U N I V E R S I T A T E A T E H N I C Ă "G H E O R G H E A S A C H I" D I N I A Ş I
Faculty / Department: Electronics, Telecommunications and Information Technology
Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session _____June_____ / __2022

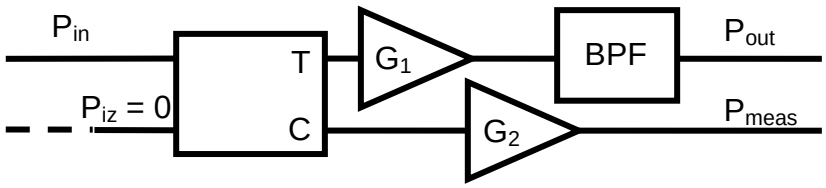
S U B J E C T N o . 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 65 Ω resistor paralel with a 0.634 pF capacitor, at 7.2 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $1.225 - j \cdot 0.995$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.55dB, two matched amplifiers G_1 = 8.9dB and G_2 = 9.8dB and a band-pass filter (equal ripple filter with a ripple equal to 0.5dB). Assume the input power is 3.90mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $43.3\Omega + j \cdot 41.7\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.2dB and Noise Factor 1.28dB) and Device 2 (Gain 11.4dB and Noise Factor 1.00dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 12.8 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	147.6°	1.720	-20.4°	0.090	-31.0°	0.550	-148.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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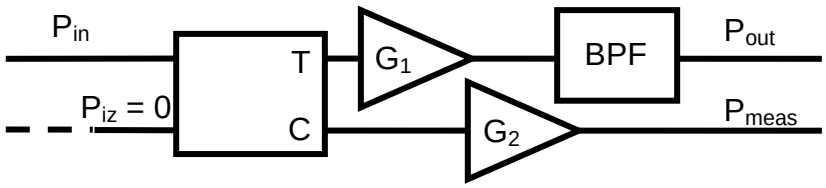
S U B J E C T N o . 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 39 Ω resistor series with a 0.580 nH inductor, at 9.0 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $1.145 - j \cdot 0.955$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.05dB, two matched amplifiers G_1 = 7.9dB and G_2 = 10.4dB and a band-pass filter (equal ripple filter with a ripple equal to 0.8dB). Assume the input power is 1.45mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $66.8\Omega - j \cdot 53.8\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.6dB and Noise Factor 1.25dB) and Device 2 (Gain 11.8dB and Noise Factor 1.00dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.612	124.8°	1.629	-42.8°	0.096	-38.8°	0.556	-164.4°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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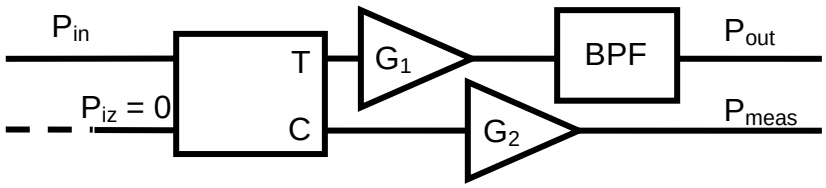
S U B J E C T N o . 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 60 Ω resistor series with a 0.897 nH inductor, at 9.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.040 − j·0.825 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.50dB, two matched amplifiers G_1 = 6.9dB and G_2 = 9.8dB and a band-pass filter (equal ripple filter with a ripple equal to 2.5dB). Assume the input power is 1.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 16.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 62.6Ω − j·48.5Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.4dB and Noise Factor 1.23dB) and Device 2 (Gain 11.6dB and Noise Factor 0.93dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.615	126.0°	1.633	-41.5°	0.095	-38.0°	0.555	-163.5°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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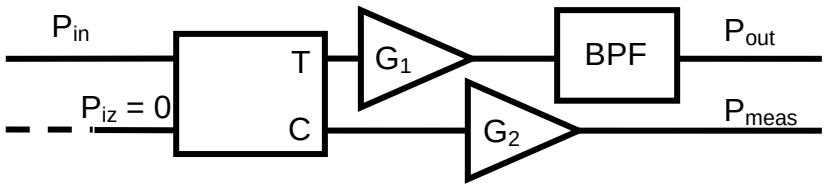
S U B J E C T N o . 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 35 Ω resistor paralel with a 1.607 nH inductor, at 7.3 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.925 + j·0.925 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.95dB, two matched amplifiers G_1 = 6.9dB and G_2 = 11.0dB and a band-pass filter (equal ripple filter with a ripple equal to 2.7dB). Assume the input power is 2.65mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 24.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 58.5Ω + j·46.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.25dB) and Device 2 (Gain 10.4dB and Noise Factor 1.05dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.9 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.631	133.3°	1.658	-33.8°	0.090	-33.8°	0.550	-158.1°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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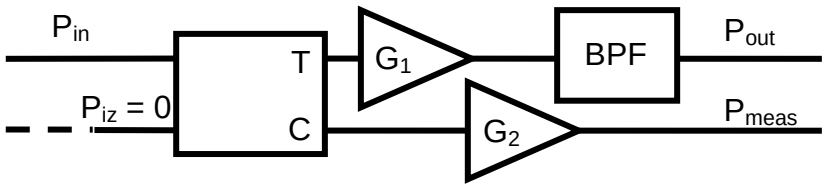
