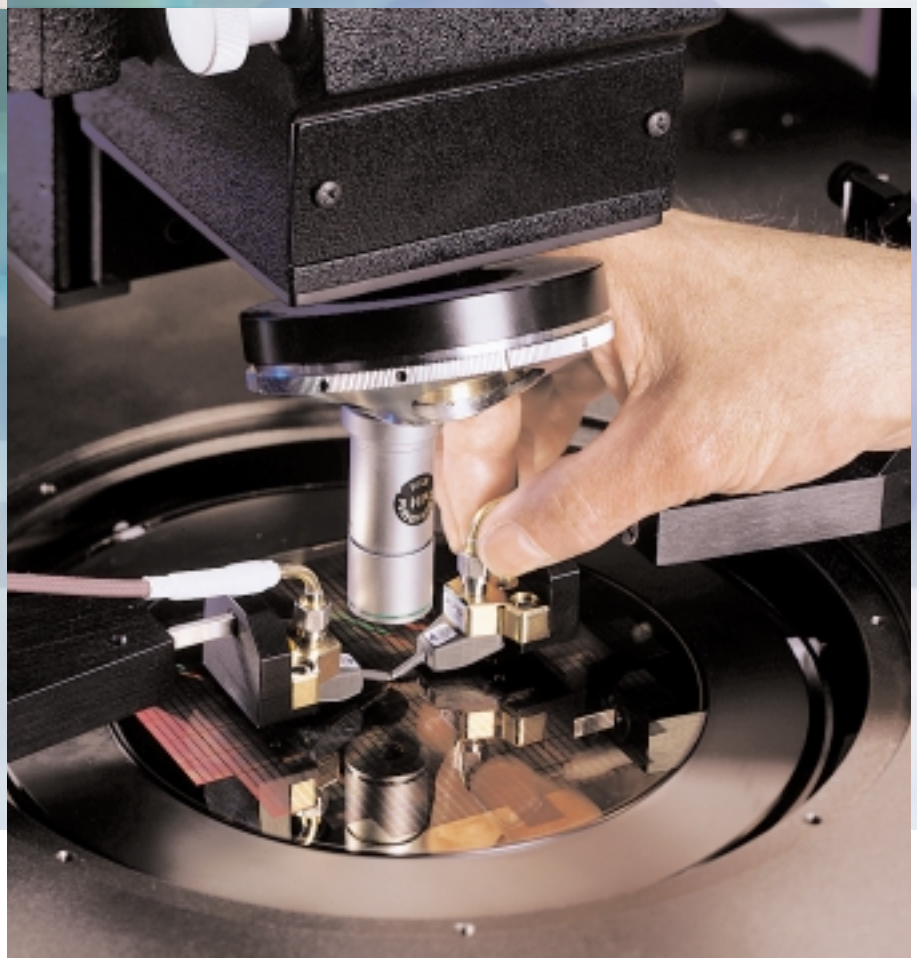




The Air Coplanar™ Probe offers a highly compliant, rugged probe with the lowest insertion loss available.

Cascade Microtech combines its extensive probing experience with the outstanding characteristics of Air Coplanar Probe (ACP) technology to create these high-performance probes. The result is a highly compliant, rugged probe with the lowest insertion loss in the industry and superior calibration accuracy.

CASCADE® MICROTECH

Innovating Test Technologies



Air Coplanar Probe family members are available for all frequency requirements and suitable industry standard connector types.

The ACP110-L offers typically less than 1.0 dB insertion loss when probing up to 110 GHz.



The World Leader in Probing Technology

With the introduction of the world's first 18 GHz wafer probe in 1983, Cascade Microtech established itself as the leader in microelectronic probing. Since then our innovative design, fabrication, microassembly, and measurement techniques have been recognized in more than 20 technical patents.

This emphasis on technological innovation, combined with our extensive probing experience and superior manufacturing techniques has led to the development of the patented Air Coplanar™ Probes (ACPs).

Air Coplanar refers to the unique "coplanar waveguide in air" construction of the probe tip. This tip construction results in a controlled impedance transmission line with individually supported, compliant contact fingers.

ACP probes now cover a wide range of frequencies and are available in single or multiple tip configurations.

