

# Homework #3

Introduction to AWR and/or ADS;  
Transmission Lines

# 1. ADS filter optimization

The screenshot displays the ADS software interface for filter optimization. The main workspace shows a circuit diagram of a filter with the following components:

- Term1:  $Z=50 \text{ Ohm}$
- L1:  $L=IND \text{ nH}$
- C1:  $C=CAP \text{ pF}$
- L2:  $L=30 \text{ nH}$
- R:  $R=$
- C2:  $C=10 \text{ pF}$
- L3:  $L=30 \text{ nH}$
- R:  $R=$
- C3:  $C=CAP \text{ pF}$
- L4:  $L=IND \text{ nH}$
- R:  $R=$
- Term2:  $Z=50 \text{ Ohm}$

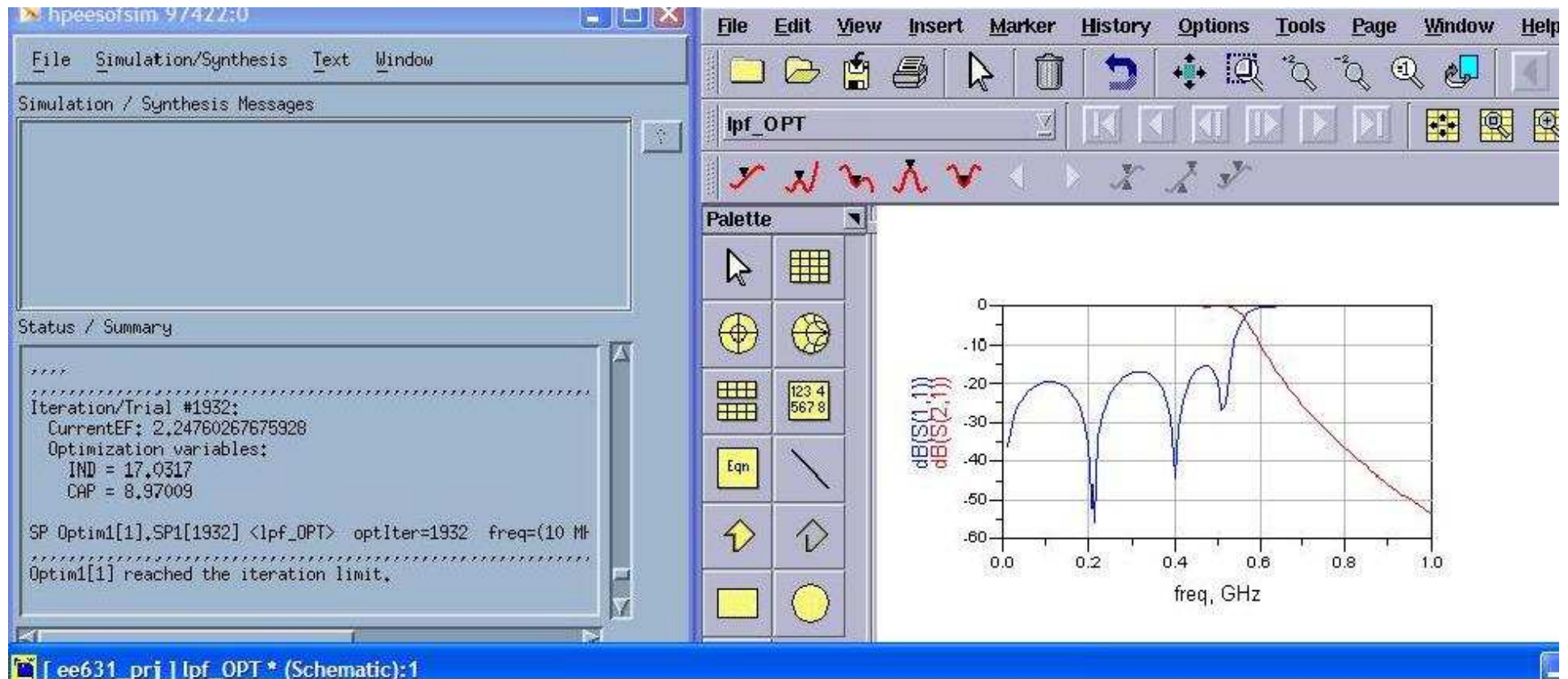
Two optimization variables are defined:

- VAR1:  $IND=17.0317 \text{ opt}\{1 \text{ to } 40\}$
- VAR2:  $CAP=8.97009 \text{ opt}\{1 \text{ to } 40\}$

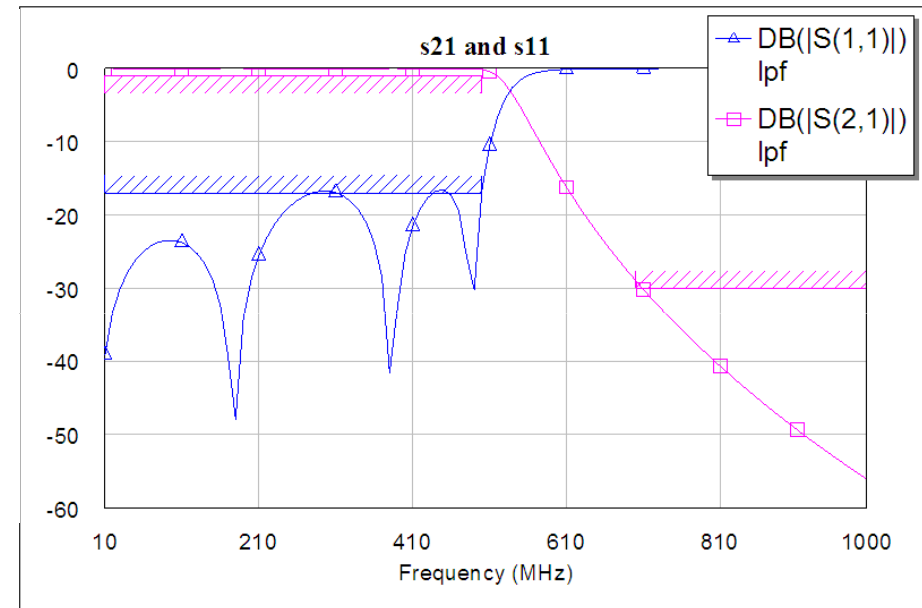
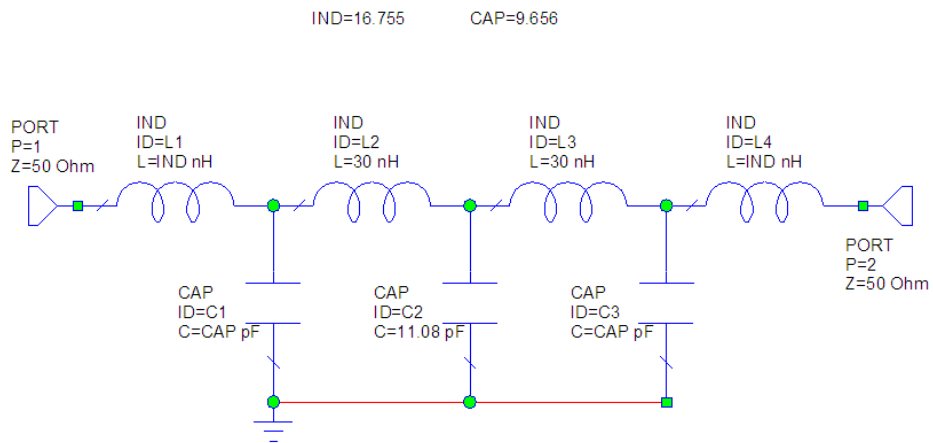
The optimization settings are configured as follows:

- S-PARAMETERS:**
  - SP1: Start=10.0 MHz, Stop=1000.0 MHz, Step=
- GOAL:**
  - OptimGoal1: Expr="dB(S(1,1))", SimInstanceName="SP1", Min=-17, Weight=, RangeVar[1]="freq", RangeMin[1]=, RangeMax[1]=500 MHz
- GOAL:**
  - OptimGoal3: Expr="dB(S(2,1))", SimInstanceName="SP1", Min=-, Max=30, Weight=, RangeVar[1]="freq", RangeMin[1]=700 MHz, RangeMax[1]=
- OPTIM:**
  - Optim1: Optim Type=Random, UseAllGoals=yes, MaxIters=2500, SaveCurrentEF=no, DesiredError=0.0, StatusLevel=4, FinalAnalysis="None", NormalizeGoals=no, SetBestValues=yes, Seed=, SaveSols=yes, SaveGoals=yes, SaveOptimVars=no, UpdatedDataset=yes, SaveNominal=no, SaveAllIterations=no, UseAllOptVars=yes
- GOAL:**
  - OptimGoal2: Expr="dB(S(2,1))", SimInstanceName="SP1", Min=-, Max=1, Weight=, RangeVar[1]="freq", RangeMin[1]=, RangeMax[1]=500 MHz

# 1. Result with L and C finals



# 1. MWO filter optimization



## 2. Appropriate line widths for TMLS

Source	Impedance (Ohms)	Microstrip width (mm)	Stripline width (mm)	CPW width (mm)	CPW gap (mm)
TML calculator		3.81	2.08	2	0.0001
	50	1.143	0.63	2	0.08
	100	0.3429	0.16	2	1
TXLine	20	3.92	2.03	No solution	No solution
	50	1.16	0.603	0.078	0.01
	100	0.327	0.145	0.055	0.05
	100	na	na	0.872	0.5
	100	na	na	2.03	1
Linecalc	20	3.91	2.028	105	0.008
	50	1.16	0.603	0.0614	0.01
	50	na	na	0.249	0.02
	50	na	na	5	110
	100	0.325	0.145	0.0097	0.002
	100	na	na	0.05	0.00895

# 2. Linecalc in ADS

The screenshot shows the LineCalc software interface with the following sections:

- Component:** Type: CPW, ID: CPW: CPW\_DEFAULT
- Substrate Parameters:** ID: CPWSUB\_DEFAULT, Cond: 4.1e7, TanD: 0.000, Rough: 0.000
- Physical:** W: 105.000 mm (Fixed), G: 0.008500 mm (Fix), L: 6.565380 mm
- Electrical:** Z0: 20.491800 Ohm, E\_Eff: 90.000 deg
- Calculated Results:** K\_Eff = 1.303, A\_DB = 0.212, SkinDepth = 0.030

The diagram on the right illustrates the cross-section of a Coplanar Waveguide (CPW) structure. It shows a central conductor of width  $W$  and two ground planes on either side, separated by gaps of width  $G$ . The substrate has a thickness  $H$  and a dielectric constant  $\epsilon_r$ . The conductor is labeled with '1' and '2' at its ends.

