100 – 1000 MHZ AMATEUR RADIO ANTENNA

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BayCon
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AA6PZ – Amateur Ratio

Continuously licensed since 1963

Passed 20 wpm for Extra Exam using the FCC examiner's straight key

Published articles include:

Computerized Contest Duplicate Checking, QST

Build the AA6PZ Power Charger, QST , ARRL Handbook

Handi-Antennas Ham Radio May 1983

AA6PZ – Career

MSEE, Purdue University

29 years designing microwave test equipment for Hewlett Packard

Currently independent consultant for medical and scientific devices

Chairman of local chapter of Antennas and Propagation Society of IEEE

AA6PZ – Amateur Ratio

Conducted license classes

Taught Radio Merit Badge for Boy Scouts

Booth duty at Maker Faire.

If you do one new thing with ham radio this year, make it sharing our hobby!

Antenna Philosophy

I've always thought that antennas were fun projects because typically all you needed was wire and insulators. You don't have to round up a bunch of different resistors and IC's of various types and values.

I used to think that "bigger was better". If it didn't occasionally blow down, it wasn't big enough. That was before moving to California and our small lots that don't have room for an antenna to fall down "safely."

My first HT circa 1980 was a TR-2800. It was literally the size of a brick.

There weren't many existing antennas, besides the rubber duck. And we all know those are not very efficient.

THERE WAS A LOT OF EXPERIMENTATION WITH ANTENNAS

- Telescoping whips
- Counter-poise wires to hang down
- DIY mag mounts
- Roll up wire antennas with suction cups to mount on hotel windows
- Beams that were easy to disassemble or fold up when not in use.

AND OTHER ACCESSORIES

The AA6PZ Power Charger

The battery charger shown in Figs. 52 through 58 combines the best features of constant-current and constant-voltage NiCd chargers. This charger was originally described by Paul Zander, AA6PZ, in December 1982 *QST*.

The Power Charger

As shown in Fig. 53, when the battery voltage is low, the current available from the charger is high enough to keep the transmitter on the air. As the battery voltage increases, the charging current decreases in order to avoid overcharging the battery. Finally, as the battery approaches full charge the current tapers off more slowly with increasing voltage. This action provides a topping-off charge with ... latitude for variations in battery

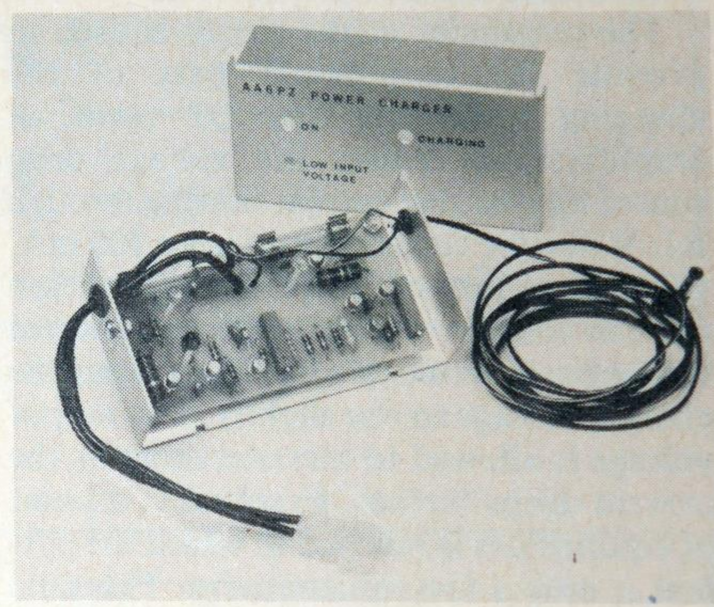


Fig. 52 — Interior view of the Power Charger. The three LEDs are mounted on long leads so they protrude through the top cover.

I bought the Kenwood TH-D74 which is a tri-band HT.

I expected I could just buy a tri-band antenna to use with it.

I had previously operated bicycle mobile using a 2 meter J-pole. For a single band, I think that is still the best bicycle mobile antenna.

Ed Fong's 3-band antenna was too tall and too fragile for bicycles.

Scarcity of other choices.

Time to make something new.

SURVEY OF POSSIBLE ANTENNAS

J-Pole

J Pole Antennas

- Don't depend on a metal ground plane.
- I have used 2 meter J Pole for bicycle mobile. It worked well.
- The 3-band J Pole is almost 8 feet tall.
- NOT practical for mobile operation.

SURVEY OF POSSIBLE ANTENNAS

J-Pole

Log Periodic

LOG PERIODIC ARRAY ANTENNAS

LOG PERIODIC ARRAY ANTENNAS

- Can be designed to have gain and matching that is flat over a very wide frequency range.
- Can have high gain and are therefore directional.
- Possibly a little “big” for portable operation.

SURVEY OF OTHER ANTENNAS

J-Pole

Log Periodic

Discone

DISCONE ANTENNAS

It is widely believed that the discone antenna works equally well at all frequencies over wide range.

BUT that is not correct.

The discone is really a variation of a dipole antenna that is fed off-center.

One side is a disk; the other is a cone.

There are resonances in the response, and they are much broader than a dipole made from thin wires.

DISCONE ANTENNAS

The elements can be either sheet metal or a series of rods.

8 rods are “probably” enough.

The lowest useful frequency is determined by the physical size.

The highest frequency is typically limited by the details of connecting the disc and cone.

In between there are a series of resonant frequencies, some with reasonable impedance match.

DISCONE ANTENNAS

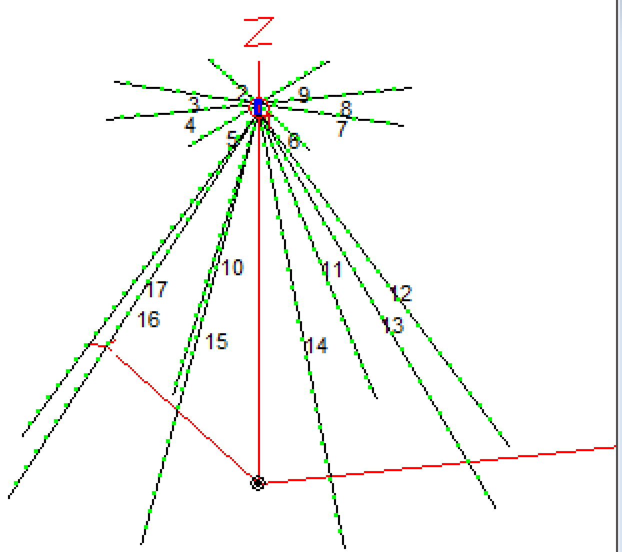
After much computer simulation, the “best” dimensions for 144, 222 and 440 MHz were:

Flat rods: 11” long

Sloped rods: 32” long

Slope: 35 degrees

DISCONE ANTENNAS



Wires

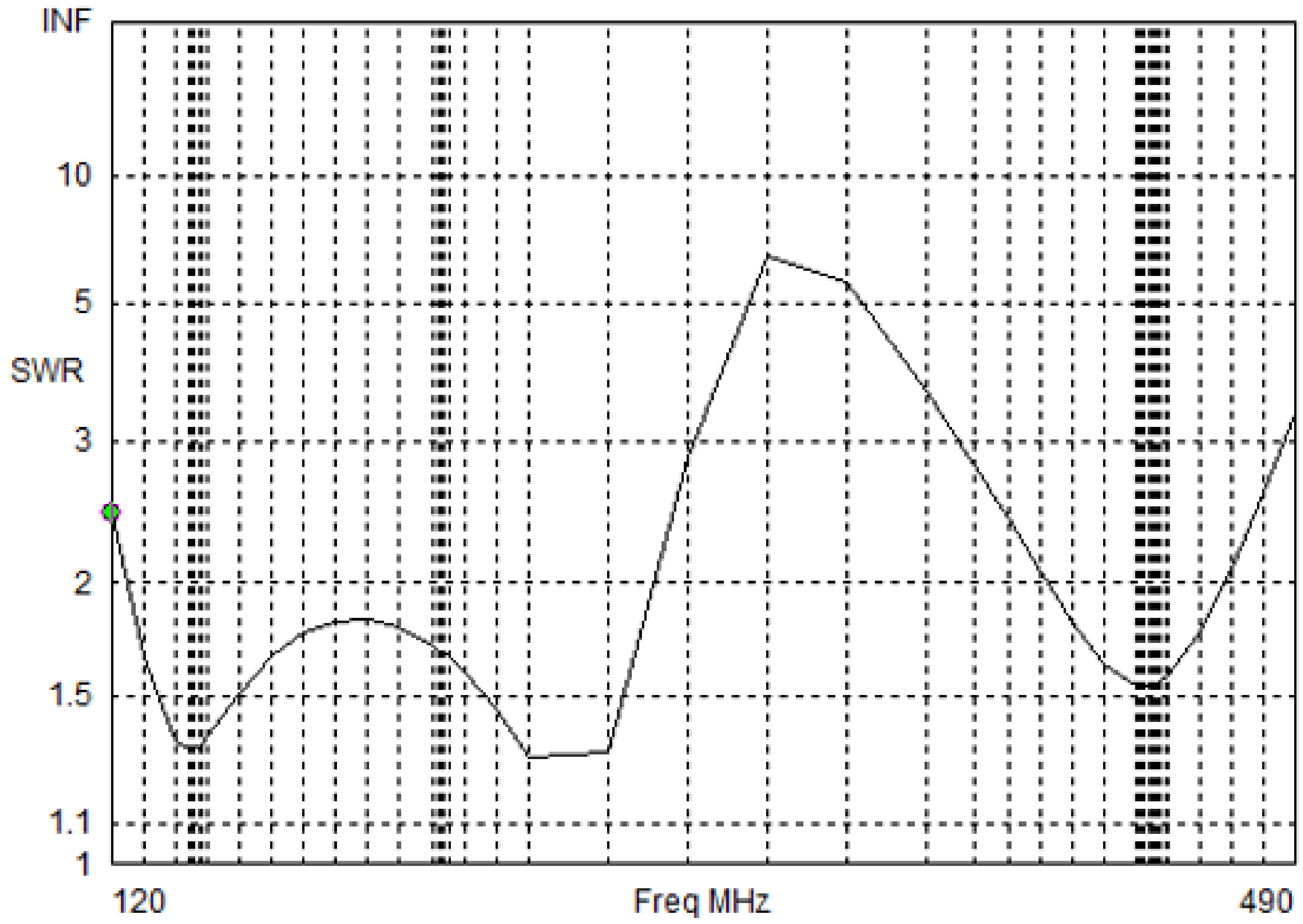
Wire Create Edit Other

☐ Coord Entry Mode ☐ Preserve Connections ☐ Show Wire Insulation

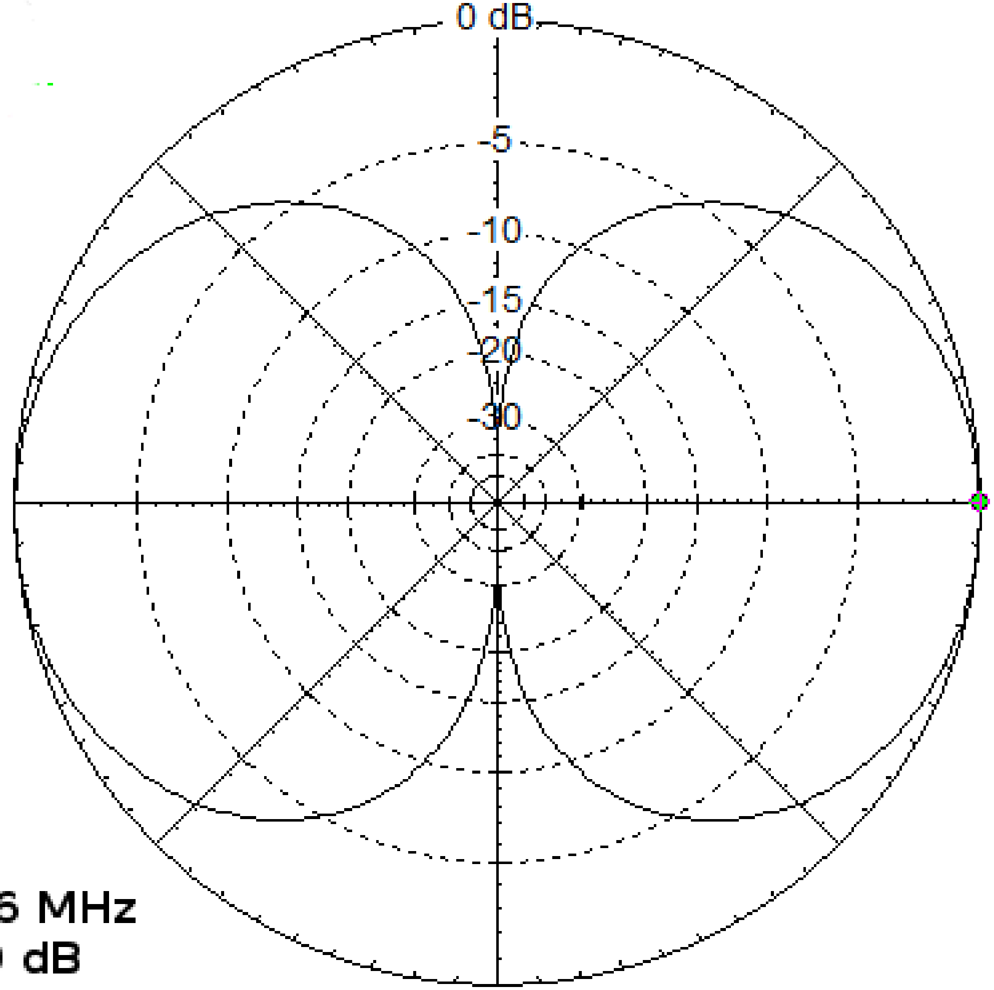
Wires

No.	End 1				End 2			
	X (in)	Y (in)	Z (in)	Conn	X (in)	Y (in)	Z (in)	Conn
1	0	0	26.9886	W10E1	0	0	27.5284	W2E1
2	0	0	27.5284	W3E1	0	11.1949	27.5284	
3	0	0	27.5284	W4E1	-7.91598	7.91598	27.5284	
4	0	0	27.5284	W5E1	-11.1949	0	27.5284	
5	0	0	27.5284	W6E1	-7.91598	-7.91598	27.5284	
6	0	0	27.5284	W7E1	0	-11.1949	27.5284	
7	0	0	27.5284	W8E1	7.91598	-7.91598	27.5284	
8	0	0	27.5284	W9E1	11.1949	0	27.5284	
9	0	0	27.5284	W1E2	7.91598	7.91598	27.5284	
10	0	0	26.9886	W11E1	0	18.3415	0.788068	
11	0	0	26.9886	W12E1	12.9761	12.9761	0.788068	
12	0	0	26.9886	W13E1	18.3415	0	0.788068	
13	0	0	26.9886	W14E1	12.9761	-12.9761	0.788068	
14	0	0	26.9886	W15E1	0	-18.3415	0.788068	
15	0	0	26.9886	W16E1	-12.9761	-12.9761	0.788068	
16	0	0	26.9886	W17E1	-18.3415	0	0.788068	
17	0	0	26.9886	W1E1	-12.9761	12.9761	0.788068	