A Broad Family for Diverse Applications

The Air Coplanar Probe was developed in response to the need for a rugged microwave probe with a compliant tip for accurate, repeatable measurements on-wafer. Air Coplanar Probes feature vastly improved probe-tip visibility and the lowest loss available.

The best selling ACP40 (with 150 µm contact pitch) in the ground-signal-ground configuration leads the industry. Metrology grade measurement accuracy, combined with precise probe mechanics make the ACP the best performing, most widely used microwave probe available.

With specifications of less than 0.6 dB insertion loss (ACP40-L low-loss configuration) and typical return loss better than 20 dB, the ACP40 provides a nearly ideal transition from coaxial instrumentation to the pads on your wafer. The 5A DC current, 15 W (@10 GHz) power handling, and -65°C to 200°C temperature range ratings support the most demanding of measurement needs. A special purpose cryogenic ACP is also available.

Freq. GHz	S_{11} (dB)	S_{22} (dB)	S_{21}(dB)
0.5	-40	-47	-0.05
5.0	-30	-34	-0.15
10.0	-24	-26	-0.2
20.0	-22	-26	-0.3
40.0	-25	-21	-0.4
60.0	-23	-20	-0.5
70.0	-15	-14	-0.7
80.0	-15	-13	-0.9
90.0	-17	-14	-1.0
110.0	-26	-30	-0.8

Typical ACP110-L frequency response.

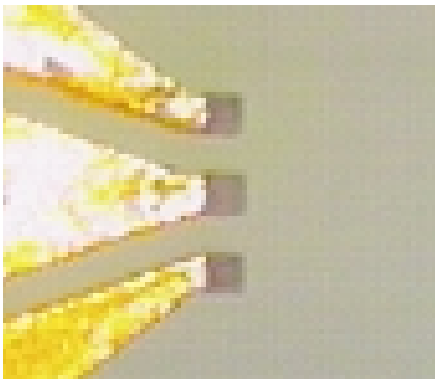
ACP40-GSG-150	
Frequency Range:	DC to 40 GHz
Insertion Loss:	
standard	< 1.0 dB
low-loss	< 0.6 dB
Return Loss (typical)	
DC-20 GHz	> 20 dB
20 to 40 GHz	> 15 dB
Probe Isolation (typical):	
Probes on Alumina	> 40 dB
Probes in Air	> 46 dB
Meas. Repeatability	< -50 dB

Typical ACP40 Probe Performance.



Dual-tip ACPs have individually supported contacts which provide outstanding compliance for probing non-planar surfaces.

View of the Air Coplanar tip. The ACP-Series provides superior impedance control and pitch accuracy.



The standard 40, 50, and 65 GHz versions feature 2.92 mm (K), 2.4 mm, and 1.85 mm connectors respectively. Alternative connector choices are available – such as the ACP40 with the 2.4 mm connector – for use with measurement instruments that don't use the full frequency range of their connector type.

The 75 and 110 GHz probes are available with a waveguide interface. The ACP110-C/L 1.0 mm coaxial versions may be used to provide broadband coverage from dc to 110 GHz. The waveguide versions' integrated bias tee provides superior out-of-band match to eliminate device oscillations.

A broad range of tip configurations are available from the standard, high performance ground-signal-ground (G-S-G) to the dual tip configurations such as G-S-G-S-G. The G-S and S-G versions are for less demanding measurement applications. Versions with probe contact 'pitch' or center-to-center contact spacing of 100 to 250 µm are standard. A much wider range (50 to 1250 µm) is also available.

The dual tip ACP (ACP40-D) provides a precisely aligned second signal contact built right into the Air Coplanar tip and connector block. Available in a wide variety of contact configurations, the unique dual-tip configuration is ideal for those cases where side-by-side probes don't fit. The unique tip allows complete contact of a transistor process control monitor using a single dual-tip probe.

Multi-contact configurations are also available in the ACP Quadrant Probe (ACP40-Q). The Quadrant ACP combines the superior performance of Air Coplanar tipped RF coaxial connections with dc needles and power bypass capacitors for multiport test capability in a single probe head. Ideal for MMIC or module applications, the Quadrant ACP is available with up to 3 RF ports and up to 8 DC needles.

