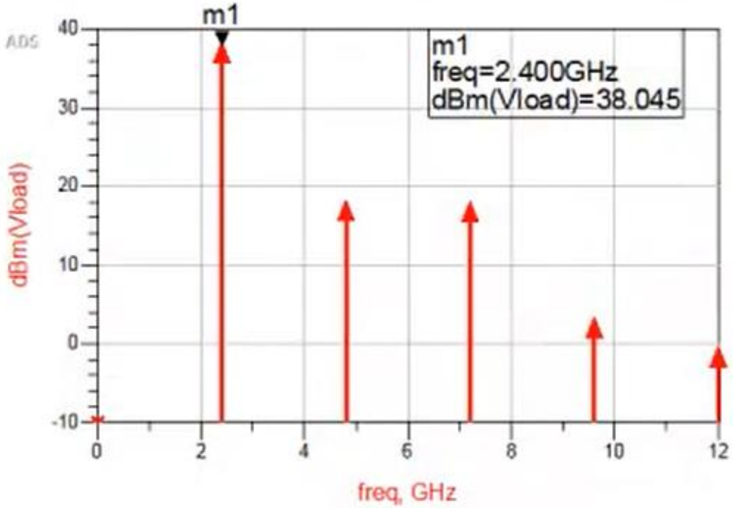
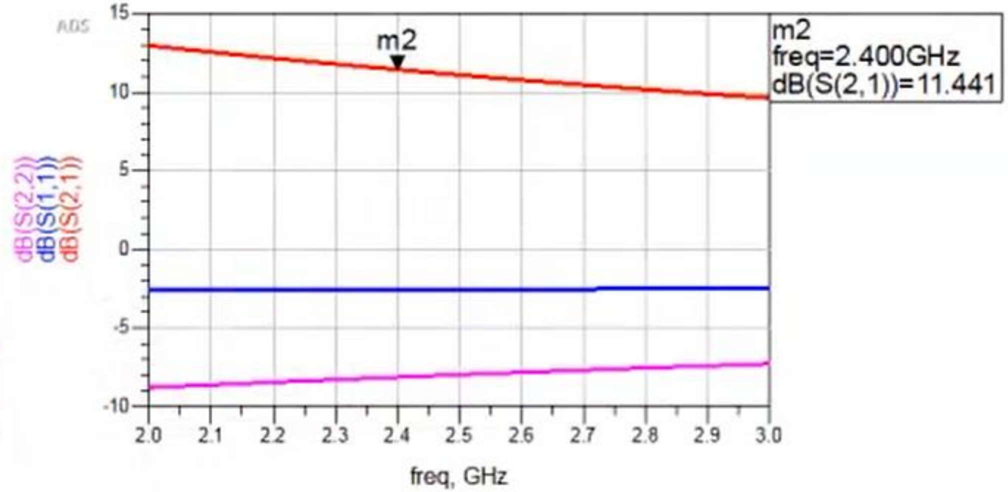
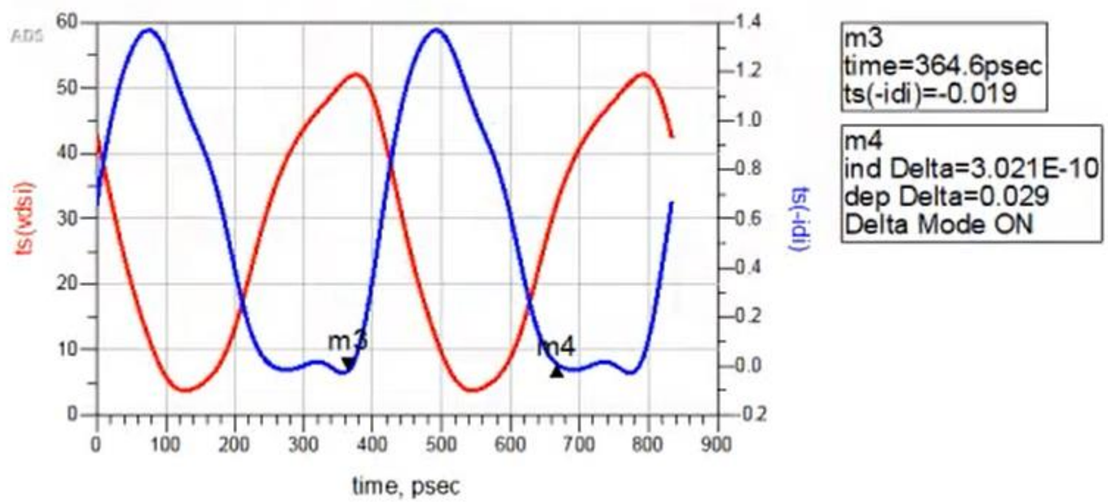
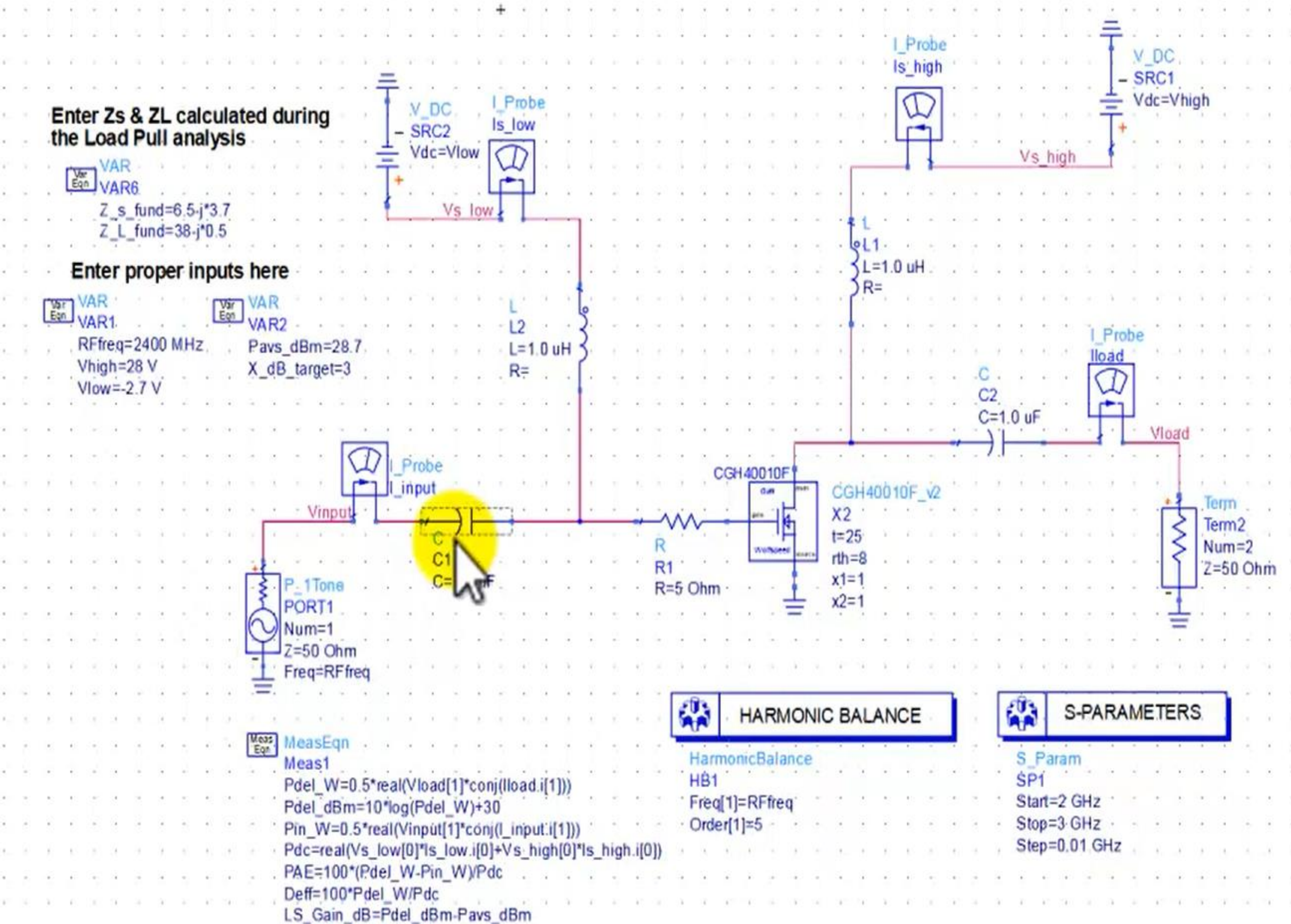
Pdel_dBm	PAE	Deff	LS_Gain_dB	Pdel_W
38.045	39.601	41.748	9.345	6.376

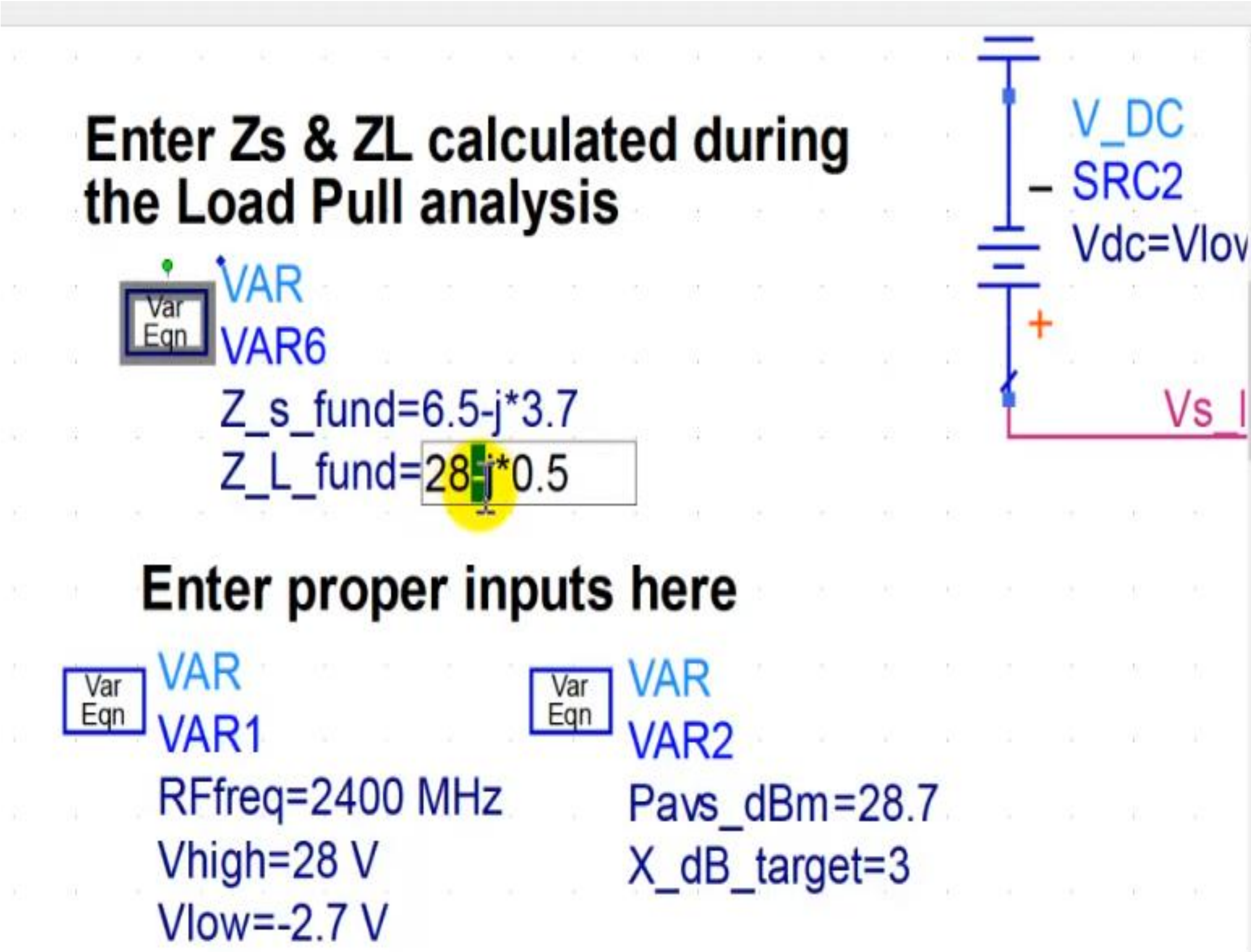




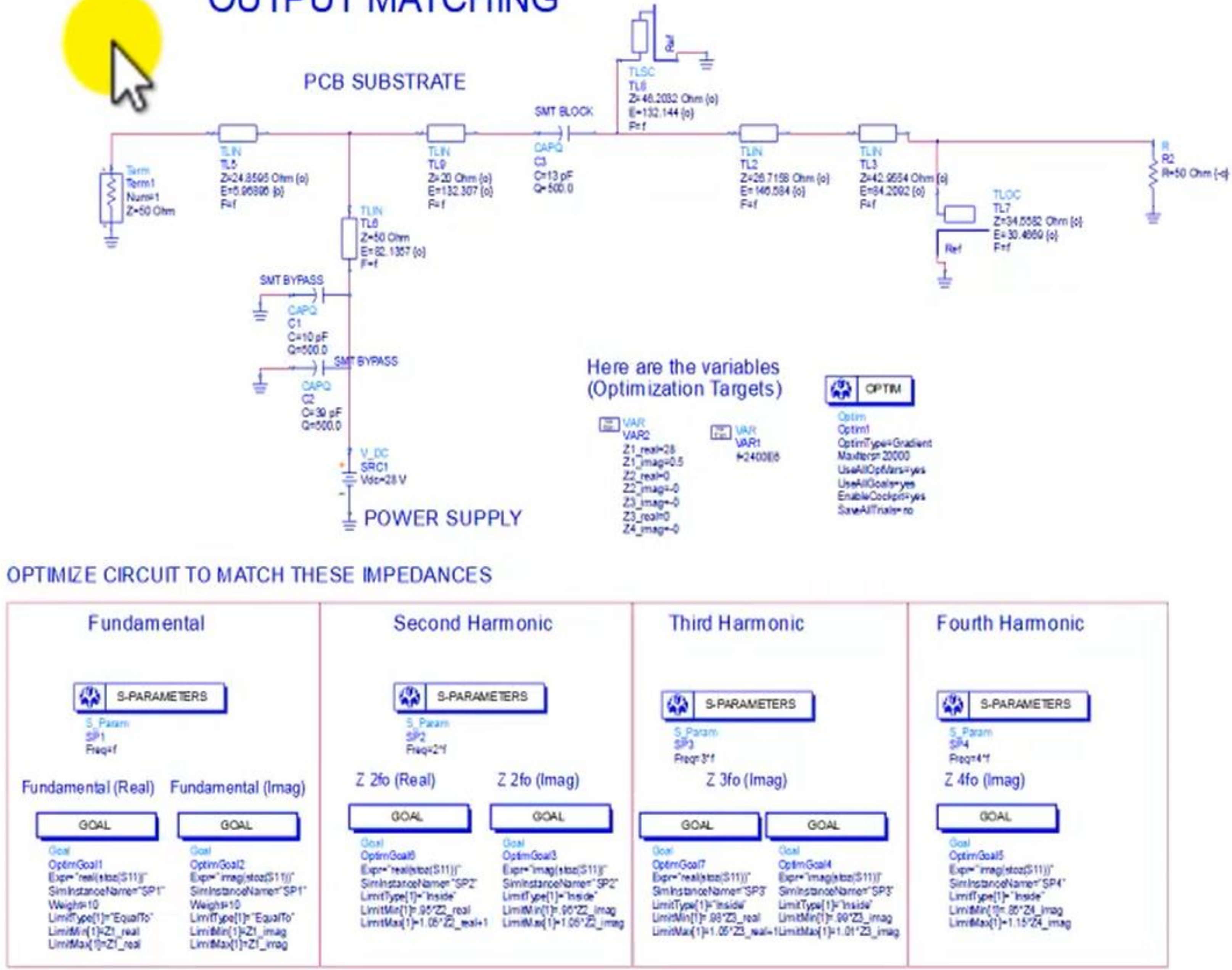




Enter Zs & ZL calculated during the Load Pull analysis
VAR
VAR6
Z_s_fund=6.5-j*3.7
Z_L_fund=38-j*0.5
Enter proper inputs here
VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=28.7
X_dB_target=3
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
L
L2
L=1.0 uH
R=
I_Probe
Is_high
V_DC
SRC1
Vdc=Vhigh
Vs_high
L
L1
L=1.0 uH
R=
I_Probe
Iload
C
C2
C=1.0 uF
Vload
I_Probe
I_input
Vinput
C
C1
CGH40010F
CGH40010F_v2
X2
t=25
rth=8
x1=1
x2=1
R
R1
R=5 Ohm
Term
Term2
Num=2
Z=50 Ohm
P_1Tone
PORT1
Num=1
Z=50 Ohm
Freq=RFfreq
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
Pdel_dBm=10*log(Pdel_W)+30
Pin_W=0.5*real(Vinput[1]*conj(I_input.i[1]))
Pdc=real(Vs_low[0]*Is_low.i[0]+Vs_high[0]*Is_high.i[0])
PAE=100*(Pdel_W-Pin_W)/Pdc
Deff=100*Pdel_W/Pdc
LS_Gain_dB=Pdel_dBm-Pavs_dBm
HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq
Order[1]=5
S-PARAMETERS
S_Param
SP1
Start=2 GHz
Stop=3 GHz
Step=0.01 GHz


Enter Zs & ZL calculated during the Load Pull analysis
VAR
VAR6
Z_s_fund=6.5-j*3.7
Z_L_fund=28-j*0.5
Enter proper inputs here
VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=28.7
X_dB_target=3
V_DC
SRC2
Vdc=Vlov
Vs_I
Var
Eqn

OUTPUT MATCHING



Fundamental (Real)

