

EE572/EEP572 Microwave Engineering

Fall 2021

Instructor: Professor Yasuo Kuga, Rm430 EEB, OH: TBD
Tel: 543-0478, ykuga@u.washington.edu
Schedule: Lecture: TBD 6-9pm Lab: TBD
TA: TBD
Prerequisite: Basic EM course, EE361 or equivalent

This course will be based on my lectures notes and references

Textbooks: (recommended but not required)

(1) *Microwave Engineering*, Addison Wesley, 2012. D. Pozar

Topics (tentative):

1. Transmission line
2. Transmission line matching techniques.
3. Microwave circuit analysis using S-parameters
4. Electrical properties of materials and measurement techniques
5. Dispersion and anisotropic media
6. TDR, time domain analysis and parameter extraction techniques
7. 90° and 180° hybrid analysis and design
8. Microwave filter analysis and design
9. Design of microwave amplifiers

HW/Lab projects (tentative)

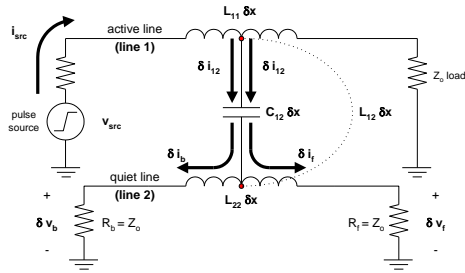
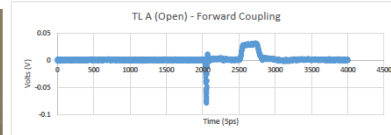
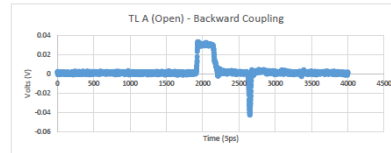
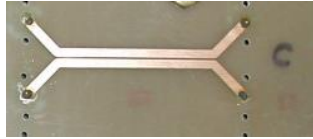
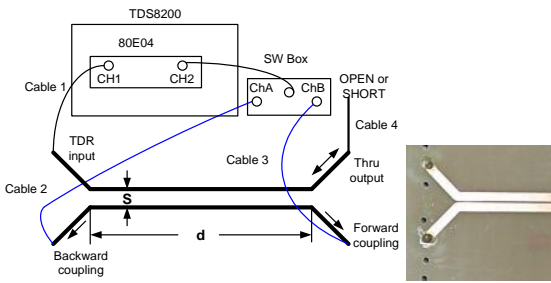
- TDR time-domain analysis of complex loads
- TDR coupled noise on TLs
- Forward and inverse problem: Estimation of the dielectric constant
- Estimation of the dielectric constant using the reflection method
- Microwave hybrid design
- Microwave filter design
- Microwave amplifier design

Lab instruments and simulation software: TBD in Fall 2021

Time-domain reflectometer (TDR)
Microwave Network analyzer (NWA)
Ansys ED (Electronics Desktop)

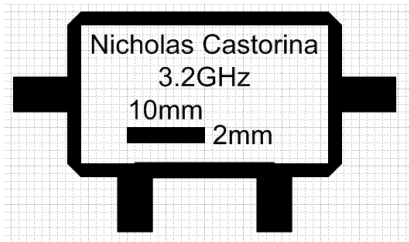
Grading policy: Five to six HW/projects will be assigned. The final grade will be based on the projects/reports. No exam.

TDR Lab (Forward and backward coupled noise on TL)

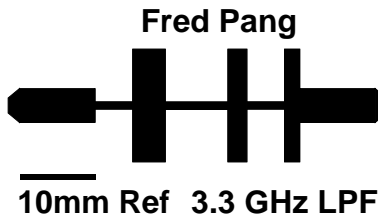


$$V_b = \int_0^d \left(\frac{K_C + K_L}{2v_o} \right) \frac{dV_{src}}{dt} dx$$

Examples of microwave circuits

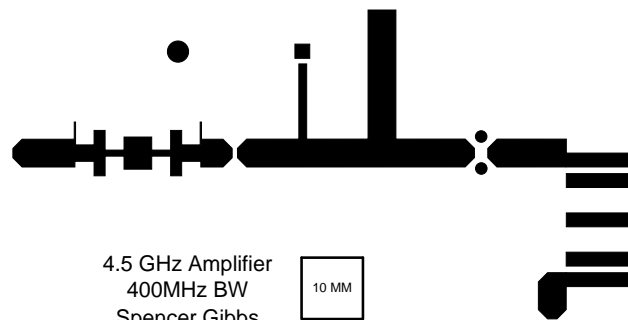
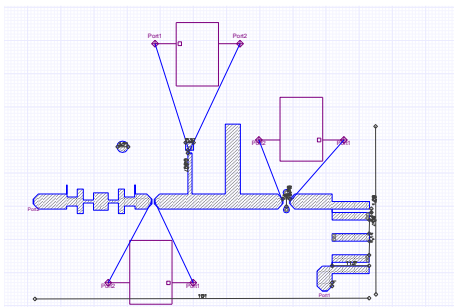