DISCONE ANTENNAS

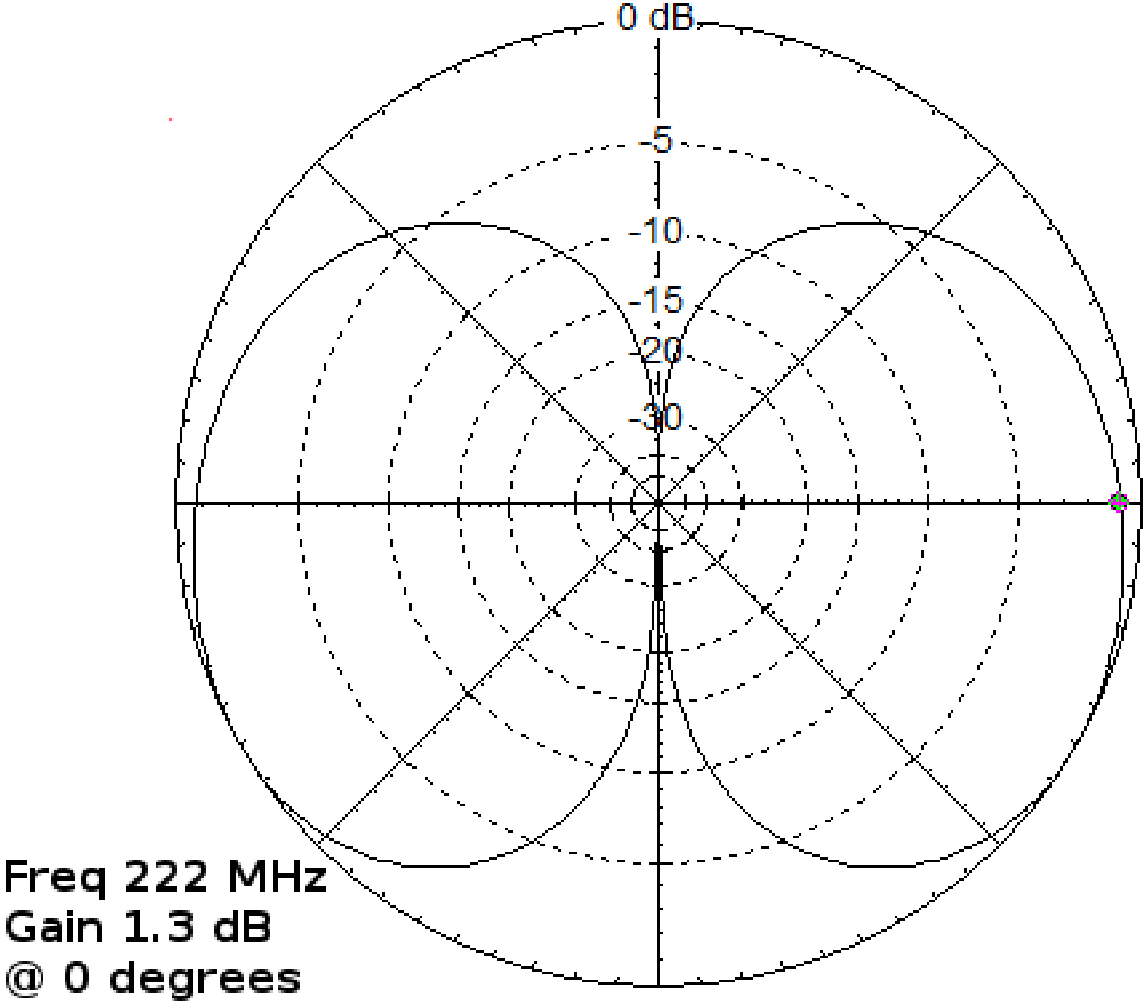


DISCONE ANTENNAS

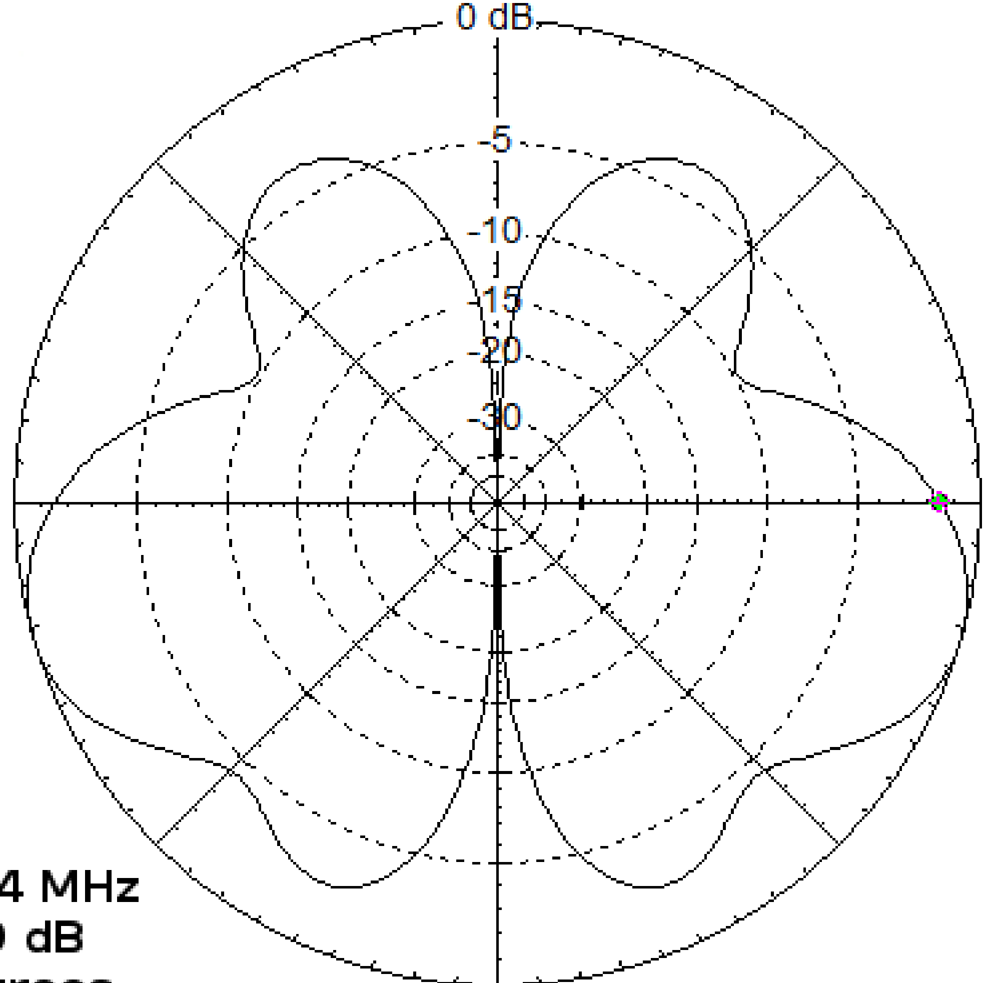


Freq 146 MHz
Gain 2.0 dB
Elevation 0 deg

DISCONE ANTENNAS

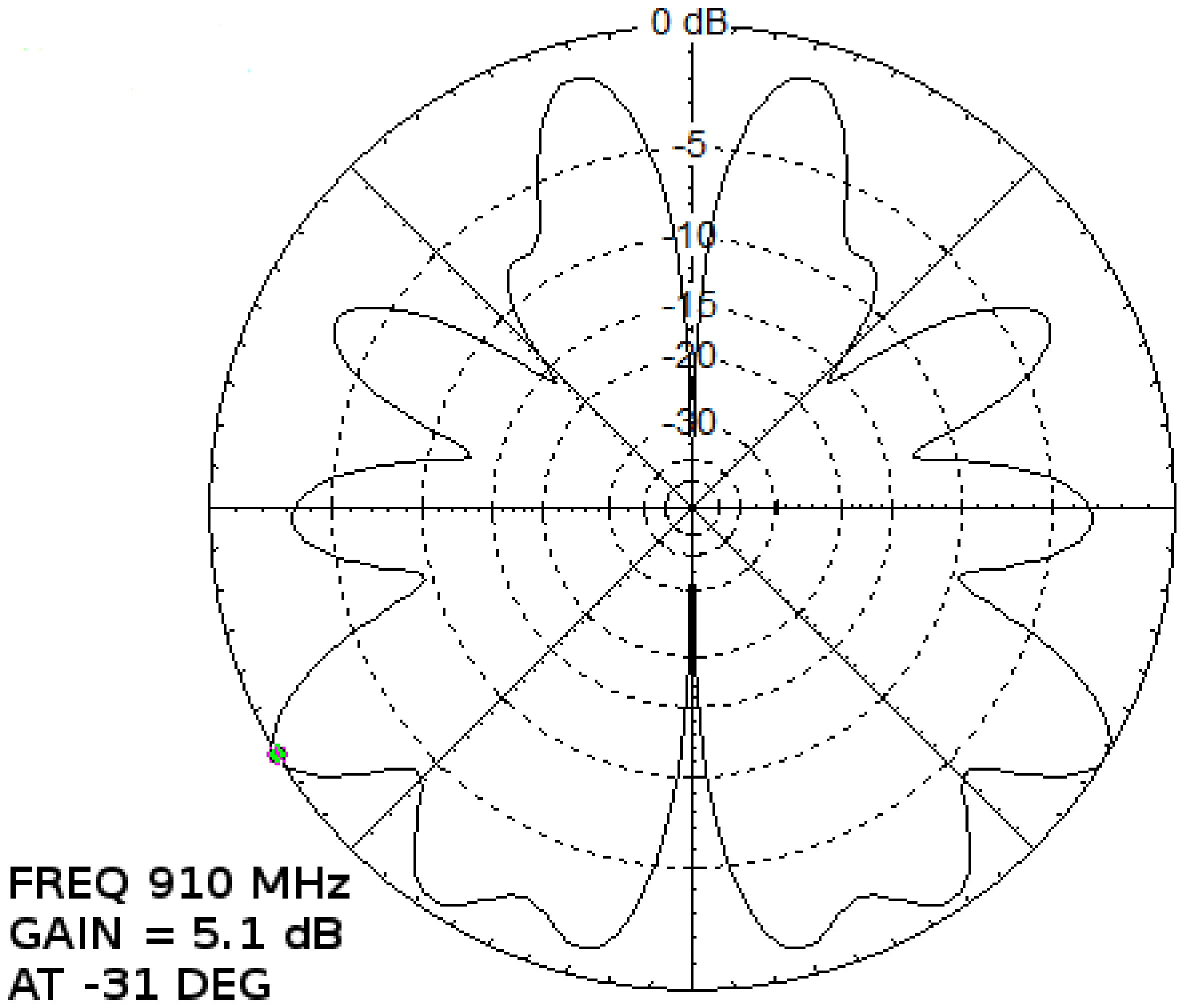


DISCONE ANTENNAS



Freq 444 MHz
Gain 1.9 dB
@ 0 degrees

DISCONE ANTENNAS



PAUL’S RULE FOR ANTENNAS

- Put up something reasonably quick and easy.
- Get on the air.
- When you build a “better” antenna, use this for comparison.

PAUL’S RULE FOR ANTENNAS

- I was given the hub from a commercially made discone.
- So I put one up.
- It does work all the repeaters I wanted to use.
- Construction is not very robust with the many long sloping elements.
- Not a good choice for portable or mobile.

DESIGN OBJECTIVES

- Multi-band antenna that could be mounted on a bicycle.
- I knew it could be done for a single band.
- If I could find a design that worked on a bike, it could probably work on other platforms.

But First A Review

of some basic principles which

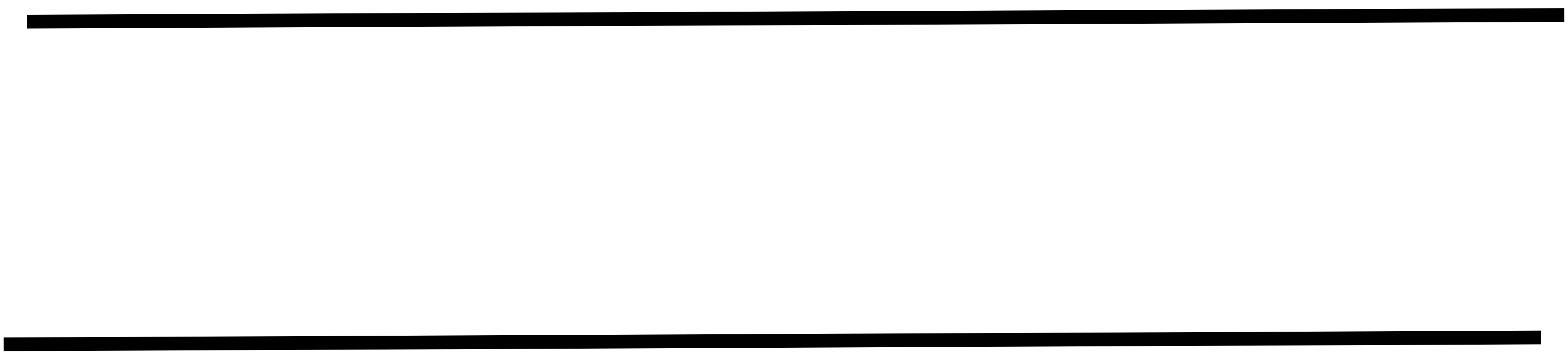
will be useful later

in this talk.

TRANSMISSION LINE REVIEW

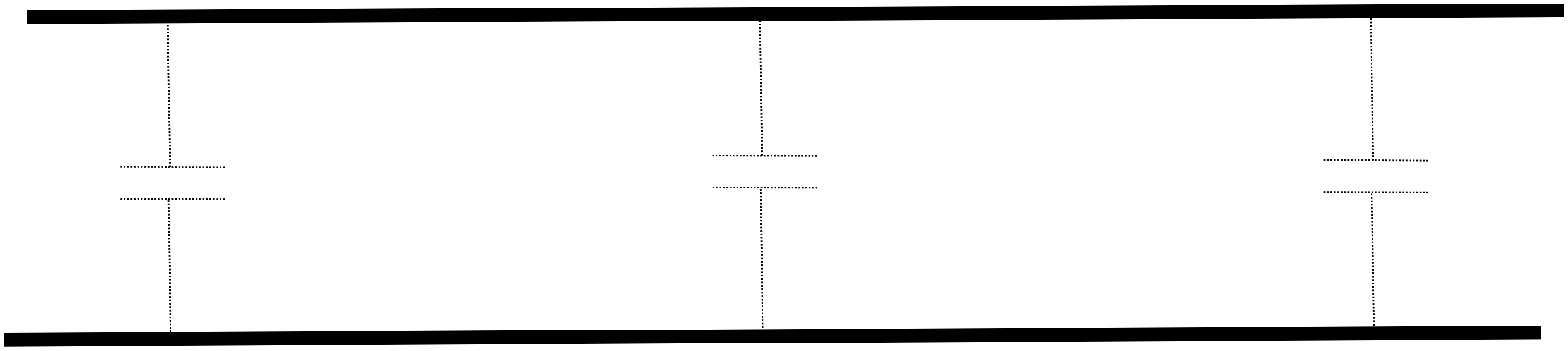
- Parallel transmission lines
- Coaxial transmission lines

PARALLEL TRANSMISSION LINES



PARALLEL TRANSMISSION LINES

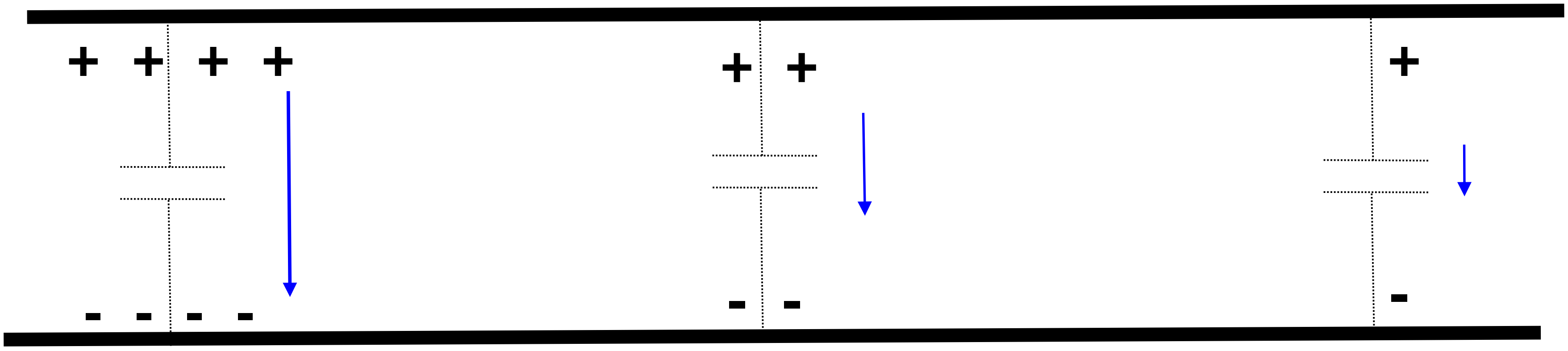
Capacitive coupling between the wires



PARALLEL TRANSMISSION LINES

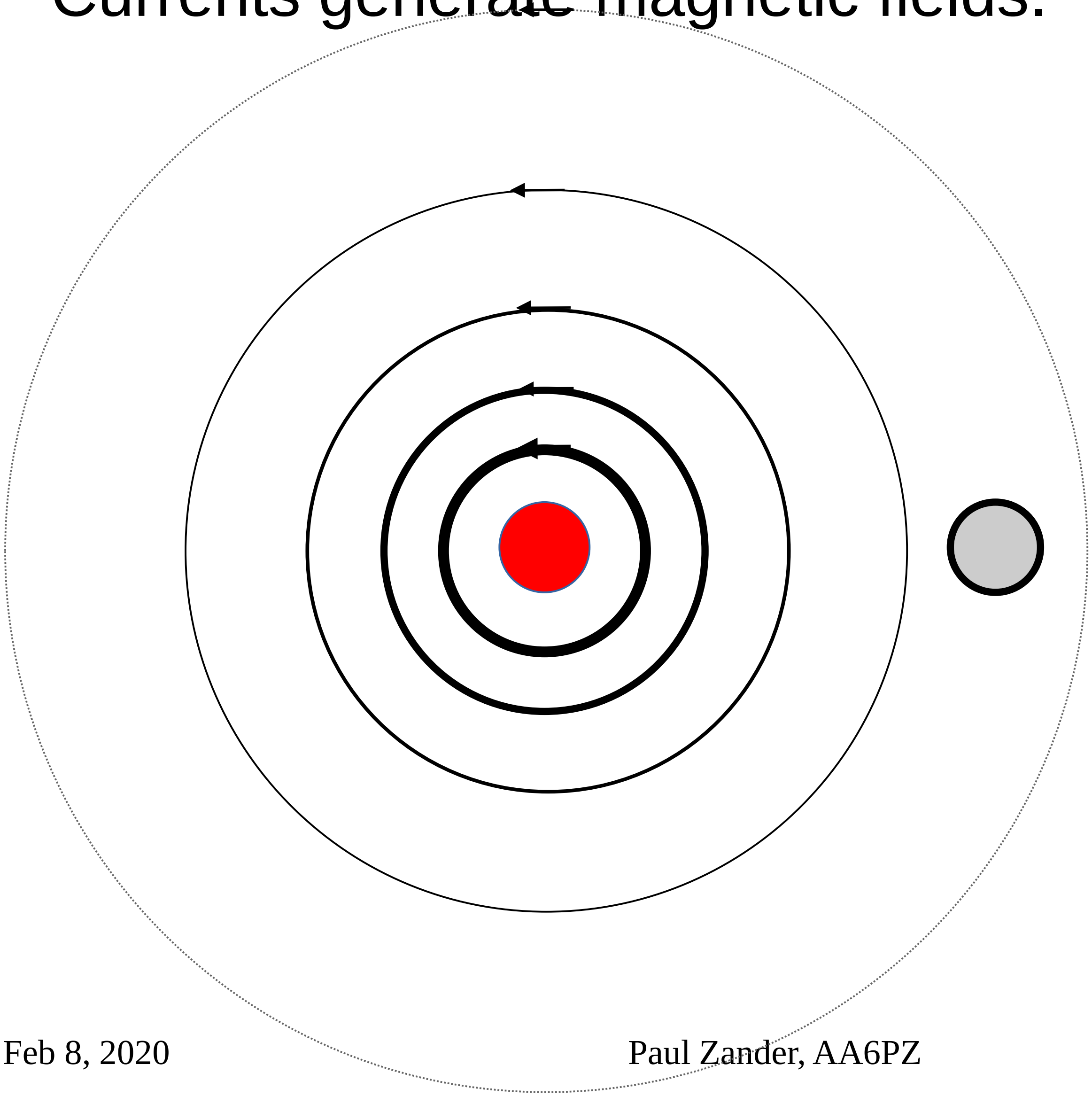
Capacitive coupling between the wires

Charge on one wire induces charge on opposite wire.



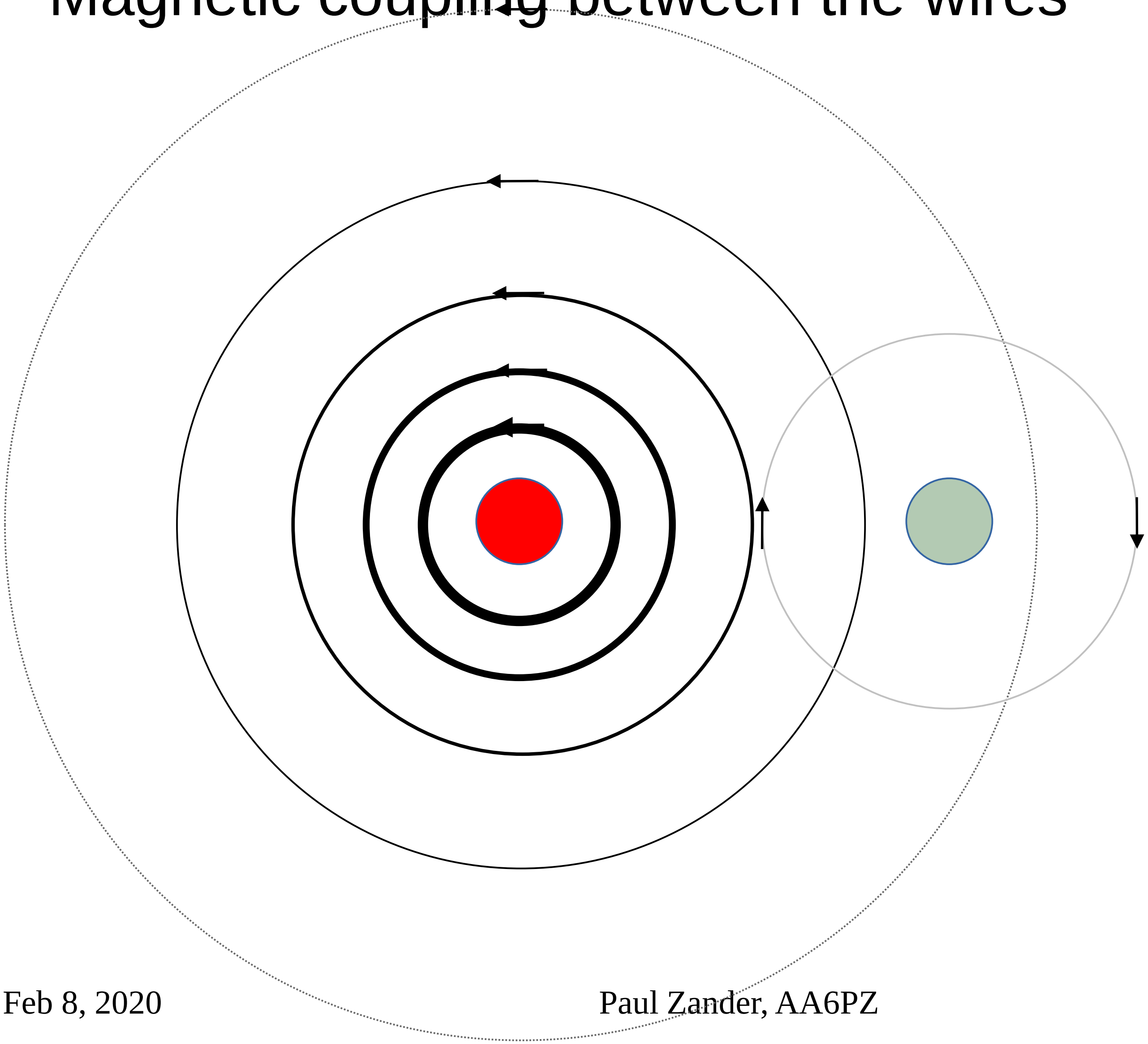
PARALLEL TRANSMISSION LINES

Currents generate magnetic fields.



