Vector Modulator
Final Report

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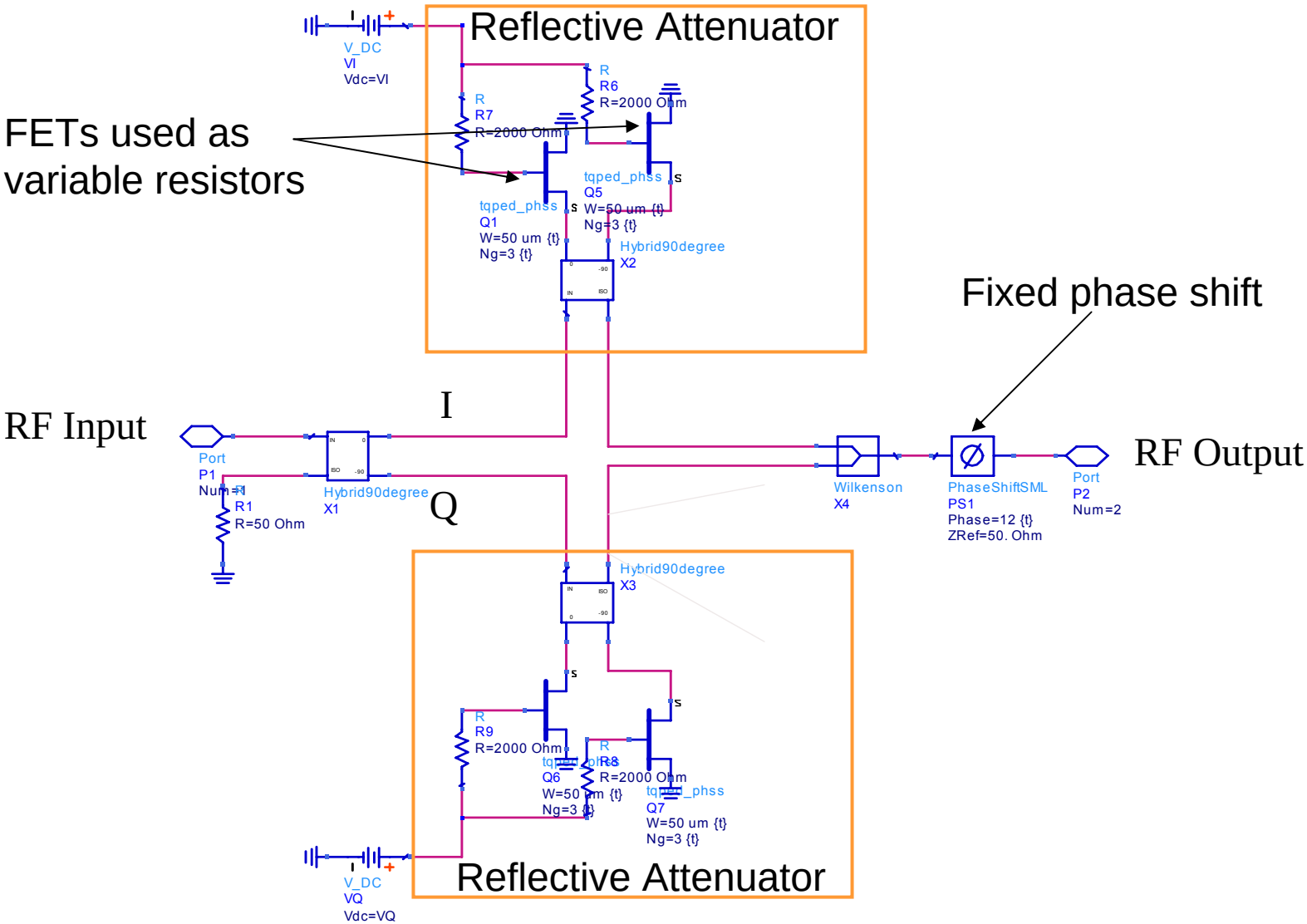
What is this thing?

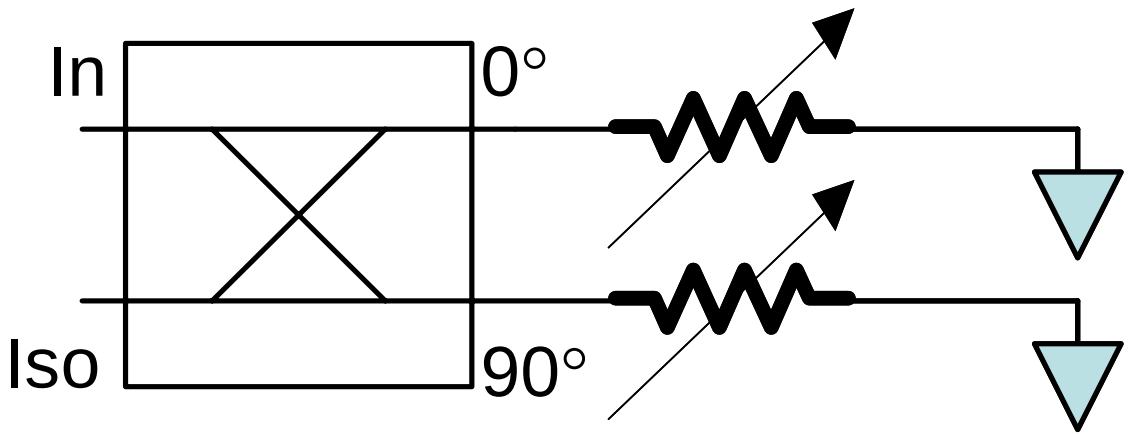
- Varies the amplitude and phase of a signal
- It uses In-phase (I) and Quadrature (Q) controls
- It is used to digitally modulate wireless signals.
- It is connected to the transmitter.

