6m / 50MHz J-Pole Antenna

(THE EXTRA TERMS 6M / 6 METERS / SIX METERS / SIX METERS WERE ADDED TO HELP GOOGLE...)

or a 50 MHz / 6 metre Yagi (/~vk4adc/web/../50mhz_yagi.php)

Mouse over the graphics to see larger images

Need a general purpose antenna on ‘ 6 metres - the magic band ' ? The J-Pole is an easy-to-build and inexpensive device that provides an omni-directional vertically polarised antenna without the need for a ground plane. In technical terms, it is an end fed vertical 1/2 wave which is fed via a 1/4 wave matching stub.

I take no credit for the design values for this project - only the easy construction technique. If you need more info or dimensions for other frequencies, check out the web pages for articles by Buck Rogers K4ABT at http://www.packetradio.com (http://www.packetradio.com) and other authors. In particular for J Pole design info, look at http://www.packetradio.com/jpol.htm (http://www.packetradio.com/jpol.htm) and http://www.vk1.wia.ampr.org/bulletins/jpole.html (http://www.vk1.wia.ampr.org/bulletins/jpole.html)

UPDATE : 2nd January 2005 : Feedback from Doug Adair N8WWM [50MHz VUCC #1373] with alternative spacer arrangements.
His email plus pictures are at the bottom of the original page - here.

Construction time : About 1-2 hours

Costs : about $AUD25 to $AUD50 – cost breakdown below is for the material actually used – longer tubing lengths may be required that inflate the apparent cost. Costs listed below relate to costs of the materials at the time this antenna was constructed and do not necessarily reflect the current price of materials.

Materials :

1 x 6.1 metre length 19mmx1.5mm round aluminium tubing ($12.75)

1 x 1000mm length 16mmx1.2mm round aluminium tubing ($1.50)

1 x 200mm length 38x25mm rectangular aluminium tube (x 1.0mm wall) ($1.80)

4 x 12-23mm stainless steel worm-style hose clamps ($1.50 each)

2 x 16mm (tubing size) plastic chair tips ($0.70 each)

16 x aluminium pop rivets

50 ohm coax cable, eg RG58A/U, minimum length 3-4 metres

200mm x 32mm white outdoor conduit

Nylon cable ties etc...

Calculated dimensions – 50.1 MHz

Long section :	4290 mm
Short section :	1423 mm
Feed point spacing :	140mm (external coax 'Y' style) **
Element spacing -metal tube outer to outer at closest dimension :	135mm

** This dimension is based on the original 'Y' external feed. Using a modified feed system, this distance is about 180 -210mm. Details of the modified feed are listed near the end of this page.

Construction :

Creating the shorting stub – this is the hardest part of the entire construction :

The critical dimension is the 135mm spacing between the elements but this dimension is not the centre-to-centre value – it is the spacing from tube outer to tube outer. With 19mm diameter tube, adding 19mm gives the centre-to-centres of the holes as 154mm. Therefore the outside to outside is 173mm so it does not leave much from our 200mm material.

1. Measure in 23mm from one end along the 25mm side section and then drill a pilot hole as a guide for a larger drill.
2. Making sure it is square, mark the hole position on the 25mm section opposite face and drill it.
3. Enlarge the hole to 19-20mm. I cheated here – I used a ¾" chassis punch from each side to get a neat hole with about 0.5mm of play.
4. From the inner edge of the hole, measure and mark the position 145mm along the tube on one face and then repeat the process for the opposite face.
5. Drill these pilot holes and enlarge them to 19-20mm.
6. Not really hard unless you don't have a suitable drill press with a ¾" drill or chassis punches to get the neat 19-20mm holes !

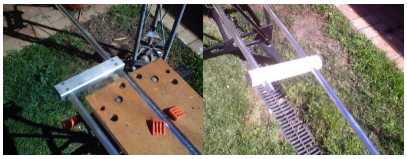
The separator : To provide mechanical rigidity, an insulating separator must be fitted near the top of the matching section joining both tubes. It is similar in dimension and technique to the shorting stub but is made out of PVC electrical conduit rather than aluminium.

