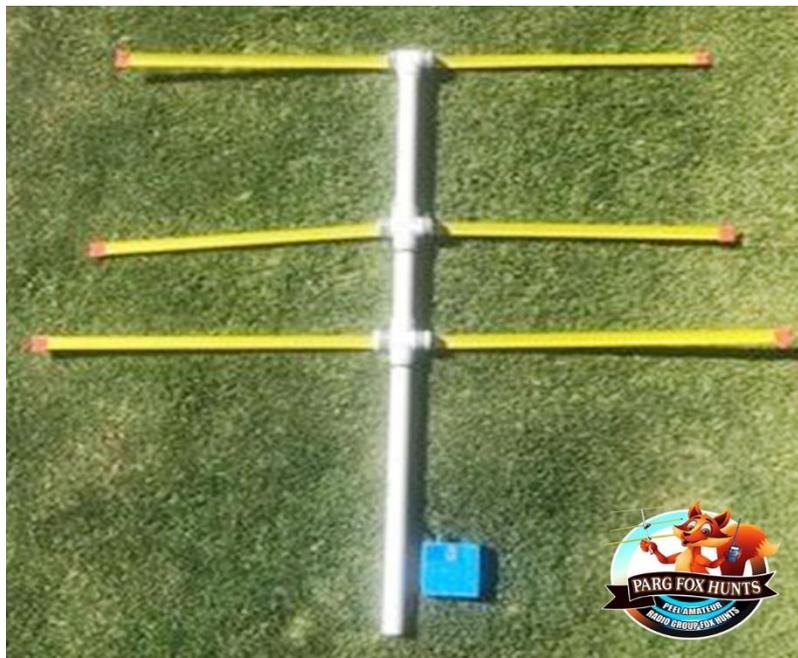




### Fox Hunt Yagi Antenna

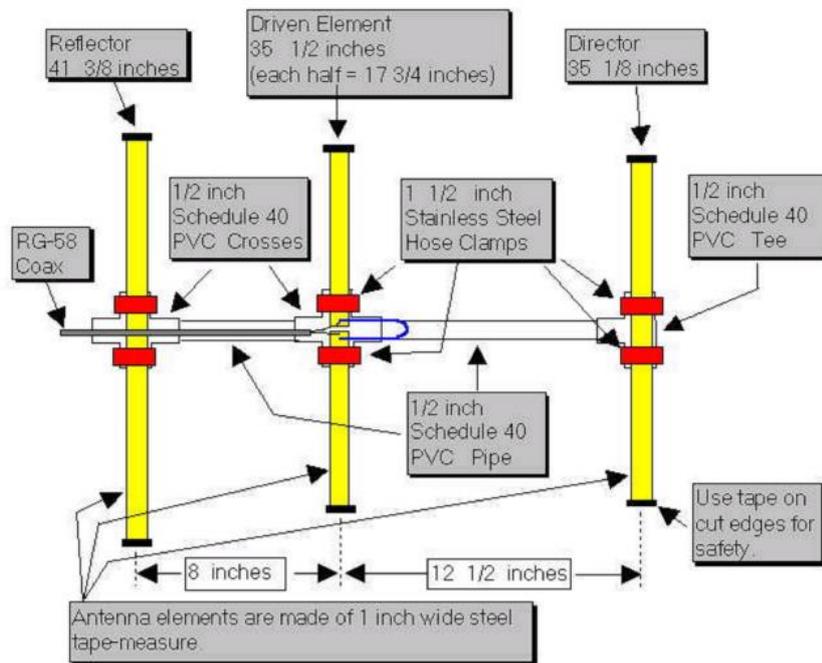
The home brew 'tape measure' Yagi is light weight and easy to use. The tape measure elements mean it will bend and flex in confined spaces. Plus, the elements can be folded when not in use.



It has a 7.3 dBd gain and an SWR of around 1:1.5 in the middle of the two metre band. By tuning the length of the 'hairpin matching' it could get down to 1:1 on say ... 146.150, which is the centre of the 2 metre simplex FM portion of the band in Australia.

Performance Predicted by YAGI-CAD	
GAIN	7.3 dBd
Front-to-Back Ratio	>50 db
3 db Beamwidth	E = 67.5 degrees
3 db Beamwidth	H = 110 degrees

It will take around 30 minutes to construct for a cost of around Australian \$45, with enough steel tape, insulation tape and PVC pipe left over to make up to two more antennas.