GOAL

Goal
OptimGoal1
Expr="real(stoz(S11))"
SimInstanceName="SP1"
Weight=10
LimitType[1]="EqualTo"
LimitMin[1]=Z1_real
LimitMax[1]=Z1_real

Fundamental (Imag)

GOAL

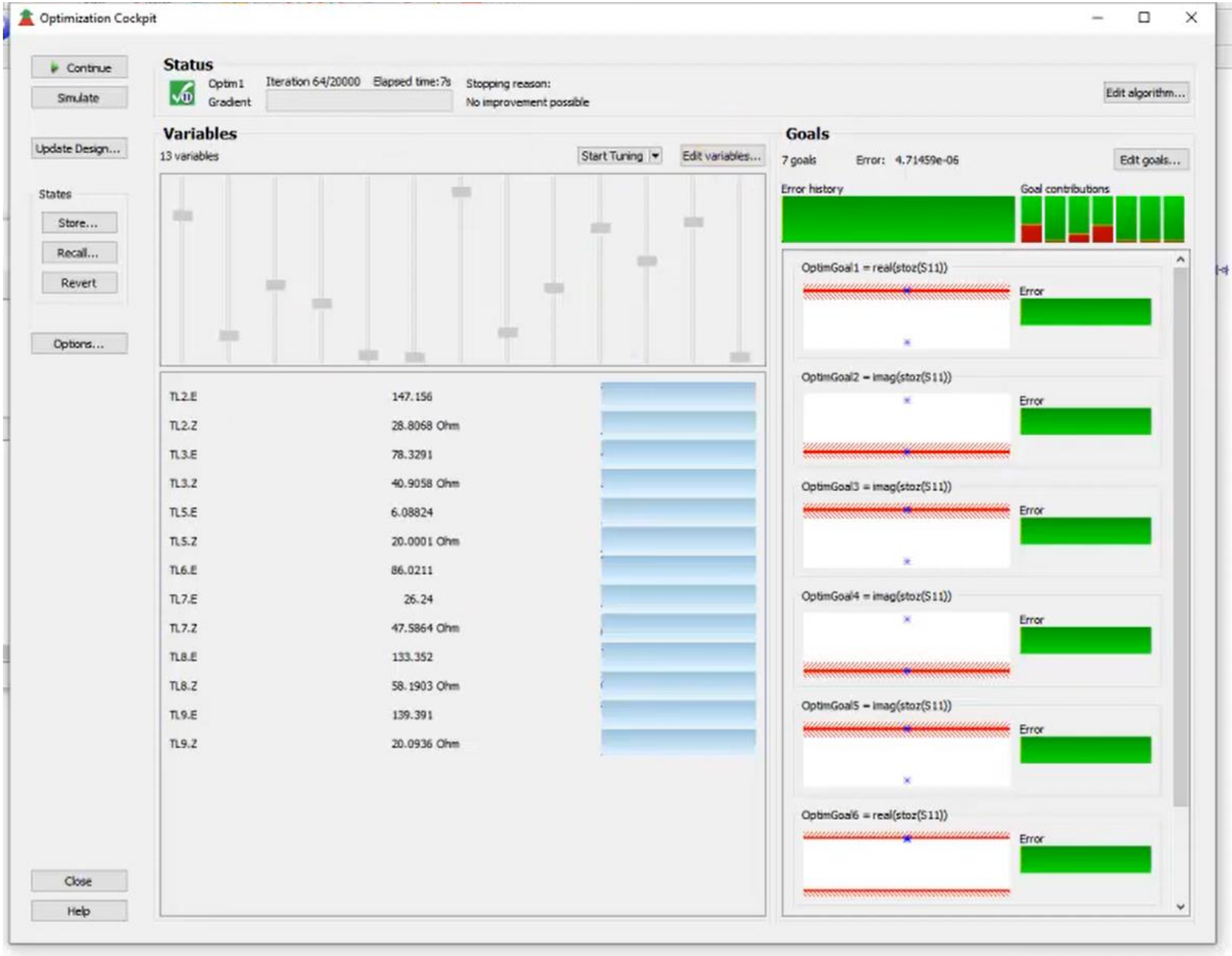
Goal
OptimGoal2
Expr="imag(stoz(S11))"
SimInstanceName="SP1"
Weight=10
LimitType[1]="EqualTo"
LimitMin[1]=Z1_imag
LimitMax[1]=Z1_imag

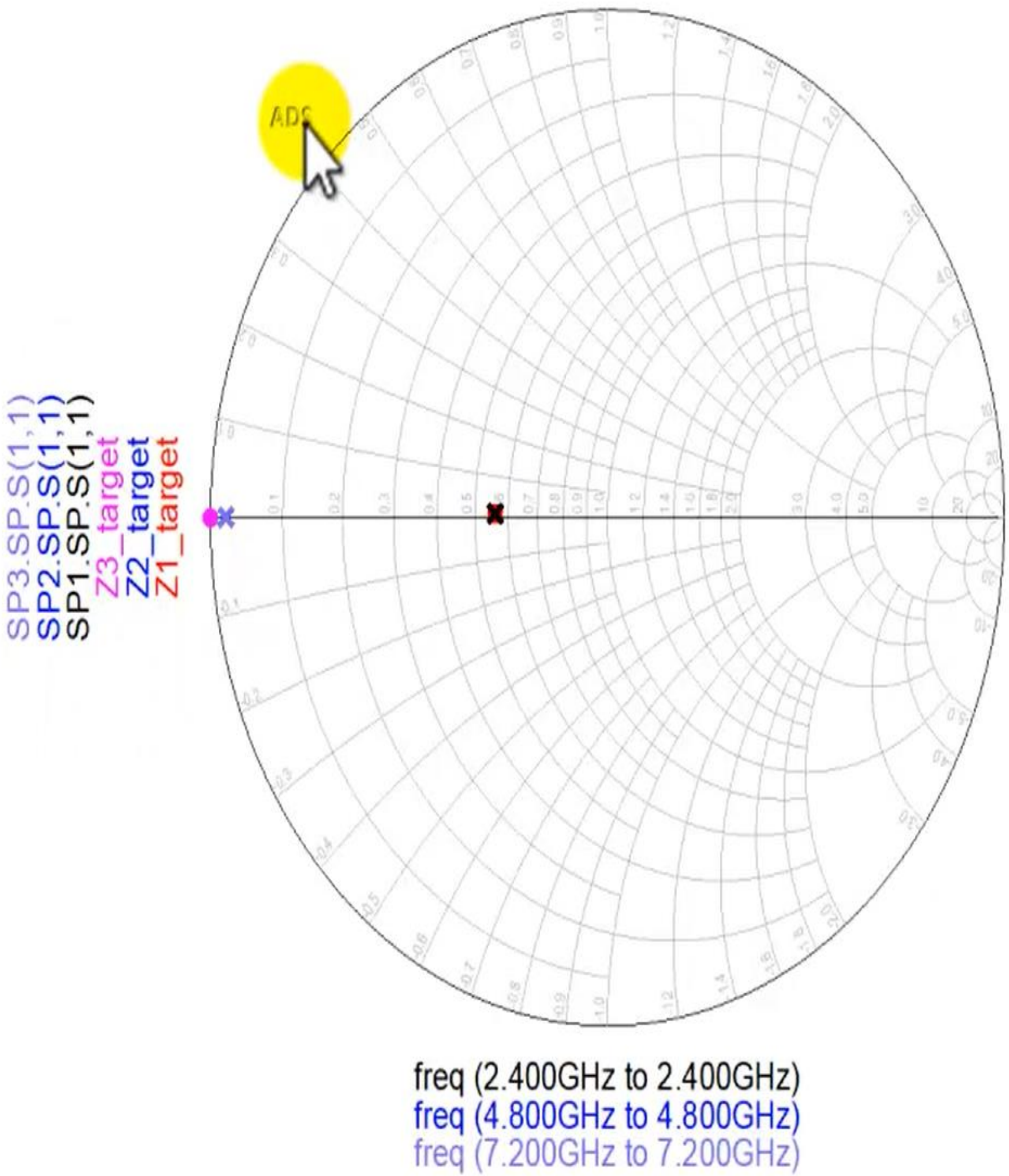
Z 2fo (Real)

GOAL

Goal
OptimGoal6
Expr="real(stoz(S11))"
SimInstanceName="SP2"
LimitType[1]="Inside"
LimitMin[1]=.95*Z2_real
LimitMax[1]=1.05*Z2_real+1

METERS
Z 2fo (Imag)
GOAL
Goal
OptimGoal3
Expr="imag(stoz(S11))"
SimInstanceName="SP2"
LimitType[1]="Inside"
LimitMin[1]=.95*Z2_imag
LimitMax[1]=1.05*Z2_imag
S-PARAMETERS
S_Param
SP3
Freq=3*f
Z 3fo (Imag)
GOAL
Goal
OptimGoal7
Expr="real(stoz(S11))"
SimInstanceName="SP3"
LimitType[1]="Inside"
LimitMin[1]=.98*Z3_real
LimitMax[1]=1.05*Z3_real+1
GOAL
Goal
OptimGoal4
Expr="imag(stoz(S11))"
SimInstanceName="SP3"
LimitType[1]="Inside"
LimitMin[1]=.99*Z3_imag
LimitMax[1]=1.01*Z3_imag
S-PARAMETERS
S_Param
SP4
Freq=4*f
Z 4fo (Imag)
GOAL
Goal
OptimGoal5
Expr="imag(stoz(S11))"
SimInstanceName="SP4"
LimitType[1]="Inside"
LimitMin[1]=.85*Z4_imag
LimitMax[1]=1.15*Z4_imag

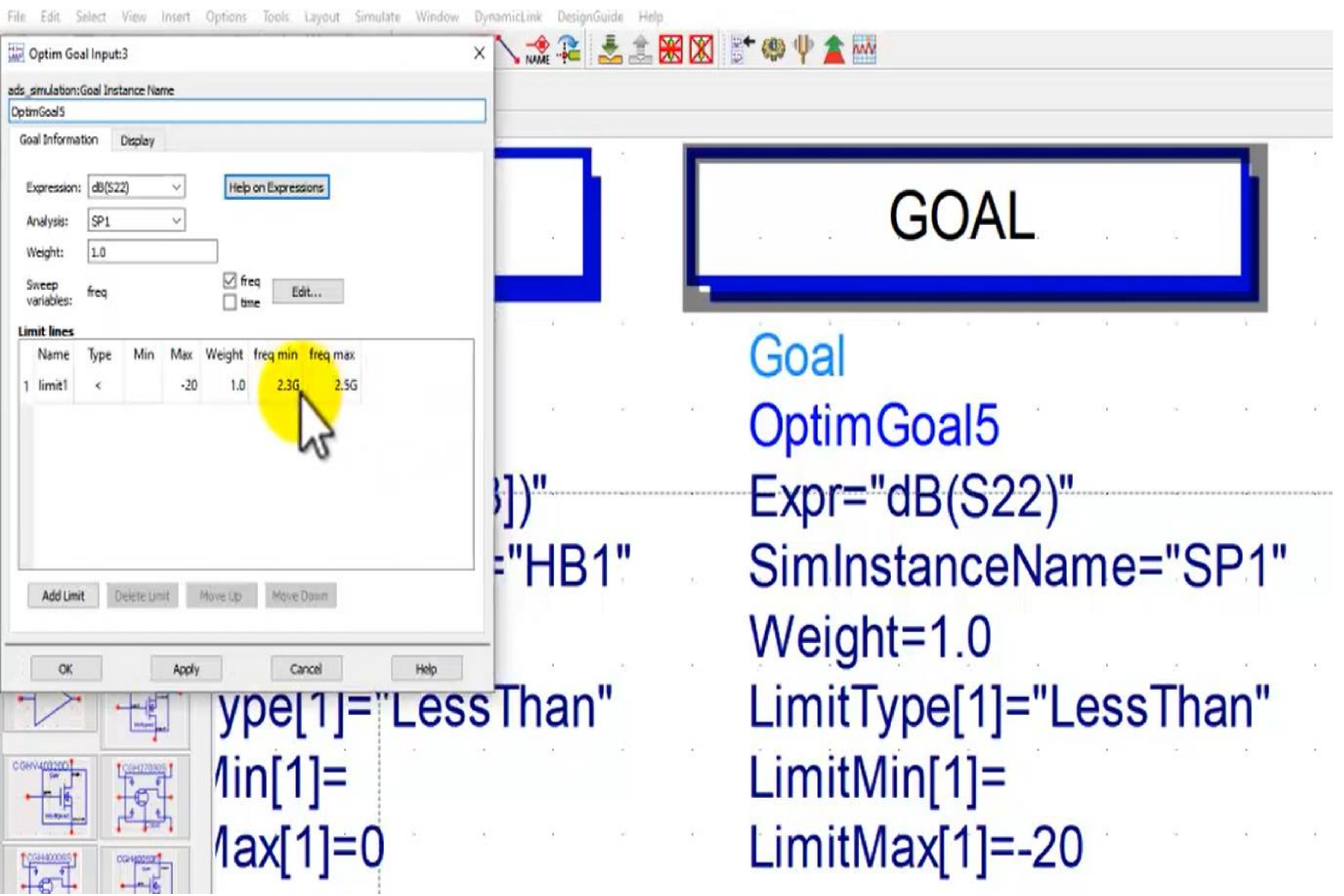

Optimization Cockpit
Continue
Simulate
Update Design...
States
Store...
Recall...
Revert
Options...
Close
Help
Status
Optim1
Gradient
Iteration 64/20000
Elapsed time: 7s
Stopping reason:
No improvement possible
Edit algorithm...
Variables
13 variables
Start Tuning
Edit variables...
TL2.E 147.156
TL2.Z 28.8068 Ohm
TL3.E 78.3291
TL3.Z 40.9058 Ohm
TL5.E 6.08824
TL5.Z 20.0001 Ohm
TL6.E 86.0211
TL7.E 26.24
TL7.Z 47.5864 Ohm
TL8.E 133.352
TL8.Z 58.1903 Ohm
TL9.E 139.391
TL9.Z 20.0936 Ohm
Goals
7 goals
Error: 4.71459e-06
Edit goals...
Error history
Goal contributions
OptimGoal1 = real(stoz(S11))
Error
OptimGoal2 = imag(stoz(S11))
Error
OptimGoal3 = imag(stoz(S11))
Error
OptimGoal4 = imag(stoz(S11))
Error
OptimGoal5 = imag(stoz(S11))
Error
OptimGoal6 = real(stoz(S11))
Error

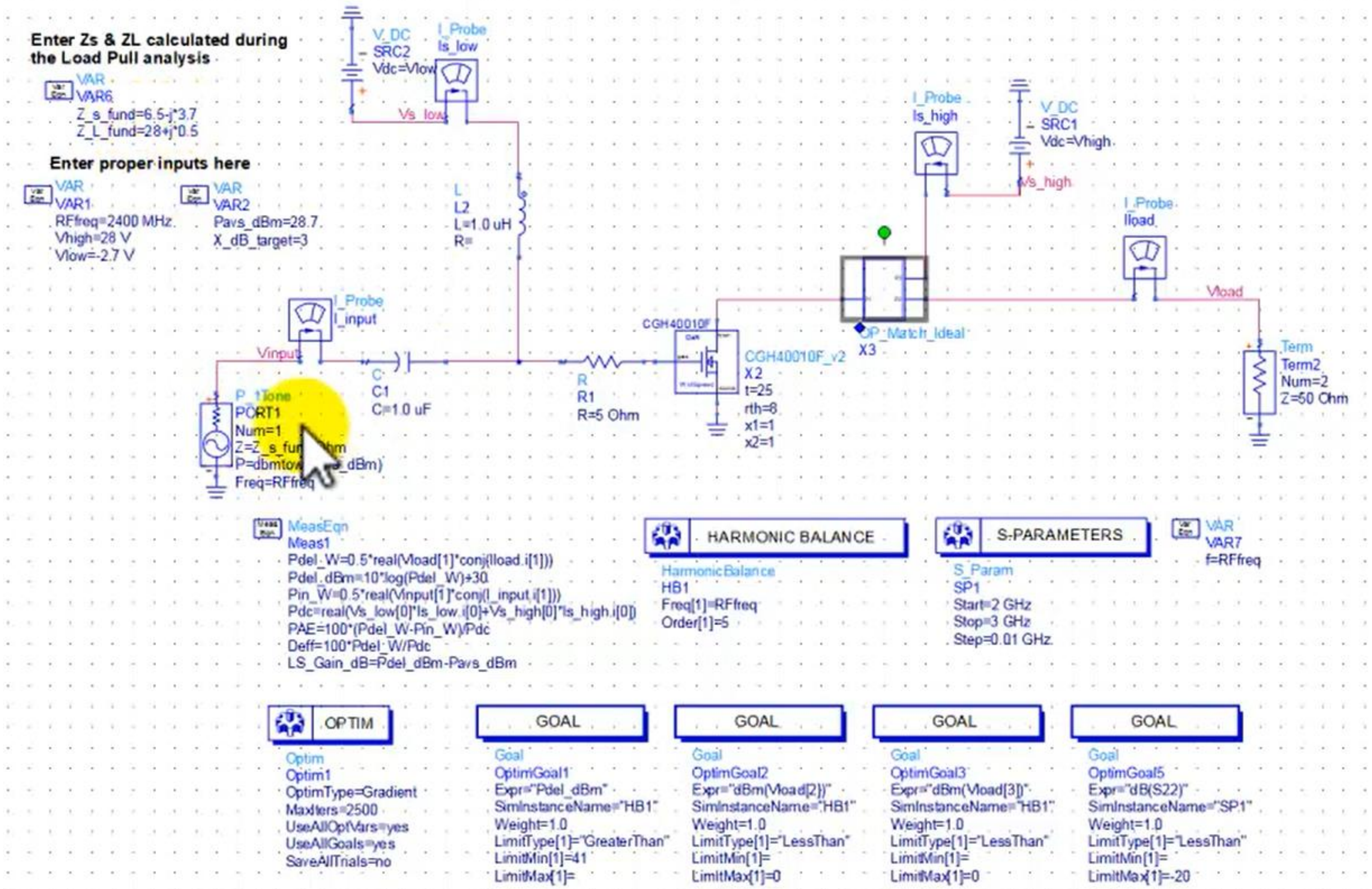


Eqn Z1_target=ztos(Z1_real+j*Z1_imag)