Use the same dimensions as in the construction of the shorting stub for the spacing of the hole centres and drill 19-20mm holes through the conduit (the chassis punch works well on the PVC tube too). Make sure that the alignment of the holes is correct otherwise the aluminium tubes will not fit through. The separator is held in place by nylon ties fed around the vertical aluminium tubes but placed within the end of the conduit and later tightened so as to not allow any slippage down the aluminium tubing - and without requiring additional holes.

The round tubing now needs to be cut to length and prepared for fixing :

1. From the 6.1 metre tube length, cut off 1300mm - leaving a 4.8 metre section for the main vertical radiator and mounting.
2. Cut a contraction slot in one end of each tube (4.8m & 1.3m) section for about 50mm.
3. Mark 4000mm from the slotted end of the main radiator. This is the position for the main shorting stub.

Assembly into the finished product :



1. Slide the shorting stub along the main radiator tube until the upper edge lines up with the 4000mm mark (the stub will be on the shorter length side of the mark).
2. Making sure that the tubing is square to the cross stub, drill clearance holes in the 38mm section sides for the pop rivets you are using and set the rivets. I recommend drilling one hole and installing the rivet before drilling the next hole etc.. Rivet both sides of the bottom stub tube to the main radiator tubing. This will pull in the 25mm dimension of the tube a little but that is the reason why it is so close to the end of the rectangular tube !
3. Install the unslotted end of the matching tube – the shorter length of 19mm section into the shorting stub with about 3-5mm protruding through the bottom.
4. Making sure that this tubing is also square to the cross stub, drill clearance holes for the pop rivets you are using and set the rivets. As before, I recommend drilling one hole and installing the rivet before drilling the next hole etc.. Rivet both sides of the bottom stub tube to the matching section tubing.
5. Slide a worm clamp down each 19mm tube down to the matching stub.
6. Form a loop from a single nylon tie making sure it will fit over the 19mm tube (make 2 of these.)
7. Fit a looped tie into one end of the separator and carefully feed onto the main radiator tube
8. Slide the separator down over the long tube first then over the matching tube so that it is just above the slotted top of the matching tube. Install the second looped nylon tie into the other end of the separator tube and feed it down over the aluminium matching tube until it is just below the slotted section. Pull each tie tight so that it will not slip on the aluminium tubing. Multiple ties can be fitted if desired.
9. Slide a second worm clamp over the slotted section on each 19mm tube and insert the 16mm tube and adjust the worm to just hold the clamp in position.
10. Measure the main radiator tube from the top of the shorting stub and set the adjuster to 4290mm before tightening the worm again to just hold the tube in position. Do not overtighten at this stage.
11. Measure the matching stub tube from the top of the shorting stub and set the adjuster to 1423mm before tightening the worm again to just hold this tube in position. Do not overtighten at this stage.
12. From the shorting stub, mark a position 140mm up each 19mm tube. This is the position to attach the coax cable. Note that the coax inner goes to the main radiator while the outer goes to the matching stub tube.
13. Slide the worm clamps up to these marks and lightly tighten in position.

Final steps : Cable connection and adjustment - standard 'Y' cable feed.

1. Create an RF choke by winding 5 turns of the RG58 cable around a 125mm former and nylon tie it into a stable structure. Leave at least 400mm of cable free from the feed end. The other end (the tail) can either be terminated in a BNC or other coax connector to suit the cable type or can simply be the start of the feeder that takes it to the radio.
2. Strip back 100 - 125mm of the outer on the feed end.
3. Push the braid back a bit to loosen it up, then poke a ‘hole’ in the braid and ‘fish out’ the coax inner.
4. Strip the inner back to about 75mm of exposed poly and the rest the inner conductor.
5. Tin the inner conductor and then screw it under the worm clamp on the main radiator.

6. Feed the braid under the worm clamp on the matching section and pull it until there is just a little slack in the cable. Cut it off, remove it and tin the braid before placing it back under the worm clamp.
7. Mount the antenna vertically in a clear space in such a manner that it can easily be brought down to adjust at each of the following stages :
8. Connect a suitable transmitter via a SWR bridge to the coax ‘tail’ and check the VSWR at say 50.160 Mhz. Do not use 50.110 MHz as a test frequency !
9. Check the VSWR at various spot frequencies in that segment. If the VSWR goes up as the frequency rises, the tube lengths are too long and need to be shortened. If the VSWR goes down as the frequency rises, the tube lengths are too short and need to be lengthened. Lengthen both together but make sure that the main radiator adjustments are about triple the matching section’s length changes.
10. Once the VSWR is minimum at the centre of the desired section of the band, it is time to adjust the feed point positions on both tubes to bring the VSWR down to the absolute minimum. Slide the clamps up or down the tubes TOGETHER and see where the trend goes.
11. If the VSWR rises, move in the opposite direction. It should be possible to get the SWR down to 1.05 or better without any problem.