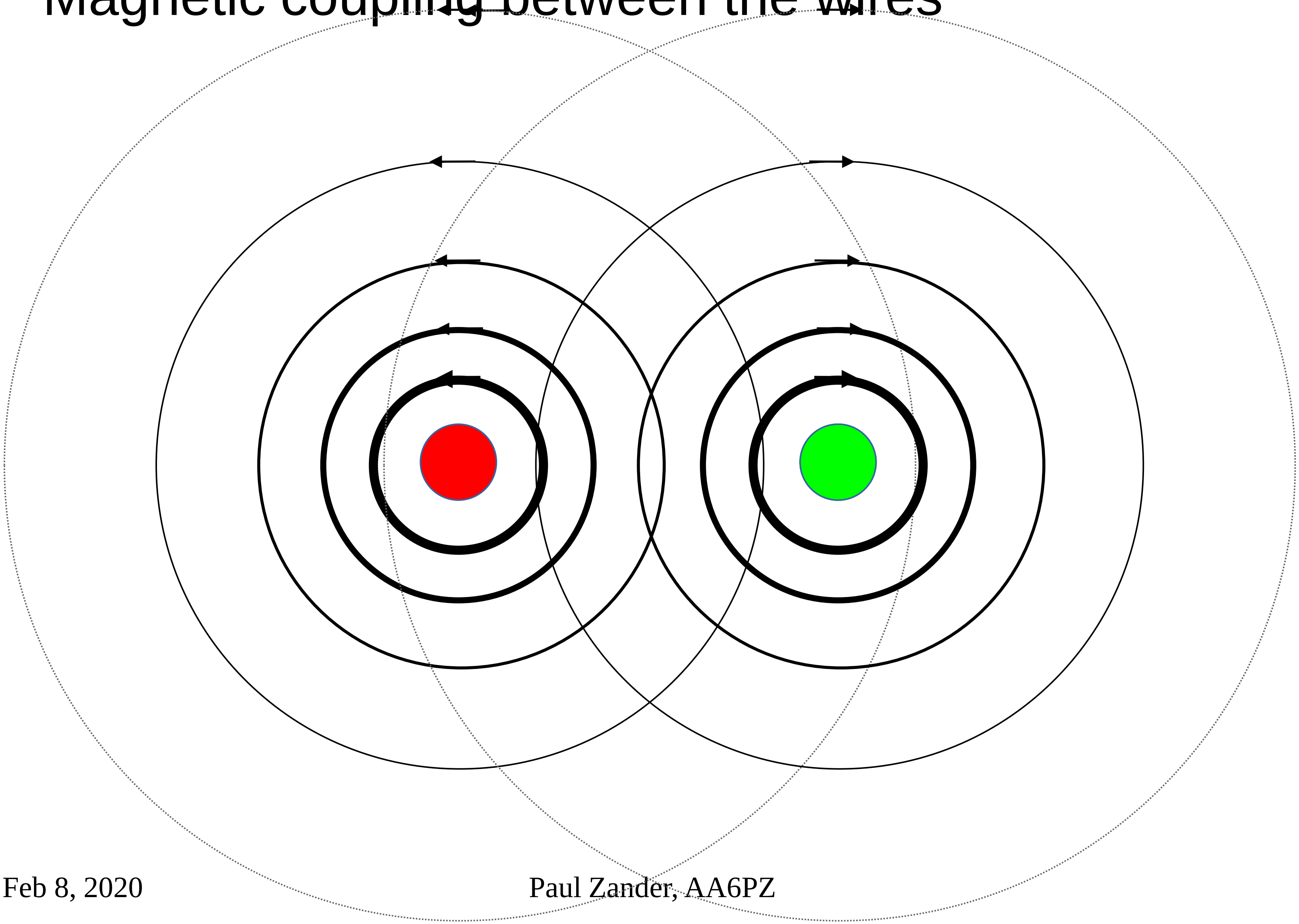
PARALLEL TRANSMISSION LINES

Magnetic coupling between the wires



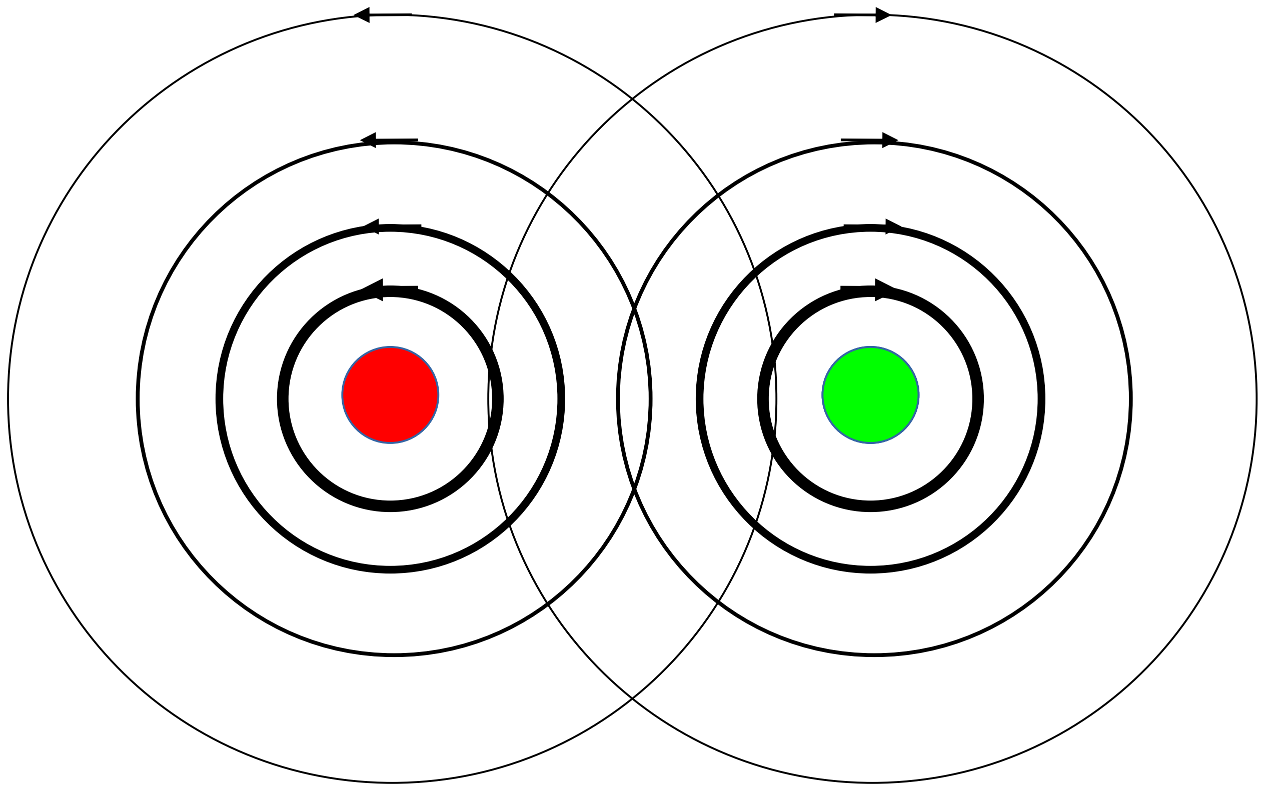
PARALLEL TRANSMISSION LINES

Magnetic coupling between the wires



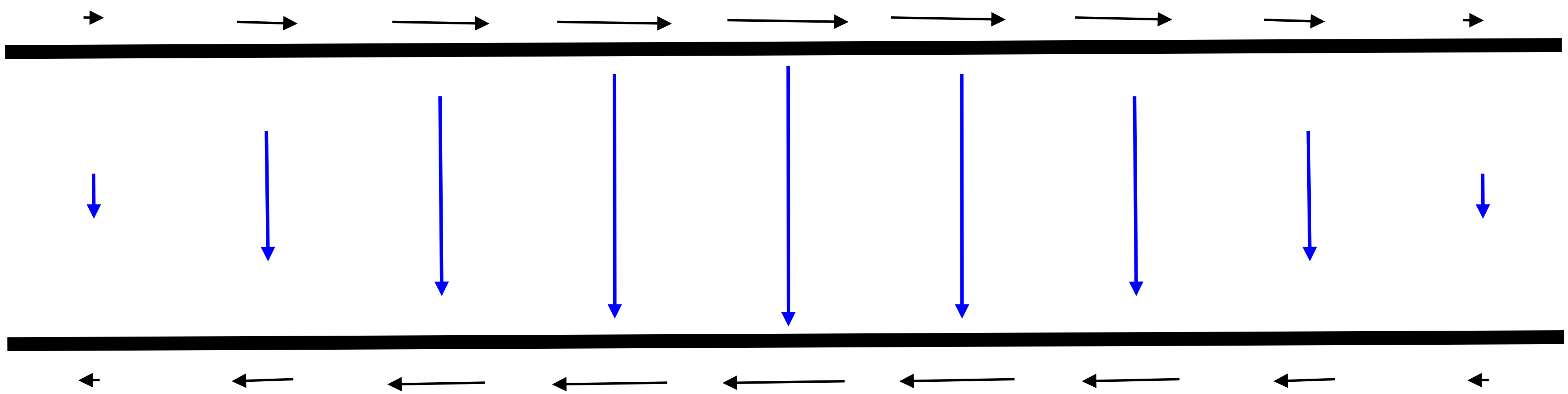
PARALLEL TRANSMISSION LINES

Magnetic coupling between the wires



PARALLEL TRANSMISSION LINES

Combination of electrical and magnetic coupling results in voltages and currents in the conductors.

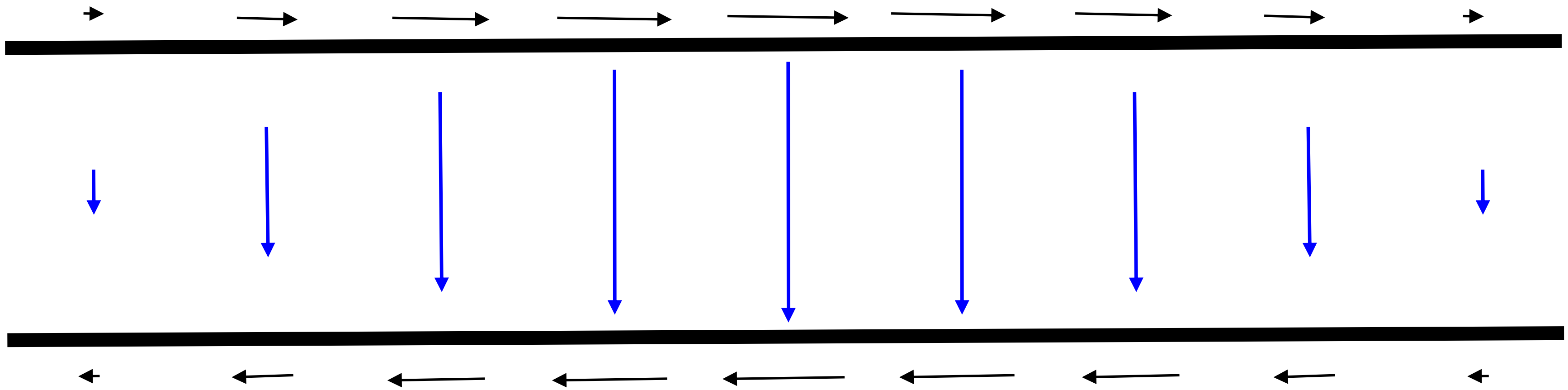


This is representation snapshot of a simple traveling wave.
With reflections and standing waves, it could be very different.

PARALLEL TRANSMISSION LINES

Combination of electrical and magnetic coupling results in voltages and currents in the conductors.

The ratio of voltage to current has the units of resistance.

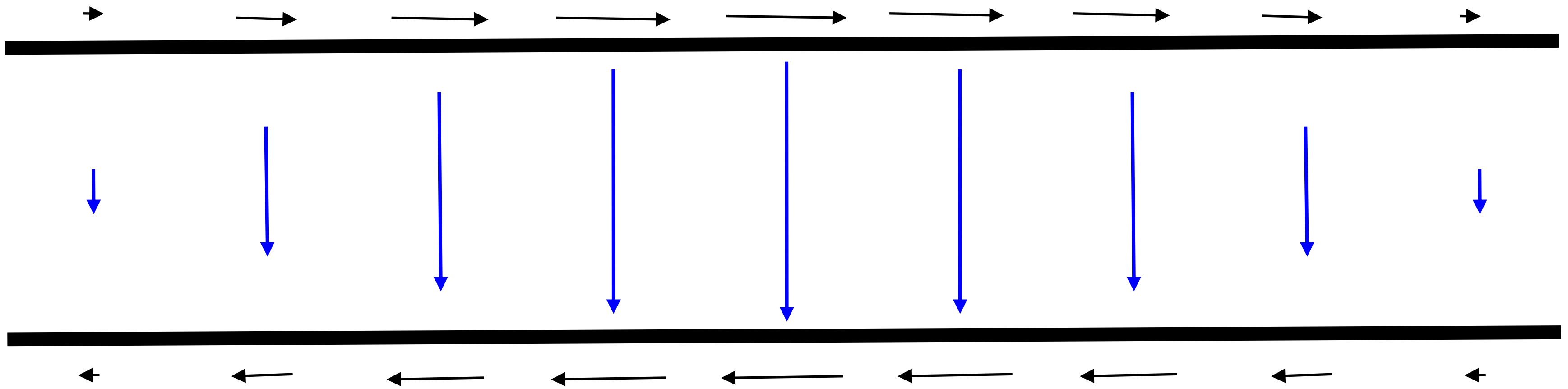


This is representation snapshot of a simple traveling wave.
With reflections and standing waves, it could be very different.

PARALLEL TRANSMISSION LINES

This the “characteristic impedance”.

Your DC Ohmmeter will measure 0 Ω, but we might call one line “300 Ω” and a different one “450 Ω”.



This is representation snapshot of a simple traveling wave.
With reflections and standing waves, it could be very different.

PARALLEL TRANSMISSION LINES

This the "characteristic impedance", Z_o.

$$Z_o = \frac{V}{I}$$

$$Z_o = \sqrt{\left(\frac{L}{C}\right)}$$

PARALLEL TRANSMISSION LINES

This the “characteristic impedance”, Z_o.

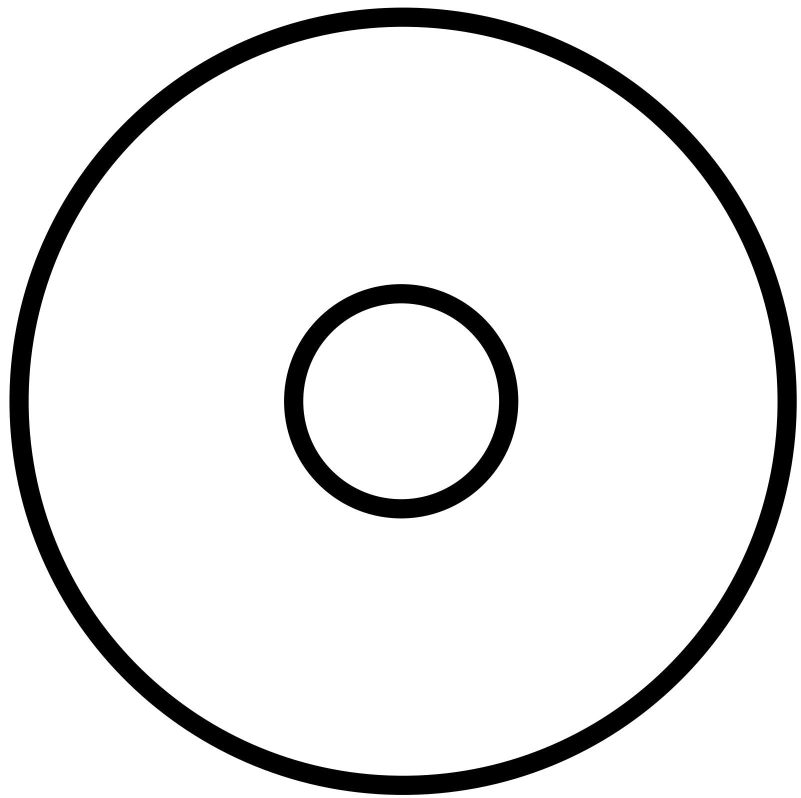
d = distance between conductors

r = radius

$$Z_o \simeq 276 * \log\left(\frac{d}{r}\right)$$

COAXIAL TRANSMISSION LINES

Concentric structure



COAXIAL TRANSMISSION LINES

- Sometime coax is used to make tuning stubs.
- Make a line that is one quarter wavelength long.
- Short the conductors at one end.
- At the other end, it will appear as an open circuit!

COAXIAL TRANSMISSION LINES

How long is a quarter wavelength?

In free space:

quarter wavelength = 246 ft / MHz

= 2952 inches / MHz

At 146 MHz, just over 20 inches.

COAXIAL TRANSMISSION LINES

How long is a quarter wavelength?

One half of a half-wave dipole:

quarter wavelength = 234 ft / MHz

= 2808 inches / MHz

At 146 MHz, just over 19 inches.

COAXIAL TRANSMISSION LINES

How long is a quarter wavelength?

Inside a coaxial transmission line, the insulating material that holds the conductors apart, also slows the signal.

Velocity Factor, VF, tells how much slower.

Material	VF
Foam polyethylene	0.88 to 0.79
Solid polyethylene	0.66
Solid PTFE (Teflon)	0.70

COAXIAL TRANSMISSION LINES

Situation	Length at 146 MHz
¼ wavelength in free space	20.2”
¼ wave antenna	19.2”
¼ wave stub with VF = .66	12.7”

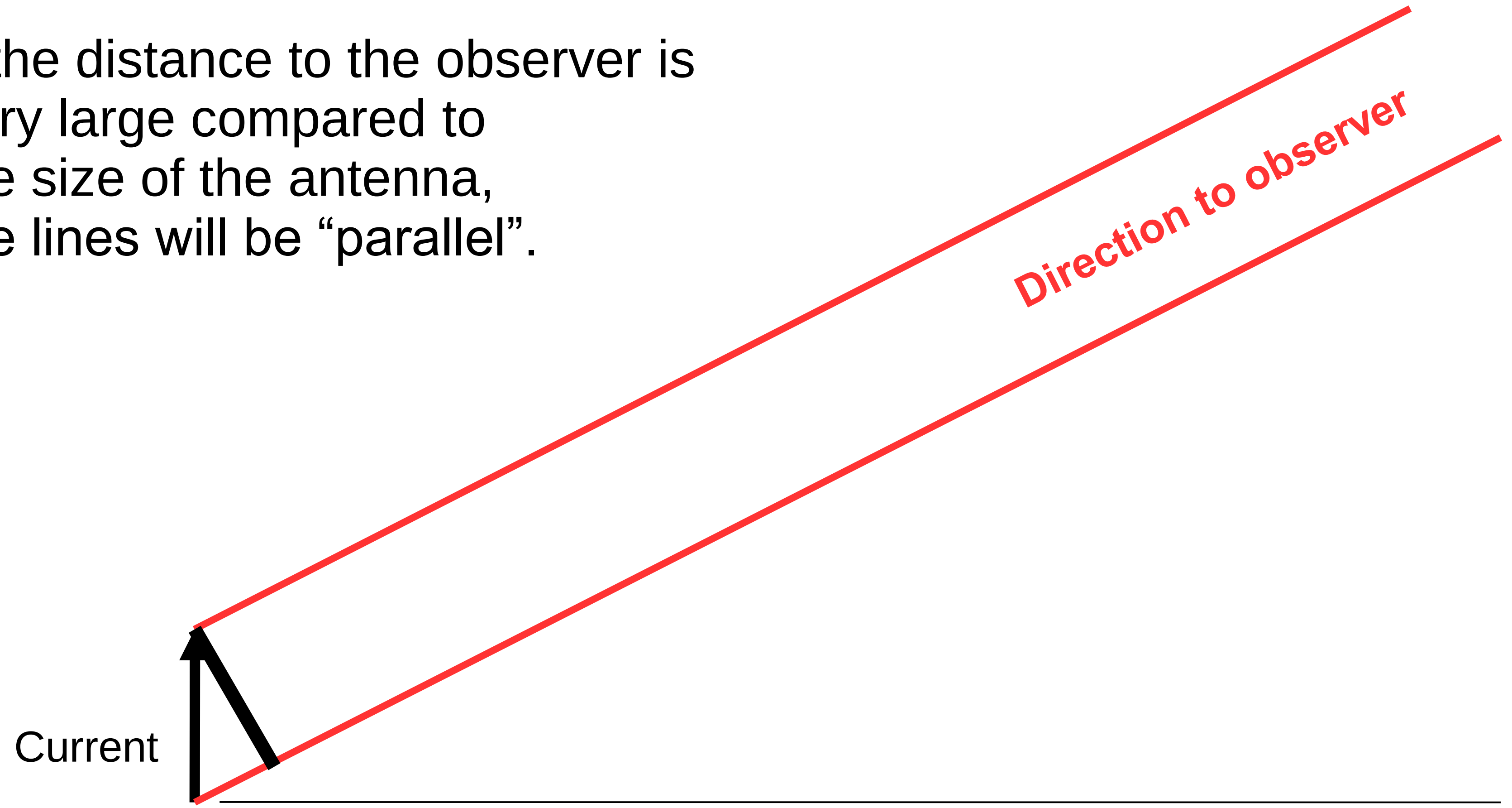
DIRECTIONALITY OF ANTENNAS

“IDEAL” UNIT ANTENNA

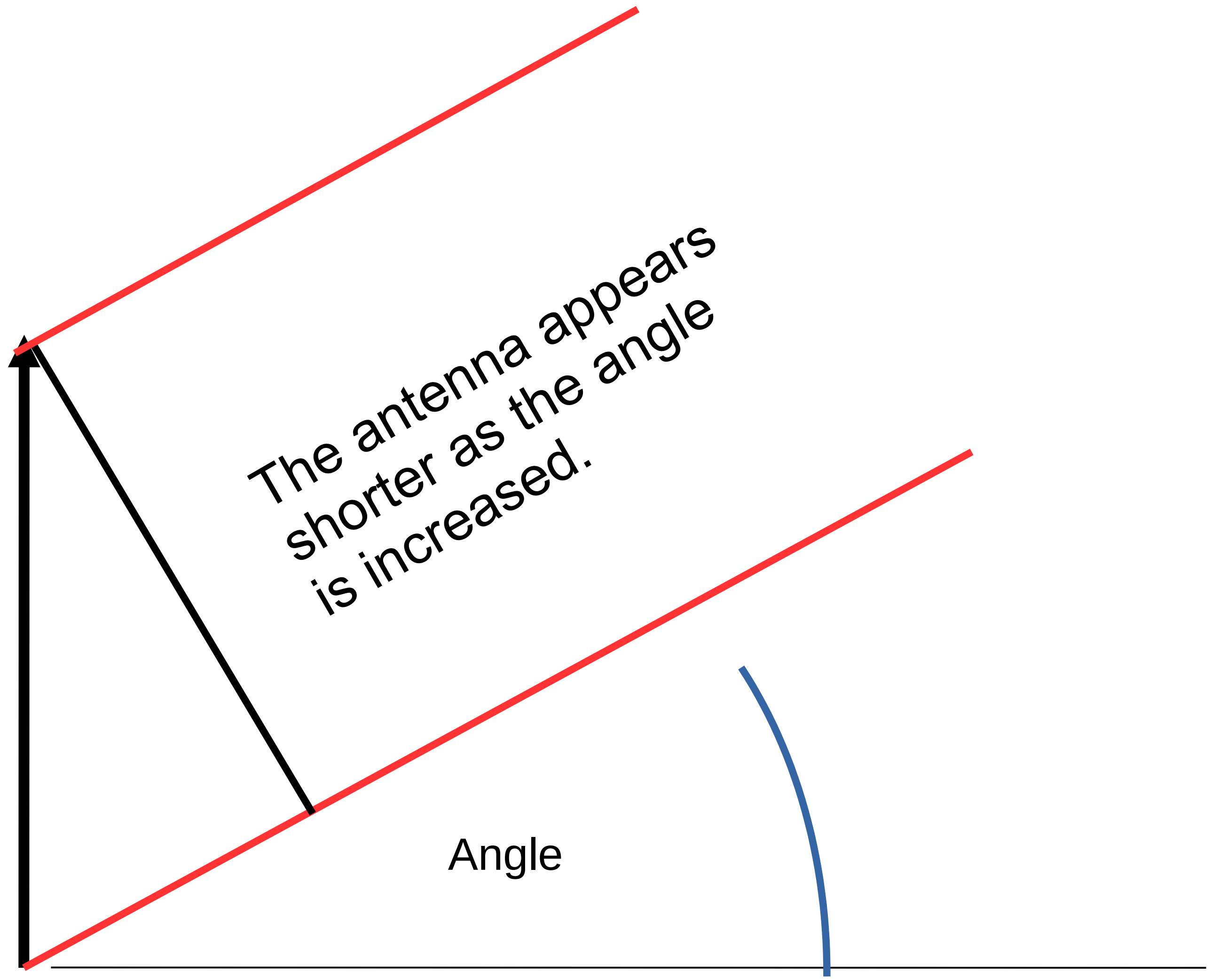
- Straight conductor with uniform current.
- **Length << ¼ wavelength**
- Easy to analyze.
- Magnetic field forms concentric circles a wire carrying current.
- Simple for mathematical model.
- **“Hard” to actually build. The current at the ends must go somewhere!**

GEOMETRY OF DIFFERENT ANGLES

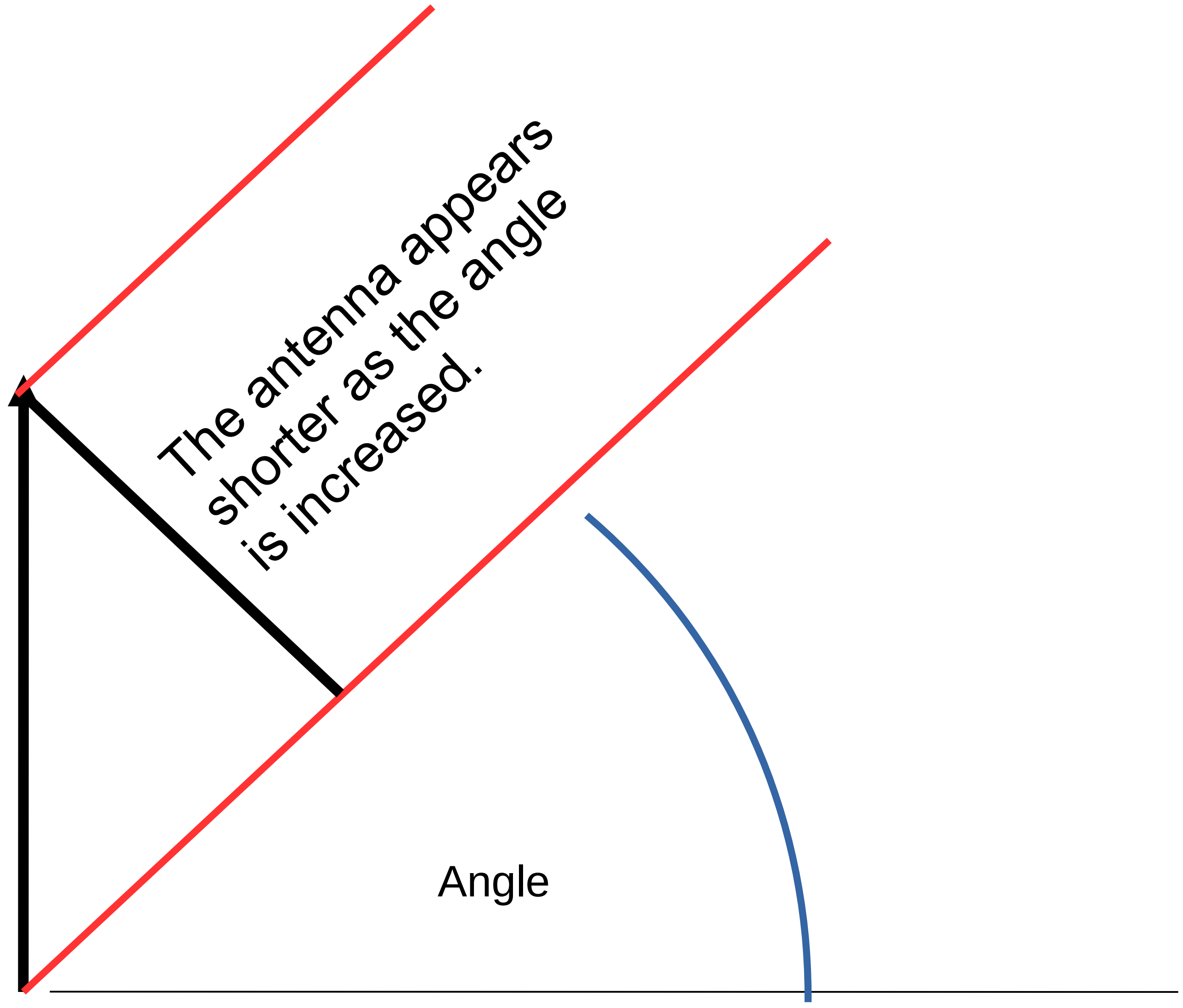
If the distance to the observer is very large compared to the size of the antenna, the lines will be "parallel".



