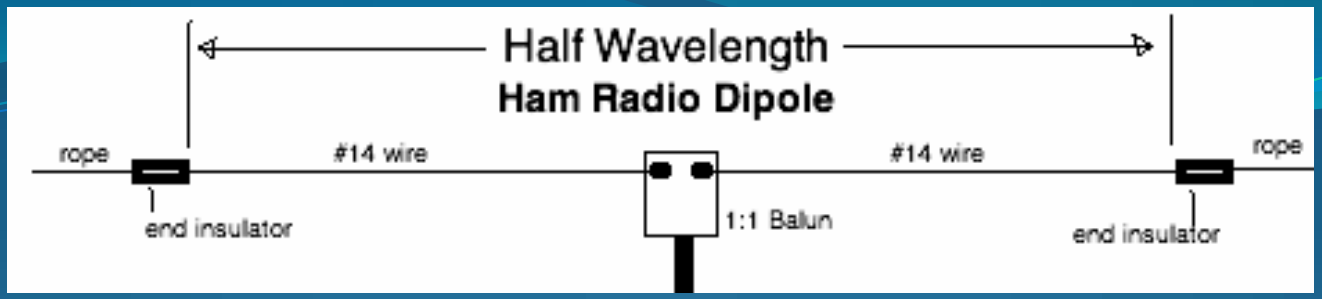
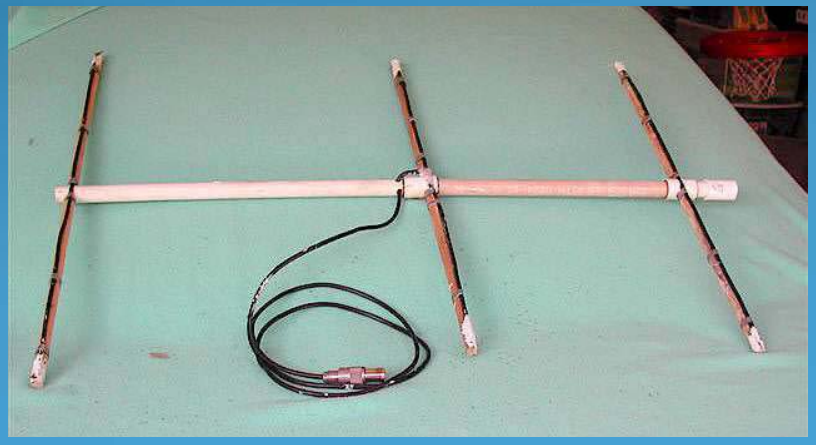
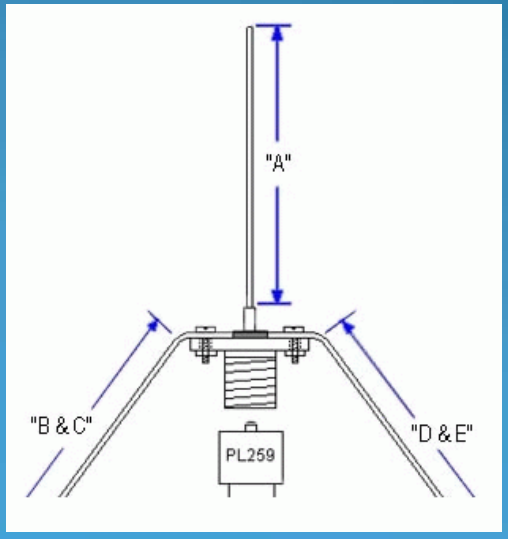


"A Beginners Guide to Making Antennas"





What criteria am I looking for in an antenna?

- It is like looking for a car.
  - How many people will it hold?
  - What is the gas mileage?
  - 2 wheel drive, 4 wheel drive, all wheel drive?
  - Does it have enough power to tow my boat?

What criteria am I looking for in an antenna?

- Polarity
- Gain
- Size
- Directionality
- Portability
- Multi band

Gain

- What gain is
- How it is expressed
- How it is connected to an antenna

Gain (Horse Power + Drivetrain)

- An antenna's **power gain** or simply **gain** is a key performance figure which combines the antenna's directivity and electrical efficiency. As a transmitting antenna, the gain describes how well the antenna converts input power into radio waves headed in a specified direction. As a receiving antenna, the gain describes how well the antenna converts radio waves arriving from a specified direction into electrical power. Due to reciprocity, the specified gain for any antenna applies identically whether it is used for transmitting or receiving.

