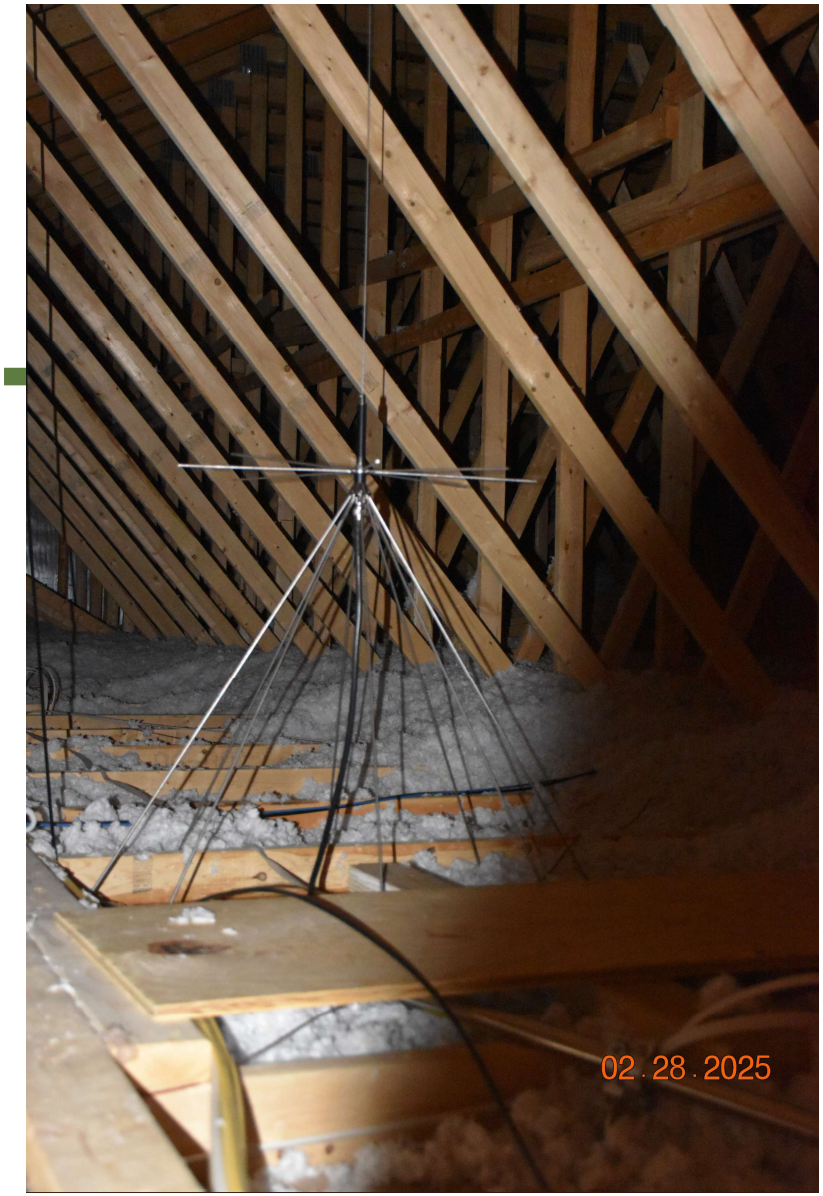
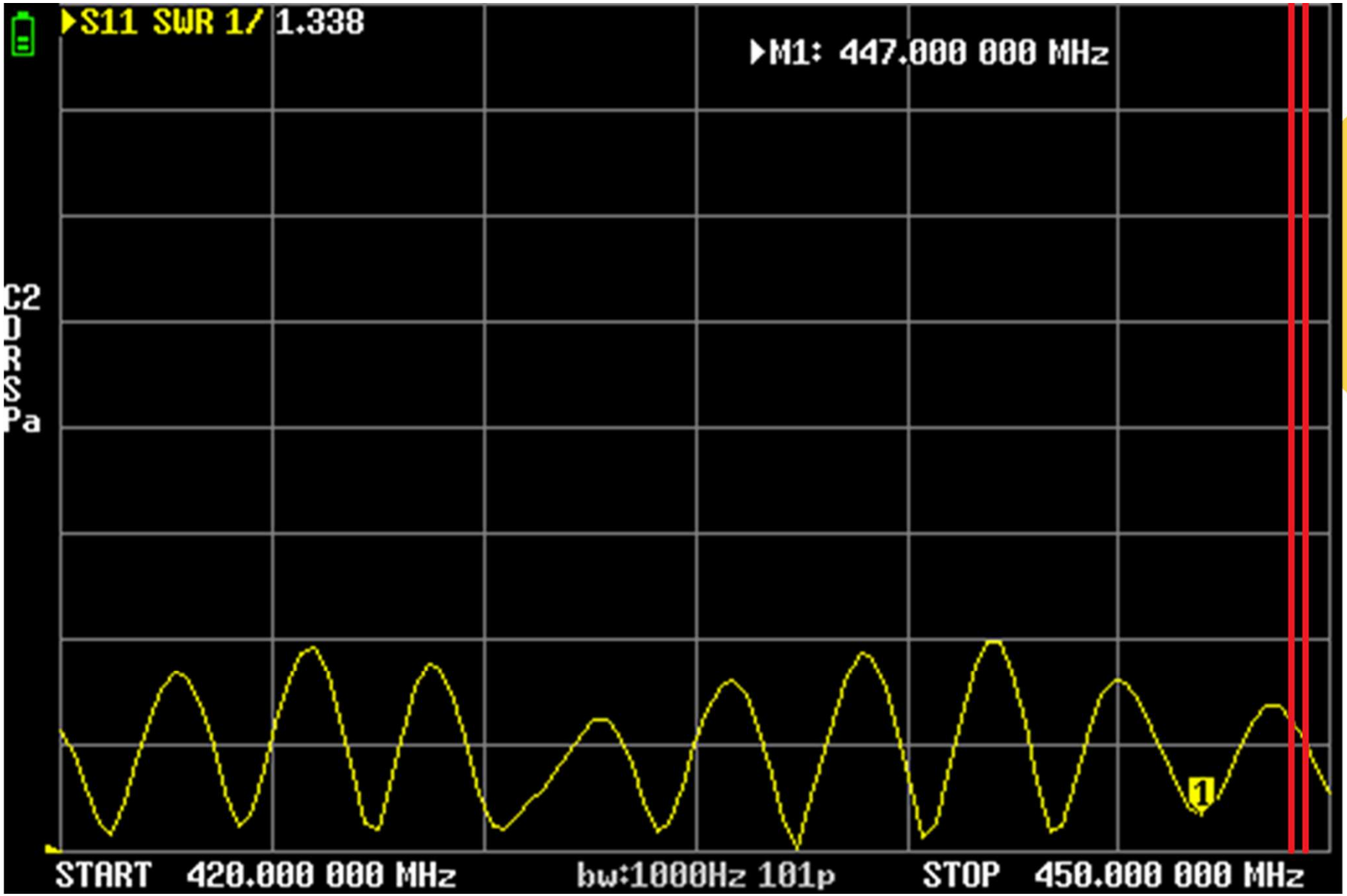
300 Ω Twin Lead J-pole Variations

N9TEO – Mike Hall



My “government solution” for VHF/UHF



448.55 MHz &
448.95 MHz

Agenda

- 300 Ω Twin Lead
- A Little J-pole Theory
- Constructing a Simple J-pole
- The Super-J
- The Dual-band J

300Ω Twin Lead

- **Twin lead** cable is a two-conductor flat cable used as a balanced transmission line to carry radio frequency (RF) signals

- It is constructed of two, stranded copper wires, or solid copper-clad steel wires

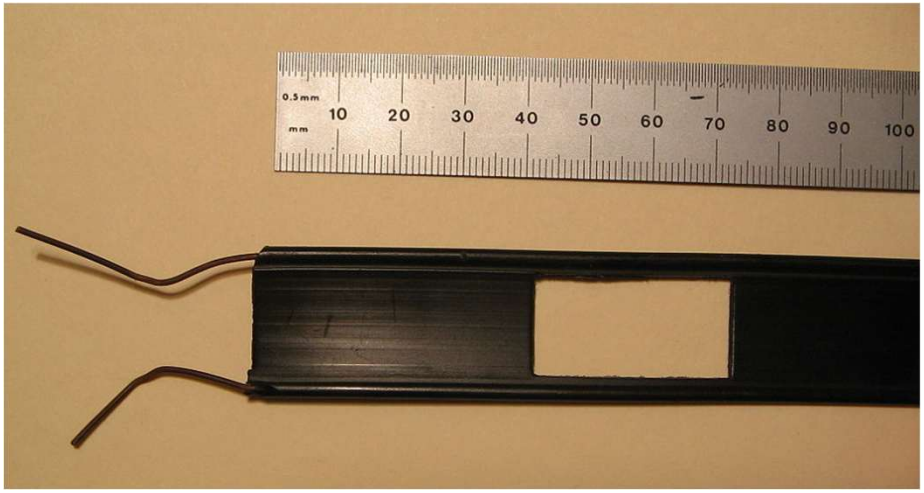
300Ω Twin Lead

- It can have significantly lower signal loss than smaller flexible coaxial cable

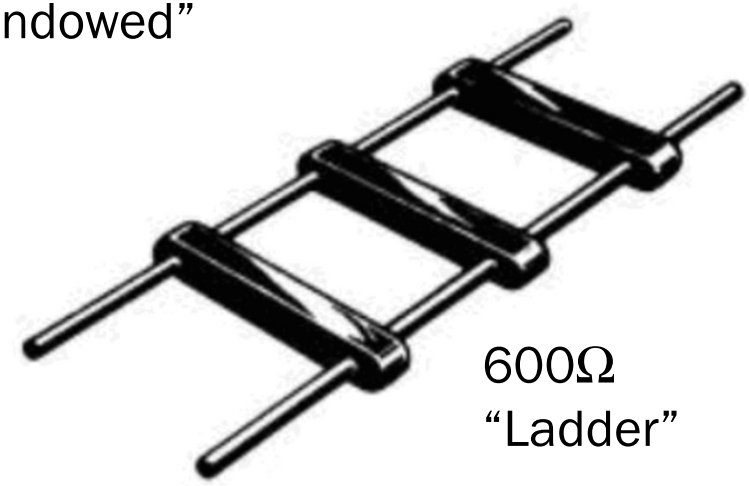
Cable Type	Frequency (MHz)	Loss (dB) per 100m
RG-58A/U	30 MHz	6.6
300 Ω Twin Lead	30 MHz	0.55

300Ω Twin Lead

- Popular with home TV applications
- Other impedances include 450Ω and 600Ω



450Ω “windowed”

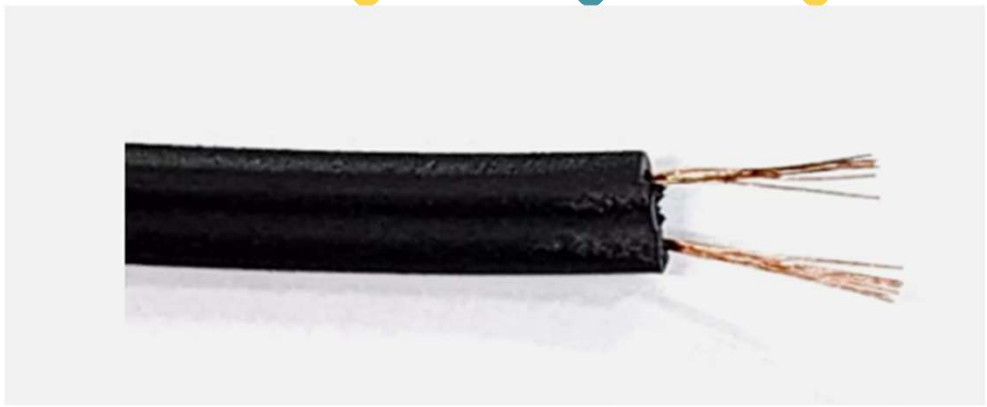


600Ω
“Ladder”

300Ω Twin Lead

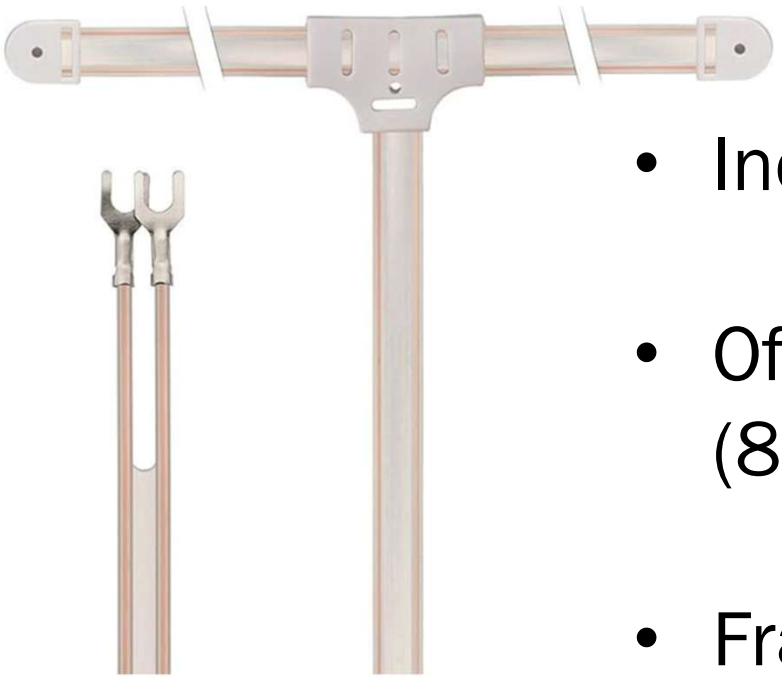
- 300Ω twin lead comes in two types

300Ω “windowed”



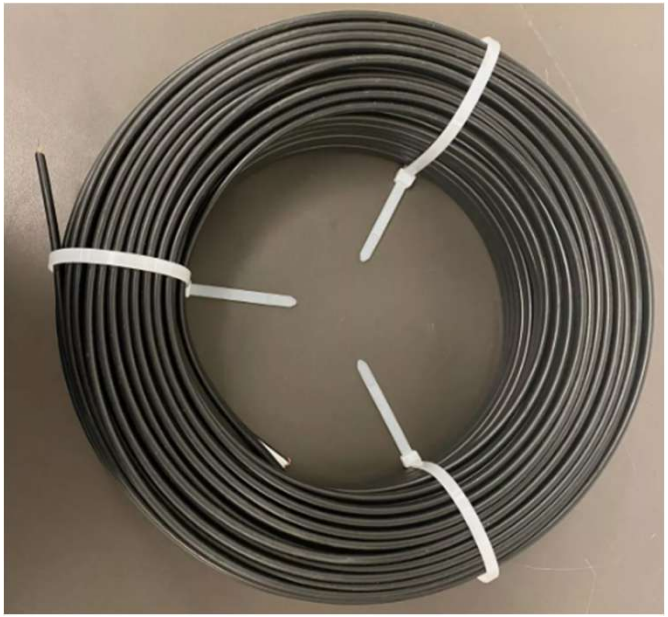
300Ω “tv antenna wire”

300 Ω Twin Lead



- Indoor use only
- Often used for FM folded dipoles (88 – 108 MHz)
- Fragile; hard to alter for ham use

300 Ω Twin Lead



Outdoor rated

Foam-filled for low loss

Twin Lead Cable 300 ohm Foam Insulated Flat Wire TV Video Antenna, 10 Feet, 10'