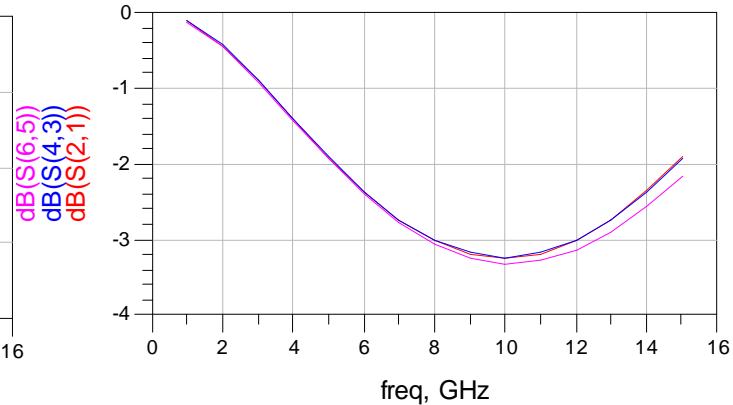
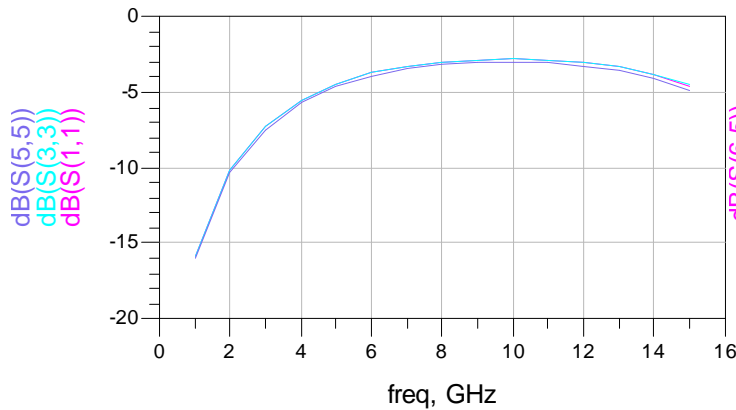
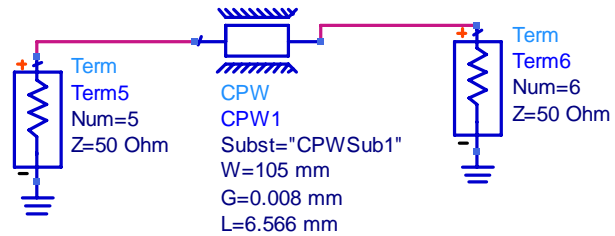
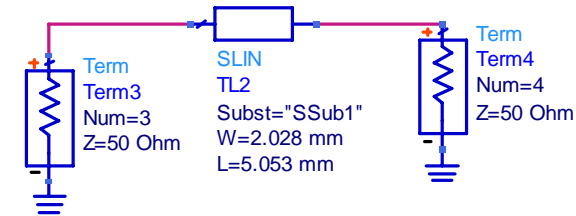
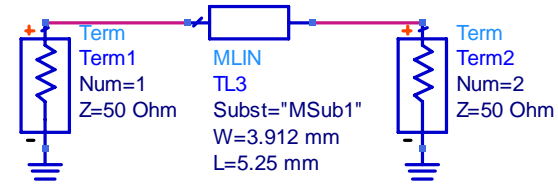
Values are consistent

# ADS, 20 Ohm design (mstrip, cpw, stripline)

## S-PARAMETERS

S\_Param  
 SP1  
 Start=1.0 GHz  
 Stop=15.0 GHz  
 Step=1.0 GHz

CPWSub	SSub	MSub
CPWSUB	SSUB	MSub
CPWSub1	SSub1	MSub1
H=1 mm	Er=2.2	H=0.381 mm
Er=2.2	Mur=1	Er=2.2
Mur=1	B=0.762 mm	Mur=1
Cond=4.1e7	T=10 um	Cond=4.1e7
T=10 um	Cond=4.1e7	Hu=1.0e+36 um
TanD=0.0002	TanD=0	T=10 um
Rough=0 um		TanD=0.002
		Rough=0 um