Gain

- Antenna gain can be specified in a few different ways, sometimes invoking confusion. Most often gain is expressed in decibels with the units denoted as *dBi*. However sometimes the gain is compared to the maximum gain of a lossless half-wave dipole antenna (1.64-2.2) in which case the units are written as *dBd*.
- Gain is always a comparison to something else

Gain

- For a given frequency the antenna's effective area is proportional to the power gain. An antenna's effective length is proportional to the *square root* of the antenna's gain for a particular frequency and radiation resistance.
- In other words, as the length increases the gain increases exponentially.
- It is like a fishing net, the bigger it is the better chance you have to catch something.

Why do I care?

- Gain is a major factor as to how well an antenna functions both in transmit and receive.

- Power Gains
- 3 db = X2 power
- 6 db = X4 power
- 10 db = X10 power
- 20 db = X100 power

- Power Loss
- -3 db = ½ power
- -6 db = ¼ power
- -10 db = 1/10 power
- -20 db = 1/100 power

Reading Materials

- ARRL Antenna Source Book
- QST Magazine
- Internet
  - Most of the designs in this presentation were found online.

Basic antenna types

- Dipole antenna, consists of 2 radiating elements apposed from each other, feed point is at the center of the 2 elements
- Ground plane antenna, consists of one radiating element and a ground plane, feed point is at the connection of the ground plane and the radiating element
- Yagi antenna, directional dipole, dB, how long do you want to make it?

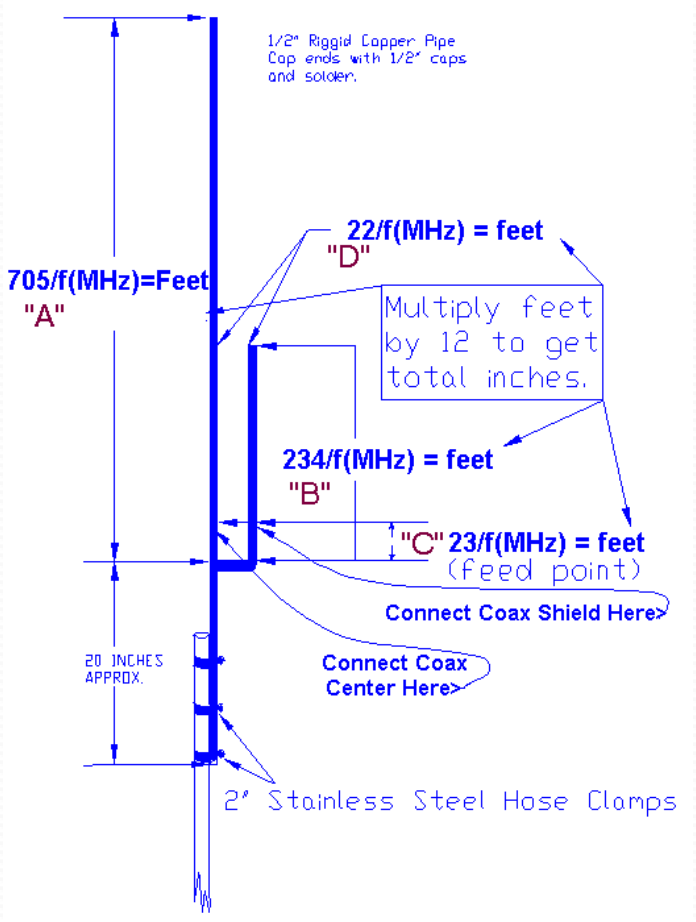
- 1/4 Wave length radiators 2.2 dBi, 0 dBd
- 1/2 Wave length radiators 3.8 dBi, 1.6 dBd
- 5/8 Wave length radiators 5.2 dBi, 3.0 dBd