Brand New

$10.95

or Best Offer

Free shipping

dcha461 (369) 100%

25 Foot 300 Ohm Foam Insulated Twin Lead-in Wire for TV Video Antenna 25' 25ft.

Brand New

$18.25

Buy It Now

Free shipping

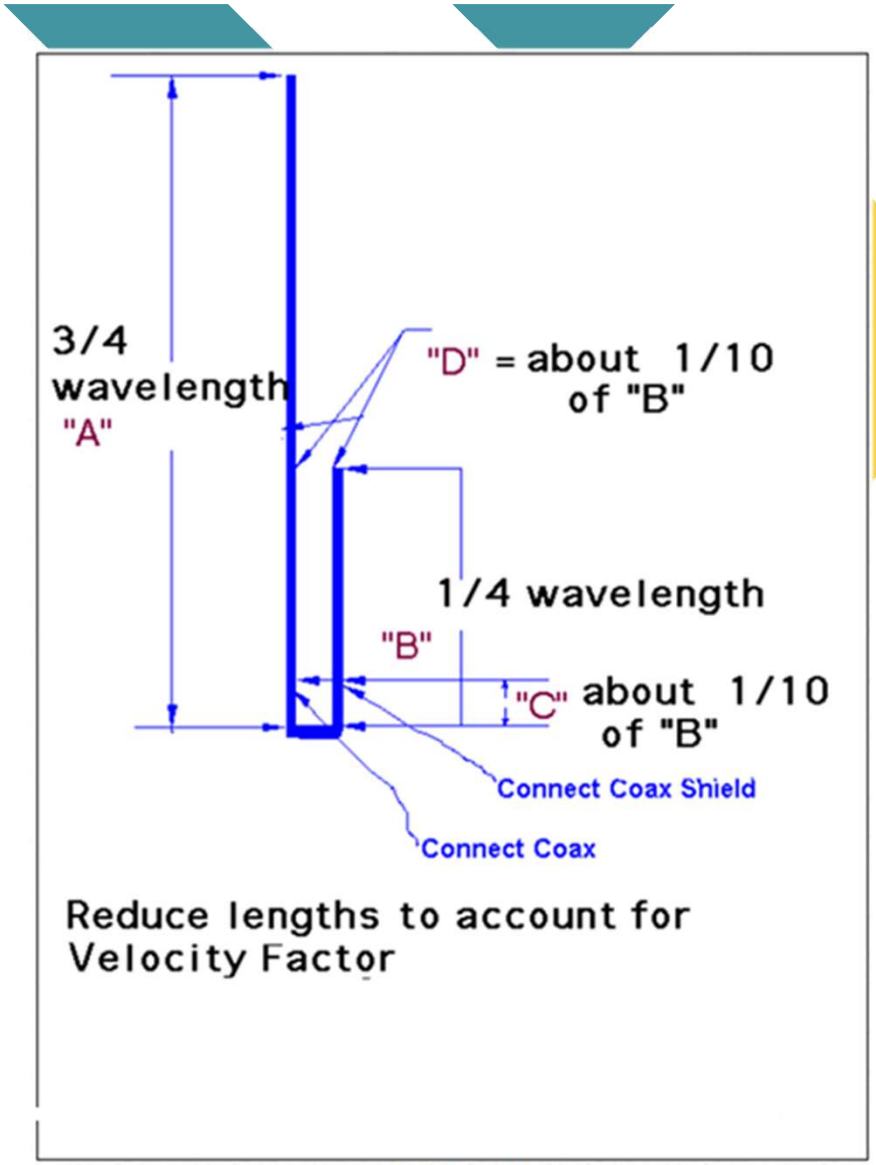
Free returns

311 sold

elh100 (7,177) 100%

A Little J-pole Theory

- **End-fed half-wavelength antenna**
- **Fed through a shorted 1/4 wave matching stub (no radials)**



J-pole dimensions

A Little J-pole Theory

- Online calculators put you in the ballpark
- *https://m0ukd.com/calculators/slim-jim-and-j-pole-calculator/american-version/*
- The velocity factor (Vf) is *critical*

Table of Twinlead Velocity Factors

Key points about twin lead velocity factors:

- **Typical range:** Most twin lead cables will have a velocity factor between 0.80 and 0.83.
- **Dependence on insulation material:** The exact velocity factor can slightly vary depending on the type of insulation used in the twin lead cable.

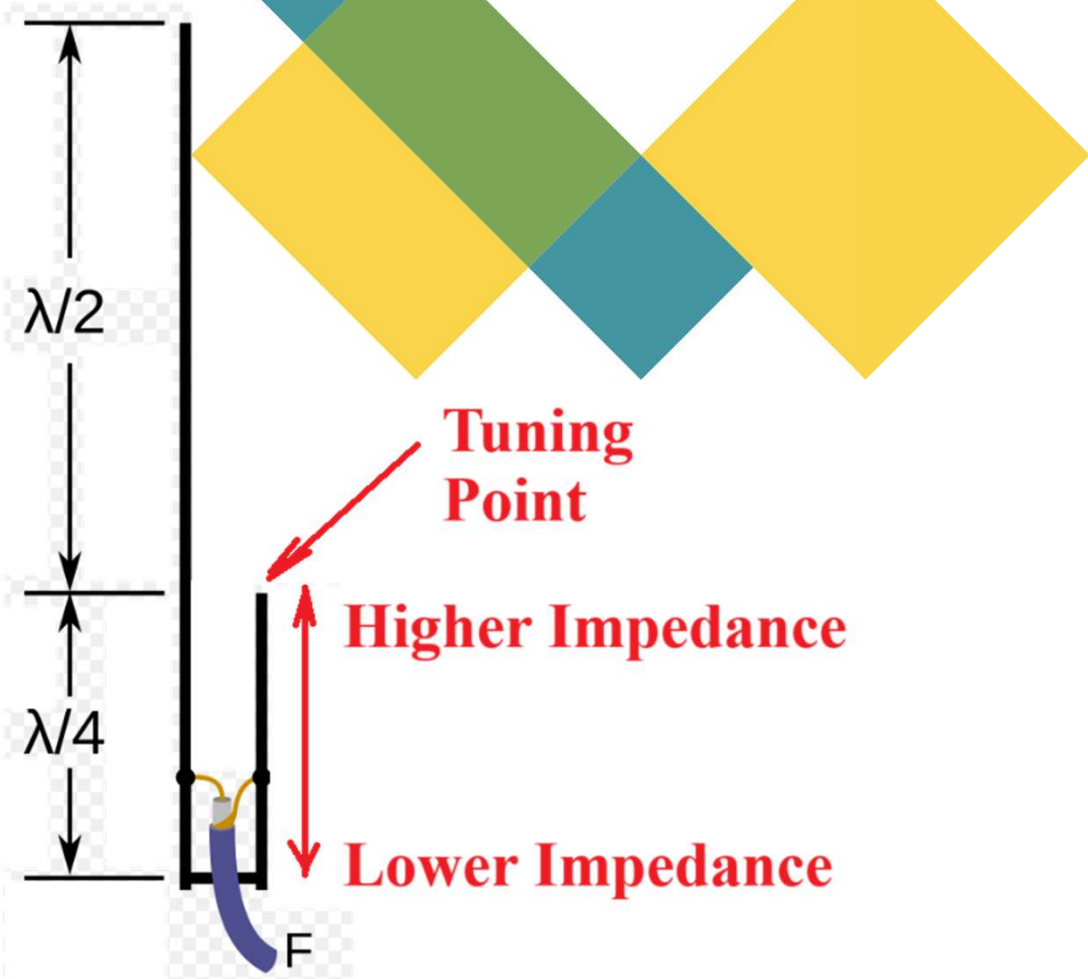
TABLE OF WIREMAN WINDOWLINE AND TWINLINE:

WIREMAN BALANCED LINES								
P/N	Nominal Impedance	Real Imp.	Velocity Factor Claimed	Velocity Factor Real*	Nominal Outer Diameter	AWG	Strands / AWG	xx
551	450 Ω	450 Ω	0.91	0.902	.065 X .930	18	1 / 18	1318
552	450 Ω	400 Ω	0.91	0.917	.065 X .930	16	19 / 29	1315
553	450 Ω	450 Ω	0.91	0.898	.065 X .930	18	19 / xx	1317
554	440 Ω	370 Ω	0.91	0.928	.065 X .930	14	19 / 27	1313
562	300 Ω	300 Ω	0.91	Unknown	.150 x .400	20	7 / 28	1320

*Source: N7WS

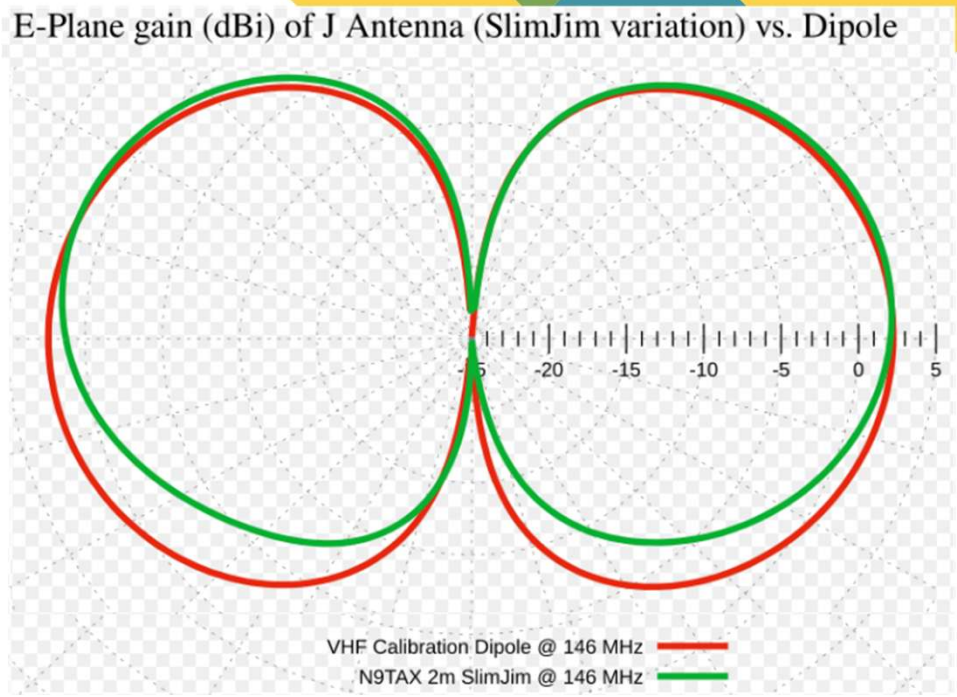
A Little J-pole Theory

- Impedance determined by location of feed point
- Tuning is by changing the length of the tuning stub



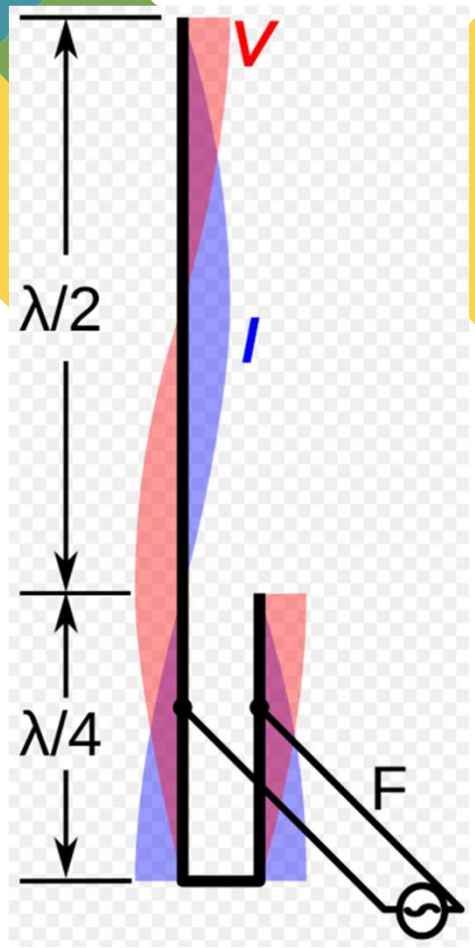
A Little J-pole Theory

- **E-plane (vertical) RF distribution**
- **Free space gain approximately 2.2 dB**
- **Sensitive to electrically conductive objects in its induction fields**

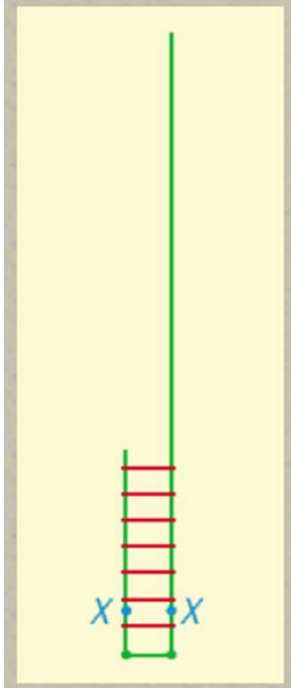


A Little J-pole Theory

- Voltage (V) & Current (I) standing wave distributions
- If built correctly, the matching section is not a part of the antenna (NOTE: can help with mounting)

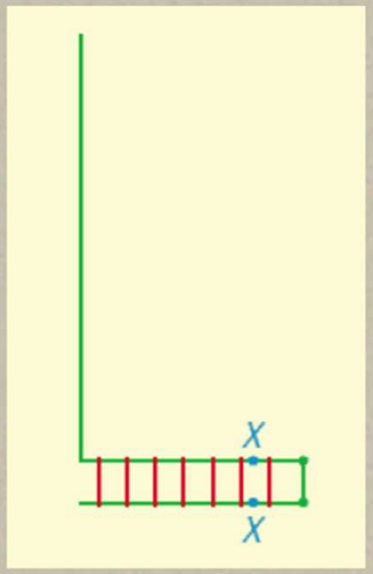


The antenna can be mounted in several ways:



The classic J-Pole with both sections mounted vertically.

Length 3/4-lambda, only for the higher bands.



It is no difference in the radiating conditions, if the lambda/4-part is vertical or horizontal.

The pattern is identical with a vertical dipole.

Both parts horizontally mounted

The "Zepp"-configuration

Constructing a Simple J-pole

- 70 cm band dimensions

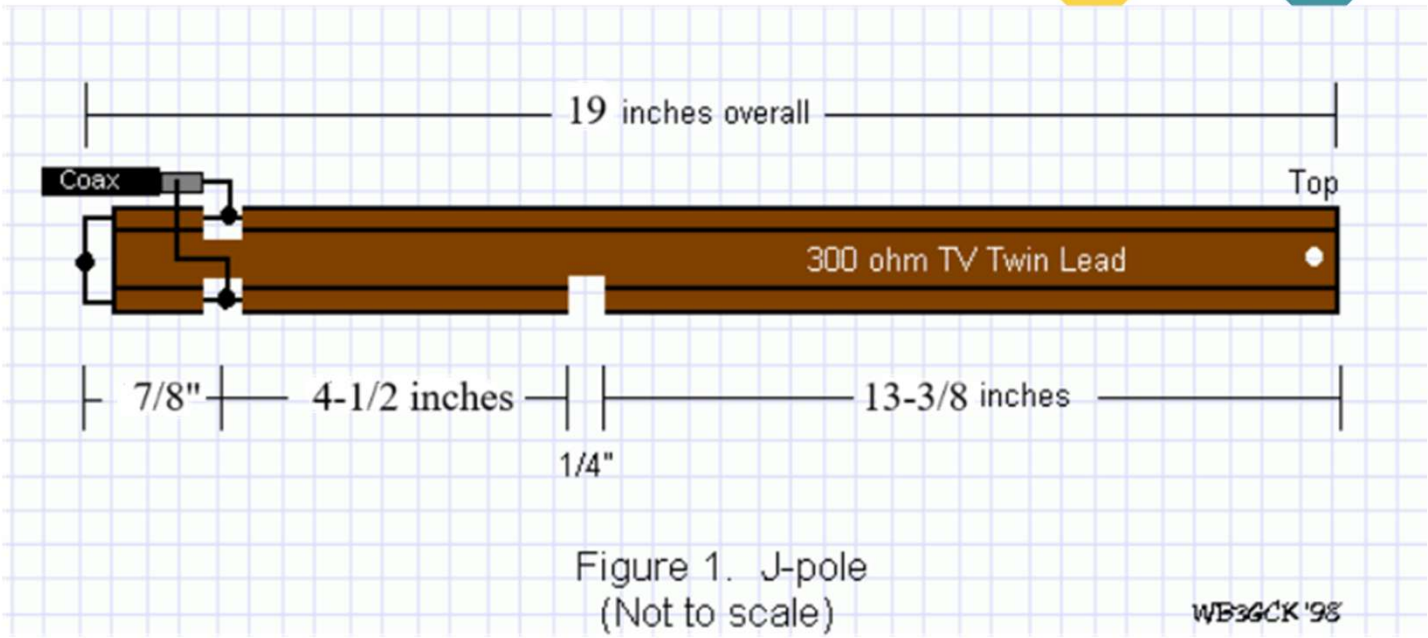
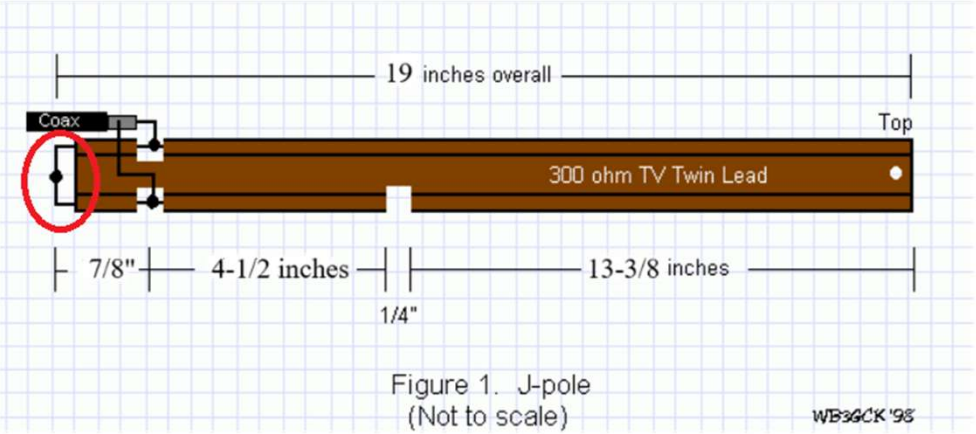