S U B J E C T N o . 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 73 Ω resistor paralel with a 0.433 pF capacitor, at 9.3 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.170 − j·1.105 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.10dB, two matched amplifiers G_1 = 8.9dB and G_2 = 10.9dB and a band-pass filter (equal ripple filter with a ripple equal to 1.3dB). Assume the input power is 2.50mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 19.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 62.9Ω − j·66.2Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.6dB and Noise Factor 1.24dB) and Device 2 (Gain 11.4dB and Noise Factor 0.92dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 15.0 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.600	120.0°	1.614	-48.0°	0.100	-42.0°	0.560	-168.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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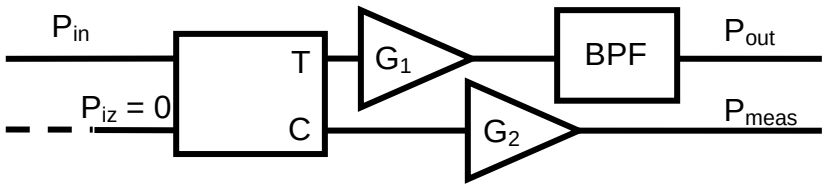
S U B J E C T N o . 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 38 Ω resistor paralel with a 0.701 nH inductor, at 9.6 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.910 - j \cdot 1.225$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.55dB, two matched amplifiers G_1 = 7.4dB and G_2 = 10.9dB and a band-pass filter (equal ripple filter with a ripple equal to 2.4dB). Assume the input power is 3.50mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $55.3\Omega - j \cdot 41.7\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.8dB and Noise Factor 1.27dB) and Device 2 (Gain 11.1dB and Noise Factor 1.03dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.0 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.650	-164.0°	2.508	28.0°	0.070	3.0°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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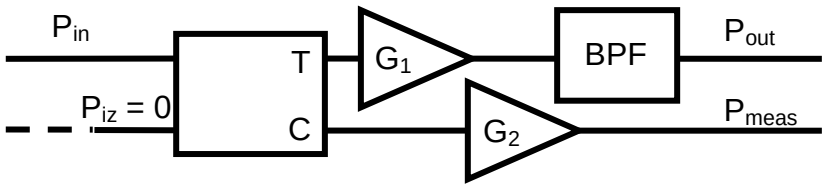
S U B J E C T N o . 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 31 Ω resistor paralel with a 1.291 nH inductor, at 8.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.750 - j\cdot 0.725$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.05dB, two matched amplifiers G_1 = 8.1dB and G_2 = 11.5dB and a band-pass filter (equal ripple filter with a ripple equal to 1.6dB). Assume the input power is 3.45mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 20.2dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $36.4\Omega - j\cdot 40.9\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.7dB and Noise Factor 1.10dB) and Device 2 (Gain 11.6dB and Noise Factor 0.95dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.2 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.638	142.4°	1.698	-25.4°	0.090	-32.4°	0.550	-151.8°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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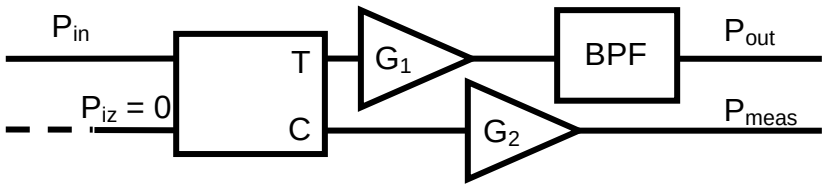
S U B J E C T N o . 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 53 Ω resistor paralel with a 0.286 pF capacitor, at 9.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $1.165 - j \cdot 0.840$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.05dB, two matched amplifiers G_1 = 9.9dB and G_2 = 11.3dB and a band-pass filter (equal ripple filter with a ripple equal to 0.8dB). Assume the input power is 3.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 24.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $36.7\Omega - j \cdot 58.1\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.5dB and Noise Factor 1.12dB) and Device 2 (Gain 11.3dB and Noise Factor 0.91dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.602	174.0°	2.306	7.2°	0.080	-4.0°	0.520	-114.4°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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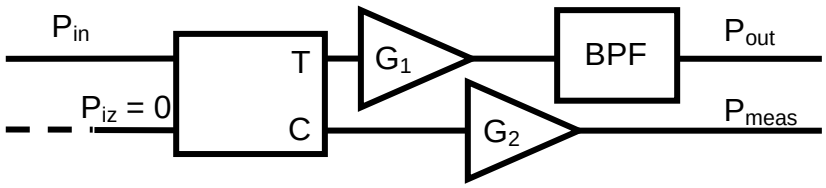
S U B J E C T N o . 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 72 Ω resistor paralel with a 0.421 pF capacitor, at 10.0 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.730 + j·0.865 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.30dB, two matched amplifiers G_1 = 7.4dB and G_2 = 11.0dB and a band-pass filter (equal ripple filter with a ripple equal to 1.2dB). Assume the input power is 3.65mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 18.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 36.0Ω + j·36.6Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.4dB and Noise Factor 1.22dB) and Device 2 (Gain 11.4dB and Noise Factor 0.97dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.632	-171.8°	2.430	20.2°	0.076	0.6°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session _____June_____ / __2022

