

S600DC/RF

DC/RF Parametric Test System



- Combines DC and RF measurement functions in a single tester/prober combination
- Independent DC and RF test execution
- Incorporates technology-leading Vector Network Analyzers and DC/RF probe cards
- Uses existing S600 and S630 systems
- 12 term SOLT calibration or user-defined calibration algorithm
- 1fA/1 μ V DC precision
- 1Hz frequency resolution
- Compatible with 200mm and 300mm probes
- Supports “lights out” factory automation
- Adapts easily and economically to new processes and applications

High Performance Single-Insertion RF and DC Test Solution

Keithley's S600DC/RF Test System is designed to speed and simplify measuring RF parameters in concert with DC parametric testing. This system integrates DC and RF parametric testing capabilities in a single automated tester, allowing independent DC and RF test execution when used with a suitable test structure layout. The S600DC/RF system adds 2-port s-parameter measurement capabilities to Keithley's S600 Series Automated Parametric Test Systems, one of the most versatile and widely accepted DC test platforms available.

The measurement capabilities built into the S600DC/RF system were defined in cooperation with leading manufacturers of telecommunications components, many of whom employ Keithley test systems in their wafer fabrication facilities. To meet their requirements, Keithley has formed working partnerships with two companies at the cutting edge of RF test technology—Anritsu Corporation, a leading producer of Vector Network Analyzers (VNAs), and GGB Industries, Inc., the foremost maker of combined DC/RF probe cards.

The S600 DC/RF Test System is targeted at the technology development testing needs of a fab's modeling and process integration engineering departments as well as manufacturing test operations. It offers an economical wafer level testing approach to handling the growing demand for wireless and telecom devices.

Dramatic Reductions in COT

The S600DC/RF System offers fabs producing components for telecommunications manufacturers a variety of ways to reduce their Cost of Test at the wafer level. The most obvious advantage is the extended use of existing S600 testers. By re-purposing these testers, fabs can continue to get returns on their original investments while adding RF testing functionality. Combining RF and DC parametric testing capabilities in a single existing system eliminates the high cost and significant floor space required for a separate RF tester and prober. The S600DC/RF is compatible with many popular probes, including many of those used with existing S600 testers.

Throughput improvements also allow S600DC/RF users to reduce their testing costs dramatically; depending on the system configuration chosen, S600DC/RF testers can offer up to ten times faster throughput than other RF testing approaches. This speed increase is made possible through the use of Anritsu's self-calibrating Vector Network Analyzer and GGB's DC/RF probe cards and calibration substrates. These system components work in cooperation with the rest of the tester hardware to reduce measurement calibration time to less than two minutes. The S600DC/RF tester employs a full Short-Open-Load-Through (SOLT) system-level measurement calibration process. By giving users improved confidence in the integrity of their test results, this calibration technique, which includes enhanced reflection standards, helps eliminate the need for time-consuming re-probing.

The system software includes a library of test macros that allow users to reduce 2-port s-parameters (transmission and reflection) to RF parameters rapidly and automatically. These parameters include maximum frequency, transit



Electrical precision and mechanical stability ensure highly repeatable RF parametric measurements.

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Speed and simplify DC and RF testing

SEMICONDUCTOR

S600DC/RF

Ordering Information

60500

High frequency, 2-port
s-parameter measurement
system upgrade for S600
systems

This product is available with
an Extended Warranty.

APPLICATIONS

Wafer level s-parameter testing for:

- Device modeling (data compatible with popular packages such as BSIMPRO, IC-CAP, UTMOST)
- Process monitoring (with test macros for converting s-parameters to RF parameters such as f_{max} , f_t , R_{bb} , and Q)
- General analysis of complex signals, including user-defined combinations of a_1 , a_2 , b_1 , and b_2

DC/RF Parametric Test System

time as a function of current, base resistance of the bipolar transistor, and inductor quality. The repeatable, reliable measurements produced by the S600DC/RF tester correlate to any properly configured benchtop or rack solution.