Eqn Z2_target=ztos(Z2_real+j*Z2_imag)

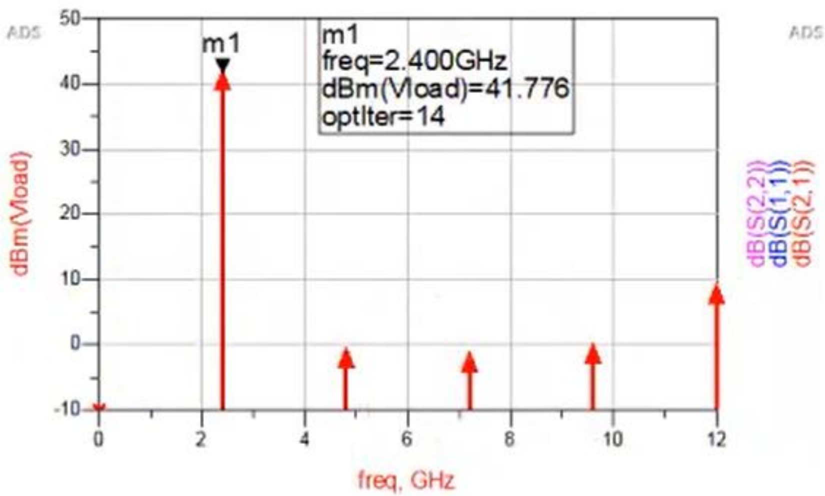
Eqn Z3_target=ztos(Z3_real+j*Z3_imag)

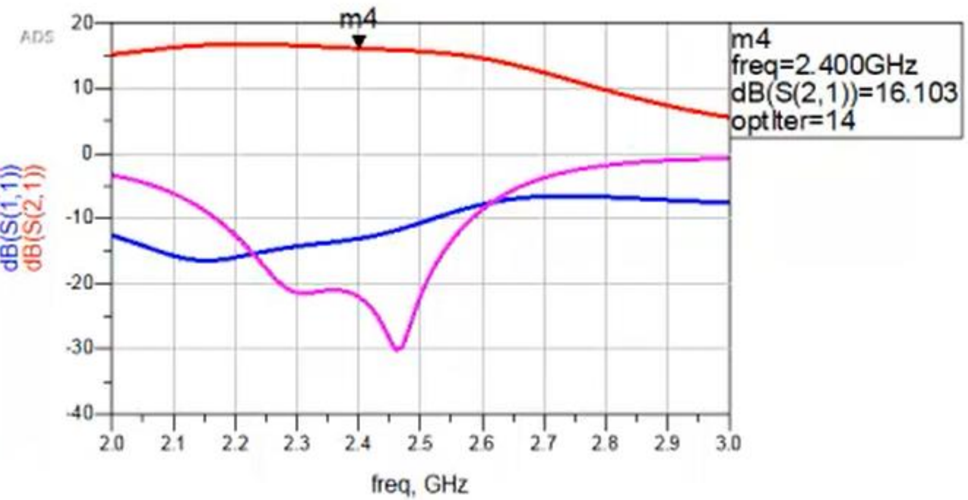

File Edit Select View Insert Options Tools Layout Simulate Window DynamicLink DesignGuide Help
Optim Goal Input:3
ads_simulation:Goal Instance Name
OptimGoal5
Goal Information
Display
Expression: dB(S22)
Help on Expressions
Analysis: SP1
Weight: 1.0
Sweep variables: freq
freq
time
Edit...
Limit lines
Name Type Min Max Weight freq min freq max
1 limit1 < -20 1.0 2.3G 2.5G
Add Limit
Delete Limit
Move Up
Move Down
OK
Apply
Cancel
Help
GOAL
Goal
OptimGoal5
Expr="dB(S22)"
SimInstanceName="SP1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=-20

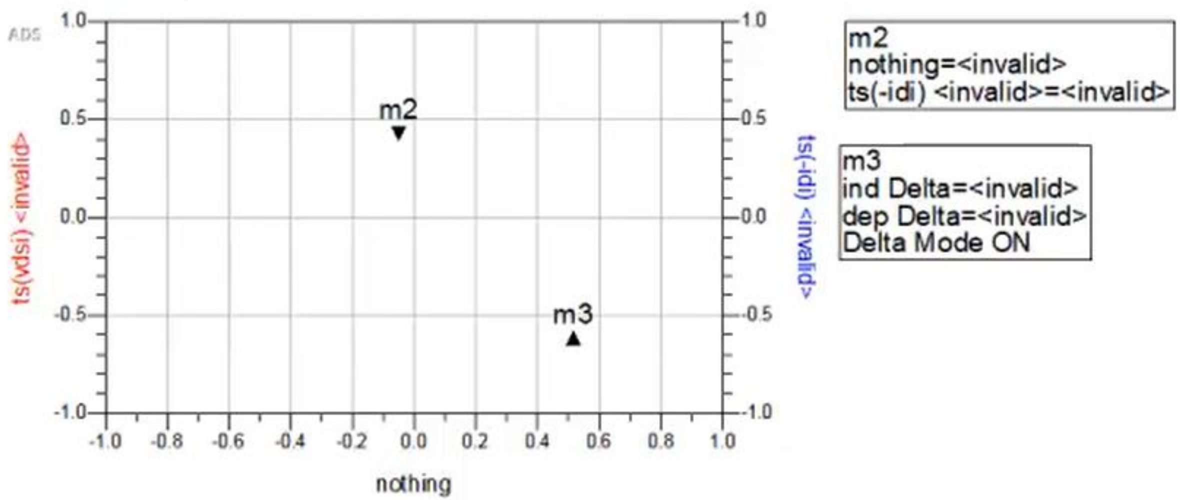


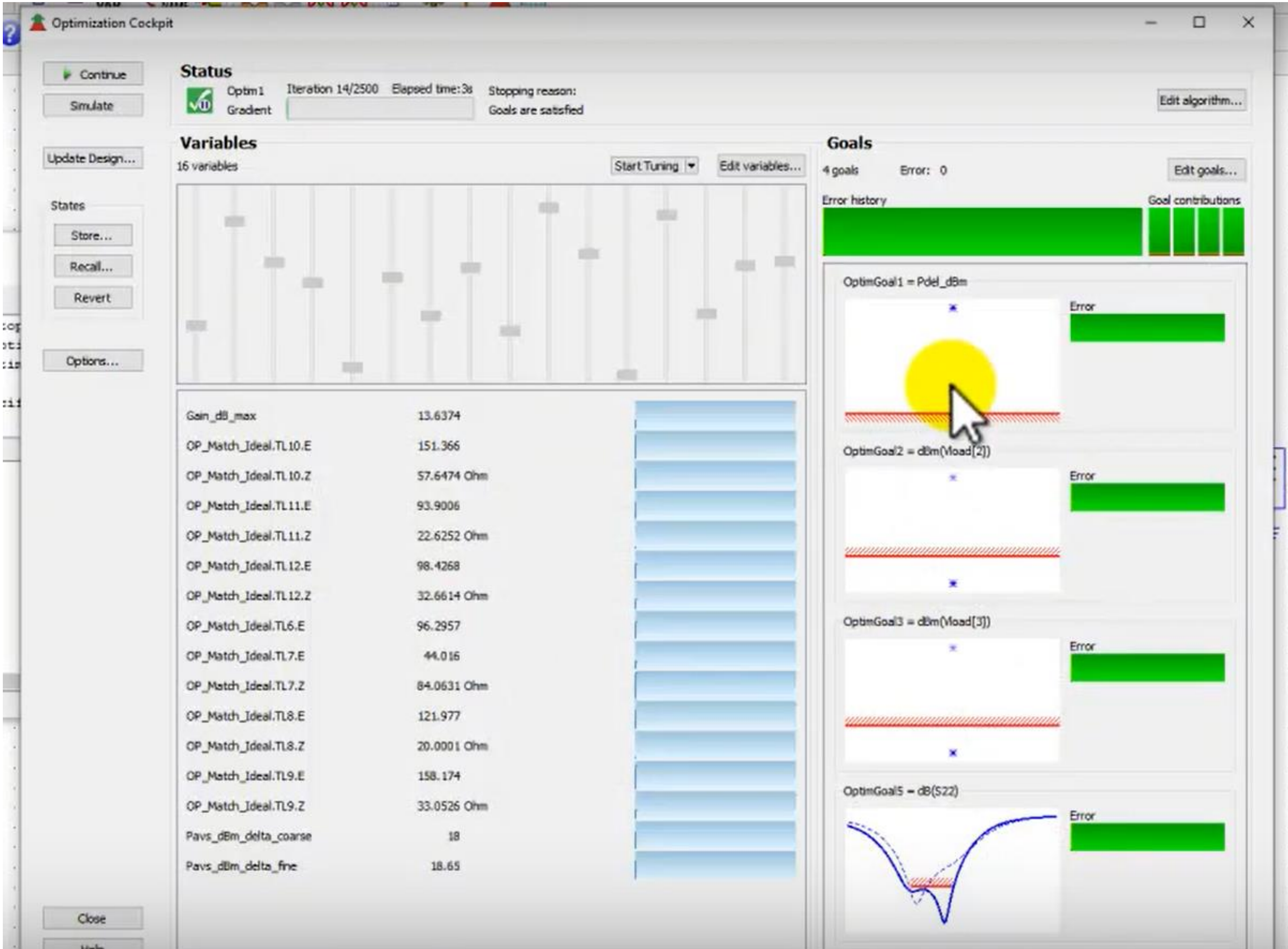
Enter Zs & ZL calculated during the Load Pull analysis
VAR
VAR6
Z_s_fund=6.5-j*3.7
Z_L_fund=28+j*0.5
Enter proper inputs here
VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=28.7
X_dB_target=3
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
L
L2
L=1.0 uH
R=
I_Probe
I_input
Vinput
C
C1
C=1.0 uF
P_1Tone
PORT1
Num=1
Freq=RFfreq
R
R1
R=5 Ohm
CGH40010F
CGH40010F_v2
X2
t=25
rth=8
x1=1
x2=1
OP_Match_Ideal
X3
I_Probe
Is_high
V_DC
SRC1
Vdc=Vhigh
Vs_high
I_Probe
Iload
Vload
Term
Term2
Num=2
Z=50 Ohm
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
Pdel_dBm=10*log(Pdel_W)+30
Pin_W=0.5*real(Vinput[1]*conj(I_input.i[1]))
Pdc=real(Vs_low[0]*Is_low.i[0]+Vs_high[0]*Is_high.i[0])
PAE=100*(Pdel_W-Pin_W)/Pdc
Deff=100*Pdel_W/Pdc
LS_Gain_dB=Pdel_dBm-Pavs_dBm
HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq
Order[1]=5
S-PARAMETERS
S_Param
SP1
Start=2 GHz
Stop=3 GHz
Step=0.01 GHz
VAR
VAR7
f=RFfreq
OPTIM
Optim
Optim1
OptimType=Gradient
MaxIters=2500
UseAllOptVars=yes
UseAllGoals=yes
SaveAllTrials=no
GOAL
Goal
OptimGoal1
Expr="Pdel_dBm"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="GreaterThan"
LimitMin[1]=41
LimitMax[1]=
GOAL
Goal
OptimGoal2
Expr="dBm(Vload[2])"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=0
GOAL
Goal
OptimGoal3
Expr="dBm(Vload[3])"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=0
GOAL
Goal
OptimGoal5
Expr="dB(S22)"
SimInstanceName="SP1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=-20

...Bm <invalid>	PAE <invalid>	Deff <invalid>	..._dB <invalid>	...I_W <invalid>

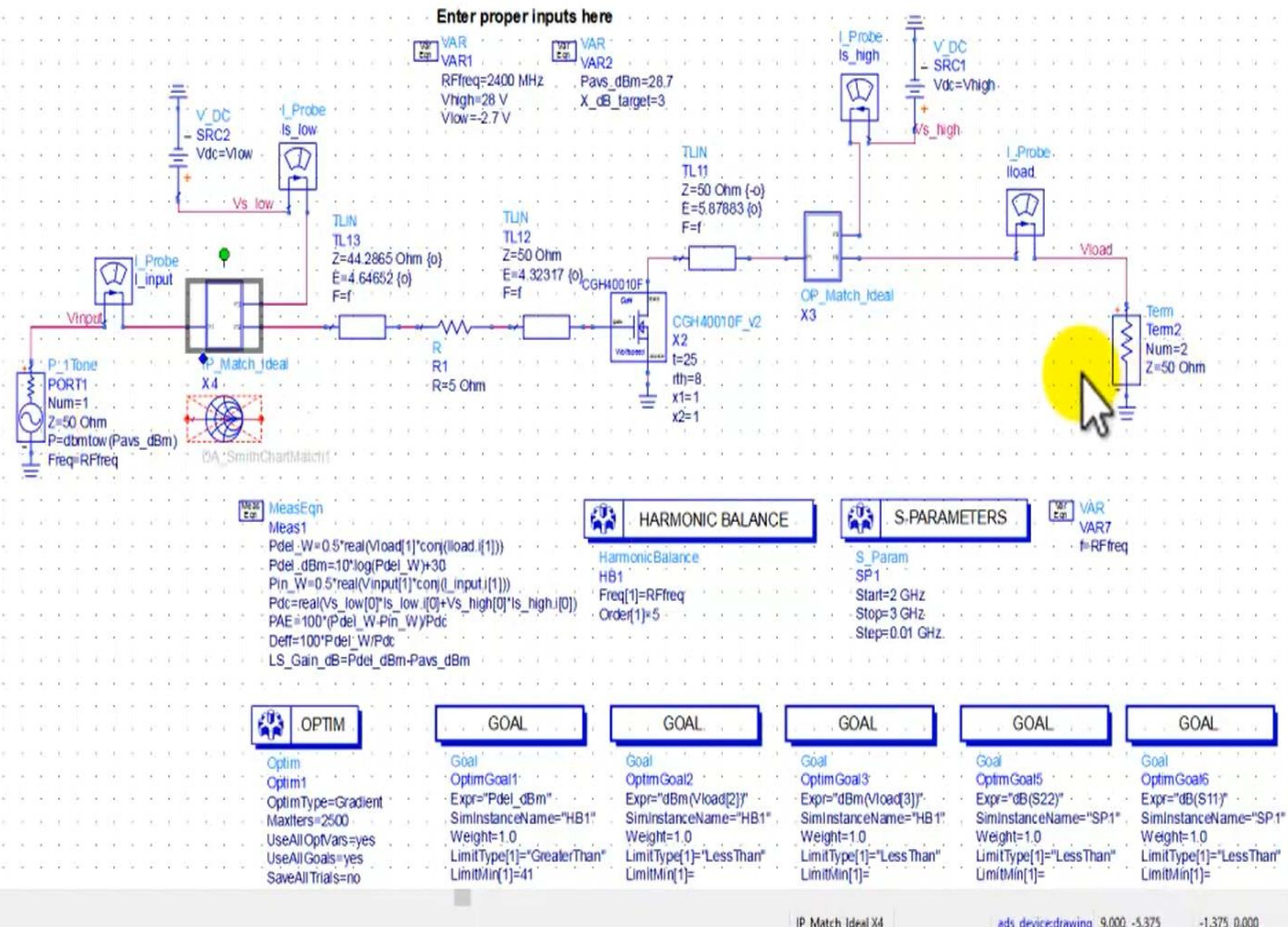




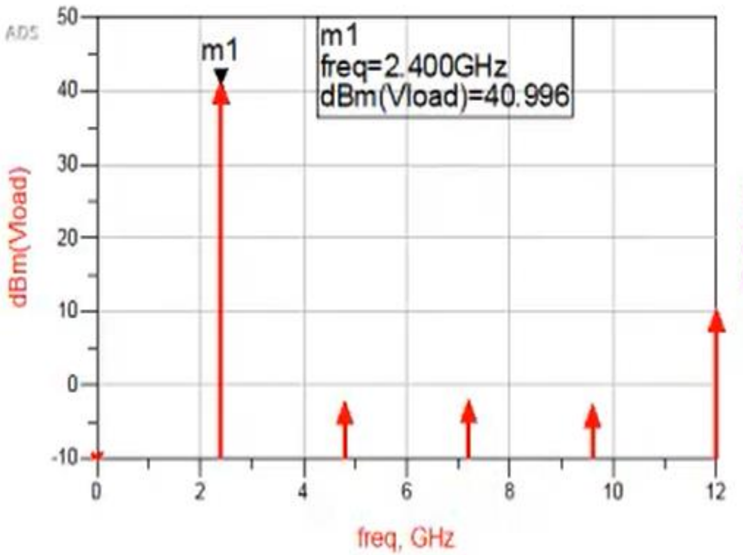


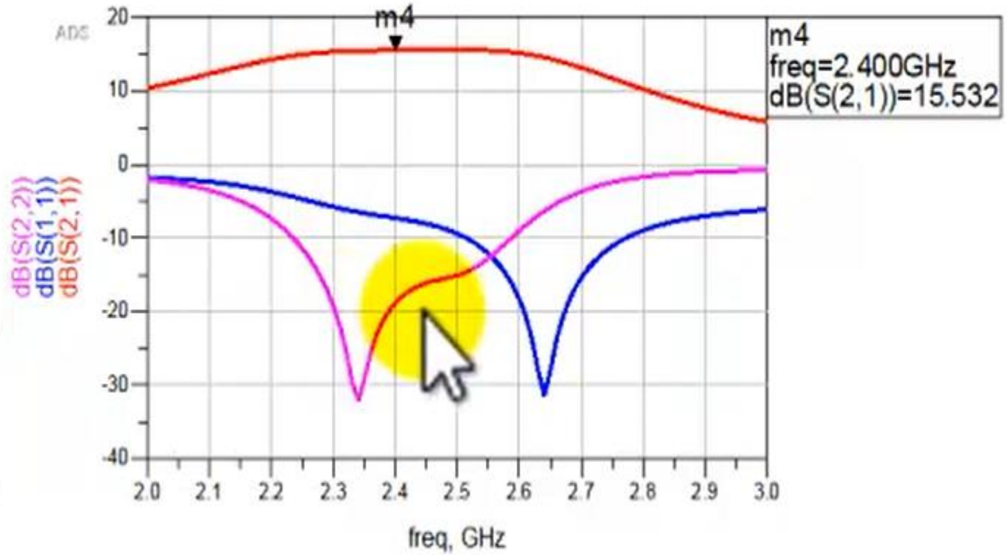

Optimization Cockpit
Continue
Simulate
Status
Optim1
Gradient
Iteration 14/2500
Elapsed time:3s
Stopping reason:
Goals are satisfied
Edit algorithm...
Update Design...
Variables
16 variables
Start Tuning
Edit variables...
Goals
4 goals
Error: 0
Edit goals...
Error history
Goal contributions
States
Store...
Recall...
Revert
Options...
Gain_dB_max 13.6374
OP_Match_Ideal.TL10.E 151.366
OP_Match_Ideal.TL10.Z 57.6474 Ohm
OP_Match_Ideal.TL11.E 93.9006
OP_Match_Ideal.TL11.Z 22.6252 Ohm
OP_Match_Ideal.TL12.E 98.4268
OP_Match_Ideal.TL12.Z 32.6614 Ohm
OP_Match_Ideal.TL6.E 96.2957
OP_Match_Ideal.TL7.E 44.016
OP_Match_Ideal.TL7.Z 84.0631 Ohm
OP_Match_Ideal.TL8.E 121.977
OP_Match_Ideal.TL8.Z 20.0001 Ohm
OP_Match_Ideal.TL9.E 158.174
OP_Match_Ideal.TL9.Z 33.0526 Ohm
Pavs_dBm_delta_coarse 18
Pavs_dBm_delta_fine 18.65
OptimGoal1 = Pdel_dBm
Error
OptimGoal2 = dBm(Vload[2])
Error
OptimGoal3 = dBm(Vload[3])
Error
OptimGoal5 = dB(S22)
Error
Close
Help