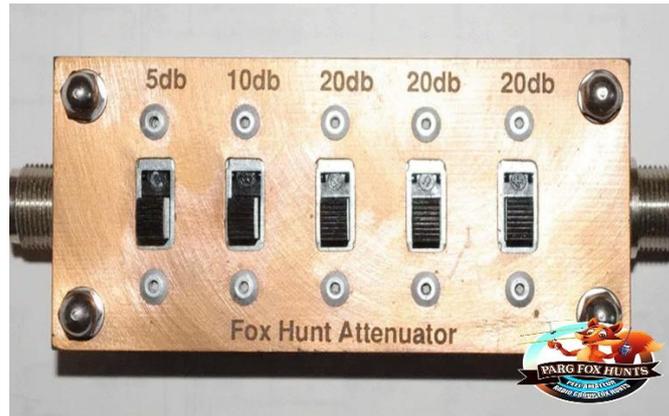


[https://wparc.us/hints-sub/hints-pdf/tape\\_measure\\_df\\_antenna.pdf](https://wparc.us/hints-sub/hints-pdf/tape_measure_df_antenna.pdf)

#### Parts List

<https://www.bunnings.com.au/> and <https://www.jaycar.com.au>

- 1 x 3M x 20mm (10' x 3/4") PVC pipe. (\$9.15 at Bunnings. Good for up to 3 Yagi antennas)
  - 1 x 8M x 25mm (25' x 1") steel tape measure (\$20.00 at Bunnings Tool Shop. Good for up to 3 Yagi antennas)
  - 1 x 20mm (3/4") PVC 'tee' connector piece (\$2.80 each at Bunnings)
  - 2 x 20mm (3/4") PVC 'cross' connector piece (\$4.75 each at Bunnings)
  - 6 x 19mm (1") hose clamps. stainless steel and worm-drive screw. (\$1.68 each at Bunnings)
  - 1 x 127 (5") 14 gauge insulated wire. I am using some left-over clothesline insulated steel cable.
  - 1 x 20M (66') roll of insulation tape (\$2.25 at Jaycar)
  - 3 x cable ties. I always have a selection of those on hand.
  - 1 x 152 CM or 182 CM (5' or 6') RG58 50 Ohm coax cable with connector (BNC or PL259) at one end and bared to braid and centre conductor at the other end. (\$1.80 per metre at Jaycar). Plus more for an RF choke winding coax 7 times around the PVC pipe.
- I suggest 30 CM (1') RG58 between your Fox Hunt receiver and the connector on the end of this RG58 coax cable. It can be used to body attenuate signals from the Fox as demonstrated in our video. An alternative is a commercial or home brew attenuator between these two connectors as shown in this image.



Alternatively, the attenuator might be fixed to the handle of the Yagi with enough RG58 coax to run to the receiver. You can also attenuate the received signal buy progressively changing the frequency on your receiver.



#### Tools

1 x sand paper

1 x PVC cutter (\$35 at Bunnings) or hack saw (From \$10 at Bunnings)

solder and flux and soldering iron (From \$25 at Bunnings)

1 x screwdriver for hose clamps (From about \$8 at Bunnings)

1 x tin snips (From \$6.98 at Bunnings)

1 x wire cutter (From \$19.98 at Jaycar)

1 x ruler or tape measure. (Around \$20.00 at Bunnings)

All prices in Australian dollars. Bunnings Hardware Warehouse and Jaycar Electronics are nation-wide stores.

## Instructions

1. Cut 3 pieces of PVC tubing. 1 x 285 (11 ¼"). 1 x 175 (6 7/8"). 1 x 457 (18")
2. Fit pieces of PVC with PVC crosses and PVC tee connectors. The longer connector piece in front and the shorter connector piece in the rear.
3. Centre point of the tee to the middle cross should be 318 (12 ½") apart.
4. Middle cross to the end cross connector needs to be 203 (8") apart.
5. These dimensions are *critical*. If they are too far apart, use a rubber mallet to persuade the pieces to go in. They will fit tight. No glue should be required.



- 6.
7. Cut the end off the steel tape measure. Be careful not to let it rewind inside the casing.
8. The cut ends of the steel tape are *dangerously sharp*. Immediately cover them with insulation tape. Or carefully trim the ends of the tape into a curved semi-circle. You might consider covering with plastic as a safety precaution.



- 9.
10. Cut the Reflector element. 1 x 1046 (41 3/8") and the Director element 1 x 8009 (35 1/8")
11. Cut two pieces for the Driven element each 452 (17 3/4") long.
12. Sandpaper the paint off the steel measuring tape on the corner edge of the Driven elements.
13. Apply solder flux and tin on the bare areas (where the paint was removed) with solder.
14. Mark the centre point of the Director and Reflector elements to make alignment easier.
15. Attach Director element to the PVC tee connector piece with hose clamps.
16. Attach the Driven elements to middle cross connector piece with hose clamps.
17. Leave a 25 (1") gap between the two Driven elements.

18. For the 'Hairpin Match' strip 7 (¼") of insulation and fold into a 'U' shape 7 (¾") in width. Tin the ends of the 'Hairpin' matching wire and solder to the pads on the Driven elements. If you tin 7 (1/4 ") of each end of the hairpin it will leave 115 (4 1/2 ") to shape into the "U"



19.

