



Version
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SWR Bridge R&S® ZRC

Measurement of reflection coefficient from 40 kHz to 4 GHz

- ◆ Very wide frequency range
- ◆ High directivity
- ◆ Good matching characteristics
- ◆ Rugged design
- ◆ Calibration accessories included
- ◆ Characteristic impedance 50 Ω or 75 Ω (up to 2.5 GHz)

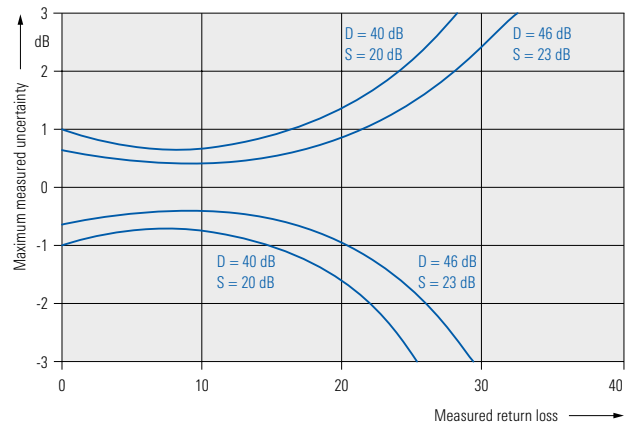
The SWR Bridge R&S®ZRC is used to measure the magnitude and phase of the reflection coefficient of RF circuits and components such as filters, amplifiers, mixers and antennas. The output signal from the test generator is applied to the DUT via the SWR bridge. Depending on the reflection coefficient r of the DUT, part of the signal is reflected to the bridge and then routed to the receiver, where it is detected and displayed.

A shopen (short circuit/open circuit) and a match that can be used for calibration and verification of nominal data are part of the equipment supplied. A connector adapter that can directly connect the bridge to a test generator without the use of cables is also supplied.

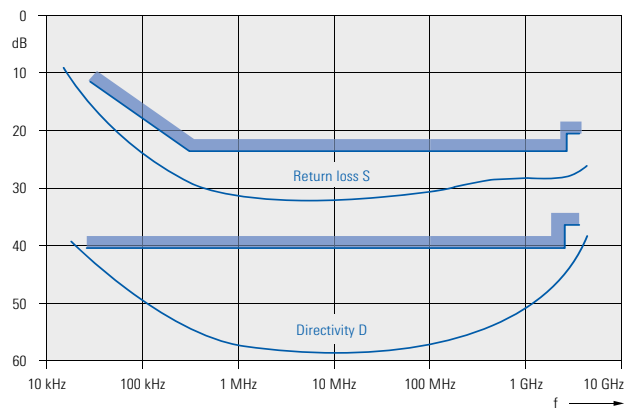
Measurement accuracy

The accuracy of a bridge is generally defined by its directivity and by multiple reflections between the DUT and the measurement port. When measuring small reflection coefficients, the finite directivity is decisive. Reflection coefficients that are smaller than the directivity can no longer be measured directly.

The measurement accuracy of large reflection coefficients mainly depends on the port matching of the bridge. At a directivity of $D = 40$ dB, for example, and a return loss of the measurement port of $S = 23$ dB, the maximum absolute error as a function of the reflection coefficient to be measured is $0.01 + 0.07 \cdot |r|^2$.



Maximum measurement uncertainty for a return loss S of 20 dB and 23 dB at the test port and directivity D of 40 dB and 46 dB



Typical response and tolerance limits of return loss S at test port and directivity D of 50 Ω bridge

The diagram above is ideal for assessing this quantitatively. The maximum positive and negative measurement uncertainty is plotted as a function of the measured return loss. The specified limit values of the R&S®ZRC are used here. For the center frequency range of approx. 1 MHz to 1 GHz, both the return loss at the measurement port (typ. >28 dB) and the directivity (typ. >50 dB) are higher than specified. The measurement uncertainties that arise are smaller than the limit values shown and usually negligible during practical measurements.

Specifications

| | | |
|--------------------------------|---|--|
| Characteristic impedance | 50 Ω | 75 Ω |
| Frequency range | 40 kHz to 4 GHz | 40 kHz to 2.5 GHz |
| Directivity | | |
| up to 2.5 GHz | ≥ 40 dB | ≥ 40 dB |
| 2.5 GHz to 3 GHz | ≥ 40 dB | — |
| 3 GHz to 4 GHz | ≥ 36 dB | — |
| Return loss at test port | | |
| up to 400 kHz | ≥ 12 dB + 11 dB $\cdot \log(f/40 \text{ kHz})$ | ≥ 8 dB + 12 dB $\cdot \log(f/40 \text{ kHz})$ |
| 400 kHz to 2.5 GHz | ≥ 23 dB | ≥ 20 dB |
| 2.5 GHz to 3 GHz | ≥ 23 dB | — |
| 3 GHz to 4 GHz | ≥ 20 dB | — |
| Measurement error | | |
| up to 400 kHz | $\leq 0.01 + s \cdot r ^2$ | $\leq 0.01 + s \cdot r ^2$ |
| 400 kHz to 2.5 GHz | $\leq 0.01 + 0.07 \cdot r ^2$ | $\leq 0.01 + 0.1 \cdot r ^2$ |
| 2.5 GHz to 3 GHz | $\leq 0.01 + 0.07 \cdot r ^2$ | — |
| 3 GHz to 4 GHz | $\leq 0.016 + 0.01 \cdot r ^2$ | — |
| Insertion loss at 5 MHz | | |
| Total | 13 dB | |
| Input \rightarrow test port | 7 dB | |
| Test port \rightarrow output | 6 dB | |

s = reflection coefficient at test port ($s = 10^{-a/20}$ dB)

a = return loss at test port

$|r|$ = magnitude of reflection coefficient measured

General data

| | |
|-----------------------------|--------------------|
| Power-handling capacity | 0.5 W |
| Operating temperature range | 0 °C to +55 °C |
| Storage temperature range | −40 °C to +70 °C |
| Connectors | N female |
| Test port connector | N female or N male |

| | |
|--|---------------------------------------|
| Dimensions without connectors | 72 mm \times 77 mm \times 23 mm |
| Length of connectors | female 17 mm, male 19 mm |
| Weight | 340 g |
| Dimensions of case | 264 mm \times 172 mm \times 48 mm |
| Total weight with accessories and case | 980 g |

Ordering information

| Designation | Order No. |
|--|----------------------------------|
| SWR Bridge R&S®ZRC 50 Ω , test port connector, female | 1039.9492.52 |
| SWR Bridge R&S®ZRC 50 Ω , test port connector, male | 1039.9492.55 |
| SWR Bridge R&S®ZRC 75 Ω , test port connector, female | 1039.9492.72 |
| SWR Bridge R&S®ZRC 75 Ω , test port connector, male | 1039.9492.75 |
| Accessories supplied | shopen, match, connector adapter |

Accessories supplied

| | |
|-------------------|---|
| Shopen | 50 Ω version phase difference between open-circuit and short-circuit $180^\circ \pm 5^\circ$ 75 Ω version phase difference between open-circuit and short-circuit $180^\circ \pm 10^\circ$ |
| Match | return loss ≥ 46 dB (50 Ω), ≥ 40 dB (75 Ω) |
| Connector adapter | insertion loss ≤ 0.1 dB return loss ≥ 34 dB |

Note: SWR bridge specifications can be affected by strong magnetic fields ($B \geq 50$ mT at housing surface).