Ultra Wideband (UWB) Antenna Progress Report
January/February
By: Ross Stange
Advisor: Dr. Prasad Shastry
Bradley University
Outline of Presentation

- Summary on Antennas and UWB
  - Introduction to Antennas
  - Introduction to UWB
- 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.)

Ultra Wideband Communication

Time-domain behavior

1 0 1

Impulse Modulation
time

Frequency-domain behavior

3 10 GHz

(FCC Min=500 Mhz)

Narrowband Communication

Frequency Modulation

0 1 0 1

2.4 GHz
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Updated Block Diagram

Transmitter (Signal Generator)

Receiver (spectrum analyzer)

Coaxial Connector

Coplanar Waveguide

Radiating Part

Air

Coaxial Connector

Coplanar Waveguide
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Reference Antenna

- Picture of a Monopole Antenna [Left = Final (Optimized) Result] [Right = Initial Set-Up]
- Final Values: $\theta = 63^\circ$  $B = 16\ mm$  $A = 15\ mm$
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Changes to be Made to Reference Antenna

• Reference Antenna to be designed first
  \(\forall \theta = 63^\circ\) (Original Value)
  • Will be changed to 0°, 30°, 45°, and 75°.

• Change shape of Coplanar Waveguide
  • Trapezoidal (Angle = 90 - \(\theta\))

• 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
Fri Feb 22 2008 - Dataset: cpwg_mom_a

Simulation and Layouts

- **S11**
- **S22**
- **S12**
- **S21**
- **S11**
- **S22**
Simulation and Layouts

Simulations have bad data. Need to re-simulate
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Equipment List

• Network analyzer - HP8722C or HP8410C
• Spectrum analyzer - HP8593E or HP8559A
• Signal generator - HPE4433B (May be used)
• Agilent Advanced Design System - ADS
• Sonnet 10.52 (Not Going to be Used! – Time Constraint)
• Anechoic Chamber
• Agilent VEE pro (Not Going to be Used!)
• Pulse Generator – HP8011A (New! – Possibility the Signal Generator)
Some Pictures of 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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• Revised Tentative Schedule and Progress
## Tentative Schedule

### Schedule for UWB Antenna Senior Project

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Objective</th>
<th>% of Project</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre-work 14-Jan-08 to 18-Jan-08 Network Analyzer Lab (EE 409 Lab)</td>
<td>5.00%</td>
<td>100%</td>
</tr>
<tr>
<td>1</td>
<td>24-Jan-08</td>
<td>Obtain Reference Paper and Learn about Signal Generator</td>
<td>5.00%</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>31-Jan-08</td>
<td>Learn about Signal Generator</td>
<td>4.00%</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>7-Feb-08</td>
<td>ADS Lab (EE 409 Lab)</td>
<td>5.00%</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>14-Feb-08</td>
<td>ADS Lab (EE 409 Lab)</td>
<td>5.00%</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>21-Feb-08</td>
<td>Design and Simulate Coplanar Waveguide in ADS</td>
<td>5.00%</td>
<td>20%</td>
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<tr>
<td>6</td>
<td>28-Feb-08</td>
<td>Give Monthly Presentation and Build Many Antennas on a Microstrip</td>
<td>5.00%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>6-Mar-08</td>
<td>Build Many Antennas on a Microstrip</td>
<td>5.00%</td>
<td>0%</td>
</tr>
<tr>
<td>8</td>
<td>13-Mar-08</td>
<td>Build Antennas and Send Antennas Out to Fabricated and Do Antenna Testing Lab (EE 409 Lab)</td>
<td>5.00%</td>
<td>0%</td>
</tr>
<tr>
<td>9</td>
<td>20-Mar-08</td>
<td>Spring Break</td>
<td>1.00%</td>
<td>0%</td>
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<tr>
<td>10</td>
<td>27-Mar-08</td>
<td>Testing and Recording (Anechoic Chamber)</td>
<td>7.50%</td>
<td>0%</td>
</tr>
<tr>
<td>11</td>
<td>3-Apr-08</td>
<td>Testing and Recording (Anechoic Chamber)</td>
<td>7.50%</td>
<td>0%</td>
</tr>
<tr>
<td>12</td>
<td>10-Apr-08</td>
<td>Possible Design Changes</td>
<td>5.00%</td>
<td>0%</td>
</tr>
<tr>
<td>13</td>
<td>17-Apr-08</td>
<td>Send Design Changes to be Fabricated</td>
<td>7.50%</td>
<td>0%</td>
</tr>
<tr>
<td>14</td>
<td>24-Apr-08</td>
<td>Testing and Recording (Anechoic Chamber)</td>
<td>7.50%</td>
<td>0%</td>
</tr>
<tr>
<td>15</td>
<td>1-May-08</td>
<td>Final Report and Presentation</td>
<td>10.00%</td>
<td>0%</td>
</tr>
<tr>
<td>16</td>
<td>8-May-08</td>
<td>Final Report and Presentation</td>
<td>10.00%</td>
<td>0%</td>
</tr>
<tr>
<td>16</td>
<td>8-May-08</td>
<td>Project 100% Completed</td>
<td>100.00%</td>
<td>25%</td>
</tr>
</tbody>
</table>
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.