Figure 1. J-pole
(Not to scale)

WB3GCK '98

Constructing a Simple J-pole

- Cut overall length (add ¼” for bottom ‘short’)
- Start with the bottom



Constructing a Simple J-pole

- Remove ¼” of insulation

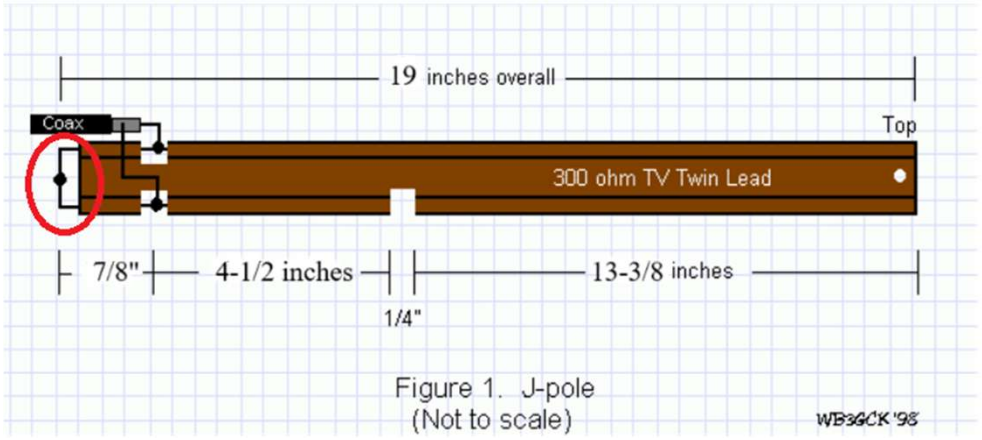
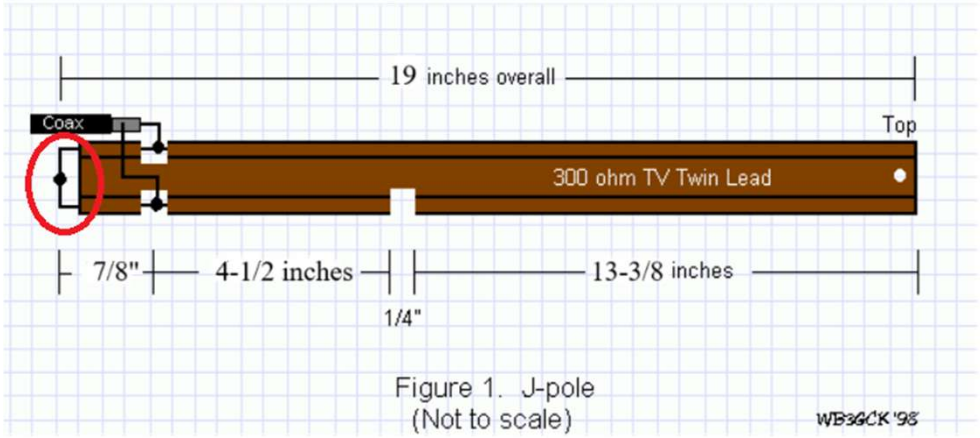


Figure 1. J-pole
(Not to scale)

Constructing a Simple J-pole

- Remove ¼” of insulation
- “Tin” the ends



Constructing a Simple J-pole

- Remove ¼” of insulation
- “Tin” the ends
- Short the ends together

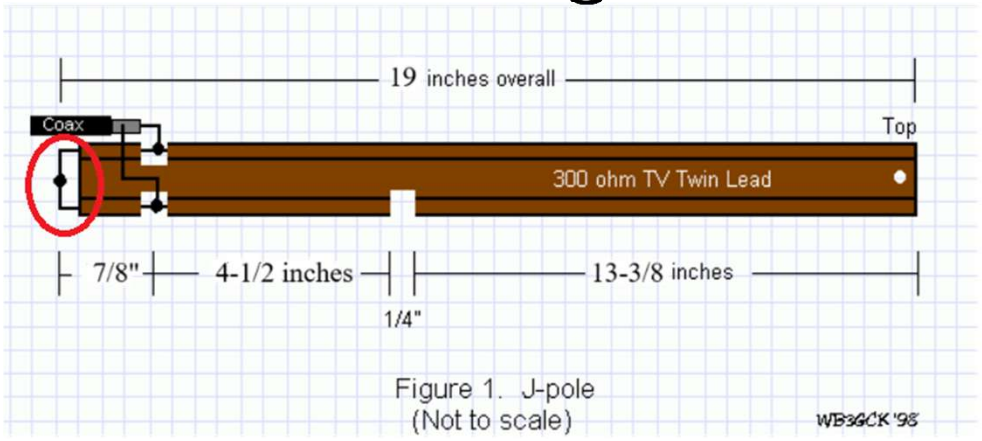
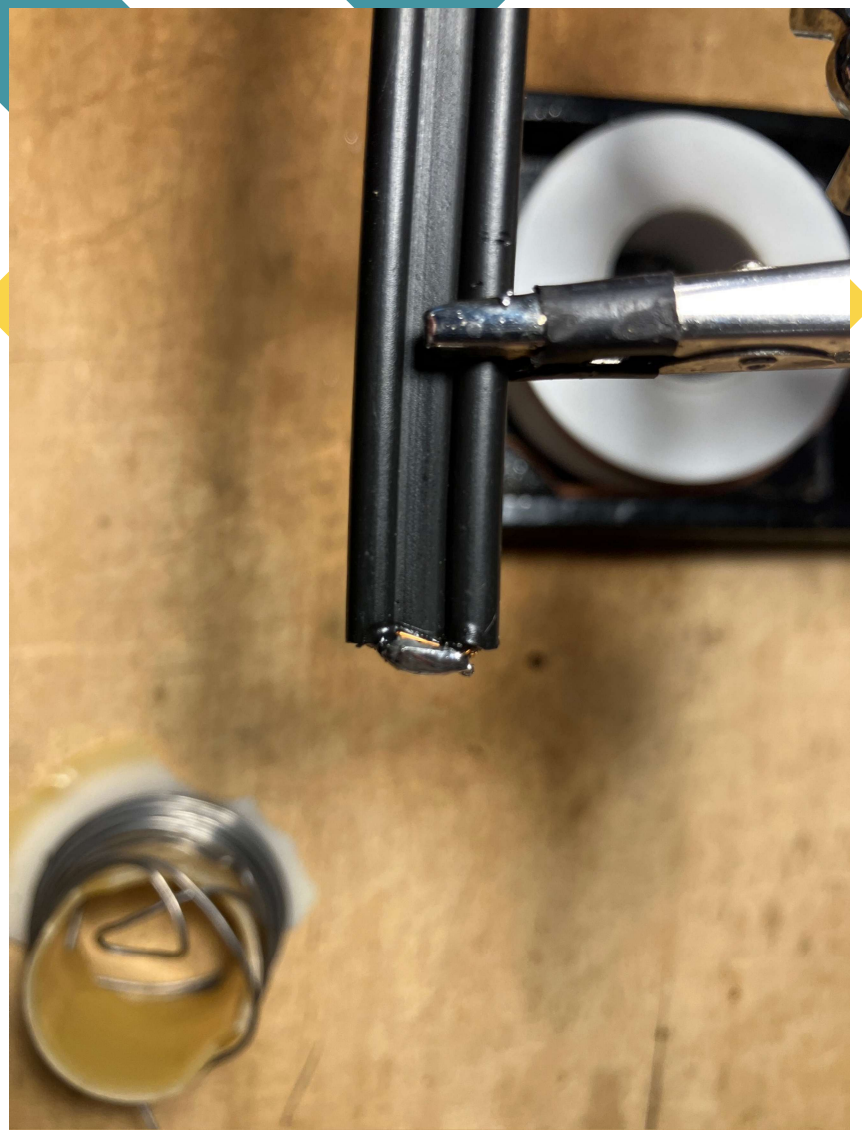


Figure 1. J-pole
(Not to scale)
WB3GCK '98



Constructing a Simple J-pole

- Open “window” for coax connection

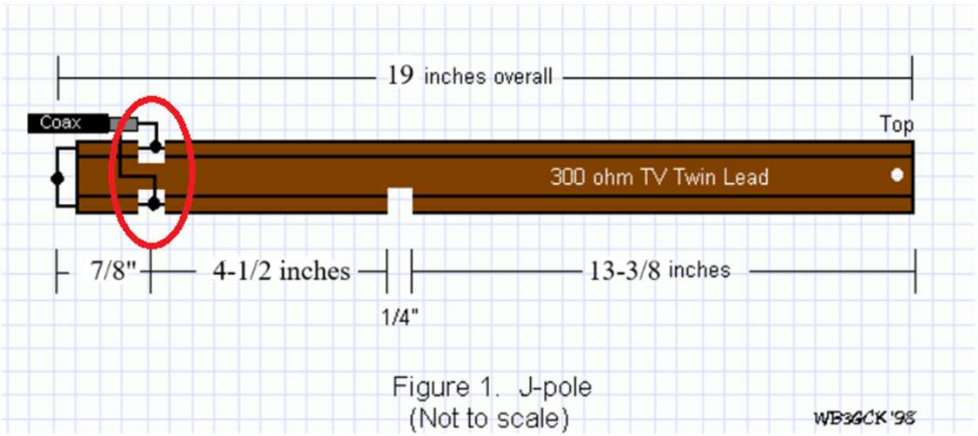
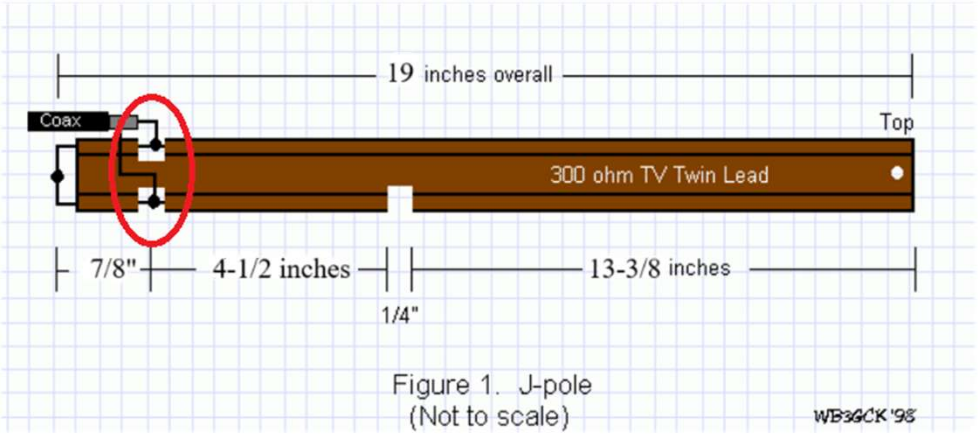


Figure 1. J-pole
(Not to scale)

WB3GCK '98

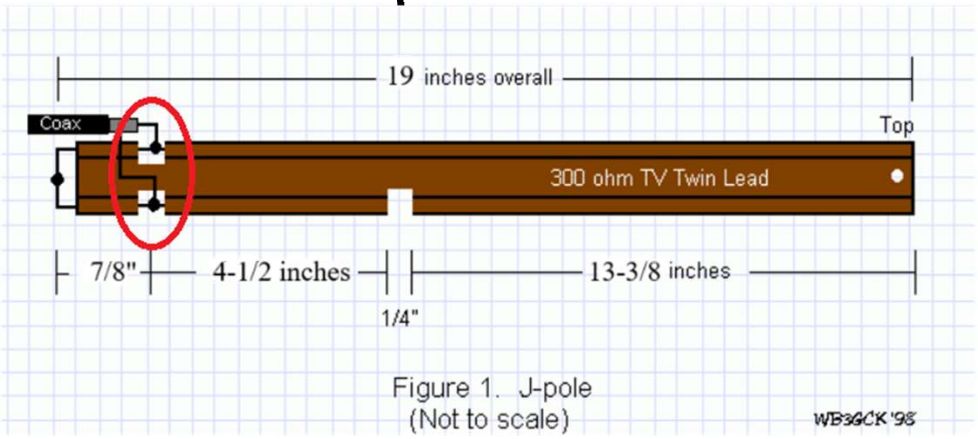
Constructing a Simple J-pole

- Open “window” for coax connection
- Strip insulation from sides



Constructing a Simple J-pole

- Open “window” for coax connection
- Strip insulation from sides
- “Tin” the exposed wires



Constructing a Simple J-pole

- Cut ¼” notch for tuning stub

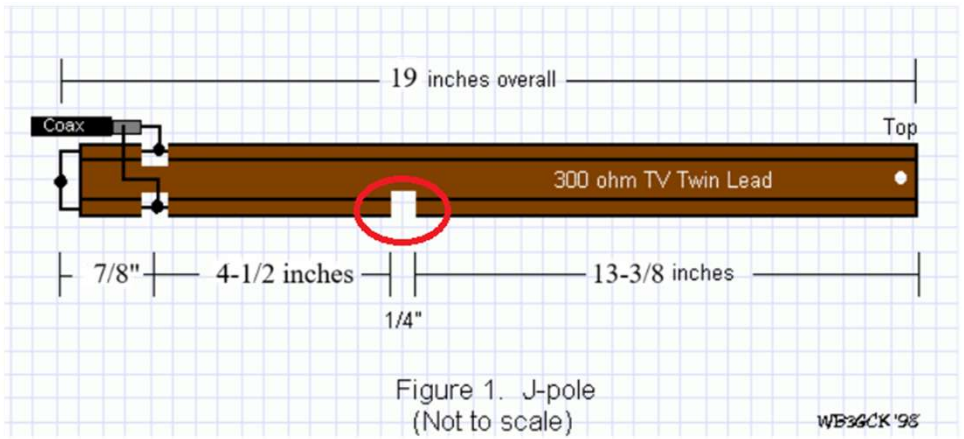
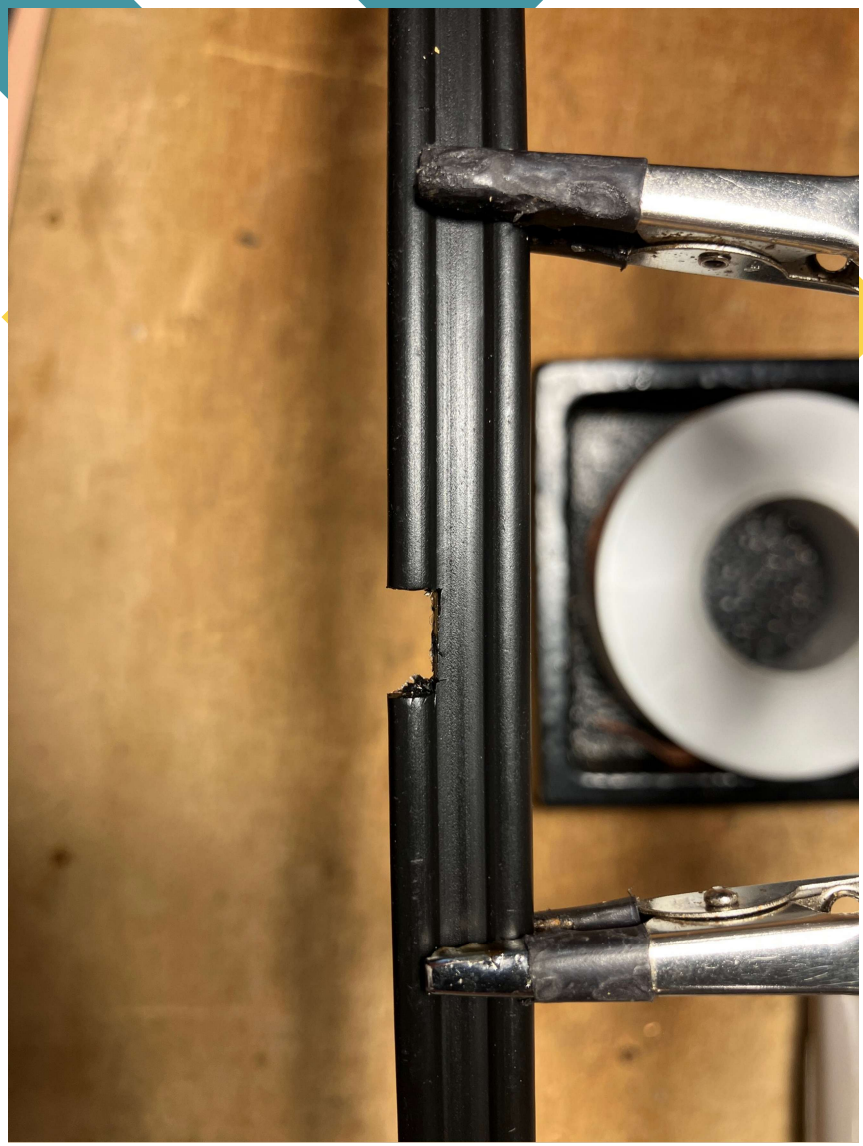


