SWR Bridge ZRB2

Broadband impedance and reflection coefficient measurements

- Wide frequency range: 5 to 3000 MHz
- Characteristic impedance 50 Ω or 75 Ω
- High directivity
- Good matching characteristics
- Sturdy construction

Characteristics and uses

The SWR Bridge ZRB2 is used to measure the magnitude and phase of the reflection coefficient, e.g. of filters, amplifiers, mixers or antennas. The output signal **a** from the generator is fed via the SWR Bridge to the device under test. Part of the signal is reflected via the SWR Bridge to the indicator, the amount depending on the reflection coefficient **r** of the device under test. This part **b** of the signal is a measure of the complex reflection coefficient **r** of the device under test. Intelligent indicators convert the measured reflection coefficient into other parameters, e.g. the impedance or admittance of the device under test. In this case, display is possible as magnitude and phase as well as real and imaginary quantities.

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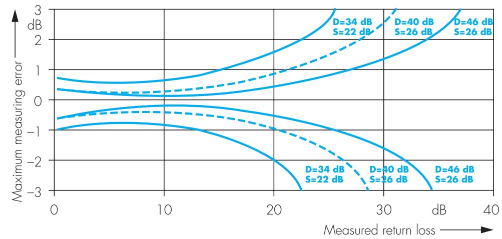
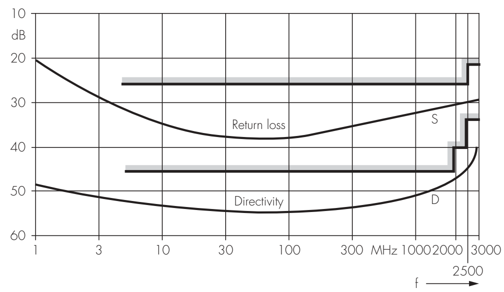
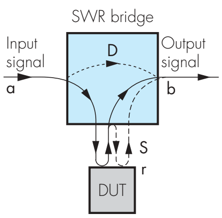
Maximum measurement errors with an assumed return loss at the test port of 22 and 26 dB (SWR = 1.17 and 1.1) and a directivity of 34, 40 and 46 dB



Precision model ZRB2 (50 Ω): typical response and tolerance limits of return loss S at test port and directivity D





Measurement accuracy

Measurement accuracy is determined by two effects (small diaram above):

1. The finite directivity of the SWR Bridge; the error signal is coupled directly to the bridge output (dotted signal path D).

2. Multiple reflections between the device under test and the test port; it is enough for the estimation of the error to consider one reflection only (dashed signal path s).

The approximate relationship between the input signal a and the output signal b is:

$$b = T \times (D + r + S \times r^2) \times a$$

where T = insertion loss, D = directivity, S = return loss at the test port of the SWR Bridge and r = reflection coefficient of the device under test.

This equation shows that measurement of small reflection coefficients will be detrimentally affected by the finite directivity D of the SWR Bridge. The relative measurement error increases with decreasing reflection coefficient. Reflection coefficients that are smaller than the directivity of the bridge cannot be measured dirctly. With measurements of large reflection coefficients, this error can be neglected. The error of the measurement depends on the mismatch of the test port of the SWR Bridge. With a directivity of 46 dB and a return loss at the test port of 26 dB, the maximum absolute error as a function of the reflection coefficient to be measured will be $0.005 + 0.05\,|r|^2$.

The diagram above shows the maximum measurement error to be expected with respect to the measured return loss and allows a quantitativ determination of this relationship. The plotted curves represent the highest possible positive and negative deviations of the measured value from the true value of the return loss. It is to be noted that these values are the specified limit values of the ZRB2. For the lower and middle frequency ranges both the return loss at the test port (typ. >28 dB) and the directivity (typ. >50 dB) are higher than shown. Any measurement uncertainty that than occurs is lower than the limits plotted and can in most cases be neglected for pratical measurements.

Specifications

	Precision model 50 Ω	**Standard model 50 Ω**	**Standard model 75 Ω**
Frequency range	5 to 3000 MHz	5 to 2500MHz	5 to 2000 MHz
Characteristic impedance	50 Ω	50 Ω	75 Ω
Directivity	≥46 dB up to 2 GHz, ≥40 dB up to 2.5 GHz, ≥34 dB up to 3 GHz	≥40 dB	≥40 dB
Return loss at test port	≥26 dB up to 2.5 GHz, ≥22 dB up to 3 GHz	≥23 dB	≥20 dB up to 1.5 GHz, ≥18 dB up to 2 GHz
Measurement error (|r| = magnitude of measured reflection coefficient)	$0.005 + 0.05\,\|r\|^2$ up to 2 GHz, $0.01 + 0.05\,\|r\|^2$ up to 2.5 GHz, $0.02 + 0.08\,\|r\|^2$ up to 3 GHz	$0.01 + 0.07\,\|r\|^2$	$0.01 + 0.1\,\|r\|^2$ up to 1.5 GHz, $0.01 + 0.13\,\|r\|^2$ up to 2 GHz
Insertion loss (5 MHz)			
Total	13 dB	13 dB	14 dB
Input – test port	7 dB	7 dB	8 dB
Test port – output	6 dB	6 dB	6 dB
Power-handling capacity	0.5 W	0.5 W	0.5 W

General data	
Nominal temperature range	0 to +50°C
Storage temperature range	–40 to +70°C
Connectors	N female
Test port connector	N female or N male
Dimensions without connectors (L x W x H; mm)	72 x 57 x 20
Connector length, female	17 mm
male	19 mm
Weight	240 g

Order designation	SWR Bridge ZRB2
50 Ω, 5 to 3000 MHz, test port connector female	373.9017.52
male	373.9017.55
50 Ω, 5 to 2500 MHz, test port connector female	373.9017.53
male	373.9017.56
75 Ω, 5 to 2000 MHz, test port connector female	802.1018.73
male	802.1018.76

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