# ADS, 50 Ohm design (mstrip, cpw, stripline)

## S-PARAMETERS

S\_Param  
 SP1  
 Start=1.0 GHz  
 Stop=15.0 GHz  
 Step=1.0 GHz

### SSub

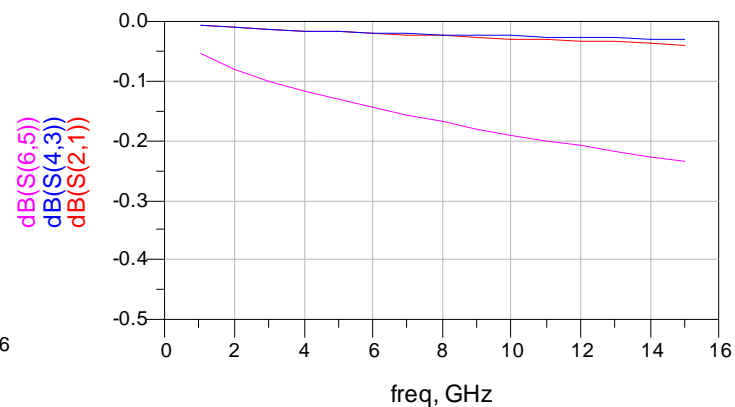
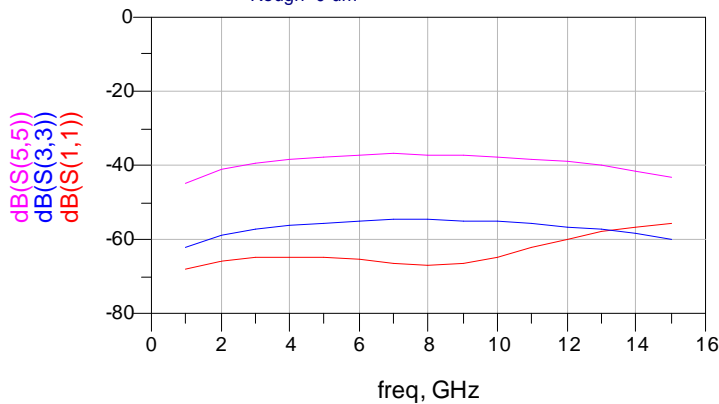
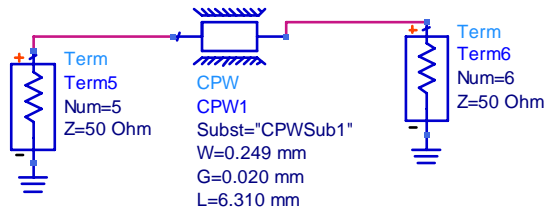
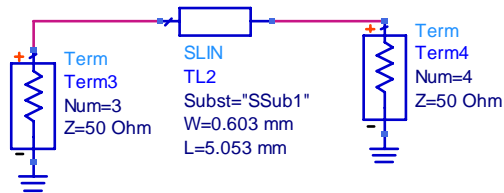
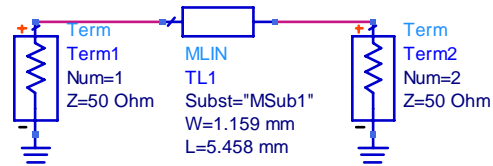
SSUB  
 SSub1  
 Er=2.2  
 Mur=1  
 B=0.762 mm  
 T=10 um  
 Cond=4.1e7  
 TanD=0

### CPWSub

CPWSUB  
 CPWSub1  
 H=1 mm  
 Er=2.2  
 Mur=1  
 Cond=4.1e7  
 T=10 um  
 TanD=0.0002  
 Rough=0 um

### MSub

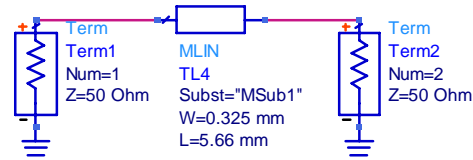
MSUB  
 MSub1  
 H=0.381 mm  
 Er=2.2  
 Mur=1  
 Cond=4.1e7  
 Hu=1.0e+36 um  
 T=10 um  
 TanD=0.002  
 Rough=0 um



