CALCULATING THE SHUNT RESISTANCE Rx IN A TRANSMISSION CIRCUIT

$R := 50$ $Rx := 30$

R = Source and detector impedance
Rx = Impedance connected in shunt ie. in parallel with the load.

ATT = Linear voltage attenuation in the transmission circuit.
R= Source and detector resistance

$$ATT := \frac{\frac{Rx \cdot R}{Rx+R}}{\frac{Rx \cdot R}{Rx + R} + R}$$

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After simplification:

$$ATT = \frac{Rx}{(2 \cdot Rx + R)} \qquad ATT := \frac{Rx}{(2 \cdot Rx + R)} \qquad ATT = 0.273$$

$$Rx = ATT \cdot \frac{R}{1 - 2 \cdot ATT}$$

$att := 2 \cdot ATT$ $att = 0.545$

att = attenuation in a R - R ohms (source - det) system
This is the attenuation referenced to the attenuation obtained when Rx is absent.

$$Rx := \frac{1}{2} \cdot att \cdot \frac{R}{(1 - att)} \qquad ATT := \frac{att}{2}$$

$$att = 10^{\frac{dB}{20}} \qquad dB := 20 \cdot \log(att) \qquad dB = -5.265$$

$$Rx := \frac{1}{2}\cdot 10^{\frac{dB}{20}}\cdot\frac{R}{\left(1-10^{\frac{dB}{20}}\right)}$$

$$Rx(dB) := \frac{1}{2}\cdot\frac{R\cdot 10^{\frac{dB}{20}}}{\left(1-10^{\frac{dB}{20}}\right)}$$

FINAL FORMULA

$Rx(-5.265) = 29.999$

$dB := -50, -49.9 .. -0.3$