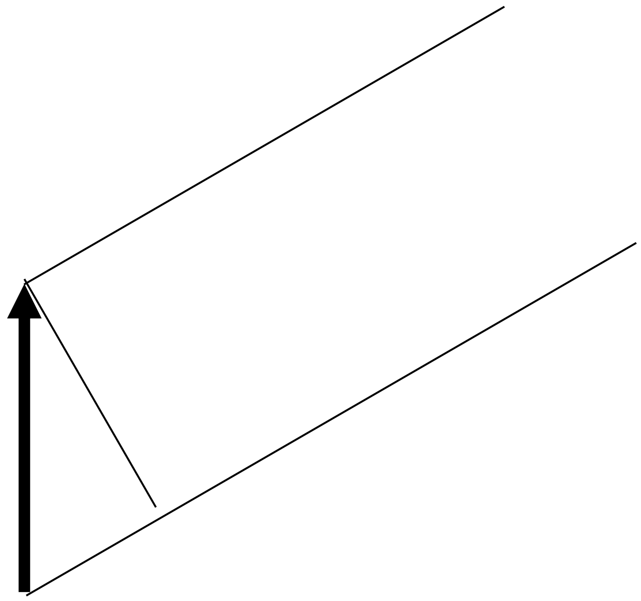
GEOMETRY OF DIFFERENT ANGLES

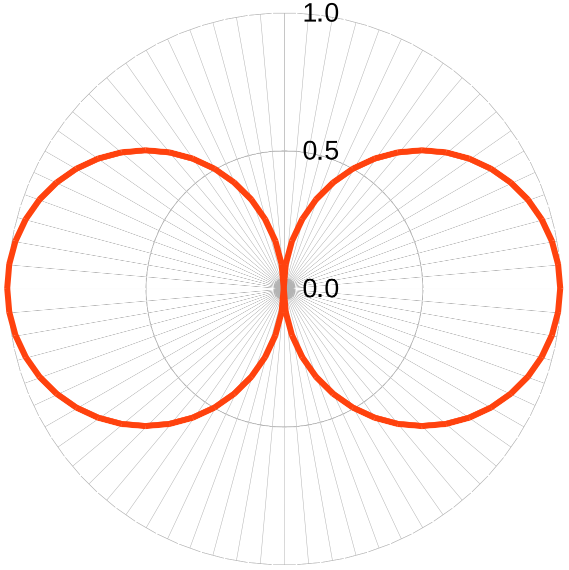


GEOMETRY OF DIFFERENT ANGLES



RELATION BETWEEN ANGLE AND APPARENT LENGTH OF ANTENNA



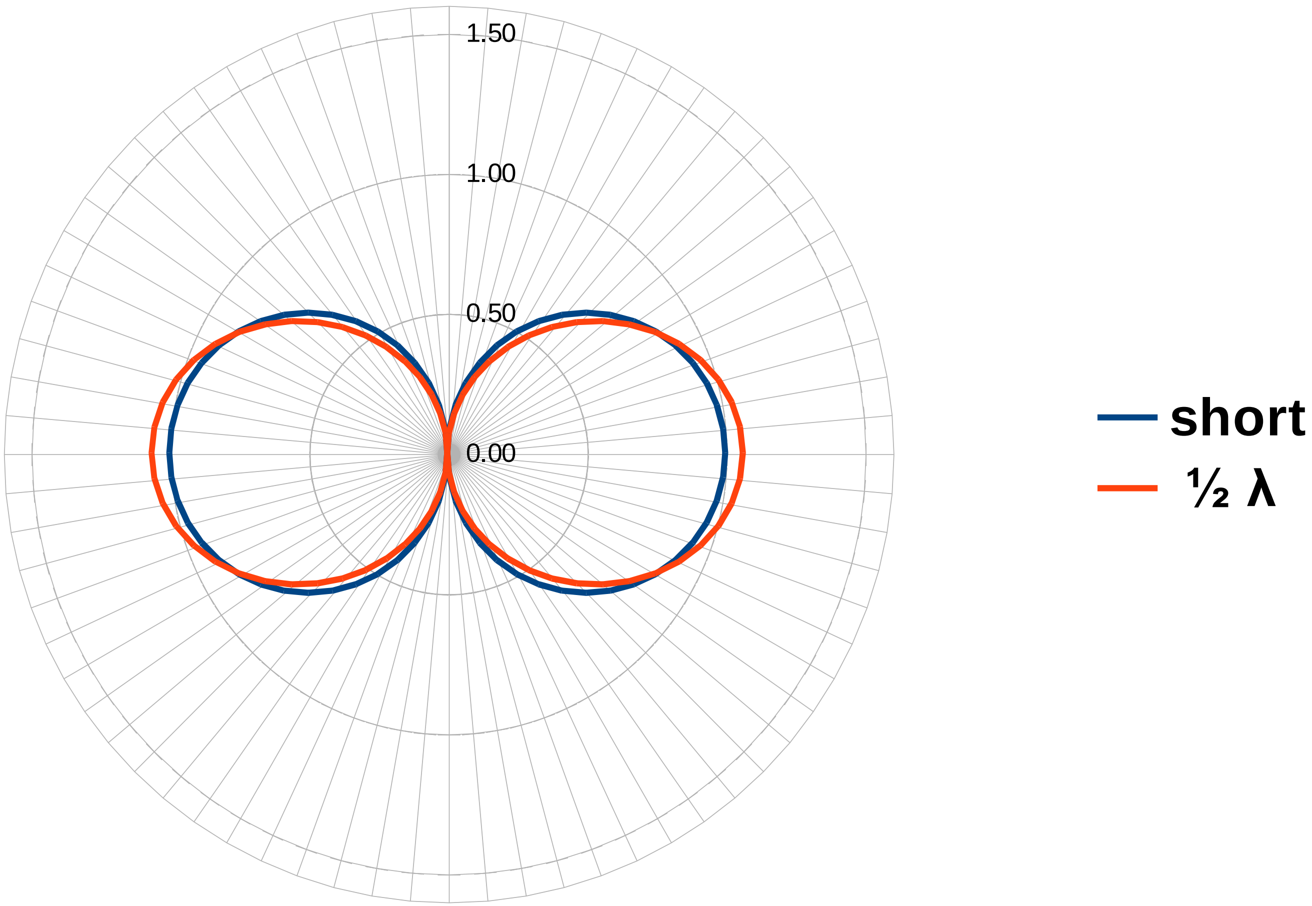


Viewed from different angles, the antenna appears shorter as the cosine of the angle.

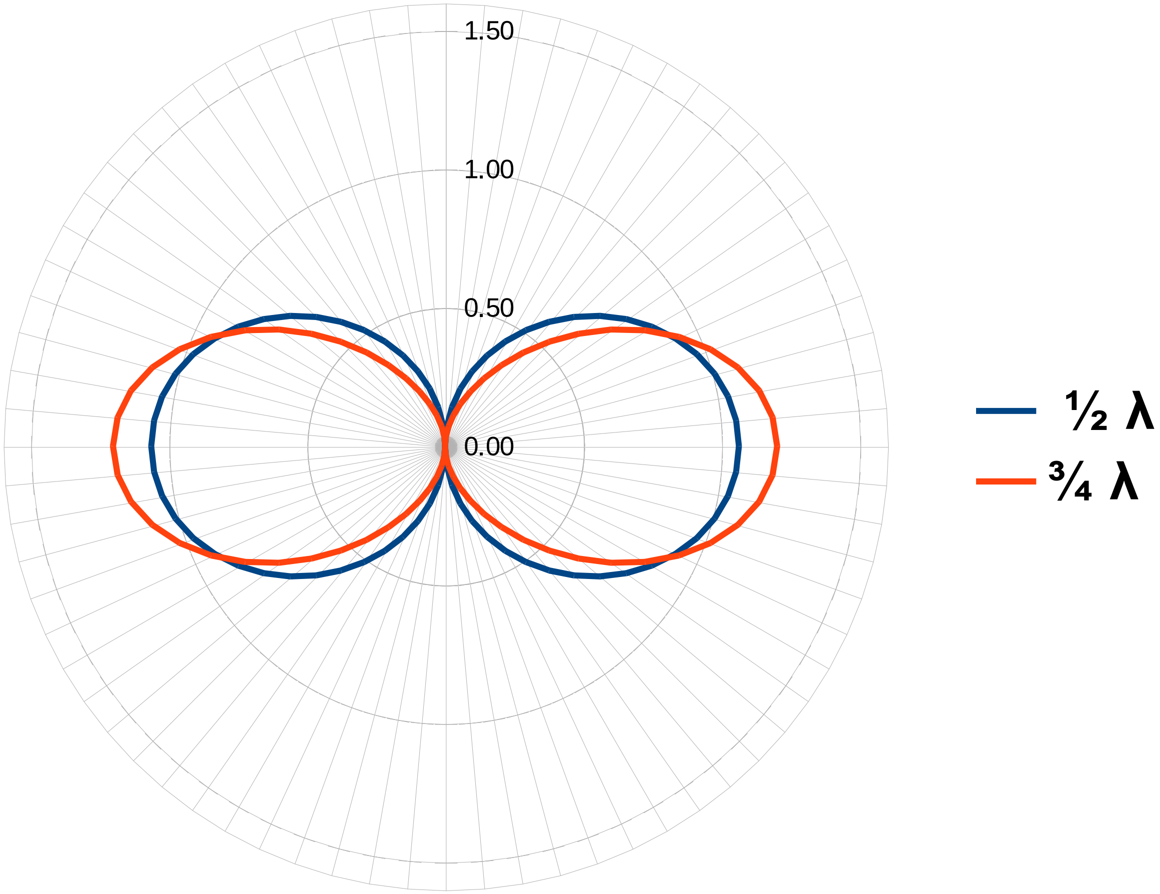
MORE REALISTIC ANTENNA

- Combine several unit antennas to simulate a dipole.
- Different current, and possibly phase, in each segment.
- At each angle, must combine the signal from each segment with regard to the phase shift caused by distance.

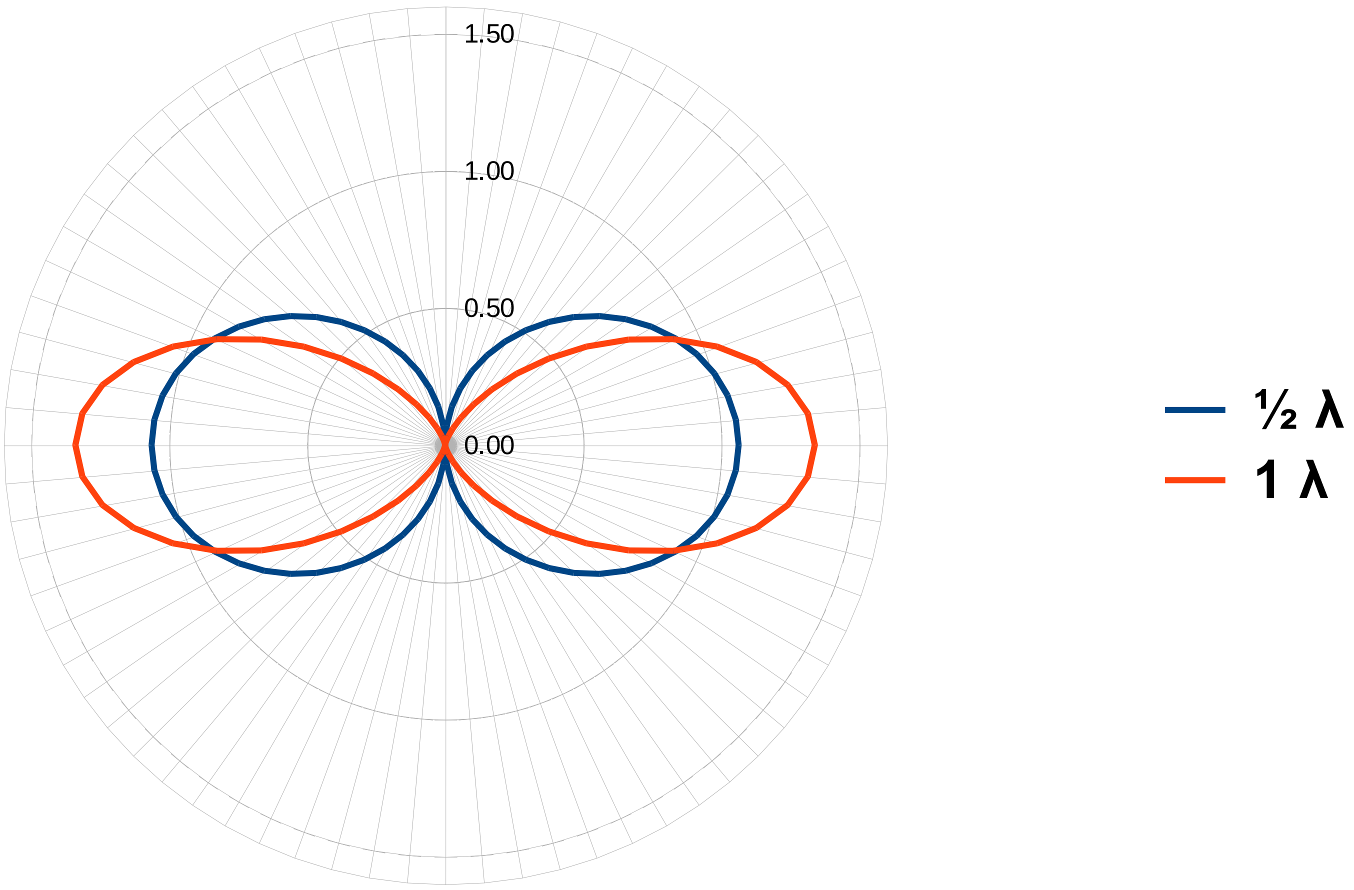
DIPOLES WITH DIFFERENT LENGTHS



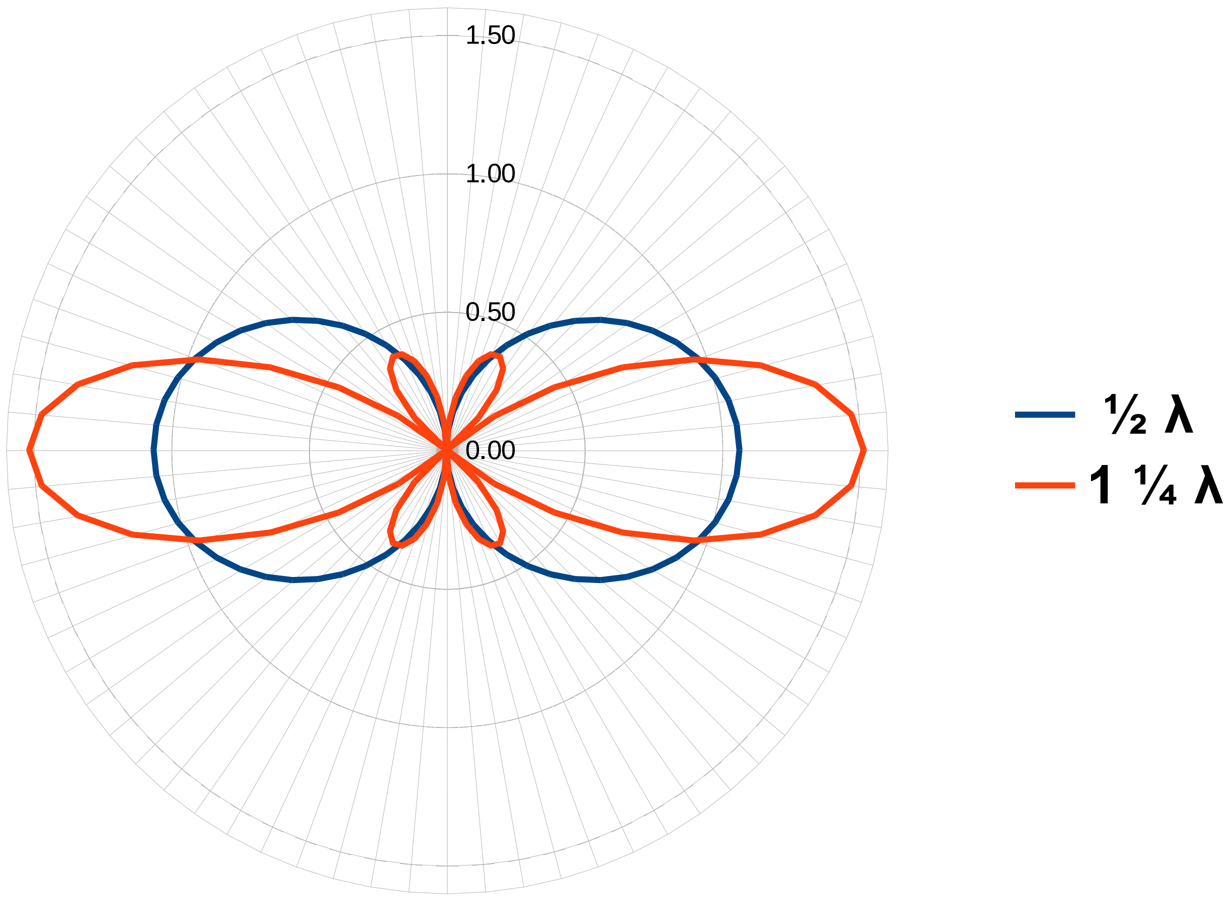
DIPOLES WITH DIFFERENT LENGTHS



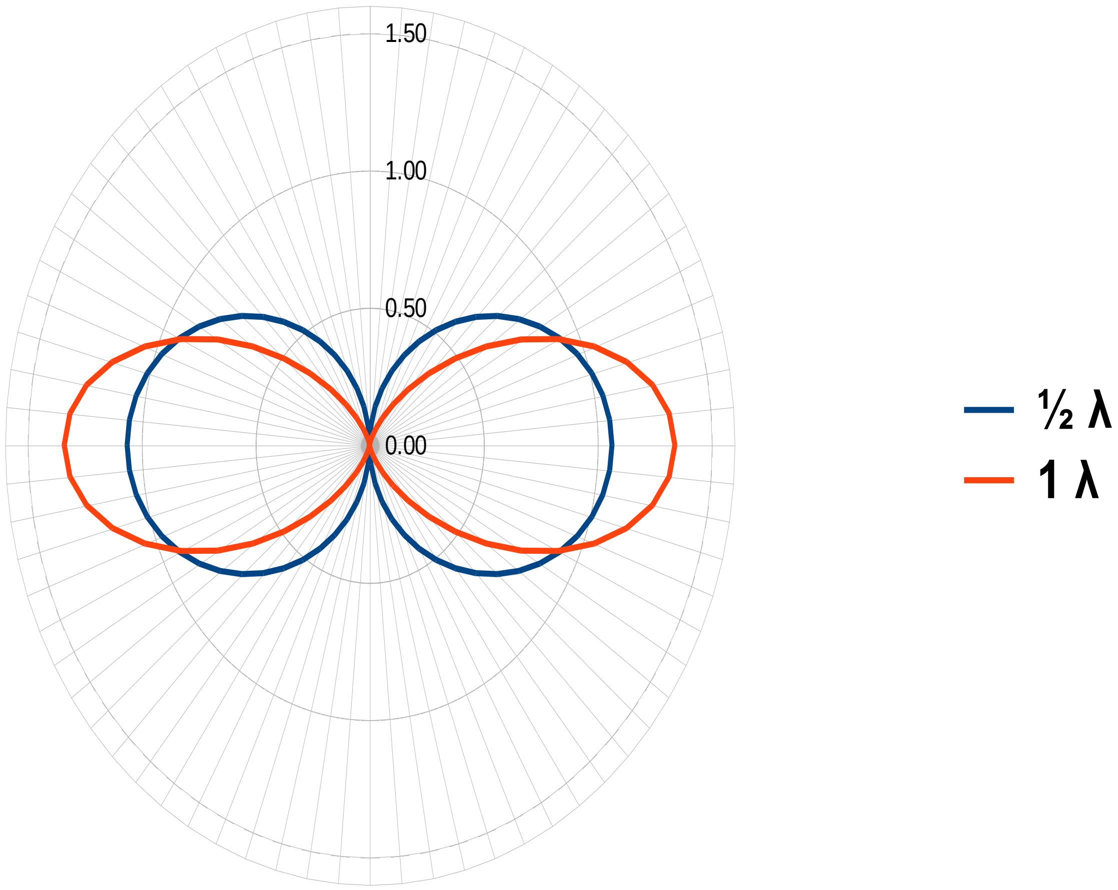
DIPOLES WITH DIFFERENT LENGTHS



DIPOLES WITH DIFFERENT LENGTHS



DIPOLES WITH DIFFERENT LENGTHS



DIPOLES WITH DIFFERENT LENGTHS

- Gain increases with length, to a point.
- Maximum gain at 1 ¼ wavelength.
- As the length is increased beyond 1 ¼, the pattern breaks up.

