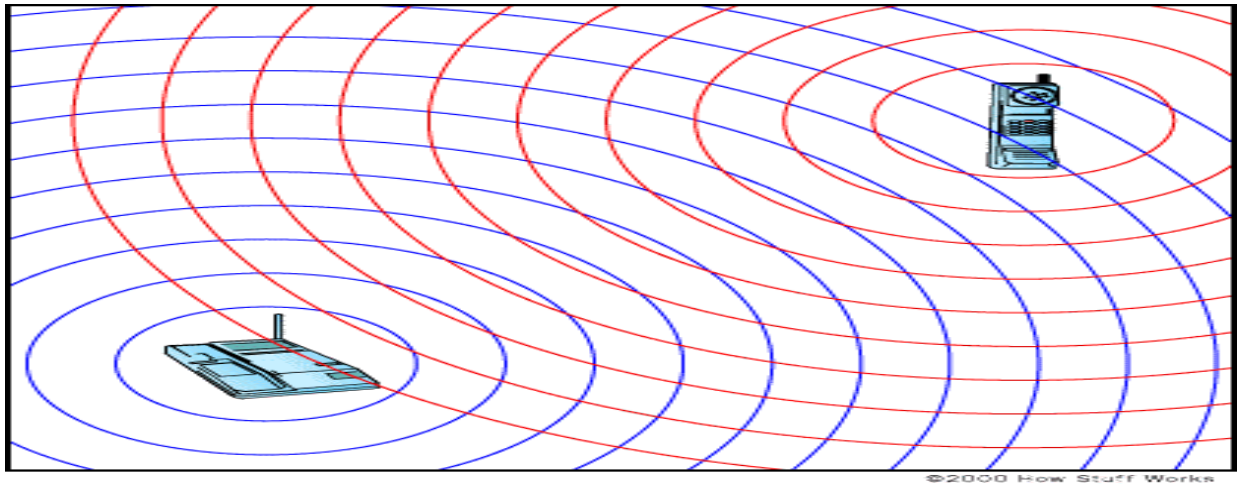
Circularly Polarized Microstrip Antenna for Cordless Phones



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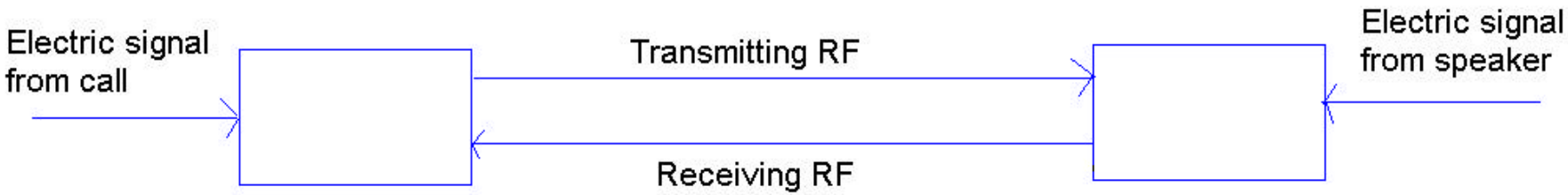
Date: June 06,2002

UCR Electrical Engineering

HISTORY OF PROBLEM



- Cordless phones require two frequencies to operate
- Bandwidth is becoming increasingly expensive
- Eliminate bandwidth = decrease cost

PROJECT

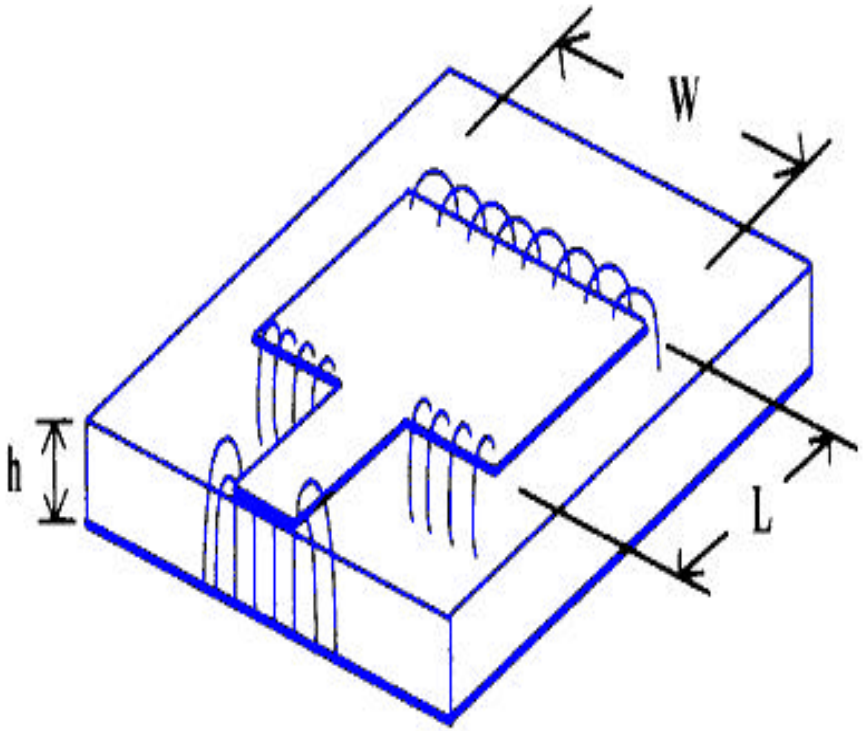
Create a microstrip antenna that can be used to minimize bandwidth usage of cordless phones through the use of orthogonal polarizations.