This reference material uses 2.2 dB as dipole gain

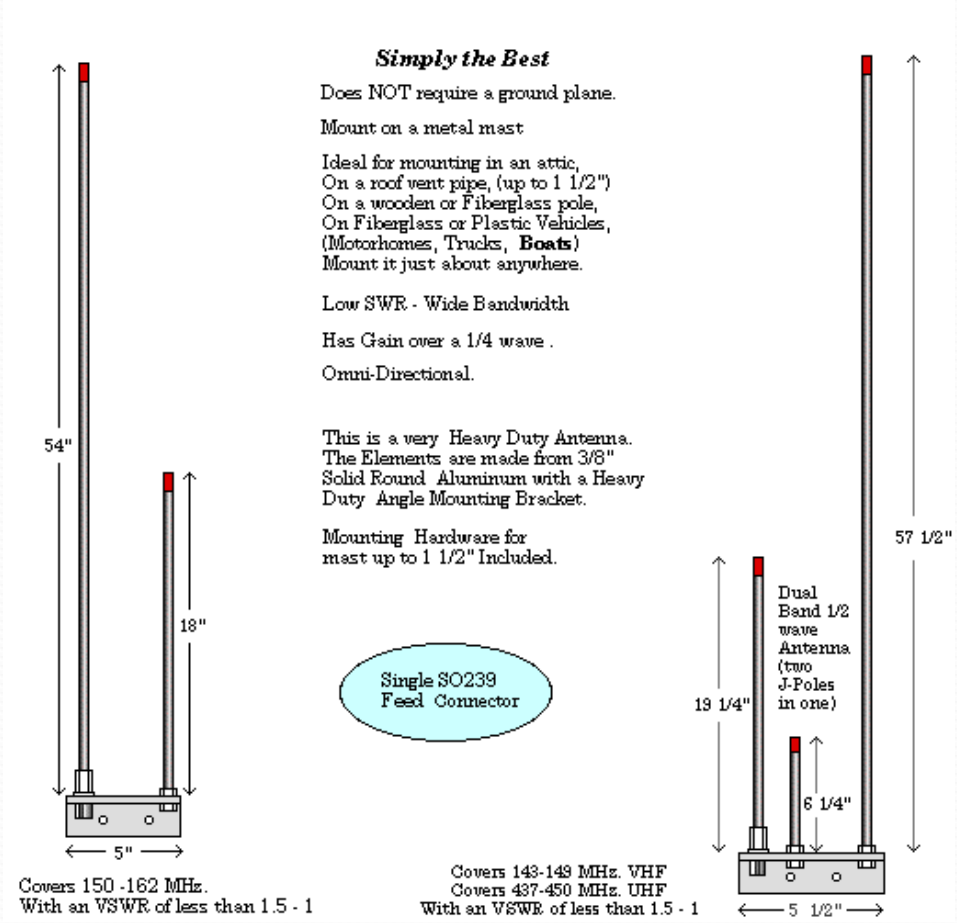
Collinear Antennas

- A collinear antenna is 2 or 3 radiating elements stacked on top of each other separated by a phasing coil to increase gain
- 5/8 Wave over 1/4 wave 5.4dBi, 3.2dBd
- 5/8 Wave over 1/2 wave 5.6dBi, 3.4dBd
- 5/8 Wave over 5/8 Wave over 1/4 wave 7.2dBi, 5.0dBd
- 5/8 Wave over 5/8 Wave over 1/2 wave 7.6dBi, 5.4dBd

