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ECE-5341-001

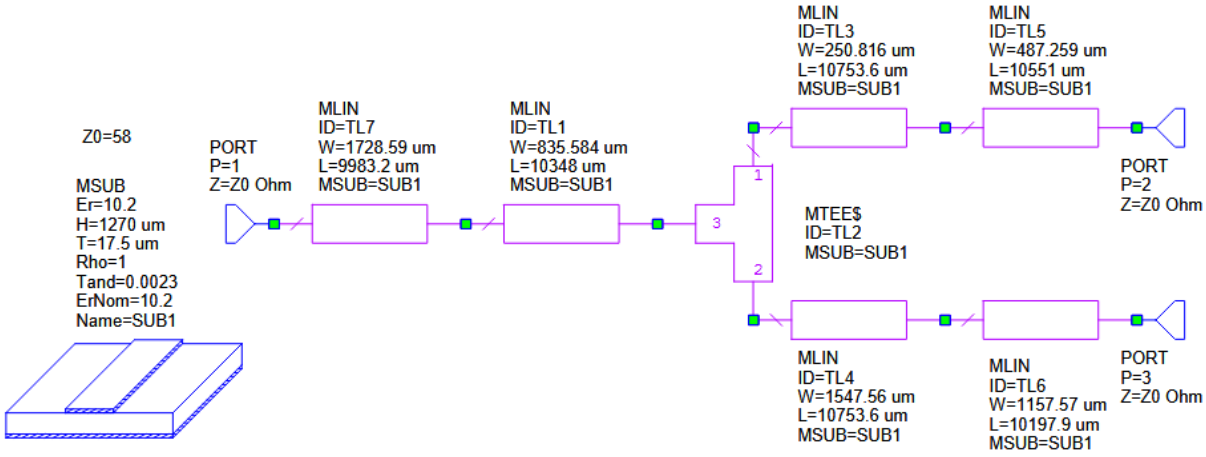
21 November 2024

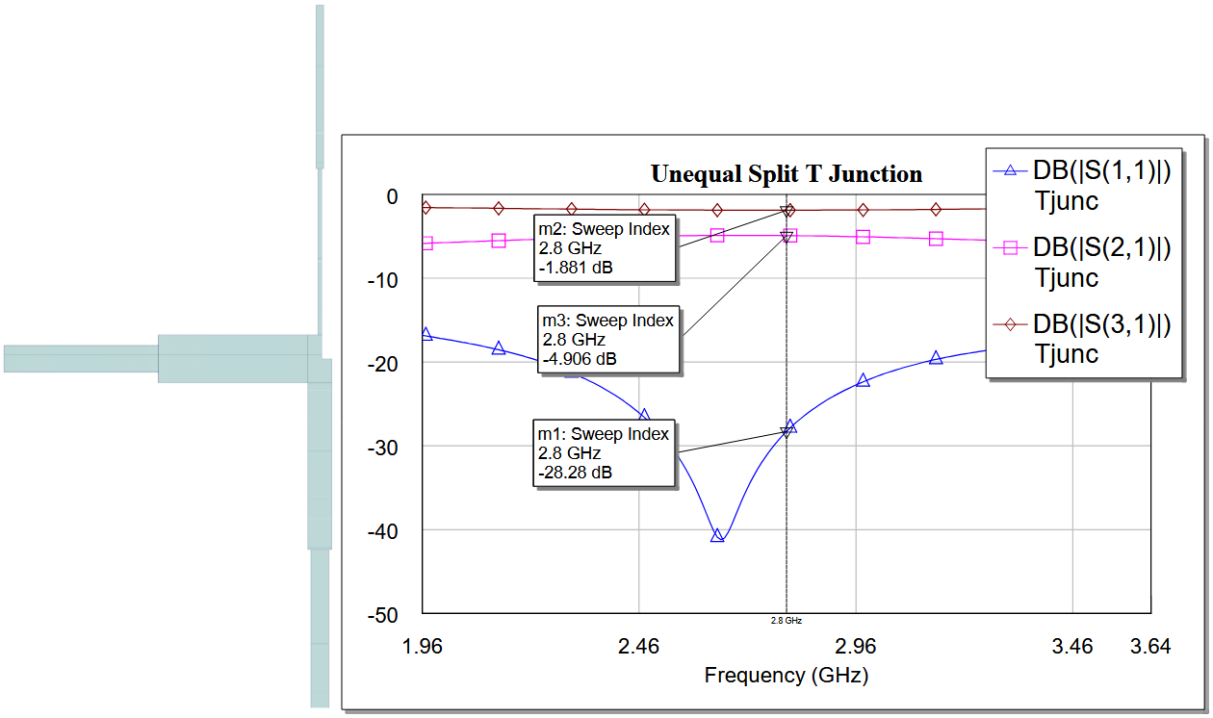
Test 2 – Simulation Part

My specifications were a Z_0 of 58 Ω and a f_0 of 2.8 GHz.

1:2 T-Junction Power Divider:

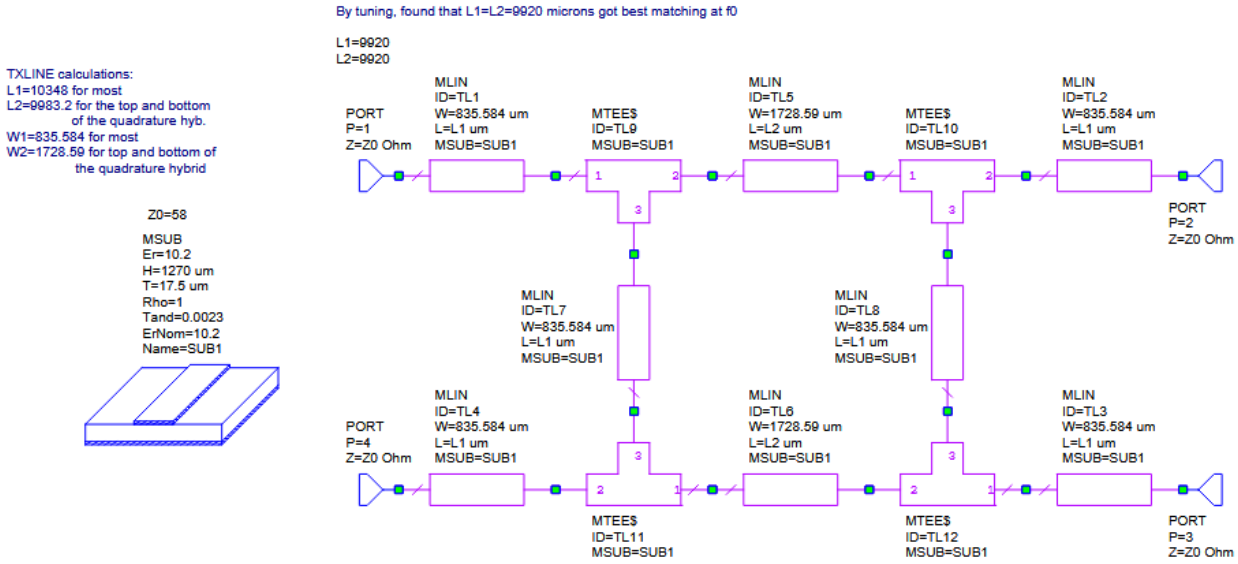
The Z_0 I was assigned causes one of the outputs to necessitate a 174 Ω line, which is not viable for microstripline. Therefore, my Z_0 for the power divider was 29 Ω and I added quarter-wave transformers at each port.