Specifications:

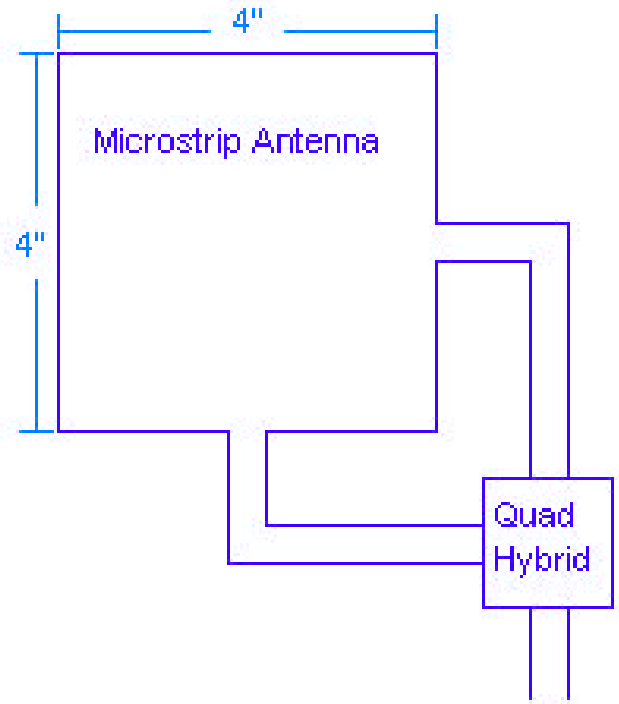
- Frequency made for phones
  * 900 MHz
- Bandwidth made for voices
  * 30 KHz
- Must fit on phone
  * 2” x 6” x .132”
- Must be affordable
- Polarizationally Pure

POSSIBLE SOLUTIONS

- Antenna Type:
  * Cost, ease of fabrication
- Patch shape:
  * Analysis ease
- Substrate Choice
  * Polarization purity
- Feed Type:
  * Size, ease of fabrication