Block Diagram

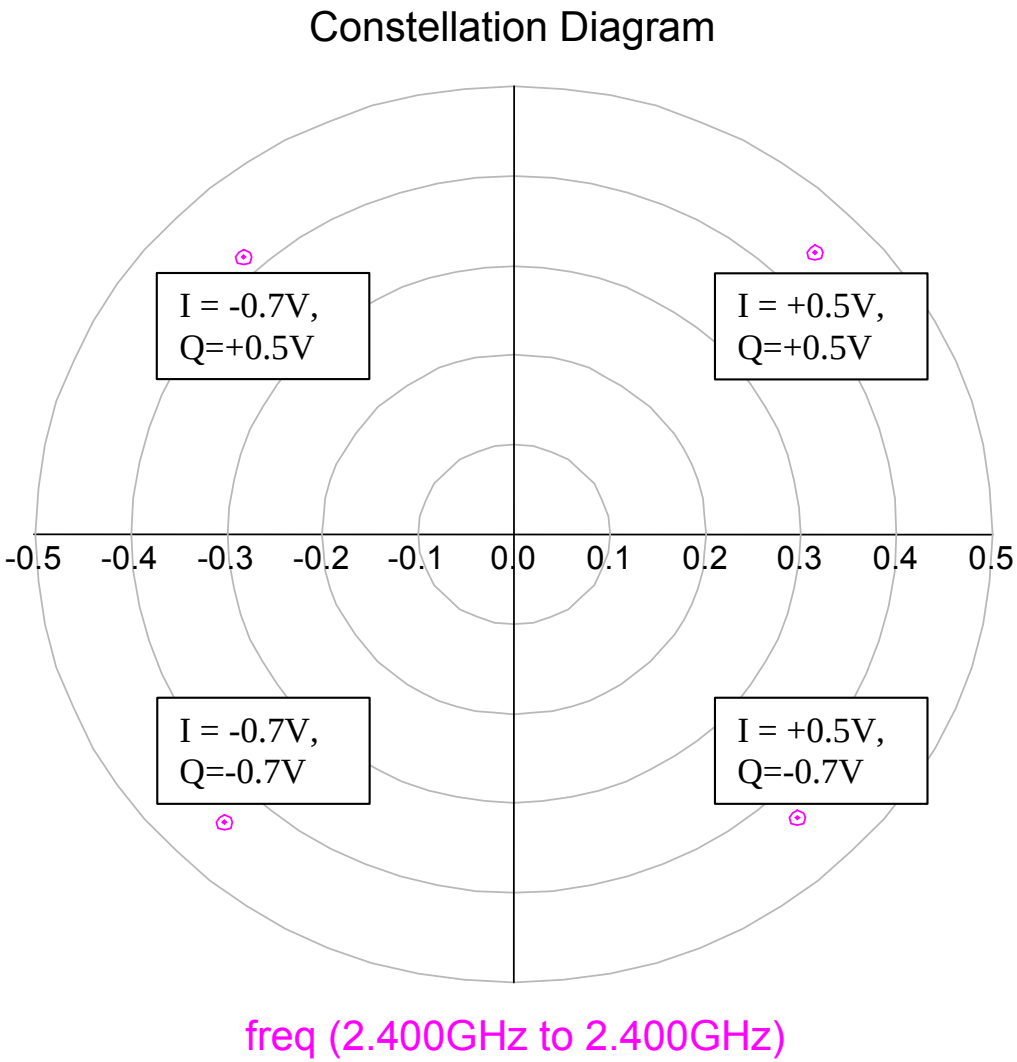


Explanation of a Reflective Attenuator

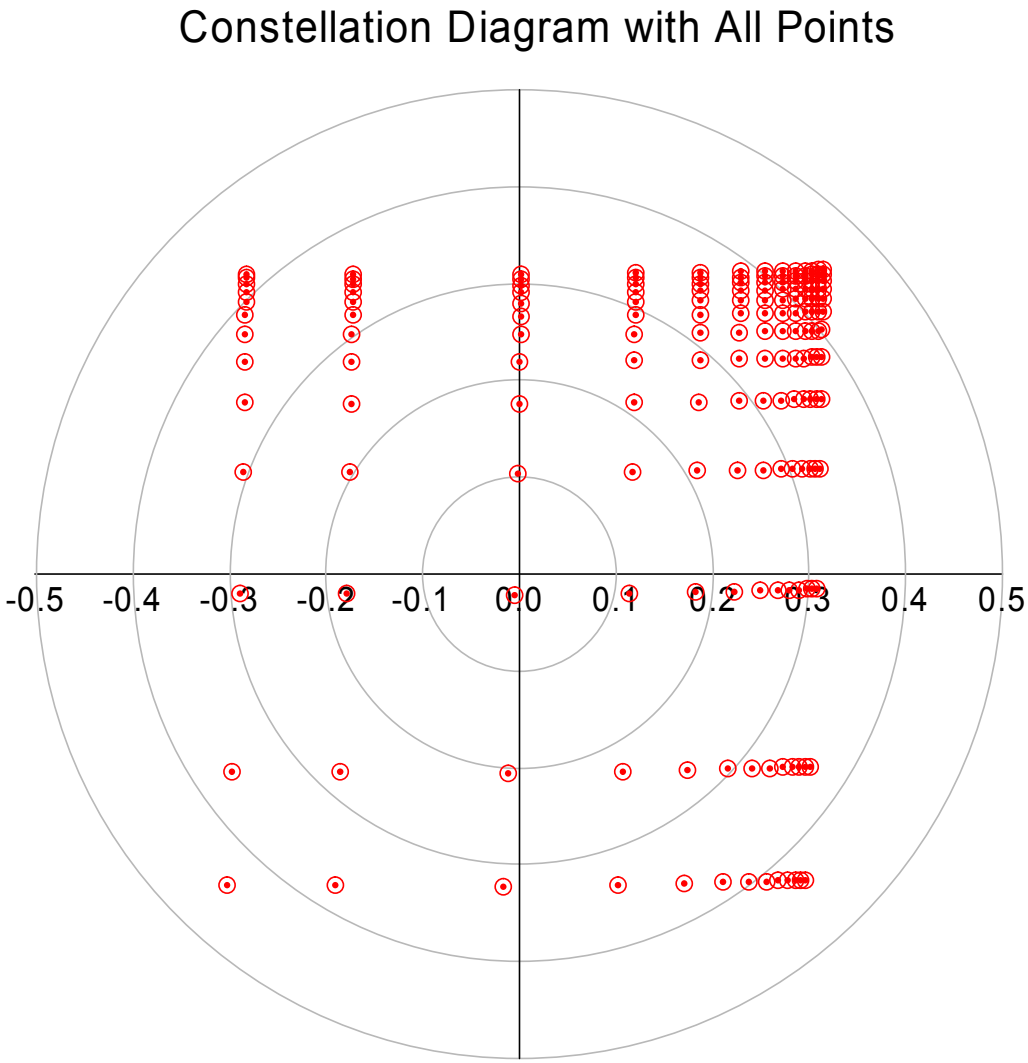
- Input signal separated by 90°
- Variable resistor creates a mismatch causing power to be reflected
- Reflected power is combined at the Isolated port



QPSK Constellation Diagram Simulated



