

EE614 : Course Project

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Project objective:

Design a power amplifier using AFIC901N

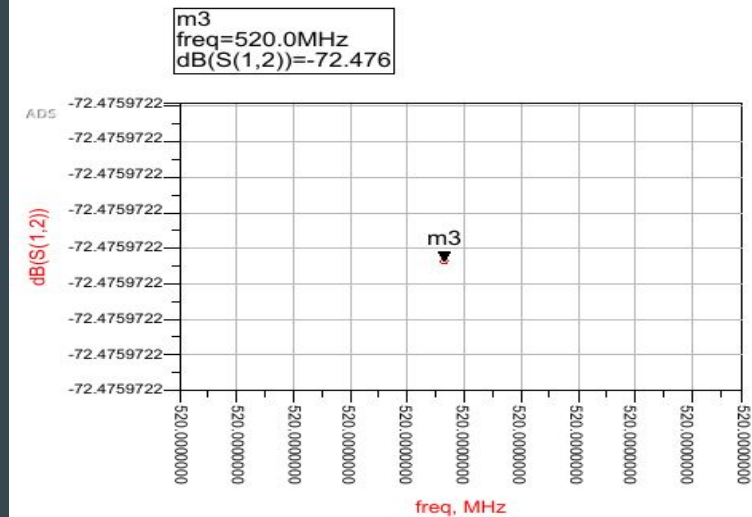
- for a gain of at least 20 dB at 520 MHz
- with appropriate matching networks and bias-tee
- with S11 and S12 values less than -10 dB and -60 dB respectively

Design Steps

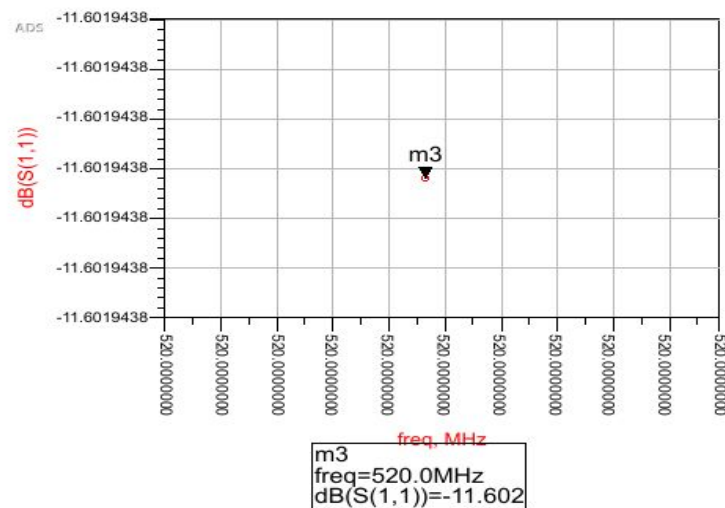
- Check for the stability ($K = 17.61 > 1$ & $|\Delta| = 0.244 < 1$) using s-parameters
- Testing the validation of unilateral assumption from U_{minus} and U_{plus} values = 0.06
- Designing for fixed gain $G_T = G_S + |S_{21}|^2 + G_L = 30\text{dB}$, where $|S_{21}|^2 = 20.15\text{dB}$ and choosing G_S at maximum i.e. $G_S = 6.49$ And $G_L = 3.36$
- Choosing Γ_S close to S_{11}^* on constant G_S circle and Γ_L close to S_{22}^* on constant G_L circle for matching network
- Matching network for the source and load is designed using lumped elements and transmission lines
- Bias tee network (also made of lumped elements) is added to the source and load side
- Finally length of the transmission lines and lumped element parameter are adjusted to get the desired s-parameters.