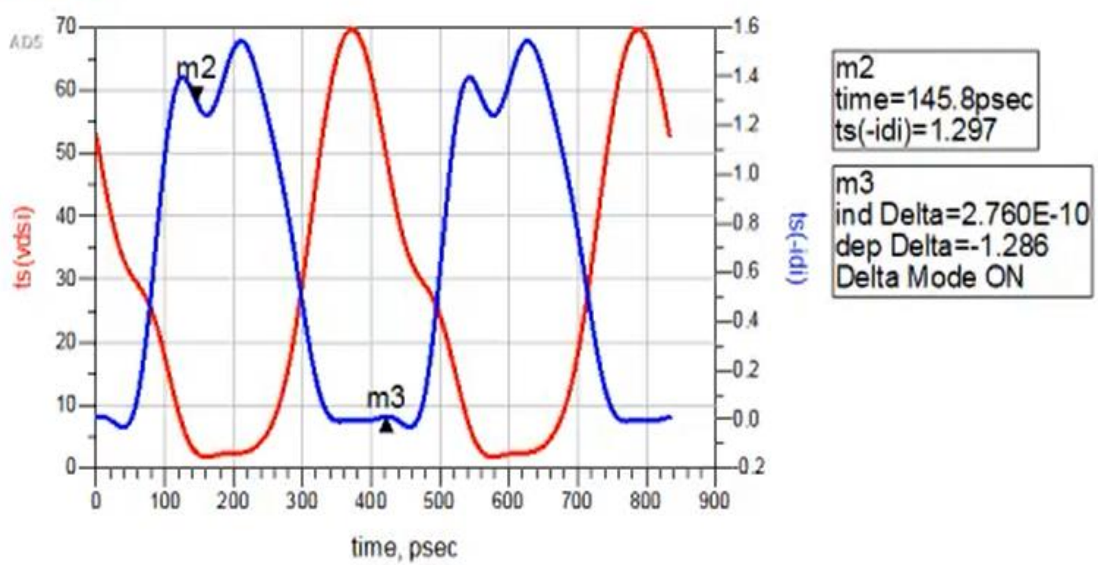
Input Matching Network

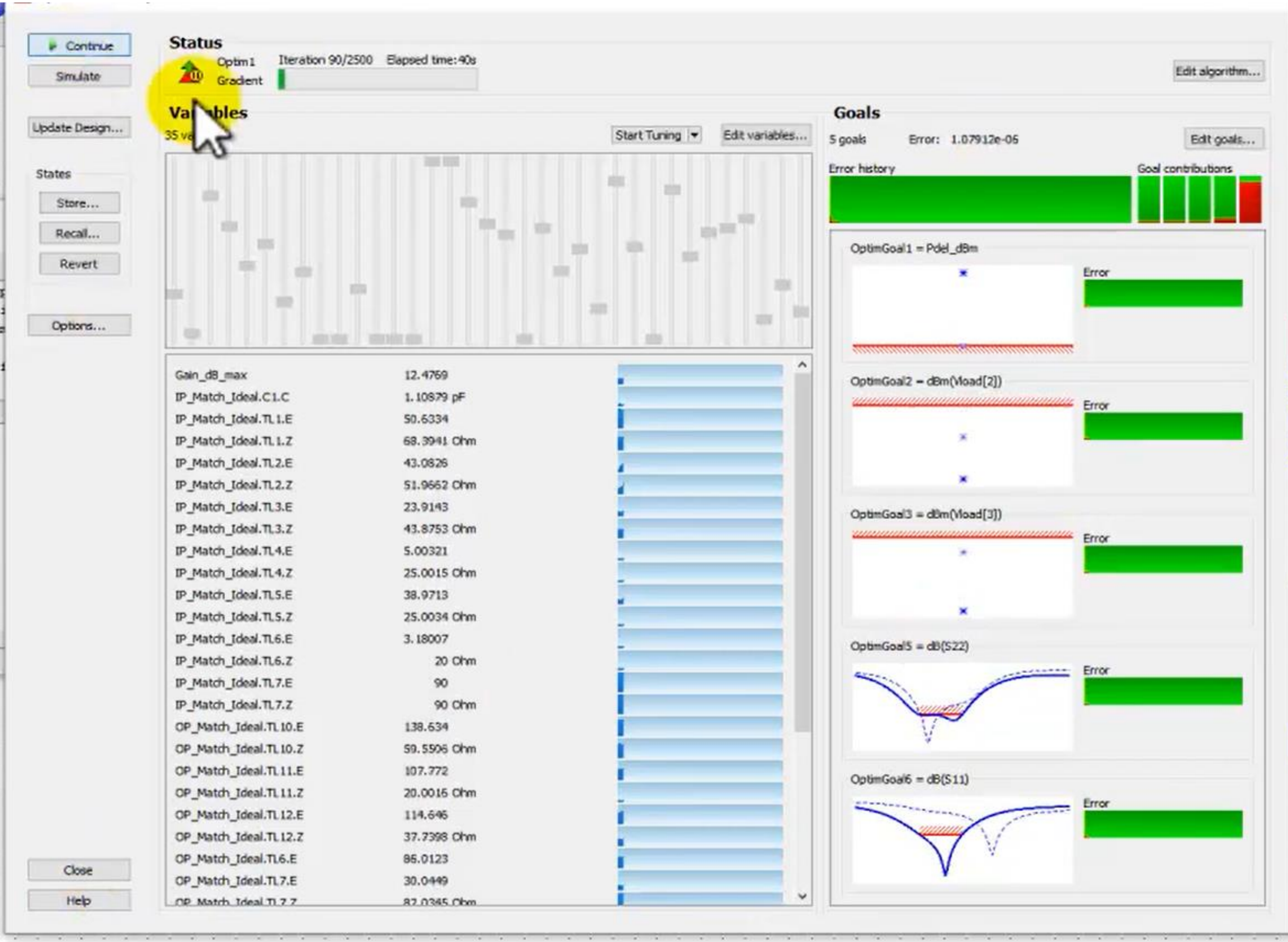

Enter proper inputs here
VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=28.7
X_dB_target=3
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
I_Probe
Is_high
V_DC
SRC1
Vdc=Vhigh
Vs_high
TLIN
TL11
Z=50 Ohm {-o}
E=5.87883 {o}
F=f
I_Probe
Iload
Vload
I_Probe
I_input
Vinput
TLIN
TL13
Z=44.2865 Ohm {o}
E=4.64652 {o}
F=f
TLIN
TL12
Z=50 Ohm
E=4.32317 {o}
F=f
CGH40010F
CGH40010F_v2
X2
t=25
rth=8
x1=1
x2=1
OP_Match_Ideal
X3
Term
Term2
Num=2
Z=50 Ohm
P_1Tone
PORT1
Num=1
Z=50 Ohm
P=dbmtow(Pavs_dBm)
Freq=RFfreq
IP_Match_Ideal
X4
R
R1
R=5 Ohm
DA_SmithChartMatch1
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
Pdel_dBm=10*log(Pdel_W)+30
Pin_W=0.5*real(Vinput[1]*conj(I_input.i[1]))
Pdc=real(Vs_low[0]*Is_low.i[0]+Vs_high[0]*Is_high.i[0])
PAE=100*(Pdel_W-Pin_W)/Pdc
Deff=100*Pdel_W/Pdc
LS_Gain_dB=Pdel_dBm-Pavs_dBm
HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq
Order[1]=5
S-PARAMETERS
S_Param
SP1
Start=2 GHz
Stop=3 GHz
Step=0.01 GHz
VAR
VAR7
f=RFfreq
OPTIM
Optim
Optim1
OptimType=Gradient
MaxIters=2500
UseAllOptVars=yes
UseAllGoals=yes
SaveAllTrials=no
GOAL
Goal
OptimGoal1
Expr="Pdel_dBm"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="GreaterThan"
LimitMin[1]=41
GOAL
Goal
OptimGoal2
Expr="dBm(Vload[2])"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
GOAL
Goal
OptimGoal3
Expr="dBm(Vload[3])"
SimInstanceName="HB1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
GOAL
Goal
OptimGoal5
Expr="dB(S22)"
SimInstanceName="SP1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
GOAL
Goal
OptimGoal6
Expr="dB(S11)"
SimInstanceName="SP1"
Weight=1.0
LimitType[1]="LessThan"
LimitMin[1]=
IP_Match_Ideal X4
ads_devicedrawing 9.000 -5.375 -1.375 0.000

Pdel_dBm	PAE	Deff	LS_Gain_dB	Pdel_W
40.996	64.339	67.182	12.296	12.576

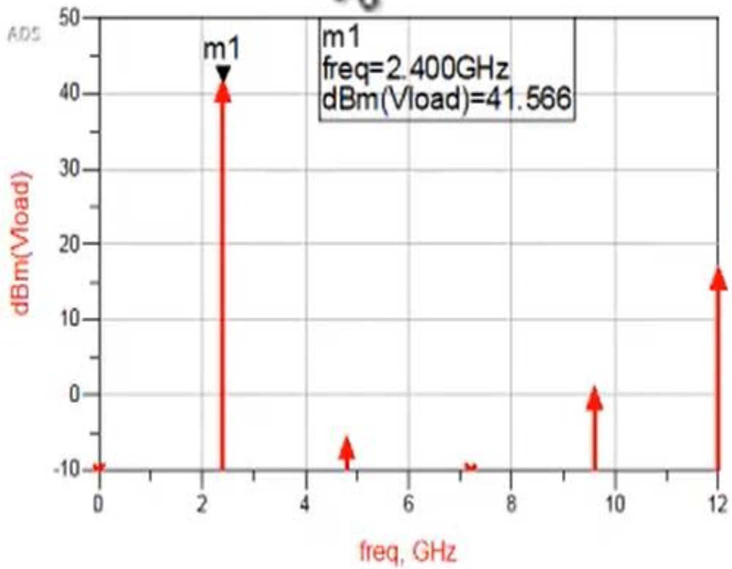


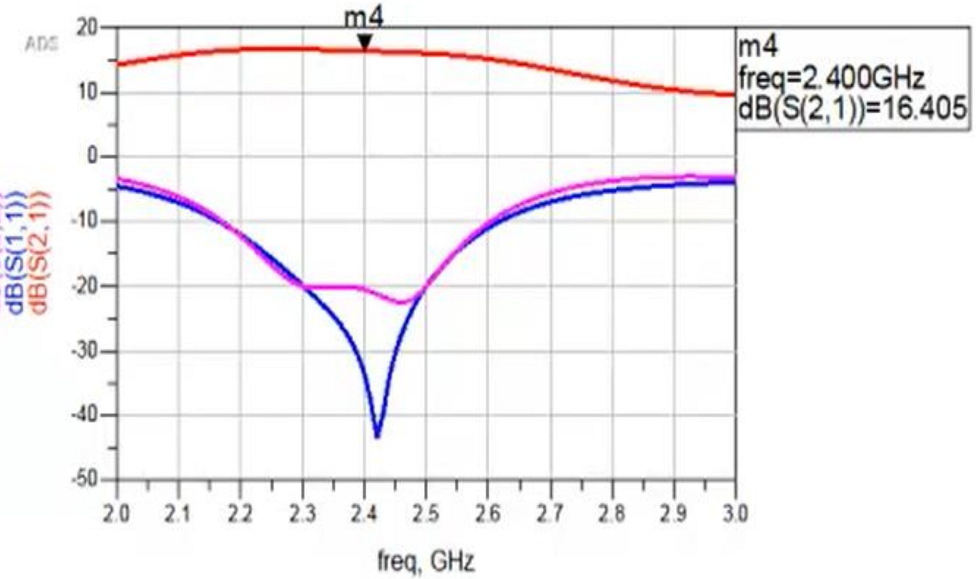


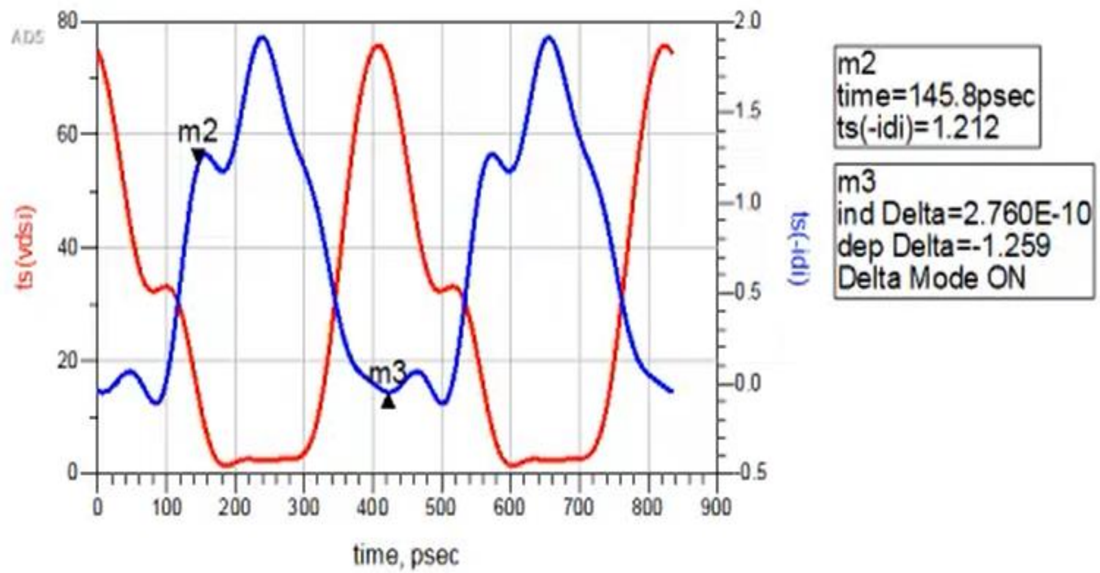



Continue
Simulate
Update Design...
States
Store...
Recall...
Revert
Options...
Close
Help
Status
Optim1
Gradient
Iteration 90/2500
Elapsed time: 40s
Edit algorithm...
Variables
Start Tuning
Edit variables...
Gain_dB_max 12.4769
IP_Match_Ideal.C1.C 1.10879 pF
IP_Match_Ideal.TL1.E 50.6334
IP_Match_Ideal.TL1.Z 68.3941 Ohm
IP_Match_Ideal.TL2.E 43.0826
IP_Match_Ideal.TL2.Z 51.9662 Ohm
IP_Match_Ideal.TL3.E 23.9143
IP_Match_Ideal.TL3.Z 43.8753 Ohm
IP_Match_Ideal.TL4.E 5.00321
IP_Match_Ideal.TL4.Z 25.0015 Ohm
IP_Match_Ideal.TL5.E 38.9713
IP_Match_Ideal.TL5.Z 25.0034 Ohm
IP_Match_Ideal.TL6.E 3.18007
IP_Match_Ideal.TL6.Z 20 Ohm
IP_Match_Ideal.TL7.E 90
IP_Match_Ideal.TL7.Z 90 Ohm
OP_Match_Ideal.TL10.E 138.634
OP_Match_Ideal.TL10.Z 59.5506 Ohm
OP_Match_Ideal.TL11.E 107.772
OP_Match_Ideal.TL11.Z 20.0016 Ohm
OP_Match_Ideal.TL12.E 114.646
OP_Match_Ideal.TL12.Z 37.7398 Ohm
OP_Match_Ideal.TL6.E 86.0123
OP_Match_Ideal.TL7.E 30.0449
Goals
5 goals
Error: 1.07912e-06
Edit goals...
Error history
Goal contributions
OptimGoal1 = Pdel_dBm
Error
OptimGoal2 = dBm(Vload[2])
Error
OptimGoal3 = dBm(Vload[3])
Error
OptimGoal5 = dB(S22)
Error
OptimGoal6 = dB(S11)
Error

