
FRAGILE

Ultra Wideband Antenna – Senior Project

By: Ross Stange

Advisor: Dr. Prasad Shastry

Bradley University

Outline of Presentation

- Summary on Antennas and UWB
  - Introduction to Antennas
  - Introduction to UWB
- Deliverables Due during Fall Semester
- Updated Block Diagram
- Picture of Reference Antenna
- Changes to be Made to Reference Antenna
- EE 409 (RF Comm Lab) Labs
- Simulations and Layouts
- Updated Equipment List
- New Information Received from Cunningham Graphics
- Revised Tentative Schedule and Progress

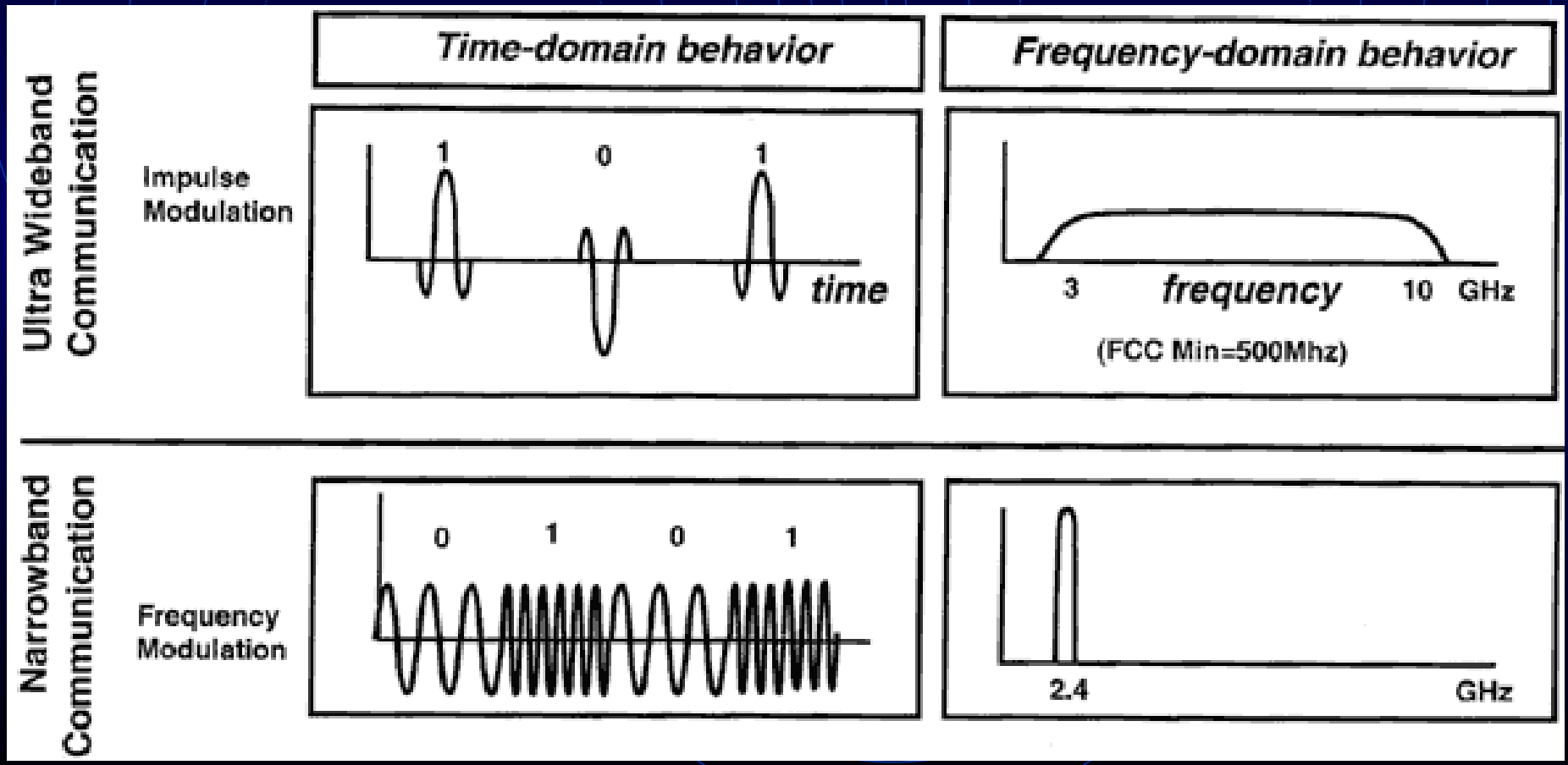
Intro to Antennas

- An antenna is a transducer between a guided wave propagating in a transmission line, and an electromagnetic wave propagating in an unbounded medium, like air.
- All antennas are both transmitting and receiving antennas.
- Car antenna mainly in receiving mode

Intro to UWB

- UWB is defined as a system having a bandwidth greater than 500 megahertz (MHz).
- UWB signals are pulse-based waveforms compressed in time, instead of sinusoidal waveforms compressed in frequency.

Intro to UWB (cont.)



Intro to UWB (cont.)

- Applications

- Low Power
- Low Energy Levels for Short-Range High Communications
- Non Cooperative Radar Imaging
- Radio Communications

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Deliverables Due during Fall Semester

- Functional Description and Block Diagram
- Functional Requirements List and Specifications
- Proposal
  - Paper Version
  - Presentation Version