Matching S constraints

$S_{12} (-72.476 \text{ dB}) < -60$

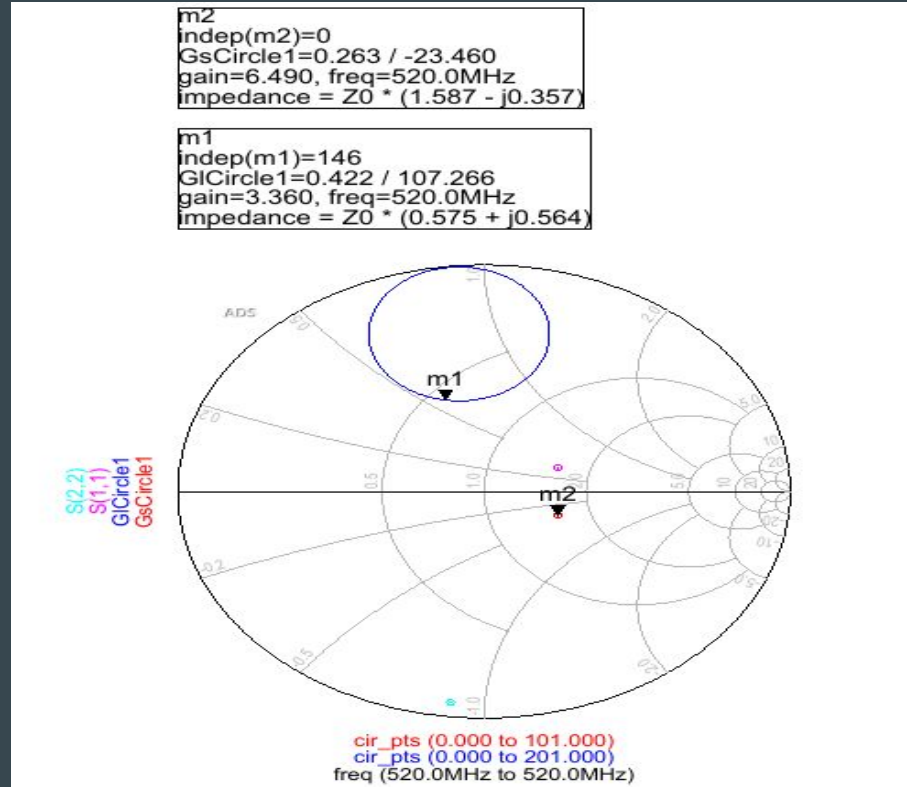


$S_{11} (-11.602 \text{ dB}) < -10$



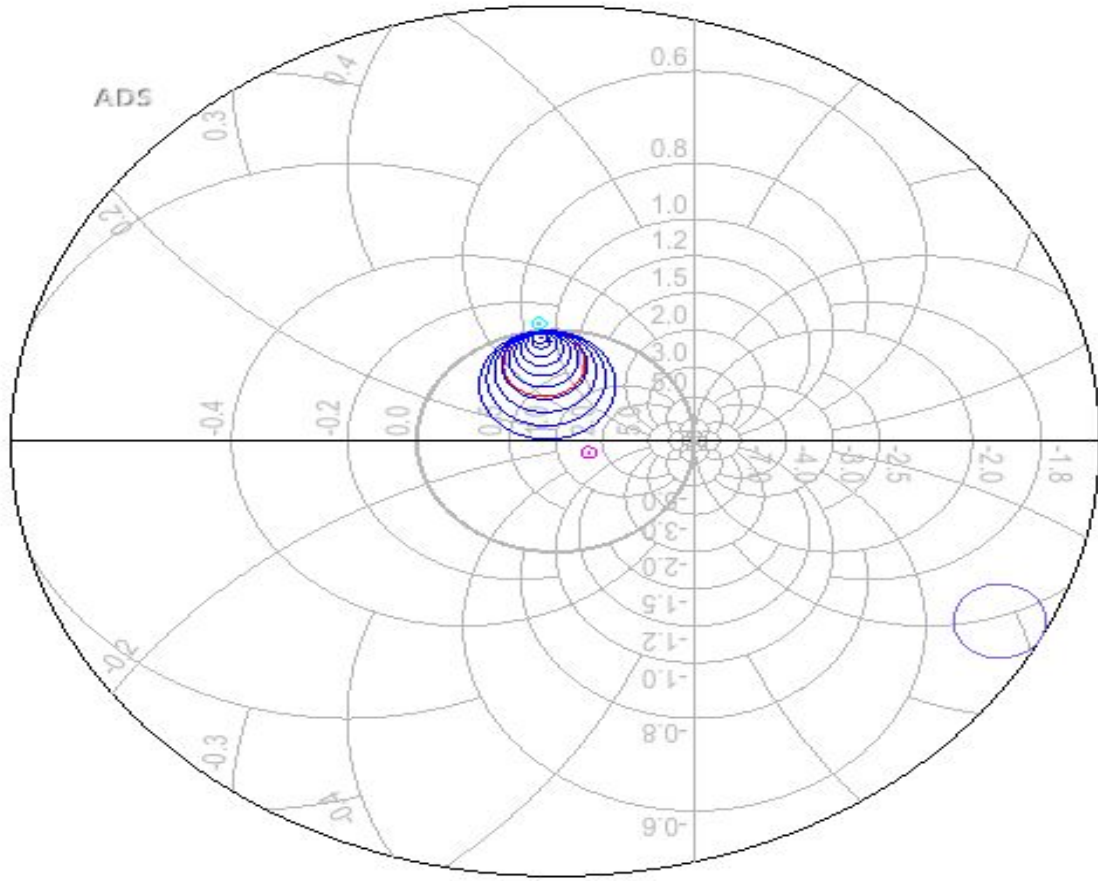
G_S and G_L Circles

- The value of Γ_S is chosen close to S_{11}^* on the constant G_S circle for source matching
- The value of Γ_L is chosen close to S_{22}^* on constant G_L circle for load matching
- Total gain $G_T = G_S + |S_{21}|^2 + G_L$
- $|S_{21}|^2 = 20.15\text{dB}$
- $G_S = G_{S,\text{max}} = 6.49\text{dB}$
- $G_L = 3.36\text{dB}$
- $G_T = 30\text{dB}$