Pdel_dBm	PAE	Deff	LS_Gain_dB	Pdel_W
41.566	66.784	70.298	12.866	14.343

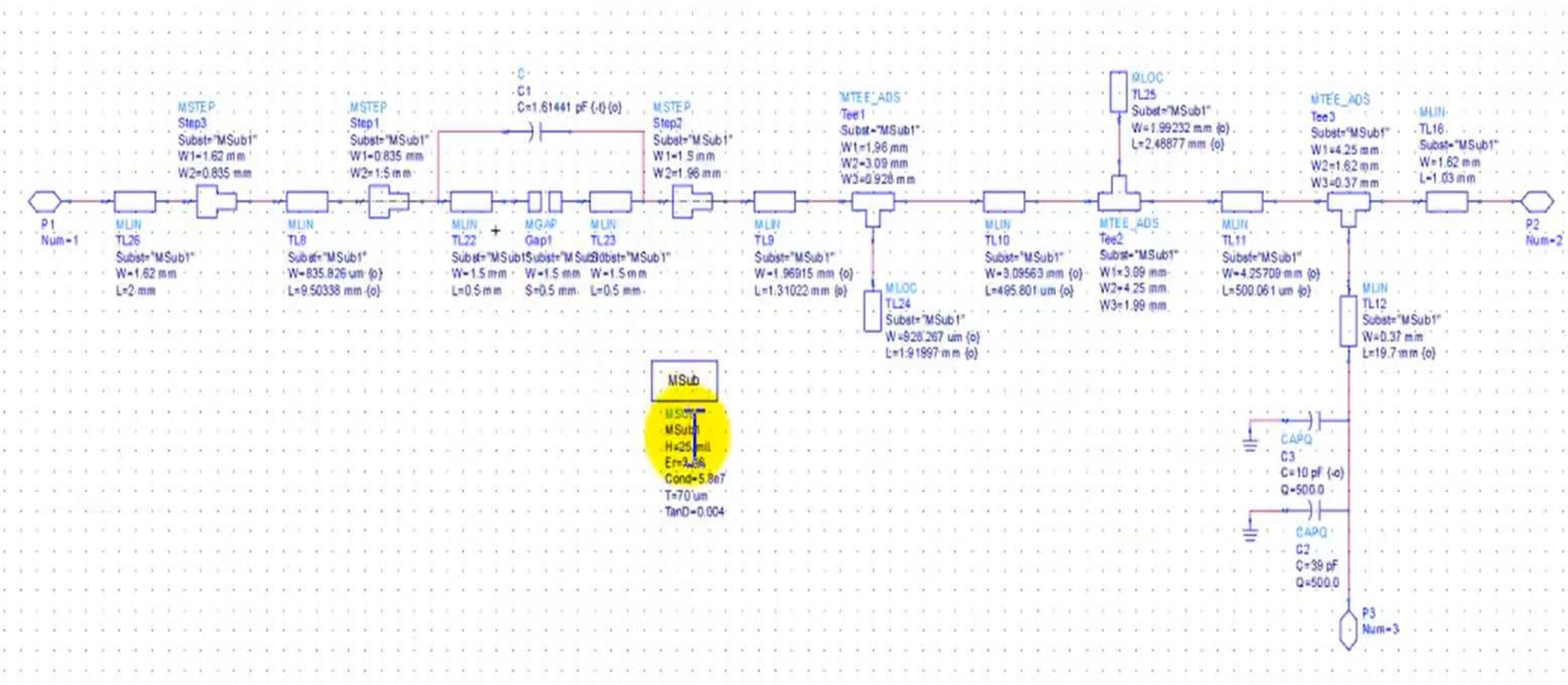


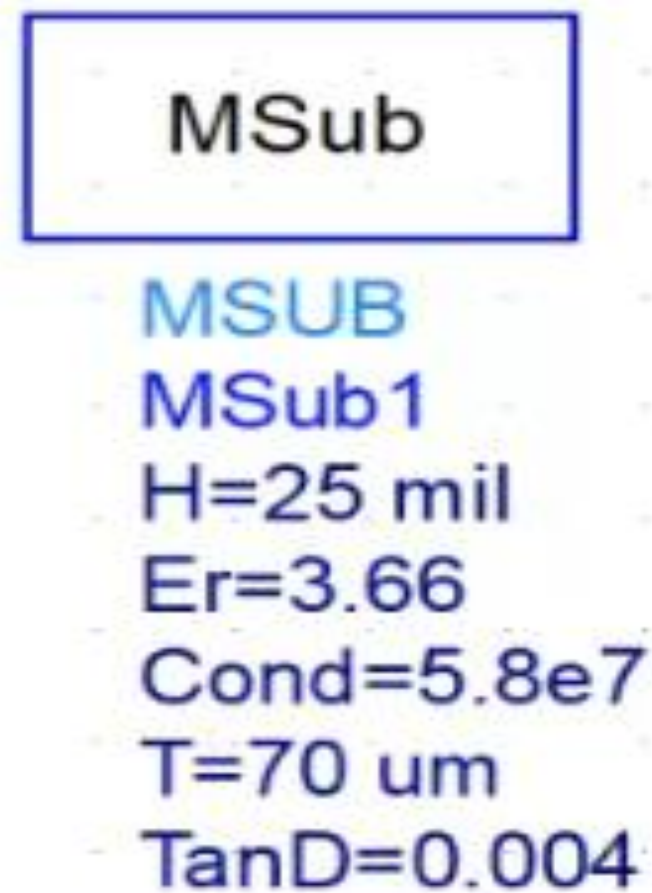




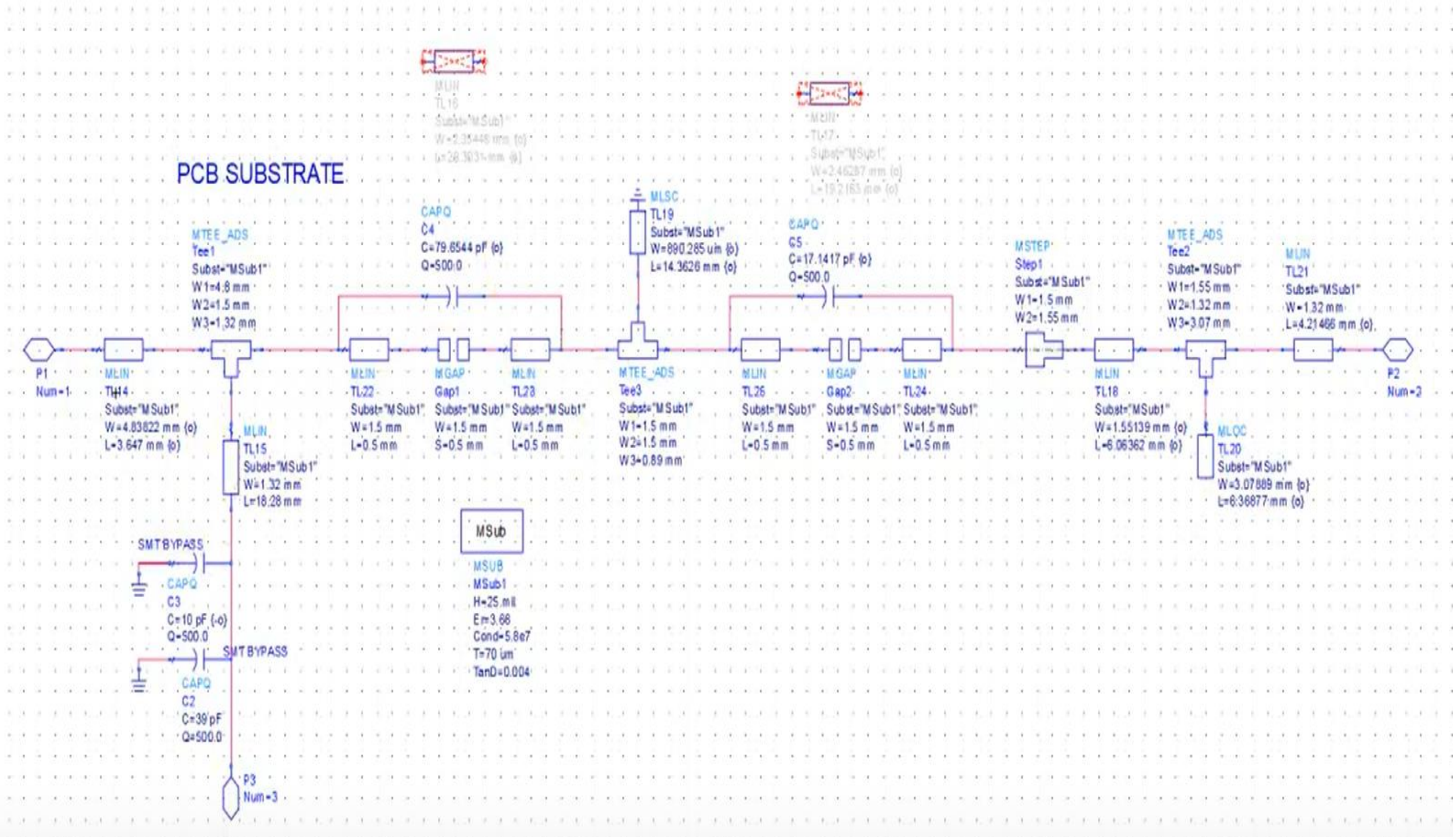
Substrate: Rogers4035

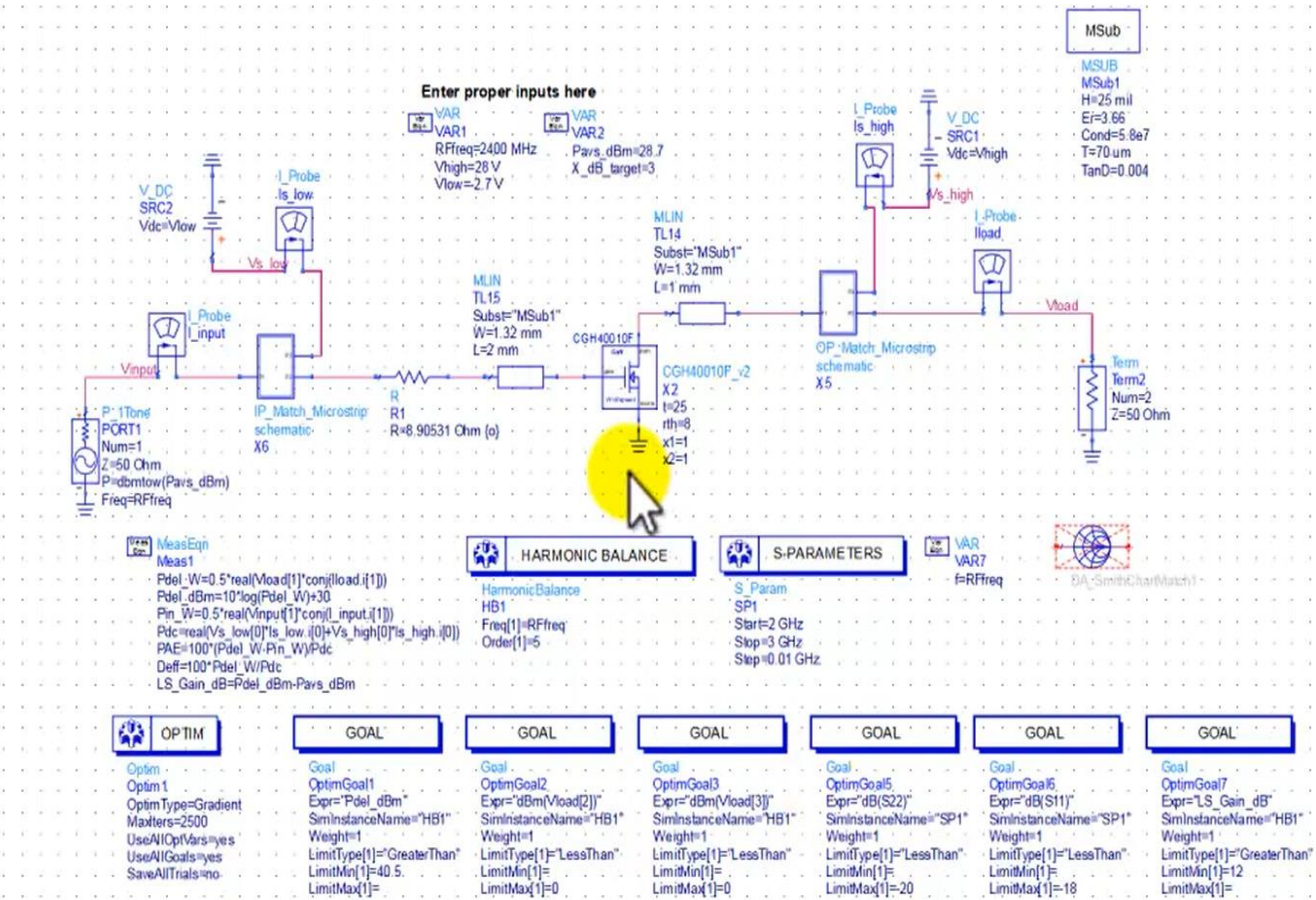
Input Matching Network



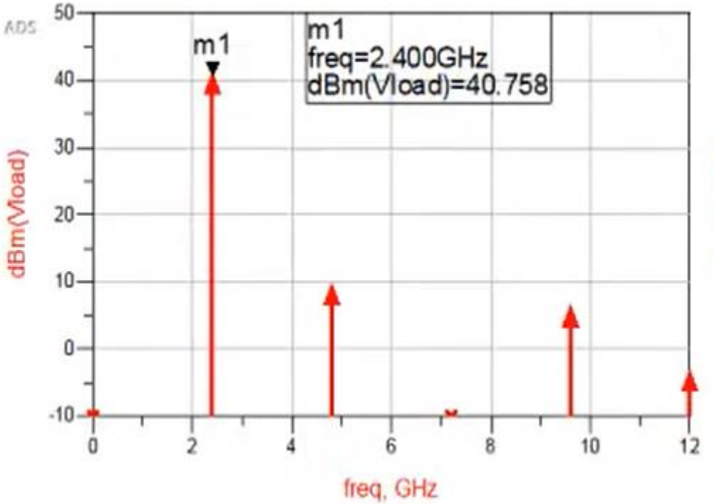

MSub
MSUB
MSub1
H=25 mil
Er=3.66
Cond=5.8e7
T=70 um
TanD=0.004

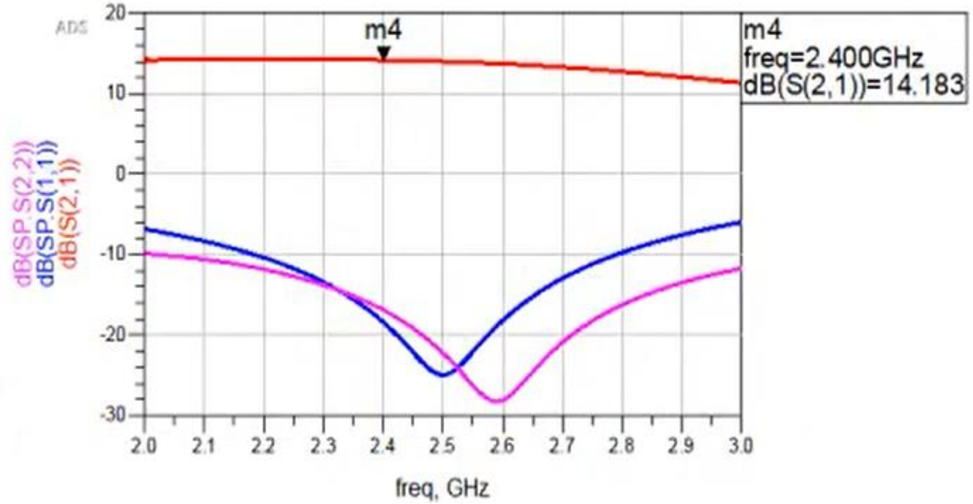
Output Matching Network

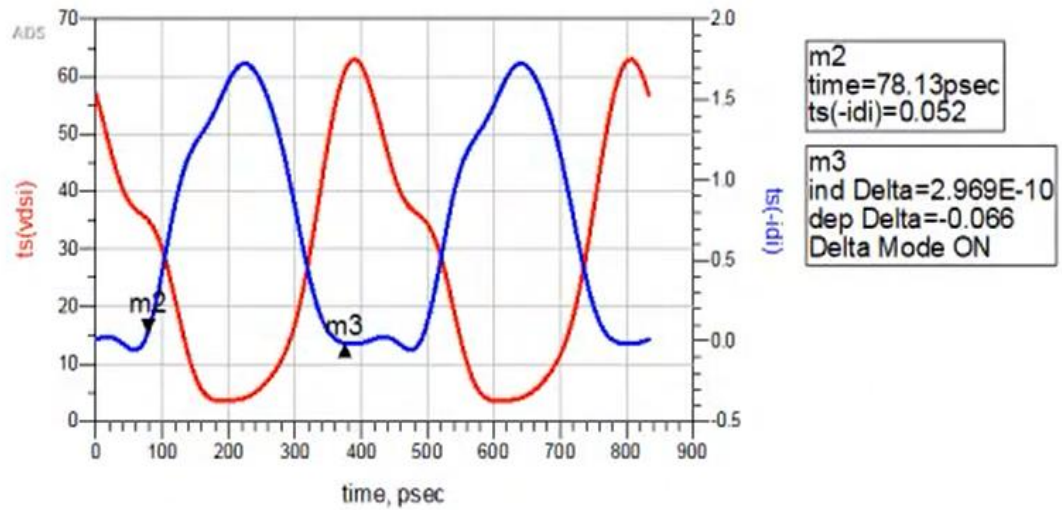



Enter proper inputs here
VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=28.7
X_dB_target=3
MSub
MSUB
MSub1
H=25 mil
Er=3.66
Cond=5.8e7
T=70 um
TanD=0.004
I_Probe
Is_high
V_DC
SRC1
Vdc=Vhigh
Vs_high
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
MLIN
TL14
Subst="MSub1"
W=1.32 mm
L=1 mm
I_Probe
Iload
Vload
I_Probe
I_input
Vinput
MLIN
TL15
Subst="MSub1"
W=1.32 mm
L=2 mm
CGH40010F
CGH40010F_v2
X2
t=25
rth=8
x1=1
x2=1
OP_Match_Microstrip
schematic
X5
Term
Term2
Num=2
Z=50 Ohm
P_1Tone
PORT1
Num=1
Z=50 Ohm
P=dbmtow(Pavs_dBm)
Freq=RFfreq
IP_Match_Microstrip
schematic
X6
R
R1
R=8.90531 Ohm {o}
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
Pdel_dBm=10*log(Pdel_W)+30
Pin_W=0.5*real(Vinput[1]*conj(I_input.i[1]))
Pdc=real(Vs_low[0]*Is_low.i[0]+Vs_high[0]*Is_high.i[0])
PAE=100*(Pdel_W-Pin_W)/Pdc
Deff=100*Pdel_W/Pdc
LS_Gain_dB=Pdel_dBm-Pavs_dBm
HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq
Order[1]=5
S-PARAMETERS
S_Param
SP1
Start=2 GHz
Stop=3 GHz
Step=0.01 GHz
VAR
VAR7
f=RFfreq
OPTIM
Optim
Optim1
OptimType=Gradient
MaxIters=2500
UseAllOptVars=yes
UseAllGoals=yes
SaveAllTrials=no
GOAL
Goal
OptimGoal1
Expr="Pdel_dBm"
SimInstanceName="HB1"
Weight=1
LimitType[1]="GreaterThan"
LimitMin[1]=40.5
LimitMax[1]=
GOAL
