# Features

- Excellent dynamic range

  **>130 dB (IF bandwidth 10 Hz)**

- Low inherent noise

  **<-130 dBm (measurement bandwidth 3 kHz)**

- Broad frequency range for universal use

  **10 Hz to 4 GHz (ZVRE, ZVR)**
  **20 kHz to 8 GHz (ZVCE, ZVC)**

- High measurement speed

  **<125 µs/point (normalized)**
  **<240 µs/point (fully calibrated)**

- Fast data transfer via IEC/IEEE bus

  **Transfer time <15ms (200 points)**

- Customized, upgradable family concept

  **Modular design using options**

- High sweep rate

  **>>25 sweeps/s (200 points)**

- Manual calibration techniques

  **TOM, TRM, TRL, TNA, TOM-X, TOSM**

- Automatic calibration AutoKal
- Compatibility with PC, CAE

  **Internal PC with Windows NT operating system suitable for PC applications**

**Speed >>25 sweeps/s**

The extremely low-noise and fast synthesizer in conjunction with an exceptionally large measurement bandwidth of up t o 26 kHz al l ows real - time result display. The ZVx measures not in two subsequent sweeps but at every frequency point in forward and backward direction and thus all four S-parameters - including system error correction. This ensures real-time display of fully corrected data even during alignments with reduced sweep speeds. The dynamic range of ZVx is more than 95 dB even at a high measurement rate of 25 sweeps/s and 10 kHz measurement bandwidth.

**Dynamic range >130 dB**

The high stopband and low passband attenuation of modern RF components place new demands on network analyzers. Thanks to fundamental mixing, the useful dynamic range of Rohde & Schwarz network analyzers is more than 25 dB better than with conventional sampling techniques. Because of the low-noise front end, Rohde & Schwarz network analyzers attain a dynamic range of >130 dB, so transmission measurements on DUTs with extremely high stopband attenuation can be performed with high accuracy, even at low input levels.

**Power calibration: testing active DUTs**

Power calibration performed in the factory enables constant output power and high accuracy in the measurement of absolute input level over the full frequency range. This is particularly important for frequency-converting measurements and non-linear measurements on active components. Furthermore, frequency-dependent level variations of an external test setup can be measured and compensated with the aid of the Power Calibration option.

**Simultaneous display of four traces on the 26 cm colour LCD**

The ZVx models are the first network analyzers in this price class to simultaneously display up to four measurement traces with independent parameters (measured quantity, frequency range, bandwidth, etc). The large, active colour LCD with high refresh rate allows precise alignments without operator fatigue.

**Internal PC**

The network analyzers are equipped with a PC board including interfaces for keyboard, mouse, printer, external monitor and WindowsNT as the operating system. In the PC mode, the internal hard disk can be accessed and PC programs executed on the ZVR. This function considerably simplifies operation, processing and result recording. The optional Ethernet link, the integration of any printer driver and the execution of IEC/IEEE bus control programs on ZVR considerably extend the application range and performance. Complete setups, traces, numerical results, limit lines, calibration data, macros and screenshots can be stored on the hard disk or on floppy disks. The available formats (e.g. WMF, ASCII, Serenade....) allow problem-free import to Windows programs. The data can be processed in the ZVR with the aid of the internal PC.

**Automatic test systems**

Fast recording and processing of measured data and, in addition, an SCPI-conformal IEC/IEEE bus command set make all models of the ZVR family ideal for use in automatic measurement systems. All models are equipped with two IEC/IEEE bus interfaces as standard. One is used for analyzer control via an external PC, the other for controlling external devices, e.g. signal sources for intermodulation or mixer measurements, from the ZVR. Another optional IEC/IEEE bus interface is provided for the internal PC. Via this interface, IEC/IEEE control programs can be executed on the internal PC, thus enabling the ZVR to control itself or complete test systems. The Ethernet option allows data exchange and control via LAN.

**Efficient calibration techniques**

The classic 12-term calibration method requires four calibration standards: Through, Open, Short and Match. The name TOSM given to this method is an abbreviation of the standards' names. A number of other modern calibration methods (TOM, TRM, TRL, TNA) are also provided in ZVR and ZVC. Unlike TOSM (12-term) they require only three different standards. Additionally, lines (L), reflecting one-ports with unknown reflection coefficient (R), matched attenuators (A) and two-port networks (N) with symmetrical reflection can be used. Due to its simplicity, TOM is the method recommended for general applications. For calibration at frequencies up to 100 MHz it is not even necessary to connect an open circuit, and the ports may simply be left open. Thus a complete two-port calibration can be performed with only two calibration standards. TOM allows also implicit verification so that errors caused by defective calibration kits or operating errors are excluded. This considerably enhances reliability in the laboratory and particularly in production.

