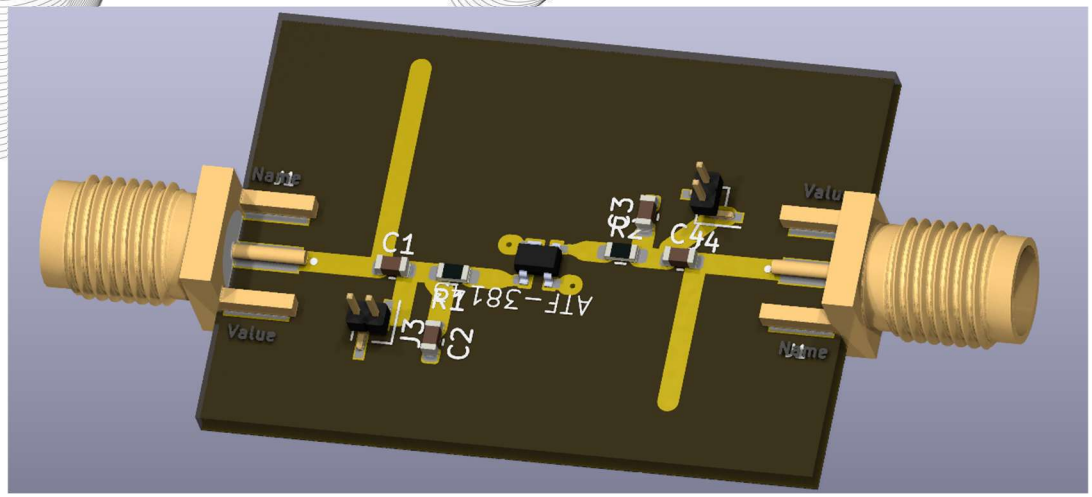
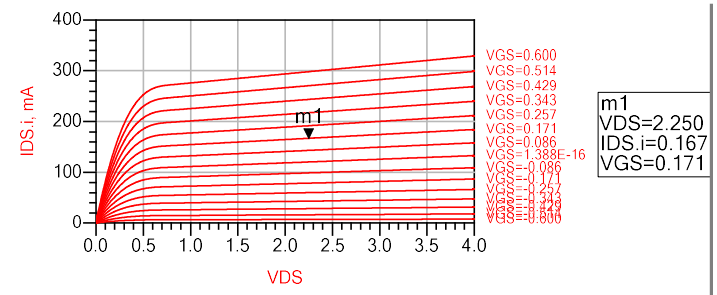
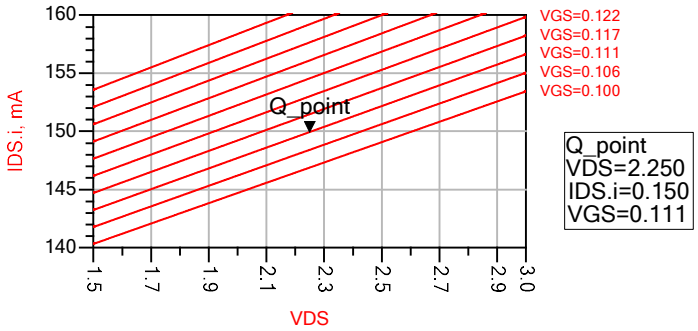
RF Transceivers Design & Analysis
Project 2 – Microwave Amplifier

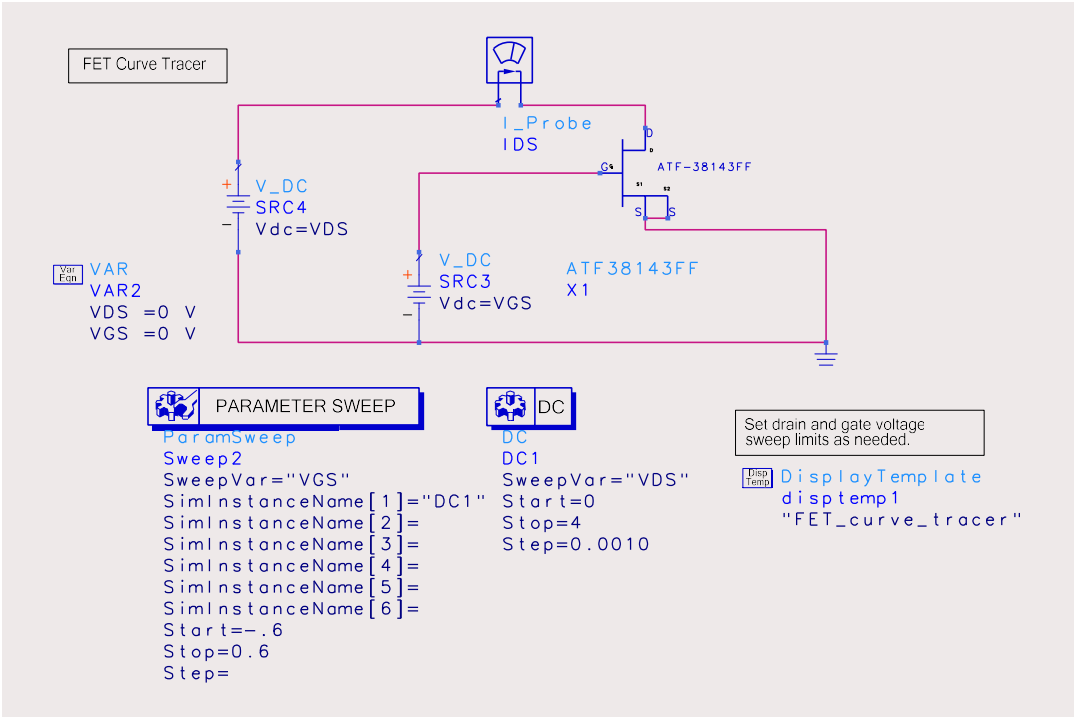


Marwan Emira – b00095126

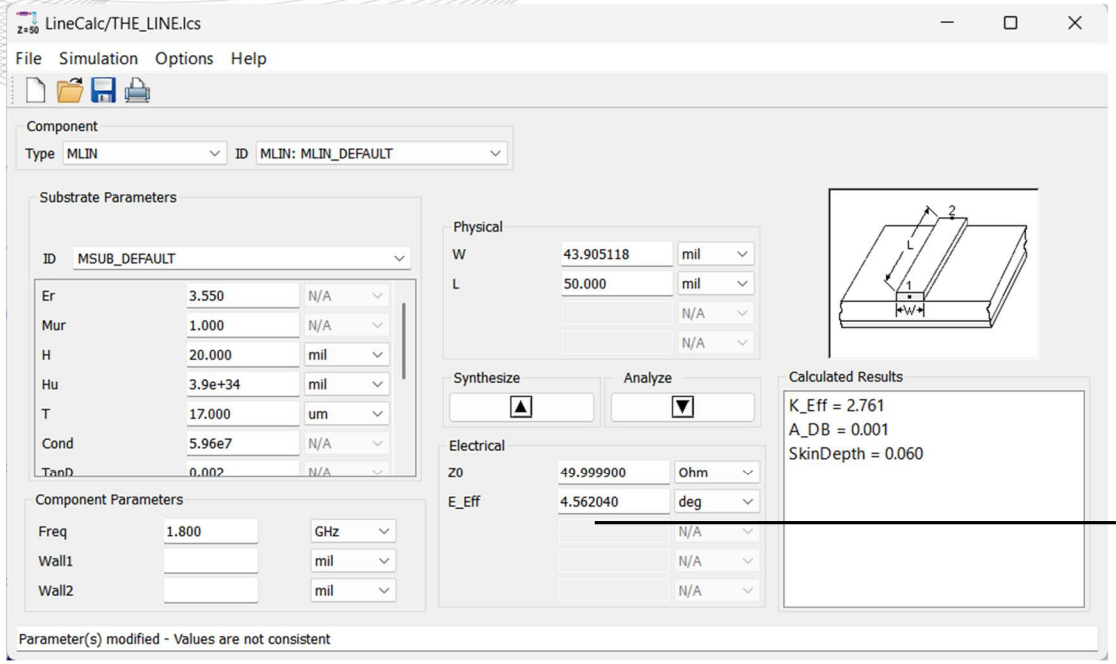
10/20/2025


400
300
200
100
0
IDS.i, mA
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
VDS
m1
VGS=0.600
VGS=0.514
VGS=0.429
VGS=0.343
VGS=0.257
VGS=0.171
VGS=0.086
VGS=1.388E-16
VGS=-0.086
VGS=-0.171
VGS=-0.257
m1
VDS=2.250
IDS.i=0.167
VGS=0.171