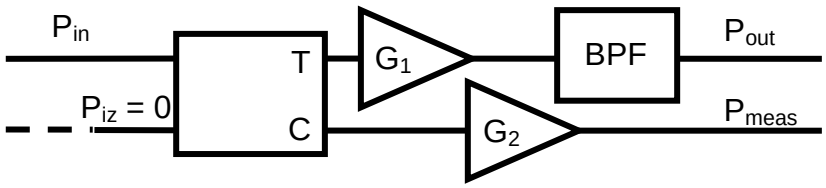
S U B J E C T N o . 1 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 44 Ω resistor paralel with a 0.348 pF capacitor, at 7.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.950 + j·1.100 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.40dB, two matched amplifiers G_1 = 9.3dB and G_2 = 10.2dB and a band-pass filter (equal ripple filter with a ripple equal to 1.0dB). Assume the input power is 1.50mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 19.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 44.9Ω − j·55.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.1dB and Noise Factor 1.16dB) and Device 2 (Gain 10.3dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.0 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	145.0°	1.709	-23.0°	0.090	-32.0°	0.550	-150.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Course : MDCR - EDID407
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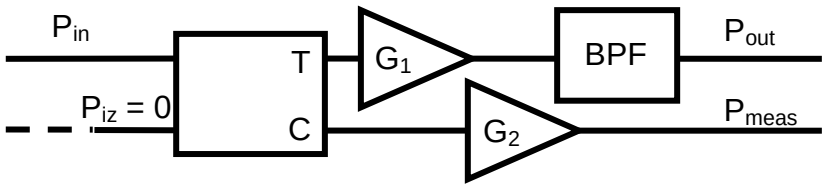
S U B J E C T N o . 1 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 40 Ω resistor paralel with a 0.626 nH inductor, at 9.6 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.225 + j·1.200 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.80dB, two matched amplifiers G_1 = 7.4dB and G_2 = 8.0dB and a band-pass filter (equal ripple filter with a ripple equal to 2.3dB). Assume the input power is 2.65mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 48.8Ω + j·51.6Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.1dB and Noise Factor 1.29dB) and Device 2 (Gain 10.7dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.2 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.644	-166.6°	2.482	25.4°	0.072	2.2°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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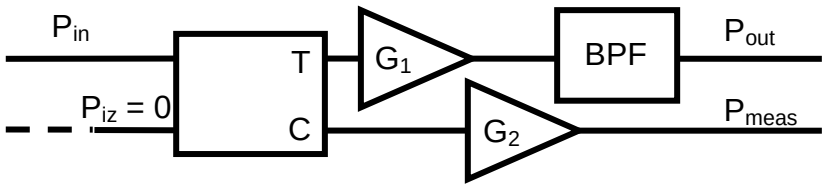
S U B J E C T N o . 1 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 35 Ω resistor paralel with a 0.445 pF capacitor, at 8.2 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $1.015 - j \cdot 0.710$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.65dB, two matched amplifiers G_1 = 9.6dB and G_2 = 8.2dB and a band-pass filter (equal ripple filter with a ripple equal to 1.6dB). Assume the input power is 2.25mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $54.5\Omega + j \cdot 55.0\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.2dB and Noise Factor 1.16dB) and Device 2 (Gain 10.6dB and Noise Factor 1.07dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.4 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.638	-169.2°	2.456	22.8°	0.074	1.4°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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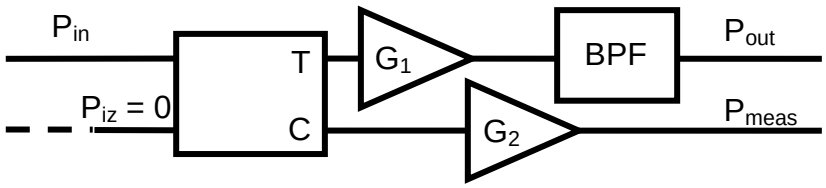
S U B J E C T N o . 1 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 50 Ω resistor paralel with a 0.364 pF capacitor, at 8.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.910 − j·0.810 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.45dB, two matched amplifiers G_1 = 6.5dB and G_2 = 9.9dB and a band-pass filter (equal ripple filter with a ripple equal to 1.1dB). Assume the input power is 1.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 16.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 58.0Ω − j·39.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.0dB and Noise Factor 1.18dB) and Device 2 (Gain 10.8dB and Noise Factor 0.98dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 12.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	150.2°	1.732	-17.8°	0.090	-30.0°	0.550	-146.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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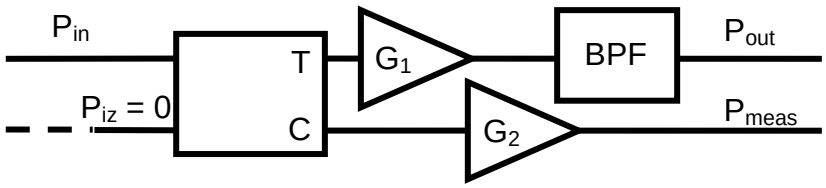
S U B J E C T N o . 1 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 52 Ω resistor series with a 0.674 nH inductor, at 7.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.040 + j·1.085 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.10dB, two matched amplifiers G_1 = 7.9dB and G_2 = 8.2dB and a band-pass filter (equal ripple filter with a ripple equal to 2.2dB). Assume the input power is 2.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 63.4Ω − j·55.6Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.1dB and Noise Factor 1.18dB) and Device 2 (Gain 10.6dB and Noise Factor 1.05dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 12.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	151.5°	1.737	-16.5°	0.090	-29.5°	0.550	-145.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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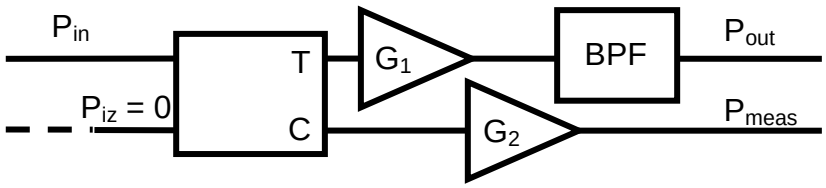
S U B J E C T N o . 1 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 71 Ω resistor paralel with a 0.595 pF capacitor, at 6.5 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.950 + j·1.275 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.60dB, two matched amplifiers G_1 = 7.1dB and G_2 = 10.2dB and a band-pass filter (equal ripple filter with a ripple equal to 2.1dB). Assume the input power is 2.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 18.5dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 52.1Ω − j·34.0Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.9dB and Noise Factor 1.27dB) and Device 2 (Gain 10.2dB and Noise Factor 1.08dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.0 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.620	-177.0°	2.378	15.0°	0.080	-1.0°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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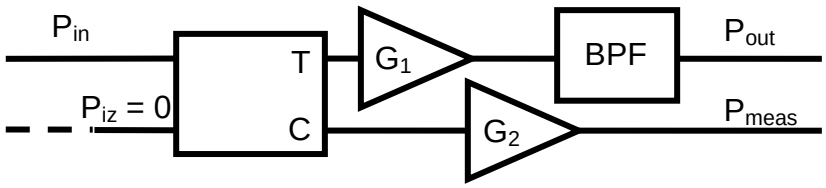
S U B J E C T N o . 1 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 38 Ω resistor paralel with a 0.896 nH inductor, at 7.3 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.855 + j·1.275 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.90dB, two matched amplifiers G_1 = 8.3dB and G_2 = 9.6dB and a band-pass filter (equal ripple filter with a ripple equal to 2.2dB). Assume the input power is 1.60mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 67.8Ω − j·62.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.9dB and Noise Factor 1.15dB) and Device 2 (Gain 10.3dB and Noise Factor 1.07dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.609	123.6°	1.625	-44.1°	0.097	-39.6°	0.557	-165.3°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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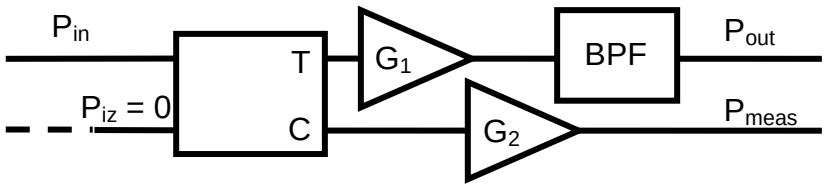
S U B J E C T N o . 1 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 60 Ω resistor series with a 0.301 pF capacitor, at 7.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.735 + j·0.905 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.75dB, two matched amplifiers G_1 = 8.9dB and G_2 = 10.3dB and a band-pass filter (equal ripple filter with a ripple equal to 0.7dB). Assume the input power is 1.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.5dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 47.1Ω − j·53.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.7dB and Noise Factor 1.23dB) and Device 2 (Gain 10.5dB and Noise Factor 1.08dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.634	137.2°	1.675	-30.2°	0.090	-33.2°	0.550	-155.4°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session _____June_____ / __2022

