THE W3FF HOMEBREW BUDDIPOLE

A PORTABLE ANTENNA DESIGN FOR AMATEUR RADIO

History of the Buddipole

In January of 2000, I began experimenting with a “walking portable” ham station. Since then, thousands of stations have been worked on the amateur radio bands, mostly from 10 Meters through 60 Meters.

The radio of choice here is a Yaesu FT-857ND. The new Lithium Ion Nano-phosphate batteries, the A-123's are the way to go for power. A two pound A-123 gives me two hours of SSB operating with 100 watts and the '857d. (A-123's and chargers are under accessories at Buddipole.com.)

Instructions are on this website for two homebrew HF antennas that are easy to build and very effective.....the Buddipole and the Buddistick, a vertical antenna that uses PVC with a variety of whip options.

The mast is important. I have several, but in order to get the feedpoint up high, I use either a Buddipole commercial mast (Buddipole.com) or a painter's pole with a Center Tee Adapter. That adapter changes the odd Acme thread to a half inch pipe thread. That's the thread used on the homebrew and commercial antennas I will describe.

My son, Chris W6HFP, suggested we go commercial with the Buddipole, and we did that back in July 2002. You can see the commercial products at Buddipole.com. Chris now runs the company, and I do the technical support and help the homebrewers with any questions.

Build the Buddipole

This is the antenna I designed for my “walking portable” station. It is a dipole constructed out of plastic plumbing pipe CPVC. There are telescoping whips at the ends of each side of the dipole, and these whips are adjusted to bring the antenna into resonance on each of five HF Bands: 10, 12, 15, 17, and 20 Meters. The longest elements are on 12 and 10 Meters, where the dipole is actually a full half wave. On the lower three bands, coils are used to shorten the antenna. It takes just about a minute to make band changes. Operation on 6 and 2 Meters has been tried successfully as well.

Note that the coils are not tapped. They are taken out of the circuit entirely on 10 and 12 Meters. I use one coil for 15 and 17 Meters, and a separate coil for 20 Meters. Details on the 2 and 6 Meter operation may be found later in this text.

Parts List for the homebrew Dipole:

- CPVC pipe is a cream-colored plastic pipe. Buy a 10 foot section of it. Get the ½ inch inner diameter size. It will be about 5/8 inch outside diameter. CPVC pipe is found at Ace Hardware stores and many other home improvement outlets in the USA.
- You will need 6 CPVC couplers. These are cream-colored also, and are straight. Be sure to get the size that fits the above pipe.
- One PVC T in the ½ inch size. This is a slip-slip-thread. The thread is on the bottom of the T.
  NOTE: This is the only piece of PVC used in this project.
- While at the hardware store, buy some electrician's tape. You will need a roll of black plastic tape to wrap the coils.
- One spool of #20 Radio Shack insulated speaker wire. It comes in 75' spools, and that is more than enough to make several antennas.
  RS Part Number 278-138
- One bag of the blue Radio Shack end connectors. Make sure you have at least six pairs of male/female connectors.
- Two “Featherweight” whips: Buddipole.com under “Accessories”.

Tools Needed

You will need a hacksaw, a small hammer, a screwdriver, a pair of needle-nosed pliers, a measuring tape, a drill with 3/16” bit, a crimping tool, and a tool for removing insulation from wire. Keep a pad and pencil handy to record measurements. A Marks-alot felt pen will be needed in the final tuning phase. You should buy or borrow an antenna analyzer if you don't own one.

Antenna Construction

- ❑ Cut two pieces of CPVC, each 22” long.
- ❑ Drill a 1/8” hole about 3/4” in from each end of the CPVC pieces. Don't drill the whole way through. Angle the drill slightly toward the long end, so that you can slide a wire into the piece of pipe. Drill the holes on the same side of the pipe.

- ❑ Cut 28” of wire from the spool, and split it into two 28” pieces. If you leave the speaker wire in its pair form before you cut it, you will be sure to use the same amount of wire on each coil. Put one end of one of the wires into the hole you just drilled in the CPVC. Gently push the wire until you see it come out the other side of the pipe. Take a pair of needle-nosed pliers and work the protruding end into the hole at the end of the CPVC. You will have about 3" of wire on each side of the pipe when you are finished. Repeat for the second 22” CPVC pipe piece.
- ❑ Crimp a female electrical connector on one side of each piece of the section you just finished. Put a male electrical connector on the other side on each section. You are now finished with the 'arms' of the dipole.
- ❑ Now let's construct the 15 and 17 Meter coils. You get two bands with one set of two coils. Cut a 3-1/4” section of CPVC with the hacksaw. This is the form for the coil. Drill a 1/8” hole all the way through the section, about 3/4” in from each end. Cut a piece of wire 64” long and poke about three inches through one of the holes you just drilled. Start wrapping the wire around and around the CPVC section until you have approximately 22 turns on the coil. Push the tag end through the hole you drilled earlier, and tape the whole coil tightly with plastic tape. Cut the tag end so that you have about 3” of wire coming out of the hole in the pipe. Put a female electrical connector on the one wire, and a male electrical connector on the other protruding wire.

