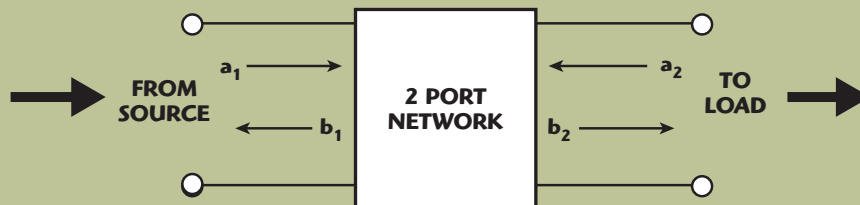


# STEM Works

## Net·work An·a·ly·zer [net-work] [an-l-ahy-zer]

Network analyzers measure the incident, reflected and transmitted energy, that is launched onto a transmission line, reflected back down the transmission line toward the source (due to impedance mismatch), and successfully transmitted to the terminating device. Network analyzers are commonly used to measure S-parameters, but there are other network parameter sets such as y-parameters, z-parameters and h-parameters. Network analyzers are often used to characterize two-port networks such as amplifiers and filters, but they can be used on networks with an arbitrary number of ports.



a: incident wave  
 b: reflected wave  
 $b_1 = S_{11}a_1 + S_{12}a_2$   
 $b_2 = S_{21}a_1 + S_{22}a_2$

**1950.** Rohde & Schwarz introduces the Zg diagraph, the world's first vector network analyzer allowing users to directly measure S-parameters. With its Smith chart display for microwave engineers, the ZDU model (30 to 300 MHz), followed by the ZDD (300 to 2400 MHz) was primarily used on TV broadcasting antennas and to test special cables in telecommunications.

**1965.** Wiltron introduces the 310 VNA with frequency ranges from 1 to 2, 2 to 4 and 4 to 8 GHz. Narrow band backward wave oscillators were used as the signal source. Plug-in monitors provided rectangular or Smith chart display.

**1967.** Hewlett-Packard introduces the 8410 network analyzer with swept capability to 12 GHz. This integrated multiple box bench-top system provided engineers with transmission, reflection and

impedance data in a single two-dimensional representation.

**1984.** The 26.5 GHz HP-8510 VNA is released. The instrument includes a synthesized source, error correction, time domain and pulse measurements. An HP-1B data bus is used for automatic operations.

**1987.** Wiltron introduces the 40 GHz 360 VNA system with color display and lower frequency range extended down to 10 MHz. Wiltron's Founder William Jarvis pushed his engineers to develop a competitive instrument to HP. HP introduces a one-box VNA, the HP-8753.

**1988.** Rohde & Schwarz introduce the 8 GHz ZVT8 which includes 8 measurement ports.

**2000.** Anritsu (formerly Wiltron) introduces a VNA series with a frequency range up to 65 GHz. HP (now Agilent) releases its PNA with a range up to 50 GHz.

**2006.** R&S introduces the ZVA with four internal phase coherent sources up to 67 GHz. It is the first VNA with four internal sources up to 67 GHz for fast two-tone measurements on amplifiers and mixers.

**2008.** Agilent introduces NVNA software which transforms one of the company's four port PNA-X VNA systems into a nonlinear VNA.

**2012.** Anritsu introduces a VNA family with 70 kHz to 125 GHz noise figure measurement capability, enabled in part by a unique receiver optimized for measurements from 30 to 125 GHz.