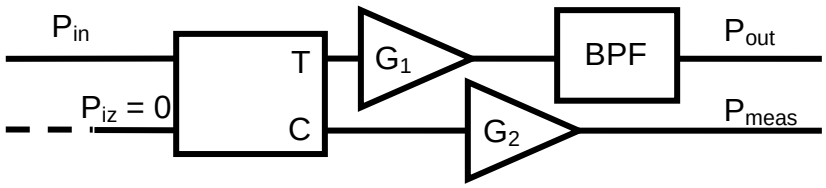
S U B J E C T N o . 1 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 36 Ω resistor series with a 1.178 nH inductor, at 7.3 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.890 + j·1.110 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.10dB, two matched amplifiers G_1 = 8.7dB and G_2 = 8.5dB and a band-pass filter (equal ripple filter with a ripple equal to 2.9dB). Assume the input power is 1.95mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.5dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 51.7Ω + j·63.0Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.25dB) and Device 2 (Gain 10.3dB and Noise Factor 0.98dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.6 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.662	-158.8°	2.576	33.6°	0.070	5.4°	0.516	-101.4°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Course : MDCR - EDID407
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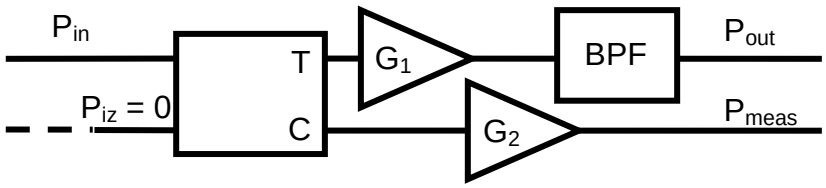
S U B J E C T N o . 1 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 51 Ω resistor series with a 0.649 pF capacitor, at 7.1 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.825 + j·1.280 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.50dB, two matched amplifiers G_1 = 9.5dB and G_2 = 10.5dB and a band-pass filter (equal ripple filter with a ripple equal to 1.3dB). Assume the input power is 2.00mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 19.8dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 68.9Ω − j·68.1Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.10dB) and Device 2 (Gain 10.5dB and Noise Factor 0.92dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.3 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.621	128.4°	1.641	-38.9°	0.093	-36.4°	0.553	-161.7°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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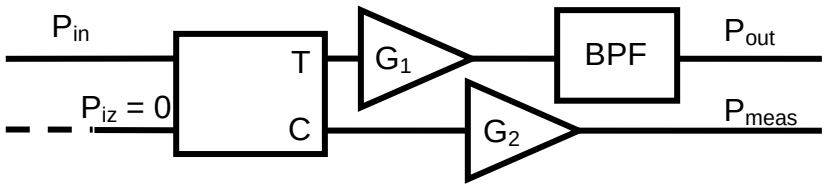
S U B J E C T N o . 2 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 44 Ω resistor series with a 0.477 pF capacitor, at 8.1 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.840 + j·0.810 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.40dB, two matched amplifiers G_1 = 7.7dB and G_2 = 9.8dB and a band-pass filter (equal ripple filter with a ripple equal to 2.3dB). Assume the input power is 1.60mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.0dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 46.2Ω + j·38.4Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.4dB and Noise Factor 1.19dB) and Device 2 (Gain 10.8dB and Noise Factor 0.90dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.9 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.653	-162.7°	2.525	29.4°	0.070	3.6°	0.519	-107.1°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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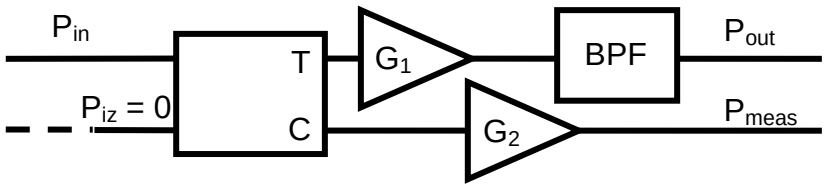
S U B J E C T N o . 2 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 38 Ω resistor series with a 1.417 nH inductor, at 8.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.240 + j·0.825 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.55dB, two matched amplifiers G_1 = 8.4dB and G_2 = 10.8dB and a band-pass filter (equal ripple filter with a ripple equal to 0.8dB). Assume the input power is 2.45mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 24.8dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 41.7Ω − j·54.6Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.4dB and Noise Factor 1.15dB) and Device 2 (Gain 11.0dB and Noise Factor 1.02dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 12.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	148.9°	1.726	-19.1°	0.090	-30.5°	0.550	-147.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
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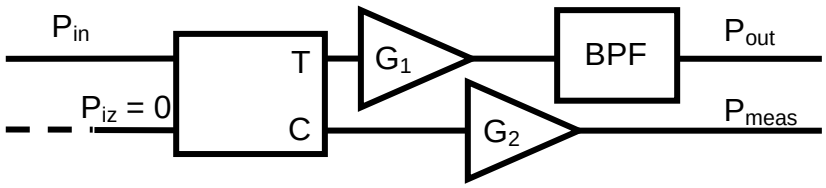
S U B J E C T N o . 2 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 50 Ω resistor series with a 0.318 pF capacitor, at 9.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.995 - j \cdot 0.700$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.20dB, two matched amplifiers G_1 = 9.8dB and G_2 = 8.3dB and a band-pass filter (equal ripple filter with a ripple equal to 1.6dB). Assume the input power is 3.20mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 20.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $43.7\Omega + j \cdot 57.3\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.8dB and Noise Factor 1.12dB) and Device 2 (Gain 11.8dB and Noise Factor 1.06dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.8 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.656	-161.4°	2.542	30.8°	0.070	4.2°	0.518	-105.2°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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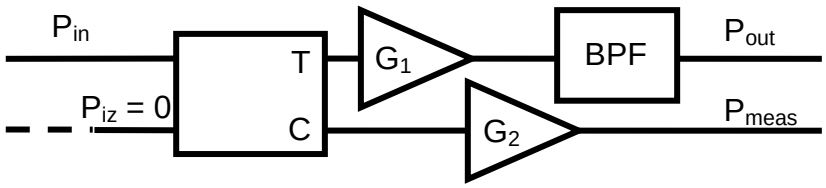
S U B J E C T N o . 2 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 48 Ω resistor paralel with a 1.068 nH inductor, at 9.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.745 + j·0.855 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.95dB, two matched amplifiers G_1 = 6.0dB and G_2 = 8.7dB and a band-pass filter (equal ripple filter with a ripple equal to 0.8dB). Assume the input power is 2.20mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 24.2dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 46.8Ω + j·56.4Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.0dB and Noise Factor 1.27dB) and Device 2 (Gain 10.2dB and Noise Factor 1.02dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.9 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.623	-175.7°	2.391	16.3°	0.079	-0.6°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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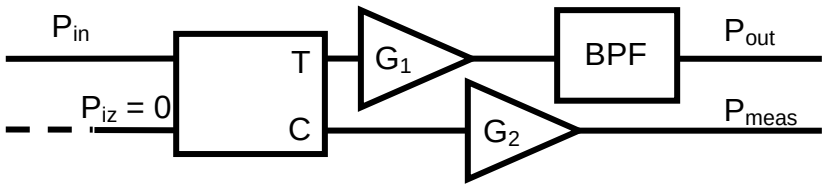
S U B J E C T N o . 2 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 51 Ω resistor paralel with a 0.511 pF capacitor, at 8.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.805 + j·0.845 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.45dB, two matched amplifiers G_1 = 7.4dB and G_2 = 9.4dB and a band-pass filter (equal ripple filter with a ripple equal to 2.9dB). Assume the input power is 3.60mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 55.3Ω − j·56.2Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.1dB and Noise Factor 1.29dB) and Device 2 (Gain 10.0dB and Noise Factor 0.97dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.4 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.618	127.2°	1.637	-40.2°	0.094	-37.2°	0.554	-162.6°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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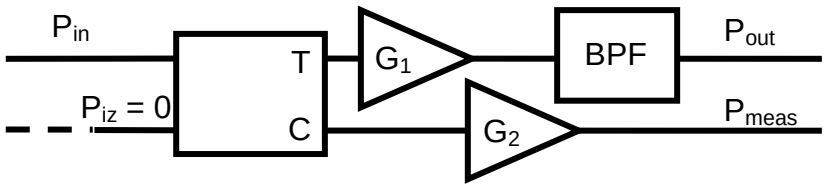
S U B J E C T N o . 2 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 59 Ω resistor series with a 0.630 pF capacitor, at 8.2 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $1.135 - j \cdot 0.775$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.85dB, two matched amplifiers G_1 = 7.0dB and G_2 = 10.3dB and a band-pass filter (equal ripple filter with a ripple equal to 1.0dB). Assume the input power is 2.45mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 20.5dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $30.2\Omega + j \cdot 41.1\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.12dB) and Device 2 (Gain 11.5dB and Noise Factor 0.93dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.3 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.641	-167.9°	2.469	24.1°	0.073	1.8°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session _____June_____ / __2022

