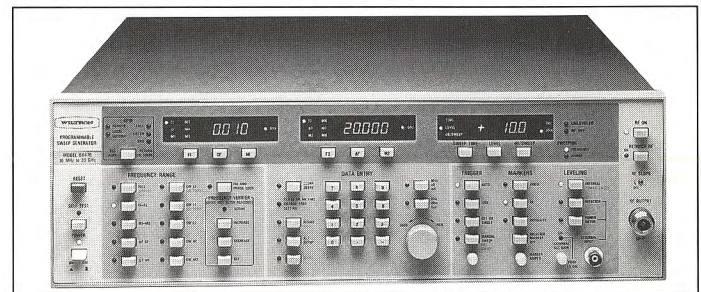
The 360 controls the 6700 over its GPIB interface. The 6700 Series offers 1 kHz resolution and internal pulse capability.



6700B Series Synthesizers

6600B Series Sweep Generators

Also compatible with the 360 are the 6600B Sweep Generators (with Option 14, 360 compatibility). The 360 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

Coaxial systems, consisting of a 360, test set, and source are available either in the 360C2 System Console or 360C1 System Cabinet. Waveguide systems are available in the 360C3 Millimeter-Wave System Console.

Vector Network Analyzer (Cont.)

Model 360

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. Can be switched to a nominal 168 or a nominal 85 points 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 to become 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 $\pm X$ 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 $2 \leq N \leq 501$.

Scale Resolution (minimum):

Log Magnitude: 0.001 dB/div	Linear Magnitude: 1 pU
Phase: 0.01 degrees/div	Group Delay: 0.001 ps
Time: 0.001 μ s	Distance: 0.001 μ m
SWR: 1 pU	

Dynamic Range: Table 1, on the following page, gives dynamic range in two manners. "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 and is the available receiver dynamic range. The dynamic range for passive microwave measurements is defined as the ratio of the power incident on Port 2 in a through line connection to the noise floor referred to Port 2 (forward measurements only). In preparing the table, minimum IF bandwidth and 1024 averages were used in calibration and measurement.

DISPLAY CAPABILITIES

Number of 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 display. Graticules are displayed in green, measurement data in red, and markers and limits in blue. Trace data stored in memory are displayed in green.

Trace Memory: A separate memory for each channel can be used to store measurement data for later display or for subtraction, addition, multiplication or division with current measurement data.

Scale Resolution (minimum):

Log Magnitude: 0.001 dB/div	Linear Magnitude: 1 pU
Phase: 0.01 degrees/div	Group Delay: 0.001 ps
Time: 0.001 μ s	Distance: 0.001 μ m
SWR: 1 pU	

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.

HARD COPY

Dot Matrix Printer: Menu selects full screen, graphical, or tabular data. The number of data points of tabular data can be selected as well as data at markers only. Compatible with the 2225C Ink Jet Printer. Parallel (Centronics) interface.

GPIB Plotter: The 360 is compatible with HP Models 7440A, 7470A, or 7475A. Menu selects plotting of full graphical data or only the measurement trace. Plotter is connected to the dedicated system bus, which also controls the microwave 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.

MEASUREMENT ENHANCEMENT

Vector Error Correction:

There are three methods of calibration:

- 1) standard calibration using open circuits or offset short circuits and terminations,
- 2) waveguide calibration, and
- 3) LRL calibration.

There are four vector error corrections:

- 1) Full 12-Term,
- 2) One Path-Two Port,
- 3) Frequency Response, and
- 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 calibration data are being applied.

Calibration Standards: User selects SMA, GPC-3.5, GPC-7, Type N, TNC, K Connector, and V Connector from calibration menu. Use of fixed or sliding load can be selected for each connector type. Open circuit capacitance coefficients can be modified manually or through the GPIB interface.

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 MIN selections correspond to approximately 10 kHz, 1 kHz, and 100 Hz, respectively.

Trace Smoothing: Functions similarly to Frequency Averaging. 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.

LRL CALIBRATION

Option 3 for the Wiltron 360 VNA enables calibration of the 360 using the Line-Reflect-Line (LRL) calibration technique. 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. Using this technique full 12-term error correction can be performed on the 360 VNA.

Because very high quality air lines are readily available, excellent directivity and source match are possible with LRL calibration. Wiltron 360, LRL calibration is excellent for measurements in transmission media, such as microstrip or waveguide, in which opens or precision terminations are difficult to realize. The impedance standard is the transmission line, meaning calibration standards are more readily achievable in these media.

The Wiltron 360, LRL calibration is well suited to "non-insertable devices" such as devices with the same-sex connector on each end. With the proper airline standards, and LRL calibration can be performed on the 360 with virtually any desired connector configuration.

LRL CALIBRATION (Cont'd)

Performance:

Calibration Performed: LRL + Isolation

Dispersion 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 (page 24) apply.

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 (forward measurements only).

The waveguide module specifications describe the system performance for the millimeter-wave test systems with the specific waveguide modules attached. The millimeter waveguide systems are configured using the 3635A Test Set, the 3640 and 3641 Series Modules, the 360SS47 System Source, and 6729A Microwave Synthesizer. All measurements require the use of the appropriate waveguide calibration kits.

Table 1. Test Set Dynamic Range Summary

Test Set Model		Frequency (GHz)	Maximum Signal Into Port 2 (dBm)	Noise Floor (dBm)	Dynamic Range (dB)	Port 1 Power (dBm, typical)	Noise Floor Relative to a Thru Calibration (dB, typical)
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
		60	+3	−86	95	−23	63
3637A High Power Reversing Test Set		0.270	+43	−99	142	−4	95
		1	+43	−110	153	−5	105
		20	+43	−98	141	−8	90
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
		60	+30	−83	113	−26	57
3630A Frequency Converter		0.01	−10	−117	107	n/a	n/a
		1	−10	−117	107		
		20	−10	−115	105		
		40	−10	−107	97		
3631A Frequency Converter		0.04	−10	−117	107	n/a	n/a
		1	−10	−117	107		
		20	−10	−115	105		
		40	−10	−107	97		
		60	−10	−90	77		
364X Waveguide Modules (Used with 3635A Millimeter Wave Test Set)	3640Q/3641Q (WR-22) 33-50 GHz	40	−1	−102	101	−4	98
	3640U/3641U (WR-19) 40-60 GHz	50	+1	−101	102	−4	97
	3640V/3641V (WR-15) 50-75 GHz	60	−7	−100	93	−10	90
	3640W/3641W (WR-10) 75-110 GHz	94	−4	−100	96	−15 ^①	85 ^①

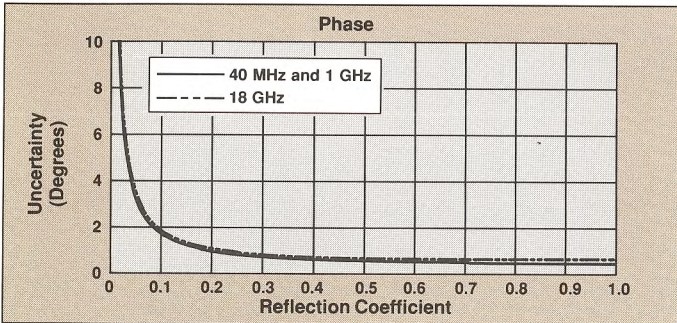
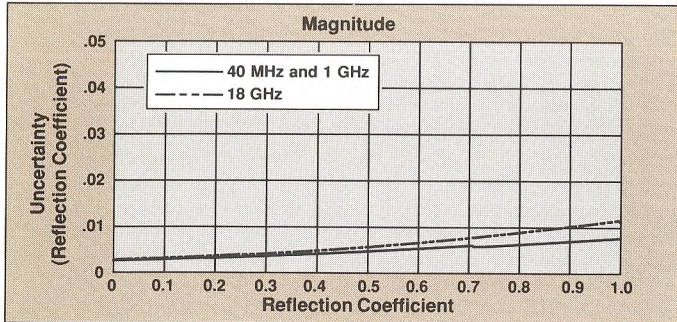
^①Optimized over a 10 GHz span within the 75 to 110 GHz frequency range.

Vector Network Analyzer (Cont.)

Model 360

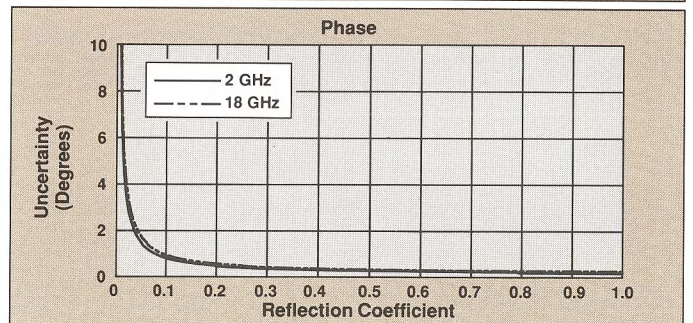
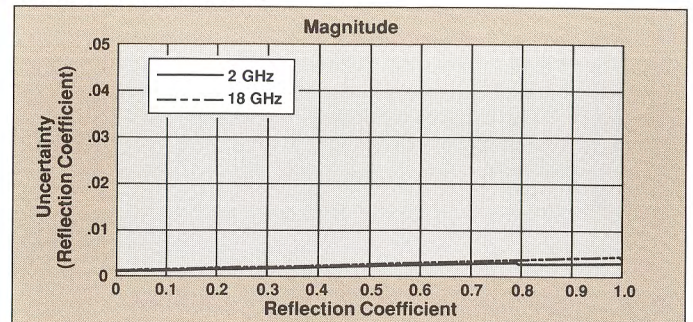
UNCERTAINTY CURVES:

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

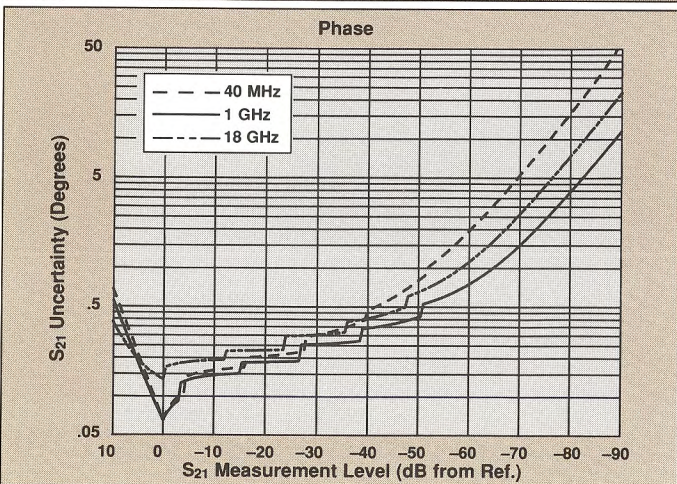
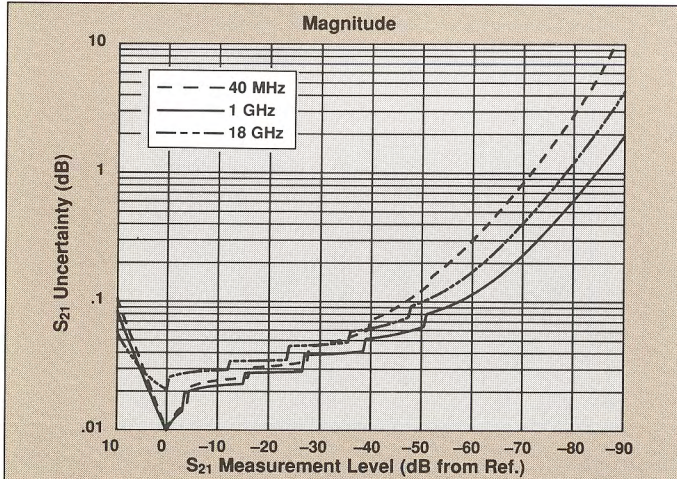


UNCERTAINTY CURVES:

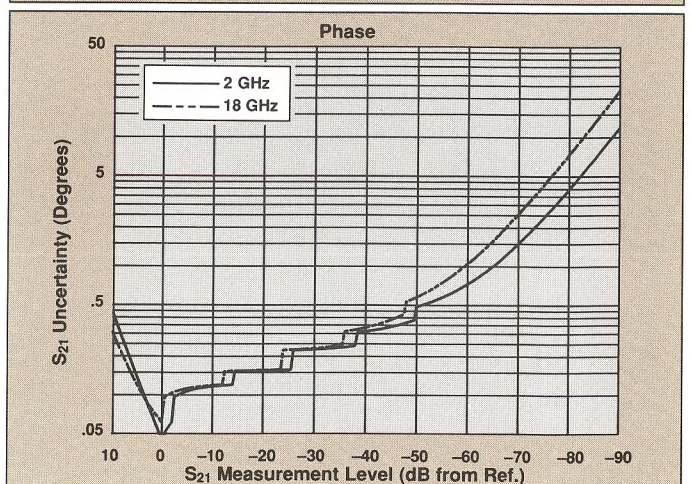
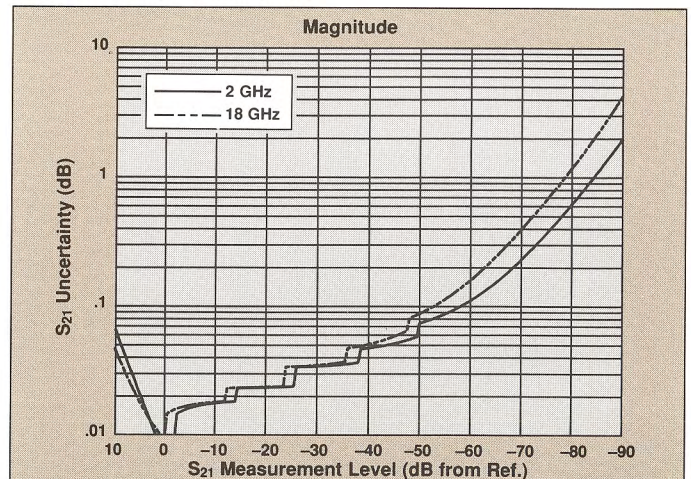
Models 3610A and 3620A (With Option 3 LRL Cal; K Connectors)
Reflection Measurements:



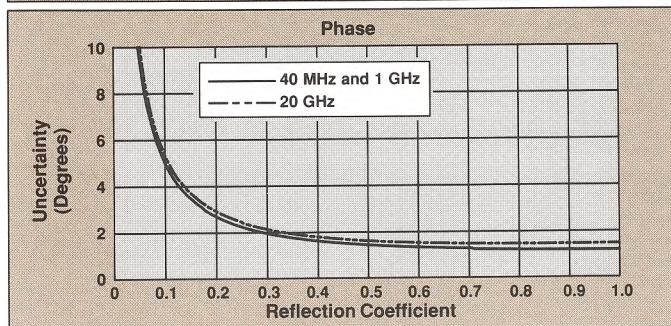
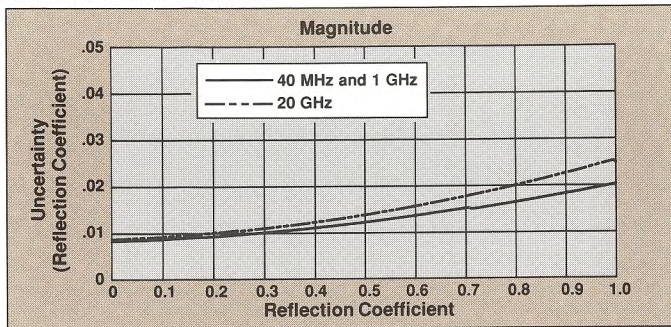
Transmission Measurements:



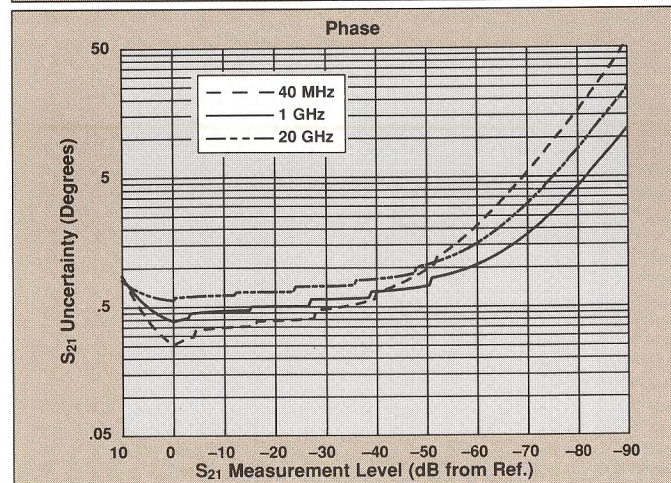
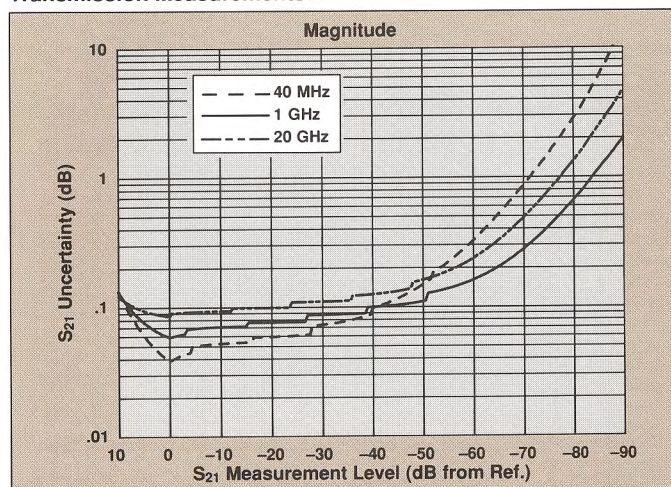
Transmission Measurements:



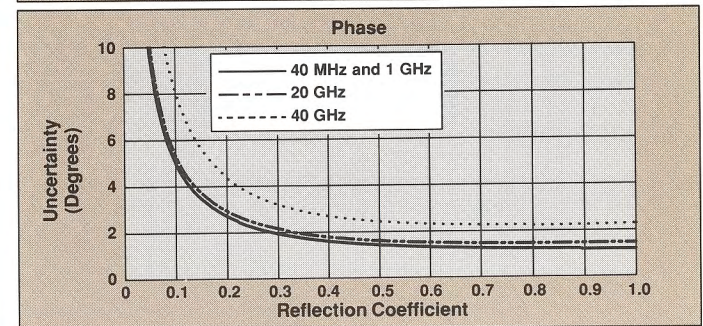
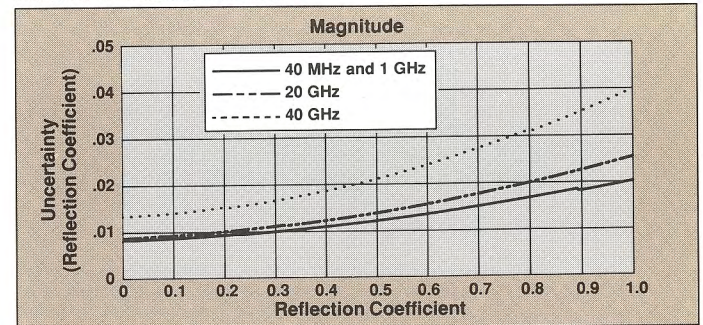
UNCERTAINTY CURVES:
Models 3610A and 3620A Test Sets (K Connectors)
Reflection Measurements:



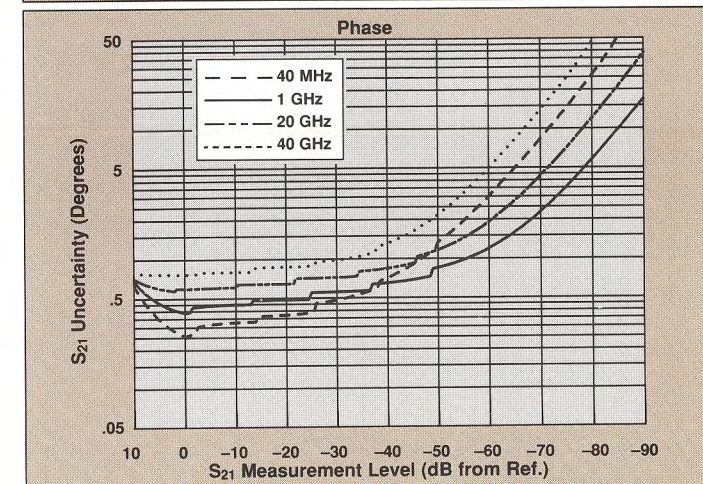
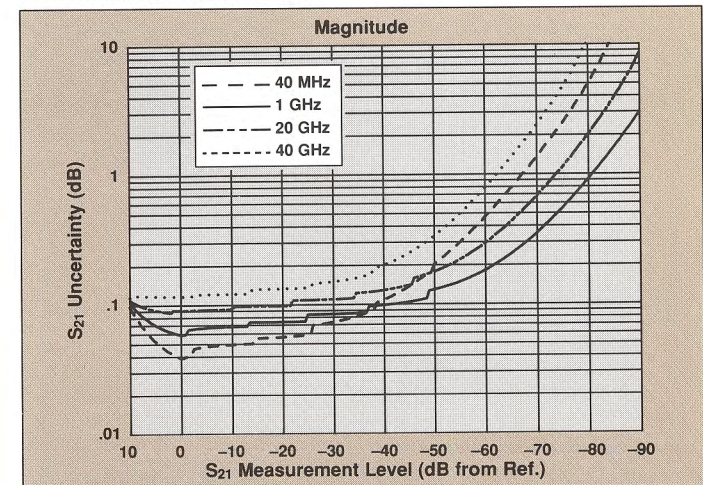
Transmission Measurements:



UNCERTAINTY CURVES:
Models 3611A and 3621A Test Sets (K Connectors)
Reflection Measurements:



Transmission Measurements:



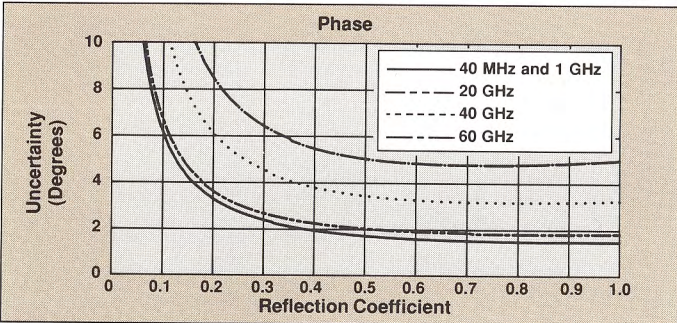
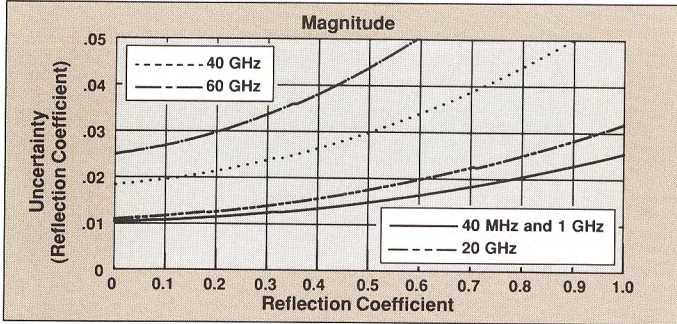
Vector Network Analyzer (Cont.)

Model 360

UNCERTAINTY CURVES:

Models 3612A and 3622A Test Sets (V Connectors)

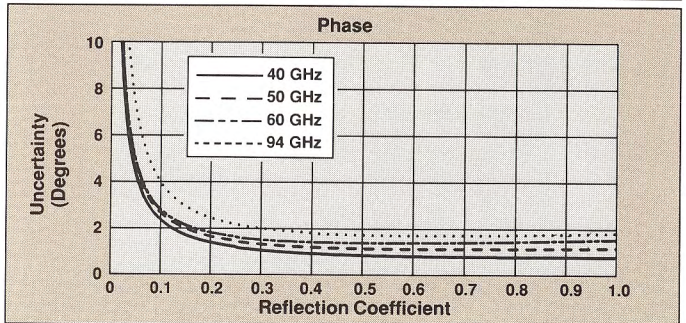
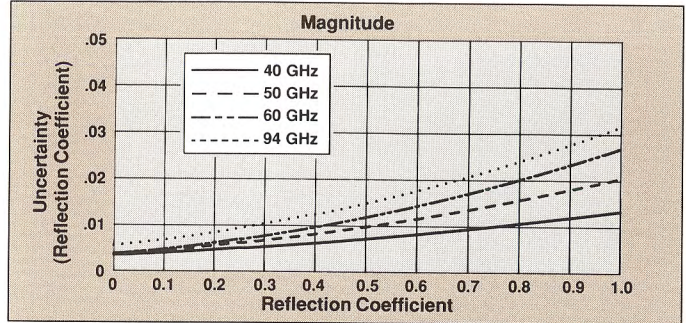
Reflection Measurements:



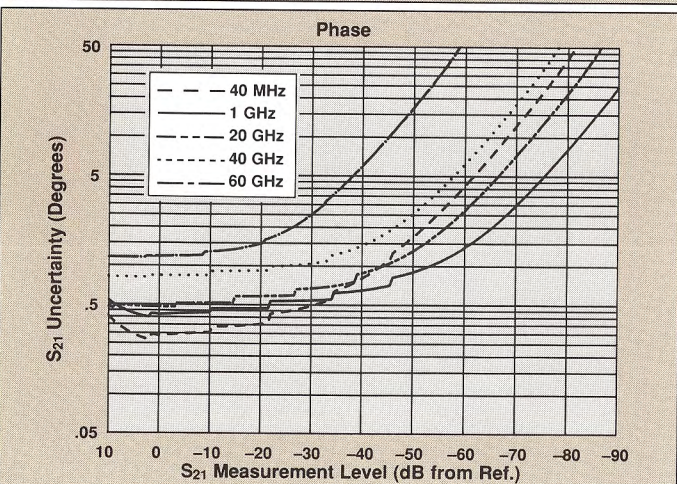
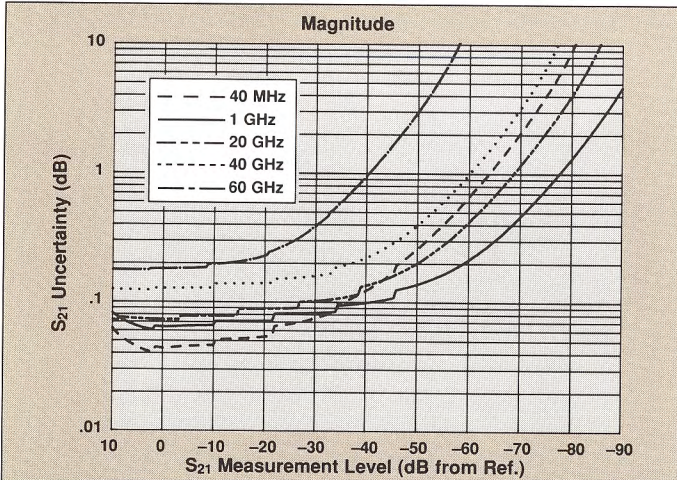
UNCERTAINTY CURVES:

3640A and 3641A Series Waveguide Modules (Q, U, V, W Bands)

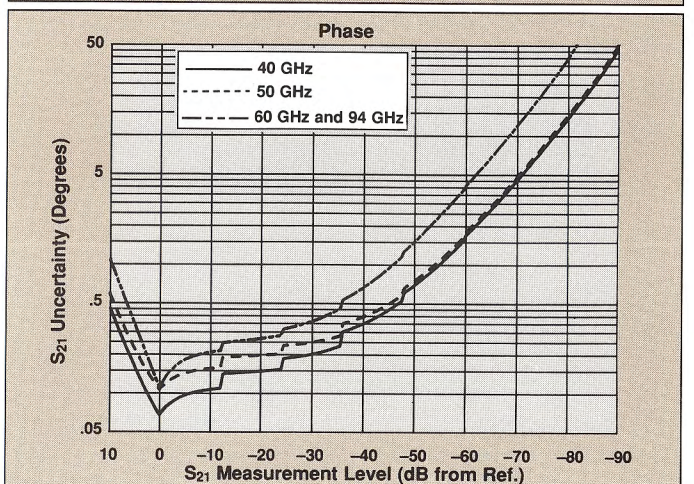
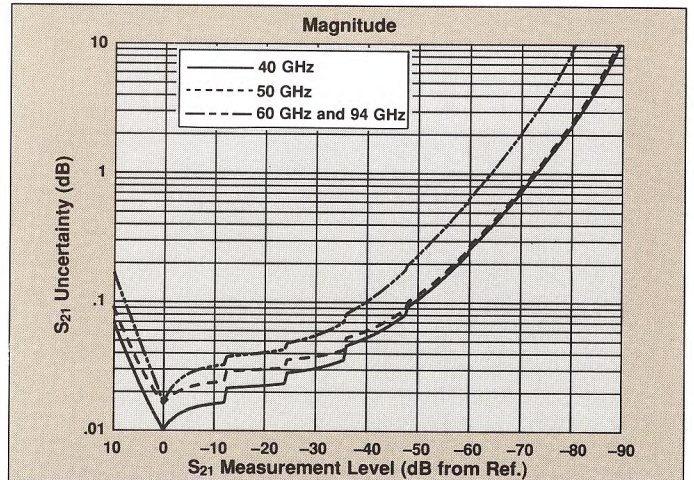
Reflection Measurements:



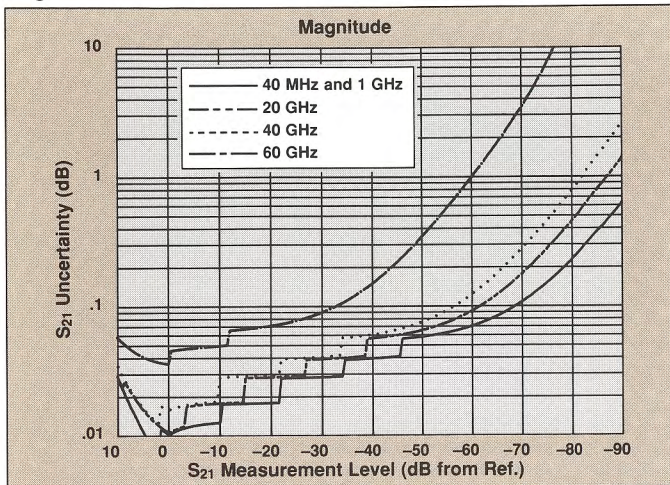
Transmission Measurements:



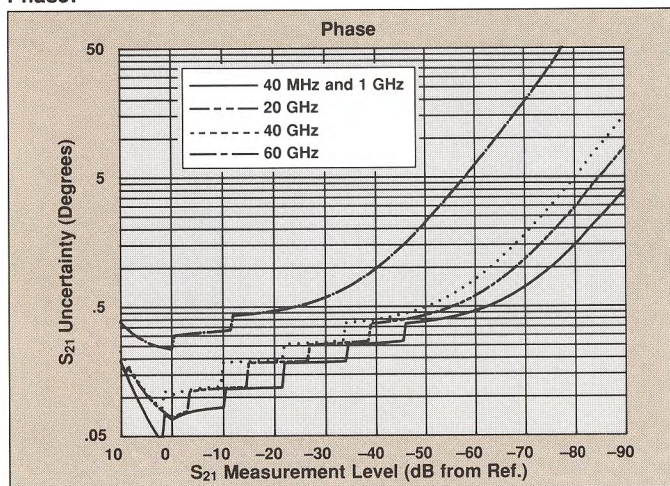
Transmission Measurements:



DYNAMIC ACCURACY CURVES:
3630A Frequency Converter (K Connector)
and 3631A Frequency Converter (V Connector)
Magnitude:



Phase:



GROUP DELAY ACCURACY

Group Delay is measured by computing the phase change in degrees across a frequency step by applying the formula: $\tau_g = -1/360 \text{ d}\phi/\text{d}f$

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:

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

*See 6700B Phase Noise specifications, page 64.

Accuracy:

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

SOURCE CONTROL

Compatibility: The 360 is compatible with the Wiltron 360SS System Sources and the 6600B Sweep Generators. The output frequency of both is phase locked by the 360 to the internal 10 MHz crystal standard, providing synthesizer stability. Phase-lock time is typically 2 ms. Frequency resolution is 100 kHz. The 360 is also compatible with the 6700A or 6700B Swept Frequency Synthesizers which offer 1 kHz frequency resolution.

SOURCE FREQUENCY ACCURACY

Time Base Freq. Accuracy: Same as internal or external time base.

Internal 10 MHz Time Base Stability:

With Aging: $< \pm 1 \times 10^{-9}/\text{day}$

With Temperature: $< \pm 5 \times 10^{-9}$ over 0° to $+55^\circ\text{C}$ range

DUAL SOURCE CONTROL

Option 4, Dual Source Control software for the 360 Vector Network Analyzer (VNA) allows 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. With Option 4, 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.

Controllable Sources:

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

Control Formula: Dual source control is specified as a displayed frequency range partitioned into 1 to 5 consecutive bands. For each band source 1, source 2, and receiver frequencies may be independently specified per the formula:

$$\text{Frequency} = (\text{Multiplier/Divisor} \times F) + \text{Offset Frequency}$$

Where: Multiplier and Divisor are integer constants

F is the displayed frequency

Offset Frequency is the offset frequency constant

Multiplier, Divisor and Offset Frequency may be independently specified for each source and receiver.

F is global, and is the same value in all formulas.

Each source or receiver may, if desired, be set to a CW frequency, removing F from the equation.

Note: When a formula results in an unachievable frequency, such as $1/3 \times 1 \text{ GHz}$, the result is rounded to the nearest achievable frequency, defined by the source frequency resolution. Frequency resolution is 100 kHz for a 360SS and 1 kHz for a 6700B (2kHz 26.5 to 40 GHz). For 40 to 60 GHz, the resolution is 300 kHz for the 360SS and 3 kHz for the 6700B.

Bands: The displayed frequency range may be divided into one to five bands. Band 1 must start at the beginning of the frequency range and end at the user-specified stop frequency or the end of the frequency range. Band 2 must begin at the next point after band 1 and continue until the user-specified stop frequency or the end of the frequency range, etc. Band 5 must end at the end of the frequency range. Independent source and receiver control formulas may be specified for each band.

Power Control: Source output power may be independently set for each source by the 360.

Vector Network Analyzer (Cont.)

Model 360

TEST PORT CHARACTERISTICS

The specifications in Table 2 below 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 a sliding load and 12-term error correction (forward measurements only).

DISK DRIVE

A 3.5-inch microdiskette drive with 720K bytes formatted capacity is used to load measurement programs and to store measurement and calibration data and front-panel setups. All files are MS-DOS compatible. File names can be 1 to 8 characters long.

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

Calibration Data: 57K bytes per 501 point, 12-term calibration plus front-panel setup.

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

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, 64 bit floating point.

Speed: 40K bytes/s

Interface Function Codes: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, C0.

HIGH SPEED TIME (DISTANCE) DOMAIN

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

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

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	>52	>44	>52	±0.003	±0.004	>105
	1.0	>52	>44	>52	±0.003	±0.004	>115
	18	>52	>42	>52	±0.004	±0.012	>112
GPC-7 ^① LRL Calibration	2	>60	>60	>60	±0.001	±0.001	>115
	18	>60	>60	>60	±0.001	±0.001	>112
3.5 mm	0.04	>44	>40	>44	±0.005	±0.030	>105
	1.0	>44	>40	>44	±0.005	±0.030	>115
	20	>44	>38	>44	±0.006	±0.050	>110
	26.5	>44	>34	>44	±0.006	±0.070	>102
K	0.04	>42	>40	>42	±0.005	±0.030	>105
	1.0	>42	>40	>42	±0.005	±0.050	>115
	20	>42	>38	>42	±0.006	±0.070	>110
	40	>38	>33	>38	±0.006	±0.080	>100
V	0.04	>40	>38	>40	±0.005	±0.030	>105
	1.0	>40	>38	>40	±0.005	±0.050	>115
	20	>40	>36	>40	±0.008	±0.050	>110
	40	>36	>31	>36	±0.008	±0.080	>97
	60	>34	>27	>34	±0.010	±0.100	>77
WR-22 ^①	33-50 GHz	>50	>45	>50	±0.025	±0.002	>100
WR-19 ^①	40-60 GHz	>50	>40	>50	±0.040	±0.005	>100
WR-15 ^①	50-75 GHz	>50	>37	>50	±0.060	±0.005	>90
WR-10 ^①	75-110 GHz	>46	>36	>46	±0.070	±0.007	>90

^①When used with an appropriate Maury Microwave Calibration Kit (or equivalent)

HIGH SPEED TIME (DISTANCE) DOMAIN (Cont'd)

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:

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

The resolution is given by the formula:

$$\text{Main Lobe Width (null-null) in ns} = \frac{Kw}{\text{Frequency Sweep Range (GHz)}}$$

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.

GENERAL

Rear Panel Connectors and Controls:

CRT INTEN: Continuous control of CRT intensity.

CRT DEGAUSS: Pushbutton control degausses CRT.

PRINTER: Connects to external printer with Centronics interface.

10 MHz REF IN: Connects to external reference frequency standard, 10 MHz, +5 dBm to -5 dBm, 50 ohms, BNC female.

10 MHz REF OUT: Connects to internal reference frequency standard, 10 MHz, 0 dBm, 50 ohms, 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.

EXT FM Phase Lock Output: Connects to 6600B Series or 360SS for phase locking the source.

SYSTEM BUS: IEEE-488 interface.

TEST SET SIGNAL: Used to interconnect system components.

TEST SET CONTROL: Used to interconnect system components.

GPIOB: IEEE-488 interface

EXTERNAL DIGITAL CONTROL: Allows external triggering of 360 measurement, BNC female. ±1V to trigger. 10 kΩ input impedance.

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 (f).

GENERAL (Cont'd)

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 & Frequency Converter:

None; power supplied by 360.

Dimensions:

360 VNA:

222H x 432W x 603D mm
(8.75H x 17W x 23.75D in.)

System Sources:

133H x 432W x 476D mm
(5.25H x 17W x 18.75D in.)

Test Sets and Frequency Converter:

133H x 432W x 603D mm
(5.25H x 17W x 23.75D in.)

Printer:

89H x 292W x 203D mm
(3.5H x 11.5W x 8D in.)

System Cabinet:

572H x 559W x 699D mm
(22.5H x 22W x 27.5D in.)

System Console:

1245H x 559W x 699D mm
(49H x 22W x 27.5D 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.)

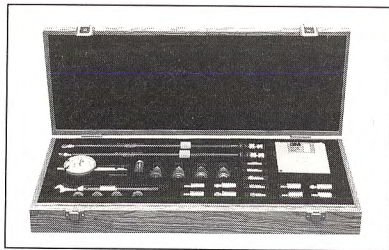
Vector Network Analyzer (Cont.)

Model 360

Calibration Kits

3650 SMA/3.5 mm Calibration Kit

The 3650 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of devices with SMA or 3.5 mm connectors. Components are included for calibrating male and female test ports. The kit supports calibration with broadband loads. Option 1 adds sliding loads.



