2m / 70cm Dual Band Sleeve Antenna

Donn Hilton / VA7DH 2 January 2009

Adapted from a similar project by KV5V (Harold Melton) which can be found at:
http://www.athensarc.org/sleevedipole.asp

This antenna is an off-centre fed vertical dipole, sometimes called a sleeve antenna. The antenna is fed with a piece of coax going up the inside of the lower element and so the lower element forms a sleeve around the coax. The lower element is shorter than the upper one simply because there is capacitance between the lower element and the coax thus changing the resonant frequency of the lower element. To balance it out it's necessary for the lower element to be shorter.

The antenna is constructed from white PVC. It has been noted by others that PVC on the northwest of North America seems to be lacking in UV inhibitors and so can get brittle after a while and breaks easily. PVC pipe sold in the south east of tends to have lots of UV inhibitors and so stands up well to sunlight for years. I suggest you give your project a couple of coats of outdoor paint to protect it from the sun. Do not use metallic paints (for obvious reasons). Give the outside of the ¾" PVC pipe a rub down with sandpaper to take the gloss off so paint can cling to it.

The conductive part of the antenna is a couple of 38 ½" lengths of a material called aluminum foil duct tape. Aluminum duct tape comes in rolls 2" wide and in different lengths. It can usually be found in hardware or building supply stores such as Home Depot. Coax (RG-58) can be found at Radio Shack, The Source, your local mobile radio shop, Burnaby Radio, Com-West, Radio World, etc., same with PL-259 connectors.

Regarding the PVC pipe, I am referring to it as SDR21. This is a relatively thin walled pipe. It will have SDR21 stamped along the length in several places. SDR21 refers to a piping standard that qualifies it as being able to support 200 PSI inside. There is another PVC pipe often sold in the same stores called "schedule 40" and it has a much thicker wall. Schedule 40 is about 5 times the price, is much heavier, and the dielectric value is different so the antenna will not be in tune with the values I'm providing. Don't use it.

I give some lengths for the ½" and ¾" PVC pipe in the following materials list. Those lengths were specific for the antenna I built for myself. You can make your poles longer than that if you want them to extend higher. Higher is always better to go for longer distance in VHF and UHF radio. Just don't make them much shorter. The pipe comes in ten foot (120") lengths so if you cut one in half you can make two antennas out of it.

Do not mount the antennas up against metal objects such as metal flashing, rain gutters, that sort of thing. That would detune the antenna and would also rob the antenna of its omni-directional ability to radiate in 360 degrees.

Important Note: Just came back from a weekend of seminars helping upgrade the knowledge of new hams. My part was to demonstrate how to build antennas. I had to trim back the foil elements on the antenna I was working on over an inch on each side. I believe that the dielectric values of the PVC pipe were quiet different than that which I worked on at home. So, be warned that some trimming/tuning may be required. Try to find someone with an antenna analyser to help speed the process up. Try an MFJ-249, MFJ-259, or MFJ-269. They will all do the job.

Materials

1 piece ½" X 60" SDR21 white PVC pipe

1 piece ¾" X 53" SDR21 white PVC pipe - weather shield

1 each ¾ " PVC pipe cap for the top of the weather shield

2 each 38 ½" strips of aluminum duct tape **(exact length)**

1 each 12' length of RG-58 coax (or whatever length that you need for your purpose)

1 each Suitable RF connector (PL 259 is the most common connector type for mobile and base radios)

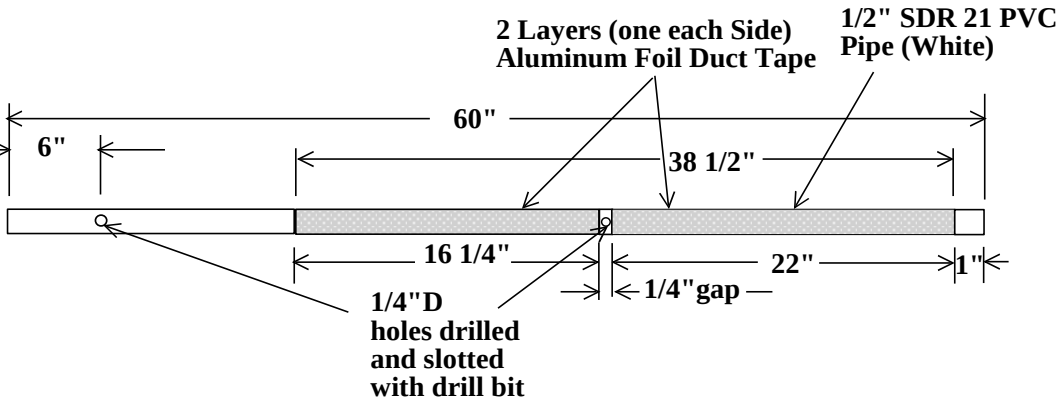
1 length of flexible wire to use for fishing the coax up the inside of the ½" pipe

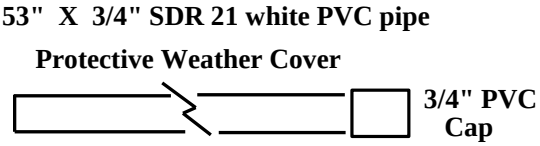
1 roll of vinyl electrical tape.

