# The Coax fed Fan Di-Pole, Lot's of Bang for a few Bucks.

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The Coax Fed Fan Di-Pole can get you on the air over 4 different bands with a single coax penetration into the shack. Even better, there is no need for a tuner or the signal loss that a tuner implies. How does this work and what bands are you talking about?That's usually the next question I've been asked when I mention this antenna. Well, how about 80m, 40m, 20m, 10m for the bands?

As for how this thing works...RF will always take the path of least resistance (impedance). What does this mean? Well if you have 2 di-poles connected to the same feed, one cut for 80m and the other cut for 40m and when RF is applied to the feed point at a frequency of 3.8MHZ (80m), the 40m di-pole is too short to provide a good match and so presents very high impedance to the feed point. But the 80m di-pole connected the the same feed point is cut to provide a very good match for the RF at the feed point. The RF "chooses" the 80m di-pole pathway when the frequency is 3.8MHZ. Let me say that again as it's the core principal here. The RF "chooses" the correct di-pole based on the frequency of the RF.

Think about that for a moment. I'll wait.....

You want to make one, you say? OK. Here is a simple plan to do just that.

First, You need to determine how long the longest wire will be on 80m, so you know how to hang the antenna on your property.
Use the standard formula for a1/2 wave di-pole:

468 / Frequency in MHZ = Overall length of di-pole in feet

This will give you the OVERALL length of the di-pole. I used a frequency of 3.9MHZ which is the center of the SSB voice (phone) General spectrum in the band plan.

My result : 120 feet. Wait! Don't cut any wire yet. Run the calculation for each band and total up the amount of wire you will need. Patience here, I'm about to save you a bunch of cash and not an insignificant amount of work :

| Band /Mhz | Di-pole length | Adjusting length | Total length |
|---|---|---|---|
| | | | |
| 80m / 3.900Mhz | 120 | 8 | 128 |
| 40m / 7.237Mhz | 64.67 | 6 | 70.67 |
| 20m / 14.292Mhz | 32.75 | 4 | 36.75 |
| 10m / 29.000Mhz | 16.14 | 2 | 18.14 |
| | | **Total Feet:** | **253.56** |

Save some cash: That's a total of 254 feet of wire! It's going to cost a lot of cash! Nope. The di-poles can be made out of inexpensive **18 gauge stranded wire**. Go to your local Lowes, Home Depot, or home improvement center and look in the electrical/outdoor section.

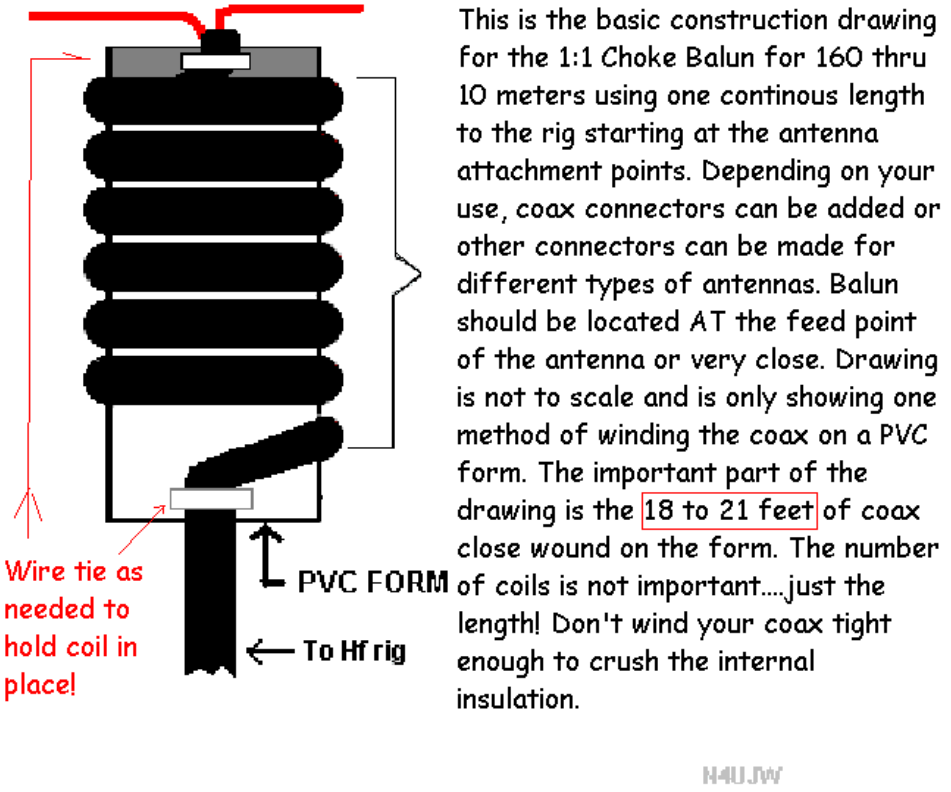
You want to find radio-dog fences. Yes. Radio-Dog Fencing. The wire is usually sold in a 500 foot spool and guess what? It's 18 gauge stranded wire intended for burial. I bought mine a few years

