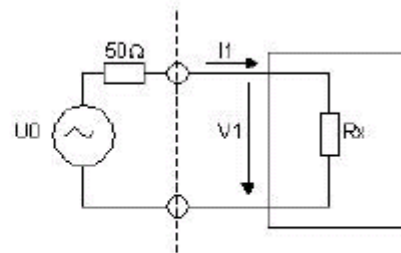
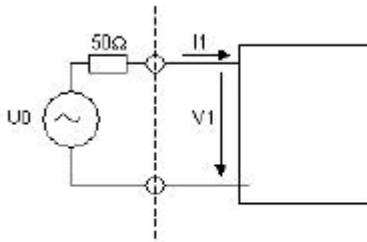


# S-Parameter-Rechnung bei ohmschen Lasten

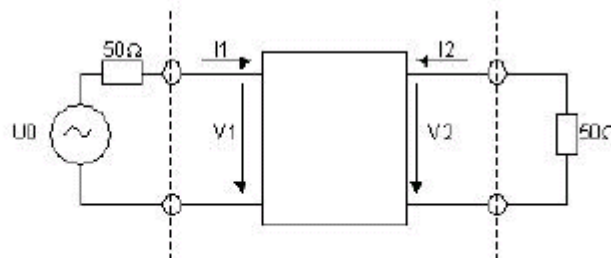
## 1. One-Port Messung (S11) :



$$S_{11} = \frac{b_1}{a_1} = \frac{\frac{V_1}{I_1} - 50\Omega}{\frac{V_1}{I_1} + 50\Omega} = \frac{R_x - 50\Omega}{R_x + 50\Omega}$$

$$R_x = 50\Omega \cdot \frac{(1 + S_{11})}{(1 - S_{11})}$$

## 2. Two-Port Messung (S11 & S21) :

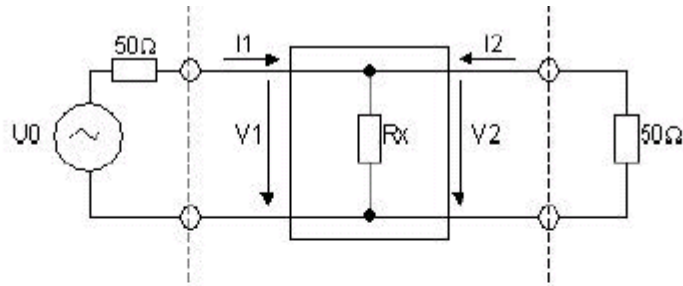


$$a_1 = \frac{V_1 + I_1 \cdot 50\Omega}{2 \cdot \sqrt{50\Omega}} \quad b_1 = \frac{V_1 - I_1 \cdot 50\Omega}{2 \cdot \sqrt{50\Omega}}$$

$$a_2 = \frac{V_2 + I_2 \cdot 50\Omega}{2 \cdot \sqrt{50\Omega}} \quad b_2 = \frac{V_2 - I_2 \cdot 50\Omega}{2 \cdot \sqrt{50\Omega}}$$

$$S_{21} = \frac{b_2}{a_1} \quad S_{11} = \frac{b_1}{a_1} \quad S_{12} = \frac{b_1}{a_2} \quad S_{22} = \frac{b_2}{a_2}$$

## 3. Two-Port Messung (S11 & S21) - Shunt :



$$V_1 = \frac{\frac{(R_{xx} * 50 \Omega)}{(R_x + 50 \Omega)}}{50 \Omega + \frac{(R_x * 50 \Omega)}{(R_x + 50 \Omega)}}$$

$$I_1 = \frac{V_1}{\frac{(R_x * 50 \Omega)}{(R_x + 50 \Omega)}}$$

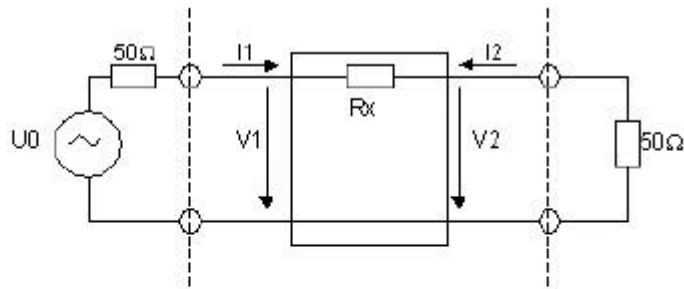
$$V_2 = V_1$$

$$I_2 = -\frac{V_2}{50 \Omega}$$

$$S_{21} = \frac{b_2}{a_1}$$

$$S_{11} = \frac{b_1}{a_1}$$

4. Two-Port Messung (S11 & S21) - Series :



$$V_1 = \frac{R_x + 50\Omega}{R_x + 100\Omega} U_0$$

$$I_1 = \frac{V_1}{R_x + 50\Omega}$$

$$V_2 = \frac{50\Omega}{R_x + 100\Omega} U_0$$

$$I_2 = -I_1$$

$$S_{21} = \frac{b_2}{a_1}$$

$$S_{11} = \frac{b_1}{a_1}$$

#### 5. Messgrenzen eines Network-Analyzers bei ohmschen Lasten :

Als Beispiel nehmen wir den TenTec-VNA mit seinen Datenblatt-Grenzen von - Max. Rückflussdämpfung 40dB - Max. Durchflussdämpfung 80dB

Welche ohmschen Lasten könnte man hiermit noch messen ?

One-Port	:	S11 Rx = 49 Ohm	oder	Rx = 51 Ohm
Two-Port (Shunt)	:	S11 Rx = 2475 Ohm		
		S21 Rx = 0,0025 Ohm		
Two-Port (Series)	:	S11 Rx = 1,01 Ohm		
		S21 Rx = 999889 Ohm		

#### 6. Nützliche Formeln :

$$\text{returnloss}[dB] = -20 dB * \log|\Gamma|$$

$$\text{transmissionloss}[dB] = -10 * \log(1 - |\Gamma|^2)$$

$$\Gamma(\rho) = \frac{(R_{Last} - 50\Omega)}{(R_{Last} + 50\Omega)}$$

From:

<https://dg1sfj.de/> - **dg1sfj.de**

Permanent link:

<https://dg1sfj.de/doku.php?id=funk:messtechnik:sparam>

Last update: **2025/01/19 14:03**