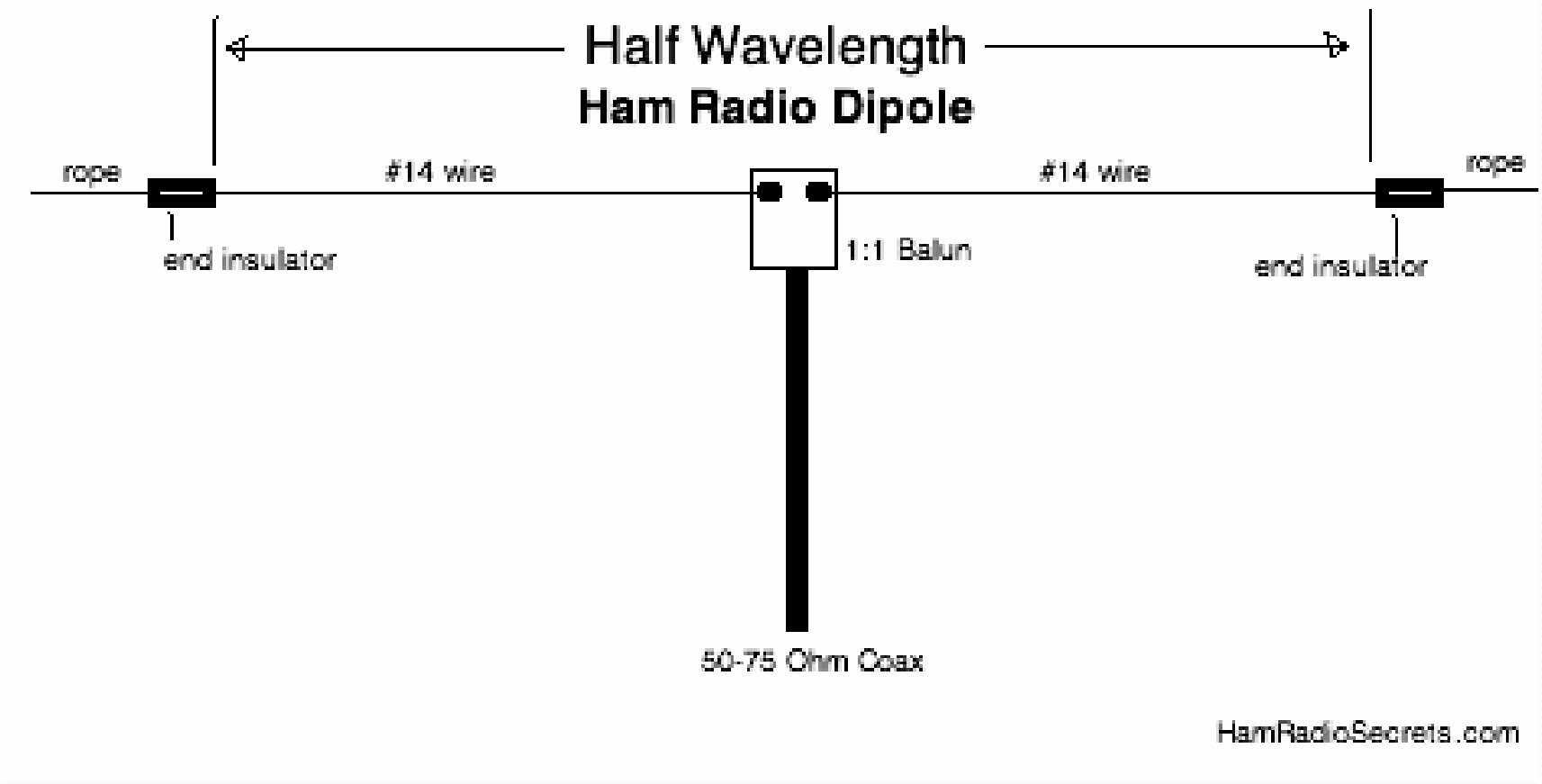
J Pole


1/2" Riggid Copper Pipe
Cap ends with 1/2" caps
and solder.
22/f(MHz) = feet
"D"
705/f(MHz)=Feet
"A"
Multiply feet
by 12 to get
total inches.
234/f(MHz) = feet
"B"
"C" 23/f(MHz) = feet
(feed point)
Connect Coax Shield Here
20 INCHES
APPROX.
Connect Coax
Center Here
2" Stainless Steel Hose Clamps