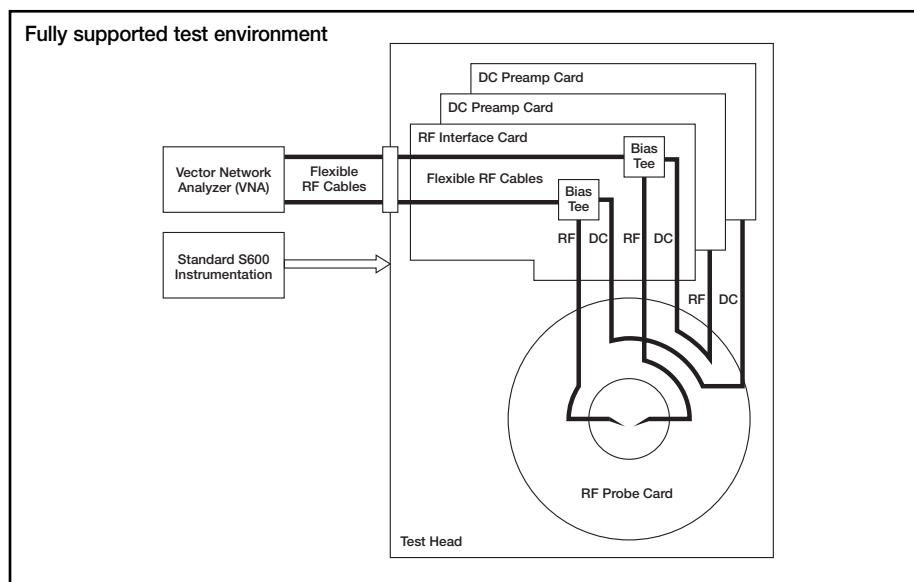
Ultra-Low-Loss Interconnect

The S600DC/RF's measurement accuracy is specified as a complete system—VNA, interconnects, probe card adapter, probe card, and the calibration substrate—right to the probe tips. The S600DC/RF's high accuracy is a sharp contrast to the typical rack-and-stack RF testing approach, the accuracy of which depends largely on the skill of the engineer assembling the system and the care with which it is maintained and operated.

Fully Supported Test Environment

Unlike existing rack-and-stack approaches to RF parametric testing, which are often difficult to maintain or expand as needs change, the S600DC/RF tester is based on a standard test environment, the latest release of the Keithley Test Environment. All currently marketed Keithley testers can be operated in this same testing environment, which shortens the learning curve associated with new systems or applications significantly. Just as important, KTE provides the foundation for a growing line of operational productivity tools from Keithley. These optional tools include:

- The new WaferMap Software Option, which enables test engineers and operators to do rapid on-tester visualization, plotting, and analysis of parametric test data at the site, die, wafer, and cassette levels. It includes tools for visualizing and analyzing both live test data (dynamic results displayed in real time from tests in progress) and stored test data.
- SofTouch Probing Solution. Unlike aluminum pads, probing copper pads typically doesn't produce scrub marks, which are used to verify contact. The SofTouch probing solution automates detecting probe-to-pad contact on copper pads. It minimizes overdrive while maximizing contact.
- Probe Tip Cleaning Option. Probing copper pads requires more frequent cleaning than the traditional aluminum pads. The automated Probe Tip Cleaning technique tracks probe tip usage, allowing tips to be cleaned before data integrity can be compromised. Tips are cleaned automatically when cleaning is required, and the system returns to testing without the need for operator intervention. This solution is compatible with most major automatic wafer probers.
- Keithley Recipe Manager Option. This package helps test program developers generate valid test plans quickly by allowing them to modify existing test plans easily for reuse. By providing the version control



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tools needed to prevent unintentional, undesired, or undocumented code changes, it also ensures only approved test sequences are released to production.