Consisting of:

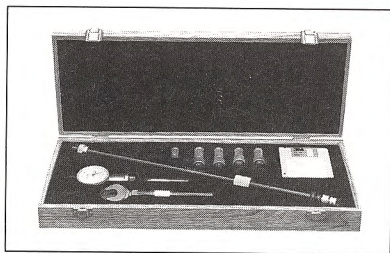
23S50	Short, 3.5 mm Male
23SF50	Short, 3.5 mm Female
24S50	Open, 3.5 mm Male
24SF50	Open, 3.5 mm Female
28S50-2	Termination, 3.5 mm Male (dc-26.5 GHz) (2 each)
28SF50-2	Termination, 3.5 mm Female (dc-26.5 GHz) (2 each)
33SFSF50	Insertable, 3.5 mm Female/Female (2 each)
33SS50	Insertable, 3.5 mm Male/Male
33SSF50	Insertable, 3.5 mm Male/Female (2 each)
34AS50-2	Adapter, GPC-7/3.5 mm Male (2 each)
34ASF50-2	Adapter, GPC-7/3.5 mm Female (2 each)
01-201	Torque Wrench
01-21	Reference Flat
01-222	Connector Gauge
01-223	Gauge Kit Adapter

Option 1: Add the following.

17S50	Sliding Load, 3.5 mm Male
17SF50	Sliding Load, 3.5 mm Female
01-211	Female Flush Short
01-212	Male Flush Short

3651 GPC-7 Calibration Kit

The 3651 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of test devices with GPC-7 connectors. The kit supports calibration with broadband loads. Option 1 adds a sliding load and a pin depth gauge.



Consisting of:

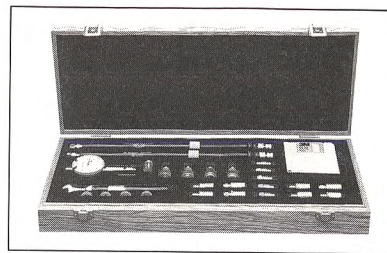
23A50	Short, GPC-7
24A50	Open, GPC-7
28A50-2	Termination, GPC-7 (dc-18 GHz) (2 each)
01-200	Torque Wrench
01-221	Collet Extractor Tool and Vial of 4 Collets

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

The 3652 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of test devices with K Connectors. Components are included for calibrating both male and female test ports. The kit supports calibration with broadband loads. Option 1 adds sliding loads.



Consisting of:

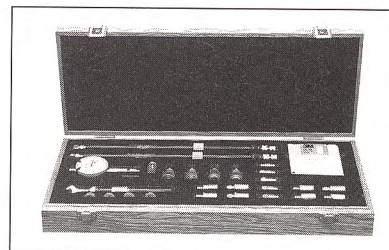
23K50	Short, K Male
23KF50	Short, K Female
24K50	Open, K Male
24KF50	Open, K Female
28K50	Termination, K Male (dc-40 GHz) (2 each)
28KF50	Termination, K Female (dc-40 GHz) (2 each)
33KK50	Insertable, K Male/Male
33KFKF50	Insertable, K Female/Female (2 each)
33KKF50	Insertable, K Male/Female (2 each)
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

3654 V Connector® Calibration Kit

The 3654 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of test devices with V Connectors. Components are included for calibrating both male and female test ports. The kit supports calibration with broadband loads.

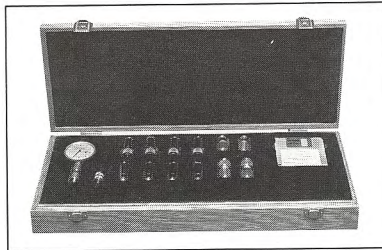


Consisting of:

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
33VVF50	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

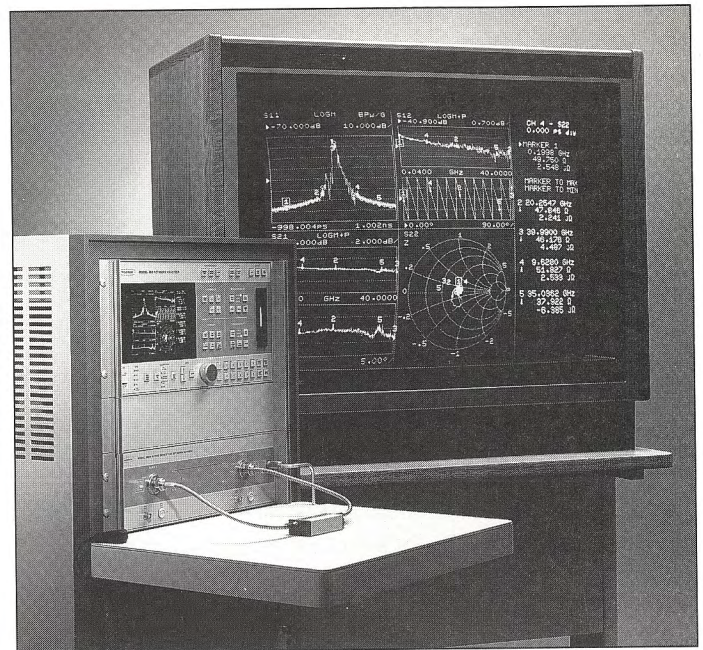
3653 Type N Calibration Kit

The 3653 Calibration Kit contains all the precision components and tools required to calibrate for 12-term error-corrected measurements of test devices with Type N connectors. Components are included for calibrating both male and female test ports. The kit supports calibration with broadband loads.



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



Verification Kits

3666 3.5 mm Verification Kit

The 3666 Verification Kit contains precision 3.5 mm components with characteristics that are traceable to the National Bureau of Standards. 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.

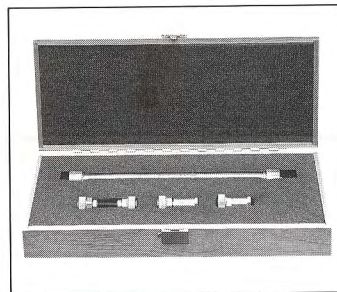


Consisting of:

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

The 3667 Verification Kit contains precision GPC–7 components with characteristics that are traceable to the National Bureau of Standards. 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 each component is supplied for comparison with customer-measured data by Wiltron Service personnel.

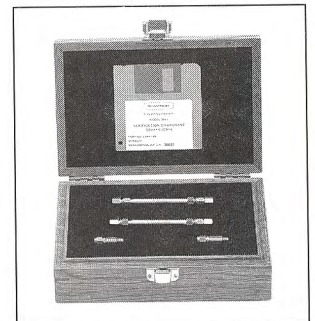


Consisting of:

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

3668 K Connector® Verification Kit

The 3668 Verification Kit contains precision components with characteristics that are traceable to the National Bureau of Standards. 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 each component is supplied for comparison with customer-measured data by Wiltron Service personnel.

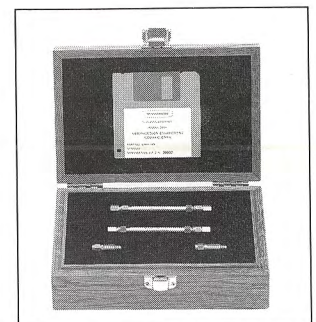


Consisting of:

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

The 3669 Verification Kit contains precision components with characteristics that are traceable to the National Bureau of Standards. 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 each component is supplied for comparison with customer-measured data by Wiltron Service personnel.



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

Vector Network Analyzer (Cont.)

Model 360

Ordering Information

NETWORK ANALYZER (One Required)

360 Vector Network Analyzer Please order 360C1 System Console, 360C2 System Cabinet, or 360C3 Millimeter System Console separately

360 Option 1S: Configured for Wiltron 360C1 System Console, 360 C2 System Cabinet, or 360C3 Millimeter System Console

360 Option 1: The 360 instrument is supplied with rack-mount slides and ears. Add \$350

360 Option 2A: High Speed Time (Distance) Domain Measurement Capability. Add \$9,000

360 Option 3: LRL Calibration Capability. Add \$3,000

360 Option 4: Dual Source Control Capability. Add \$4,000

360 Option 102A: Field Upgrade of Option 2A High Speed Time (Distance) Domain Measurement Capability

360C1 System Console including support rails, component storage drawer, and power distribution

360C2 System Cabinet including support rails and power distribution. \$1,100

360C3 Millimeter Wave System Cabinet including support rails, component storage drawer, and power distribution. \$3,000

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	
3637A High Power Reversing Test Set	270 MHz to 20 GHz	K Male	
3720A 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 Male	
3631A Frequency Converter	10 MHz to 60 GHz	V Male	

Test Set Options:

Option 1S: Configured for Wiltron 360C1 System Console, 360C2 System Cabinet, or 360C3 mm-Wave System Console

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 to 20 GHz Frequency Coverage (Available for Models 3610A and 3611A only.)

Option 5: 40 MHz to 62.5 GHz Frequency Coverage (Available for Model 3612A only.)

MILLIMETER TEST SETS and MODULES

3635A Millimeter Test Set

Interfaces with 360 Network Analyzer to provide necessary DC, RF, and IF signals for 3640 and 3641 Series modules

3640 Series Transmission/Reflection Modules Provides RF stimulus to device under test and measures relative forward and reflected power.

3640Q Transmission/Reflection Module, (33-50 GHz)

3640U Transmission/Reflection Module, (40-60 GHz)

3640V Transmission/Reflection Module, (50-75 GHz)

3640W Transmission/Reflection Module, (75-110 GHz)

3641 Series Transmission Modules Measures relative forward power.

3641Q Transmission Module, (33-50 GHz)

3641U Transmission Module, (40-60 GHz)

3641V Transmission Module, (50-75 GHz)

3641W Transmission Module, (75-110 GHz)

TEST SET MULTIPLEXER

360TSM Test Set Multiplexer

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 No charge

Option 1: Supplied with rack-mount slides and ears . . . Add \$250

Wiltron Swept Frequency Synthesizers and Sweep Generators:

The Wiltron 6700B Series Swept Frequency Synthesizers (see page 60) with 1 kHz resolution for high resolution measurements and the 6600B Series Sweep Generators (see page 67) are also compatible with the 360. 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

VERIFICATION KITS

3666 3.5 mm Verification Kit

3667 GPC-7 Verification Kit

3668 K Connector Verification Kit

3669 V Connector Verification Kit

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.

3670V50-1.5 Test Port Cable, dc to 60 GHz, V Connectors, 1.5 feet long, male/female

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.)

TEST PORT CONVERTERS

Test port converters for 3611A, 3621A, and 3630A 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/APC-3.5

Test port converters for 3612A, 3622A, and 3631A Test Sets.

34YA50 Test Port Converter, Universal/GPC-7

34YK50 Test Port Converter, Universal/K Connector, male.

34YV50 Test Port Converter, Universal/V Connector, male

34YSS50 Test Port Converter, Universal/SSMA, male

01-202 Wrench for changing test set Test Port Converters

SOFTWARE

2300-10 ANACAT® Software

ACCESSORIES

2225C Ink Jet Dot-Matrix Printer, including 2225-1 Interface Cable, 1 ink cartridge, and 50 sheets of Ink Jet 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 360 features, operation and measurements. Enrollment for two operators is provided at no charge with the purchase of each 360 system.

ON-SITE SUPPORT

360MS Option 11: On-Site Verification On-site 360 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 360, 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

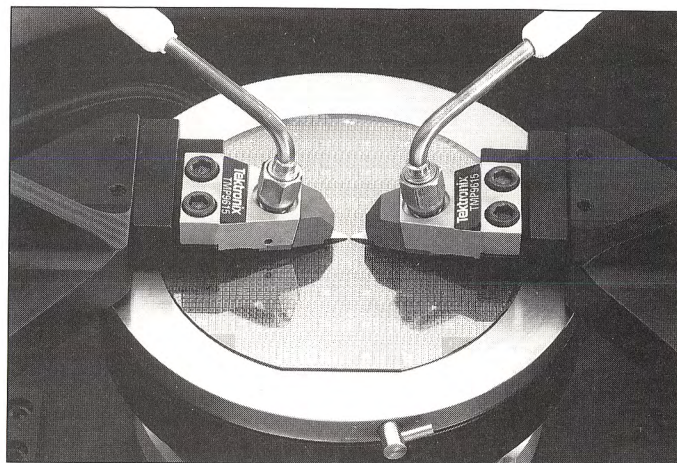
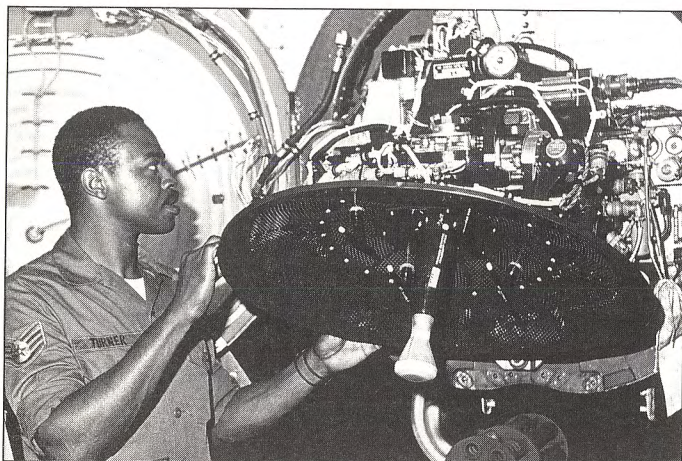
Additional, one year and two year "return to Wiltron" service is available, as an option for 360 systems and components. Prices and details are available from your Wiltron Sales Representative or by contacting the factory.

360 Vector Network Analyzer Systems:

	Model Number	Coaxial Vector Network Analyzer Systems			Millimeter-Wave Vector Network Analyzer System
		360MS20A	360MS40A	360MS60A	360MSW
	System Frequency Range (GHz)	0.04 to 20	0.04 to 40	0.04 to 60	75 to 110
System Display/Receiver	360 Vector Network Analyzer	●	●	●	●
Time Domain Software	Option 2A High Speed Time (Distance) Domain Capability	●	●	●	●
Coaxial Test Sets	3610A Reversing Test Set	●			
	3611A Reversing Test Set		●		
	3612A Reversing Test Set			●	
mm-Wave Test Set	3635A Millimeter-Wave Test Set				●
	3641W Transmission/Reflection Module (2 supplied)				●
Signal Source	360SS47 Signal Source (10 MHz to 20 GHz)	●			●
	360SS69 Signal Source (10 MHz to 40 GHz)		●	●	
	6729B Swept Frequency Synthesizer (8 to 20 GHz)				●
Calibration and Verification Kits	3650 SMA/3.5 mm Calibration Kit (includes Option 1, Sliding Termination)	●	●		
	3651 GPC-7 Calibration Kit (includes Option 1, Sliding Termination)	●	●		
	3652 K Connector Calibration Kit (includes Option 1, Sliding Termination)		●		
	3654 V Connector Calibration Kit (includes Sliding Termination)			●	
	3666 3.5 mm Verification Kit	●	●		
	3667 GPC-7 Verification Kit	●	●		
	3668 K Connector Verification Kit		●		
	3669 V Connector Verification Kit			●	
Test Port Adapter	34UA50 Adapter, Universal/GPC-7 (2 each)	●	●		
Cables	3670K50-1 Semirigid K Connector Test Port Cables (1 foot long, 2 supplied)	●	●		
	3670V50-1 Semirigid V Connector Test Port Cables (1 foot long, 2 supplied)			●	
Printer	2225C Ink Jet Printer	●	●	●	●
System Consoles	360C1 System Console	●	●	●	
	360C3 System Console				●
Training	Two-Day Training Course for Two Operators	●	●	●	●

VNA Measurement Solutions

General Information



Measurement Solutions for Specific Needs

- Permittivity and Permeability of Materials
- Versatile MMIC Calibration Software
- Pulsed RF Measurements to 20 ns Pulse Width for MMIC Power Characterization and EW System Characterization
- Error-Corrected Noise Figure Measurements for GaAs FET and MMIC Characterization
- MMIC Measurement System
- Radar Cross Section Measurement System

NEW

The 360 family of vector network analyzers offers unmatched performance, accuracy, and versatility.

This year, in addition to a number of new test sets and test modules, we have added application-specific measurement systems to the 360 family. These systems focus the power of the 360 family on specific applications. You benefit with a turn-key solution to difficult measurement problems.

Materials Measurement Software

The new Wiltron materials measurement software computes the complex permittivity and permeability of materials based on 360 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 32 for more information.

MMIC Calibration Software

Wiltron's new 2300-12 MMIC Calibration software allows the calibration of the 360 Vector Network Analyzer using three arbitrary terminations. It is an important addition for accurate measurements on all types of planar or substrate materials such as alumina, Duroid, and semiconductor substrates (e.g., on-wafer GaAs measurements). The software allows modeling of wafer probes and compensation for parasitic parameters, probe losses, and contact resistances with MMIC on-wafer measurements. See page 33 for more information.

Pulsed or CW Vector Network Analyzer System

The new Wiltron Pulsed or CW Vector Network Analyzer System offers the capability to measure devices with pulsed RF stimulus and observe the phase and magnitude performance during pulse operation with as narrow as 20 ns resolution.

Designers of MMIC devices can now evaluate the 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 36 for more information.

Noise Figure/Vector Network Analyzer System

Wiltron's new Noise Figure/Vector Network Analyzer System brings a new level of ease in accurately characterizing and optimizing low noise microwave devices. GaAs FET and MMIC characterization often requires both S-parameter and noise figure measurements. Vector calibration techniques improve noise figure measurement accuracy. See page 34 for more information.

MMIC Measurement System

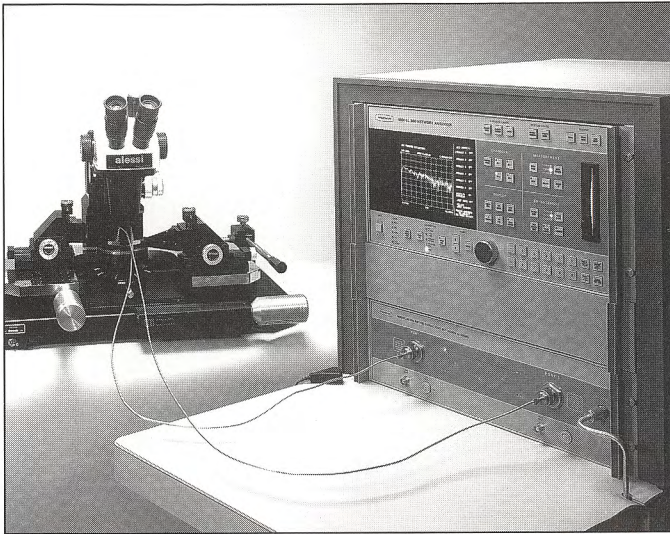
The new Wiltron 360MMS MMIC Measurement Systems combine the full performance of a CW or Pulsed VNA with that of error-corrected noise figure measurements. These systems allow designers to make pulsed or CW S-parameter measurements and noise figure measurements on-wafer without any changes in connection to the DUT. The pulse system offers the advantages that device thermal limitations can be negated by making measurements under pulse conditions. In addition, all noise figure measurements are error-corrected from the actual S-parameter measurements of the DUT. To accommodate testing with high RF power, the test sets incorporate couplers instead of resistive power dividers.

RCS Measurement System

The 360 Vector Network Analyzer is ideal for use in Radar Cross Section (RCS) and antenna measurements. RCS and antenna pattern measurements often require both horizontally-polarized and vertically-polarized data from separate antennas. The 360 is the only vector network analyzer which can make these two measurements simultaneously as the 360 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 360 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 32 for more information.

MMIC Measurement System

Model 360MMS



Model 360MMS MMIC Measurement Systems Highlights **NEW**

- Allow for On-Wafer In Situ S-Parameter (CW or Pulsed) Measurements and Noise Figure Characterization of Devices and Components
- Allow for the Characterization of High Power Devices
- Utilize the Wiltron 2300-12 MMIC Calibration Software
- Noise Figure Measurements are In Situ and are Error-Corrected by S-Parameter Measurements

Wiltron's new MMIC Measurement Systems combine the full performance of a CW or Pulsed VNA with that of Error-Corrected Noise Figure measurements in a Single-Connection Multi-Measurement System (SCMM). These systems allow the user to make in situ measurements of S-parameters and noise figure without changing connections on the DUT.

MMIC Measurements

Designers of MMIC circuits will find great usefulness when a Wiltron MMIC Measurement system is used with any available MMIC probe station (e.g., Tektronix, or Cascade). These systems will allow designers to make pulsed or CW S-parameter measurements and noise figure measurements on-wafer without any changes in connection. The pulse system offers the advantage that device thermal limitations can be negated by making measurements under pulse conditions. In addition, all noise figure measurements are error-corrected from the actual S-parameter measurements of the DUT.

Power Device Testing

To accommodate testing with high RF power, the 3636A Pulsed or CW Test Set and the 3637A High Power Reversing Test Set incorporate couplers instead of resistive directional bridges.

Ports are available on the 3636A and 3637A Test Sets for the addition of external power amplifiers, high power terminations and bias tees. The attenuators included within the 3636A and 3637A Test Sets, isolated by the 13 dB coupling

factor of the internal couplers, can handle up to 20 Watts peak or average RF power.

For CW measurements, the 3636A or 3637A Test Sets allow you to add external amplifiers to increase input power to the DUT to 20 Watts while maintaining full 12-term error correction. The 3636A Test Set allow you to perform high power testing and pulse profiling without exceeding device thermal limitations. The large CW dynamic range (105 dB at 1 GHz) and the 20 ns pulse profiling capability make this a most valuable in situ testing system.

The 3642 Noise Figure Module, with internal noise source, RF preamplifier, and broad-band down converter, allows you to make in situ noise figure measurements that are error-corrected for DUT S-parameters, including the changes in source match as the noise source is pulsed on and off.

An internal RF switch allows you to change from S-parameter to noise figure without moving the DUT. Provisions are available to attach a YIG filter for single-sideband measurements.

MMIC Calibration

360MMS Systems incorporate the Wiltron 2300-12 MMIC Calibration software. This software allows you to perform MMIC on-wafer calibration using a number of different calibrations schemes: Open-Short-Load (OSL); offset short, offset short, load; or arbitrary load calibration.

Measurement Software Capabilities

360MMS Systems are supplied with fully-functional software running on the 360 VNA and 360CC MS-DOS® Computer/Controller. This software is integrated with a user interface to allow simple menu selection of setup, calibration, and measurement functions. You may select and run S-parameter, noise figure, and pulse measurements in both the frequency and time domains. Data is presented on a 14-inch VGA color display. It may also be stored or plotted from the system controller console.

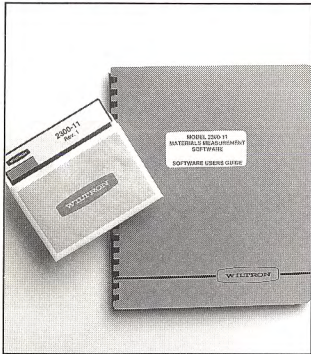
ATE Capabilities

The systems have the capability of being controlled by a customer-provided ATE controller or computer. This is accomplished through the use of the "Pass Control" protocol as defined in the IEEE-488.2-1987 standard for the general purpose interface bus (GPIB). Your computer or controller, capable of supporting this protocol, may take control of the Wiltron system GPIB and issue commands directly to the 360 or other instruments on the bus. It may also issue commands to the system to perform measurement tasks and report back with results.

To learn more about the 360MMS MMIC Measurement Systems, consult your Wiltron sales engineer or product specialist. Many configurations are available to meet your measurement needs.

Materials Measurement Software

Model 2300-11



2300-11 Materials Measurement Software Highlights **NEW**

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

The new Wiltron 2300-11 Materials Measurement software operates with any 360 Vector Network Analyzer system to compute the complex permittivity and permeability of materials based on one port S-parameter measurements. 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.

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 out of

fixture effects and compensation for fixture dispersion. Since the 360MMS 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

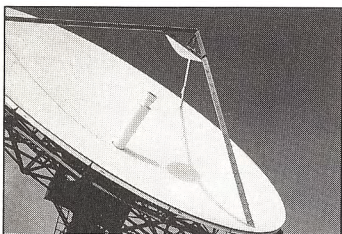
The analysis is based on measurements of two small, but different size, samples of material. Either coaxial or waveguide fixtures are supported. This approach simplifies the task of characterizing a wide variety of materials.

Wiltron's 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 software. 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.

Ordering Information

2300-11 Materials Measurement Software
360CC MS-DOS® Computer/Controller
360C4 Computer Console

Antenna and RCS Measurements



Antenna and RCS Measurement Highlights **NEW**

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

The 360 Vector Network Analyzer is ideal for use in Radar Cross Section (RCS) and antenna measurements. The high dynamic range of the 360 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- and horizontally-polarized antennas. The 360 is the only vector network analyzer which can make these two measurements simultaneously as the 360 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 360, 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.

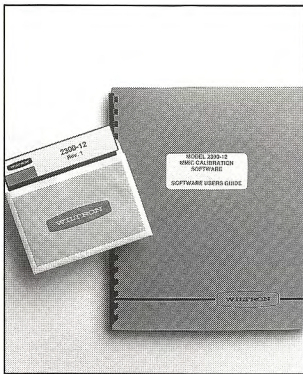
The most accurate approach to eliminating unwanted reflections is called "hard gating." The VNA receiver's range gate is opened only during the time that the desired signal is expected at the antenna. At other times, it is closed so that unwanted reflections are reduced by 80 dB.

The 360 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.

To learn more about the antenna pattern and RCS capabilities of the 360, consult your Wiltron sales engineer or product specialist. Many configurations are available to meet your measurement needs.

MMIC Calibration Software

Model 2300-12



2300-12 MMIC Calibration Software Highlights

NEW

- Allows for Modeling of Wafer Probe-Substrate Interface
- Compatible with all OSL, Offset-Short-Termination, and Arbitrary Termination Calibrations
- Compensates for Microstrip Dispersion
- Compensates for Wafer Probe Loss and Contact Resistance
- Allows for Thru Line Offsets

The Wiltron 2300-12 MMIC Calibration software allows you to calibrate the 360 Vector Network Analyzer using three arbitrary terminations. It is an important addition for accurate measurements on all types of planar or substrate materials. These include alumina, Duroid, and semiconductor substrates (e.g., on-wafer GaAs measurements). The software allows you to model wafer probes and compensate for parasitic parameters, probe losses, and contact resistances associated with MMIC on-wafer calibration.

The software assumes that all the calibration components can be modeled as a short section of transmission line of known impedance with a series R-L network terminated by an shunt R-C network. The shunt capacitance may be modeled as a function of frequency. The shunt resistance can be set to be a terminating resistor, an open circuit, or a short circuit.

The software can perform open-short-load type calibrations, offset-short type calibrations, or any three arbitrary termination type calibrations. It is also consistent with the standard open-short-load (OSL) calibrations. The calibration software includes compensation for thru line offsets and microstrip dispersion. It works with the Wiltron 3680 Series Universal Test Fixtures and most wafer probe stations. It will operate with any Wiltron 360 test set over all frequency ranges.

Once the 360 VNA is calibrated, all measurements are performed on the 360 system. The software also provides for calibration under external control in an ATE test configuration.

The 2300-12 software runs on MS-DOS® compatible computers with minimum of 2 Mbytes RAM. The Wiltron 360CC MS-DOS® Computer/Controller is the ideal hardware environment for this software. If both the MMIC calibration 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.

Ordering Information

2300-12

Wiltron Computer/Controller

Model 360CC



360CC MS-DOS® Computer/Controller

NEW

This powerful AT-compatible computer/controller runs all Wiltron measurement automation software such as 2300-11 Materials Measurements, 2300-12 MMIC Calibration, plus special system software for Noise Figure and Pulse Measurements.

In addition, MS-DOS® compatible software from other sources can be used.

The 360CC comes fully assembled with MS-DOS® provided on the hard disk. Wiltron software ordered at the time of purchase is resident on the hard disk and available after

turn-on through straightforward menu selection. Just connect the provided GPIB cable between the 360CC MS-DOS® Computer/Controller and your 360 VNA and you're ready to make measurements.

The 360CC has a 20 MHz 80386 microprocessor and 80387 numeric coprocessor with 2 Mbytes of RAM, a 3.5-inch 1.4 Mbyte disk drive, and a 40 Mbyte hard disk. The 14-inch VGA monitor has 640x480 pixels with 256 colors. The keyboard is a 101-key, enhanced AT-type keyboard. A parallel printer port and an RS-232 serial port are provided for input/output as well as a National Instruments PC2 IEEE-488 GPIB Interface card that provides interface between the computer/controller and the 360 VNA.

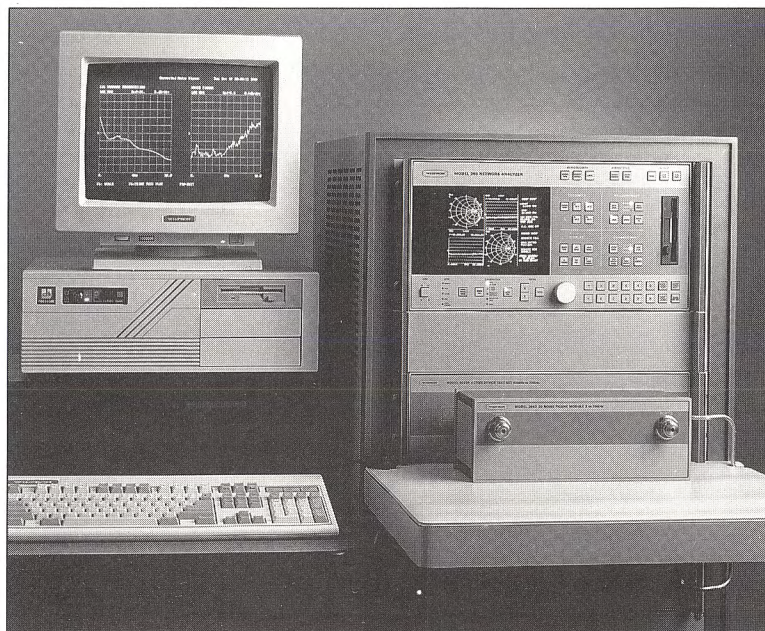
Resident software enables a pass control protocol where a system consisting of a 360 VNA with the 360CC MS-DOS® Computer/Controller can be fully GPIB-controlled by a host computer. This is especially useful for data archival, as multiple VNA systems can be serviced by a single host computer.

Ordering Information

360CC MS-DOS® Computer/Controller
360C4 Computer Console for Computer/Controller

Noise Figure/Vector Network Analyzer

Model 3642A, 2 to 20 GHz



NEW

3642A Noise Figure Module Highlights

- Error-Corrected Noise Figure and S-parameter Measurements
- 2 to 20 GHz Frequency Coverage
- Quick Upgrade for Existing 360 Systems
- Full, Reversing S-parameter Measurements

Wiltron's new Noise Figure Module for the 360 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 GaAs FET device. Together, the Wiltron Noise Figure Module and 360 Vector Network Analyzer make these measurements easily and with exceptional accuracy.

Receiver Design

Noise figure measurements are a critical element in the design and characterization of sensitive receivers. The addition of vector network data to noise figure measurements can

significantly enhance the measurement accuracy. With the use of the 360 and 3642A, the mismatch uncertainties can be minimized 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 easily be added to existing Wiltron 360 systems. The 3642A quickly attaches to the K Connector® test ports of a 3610, 3611, 3620 or 3621 Test Set (with an Auxiliary I/O Connector). The addition of a Wiltron 360CC MS-DOS® Computer/Controller 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 measurement capability is the 3642A Noise Figure Module. The 3642A includes a high performance noise source, superheterodyne receiver, and all RF switching circuitry required to measure noise figure and pass S-parameter measurements through to the test set. It uses the 360 system source as its L.O. and sends its output to the 360 for processing and display. Key nodes are available to allow the use of external mixers for "offset" measurement of front ends. Also, DAC outputs and RF ports are available to allow the addition of a tracking YIG filter for single-sideband noise figure measurements.

Specifications

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

Frequency Range: 2 to 20 GHz

Noise Figure Measurement Range: 1.5 to 30 dB
(without tracking YIG filter)

Noise Figure Measurement Uncertainty:^②

±0.1 dB @ 23°C

±1.5 dB @ 0 to +55°C

Noise Figure Measurement Resolution: ±0.001 dB

Maximum Operating Power (Noise Figure Module):

−20 dBm; damage level, +3 dBm

Excess Noise Ratio: >13 dB

Tracking Filter Drive: 1 to 10 volts, 0.5 volts/GHz

S-Parameter Dynamic Range Summary:^③

Frequency	2 GHz	20 GHz
Maximum Signal Into Port 2 (dBm)	+30	+30
Noise Floor (dBm)	−112	−107
Dynamic Range (dB)	142	137
Port 1 Power (dBm, typical) ^④	−9	−14
Noise Floor Relative to a Thru Calibration (db, typical)	105	96

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)	±0.005	±0.006
Transmission Frequency Tracking (dB)	±0.1	±0.15
Isolation (dB)	>115	>110

Ordering Information

3642A Noise Figure Module and Software

Accessories:

Wiltron 360CC MS-DOS® Computer/Controller
360C4 Computer Console

^① Test sets must have Auxiliary I/O Connector.

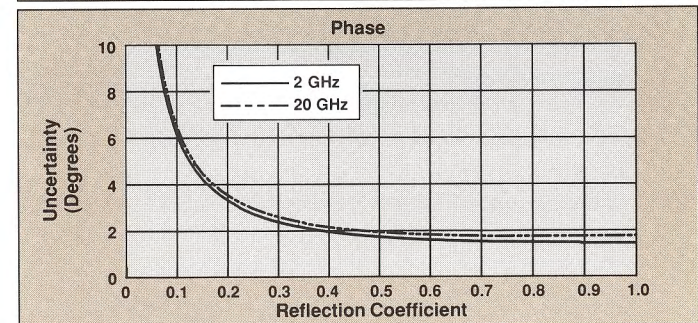
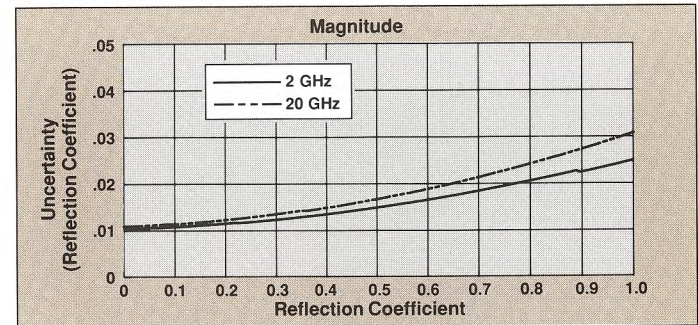
^② Excluding Noise Source Error.

^③ With minimum bandwidth and 1024 averages in the forward direction.

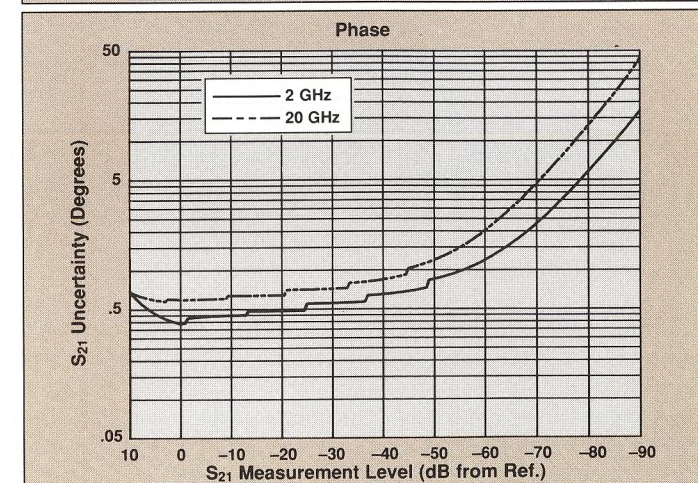
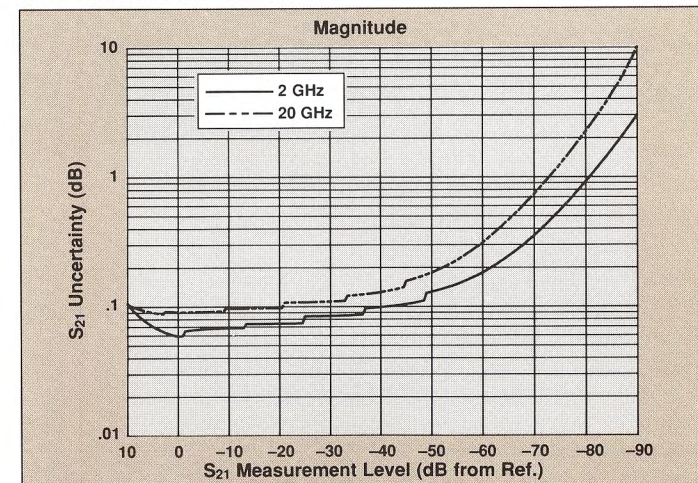
^④ Changes in the Video IF Bandwidth or averaging can result in variations at low levels.

^⑤ +10 dBm into 3620A Test Set.

MEASUREMENT UNCERTAINTY CURVES: Models 3620A Test Sets (K Connectors) with 3642A Reflection Measurements:

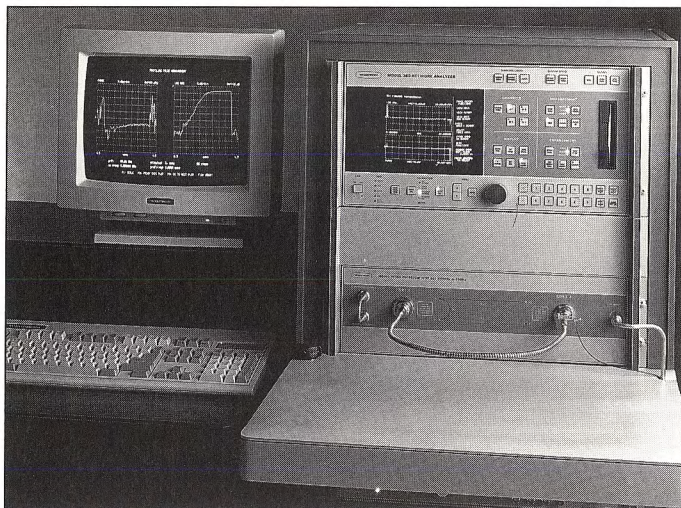


Transmission Measurements:



Pulsed or CW Vector Network Analyzer

Model 360PS20A, 270 MHz to 20 GHz



360PS20A Pulsed or CW Vector Network Analyzer Highlights

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

NEW

The Wiltron 360PS20A Pulsed or CW 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 on the wafer. 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. This saves the time and money otherwise required to scribe up the wafer and mount individual devices for power tests.

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.

To reduce power consumption, systems designers may want to turn off the bias to idle microwave components in a system. Measurements of warm-up time are needed to know when the system is available after turn-on. Many microwave components exhibit gain and phase changes during RF turn-on and turn-off. 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 μ s pulse width resolution. The 360PS20A offers the performance needed for modern EW and radar systems.

A Complete System

The 360PS20A includes installation, a one year on-site warranty, and all equipment needed for both pulsed RF and CW measurements. Existing CW Wiltron 360 systems can be upgraded into a 360PS20A. Contact the factory for details.