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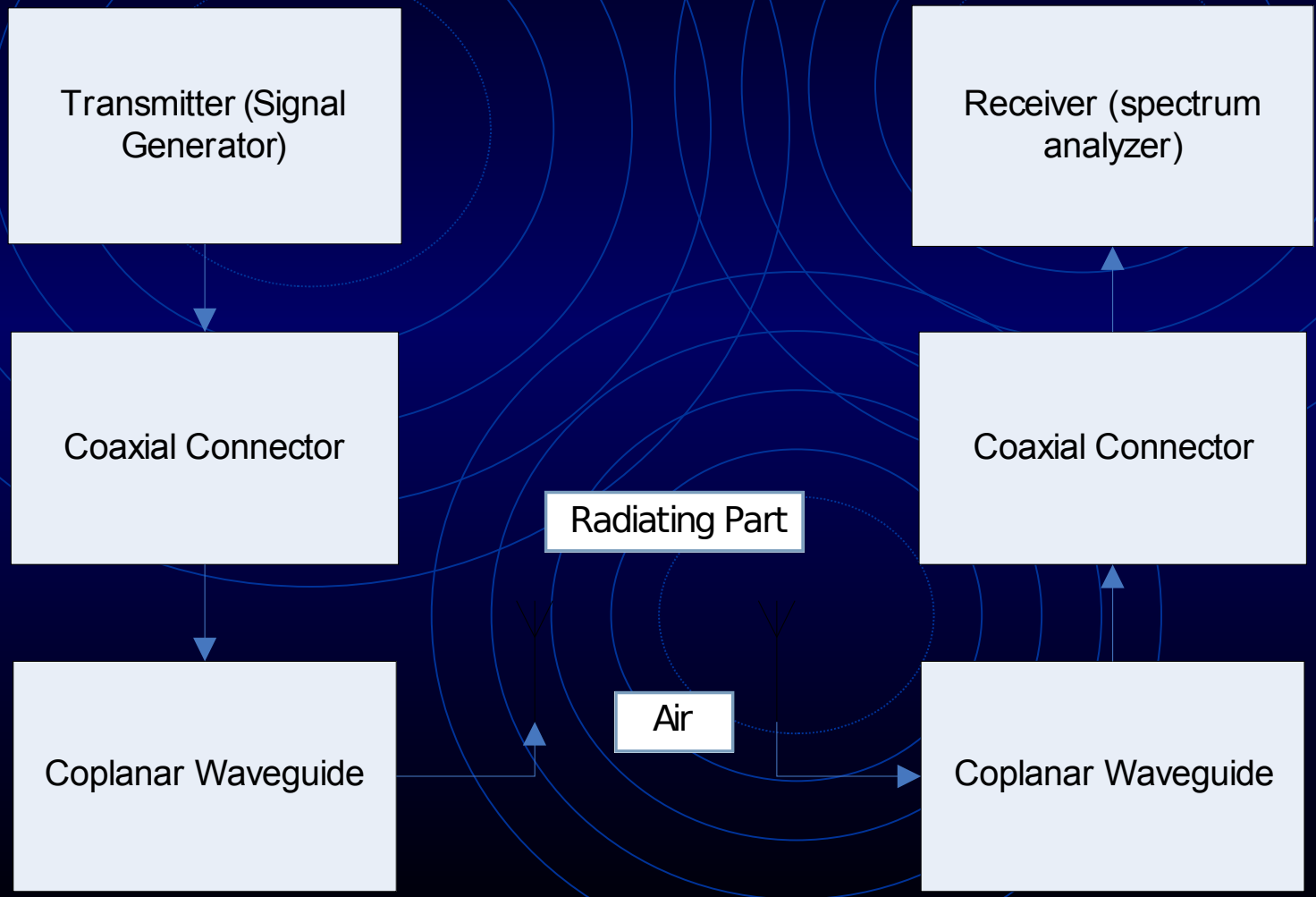
Updated Block Diagram



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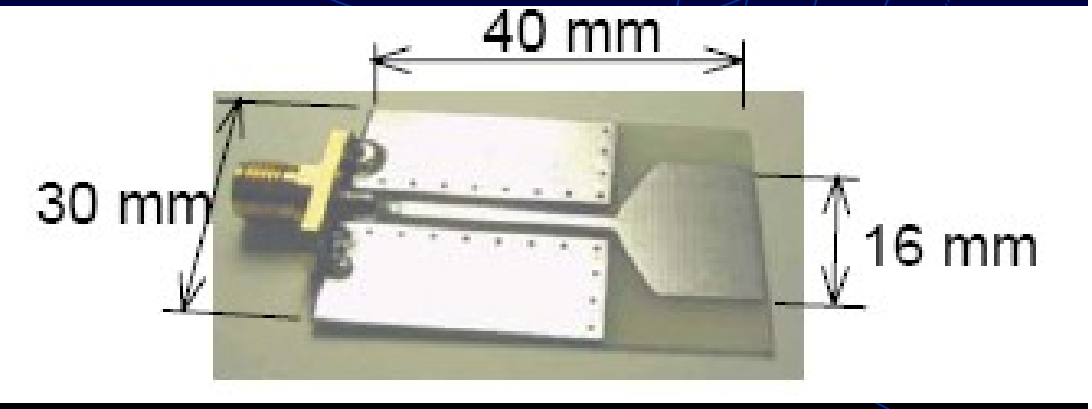
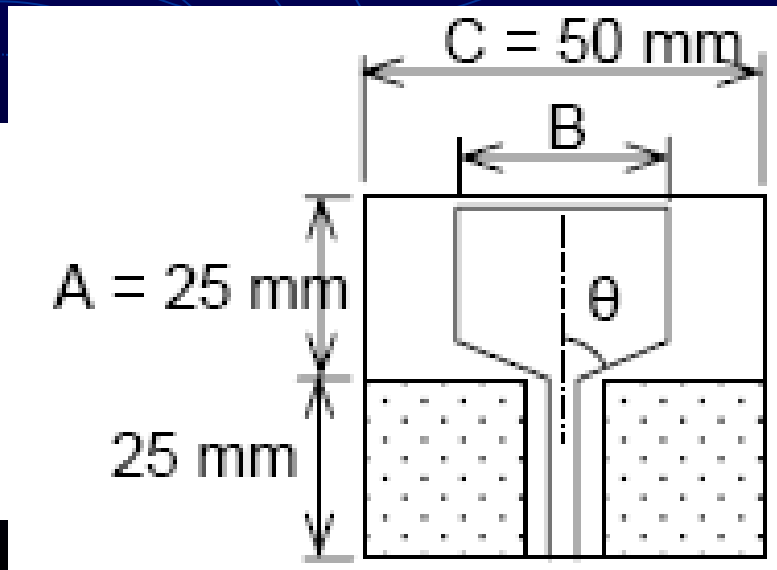
Reference Antenna

- Picture of a Monopole Antenna [Left = Final (Optimized) Result] [Right = Initial Set-Up
- Final Values: θ = 63° B = 16 mm
  A = 15 mm





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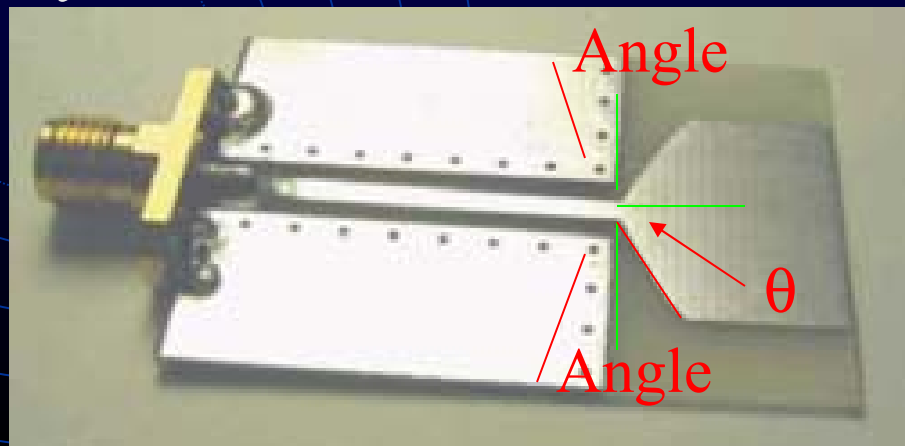
Changes to be Made to Reference Antenna

- Reference Antenna to be designed first
- ∀ θ = 63° (Original Value)
  - Will be changed to 0°, 30 °, 45 °, and 75 °.
- Change shape of Coplanar Waveguide
  - Trapezoidal (Angle = 90 - θ)
- Test Coplanar Waveguide by itself
  - At 0°, 30°, 45°, 63°, and 75°



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EE 409 (RF Comm Lab) Labs

- Network Analyzer
- ADS Lab
- Antenna Measurements (Not Finished!)
- Microstrip LPF Fabrication and Measurements (Not Finished!)