Full Constellation Diagram Simulated



Design Approach

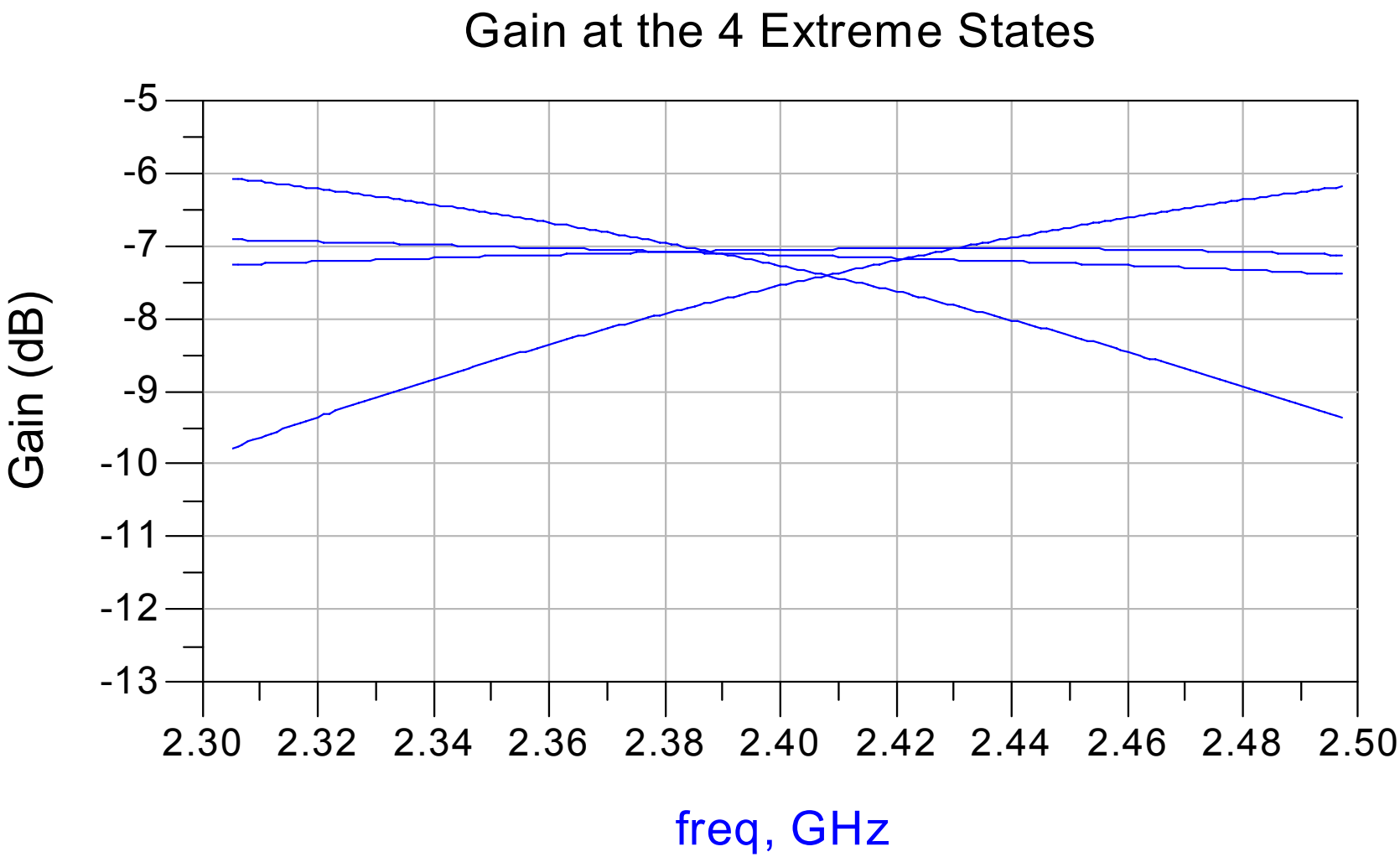
- Simulate with ADS ideal system blocks to see how it supposed to work
- Design ideal element 90° hybrid and Wilkinson
- Pick a transistor size
- Convert to TQ elements
- Add in interconnect
- Layout the circuit and modify the simulation as needed.