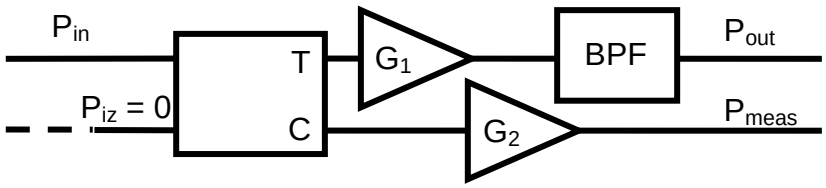
S U B J E C T N o . 2 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 50 Ω resistor paralel with a 0.515 pF capacitor, at 7.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.265 + j·1.155 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.80dB, two matched amplifiers G_1 = 6.4dB and G_2 = 9.3dB and a band-pass filter (equal ripple filter with a ripple equal to 0.9dB). Assume the input power is 1.90mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 16.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 53.9Ω − j·60.7Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.8dB and Noise Factor 1.25dB) and Device 2 (Gain 11.6dB and Noise Factor 0.91dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.629	-173.1°	2.417	18.9°	0.077	0.2°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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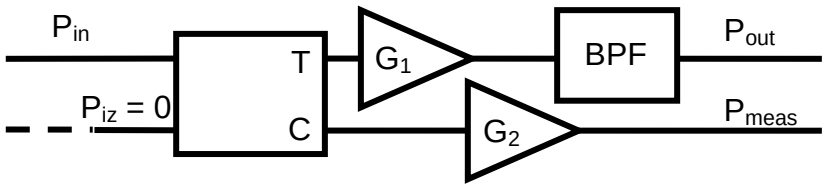
S U B J E C T N o . 2 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 74 Ω resistor series with a 1.150 nH inductor, at 8.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.085 + j·0.860 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.55dB, two matched amplifiers G_1 = 9.5dB and G_2 = 9.7dB and a band-pass filter (equal ripple filter with a ripple equal to 1.9dB). Assume the input power is 1.80mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.0dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 45.3Ω + j·31.1Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.0dB and Noise Factor 1.26dB) and Device 2 (Gain 11.6dB and Noise Factor 1.05dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.665	-157.5°	2.593	35.0°	0.070	6.0°	0.515	-99.5°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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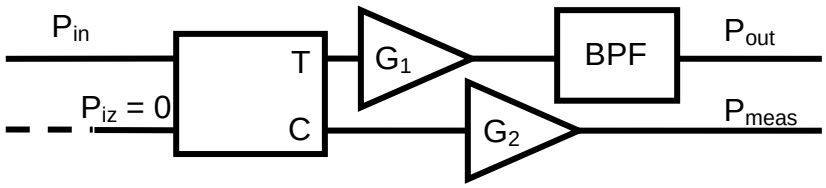
S U B J E C T N o . 2 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 50 Ω resistor paralel with a 0.221 pF capacitor, at 9.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.715 - j \cdot 0.940$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.30dB, two matched amplifiers G_1 = 8.1dB and G_2 = 8.2dB and a band-pass filter (equal ripple filter with a ripple equal to 1.0dB). Assume the input power is 2.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 23.9dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $65.2\Omega - j \cdot 67.4\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.8dB and Noise Factor 1.24dB) and Device 2 (Gain 11.0dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.8 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.626	-174.4°	2.404	17.6°	0.078	-0.2°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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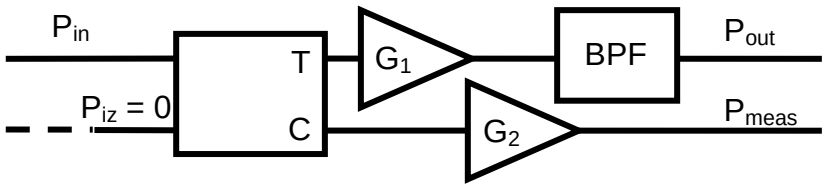
S U B J E C T N o . 2 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 42 Ω resistor paralel with a 1.559 nH inductor, at 6.5 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.985 - j \cdot 0.815$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.05dB, two matched amplifiers G_1 = 7.4dB and G_2 = 8.1dB and a band-pass filter (equal ripple filter with a ripple equal to 2.8dB). Assume the input power is 2.55mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 17.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $45.7\Omega - j \cdot 39.0\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.8dB and Noise Factor 1.24dB) and Device 2 (Gain 11.1dB and Noise Factor 1.08dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.1 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.617	-178.5°	2.366	13.7°	0.080	-1.5°	0.520	-109.9°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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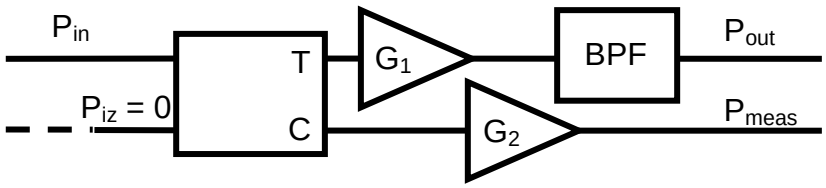
S U B J E C T N o . 3 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 57 Ω resistor paralel with a 0.320 pF capacitor, at 7.2 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.900 + j·0.990 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.65dB, two matched amplifiers G_1 = 7.3dB and G_2 = 10.5dB and a band-pass filter (equal ripple filter with a ripple equal to 1.6dB). Assume the input power is 2.80mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 65.7Ω − j·39.5Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.8dB and Noise Factor 1.11dB) and Device 2 (Gain 11.0dB and Noise Factor 0.90dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 12.9 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.640	146.3°	1.715	-21.7°	0.090	-31.5°	0.550	-149.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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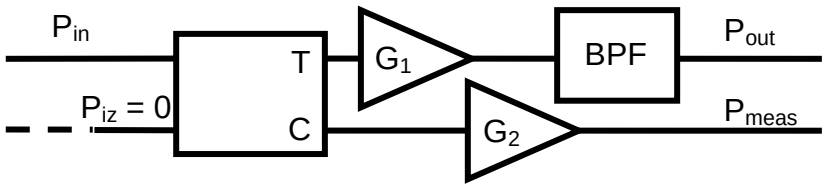
S U B J E C T N o . 3 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 60 Ω resistor paralel with a 1.179 nH inductor, at 9.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.870 − j·0.775 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.90dB, two matched amplifiers G_1 = 6.3dB and G_2 = 8.6dB and a band-pass filter (equal ripple filter with a ripple equal to 2.5dB). Assume the input power is 3.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.9dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 35.2Ω + j·64.4Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.7dB and Noise Factor 1.22dB) and Device 2 (Gain 10.4dB and Noise Factor 0.90dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.635	-170.5°	2.443	21.5°	0.075	1.0°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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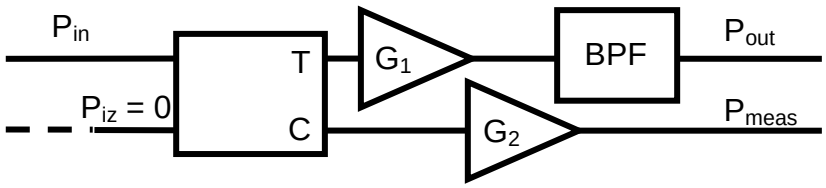
S U B J E C T N o . 3 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 40 Ω resistor series with a 0.732 nH inductor, at 6.5 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.700 + j·0.790 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.05dB, two matched amplifiers G_1 = 9.2dB and G_2 = 10.4dB and a band-pass filter (equal ripple filter with a ripple equal to 2.5dB). Assume the input power is 2.40mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 43.8Ω + j·60.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.8dB and Noise Factor 1.14dB) and Device 2 (Gain 10.5dB and Noise Factor 1.05dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.4 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.636	139.8°	1.686	-27.8°	0.090	-32.8°	0.550	-153.6°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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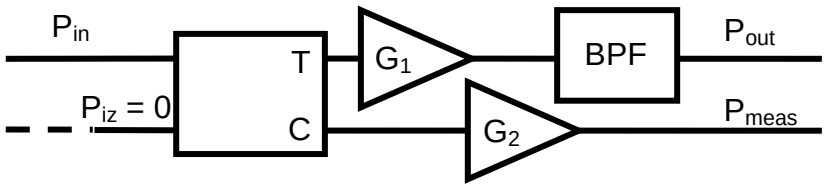
S U B J E C T N o . 3 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 62 Ω resistor paralel with a 0.549 pF capacitor, at 6.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.130 − j·0.840 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.90dB, two matched amplifiers G_1 = 6.7dB and G_2 = 9.5dB and a band-pass filter (equal ripple filter with a ripple equal to 2.0dB). Assume the input power is 2.00mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 20.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 65.7Ω − j·56.0Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.3dB and Noise Factor 1.16dB) and Device 2 (Gain 11.6dB and Noise Factor 0.94dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.9 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.603	121.2°	1.618	-46.7°	0.099	-41.2°	0.559	-167.1°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Domain: Telecommunication Technologies and Systems
Course : MDCR - EDID407
Enrollment Year: ___4____, Examination Session _____June_____ / __2022