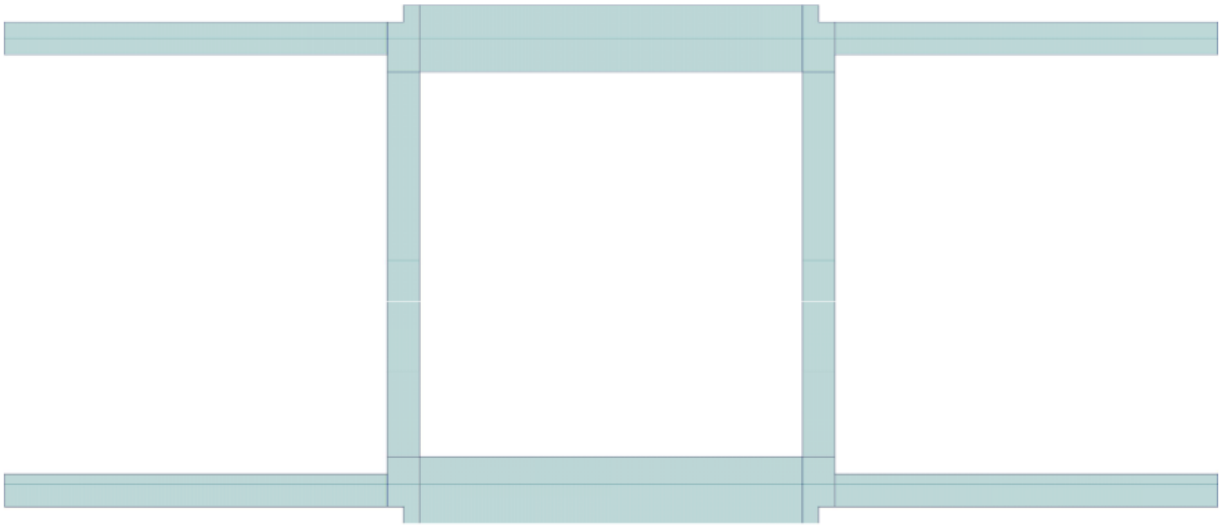


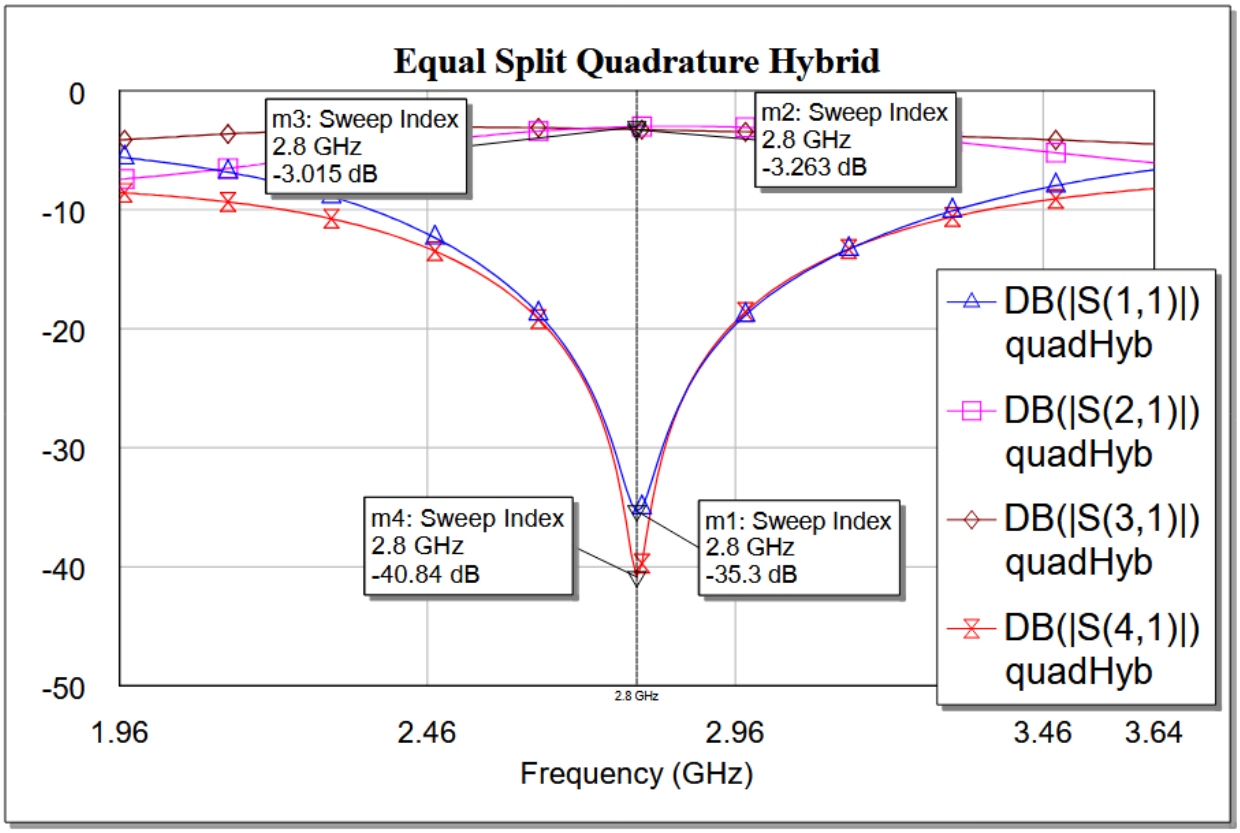