Unique Air Coplanar Technology

Air Coplanar Probe tips are precisely fabricated, allowing accurate placement on DUT contact pads without obscuring the view of the wafer. The result is superior impedance control and pitch accuracy. Beryllium copper tips are standard, tungsten is optional to provide superior native oxide penetration and lower, more repeatable contact resistance on aluminum pads. Custom tips can be copper or nickel and their alloys, steel, or molybdenum.

The unique, individually supported contacts provide outstanding compliance for probing non-planar surfaces. The low contact force of 1 to 1.5 g/mil along with excellent skate characteristics provide probe life in excess of 500,000 contacts when probing gold pads, with reported life far exceeding this with careful use.

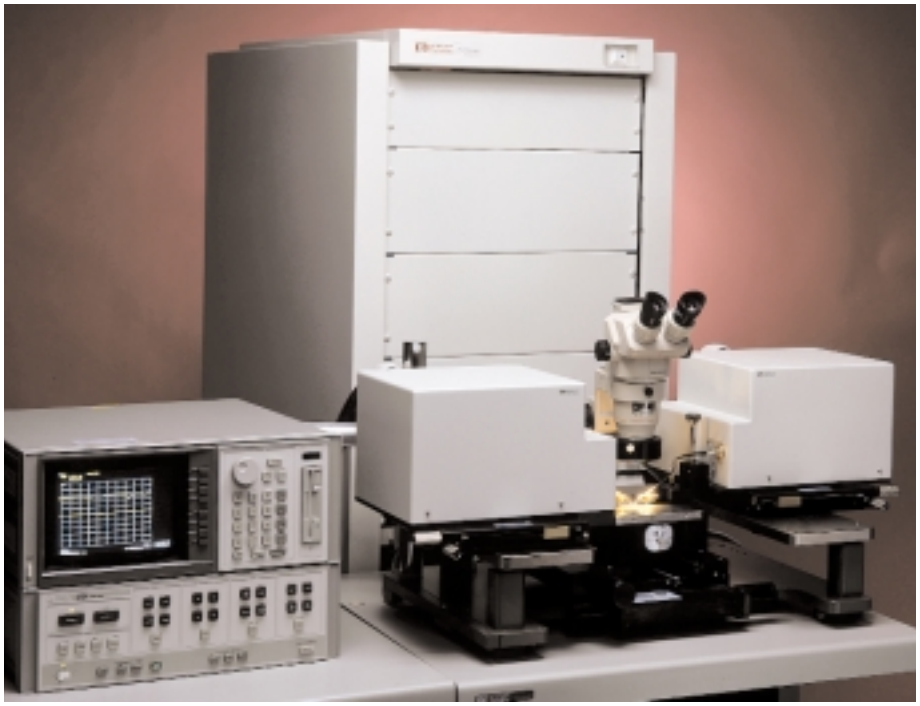
The Air Coplanar tip is attached to the connector through a coaxial cable that is filled with a low-loss, thermally stable dielectric. This cable is lower loss and more stable than ordinary Teflon filled cable, allowing higher quality, longer lasting calibrations and more repeatable measurements.

Features

- Unique Air Coplanar tip design
- Low-loss thermally stable dielectric material
- DC to 110 GHz models available
- Typical probe life of 500,000 contacts on gold pads
- Low insertion and return loss with ultra-low-loss versions
- Calibration standards and coefficients available
- Patented design for suppression of unwanted modes
- Excellent crosstalk characteristics
- Wide operating temperature -65°C to +200°C
- 100 to 250 µm standard pitch range (50 to 1250 µm available)
- Choice of beryllium copper or tungsten tip material
- Precision tip dual configuration available

Benefits

- Good visibility at probe tip allows accurate placement on DUT contact pads
- Individually supported contacts provide outstanding compliance for probing non-planar surfaces
- Stable and repeatable over-temperature measurements
- BeCu tip provides rugged, repeatable contact on gold pads
- Extremely long probe life provides low-cost-per-contact testing
- Low-contact force minimizes pad marking
- Tungsten tip provides superior performance and probe life on aluminum pads



HP8510XF positioners and ACP110 series probes on the Summit 9000 Series probe station test through 110 GHz.