Final steps : Cable connection and adjustment - modified cable feed.

1. Drill a 5/16" hole about 200mm from the top of the shorting stub along the inner side of the matching tube(facing the main radiator tube) and remove any burrs.
2. Feed the RG58 up the short tube and pull it out of the hole.
3. Strip back the cable outer sheath for about 200mm.
4. Push the braid back a bit to loosen it up, then poke a ‘hole’ in the braid and ‘fish out’ the coax inner right at the start of the exposed braid.
5. Cut the braid off with about 25-30mm left and tin it with a soldering iron making sure you do not overheat the poly inner of the RG58.
6. Slide the cable back through the hole and set the worm clamp to hold the braid on the tube adjacent to the feed hole.
7. Feed the coax inner across towards the main radiator element making sure you have about 20mm of slack on the poly and enough inner to tin about 30mm before cutting it off.
8. Feed a length of the black plastic coax sheath back over the inner to provide some protection against UV.
9. Clamp the inner to the main feed directly opposite the feed hole as an initial location.
10. Create an RF choke in the coax by winding 5 turns of the RG58 cable after it exits the tube around a 125mm former and nylon tie it into a stable structure and nylon tie it to the base of the matching section. The tail can either be terminated in a BNC or other coax connector to suit the cable type or can simply be the start of the feeder that takes it to the radio.
11. Mount the antenna vertically in a clear space in such a manner that it can easily be brought down to adjust at each of the following stages :
12. Connect a suitable transmitter via a SWR bridge to the coax ‘tail’ and check the VSWR at say 50.160 Mhz. Do not use 50.110 MHz as a test frequency !
13. Check the VSWR at various spot frequencies in that segment. If the VSWR goes up as the frequency rises, the tube lengths are too long and need to be shortened. If the VSWR goes down as the frequency rises, the tube lengths are too short and need to be lengthened. Lengthen both together but make sure that the main radiator adjustments are about triple the matching section’s length changes.
14. Once the VSWR is minimum at the centre of the desired section of the band, it is time to adjust the feed point positions on the radiator tube to bring the VSWR down to the absolute minimum. Slide the clamp up or down the tube and see where the trend goes.
15. If the VSWR rises, move in the opposite direction. It should be possible to get the SWR down to 1.05 or better without any problem.

When all is done, the centre frequency is as desired and VSWR is negligible, it is time to put the plastic chair tips on the tops of the tubes, tighten the worm clamps and weatherproof as desired. Don't forget to weatherproof the slotted adjustments and their worm clamps with a marine varnish to prevent excessive oxidisation. If using the modified feed, remember to seal up the hole where the coax feed exits across to the main radiator with a good silicone sealant.

Final dimensions – 50.1 MHz

Long section :	4425 mm
Short section :	1513 mm
Feed point spacing :	160mm
Element spacing :	135mm

How it went together here at VK4ADC ?

I can only say ‘like a dream’. I built it without needing a 'you-beaut' workshop. The tubes were cut and slotted out in the back yard just using a portable workbench. The matching section was drilled with a cordless drill and then punched out to size – again in the back yard. The assembly – yes, the back yard - again !

The 'Y' feed results : -

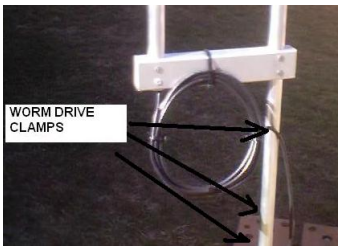
The initial VSWR at 50.100 (the design frequency) was 1.2:1 and reduced as frequency was increased. Fine, the elements obviously needed to be lengthened. Stepped the inner adjuster tubes out a bit and measured again – yes, the frequency was coming down as the VSWR had reduced to 1.15 at 50.1 and was even lower at 50.2 MHz. Extended the tubes a couple more times at about 8mm a time and the VSWR was then about 1.1:1 at 50.1 and flat across 50.0 to 50.2 – now it was time to adjust the feed connection positions. Adjusted it up about 10mm along each vertical element and the VSWR dropped to 1.02:1 – close enough !