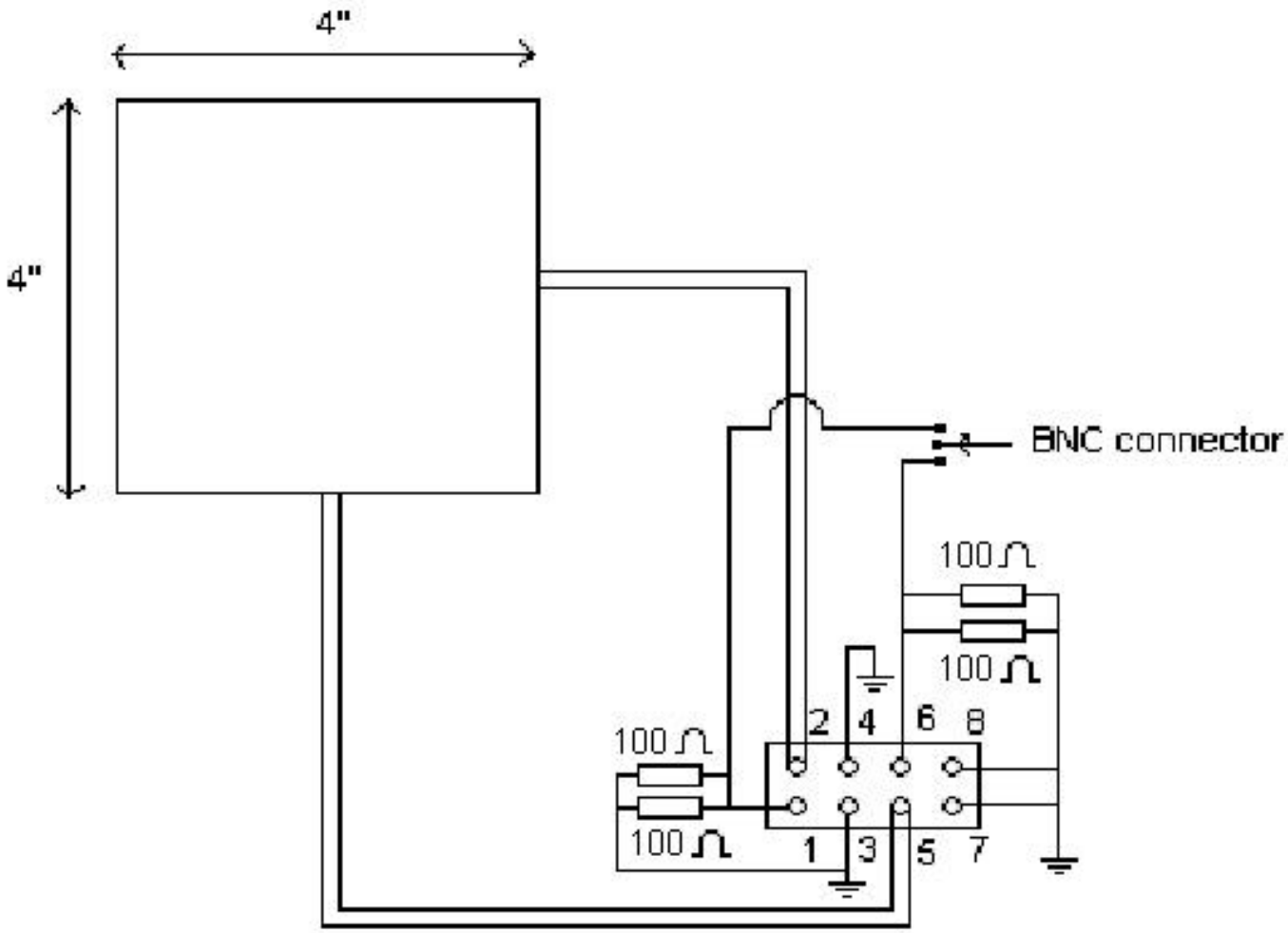


THE SOLUTION

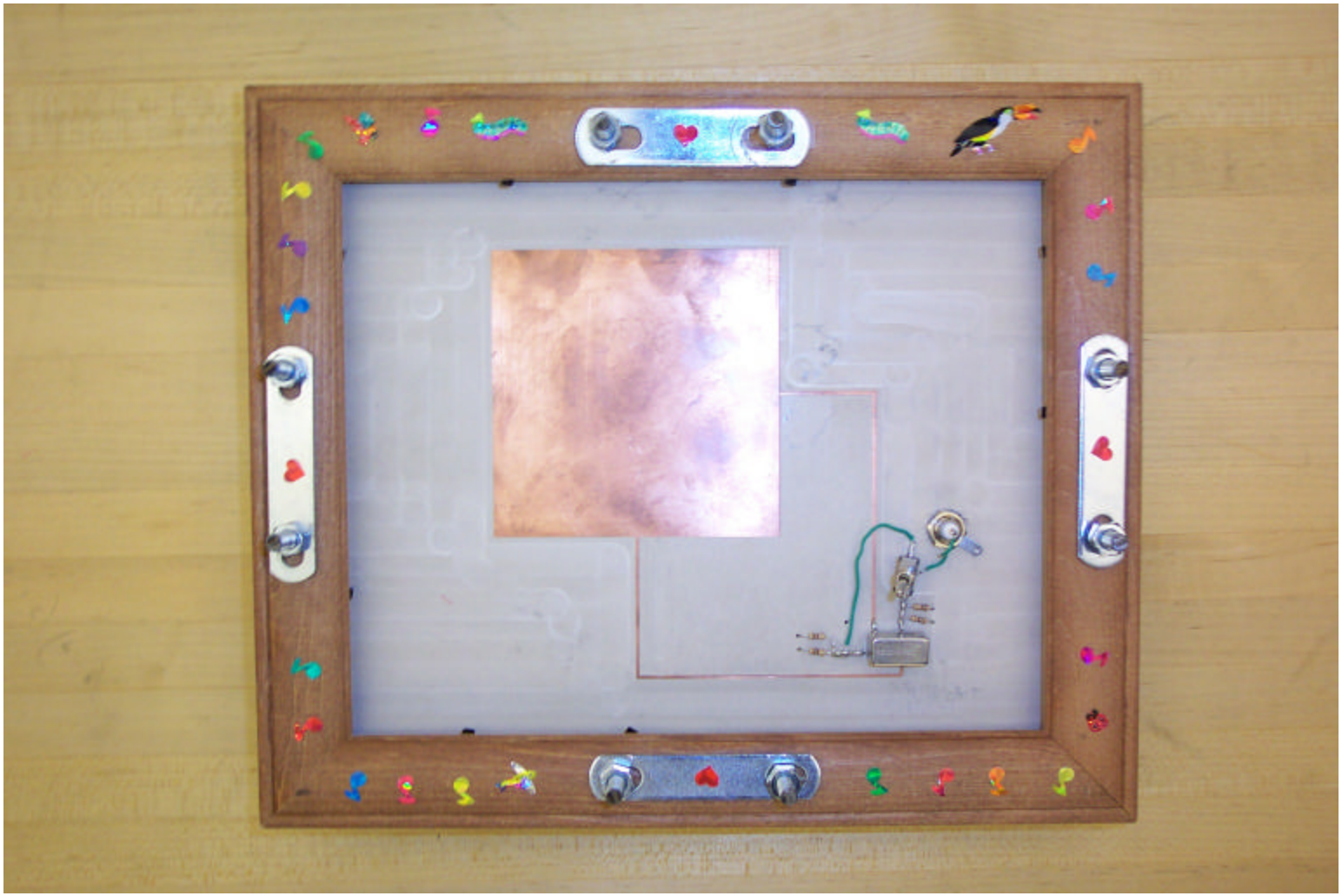


- Antenna Type:
  * Microstrip
- Patch Shape:
  * Square
- Substrate Choice:
  * RO3010
- Feed Type:
  * Microstrip Line
  * Dual Orthogonal Feed Scheme

HARDWARE DESIGN