Some Styrofoam packing material

Link to a site showing one ham's interesting way to install PL 259 coax connectors on RG-58 or RG-8X. This is not the way suggested in the ARRL manual but this way works very well.

http://www.w5fc.org/Files/PL259.PDF





Quarter inch hole drilled through the pipe. The drill should be twisted so as to chew a slightly oval slot vertically in the pipe making it easier to pull in the coax. You would do the same with the lower hole if you choose to bring the coax out the side of the pipe as I have done. You can see, in the upper picture, left, that my antenna is in a stand, hence why I exited the tube on the side rather than the bottom. If the coax, in my setup, exited the bottom of the pipe my coax could be damaged.

Instructions

1. Cut pipes to length
2. Cut two strips of aluminum duct tape 38 ½" long and apply them to the ½" PVC pipe, one on each side, both 1" down from the top end of the pipe. The duct tape is 2" wide and so there is a good overlap between the two pieces. Be careful how you apply it. The self adhesive is really sticky and if you make a mistake it's tough to get off.
3. Mark the tape 22" down from the top of the tape (not the top of the pipe). Then measure ¼ inch down from the 22" mark and make another mark. Use a razor knife to cut through the aluminum duct tape but without cutting into the PVC pipe as that would weaken the pipe.
4. Drill a ¼" hole in the middle of the band between the upper and lower aluminum duct tape sections.
5. Drill another hole 6 inches up from the bottom of the ½" PVC pipe.
6. You'll note that if you were to push a piece of RG-58 cable through either one of those holes (step 4 and 5) that the outer insulation would bind on the edges of the hole. Take the ¼" drill and lean the bit sideways up and down vertically in line with the pipe and run it. It will cut a sloping surface inside the hole and make the hole elliptical. That will make it much easier to slide the coax through in the next step. If there are any burs on the edges of the holes clean them off with a knife.
7. Take the end of your piece of coax and cut off about two inches of the outer insulation, then push back the braid and cut off about 1 ¾" of the inner insulation that surrounds the inner conductor. Take a piece of jumper wire, about 6 feet long, and attach it to that end with a few wraps of vinyl tape around the wire and braid, try and make it smooth.
8. Feed the other end of the jumper wire through the upper hole in the side of the pipe where the division is between foils and feed the wire down to the bottom. With needle nose pliers you can grasp that wire and pull it out the lower side hole. If you don't need a side hole for your application then just feed the wire out the bottom of the pipe.
9. Pull on the wire at the bottom at the same time as feeding the coax in through the top hole. The bottom side hole is a bit tricky and may require a bit of experimentation to get it to come out. Once it's out pull it most of the way through so there is only about 6 inches exposed out of the top hole. Once the coax has been satisfactorily pulled in the pulling wire can be removed from its lower end.
10. Similar to before we need to expose 1 ¾" of the top end of the coax. Then we need to tease out the centre insulation with its center conductor as close to the end of the outer insulation as possible. See the images on page 4.
11. Feed most of the coax into the top side hole of the pipe except for the exposed braid and centre conductor. Make sure that there are no wild bits of centre braid sticking out that may short out to the centre conductor (snip of loose bits of braid with scissors or diagonal cutters). Dress the centre conductor neatly as possible against the surface of the upper aluminum duct tape. Do the same for the braid, dress it as flat as possible against the lower duct tape. If they are not good and flat the ¾" weather shield pipe will not slide over it.
12. Cut a couple of 2 inch lengths of aluminum duct tape. Tape one piece over the coax inner conductor fastening it to the upper antenna element. Tape the other piece over the braid on the lower aluminum duct tape. Press it down well, this is your only connection from the coax to the antenna, no solder, no screws. Stuff styrofoam up the inside of the pipe to stop the coax from rattling around.
13. Tuning is accomplished by lengthening or shortening the aluminum duct tape elements. See the note on the bottom of page one.

Steps for teasing the inner conductor and its insulation out through the braid

14. Put the RF connector of your choice onto the far end of the coax.
15. Drill a small hole in the top of the ½" pipe and tie a string or piece of fishing line to it
16. Slide the weather shield (3/4" PVC pipe) over the antenna, pull up the string from the ½" pipe up and over the side of the ¾" pipe. Tap down the top cap of the 3'4" pipe. Friction will hold it in place plus hold the string tight so the antenna and its cover will not separate. Give the outside a couple of coats of none metallic outdoor paint for UV protection.
17. This is basically a balanced antenna connected to an unbalanced line (coax). It often leads to some RF flowing back over the outside of the sheath. To prevent that we construct something called an Ugly Balun, All it consists of is about 4 or 5 turns of feed line wrapped into a coil and taped together. That seems to do the job. See the picture to the lower right.
18. Lower left and right pictures show a simple antenna support I made for days when I provide radio coverage for marathons and such things. It's two pieces of plywood about two feet long slotted so they slide together. A piece of pipe is fastened to one as a pocket to handle one of my vertical VHF/UHF antennas.

Performance: That's always a big question. I had the antenna in my basement, hooked to a mobile radio set for its lowest power (about 4 watts). I hit the transmit switch and pulled up a repeater approximately 90km away and it was quite readable (Abbotsford 146.610).

This antenna is cheap to make, easy to duplicate, and looks great.

Enjoy – 73