Goal
OptimGoal2
Expr="dBm(Vload[2])"
SimInstanceName="HB1"
Weight=1
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=0
GOAL
Goal
OptimGoal3
Expr="dBm(Vload[3])"
SimInstanceName="HB1"
Weight=1
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=0
GOAL
Goal
OptimGoal5
Expr="dB(S22)"
SimInstanceName="SP1"
Weight=1
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=-20
GOAL
Goal
OptimGoal6
Expr="dB(S11)"
SimInstanceName="SP1"
Weight=1
LimitType[1]="LessThan"
LimitMin[1]=
LimitMax[1]=-18
GOAL
Goal
OptimGoal7
Expr="LS_Gain_dB"
SimInstanceName="HB1"
Weight=1
LimitType[1]="GreaterThan"
LimitMin[1]=12
LimitMax[1]=

Pdel_dBm	PAE	Deff	LS_Gain_dB	Pdel_W
40.758	57.678	61.378	12.058	11.908

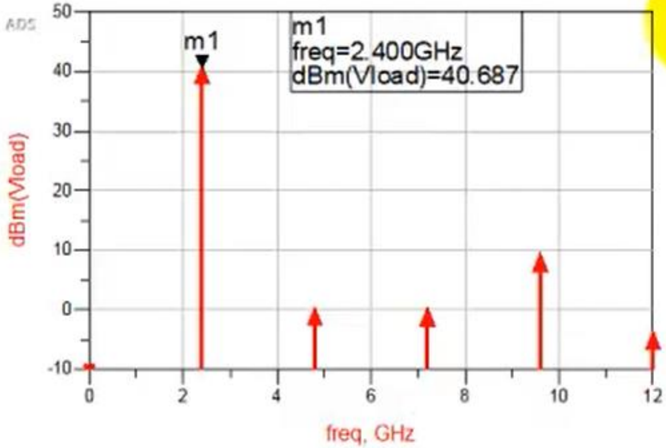


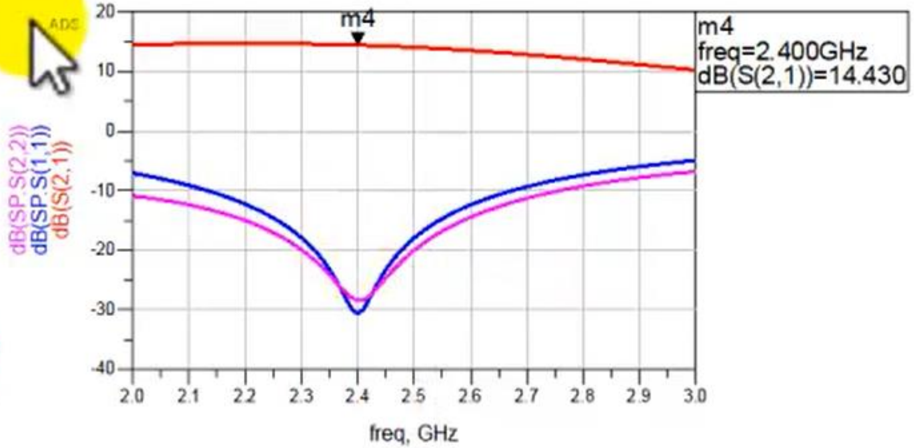


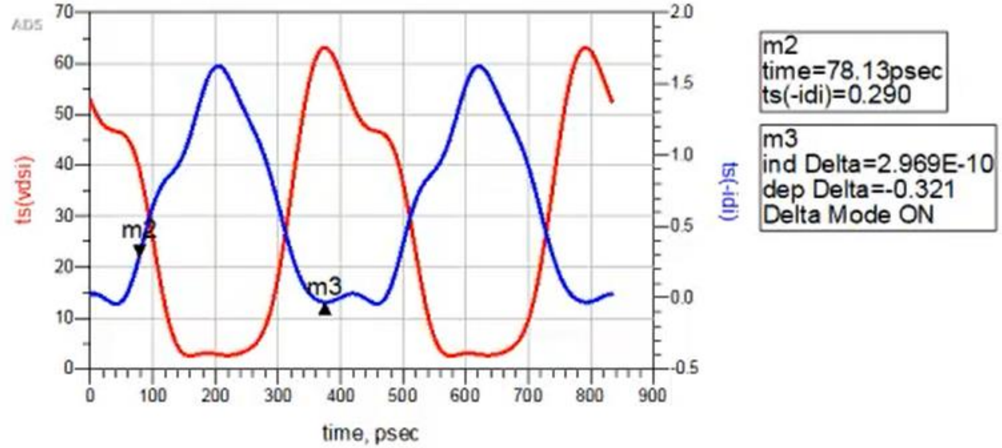


After Optimization

Pdel_dBm	PAE	Deff	LS_Gain_dB	Pdel_W
40.687	61.975	66.135	11.987	11.715



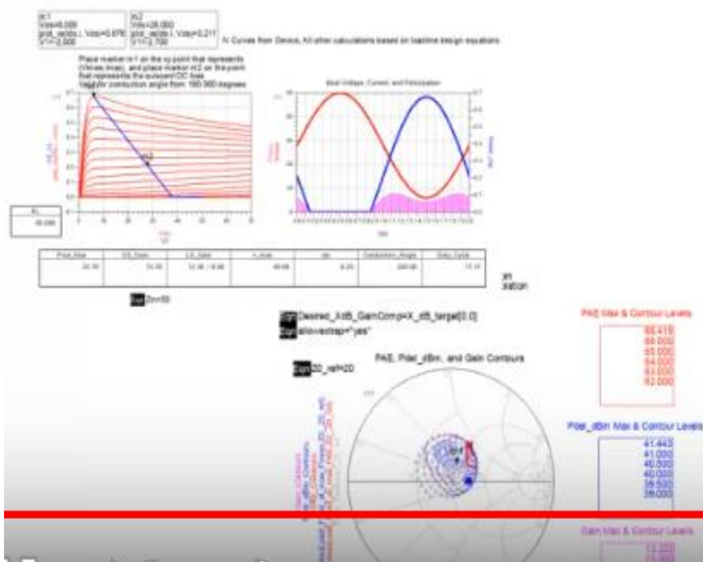




Power Amplifier Design Tutorial

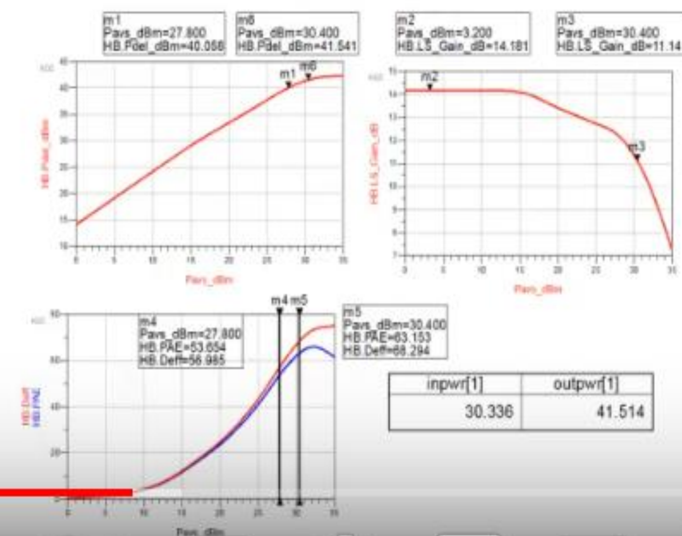
Part 1: Getting Started with PA Design

1. PA Introduction & Classes of Operation
2. DC-IV & Bias Point Analysis
3. Stability Analysis
4. Initial Load Pull
5. 3dB Load Pull – Finalize Source & Load Impedances
6. Validation of Source & Load Impedances with PA Design

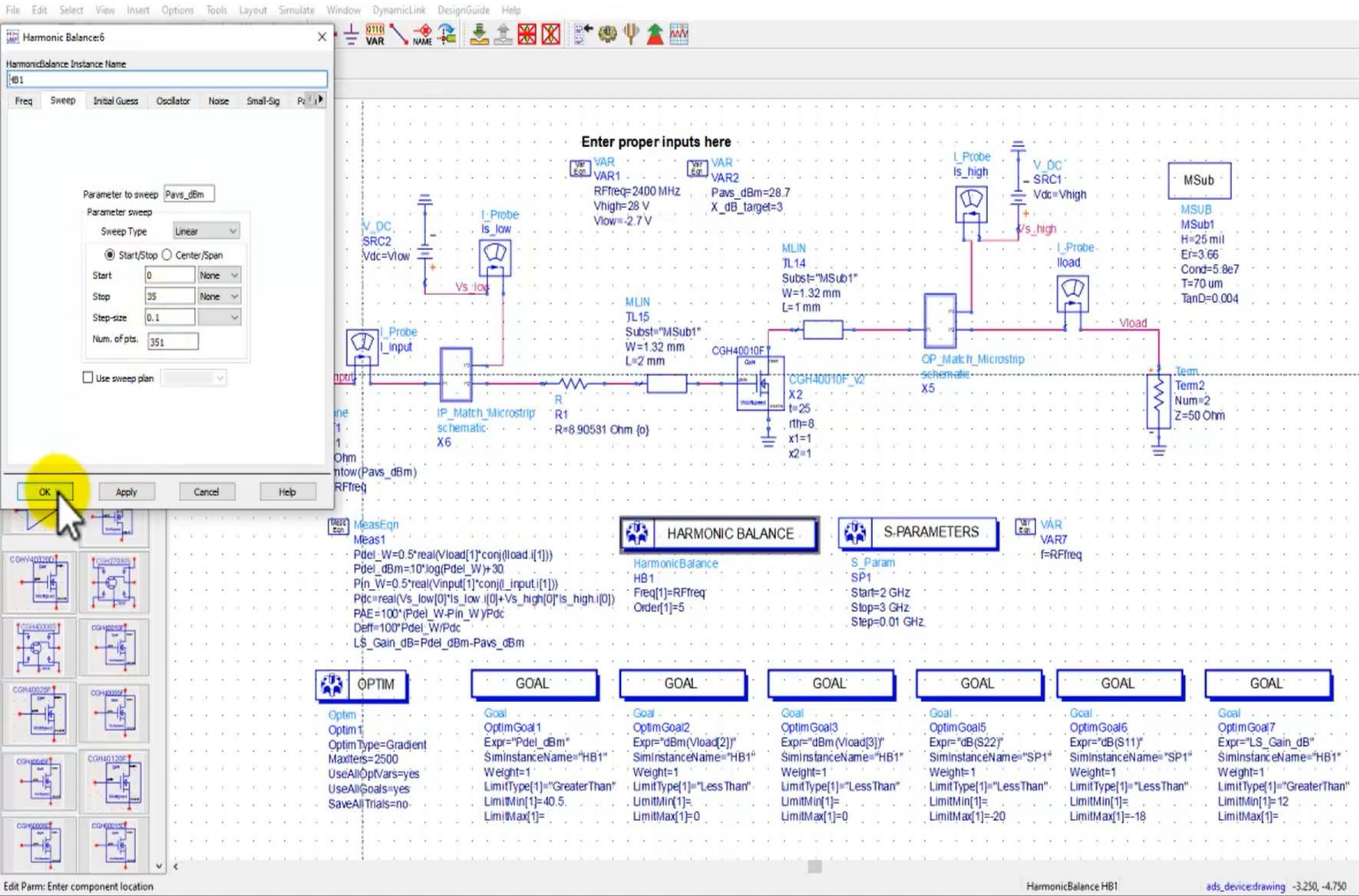


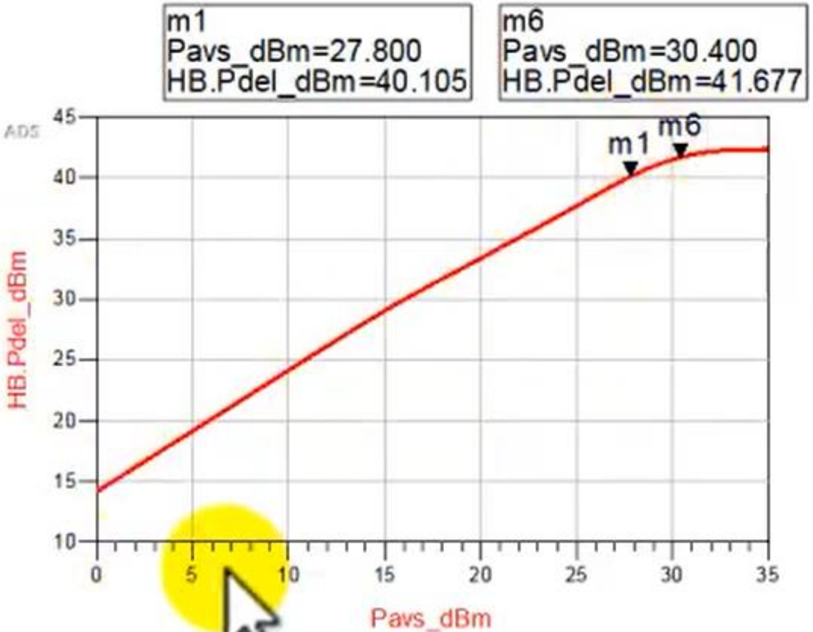
Part 2: Finalize the PA Design

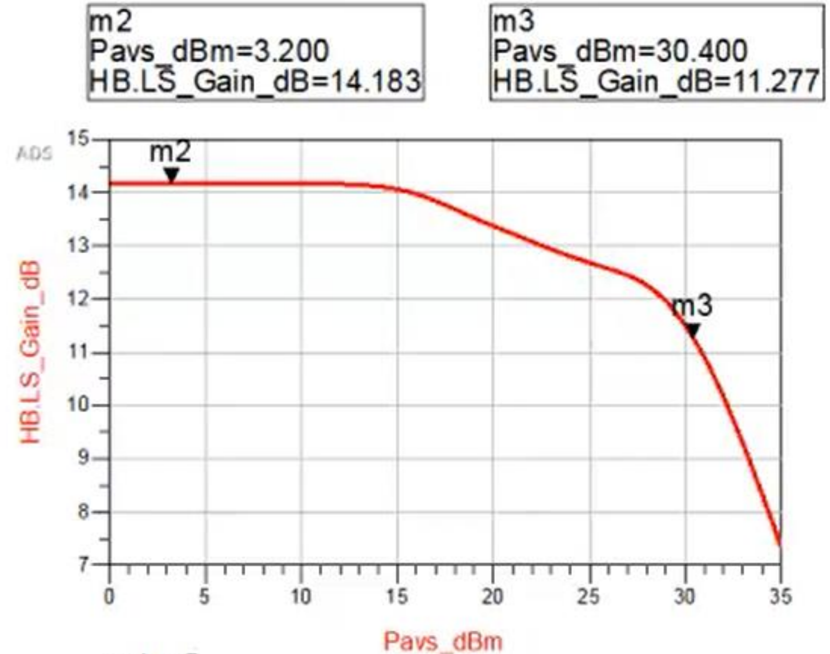
1. Ideal Input & Output Matching Network Design
2. Microstrip Output Matching N/W Design
3. Microstrip Input Matching N/W Design
4. Optimizing PA for Fundamental and Harmonic performance
5. PA Compression & 2-Tone analysis
6. Layout and EM Cosi[illegible]lation for the final PA Design

