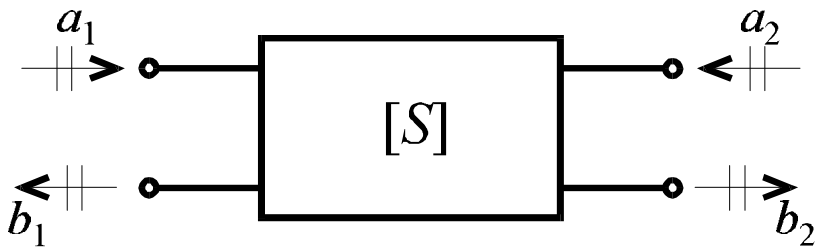
Scattering parameters

- There is a need to establish well-defined termination conditions in order to find the network descriptions for **Z**, **Y**, **h**, and **ABCD** networks
- Open and short voltage and current conditions are difficult to enforce
- RF implies forward and backward traveling waves which can form standing waves destroying the elements

Solution: S-parameters

- Input-output behavior of network is defined in terms of normalized power waves
- Ratio of the power waves are recorded in terms of so-called scattering parameters
- S-parameters are measured based on properly terminated transmission lines (and not open/short circuit conditions)

Basic configuration



$$S_{11} = \frac{b_1}{a_1}\Big|_{a_2=0} = \frac{reflected\quad power\quad wave\quad at\quad port1}{incident\quad power\quad wave\quad at\quad port1}$$

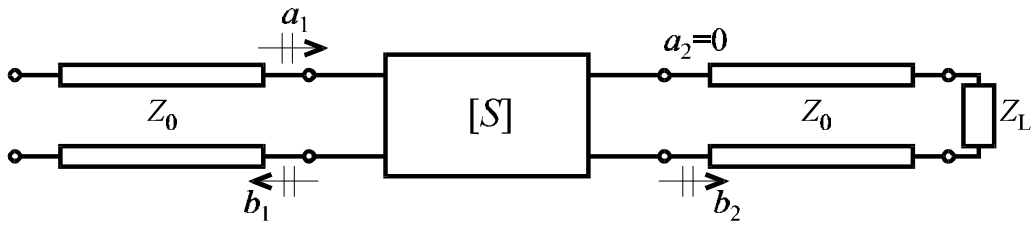
$$S_{21} = \frac{b_2}{a_1}\Big|_{a_2=0} = \frac{transmitted\quad power\quad wave\quad at\quad port2}{incident\quad power\quad wave\quad at\quad port1}$$

$$S_{22} = \frac{b_2}{a_2}\Big|_{a_1=0} = \frac{reflected\quad power\quad wave\quad at\quad port2}{incident\quad power\quad wave\quad at\quad port2}$$

$$S = \frac{b_1}{a_2}\Big|_{a_1=0} = \frac{transmitted\quad power\quad wave\quad at\quad port1}{incident\quad power\quad wave\quad at\quad port2}$$

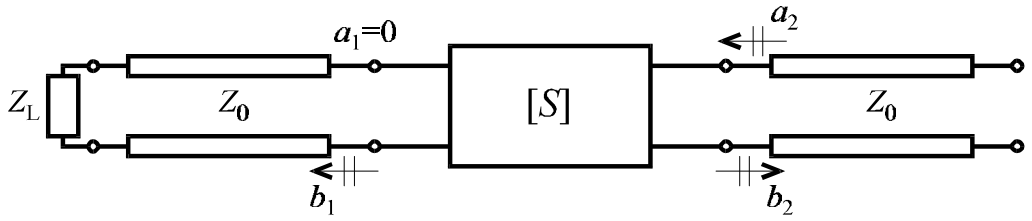
Set-up for measuring S-parameters

- Properly terminated output



Load impedance = line impedance

- Properly terminated input side



input impedance = line impedance