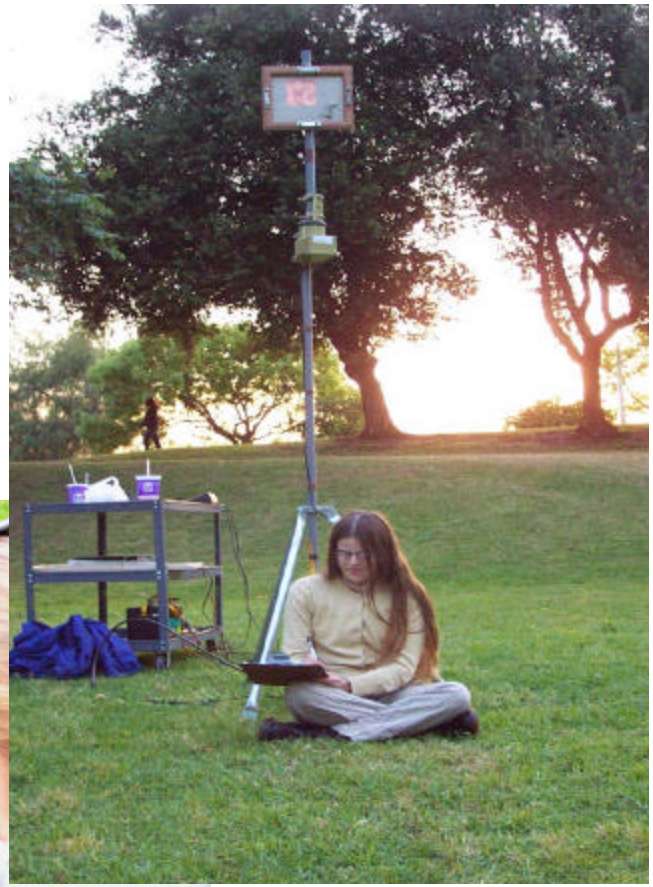
FINAL DESIGN



BUDGETS AND MATERIAL

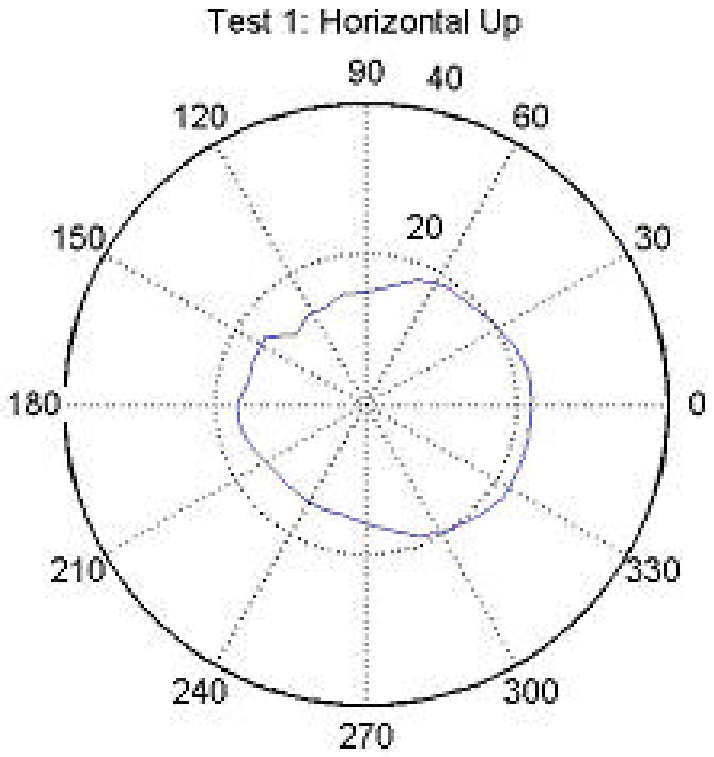
Materials	Cost of Test
Substrate Boards	$0
Quadrature Hybrid	$0
Administrative	$3.60
Resistors	$0.02
On-On Switch	$3.00
BNC Connector	$3.00
Frame	$3.99
U-Bolts	$4.00
Sum	**$17.61**