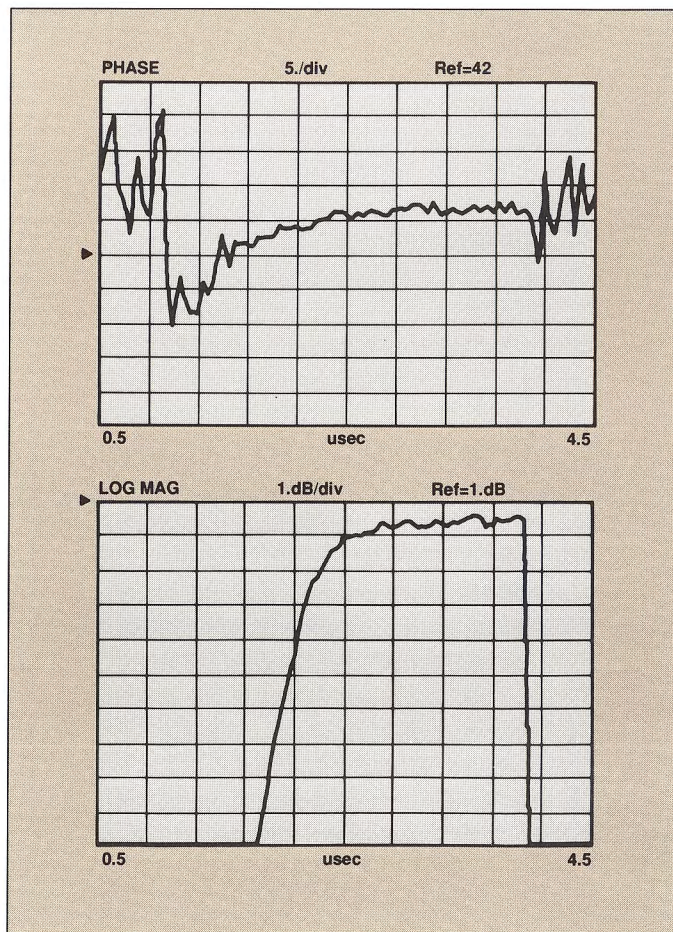
Exceptional Performance with Minimum Cost

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 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 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.



The phase and magnitude performance of a 2 to 8 GHz amplifier during a 2 μ s bias pulse are easily measured with the 360PS20A.

Specifications

Frequency Range: 270 MHz to 20 GHz

Pulse Width: 20 ns to CW

Duty Factor: 0.1% to CW (limited by profile pulse width)

Pulse Repetition Frequency Min: 1 kHz
Max: 980 kHz (limited by system pulse generator)

Power handling: 20 Watts, maximum

Equivalent Bandwidth: >50 MHz

Pulse Generator Delay: 85 ns to $\left(\frac{1}{\text{PRF}} - 1 \mu\text{s}\right)$

Minimum Trigger Width: ≥ 5 ns

Dynamic Range Summary:^①

Frequency	270 MHz	1 GHz	20 GHz
Maximum Signal ^② Into Port 2 (dBm)	+43	+43	+43
Noise Floor (dBm)	-99	-110	-98
Dynamic Range (dB)	142	153	141
Port 1 Power ^③ (dBm, typical)	-4	-5	-15
Noise Floor ^③ Relative to a Thru Calibration (db, typical)	90	105	85

Ordering Information

360PS20A Pulsed or CW Vector Network Analyzer System
 Supplied in the 360C1 System Console for automated testing over the 1 GHz to 20 GHz range

360PS20A Option 6:

270 MHz to 20 GHz frequency coverage

The 360PS20A System Consists of:

- 360 Vector Network Analyzer
- 3636A Pulsed or CW Test Set (1 GHz to 20 GHz)
- 6747B Swept Frequency Synthesizer (10 MHz to 20 GHz)
- 360PSG Pulse Generator
- 360CC MS-DOS[®] Computer/Controller
- 360C1 System Console
- 360C4 Computer Console
- 3650 SMA/3.5 mm Calibration Kit (Includes Option 1, Sliding Loads)
- 3670K50-1 Test Port Cable (2 each)
- 2225C Ink Jet Dot-Matrix Printer
- Two-Day Training Course for Two Operators
- One-Year On-Site Service

^①With minimum bandwidth and 1024 averages for CW measurements in the forward direction. Changes in the Video IF Bandwidth or averaging can result in variations at low levels.

^②With high power termination and using internal step attenuator

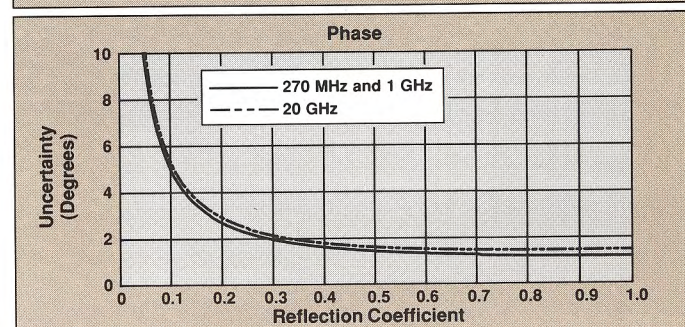
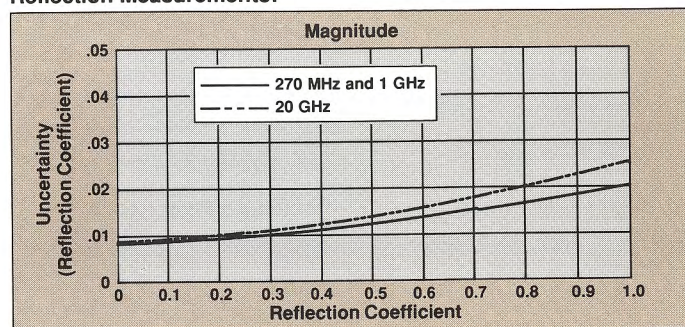
^③For pulsed measurements, average Port 1 power and noise floor relative to a thru are reduced by $20\log(\text{duty factor})$

^④For pulsed measurements, transmission uncertainty curves are shifted to the left by $20\log(\text{duty factor})$

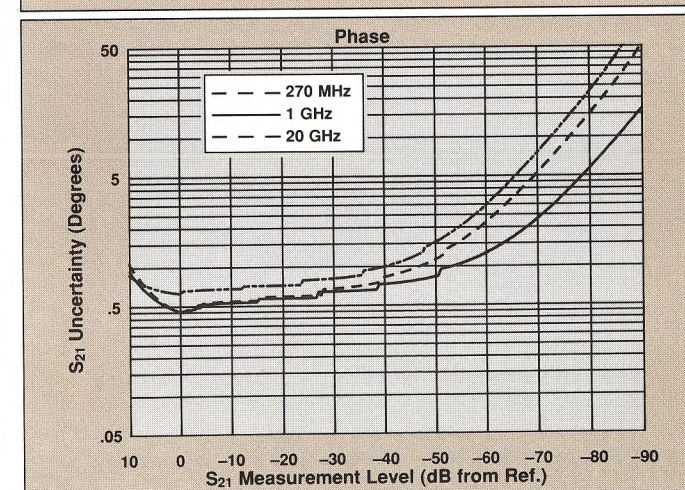
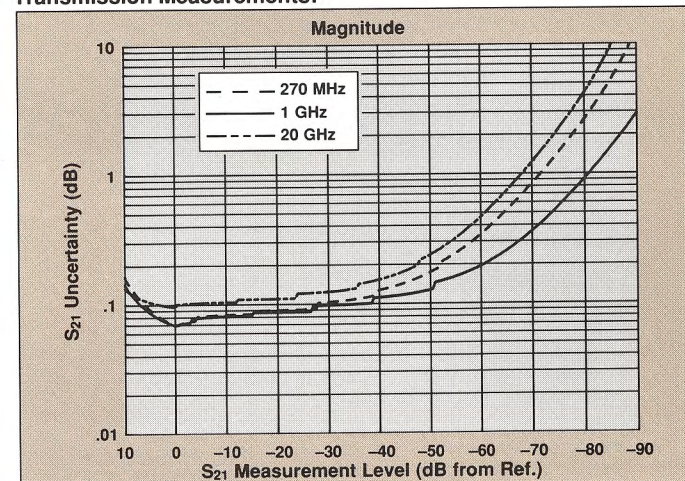
MEASUREMENT UNCERTAINTY CURVES:

Models 3636A (K Connectors)

Reflection Measurements:

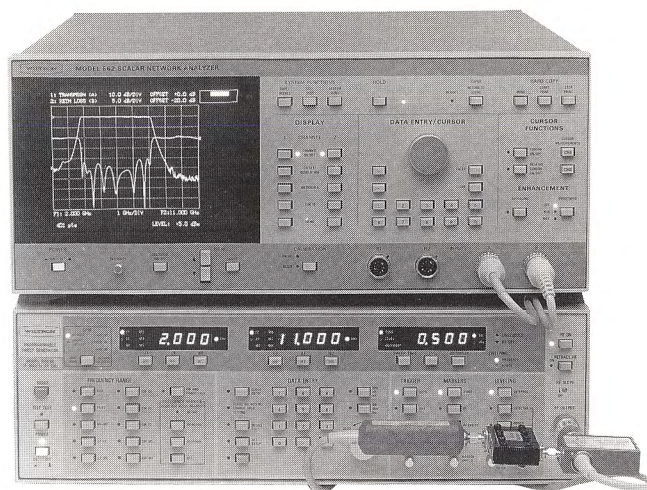


Transmission Measurements:^④



Scalar Network Analyzer Systems

5600B and 5700B Series, 10 MHz to 40 GHz



5600B and 5700B Network Analyzer System Highlights

- Superior Performance and Lower Cost
- 10 MHz to 40 GHz Measurements from a Single Coaxial Test Port
- No Controller Required for Measurement or Hard Copy Output
- Simultaneous Measurement and Printout from Buffer Memory
- Guided Step-By-Step Normalization and Measurement Procedures
- Four Input Channels
- Extensive Cursors, Markers, and Limit Lines

Automatic Operation without an External Controller

The 5600B and 5700B Series Automated Scalar Network Analyzer Systems make simultaneous measurements of transmission loss or gain, return loss (dB and SWR), and power. Each 5600B System includes a 562 Scalar Network Analyzer, 6600B Series Sweep Generator, and all required measurement components. Each 5700B system includes a 562 Scalar Network Analyzer, 6700B Series Swept Frequency Synthesizer, and all required measurement components.

Although the 562, the 6600B, and the 6700B are GPIB (IEEE-488) programmable, neither the 5600B or 5700B Systems require an external controller for automatic operation. Selections may be made on both the network analyzer and source front panels. The 562 has a dedicated port for source and plotter interface. Full band, start-stop, and CW ΔF sweep ranges are displayed on the 562 CRT. 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.

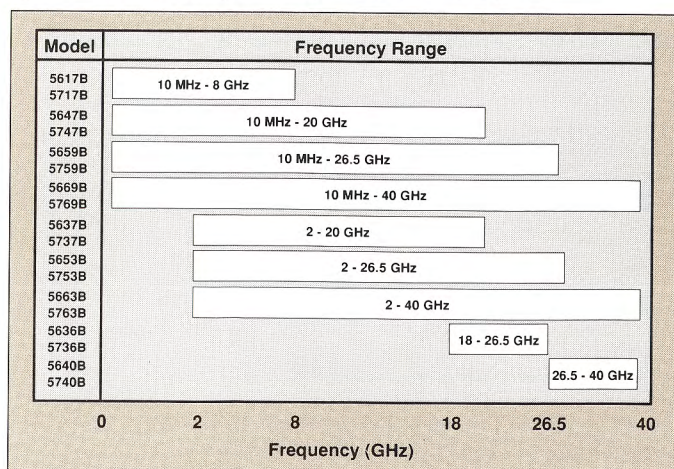
Compatible with several plotters and dot-matrix printers, the systems feature a buffer memory that allows tests to proceed while previously taken data are being printed out.

The 5600B Series Systems

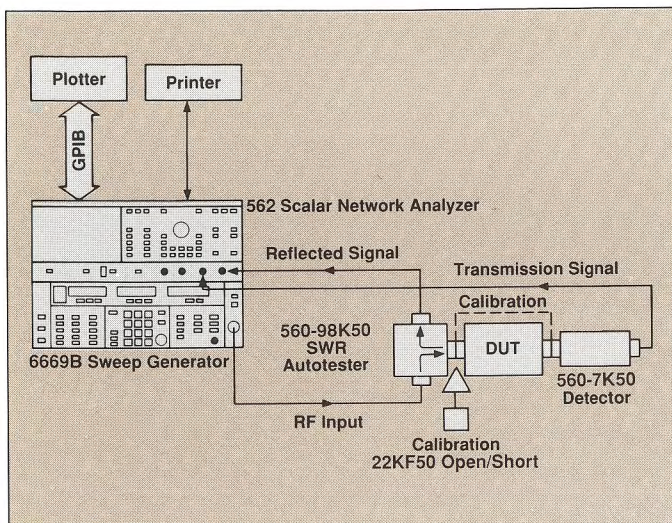
The 5600B Series consists of nine models. Each system model covers a different frequency range. The 5669B System has a coaxial frequency range of 10 MHz to 40 GHz. Each system includes a 560 Series Detector, 560 Series Autotester, and measurement accessories matching the source frequency coverage and connector type. Regardless of the model chosen, you'll be impressed with the performance. The dynamic range for each of the four channels is 76 dB (-60 dBm to $+16$ dBm).

The 5700B Series Systems

The 5700B Series also consists of nine models with the same coverage and measurement accessories as the 5600B. 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.



The 5600B and 5700B Series each consist of nine models, one of which makes coaxial measurements from a single test port over the 10 MHz to 40 GHz range.



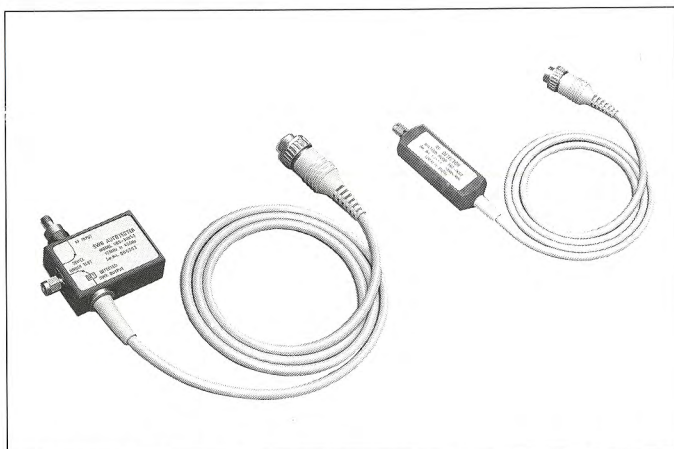
The 5600B test setup includes direct connection to a printer or GPIB plotter. An external controller can be added, but is not required for automated measurements.

Self-Explanatory Operation

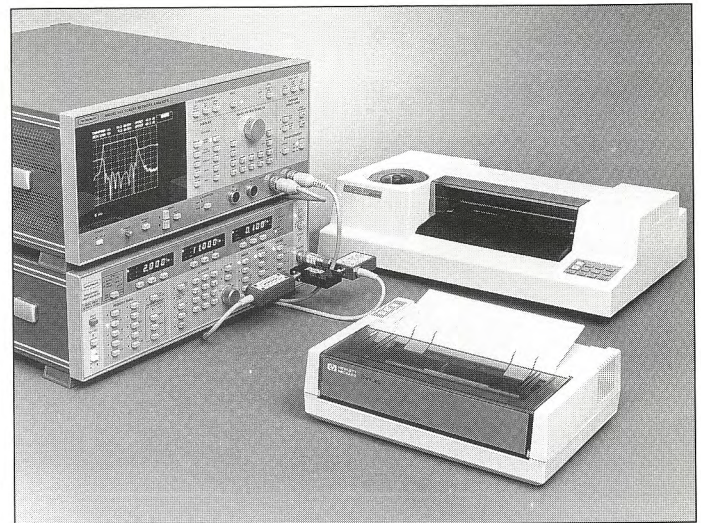
The inviting front panel reflects the extensive effort to simplify operation. Menu selections guide you through step-by-step normalization and measurement procedures. At each step, the instrument provides a comprehensive display of all pertinent system status and measurement parameters. Clear control identifiers and complete, unambiguous display data make operation self-evident.

Microprocessor-Guided Operation

During normalization, 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 normalization 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 renormalization. Set-up time is minimized by storing parameters for up to nine test setups. Four may include calibration data.



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 response.



Hard copies of all displayed test data and parameters can be made on a dot-matrix printer or GPIB plotter while measurements proceed.

Measurements can be made at 101, 201, or 401 points (user selected) with 0.005 dB vertical resolution on both channels. Since the typical data-update time is 100 ms, the test device can be adjusted while viewing a "real time" display. 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 5600B requires only about 10 seconds for print formatting. The next measurement can proceed while data from the last are being printed out.

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.

Confidence-Building Accuracy

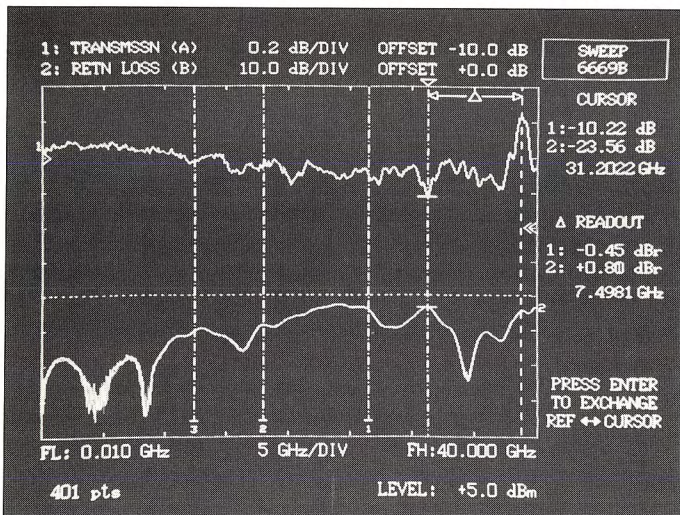
There are several features that contribute to the accuracy of the 5600B and 5700B Systems.

- Filtered, broadband, fundamental oscillators up to 26.5 GHz which avoid the serious measurement errors inherent in multiplier-type oscillators.
- High-directivity, low-reflection measurement components.
- Powerful microprocessor to normalize errors introduced by the system itself.
- Read-only-memory (ROM) to correct nonlinearities in the oscillator frequency characteristics.
- Automatic internal calibration of all channels.
- Excellent source match of the 6600B and 6700B sources.

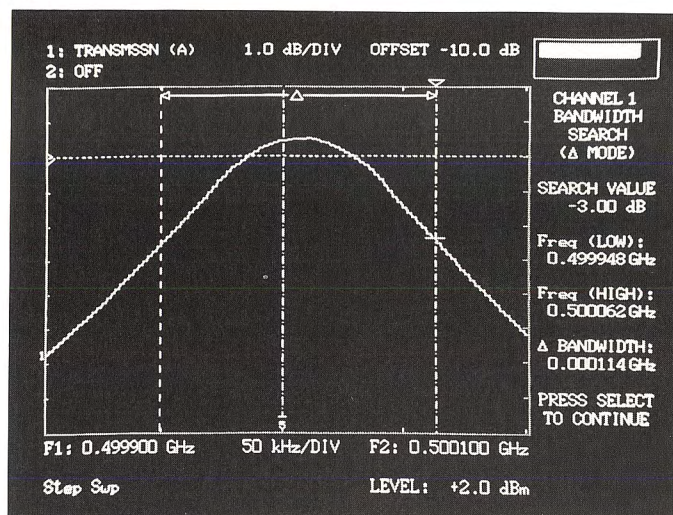
The exceptional return-loss accuracy is attributable to the high directivity of the Wiltron SWR Autotesters. For example, the 5647B and 5747B with GPC-7 test ports have directivity of greater than 40 dB from 10 MHz to 18 GHz. For the 560-98K50, the directivity exceeds 35 dB up to 18 GHz, 32 dB up to 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

Scalar Network Analyzer Systems

5600B and 5700B Series, 10 MHz to 40 GHz



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 or other selected bandwidth amplitudes.

15 dB up to 40 GHz. 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.

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.

Cursors and Markers

The 562 has an extensive set of cursor functions:

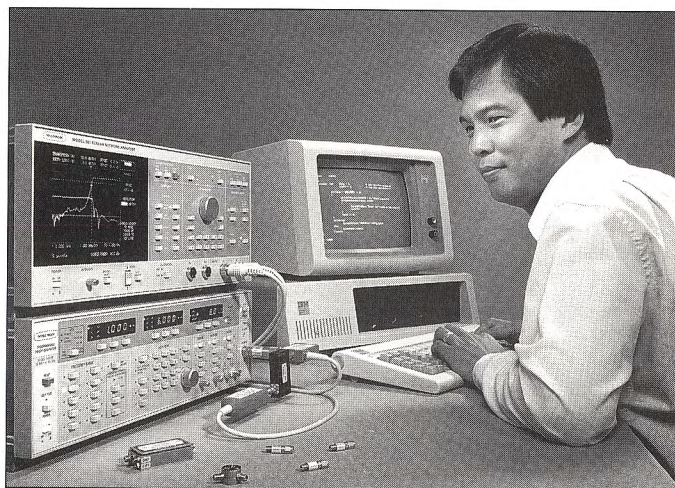
- **Cursor:** Cursor position is continuously variable with the tuning knob. The frequency and amplitude of the test data at the cursor on both traces are digitally displayed.
- **Relative Cursor:** The difference in amplitude and frequency between the main Cursor and the Relative Cursor positions on 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.

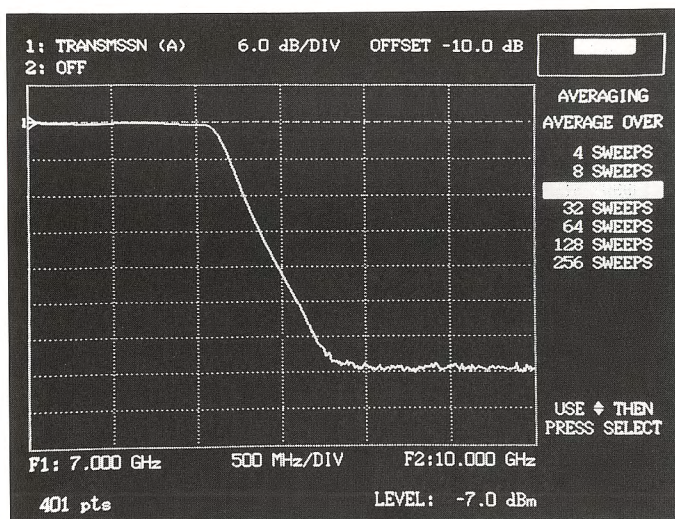
Applications Functions

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 amplifier by successively incrementing the source power and measuring the amount of compression until a preset limit is exceeded.



Though the 5600B does not require a controller for automated operation, it includes GPIB (IEEE-488) interface as standard.



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

Stored Test Setups

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

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.

Smoothing and Averaging

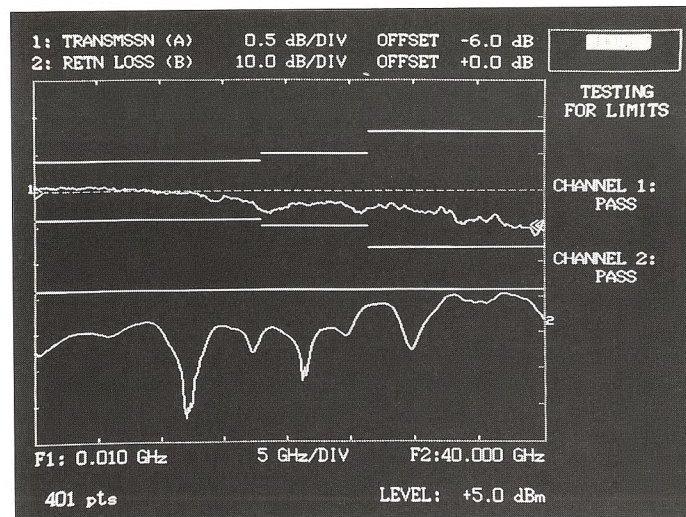
When characteristics of the test device vary rapidly with frequency at very low signal levels, the trace can be smoothed by averaging and/or smoothing. The Smoothing control has three selections: Off, Min, and Max. To maintain the accuracy of the measurement data, smoothing is performed by reducing bandwidth, rather than by averaging adjacent data points in order to preserve measurement detail.

When averaging is selected, 4 to 256 successive traces can be averaged to smooth the trace display. As various combinations of smoothing and averaging are selected, the trace update time is automatically adjusted.

System Signal Source

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.



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

- **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 5×10^{-10} aging per year.
- **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 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 characteristics.

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 continuous control knob until the desired frequency is obtained. Subsequent requests for this frequency will produce the same frequency, including the correction.

Scalar Network Analyzer Systems (Cont.)

Model 5600B and 5700B

Specifications

MEASUREMENTS

Measurement Modes: Measures and displays in dB swept transmission and return loss characteristics in dBm and SWR. 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 or 560-10BX-1 Adapter Cables.

Frequency Accuracy:

5600B: Same as 6600B Sweep Generator Frequency Accuracy specification; see page 72.

5700B: Same as 6700B Swept Frequency Synthesizer Frequency Accuracy specification; see page 64.

Frequency Resolution: Dependent on Signal Source. Refer to 6600B Sweep Generator or 6700B Swept Frequency Synthesizer frequency specifications.

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. Four of the setups may include calibration data and trace memory. All stored data can be previewed on the CRT or printer output prior to selection. Four of the setups include their own calibration data.

Power Sweep: Sweeps power over a specified range, according to signal source used. Refer to 6600B Sweep Generator or 6700B Swept Frequency Synthesizer power sweep specifications.

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.

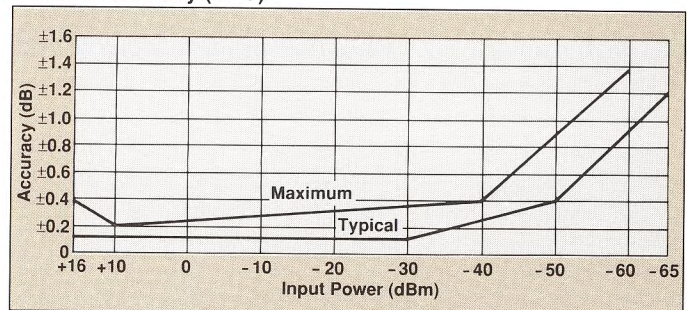
Cursor "X" Bandwidth: Automatically displays cursors to the right and left of the cursor at the frequencies where the test data are equal to the entered value of "X" dB. The frequencies of the low and high cursors and the bandwidth between them are displayed.

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):

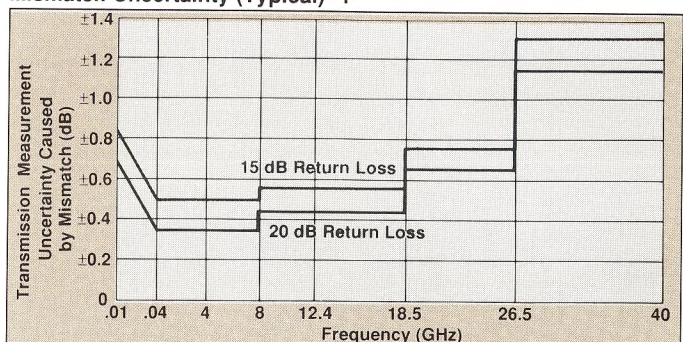


Transmission Loss or Gain Accuracy: Uncertainties from frequency response of components are automatically subtracted from test data during the normalization procedure. Overall accuracy is then:

$$\begin{matrix} \text{Transmission} \\ \text{Loss or Gain} \end{matrix} = \begin{matrix} \text{Channel} \\ \text{Accuracy} \end{matrix} + \begin{matrix} \text{Mismatch} \\ \text{Uncertainty}^* \end{matrix}$$

* 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 characteristics of the detector, sweep generator and SWR Autotester.

Mismatch Uncertainty (Typical)**:



**Varies with the return loss of the detector, SWR Autotester, connecting cables, the source impedance of the sweep generator, and the value of the measured reflection.

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:

$$\text{Return Loss Accuracy} = \text{Channel Accuracy} + \text{SWR Autotester Accuracy}$$

SWR Autotester Accuracy:

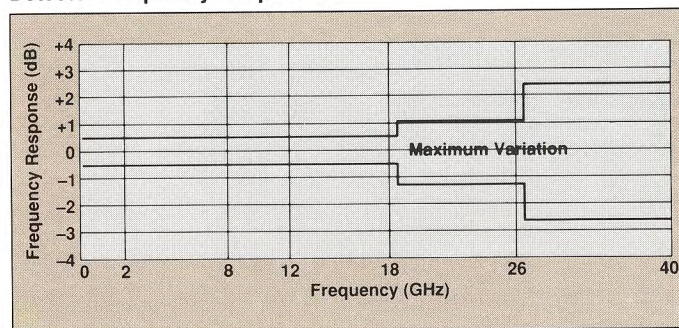
Model	Accuracy of Measured Reflection Coefficient (ρ) ^①			
	10 MHz-8 GHz	8-18 GHz	18-26.5 GHz	26.5-40 GHz
560-97A50	$0.016 \pm 0.06\rho^2$	$0.016 \pm 0.10\rho^2$	N/A	N/A
560-97A50-1	$0.010 \pm 0.06\rho^2$	$0.010 \pm 0.10\rho^2$	N/A	N/A
560-97N50	$0.018 \pm 0.08\rho^2$	$0.018 \pm 0.12\rho^2$	N/A	N/A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

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

Power Measurement Accuracy:

$$\text{Absolute Power Accuracy} = \text{Channel Accuracy} + \text{Detector Frequency Response}$$

Detector Frequency Response:



Overall Waveguide Return Loss Measurement Accuracy:

$$\text{Return Loss Accuracy} = \text{Channel Accuracy} + \text{User-Selected Coupler Accuracy}$$

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 programmable 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 typically 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 K Ω impedance.

Sweep Dwell Input: TTL-low signal stops sweep. Sweep continues when signal is removed. Rear panel BNC connector.

Bandswitching Blanking Input: Accepts ± 5 V signal coincident with bandswitching points. Rear panel BNC connector.

Retrace Blanking Input: +5V blanks traces during retrace. Rear panel BNC connector.

Video Marker Input: ± 1 V to ± 10 V 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 $\pm 10\%$, 48-63 Hz, 130 VA maximum

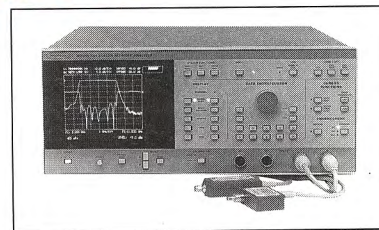
Dimensions: 177 H x 432 W x 476 D mm + 10 mm for feet
(7 H x 17 W x 18-3/4 D in. + 3/8 in. for feet)

Weight: 16 kg (35 lb.)

SYSTEM ELEMENTS

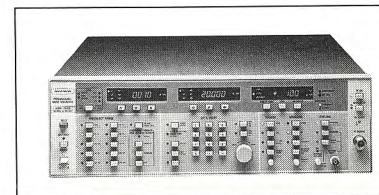
Network Analyzer:

The 562 Scalar Network Analyzer provides a simultaneous display of transmission loss/gain and return loss or power. Its test signal is supplied by the 6600B Sweep Generator or 6700B Swept Frequency Synthesizer. Because of its extensive use of internal microprocessors, the 562 does not require an external controller for automated measurements. Interface with waveguide detectors is provided by the 560-10BX or 560-10BX-1 Adapter Cables. The 562 makes direct connection to a printer or plotter. Detailed specifications are given on page 48.



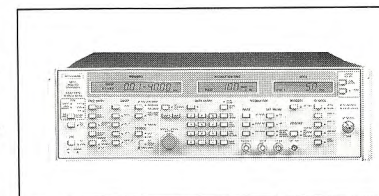
Sweep Generator:

The 6600B Sweep Generator is one of the available signal sources. It uses fundamental oscillators from 2 to 26.5 GHz to provide a clean test signal that is free of subharmonics. Detailed specifications are given on page 70.



Swept Frequency Synthesizer:

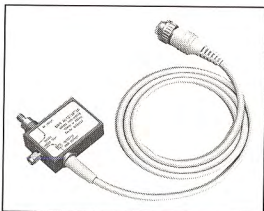
The 6700B Swept Frequency Synthesizer is one of the available signal sources. Like the 6600B, it uses fundamental oscillators from 2 to 26.5 GHz. The 6700B produces phase-locked CW or digital step-sweep signals, as well as true analog sweeps. They offer high output power and 1 kHz resolution. All models include a built-in pulse generator/modulator and an internal power meter. Detailed specifications are given on page 63.



Scalar Network Analyzer Systems (Cont.)

Model 5600B and 5700B

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		
560-97N50-1	0.01-18	38	±1.5	N Male	N Female
560-97NF50	0.01-18	35	±1.5		
560-97NF50-1	0.01-18	38	±1.5	N Female	N Female
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)	±3.0	K Male	Ruggedized K Female
560-98KF50	0.01-40	32 (18-26.5 GHz) 30 (≥26.5 GHz)	±3.0	K Female	

Maximum Input Power: 0.5 W **Cable Length:** 122 cm (4 ft.)

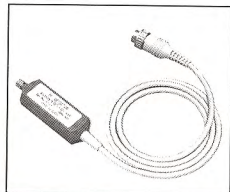
Insertion Loss: 6.5 dB nominal from input port to test port

Dimensions and Weight:

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

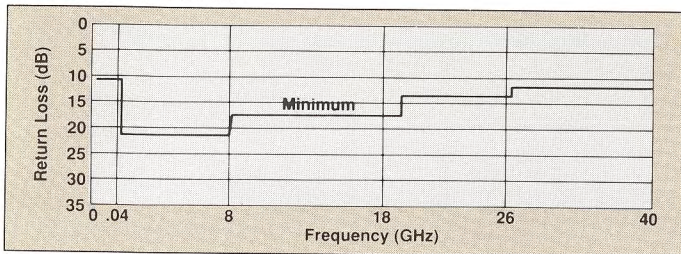
^① Plus connectors and cable

Detectors: The 560 Series Detectors are used for absolute power and relative transmission measurements. The 560 Series Detectors use zero-biased, field-replaceable Schottky diodes. Measurement range is -60 dBm (typically useable to -65 dBm with 562) to +16 dBm. Optional extender cables can be used without degradation in performance.



Model	Frequency Range	Input Connector
560-7A50	10 MHz to 18 GHz	GPC-7
560-7N50	10 MHz to 18.5 GHz	N Male
560-7S50	10 MHz to 18.5 GHz	WSMA Male
560-7S50-2	10 MHz to 26.5 GHz	WSMA Male
560-7K50	10 MHz to 40 GHz	K Male

Detector Return Loss:



Maximum Input Power: 100 mW

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.)

Replaceable Diode Modules:

Detector Model	Diode Module Model
560-7A50	560-A-7219-A (To 18 GHz)
560-7N50	560-A-7219-A (To 18 GHz)
560-7S50	560-A-7219-A (To 18 GHz)
560-7S50-2	560-A-7219-B (To 26.5 GHz)
560-7K50	ND19393

ACCESSORIES

Extender Cables:

Extender Cables can be installed between the SWR Autotester or detectors and the 562, permitting measurements from up to 200-foot distance.

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:

GPIB cables interconnect instruments on GPIB.

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:

Adapter cables allow the 562 to be used with waveguide or other detectors having a BNC or SMA female output connector. Cable length is 122 cm (4 ft.).

Model	Connector
560-10BX	BNC Female
560-10BX-1	SMA Female

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

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

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

^① Supplied with collet for mating with beadless end of air line.

Model	Connectors	Price
21A-1 ^①	GPC-7 Short Only	Included with instrument at no charge
22A50	GPC-7	
22K50	K Male	
22KF50	K Female	
22N50	N Male	
22NF50	N Female	
22S50	WSMA Male	
22SF50	WSMA Female	

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

760-75 Transit Case for the 562

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 Replacement Ink Cartridge

2225-3 Fan-fold Ink Jet Paper (500 sheets)

Ordering Information

5600B & 5700B Scalar Network Analyzer Systems See facing page.

SWR Autotesters:

560-97A50	10 MHz to 18 GHz
560-97A50-1	10 MHz to 18 GHz
560-97N50	10 MHz to 18 GHz
560-97N50-1	10 MHz to 18 GHz
560-97NF50	10 MHz to 18 GHz
560-97NF50-1	10 MHz to 18 GHz
560-98K50	10 MHz to 40 GHz
560-98KF50	10 MHz to 40 GHz
560-98S50	10 MHz to 26.5 GHz
560-98S50-1	10 MHz to 26.5 GHz
560-98SF50	10 MHz to 26.5 GHz
560-98SF50-1	10 MHz to 26.5 GHz

Detectors:

560-7A50	10 MHz to 18 GHz, GPC-7, 50Ω
560-7K50	10 MHz to 40 GHz, K Male, 50Ω
560-7N50	10 MHz to 18.5 GHz, N Male, 50Ω
560-7S50	10 MHz to 18.5 GHz, WSMA Male, 50Ω
560-7S50-2	10 MHz to 26.5 GHz, WSMA Male, 50Ω

Rack Mounting, Option 1: Source and 562 supplied with mounting ears and chassis track slides (90° tilt) installed

Connecting Cables: A 2100-1 GPIB Cable, 1 m (3.3 ft) long, and an 806-7 Interconnect Cable for the 6600B Sweep Generator are included with each 562.

806-7 Replacement Interconnect Cables**Complete 5700B/5600B Systems:**

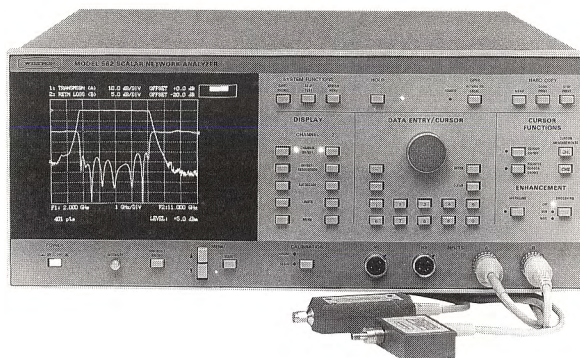
	Frequency Range								
	10 MHz to 8 GHz	18 to 26.5 GHz	26.5 to 40 GHz	10 Hz to 18 GHz	10 MHz to 20 GHz	2 to 26.5 GHz	10 MHz to 26.5 GHz	2 to 40 GHz	10 MHz to 40 GHz
5700 Series, Order Model Number	5717B	5736B	5740B	5745B	5747B	5753B	5759B	5763B	5769B
5600 Series, Order Model Number	5617B	5636B	5640B	5645B	5647B	5653B	5659B	5663B	5669B
Your system includes:									
Network Analyzer									
562 Scalar Network Analyzer	●	●	●	●	●	●	●	●	●
Swept Frequency Synthesizer (5700B Series)	6717B	6737B	6740B	6745B	6747B	6753B	6759B	6763B	6769B
or									
Sweep Generator (5600B Series; GPIB included)	6617B	6636B	6640B	6645B	6647B	6653B	6659B	6663B	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) (Not available on 6740B.)	2A 2B 2C	For 5717B, 5745B, or 5747B For 5736B, 5753B, or 5759B For 5736B or 5769B	
Adds to 6600B Series Synthesizer a 70 dB Step Attenuator (10 dB steps) (Not available on 6640B.)	2A 2B 2C	For 5617B, 5645B, or 5647B For 5636B, 5653B, or 5659B For 5636B or 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, 5745B, 5617B, 5645B	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, 5745B, 5617B, 5645B	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, 5745B, 5617B, 5645B	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

Scalar Network Analyzer

Model 562, 10 MHz to 40 GHz



562 Scalar Network Analyzer Highlights

- Full Compatibility with Wiltron and HP Sources
- Four Independent Trace Memories
- 76 dB Dynamic Range, -60 dBm Sensitivity
- 10 MHz to 40 GHz Coverage
- Accurate DC Detection
- Applications Functions for Improved Productivity
- Synthesized Step Sweep with Wiltron 6700B
- Available with Distance-to-Fault-Location System

High Performance Scalar Measurements

The Wiltron 562 Scalar Network Analyzer combined with a Wiltron sweeper or 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.

