A COST-EFFECTIVE ANTENNA POSITIONING SYSTEM FOR MODERN RADIO-FREQUENCY (RF) AND MICROWAVE ANTENNA MEASUREMENTS

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Topics

- Introduction and Background
- Motivation
- Topology of the Measurement System
- Measurement Steps and Cost
Introduction and Background

- Started with an upgrade to the microwave laboratory at NDSU.
- An Agilent E5071C 8.5 GHz ENA Network Analyzer was purchased.
- This required the development of an antenna measurement system (AMS).
- A design team was assembled to develop the AMS system.
- The AMS is about 10% the cost of commercially available systems.
Motivation

- Education
  - Senior design project – controls and wireless
  - Antenna course
  - Microwave engineering course
  - Computational electromagnetics
- Research – Radiation pattern
  - Wireless communications
  - Printed antennas and arrays
Topology

Three main components

Antenna positioner
Network analyzer
Computer
Topology
Antenna Positioner: Hardware

(control belt)

(servo and collar)
Topology

Network Analyzer: Hardware

(anechoic chamber)
Topology

Computer : Hardware

(transmitter)  (IR boards)  (receiver)

Data from PC to positioner
Topology

Computer : Software

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Some initial results:
Measurements and Cost

- **Budget**: $750
- **Measurement steps**:
  - Power-up and record values from analyzer
  - Rotate positioner
  - Wait and record value from analyzer
  - Rotate positioner
  - Wait and record value from analyzer…etc.
  - When finished, display results
Questions

Thank you for listening!
Appendix

Transmitter schematic
Appendix

Receiver schematic
Appendix

Transmitter circuit contains the following components:

(2) LED indicators
(7) 4.77µF capacitors
(4) 1kΩ resistors
(2) push button
(1) MC33063A voltage regulator
(1) MCP2120 IrDA driver
(1) 10kΩ TrimPot
(1) 100kΩ TrimPot
(1) PIC18F242-I
(2) 40MHz Crystals
Appendix

Receiver circuit contains the following components:

- (2) LED indicators
- (14) 4.77µF capacitors
- (4) 1kΩ resistors
- (2) 10kΩ resistors
- (1) 100kΩ resistor
- (4) push button
- (1) MC33063A voltage regulator
  - (1) MCP2120 IrDA driver
  - (1) 10kΩ TrimPot
  - (1) 100kΩ TrimPot
- (1) Pololu Micro-Controler SSC03A
  - (1) MAX232A RS-232 driver
    - (1) PIC18F242-I
  - (2) 32.768kHz Crystals
Appendix

IR board schematic

Parts:
(2) 1kΩ resistors
(2) 4.7µF capacitors
(2) TFDU4101 Vishay Infrared Transceivers
(1) 4 pin header to connect to transmitter or receiver