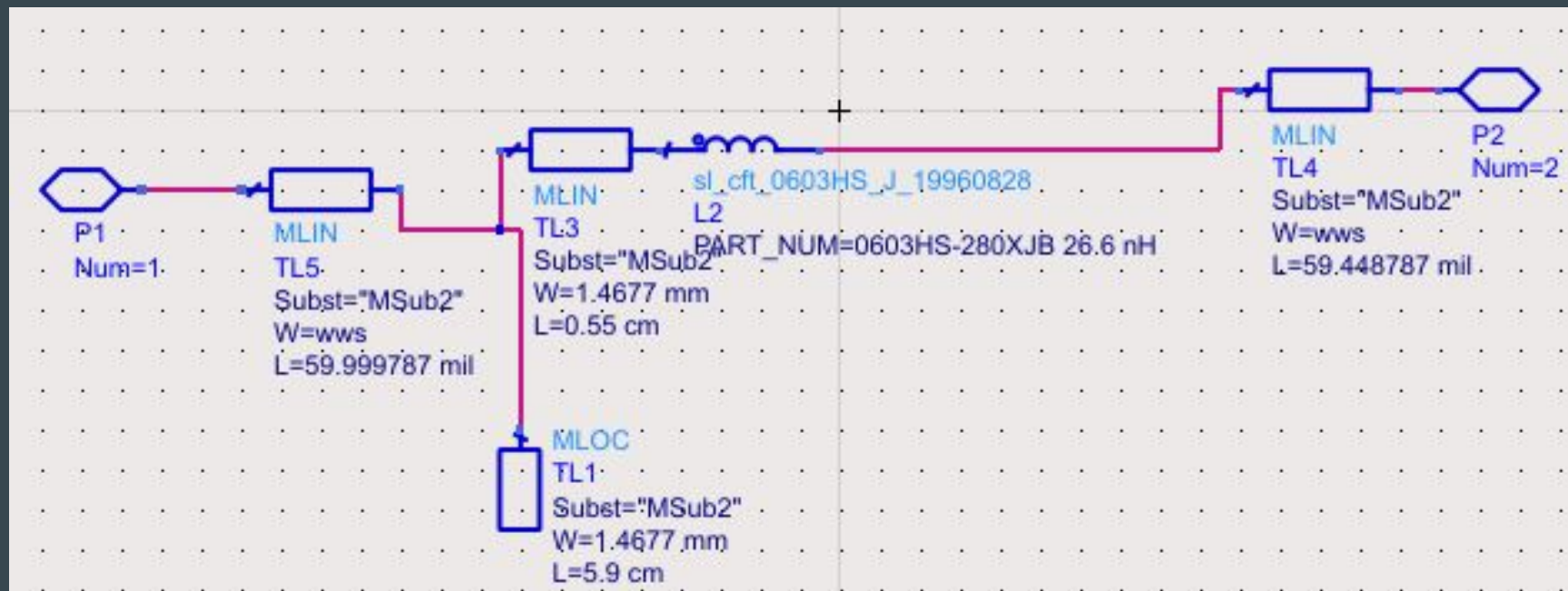
Gain Circles

S_StabCircle1
L_StabCircle1
GsCircle1
GpCircle1
GICircle1

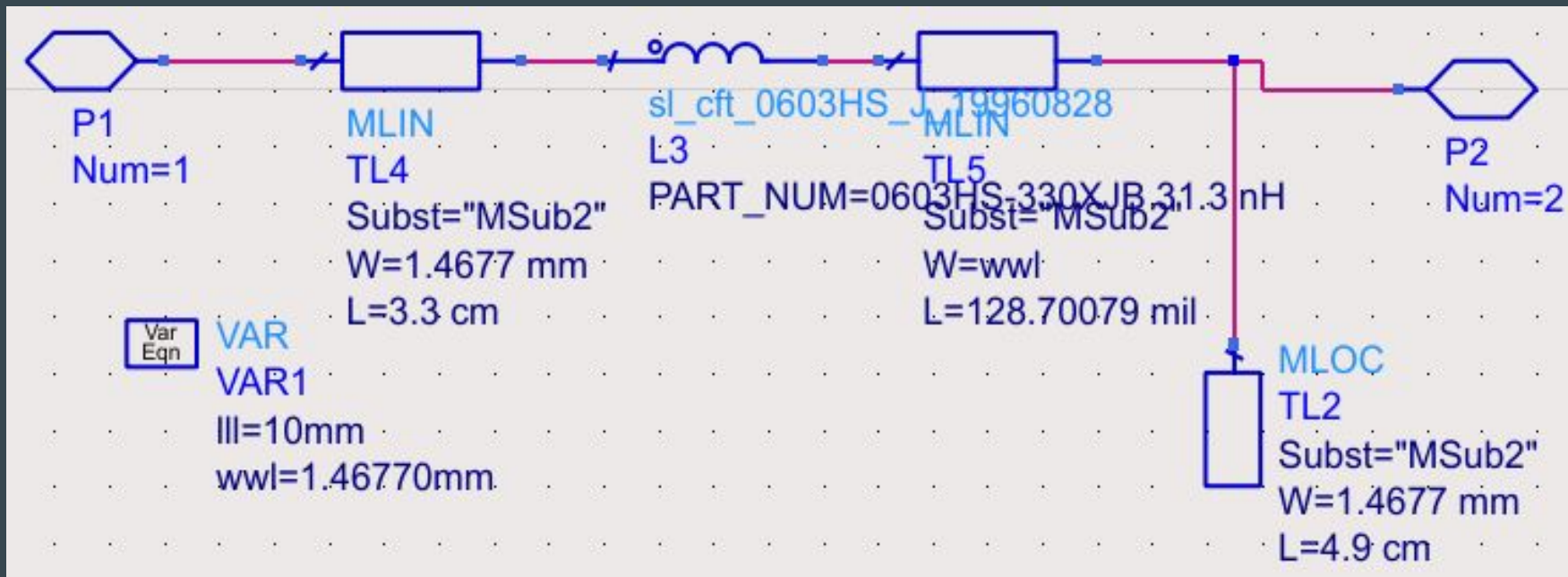


cir_pts (0.000 to 201.000)
cir_pts (0.000 to 101.000)
indep(L_StabCircle1) (0.000 to 51.000)
indep(S_StabCircle1) (0.000 to 51.000)

