VSWR, Return Loss and Mismatch Loss from Load Impedance

Reflection coefficient, VSWR, return loss, mismatch loss and transmitted power fraction of a load on a transmission line from its impedance and the line impedance.

Method: Reflection on a terminated transmission line

Input parameters

Unit system: SI

Parameter	Value	Unit
Load resistance	75.000	Ω
Load reactance (+ inductive, − capacitive)	20.000	Ω
Characteristic impedance of the line	50.000	Ω

Calculated results

Parameter	Value	Unit
Magnitude of the reflection coefficient	0.25291	
Phase of the reflection coefficient	29.570	°
Voltage standing wave ratio	1.6770	
Return loss (dB)	11.941	
Mismatch loss (dB)	0.28707	
Fraction of power delivered	93.604	%

Notes for this case

• Γ = (Z_L − Z₀)/(Z_L + Z₀) for a real line impedance. Return loss and mismatch loss in dB; a VSWR of 2 reflects 11 % of the power (0.5 dB mismatch loss).

Formula and method

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0}, \quad VSWR = \frac{1 + |\Gamma|}{1 - |\Gamma|}, \quad RL = -20 \log_{10} |\Gamma|, \quad ML = -10 \log_{10}(1 - |\Gamma|^2)$$

Variables

R_L	Load resistance	Ω
X_L	Load reactance (+ inductive, − capacitive)	Ω
Z_0	Characteristic impedance of the line	Ω
	\Gamma	$
$\angle\Gamma$	Phase of the reflection coefficient	rad
$VSWR$	Voltage standing wave ratio	-
RL	Return loss (dB)	-
ML	Mismatch loss (dB)	-
$1 -$	\Gamma	^2$

Method and standards

Transmission line reflection.

Assumptions and limits

- Lossless line with real characteristic impedance.

References

Reflection on a terminated transmission line

Report details

Report reference	FCC-BZQY-D9DJ (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/vswr-return-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.