ago for $19.98, I last saw it a month ago for $22.89. Go buy two, you'll thank me later. (Or use your preference of wire)

Now, we have our wire. We'll need some Coax to feed this guy. I used some RG-8X that my local Radio shack had laying around in the back. The 8X is much thinner and lighter than the usual RG-8 and is easier to work with for me. I highly recommend it for this application. There is a slightly higher loss with it compared with some of the more expensive types, but I don't think you're going to miss a watt or two, if it means you don't have to wrestle with the Coax. Make sure you get a PL-259 or two while you're out, with the proper adapter for 8X.

There is just one more component needed and to get this one, you will have to make some coffee. Huh? Yep. Coffee. It's sold now in 15oz (1lb is gone in my area) round plastic containers with a convenient lid that snaps on and off and is pretty much air-tight. Go get one. Empty it however you want but remember, we will be soldering later so don't drink it all in one sitting if you want to build this antenna today. OK. On to the build.

The feed point is constructed with the coffee can using it as the housing and common-mode choke. What's a common-mode choke? I will explain but I strongly suggest that you look here: http://www.hamuniverse.com/balun.html
**There are many examples of the ugly balun construction there!**




**Typical Balun Construction drawing not drawn to scale using PVC pipe.**

A common-mode choke is also called a 1:1 Balun, Ugly Balun, Choke Balun, Air Balun, etc. It is used to eliminate currents that can develop on the outside of the coax shield when the coax is used to feed a balanced antenna.
Well, a Di-Pole is balanced and coax is unbalanced, so we would benefit from a Balun to

eliminate the currents that eat up power and distort the radiation pattern of the antenna.
My idea on this is to wrap the coax around the coffee can at least 8 times before its terminated at the centers of the di-poles.

Drill a hole in the center of the bottom of the can.

Then drill another hole in the side of the can as close to the bottom as possible.

Drill another hole in the side of the can, 1.5" below the top and directly above the previous hole in the side.

The coax is strung through the bottom of the can and then out the bottom-side hole.

Wrap the coax around the can and send it back into the can through the top-side hole.

Wrap the mess with cheap electrical tape to hold it together.
You have an "Ugly Balun".
Strip the portion of the coax that is inside the can. This is where the dipoles will be connected later.

The di-poles.
If the two legs of your di-pole are not EXACTLY the same length, you will drive yourself crazy trying to tune it. Let me say that again: If the two legs of your di-pole are not EXACTLY the same length, you will drive yourself crazy trying to tune it.

Here is a good method to ensure that this does not happen to you.

First, cut the dipole for the "Total Length" in the chart above.

Then, fold that wire in half, tie the ends to something solid and walk away while holding the wires. You will end up with a loop at the end in your hand.

Cut that loop at it's apex.
Go back to the spot where you tied off the wire and measure out each wire to the "Ideal Length" below.