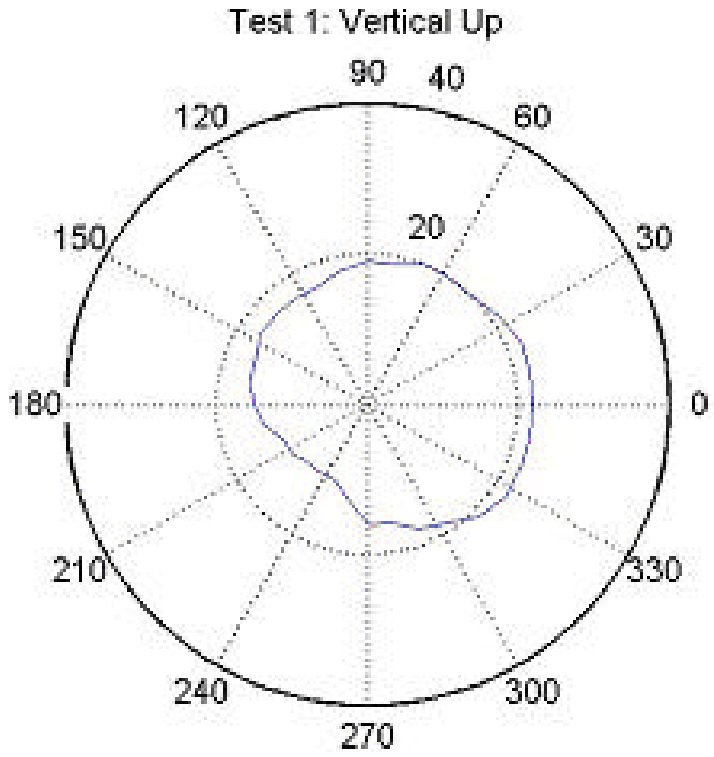
TESTING



RESULTS

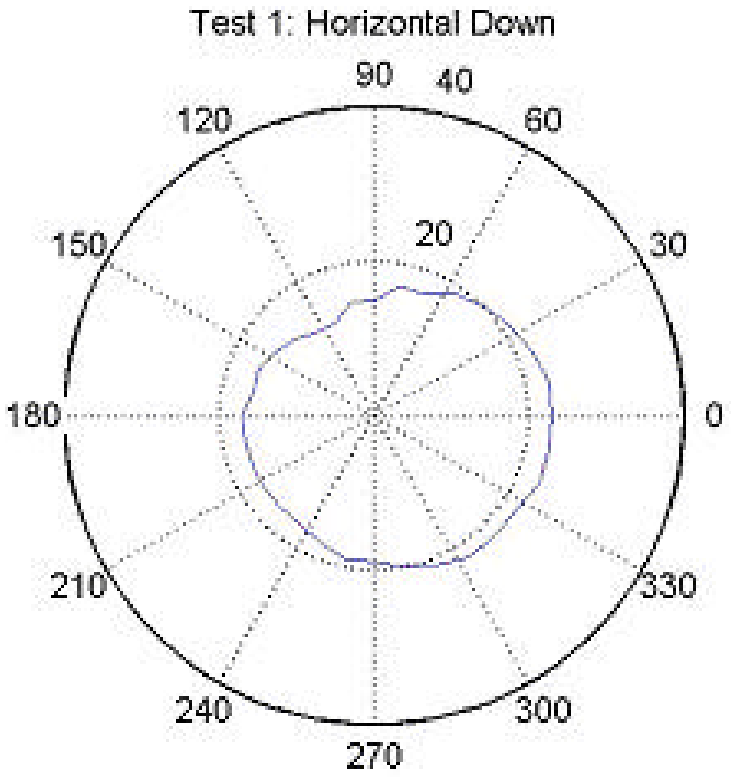
Radiation Pattern of Right Handed Circularly Polarized Antenna