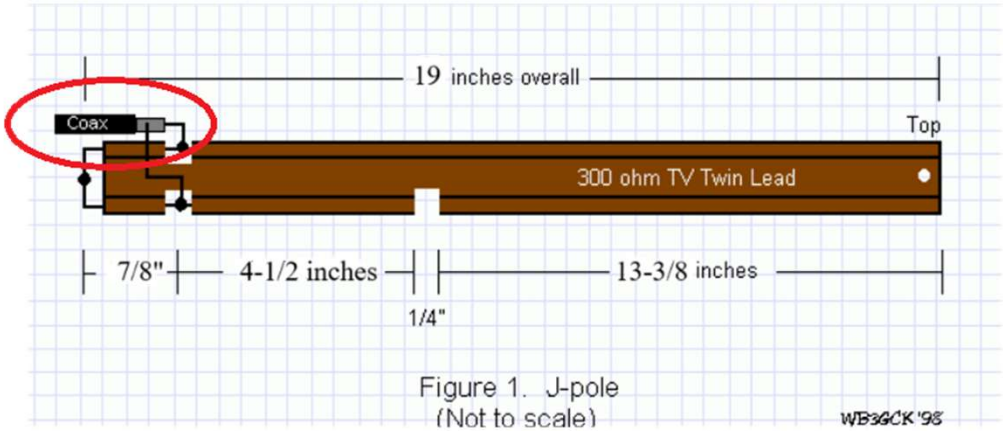
Figure 1. J-pole
(Not to scale)

WB3GCK '98



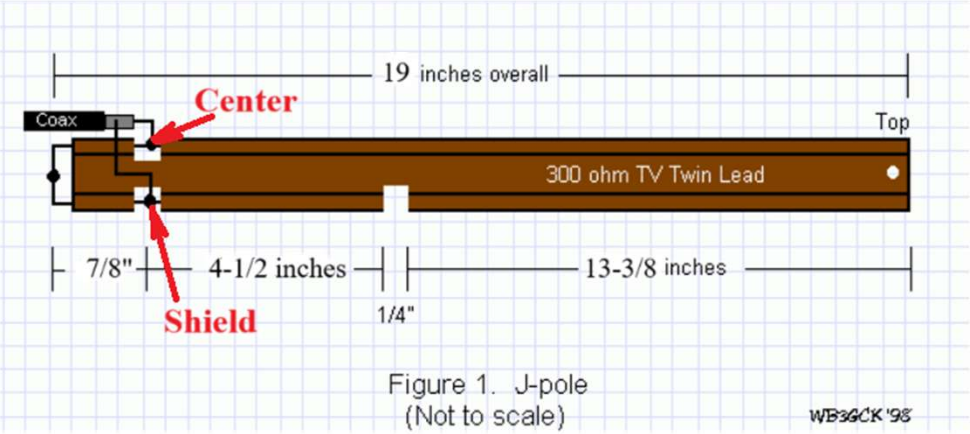
Constructing a Simple J-pole

- Strip and prepare the coax (also “tin”)



Constructing a Simple J-pole

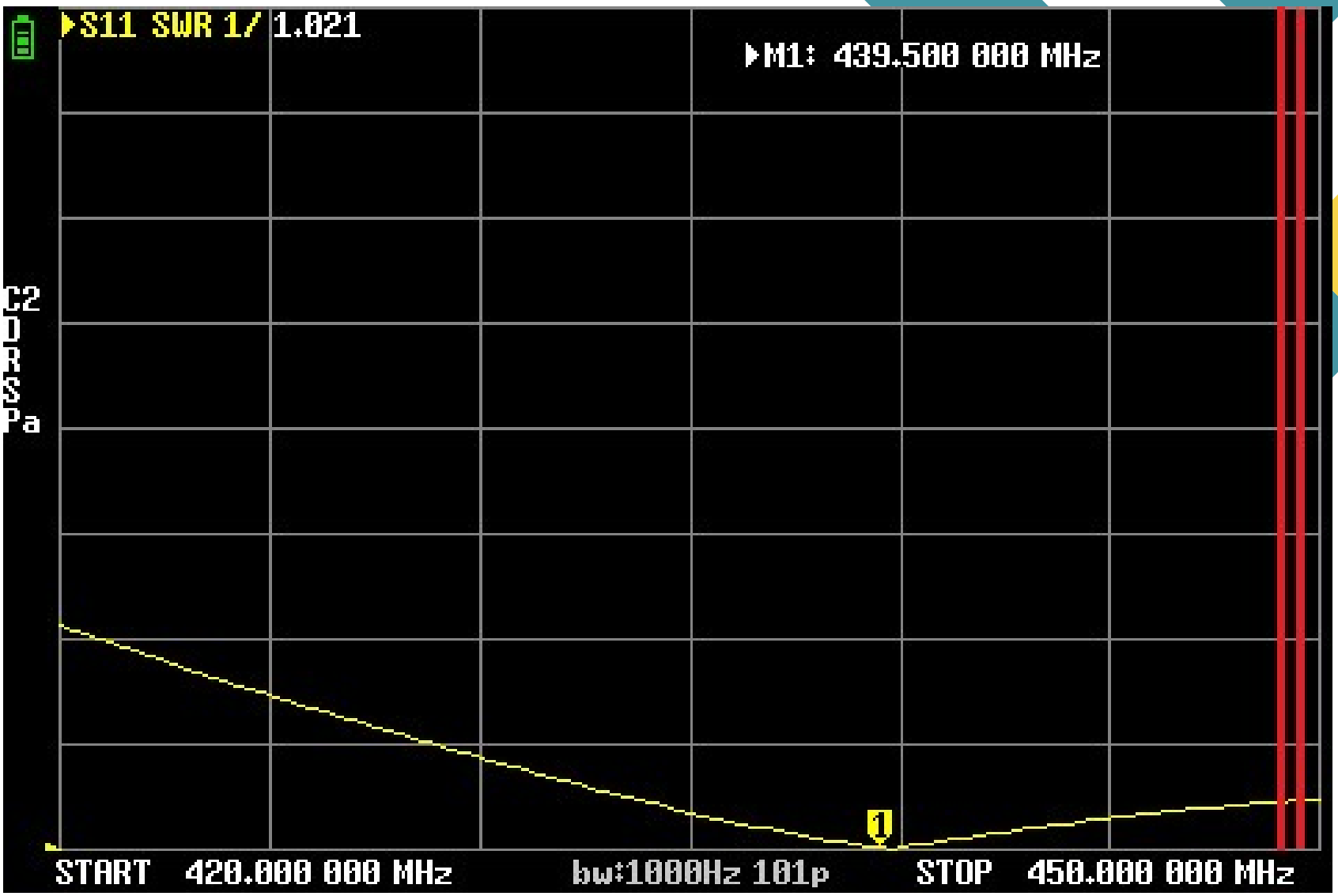
- Strip and prepare the coax (also “tin”; allows for bending)
- Solder to “window” leads



Constructing a Simple J-pole

- Cover solder joints with heat shrink, electrical tape, etc, (not pictured)
- Now reinforce the window area (“popsicle stick”) and wire ties

Attach wire tie to hole in top

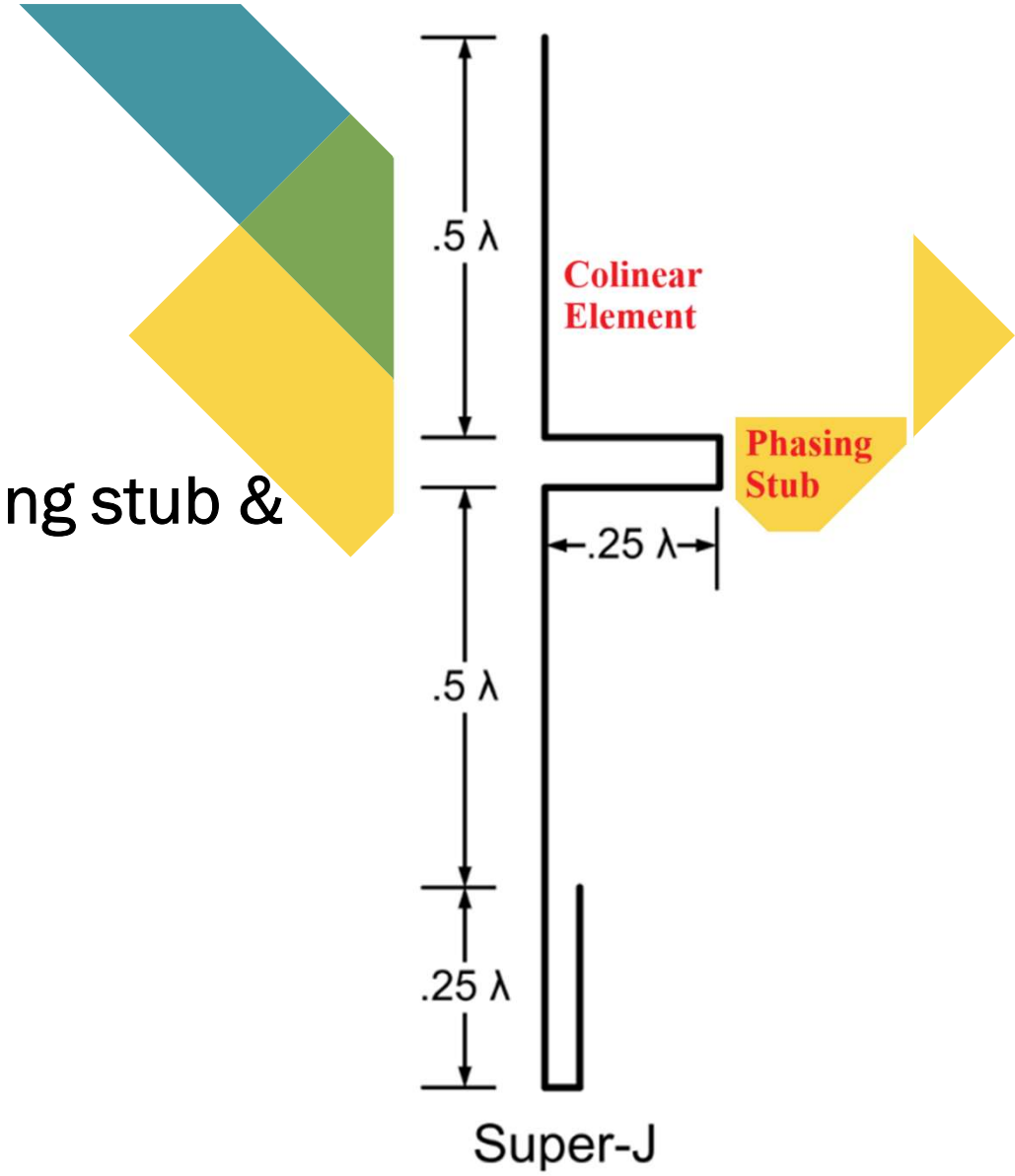


448.55 MHz &
448.95 MHz

Simple J SWR

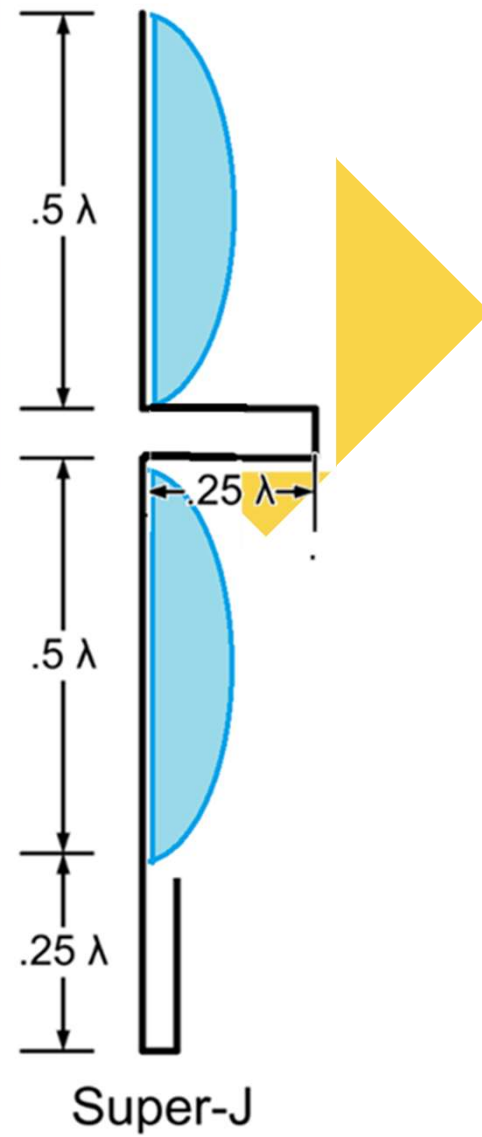
The Super-J

- Consists of a simple J + a phasing stub & a colinear element



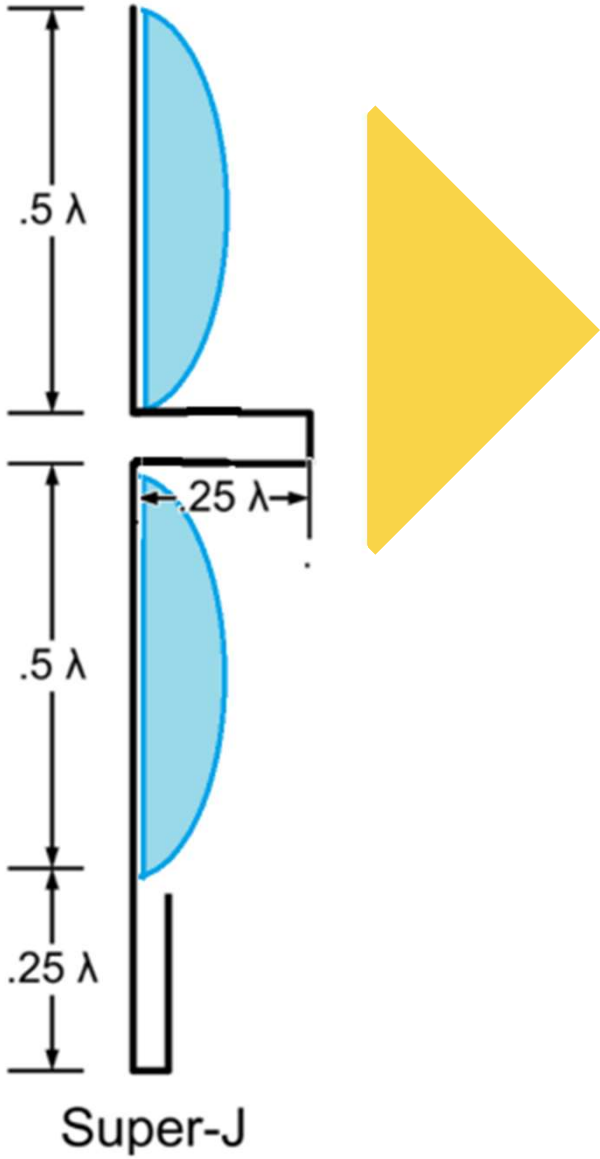
The Super-J

- Consists of a simple J + a phasing stub & a colinear element
- The phasing stub allows both half-wave sections to radiate in-phase



