ROHDE&SCHWARZ
Make ideas real

LOAD PULL MEASUREMENTS

Partner solutions – impedance tuners

Load pull analysis

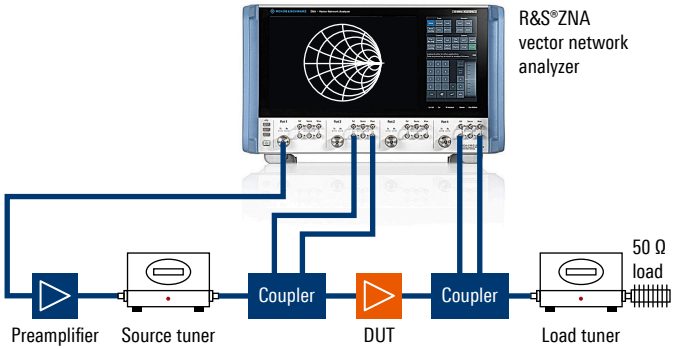
Load pull measurements are a critical technique used in RF and microwave engineering to characterize the performance of active devices such as transistors, amplifiers and mixers. Measurements are taken at various frequencies and impedance conditions. The data is often presented in the form of Smith charts, contour plots or 3D plots, showing how the performance metrics vary with load impedance.

The primary goal of load pull measurements is to characterize the performance of a device under different load or source impedances.

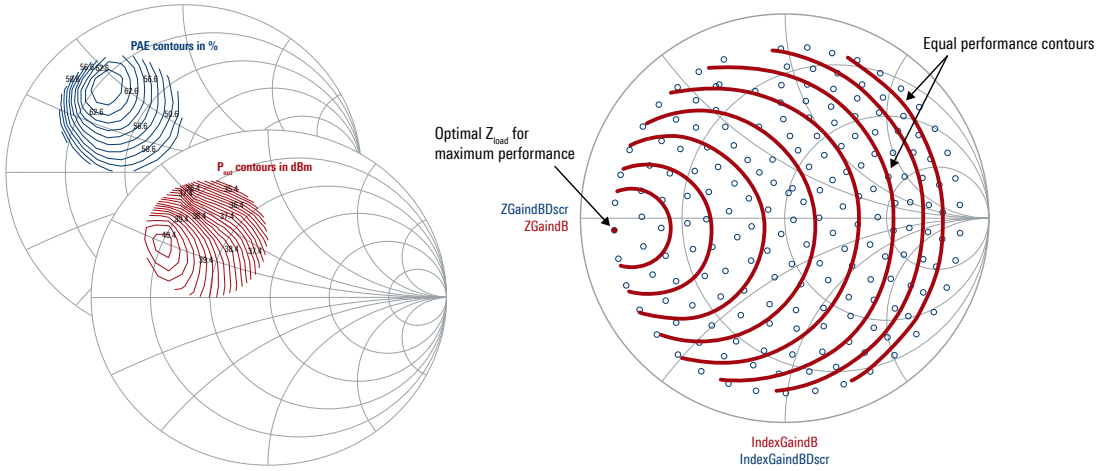
Our solution partners

- Focus Microwaves
- Maury Microwave

Block diagram of a basic passive vector-receiver load pull set



Contours of power added efficiency (PAE) in % and output power (P_{out}) in dBm

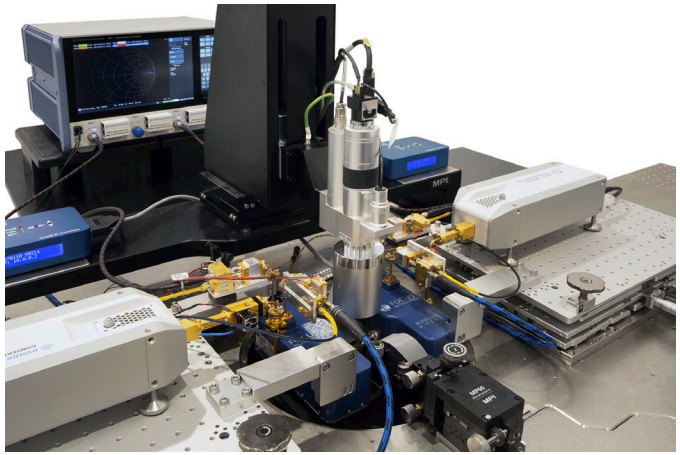


Key specifications	
Application	Design and optimization of RF power amplifiers and other active RF components under various impedance states
Key performance metrics	▶ Output power ▶ Efficiency, PAE ▶ Gain ▶ Linearity, e.g. third order intercept point (IP3) ▶ Stability
Supported vector network analyzer	R&S®ZNA