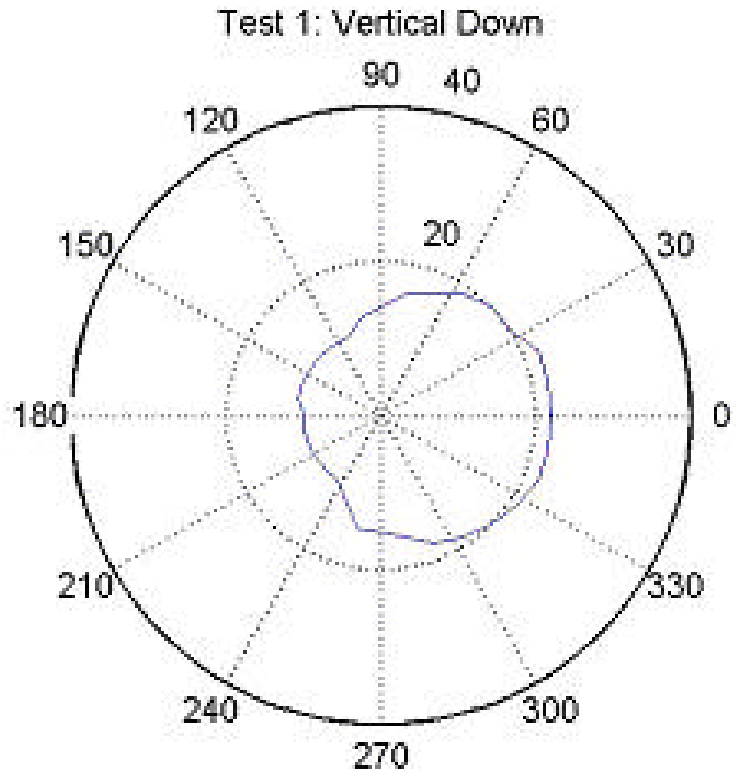




RESULTS

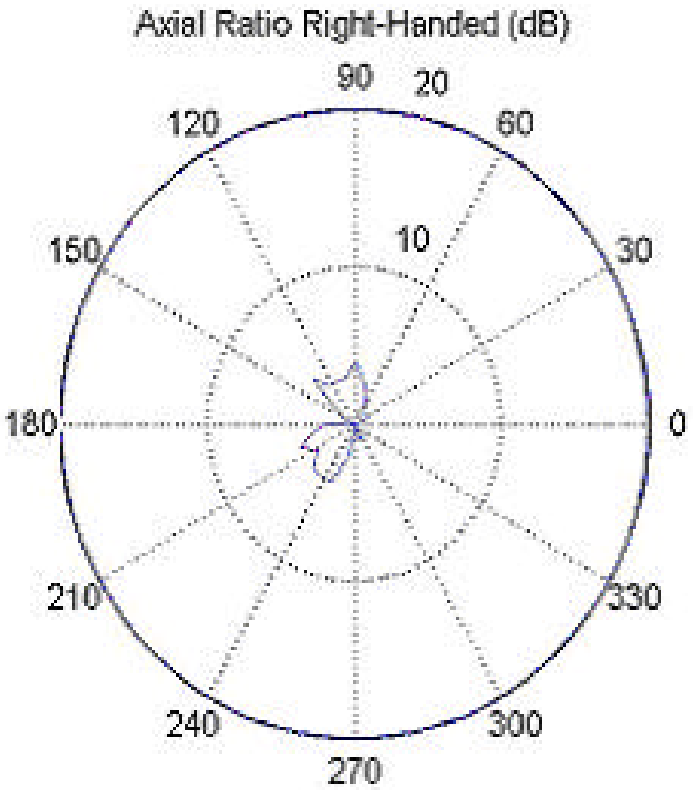
Radiation Pattern of Left Handed Circularly Polarized Antenna