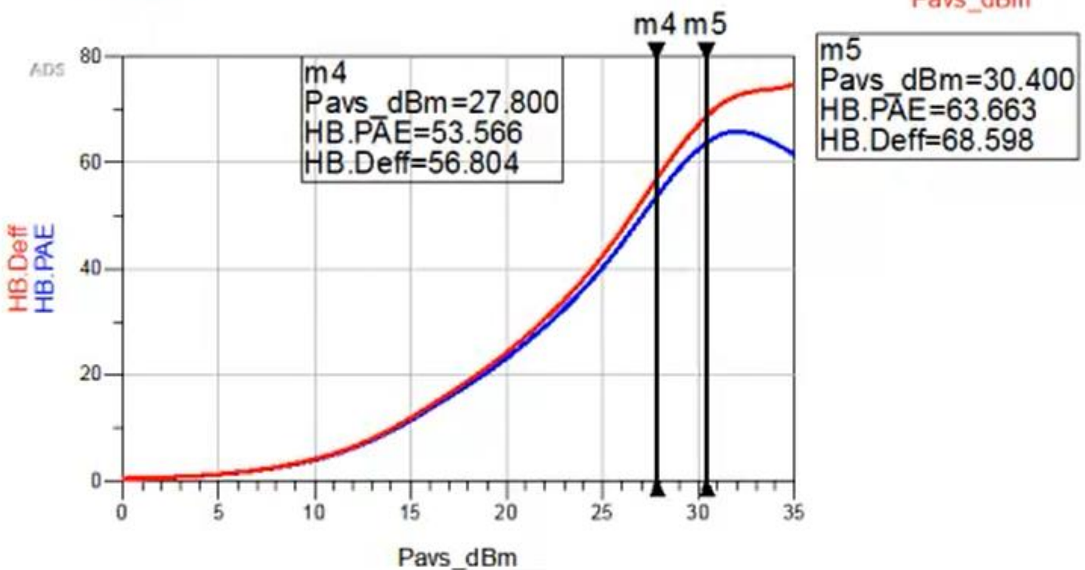


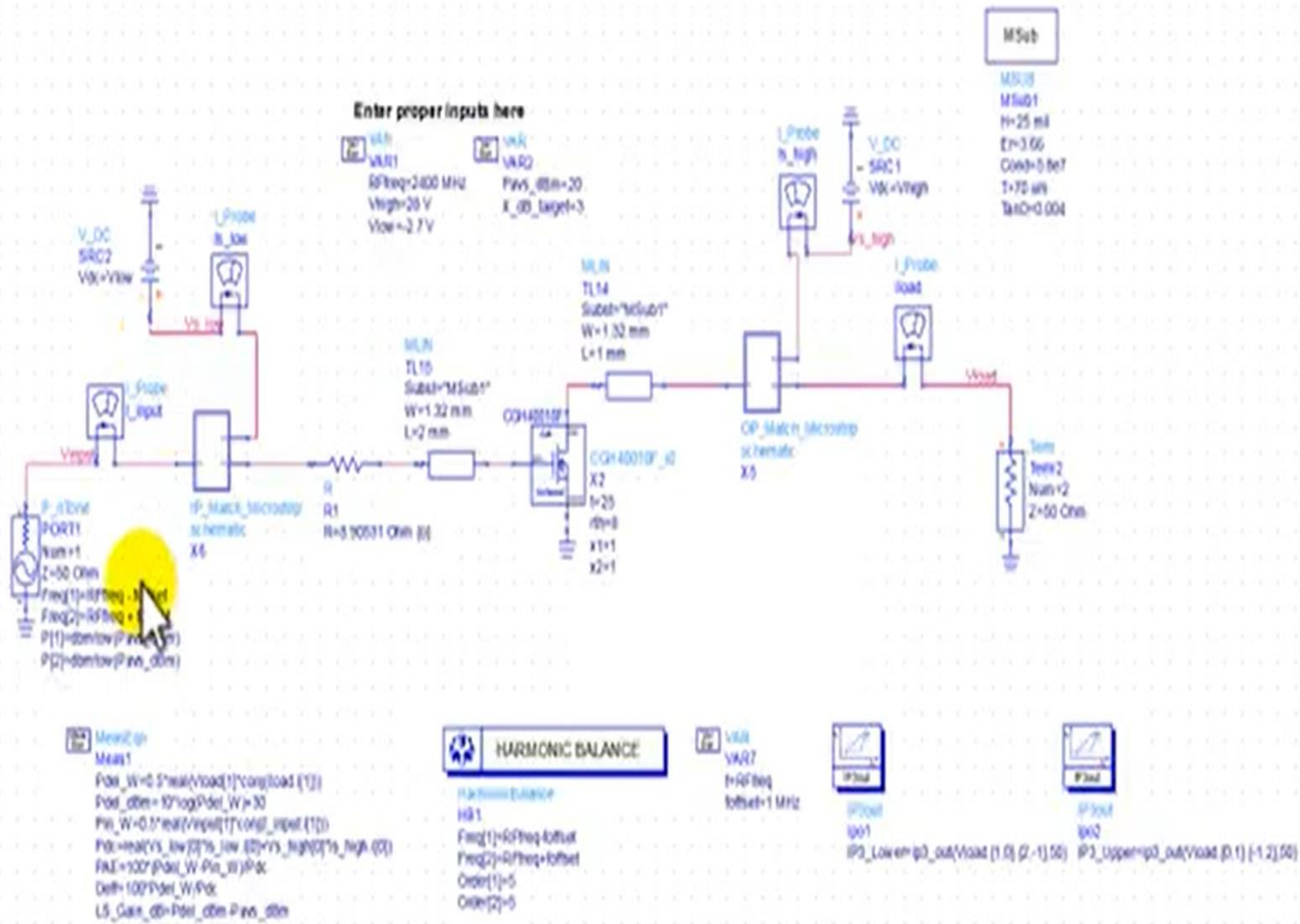
Harmonic Balance Simulation



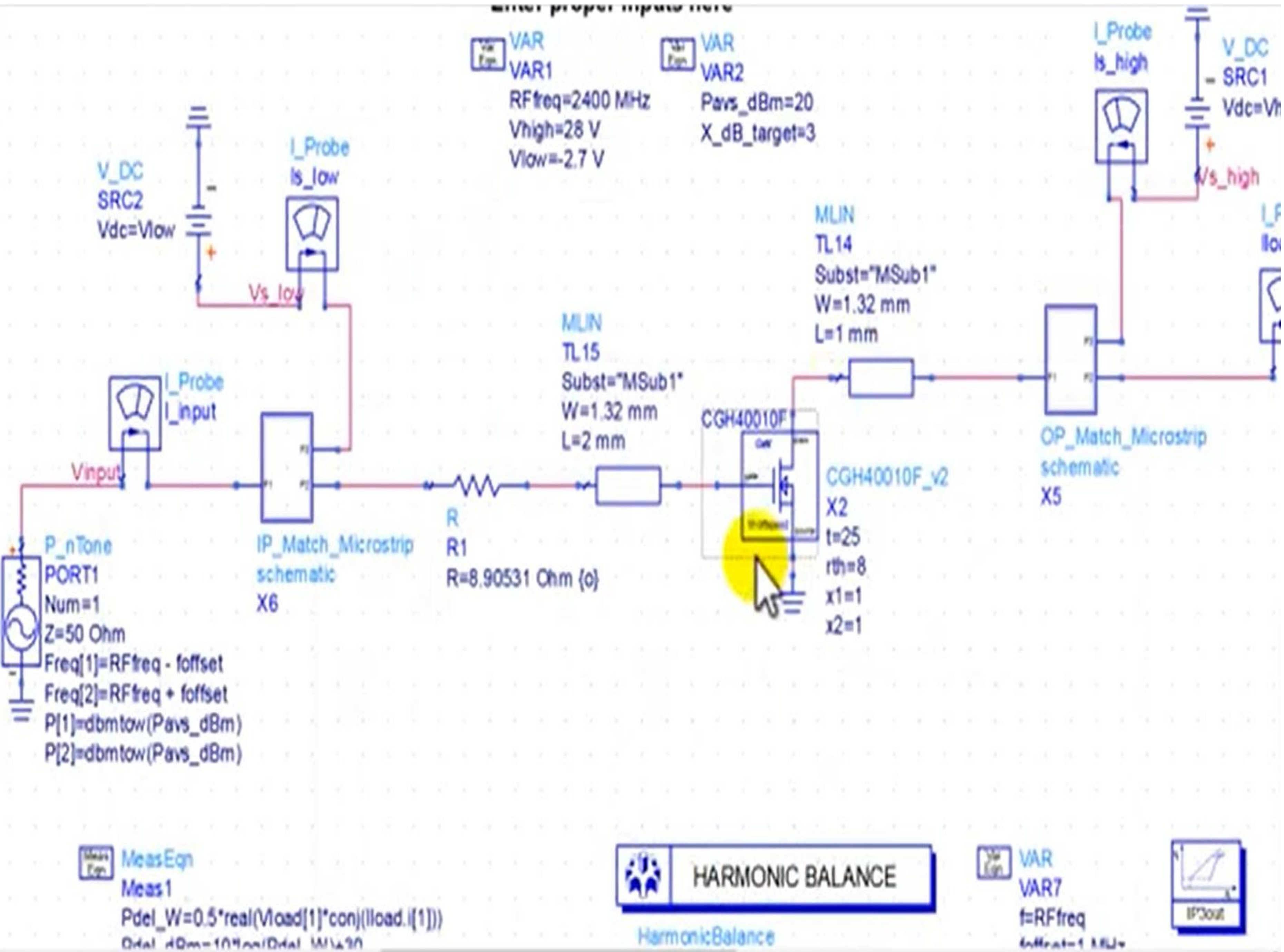

m1
Pavs_dBm=27.800
HB.Pdel_dBm=40.105
m6
Pavs_dBm=30.400
HB.Pdel_dBm=41.677
HB.Pdel_dBm
Pavs_dBm

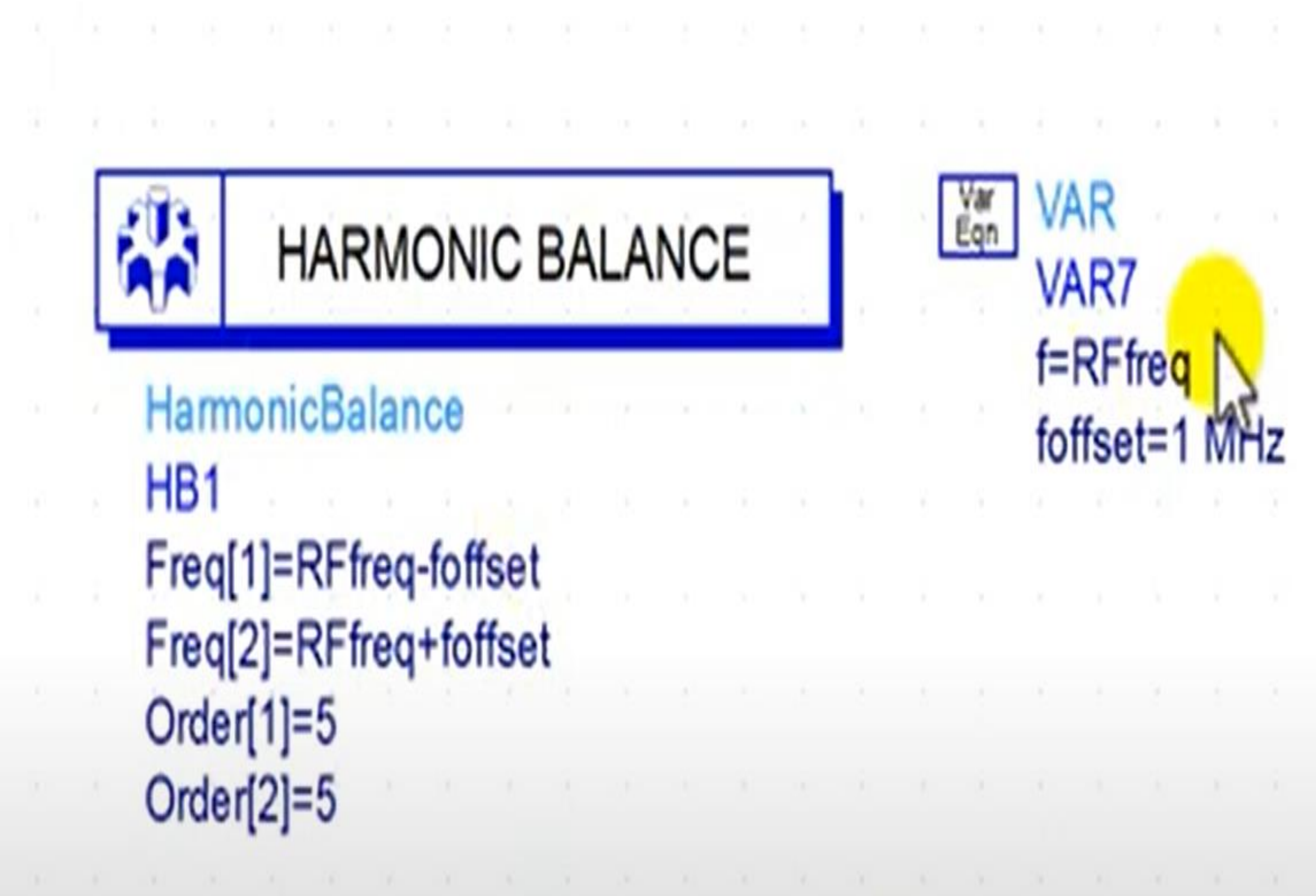

m2
Pavs_dBm=3.200
HB.LS_Gain_dB=14.183
m3
Pavs_dBm=30.400
HB.LS_Gain_dB=11.277
HB.LS_Gain_dB
Pavs_dBm

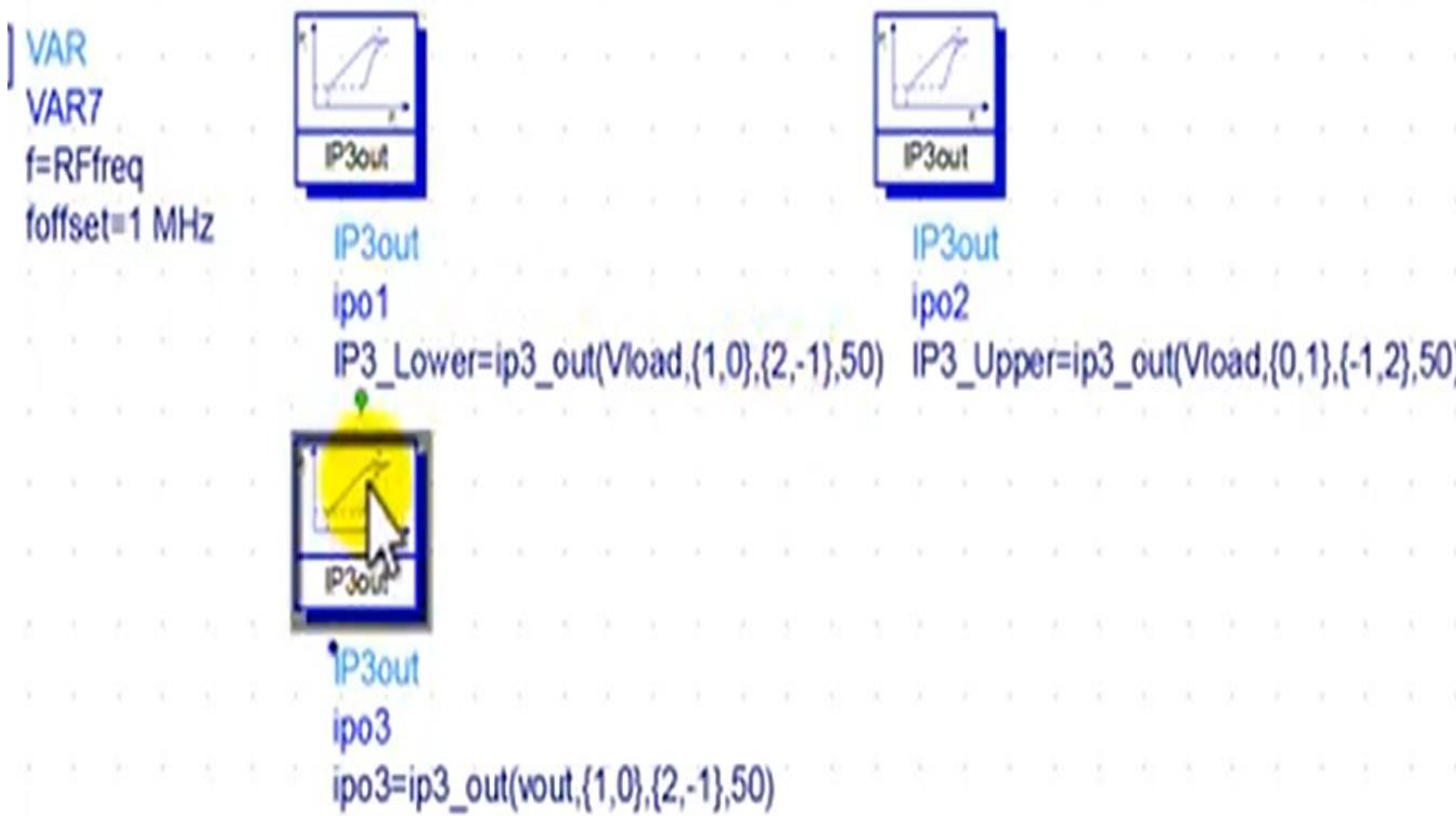

m4
Pavs_dBm=27.800
HB.PAE=53.566
HB.Deff=56.804
m5
Pavs_dBm=30.400
HB.PAE=63.663
HB.Deff=68.598
HB.Deff
HB.PAE
Pavs_dBm