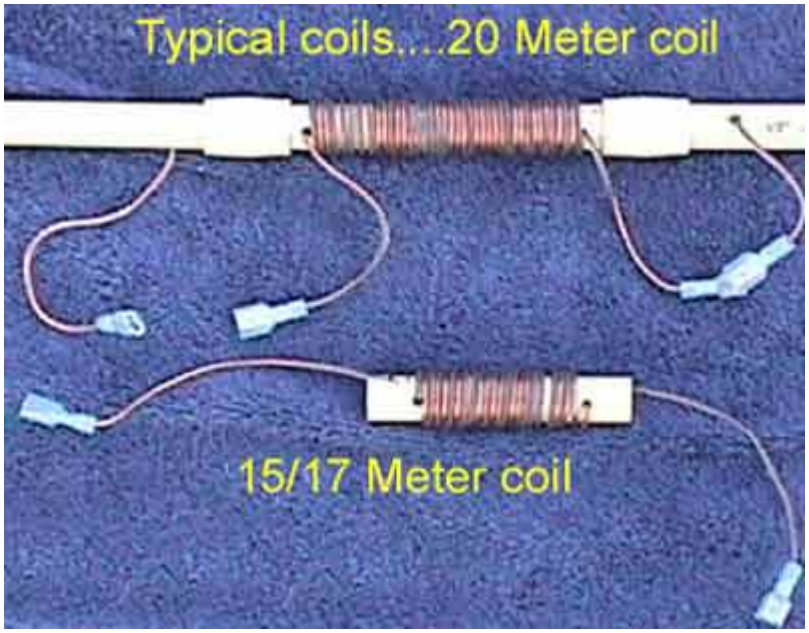

Photo 1: Coil Details

- The 20 Meter coil is prepared exactly the same way, but you start with a coil form of CPVC of about 5 -1/4", and you use 8' 4" of wire. Wrap 41 turns on this coil. For the sake of appearance, wrap the coils with black plastic tape. Then, on one 15/17 Meter coil, put on a single wrap of RED plastic tape (to differentiate it from the other 15/17 Meter coil). Do the same thing on one of the 20 Meter coils. This completes the construction of the coils.The telescoping whips are also held by CPVC. Cut two 9" pieces of pipe. Drill a 3/16" hole about an inch in from either end of each piece (not the whole way through the pipe). Take a 15" piece of wire and feed it into the hole you just drilled and out the other end of the pipe. Leave about 3" of wire sticking out of the hole you just put the wire through. Do this for each piece of pipe. Set the assembly aside.
- A very good and light telescoping whip is the one offered by Buddipole.com and is under "accessories". It's listed as a "Featherweight Whip". It weighs just two ounces and it has a ¼ inch brass stud on the base end. This whip is 72" long.

Photo 2: Whip Details

- Take the previously made assembly with the 15" of wire in the CPVC, and strip the insulation from the wire for about a half inch. The only reason this wire is not shorter is because it is much easier to put the wire through the pipe first, rather than by threading it in later. Bare the wire and wind it around the brass stud on the whip. Tighten the wire with a ¼ inch nut. Now, pull on the 3" tag end of the wire you have coming out of the hole in the CPVC, and lead the whip into the piece of pipe until you see that the hole in the metal whip is adjacent to the hole in the CPVC. Cut off the wire so that you have just 3" protruding. Strip that wire end and put a female electrical connector on the end. The whip should be snug in the CPVC. You can use black plastic tape to shim the whip to make it snug in the CPVC. At the telescoping end of the whip, where it comes out of the plastic pipe, tape the end of the pipe to the whip. This will keep it from slipping out of the pipe.
- The PVC T has slip/slip ends on it. The CPVC arms attach to this T. The sizes of the pipes are different, so an adapter is made as follows: Cut a piece of CPVC 2 1/4" long. Place a CPVC adapter onto that piece of pipe, and tap it in firmly with a small hammer. Insert the pipe end of that assembly into the PVC T. Take a second CPVC coupler and place it onto the pipe. Carefully tap that coupler into the PVC T, so that you have a final assembly that looks like the one depicted in Photo 3.