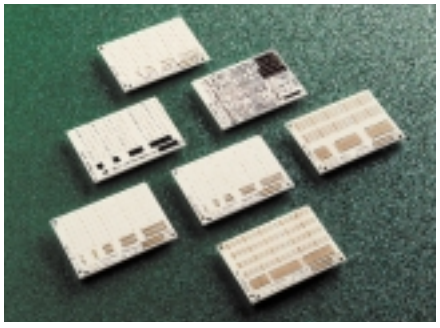
A Total System Solution

A complete customized Cascade Microtech RF/Microwave analytical test system includes a Summit series probe station, patented Air Coplanar Probes, Impedance Standard Substrates, precision phase-stable cables with integrated elbows, and powerful Nucleus™ prober control and WinCal™ Calibration Software. These carefully selected elements together with your vector network analyzer provides industry leading highly repeatable and reproducible measurement performance.

For production applications substitute the PS21 RF/Microwave autoprober for a completely automated wafer handling and measuring system.

Complete Calibration Confidence

Cascade's family of impedance standard substrates (non-dispersive calibration standards usable through 110 GHz) support all of your high-frequency probing applications.



Impedance Standard Substrates offer the proven accuracy of LRRM calibrations.

Powerful WinCal Software

Cascade's WinCal Calibration Software provides the simplest, most accurate, repeatable, network analyzer calibrations for precision on-wafer measurements.

Pad parasitic removal routines incorporated into the software perform one-step corrections for device pad parasitic removal. WinCal assures measurement integrity by allowing you to monitor system drift and conveniently recalibrate when needed.

Only Cascade's WinCal Calibration Software offers the proven accuracy of NIST-verified LRRM calibration with load-inductance compensation.

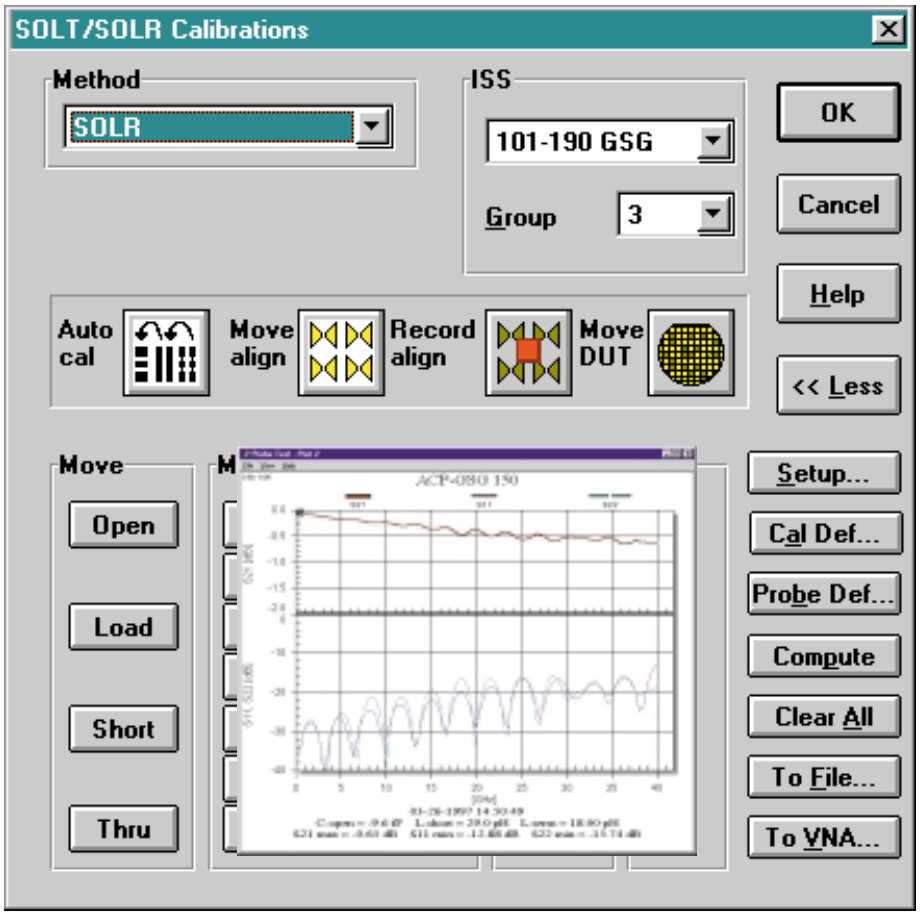
WinCal VNA Calibration Software now has the world's first SOLR calibration capability for non-ideal thru lines, applicable for orthogonal DUTs, dual and quadrant probes, or probe cards.