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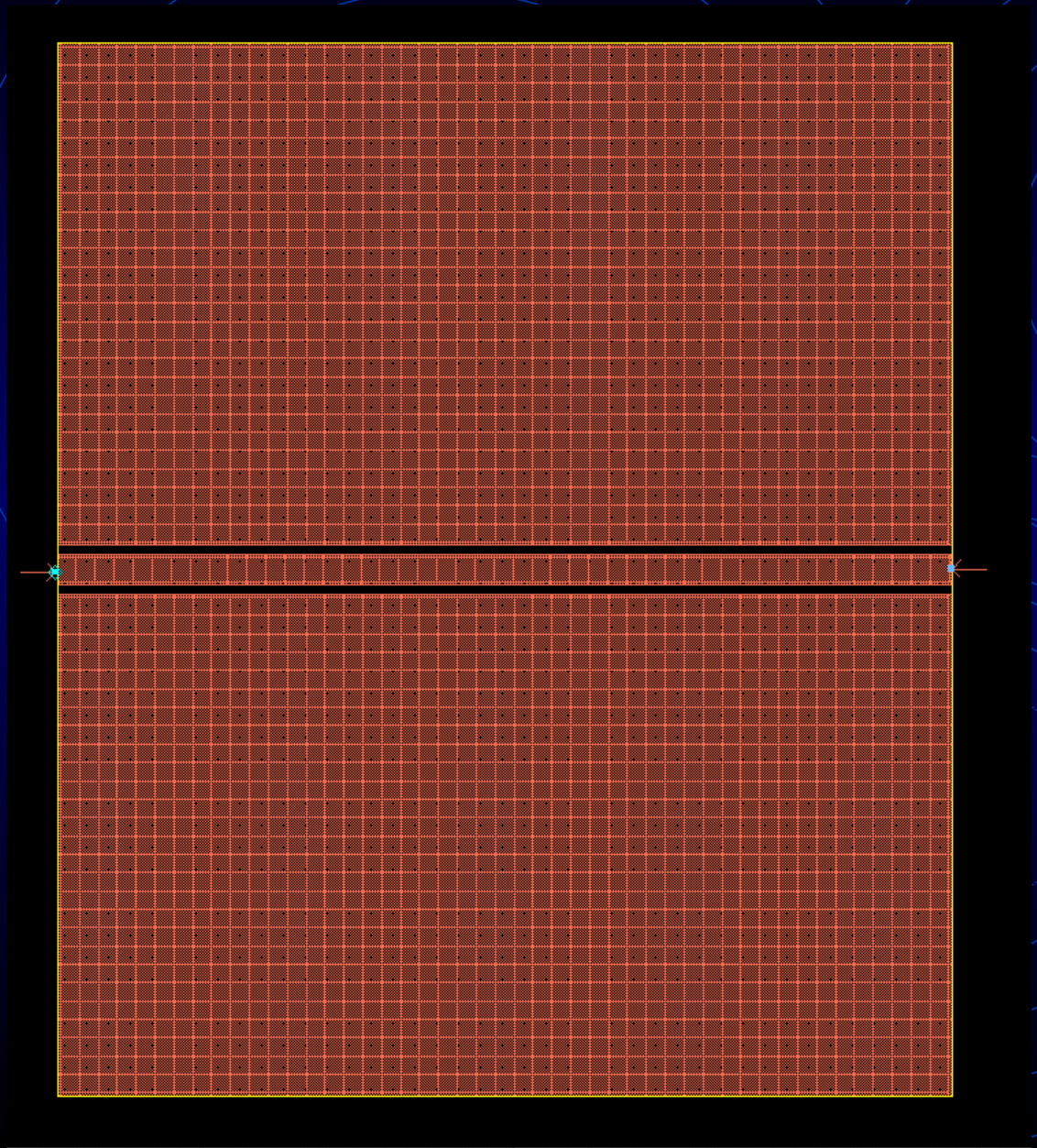
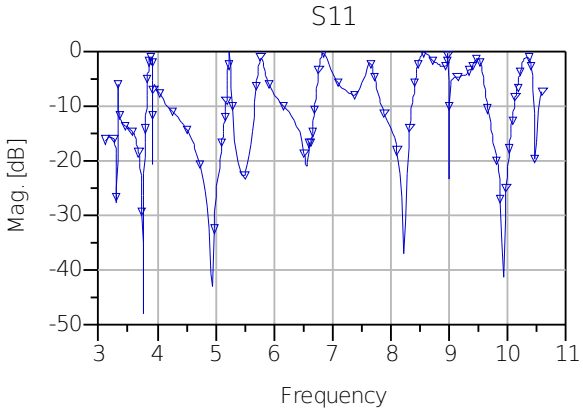
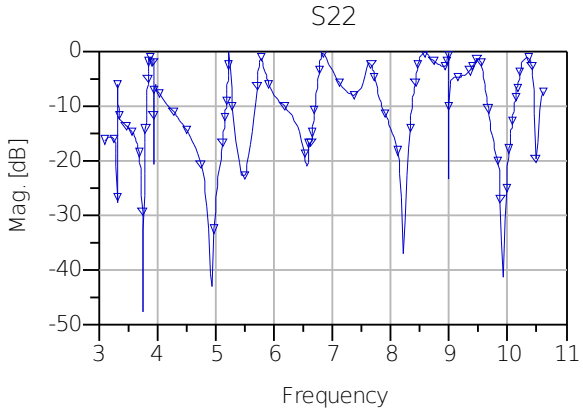
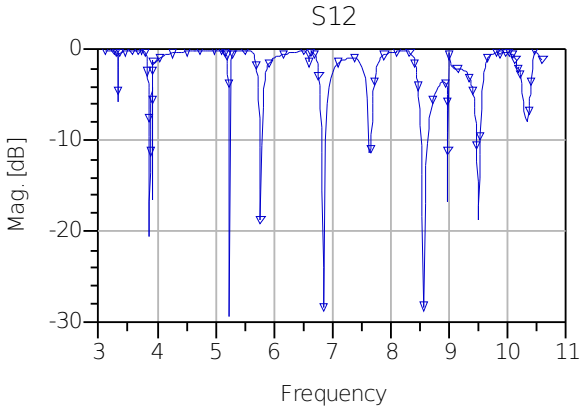
Simulation and Layouts