The Super-J

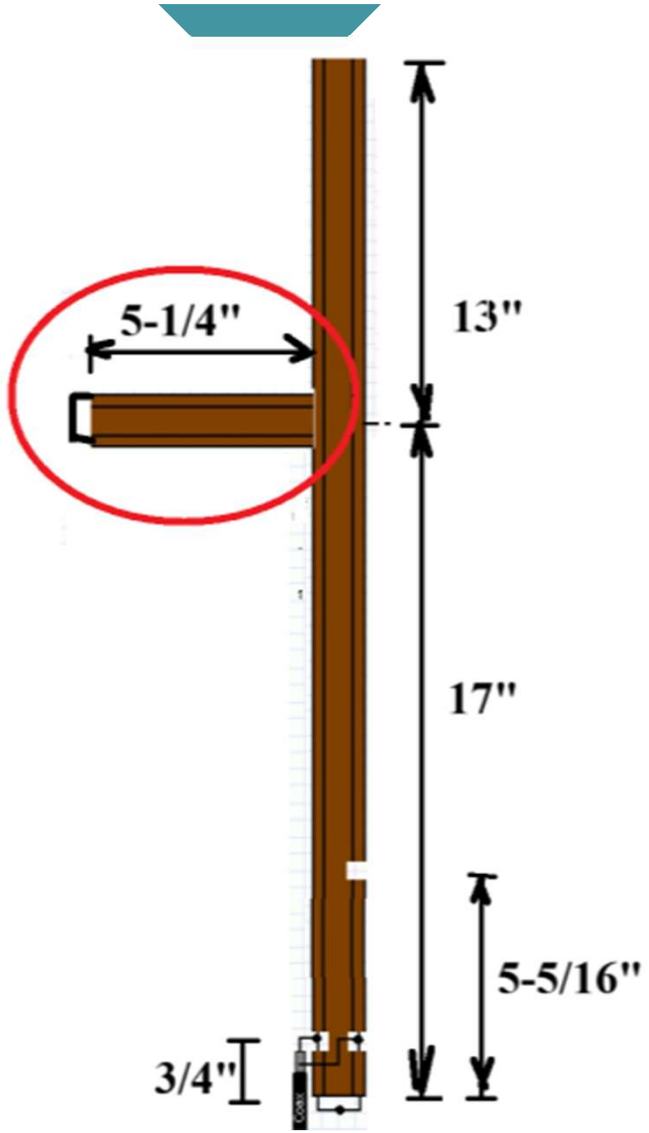
- Consists of a simple J + a phasing stub & a colinear element
- The phasing stub allows both half-wave sections to radiate in-phase
- The approximate gain of the Super-J antenna is from 4.6 to 5.2 dB



Super-J

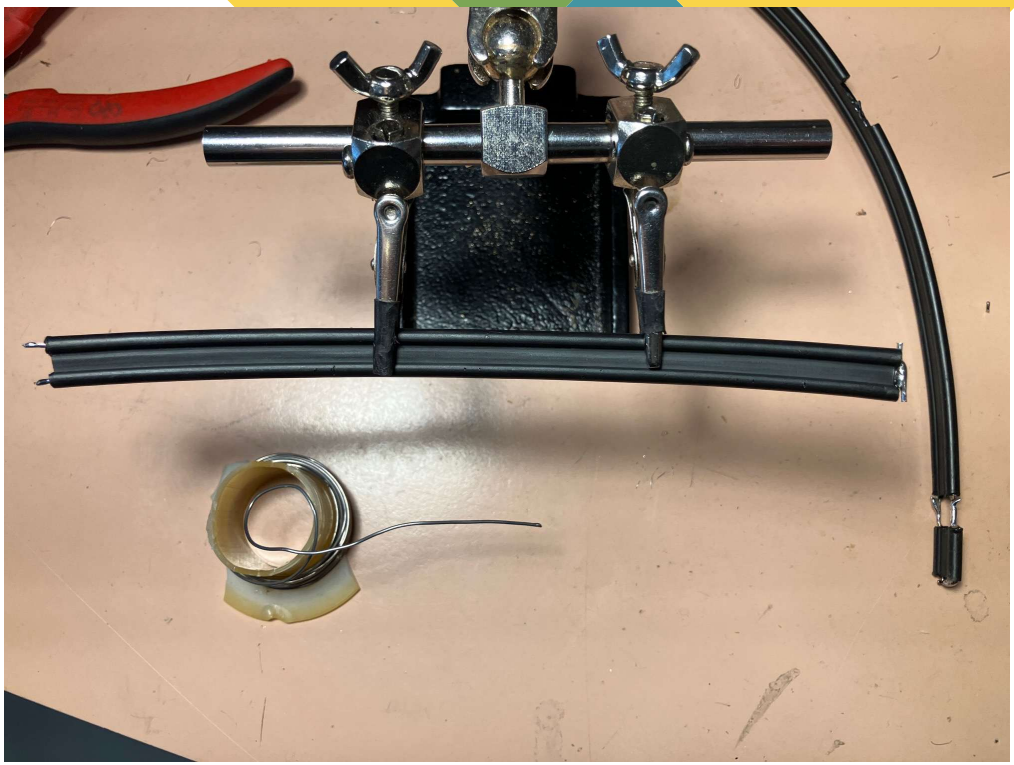
Constructing a Super-J

- We'll assume the basics are understood and focus on the differences
- The interaction between the lower and upper half results in differences in the theoretical numbers
- We'll begin with the phasing stub



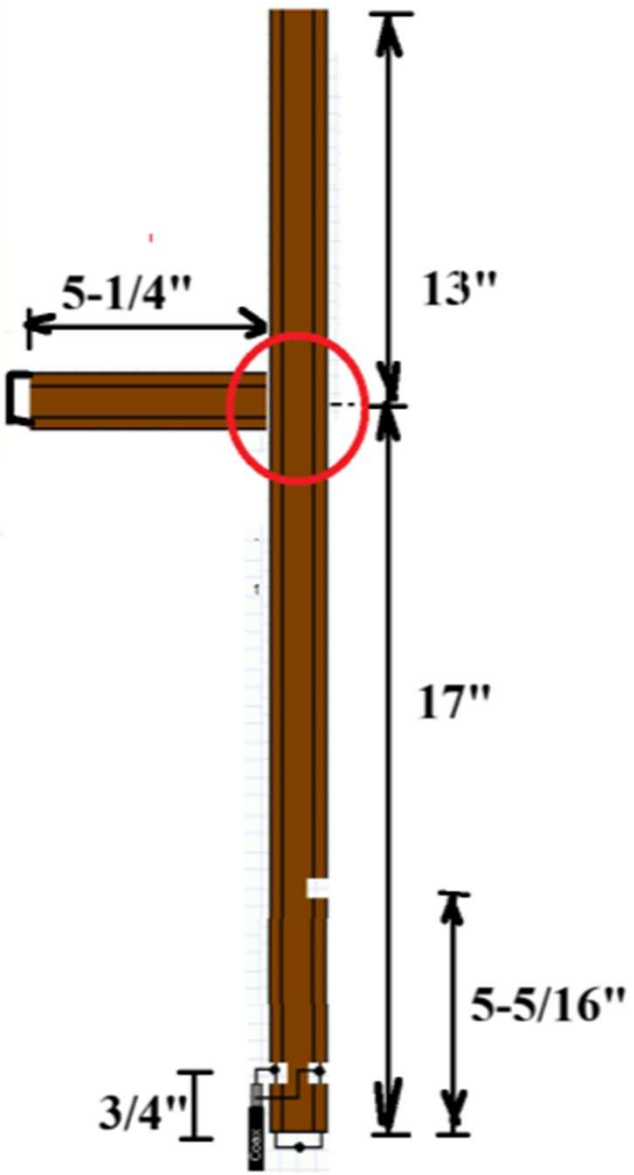
Constructing a Super-J

- Cut a 5–¾” section of 300Ω twinlead
- Includes extra length for short & connections
- Short the end opposite the connection point
- Strip/tin wire ends for connection



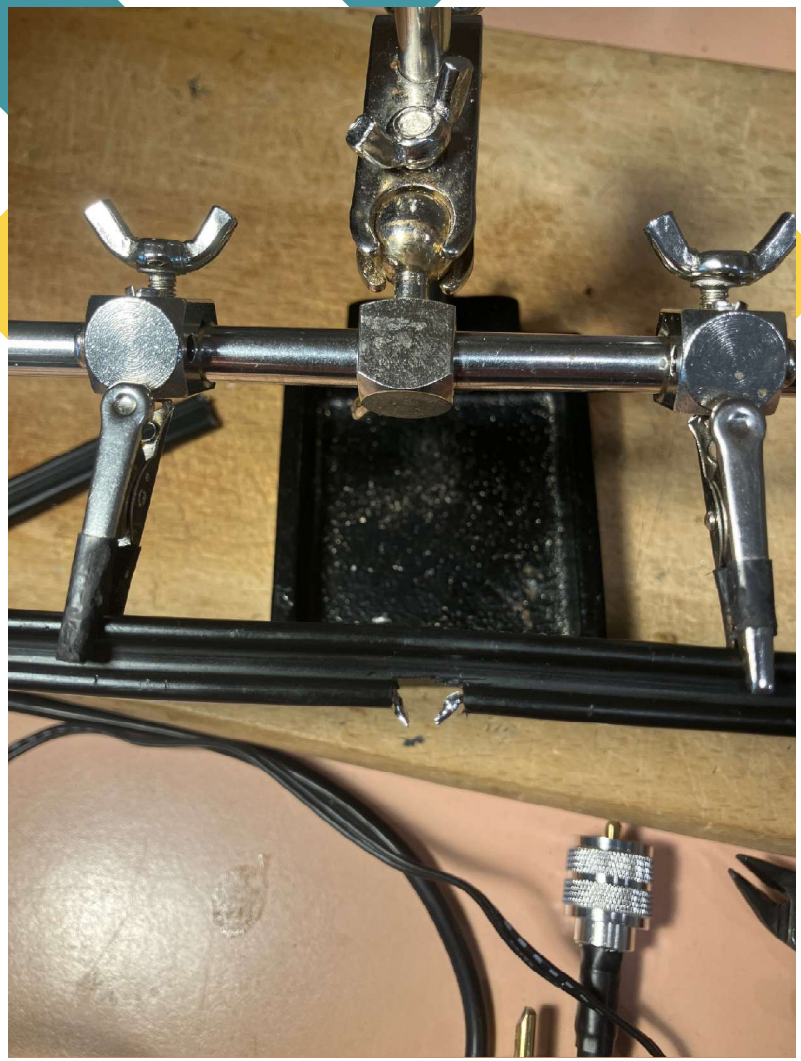
Constructing a Super-J

- Now prepare the connection for the phasing stub



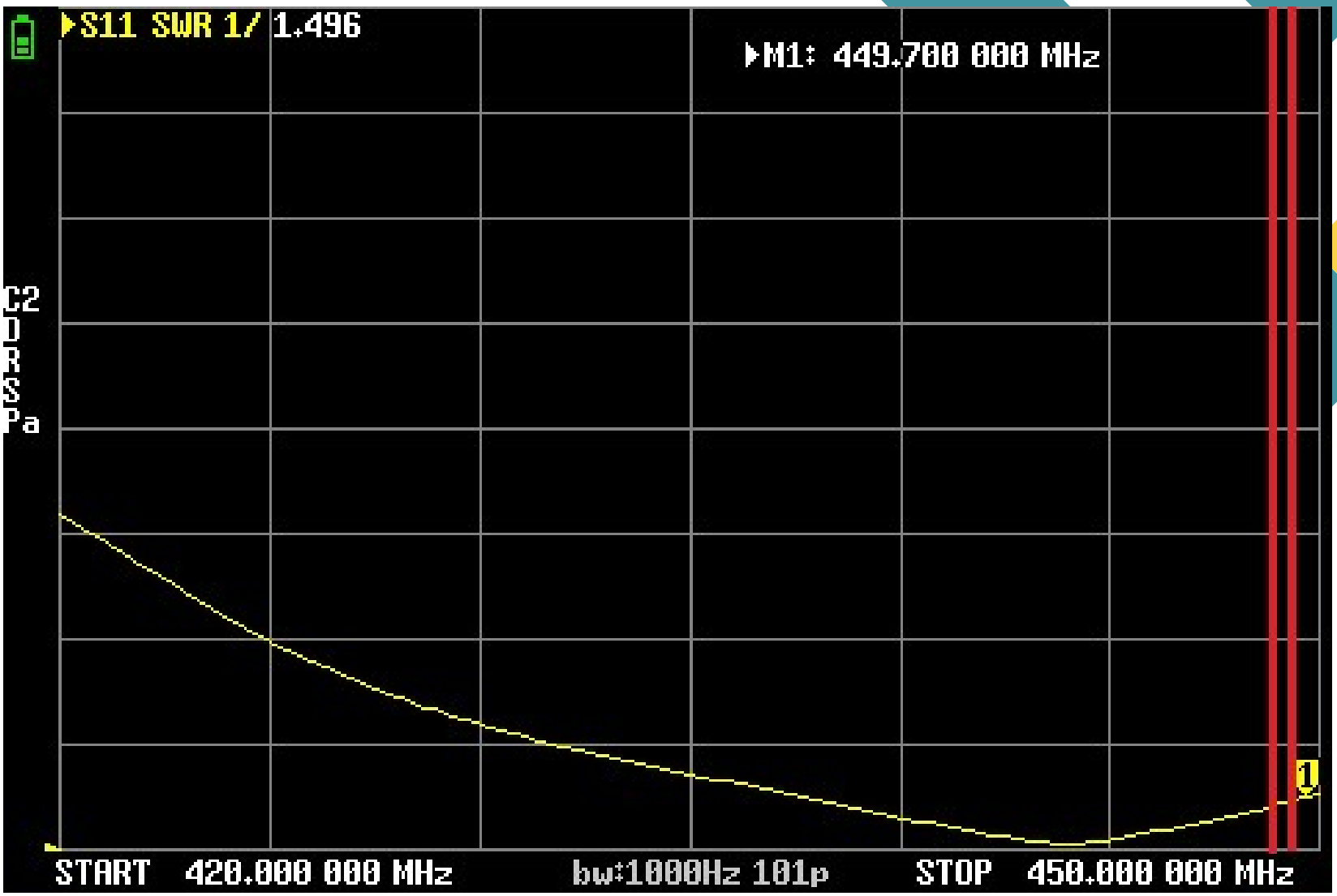
Constructing a Super-J

- Now prepare the connection for the phasing stub
- Cut the radiator element at the insertion location
- Remove the insulation and tin the wires from both ends