Specs

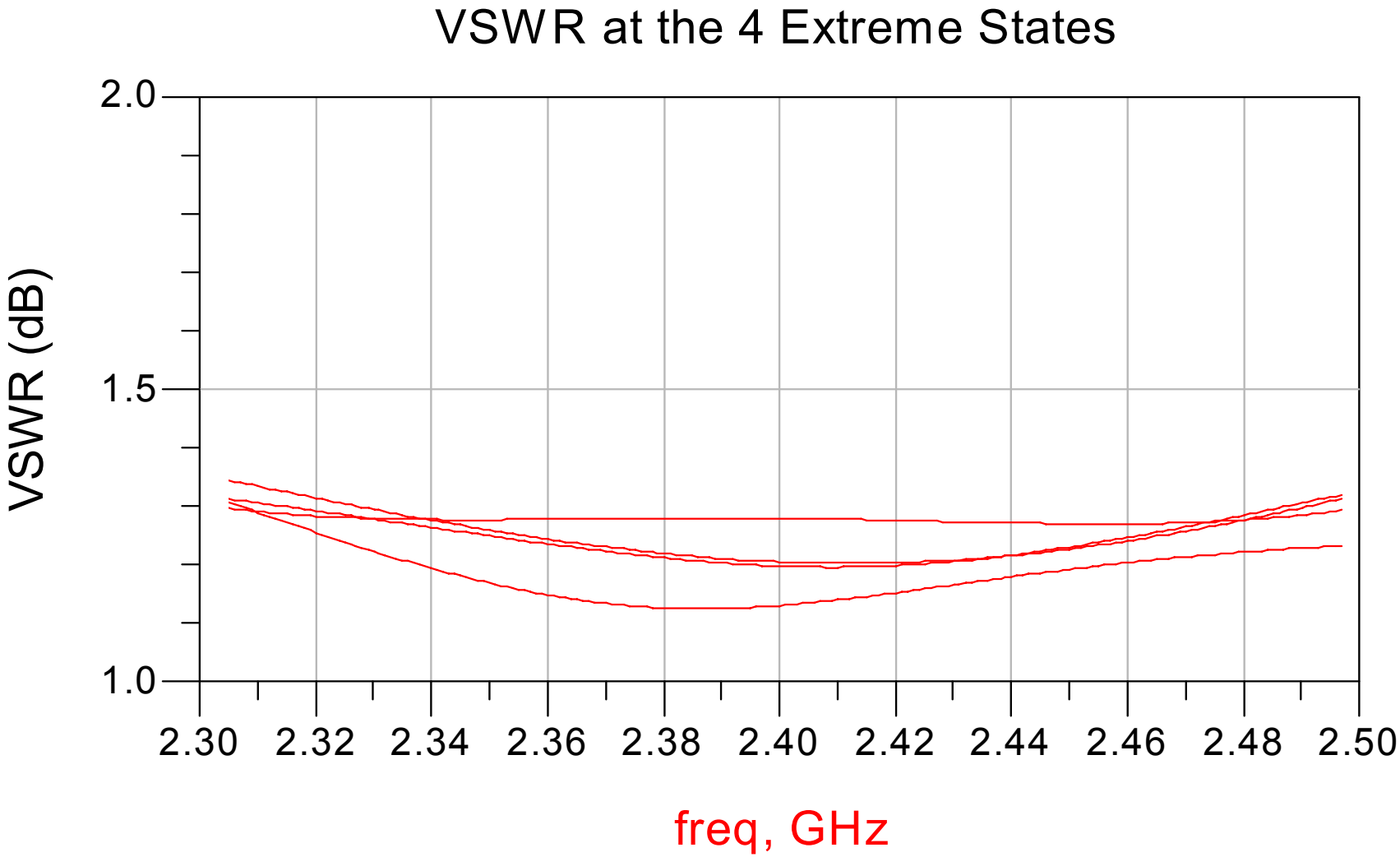
- All specs met or exceeded!