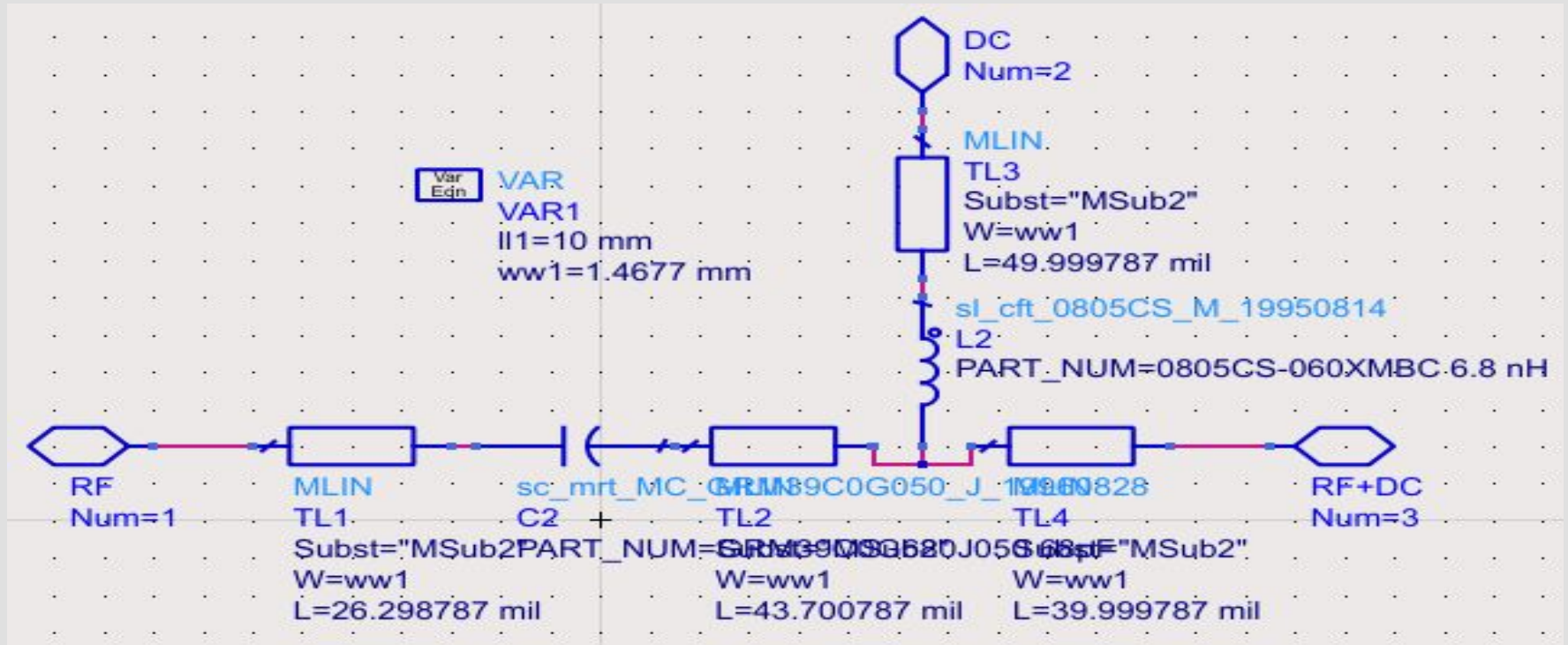
Input Matching Network



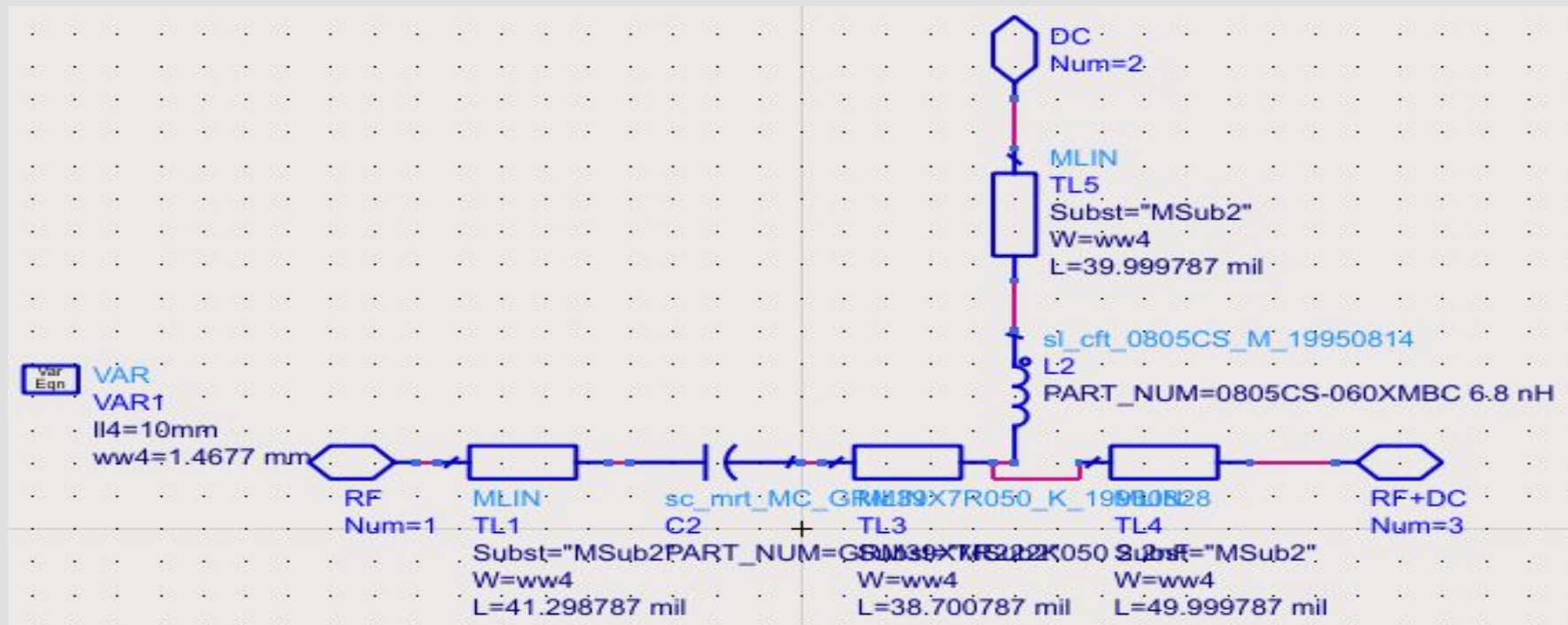
Output Matching Network