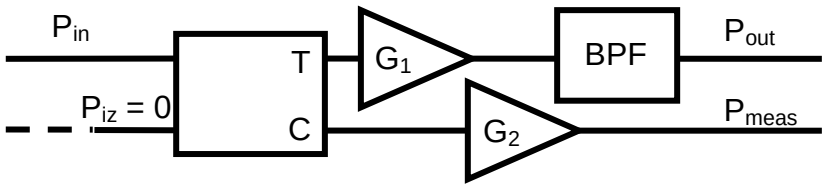
S U B J E C T N o . 3 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 53 Ω resistor paralel with a 1.198 nH inductor, at 6.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.160 − j·1.010 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.85dB, two matched amplifiers G_1 = 8.3dB and G_2 = 8.0dB and a band-pass filter (equal ripple filter with a ripple equal to 0.6dB). Assume the input power is 3.65mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.9dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 67.5Ω − j·47.8Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.0dB and Noise Factor 1.14dB) and Device 2 (Gain 10.8dB and Noise Factor 0.95dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.633	135.9°	1.669	-31.4°	0.090	-33.4°	0.550	-156.3°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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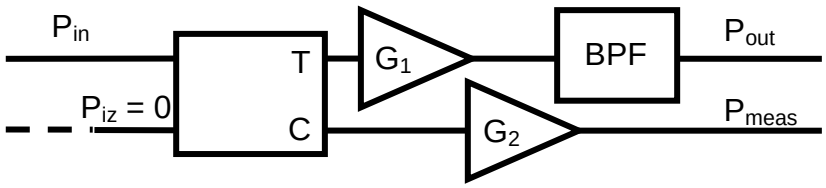
S U B J E C T N o . 3 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 42 Ω resistor paralel with a 0.357 pF capacitor, at 8.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.970 − j·0.775 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.25dB, two matched amplifiers G_1 = 9.9dB and G_2 = 8.9dB and a band-pass filter (equal ripple filter with a ripple equal to 1.5dB). Assume the input power is 2.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 15.5dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 61.9Ω + j·69.7Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.0dB and Noise Factor 1.20dB) and Device 2 (Gain 11.9dB and Noise Factor 0.98dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.2 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.624	129.6°	1.644	-37.6°	0.092	-35.6°	0.552	-160.8°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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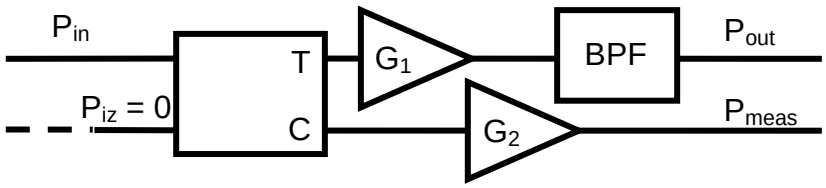
S U B J E C T N o . 3 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 58 Ω resistor paralel with a 0.370 pF capacitor, at 9.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.290 + j·1.015 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.50dB, two matched amplifiers G_1 = 6.8dB and G_2 = 9.6dB and a band-pass filter (equal ripple filter with a ripple equal to 2.4dB). Assume the input power is 2.35mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 18.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 42.1Ω + j·46.1Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.14dB) and Device 2 (Gain 10.2dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.3 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.637	141.1°	1.692	-26.6°	0.090	-32.6°	0.550	-152.7°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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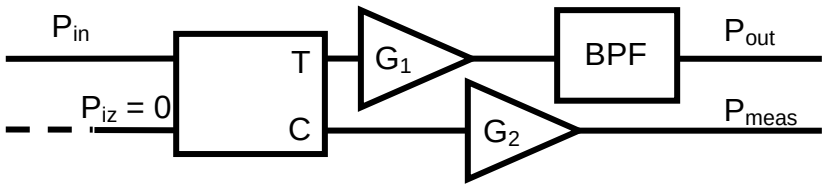
S U B J E C T N o . 3 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 31 Ω resistor paralel with a 0.817 nH inductor, at 6.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.010 − j·0.920 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.15dB, two matched amplifiers G_1 = 8.4dB and G_2 = 8.9dB and a band-pass filter (equal ripple filter with a ripple equal to 2.1dB). Assume the input power is 4.00mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 33.1Ω + j·53.7Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.9dB and Noise Factor 1.14dB) and Device 2 (Gain 11.8dB and Noise Factor 1.09dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.1 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.627	130.8°	1.648	-36.3°	0.091	-34.8°	0.551	-159.9°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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Course : MDCR - EDID407
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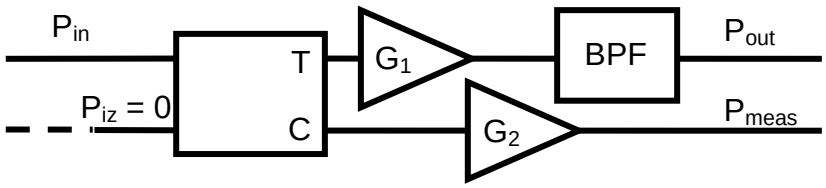
S U B J E C T N o . 3 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 45 Ω resistor paralel with a 0.278 pF capacitor, at 8.3 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.980 + j·0.970 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.70dB, two matched amplifiers G_1 = 9.0dB and G_2 = 9.7dB and a band-pass filter (equal ripple filter with a ripple equal to 2.5dB). Assume the input power is 1.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 61.1Ω + j·68.9Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.8dB and Noise Factor 1.22dB) and Device 2 (Gain 10.4dB and Noise Factor 0.98dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.3 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.611	178.5°	2.342	11.1°	0.080	-2.5°	0.520	-111.7°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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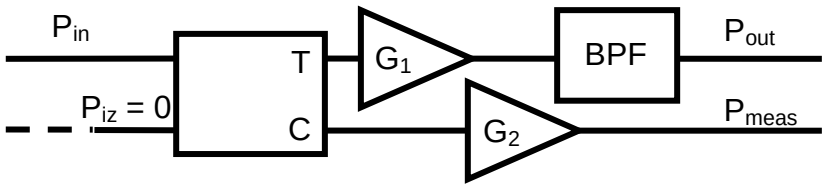
S U B J E C T N o . 3 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 67 Ω resistor paralel with a 0.275 pF capacitor, at 9.1 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to $0.920 - j \cdot 1.225$ compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.10dB, two matched amplifiers G_1 = 9.6dB and G_2 = 8.5dB and a band-pass filter (equal ripple filter with a ripple equal to 1.8dB). Assume the input power is 2.05mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a $52.3\Omega + j \cdot 33.6\Omega$ load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.6dB and Noise Factor 1.14dB) and Device 2 (Gain 11.3dB and Noise Factor 1.01dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.0 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.630	132.0°	1.652	-35.0°	0.090	-34.0°	0.550	-159.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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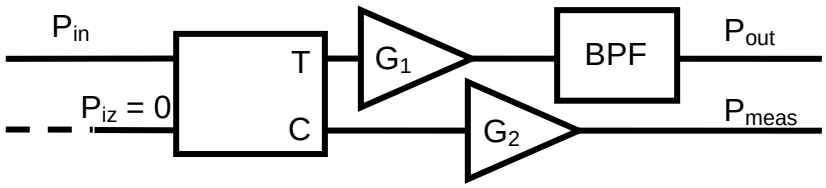
S U B J E C T N o . 4 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 39 Ω resistor series with a 0.823 pF capacitor, at 7.6 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.805 − j·1.050 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.85dB, two matched amplifiers G_1 = 6.9dB and G_2 = 8.4dB and a band-pass filter (equal ripple filter with a ripple equal to 1.9dB). Assume the input power is 4.00mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 16.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 50.9Ω − j·64.5Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.4dB and Noise Factor 1.24dB) and Device 2 (Gain 11.2dB and Noise Factor 1.08dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 9.1 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.647	-165.3°	2.495	26.7°	0.071	2.6°	0.520	-109.0°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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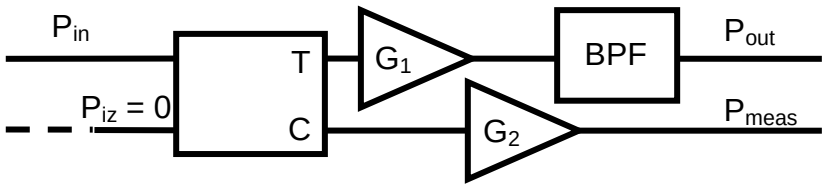
S U B J E C T N o . 4 1