160
155
150
145
140
IDS.i, mA
1.5 1.7 1.9 2.1 2.3 2.5 2.7 2.9 3.0
VDS
Q_point
VGS=0.122
VGS=0.117
VGS=0.111
VGS=0.106
VGS=0.100
Q_point
VDS=2.250
IDS.i=0.150
VGS=0.111

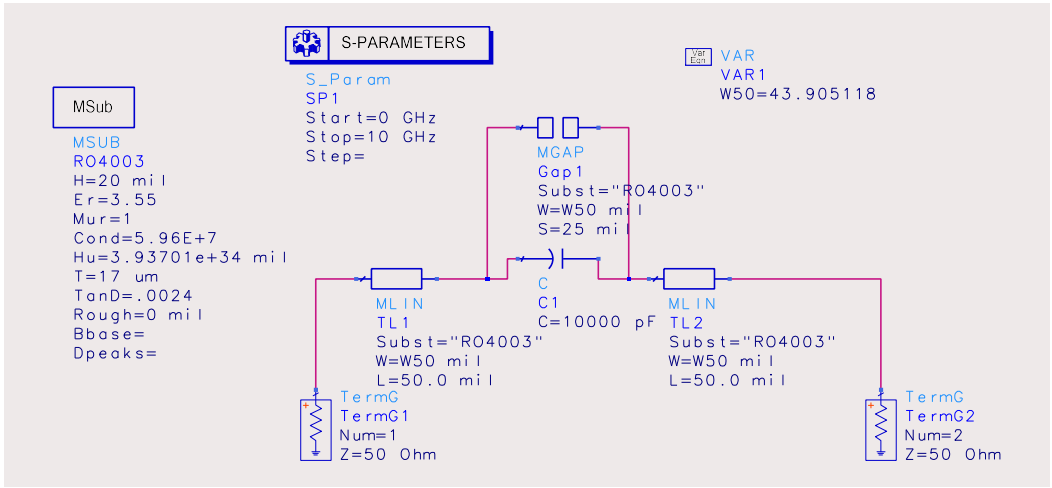

FET Curve Tracer
I_Probe
IDS
V_DC
SRC4
Vdc=VDS
ATF-38143FF
V_DC
SRC3
Vdc=VGS
ATF38143FF
X1
VAR
VAR2
VDS =0 V
VGS =0 V
PARAMETER SWEEP
ParamSweep
Sweep2
SweepVar="VGS"
SimInstanceName[1]="DC1"
SimInstanceName[2]=
SimInstanceName[3]=
SimInstanceName[4]=
SimInstanceName[5]=
SimInstanceName[6]=
Start=-.6
Stop=0.6
Step=
DC
DC
DC1
SweepVar="VDS"
Start=0
Stop=4
Step=0.0010
Set drain and gate voltage sweep limits as needed.
DisplayTemplate
disptemp1
"FET_curve_tracer"