Once you have the proper length, twist the remaining wire back around the standing portion making a loop. The apex of this loop should be at exactly your measurement.

| Band | Total Length ft. | Leg Length ft. | Ideal Length ft. |
|---|---|---|---|
| 80m | 128 | 64 | 60 |
| 40m | 70.67 | 35.34 | 32.34 |
| 20m | 36.75 | 18.38 | 16.38 |
| 10m | 18.14 | 9.07 | 8.07 |

**Final construction, Lets bring it all together.**
Find a drill bit that is just large enough for your 18 gauge wire to pass through the hole it makes.
Drill 3 holes in the side of the coffee can just below the rim where the lid snaps on. Space these holes EQUALLY.

Important! A di-pole must be symmetrical, each side must be the same. We will be re-visiting this concept later also.

Drill an identical set of holes on the other side of the coffee can, directly across from the first set.

Wait! There are only 3 holes and we have 4 di-poles! I know. The 10m di-pole will intersect the others at 90 deg. Just seemed to work out better for me that way.

Now drill another hole 90 deg. from the first set and a corresponding hole directly across from it for the 10m di-pole.

Since the longest wire is the 80m di-pole, it will provide the support for the entire antenna.
Push the 80m legs into the top-most hole of the 3 hole sets on each side of the can.
Tie a knot in the wires so that there is an equal amount of each leg inside the can and the knot butts up against the inside of the can so the wire will not pull out of the can.

I guess I could have used a split-shot lead sinker like you would use when fishing but I was not sure that it would stay put. Someone try it out and let know.
Now, repeat this for each di-pole and remember to keep the part of each leg that stays in the can **equal.**

Strip all the legs and connect one set of legs to the center conductor of the coax, solder it well.

Connect the other set of legs to the shield of the coax, I peel back the braid and twist it into a "wire" then twist it all together and solder it.
When everything is cool and tight, snap the lid on the can and use that cheap electrical tape to make a weather tight seal.

Di-pole supports.
You will need some supporting material to keep the legs of the di-poles from tangling together when its in the air. The easiest thing to use I've found is hardwood dowels.

Cut 2 pieces of dowel to 12" and place them on each side about 8-10" from the coffee can. Cable ties hold the 80m di-pole to the top of the dowel and the 20m di-pole to the bottom.

The 40m di-pole is secured in the middle of the dowel with another cable tie.

Remember. Keep the distances between each leg the same on both sides of the di-pole, along with the distance of the dowel support from the can.

Put another set of 36" long dowels 1.5 ft. before the end of the 20m di-pole. Cable tie each di-pole to the support, keeping the wires tight and equally spaced on each side of the antenna.

Use a bit of nylon mason's twine to hang the ends of the 20m di-pole from the 40m.

Do the same for the ends of the 40m di-pole to the 80m.

Hang the antenna about 6ft in the air if you can by tying off on the ends of the 80m di-pole.
We do this at 6 ft. so it's easier on us to trim & tune later.
Solder a PL-259 onto the end of the coax. You're on your own with that. My method is not ideal and I ruin PL-259's by the score. Teaching my method would not be a service to the reader.

Tuning. Tune the dipole by checking SWR on the 80m Di-pole and making adjustments by un-winding the extra wire on the end and reforming the loop. Do this the same amount on each side of the di-pole.

Only once the 80m is done can you move on to the 40m, 20m, and 10m.

Once each antenna is tuned to your satisfaction, go back and re-check each one.
It's best to develop a chart to show the frequency where the SWR "dips", I even plot mine on

graph paper. What can I say? I'm visual. This makes it easy to determine your best operational frequency ranges and provides a reference for spot checking the antenna later.

When you are done tuning, send that fan di-pole into the air as high as you are able and make some contacts! 73 - KB3PKB

Editors note:
The multiband fan dipole is probally one of the most efficient multiband antennas you can build due to the fact that individual dipoles are tuned for each band of operation and fed by one single length of coaxial cable. The end result is "one antenna" for multiple bands and a single feedline. The biggest problem with them usually is in the tuning and interaction between the individual dipoles. But when the lowest swr is achieved with each dipole, you have a very efficient antenna without the use of a tuner.
The second biggest problem is in the construction and the attempt to keep all the dipoles separated from each other on the ends which is a MUST.
If this is your first attempt at building the fan dipole, and your still not quite sure how it all goes together, you may like to see some more ideas here in another project. 73