	Specified Performance		Expected Performance
Specs	Goal	Max	from Simulation
Frequency	2.305 - 2.497 GHz		> 2.305 - 2.497 GHz
Isolation	16dB	10dB	> 20dB
Loss	7dB	10dB	10dB Max
RF Input Power	0dBm		0dBm Min
VSWR	1.5:1	2.5:1	1.4:1
Supply Voltage	0 - 5V Variable		+0.5V, -0.7V

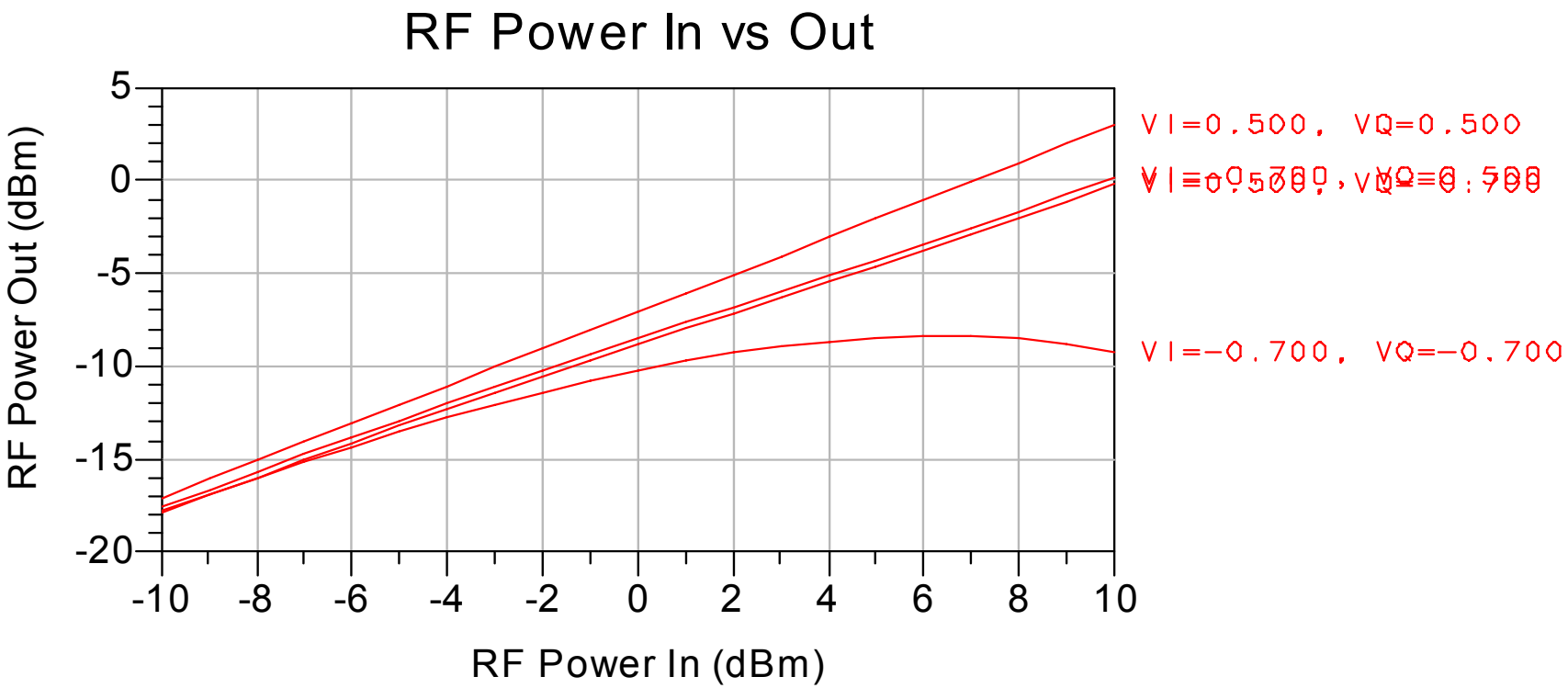
Insertion Loss



VSWR

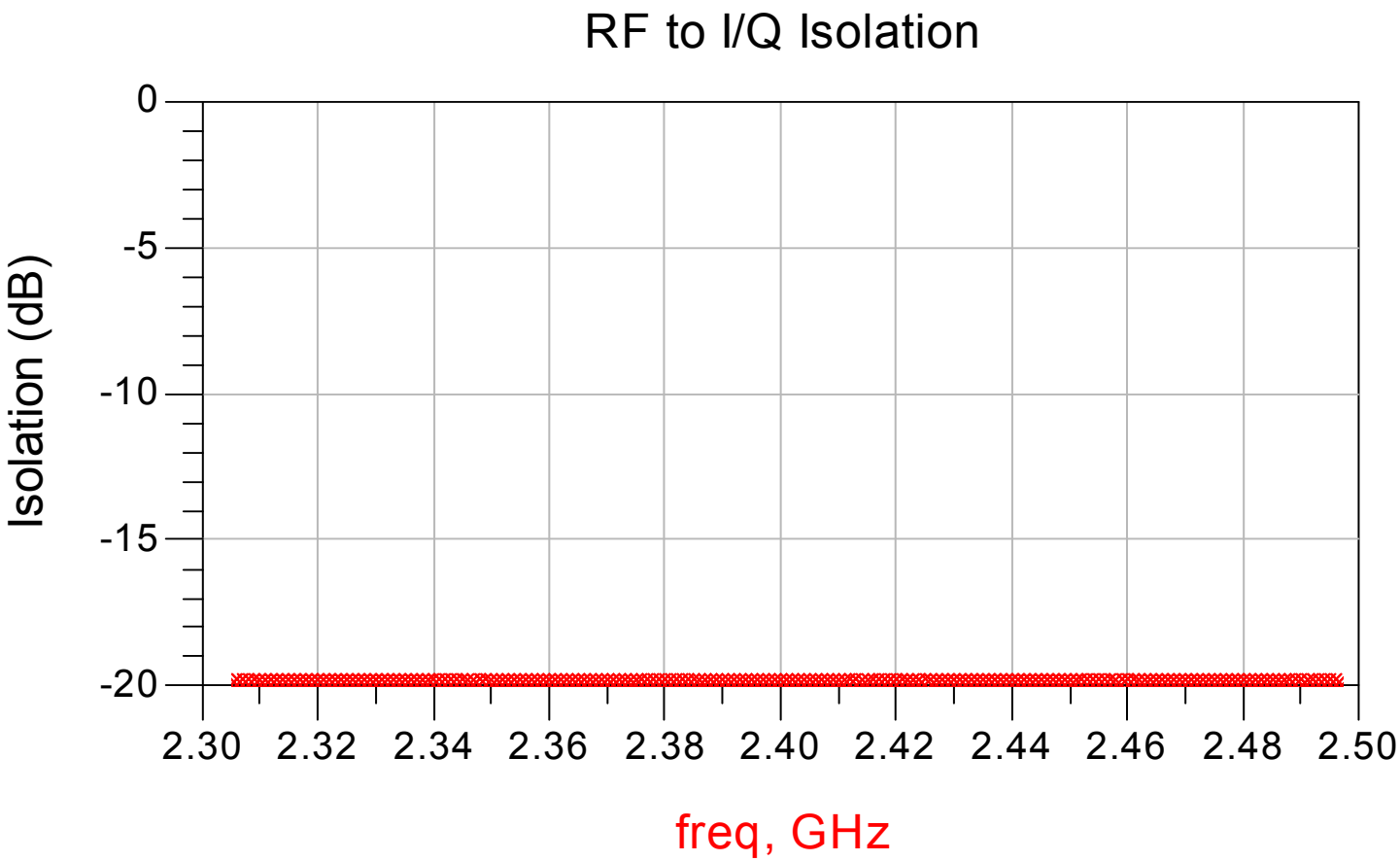

VSWR at the 4 Extreme States
VSWR (dB)
2.0
1.5
1.0
2.30
2.32
2.34
2.36
2.38
2.40
2.42
2.44
2.46
2.48
2.50
freq, GHz