# ADS, 100 Ohm design (mstrip, cpw, stripline)

## S-PARAMETERS

S\_Param  
SP1  
Start=1.0 GHz  
Stop=15.0 GHz  
Step=1.0 GHz



## CPWSub

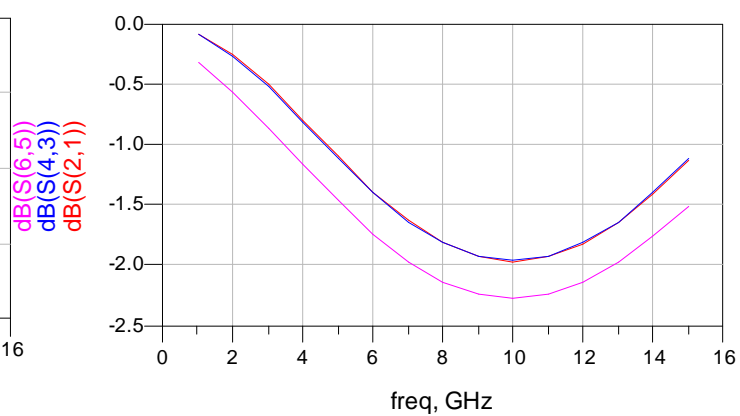
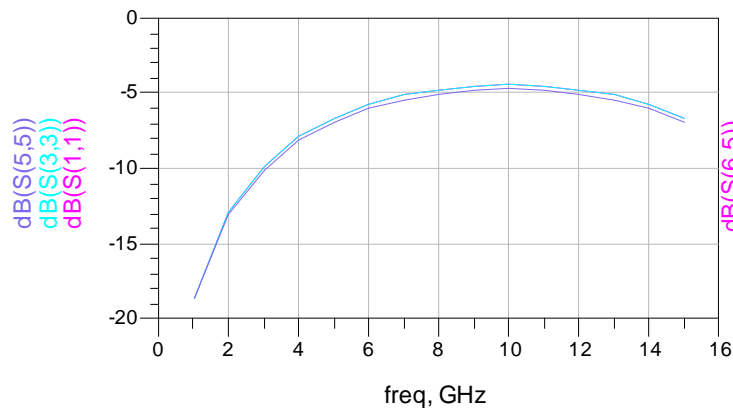
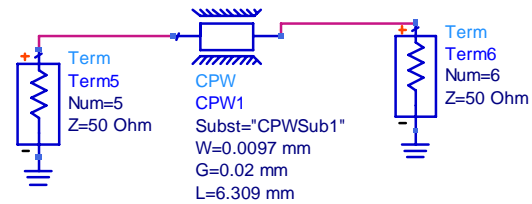
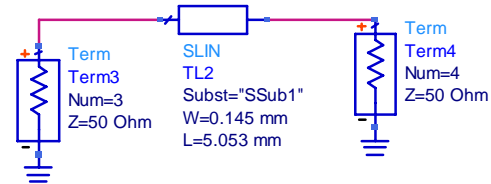
CPWSUB  
CPWSub1  
H=1 mm  
Er=2.2  
Mur=1  
Cond=4.1e7  
T=10 um  
TanD=0.0002  
Rough=0 um