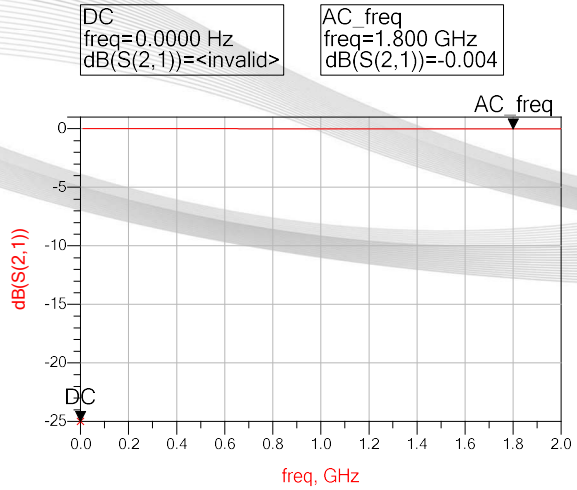
LineCalc

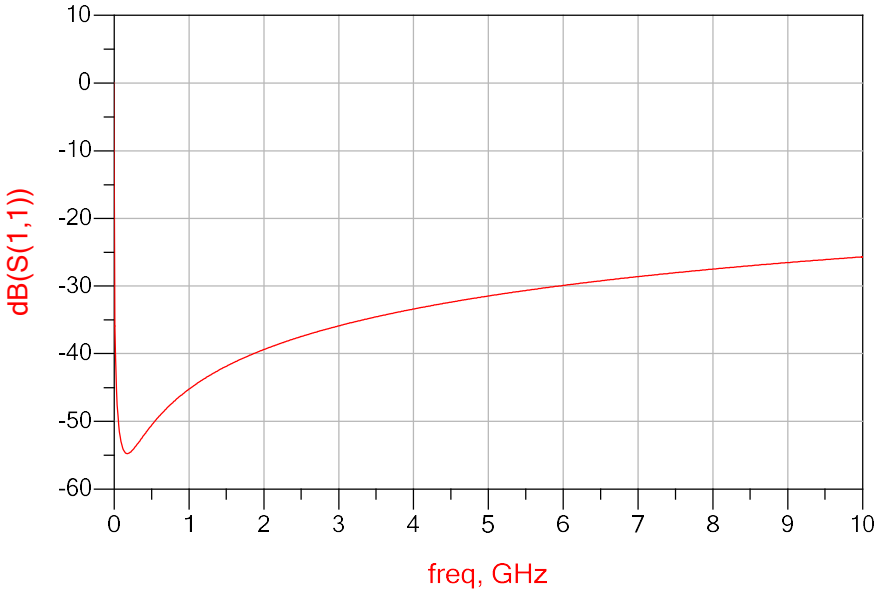


Lambda = 50 * (360/E_Eff)
= 3945.6032827 mil

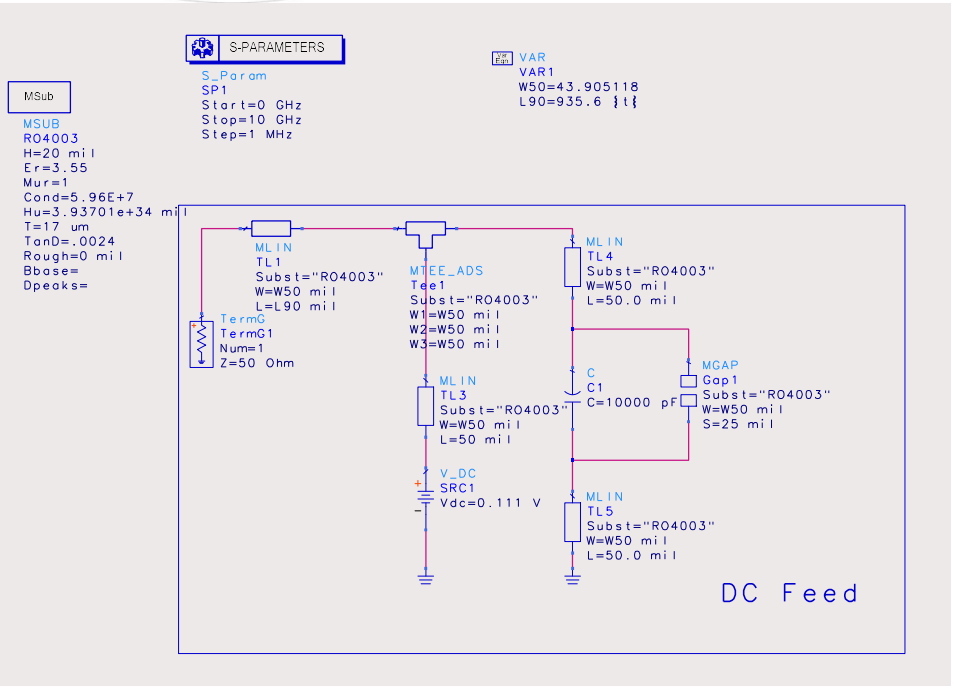
DC Block Circuit

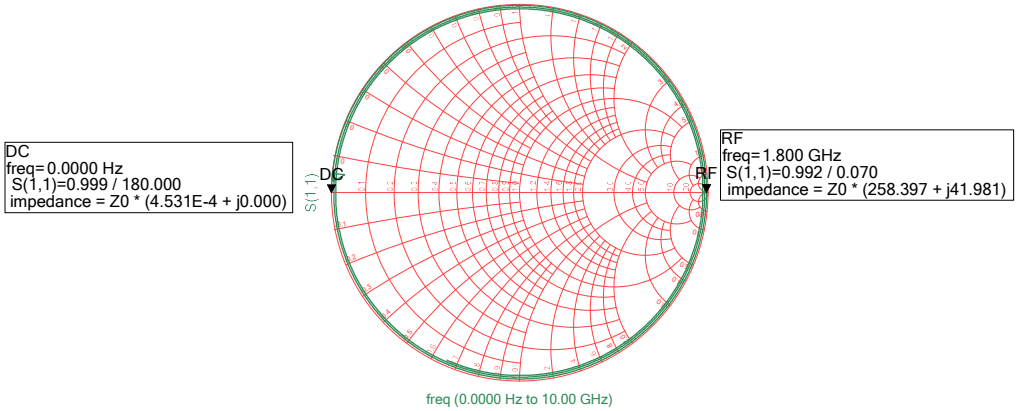




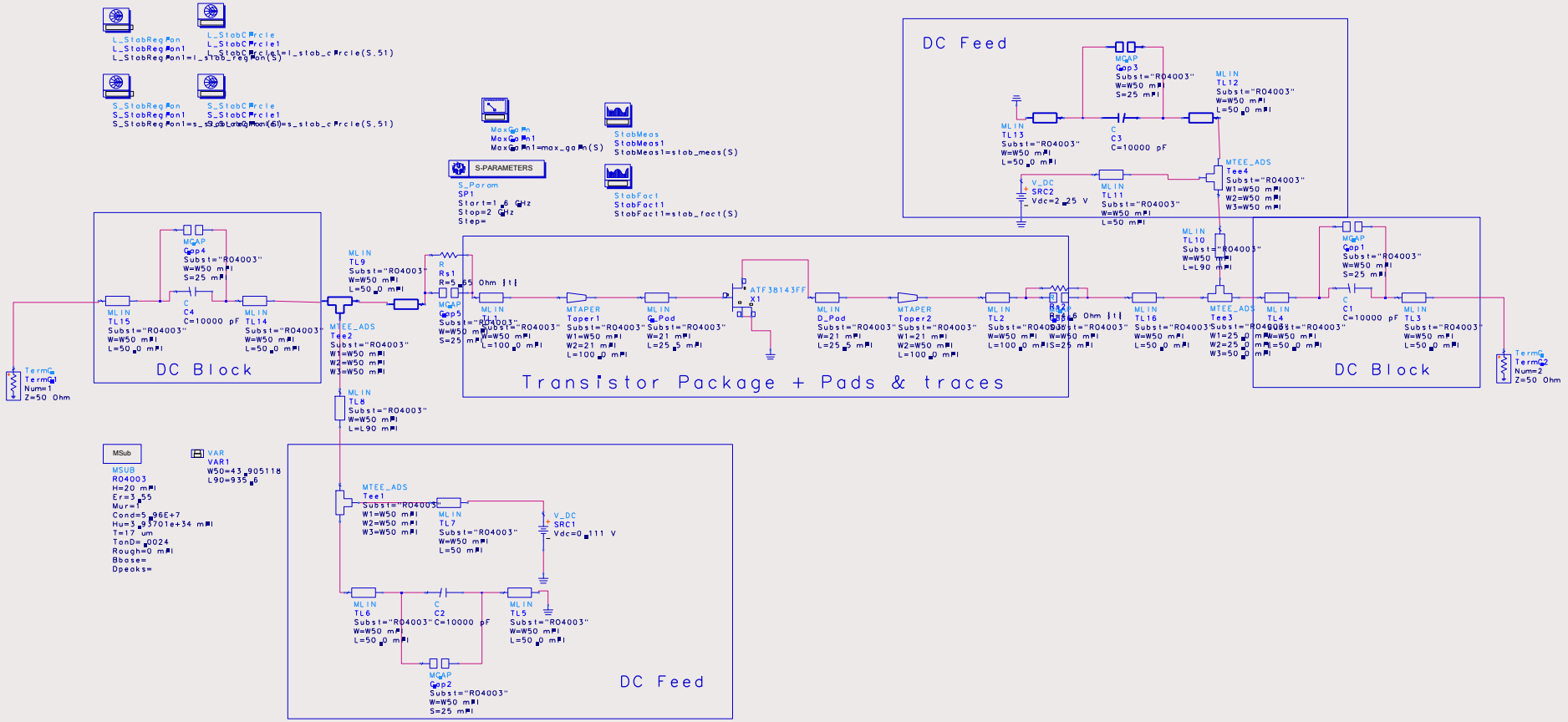


DC Feed Circuit





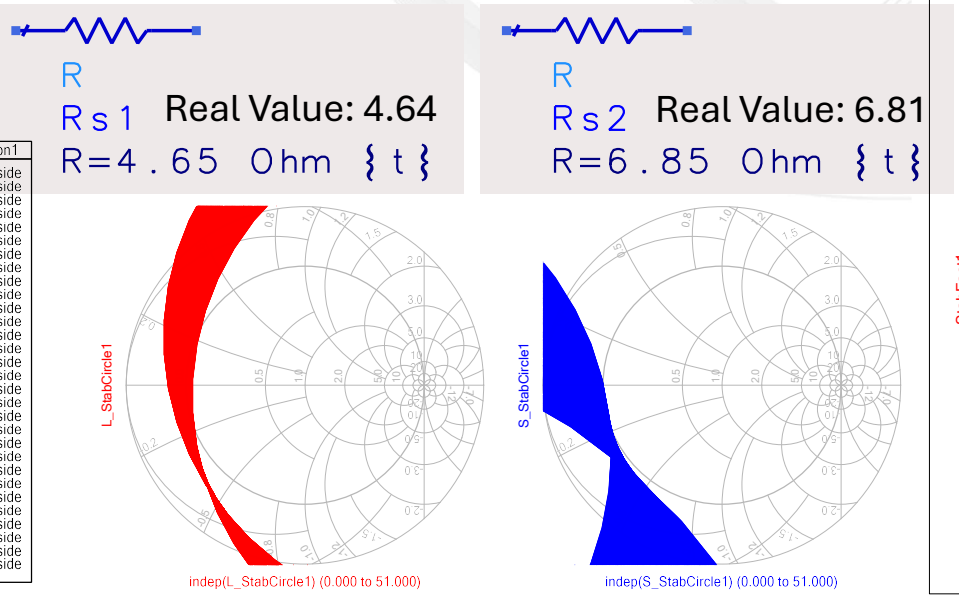
