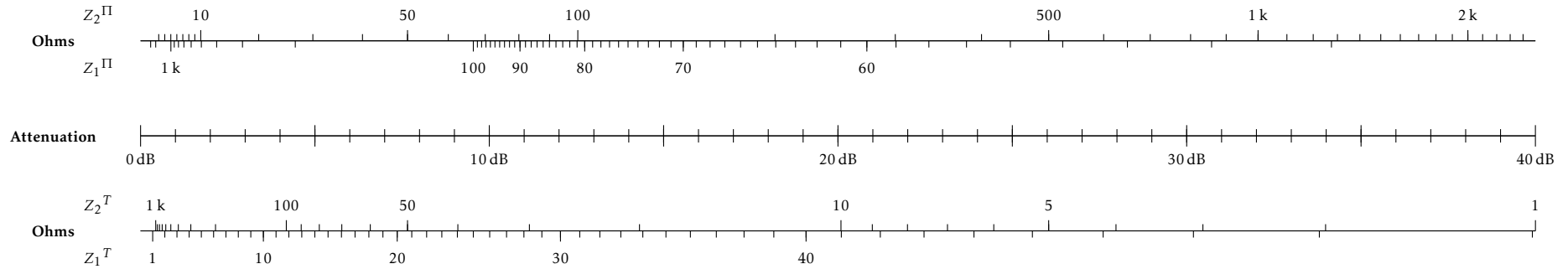


## Matched resistive lumped-element two-port attenuators

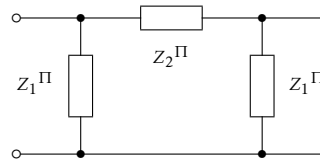


### Description

The aim of these nomographs is to facilitate the design of matched resistive lumped-element two-port attenuators. All values presume an input and output impedance of  $Z_0 = 50\Omega$ . Find the desired attenuation on the center scale and read out the required values of the resistors on the upper scale (for  $\Pi$  section) and on the lower scale (for T section) respectively.)

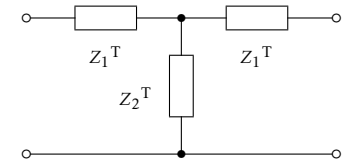
On the right hand side the exact design formulas are given\*. There  $a = \ln|U_1/U_2|$  is the attenuation in Neper when terminated with  $Z_0$ . Below each structure the involved resistances are plotted versus  $20\lg|U_1/U_2|$ .

### $\Pi$ section



$$Z_1^{\Pi} = \frac{Z_0}{\tanh \frac{a}{2}} \quad Z_2^{\Pi} = Z_0 \cdot \sinh a$$

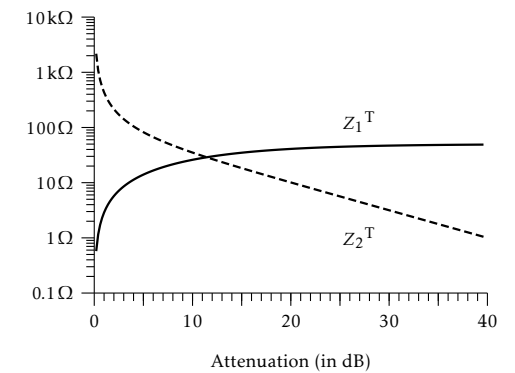
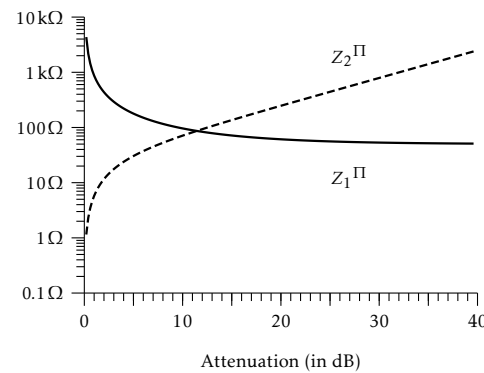
### T section



$$Z_1^{\text{T}} = Z_0 \cdot \tanh \frac{a}{2} \quad Z_2^{\text{T}} = \frac{Z_0}{\sinh a}$$

### Selected values

	3dB	6dB	10dB	15dB	20dB	30dB
$Z_1^{\Pi}$	292.4 $\Omega$	150.5 $\Omega$	96.2 $\Omega$	71.6 $\Omega$	61.1 $\Omega$	53.3 $\Omega$
$Z_2^{\Pi}$	17.6 $\Omega$	37.4 $\Omega$	71.2 $\Omega$	136.1 $\Omega$	247.5 $\Omega$	789.8 $\Omega$
$Z_1^{\text{T}}$	8.5 $\Omega$	16.6 $\Omega$	26.0 $\Omega$	34.9 $\Omega$	40.9 $\Omega$	46.9 $\Omega$
$Z_2^{\text{T}}$	141.9 $\Omega$	66.9 $\Omega$	35.1 $\Omega$	18.4 $\Omega$	10.1 $\Omega$	3.2 $\Omega$



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<http://www.siart.de/lehre/attenuator.pdf>

\*Schüßler, H. W.: Netzwerke, Signale und Systeme. Berlin, Springer, 1990 (in german)