Photo 3: T Details

- Note that there are 5 electrical connectors on each side of the Buddipole. The electrical connectors are placed on the wires in a specific order. There is a female connector on one side of the Buddipole arm and a male electrical connector on the other side. The Buddipole arm with the female electrical connector is going to be placed next to the PVC T when the antenna is assembled. The other end of the Buddipole will have the male electrical connector on it.
- Place a CPVC coupler onto the 22" arm of the Buddipole. Put one of the two 15/17

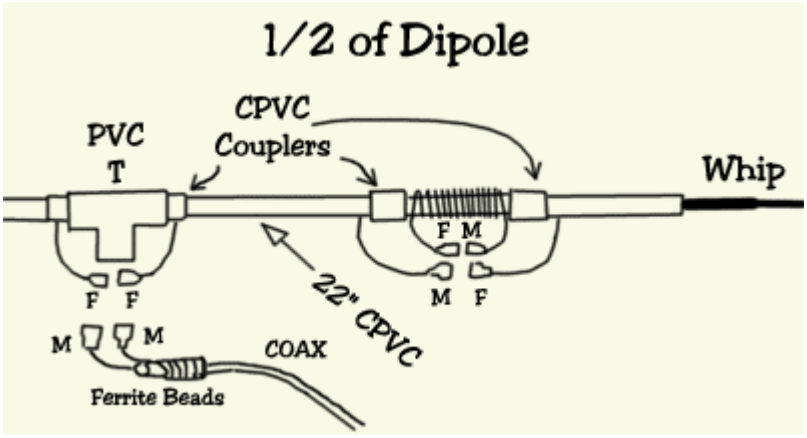

Photo 4: Half Buddipole

Meter coils into that coupler, noting that the electrical connector you want to use on the 'arm' side is a male electrical connector. It mates with the female connector on the coil.

- Place a CPVC coupler onto the other side of the coil.

- Place the piece of CPVC that holds the telescoping whip into the CPVC coupler to the coil. Note that there is a male electrical connector on the coil. This attaches to the female electrical connector on the whip assembly. This completes the antenna assembly.
- Make up a piece of RG8 Mini or RG58 or similar light-weight coax as follows: On the end that attaches to the Buddipole, make a pigtail by stripping back the covering to expose the shield of the coax. Pick out the strands of braid so that when the braid is twisting to a point, it will be small enough to fit into one of the blue male electrical connectors. Bare the inside white or clear wire of the coax. You might want to use some shrink-wrap tubing to strengthen and protect the pigtails. Put one male electrical connector on each of the coax pigtails.
- To get the radiation off of the outside of the coax (providing a better match and a lot less RF on the outside shield), you coil the coax in a 4" diameter with about 7 turns and secure the turns with black plastic tape.

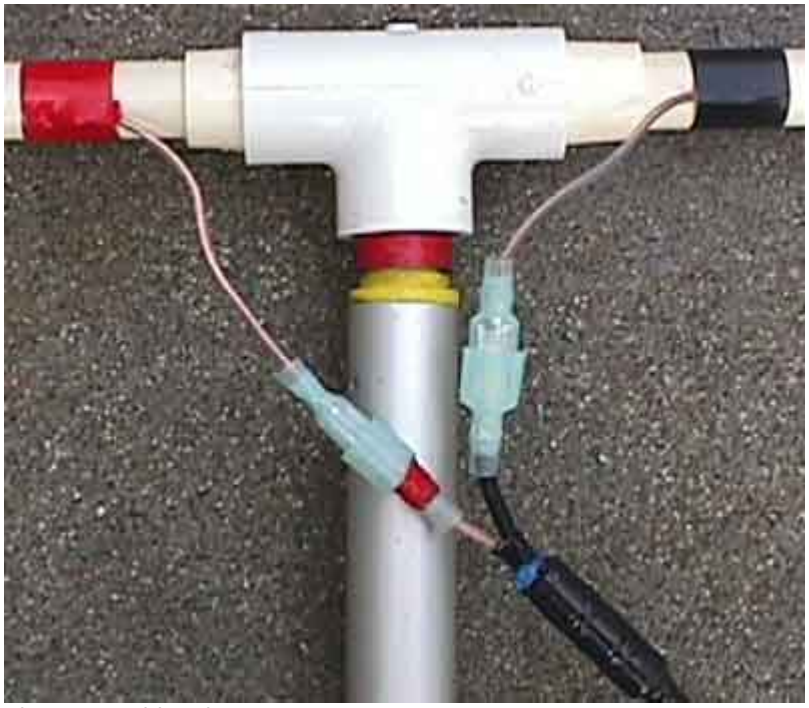

Photo 5: T with Balun

- Fit a PL-259 on the other end of the coax (with appropriate reducers, depending on the size of the coax you are using). This completes the construction phase of the project.