RF Input Power vs Output Power

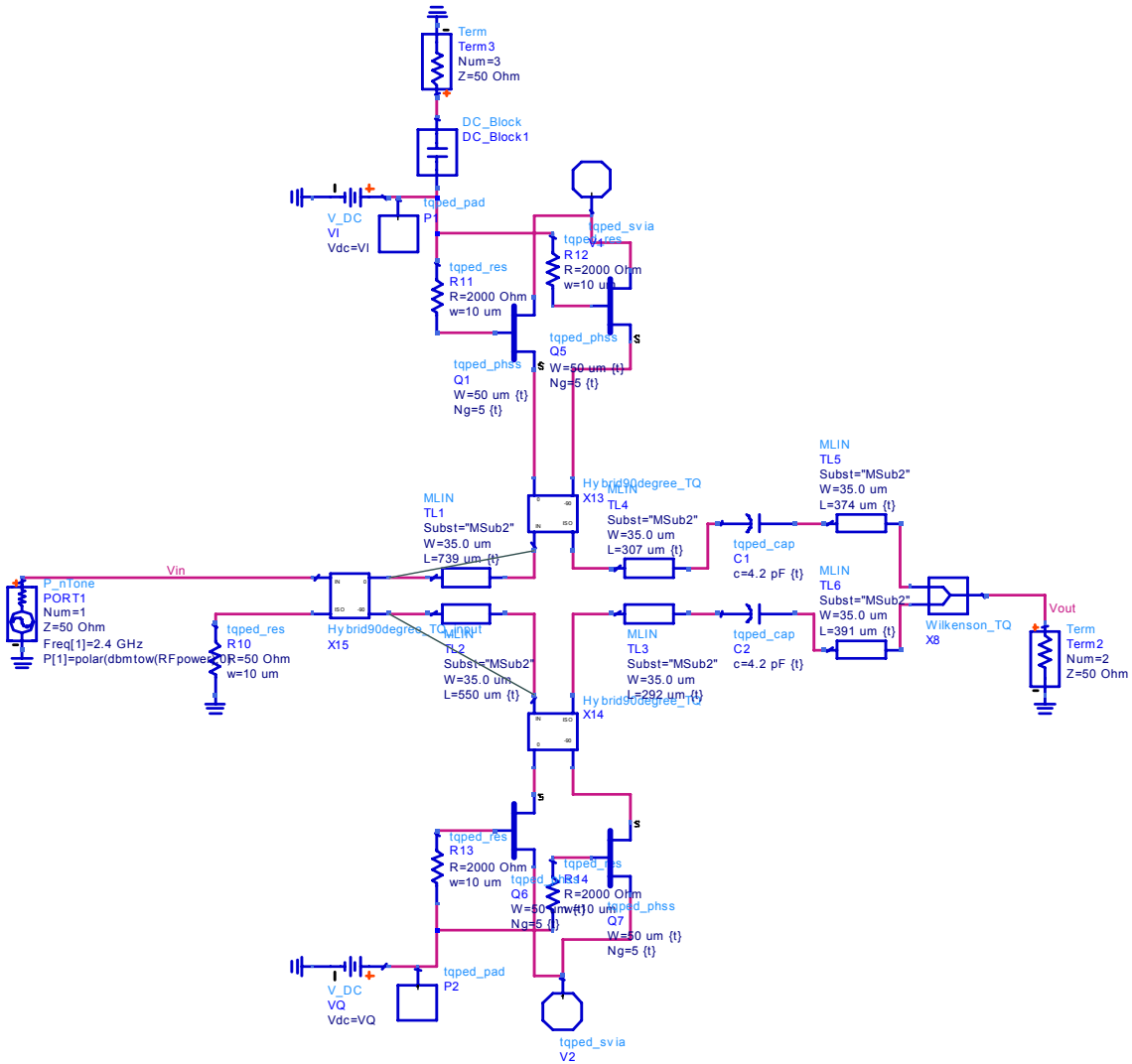


Isolation

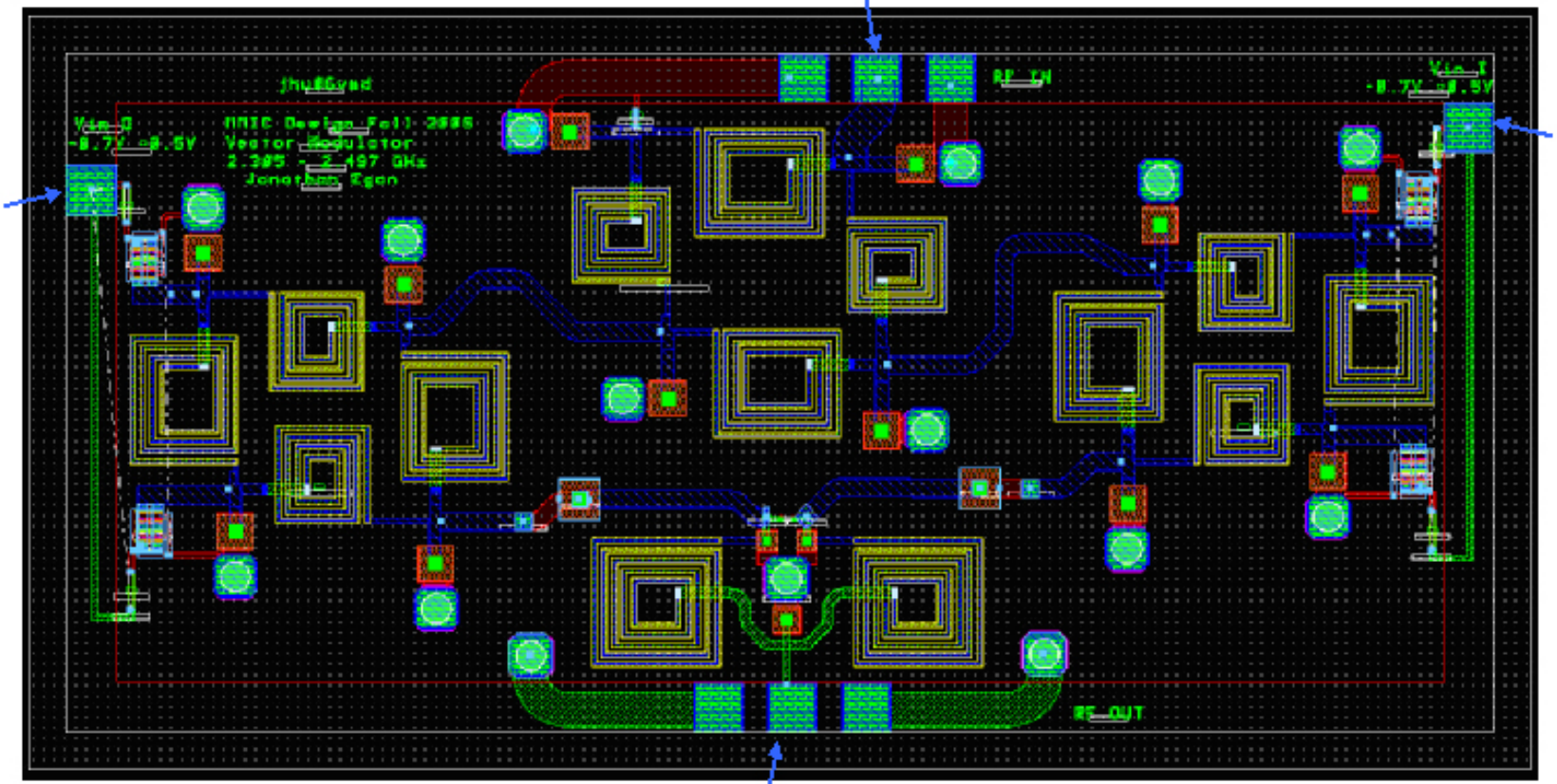
- The isolation was too high for ADS to measure.