DIPOLES WITH DIFFERENT LENGTHS

- A 3/2 wavelength antenna will probably be easy to match, **BUT**
- The radiation pattern will be very different from the 1/2 wavelength antenna.
- Possibly OK for horizontally polarized antennas.
- Terrible for vertically polarized antennas.

PLAN A

- Maximum gain at 1 ¼ wavelength.
- Make antenna not longer than 1 ¼ wavelength at 440 MHz 16 inches long max.
- Add tuning coil or traps or stubs or ??? to resonant on 146 MHz.

PLAN A

- Spent too many evenings simulating different solutions.
- Got really good at EZNEC.
- BUT, everything that had a reasonable impedance at both 146 and 444 MHz had a bad radiation pattern.

PLAN A, PART 2

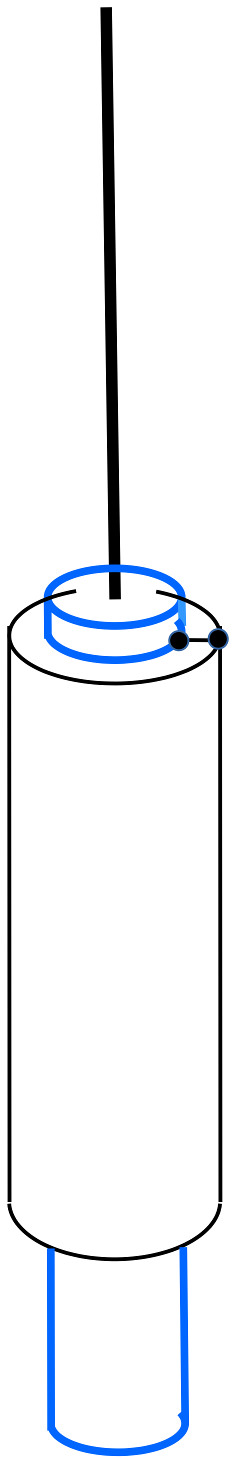
- Actually there was another part of my “Plan A” that worked much better than expected.
- With a vertical antenna it not practical to run the coax at right angles like we (at least) attempt to do with a center-fed horizontal HF dipole.
- There are 2 common methods for an end-fed vertical antenna:
    - J-Pole
    - Sleeve Dipole

SLEEVE DIPOLE

- The sleeve dipole is a center-fed dipole.
- The bottom half is hollow tube or pipe.
- The coaxial feedline goes down the middle of the tube.
- The inside of the tube and the outside of the coax braid act as a transmission line.
- A transmission line that is shorted at one end, will act as an open circuit ¼ wavelength away.

SLEEVE DIPOLE

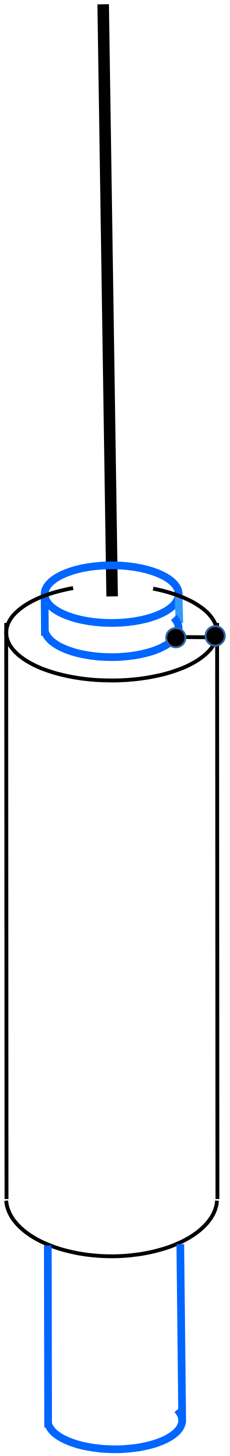
- Top rod is top half of dipole
- The bottom half of dipole is hollow.
- Coax cable feedline is inside the bottom half.
- Braid of coax is shorted to top of the tube.
- The tube is ¼ wavelength. The short acts as an open at the bottom. This decouples the cable from the antenna.



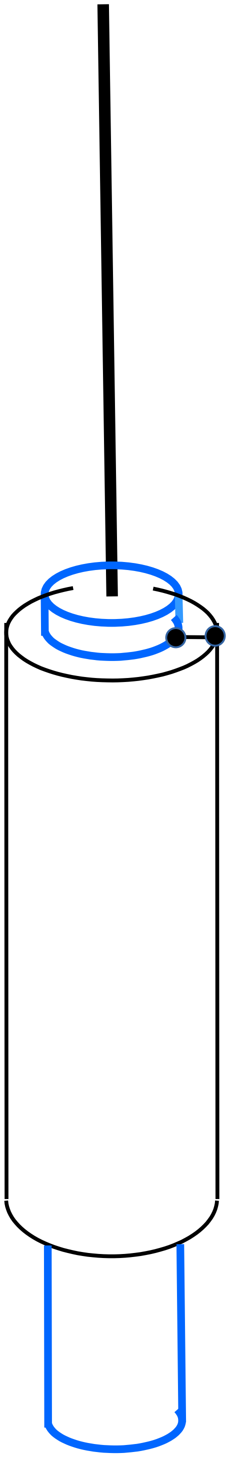
SLEEVE DIPOLE

Started puzzling:

- How is this going to work for multiple bands?
- Is it practical to make several concentric sleeves?
- Did a little web searching and discovered the “open sleeve” dipole.



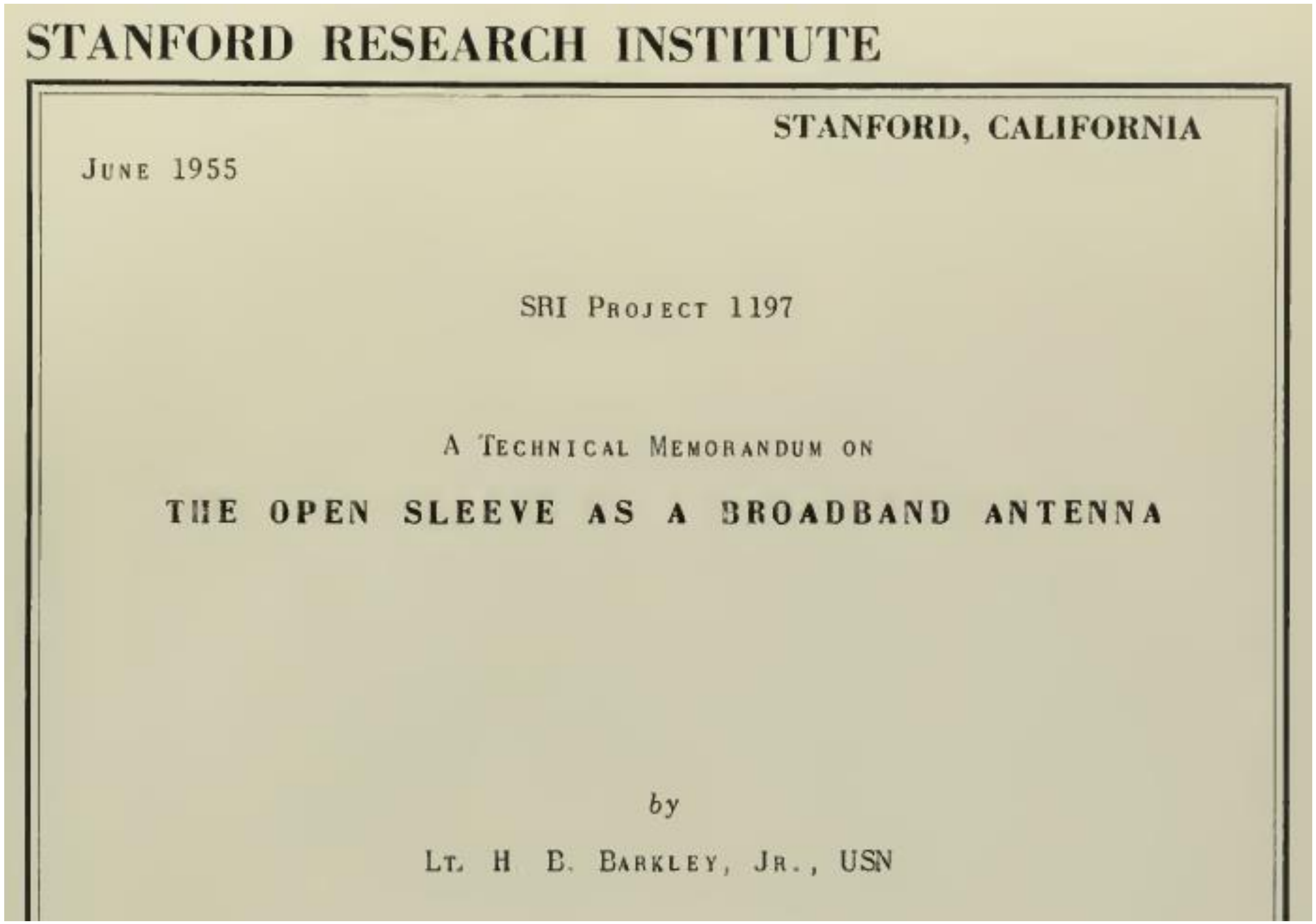
OPEN-SLEEVE ANTENNA



- The articles I had read before before were about HF antennas.
- Multiple dipoles for 20, 17, 15 meters, or some such combination.
- Mutual coupling instead of direct connection.
- **IF** the wires were of the right spacing, it might work, BUT
- Didn’t happen to see an article claiming a big advantage.

OPEN-SLEEVE ANTENNA

The idea is not really new:



STANFORD RESEARCH INSTITUTE

STANFORD, CALIFORNIA

JUNE 1955

SRI PROJECT 1197

A TECHNICAL MEMORANDUM ON

THE OPEN SLEEVE AS A BROADBAND ANTENNA

by

LT. H B. BARKLEY, JR., USN

OPEN-SLEEVE ANTENNA

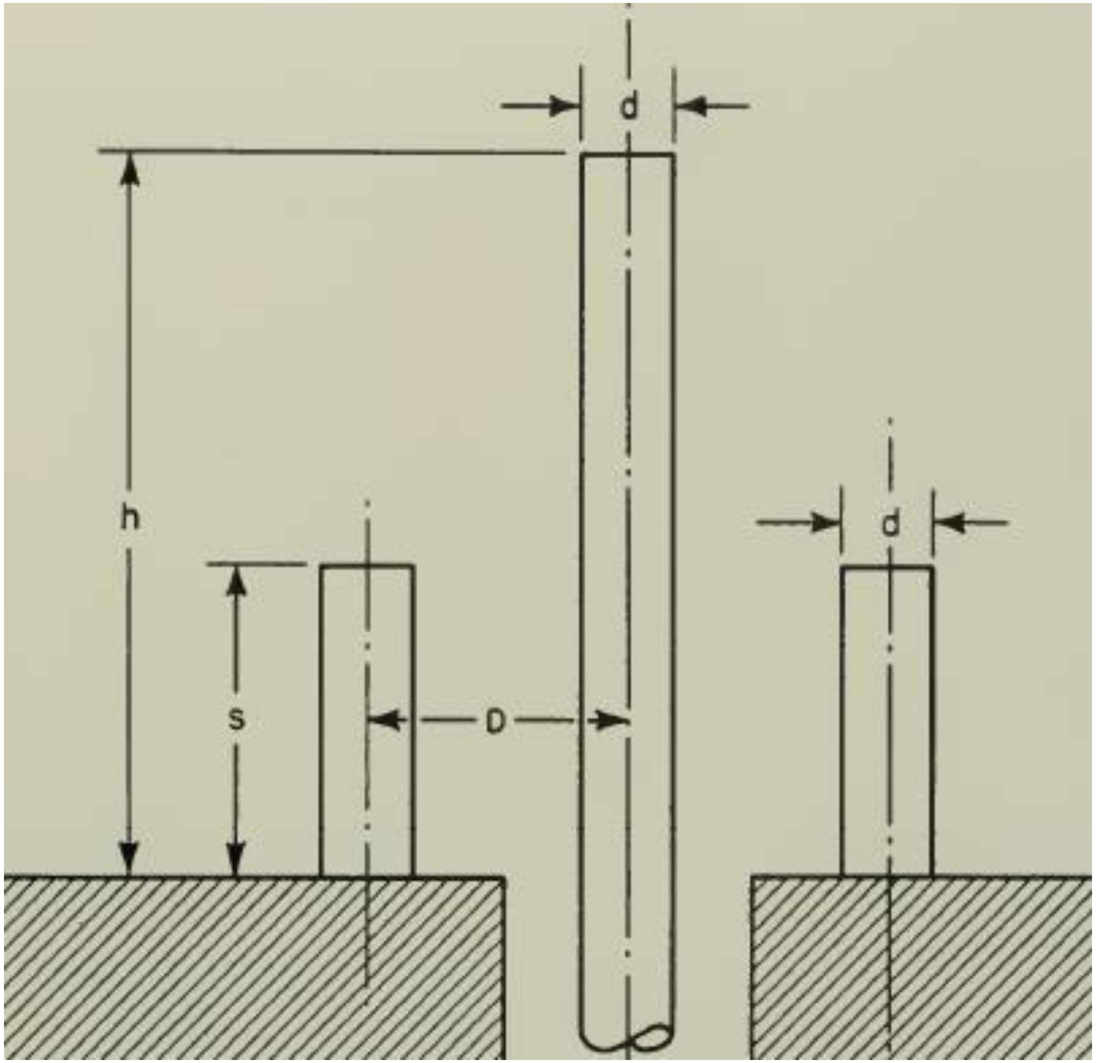
THE OPEN SLEEVE AS A BROADBAND ANTENNA

CHAPTER 1

INTRODUCTION

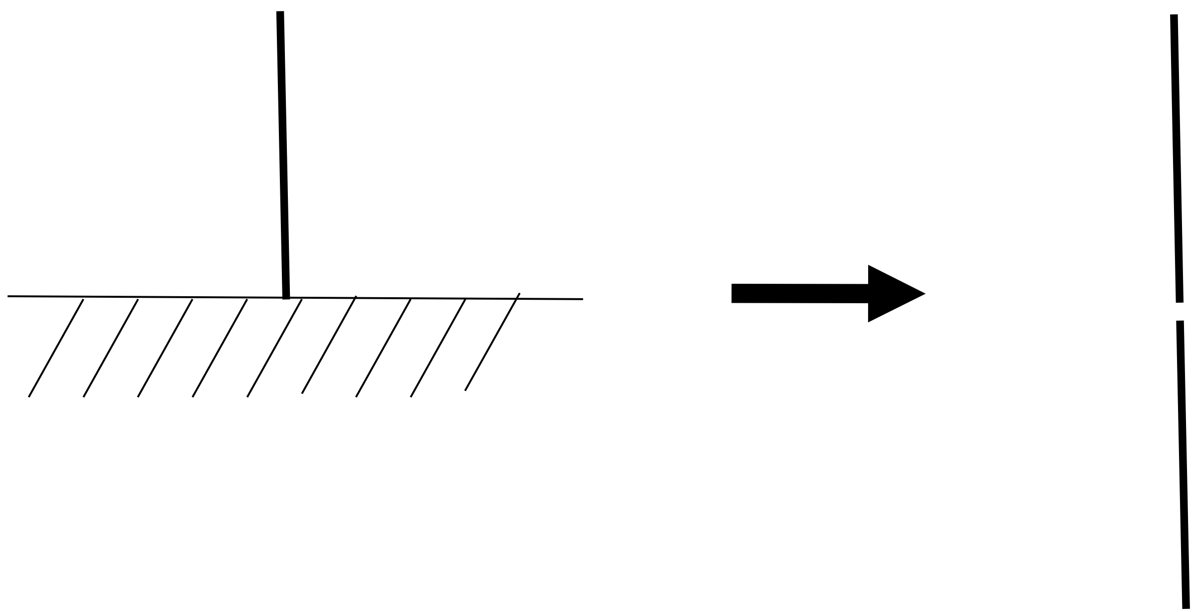
The open sleeve antenna consists of a dipole with two closely-spaced parasites, one on each side of the dipole; (Fig. 1) the lengths of the parasites are of the order of one-half that of the center dipole. This antenna was first studied at the Naval Research Laboratory by Dr. J. T. Bolljahn,*

OPEN-SLEEVE ANTENNA



OPEN-SLEEVE ANTENNA

- This design is based on ¼ wavelength over ground.
- Easy enough to transform to ½ wavelength in free space.



OPEN-SLEEVE ANTENNA

- What Lt. Barkley did was:
- Replace the “solid” sleeve with a pair of rods.
- Analyze like parallel transmission lines. (This was before computers and numeric analysis existed.)
- Amazingly his calculations and experiments agreed rather well!
- Early work was aimed at making an antenna that would work over a wide, continuous range of frequencies.

OPEN-SLEEVE ANTENNA

- Alternate explanation of open-sleeve dipole.
- Most hams are familiar with Yagi arrays.
- Yagi arrays are usually single band.
- The driven element is a half-wave dipole.
- The lengths and spacings of the parasitic elements are adjusted so the currents on each element lead to constructive interference in the desired direction.

OPEN-SLEEVE ANTENNA

- In the open-sleeve antenna:
- The driven element is a half-wave dipole for the lowest frequency.
- The lengths and spacings of the parasitic elements are adjusted to have resonances on the higher frequency bands.

PUTTING IT ALL TOGETHER

- This might just to work.
- Use closed sleeve 2 meter ½ wavelength dipole for driven element.
- Use open-sleeve or parasitic elements tuned to higher frequencies.

PUTTING IT ALL TOGETHER

- I just wanted to cover the ham bands.
- I had a computer analysis.
- **After all that time analyzing other antennas, I was able to find some promising models in a few minutes.**
- Element diameters based on available material.
- Lengths computed for resonance.
- Spacing computed for impedance.

Construction

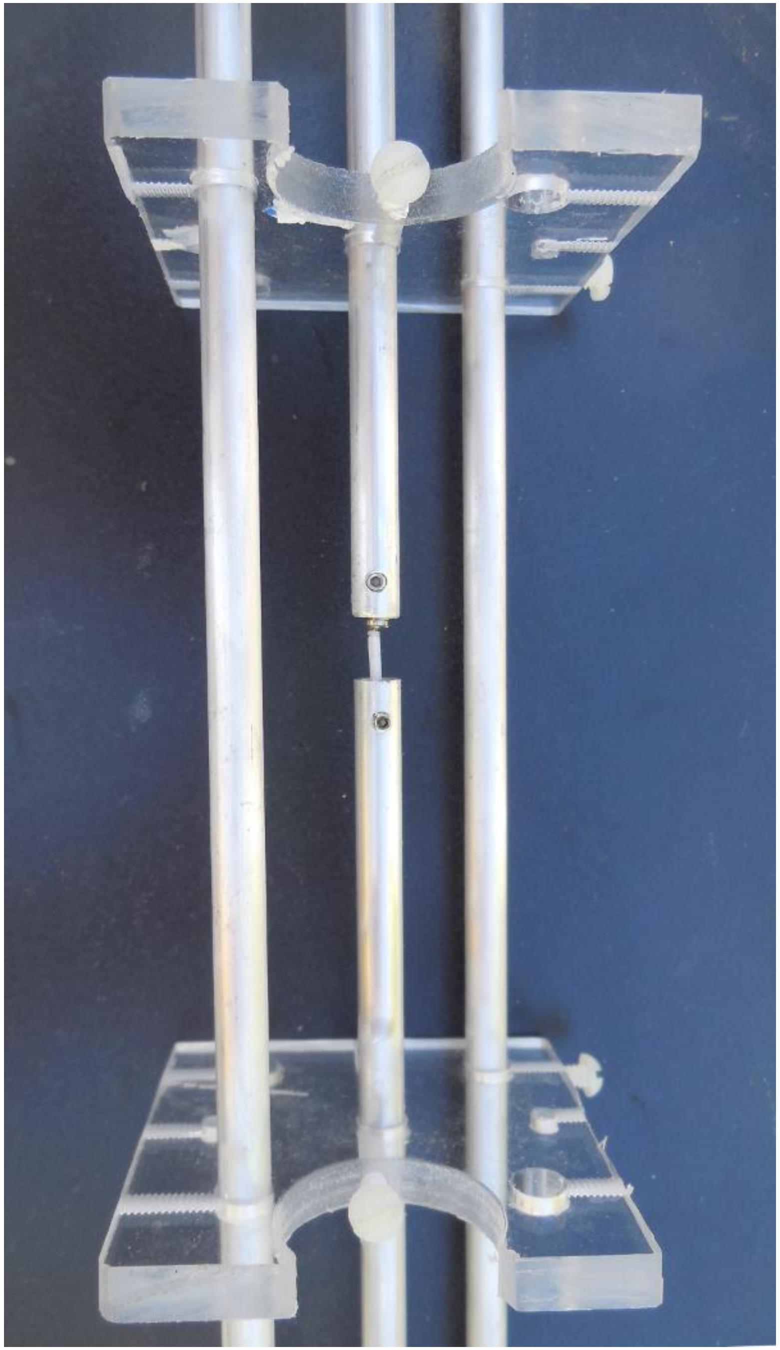
- Detail of feed point.
- Elements are ¼ inch diameter.
- Need small coax to fit inside.
- Used “pin” from BNC connector to make more consistent connection.