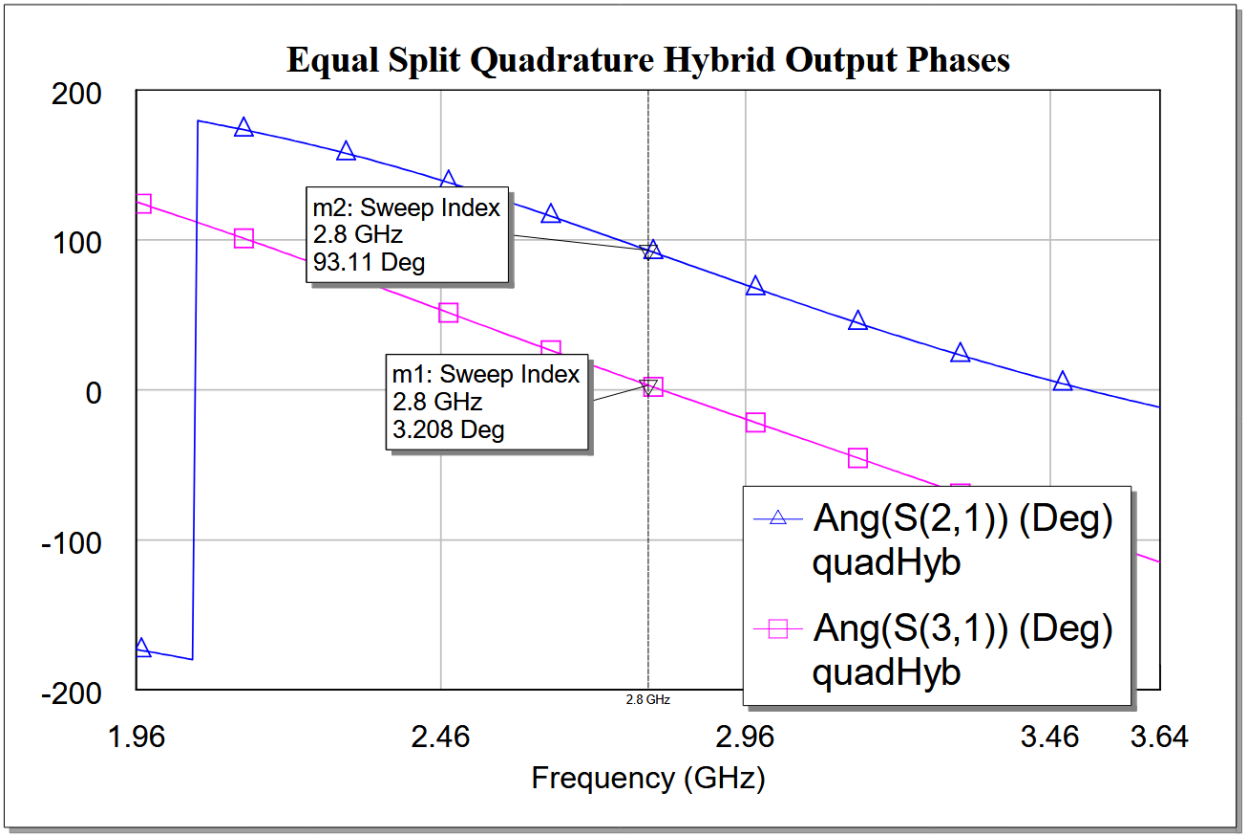
Quadrature Hybrid:

Initial lengths calculated by TXLine were pretty close to the desired performance, but, since T-junctions add some unideal behaviors, with some slight tuning the measurements looked significantly more favorable.



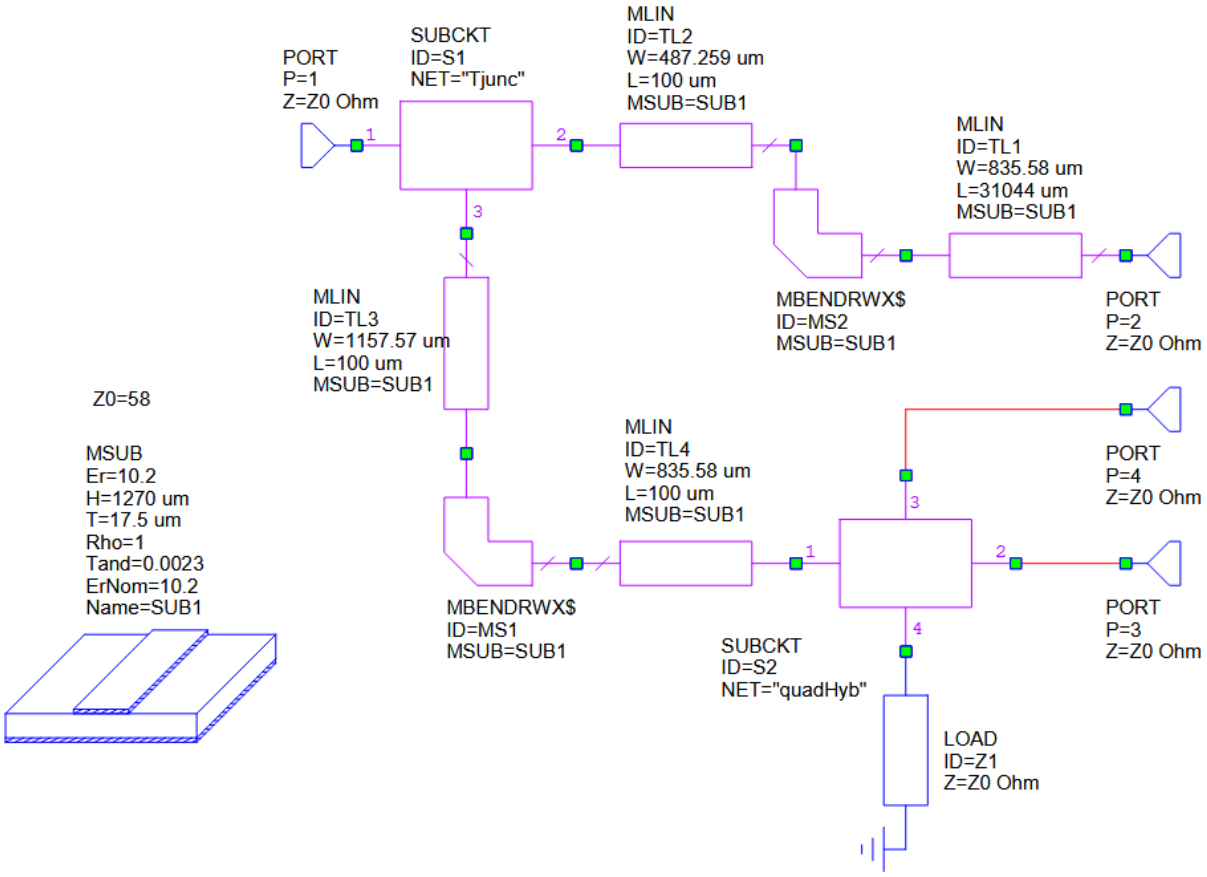


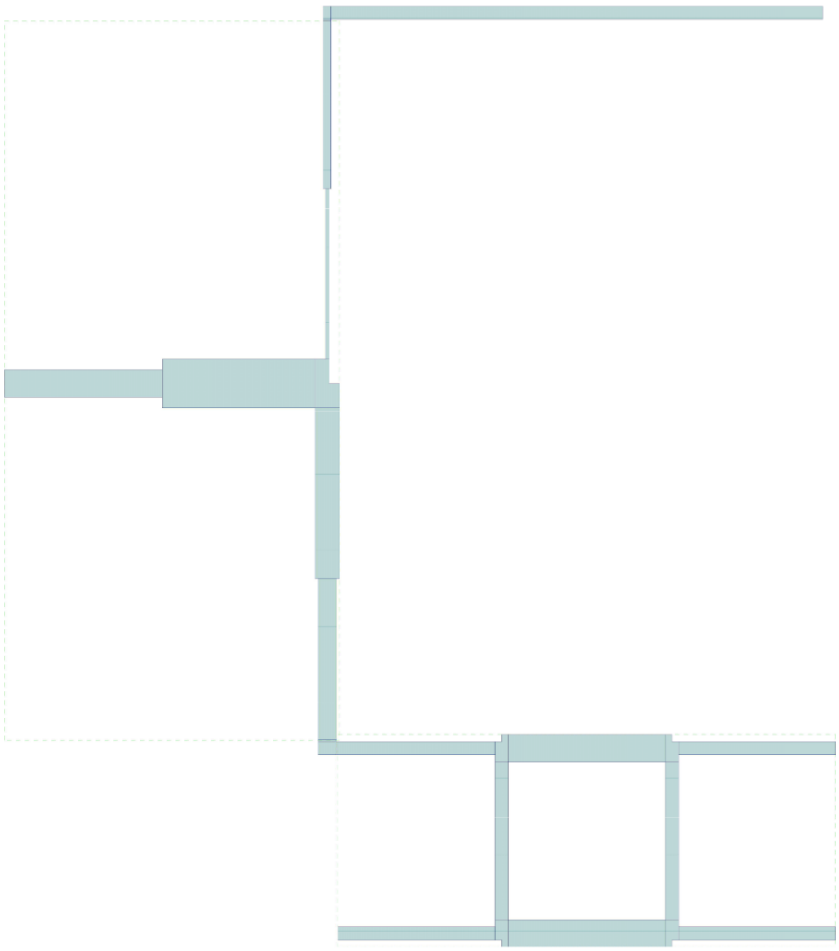

Equal Split Quadrature Hybrid
0
-10
-20
-30
-40
-50
m3: Sweep Index
2.8 GHz
-3.015 dB
m2: Sweep Index
2.8 GHz
-3.263 dB
m4: Sweep Index
2.8 GHz
-40.84 dB
m1: Sweep Index
2.8 GHz
-35.3 dB
DB(|S(1,1)|)
quadHyb
DB(|S(2,1)|)
quadHyb
DB(|S(3,1)|)
quadHyb
DB(|S(4,1)|)
quadHyb
2.8 GHz
1.96
2.46
2.96
3.46
3.64
Frequency (GHz)