Final Top Level Schematic



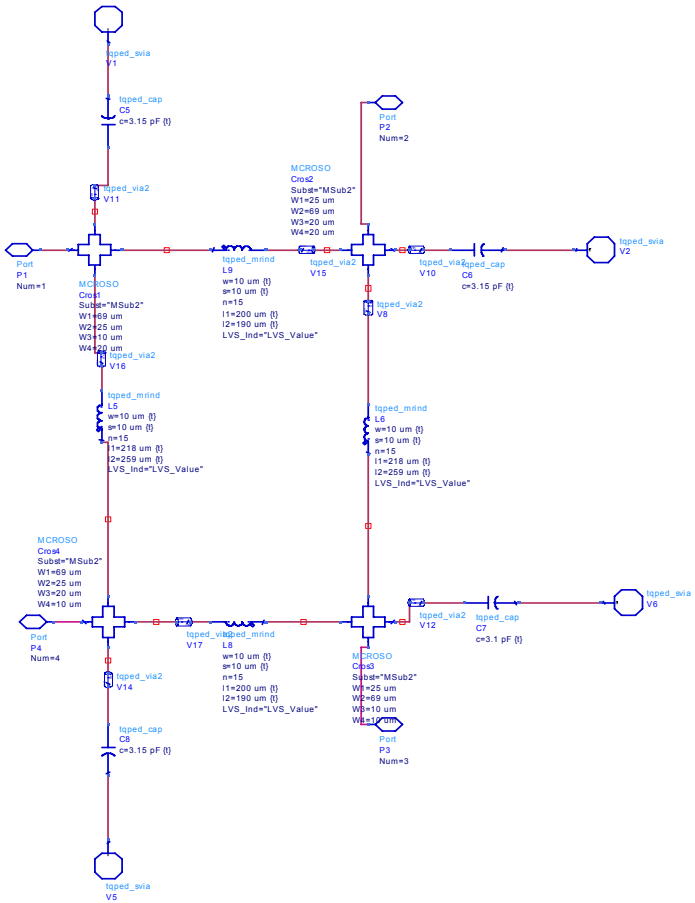
Layout



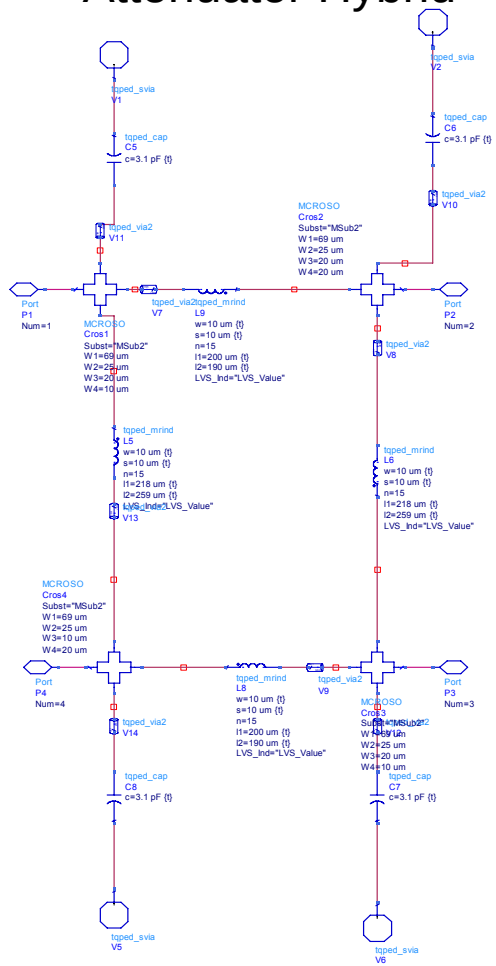
The End

90° Hybrid Schematics

Input Hybrid



Attenuator Hybrid



12/11/2006

Wilkinson Schematic