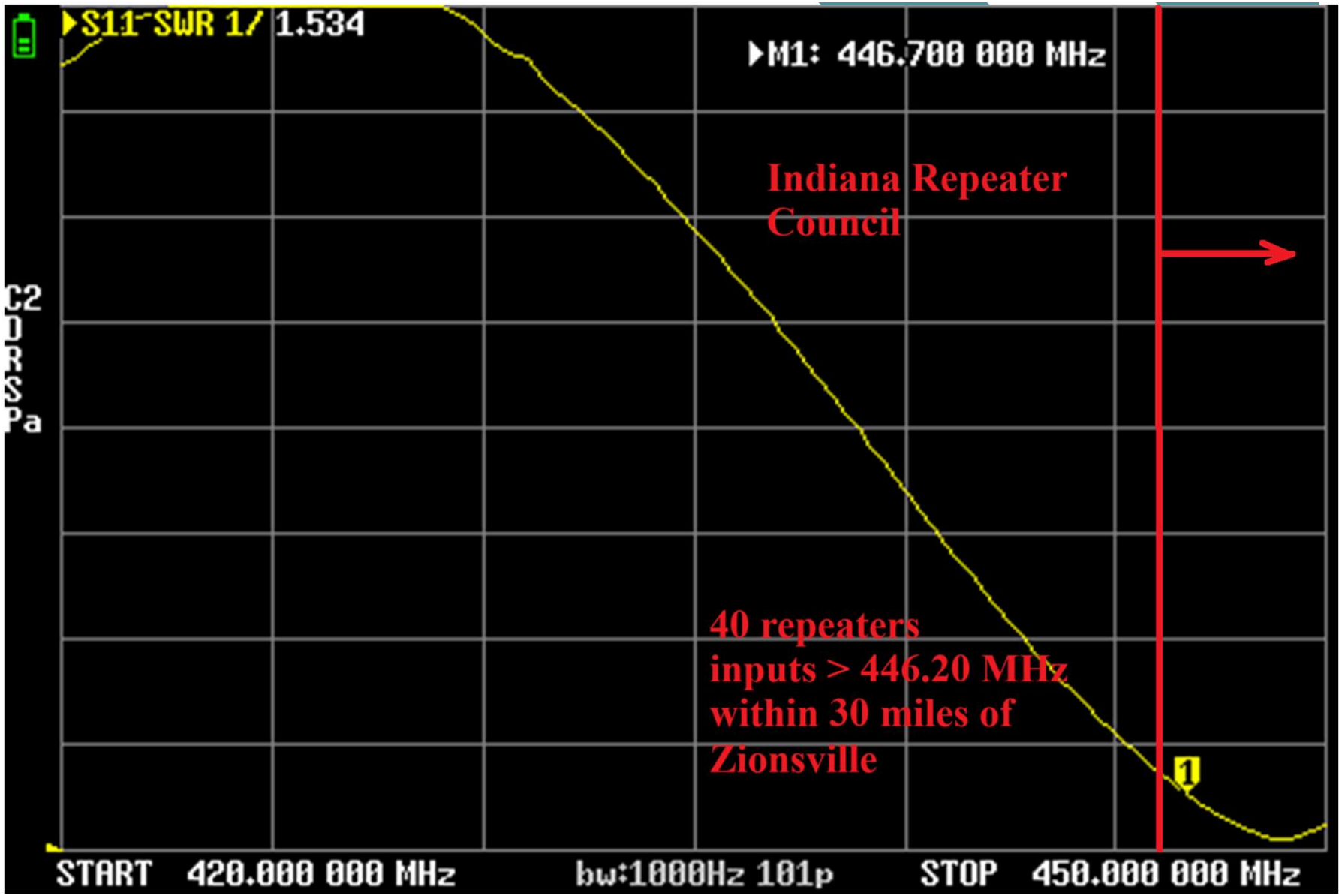
Constructing a Super-J

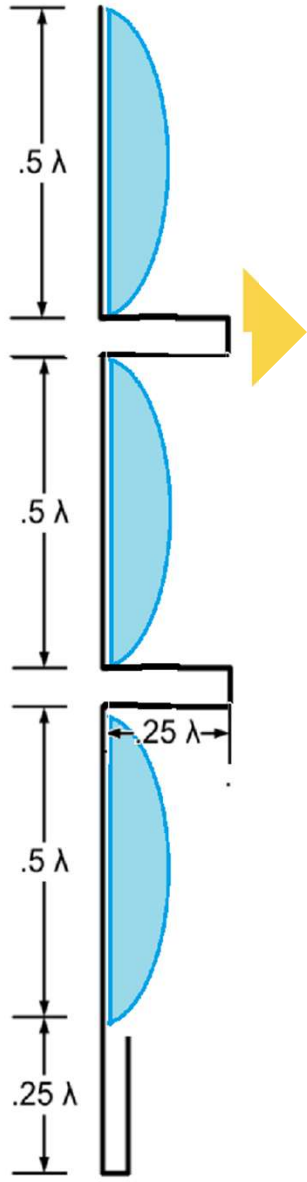
- Now solder the phasing stub into the opening



448.55 MHz &
448.95 MHz

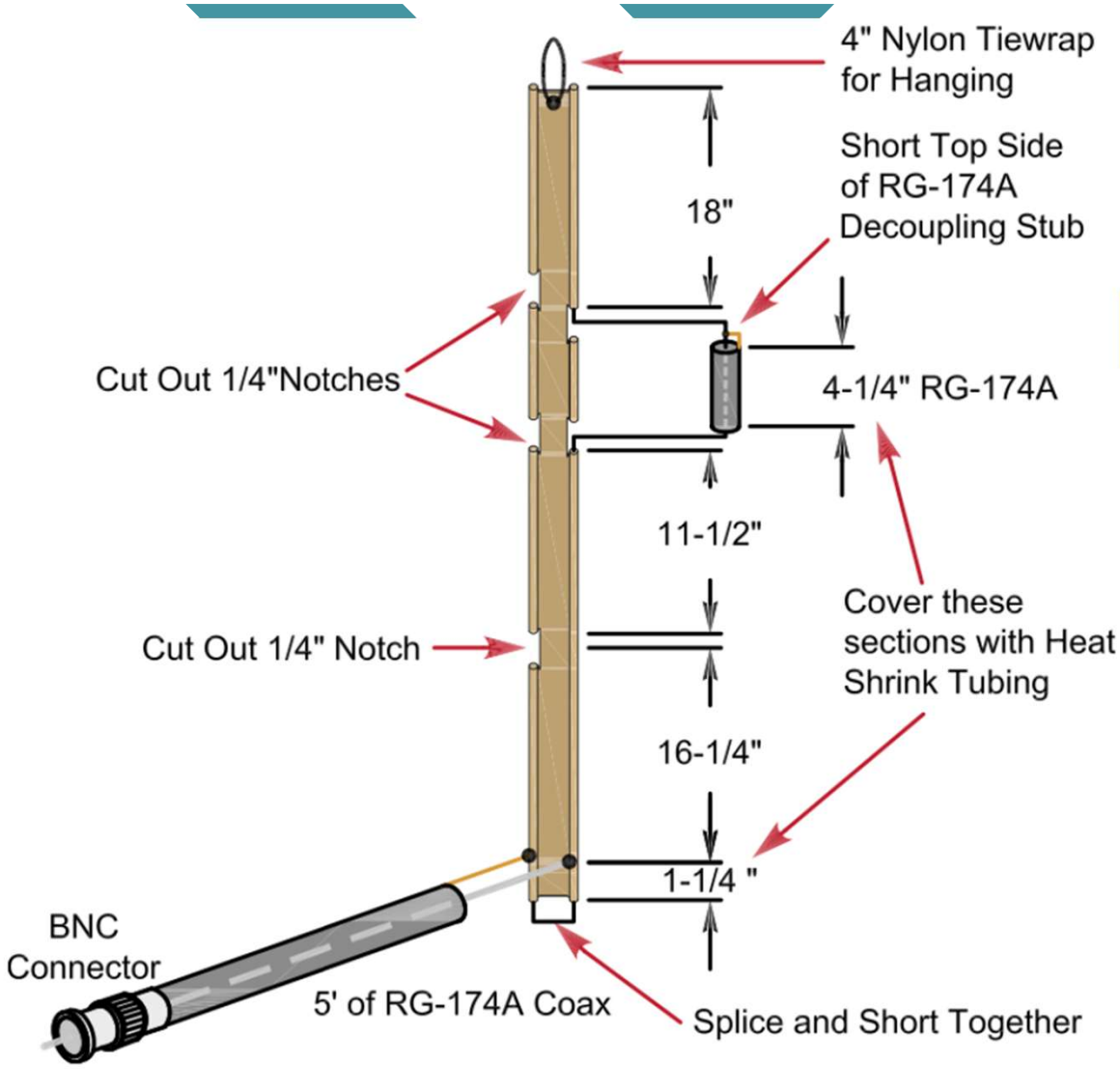
Super J SWR


S11 SWR 1/ 1.534
M1: 446.700 000 MHz
Indiana Repeater Council
40 repeaters inputs > 446.20 MHz within 30 miles of Zionsville
1
START 420.000 000 MHz
bw:1000Hz 101p
STOP 450.000 000 MHz


.5 λ
.5 λ
.25 λ
.5 λ
.25 λ

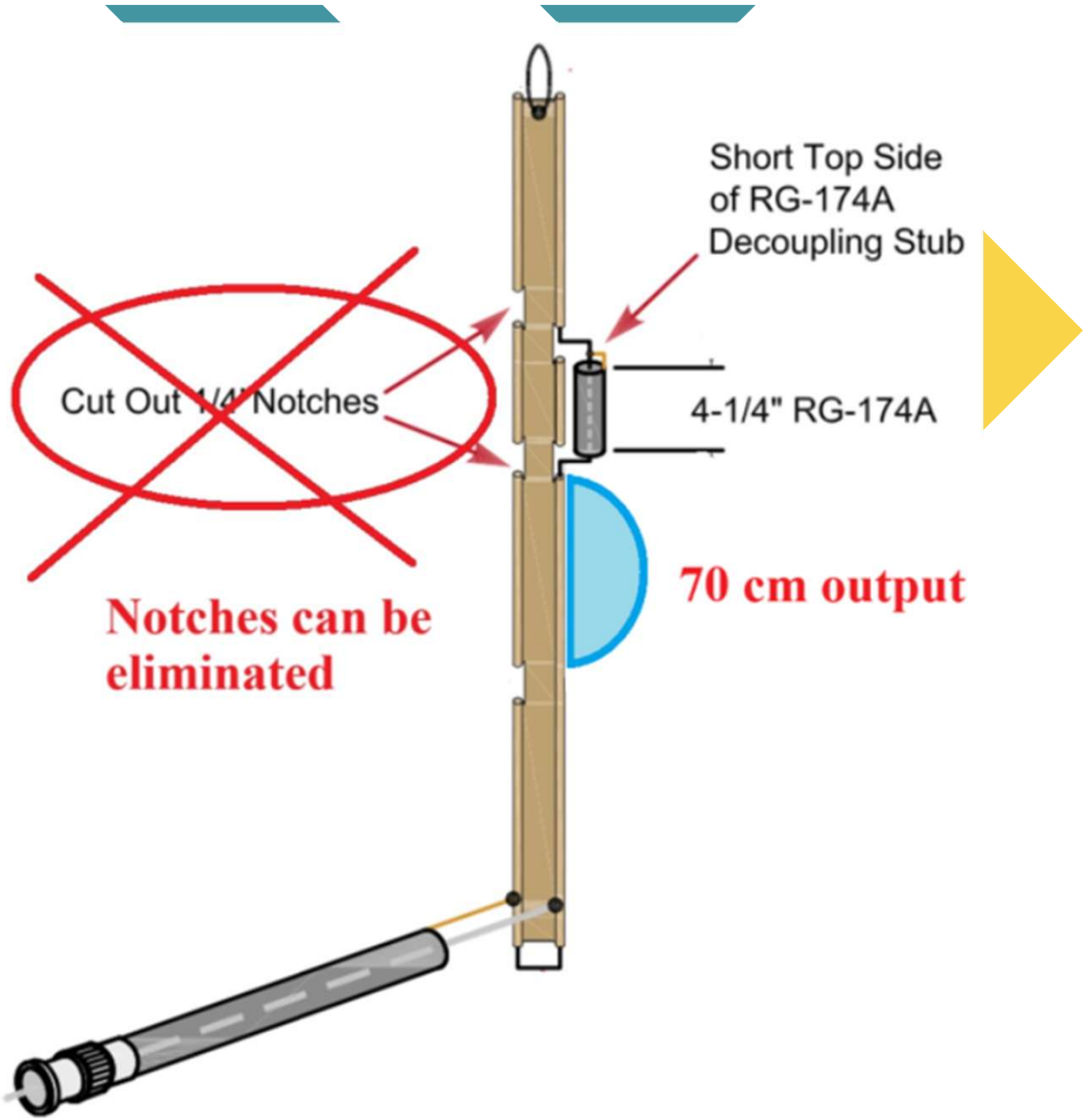
The Dual-band J

- Designed by Dr. Ed Fong
- Can be purchased directly from him, or others
- Youtube construction videos available



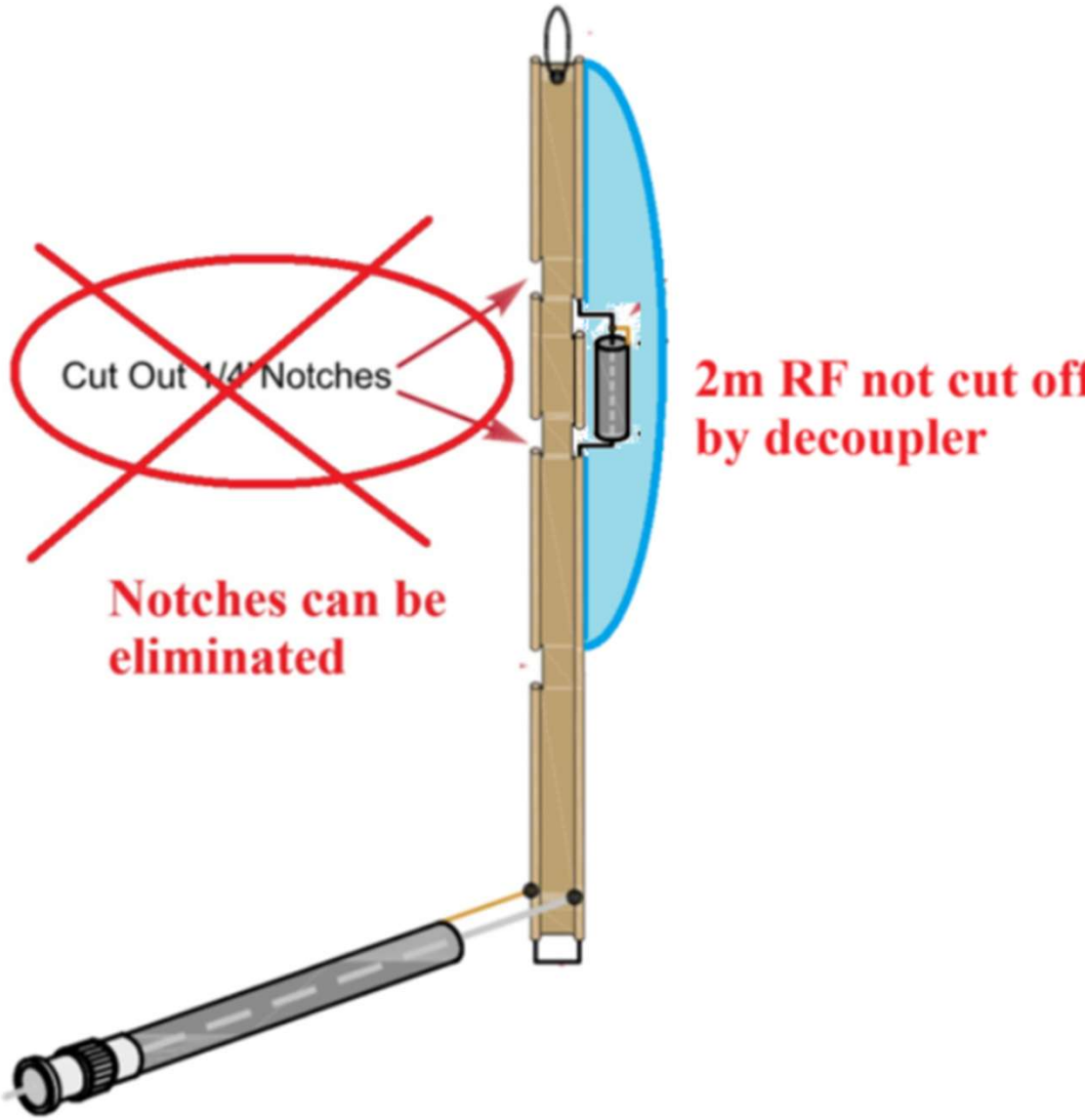
The Dual-band J

- The decoupling stub acts as a high inductive impedance to 70cm RF
- 70cm RF radiates from the element below the decoupler