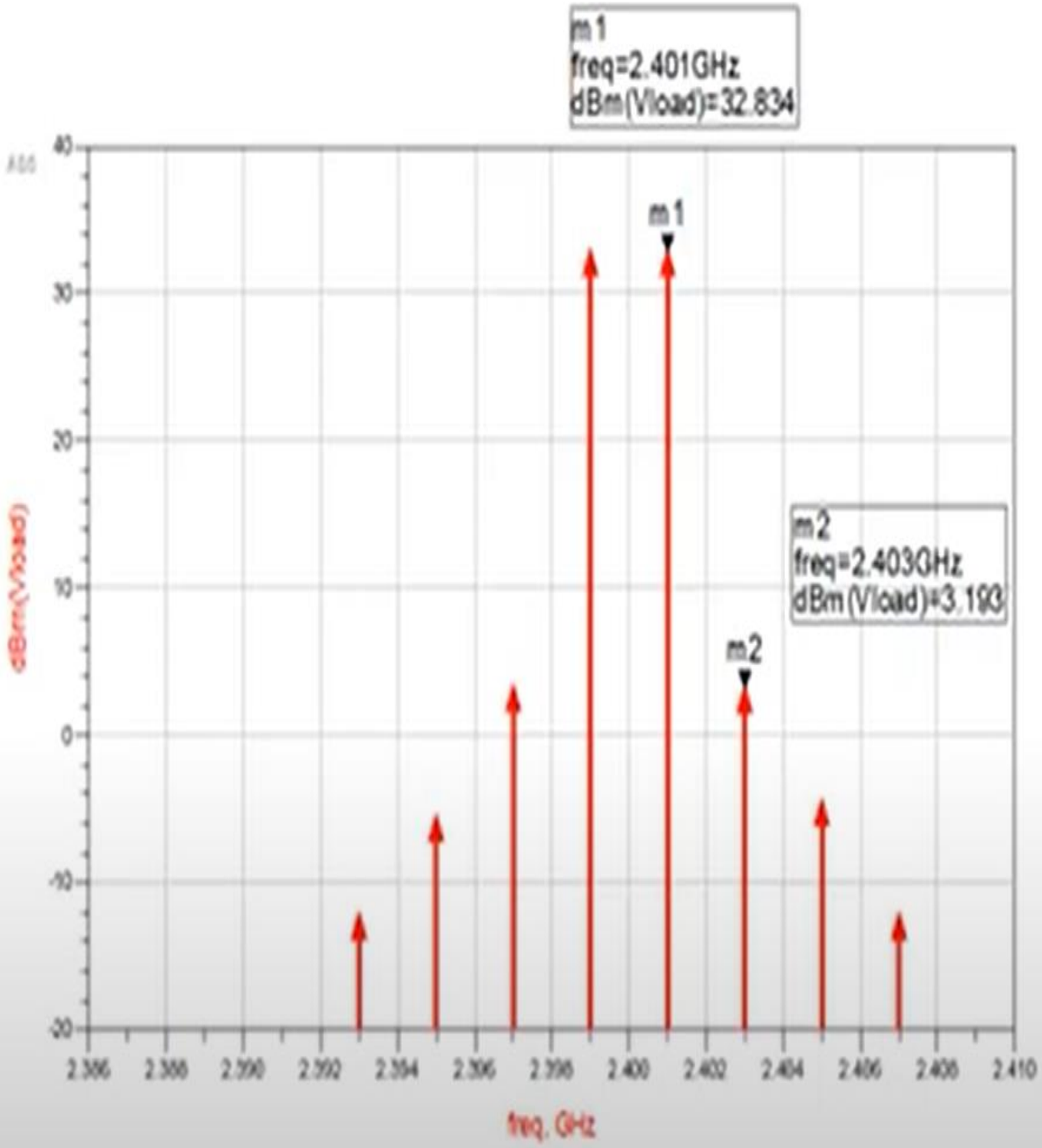
Enter proper inputs here
MSub
MSUB
MSub1
VAR
VAR1
Vhigh=28 V
VAR
VAR2
V_DC
SRC1
Vdc=Vhigh
I_Probe
Is_high
Vs_high
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
I_Probe
I_input
Vinput
MLIN
TL14
Subst="MSub1"
W=1.32 mm
L=1 mm
MLIN
TL15
Subst="MSub1"
W=1.32 mm
L=2 mm
I_Probe
Iload
Vload
R
R1
X6
X2
X5
Term
Term2
Num=2
Z=50 Ohm
PORT1
Num=1
Z=50 Ohm
P[1]=dbmtow(Pavs_dBm)
P[2]=dbmtow(Pavs_dBm)
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
Pdel_dBm=10*log(Pdel_W)+30
Pin_W=0.5*real(Vinput[1]*conj(I_input.i[1]))
Pdc=real(Vs_low[0]*Is_low.i[0]+Vs_high[0]*Is_high.i[0])
PAE=100*(Pdel_W-Pin_W)/Pdc
Deff=100*Pdel_W/Pdc
LS_Gain_dB=Pdel_dBm-Pavs_dBm
HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq-foffset
Freq[2]=RFfreq+foffset
Order[1]=5
Order[2]=5
VAR
VAR7
f=RFfreq
foffset=1 MHz
IP3out
ipo1
IP3_Lower=ip3_out(Vload,{1,0},{2,-1},50)
IP3out
ipo2
IP3_Upper=ip3_out(Vload,{0,1},{-1,2},50)


VAR
VAR1
RFfreq=2400 MHz
Vhigh=28 V
Vlow=-2.7 V
VAR
VAR2
Pavs_dBm=20
X_dB_target=3
I_Probe
Is_high
V_DC
SRC1
Vs_high
V_DC
SRC2
Vdc=Vlow
I_Probe
Is_low
Vs_low
MLIN
TL14
Subst="MSub1"
W=1.32 mm
L=1 mm
MLIN
TL15
Subst="MSub1"
W=1.32 mm
L=2 mm
I_Probe
I_input
Vinput
CGH40010F
CGH40010F_v2
X2
t=25
rth=8
x1=1
x2=1
OP_Match_Microstrip
schematic
X5
P_nTone
PORT1
Num=1
Z=50 Ohm
Freq[1]=RFfreq - foffset
Freq[2]=RFfreq + foffset
P[1]=dbmtow(Pavs_dBm)
P[2]=dbmtow(Pavs_dBm)
IP_Match_Microstrip
schematic
X6
R
R1
R=8.90531 Ohm {o}
MeasEqn
Meas1
Pdel_W=0.5*real(Vload[1]*conj(Iload.i[1]))
HARMONIC BALANCE
HarmonicBalance
VAR
VAR7
f=RFfreq


HARMONIC BALANCE
HarmonicBalance
HB1
Freq[1]=RFfreq-foffset
Freq[2]=RFfreq+foffset
Order[1]=5
Order[2]=5
Var
Eqn
VAR
VAR7
f=RFfreq
foffset=1 MHz



VAR
VAR7
f=RFfreq
foffset=1 MHz
IP3out
IP3out
ipo1
IP3_Lower=ip3_out(Vload,{1,0},{2,-1},50)
IP3out
IP3out
ipo2
IP3_Upper=ip3_out(Vload,{0,1},{-1,2},50)
IP3out
IP3out
ipo3
ipo3=ip3_out(vout,{1,0},{2,-1},50)



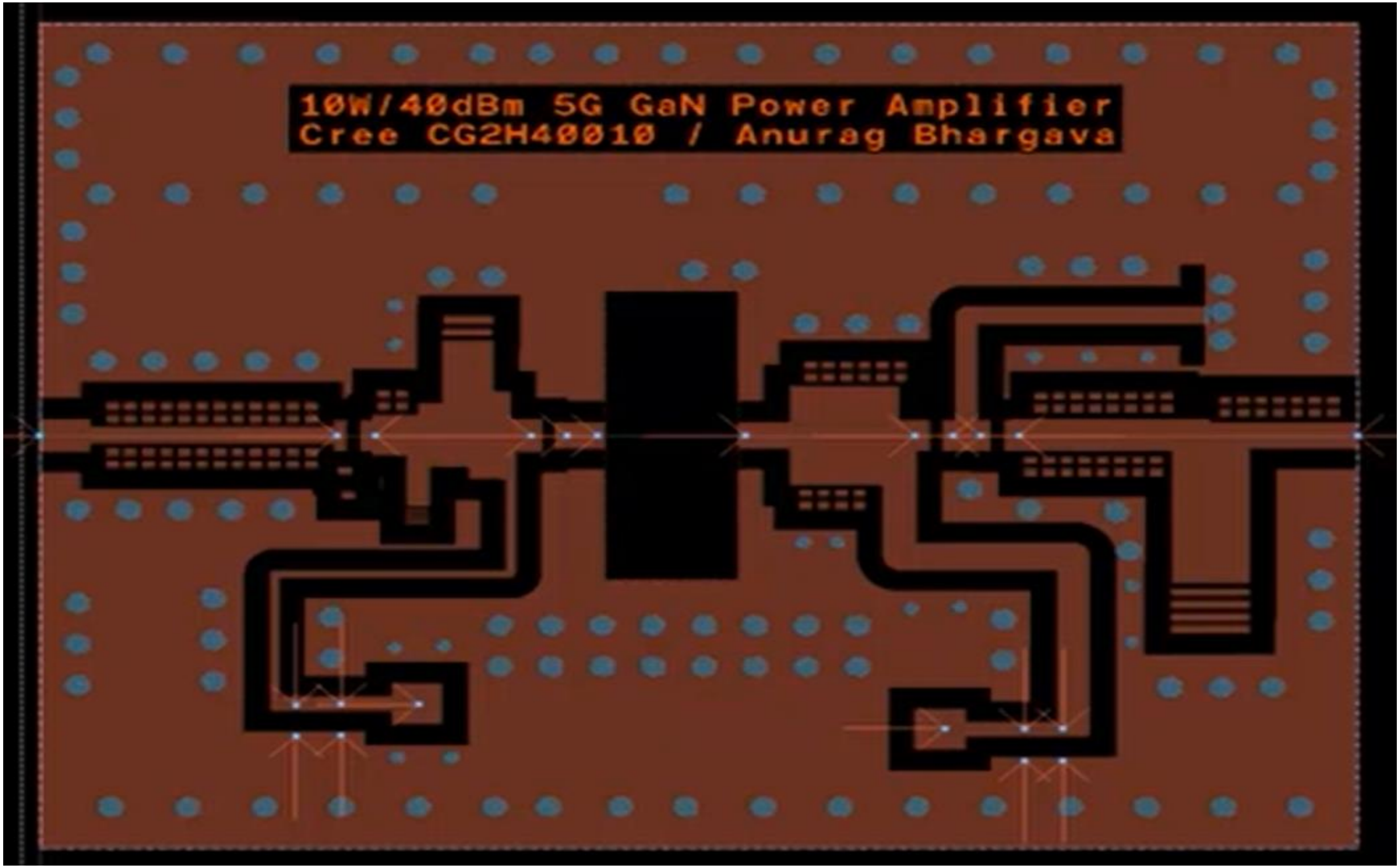
IP3_Lower	IP3_Upper
47.618	47.655

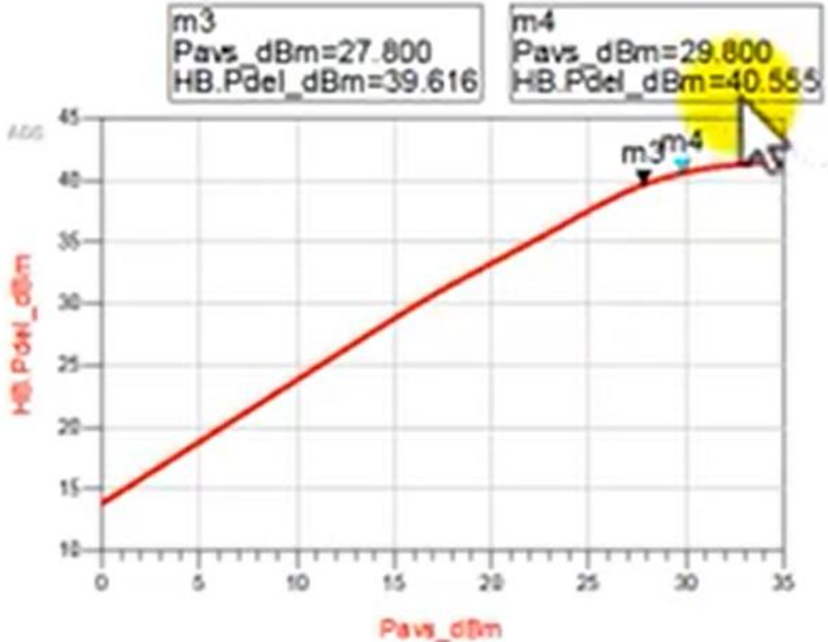
Power Amplifier Case Study for this tutorial

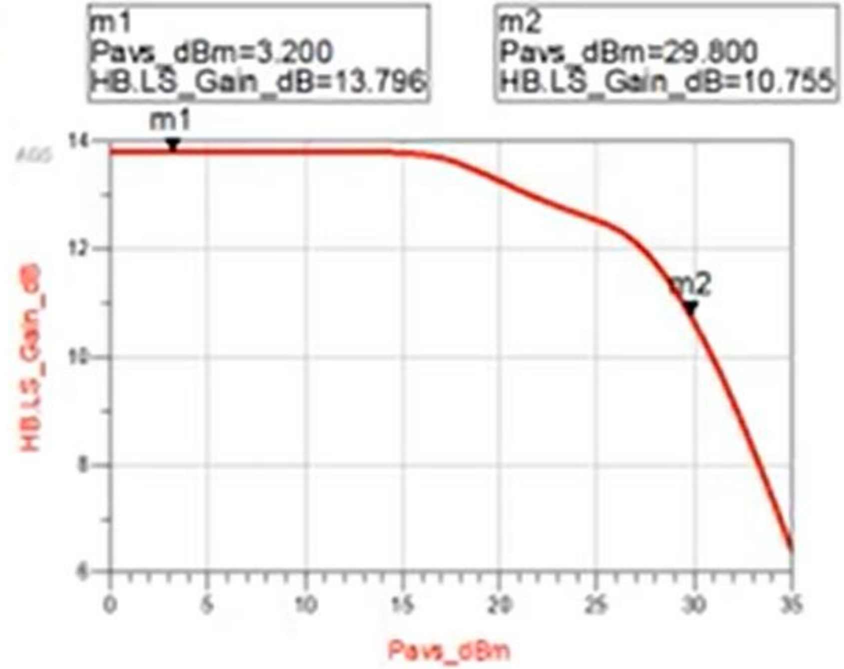
For this tutorial series, we will take a case study of designing a Power Amplifier with following specifications using a Cree GaN 10W device (CGH40010):

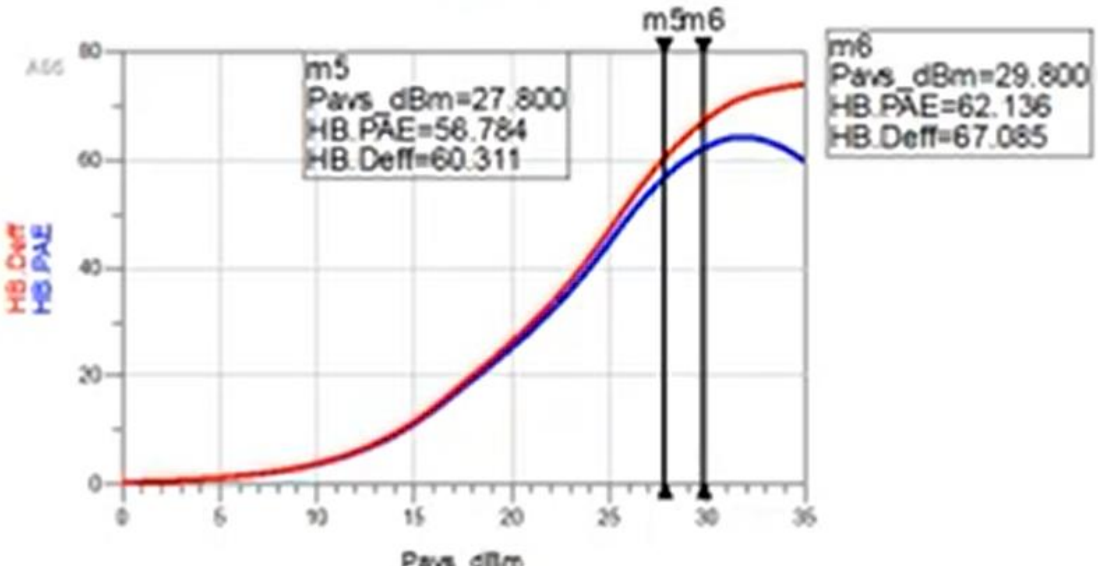
Parameters	Specifications
Centre Frequency	2.4 GHz
Bandwidth	+/- 100 MHz
Output Power	10 Watts (40dBm)
Gain	> 10 dB
Return Loss	< -15 dB
PAE	> 50%
TOI / IP3	~45 dBm
Device	CGH40010

PA LAYOUT


10W/40dBm 5G GaN Power Amplifier
Cree CG2H40010 / Anurag Bhargava


m3
Pavs_dBm=27.800
HB.Pdel_dBm=39.616
m4
Pavs_dBm=29.800
HB.Pdel_dBm=40.555
HB.Pdel_dBm
Pavs_dBm


m1
Pavs_dBm=3.200
HB.LS_Gain_dB=13.796
m2
Pavs_dBm=29.800
HB.LS_Gain_dB=10.755
HB.LS_Gain_dB
Pavs_dBm


m5
Pavs_dBm=27.800
HB.PAE=56.784
HB.Deff=60.311
m6
Pavs_dBm=29.800
HB.PAE=62.136
HB.Deff=67.085
HB.Deff
HB.PAE
Pavs_dBm