Unique Probing Solutions

The possible applications of Air Coplanar probes are endless and often involve some minor customization work such as a simple change of connector type. Strategic placement of capacitors and resistors provides capabilities from power bypass to impedance matching. Or perhaps a tip made of a special material will help. A special purpose ACP probe has proved valuable in cryogenic work.

Integrating a bypass capacitor structure at the tip of an ACP40-D probe creates a high performance and durable power connection.

The ACP40-R Resistive Probes can provide a series resistor right at the probe tip, a common technique for providing wide-bandwidth laser diode modulation. A 45 ohm resistor in series with the laser's 5 ohm dynamic resistance properly terminates the exciting signal and provides a flat, non-distorting frequency response.



WinCal Calibration Software is no longer just a calibration tool but can be used as an invaluable probe maintenance tool. New features allow you to verify that your probes are operational.

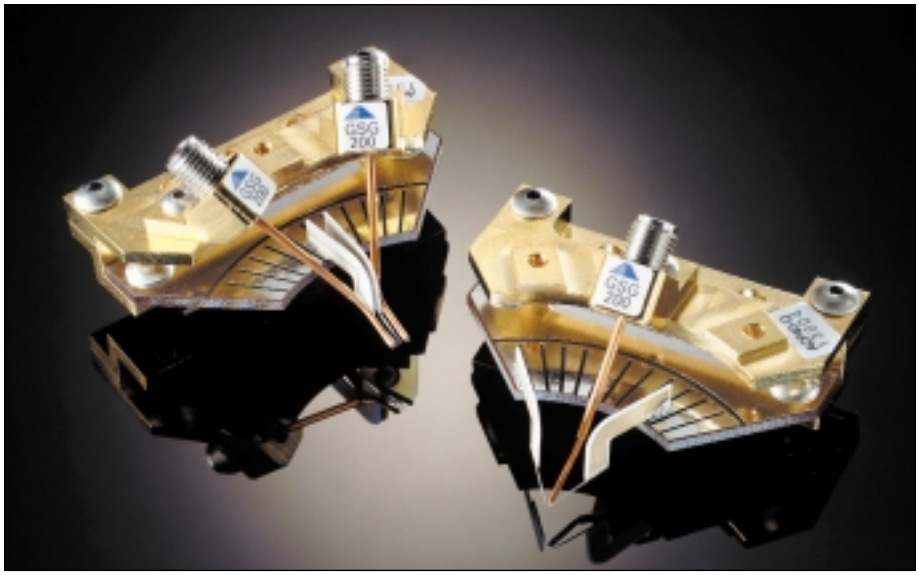
Cascade's Impedance-Matching ACP Probes enable accurate and cost-effective characterization and screening of devices with non-standard input/output impedance. Moreover, in load-pull measurements, it can effectively increase the tuning range and provide impedance states closer to the edge of the Smith Chart. ACP20-Z/ACP40-Z probes can have tip impedance down to 10 ohms and as much as 20% bandwidth for a center frequency in the 0.85-40 GHz range.



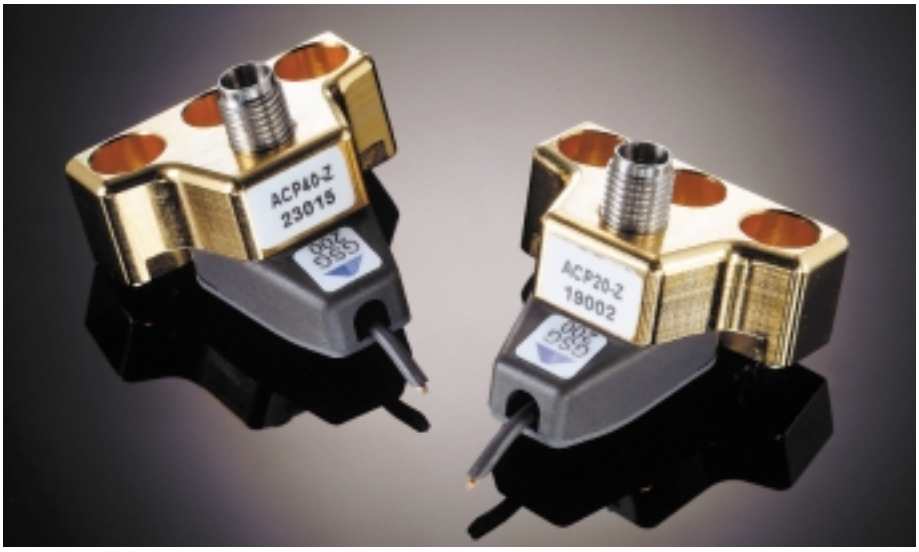
Waveguide Air Coplanar Probes are available for V-band (WR-15, 50-75 GHz) and W-band (WR-10, 75-110 GHz).