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.

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. Step-by-step guidance is provided for measurement calibration. 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.

Multi-Vendor Source Compatibility

The Wiltron 562 is the first scalar analyzer to offer full compatibility with both Wiltron and HP sweepers and synthesizers. The 562 has a dedicated port for source and plotter interface. It interfaces with *all frequency models* of any of the following sources to provide complete interaction during measurements:

Wiltron 6600A/B
Wiltron 6700A/B
HP 8350B
HP 8340A/B, 8341A/B

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.

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 amplifier by successively incrementing the source power and measuring the amount of compression until a preset limit is exceeded.

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 losing detail. Smoothing is true bandwidth

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.

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.

Recommended Signal Sources

There are many advantages in selecting the Wiltron 6600B Sweep Generator as the 562 signal source. One advantage is the power sweep. In this mode, the output power is swept over a 15 dB range, enhancing gain compression measurements. In the alternate sweep mode, the 562 can display frequency response over different frequency ranges and/or power levels.

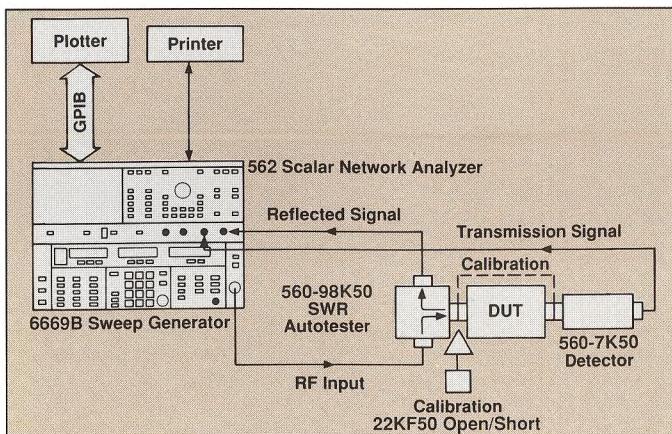
Another advantage of using a Wiltron signal source is that the 6600B uses fundamental oscillators from 2 to 26.5 GHz, avoiding the serious errors introduced by the subharmonics of frequency multipliers.

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.

Full GPIB

All 562 capability can be controlled via the IEEE-488 GPIB port. Mnemonics are logical and easy to use. A high speed data transfer mode is included for sophisticated ATE applications.



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.

Scalar Network Analyzer (Cont.)

Model 562

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 logarithm 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 or 560-10BX-1 Adapter Cables.

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.

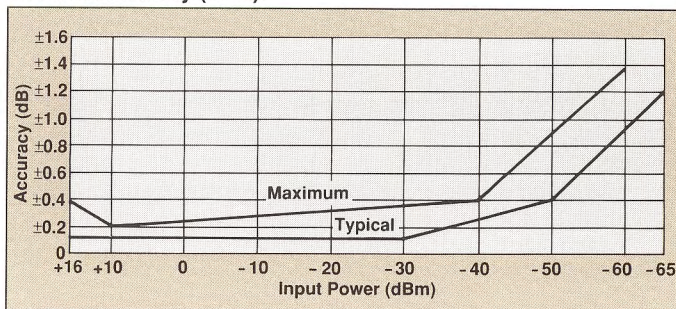
Cursor "X" Bandwidth: Automatically displays cursors to the right and left of the cursor at the frequencies where the test data are equal to the entered value of "X" dB. The frequencies of the low and high cursors and the bandwidth between them are displayed.

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):

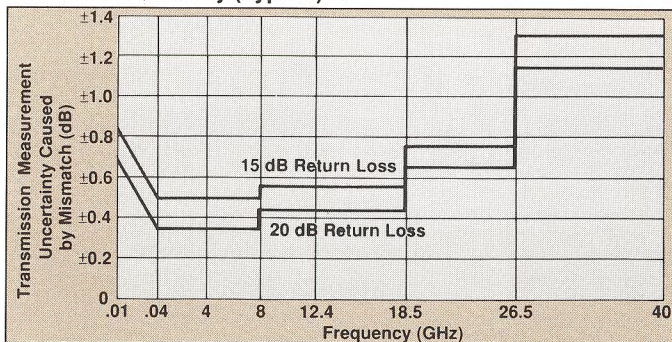


Transmission Loss or Gain Accuracy: Uncertainties from frequency response of components are automatically subtracted from test data during the normalization procedure. Overall accuracy is then:

$$\text{Transmission Loss or Gain} = \text{Channel Accuracy} + \text{Mismatch Uncertainty}^*$$

* 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 characteristics of the detector, sweep generator and SWR Autotester.

Mismatch Uncertainty (Typical)**:



** Varies with the return loss of the detector, SWR Autotester, connecting cables, the source impedance of the sweep generator, and the value of the measured reflection.

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:

$$\text{Return Loss Accuracy} = \text{Channel Accuracy} + \text{SWR Autotester Accuracy}$$

SWR Autotester Accuracy:

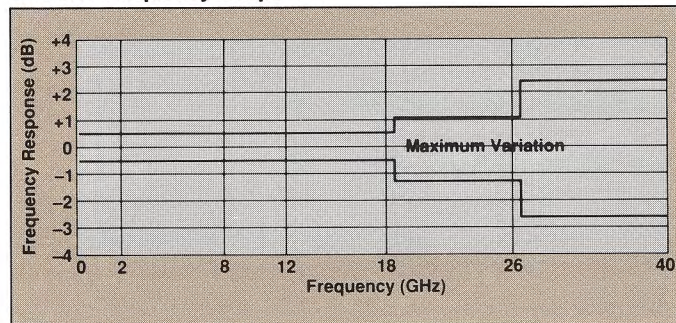
Model	Accuracy of Measured Reflection Coefficient (ρ) ^①			
	10 MHz-8 GHz	8-18 GHz	18-26.5 GHz	26.5-40 GHz
560-97A50	0.016 ± 0.06 ρ^2	0.016 ± 0.10 ρ^2	N/A	N/A
560-97A50-1	0.010 ± 0.06 ρ^2	0.010 ± 0.10 ρ^2	N/A	N/A
560-97N50	0.018 ± 0.08 ρ^2	0.018 ± 0.12 ρ^2	N/A	N/A
560-97N50-1	0.013 ± 0.08 ρ^2	0.013 ±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

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

Power Measurement Accuracy:

$$\text{Absolute Power Accuracy} = \text{Channel Accuracy} + \text{Detector Frequency Response}$$

Detector Frequency Response:



Overall Waveguide Return Loss Measurement Accuracy:

$$\text{Return Loss Accuracy} = \text{Channel Accuracy} + \text{User-Selected Coupler Accuracy}$$

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 K Ω impedance.

Sweep Dwell Input: TTL-low signal stops sweep. Sweep continues when signal is removed. Rear panel BNC connector.

Bandswitching Blanking Input: Accepts $\pm 5V$ signal coincident with bandswitching points. Rear panel BNC connector.

Retrace Blanking Input: +5V blanks traces during retrace. Rear panel BNC connector.

Video Marker Input: $\pm 1V$ to $\pm 10V$ 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

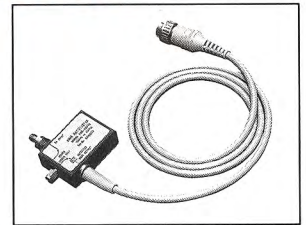
Power: 100V/120V/220V/240V $\pm 10\%$, 48-63 Hz, 130 VA maximum

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.)

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

^① Plus connectors and cable.

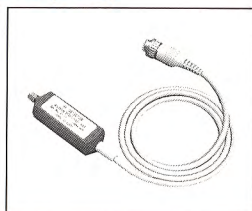
Scalar Network Analyzer (Cont.)

Model 562

Specifications

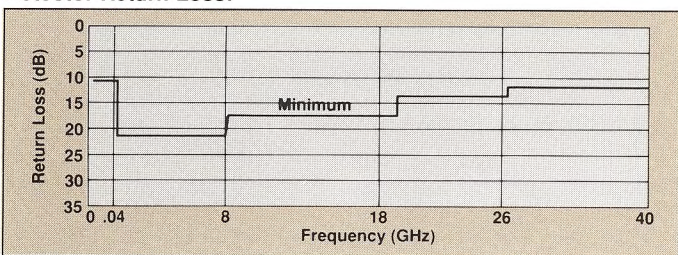
MEASUREMENT COMPONENTS (Cont.)

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 -60 dBm to +16 dBm (typically useable to -65 dBm with 562). Optional extender cables can be used without degradation in performance.



Model	Frequency Range	Input Connector
560-7A50	10 MHz to 18 GHz	GPC-7
560-7N50	10 MHz to 18.5 GHz	N Male
560-7S50	10 MHz to 18.5 GHz	WSMA Male
560-7S50-2	10 MHz to 26.5 GHz	WSMA Male
560-7K50	10 MHz to 40 GHz	K Male

Detector Return Loss:



Maximum Input Power: 100 mW

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.)

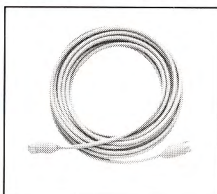
Replaceable Diode Modules:

Detector Model	Diode Module Model
560-7A50	560-A-7219-A (To 18 GHz)
560-7N50	560-A-7219-A (To 18 GHz)
560-7S50	560-A-7219-A (To 18 GHz)
560-7S50-2	560-A-7219-B (To 26.5 GHz)
560-7K50	ND19393

ACCESSORIES

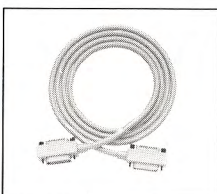
Extender Cables: These Extender Cables can be installed between the SWR Autotester or detectors and the 562, thereby permitting measurements from up to 200-feet away.

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



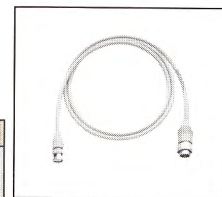
GPIB Cables: These cables interconnect instruments on the GPIB (IEEE-488 bus).

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.)



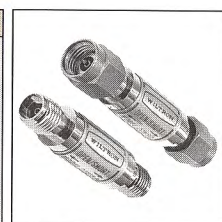
Adapter Cables: These 122 cm (4 ft.) cables allow the 562 to be used with waveguide or other detectors having a BNC or SMA female output connector.

Model	Connector
560-10BX	BNC Male
560-10BX-1	SMA Male



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

Model	Connectors
21A-1 ^①	GPC-7 Short Only
22A50	GPC-7
22K50	K Male
22KF50	K Female
22N50	N Male
22NF50	N Female
22S50	WSMA Male
22SF50	WSMA Female



^① Supplied with collet for mating with beadless end of air line.

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

760-75 Transit Case for the 562

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)

Ordering Information

562 Scalar Network Analyzer

SWR Autotesters:

560-97A50	10 MHz to 18 GHz
560-97A50-1	10 MHz to 18 GHz
560-97N50	10 MHz to 18 GHz
560-97N50-1	10 MHz to 18 GHz
560-97NF50	10 MHz to 18 GHz
560-97NF50-1	10 MHz to 18 GHz
560-98K50	10 MHz to 40 GHz
560-98KF50	10 MHz to 40 GHz
560-98S50	10 MHz to 26.5 GHz
560-98S50-1	10 MHz to 26.5 GHz
560-98SF50	10 MHz to 26.5 GHz
560-98SF50-1	10 MHz to 26.5 GHz

Detectors:

560-7A50	10 MHz to 18 GHz, GPC-7, 50Ω
560-7K50	10 MHz to 40 GHz, K Male, 50Ω
560-7N50	10 MHz to 18.5 GHz, N Male, 50Ω
560-7S50	10 MHz to 18.5 GHz, WSMA Male, 50Ω
560-7S50-2	10 MHz to 26.5 GHz, WSMA Male, 50Ω

Rack Mounting, Option 1: Unit supplied with mounting ears and chassis track slide (90° tilt) installed

Connecting Cables: A 2100-1 GPIB Cable, 1 m (3.3 ft.) long, and an 806-7 Interconnect Cable for the 6600B Sweep Generator are included with each 562.

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

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

Transmission Line Test System

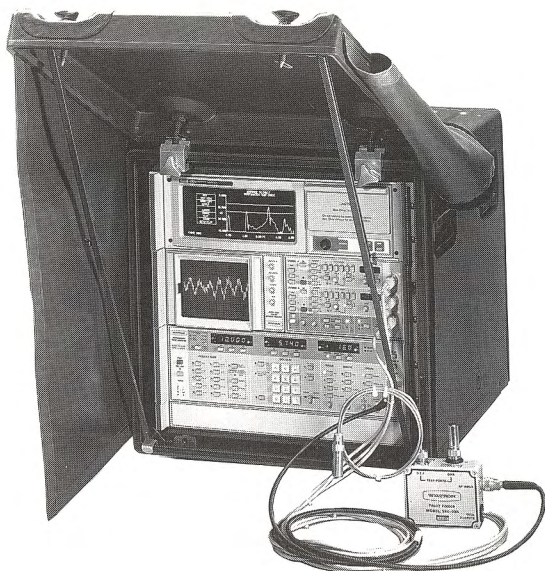
Model 5600 P2FF Series, 10 MHz to 18 GHz

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.



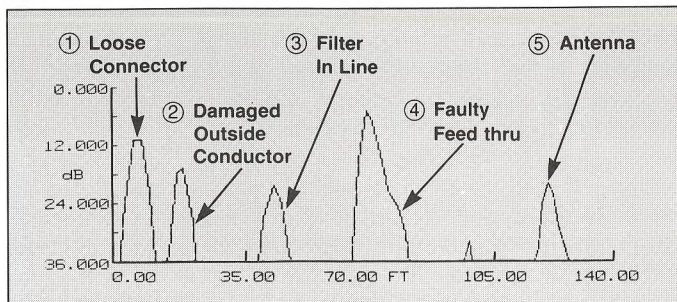
5600 P2FF Fault-Location System Highlights

- 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.



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

Specifications

SYSTEM ELEMENTS

Network Analyzer: 560 Scalar Network Analyzer

Source: 6600B Series Sweep Generator or 6700B Series Swept Frequency Synthesizer

Faultfinder: 560-95NF50

Controller: Included, contact factory for details.

Enclosure: Included, contact factory 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

34N50 N Female/N Female Adapter

34NN50A N Male/N Male Adapter

22N50 Male Open/Short

26N50 N Male Terminations (2)

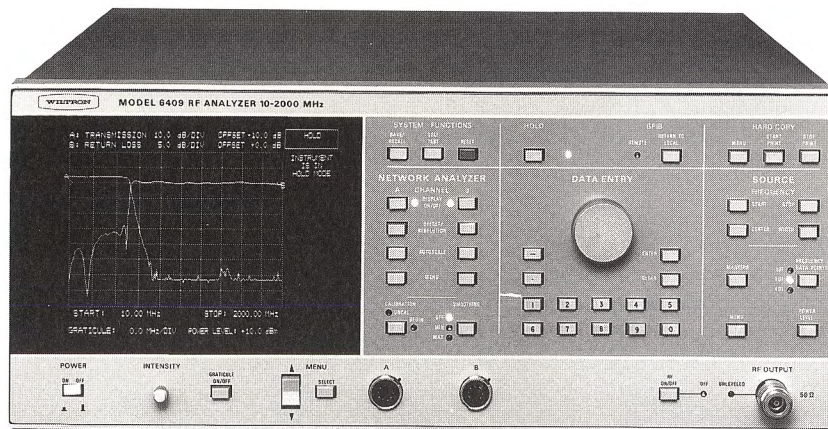
2300 Series P2FF Software

Ordering Information

5600 P2FF Series Automated Transmission Line Test and Fault-Location System

RF Analyzers

Models 6407 and 6409, 1 to 2000 MHz



6400 RF Analyzer Highlights

- Fast, Accurate Measurement of Transmission, Return Loss, and Absolute Power
- Unmatched, Drift-Free Stability
- Single, Easy-to-Use Unit with an Affordable Price
- 76 dB Dynamic Range (Typical)
- Full GPIB Programmability

Complete, Self-Contained System

The 6400 combines, in one instrument, a broadband, high-resolution signal source and a precision, two-channel scalar network analyzer. Models 6407 (1 to 1000 MHz) and 6409 (10 to 2000 MHz) make use of thin-film microelectronics technology and microprocessor enhancements to simplify and improve the accuracy of transmission, return loss, and absolute power measurements. A resident microprocessor adds operating convenience, error correction, and the drive for hard copy output of test data.

Signal Source

The microprocessor is also used to monitor internal 25 MHz comb markers with which precise identification of frequency is made automatically. With crystal-derived stability that is virtually free of temperature drift and nonlinearities, ± 100 kHz frequency accuracy, and 10 kHz resolution, the instrument makes accurate characterization of narrow-band devices with rapidly changing fine-grain structure. The exceptional stability and accuracy are achieved by "locking" the frequency to a crystal marker at the beginning of each sweep. The displays are drift-free, even when tests are made days

apart. Up to eight markers and an "intelligent" CRT graticule make identification of frequencies as simple as can be. The frequency and amplitude on both traces are displayed at the position of the last activated marker. Performance that previously required a costly synthesizer is now available at a surprisingly low price.

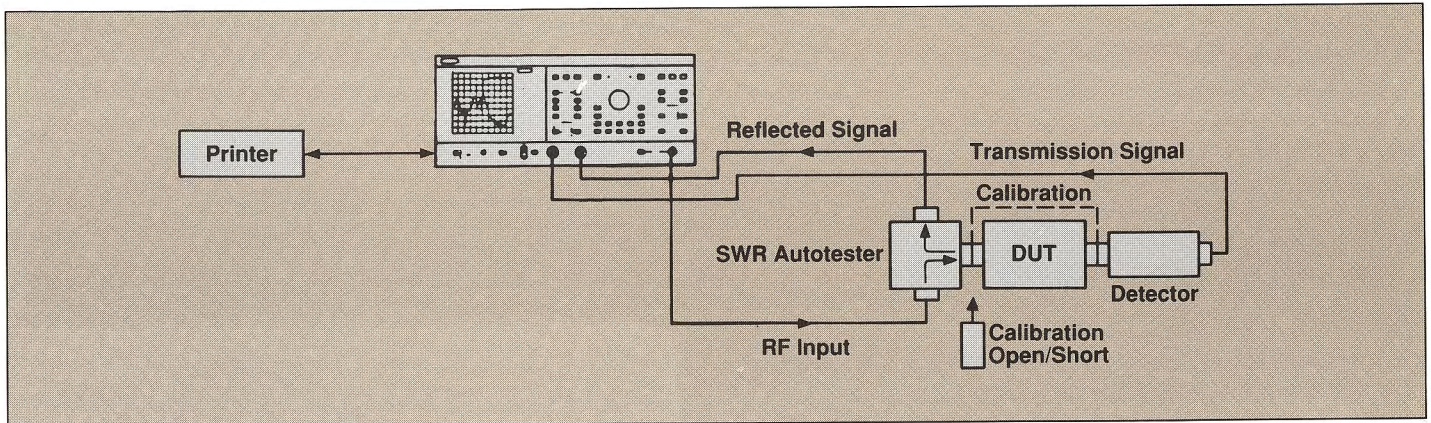
There are two sweep modes: Start/Stop and Symmetrical. In either mode, frequencies can be changed without renormalization, making it easy to zoom in on expanded frequency segments for close scrutiny. In the Alternate Sweep mode, the system displays two frequency ranges "simultaneously."

In standard units, the output power is variable in 0.1 dB steps from +12 dBm to +0.1 dBm. Output power is flat within ± 0.3 dB. With the addition of the optional 70 dB step attenuator, the output power range becomes +10 dBm to -69.9 dBm, also in 0.1 dB steps. Harmonics are < -30 dBc, spurious signals are < -40 dBc.

Network Analyzer

The built-in network analyzer typically has a 76 dB dynamic range and a low level sensitivity of -60 dBm. This range is achieved using accurate, low-drift, dc amplifiers that are automatically corrected for drift during retrace. No error-producing signal modulation is needed.

An unambiguous display of test conditions and data are shown on the large 178 mm (7 in.) diagonal screen. Information provided for each test includes offset, resolution, type of test being performed, reference line position, and trace identification. An "intelligent" graticule automatically spaces the vertical grid to provide an optimum display. Identification of frequencies is clearly evident, even without markers. A composite video output is available for connection to a larger,



In a typical 6400 transmission and return loss measurement setup, the device under test is inserted between the SWR Autotester and the RF Detector.

external screen, reducing, in some applications, the fatigue of monitoring and adjusting the test device. The data display can be further enhanced by the use of go/no-go data limit lines. With the variable knob control, these lines can be used as cursors to measure peak-to-peak variations in the test device response.

Fast, near-silent, automatic printing of displayed data and test parameters in graphical or tabular format (up to 401 data points) is performed on an optional 2225C Ink Jet Printer—a real convenience in the laboratory or production area.

Store and Recall

Up to nine complete front-panel setups can be stored and recalled, reducing test set-up time substantially. Included in the stored data are marker frequencies, data limits, frequency range, and vertical scaling. Also stored is normalization data which provides a 0 dB reference for transmission and return loss measurements. After one-time normalization, tests can be

made at any frequency. Normalization data can be retained in memory, even when power is removed.

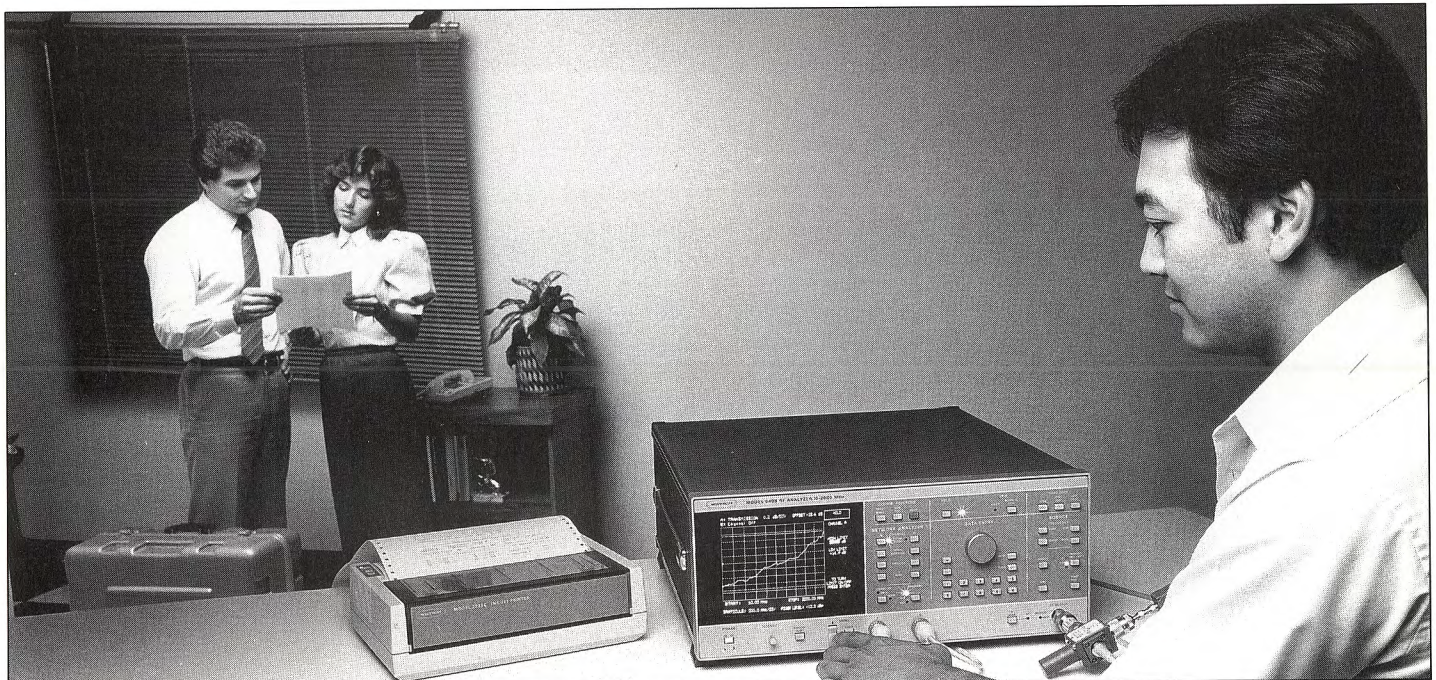
In addition, Autoscaling speeds testing by automatically selecting scale values and positioning the trace for the best display of the test device's full characteristics.

Quality Measurement Components

Contributing greatly to the overall measurement accuracy are the Wiltron high-performance measurement components. These include the SWR Autotester with 40 dB directivity and the RF Detector with ± 0.5 dB flatness and 22 dB return loss.

GPIB Programmability

An optional, easy-to-program GPIB interface is available for automated testing. With the addition of a computer, all front panel functions can be controlled via the interface bus.



Printing of the 6400's displayed data and test parameters in graphical or tabular format can be performed on an optional 2225C Ink Jet Printer.

RF Analyzers (Cont.)

Models 6407 and 6409, 1 to 2000 MHz

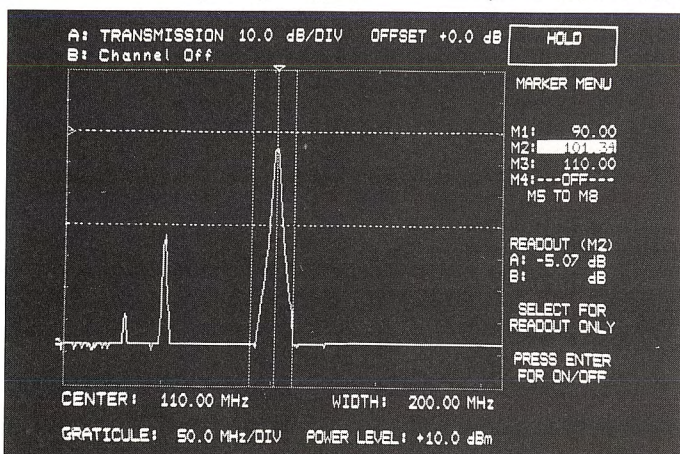
Applications

TV Systems and Repeaters

The 6400 is the ideal instrument for measuring TV related equipment. VCRs, TV tuners, repeaters, and components can be characterized quickly and accurately. For applications where the 6400 must be located across the bench to make room for a sizable system under test, the composite video output can be used to drive a large external CRT.

DBS Satellite Equipment

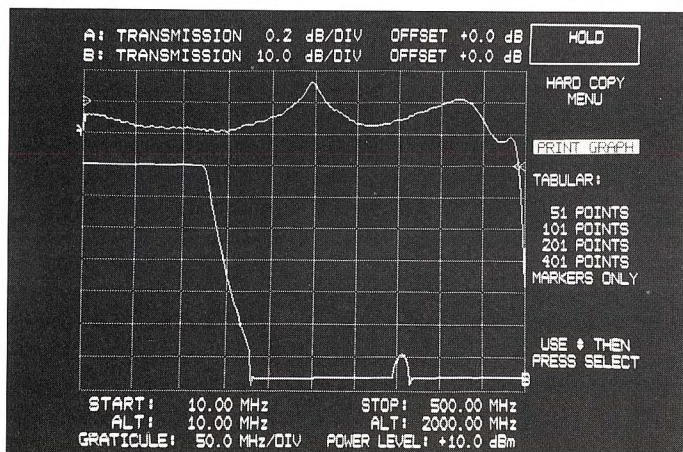
The versatility offered by a symmetrical sweep centered on a frequency and the capability to change frequencies without renormalization make testing of DBS equipment an easy task for the 6400. Frequency ranges, marker frequencies, and data



limits can be stored for up to nine test setups. Changing from one channel to another is as simple as changing the center frequency of the sweep.

Filters

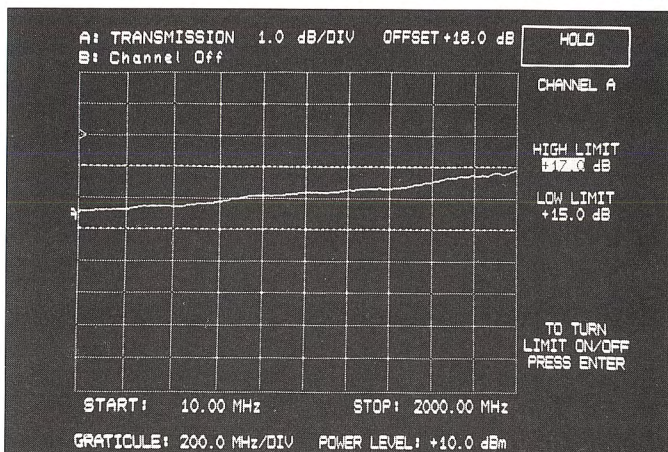
The accuracy with which filters are characterized is enhanced by the 10 kHz resolution and extremely stable output frequency of the 6400. In some setups, productivity can be improved substantially by using the Alternate Sweep mode. In this mode, a display of broadband and narrow-band characteristics can be viewed simultaneously. For example, tuning a filter whose skirt characteristics are affected by



adjustment in the passband response can now be done easily and accurately while observing results on a single display. And the capability to zoom in on frequency segments, such as the passband or 3 dB points, without renormalization reduces test time.

Amplifiers

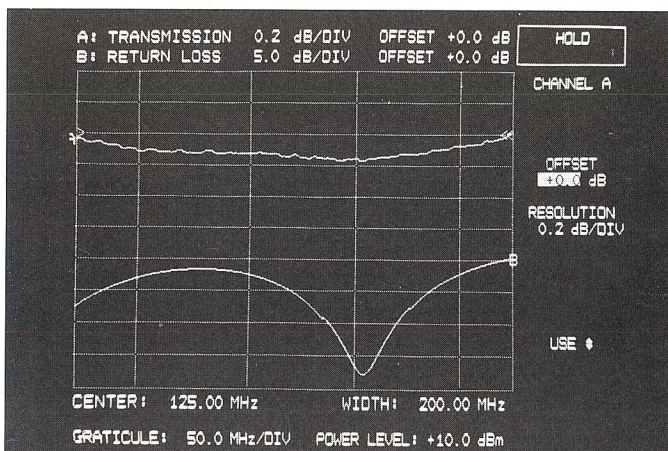
The 6400's broad frequency range, flat output power, 16 dBm detector capability, and optional 70 dB attenuator make it the best instrument for testing broadband or narrow-band



amplifiers. The procedure is simple: 1) normalize the system over the amplifier's full frequency range, 2) connect the amplifier, and 3) read gain directly in dB on the display. One measurement characterizes the amplifier.

Isolators

Measuring the forward transmission loss of an isolator requires a detector with low reflections and linear response—characteristics that distinguish Wiltron detectors. With a 76 dB dynamic range, reverse transmission loss can be measured



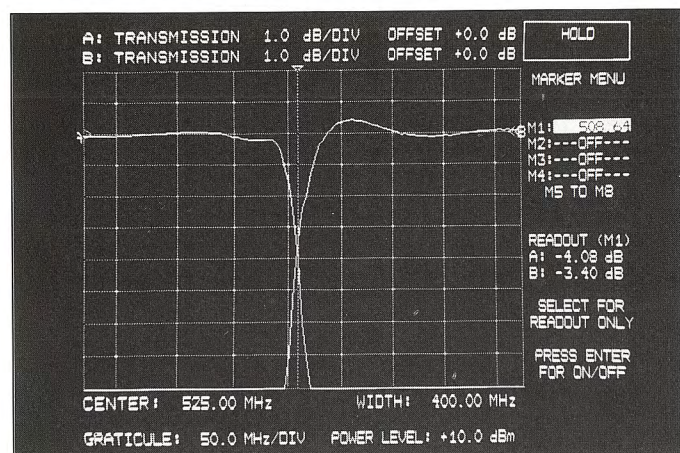
with the confidence that there is ample safety margin above the noise floor. Furthermore, a smoothing circuit that averages the noise at low signal levels takes the ambiguity out of determining the actual low level characteristics. The accuracy of return loss measurement in either direction is ensured by the 40 dB directivity of the SWR Autotester.

Antennas

The high output power and portability of the 6400 make it particularly well suited to testing antennas in the laboratory or on the range. With ample power and a wide dynamic range, measurements can be made on systems that include high-loss cables. For field applications, a lightweight carrying case is available.

Diplexers and Multiplexers

With the 6400's dual channel display, you can normalize A and B channels for transmission loss measurements and observe both outputs of a diplexer simultaneously. You can use



the zoom feature to concentrate on cross-over points or on response variations within the passband. The frequencies of important data points can be identified with up to eight markers.

Cellular Radio

The 6400 is the most cost effective system for testing cellular radio components. From individual devices such as tuners and amplifiers, to full systems including antennas, the 6400 is perfectly suited for measuring sensitivity, conversion loss, gain, power, and other characteristics. There is no longer a need for an expensive, custom-designed test system.

Specifications

SIGNAL SOURCE

Frequency Range:
 6407: 1 to 1000 MHz
 6409: 10 to 2000 MHz
Frequency Resolution: 10 kHz
Frequency Accuracy: ± 100 kHz
Frequency Drift (<40 MHz sweep width):
 With Temperature: <10 kHz/ $^{\circ}$ C
 With 10% Change in Line Voltage: <10 kHz
 With 3:1 Load SWR: <20 kHz
Leveled Output Power Range:
 Without Attenuator: +12 dBm to +0.1 dBm in 0.1 dB steps
 With Optional Attenuator: +10 dBm to -69.9 dBm in 0.1 dB steps
RF Output Impedance: 50 Ohms (Optional 75 Ohms is available on 6407, reducing output power by 2 dB).
RF Output Connector: Type N Female
Source Match: <1.5 SWR

Output Power Flatness: ± 0.3 dB

With 75 Ohm Output: ± 0.5 dB

With Attenuator: ± 1 dB plus 0.1 dB/10 dB of attenuation

Signal Purity:

Harmonics: <-30 dBc (except -25 dBc on 6407 from 1 to 2 MHz)

Nonharmonics: <-40 dBc

Residual AM: <-50 dBc in 100 kHz bandwidth

Residual FM: <5 kHz peak, 30 Hz to 15 kHz post detection BW

Sweep Time: Determined by number of data points and smoothing.

Number of Data Points	Smoothing	Typical Sweep Time
101	Off	100 ms
201	Off	250 ms
401	Off	400 ms
101	Min	350 ms
201	Min	550 ms
401	Min	1 s
101	Max	3 s
201	Max	6 s
401	Max	10 s

NETWORK ANALYZER

Display: 178 mm (7 in.) diagonal

Scale Resolution: 0.1 dB to 10 dB per division in 0.1 dB steps, independent control for each channel.

Offset Range: +99.9 dB to -99.9 dB in 0.1 dB increments.

Display Resolution:

Vertical: 0.003 dB maximum

Horizontal: 101, 201, or 401 points, front panel selectable.

Dynamic Range: 76 dB (+16 dBm to -55 dBm), both channels. Usable to -60 dBm.

Smoothing: Off, Minimum, or Maximum, front panel selectable. Minimum and Maximum smoothing use digital and analog techniques to reduce noise on low level traces.

Normalization: During normalization sequence, 800 points for each trace are stored with 0.002 dB resolution for the full band of the unit. Normalization data are automatically interpolated for ranges less than the full range.

Graticule: Ten vertical divisions. Horizontal divisions are set automatically in frequency increments of a 1, 2, 5 sequence from 1 to 500 MHz. Graticule ON/OFF control turns all graticule lines off. Tick marks remain on axis to indicate graticule position.

Markers: Up to eight individually controlled markers can be placed with 10 kHz resolution on the display. Amplitude of both traces at active marker is displayed in dB or dBm.

SYSTEM ACCURACY

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

$$\text{Transmission Accuracy} = \text{Channel Accuracy} + \text{Mismatch Uncertainty}$$

Typical mismatch uncertainty using a 6400 Series Detector is ± 0.1 dB for a test device with 20 dB return loss and ± 0.3 dB for one with 15 dB return loss.

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

$$\text{Return Loss Accuracy} = \text{Channel Accuracy} + \text{SWR Autotester Uncertainty}$$

6400 Series SWR Autotester accuracy is $\pm(0.01 + 0.06p^2)$, where p is the reflection coefficient of the device under test.

Absolute Power Accuracy:

$$\text{Absolute Power Accuracy} = \text{Channel Accuracy} + \text{Detector Frequency Response}$$

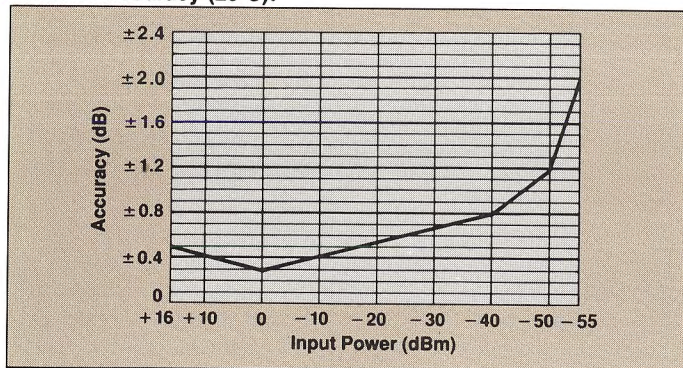
The 6400 series detector frequency response is ± 0.5 dB (± 0.2 dB from 1 to 1,000 MHz).

RF Analyzers (Cont.)

Models 6407 and 6409

SYSTEM ACCURACY (CONT.)

Channel Accuracy (25°C):



GENERAL

Dimensions: 177 H x 430 W x 495 D mm
(7 H x 17 W x 18-3/4 D in.)

Weight: 16 kg (35 lb.)

Power: 100V/110V/220V/240V ±10%, 48–63 Hz, 130 VA maximum
Operating Temperature: 0°C to 50°C

MEASUREMENT COMPONENTS

SWR Autotesters:

The 6400 Series SWR Autotesters are used to make precision return loss measurements. Fully compatible with the 6400, they are available in a variety of connector types and frequency ranges.

Maximum Input Power:

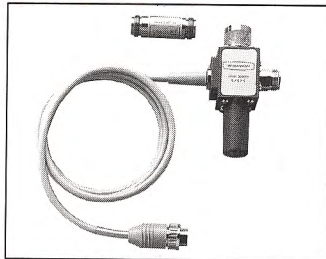
27 dBm (500 mW)

Test Port Impedance Match:

1.13 SWR (50Ω); 1.22 SWR (75Ω)

Insertion Loss (input to test port): 6.5 dB nominal

Open/Short: An Open/Short that mates directly on the test port is supplied with each SWR Autotester.



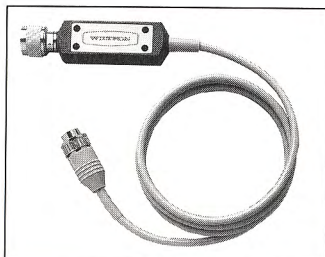
SWR Autotester Model	Frequency Range (MHz)	Test Port Connector	Impedance (Ohms)	Directivity (dB)
6400-6B50	1 to 1000	BNC Male	50	40
6400-6B75	1 to 1000	BNC Male	75	40
6400-6N75	1 to 1000	N Male	75	40
6400-6NF75	1 to 1000	N Female	75	40
6400-6N50	1 to 2000	N Male	50	40
6400-6NF50	1 to 2000	N Female	50	40
6400-6N75-1	1 to 2000	N Male	75	40, ≤1.8 GHz
6400-6NF75-1	1 to 2000	N Female	75	38, ≤1.8 GHz

Detectors:

The 6400 Series Detectors are used to make precision transmission loss or gain and absolute power measurements.

