Resistive Attenuator Pad (Pi and T) Resistor Values

Resistor values of matched pi and T attenuator pads for an impedance and attenuation in dB, with the voltage ratio and power absorbed.

Method: Matched symmetric pi and T attenuator design equations

Input parameters

Unit system: SI

Parameter	Value	Unit
System impedance	50.000	Ω
Attenuation (dB)	10.000	
Input power (for the power absorbed)	0.001000	kW

Calculated results

Parameter	Value	Unit
Voltage ratio	3.1623	
T pad: each series resistor	25.975	Ω
T pad: shunt resistor	35.136	Ω
Pi pad: each shunt resistor	96.248	Ω
Pi pad: series resistor	71.151	Ω
Power absorbed in the pad	0.90000	W

Notes for this case

• A matched pad presents Z_0 at both ports and reduces the voltage by K = 10^(A/20). For a T pad the two series arms are Z_0(K − 1)/(K + 1) and the shunt arm 2Z_0K/(K^2 − 1); for a pi pad the two shunt arms are Z_0(K + 1)/(K − 1) and the series arm Z_0(K^2 − 1)/(2K). Use the nearest standard values; at RF use non-inductive (thin-film) resistors and keep the layout short. The pad absorbs P_in(1 − 1/K^2).

Formula and method

$$K = 10^{A/20}, \quad R_{T,s} = Z_0 \frac{K-1}{K+1}, \quad R_{T,p} = \frac{2Z_0 K}{K^2-1}, \quad R_{\pi,p} = Z_0 \frac{K+1}{K-1}, \quad R_{\pi,s} = Z_0 \frac{K^2-1}{2K}$$

Variables

Z_0	System impedance	Ω
A	Attenuation (dB)	-
P_{in}	Input power (for the power absorbed)	W
K	Voltage ratio	-
$R_{T,series}$	T pad: each series resistor	Ω
$R_{T,shunt}$	T pad: shunt resistor	Ω
$R_{\pi,shunt}$	Pi pad: each shunt resistor	Ω
$R_{\pi,series}$	Pi pad: series resistor	Ω
P_a	Power absorbed in the pad	W

Method and standards

Attenuator pads.

Assumptions and limits

- Resistive, matched, symmetric pad.

References

Matched symmetric pi and T attenuator design equations

Report details

Report reference	FCC-ZGTK-EPVJ (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/electronics/resistive-attenuator-pad

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Reopens the calculator with the inputs of this report.