Source side bias tee



Load side bias tee

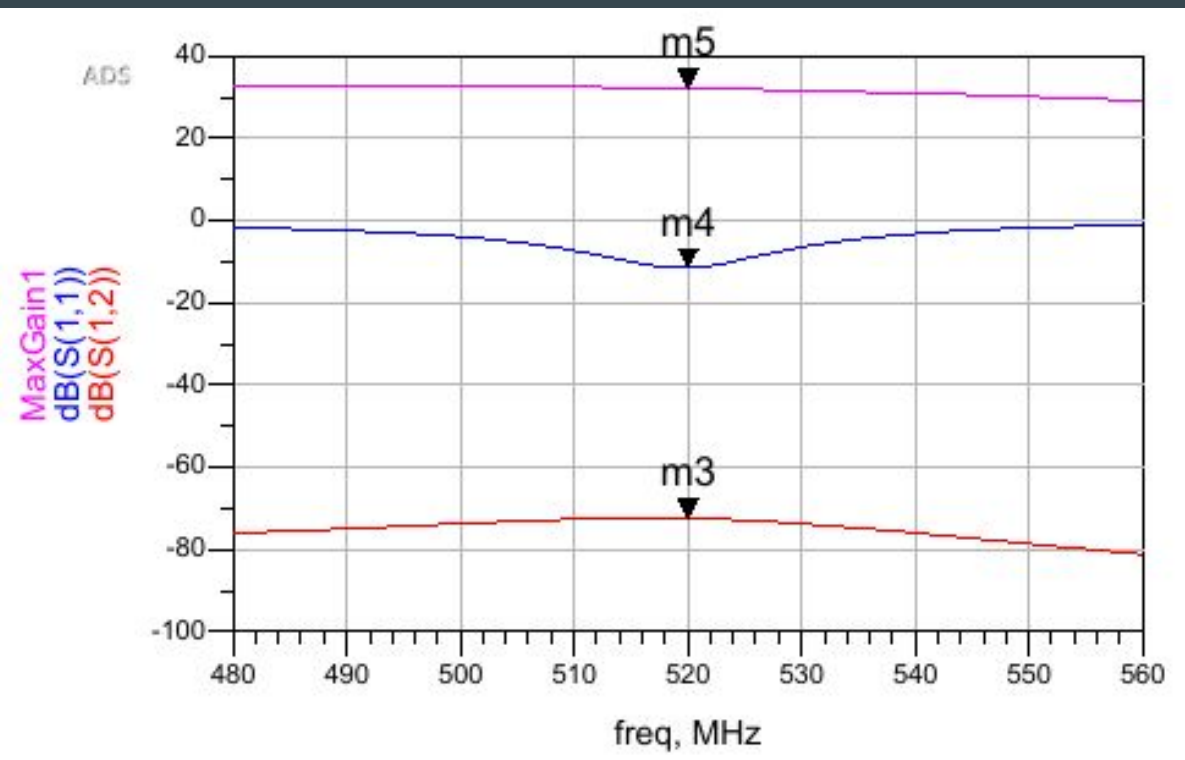


Simulation results

