1.

Calculate the noise voltage (in μV scale) and the available noise power (in dBm scale) produced by a 2-MΩ resistor at a standard temperature of $T=T_0=290$ K in a 5 kHz bandwidth. Blotzmann constant k is given by 1.138×10^{-23} J/K.

2.

An amplifier has a gain of 20 dB and a 1 GHz bandwidth. Its equivalent noise temperature is to be measured via the Y-factor method. The following data is obtained:

N_1= - 62.0 dBm for T_1 = 290 K

N_2= - 64.7 dBm for T_2 = 77 K

Find the equivalent noise temperature of the amplifier.

3.

An amplifier has a gain of 20 dB, an equivalent noise temperature of 170 K, and a 1 GHz bandwidth. If the amplifier is used with a source having an equivalent noise temperature of 450 K, what is the output noise power in dBm. Blotzmann constant k is given by 1.138×10^{-23} J/K.

4.

An amplifier with a gain of 12 dB, a bandwidth of 150 MHz, and a noise figure of 4 dB feeds a receiver with a noise temperature of 900 K. Find the noise figure of the overall system.

5.

A transistor has the following scattering parameters at 2 GHz:

$S_{11} = 0.894\angle -60.6°$

$S_{12} = 0.020\angle 62.4°$

$S_{21} = 3.122\angle 123.6°$

$S_{22} = 0.781\angle -27.6°$

Using the K-Δ test, determine whether the transistor is unconditionally stable.

6.

A transistor has the following scattering parameters at 4 GHz:

$S_{11} = 0.75\angle -120°$

$S_{12} = 0$

$S_{21} = 2.5\angle 80°$

$S_{22} = 0.6\angle -70°$

Find the maximum unilateral transducer gain.

7.

A transistor has the following scattering parameters at 4 GHz:

$S_{11} = 0.75\angle -120°$

$S_{12} = 0$

$S_{21} = 2.5\angle 80°$

$S_{22} = 0.6\angle -70°$

Find the center and the radius of the constant gain circle of the input matching section for the gain of 3 dB ($G_S = 3dB$).

8.

A transistor has the following scattering parameters at 4 GHz:

$S_{11} = 0.6\angle -60°$

$S_{12} = 0.05\angle 26°$

$S_{21} = 1.9\angle 81°$

$S_{22} = 0.5\angle -60°$

For design purposes, assume the transistor is unilateral. Calculate the maximum error in the transducer gain resulting from this assumption.

9.

A transistor has the following scattering parameters at 4 GHz:

$S_{11} = 0.6\angle -60°$

$S_{12} = 0.05\angle 26°$

$S_{21} = 1.9\angle 81°$

$S_{22} = 0.5\angle -60°$

$F_{min} = 1.6$ dB

$\Gamma_{opt} = 0.62\ \angle 100°$

For design purposes, assume the transistor is unilateral. Find the center and the radius of the 2 dB noise figure circle.

10.

A transistor has the following scattering parameters at 2 GHz:

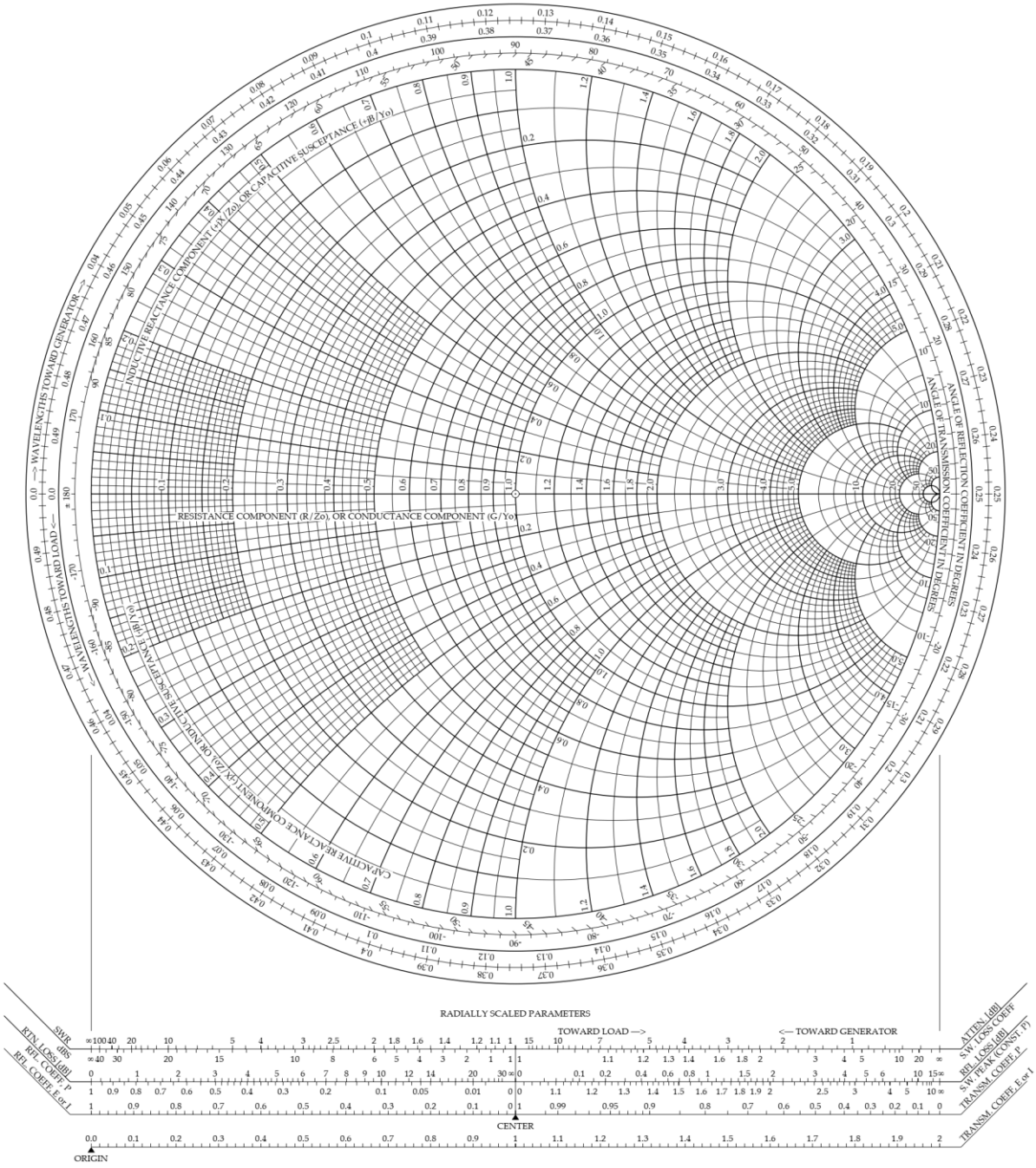
$S_{11} = 0.88\angle -115°$

$S_{12} = 0.029\angle 31°$

$S_{21} = 9.4\angle 110°$

$S_{22} = 0.328\angle -67°$

Plot the stability circles and show the stable region in the Smith chart.


RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACITIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
RADIALLY SCALED PARAMETERS
TOWARD LOAD —>
<— TOWARD GENERATOR
SWR
RTN. LOSS [dB]
REFL. COEFF. P
REFL. COEFF. E or I
ATTEN. [dB]
SW. LOSS COEFF
REFL. LOSS [dB]
SW. PEAK (CONST. P)
TRANSM. COEFF. P
TRANSM. COEFF. E or I
CENTER
ORIGIN