With on-wafer measurements, measurements on PCBs or in fixtures it is difficult to design or specify suitable calibration standards at justifiable effort. This problem can be solved with the TNA and TRM calibration methods developed and patented by Rohde& Schwarz. With these methods the

characteristics of the calibration standards need not be fully known. With TNA, for instance, a full two-port calibration can be performed with two standards: if reflection symmetry is provided at the reference planes, the calibration step with network (N) does not require a standard to be connected, the test ports can just be let open. Just a through (T) with known length and a matched attenuator (A) are required.
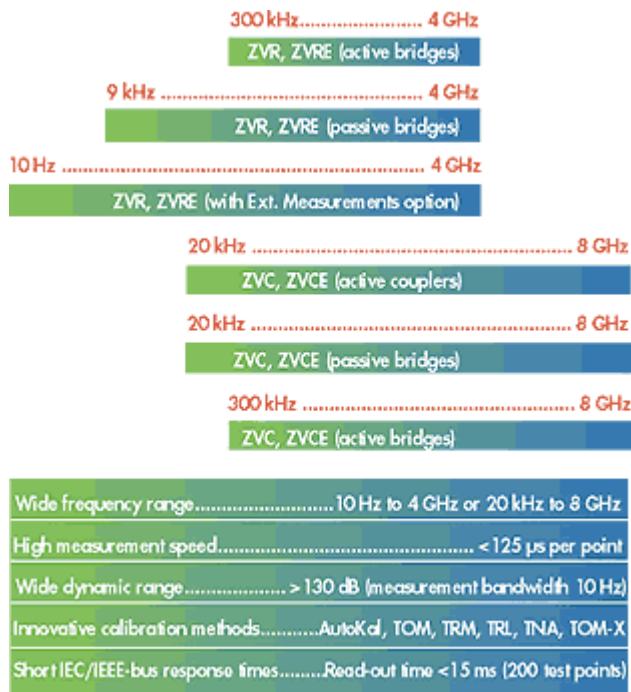
The calibration effort is reduced to a minimum when the AutoKal option is used that requires only one simple through-connection.

# Overview

The vector network analyzers of the ZVR family from Rohde&Schwarz have set standards for extremely fast, highly accurate and versatile test equipment.

The family comprises the five Vector Network Analyzers ZVRL, ZVRE and ZVR as well as ZVCE and ZVC which extend the frequency range to 8 GHz. All models are compact instruments with integrated generator, test set and receiver, each tailored to a different field of application.

**Thanks to the great variety of options and test sets, the analyzers can be tailored even to very special kinds of measurement tasks.**

| | |
|---|---|
| 300 kHz .......................... 4 GHz | |
| ZVR, ZVRE (active bridges) | |
| 9 kHz ...................................................... 4 GHz | |
| ZVR, ZVRE (passive bridges) | |
| 10 Hz .................................................................. 4 GHz | |
| ZVR, ZVRE (with Ext. Measurements option) | |
| 20 kHz ..................................................................... 8 GHz | |
| ZVC, ZVCE (active couplers) | |
| 20 kHz ..................................................................... 8 GHz | |
| ZVC, ZVCE (passive bridges) | |
| 300 kHz ..................................................................... 8 GHz | |
| ZVC, ZVCE (active bridges) | |

| | |
|---|---|
| Wide frequency range ........................... 10 Hz to 4 GHz or 20 kHz to 8 GHz | |
| High measurement speed ....................................... < 125 μs per point | |
| Wide dynamic range .................... > 130 dB (measurement bandwidth 10 Hz) | |
| Innovative calibration methods ........... AutoKal, TOM, TRM, TRL, TNA, TOM-X | |
| Short IEC/IEEE-bus response times ......... Read-out time < 15 ms (200 test points) | |

| Model | ZVRE | ZVR | ZVCE | ZVC |
|---|---|---|---|---|
| Test set | bidirectional | bidirectional | bidirectional | bidirectional |
| Receiver channels | 3 | 4 | 3 | 4 |
| Wide frequency range | 10 Hz[1] to 4 GHz | 10 Hz[1] to 4 GHz | 20 kHz to 8 GHz | 20 kHz to 8 GHz |
| Wide dynamic range[1] | >125 dB | >130 dB | >125 dB | >130 dB |
| High sensitivity[1] | <-125 dBm | >130 dBm | <-125 dBm | >130 dBm |
| High measurement speed | <125 µs/point | <125 µs/point | <125 µs/point | <125 µs/point |
| Fast IEC/IEEE bus[2] | <15 ms | <15 ms | <15 ms | <15 ms |
| High frequency resolution | 10 µHz | 10 µHz | 10 µHz | 10 µHz |
| Short calibration times[3] | <20s | <20s | <20s | <20s |
| Large display | active 26 cm colour LCD | active 26 cm colour LCD | active 26 cm colour LCD | active 26 cm colour LCD |

1) With External Measurements option.

2) From marker request to data output (real and imaginary values).

3) Automatic two-port calibration with AutoKal option.