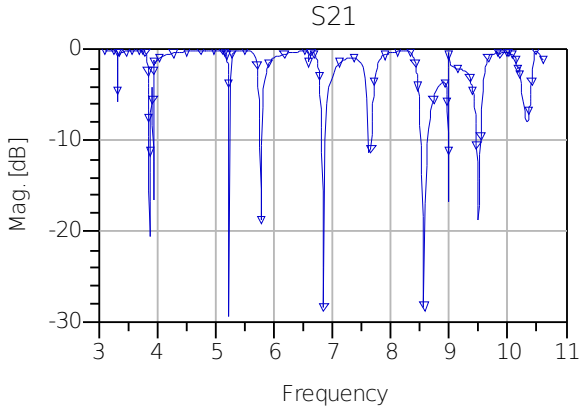


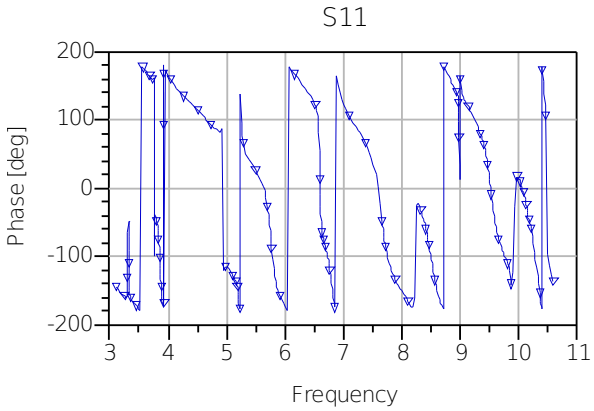
Coplanar Waveguide
for Simulation 1

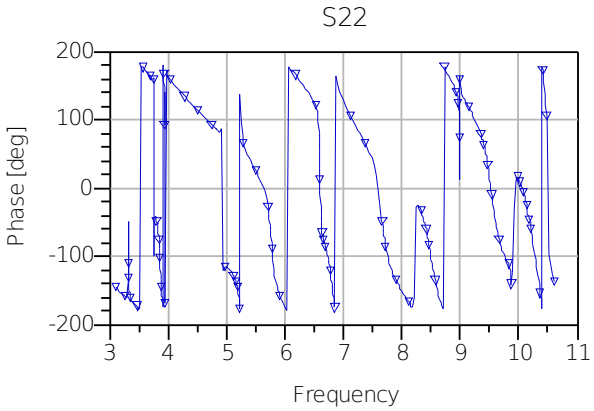










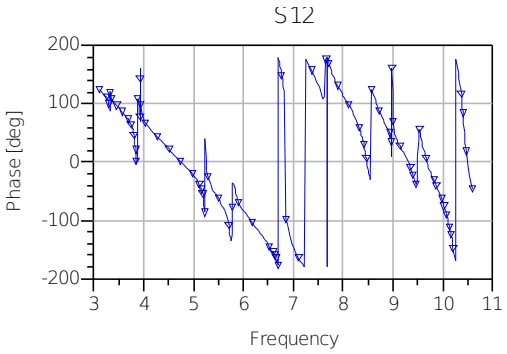


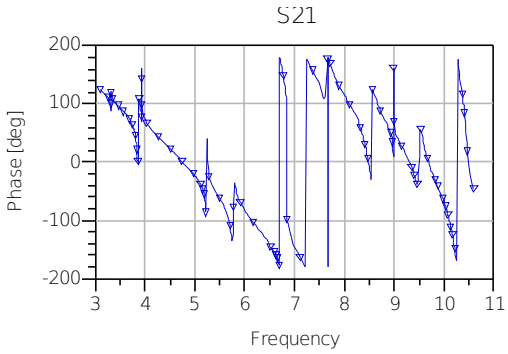
Simulation and Layouts

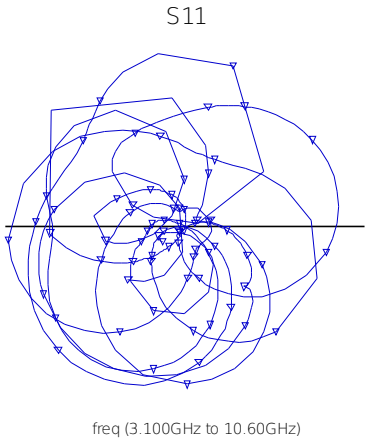
Simulation 1 – Bad Data

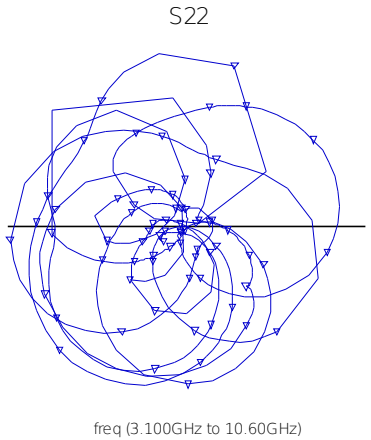
Simulation and Layouts

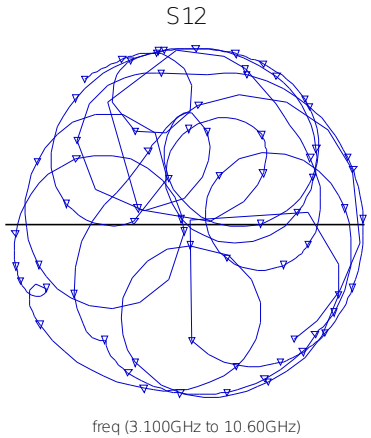
Simulation 1 (cont.)