Impedance Match: 1.17 SWR

Maximum Input Power: 20 dBm (100 mW)



Detector Model	Frequency Range (MHz)	Input Connector	Impedance (Ohms)
6400-71B50	1 to 1000	BNC Male	50
6400-71B75	1 to 1000	BNC Male	75
6400-71N75	1 to 1000	N Male	75
6400-71N50	1 to 2000	N Male	50
6400-71N75-1	1 to 2000	N Male	75

Replacement Diodes:

10-21 Replacement Diode for 6400–71 Series 50Ω Detectors

10-88 Replacement Diode for 6400–71 Series 75Ω Detectors

Terminations:

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

SWR (50Ω): 1.004 + 0.0026F

SWR (75Ω): 1.004 + 0.0025F
(F in GHz)



Termination Model	Frequency Range (MHz)	Connector	Impedance (Ohms)
26N50	DC to 18,000	N Male	50
26NF50	DC to 18,000	N Female	50
26N75	DC to 4,000	N Male	75
26NF75	DC to 4,000	N Female	75

Adapters:

These 50Ω and 75Ω precision adapters are used for calibration or measurement of non-insertable devices. The 12 Series Matching Pads convert from 50Ω to 75Ω impedance.

SWR: 1.1



Adapter Model	Frequency Range (MHz)	Connectors
34NN50A	DC to 18,000	N Male/N Male
34NFN50	DC to 18,000	N Female/N Female
34NFN75	DC to 2,000	N Female/N Female
34NN75A	DC to 2,000	N Male/N Male

50/75Ω Matching Pads:

The 12B50/75 and 12N50/75 pads are used to match 50Ω to 75Ω or 75Ω to 50Ω circuits.

Frequency Range:

DC to 1,500 MHz

SWR: 1.25

Insertion Loss: 6 dB nominal

Minimum Loss Adapter:

The 12N75 converts a 50Ω output to 75Ω with less than 3 dB loss.

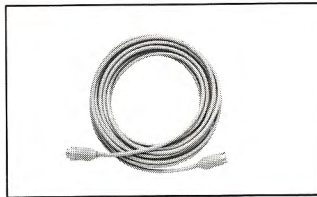


Matching Pad Model	Connectors
12B50/75	BNC Male (50Ω)/ BNC Female (75Ω)
12N50/75	N Male (50Ω)/ N Female (75Ω)
12N75	N Male/N Male (50Ω to 75Ω only)

ACCESSORIES

Extender Cables:

Extender Cables are used to make remote measurements and are placed between the SWR Autotester or detector and the 6400. Cables cause no degradation in performance.



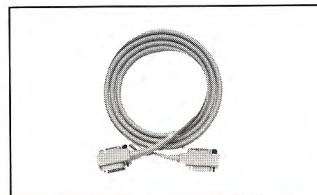
Model	Length	
800-109	7.6 m (25 ft)	
800-110	15.2 m (50 ft)	
800-111	30.4 m (100 ft)	
800-112	30.4 m (100 ft)	

RF Extender Cable:

Model 800–195, N Male/N Female connectors, 2.4 m (8 ft.) long

GPIO Cables:

GPIO cables are used to interconnect instruments on IEEE–488 bus.



Model	Length	
2100-5	0.5 m (1.6 ft)	
2100-1	1 m (3.3 ft)	
2100-2	2 m (6.6 ft)	
2100-4	4 m (13.2 ft)	

RF Limiters:

RF Limiters are used to protect the 6400 detectors against damage from:

- 1) DC Voltage—blocks voltage up to 50 Vdc.
- 2) AC Voltage—filters 60 Hz up to 100 Vac and impulse currents of 500 mA.
- 3) RF Power—provides protection up to 4 W over the 1 to 1500 MHz range.

Model	Connectors	Impedance (Ohms)	
1B50	BNC Male/BNC Female	50	
1B75	BNC Male/BNC Female	75	
1N50	N Male/N Female	50	
1N75	N Male/N Female	75	

Open/Shorts:

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



Model	Connectors	Impedance (Ohms)	
22BF50	BNC Female	50	
22BF75	BNC Female	75	
22N50	N Male	50	
22N75	N Male	75	
22NF50	N Male	50	
22NF75	N Male	75	

RF Cables:

Frequency Range: DC to 1500 MHz

Model ^①	Connectors	Impedance (Ohms)	
10B50-1,-2,-3	BNC Male to BNC Male	50	
10B75-1,-2,-3	BNC Male to BNC Male	50	
10N50-1,-2,-3	N Male to N Male	50	
10N75-1,-2,-3	N Male to N Male	75	
10BN75-1,2,3	N Male to BNC Male	75	

^①Dash numbers equal length in feet.

Signal Dividers:

Frequency Range: 1 to 1500 MHz

Model	Connectors	Impedance (Ohms)	
11B50	BNC Female	50	
11B75	BNC Female	75	
11N50	N Female	50	
11N75	N Female	75	

Ordering Information

6407 RF Analyzer¹ (1 to 1000 MHz)

6409 RF Analyzer¹ (10 to 2000 MHz)

Options

Rack Mounting, Option 1: Unit supplied with mounting ears and chassis track slide (90° tilt) installed

70 dB Step Attenuator, Option 2

GPIO Programmability (IEEE–488), Option 3

75 Ohm Output Impedance on 6407, Option 4

Front Panel Protective Cover, Option 6

Transit Cases

760-75 6400 Transit Case

760-74 6400 Components and Printer Transit Case

Printer and Printer Accessories

Model 2225C Ink Jet Printer, Option 5:

Supplied with Interface Cable, 50 sheets of paper, and one Ink Jet Cartridge

2225-1 Interface Cable

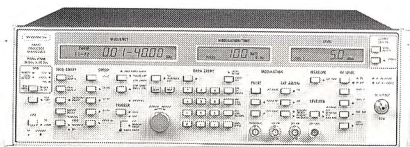
2225-2 Replacement Ink Jet Cartridge

2225-3 Fan Fold Ink Jet Paper (500 sheets)

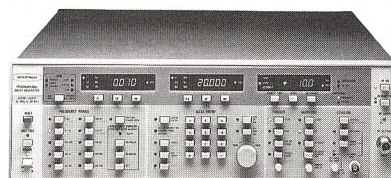
¹(Order measurement components and accessories separately)

Signal Sources

General Information



Swept Frequency Synthesizer
Model 6700B



Sweep Generator
Model 6600B

Signal Source Introduction

Microwave signal sources have traditionally been divided into three categories: sweep generators, signal generators, and synthesizers. Originally, synthesizers were intended for producing precisely accurate frequencies, while signal generators specialized in modulation capability, high signal purity, low leakage, and precise output levels. And originally, sweep generators supplied a swept frequency output for frequency response testing.

Advances in microwave source technology over the last several years have reduced the cost of frequency synthesis. At the same time, synthesizers have taken on some of the features of both signal generators and sweep generators. Wiltron's 6700A Series Swept Frequency Synthesizers, now superseded by the 6700B Series, were the first to include every feature commonly associated with sweepers and signal generators. In addition, they are available in both narrow-band and broadband models, so that you only pay for the frequency coverage you need. This is all at a price not significantly above that of a microwave sweeper.

Fundamental Oscillators

There are two approaches to microwave frequency generation: 1) the use of fundamental oscillators and 2) the use of circuits that multiply signals. Wiltron uses, in all of its products, fundamental oscillators over the 2 to 26.5 GHz range. This approach provides better signal purity, free of all subharmonics that produce significant measurement errors. The other leading manufacturer of synthesizers employs the multiplier approach with subharmonic levels as high as -25 dBc. With fundamental oscillators, Wiltron can offer narrow-band and broadband sources. You select the precise frequency range you desire, thereby reducing your test equipment costs.

All Wiltron fundamental oscillators are YIG (yttrium-iron-garnet) tuned and use bipolar transistors or GaAs FETs as their active devices. YIG-tuned oscillators have superior linearity, broader bandwidth, and better spectral purity than other types of sources.

Wiltron manufactures most of its own YIG oscillators. The inherent high reliability of the Wiltron microwave integrated circuit (MIC) processes allows the company to warrant all YIG-tuned oscillators for two years. This is assurance that your Wiltron signal source is a quality product—one that will give you years of trouble-free service.

A Carefully Planned Approach

Wiltron offers two microwave sources: the 6600B Sweep Generators and the 6700B Swept Frequency Synthesizers. The last two digits in the model number identify the frequency range and are similar for all product lines. The tables on the next page summarize the frequency range offerings within the two families.

Sources for Wiltron Network Analyzers

Wiltron signal sources are ideal companions to the many Wiltron scalar and vector network analyzers. The 562 Scalar Network Analyzer, when combined with either the 6600B Sweep Generator or 6700B Swept Frequency Synthesizer, makes a particularly attractive automated measurement system. A dedicated digital bus between the two units gives the network analyzer full frequency and power information to annotate both the CRT display and the hard-copy data.

A dedicated family of sources, the 360SS Series, was designed specifically for the Wiltron 360 Vector Network Analyzer. These sources are less expensive than the corresponding 6600B Series and are optimized for use with the 360. Since the 360SS Series is used only with the 360, from which all parameters are selected, the 360SS units have blank front panels. Because the 360 itself phase locks the signal source to the correct crystal-controlled frequency, a synthesizer is not required. If desired, the 360 will operate as described above with the 6600B or 6700B Series.

The 6600B Sweep Generators

Forty-two models cover the 10 MHz to 60 GHz range. The industry's broadest continuous frequency coverage—10 MHz to 40 GHz at 3 mW output power—is unique with the Model 6669B. This broadband coverage is made possible through Wiltron's development of the widely accepted K Connector[®] with its SMA and APC-3.5[™] compatibility and up to 46 GHz range. Extremely broadband coaxial systems can now be designed and production tested using these connectors.

The 6600B family meets the most stringent narrow-band test requirements as well. Single-band units are available from 10 MHz to 60 GHz and are especially well suited to design and production testing of narrow-band devices, such as those in telecommunications systems. With output power levels as high as 50 mW, the 6600B units can be directly substituted for local oscillators in mixer and receiver test setups or used as drivers for high power TWT amplifiers.

All 6600B models, whether broadband or narrow-band, have excellent spectral purity with harmonics typically less than -40 dBc and spurious less than -60 dBc. The 6600B family is lightweight, typically 16 kg (35.4 lbs.); therefore it is ideally suited to field, antenna, and shipboard use. Features include eight frequency markers, an alternate sweep for simultaneous narrow-band and broadband testing, and an alternate power sweep for amplifier compression and mixer saturation measurements. Nine stored setups reduce production set-up time, and the full-capability GPIB interface makes the 6600B ideal for automated test (ATE) systems.

The 6700B Swept Frequency Synthesizer

The new 6700B family combines all the features of synthesizers, sweep generators, and signal generators in a truly universal microwave signal source with upgraded performance over the prior 6700A family. Full capability AM, FM, and pulse modulation makes testing of communications and radar systems straightforward. The 6700B even contains a standard internal pulse generator, eliminating the need for an external pulse generator. Pulse rate and width are easily entered from the front panel or the GPIB. Pulse rise and fall time of the modulated signal is less than 10 ns, thus ensuring excellent pulse fidelity.

You can also eliminate an external power meter. The 6700B has its own built-in power meter that uses the 560-7 Series Detectors with bandwidths as wide as 10 MHz to 40 GHz.

Measurements made using the 6700B will be accurate

6700B Swept Frequency Synthesizers (Page 60)

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
6745B	10 MHz to 18 GHz	10 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

①Without optional attenuator. ②External leveling only.

since unwanted spurious and harmonic signals are virtually eliminated. Through the 2 to 26.5 GHz range, both harmonic and spurious signals are less than -60 dBc, and there are no subharmonics. Harmonic and spurious signals in the 10 MHz to 2 GHz band are significantly reduced in the 6700B. Single sideband noise has been reduced and fully specified through improvements in phase-lock loop design. Frequency resolution of 1 kHz (2 kHz above 26.5 GHz) with fast frequency switching, typically 15 ms, make the 6700B ideal for bench or ATE system use.

The superb mechanical packaging design of the 6700B ensures EMI performance meeting MIL-STD-461B. In fact, during EMI qualification tests, technicians were surprised to find that they could detect no radiated emissions. Leakage from the 6700B was below the sensitivity of their measuring receivers. You can be sure that the 6700B won't interfere with sensitive receivers in your ATE system. Furthermore, the RF deck tilts out for easy servicing, and the weight of the unit is only 25 kg (55 lbs.).

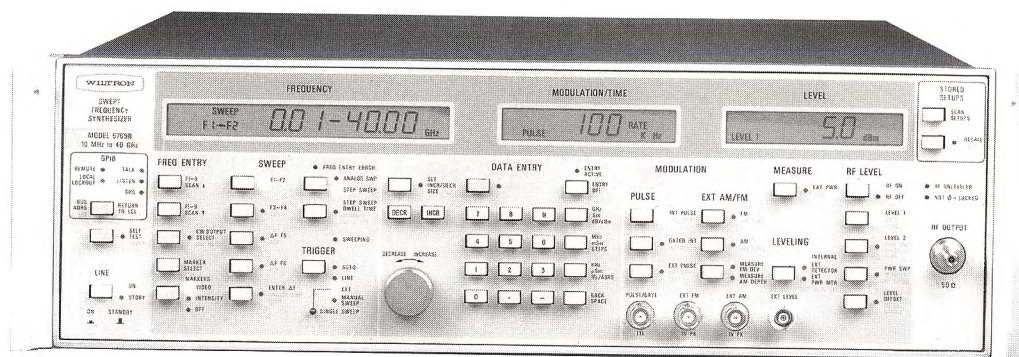
6600B Sweep Generators (Page 67)

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
6645B	0.01 to 18 GHz	10 mW
6645B-40	0.01 to 18 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
6668B	0.01 to 40 GHz	4 mW
6669B	0.01 to 40 GHz	3 mW
6610B	1 to 2 GHz	20 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
6635B	2 to 18 GHz	10 mW
6635B-40	2 to 18 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
6662B	2 to 40 GHz	4 mW
6663B	2 to 40 GHz	3 mW
6620B	3.6 to 6.5 GHz	20 mW
6624B	4 to 8 GHz	10 mW
6627B	5.9 to 9 GHz	10 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
6632B	17 to 22 GHz	5 mW
6636B	18 to 26.5 GHz	3 mW
6640B ^②	26.5 to 40 GHz	1 mW
6640B-10	26.5 to 40 GHz	10 mW
6672B ^②	40 to 60 GHz	1 mW

①Without optional attenuator. ②External leveling only.

Swept Frequency Synthesizers

6700B Series, 10 MHz to 60 GHz



6700B Swept Frequency Synthesizer Highlights

- 25 ms Switching Speed Over Any Frequency Step Size
- 40 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 31 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.

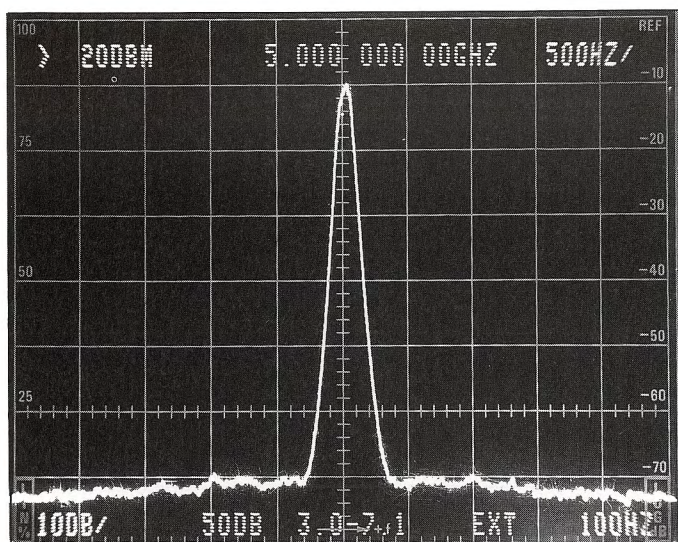
Broadest Selection

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
6745B	10 MHz to 18 GHz	10 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

^①Without optional attenuator. ^②External 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.

For additional pulse modulation capability, you can apply externally generated pulse 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.

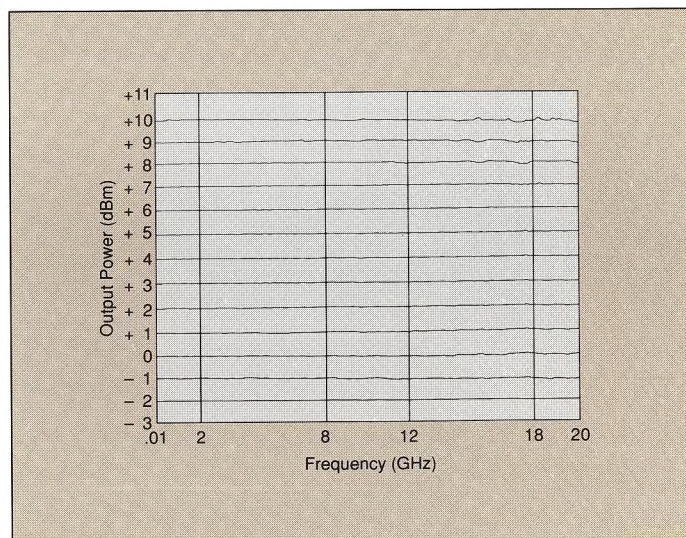
AM, FM, and Pulse Modulation

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



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

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

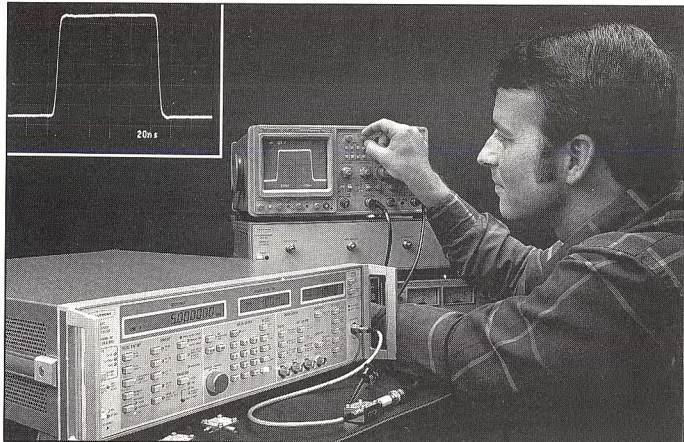
In both the step and analog sweep modes, you have up to nine markers for precise frequency identification. These can be saved with other sweep parameters for recall, reducing set-up time when changing from one test device to another.

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 66, 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 (Cont.)

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.

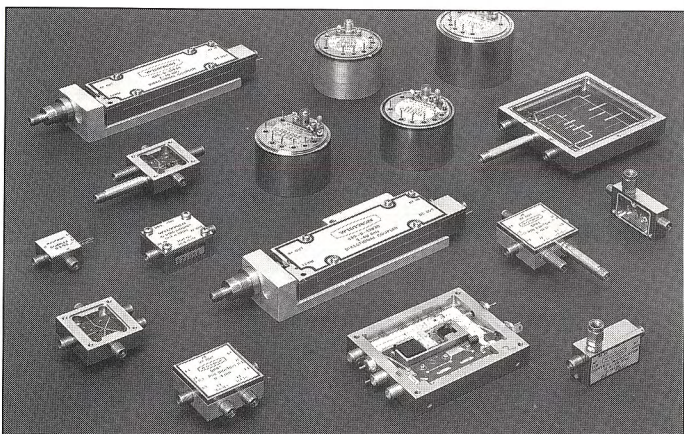
Source match is better than 13 dB return loss (1.6 SWR), a result of the excellent directivity of the Wiltron-designed leveling loop coupler. The addition of external components to improve match is unnecessary.

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.

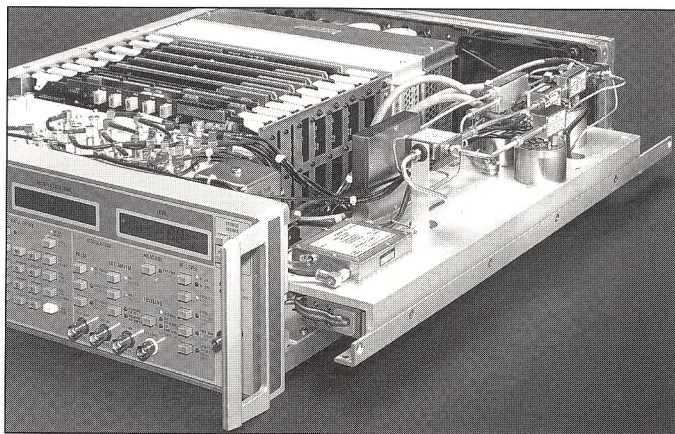
Serviceability

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 seven! 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.

Specifications

FREQUENCY

Model	Frequency Range	Output Power ^①
6772B ^②	40 to 60 GHz	0 dBm (1 mW)
6769B	10 MHz to 40 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6763B	2 to 40 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6760B	12.4 to 40 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6740B	26.5 to 40 GHz	+10 dBm (10 mW)
6759B	10 MHz to 26.5 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6759B-10	10 MHz to 26.5 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6753B	2 to 26.5 GHz	+10 dBm (10 mW), ≤20 GHz +5 dBm (3 mW), >20 GHz
6753B-10	2 to 26.5 GHz	+10 dBm (10 mW)
6736B	18 to 26.5 GHz	+7 dBm (5 mW)
6736B-10	18 to 26.5 GHz	+10 dBm (10 mW)
6747B	10 MHz to 20 GHz	+10 dBm (10 mW)
6747B-20	10 MHz to 20 GHz	+13 dBm (20 mW)
6737B	2 to 20 GHz	+10 dBm (10 mW)
6737B-20	2 to 20 GHz	+13 dBm (20 mW)
6729B	8 to 20 GHz	+10 dBm (10 mW)
6729B-20	8 to 20 GHz	+13 dBm (20 mW)
6730B	12.4 to 20 GHz	+13 dBm (20 mW)
6730B-40	12.4 to 20 GHz	+16 dBm (40 mW)
6745B	10 MHz to 18 GHz	+10 dBm (10 mW)
6722B	10 MHz to 12.4 GHz	+10 dBm (10 mW)
6722B-20	10 MHz to 12.4 GHz	+13 dBm (20 mW)
6721B	2 to 12.4 GHz	+10 dBm (10 mW)
6721B-20	2 to 12.4 GHz	+13 dBm (20 mW)
6728B	8 to 12.4 GHz	+13 dBm (20 mW)
6728B-40	8 to 12.4 GHz	+16 dBm (40 mW)
6717B	10 MHz to 8.4 GHz	+10 dBm (10 mW)
6717B-20	10 MHz to 8.4 GHz	+13 dBm (20 mW)
6719B	2 to 8.4 GHz	+13 dBm (20 mW)
6709B	10 MHz to 2 GHz	+10 dBm (10 mW)
6709B-40	10 MHz to 2 GHz	+16 dBm (40 mW)

^①Without optional attenuator. ^②External leveling only.

CW MODE

Output: Nine independent, presettable CW frequencies.

Accuracy: Same as internal or external time base.

Internal 10 MHz Time Base Stability:

With Aging: $<5 \times 10^{-10}/\text{day}$

With Temperature: $<\pm 5 \times 10^{-9}$ over 0° to +55°C range

Resolution: 1 kHz at ≤26.5 GHz
2 kHz at >26.5 to 40 GHz
3 kHz at >40 to 60 GHz

10 MHz Reference Output: 2 Vp-p typical into 50Ω. AC coupled. BNC, rear panel, 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. BNC, rear panel, 50Ω impedance.

High Resolution Input: Accepts 20–32.1 MHz external synthesizer signal to improve resolution to equal that of external instrument. BNC, rear panel, 50Ω impedance, 0 dBm.

Switching Time (for any step size): <15 ms typical, 25 ms max. to within 1 kHz.

Lock Output: Provides TTL-high signal when frequency is phase locked.

SWEEP MODES

Analog Sweep

F1–F2, F3–F4, ΔF F5, and ΔF F6 Sweep Width: Independently selected, 1 MHz to full range continuous sweep. For >50 MHz sweep width, start/stop and bandswitching frequencies are phase-lock-corrected during every sweep. For ≤50 MHz width, 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

F1–F2, F3–F4, ΔF F5, and ΔF F6 Sweep Width: Independently selected, 1 kHz to full range. Every frequency step in sweep range is phase locked.

Accuracy: Same as internal or external time base.

Resolution: Minimum step size is 1 kHz at ≤26.5 GHz
2 kHz at >26.5 to 40 GHz
3 kHz at >40 to 60 GHz

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 within 1 kHz

Alternate Sweep:

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:

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

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 within 1 kHz.

Markers: Up to nine independent, presettable markers.

Video: TTL high during marker. BNC, rear panel.

Intensity (analog sweep only): Intensified dot on trace. Obtained by momentary dwell in sweep.

Accuracy: Same as sweep frequency accuracy.

Resolution (Step Sweep): 1 kHz at ≤26.5 GHz
2 kHz at >26.5 to 40 GHz
3 kHz at >40 to 60 GHz

Resolution (Analog Sweep): 1 MHz or sweep width divided by 4096, 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. BNC, rear panel.

Single: Triggers, aborts, and resets a single sweep. Front-panel pushbutton.

Sweep Dwell Input: Accepts TTL-low signal to stop sweep. Sweep continues when signal is removed. BNC, rear panel.

Horizontal Sweep Output: Provides 0V at beginning to 10V at end of sweep for all sweep modes, regardless of sweep width. 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. BNC, rear panel.

V/GHz Output: 0.5 V/GHz or 1 V/GHz up to 20V maximum. BNC, rear panel.

Bandswitch Blanking Output: +5V or –5V signal coincident with bandswitching points. BNC, rear panel.

Retrace Blanking Output: +5V or –5V output signal coincident with sweep retrace. AUX I/O Cannon 25 pin D style, rear panel.

Pen Lift Output: Normally open or normally closed internal relay contacts during sweep retrace. BNC, rear panel.

Sequential Sync Output: Provides TTL-high signal during retrace and at bandswitching points for interface to network analyzers, –5V during marker and –10V during selected marker. BNC, rear panel.

Swept Frequency Synthesizers (Cont.)

6700B Series

SPECTRAL PURITY

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

Spurious Signals:

- Subharmonics:** ≤ 26.5 GHz: None
 26.5 to 28 GHz: -20 dBc
 28 to 40 GHz: -40 dBc
- Harmonics:** ≤ 2 GHz: -40 dBc
 (-30 dBc for 6709B-40, 6717B-40, 6722B-40, 6747B-20)
 >2 to 60 GHz: -60 dBc
- Nonharmonics:** -60 dBc, typically -70 dBc

Single-Sideband Phase Noise (dBc, CW mode, max.):

Range (GHz)	Offset From Carrier				
	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 (dBc, CW mode, max.):

Range (GHz)	Offset From Carrier		
	<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, 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	30
40 to 60	30

RF OUTPUT

Power level specifications apply at $25^{\circ}\text{C} \pm 10^{\circ}$. Please see page 63 for power ratings.

Leveled Output Power Range:

- Without Attenuator:** 12 dB
With Option 2A, 2B, or 2C: 122 dB

Attenuator Insertion Loss: Reduces rated power by 3 dB max.

With Option 2A and 2B: 3dB

With Option 2C: 4dB

Output Power Entry Resolution: 0.01 dB

Output Power Display Resolution: 0.1 dB

Power Level Stability with Temperature: Typically 0.02 dB/ $^{\circ}\text{C}$

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

Output Power Accuracy and Flatness:

Step Sweep and CW Modes:

Attenuation Below Maximum Power	Frequency				
	0.01 to 2 GHz	2 to 20 GHz	20 to 26.5 GHz	26.5 to 40 GHz	40 to 60 GHz
Accuracy^①					
0 to 12 dB	± 0.6 dB	± 0.6 dB	± 0.6 dB	± 0.8 dB	± 1.2 dB ^③
0 to 30 dB ^②	± 1.4 dB	± 1.4 dB	± 2.0 dB	± 3.0 dB	N/A
30 to 60 dB ^②	± 2.6 dB	± 2.6 dB	± 2.6 dB	± 4.6 dB	N/A
60 dB ^②	± 3.1 dB	± 3.1 dB	± 4.0 dB	± 5.0 dB	N/A
Flatness					
0 to 12 dB	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.6 dB	± 0.8 dB ^③
0 to 30 dB ^②	± 0.8 dB	± 0.8 dB	± 1.0 dB	± 2.0 dB	N/A
30 to 60 dB ^②	± 2.0 dB	± 2.0 dB	± 2.0 dB	± 3.0 dB	N/A
60 dB ^②	± 2.5 dB	± 2.5 dB	± 3.0 dB	± 4.0 dB	N/A

^①Includes flatness variations. ^②For models with attenuator. ^③External leveling.

Analog Sweep Modes (typical):

Attenuation Below Maximum Power	Frequency				
	0.01 to 2 GHz	2 to 20 GHz	20 to 26.5 GHz	26.5 to 40 GHz	40 to 60 GHz
Accuracy^{①④}					
0 to 12 dB	± 2.0 dB	± 1.0 dB	± 1.5 dB	± 2.0 dB	± 3.0 dB ^③
0 to 30 dB ^②	± 3.2 dB	± 3.2 dB	± 3.3 dB	± 4.3 dB	N/A
30 to 60 dB ^②	± 3.7 dB	± 3.7 dB	± 3.8 dB	± 4.8 dB	N/A
60 dB ^②	± 4.4 dB	± 4.4 dB	± 4.6 dB	± 5.6 dB	N/A
Flatness^①					
0 to 12 dB	± 2.0 dB	± 1.0 dB	± 1.5 dB	± 2.0 dB	± 3.0 dB ^③
0 to 30 dB ^②	± 3.0 dB	± 3.0 dB	± 3.1 dB	± 4.1 dB	N/A
30 to 60 dB ^②	± 3.5 dB	± 3.5 dB	± 3.6 dB	± 4.6 dB	N/A
60 dB ^②	± 4.0 dB	± 4.0 dB	± 4.2 dB	± 5.2 dB	N/A

^①Includes flatness variations. ^②For models with attenuator. ^③External leveling.

^④ ± 2 dB from 10 to 25 MHz

Source Impedance: 50 Ω

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 typical

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

RF On/Off Between Frequency Steps: RF On or Off during frequency switching in CW or step sweep mode.

Retrace RF On/Off: Rear panel switch selects 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 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, $\pm 1\text{V}$ 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 10 s

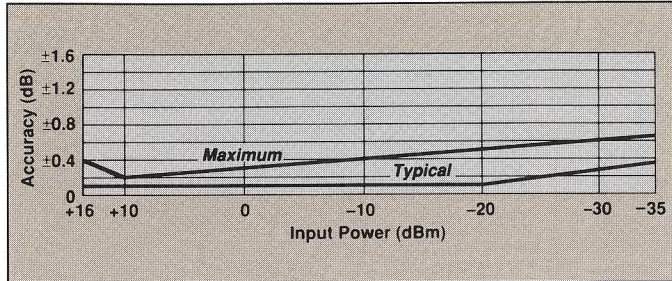
POWER METER

Built-In Power Meter Range: +16 dBm to -35 dBm. Compatible with Wiltron 560-7 or 6400-71 Series Detectors. Rear panel input.

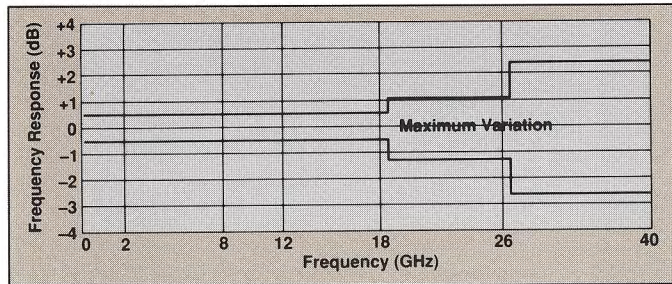
Built-In Power Meter Accuracy:

$$\text{Power Measurement Accuracy} = \text{Meter Accuracy} + \text{Detector Frequency Response}$$

Meter Accuracy (25°C):



Detector Frequency Response:



MODULATION

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

PULSE MODULATION

On/Off Ratio: 80 dB

Pulse Rise and Fall Time: <5 ns typical, 10 ns max.

Pulse Overshoot and Ringing: <10% typical

Pulse Width Compression: ±5 ns max.

Video Feedthrough: <±2 mVpk typical, ±5 mVpk max. (>26 GHz)
<±5 mVpk typical, ±10 mVpk max. (≤26 GHz)

Accuracy of Peak Pulse Power

(relative to CW level, 100 Hz ≤ PRF ≤ 1 MHz):

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

① RF Power is controllable, but not automatically leveled for very narrow pulses.

Internal Pulse Generator:

Pulse Period: 1 μs to 100 ms

Pulse Period Resolution: 0.1 μs (1 μs to 99.9 μs pulse period)
1 μs (100 μs to 999 μs pulse period)
10 μs (1 ms to 9.99 ms pulse period)
100 μs (10 ms to 100 ms pulse period)

Pulse Width Accuracy: ±10 ns, typical

Gate Width Range: 100 ns to infinity

Pulse Input: Rear panel switch selects TTL-high or -low signal for triggering or gating internal pulse generator. BNC, rear panel.

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

Pulse Period Accuracy: Same as time base

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

Delay Range: 200 ns to 100 ms

Delay Resolution: 200 ns to 99.9 μs: 100 ns
100 μs to 999 μs: 1 μs
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: Rear panel switch selects ac or dc coupling. BNC, front and rear panel, 600Ω impedance.

Sensitivity: 1%/V to 100%/V, selectable

Sensitivity Accuracy: ±10% of displayed value ±1% AM plus AM flatness

Depth: 0–90% at ≤26.5 GHz, typical; 0–80% at >26.5 GHz, typical; with RF level at 6 dB below maximum rated output

AM Depth Metering Accuracy: Same as Sensitivity Accuracy

Bandwidth (3 dB, pulse off):

DC to 100 kHz or 50 Hz to 100 kHz, selectable (>2 GHz),

DC to 50 kHz or 50 Hz to 100 kHz, selectable (≤2 GHz)

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. BNC, front and rear panel, 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 (500 kHz typical) at ≤300 kHz/V sensitivity

1–250 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

INSTRUMENT STATUS (IEEE-488)

GPIB Indicators: LED lights indicate the following conditions:

Remote: Operating on GPIB

Talk: Talking on GPIB

Listen: Listening on GPIB

SRG: 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/mafunction messages, operational status, self-test diagnostics.

Swept Frequency Synthesizers (Cont.)

6700B Series

INSTRUMENT STATUS (Cont.)

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. BNC, rear panel.

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. 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

Warm-Up Time From Power Application: 72 hours to achieve 1×10^{-9} per day frequency stability

Output Connectors:

Models with Output Frequency ≤ 20 GHz: Type N female

Models with Output Frequency > 20 GHz and ≤ 40 GHz: K female

Model 6772B: WR19 Waveguide (UG-383/U Flange)

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 120–240V, 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 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.) long

2100-2 GPIB Cable, 2 m (6.6 ft.) long

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

Ordering Information

Model	Frequency Range	Output Power ^① (Minimum)	
6709B	10 MHz to 2 GHz	+10 dBm (10 mW)	
6709B-40	10 MHz to 2 GHz	+16 dBm (40 mW)	
6717B	10 MHz to 8.4 GHz	+10 dBm (10 mW)	
6717B-20	10 MHz to 8.4 GHz	+13 dBm (20 mW)	
6719B	2 to 8.4 GHz	+13 dBm (20 mW)	
6721B	2 to 12.4 GHz	+10 dBm (10 mW)	
6721B-20	2 to 12.4 GHz	+13 dBm (20 mW)	
6722B	10 MHz to 12.4 GHz	+10 dBm (10 mW)	
6722B-20	10 MHz to 12.4 GHz	+13 dBm (20 mW)	
6728B	8 to 12.4 GHz	+13 dBm (20 mW)	
6728B-40	8 to 12.4 GHz	+16 dBm (40 mW)	
6729B	8 to 20 GHz	+10 dBm (10 mW)	
6729B-20	8 to 20 GHz	+13 dBm (20 mW)	
6730B	12.4 to 20 GHz	+13 dBm (20 mW)	
6730B-40	12.4 to 20 GHz	+16 dBm (40 mW)	
6736B	18 to 26.5 GHz	+7 dBm (5 mW)	
6736B-10	18 to 26.5 GHz	+10 dBm (10 mW)	
6737B	2 to 20 GHz	+10 dBm (10 mW)	
6737B-20	2 to 20 GHz	+13 dBm (20 mW)	
6740B	26.5 to 40 GHz	+10 dBm (10 mW)	
6745B	10 MHz to 18 GHz	+10 dBm (10 mW)	
6747B	10 MHz to 20 GHz	+10 dBm (10 mW)	
6747B-20	10 MHz to 20 GHz	+13 dBm (20 mW)	
6753B	2 to 26.5 GHz	+10 dBm (10 mW), ≤ 20 GHz +5 dBm (3 mW), ≤ 26.5 GHz	
6753B-10	2 to 26.5 GHz	+10 dBm (10 mW)	
6759B	10 MHz to 26.5 GHz	+10 dBm (10 mW), ≤ 20 GHz +5 dBm (3 mW), ≤ 26.5 GHz	
6759B-10	10 MHz to 26.5 GHz	+10 dBm (10 mW)	
6760B	12.4 to 40 GHz	+10 dBm (10 mW), ≤ 20 GHz +5 dBm (3 mW), ≤ 26.5 GHz	
6763B	2 to 40 GHz	+10 dBm (10 mW), ≤ 20 GHz +5 dBm (3 mW), 20 GHz	
6769B	10 MHz to 40 GHz	+10 dBm (10 mW), ≤ 20 GHz +5 dBm (3 mW), 20 GHz	
6772B ^②	40 to 60 GHz	0 dBm (1 mW)	

^①Without optional attenuator. ^②External leveling only.

Options:

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

Attenuator, Option 2: Adds 110 dB step attenuator to increase the RF output range. Reduces rated power by 3 dB (4 dB for Option 2C).

For Models With Upper Frequency Limit	Maximum Attenuation	Order	
≤ 20 GHz	110 dB	Option 2A	
26.5 GHz	110 dB	Option 2B	
40 GHz	110 dB	Option 2C	

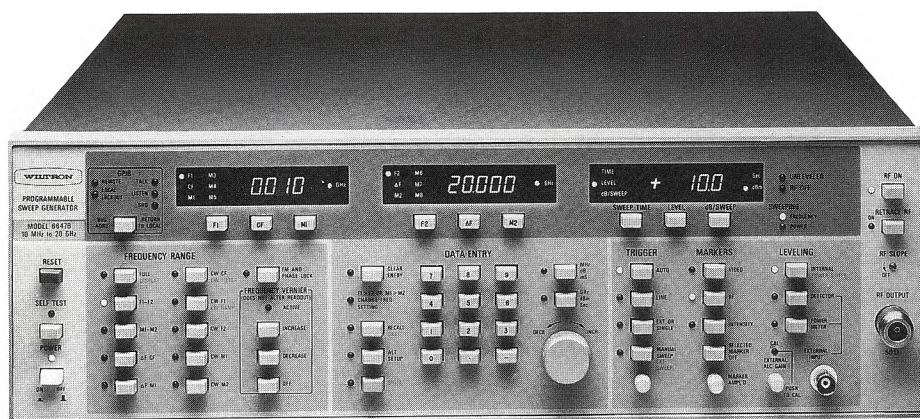
Rear Panel RF Output, Option 9K: Adds rear panel K Connector RF output. Deletes front panel connector. Degrades output power, flatness, and SWR.