- Copper Analysis Algorithm Library. To help fabs address new process monitoring challenges, Keithley has bundled a library of copper process analysis algorithms and test structures with other utilities designed to speed and simplify copper process monitoring.
- Adaptive Testing enhances throughput, yield, and process control by enabling the test system to make automatic changes to the test plan for each wafer being tested. These changes may be based on pre-defined zones or patterns contained in the wafer definition file. The software also supports result-based testing, which changes the sites and/or tests to be used based on the results of previous site tests.
- A SECS-II/GEM interface for easy tester integration into fab-wide automation/control systems.

In addition to these capabilities, KTE offers test engineers the flexibility of User Access Points (UAPs), which simplify integrating fab-specific functionality into the overall test environment. Backed by Keithley's worldwide technical and applications support network, KTE eliminates the time-consuming and cumbersome programming of new test functions associated with older RF test hardware. There's no need for the device modeling engineer to "babysit" a problematic test setup, so he can spend time analyzing reliable data because all aspects of system automation and program generation are part of a standard, well-supported test environment.

S600DC/RF SYSTEM BENEFITS

The S600DC/RF test solution offers fabs' modeling and process integration engineering departments capabilities and advantages never before available:

- Up to 10 times faster throughput than other RF approaches.
- Integrated single-insertion DC/RF test solution.
- Complete-high speed 12 term SOLT calibration process and supporting substrates.
- Fully integrated package with ultra-low-loss interconnections for high accuracy measurements.
- Full range of DC measurements to provide complete DC and RF characterization and monitoring.
- A full package of RF extraction library routines to provide industry standard analysis.
- Support for user extensions of extraction library to provide company specific analyses.
- Complete KTE support for development and operational tools that are easy to use.

60500-13.5G: 13.5GHz VNA without Switch Matrix

RF PARAMETERS:

FREQUENCY: 40MHz-13.5GHz

IMPEDANCE: 50Ω

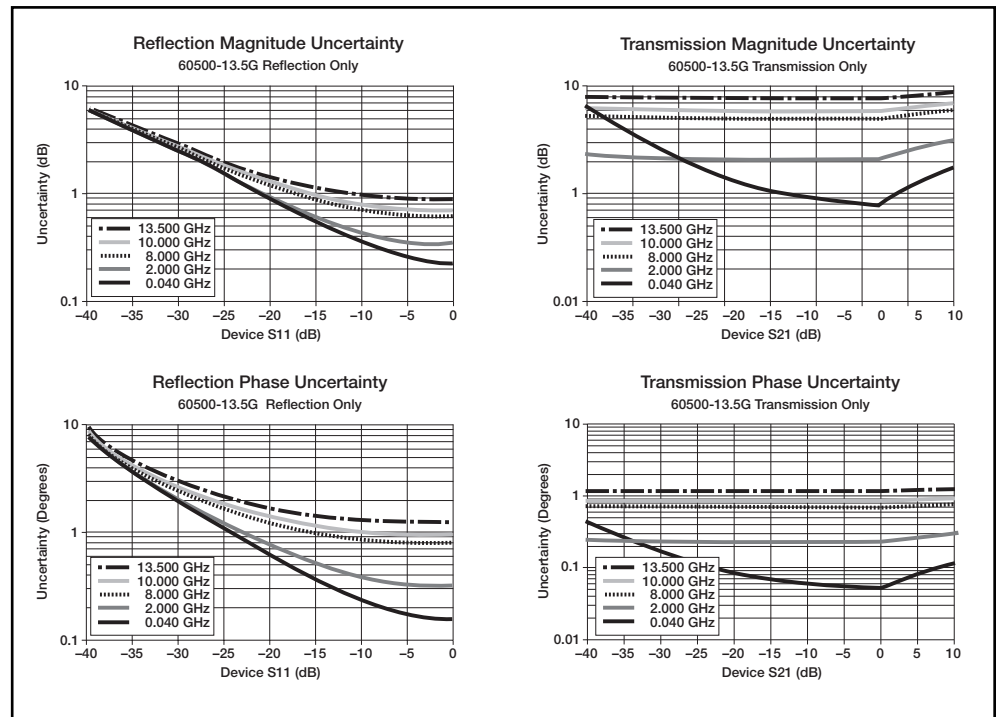
PROBE CARD: Coplanar Probes – Ground, Signal, Ground.