Construction

- Feed point assembled.

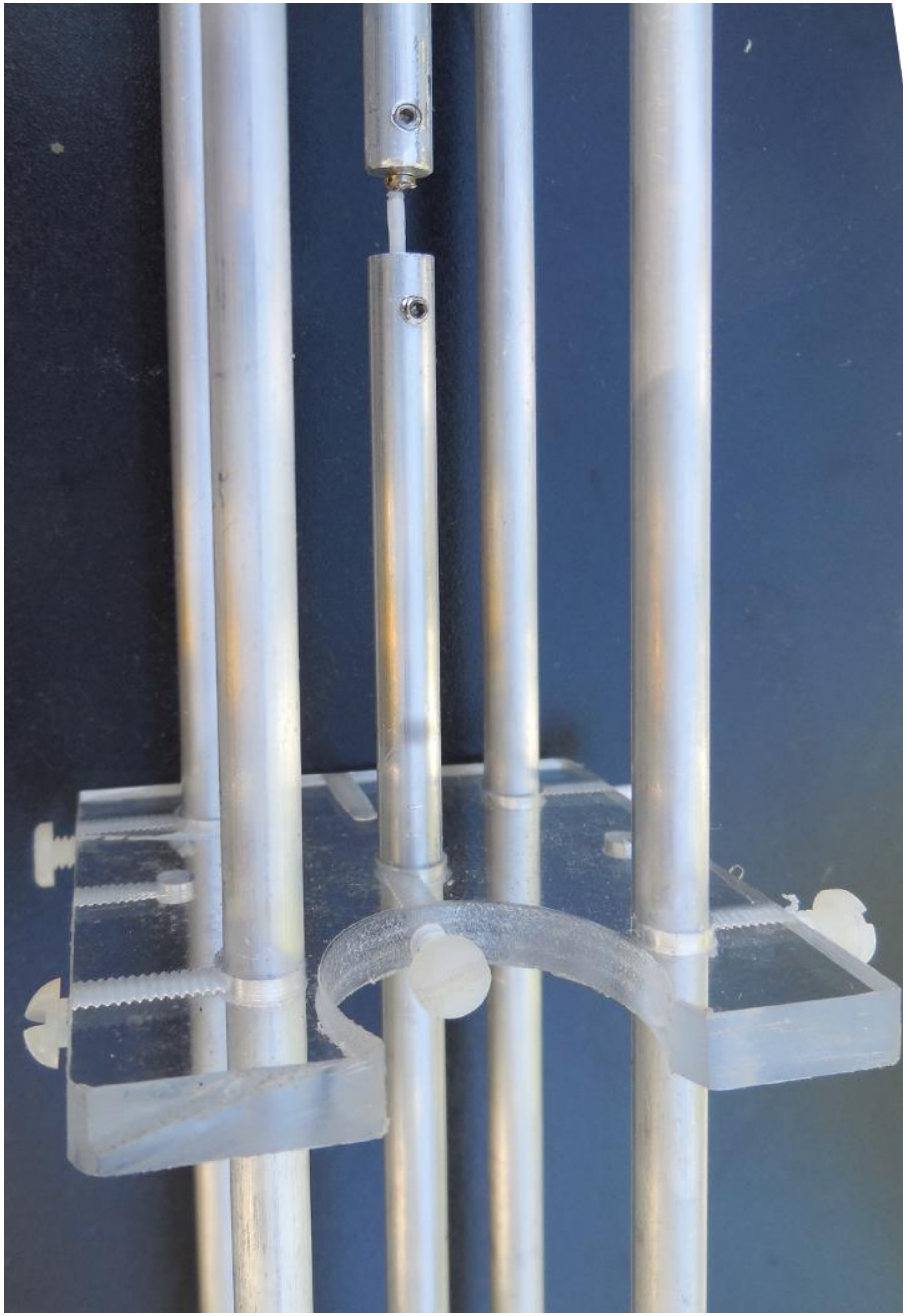
Construction

- Closed sleeve dipole for 146 MHz
- 2 “parasitic” elements for 222 MHz
- 220 elements provide mechanical strength for driven element.



Construction

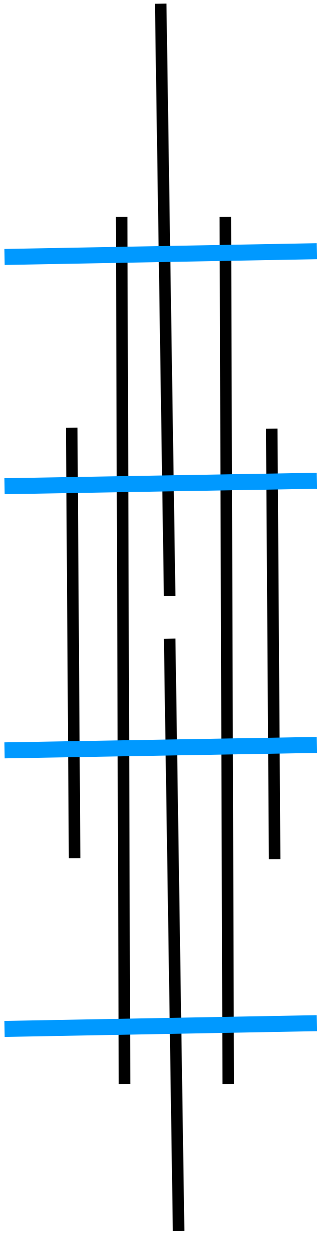
440 MHz elements added.



Construction

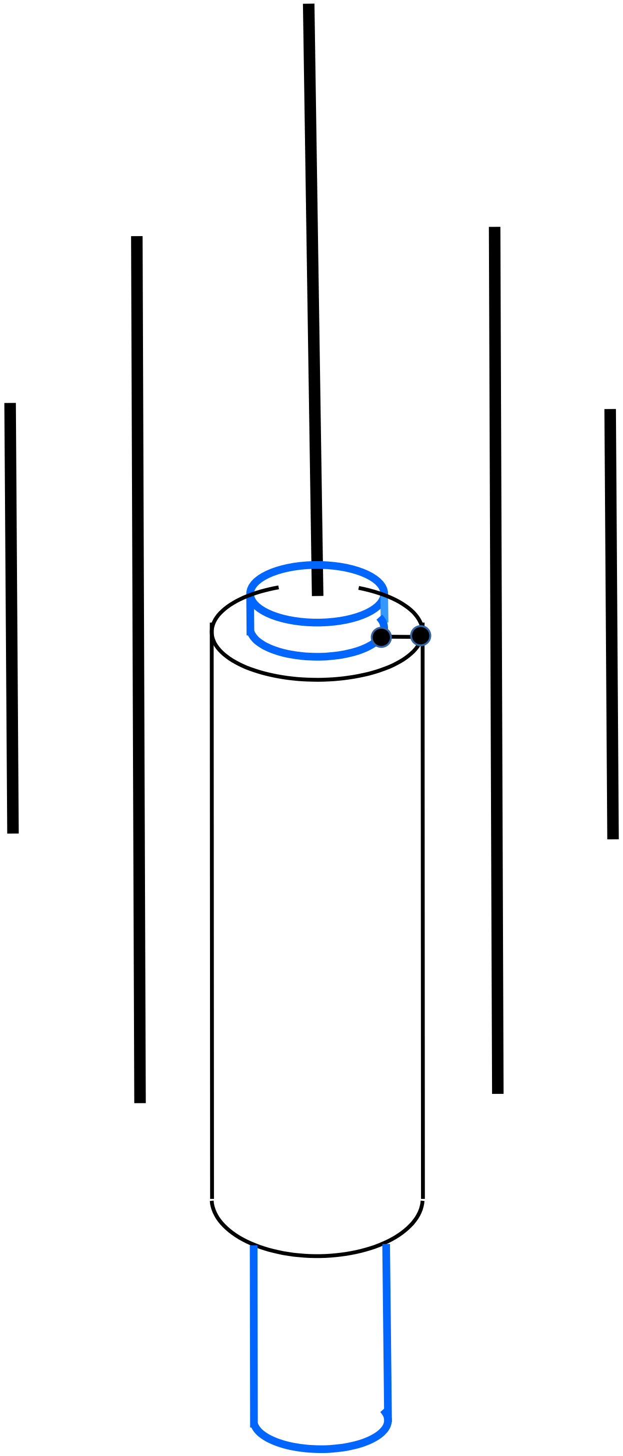
Summary

- Closed sleeve dipole for 146 MHz
- 2 “parasitic” elements for 222 MHz
- 2 more elements for 440 MHz
- Select diameters of available materials.
- Used computer to adjust spacing to get impedance match.
- 4 plastic spacers hold everything in place.



Multi-Band Antenna

- Closed sleeve dipole for 146 MHz
- 2 “parasitic” elements for 222 MHz
- 2 more elements for 440 MHz
- Select diameters of available materials.
- Used computer to adjust spacing to get impedance match.



Multi-Band Antenna

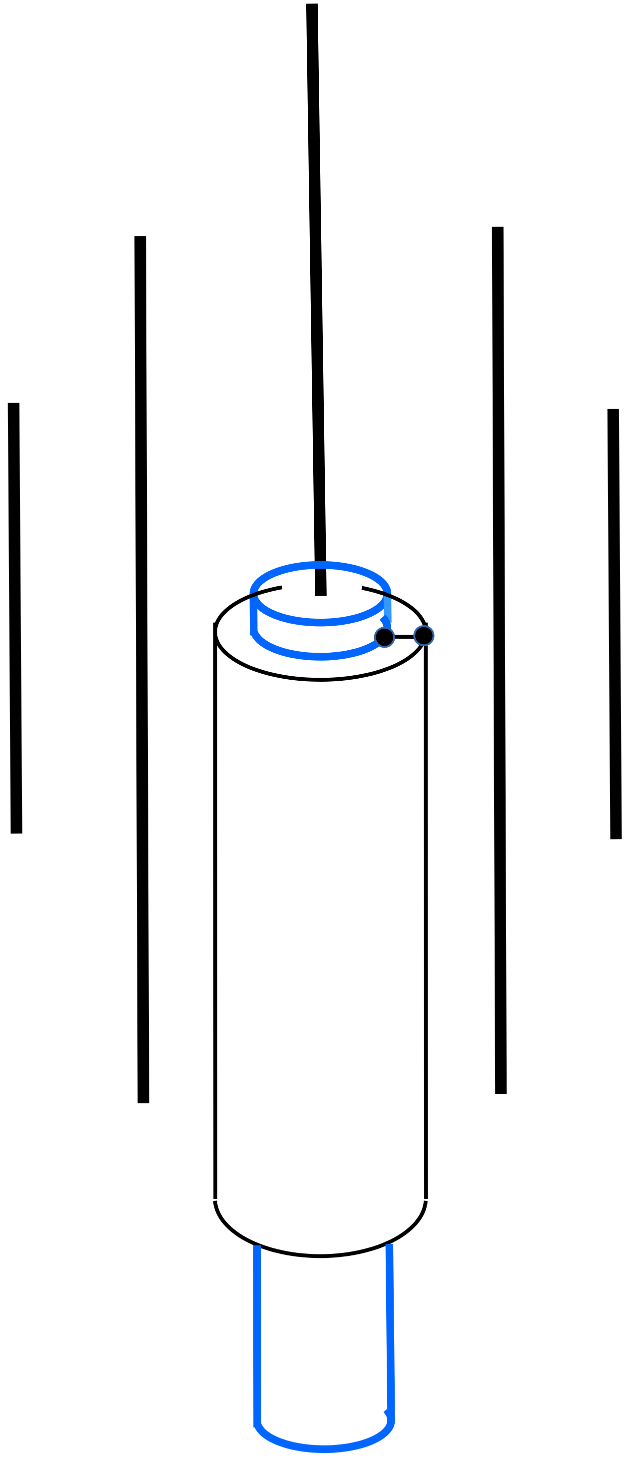
FIRST TEST

After preliminary checks of SWR, does it work?

Local repeater has S-meter feature.

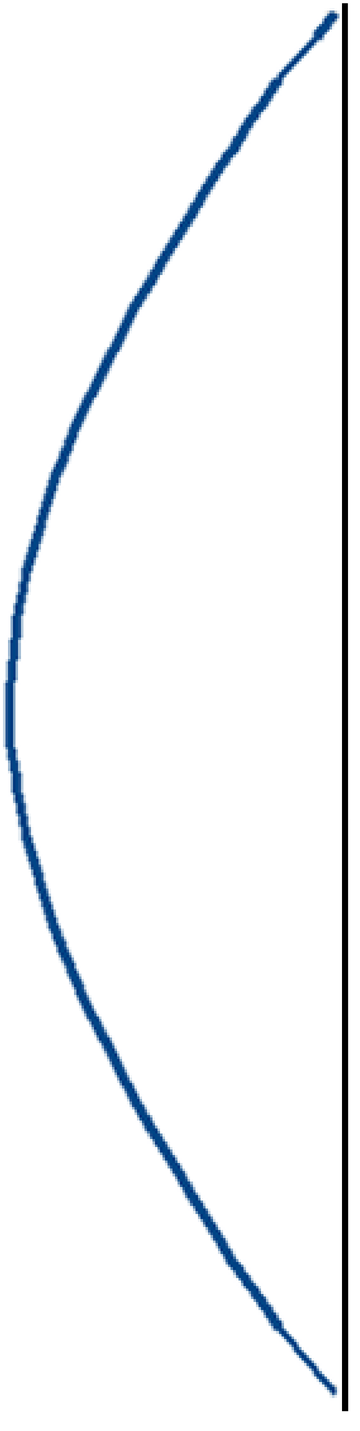
Kenwood antenna S-5

This antenna   S-7.