20. Attach Reflector element to the end cross connector piece with hose clamps.
21. Tin the ends of the RG58 coax cable and solder to the pre tinned Driven element pads.
22. Cut the coax feeder to an odd half wave length (\* velocity factor) of the design frequency, 0.66 being the VF for RG58 coax. The number 5 being an odd number of half wavelengths long. Choose any odd number for the length of coax. Coax feeder length (meters) = ( (150 / 145.000) \* 0.66 ) \* 5
23. Make an RF choke by winding the feeder coax 7 times around the PVC pipe\*.



24.

25. Tape down or use cable ties to lock down the RG58 coax cable to the antenna boom PVC pipe or
26. You can drill a hole and poke the coax through the centre of the PVC pipe to make it tidy.
27. The result is a 3 element Yagi with a gain of 6.9 to 7.3dbi. Depending who you believe.
28. You can add another two extra directors to make a larger 5 element Yagi with a gain of 9.9dBi.
29. Director 2 length 894.6mm tip to tip, solid, at 940.7mm boom position, and
30. Director3 length 885.5mm tip to tip, solid, at 1115.2mm boom position

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\*Even though the "Bunnings Yagi" (VHF Tape Measure Yagi) is matched to 50-ohms by the hairpin match, it is still a balanced antenna like any other Yagi. If it is connected directly to a coaxial cable, which is unbalanced, some amount of transmitter current will travel along the OUTSIDE of the coax braid, resulting in an imbalance to the antenna, and feedline radiation. To prove this, with a direct coax connection to the feed point, we can use a nano VNA or antenna analyser to measure the VSWR around 2m, and observe the effect of enclosing the coax in your hand near the feed-point.

Moving the hand up and down the cable will significantly alter the SWR, meaning that you (as a capacitor) are affecting the feedline radiation on the coax braid, by changing its impedance.

Essentially what happens is that the impedance of the OUTSIDE of the coax braid forms a potential divider with the radiation resistance of the ground-side element of the Yagi. Depending at least partly on the ratio of these impedances some fraction of the transmit power will go into the ground-side element, and the remainder will run down the outside of the coax - feedline radiation!

In order to counteract this and force as much current into the ground-side element of the Yagi, we need to increase the impedance of the OUTSIDE of the coax braid, without altering the impedance seen INSIDE the coax. We can do this easily by placing a "choke balun" (also known as a 'dirty balun') at the feed point. This can be either a clip-on ferrite element. The Altronics ([www.altronics.com.au/p/l4644-6.5mm-clip-on-cable-core/](http://www.altronics.com.au/p/l4644-6.5mm-clip-on-cable-core/)) L4644 has been found to work well.

Or it can be created by close-winding seven turns of the feedline coax. (See photo above) cable around the plastic (PVC) boom, immediately behind the driven element and towards the reflector (rear). This forms an inductor from of the OUTSIDE of the coax braid. Both of these solutions increase the impedance of the outside coax braid, without affecting the inner 50-ohm transmission line impedance of the coax. This changes the balance. of the "potential divider" in favour of the driven element, rather than the coax outer, forcing more RF current onto the ground-side element.

Note that this can never be "perfect" since we can't make the impedance of the outside of the coax infinite. However, if we get it at least ten times higher than the radiation resistance of the antenna element, then we get more than 90% of the transmit power into the antenna, and less than 10% as feedline radiation.

An alternative solution would be to insert a true 1:1 50-ohm impedance balun at the feed point, but this is more expensive and unwieldy, and would still not provide a perfect solution (any asymmetry in the windings of the 1:1 balun would result in some feedline radiation anyway).

73,

Denis VK6AKR

Dave VK6KV

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Other videos and articles

Michael KB9VBR has an informative video for building a 2 metre Fox Hunt Yagi antenna at

<https://www.youtube.com/watch?v=BmHoQrDfw-0>

[https://wparc.us/hints-sub/hints-pdf/tape\\_measure\\_df\\_antenna.pdf](https://wparc.us/hints-sub/hints-pdf/tape_measure_df_antenna.pdf)

<http://nt1k.com/blog/2012/vhf-3el-tape-measure-yagi/>

[http://theleggios.net/wb2hol/projects/rdf/tape\\_bm.htm](http://theleggios.net/wb2hol/projects/rdf/tape_bm.htm)

<https://ramdor.co.uk/2016/03/30/another-2m-tape-measure-yagi/>

<https://www.bing.com/videos/search?q=how+to+cover+enbd+of+tape+measure+yagi+antenna+for+protection%3f&&view=detail&mid=14F9EBF1DD041D03550714F9EBF1DD041D035507&&FORM=VDRVRV>

<https://www.bing.com/videos/search?q=how+to+cover+enbd+of+tape+measure+yagi+antenna+for+protection%3f&docid=608047308120788661&mid=EACCC2AC3515047E6ED2EACCC2AC3515047E6ED2&view=detail&FORM=VIRE>

<https://www.bing.com/search?q=Satellite+Yagi+2m+70cm+Tape+Measure+Antenna+-+Hombrew+DIY+Cheap+-+KM6JUR>