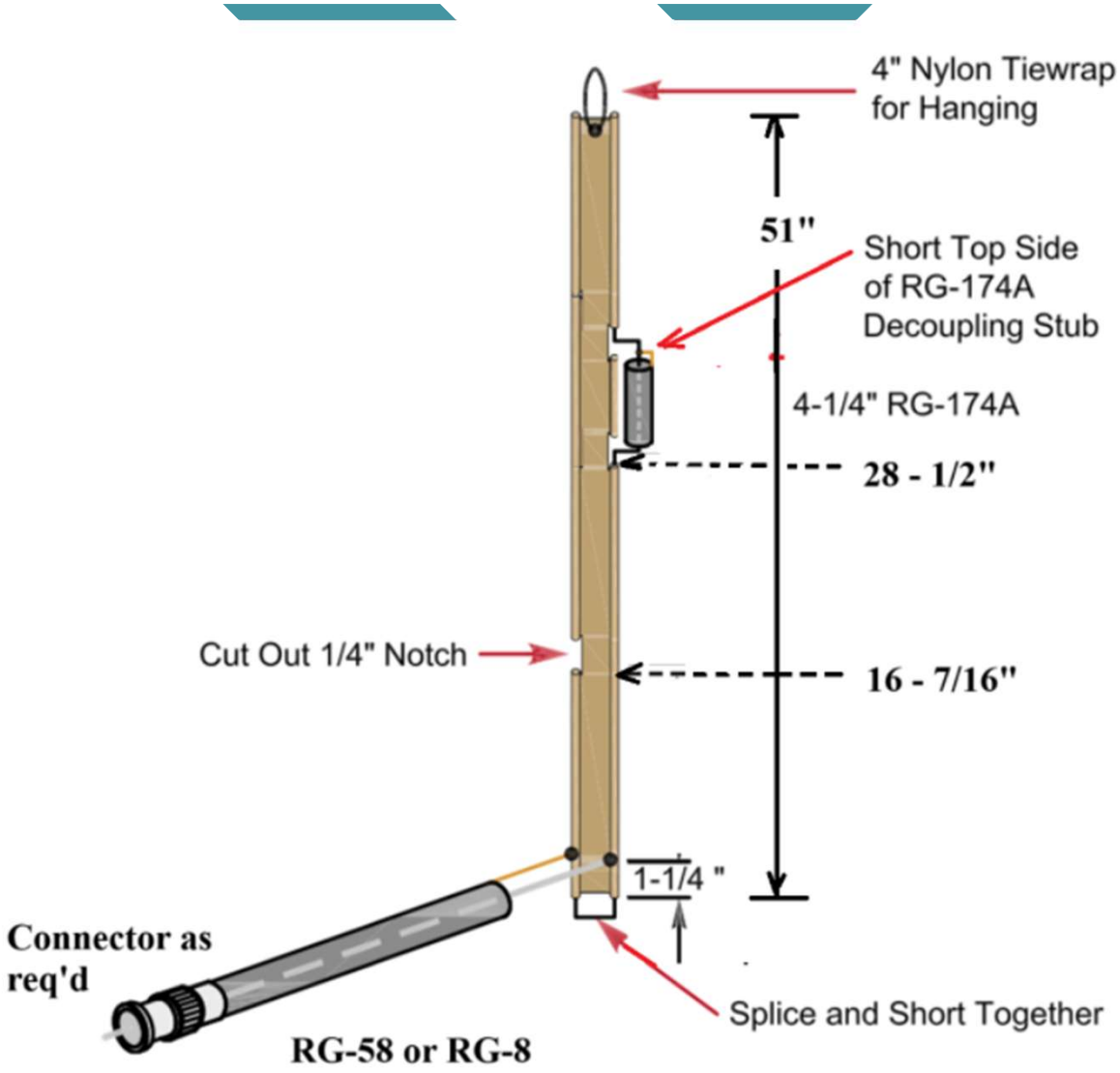
The Dual-band J

- The frequency of 2m RF is too low to activate the decoupler
- The entire length is used as the radiator



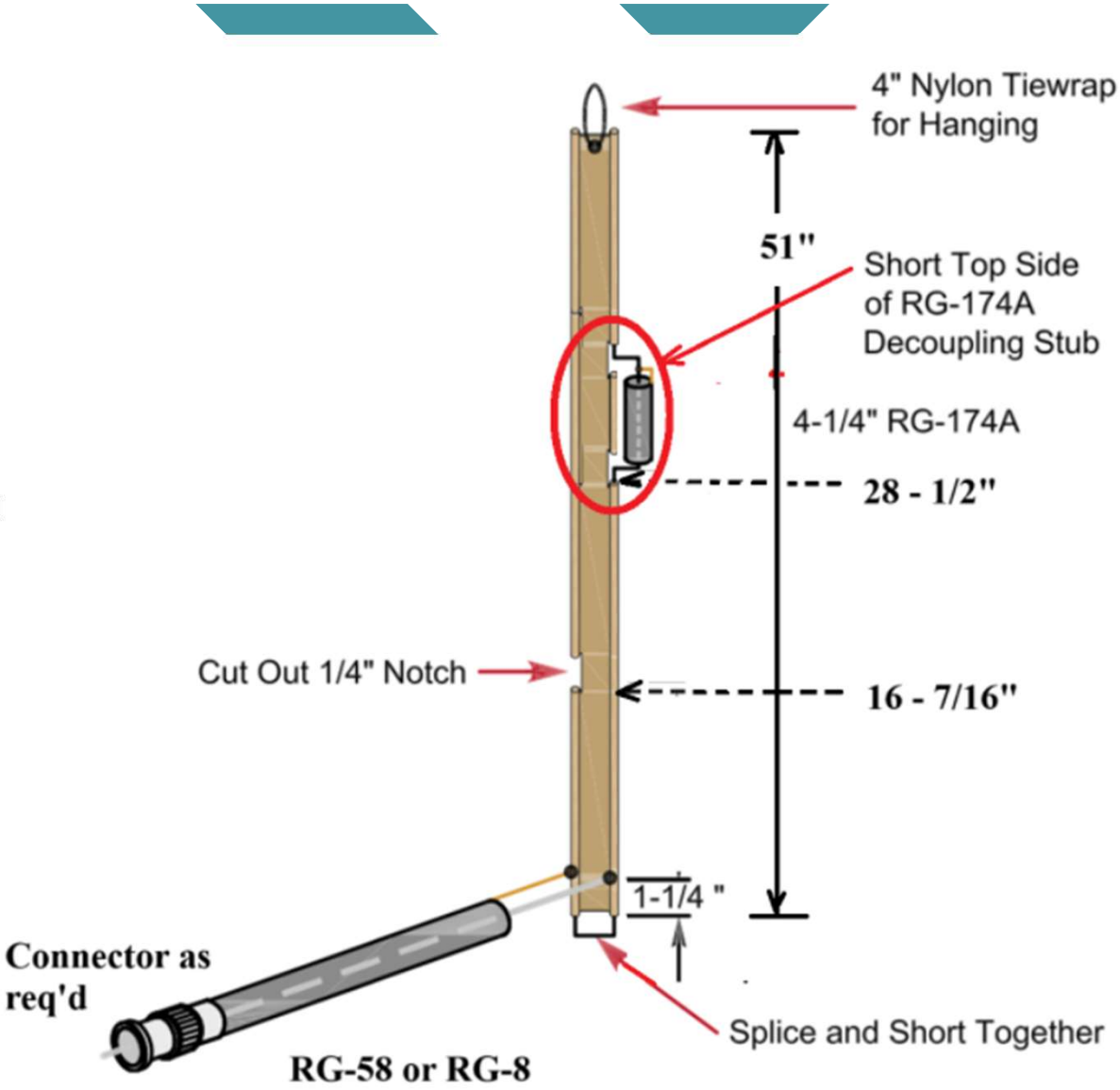
The Dual-band J Construction

- As with the Super-J, we'll assume the prereqs are mastered
- Only the unique features will be shown



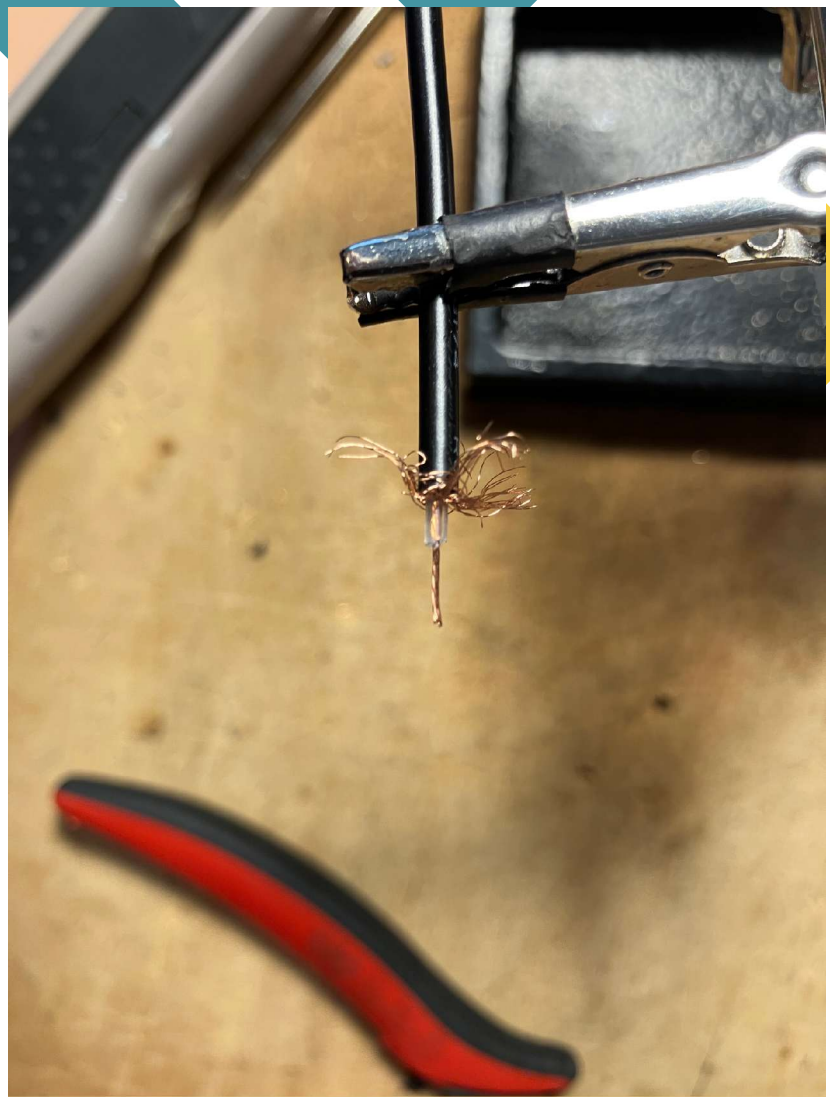
The Dual-band J Construction

- Cut a 4-1/2” length of RG 174 (the extra length needed for soldering connections)
- Do not try other types of coax (I did – failures galore)



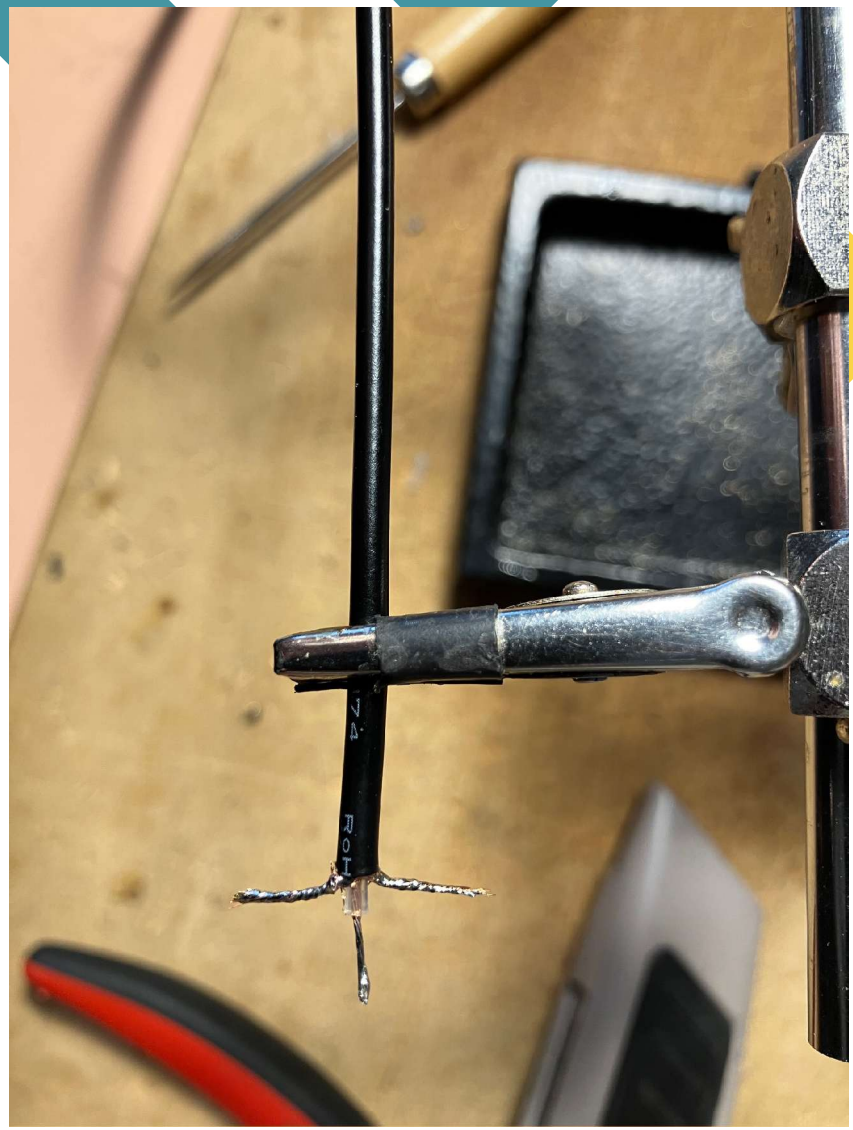
The Dual-band J Construction

- Strip both ends, separating the center conductor



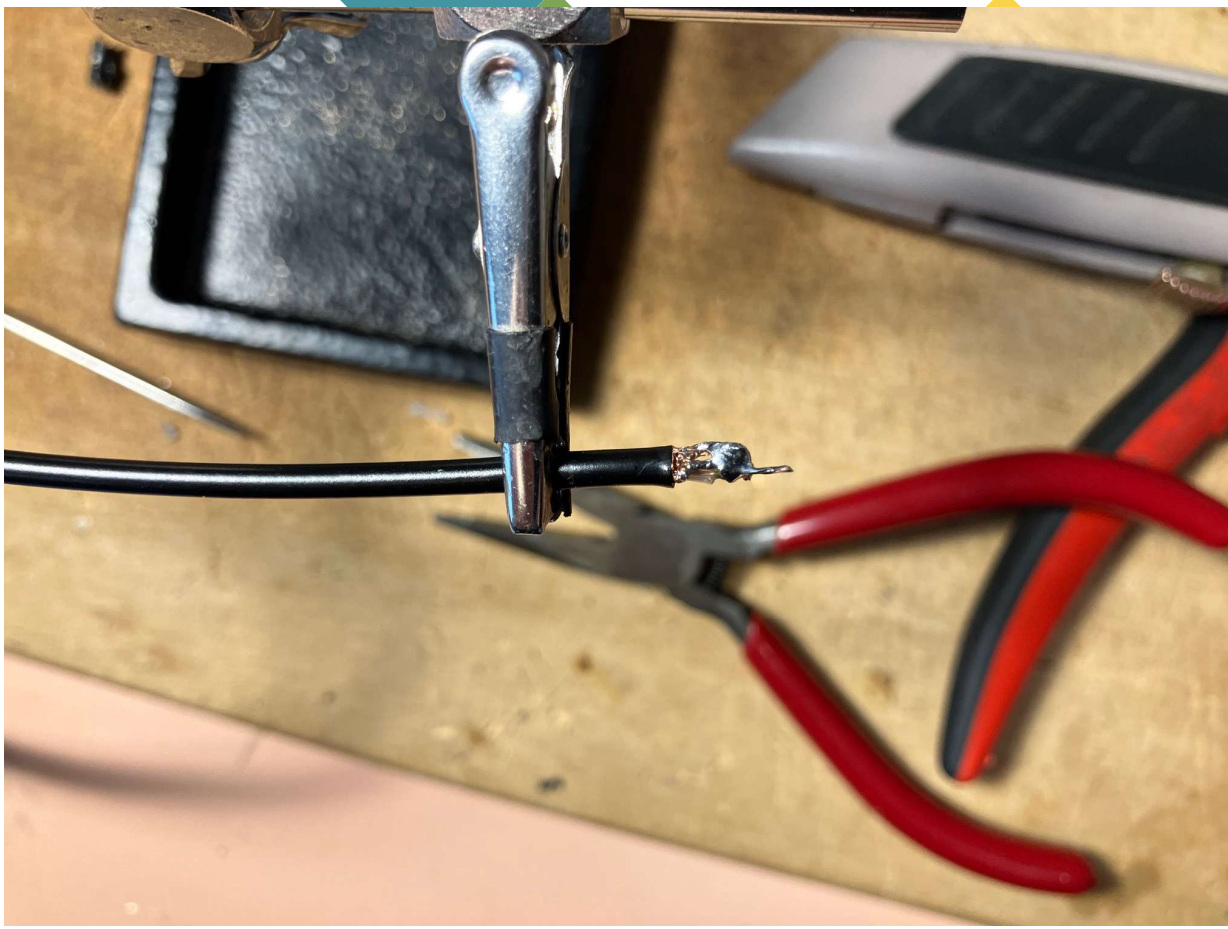
The Dual-band J Construction

- Strip both ends, exposing the center conductor
- For the top, twist the shield braids together
- Tin all conductors