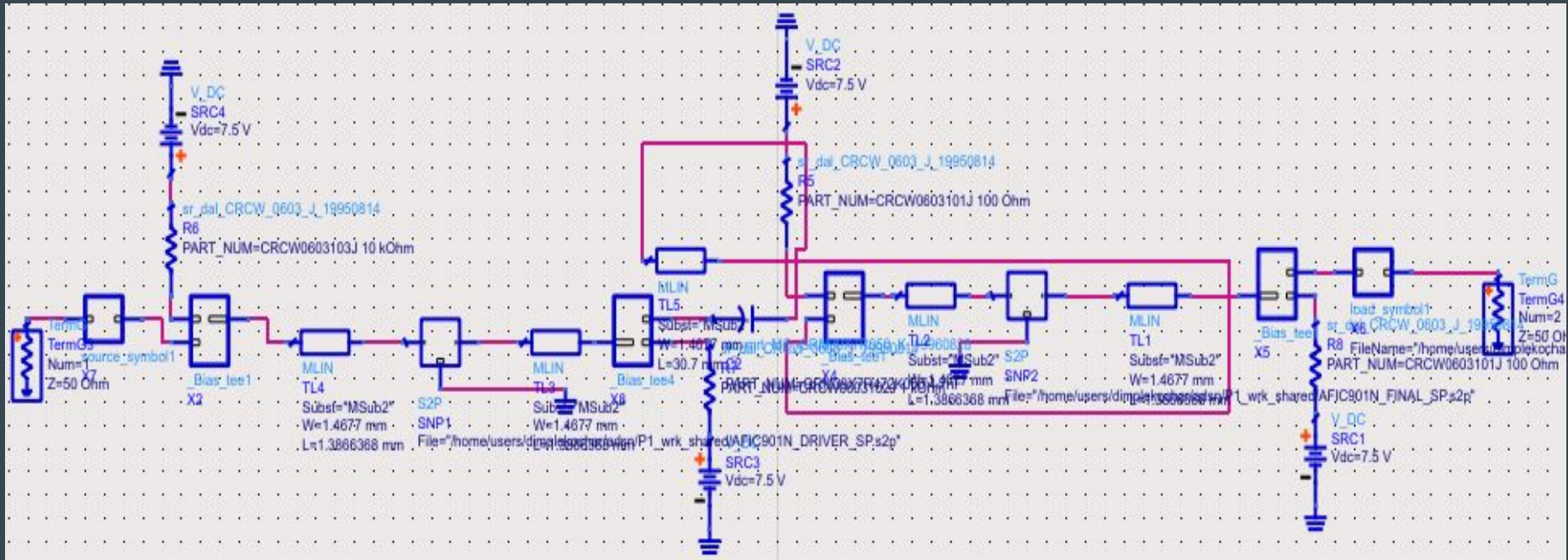
m3
freq=520.0MHz
dB(S(1,2))=-72.476

m4
freq=520.0MHz
dB(S(1,1))=-11.602

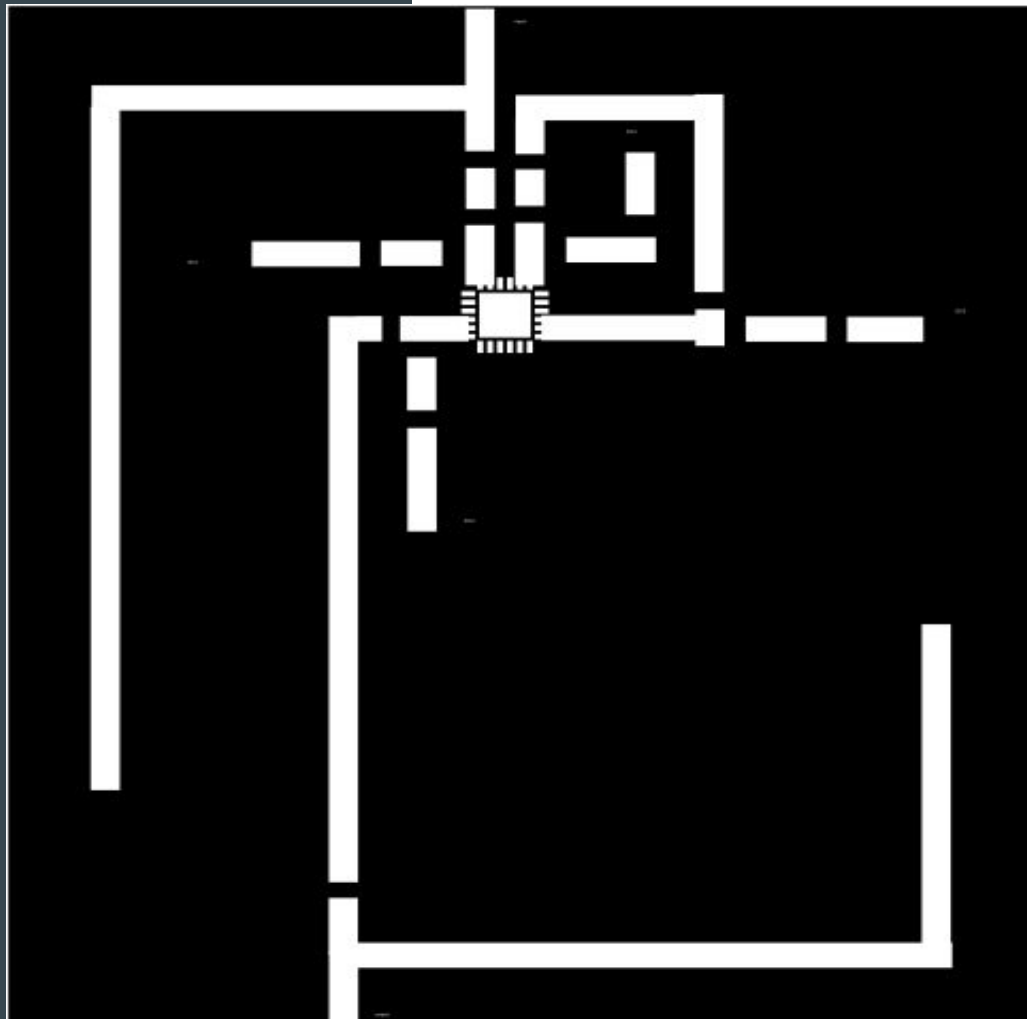