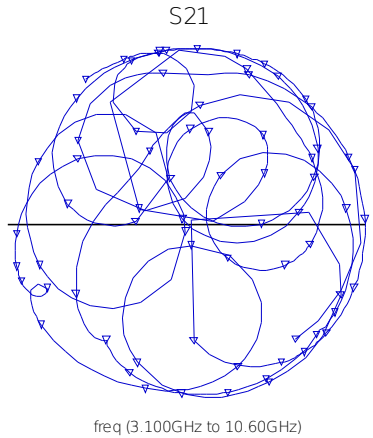


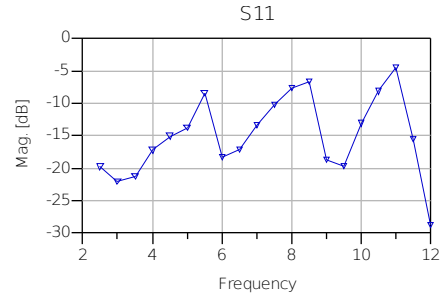


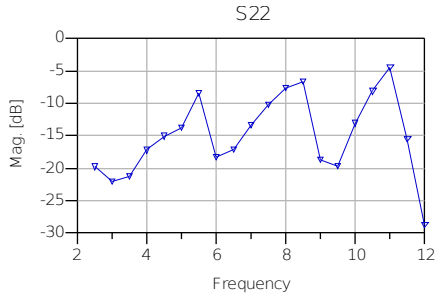


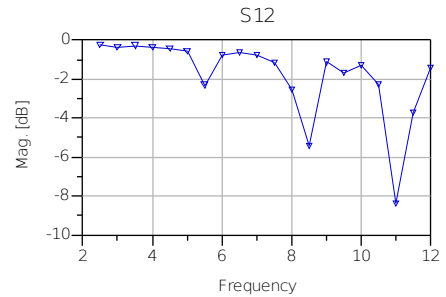


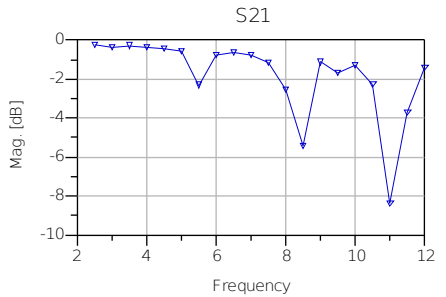


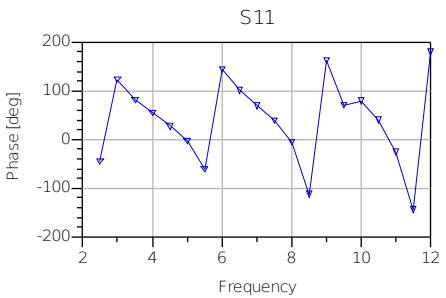


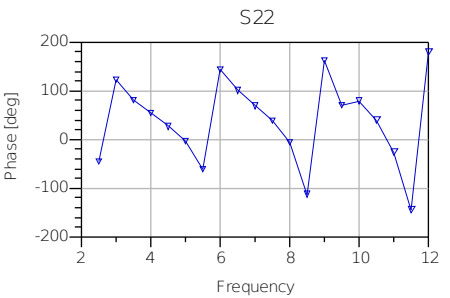


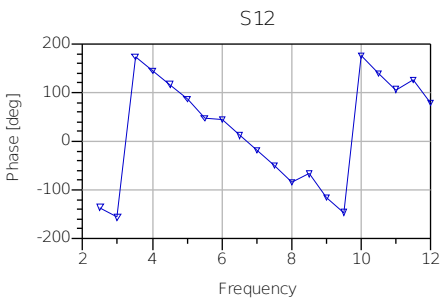


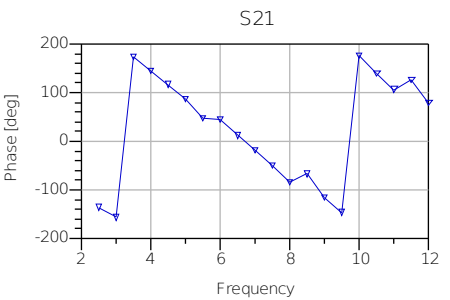












Simulation and Layouts

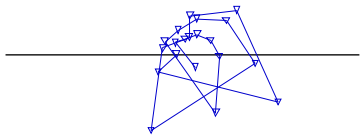
Simulation 2 – better results

Date Simulation Done – 3/6/2008

Simulation and Layouts

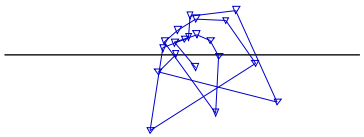
Simulation 2 – (cont.)

S11



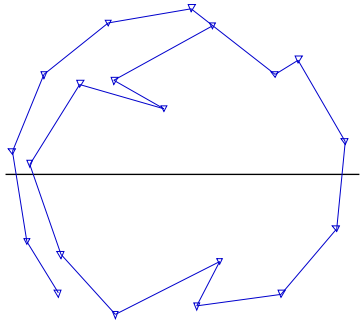
freq (2.500GHz to 12.00GHz)

S22



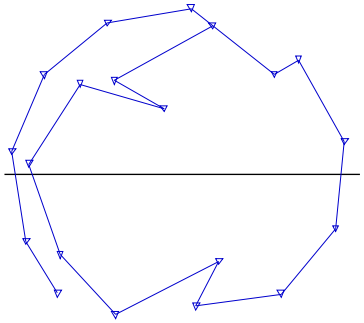
freq (2.500GHz to 12.00GHz)

S12



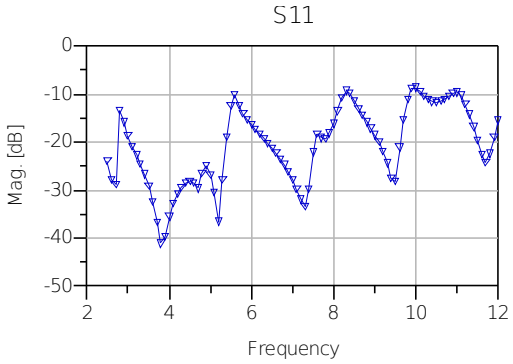
freq (2.500GHz to 12.00GHz)

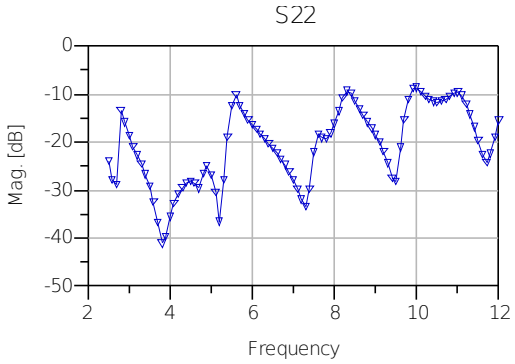
S21

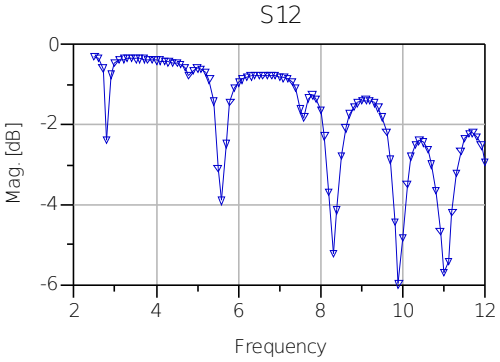


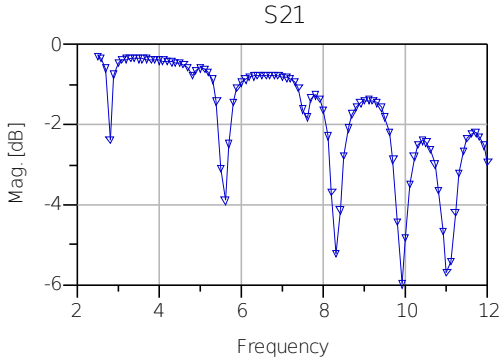
freq (2.500GHz to 12.00GHz)

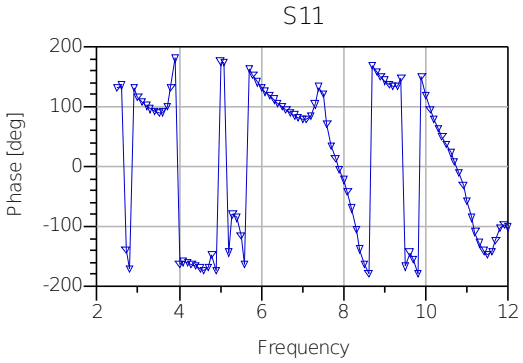
Simulation 2's conductor is different than Simulation 1's