Air Coplanar Probe Measurement Advantages

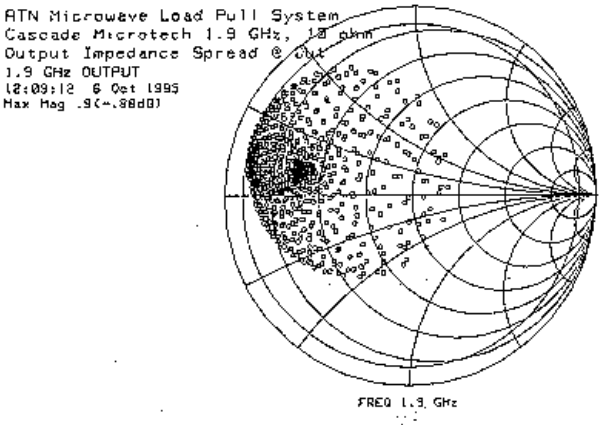
Measurement	Common Problem	ACP Measurement Advantage
mmWave Measurements	Difficult to achieve calibration accuracy, data repeatability and reproducibility	Better tip visibility ensures more accurate probe placement
	Out of band match for waveguide input probes typically poor	Waveguide input ACPs have built-in out-of-band termination circuits in bias tee
	Insertion loss of probes limit system's dynamic range	ACP mmWave probes have lowest insertion loss in the industry
Over-Temperature S-Parameter Measurements	Ordinary coaxial probes won't survive at high temperatures	Dielectric material in ACPs is thermally stable over-temperature
	Ordinary coaxial probes thermally load test samples and are mechanically unstable at cryogenic temperatures	Special purpose steel-tipped ACPs are ideal for cryogenic testing; They allow probing from -263°C to +200°C without reduced thermal loading of DUT and optimized mechanical stability
	System calibration drift is often >10% over temperature	WinCal software checks stability of probes, cables, and VNA to user-definable limits
Load Pull	Inability to measure very low impedances with 50 Ω probes	Partial-Matching Air Coplanar Probes extend the tuning range of load-pull systems
Noise Parameter	Probe and cable losses limit source gamma and accuracy	Ultra-low loss ACPs have loss typically < 0.25 dB up to 20 GHz
MMIC Functional Testing	Power bypass and ground inductance too high to maintain stable device operation	The Quadrant ACP combines the performance of Air Coplanar probes with bypassed dc needles to provide multicontact solutions ideal for MMIC or module probing applications.
Ft Measurements	Pad parasitics mask intrinsic Silicon device parameters	WinCal's pad-parasitic removal routines de-embed Ft and S-parameter measurements to reveal intrinsic device performance
Lightwave/OE	Laser diode impedances are too low to use a 50 Ω probe for pulsed bias measurements	Resistive matching ACP probe allows broadband impedance matching
Device Characterization	Demands best measurement accuracy available with small contact pads	The High Performance Characterization (HPC) series probes use reduced contact size ACP tip designs optimized for best accuracy in on-wafer device characterization
High-Speed Digital Functional Testing	Power supply inductance, resonances, and signal line VSWR and insertion loss increase bit-error rate and cause closed "eye" diagram	The Special Purpose 40/80 Gb/s High Performance Quadrant provides low-inductance, resonance-free power connections and industry leading signal fidelity
		Open "eye" diagrams to at least 80 Gb/s have been demonstrated with this defacto standard PGSGSGP-150 probe configuration



ACP40-Q Quadrant Probes are available with up to 3 RF ports and up to 8 DC needles.



Impedance Matching Probes provide the ideal solution for on-wafer measurements of low-impedance power devices.