CALIBRATION SUBSTRATE: Manufactured for probe card design.

DC BIAS: 16V max., 500mA max.¹

MEASUREMENT UNCERTAINTY²:

The graphs give measurement uncertainty 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 graphs, 10Hz IF bandwidth and averaging of 512 points were used. Changes in the IF bandwidth or averaging can result in variations at low levels. 0dB = -7dBm.



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60500-20G: 20GHz VNA without Switch Matrix

RF PARAMETERS:

FREQUENCY: 40MHz–20GHz

IMPEDANCE: 50Ω

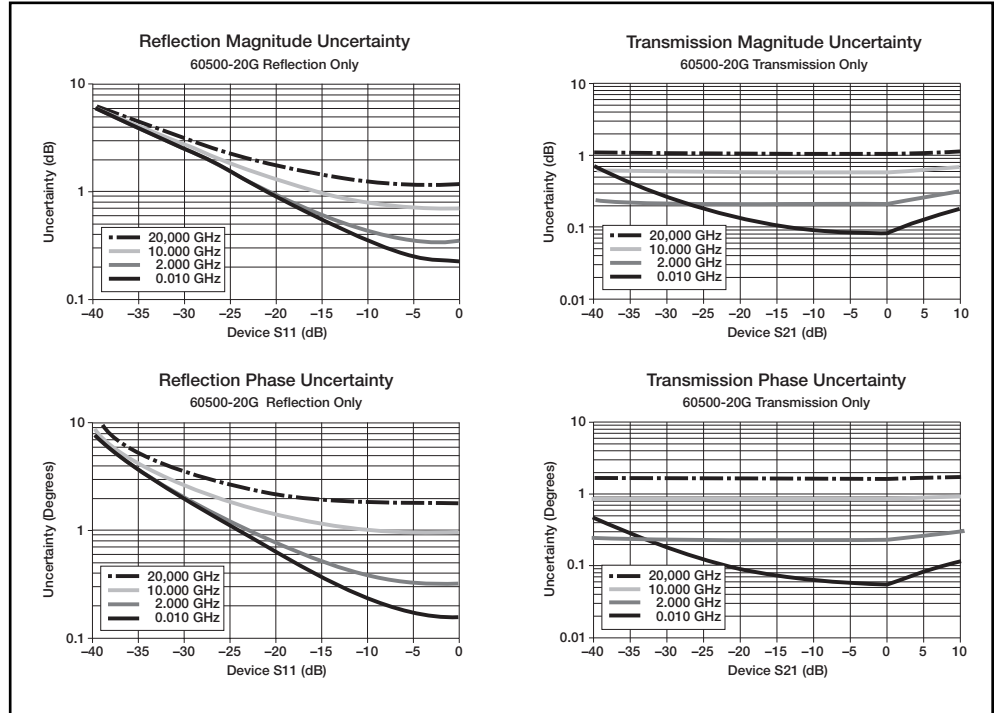
PROBE CARD: Coplanar Probes – Ground, Signal, Ground.

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GENERAL

SAFETY: Conforms with European Union Directive 73/23/EEC: EN61010-1.

EMC: Conforms with European Union Directive 89/336/EEC: EN61326.

ENVIRONMENT:

Operating: 18°C to 28°C, <50% relative humidity, ±3°C operation from calibration temperature.

Storage: -25°C to +65°C.

NOTES:

1. The S600 system is capable of outputting higher voltages and currents than the bias tees are rated. The user must take this into consideration when programming the test routines by limiting voltage and current levels.
2. All RF specifications listed are typical based on a 24 hour calibration and are relative to the calibration substrate and the calibration factors provided with the calibration substrate. Changing of probe card, breaking and reconnecting interconnect cables, or 24 hours elapsed time from calibration requires that the system be recalibrated.

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