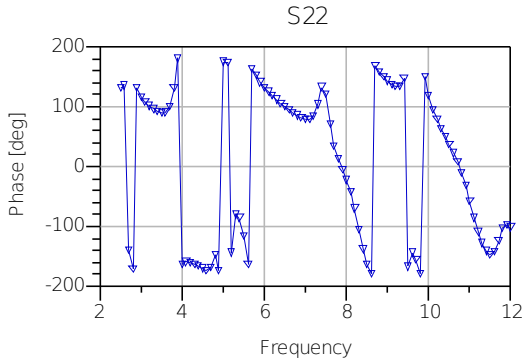








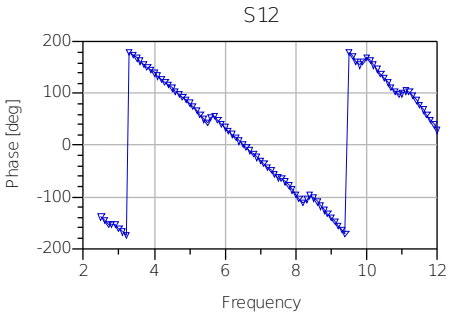


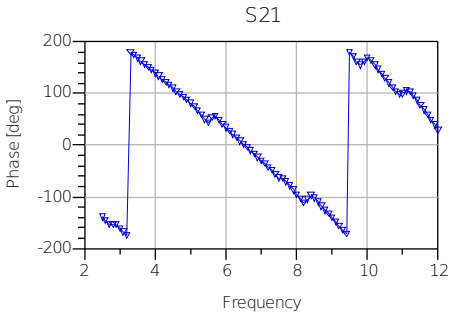


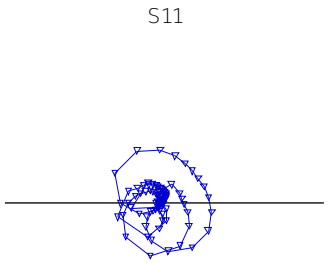
Simulation and Layouts

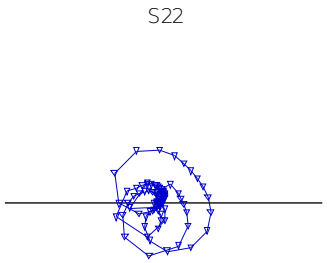
Simulation 3

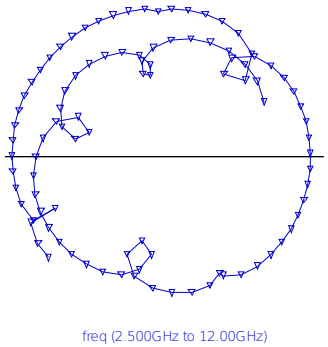
Date Simulation Done – 3/13/2008

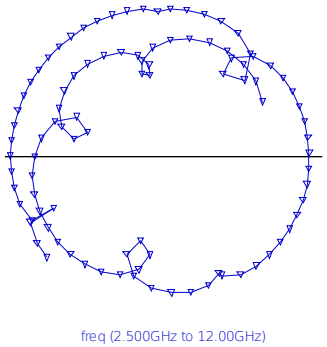










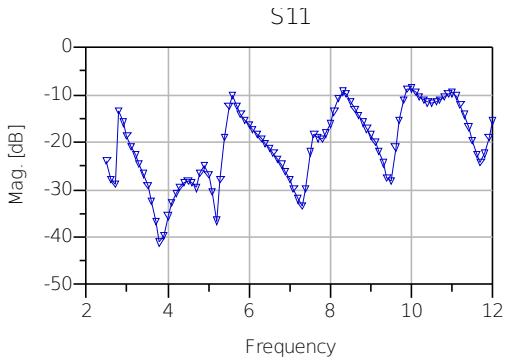


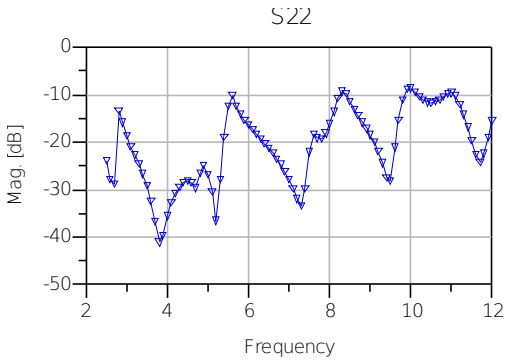
Simulation and Layouts

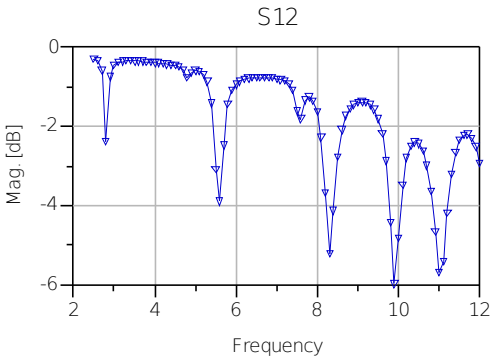
Simulation 3 – (cont.)

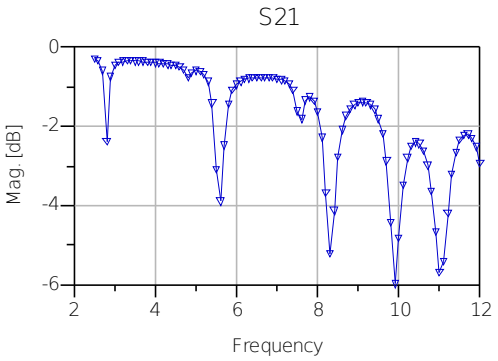
Simulation 3 thickness of copper with 1 oz., which is different to Simulations 1 and 2