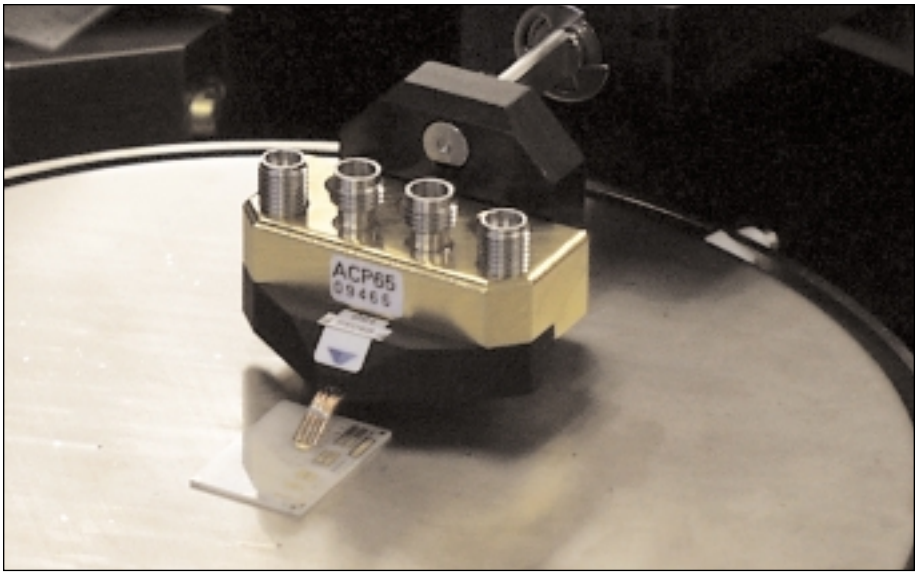
Output impedance spread at DUT of a 50-to-10 W impedance matching ACP used with load pull system.

Ordering Information

Representative examples are shown below. See the RF Probe Selection Guide for complete ordering details.

ACP40-GS ACP40-SG ACP40-GSG	DC-40 GHz Probe BeCu Tip
ACP40-L-GSG	Low loss version
ACP40-W-GS ACP40-W-SG ACP40-W-GSG	DC-40 GHz Probe Tungsten Tip
ACP40-LW-GSG	Low loss version & Tungsten Tip
ACP40-D-GSGSG ACP40-D-GSGS ACP40-D-GSS ACP40-D-GSSG ACP40-D-SGS ACP40-D-SGSG ACP40-D-SSG	DC-40 GHz Probe Dual-line BeCu Tip
ACP50-GS ACP50-SG ACP50-GSG	DC-50 GHz Probe BeCu Tip
ACP65-GSG	DC-65 GHz Probe BeCu Tip
ACP75-GSG	50-75 GHz Probe WR-15 flange, BeCu Tip
ACP75-M-GSG	MicroChamber version
ACP110-GSG	75-110 GHz Probe WR-10 flange, BeCu Tip
ACP110-M-GSG	MicroChamber version
ACP110-C-GSG	DC-110 GHz Probe 1.0 mm conn., BeCu Tip
ACP110-L-GSG	Low loss version
ACP20-Z-GSG*	0.85-20 GHz Reactive Probe, BeCu Tip
ACP40-Z-GSG*	20-40 GHz Reactive Probe, BeCu Tip
ACP-R-GS* ACP-R-SG* ACP-R-GSG*	10-300 Ω Resistive Probe, 45 Ω standard, BeCu Tip
FPC-R-GS* FPC-R-SG* FPC-R-GSG*	10-300 Ω Resistive Probe, 45 Ω standard, BeCu Tip
Quadrant ACP Probes*	Up to 3 RF probes and 8 DC needles

* Custom probes. Configuration information required.



The 40/80 Gb/s High Performance Quadrant ACP provides distortion-free, wide-bandwidth RF and low-inductance, resonance-free power bypass connections for the special needs of high-speed mixed-mode ICs for optical networks.



The High Performance Characterization series probes use ACP tip technology optimized for the demanding requirements of on-wafer device characterization.

For More Information

Refer to the RF Probe Selection Guide, WinCal Calibration Software, ISS Family, and Summit RF/Microwave Probing Systems brochures. Or visit our web site at www.cmicro.com.

CASCADE® MICROTECH

Innovating Test Technologies for better measurements faster

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