Your benefit	Features of the load pull measurement
Proven solution	▶ Both partners integrate the R&S®ZNA to offer reliable and precise load pull measurements into their turnkey load pull solutions ▶ User-friendly partner system software controls the entire setup
Wide range of load pull scenarios	▶ Depending on the application, we offer the following load pull solutions in collaboration with our partners: – Passive load pull – Active load pull – Hybrid load pull – Harmonic load pull – Wideband modulated load pull
Load pull measurements expertise	▶ We and our partners can support you and provide demonstrations and guidance for your active RF component measurements ▶ Access to customer support, training and resources from both Rohde&Schwarz and load pull partner companies

Focus Microwaves solution

Complete system solutions including impedance tuners, software products and accessories.



Maury Microwave solution

Complete system solutions including impedance tuners, software products and accessories.

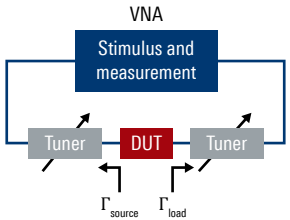
R&S®ZNA models	
Description	**Type**
Vector network analyzer, 2 or 4 ports, 26.5 GHz, 3.5 mm connectors	R&S®ZNA26
Vector network analyzer, 2 or 4 ports, 43.5 GHz, 2.92 mm or 2.4 mm connectors	R&S®ZNA43
Vector network analyzer, 2 or 4 ports, 50 GHz, 2.4 mm connectors	R&S®ZNA50
Vector network analyzer, 2 or 4 ports, 67 GHz, 1.85 mm connectors	R&S®ZNA67
Vector network analyzer system, 2 or 4 test ports, 110 GHz, complete system based on R&S®ZNA67, 2-port or 4-port model, standard or high power	R&S®ZNA67EXT

Your local Rohde&Schwarz expert will help find the best solution for you. Contact your local Rohde&Schwarz sales office for more information.

Summary

Load pull analysis is crucial for identifying the optimal operating conditions or "sweet spot" for the design of e.g. a power amplifier. In wireless systems, amplifiers drive RF signals into antennas, which can exhibit significant impedance variations around the nominal 50 Ω. These variations can unpredictably affect amplifier performance, including gain, efficiency and modulation metrics such as error vector magnitude (EVM). Rohde&Schwarz collaborates with leading load pull companies to provide comprehensive solutions for passive, active and hybrid load pull systems.

Load pull impedance control to characterize nonlinear behavior of the DUT for different matchings



Useful marketing collateral

Load pull testing
www.rohde-schwarz.com/loadpull

Amplifier characterization using load pull
https://scdn.rohde-schwarz.com/ur/pws/dl_downloads/dl_application/pdfs/Amplifier-characterization_ac_en_3608-5570-92_v0100.pdf

Maximizing power amplifier efficiency with harmonic load pull measurements
https://scdn.rohde-schwarz.com/ur/pws/dl_downloads/dl_application/pdfs/Maximizing-PA-efficiency-with-harmonic-load-pull_ac_en_3684-0224-92_v0100.pdf

Nonlinear applications using Rohde&Schwarz vector network analyzers
https://scdn.rohde-schwarz.com/ur/pws/dl_downloads/dl_common_library/dl_brochures_and_datasheets/pdf_1/Nonlinear-applications_fly_en_3608-5335-32_v0100.pdf

Vector receiver load pull measurements
https://www.rohde-schwarz.com/us/knowledge-center/videos/vector-receiver-load-pull-measurements-video-detail-page_251220-1019397.html

www.rohde-schwarz.com | www.rohde-schwarz.com/support | www.training.rohde-schwarz.com

Load pull measurements
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Data without tolerance limits is not binding | Subject to change