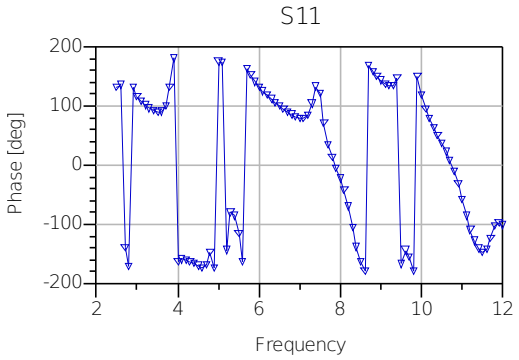
Simulation and Layouts

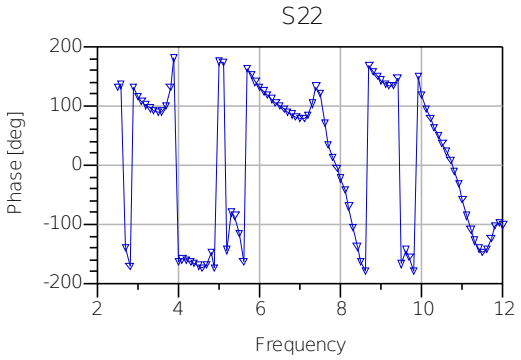






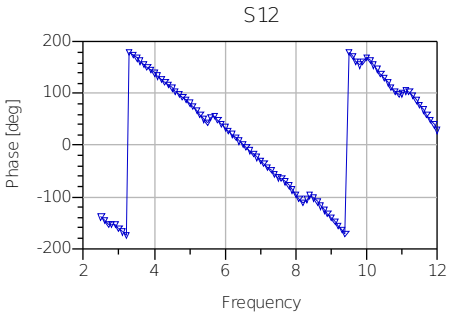


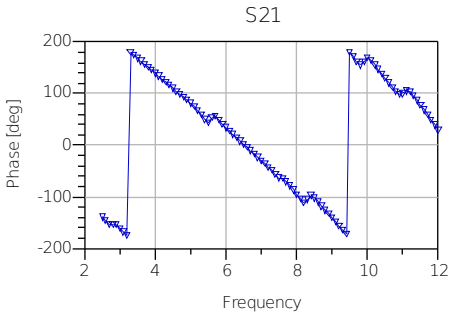


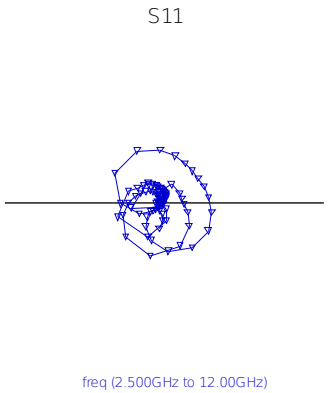


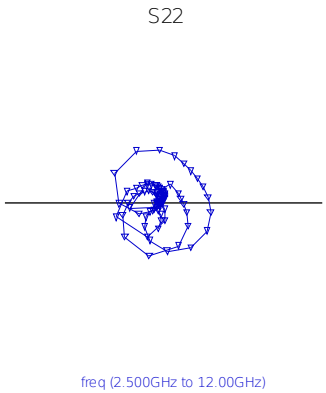
Simulation 4

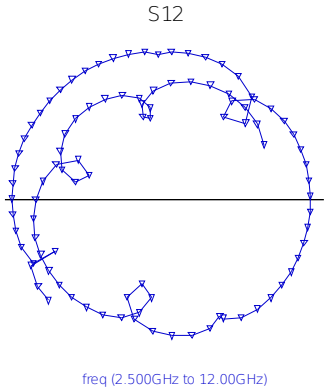
Date Simulation Done – 3/14/2008

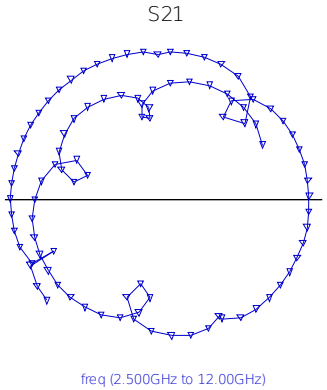












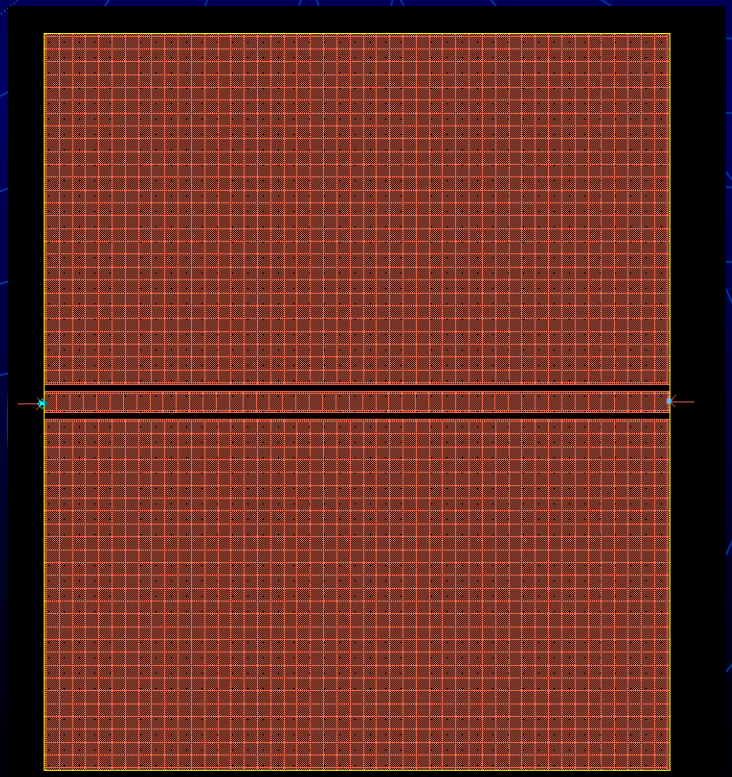
Simulation and Layouts

Simulation 4

Simulation 4 similar to Simulation 3 because only width and gap change.

Simulations and Layouts

- All Layouts look the same the same as the first one since the actual size is not being viewed.



Outline of Presentation

- Summary on Antennas and UWB
  - Introduction to Antennas
  - Introduction to UWB
- Deliverables Due during Fall Semester
- Updated Block Diagram
- Picture of Reference Antenna
- Changes to be Made to Reference Antenna
- EE 409 (RF Comm Lab) Labs
- Simulations and Layouts
- Updated Equipment List
- New Info from Cunningham Graphics
- Revised Tentative Schedule and Progress

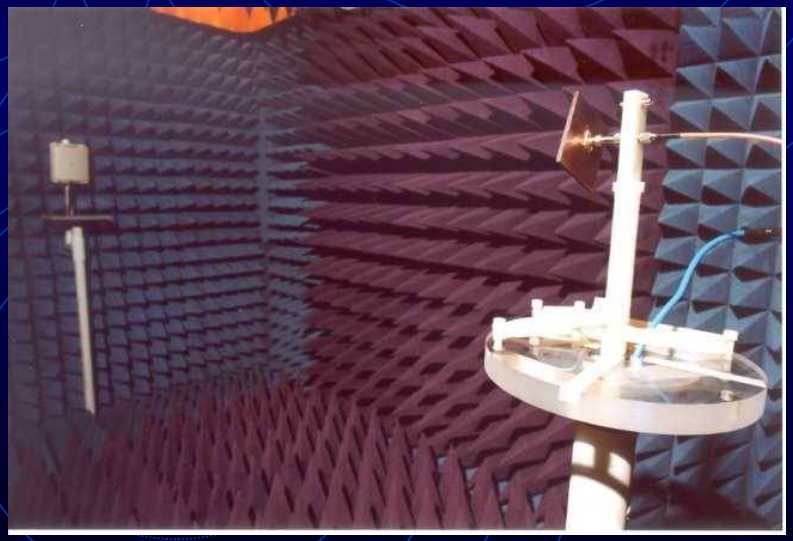
Equipment List

- Network analyzer - HP8722C or HP8410C
- Spectrum analyzer - HP8593E or HP8559A
- Signal generator - HPE4433B (May be used instead of Pulse Generator)
- Agilent Advanced Design System - ADS
- Sonnet 10.52 (Not Going to be Used! – Time Constraint)
- Anechoic Chamber
- Pulse Generator – HP8011A (New! – Possibility the Signal Generator)