## MSub

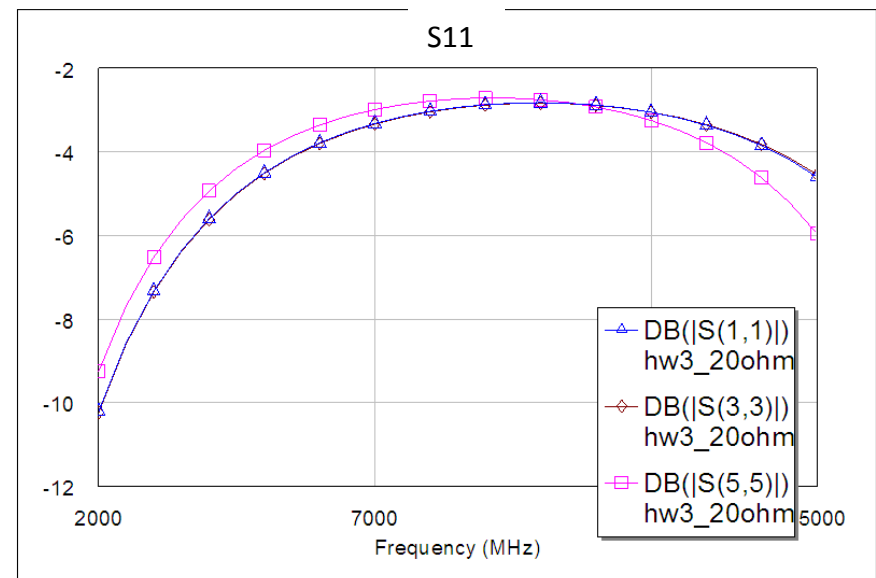
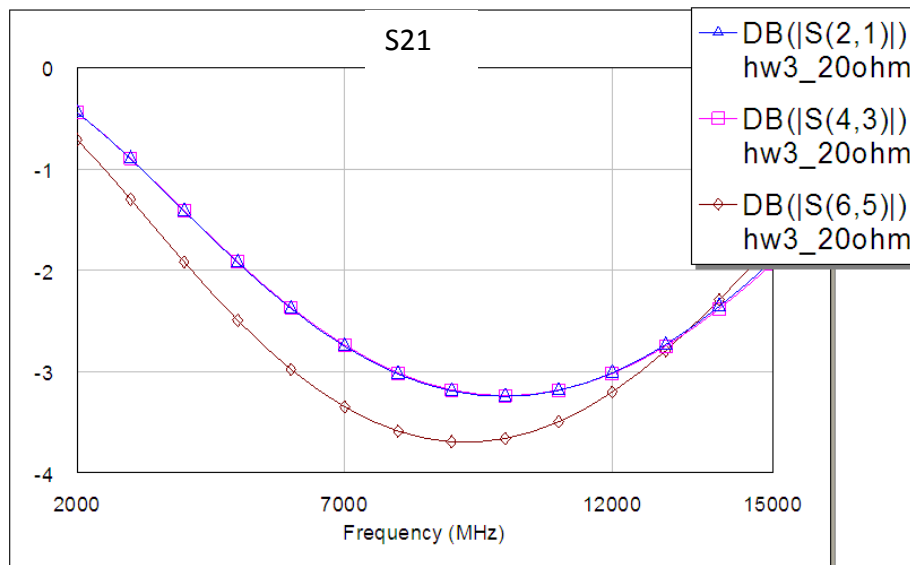
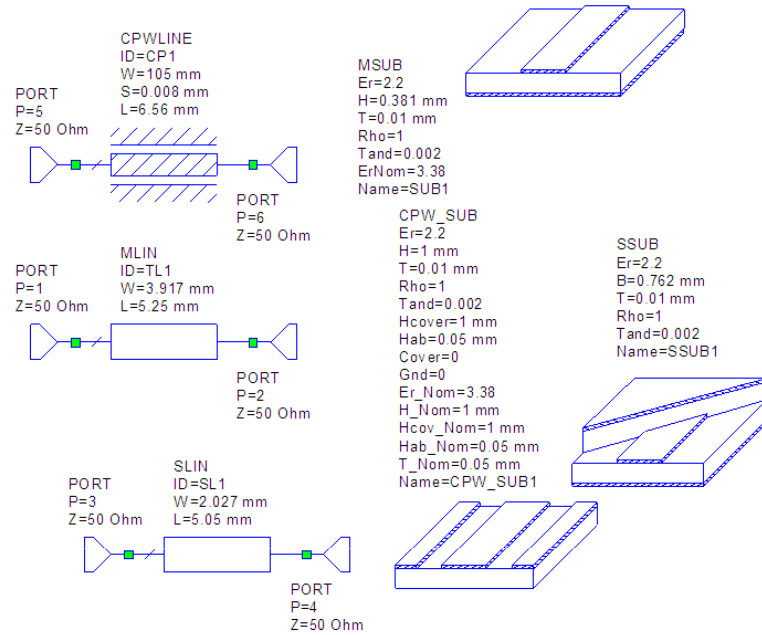
MSUB  
MSub1  
H=0.381 mm  
Er=2.2  
Mur=1  
Cond=4.1e7  
Hu=1.0e+36 um  
T=10 um  
TanD=0.002  
Rough=0 um