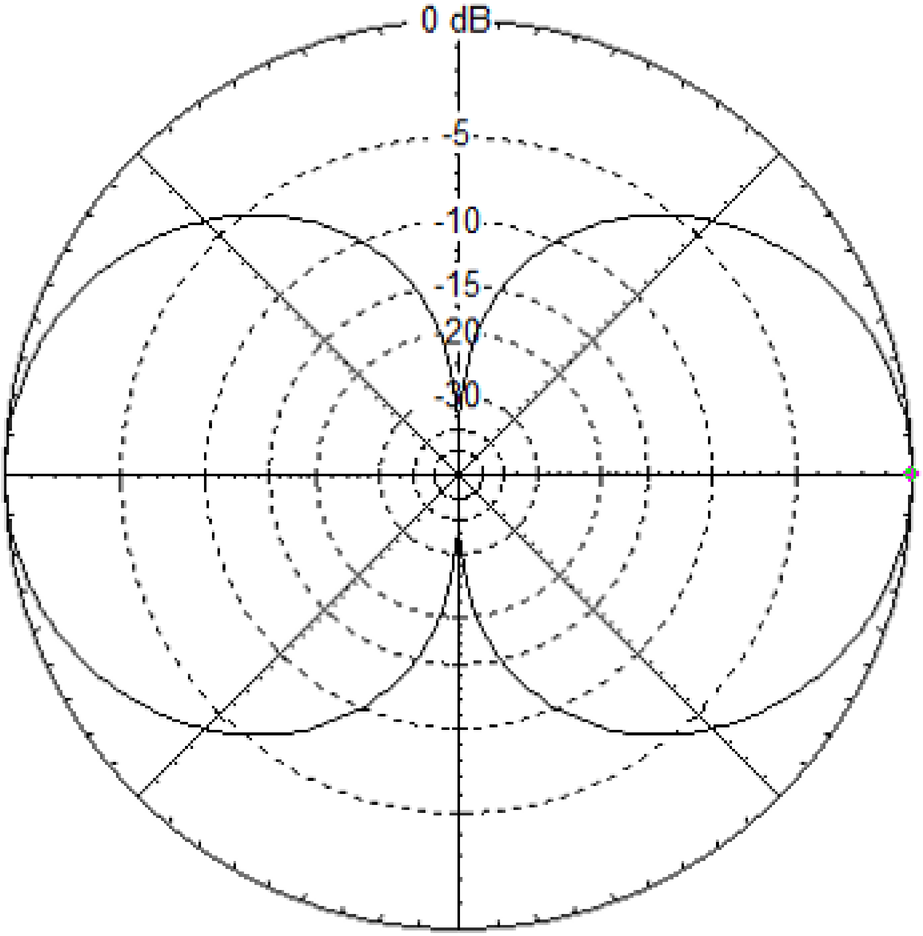


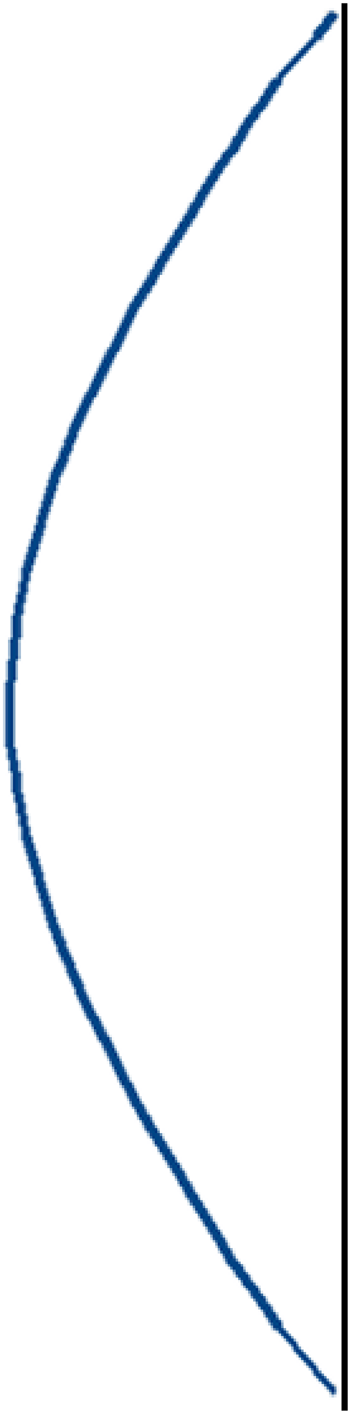
146 MHz

146 MHz

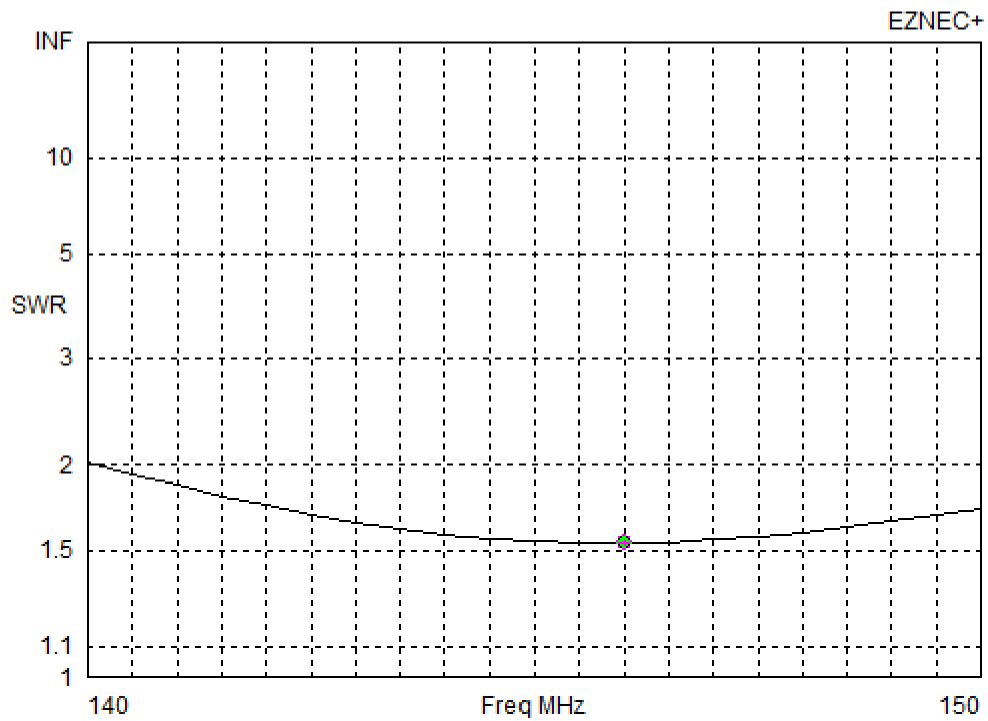


146 MHz Gain 2.1 dBi

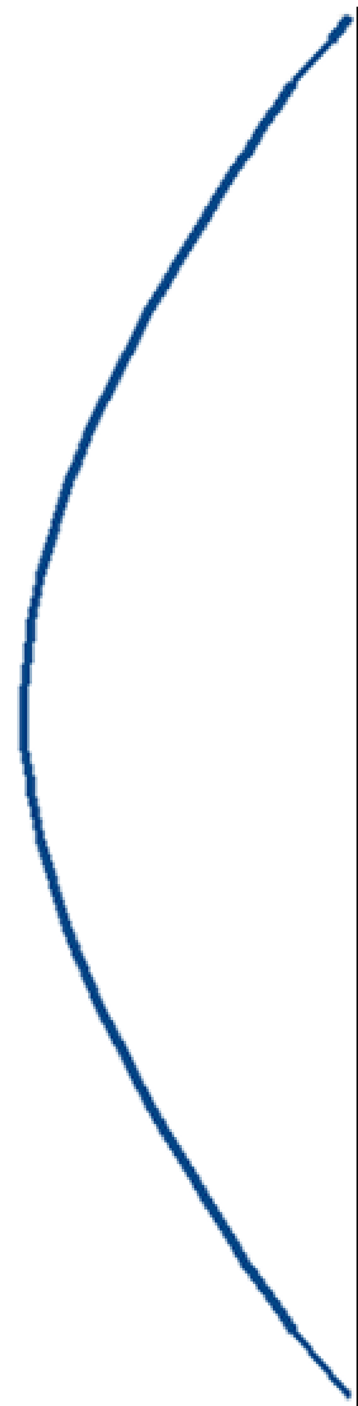




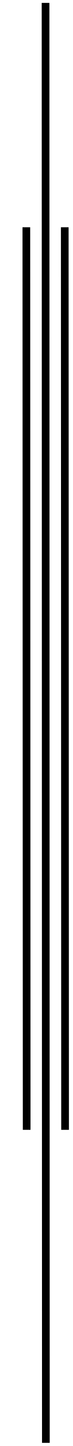
146 MHz   Gain 2.1 dBi



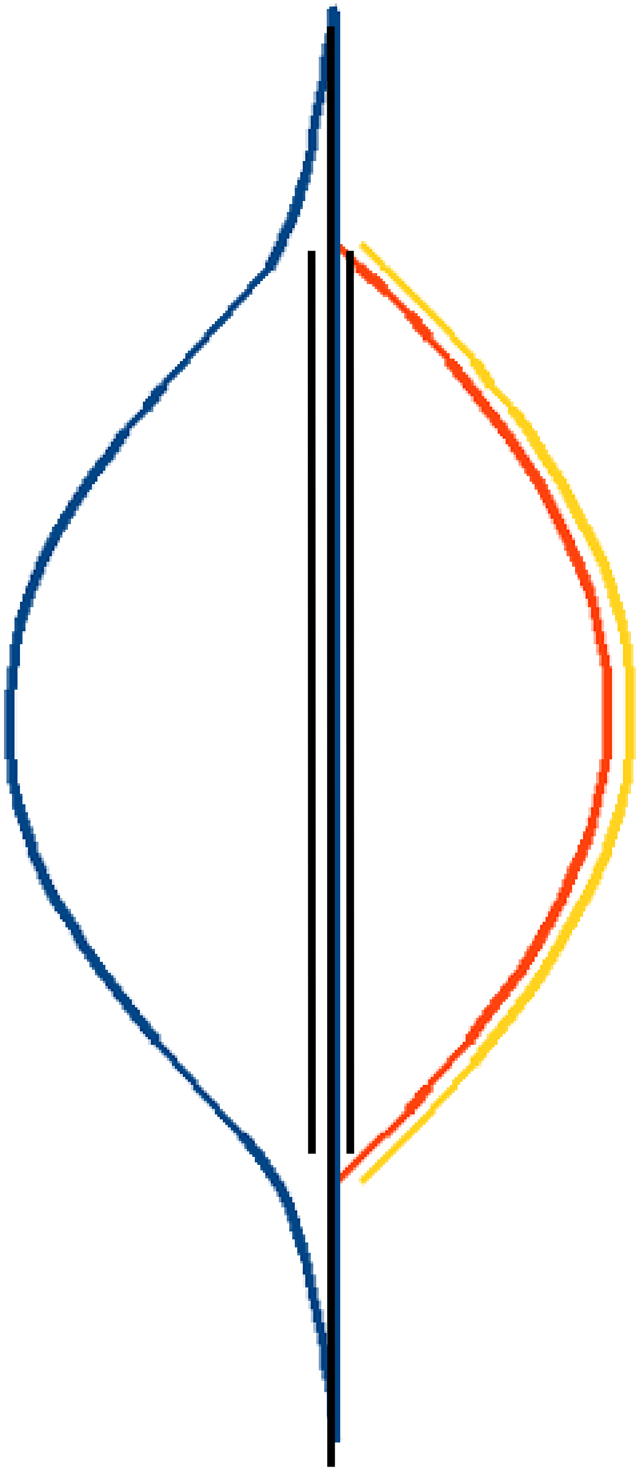
Freq	146 MHz	Source #	1
SWR	**1.53**	Z0	50 ohms
Z	72.7 at -11.52 deg.		
	= 71.24 - j 14.51 ohms		
Refl Coeff	0.2107 at -27.52 deg.		
	= 0.1868 - j 0.09735		
Ret Loss	13.5 dB		



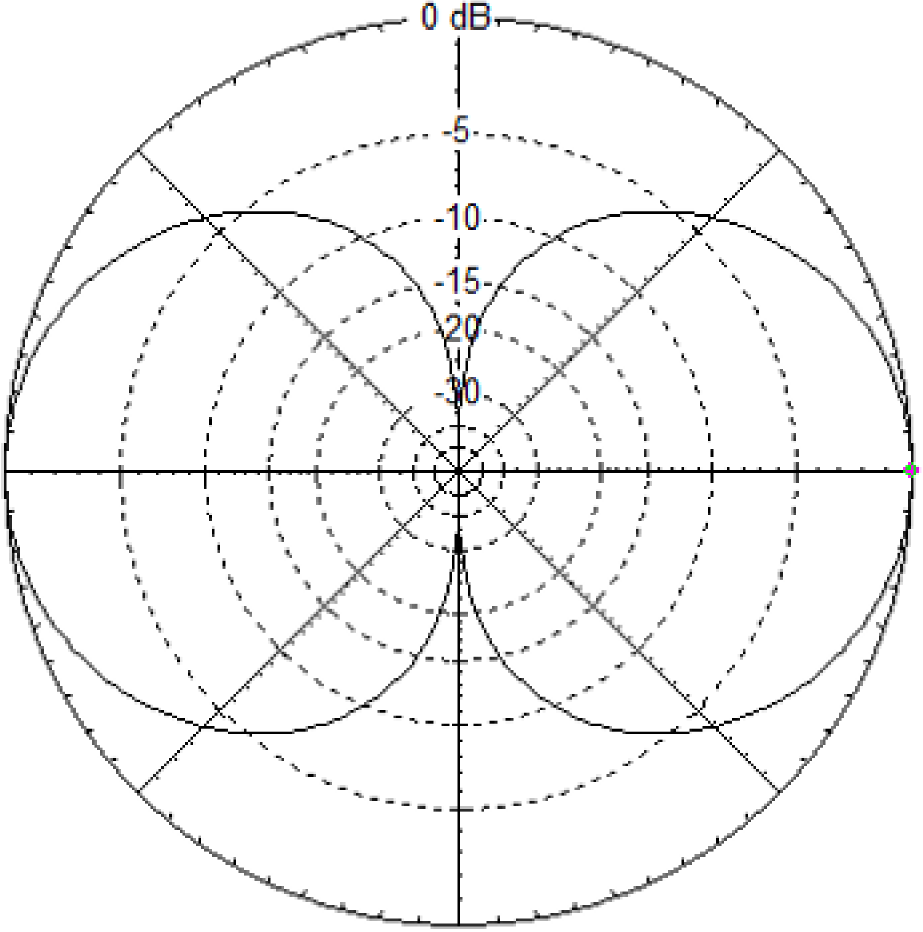
222 MHz

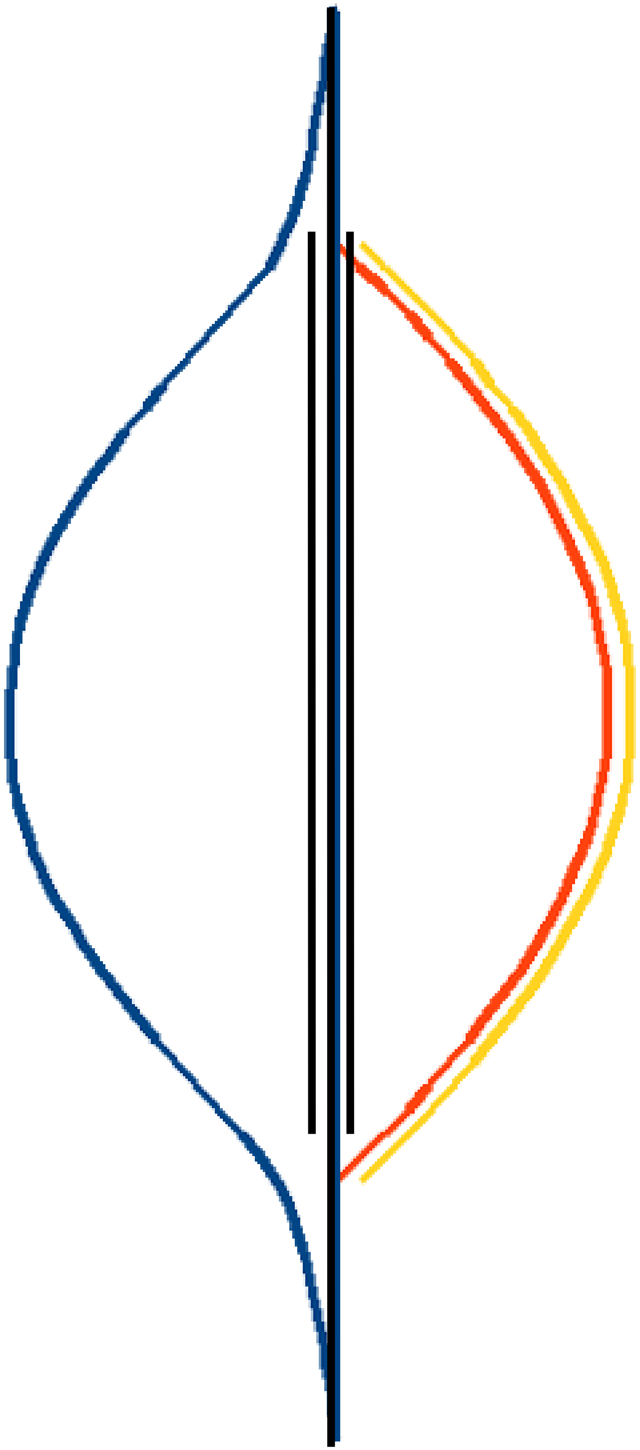


222 MHz

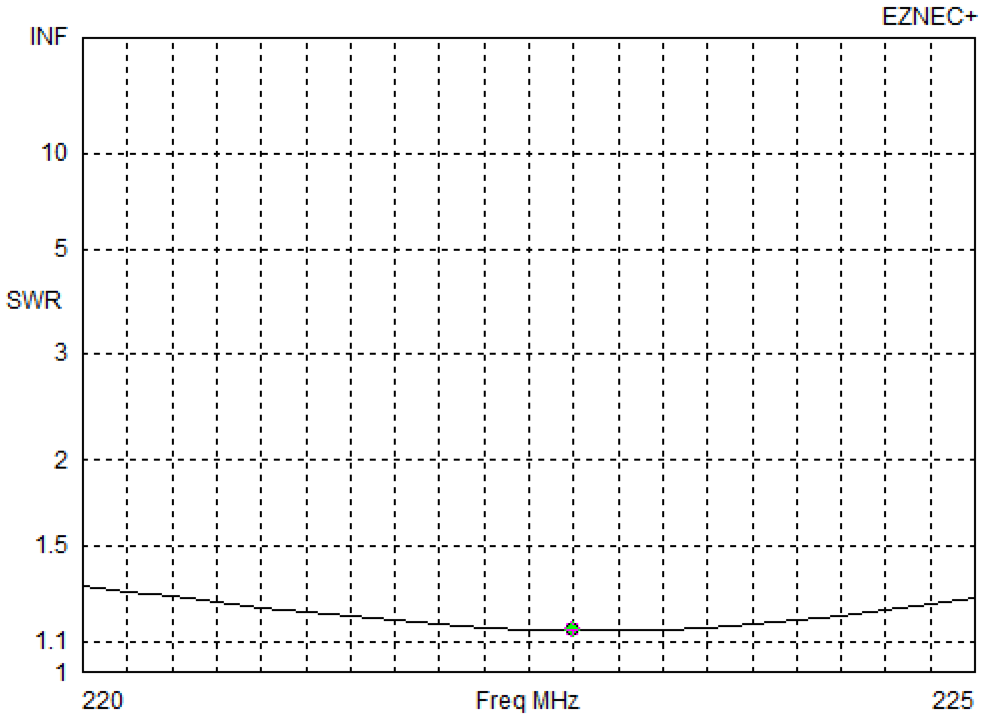


222 MHz   Gain 2.1 dBi

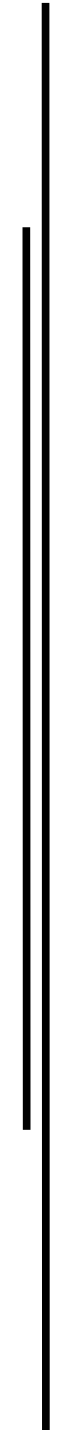




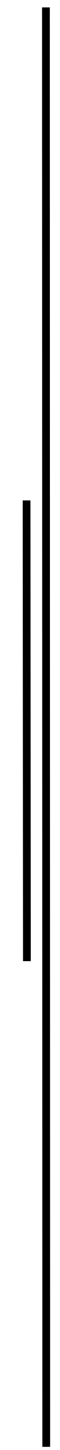
222 MHz Gain 2.1 dBi



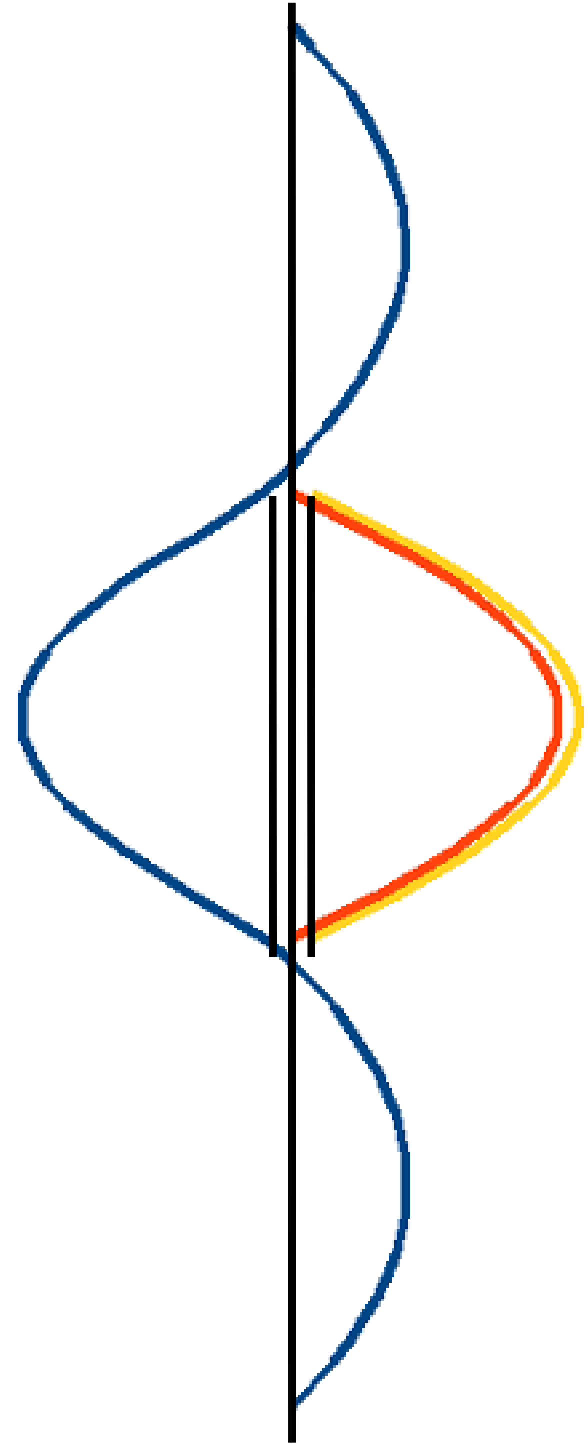
Freq	222.75 MHz	Source #	1
SWR	**1.14**	Z0	50 ohms
Z	44.51 at -3.35 deg.		
	= 44.43 - j 2.604 ohms		
Refl Coeff	0.06509 at -153.37 deg.		
	= -0.05818 - j 0.02918		
Ret Loss	23.7 dB		