Power Meter Detectors:

Detector Model	Frequency Range	Input Connector	
6400-71N50	10 MHz to 2 GHz	N Male, 50 Ω	
6400-71N75-1	10 MHz to 2 GHz	N Male, 75 Ω	
560-7A50	10 MHz to 18 GHz	GPC-7	
560-7S50	10 MHz to 18.5 GHz	WSMA Male	
560-7N50	10 MHz to 18.5 GHz	N Male	
560-7S50-2	10 MHz to 26.5 GHz	WSMA Male	
560-7K50	10 MHz to 40 GHz	K Male	

Sweep Generators

6600B Series, 10 MHz to 60 GHz



6600B Sweep Generator Highlights

- 50 mW Leveled Power from 10 MHz to 20 GHz
- 10 MHz to 60 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 the latest 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 42 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 [®] (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
6645B	0.01 to 18 GHz	10 mW
6645B-40	0.01 to 18 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
6668B	0.01 to 40 GHz	4 mW
6669B	0.01 to 40 GHz	3 mW
6610B	1 to 2 GHz	20 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
6635B	2 to 18 GHz	10 mW
6635B-40	2 to 18 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
6662B	2 to 40 GHz	4 mW
6663B	2 to 40 GHz	3 mW
6620B	3.6 to 6.5 GHz	20 mW
6624B	4 to 8 GHz	10 mW
6627B	5.9 to 9 GHz	10 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
6632B	17 to 22 GHz	5 mW
6636B	18 to 26.5 GHz	3 mW
6640B	26.5 to 40 GHz	1 mW
6640B-10	26.5 to 40 GHz	10 mW
6672B [®]	40 to 60 GHz	1 mW

[®]Without optional attenuator. [®]External leveling only.

Sweep Generators (Cont.)

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 simply pressing the security key. Also, the secure information can be easily cleared to reduce protection problems.

Fundamental Oscillators

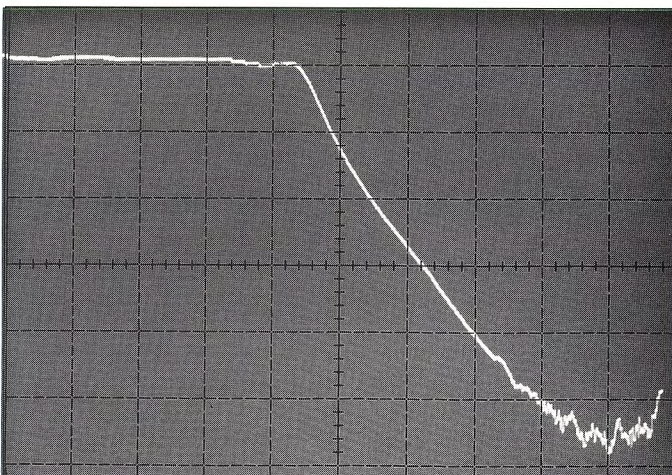
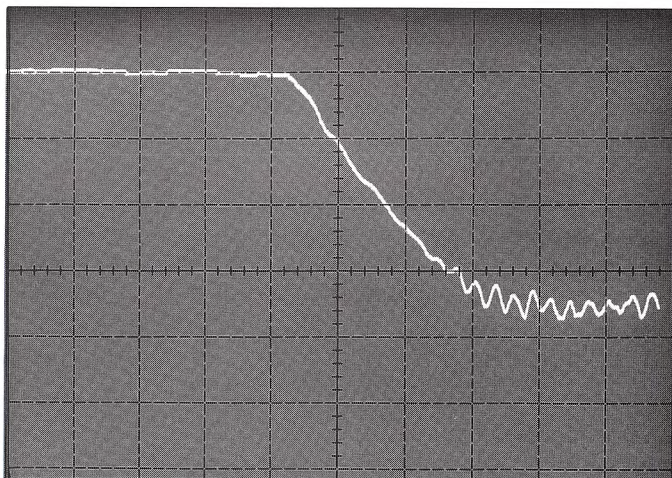
The 6600B Series uses fundamental oscillators over the 2 to 26.5 GHz range because they deliver the purest, most accurate signals. Four aspects of their performance contribute to accurate measurements:

- **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, multiplier-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).

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

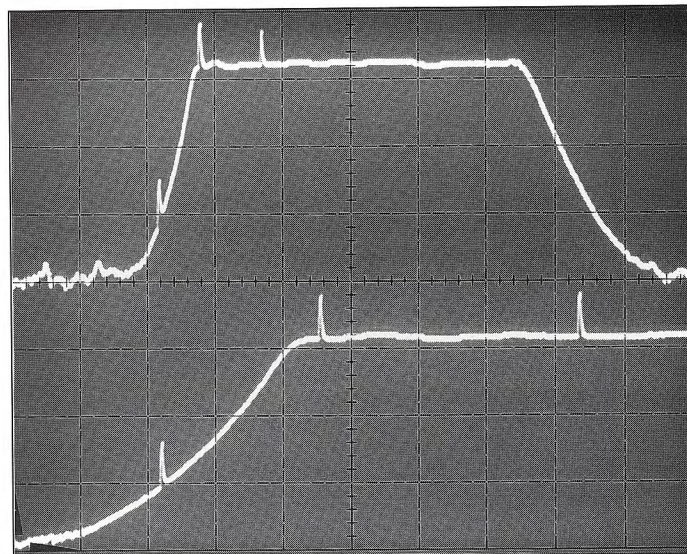
A poor source impedance match can introduce significant errors in test results. Energy reflected from the mismatch causes uncertainty in return loss and transmission measurements. This error is minimized by the exceptionally good source match of the 6600B. In the 6637B, for example, source SWR is 1.5 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 will produce the same frequency, including 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

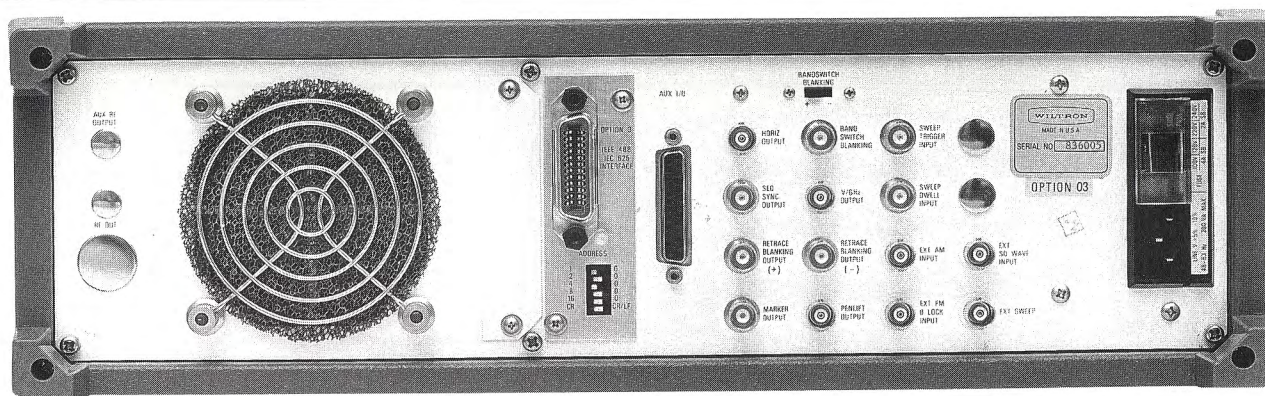


Alternate Sweep mode sweeps alternately between two independent selected frequency ranges: 2–12.4 GHz for the top trace, 3–5 GHz for the bottom trace.

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.

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 (Cont.)

6600B Series

Specifications

FREQUENCY

Frequency Range: 10 MHz to 60 GHz in 42 models.
Please see pages 72 and 73.

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

^①After 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 72 and 73.

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 72.

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 72 and 73 for power variation specifications. Not available on 6640B and 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.

Uneveled Indicator: Lights when output 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 72 and 73 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.

MODULATION

External AM Input: Rear panel BNC connector. 10 K Ω impedance.

Sensitivity: 1 dB/V

Frequency Response (typical): DC–50 kHz

Input Impedance: 10 K Ω

Amplitude Control Range: 13 dB

Maximum Input: 20V

External FM and Phase-Lock Input: Rear panel BNC connector. 10 K Ω 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 ± 6 V square wave. On/Off ratio, typically 40 dB.

Maximum Input: ± 20 volts.

Rear panel BNC connector.

Order Option 11 for 6610B, 6616B, 6619B 6619B–40, 6620B, 6624B, 6627B, 6628B, 6628B–50, 6630B, 6630B–50, 6631B, 6632B, 6636B, 6640B, 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/ $^{\circ}$ 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:

Model 6632B and 6636B: Ruggedized WSMA female

Model 6640B: WR28 Waveguide (UG–599/U Flange)

Models 6662B and 6668B: Ruggedized WSMA female to

26.5 GHz; WR28 Waveguide, (UG–599/U), 26.5 to 40 GHz

Models 6653B, 6659B, 6660B, 6663B, and 6669B: 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, Δ F 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: 100V/120V/220V/240V $\pm 5\%$, -10% , selectable on rear panel, 48–63 Hz, 250 VA maximum

Operating Temperature Range: 0 to 55 $^{\circ}$ C

Ordering Information

Frequency Ranges: Please see pages 72 and 73.

Options:

Rack Mounting, Option 1: Unit supplied with mounting ears and chassis track slide (90 $^{\circ}$ tilt) installed

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 dBm) sample of the reduced RF output signal (typically 1.5 dB ≤ 20 GHz; 2 dB, >20 GHz). Not available on models with upper frequency limit above 26.5 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 ± 6 V square wave.

Order for 6610B, 6616B, 6619B, 6619B–40, 6620B, 6624B, 6627B, 6628B, 6628B–50, 6630B, 6630B–50, 6631B, 6632B, 6636B, 6640B, 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 760-84

6600B/2 GPIB Retrofit Kit Provides field upgrade of GPIB interface to Model 6600B units

6600B Series Sweep Generator Specifications (Cont.)

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 Add (dB)	Attenuator Accuracy Per Step (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 (≤18 GHz) 1.7 (>18 GHz)
6668B ^①		>10 (≤18 GHz) >4 (>18 GHz)	N/A	±1.5 N/A (>26.5 GHz)	N/A	N/A	±1 N/A (>26.5 GHz) ^①	N/A	2 (>26.5 GHz) 1.5 (≤18 GHz) 1.7 (>18 GHz) N/A (>26.5 GHz) ^①
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 (≤18 GHz) 1.7 (>18 GHz)
6647B	0.01 to 20	>10	>6.6	±1	±1.5	±0.4	±0.6	±1.5	1.5
6647B-40		>40	>26.3						
6645B	0.01 to 18	>10	>6.6	±1	±1.5	±0.4	±0.6	±1.5	1.5
6645B-40		>40	>26.3						
6622B	0.01 to 12.4	>10	>7.4	±1	±1.5	±0.4	±0.5	±1.4	1.5
6622B-40		>40	>29.5						
6617B	0.01 to 8	>10	>7.9	±0.9	±1	±0.4	±0.5	±1	1.5
6617B-40		>40	>31.6						
6609B	0.01 to 2	>20	>17.8	±0.6	±0.8	±0.3	±0.3	±0.8	1.3
6609B-50		>50	>44.5						
6610B	1 to 2	>20	>17.8	±1	±1.5	±0.4	±0.3	±0.5	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 (≤18 GHz) 1.7 (>18 GHz)
6662B ^②		>10 (≤18 GHz) >4 (>18 GHz)	N/A	±1.5 N/A (>26.5 GHz)	N/A	N/A	±1 N/A (>26.5 GHz)	N/A	2 (>26.5 GHz) 1.5 (≤18 GHz) 1.7 (>18 GHz) N/A (>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 (≤18 GHz) 1.7 (>18 GHz)
6637B	2 to 20	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5
6637B-40		>40	>26.3						
6635B	2 to 18	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5
6635B-40		>40	>26.3						
6621B	2 to 12.4	>10	>7.4	±1	±1.5	±0.4	±0.5	±1.4	1.5
6621B-40		>40	>29.5						
6619B	2 to 8	>10	>7.9	±1	±1.5	±0.4	±0.4	±0.9	1.5
6619B-40		>40	>31.6						
6620B	3.6 to 6.5	>20	>15.6	±1	±1.5	±0.4	±0.3 (±0.03 dB/30 MHz)	±0.8	1.5
6624B	4 to 8	>10	>7.8	±1	±1.5	±0.4	±0.4	±0.9	1.5
6627B	5.9 to 9.0	>10	>7.8	±1	±1.5	±0.4	±0.3	±0.8	1.5
6628B	8 to 12.4	>10	>7.4	±1	±1.5	±0.4	±0.4	±0.9	1.5
6628B-50		>50	>37.2						
6629B	8 to 20	>10	>6.6	±1	±1.5	±0.4	±0.5	±1.5	1.5
6629B-40		>40	>26.3						
6631B	10 to 15.5	>10	>7	±1	±1.5	±0.4	±0.4	±0.9	1.5
6630B	12.4 to 20	>10	>6.6	±1	±1.5	±0.4	±0.5	±1	1.5
6630B-50		>50	>33.9						
6660B	12.4 to 40	>4	>2	±2	±2.5	±1	±1.5	±2	1.5 (≤18 GHz) 1.7 (18-26.5 GHz) 2 (>26.5 GHz)
6632B	17 to 22	>5	>3.2	±1	±3	±0.7	±0.8	±2.3	1.7
6636B	18 to 26.5	>3.1	>1.2	±1	±3	±0.7	±1	±2.5	1.7
6640B	26.5 to 40	>1 ^③	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6640B-10		>10	>5	±1	±2	±1	±1	±2	2.0
6672B	40 to 60	>1 ^③	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

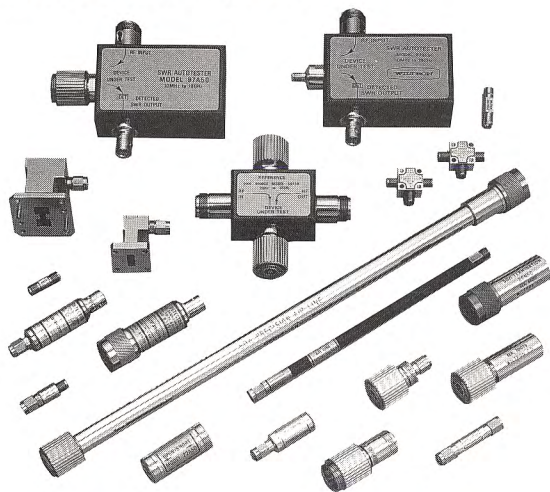
Source SWR With Opt., 2 70 dB Attenuator	Signal Purity			Frequency Accuracy [®]		Frequency Stability			Model
	Harmonics (dBc)	Non- Harmonics (dBc)	Residual FM [®] (kHz peak)	Cw Mode (MHz)	Sweep Mode ≤50 MHz (MHz)	With Temperature (MHz/°C)	With 10 dB Power Level Change (kHz)	With 3:1 Load SWR (kHz)	
1.25 (<8 GHz) 1.45 (8-12.4 GHz) 1.6 (12.4-20 GHz) 1.8 (20-26.5 GHz) 2.1 (26.5-40 GHz)	<-30 (<2 GHz) <-40 (2-26.5 GHz) <-30 (>26.5 GHz) [®]	<-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 6668B [®]
1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<-30 (<2 GHz) <-40 (>26.5 GHz)	<-40 (≤2 GHz) <-60 (>2 GHz)	<7 (<8 GHz) <10 (8-18 GHz) <15 (>26.5 GHz)	±20	±30	±1 (≤2 GHz) ±0.5 (>2 GHz)	±500	±300	6659B
1.7 (≤12.4 GHz) 2 (>12.4 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 (<8 GHz) 1.6 (8-12.4 GHz) 1.8 (>12.4 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	6645B 6645B-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	<-30 [®]	<-60	<7	±10	±15	±0.5	±500	±300	6610B
1.5	<-20 (<2.26 GHz) <-30 (≥2.26 GHz)	<-60	<7	±10	±15	±0.5	±500	±300	6616B
1.25 (<8 GHz) 1.45 (8-12.4 GHz) 1.6 (12.4-20 GHz) 1.8 (20-26.5 GHz) 2.1 (26.5-40 GHz)	<-40 (2-26.5 GHz) <-30 (>26.5 GHz) [®]	<-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 6662B [®]
1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<-40	<-60	<7 (<8 GHz) <10 (8-18 GHz) <15 (>8 GHz)	±20	±30	±1	±500	±300	6653B
1.7 (≤12.4 GHz) 2 (>12.4 GHz)	<-40 <-25	<-60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300	6637B 6637B-40
1.5 (<8 GHz) 1.6 (8-12.4 GHz) 1.8 (>12.4 GHz)	<-40 <-25	<-60	<7 (<8 GHz) <10 (>8 GHz)	±10	±15	±0.5	±500	±300	6635B 6635B-40
1.5 (<8 GHz) 1.6 (8-12.4 GHz)	<-40 <-25	<-60	<10	±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	<7	±10	±15	±0.5	±500	±300	6620B
1.5	<-30 [®]	<-60	<7	±10	±15	±0.5	±500	±300	6624B
1.8	<-40	<-60	<10	±10	±15	±0.5	±500	±300	6627B
1.8	<-40 <-25	<-60	<10	±10	±15	±0.5	±500	±300	6628B 6628B-50
1.6 (≤12.4 GHz) 1.8 (>12.4 GHz)	<-40 <-25	<-60	<10	±10	±15	±0.5	±500	±300	6629B 6629B-40
1.8	<-40	<-60	<10	±10	±15	±0.5	±500	±300	6631B
1.8	<-32 <-25	<-60	<10	±10	±15	±0.5	±500	±300	6630B 6630B-50
N/A	<-40 (≤26.5 GHz) <-20 (>26.5 GHz)	<-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
2	<-40	<-60	<10	±15	±25	±1	±500	±300	6632B
2	<-40	<-60	<30	±15	±25	±2	±500	±300	6636B
N/A	<-30 [®]	<-60	<40	±20	±30	±2	±500	±300	6640B 6640B-10
N/A	<-20 [®]	<-60	<50	±30	±45	±3	N/A	±300	6672B

[®]Dual outputs: 0.01-26.5 GHz and 26.5-40 GHz

[®]Dual outputs: 2-26.5 GHz and 26.5-40 GHz

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 46) and the Model 6400 RF Analyzer (page 52) or with 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.

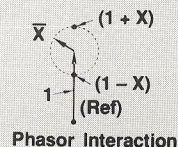
The directivity of the SWR Autotester or bridge is the measure of how well the incident and reflected signals can be separated. For example, 40 dB directivity means that the error signal in the output is 40 dB below the reflected signal to be measured. This error signal is present regardless of the reflected 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 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

RF Measurement Chart

Conversion tables for return loss, reflection coefficient, and SWR with values for interactions of a small phasor X with a large phasor (unity reference) expressed in dB related to reference.



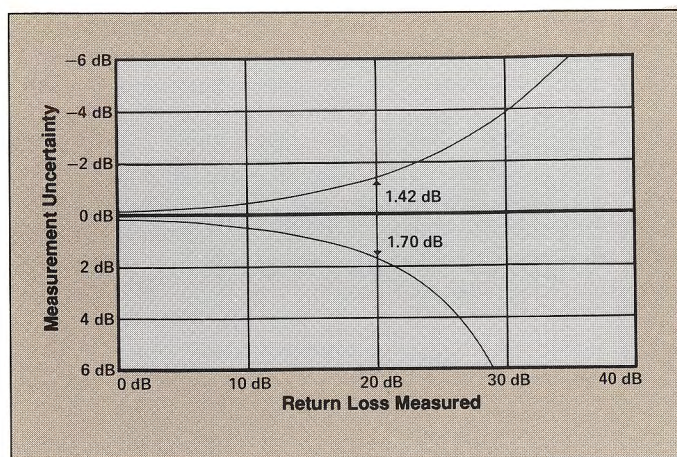
Phasor Interaction

Relative to Unity Reference

SWR	Reflection Coefficient	Return Loss (dB)	X dB Below Reference	Ref + X (dB)	Ref - X (dB)	Ref ± X Pk to Pk Ripple (dB)
17.3910	.8913	1	1	5.5350	-19.2715	24.8065
8.7242	.7943	2	2	5.0780	-13.7365	18.8145
5.8480	.7079	3	3	4.6495	-10.6907	15.3402
4.4194	.6310	4	4	4.2489	-8.6585	12.9073
3.5698	.5623	5	5	3.8755	-7.1773	11.0528
3.0095	.5012	6	6	3.5287	-6.0412	9.5699
2.6146	.4467	7	7	3.2075	-5.1405	8.3480
2.3229	.3981	8	8	2.9108	-4.4096	7.3204
2.0999	.3548	9	9	2.6376	-3.8063	6.4439
1.9250	.3162	10	10	2.3866	-3.3018	5.6884
1.7849	.2818	11	11	2.1567	-2.8756	5.0322
1.6709	.2512	12	12	1.9465	-2.5126	4.4590
1.5769	.2239	13	13	1.7547	-2.2013	3.9561
1.4985	.1995	14	14	1.5802	-1.9331	3.5133
1.4326	.1778	15	15	1.4216	-1.7007	3.1224
1.3767	.1585	16	16	1.2778	-1.4988	2.7766
1.3290	.1413	17	17	1.1476	-1.3227	2.4703
1.2880	.1259	18	18	1.0299	-1.1687	2.1986
1.2528	.1122	19	19	.9237	-1.0337	1.9574
1.2222	.1000	20	20	.8279	-.9151	1.7430
1.1957	.0891	21	21	.7416	-.8108	1.5524
1.1726	.0794	22	22	.6639	-.7189	1.3828
1.1524	.0708	23	23	.5941	-.6378	1.2319
1.1347	.0631	24	24	.5314	-.5661	1.0975
1.1192	.0562	25	25	.4752	-.5027	.9779
1.1055	.0501	26	26	.4248	-.4466	.8714
1.0935	.0447	27	27	.3796	-.3969	.7765
1.0829	.0398	28	28	.3391	-.3529	.6919
1.0736	.0355	29	29	.3028	-.3138	.6166
1.0653	.0316	30	30	.2704	-.2791	.5495
1.0580	.0282	31	31	.2414	-.2483	.4897
1.0515	.0251	32	32	.2155	-.2210	.4365
1.0458	.0224	33	33	.1923	-.1967	.3890
1.0407	.0200	34	34	.1716	-.1751	.3467
1.0362	.0178	35	35	.1531	-.1558	.3090
1.0322	.0158	36	36	.1366	-.1388	.2753
1.0287	.0141	37	37	.1218	-.1236	.2454
1.0255	.0126	38	38	.1087	-.1100	.2187
1.0227	.0112	39	39	.0969	-.0980	.1949
1.0202	.0100	40	40	.0864	-.0873	.1737
1.0180	.0089	41	41	.0771	-.0778	.1548
1.0160	.0079	42	42	.0687	-.0693	.1380
1.0143	.0071	43	43	.0613	-.0617	.1230
1.0127	.0063	44	44	.0546	-.0546	.1096
1.0113	.0056	45	45	.0487	-.0490	.0977
1.0101	.0050	46	46	.0434	-.0436	.0871
1.0090	.0045	47	47	.0387	-.0389	.0776
1.0080	.0040	48	48	.0345	-.0346	.0692
1.0071	.0035	49	49	.0308	-.0309	.0616
1.0063	.0032	50	50	.0274	-.0275	.0549
1.0057	.0028	51	51	.0244	-.0245	.0490
1.0050	.0025	52	52	.0218	-.0218	.0436
1.0045	.0022	53	53	.0194	-.0195	.0389
1.0040	.0020	54	54	.0173	-.0173	.0347
1.0036	.0018	55	55	.0154	-.0155	.0309
1.0032	.0016	56	56	.0138	-.0138	.0275
1.0028	.0014	57	57	.0123	-.0123	.0245
1.0025	.0013	58	58	.0109	-.0109	.0219
1.0022	.0011	59	59	.0097	-.0098	.0195
1.0020	.0010	60	60	.0087	-.0087	.0174

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.



These curves show measurement uncertainty of return loss measurements with a directional device having 35 dB directivity (test port match not included).

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.

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 compatibility.

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.

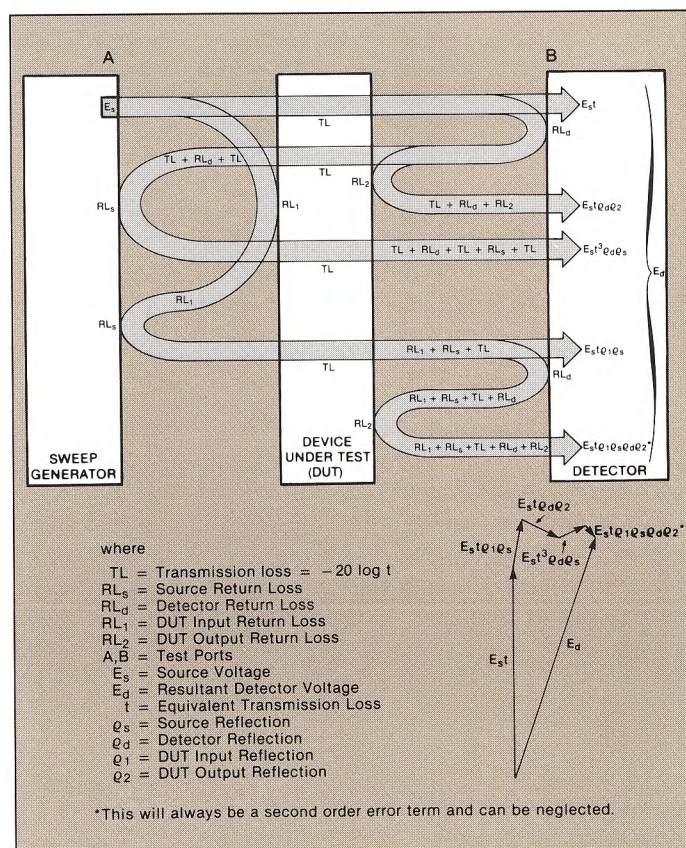
Model 43K Series Fixed Attenuators

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

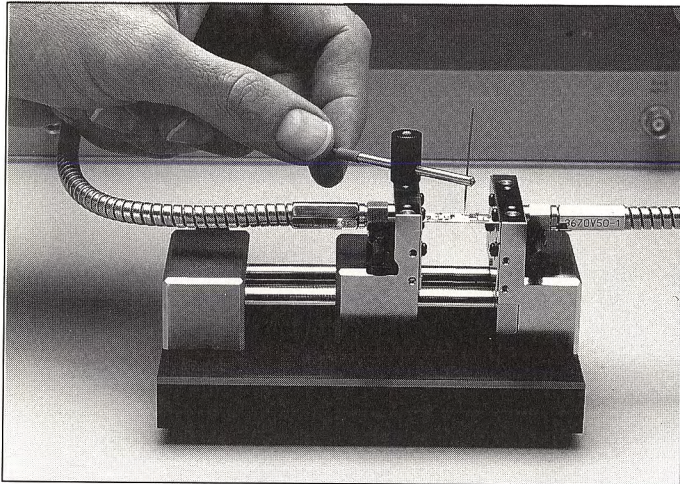
The Wiltron K240C is the first power divider to operate from dc to 40 GHz. In addition, there is the Model K240B for the dc to 26.5 GHz range. Both models use the Wiltron K Connector on all ports.



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 Fixture

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)

NEW

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 and substrates with line offsets of up to 1/2 inch. The 3680 Series includes two models: 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®.

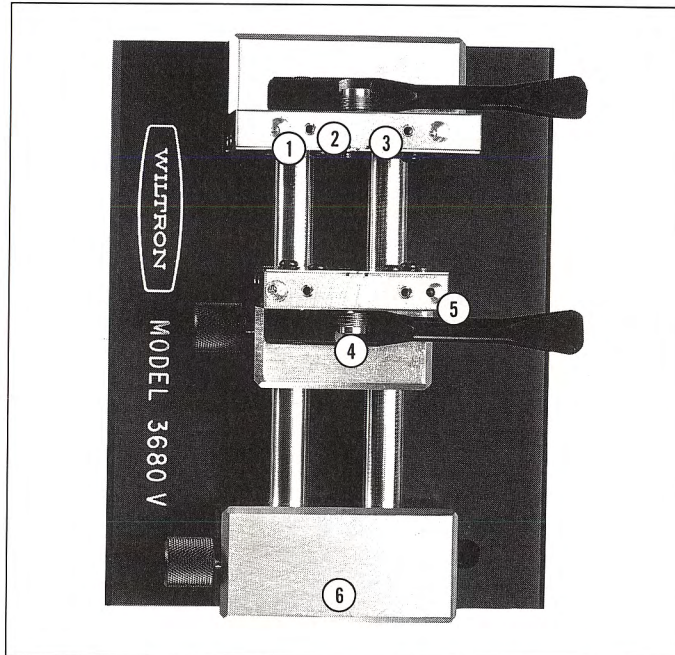
A Complete Measurement Solution

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 360 Vector Network Analyzer provides unmatched dynamic range

and directivity performance. And, the 360 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 repeatability 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: the K Connector model yields DC to 40 GHz operation; the V Connector model yields DC to 60 GHz operation.
5. Adjustable launch measures substrates up to 2 inches long without requiring custom center sections.
6. Line offset up to $\pm 1/2$ inch 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 pressure rods on the MMIC attachment. The cam-actuated pressure rods 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)

2.0" (5 cm) max.

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)

Input and Output Connectors:

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"

(Block can be modified for other thicknesses.)

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
	3680K	3680V	36801K	36801V	36802
Frequency Range (GHz)	DC to 40	DC to 60	DC to 40	DC to 60	DC to 60
Return Loss (dB)					
DC to 20 GHz	>17	>17	>16	>16	>15
20 to 40 GHz	>14	>14	>12	>12	>12
40 to 60 GHz		>10		>9	>9
Repeatability (dB)					
DC to 20 GHz	≤±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

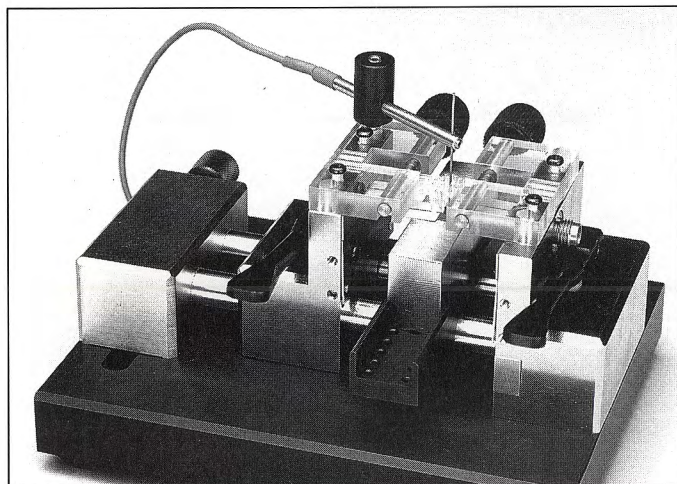
When Used with the Wiltron 360 Vector Network Analyzer

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)	Noise Floor Relative to a Thru (dB typical)
0.04	>38	>34	>38	±0.005	±0.030	>84
1.0	>38	>34	>38	±0.005	±0.050	>100
20	>38	>34	>38	±0.008	±0.050	>90
26.5	>34	>30	>34	±0.008	±0.070	>85
40	>34	>28	>34	±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:

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

36804 Calibration/Verification Kits:

36804-10M 10 mil Microstrip Cal/Verif. Kit

36804-15M 15 mil Microstrip Cal/Verif. Kit

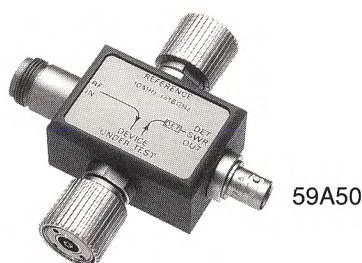
36804-25M 25 mil Microstrip Cal/Verif. Kit

36804-25C 25 mil Coplanar Waveguide Cal/Verif. Kit

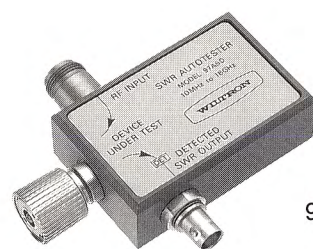
Verification Data, Option 1: Adds verification data to any of the above kits.

SWR Autotesters

Model 59A50 and 97 Series, 10 MHz to 18 GHz



59A50



97A50

59 Comparison SWR Autotester Highlights

- Compatibility with Ripple Extraction Technique for Accurate SWR Measurements with 60 dB Effective Directivity
- 10 MHz to 18 GHz Frequency Range
- Integrated Microwave Bridge and Detector
- SWR Measurements Down to 1.006
- Precision GPC-7 Test and Reference Port Connectors

When combined with an 18A50 Precision Air Line (page 82) and a 29A50-20 Reference Offset Termination (page 83) in the Ripple Extraction test setup described in *Wiltron Technical Review #8*, the 59A50 makes precise SWR measurements with an effective directivity of 57 dB. Contained in the small package is a broadband microwave bridge and a detector.

Specifications

Model	Test and Reference Port Connectors	Directivity (dB)	Accuracy ^{①②}	
			10 MHz-8 GHz	8-18 GHz
59A50	GPC-7	36	$0.016 \pm 0.06\rho^2$	$0.016 \pm 0.10\rho^2$

Frequency Range: 10 MHz to 18 GHz

Frequency Sensitivity: ± 1.5 dB maximum

Accuracy:^③ $0.0014 \pm 0.01\rho^2$

Insertion Loss: 6.5 dB nominal^④

Detector Polarity: Negative

SWR Output Time Constant: 2 μ s

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, 29A50-20 Precision Termination, and 18A50 Air Line

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.

Specifications

Model	Test Port Connector	Directivity (dB)	Accuracy ^{①②}	
			10 MHz-8 GHz	8-18 GHz
97A50	GPC-7	36	$0.016 \pm 0.06\rho^2$	$0.016 \pm 0.10\rho^2$
97A50-1	GPC-7	40	$0.010 \pm 0.06\rho^2$	$0.010 \pm 0.10\rho^2$
97N50	Type N Male	37	$0.018 \pm 0.08\rho^2$	$0.018 \pm 0.08\rho^2$
97NF50	Type N Female			
97N50-1	Type N Male	38	$0.013 \pm 0.08\rho^2$	$0.013 \pm 0.12\rho^2$
97NF50-1	Type N Female			
97S50	WSMA Male	35	$0.018 \pm 0.08\rho^2$	$0.018 \pm 0.08\rho^2$
97SF50	WSMA Female			
97S50-1	WSMA Male	38	$0.013 \pm 0.08\rho^2$	$0.013 \pm 0.12\rho^2$
97SF50-1	WSMA Female			

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 μ s

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 When used with the Ripple Extraction method (*Wiltron Technical Review #8*).

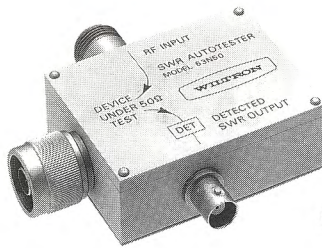
^④ Typically 9 dB at 18 GHz from RF input port to test port.

^① Including effects of test port reflections and directivity.

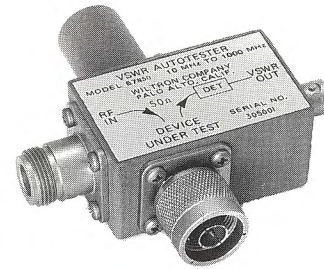
^② Where ρ is the measured reflection coefficient.

^③ Typically 8.5 dB at 18 GHz from RF input port to test port.

63 and 67 Series, 10 MHz to 4200 MHz



63N50



67N50

63 Precision SWR Autotester Highlights

- 10 to 4200 MHz Frequency Range
- Precision Stainless Steel Test Port Connector
- Small Package Containing RF Bridge, Reference Termination, and a Detector
- Directivity Better Than 46 dB

With directivity that is better than 46 dB, these highest performing SWR Autotesters provide SWR measurement accuracy of $0.005 \pm 0.06\rho^2$ (where ρ is the measured reflection coefficient). In addition to a GPC-7 test port connector, the series offers stainless-steel Type N connectors that conform to MIL-G-39012. All models include a built-in microwave bridge, reference termination, and a negative output detector.

Specifications

Model	Test Port Connector	Frequency Range (MHz)	Directivity (dB)	Accuracy ^①
63A50	GPC-7	10 to 4000	40	$0.010 \pm 0.06\rho^2$
63A50-1			46 ^②	$0.005 \pm 0.06\rho^2$
63A50-2	GPC-7	10 to 4200	40	$0.010 \pm 0.06\rho^2$
63A50-1,2			46 ^②	$0.005 \pm 0.06\rho^2$
63N50	N Male	10 to 4000	40	$0.010 \pm 0.06\rho^2$
63N50-1			46	$0.005 \pm 0.06\rho^2$
63N50-2	N Male	10 to 4200	40	$0.010 \pm 0.06\rho^2$
63N50-1,2			46 ^②	$0.005 \pm 0.06\rho^2$
63NF50	N Female	10 to 4000	40	$0.010 \pm 0.06\rho^2$
63NF50-1			46 ^②	$0.005 \pm 0.06\rho^2$
63NF50-2	N Male	10 to 4200	40	$0.010 \pm 0.06\rho^2$
63NF50-1,2			46 ^②	$0.005 \pm 0.06\rho^2$

Impedance: 50 Ω

Insertion Loss: 6.5 dB nominal from input to test port

Detector Polarity: Negative

SWR Output Time Constant: 2 μ s

Maximum Input Power: 0.5 W

Input Connector: Type N Female, stainless steel

Detector Output Connector: BNC Female

Dimensions: 6.7 x 5.1 x 2.54 cm (2-5/8 x 2 x 1 in.) plus connectors

Weight: 340 g (12 oz.)

Companion Equipment: 562 Network Analyzer and 6600B Sweep Generator

^① Where ρ is measured reflection coefficient.

^② Over 10 to 4000 MHz range.

67 Low-Cost SWR Autotester Highlights

- 50 or 75 Ω Impedance
- Type N, F, or BNC Test Port Connectors
- 10 to 1000 MHz Frequency Range
- Low Price Includes Built-In Bridge, Reference Termination, and Detector

Compared to a reflectometer setup, slotted line, or a lower-directivity bridge device, the 67 Series offers the advantages of convenience, accuracy and cost saving. With an integrated RF bridge, reference termination, and detector, these units provide an output that is direct reading in SWR without the need for calibrated mismatches or terminations. Specifications give an overall accuracy equation that includes the effects of the termination, detector, and reflections from the test port connector. All models are available in 50 or 75 Ω impedance. The 75 Ω Models 67N75 and 67NF75 are fitted with a special Type N female input connector that will not be damaged if mated with a 50 Ω connector.