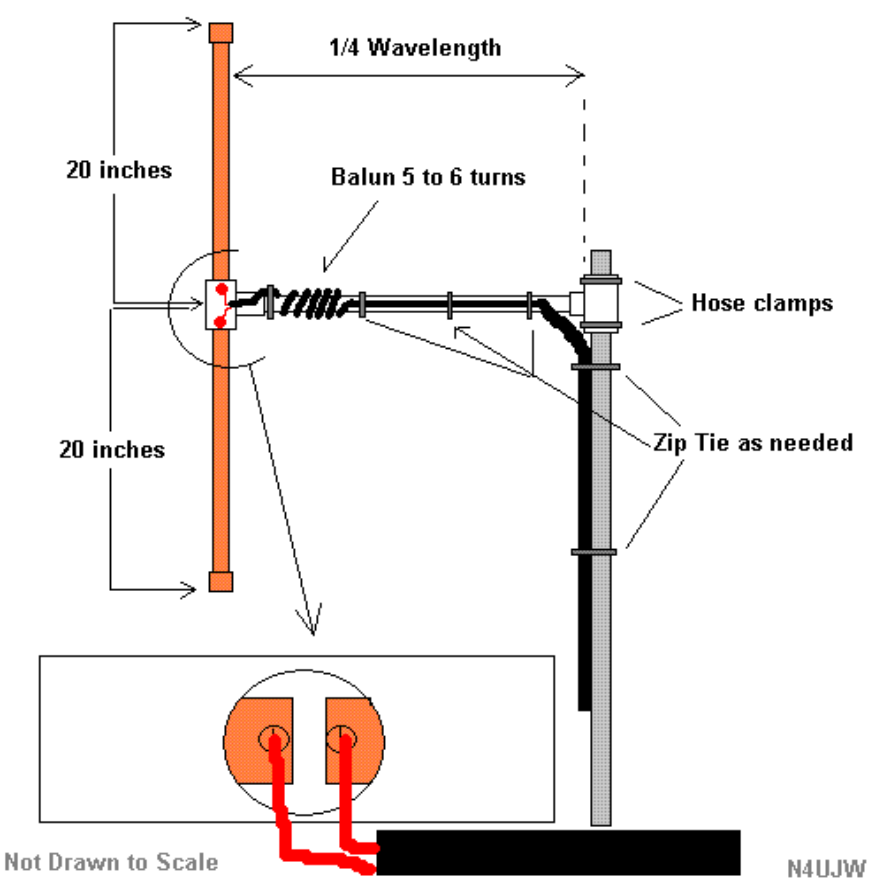
Arrow J pole

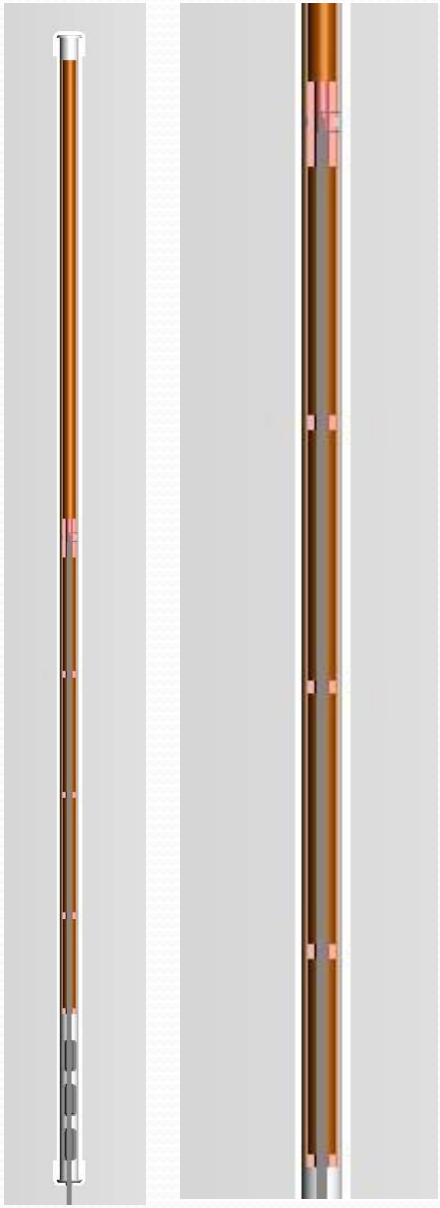

Simply the Best
Does NOT require a ground plane.
Mount on a metal mast
Ideal for mounting in an attic,
On a roof vent pipe, (up to 1 1/2")
On a wooden or Fiberglass pole,
On Fiberglass or Plastic Vehicles,
(Motorhomes, Trucks, Boats)
Mount it just about anywhere.
Low SWR - Wide Bandwidth
Has Gain over a 1/4 wave .
Omni-Directional.
This is a very Heavy Duty Antenna.
The Elements are made from 3/8"
Solid Round Aluminum with a Heavy
Duty Angle Mounting Bracket.
Mounting Hardware for
mast up to 1 1/2" Included.
54"
18"
5"
Single SO239
Feed Connector
Covers 150 -162 MHz.
With an VSWR of less than 1.5 - 1
57 1/2"
Dual
Band 1/2
wave
Antenna
(two
J-Poles
in one)
19 1/4"
6 1/4"
5 1/2"
Covers 143-149 MHz. VHF
Covers 437-450 MHz. UHF
With an VSWR of less than 1.5 - 1