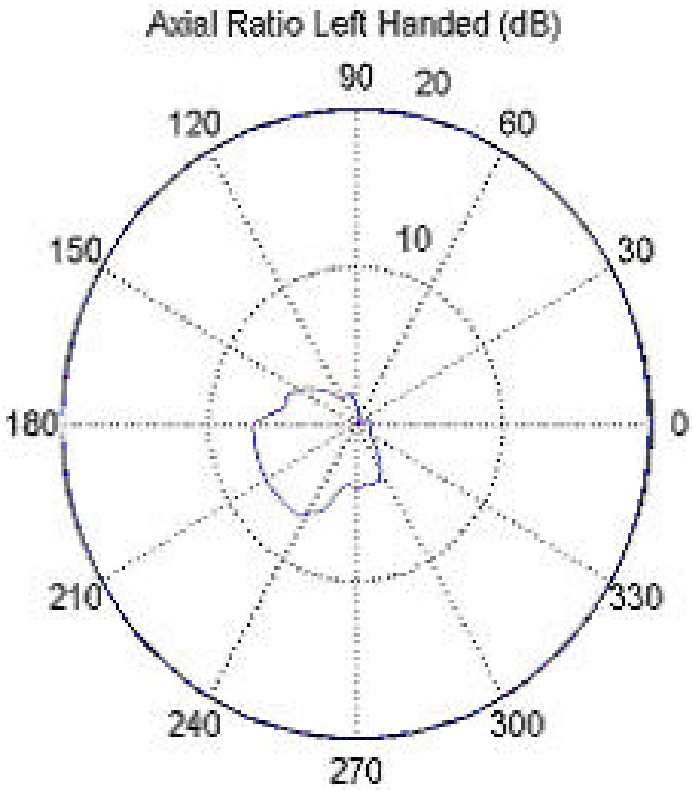




DISCUSSION OF RESULTS

Axial ratios of right and left handed circular polarizations





NUMERICAL RESULTS

			1/2 Power Beamwidth (degrees)	Directivty	Axial Ratio Range (dB)
Test 1	R-Handed	Horizontal	101.25	2.59	0-4
		Vertical	123.75		
	L-Handed	Horizontal	112.5	2.84	0-7
		Vertical	101.25		
Test 2	R-Handed	Horizontal	123.75	2.59	1-19
		Vertical	101.25		
	L-Handed	Horizontal	213.75	1.92	0-11
		Vertical	78.75		
Test 3	R-Handed	Horizontal	78.75	3.66	0-8
		Vertical	112.5		
	L-Handed	Horizontal	123.75	2.12	0-9
		Vertical	123.75		

AREAS OF IMPROVEMENT

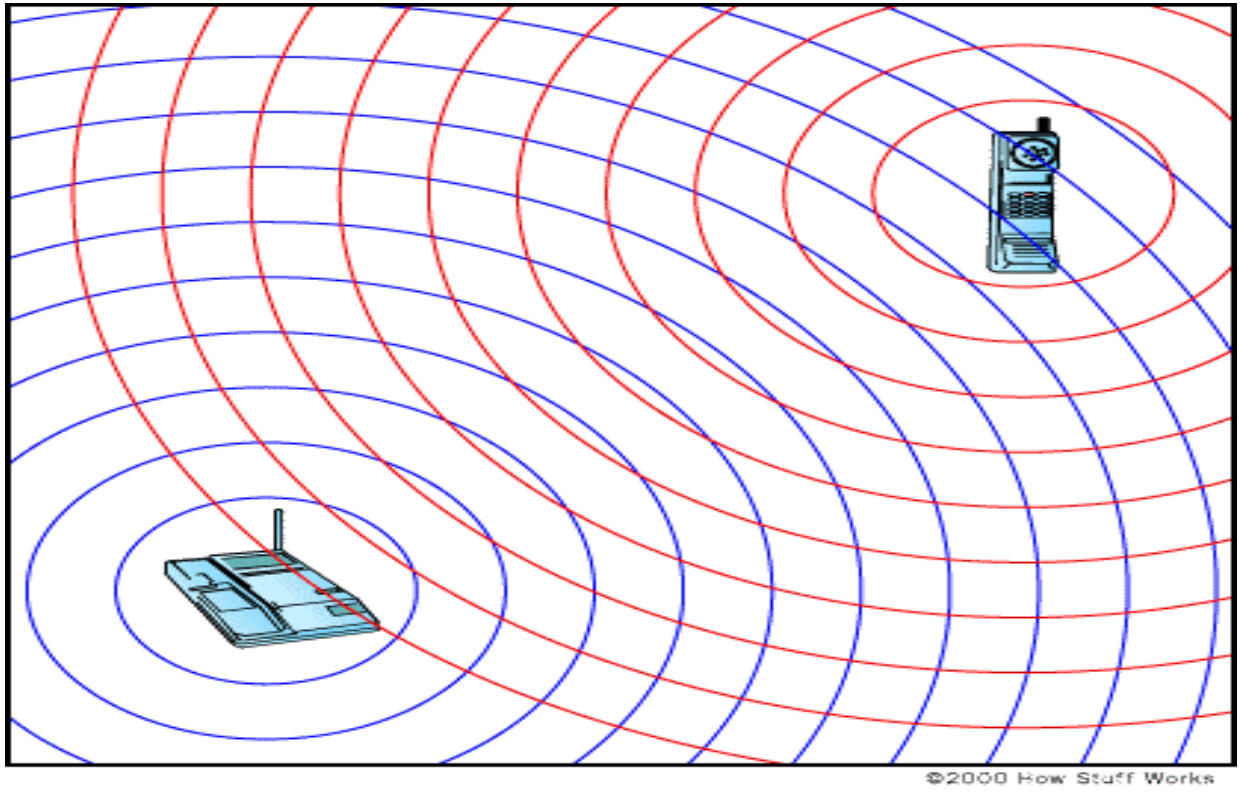
- Addition of insets around feed lines
  * Improve impedance matching
- Rotate antenna around axis horizontal to ground
  * Get better picture of axial ratio
- Try new test location
  * Eliminate error
- Use transmitter with circular polarization
  * Test receiving circular polarization
- Bandwidth measurements