Stability Analysis



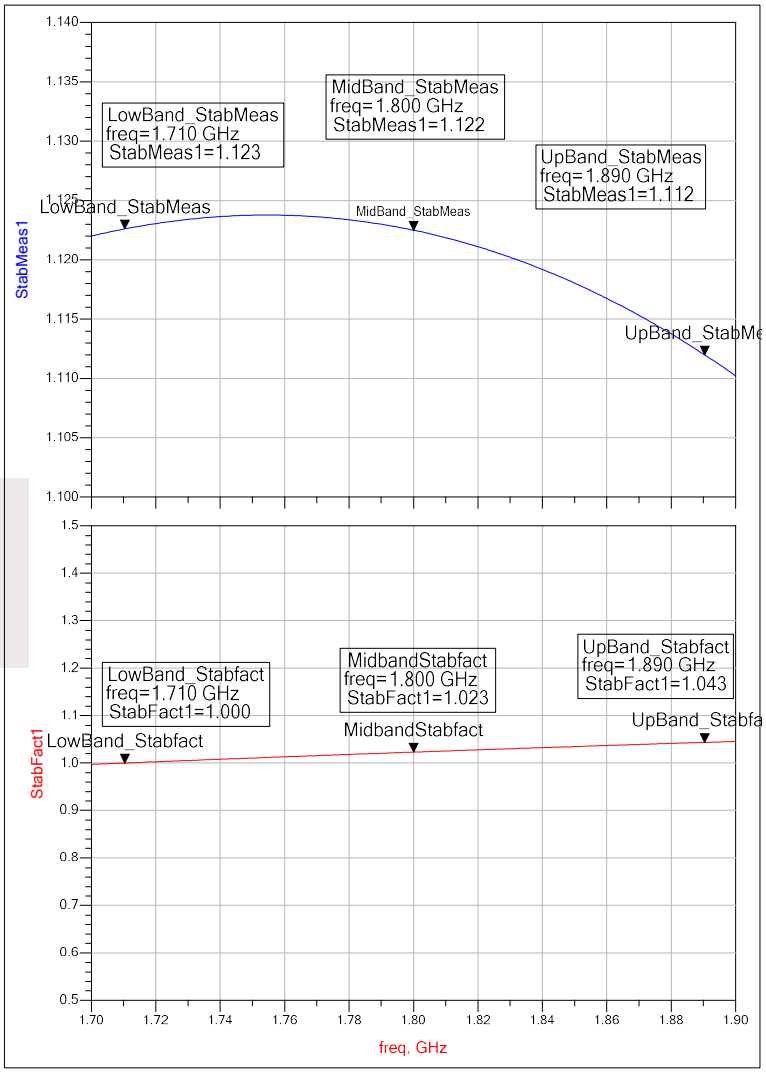
Stability Analysis Results

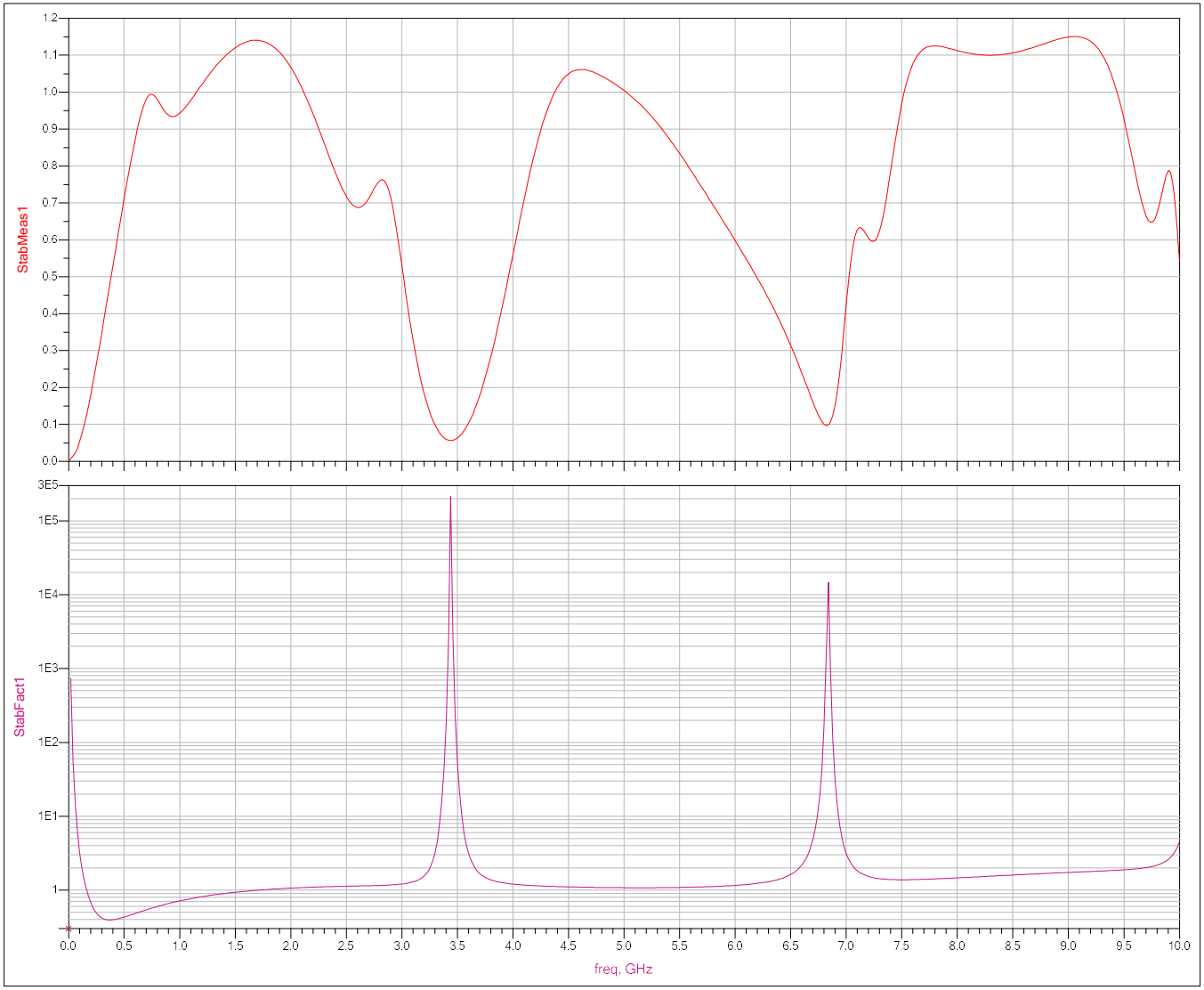
The necessary and sufficient conditions for unconditional stability are that:

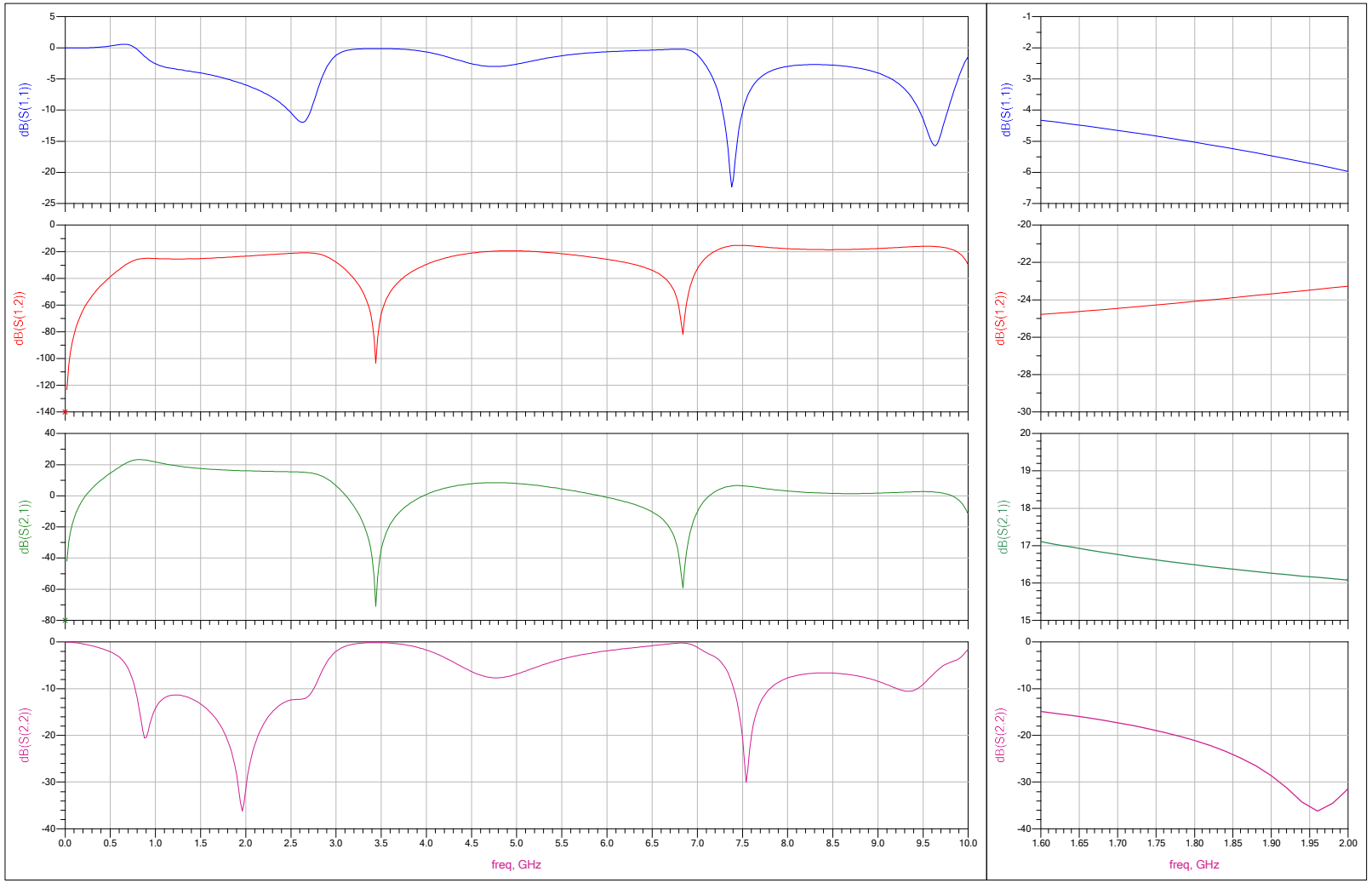
- The stability factor is greater than unity
- The stability measure is positive