m5
freq=520.0MHz
MaxGain1=32.086



Final Schematic

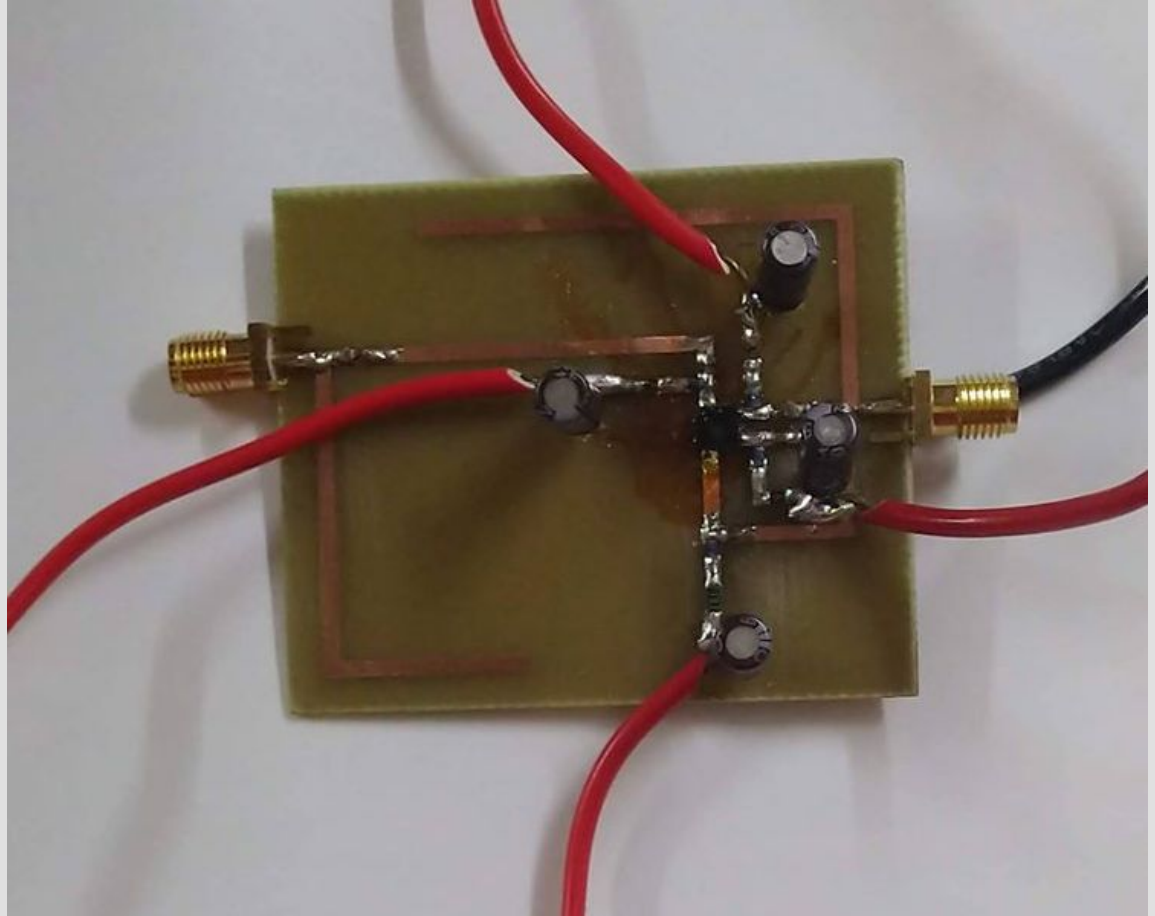


Layout