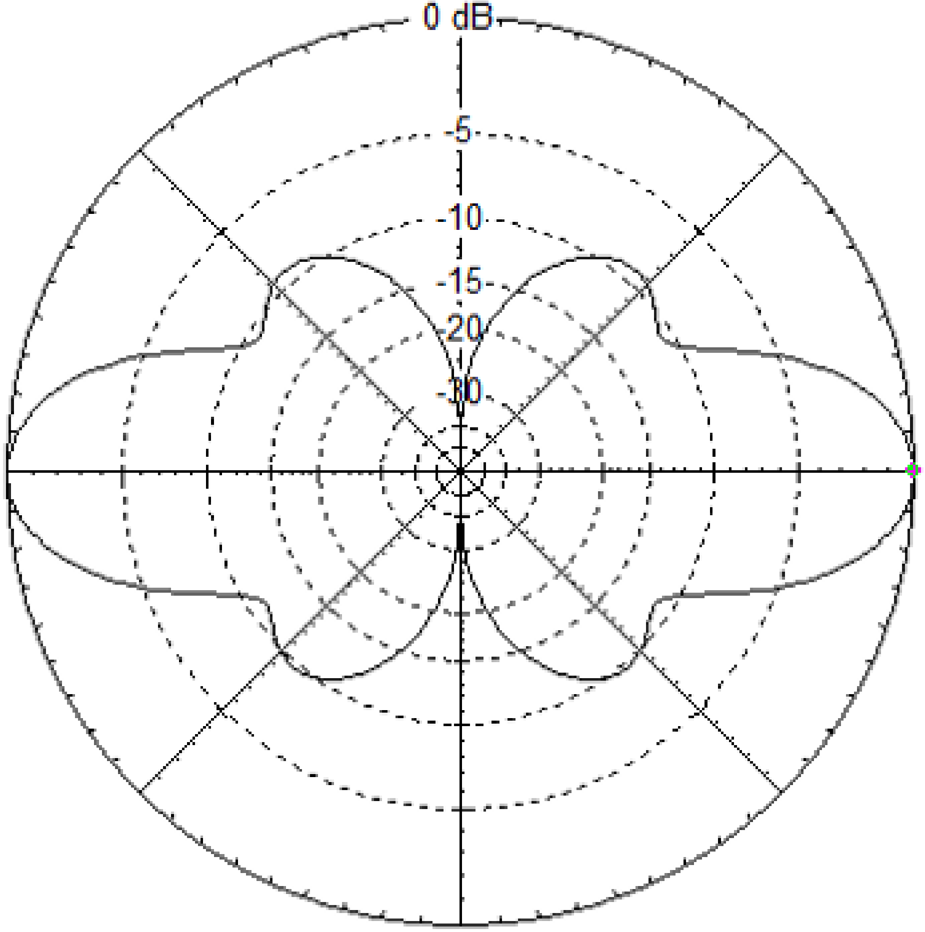
440 MHz

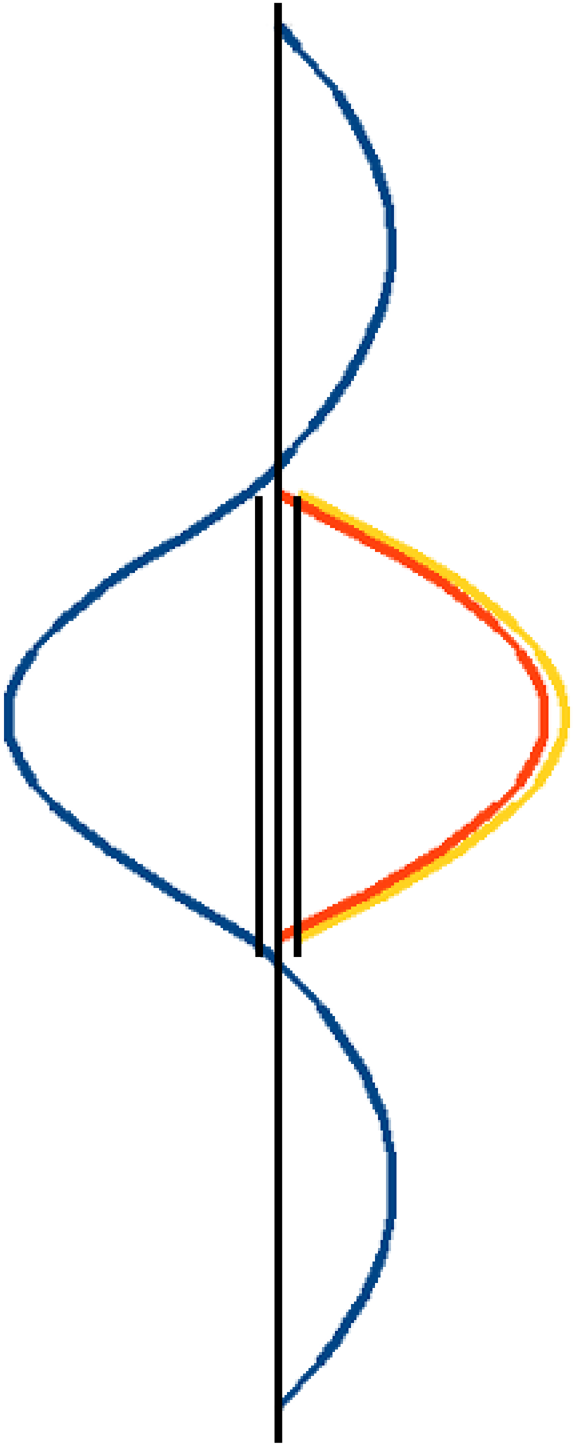


440 MHz

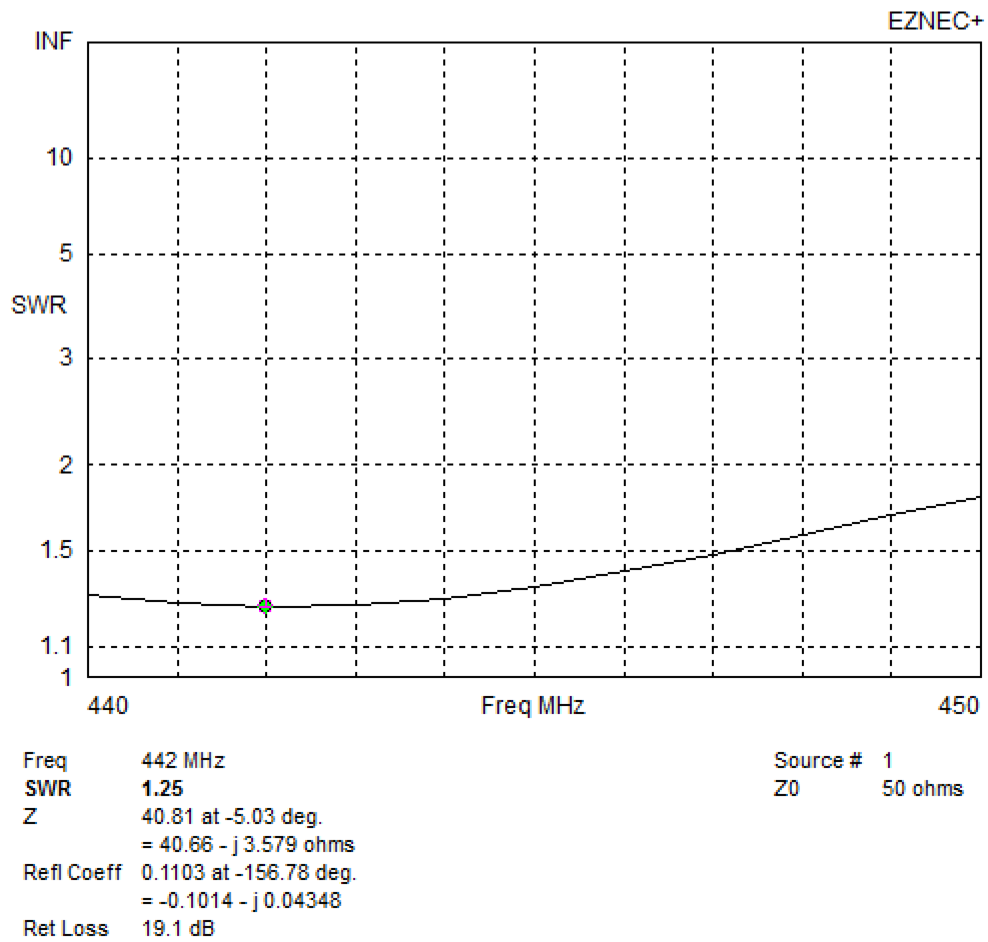


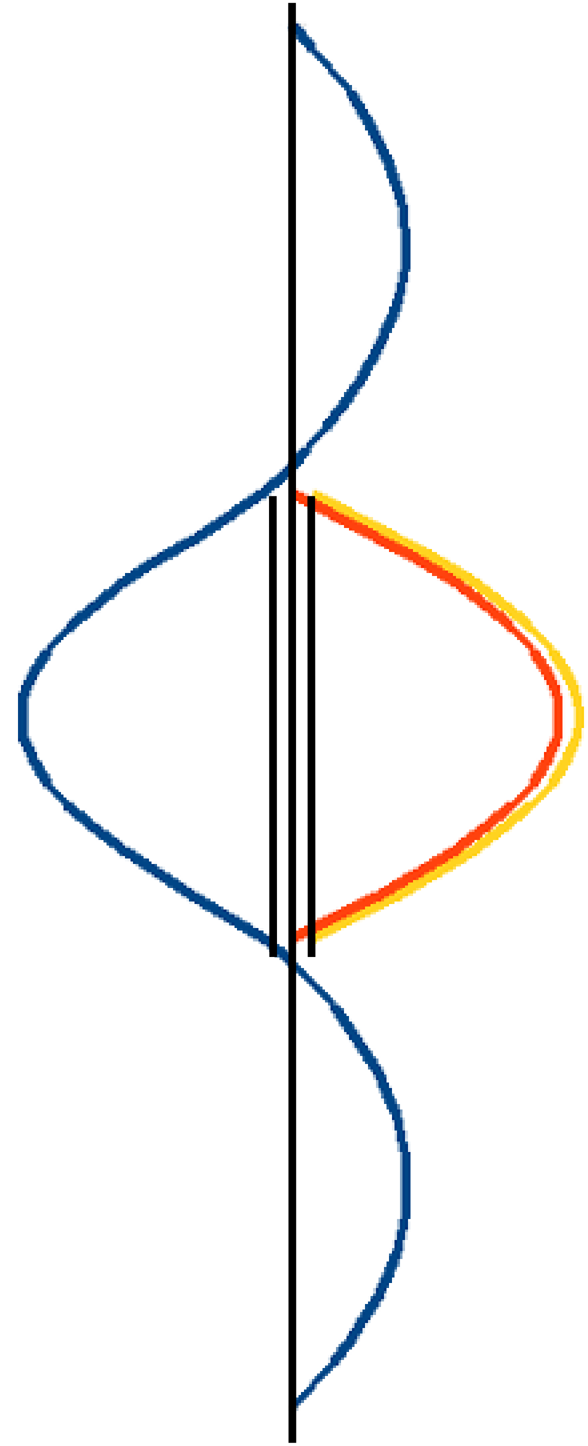
440 MHz   Gain 5.1 dBi



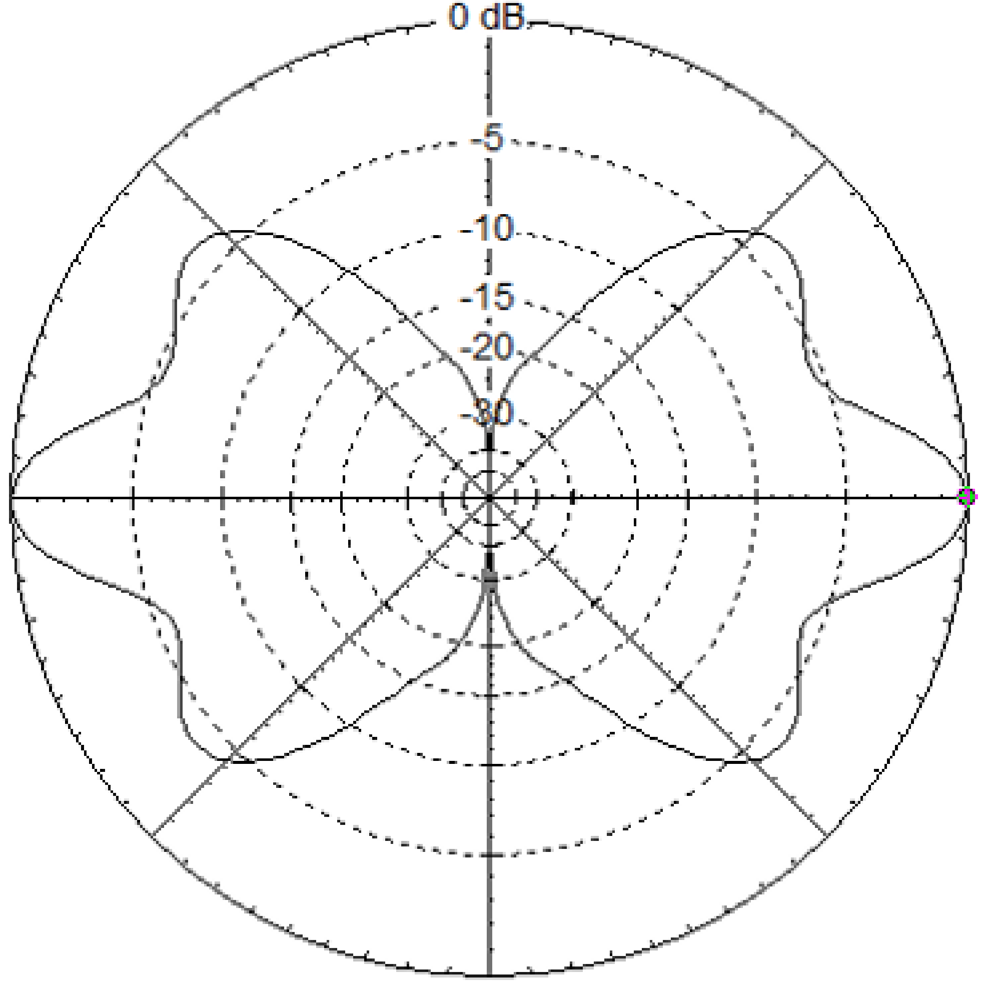


440 MHz Gain 5.1 dBi

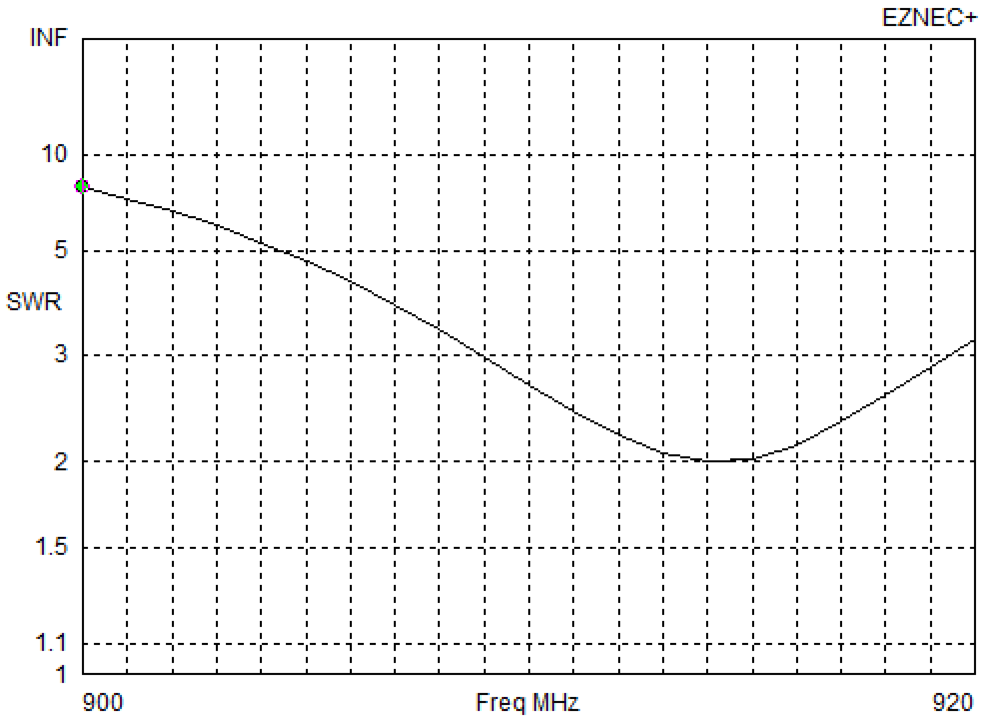




915 MHz Gain 3.2 dBi



915 MHz Gain 3.2 dBi



Freq	900 MHz
SWR	**7.54**
Z	200.5 at -56.29 deg.
	= 111.3 - j 166.8 ohms
Refl Coeff	0.7659 at -23.86 deg.
	= 0.7004 - j 0.3098
Ret Loss	2.3 dB

Source #	1
Z0	50 ohms

SLEEVE DIPOLE RE-VISITED

- Built 4-band proto-type. The parasitic elements were vital to holding the driven element together.
- 220 MHz, 440 MHz and 910 MHz required only a small adjustment to achieve a good match.
- 146 MHz was a different story.

SLEEVE DIPOLE RE-VISITED

- 146 MHz was a different story.
- Resonance was ~130 MHz.
- Added some ferrite beads to decouple the coax cable.
- Didn’t really change the tuning.

SLEEVE DIPOLE RE-VISITED

- Back inside to the test bench.
- Measure just the coaxial sleeve.
- Sure enough it resonated well below 146 MHz.
- (Remember the previous slide showing that ¼ wavelength can be different number of inches!)
- Did some experiments to find length with high-Z at 146 MHz was roughly 17 inches.

SLEEVE DIPOLE RE-VISITED

- Experimented with different types of coaxial cable on the inside of the sleeve.
- Different cables had different resonant lengths.
- Settled on using RG-316.

SLEEVE DIPOLE RE-VISITED

- Settled on using RG-316.
- OD is 0.102 in (Max).
- The outer jacket is Teflon.
- Some other cables use “UV resistant” PVC; with no specification on electrical properties..
- Besides, I have a large spool of RG-316!

SLEEVE DIPOLE
RE-VISITED

- Bottom half of driven dipole is 1/4” aluminum tube.
- Using RG-316, ¼ wavelength at 146 MHz is ~17 inches.
- Drill and tap hole 17” from bottom of sleeve.
- Set screw shorts sleeve to coax braid.
- Antenna resonance is now in 2 meter band.

SLEEVE DIPOLE RE-VISITED

- Later experiments with antenna on network analyzer.
- Re-positioning the ferrite beads showed no effect on the impedance,
- Conclusion: Yet another time when ferrites gave me something to mess with until I found the real solution!

SLEEVE DIPOLE RE-VISITED

- Others have described sleeve dipole antennas, but offer different explanations.

SLEEVE DIPOLE RE-VISITED

http://kv5r.com/ham-radio/2-meter-sleeve-dipole/

- This is an off-center-fed sleeve dipole, made of ½″ CPVC and aluminum foil tape. The elements are fed 3-¼ inches below center, with the coax inside.
- **Off-center feed is required because of the interaction of the lower element with the coax inside.**
- **useable from about 142 to 152, and all of the 440 band as a 3/2 dipole.**

SLEEVE DIPOLE
RE-VISITED

QST, March 2015, page 64.

Roll Up Your Sleeves And Make A Sleeve Dipole.

Joel R. Hallas, W1ZR

SLEEVE DIPOLE

QST, March 2015, page 64.

Roll Up Your Sleeves And Make A Sleeve Dipole.

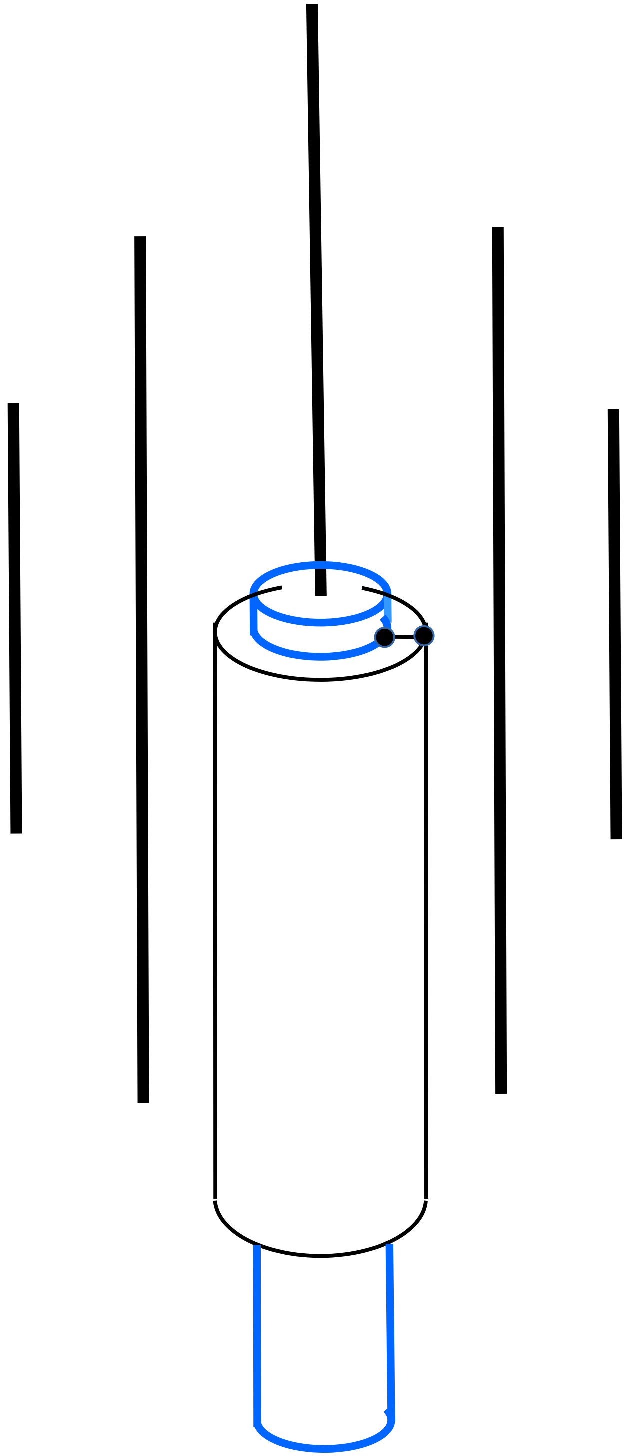
Figure 1 — A *sleeve* vertical dipole made from a length of coaxial cable. This is easy to make and handy for a vertical because the feed comes from the bottom. As noted in the text, unless eliminated, there will be coupling from the sleeve to the coax feed, resulting in common mode current headed toward the station.

There is a subtle effect to consider here (thanks to Kai Siwiak, KE4PT). There are actually two different functions performed by the sleeve. The outside of the sleeve acts as the lower half of the dipole, as expected. The system consisting of the inside of the sleeve and the outside of the coax inside it act to signals on the coax shield as a shorted transmission line section. If that section is an electrical ¼-wave long, it will have a high impedance and act like a common mode choke (often called a *bazooka* — hence your published design's name) to signals on the outside of the coax — a good thing.

SUMMARY

MULTI-BAND ANTENNA WITH OPEN SLEEVES AND CLOSED SLEEVE

- Closed sleeve dipole for 146 MHz
- 2 “parasitic” elements for 222 MHz
- 2 more elements for 440 MHz
- Additional elements can be added for 910 MHz.
- All the Ham bands 100 – 1000 MHz



Multi-Band Bicycle Mobile

Alternate Designs

- The first design was light and could be used on a bicycle
- It took some time and effort to assemble and tune.
- It wasn't very rugged..

Design 2.0

- Note that all of the parasitic elements were at the same distance from the center dipole. Spacing is 1" on center.
- Consider using plastic pipe.
- Trade size 1 ½ inch pipe is about 2 inches OD.
- Built another sleeve dipole and put in the center of a length of PCV Pipe

Design 2.0

- Built another sleeve dipole and put in the center of a length of PCV Pipe.
- Actual construction was like making a ship in a bottle.
- The dipole has no strength in the center.
- And needs to be securely held in the center of the pipe.
- Parasitic elements are simply ¼" copper foil tape on the outside of the pipe.   Very easy to apply and trim to resonance.

Design 2.0

- At the time, I had an vintage Ford Ranger pick-up truck.
- The PVC pipe made a very rugged structure for mobile operation.

Design 2


California
AA6PZ


AAI
RF VECTOR IMPEDANCE ANALYZER
N1201SA
S-Frq
CAL1
AAI
70%
FRQ
445.000 MHz
R (Ω)
X (Ω)
49.50
-12.64
VSWR
S11 (dB)
1.288
-18.00
|Z| (Ω)
ESC(pF))
51.08
28.34
M
OK
CTRL
ACCURACY AGILITY INSTRUMENT

Design 3.0

- The antenna worked well.
- Alas the almost 30 year old truck stopped working.
- I now wanted a mag-mount antenna to use on my car.

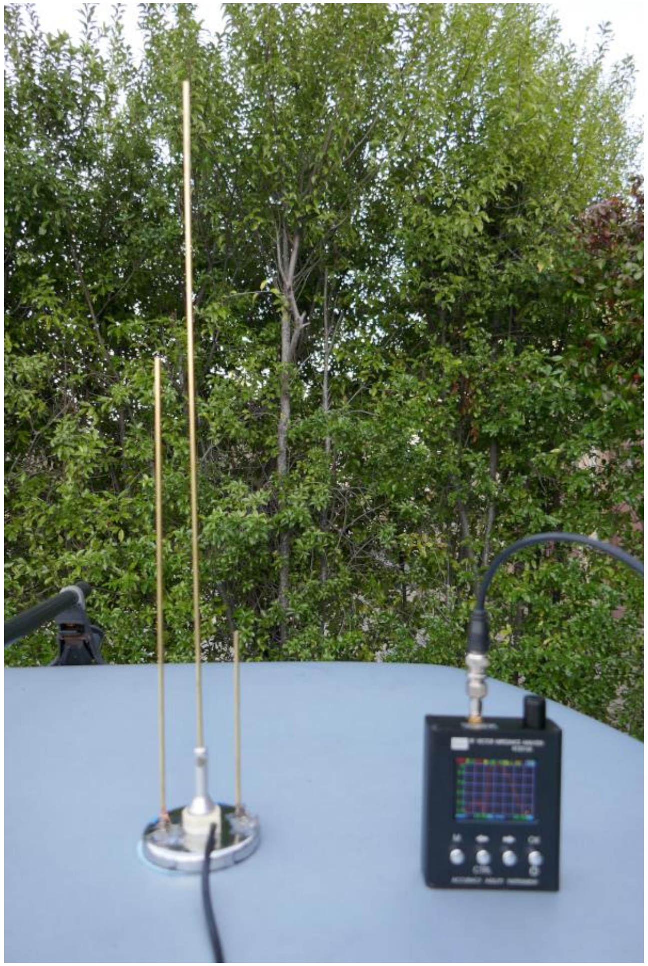
Design 3.0

- A previous slide showed the correspondence between a vertical antenna in free space and one half as long over a ground plane.
- A ¼ wavelength antenna over a ground plane is very much like a ½ wavelength vertical dipole in space.
- So how to build half of the multi-band antenna on a mag mount?

Design 3.0

- In my junque box was a mag-mount I got at the Electronics Flea Market years ago.
- Prototype proves the concept but is a little fragile. Can't drill into or solder to the magnet.
- Glue is adequate, as long as you are careful in pulling the antenna off the car roof.
- I'm looking for a source of magnetic bases and make a rugged and reproducible design.

Design 3.0



Design 3.0


VSWR X2.0 CAL1 Mk 146.000MHz 1.239
11
9.0
7.0
5.0
3.0
1.0
start: 138.000MHz stop: 475.000MHz

Design 3.0

VSWR X2.0 CAL1 Mk 224.000MHz 1.493
74%
11
9.0
7.0
5.0
3.0
1.0
start: 138.000MHz stop: 475.000MHz

Design 3.0

VSWR X2.0 CAL1 Mk 445.000MHz 1.342
71%
11
9.0
7.0
5.0
3.0
1.0
start: 138.000MHz stop: 475.000MHz

About The VNA

- This unit works from 137.500 MHz to 2700 MHz.
- Compared to nanoVNA, the visibility outdoors is better, because it has bigger size characters.
- Only measures 1 port, but that is all you need for antennas.

REFERENCES

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QUESTIONS?