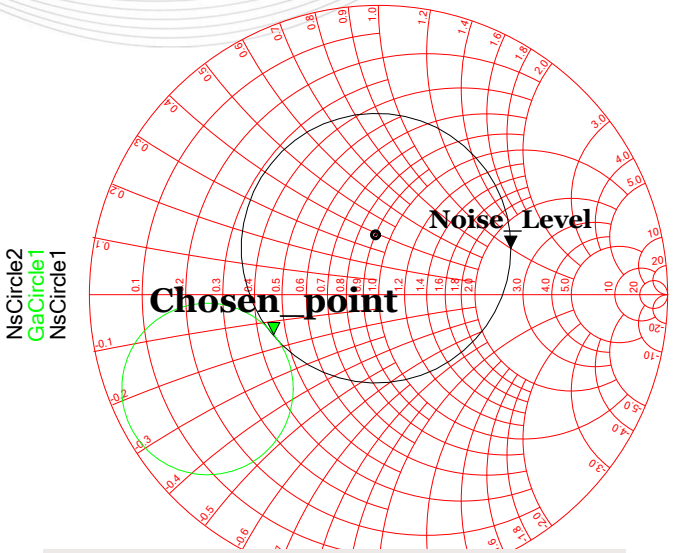
freq	S_StabRegion1	L_StabRegion1
1.600 GHz	Outside	Inside
1.601 GHz	Outside	Inside
1.602 GHz	Outside	Inside
1.602 GHz	Outside	Inside
1.603 GHz	Outside	Inside
1.604 GHz	Outside	Inside
1.605 GHz	Outside	Inside
1.606 GHz	Outside	Inside
1.606 GHz	Outside	Inside
1.607 GHz	Outside	Inside
1.608 GHz	Outside	Inside
1.609 GHz	Outside	Inside
1.610 GHz	Outside	Inside
1.610 GHz	Outside	Inside
1.611 GHz	Outside	Inside
1.612 GHz	Outside	Inside
1.613 GHz	Outside	Inside
1.614 GHz	Outside	Inside
1.614 GHz	Outside	Inside
1.615 GHz	Outside	Inside
1.616 GHz	Outside	Inside
1.617 GHz	Outside	Inside
1.618 GHz	Outside	Inside
1.618 GHz	Outside	Inside
1.619 GHz	Outside	Inside
1.620 GHz	Outside	Inside
1.621 GHz	Outside	Inside
1.622 GHz	Outside	Inside
1.622 GHz	Outside	Inside
1.623 GHz	Outside	Inside




StabMeas1
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
StabFact1
3E5
1E5
1E4
1E3
1E2
1E1
1
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
freq, GHz

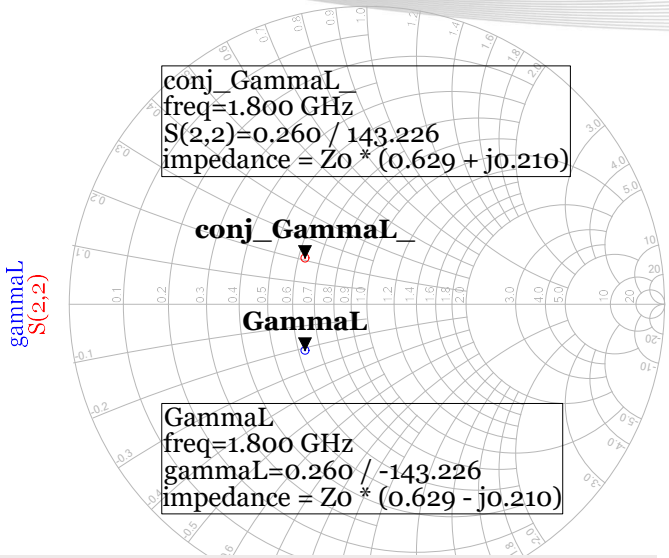

dB(S(1,1))
dB(S(1,2))
dB(S(2,1))
dB(S(2,2))
freq, GHz
dB(S(1,1))
dB(S(1,2))
dB(S(2,1))
dB(S(2,2))
freq, GHz

Γ_S & Γ_L Ideal Matching Networks



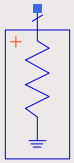
Noise_Level
indep(Noise_Level)=0
NsCircle1=0.485 / 19.311
ns figure=1.200
impedance = Zo * (2.393 + j1.005)

Chosen_point
indep(Chosen_point)=22
GaCircle1=0.388 / -159.089
gain=18.100, freq=1.800E9
impedance = Zo * (0.453 - j0.148)

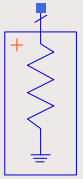


conj_GammaL_
freq=1.800 GHz
S(2,2)=0.260 / 143.226
impedance = Zo * (0.629 + j0.210)

GammaL
freq=1.800 GHz
gammaL=0.260 / -143.226
impedance = Zo * (0.629 - j0.210)