The Dual-band J Construction

- At the top, solder the shield around the center conductor

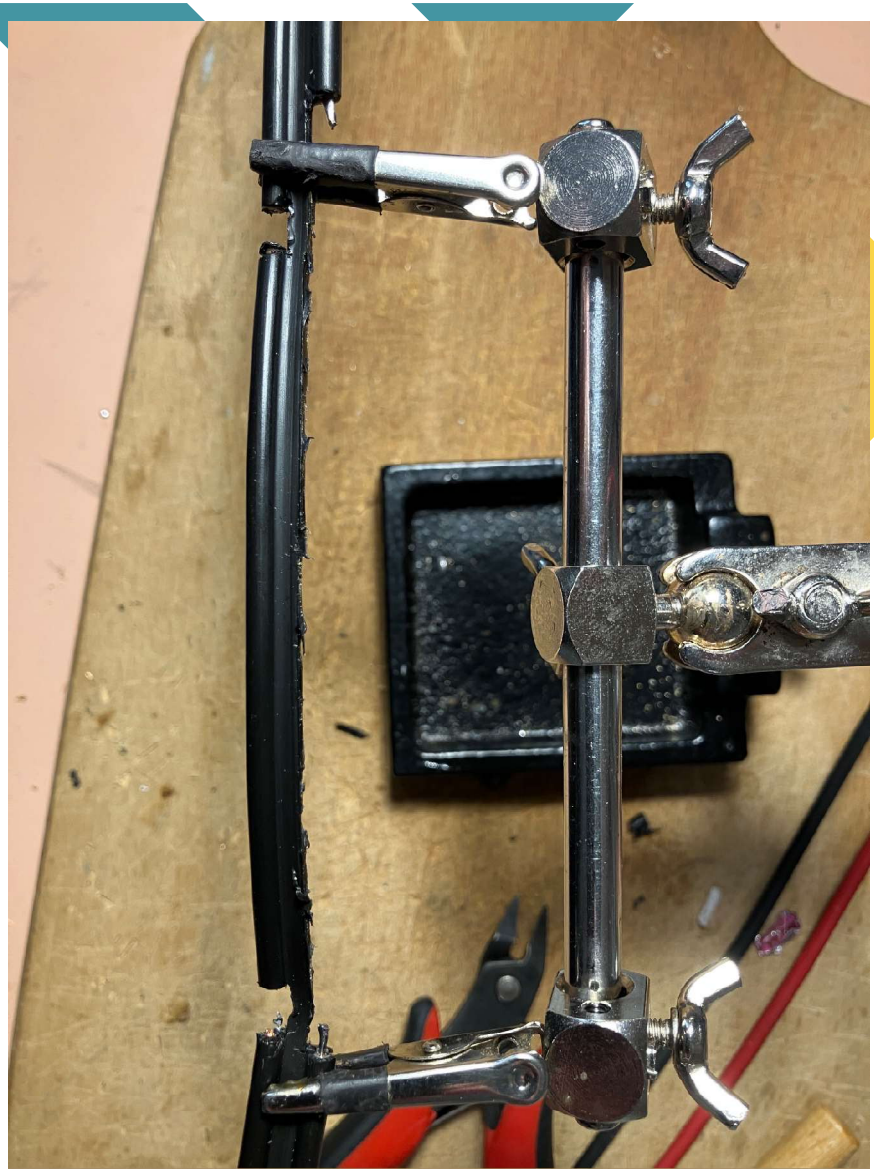


The Dual-band J Construction

- At the bottom, remove all traces of the shield. Tin the center conductor

The Dual-band J Construction

- On the radiating element, remove a 4-1/2” section for the RG-174 to fit.
- Note the unnecessary notches

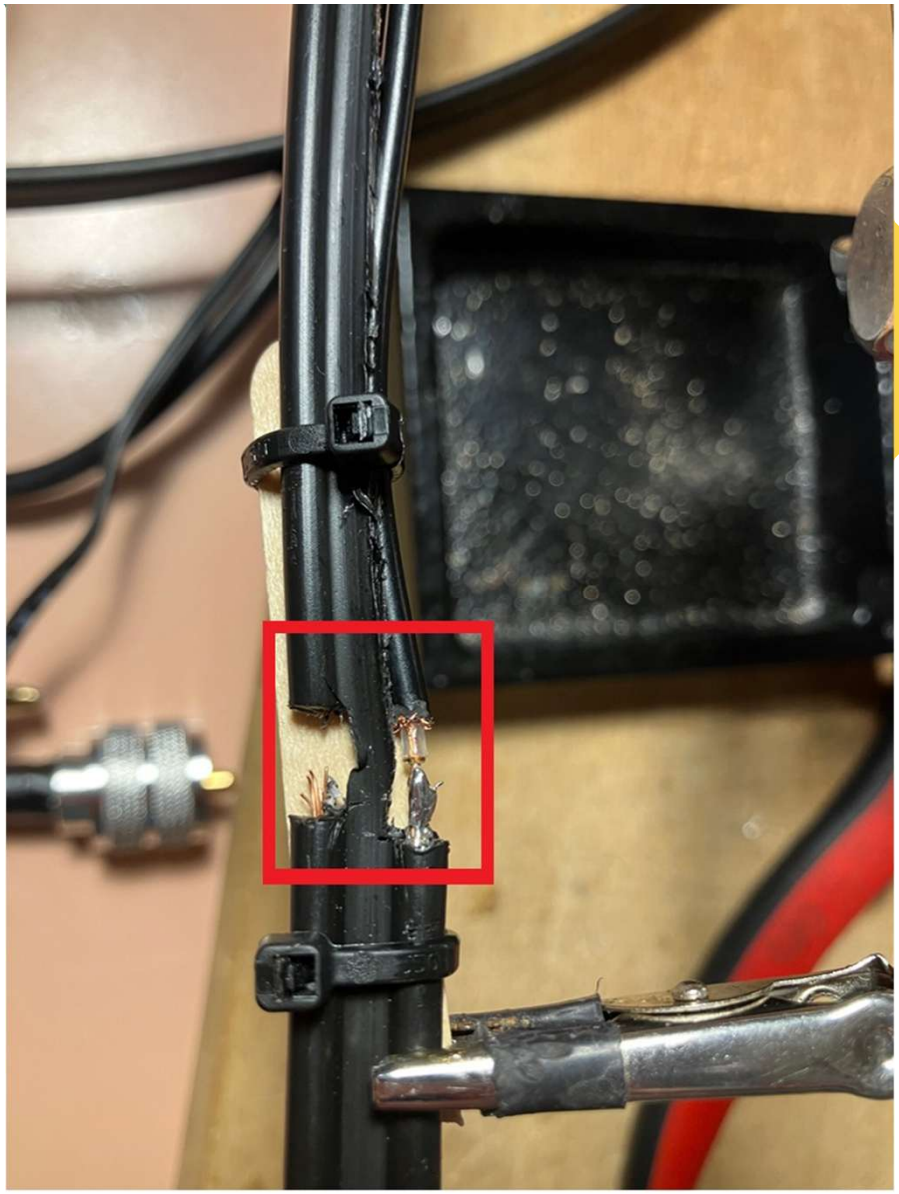


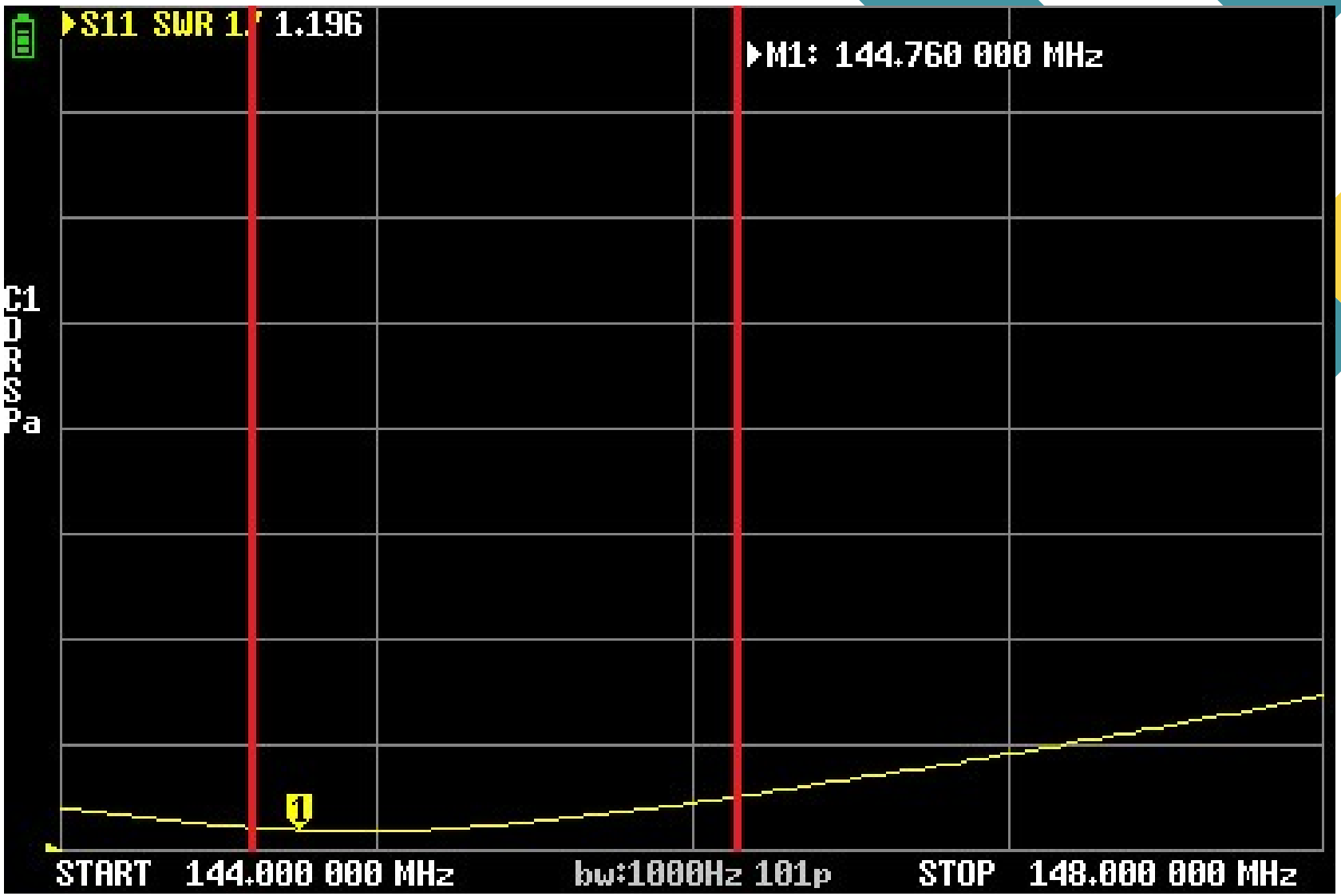
The Dual-band J Construction

- On the radiating element, remove a 4-1/2” section for the RG-174 to fit.
- Note the unnecessary notches)
- Tin the small “stubs” of conductor for soldering the RG-174 coax (top shown)

The Dual-band J Construction

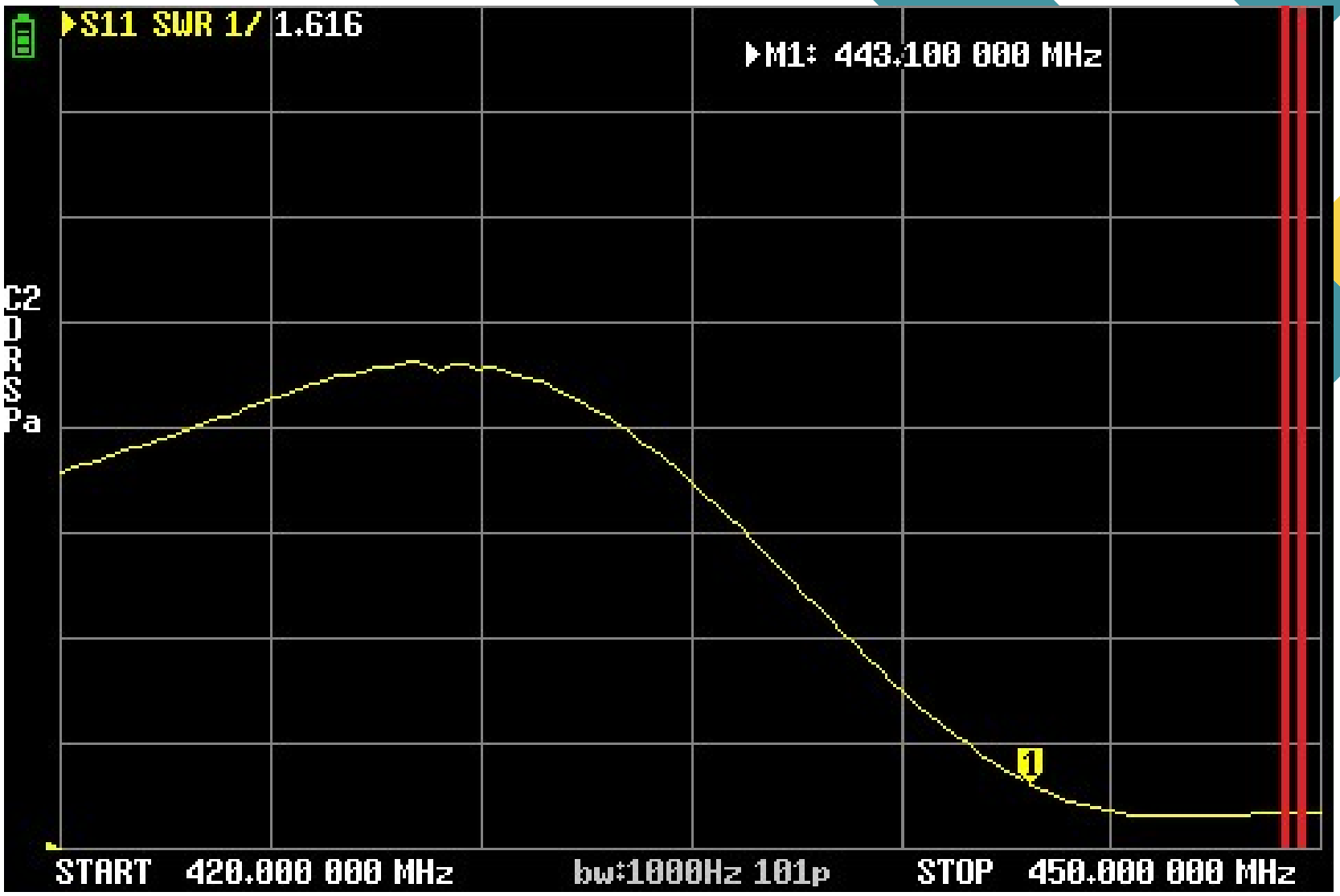
- Solder the RG-174 segment into the space provided (bottom shown)
- Strengthen section using popsicle sticks and cover with shrink tubing





144.57
146.265

Dual Band J
2M band



448.55 MHz &
448.95 MHz

Dual Band J
70 cm band

Any Questions?

- NOTE: Dimensions must be “slightly” shorter if the J-pole is to inserted into a Schedule 200 pipe for a permanent outdoor installation
- Experimentation is essential!