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 45 Ω resistor paralel with a 0.428 pF capacitor, at 8.9 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.130 − j·0.915 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.45dB, two matched amplifiers G_1 = 7.1dB and G_2 = 11.2dB and a band-pass filter (equal ripple filter with a ripple equal to 2.7dB). Assume the input power is 2.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 18.1dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 60.2Ω + j·49.2Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.5dB and Noise Factor 1.25dB) and Device 2 (Gain 11.2dB and Noise Factor 0.94dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.659	-160.1°	2.559	32.2°	0.070	4.8°	0.517	-103.3°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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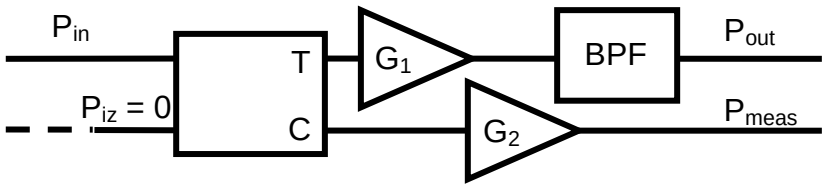
S U B J E C T N o . 4 2

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 33 Ω resistor paralel with a 0.775 nH inductor, at 7.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.880 − j·1.205 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.75dB, two matched amplifiers G_1 = 6.5dB and G_2 = 10.6dB and a band-pass filter (equal ripple filter with a ripple equal to 0.9dB). Assume the input power is 3.15mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.9dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 64.0Ω + j·52.7Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.1dB and Noise Factor 1.21dB) and Device 2 (Gain 10.4dB and Noise Factor 1.03dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.1 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.639	143.7°	1.703	-24.2°	0.090	-32.2°	0.550	-150.9°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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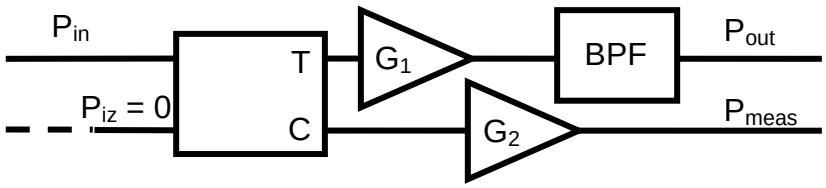
S U B J E C T N o . 4 3

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 46 Ω resistor paralel with a 0.488 pF capacitor, at 9.4 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.870 + j·1.140 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.90dB, two matched amplifiers G_1 = 8.6dB and G_2 = 10.3dB and a band-pass filter (equal ripple filter with a ripple equal to 2.3dB). Assume the input power is 2.15mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 23.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 48.2Ω − j·67.5Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.9dB and Noise Factor 1.25dB) and Device 2 (Gain 11.5dB and Noise Factor 0.97dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.605	175.5°	2.318	8.5°	0.080	-3.5°	0.520	-113.5°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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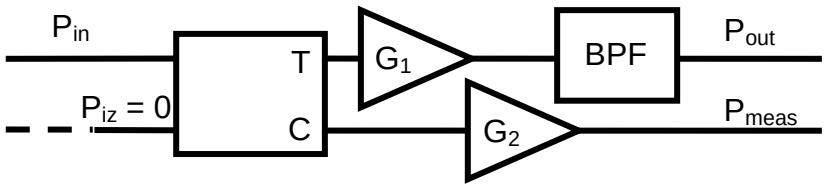
S U B J E C T N o . 4 4

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 41 Ω resistor paralel with a 0.476 pF capacitor, at 6.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.010 − j·0.920 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 6.25dB, two matched amplifiers G_1 = 6.3dB and G_2 = 11.8dB and a band-pass filter (equal ripple filter with a ripple equal to 1.9dB). Assume the input power is 3.45mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 23.8dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 31.1Ω − j·51.0Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.8dB and Noise Factor 1.21dB) and Device 2 (Gain 10.0dB and Noise Factor 0.93dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.4 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.608	177.0°	2.330	9.8°	0.080	-3.0°	0.520	-112.6°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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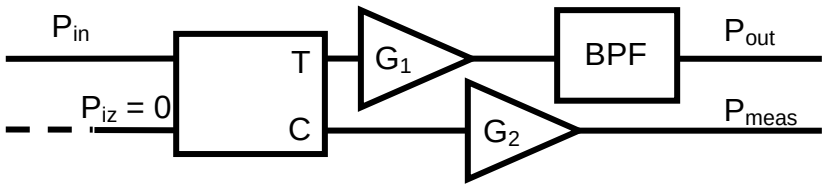
S U B J E C T N o . 4 5

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 44 Ω resistor paralel with a 0.490 pF capacitor, at 10.0 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.740 + j·1.175 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.60dB, two matched amplifiers G_1 = 6.4dB and G_2 = 9.7dB and a band-pass filter (equal ripple filter with a ripple equal to 2.1dB). Assume the input power is 1.65mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 69.9Ω + j·42.2Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.3dB and Noise Factor 1.20dB) and Device 2 (Gain 11.5dB and Noise Factor 0.91dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 8.4 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.668	-156.2°	2.610	36.4°	0.070	6.6°	0.514	-97.6°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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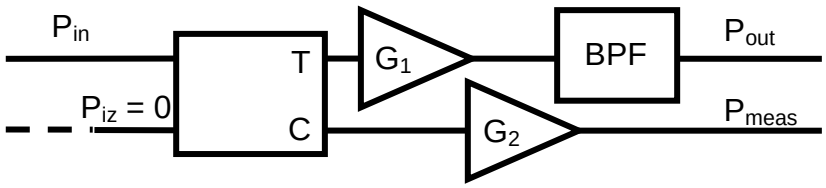
S U B J E C T N o . 4 6