CONCLUSION

In conclusion, most of our specifications were met

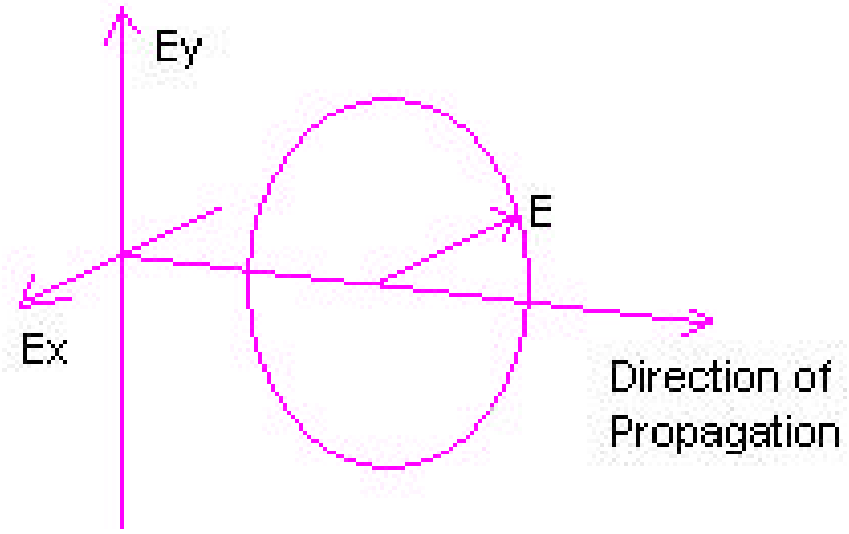
- The prototype was tested at 450 MHz
  * Could easily be scaled to 900 MHz and up
- Would fit on phone after frequency scaling
- Affordable
- Polarizationally pure
  * Changes with angle, but for the most part relatively pure

QUESTIONS???



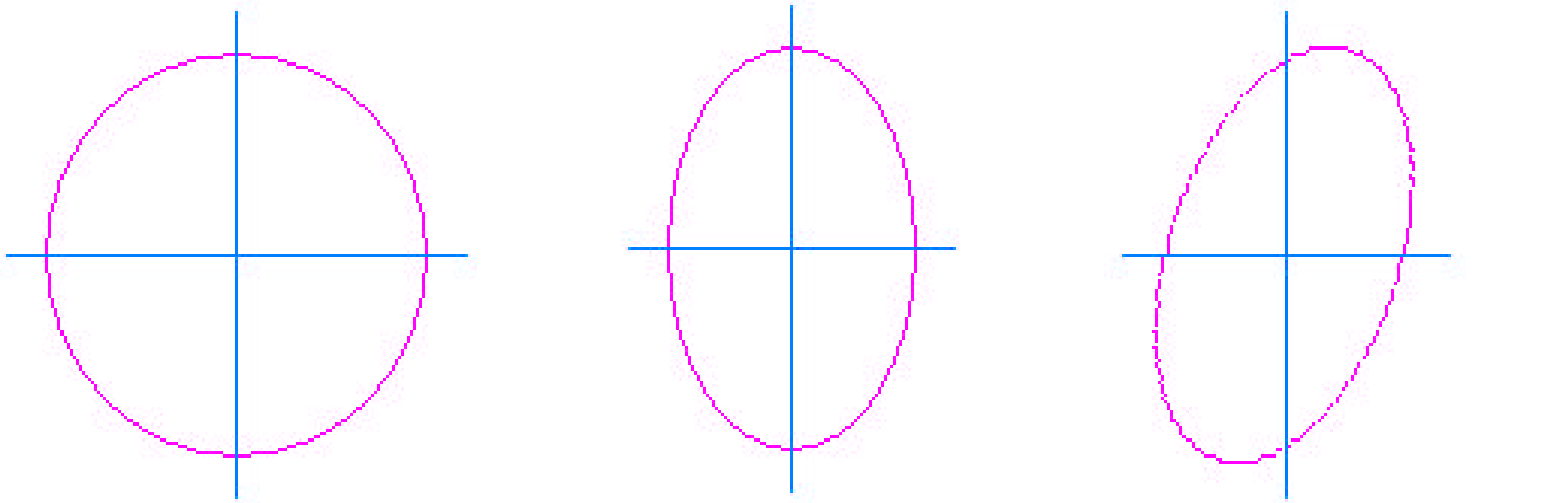
WHAT IS POLARIZATION?

- The tip of the *electric field* at a given point in time.
  - * Ey Versus Ex at any given point when Ez is held constant
- $Ex^2 + Ey^2 = E^2$
- If the tip of the electric field traces a circle the wave is said to be *circularly polarized*.
  - * Happens when Ey and Ex have equal magnitude
- Back



WHAT IS AXIAL RATIO?

- Axial Ratio describes polarization purity
- AR = $V_{major\ axis}$ /$V_{minor\ axis}$
- AR(dB) = difference in radiation patterns
- Back



a) axial ratio = 0 dB b) axial ratio > 0 dB c) axial ratio ≠ measured ratio