Specifications

Model	Test Port Connector	Input Impedance (Ohms)
67B50	BNC Male	50
67BF50	BNC Female	
67B75	BNC Male	75
67BF75	BNC Female	
67FF75	F Female	75
67N50	N Male	
67NF50	N Female	50
67N75	N Male	
67NF75	N Female	

Frequency Range: 10 to 1000 MHz

Directivity: 40 dB

Accuracy: $0.01 \pm 0.1\rho^2$, where ρ is the measured reflection coefficient

Insertion Loss: 6 dB nominal from input to test port

Detector Output Polarity: Negative

SWR Output Time Constant: 2 μ s

Maximum Input Power: 0.5 W

Video Impedance: <15 K Ω at -15 dBm

Input Connector: BNC Female; Type N Female on 67N50, 67NF50, 67N75, and 67NF75

Detector Output Connector: BNC Female

Dimensions: 5.7 x 3.5 x 2.86 cm (2-1/4 x 1-3/8 x 1-1/8 in.) plus connectors

Weight: 170 g (6 oz.)

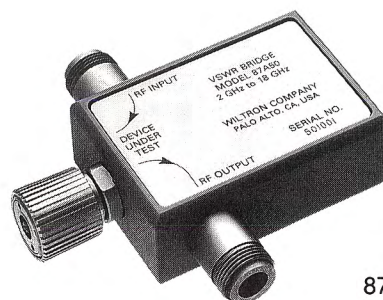
Companion Equipment: 562 Network Analyzer and 6600B Sweep Generator

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 82) and a 29A50-20 Reference Offset Termination (page 83) 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} $0.0014 \pm 0.01\rho^2$ 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.)

Companion Equipment: 18A50 Air Line, 29A50-20 Reference Offset Termination, 70 or 75 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 Autotesters 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.

Specifications

Model	Directivity (dB)	Accuracy ^①		
		2 to 3 GHz	3 to 4 GHz	4 to 18 GHz
87A50	35	$0.018 \pm 0.31\rho^2$	$0.018 \pm 0.2\rho^2$	$0.018 \pm 0.12\rho^2$
87A50-1	38	$0.013 \pm 0.31\rho^2$	$0.013 \pm 0.2\rho^2$	$0.013 \pm 0.12\rho^2$

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

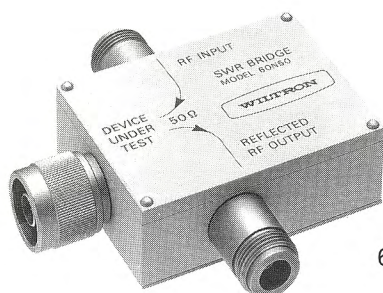
Weight: 340 g (12 oz.)

Companion Equipment: 70 or 75 Series Detector, 562 Network Analyzer and 6600B Sweep Generator.

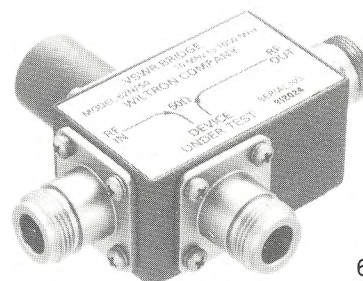
^① Where ρ is the measured reflection coefficient.

^② Typically 9 dB at 18 GHz from input to test port.

60 and 62 Series, 5 to 2000 MHz



60N50



62NF50

60 RF SWR Bridge Highlights

- 5 to 2000 MHz Frequency Range
- 46 dB Directivity
- GPC-7 or Type N Test Port Connector
- Built-In Reference Termination
- Attractive Hardwood Storage Case

The 60 Series RF SWR Bridges are precision devices, designed to make very accurate measurement of SWR over the 5 to 2000 MHz range. 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. Wiltron 73 or 74 Series RF Detectors (page 86) are perfect companions to the 60 Series SWR Bridges. Storage is convenient in the handsome hardwood case supplied.

Specifications

Model	Test Port Connector	Directivity (dB)	
60A50	GPC-7	40	
60A50-1		46	
60N50	N Male	40	
60N50-1		46	
60NF50	N Female	40	
60NF50-1		46	

Frequency Range: 5 to 2000 MHz

Accuracy:^① $0.01 \pm 0.09\rho^2$, where ρ is the measured reflection coefficient

Insertion Loss: 6.5 dB nominal from input to test port

Maximum Input Power: 0.5 W

Test Port Connector: GPC-7 or Type N

Input and Output Connector: Type N Female

Dimensions: 6.7 x 5.1 x 2.54 cm (2-5/8 x 2 x 7/8 in.) plus connectors

Weight: 340 g (12 oz.)

Companion Equipment: 73 or 74 Series Detector, 562 Network Analyzer and 6600B Sweep Generator.

^① Including the effects of test port reflections and directivity.

62 RF SWR Bridge Highlights

- Exceptional Value at Low Cost
- 10 to 1000 MHz Frequency Coverage
- 40 dB Directivity
- 50Ω or 75Ω Impedance
- BNC and Type N Test Port Connector

The 62 Series SWR Bridges are low-cost SWR measurement components with 40 dB directivity and a choice of 50Ω or 75Ω impedance. Every model includes a highly accurate internal reference termination. Models 62N75 and 62NF75 are fitted with special Type N female input connectors that will not be damaged if mated with a 50Ω connector. For accurate SWR measurements over the 10 to 1000 MHz range, the 62 Series has no equal. For optimum performance, a 73 or 74 Series RF Detector (page 86) is recommended.

Specifications

Model	Test Port Connector	Input Impedance (Ohms)	
62B50	BNC Male	50	
62BF50	BNC Female		
62B75	BNC Male	75	
62BF75	BNC Female		
62FF75	F Female	75	
62N50	N Male	50	
62NF50	N Female		
62N75	N Male	75	
62NF75	N Female		

Frequency Range: 10 to 1000 MHz

Accuracy:^① $0.01 \pm 0.12\rho^2$, where ρ is the measured reflection coefficient

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 and 62NF BNC Female on 62B, 62BF, and 62FF

Dimensions: 5.7 x 3.5 x 2.86 cm (2-1/4 x 1-3/8 x 1-1/8 in.) plus connectors

Weight: 170 g (6 oz.)

Companion Equipment: 73 or 74 Series Detector, 562 Network Analyzer and 6600B Sweep Generator.

^① Including the effects of test port reflections and directivity.

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 beaded 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 beaded 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 beaded 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 beaded 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	1.002 + 0.0026F
28A50 28A50-1	DC to 18	GPC-7	50	1.010 + 0.001F 1.020
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



34 Precision Adapter Highlights

- Low SWR and Insertion Loss
- GPC-7, K Connector®, Type N, and WSMA Connectors
- Convenient Transition with Minimal Effect on Signal
- 50Ω or 75Ω Impedance

The 234 Series of adapters enables accurate measurements with GPC-7, K 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
34NN75A 34NFN75	DC to 2	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 34NFN50	DC to 18	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
34KV50 34KVF50	DC to 46	K Male to V Male K Male to V Female	1.5
34KFV50 34KFVF50	DC to 46	K Female to V Male K Female to V Female	1.5

Impedance: 50Ω, except 34NN75 and 34NFN75 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	1.2

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™

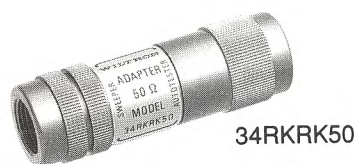
The K230 Series is the panel-mount version of the K220 Series Adapters. These units mount in a standard 3/8-inch "D" hole.

Specifications

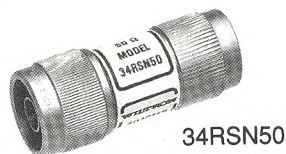
Model	Frequency Range (GHz)	Connectors	SWR
K230 K232 K234	DC to 40	K Male to K Male K Female to K Female K Female to K Male	1.2

Ruggedized and W/G-to-Coaxial Adapters

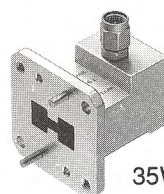
34R Series, DC to 40 GHz; 35 Series, 7.5 to 60 GHz



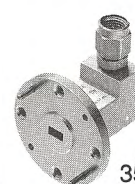
34RKRK50



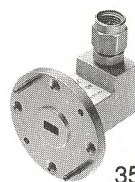
34RSN50



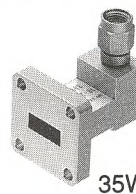
35WRD750K



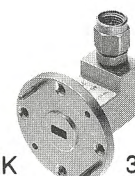
35WR19K



35WR22V



35WR42K



35WR19V

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 6600 Series Sweep Generator 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® Compatibility 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	1.25	
35WR22V 35WR22VF	33 to 50	WR22 to V Male WR22 to V Female	383	1.30	
35WR19K 35WR19KF	40 to 50	WR19 to K Male WR19 to K Female	383	1.25	
35WR19V 35WR19VF	Usable to 54	WR19 to V Male WRX19 to V Female	383	1.30	
	40 to 60				

Impedance: 50Ω

Maximum Input Power: 1 W

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 1000 Ω have typical rise times of less than 50 ns.

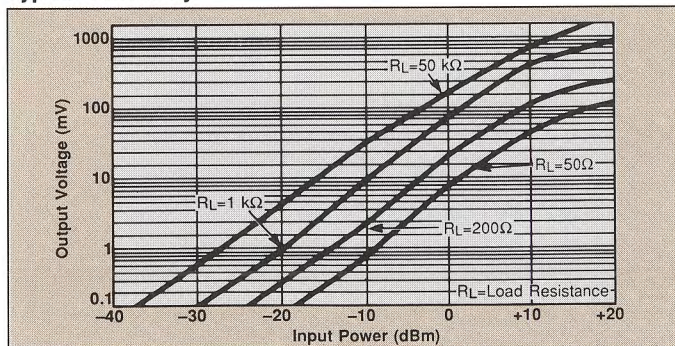
Field Replaceable Diodes

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.

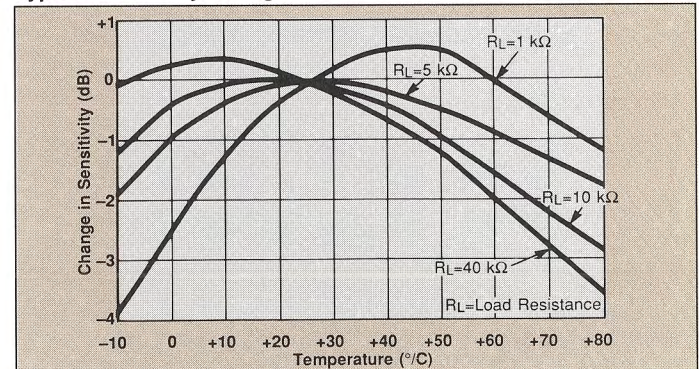
Specifications

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 16.5 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.

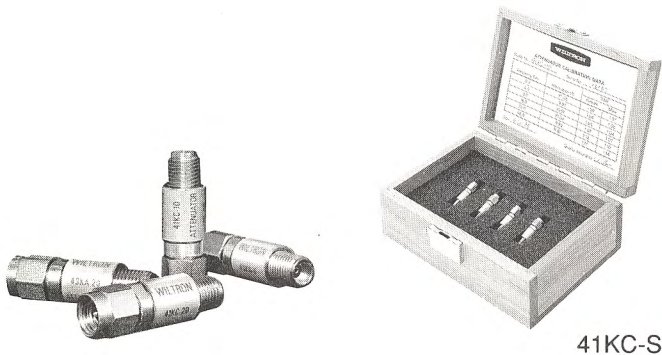
Upper Frequency Limit (GHz)	≤8	≤12.4	≤18	≤26.5	≤40
Frequency Response Tracking (dB)	±0.2	±0.3	±0.6	±0.8	±1.2

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

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, 1.25 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 distinguishing 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 reliability 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

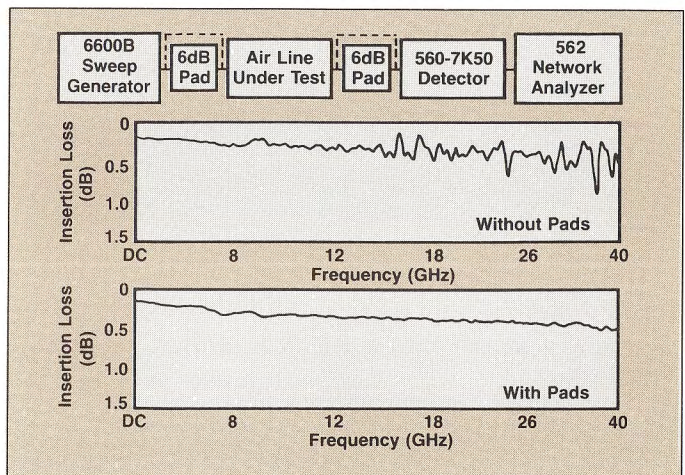
Adding Gold Line attenuators to your attenuation measurement setup will improve your measurement accuracy. In the test setup shown, the insertion loss of an air line was measured, first without and then with matching 6 dB pads. The difference in the accuracy of the two measurements is striking. By attenuating 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 28.6 mm length (0.312 x 1.125 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: 28.6 mm (1.125 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	Absolute Attenuation ^① (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.

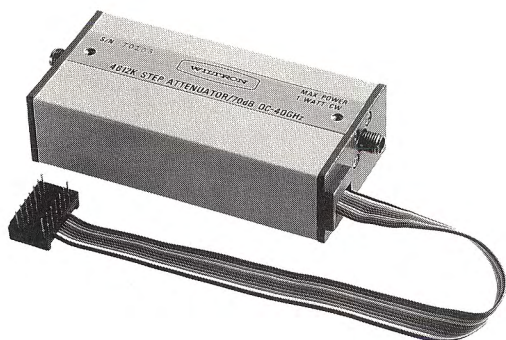
Silver Line Specifications

Model	Absolute Attenuation ^① (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 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	—	—	
DC to 18 GHz											
43KA-3	3	±0.5	—	—	—	±1.15	±1.20	—	—	—	
43KA-6	6	±0.5	—	—	—	±1.15	±1.20	—	—	—	
43KA-10	10	±0.5	—	—	—	±1.15	±1.20	—	—	—	
43KA-20	20	±0.5	—	—	—	±1.15	±1.20	—	—	—	

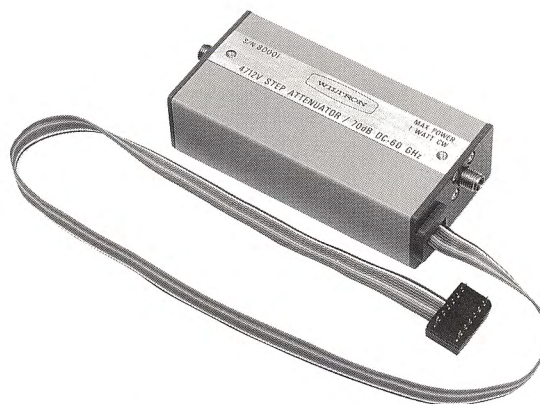
^① ±1 dB from dc to 26.5 GHz; ±1.3 dB from >26.5 to 40 GHz, including frequency response.

Step Attenuators

4400, 4500, 4600, and 4700 Series, DC to 60 GHz



4612K



4712V

Step Attenuator Highlights

- DC–20 GHz, DC–26.5 GHz, DC–40 GHz, and DC–60 GHz Ranges
- 70 dB and 110 dB Attenuation Ranges
- Lowest Insertion Loss
- Precise Repeatability
- Life of 5 Million Operations
- Small, Rugged, Light Weight

Broadest Frequency and Attenuation Ranges

Wiltron programmable 10 dB step attenuators bring a substantial increase in the frequency and attenuation range available in one small package. Using the latest technology, these units offer superior performance, reliability, and ease of use. All are plug-compatible with competitive units.

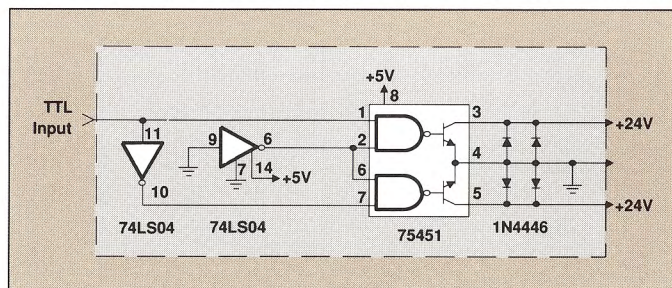
Advanced Technology—Advanced Performance

Wiltron has lowered throughline loss by designing the first 40 dB attenuator sections to operate above 18 GHz. Compared with designs that use 30 dB sections, Wiltron attenuators have a shorter thru path and fewer switching contacts. As a result, insertion loss is as much as 1.7 dB less than that of units made by other companies. RF input power requirements for systems that use these attenuators can be reduced, saving money, space, and weight.

Integrated Switching Structure

The push rods that switch in the attenuator modules and thru lines are driven by a solenoid actuator. By designing the solenoid as an integral part of the attenuator assembly, switching speeds of 20 ms (including settling time) are achieved. Upon completion of the switching operation, the solenoid is magnetically latched to withstand severe shock and vibration. At the same time, the solenoid current is automatically turned off to save power and to minimize temperature rise.

Also integrated in the design is solid state dc switching circuitry that avoids the relatively high failure rate of mechanical dc switches. Each attenuator section is controlled by its own driver circuit, which requires 24V, 125 mA. A typical external driver circuit for one section is shown in the figure below.



Typical external driver circuit for attenuator control.

Superior Microwave Connectors

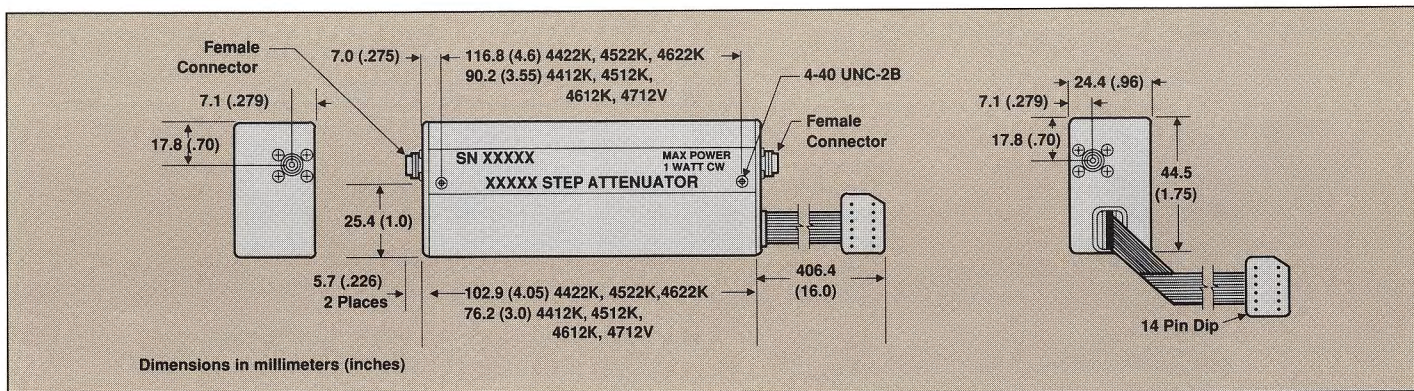
Wiltron 4700 Series Step Attenuators use the new V Connector®, all other Wiltron Step Attenuators use in-line, female K Connectors®. These connectors are used because of their wider dc to 60 GHz coverage and dc to 40 GHz coverage, greater outer-conductor mating area, improved mating alignment arrangement, and lower required insertion force—design features that improve reliability and repeatability.

Environmental Testing

Designed and tested extensively to operate in military test equipment environments, the attenuators meet stringent shock, vibration, humidity, and temperature requirements.

Accuracy Enhancing Calibration Data

Attenuation accuracy can be improved by using optional calibration data taken on the Wiltron 360 Vector Network Analyzer. The calibration data can be used to normalize the effect of frequency response and reflections. The calibration data is traceable to NBS.

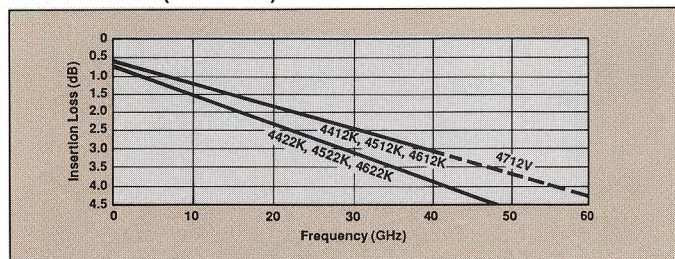


Specifications

Frequency and Attenuation Ranges:

Model	Frequency Range	Attenuation Range In 10 dB Steps
4412K	DC to 20 GHz	0 to 70 dB
4422K	DC to 20 GHz	0 to 110 dB
4512K	DC to 26.5 GHz	0 to 70 dB
4522K	DC to 26.5 GHz	0 to 110 dB
4612K	DC to 40 GHz	0 to 70 dB
4622K	DC to 40 GHz	0 to 110 dB
4712V	DC to 60 GHz	0 to 70 dB

Insertion Loss (maximum):



Connections:

Pin	Wire Color	Models 4412K, 4512K, 4612K, and 4712V	Models 4422K, 4522K, and 4622K
1	—	—	—
2	White	10 dB Section Attenuator	10 dB Section Attenuator
3	Violet	40 dB Section Thru Line	40 dB Section 1 Thru Line
4	Green	—	40 dB Section 2 Thru Line
5	Orange	20 dB Section Attenuator	20 dB Section Attenuator
6	Brown	+24 Vdc	+24 Vdc
7	—	—	—
8	—	—	—
9	Red	40 dB Section Attenuator	40 dB Section 1 Attenuator
10	Yellow	—	40 dB Section 2 Attenuator
11	Blue	20 dB Section Thru Line	20 dB Section Thru Line
12	Grey	—	—
13	Black	10 dB Section Thru Line	10 dB Section Thru Line
14	—	—	—

Impedance Match:

Frequency (GHz)	Return Loss (dB)	SWR
DC to 8	19	1.25
8 to 12	14	1.5
12 to 20	13	1.6
20 to 26.5	11	1.8
26.5 to 40	9	2.0
40 to 60	8	2.3

Attenuator Accuracy ($\pm$ dB):

Frequency (GHz)	Attenuation (dB)							
	10	20	30	40	50	60	70	80-110
DC to 8	0.3	0.5	0.6	0.7	0.8	1.0	1.1	1.4
8 to 12	0.4	0.5	0.7	0.9	1.0	1.3	1.5	2.0
12 to 20	0.5	0.6	0.8	1.1	1.2	1.4	1.7	2.2
20 to 26.5	0.7	0.8	1.0	1.5	1.6	1.9	2.3	2.8
26.5 to 40	0.9	1.0	1.2	1.7	1.9	2.3	2.6	3.2
40 to 60	1.1	1.2	1.4	1.9	2.2	2.5	3.0	N/A

Switching Speed (maximum): 20 ms

Operating Voltage: 20 to 30V

Switching Control Current: 125 mA at 24V nominal per section

3 sections in 4412K, 4512K, 4612K, 4712V;

4 sections in 4422K, 4522K, 4622K

Solenoid Coil Impedance: 190 Ω

Solenoid Coil Inductance: 65 mH

RF Input Power (maximum): 1 W average, 100 W peak for 10 μ s

RF Power Sensitivity: 0.001 dB/W

Temperature Coefficient: <0.0001 dB/dB/°C

Life (minimum operations per section): 5 million

Repeatability (typical after 1 million operations):

$\pm$ 0.03 dB to 18 GHz, $\pm$ 0.05 dB to 26.5 GHz, $\pm$ 0.08 dB to 40 GHz

Mounting Position: Any

RF Connectors:

All models except 4712V: K Connectors, female, in-line

4712V Model: V Connector, female, in-line

Programming Connector: 14 pin DIP

Programming Cable Length: 406 mm (16 in.)

Weight:

4412K, 4512K, 4612K, 4712V: 170 g (6.0 oz.)

4422K, 4522K, 4622K: 213 g (7.5 oz.)

Operating Temperature:

-20°C to +75°C per ATP at -20°C and +75°C

Ordering Information

Model 4412K, DC to 20 GHz, 70 dB

Model 4512K, DC to 26.5 GHz, 70 dB

Model 4612K, DC to 40 GHz, 70 dB

Model 4712V, DC to 60 GHz, 70 dB

Model 4422K, DC to 20 GHz, 110 dB

Model 4522K, DC to 26.5 GHz, 110 dB

Model 4622K, DC to 40 GHz, 110 dB

OEM quantity discounts are available.

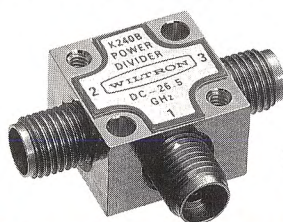
Options:

Option C: Calibration Data (4412K, 4512K, 4612K)

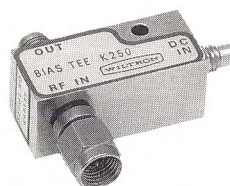
(Calibration data is taken every 100 MHz from DC to 900 MHz and every 500 MHz from 1 GHz to 40 GHz.)

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

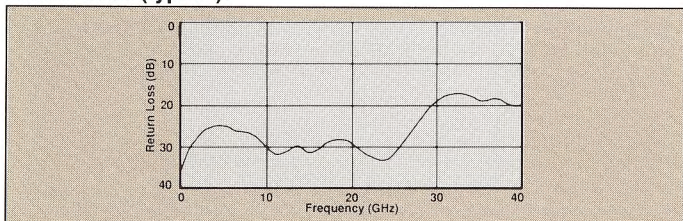
Impedance: 50 Ω

Maximum Input Power: 1 W

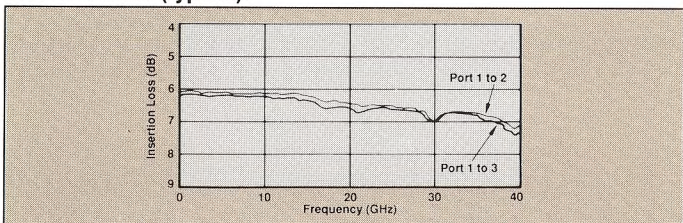
Connectors: K Female

Weight: 43 g (1.5 oz.)

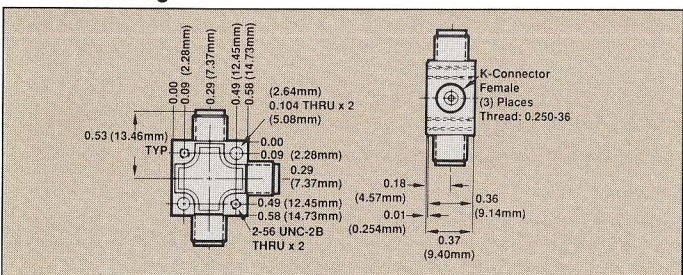
Return Loss (typical):



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 GHz ^①	0.1 to 60 GHz ^①
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

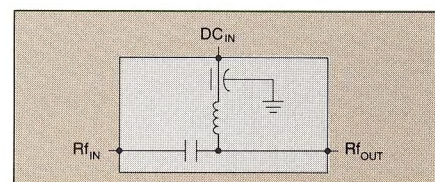
^① Usable between 0.04 and 0.1 GHz with degraded performance. ^② Typical.

Temperature: 0 to 60° C

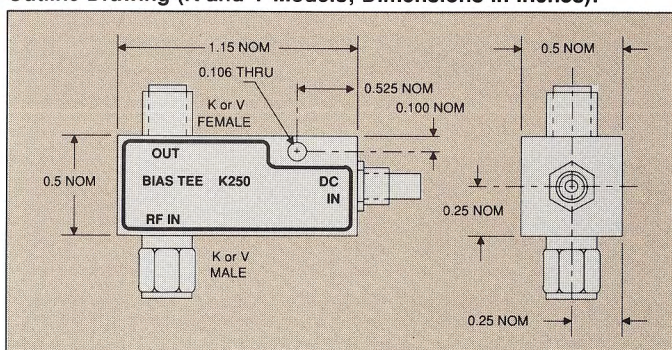
Weight: 57 g (2 oz.)

Mounting Position: Any

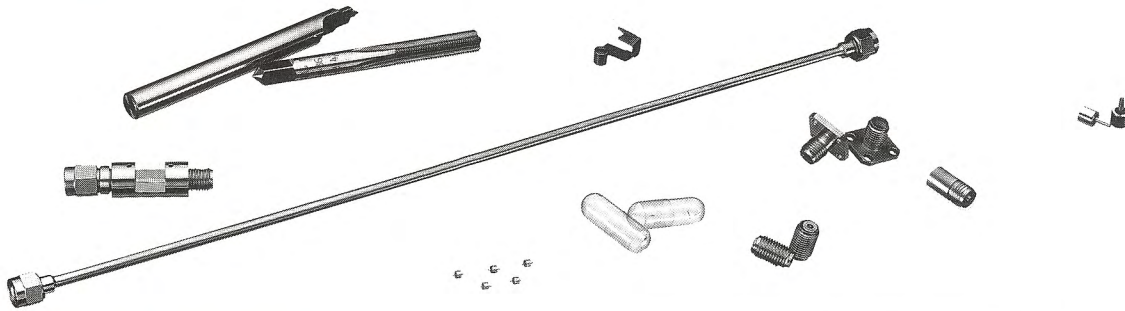
Schematic Diagram
(K and V Connector Models):



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 new V Connector®, just recently introduced by Wiltron, 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

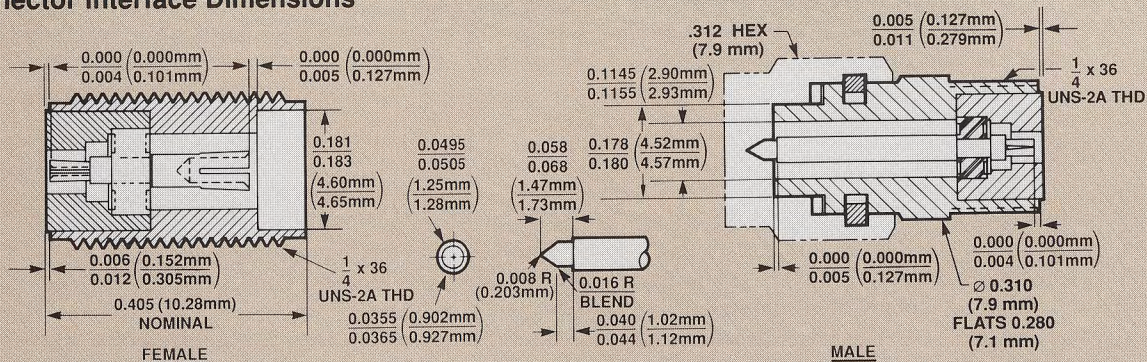
Vector Network Analyzer, page 8) and an assortment of V Connector hardware.

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.

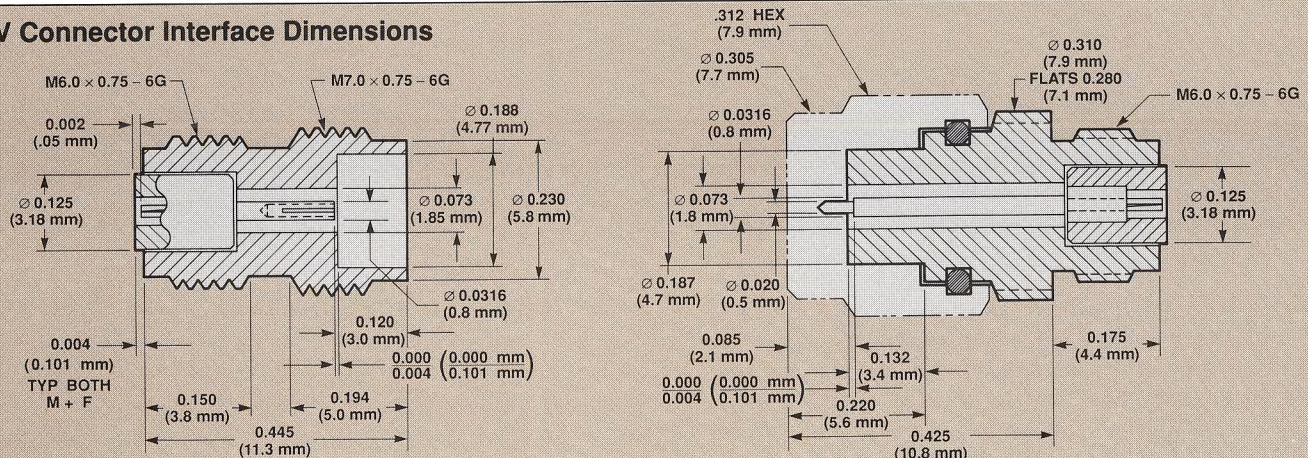
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K Connector Interface Dimensions

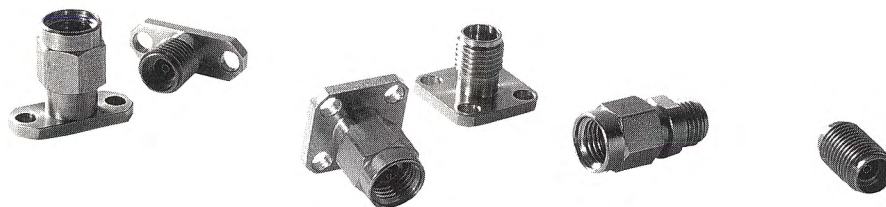


V Connector Interface Dimensions



K and V Connectors (Cont.)

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 12 mil center conductor and readily connects to fragile devices. The bead is appropriate for most applications employing Duroid and ceramic (Alumina) microstrip, such as the 10 mil wide center conductor on a 10 mil 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.

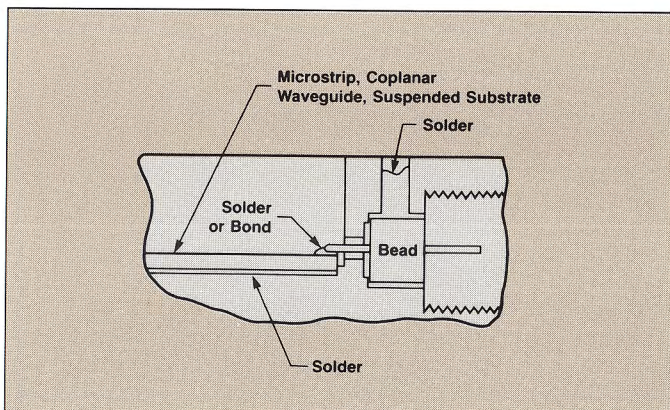
The outstanding design of the bead is largely accountable for the excellent performance of the K Connector launchers. Because the small 12 mil pin introduces minimal discontinuity, return loss is typically better than 20 dB at 40 GHz and better than 25 dB below 18 GHz. In addition, the design provides 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 overtightening. 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



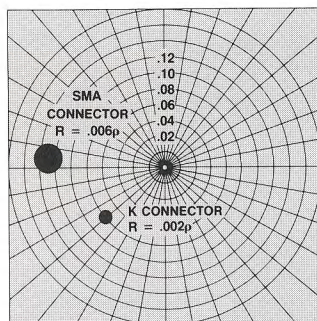
The K Connector's glass bead provides a high quality transition from a microcircuit to an outside transmission line.

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

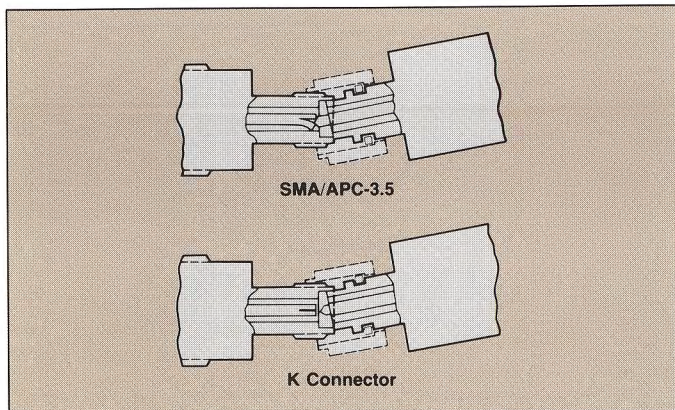
There are other advantages to the mating interface design. The K Connector female center conductor has four slots. Most SMA connectors have only two. With four slots, the pressure exerted by the male pin on the female is distributed more evenly, improving reliability and repeatability. A polar plot shows 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.

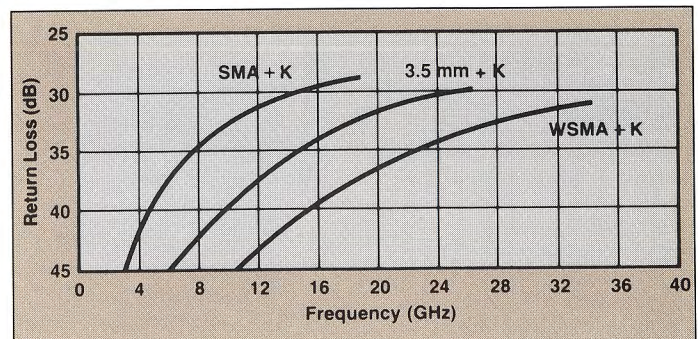
There are six different models of K Connector launchers. Two types of sparkplug (screw-in) launchers are available: the K102F female version and the K102M male version. Both screw into the housing that encloses the microwave circuit. And, like all Wiltron launchers, they can be easily removed for replacement 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). Connectors for use with 0.085-inch cable are also available.



Return loss characteristics of K Connector when mated with SMA, APC-3.5, and WSMA ensure excellent electrical compatibility.

K and V Connectors (Cont.)

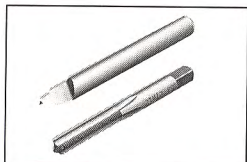
K Series; DC to 46 GHz

TOOLS AND FIXTURES

01-103 Soldering Fixture for sparkplug launcher glass beads, package of 10.



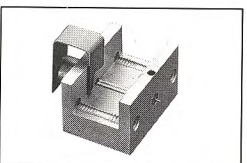
01-104 Drill and Tap Set for precision machining of concentric holes for mounting K Connector in microwave housing. Drill Part No. B14094 Tap Part No. 783-255



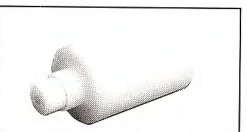
01-105 Male and Female Sparkplug Torquing Kit



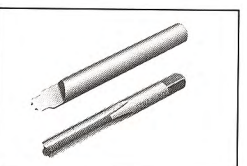
01-106 K Soldering Fixture for flange launcher glass bead, package of 5.



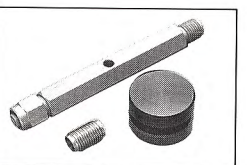
01-107M or 01-107F Cable Sleeve Soldering Fixture for K101M Male and K10F Female Cable Connectors, package of 10.



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.



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 01-104 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 (0.118 in.)

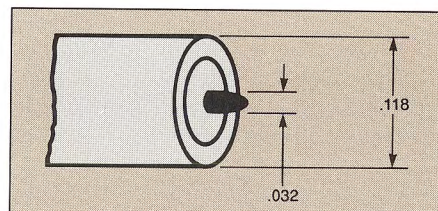
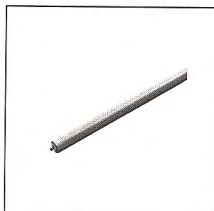
Center Conductor Diameter: 0.081 cm (0.032 in.)

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.



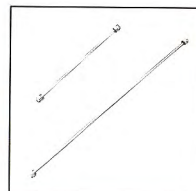
Quantity	1-9	10-49	50-99

CABLE ASSEMBLIES

K120-6 or K120-12 Cable Assemblies

Description: Semirigid cable with K101M Male connector on each end.