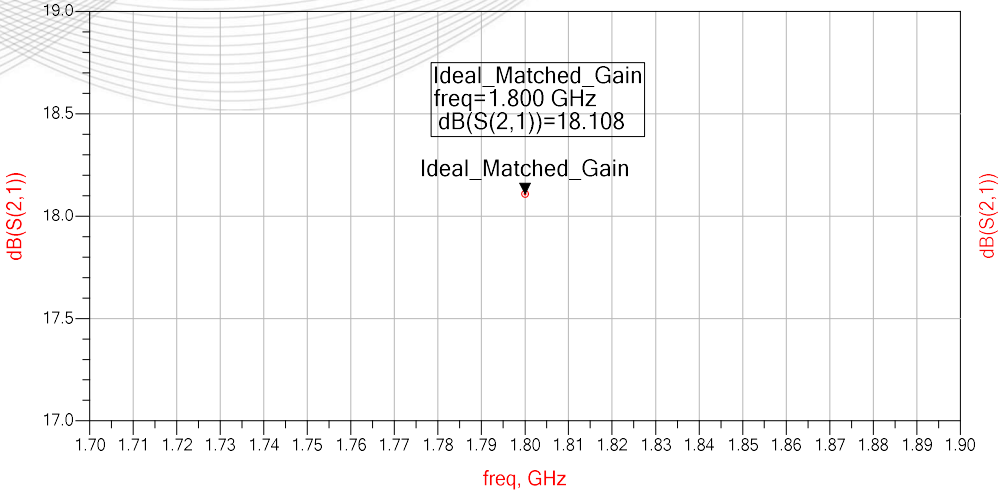


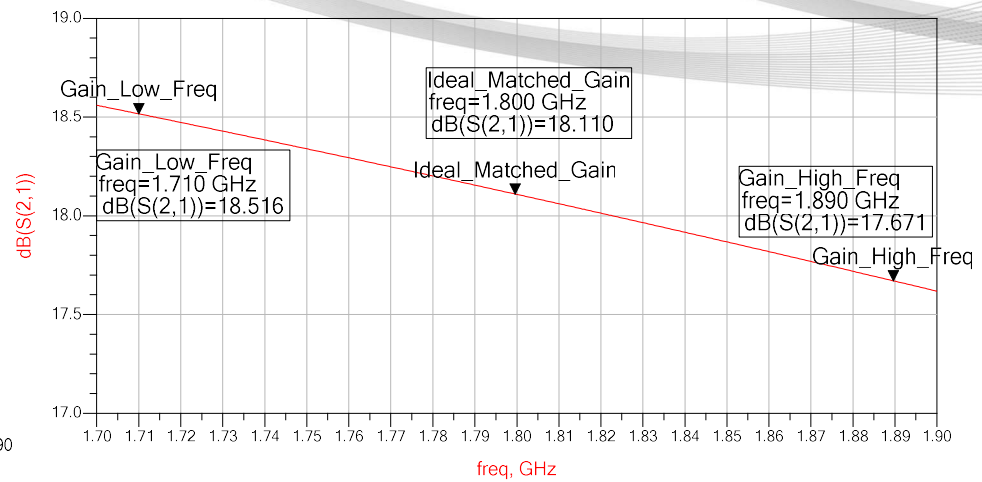
TermG
TermG1
Num=1
Z=22.5-j*7.40 Ohm



TermG
TermG2
Num=2
Z=31.45-j*10.5 Ohm

Γ_S & Γ_L Ideal Matching Gains

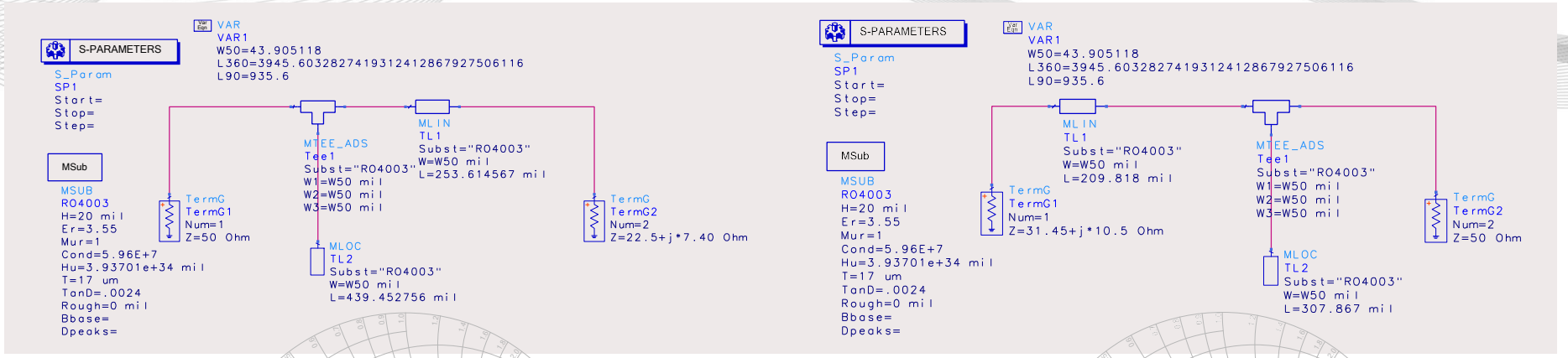


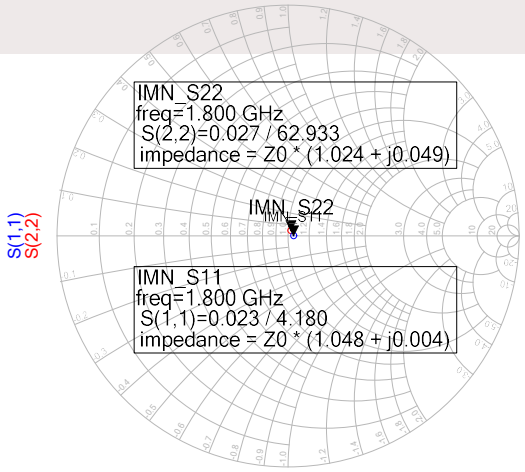


freq	S			
	S(1,1)	S(1,2)	S(2,1)	S(2,2)
1.800 GHz	0.357 / 152.136	0.075 / -26.493	8.043 / 23.848	4.062E-4 / -118...

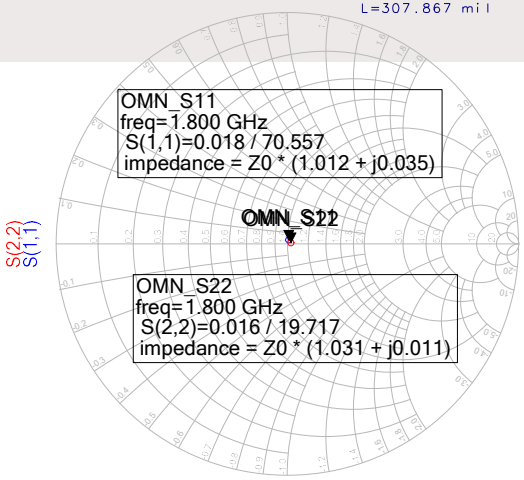
freq	dB(S)			
	(1,1)	(1,2)	(2,1)	(2,2)
1.800 GHz	-8.941	-22.463	18.108	-67.826

Γ_S & Γ_L



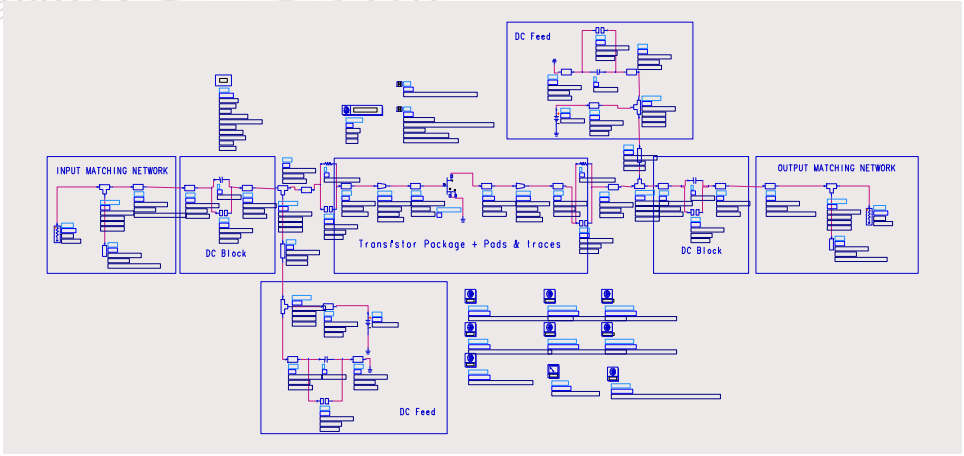


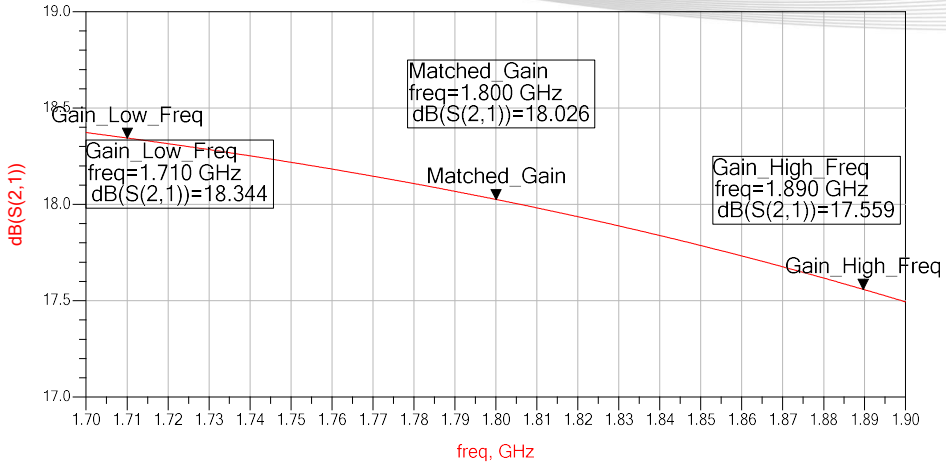
freq (1.800 GHz to 1.800 GHz)



freq (1.800 GHz to 1.800 GHz)