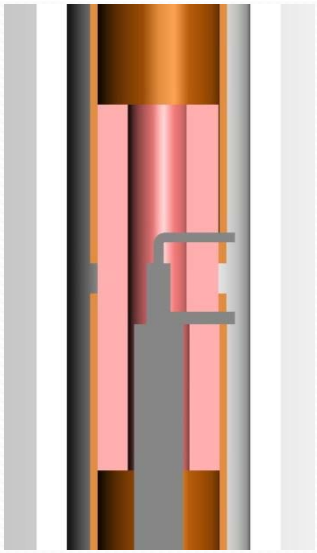
Horizontal Dipole



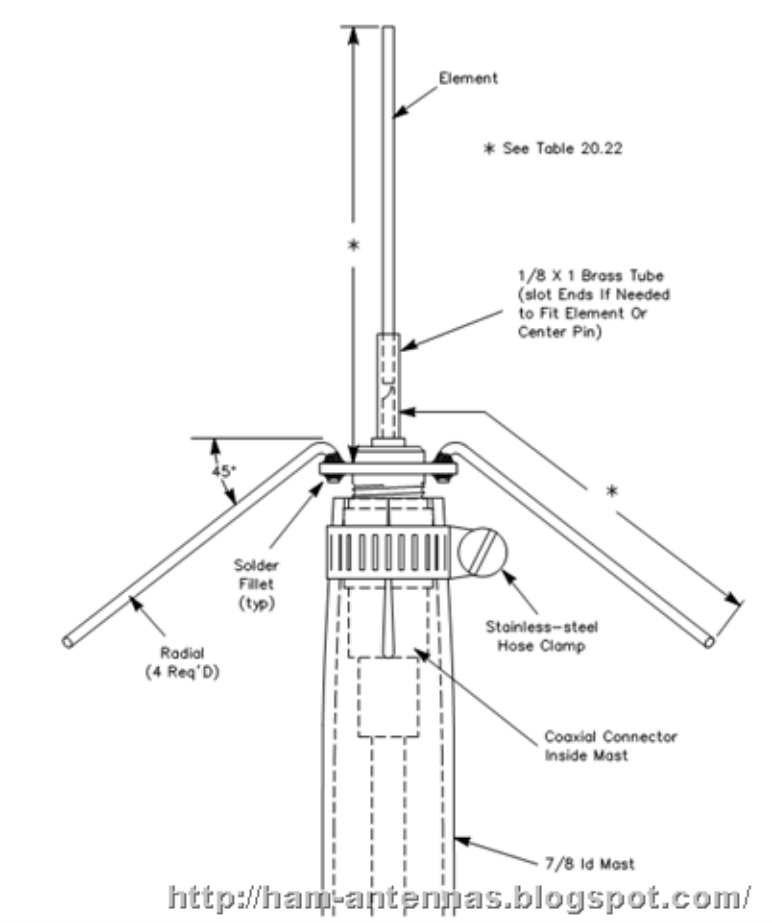
Vertical Dipole



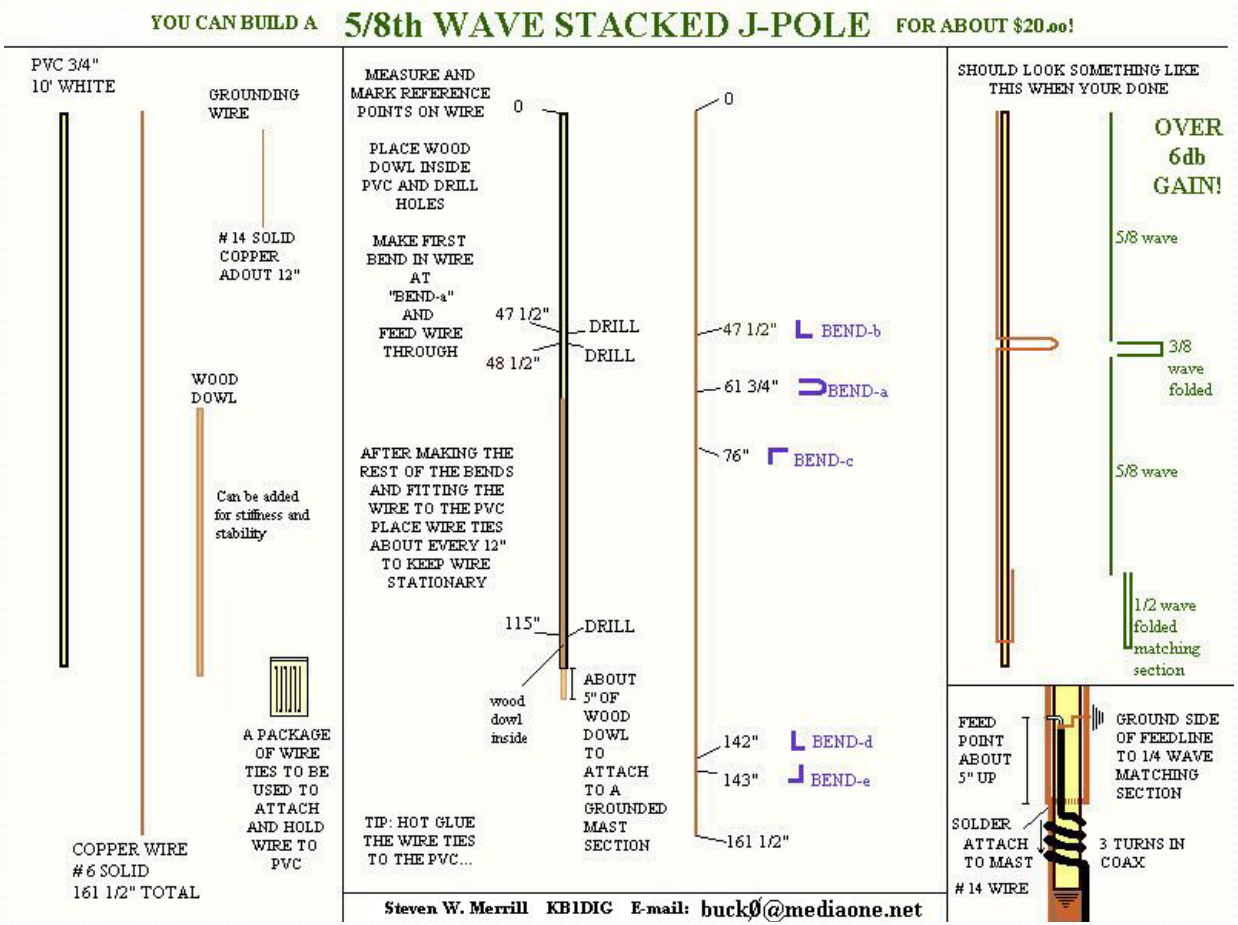




Vertical with Ground Plane



Stacked J Pole



Stacked Vertical

MODEL	FREQUENCY (MHz)
FB3740WA	740 - 806
FB3800WA	806 - 866
FB3825WA	824 - 896

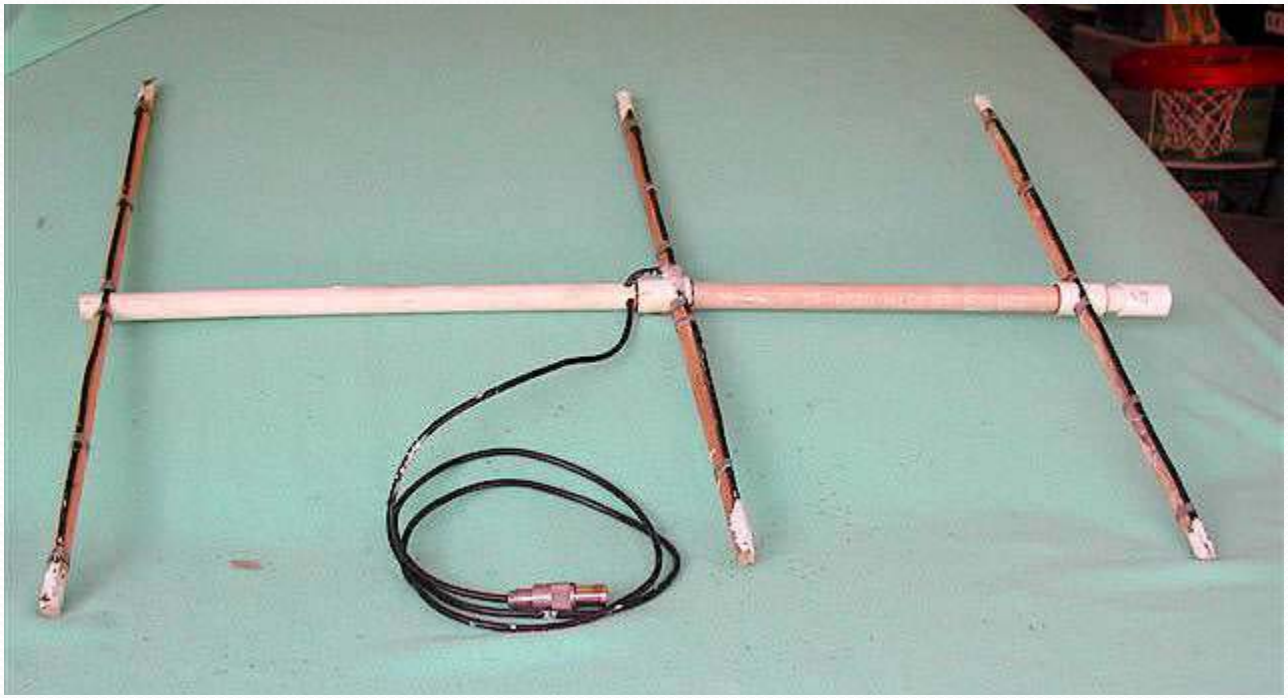
SPECIFICATIONS	
GAIN	5.4 dBi
TYPE	5/8 over 1/4 wave
VSWR	2:1
COLOR	Black
WHIP	.100, open coil
POWER RATING	150 Watts
MAX HEIGHT	16”
FEED CONNECTION	N Female
WIND LOAD	100 mph

Stacked Vertical

MODEL	FREQUENCY (MHz)
FB35T800WA	806 - 866
FB35T825WA	824 - 896

SPECIFICATIONS	
GAIN	7.2 dBi
TYPE	5/8 over 5/8 over 1/4 wave
VSWR	2:1
COLOR	Black
WHIP	.100, twin open coil
POWER RATING	150 Watts
MAX HEIGHT	32”
FEED CONNECTION	N Female
WIND LOAD	100 mph

Yagi



Construction tips

- Soldering
  - Solder iron
  - Solder gun
  - Propane torch
- Heat shrink
  - Encapsulating
  - Non encapsulating
- PVC tubing
- Loading effect