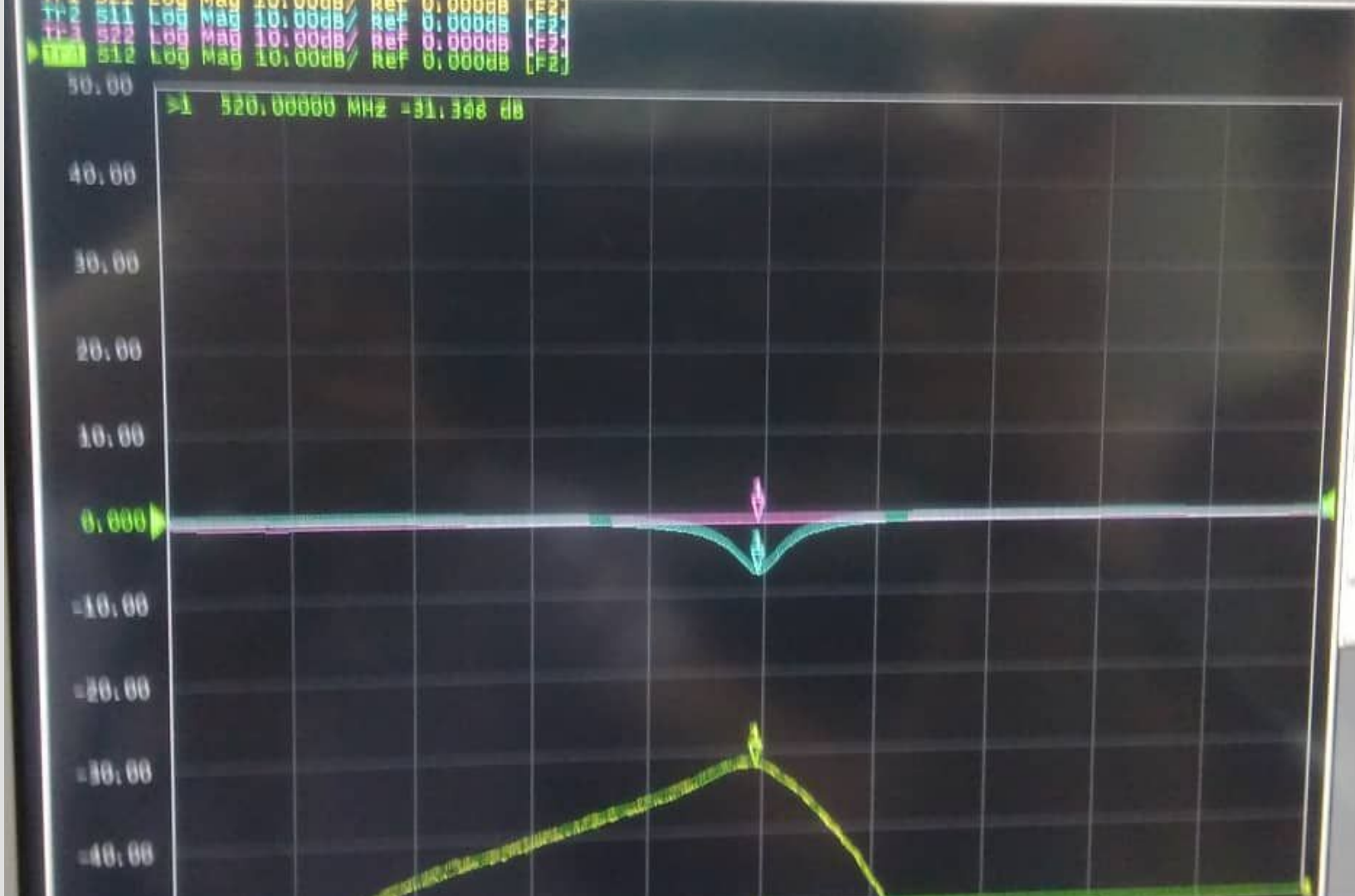


Soldered PCB

with SMD and
SMA connectors



Testing results



Final Testing results