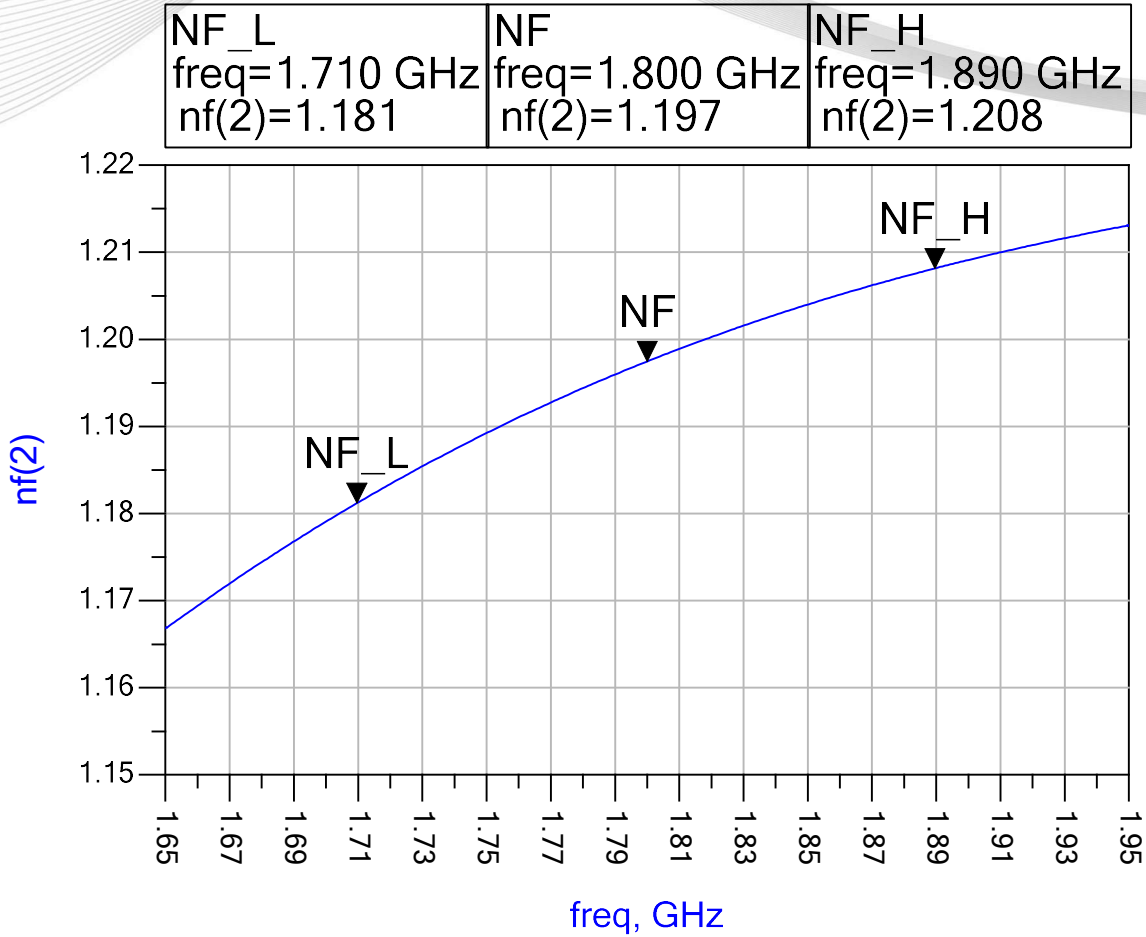
Complete Amplifier Design

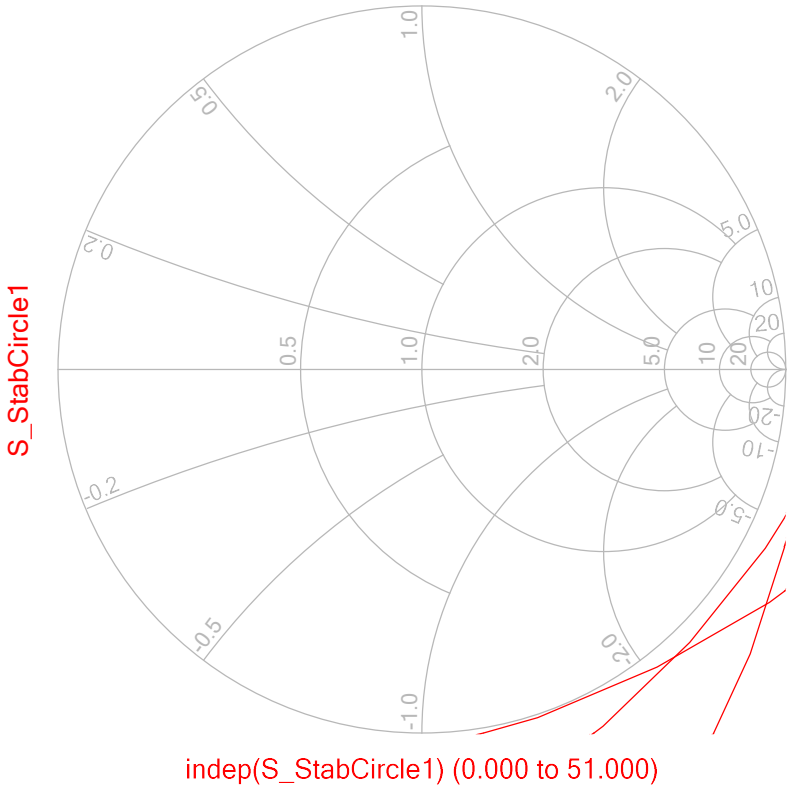


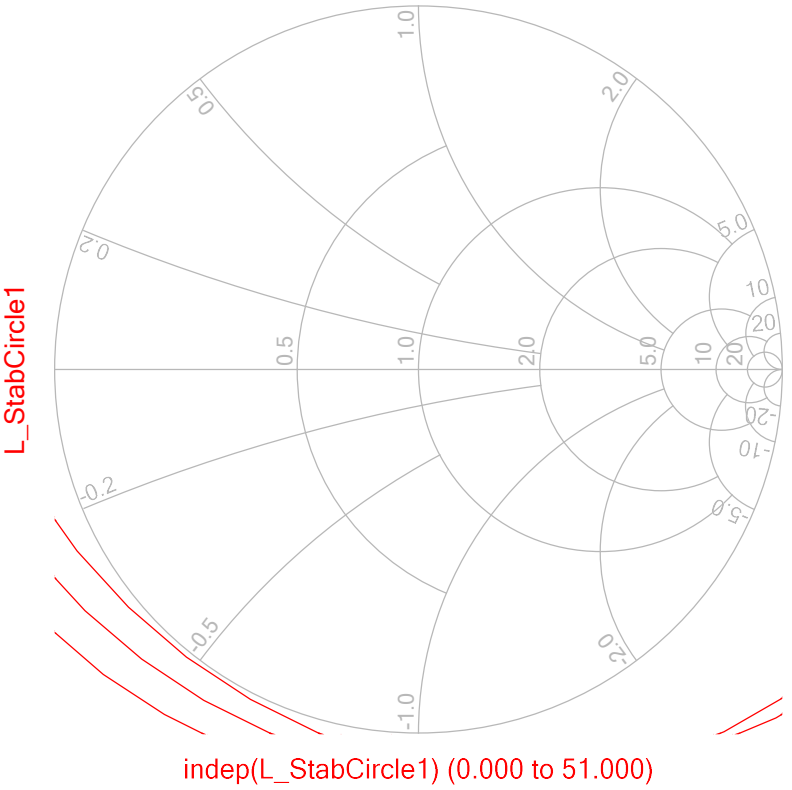


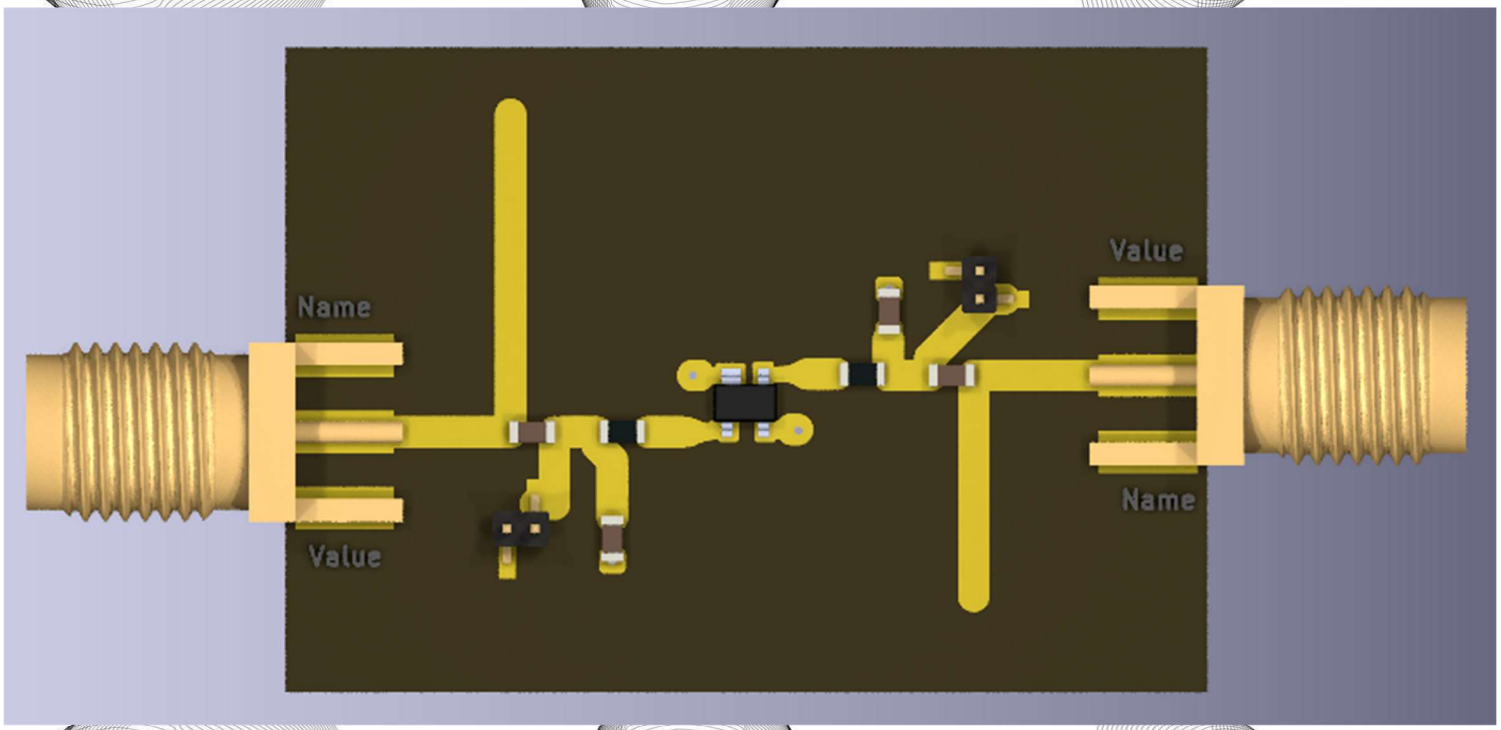
freq	dB(S)			
	(1,1)	(1,2)	(2,1)	(2,2)
1.710 GHz	-8.490	-22.810	18.345	-25.007
1.800 GHz	-8.891	-22.545	18.026	-42.449