Some Pictures of the Equipment

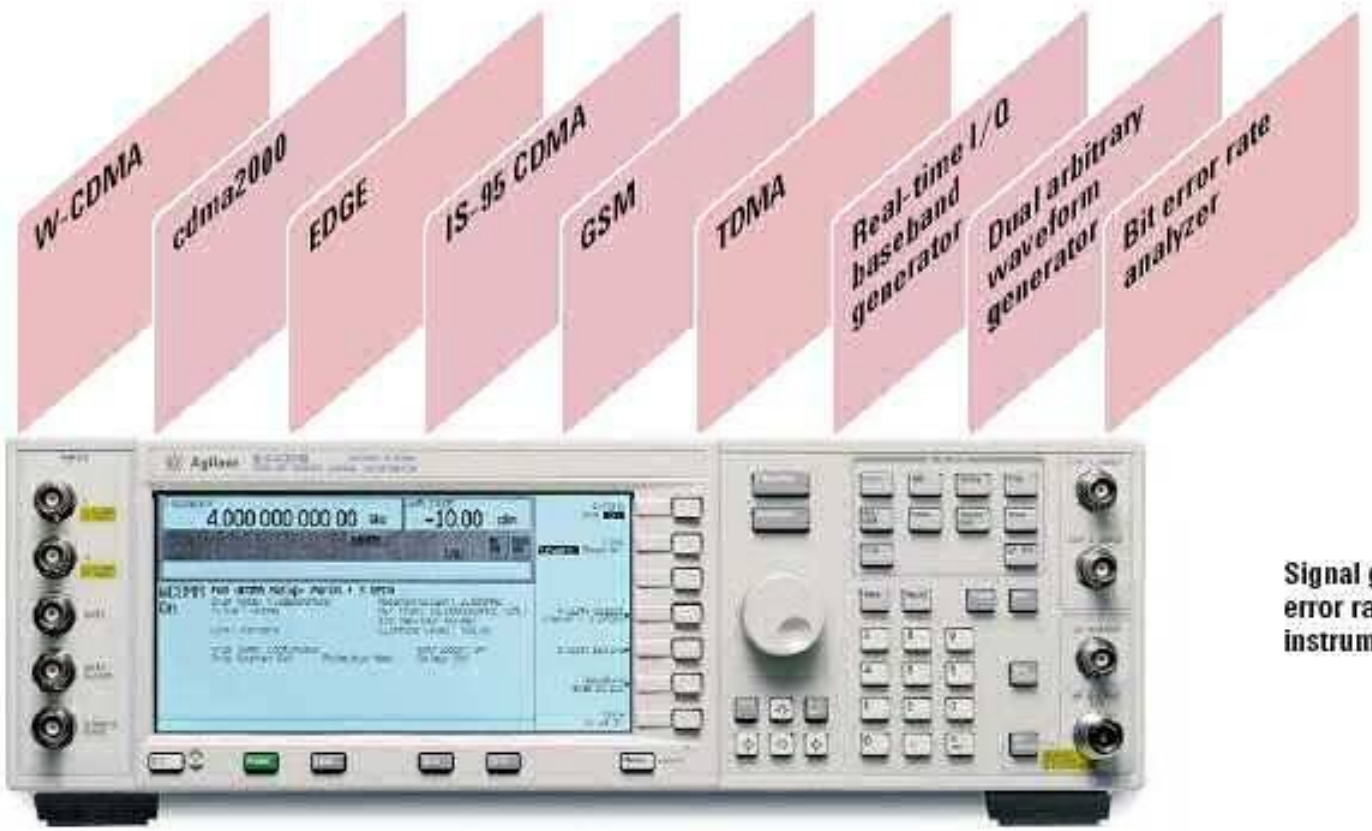
Spectrum Analyzer

Anechoic Chamber



Some Pictures of Equipment

Signal Generator



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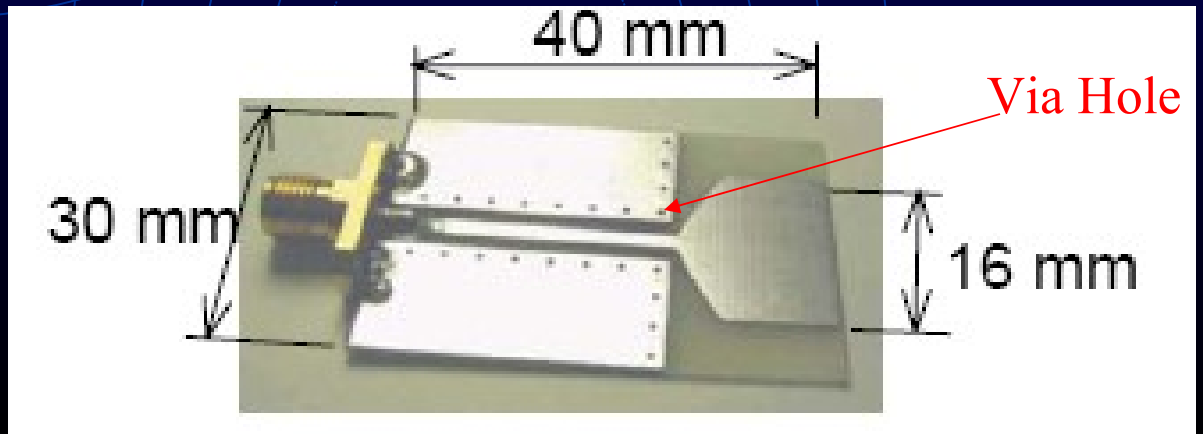
New Info from Cunningham Graphics

- Printed Circuit Board – 31 mil thickness
- 1 Oz. Copper thickness [Will increase due to electro-platting which was necessary due to via holes (platted-through holes)]
- Where antennas will be fabricated (with via holes)
- Via holes are used to connect the ground plate to upper conductor plate so it wouldn't create a T-line



New Info from Cunningham Graphics

- Telephone Conference with Bob Modica
- Possible Problem because of glass fiber amount
  - Each Company uses a different amount of glass fiber and epoxy
  - Just because the printed circuit board is a FR-4, does not mean it is exactly the same
  - Loss, dielectric constant can change

New Info from Cunningham Graphics

- From Cunningham Graphics, actual specs:
  - FR-4 Printed Circuit Board will have a 30 mil core, 4.6 dielectric constant, copper plating of 2.6 mil, 100 micro-inches of electroless nickel, 3-5 micro-inches of immersion gold
  - Fabrication Process 2 weeks
  - Fit 25-30 antennas on one sheet

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Tentative Schedule

Schedule for UWB Antenna Senior Project					
Week	**Date**	**Objective**		**% of Project**	**Completion**
Pre-work	14-Jan-08 to 18-Jan-08	Network Analyzer Lab (EE 409 Lab)		5.00%	100%
1	24-Jan-08	Obtain Reference Paper and Learn about Signal Generator		5.00%	100%
2	31-Jan-08	Learn about Signal Generator		4.00%	100%
3	7-Feb-08	ADS Lab (EE 409 Lab)		5.00%	100%
4	14-Feb-08	ADS Lab (EE 409 Lab)		5.00%	100%
5	21-Feb-08	Design and Simulate Coplanar Waveguide in ADS		5.00%	20%
6	28-Feb-08	Give Monthly Presentation and Build Many Antennas on a Microstrip		5.00%	0%
7	6-Mar-08	Build Many Antennas on a Printed Circuit Board		5.00%	0%
8	13-Mar-08	Build Many Antennas on a Printed Circuit Board		5.00%	0%
9	20-Mar-08	Spring Break		1.00%	0%
10	27-Mar-08	Build Many Antennas on a Printed Circuit Board		5.00%	0%
11	3-Apr-08	Antenna being Fabricated at Cunningham Graphics/Do EE 409 Labs		7.50%	0%
12	10-Apr-08	Antenna being Fabricated at Cunningham Graphics/Do EE 409 Labs		7.50%	0%
13	17-Apr-08	Testing and Recording (Anechoic Chamber)		7.50%	0%
14	24-Apr-08	Testing and Recording (Anechoic Chamber)		7.50%	0%
15	1-May-08	Final Report and Presentation		10.00%	0%
16	8-May-08	Final Report and Presentation		10.00%	0%
16	8-May-08	Project 100% Completed		100.00%	25%

Special Thanks

- Special thanks to Bob Modica (Cunningham)
- Suresh (Validus) and Bala (Validus)
- Divya (Grad Student)

Questions ?

- I’m sorry; you did not answer in the form of a question.