Quantity	1-24	25-99	100-499
K120-6 15.25 cm (6 in.)			
K120-12 30.5 cm (12 in.)			



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

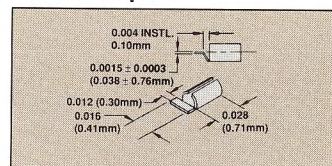
Return Loss: 20 dB @ ≤ 26.5 GHz; 17 dB @ > 26.5 GHz

Plating: 300 μ in. gold over 25 μ in. nickel flash

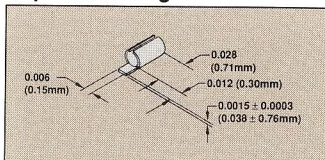
Packaging: Lots of 25

K110-2 Stripline

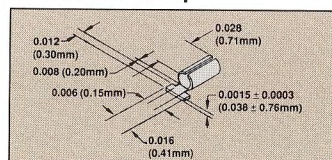
Quantity	25-99	100-499
K110-1		
K110-2		
K110-3		



K110-1 Microstrip and Coplanar Waveguide



K110-3 Microstrip



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.

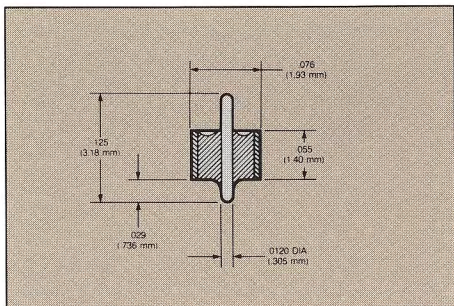
Temperature Range: -55°C to +125°C (200°C available; contact factory)

Contact the factory for order quantities greater than those listed above.

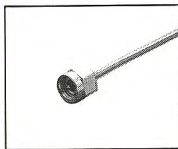


K100

Description: Glass Beads for K102, K103, and K104 connectors (package of 5)

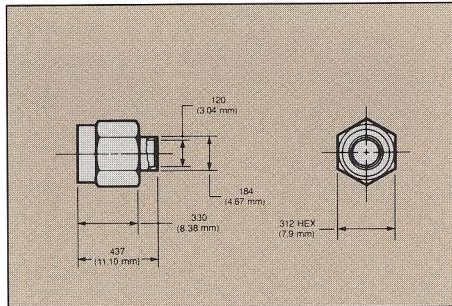


Quantity	1-24	25-99	100-499

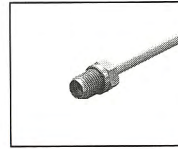


K101M

Description: K Male In-Line Cable Connector, DC-46 GHz for 0.118 cable

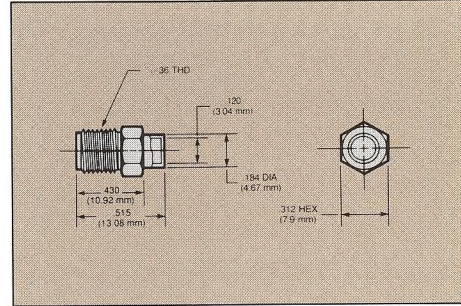


Quantity	1-24	25-99	100-499



K101F

Description: K Female In-Line Cable Connector, DC-46 GHz for 0.118 cable

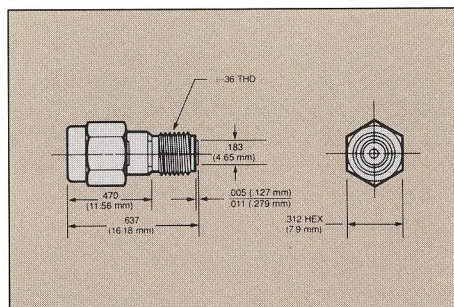


Quantity	1-24	25-99	100-499

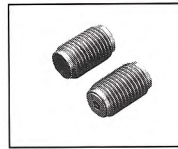


K102M

Description: K Male Sparkplug Launcher Connector, DC-46 GHz

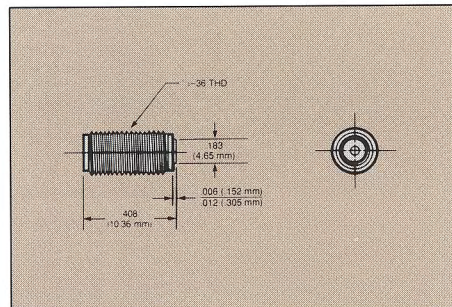


Quantity	1-24	25-99	100-499

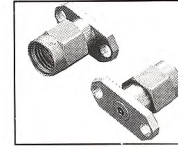


K102F

Description: K Female Sparkplug Launcher Connector, DC-46 GHz

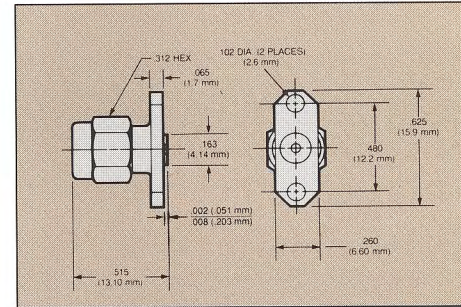


Quantity	1-24	25-99	100-499



K103M

Description: K Male Flange Launcher, two-hole, DC-46 GHz

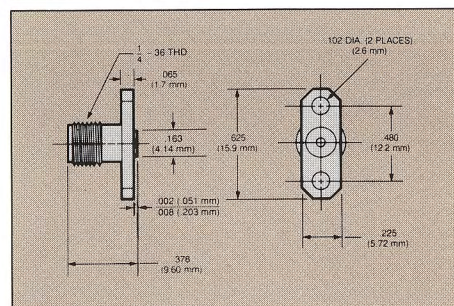


Quantity	1-24	25-99	100-499

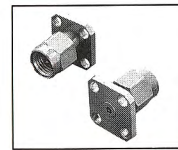


K103F

Description: K Female Flange Launcher, two-hole, DC-46 GHz

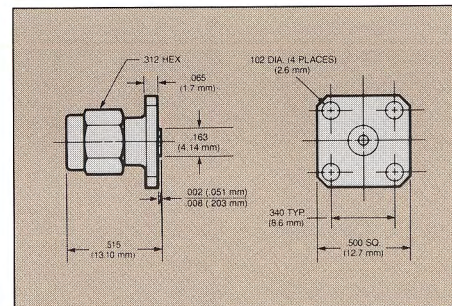


Quantity	1-24	25-99	100-499

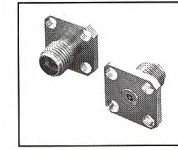


K104M

Description: K Male Flange Launcher, four-hole, DC-46 GHz

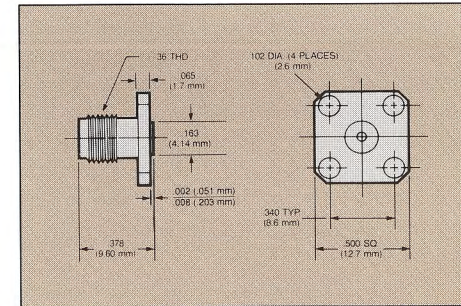


Quantity	1-24	25-99	100-499



K104F

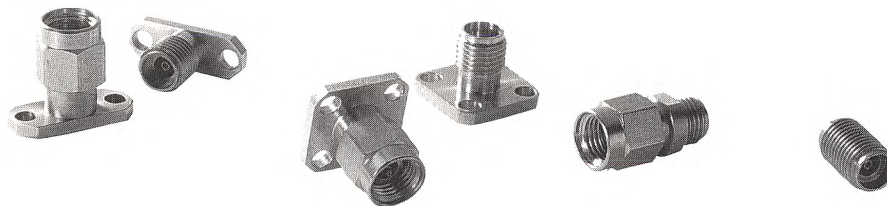
Description: K Female Flange Launcher, four-hole, DC-46 GHz



Quantity	1-24	25-99	100-499

K and V Connectors (Cont.)

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 9 mil center conductor and readily connects to fragile devices. The bead is appropriate for most applications employing Duroid® and ceramic (Alumina) microstrip, such as the 10 mil wide center conductor on a 10 mil 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 microcir-

cuit will not be subjected to the additional stress caused by heating to soldering temperature.

Exceptional Reliability and Repeatability

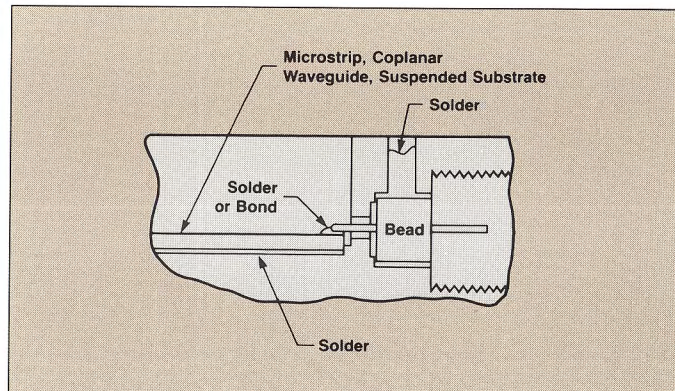
Microwave connector reliability is affected by insertion force, outer conductor strength, stress relief while mating, and mating alignment. The V Connector exhibits exceptional performance in all of these areas.

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.

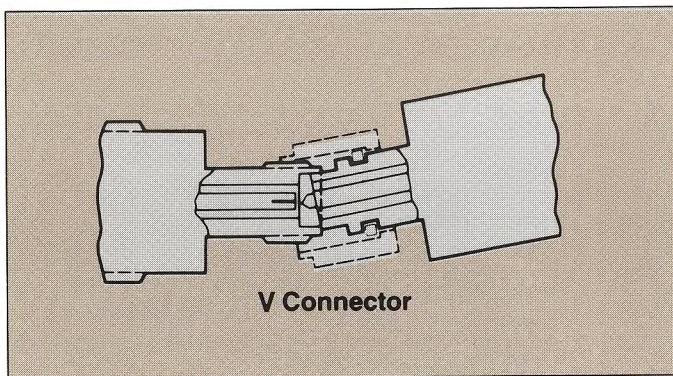
Complete Family

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



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.

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 conductor 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. The typical return loss of a Wiltron assembled cable is greater than 20 dB to 60 GHz. The maximum useable frequency range of the cables is dc to 70 GHz.

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 (Cont.)

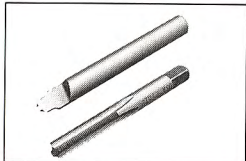
V Series; DC to 65 GHz

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.



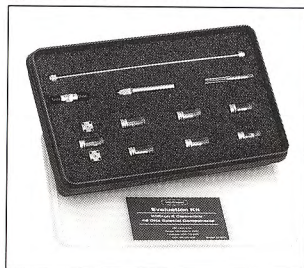
01-105A K and V Connector Male and Female Sparkplug Torquing Kit



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, two 01-302 Test Fixture, one 01-303 Soldering Fixture.



SEMRIGID 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: 0.218 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

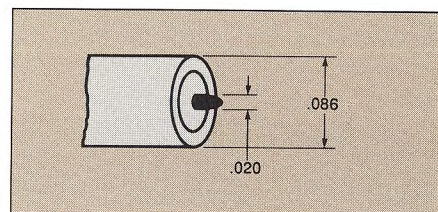
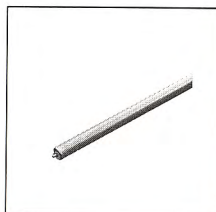
1.3 dB/ft at 30 GHz

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.



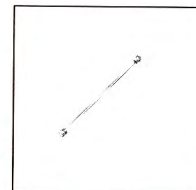
Quantity	1-9	10-49	50-99

CABLE ASSEMBLIES

V120-6 Cable Assemblies

Description: Semirigid cable with V101M Male Connector on each end. Assembled length is 15.25 cm (6 in.).

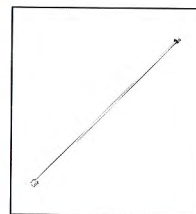
Quantity	1-24	25-99	100-499



V120-12 Cable Assemblies

Description: Semirigid cable with V101M Male Connector on each end. Assembled length is 30.5 cm (12 in.).

Quantity	1-24	25-99	100-499



MICROSTRIP-TO-V LAUNCHERS & CABLE CONNECTORS

Return Loss (launchers only): 15 dB up to 40 GHz.

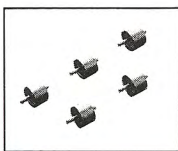
Coupling Nut Tightening Torque: 13.8 Kg-cm (12 in.-lb.) max.

Material: Passivated stainless steel with heat-treated beryllium copper center conductors.

Pin Depth: 0.000 to -0.076 mm (0.000 to -0.003 in.) for male and female connectors.

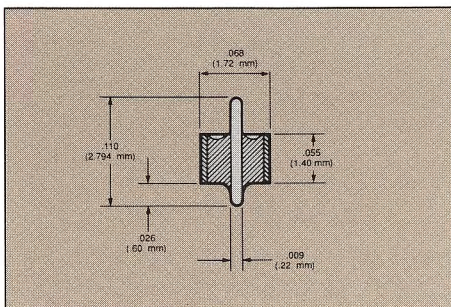
Temperature Range: -55°C to +125°C

Contact the factory for order quantities greater than those listed above.

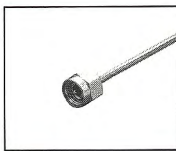


V100

Description: Glass Beads for V102 and V103 connectors (package of 5)

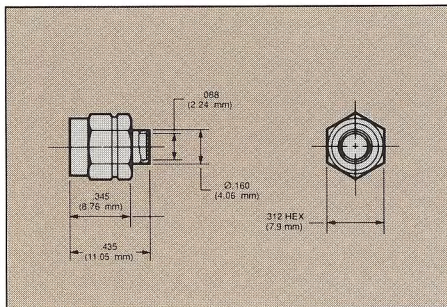


Quantity	1-24	25-99	100-499

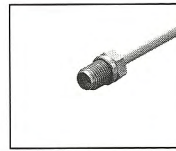


V101M

Description: V Male In-Line Cable Connector, DC-65 GHz for V085 cable

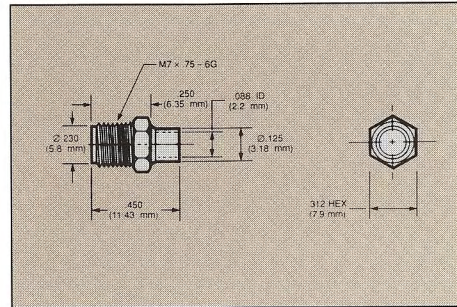


Quantity	1-24	25-99	100-499



V101F

Description: V Female In-Line Cable Connector, DC-65 GHz for V085 cable

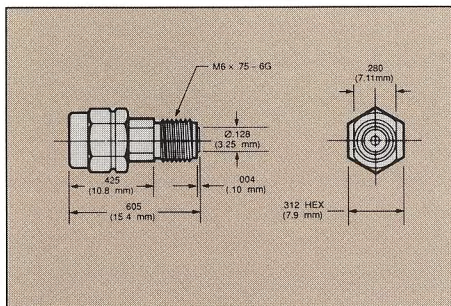


Quantity	1-24	25-99	100-499



V102M

Description: V Male Sparkplug Launcher Connector, DC-65 GHz

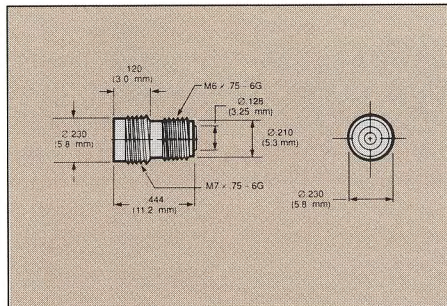


Quantity	1-24	25-99	100-499

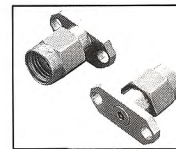


V102F

Description: V Female Sparkplug Launcher Connector, DC-65 GHz

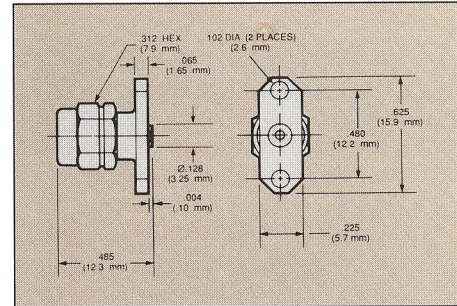


Quantity	1-24	25-99	100-499



V103M

Description: V Male Flange Launcher, two-hole, DC-65 GHz

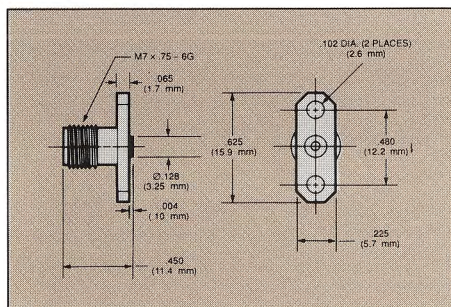


Quantity	1-24	25-99	100-499



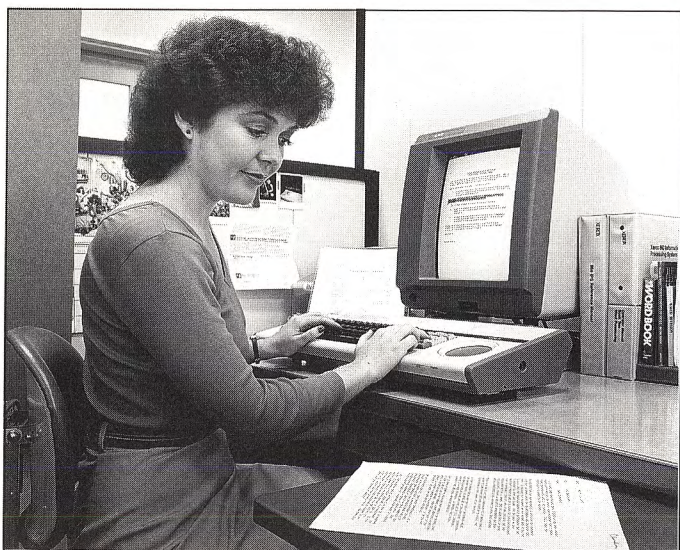
V103F

Description: V Female Flange Launcher, two-hole, DC-65 GHz



Quantity	1-24	25-99	100-499

Ordering Information



Placing Purchase Orders

Orders may be placed through Wiltron Regional or Representative Sales Offices listed inside the rear cover or directly with the factory at: Wiltron Company, 490 Jarvis Drive, Morgan Hill, California 95037-2809; Telephone: (408) 778-2000; Telex: 285227 WILTRON MH; Fax: (408) 778-0239.

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. factory. 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 at 10% of the selling price per month for a minimum rental period of 3 months. Sixty percent of the rent paid may be applied toward purchase. Two to five year lease terms are 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-03441, Section H, Instruments and Laboratory Equipment, August 1, 1988 through July 31, 1991
- Contract GS-OOF-01911, Section J, Instruments and Laboratory Equipment, February 12, 1988 through May 31, 1990

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.

Our Commitment to You

Wiltron 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

NEW

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.

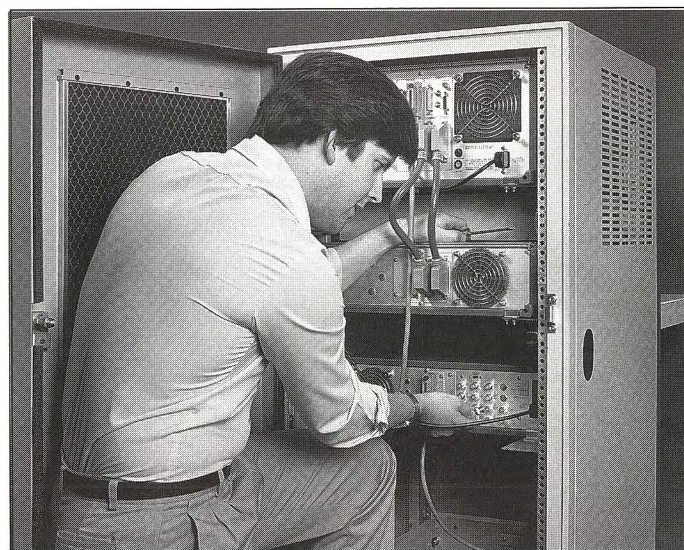
- **Repair Agreement:** Includes all labor and material required to maintain your product in good working condition. Should repair be required, the product is returned to the nearest Wiltron Service Center where it will be repaired and returned within the time span stated on the agreement (generally 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 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 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 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. Your Service Engineer can give you details on establishing a Blanket Service Agreement.
- **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 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.

Sales Offices

USA

ALABAMA

GENTRY ASSOCIATES, INC.
4950 Research Drive
Huntsville, AL 35805
Telephone: (205) 837-0692

ALASKA

WILTRON COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037
Telephone: (408) 778-2000

ARIZONA

TREMBLY ASSOCIATES, INC.
2740 S. Hardy Drive, Suite 3
P.O. Box 27468
Tempe, AZ 85282
Telephone: (602) 967-2058 (Phoenix)
(602) 790-9945 (Tucson)

ARKANSAS

TESTECH, INC.
401 International Parkway, Suite 108
Richardson, TX 75081
Telephone: (214) 644-5010

CALIFORNIA (Northern)

WILTRON AREA OFFICE
2025 Gateway Place, Suite 138
San Jose, CA 95110
Telephone: (408) 452-8848

CALIFORNIA (Southern)

BLAIR ASSOCIATES
2568 West Woodland Drive
Anaheim, CA 92801
Telephone: (714) 220-1201

COLORADO

TREMBLY ASSOCIATES, INC.
4800 Wadsworth Blvd., Suite 208
Wheatridge, CO 80033
Telephone: (303) 421-8900

CONNECTICUT

CENTRAL ASSOCIATES NY/NJ, INC.
11 Neil Drive
Old Bethpage, NY 11804
Telephone: (516) 694-3205

DELAWARE

WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (301) 381-5397

DISTRICT OF COLUMBIA

WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (301) 381-5397

FLORIDA (Orlando)

GENTRY ASSOCIATES, INC.
2447 Orlando Central Parkway
Orlando, FL 32809-6989
Telephone: (407) 859-7450

FLORIDA (Tampa)

GENTRY ASSOCIATES, INC.
5460 Beaumont Center Drive, Suite 542
Tampa, FL 33634
Telephone: (813) 886-0720

GEORGIA

GENTRY ASSOCIATES, INC.
9800 Grimes Bridge Road
Roswell, GA 30075
Telephone: (404) 998-2828

HAWAII

WILTRON COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037
Telephone: (408) 778-2000

IDAHO (Western)

CAIN-WHITE & COMPANY, INC.
10800 NE 8th Street, Suite 800
Bellevue, WA 98004
Telephone: (206) 462-2118

IDAHO (Eastern)

TREMBLY ASSOCIATES, INC.
450 East 1000 North, Suite 312
North Salt Lake, UT 84054
Telephone: (801) 295-4703

ILLINOIS (Eastern)

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
6357 Green Leaves Road
Indianapolis, IN 46220
Telephone: (317) 257-7231

ILLINOIS (Northern)

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
1400 Renaissance Drive
Park Ridge, IL 60068
Telephone: (708) 298-2290

ILLINOIS (Southern and Western)

EIR COMPANY
Route 1, Box 95
Leasburg, MO 65535
Telephone: (314) 245-6579

INDIANA

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
6357 Green Leaves Road
Indianapolis, IN 46220
Telephone: (317) 257-7231

IOWA

EIR COMPANY
1212 Bowler St.
Hiawatha, IA 52233
Telephone: (319) 395-7500

KANSAS

EIR COMPANY
605 NW 44th Terrace
Kansas City, MO 64116
Telephone: (816) 452-7030

KENTUCKY (Western)

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
6357 Green Leaves Road
Indianapolis, IN 46220
Telephone: (317) 257-7231

KENTUCKY (Eastern)

EQS SYSTEMS, INC.
7009 B Taylorsville Road
Dayton, OH 45424
Telephone: (513) 236-7676

LOUISIANA

GENTRY ASSOCIATES, INC.
5460 Beaumont Center Drive, Suite 542
Tampa, FL 33634
Telephone: (813) 886-0720

MAINE

WILTRON AREA OFFICE
53 Commerce Way
Woburn, MA 01801
Telephone: (617) 933-8330

MARYLAND

WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (301) 381-5397

MASSACHUSETTS

WILTRON AREA OFFICE
53 Commerce Way
Woburn, MA 01801
Telephone: (617) 933-8330

MICHIGAN

EQS SYSTEMS, INC.
9388 Lilley Road
Plymouth, MI 48170
Telephone: (313) 455-5760

MINNESOTA

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
4166 Heatherston Place
Minnetonka, MN 55345
Telephone: (612) 933-7793

MISSISSIPPI

GENTRY ASSOCIATES, INC.
4950 Research Drive
Huntsville, AL 35805
Telephone: (205) 837-0692

MISSOURI (Eastern)

EIR COMPANY
Route 1, Box 95
Leasburg, MO 65535
Telephone: (314) 245-6579

MISSOURI (Western)

EIR COMPANY
605 NW 44th Terrace
Kansas City, MO 64116
Telephone: (816) 452-7030

MONTANA

TREMBLY ASSOCIATES, INC.
450 East 1000 North, Suite 312
North Salt Lake, UT 84054
Telephone: (801) 295-4703

NEBRASKA

EIR COMPANY
1212 Bowler St.
Hiawatha, IA 52233
Telephone: (319) 395-7500

NEVADA (Northern)

WILTRON AREA OFFICE
2025 Gateway Place, Suite 138
San Jose, CA 95110
Telephone: (408) 452-8848

NEVADA (Southern)

TREMBLY ASSOCIATES, INC.
5030 Paradise Road, Suite B109
Las Vegas, NV 89119
Telephone: (702) 739-9770

NEW HAMPSHIRE

WILTRON AREA OFFICE
53 Commerce Way
Woburn, MA 01801
Telephone: (617) 933-8330

NEW JERSEY (Northern)

CENTRAL ASSOCIATES NY/NJ, INC.
29 Canterbury Road
Chatham, NJ 07928
Telephone: (201) 568-0808

NEW JERSEY (Southern)

WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (215) 934-3728

NEW MEXICO

TREMBLY ASSOCIATES, INC.
119 Quincy N.E.
Albuquerque, NM 87108
Telephone: (505) 266-8616 (North)
(505) 526-1615 (South)

NEW YORK

(Metro New York City Area)
CENTRAL ASSOCIATES NY/NJ, INC.
11 Neil Drive
Old Bethpage, NY 11804
Telephone: (516) 694-3205

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EM-TECH ASSOCIATES, INC.
5 Adler Drive
East Syracuse, NY 13057
Telephone: (315) 437-6410

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GENTRY ASSOCIATES, INC.
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Telephone: (919) 584-1620

NORTH DAKOTA

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4166 Heatherston Place
Minnetonka, MN 55345
Telephone: (612) 933-7793

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EQS SYSTEMS, INC.
8588 Mayfield Road
P.O. Box 445
Chesterland, OH 44026
Telephone: (216) 729-2222

OHIO (Southern)

EQS SYSTEMS, INC.
7009 B Taylorsville Road
Dayton, OH 45424
Telephone: (513) 236-7676

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TESTECH, INC.
401 International Pkwy., Suite 108
Richardson, TX 75081
Telephone: (214) 644-5010

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CAIN-WHITE & COMPANY, INC.
10800 NE 8th Street, Suite 800
Bellevue, WA 98004
Telephone: (206) 462-2118

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WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (215) 934-3728

PENNSYLVANIA (Western)

EQS SYSTEMS, INC.
8588 Mayfield Road
P.O. Box 445
Chesterland, OH 44026
Telephone: (216) 729-2222

RHODE ISLAND

WILTRON AREA OFFICE
53 Commerce Way
Woburn, MA 01801
Telephone: (617) 933-8330

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GENTRY ASSOCIATES, INC.
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Roswell, GA 30075
Telephone: (404) 998-2828

SOUTH DAKOTA

ELECTRONIC INSTRUMENT
ASSOCIATES, INC.
4166 Heatherston Place
Minnetonka, MN 55345
Telephone: (612) 933-7793

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4950 Research Drive
Huntsville, AL 35805
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Austin, TX 78759
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Albuquerque, NM 87108
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4201 FM 1960 West, Suite 310
Houston, TX 77068
Telephone: (713) 893-9661

TEXAS (Dallas/Ft. Worth)

TESTECH, INC.
401 International Parkway, Suite 108
Richardson, TX 75081
Telephone: (214) 644-5010

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North Salt Lake, UT 84054
Telephone: (801) 295-4703

VERMONT

WILTRON AREA OFFICE
53 Commerce Way
Woburn, MA 01801
Telephone: (617) 933-8330

VIRGINIA

WILTRON-MID ATLANTIC
10290B Old Columbia Road
Columbia, MD 21046
Telephone: (301) 381-5397

WASHINGTON

CAIN-WHITE & COMPANY, INC.
10800 NE 8th Street, Suite 800
Bellevue, WA 98004
Telephone: (206) 462-2118

WEST VIRGINIA

EQS SYSTEMS, INC.
8588 Mayfield Road
P.O. Box 445
Chesterland, OH 44026
Telephone: (216) 729-2222

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1400 Renaissance Drive
Park Ridge, IL 60068
Telephone: (708) 298-2290

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WILTRON PTY. LTD.
1/410 Church Street
North Parramatta
NSW 2151 Australia
Telephone: (02) 6308166
Fax: (02) 6836997

AUSTRIA

WILTRON GmbH
Rudolf Diesel Str 17
8031 Gilching, West Germany
Telephone: (08105) 8055
Telex: (841) 528523
Fax: (08105) 1700

BADEN BADEN OFFICE
Telephone: (49) 7221-54055
Fax: (49) 7221-1655

BELGIUM

HEYNEN N.V.
Industriepark Houthalen-Zuid
De Koelen 6
3530 Houthalen
Telephone: (011) 525757
Telex: (846) 39047
Fax: (011) 525777

BRAZIL

TECELINCO TECNOLOGIA
ELECTRONICA LTDA.
Rua Major Sertorio, 463 - 4 Andar
01222 Sao Paulo
Telephone: (011) 2573645
Telex: (391) 1125588 PYRO BR
Fax: (011) 2566446

CANADA

WILTRON INSTRUMENTS LTD.
215 Stafford Road, Unit 102
Nepean, Ontario K2H 9C1
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P.O. Box 2452, Beijing
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FAX: (01) 201-7108

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Carrera 71, No. 55-98, Bogota
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Fax: (01) 263-2874

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P.O. Box 620-1000, San Jose
Telephone: (31) 5701
Telex: (303) 2645 ELEPEX
Fax: (31) 6531

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S C METRIC A/S
Skodsborgvej 305
DK-2850 Naerum
Telephone: (42) 804200
Telex: (855) 37163
Fax: (42) 804131

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2 El Mesaha Square, Dokki, A.R.E.
P.O. Box 1913, Cairo 11511
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Fax: (02) 3499253

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INSTRUMENTARIUM ELEKTRONIIKKA
P.O. Box 64, Vitikka 1
SF-02631 Espoo
Telephone: (0) 5281
Telex: (857) 124426 HAVUL
Fax: (0) 5021073

FRANCE

WILTRON S.A.
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: (1) 6446546
Fax: (1) 64461065

WEST GERMANY

WILTRON GmbH
Rudolf Diesel Str 17, 8031 Gilching
Telephone: (08105) 8055
Telex: (841) 528523
Fax: (08105) 1700

WILTRON GmbH

Baden-Baden
Telephone: (07221) 54055
Fax: (07221) 1655

GREECE

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302 Messogian Avenue
GR-155 62 Holargos Athens
Telephone: (01) 6527008
Telex: (863) 224105
Fax: (01) 6516712

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SCHMIDT & COMPANY (H.K.) LTD.
18th Floor, Great Eagle Centre
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Telephone: (05) 8330222
Telex: (780) 74766
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NATIONAL TELECOM OF INDIA LTD.
F-16-17 Commerce Centre
78, Tardeo Road
Bombay 400 034
Telephone: (22) 4938080
Telex: (953) 1176180
Fax: (22) 6300389

BANGALORE OFFICE

203, Somerset Apartments
B-Block M G Road
Opp Taj Residency
Bangalore 560 001
Fax: (812) 563548
Telex: (953) 8458367
Telephone: (812) 568128

INDONESIA

PT CENTRONIX
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Telex: (796) 48216
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Lynwood House, Ballinteer Road,
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Fax: (01) 988958

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P.O. Box 43259
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Fax: (03) 481958

ITALY

WILTRON Sp.A.
Via E. Vittorini 129
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Fax: (06) 5005273

WILTRON Sp.A.

Centro Direzionale Colleoni
Palazzo Andromeda 2
20041 Agrate Brianza ZA (MI), Milano
Telephone: (39) 651871
Fax: (39) 6056589

JAPAN

WILTRON K.K.
5 Chome, 29-20, Shiba,
Mita Building 6F, Minato-ku Tokyo 108
Telephone: (03) 7980411
Fax: (03) 7980419

WILTRON K.K.

Saito Bldg. #201, 3-35-11, Tsuruya-cho
Kanagawa-ku, Yokohama 221
Telephone: (045) 316-0381
Fax: (045) 316-0380

WILTRON K.K.

Osaka Sales Office
Telephone: (06) 7280532
Fax: (06) 7283348

KOREA

WILTRON CORPORATION
1201 Sinsong Bldg., 25-4 Yeoeui
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Telephone: (02) 785-6407
Fax: (02) 784-6409

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P.O. Box Safat 20506, 13066 SAFAT
Telephone: (02) 436100
Telex: (959) 22315 KT
Fax: (02) 437700

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HEYNEN N.V.
Industriepark Houthalen-Zuid
De Koelen 6, 3530 Houthalen, Belgium
Telephone: (11) 525757
Telex: (846) 39047
Fax: (11) 525777

MALAYSIA

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Lot 20, Jalan 225
46700 Petaling Jaya, Selangor
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Telex: (784) 37764
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10 Woodhall Road, Epsom
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Fax: (09) 601720

NORWAY

WILTRON AB
Box 247
S-127 25 Skarholmen, Sweden
Telephone: (46) 8-7405840
Telex: (854) 8135089
Fax: (46) 8-7109960

PAKISTAN

SUPERIOR ELECTRONICS
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B-98 Block H
North Nasimabad, Karachi 33
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(Edificio Rimac) Lima 1
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SINGAPORE ELECTRONIC &
ENGINEERING (PRIVATE), LTD.
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Industrial Park 3
Singapore 2056
Telephone: 4818888
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P.O. Box 39127, Bramley 198
Telephone: (011) 7863170
Telex: (960) 451821 SA
Fax: (011) 7865891

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UNITRONICS, S.A.
Plaza Espana, 18
Torre de Madrid
Pl. 12, Ofc. 9, 28008 Madrid
Telephone: (01) 5425204
Telex: (831) 46786
Fax: (01) 2484228

UNITRONICS S.A.

Infanta Carlota 80-82
08029 Barcelona
Telephone: (03) 3212800
Telex: (831) 54211 UTRON E
Fax: (03) 3226800

SWEDEN

WILTRON AB
Box 247
S-127 25 Skarholmen
Telephone: (08) 7405840
Telex: (854) 8135089
Fax: (08) 7109960

SWITZERLAND

AMOTEC ELECTRONIC AG
Buehlstr. 1 / P.O. Box 45
CH-8125 Zollikerberg
Telephone: (01) 3915901
Telex: (845) 816906
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TAIWAN

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Roosevelt Road, Taipei
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12 Soi Pasana, Ekamai
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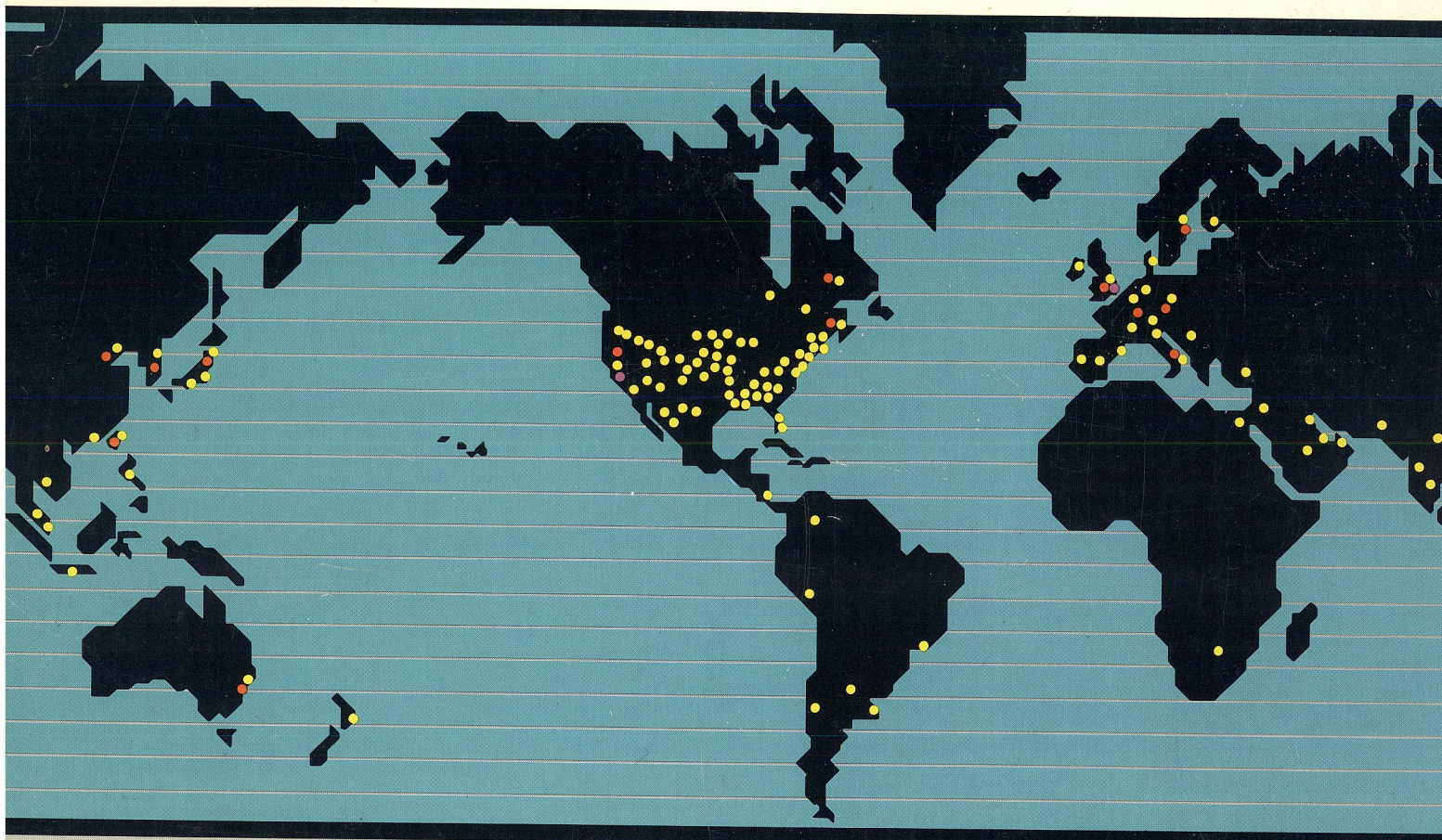
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England
Telephone: (0344) 777778
Telex: (851) 847913
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WILTRONCOMPANY
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