You will need a mast to support the antenna. I have been using the aluminum paint masts that one would use to roller-paint ceilings with. They come in varying sizes, and the one I use most is the model that collapses to 6' and extends to 12'. There is a male,

threaded, plastic top on most of these tiny masts. Take a piece of black plastic tape, and wind it around the plastic top just one and a half times. Cut the tape off, and press it to the plastic top. You will find that when you prepare the mast in that manner, it will thread nicely directly onto the PVC T of the dipole, even though it is a 'cross-thread'. NOTE: An alternative is to purchase a Center Tee Adapter from Buddipole.com. The CTA has the odd Acme thread on the inside, and it threads right into the half inch pipe thread of the PVC T on the top end.

You are now ready to assemble and tune the antenna.

Tuning the Homebrew Buddipole

This procedure is easy if you have an antenna analyzer to help you do the work. It can be done with a transceiver in the CW position by checking the power output at a known level, but using an analyzer such as the MFJ model, is better.

Set up a testing range by using a tripod or similar method of holding up the mast and the antenna while you are making the adjustments.

Each band is tuned separately. Start with 10 Meters. Bypass the coil entirely by simply leaving the coil out of the circuit. Pull out all of the sections on each side of the Buddipole's telescoping whips. Check the resonance of the antenna with the SWR analyzer. Push the ends of each side of the antenna in slightly until you see that the antenna is in resonance; that is, that you have an SWR in the neighborhood of 1.7 or less. Note the number of sections it takes you to do this. Write this information down on a pad, and move onto the next band.

On 12 Meters, simply pull the whip ends out slightly, and check to see if the antenna is in resonance by doing so. No coils are used on 10 or 12 Meters.

If you find that your antenna is just not long enough to resonate on 12 Meters, simply take a 9" piece of #20 wire, install a female electrical connector on one end and a male electrical connector on the other end. Insert this jumper on the *red* (or "hot") side of the Buddipole where the coil is bypassed. This lengthens the antenna just enough to make a perfect match on 12 Meters.

To load the antenna on 17 Meters, plug in the 15/17 Meter coils and pull out the whips until they are in full extension. Check the resonance. You might be right on the 17 Meter band with very little adjustment. If the frequency shown on the antenna analyzer is too low, say in the 16 or 17 MHz range, simply shorten the *red* ("hot") side by one section. Note on your pad the number of sections out on the ground side and the number of sections out on the hot side. In the *Tuning Tips* section, see the list of how many

sections it takes to resonate on various bands.

When you are satisfied that 17 Meters looks good, go to the 15 Meter position on the analyzer and start shortening the whip elements to go up in frequency to about 21.300 MHz. When you get a dip, experiment as you did with the other bands. Just changing the whips slightly will change the resonance as you will see.

On 20 Meters, remove the 15/17 Meter coils, and insert the 20 Meter coils. Use the same tune-up procedure to get a big dip in the middle of the band, say about 14.200 MHz.

Now, if you are satisfied that the measurements you made are in the ballpark on each band, check it out with your transceiver in the CW position. Just pick a frequency and check for power output. By lengthening and shortening the elements slightly, you will find settings where the power will maximize on each band. Mark those measurements *on* the arms of the dipole, so that you will be able to change bands in just a few minutes. Use a Marx-alot or a similar product to mark the CPVC arms.

Tuning Tips

Tune the antenna away from metallic objects, like cars, other antennas, towers, etc.

Use these *approximate* settings for your antenna. If you have the proper # of turns on the coils, and if you used the correct Radio Shack speaker wire (#20), here are the settings you typically get:

Band	*Red Side Whip*	*Black Side Whip*	*Coil*
10 Meters	4.5 sections	4 sections	None
12 Meters	All sections plus 9" jumper	All sections	None
15 Meters	2 sections plus 2"	3 sections	15/17 Meter
17 Meters	3.5 sections	5 sections	15/17 Meter
20 Meters	3 sections plus 4"	5 sections	20 Meter

These will vary with your antenna, but the settings are an excellent starting point. If you set the whips as shown and then use a manual or automatic antenna tuner, you will be good to go.

BONUS! Six Meters works well on all these I have tried. No coils. Push all sections in, and check the resonance. Pull the RED side out an inch or two at a time until you get the

frequency you want. It's about four and a half feet on each side of the T.

BONUS! Two Meters can be used, just by taking the 9" CPVC whip assemblies and putting them into the PVC T. Adjust the whips carefully to resonate on 146 MHz. Remember to hold the antenna in a vertical position when working stations on FM.

The antenna is not efficient on 40 or 80 Meters. BUT…….the homebrew Buddistick design is very efficient, and that design is on my sites.Google.com website: W3FF Homepage.

Finally...

If this seems too complicated or confusing, simply email me at w3ff@buddipole.com and I will help you with the construction or the tuning. It takes me about an hour to construct a complete antenna. Several builders have said it takes them 2 to 3 hours to complete the project. It takes me 20 minutes to tune one, and it should take you less than an hour.

Have fun with it, and let me know your suggestions for improving it!

—Budd W3FF June/2010