1.890 GHz	-8.242	-22.451	17.557	-23.507

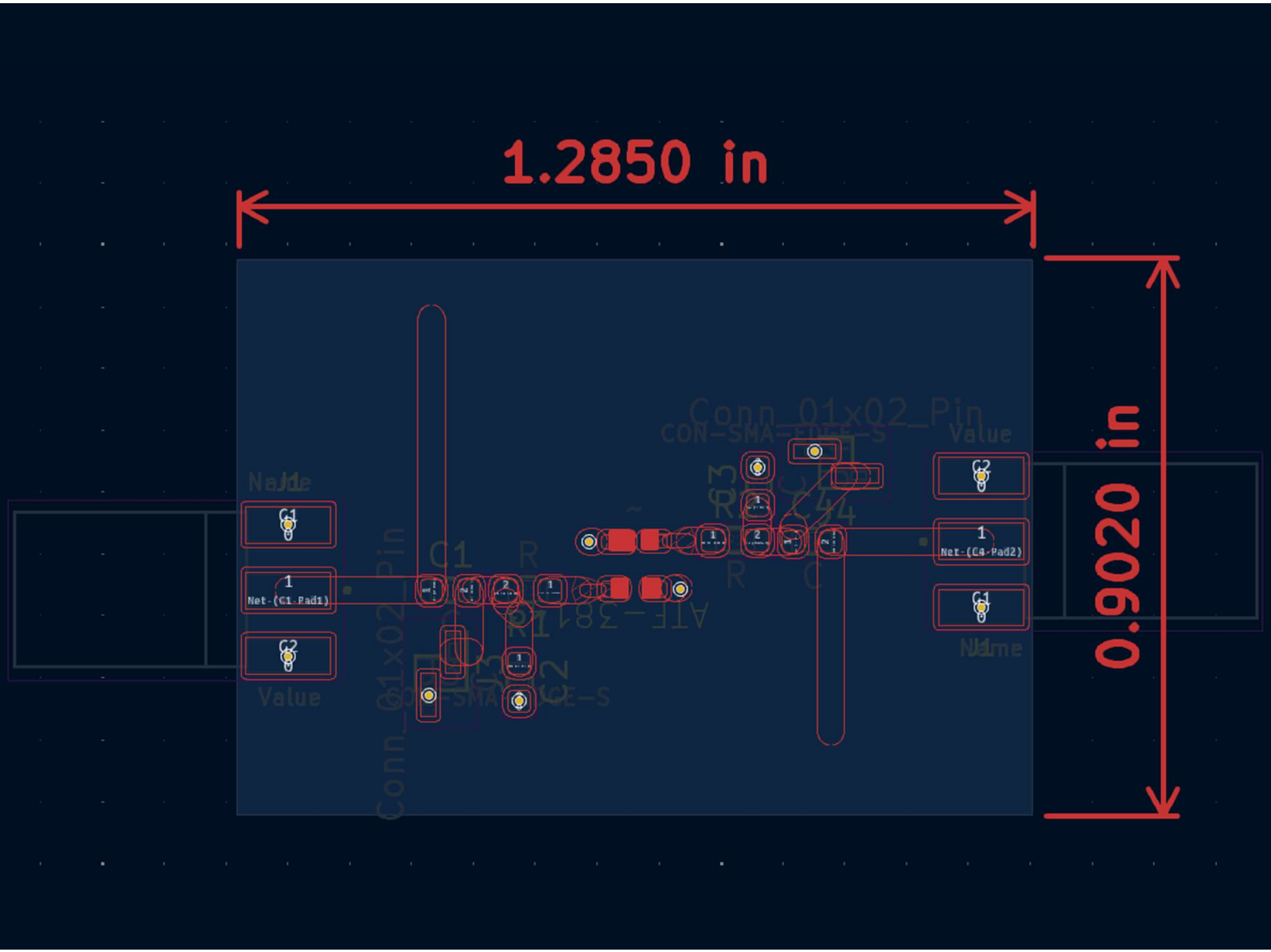
Complete Amplifier Design




S_StabCircle1
indep(S_StabCircle1) (0.000 to 51.000)


L_StabCircle1
indep(L_StabCircle1) (0.000 to 51.000)


Name
Value
Value
Name


1.2850 in
0.9020 in
Net-(C1-Pad1)
Net-(C4-Pad2)
Value
Value