## SSub

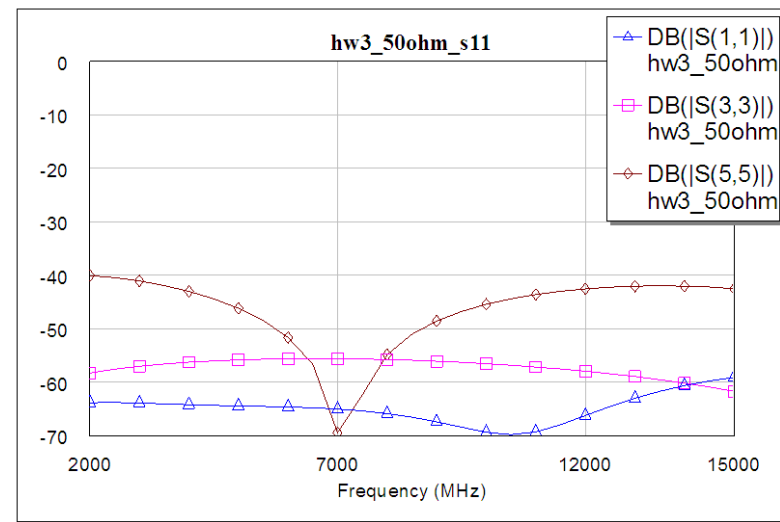
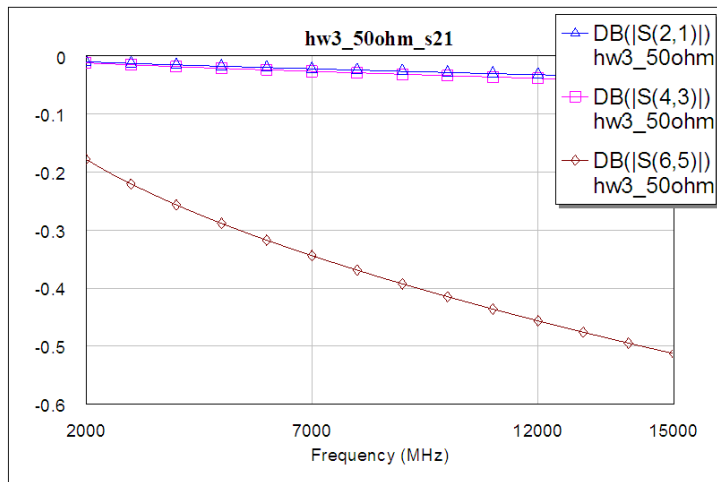
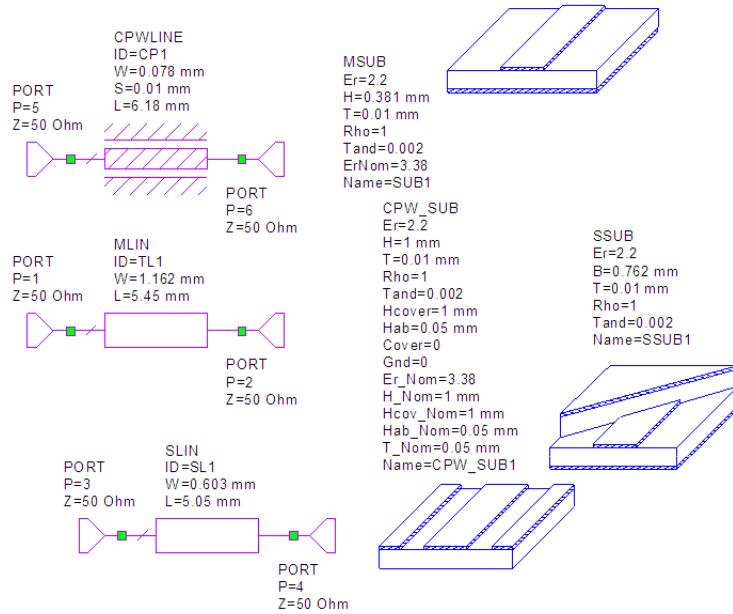
SSUB  
SSub1  
Er=2.2  
Mur=1  
B=0.762 mm  
T=10 um  
Cond=4.1e7  
TanD=0



# MWO, 20 Ohm design (mstrip, cpw, stripline)



# MWO, 50 Ohm design (mstrip, cpw, stripline)



# MWO, 100 Ohm design (mstrip, cpw, stripline)

