Microwave Engineering

11/07/13

Last name:	First name:

Exercise 1

a) Transmission line resonators: discuss the operation principles and determine the quality factor of a $\lambda/2$ short circuited transmission line resonator.

b) A $\lambda/2$ short circuited transmission line resonator is made from an air filled piece of copper coaxial line ($\sigma=6 \cdot 10^7$ S/m); the radius of the inner conductor is 1.5 mm and the radius of the outer conductor is 4 mm. Assuming an operating frequency of 6 GHz, determine the quality factor of the resonator.
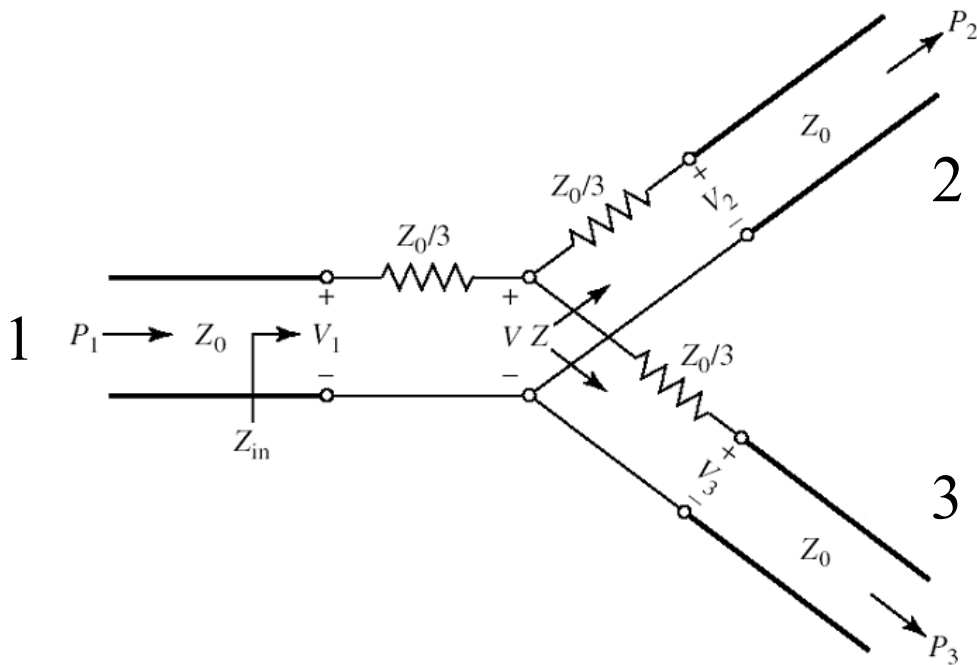
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Exercise 2

a) Prove that we can not build a three-port lossless reciprocal network matched at all ports.

b) Derive the scattering matrix of the resistive divider schematically described in the figure.

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Exercise 3

a) Introduce the radar equation

b) A monostatic radar operating at 14 GHz has an antenna gain of 28 dB and a transmitted power of 2 kW. The target has a cross section of 12 m² and the minimum detectable signal is P_{min}=-90 dBm. What is the maximum range of the radar?