The modified feed results :-

Again, the initial VSWR was about 1.2:1 and the array was obviously high in frequency. Extending the adjuster tubes brought the SWR down and the final SWR was achieved by moving the worm clamp on the coax inner up and down slightly to provide the best overall match. Again the SWR of 1.02 to 1.05 over the 50.0 to 50.2 was achieved. The lengths were different to the 'Y' feed but the feeder was a far better version mechanically. Certainly it is the style I recommend for general construction.

Mounting

As per the suggestion by Buck Rogers, I just purchased a 1.2m TV-style galvanised steel fascia mount and a couple of 50mm coach bolts plus 3 x 50mm stainless steel worm clamps to mount it. JUST MAKE SURE THAT THE "J" SECTION IS CLEAR ABOVE ANY SUPPORTING PIPE SEGMENT FOR BEST OPERATION.



I wasn't looking for great height so it was simply a matter of attaching the fascia mount to the exposed fascia under the guttering with the coach bolts and aligning it so it was vertical.

I do recommend using a suitable size hex socket on the end of a cordless drill to tighten up the worm clamps rather than a screwdriver. Make sure you have the drill set to ratchet otherwise you will strip the worm. Nominally tighten them, check the antenna alignment is vertical and then tighten completely.

A couple of nylon ties hold the coax back to the vertical pipe before it feeds away to the shack.

Overall

How well it works in practice will need to be seen over a period of time. It’s main use here at VK4ADC is to feed to a modified 27MHz CB as a monitoring receiver for the 50.110 calling frequency. If I need to hit the CB’s transmit button, I will know that it will be a perfect match to the transmitter right across that (VK4) segment from 50.0 to 50.3 MHz !

Doug Hunter VK4ADC

18/19 August 2001

Date: Sun, 2 Jan 2005 00:33:00 GMT

Hello Doug,

I was looking at your great ideas for yagis and jpoles on 6 meters and thought I would pass my own idea along. I have built 14 6 meter jpoles using this variation of your idea for the feed system plastic spacers.

I used the plastic tubing for spacers, as you did, but with one hole in the middle of the spacer, used two plastic ties to anchor the spacer in a sandwich between the feeder sections. Using a product we have in the states called plumber's goop to literally meld with the plastic and make a wrap around fit.

2 benefits I have discovered in this method: Extremely strong bond at the spacers, and the fact that one does not have to line up 2 holes accurately when cutting and fitting them to the antenna. I am always looking for methods that make it easier for laymen to make antennas. Curse those expensive commercial antennas!

Along with the antenna picture there are a few more that are more personal. Myself, XYL, and simple but effective shack included.

73 and good DX on 6!

Doug Adair N8WWM
50MHz VUCC #1373

{ Editing note : I have found that even the black nylon ties weaken after a few years in severe UV environments (like here in VK). The glue here is what is used here to bond the spacer to the tubing and the ties just hold it in position until the glue has set. Do NOT just use nylon ties - a longlife glue is an absolute necessity. The original conduit tube with parallel holes method obviates this but is just a little harder to achieve those parallel holes - but then again the electrical conduit is cheap, lasts a lot longer and with greater strength. If you are going to build a number of these, build a simple jig or use a drill press with a sliding bed. }

Close-up of the alternative spacer

Overview of the alternative spacer arrangement from N8WWM

Thanks for the feedback Doug. Anyone else have alternative construction methods or suggestions ???

From Tom Horne, W3TDH 24 Dec 2011 :

An alternative methodology for making the spacer is to connect the appropriate length of PVC conduit to two T condulets. Cut away the unneeded plastic and fasten the spacer in place with worm gear clamps. Plumbing pipe would be cheaper to use but unlike Rigid Nonmetallic Conduit it is not sunlight resistant. You can use pvc or cpvc water pipe and Ts if you sand paper the exposed surfaces and paint them with a non metallic paint.