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 48 Ω resistor series with a 0.334 pF capacitor, at 9.6 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.815 − j·1.040 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.55dB, two matched amplifiers G_1 = 8.4dB and G_2 = 9.1dB and a band-pass filter (equal ripple filter with a ripple equal to 1.2dB). Assume the input power is 3.30mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 19.3dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 32.0Ω − j·32.1Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.8dB and Noise Factor 1.16dB) and Device 2 (Gain 10.0dB and Noise Factor 0.93dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 14.8 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.606	122.4°	1.622	-45.4°	0.098	-40.4°	0.558	-166.2°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

U N I V E R S I T A T E A T E H N I C Ă " G H E O R G H E A S A C H I " D I N I A Ş I
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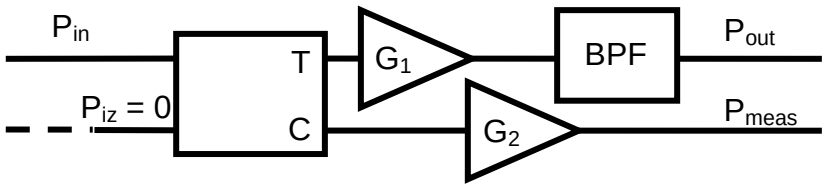
S U B J E C T N o . 4 7

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 49 Ω resistor paralel with a 0.371 pF capacitor, at 7.5 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.930 − j·1.070 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.65dB, two matched amplifiers G_1 = 7.1dB and G_2 = 9.9dB and a band-pass filter (equal ripple filter with a ripple equal to 1.5dB). Assume the input power is 2.35mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 21.6dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 40.3Ω − j·67.5Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.2dB and Noise Factor 1.19dB) and Device 2 (Gain 10.9dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.7 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.599	172.5°	2.294	5.9°	0.080	-4.5°	0.520	-115.3°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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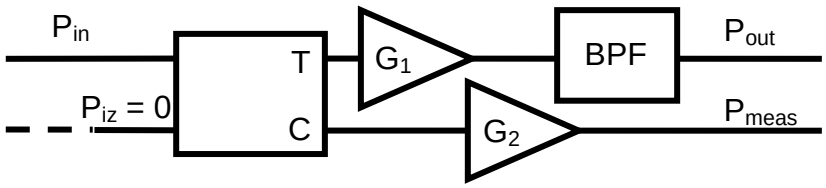
S U B J E C T N o . 4 8

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 40 Ω resistor series with a 0.394 pF capacitor, at 7.7 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 1.295 + j·1.230 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 5.45dB, two matched amplifiers G_1 = 8.6dB and G_2 = 8.7dB and a band-pass filter (equal ripple filter with a ripple equal to 1.2dB). Assume the input power is 3.05mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 22.2dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 69.3Ω + j·30.6Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 9.4dB and Noise Factor 1.13dB) and Device 2 (Gain 11.0dB and Noise Factor 0.93dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.8 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.632	134.6°	1.663	-32.6°	0.090	-33.6°	0.550	-157.2°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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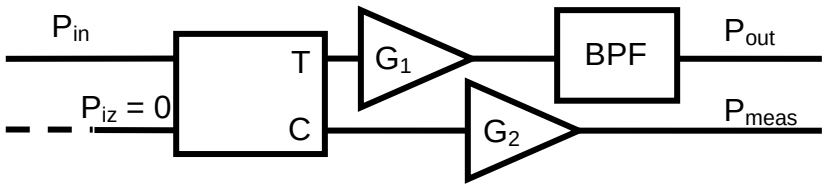
S U B J E C T N o . 4 9

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 40 Ω resistor paralel with a 0.303 pF capacitor, at 8.0 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.765 + j·1.135 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.35dB, two matched amplifiers G_1 = 7.3dB and G_2 = 11.6dB and a band-pass filter (equal ripple filter with a ripple equal to 2.9dB). Assume the input power is 1.85mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 19.4dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 45.0Ω + j·57.8Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.2dB and Noise Factor 1.24dB) and Device 2 (Gain 11.8dB and Noise Factor 1.03dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 13.5 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.635	138.5°	1.681	-29.0°	0.090	-33.0°	0.550	-154.5°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**

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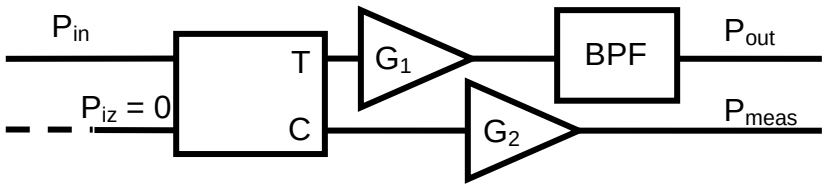
S U B J E C T N o . 5 0

Time allowed: 2 hours; All materials/equipments authorized

Instructor: assoc. prof. Radu Damian Student: _____ Group_____

Note. Except where otherwise specified, assume 50Ω reference impedance.
Note. Any CAD solution (Matlab, Mathcad, ADS) must contain relevant intermediate results for maximum points.

1. For a load composed from a 25 Ω resistor series with a 0.717 pF capacitor, at 7.8 GHz, compute the corresponding reflection coefficient **(1p)** and then plot on a Smith Chart (only the external circle and the complex plane axes) the corresponding point **(1p).**
2. For a normalized admittance equal to 0.745 + j·1.165 compute the impedance. **(1p)**
3. A measurement system contains an ideal lossless coupler (wide bandwidth, matched on all ports with infinite isolation) with a coupling factor C = 4.65dB, two matched amplifiers G_1 = 7.4dB and G_2 = 8.2dB and a band-pass filter (equal ripple filter with a ripple equal to 2.3dB). Assume the input power is 3.95mW.
   a) Compute the minimum and maximum power at the output port P_{out} (**in mW**) for signals inside the filter passband **(2p)**
   b) Compute the power at the measurement port P_{meas} **(0.5p)**
   c) Assume the same input signal is outside the filter passband at a frequency where the filter provides a 23.7dB attenuation. Compute the power at the output port P_{out} (**in mW**) **(1p)**



4. A 50Ω source is connected to a 64.1Ω + j·38.2Ω load .
   a) Compute the reflection coefficient seen by the source. **(0.5p)**
   b) Design the match with single-stub matching sections (shunt stub, both solutions). **(1.5p)**
   c) **Draw** the match schematic. (**0.5p**)
5. You must design a LNA using two amplifiers: Device 1 (Gain 8.4dB and Noise Factor 1.29dB) and Device 2 (Gain 11.7dB and Noise Factor 1.04dB). Which is the best order to place the two devices? Compute the gain and the noise factor of the cascaded schematic. **(1p)**
6. The scattering parameters of a transistor at 10.2 GHz are as follows:

S_{11}		S_{12}		S_{21}		S_{22}	
Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.614	180.0°	2.354	12.4°	0.080	-2.0°	0.520	-110.8°

   a) Prove that you can design a match for maximum gain (**0.5p**)
   b) Compute the reflection coefficients required towards the source and the load for maximum gain (**1.5p**)
   c) Design the match at both input and output with single-stub matching sections (shunt stub solution) **(1.5p)**