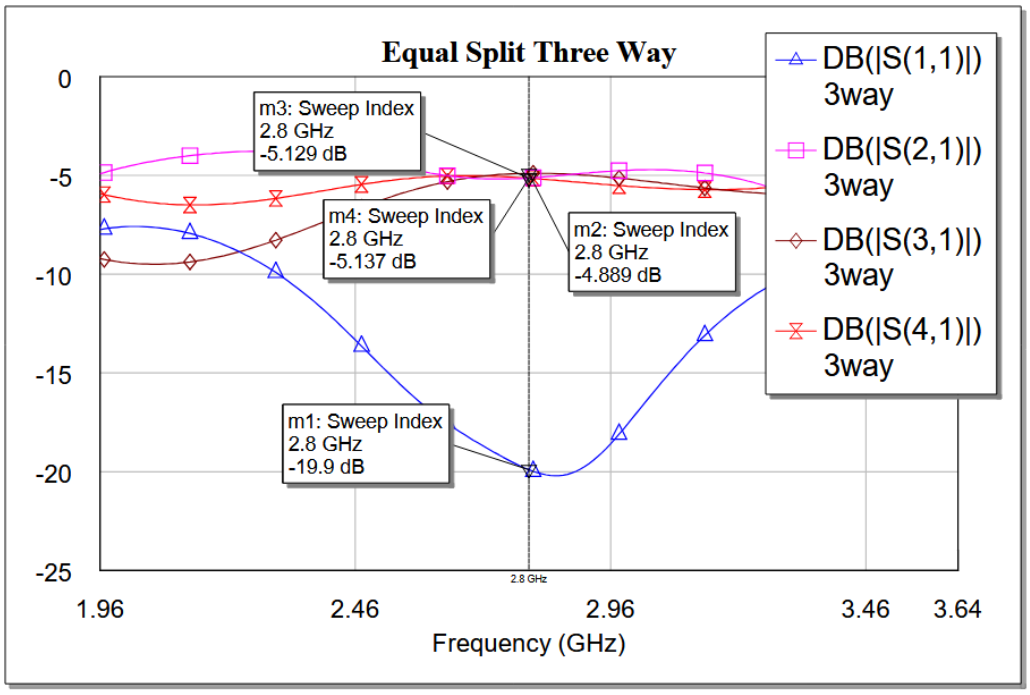


Total 3-Way Equal-Split Power Divider:

I had to add some extra transmission lines and bends to make the connections work correctly, and for the outputs to face the same way and be at about the same plane. Thankfully, they do not seem to have much effect. The total power output is decently evenly split amongst the three outputs!


PORT
P=1
Z=Z0 Ohm
SUBCKT
ID=S1
NET="Tjunc"
MLIN
ID=TL2
W=487.259 um
L=100 um
MSUB=SUB1
MLIN
ID=TL1
W=835.58 um
L=31044 um
MSUB=SUB1
MBENDRWX$
ID=MS2
MSUB=SUB1
PORT
P=2
Z=Z0 Ohm
MLIN
ID=TL3
W=1157.57 um
L=100 um
MSUB=SUB1
Z0=58
MSUB
Er=10.2
H=1270 um
T=17.5 um
Rho=1
Tand=0.0023
ErNom=10.2
Name=SUB1
MLIN
ID=TL4
W=835.58 um
L=100 um
MSUB=SUB1
PORT
P=4
Z=Z0 Ohm
MBENDRWX$
ID=MS1
MSUB=SUB1
PORT
P=3
Z=Z0 Ohm
SUBCKT
ID=S2
NET="quadHyb"
LOAD
ID=Z1
Z=Z0 Ohm




Equal Split Three Way
0
-5
-10
-15
-20
-25
1.96
2.46
2.96
3.46
3.64
2.8 GHz
Frequency (GHz)
m3: Sweep Index
2.8 GHz
-5.129 dB
m4: Sweep Index
2.8 GHz
-5.137 dB
m2: Sweep Index
2.8 GHz
-4.889 dB
m1: Sweep Index
2.8 GHz
-19.9 dB
DB(|S(1,1)|)
3way
DB(|S(2,1)|)
3way
DB(|S(3,1)|)
3way
DB(|S(4,1)|)
3way