- Ferrite chokes
- Waterproofing

SWR

- VSWR Voltage standing wave ratio, commonly referred to as SWR
- The SWR of the antenna is the ratio of the maximum to minimum values of voltage in the standing wave pattern appearing along a transmission line with an antenna as a load
- Basically it is an indication of how much energy is being radiated and how much is being reflected back, typically < 2:1 SWR is ok

SWR

- Now, just because the SWR of an antenna is less than 2:1 does not mean it is radiating energy
- A 50Ω load or 1000 ft of coax will result in a very low SWR
- Low SWR is an indicator that it will not harm the transmitter, using tried and tested designs ` having a low SWR will usually result in a good performing antenna

Test Equipment

- SWR Meter
- SWR Tester
- Antenna Analyzer
- Field Strength Meter

SWR Meter

- SWR meter is the minimum test equipment needed to tune an antenna. (frequency specific)
- An SWR meter measures how much power is reflected back toward the radio from the antenna
- When using this method you will need to announce your call sign when testing, and stay 5 KHz inside the ham bands

SWR Tester

- This is similar to an SWR meter but the SWR tester has it's own transmitter that has a dial to sweep a frequency range very quickly and display SWR as it sweeps across the band

Antenna Analyzer

- An SWR analyzer does more than just tell you SWR ratio, depending on the make and model it will display information like;
  - Impedance
  - Inductance
  - Phase shift
  - Frequency
- If you are series about designing antennas you will need an antenna analyzer

Field Strength Meter

- A field strength meter measures the strength of the Rf field generated by a transmitting antenna
- Basically this is a comparative device to determine RF energy at a given distance, it will give you an indication of improvements you've made to an antenna or compare different antenna performances
- Poor mans "gain tester"