180 degree hybrid



Low-Pass Filter: $f_c=3.3$ GHz

Example of microwave amplifier using Ansys ED



4.5 GHz Amplifier
400MHz BW
Spencer Gibbs

2020 Final Project: 2.4 GHz Balanced Amplifier Design

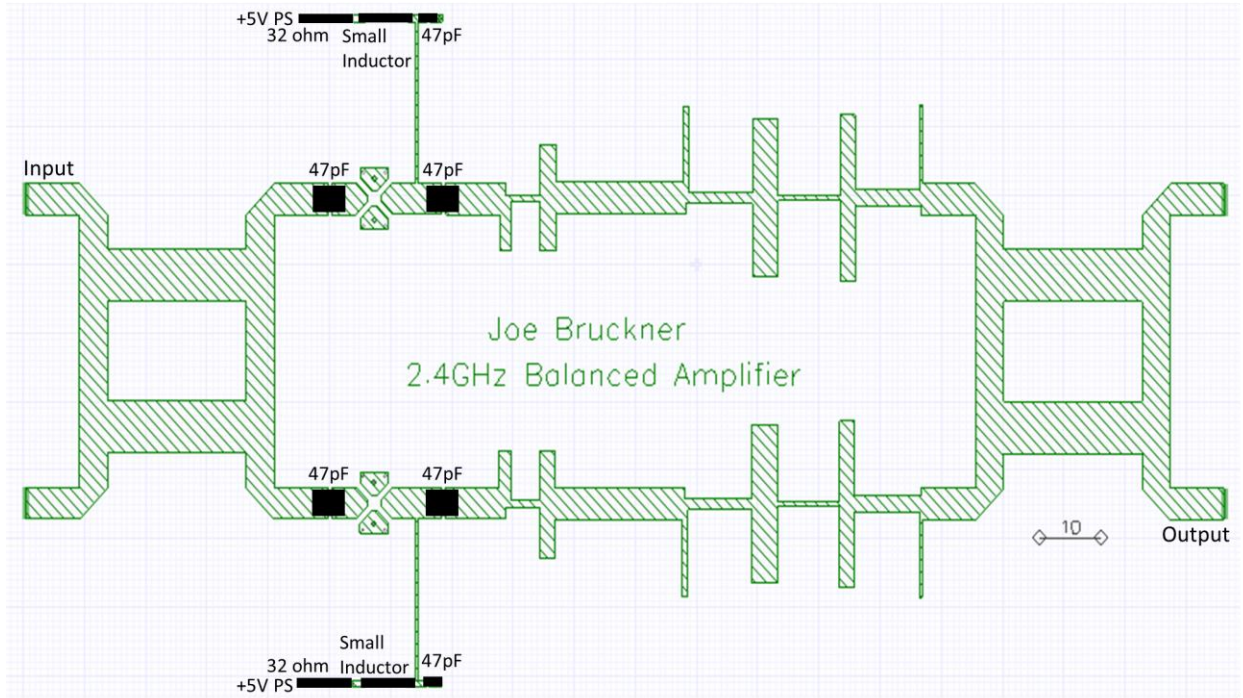


Figure 1: 2.4 GHz Balanced Amplifier EM Layout with Elements

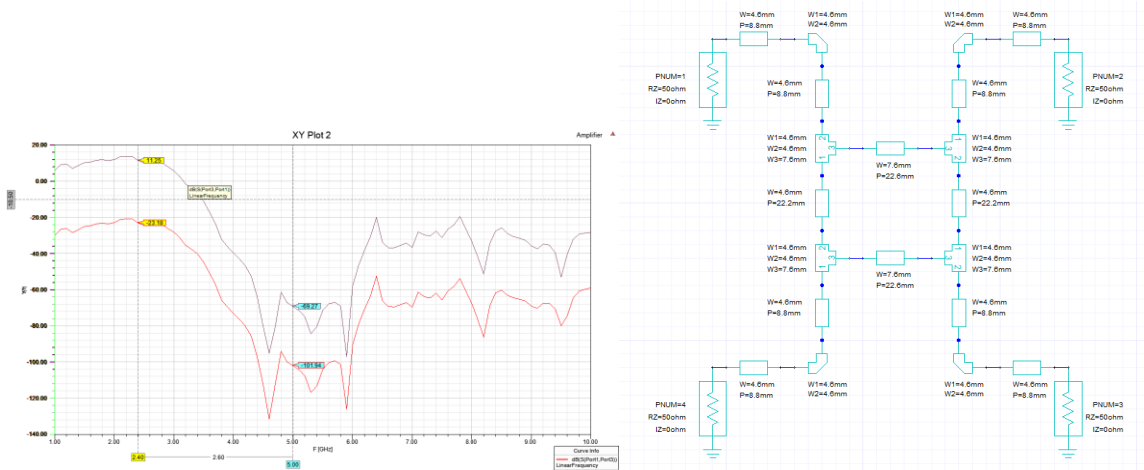


Figure 2: 2.4 GHz Balanced Amplifier Circuit Simulation

Figure 3: 2.4 GHz 90 Deg Hybrid Circuit Design