BUILD A 30-METER BLACK WIDOW VERTICAL "L" ANTENNA

Recently, I helped a fellow ham, Dick - K4NJ fine tune his ¼ wave 10-meter vertical antenna. Dick spends much of his operating time in state parks and recreational areas making lots of POTA contacts. He designed and built his 10-meter vertical using a telescopic pole, insulated stranded wire and a dual BNC binding post coaxial connector. The antenna uses a nifty metal umbrella spike to anchor the telescopic pole.

Dick's ¼ wave 10-meter vertical is simplicity personified. It uses lengths of insulated stranded wire for both the vertical radiating element and the elevated radials. In no time we had it resonating on 10-meters with an SWR that made his FT-891 very happy. No power wasting tuner was required. This easy to erect vertical antenna is POTA perfect for Dick.

Heading home, I started thinking about the performance possibilities of a similar ¼ wave 30-meter vertical antenna. 30-meter is an interesting band. It has propagation characteristics akin to 20 and 40-meters, making it very versatile. With Mother Sol beginning to reduce those around the world contacts on the higher frequencies, the 30-meter band looked like it might be a good choice to pursue. My thoughts quickly became a quest and it was off to the races.

SELECTING A TELESCOPIC FISHING POLE & WIRE

What would I need to build a 30-meter vertical antenna?

Dick's telescopic pole was around 13 feet in length. That length is fine for 10-meters, but too short for the 30-meter's 23-foot length. I checked the Internet for telescopic poles. Little Mighty had a 25-foot telescopic pole for $135. DX Commander also had one, but it was more expensive. While a 23 or 25-foot telescopic pole would be ideal for the project, finding one within my budget would be a challenge.

I revised my search to include 20-foot telescopic fishing poles. That size would work with a little bit of antenna alchemy. I checked Bass Pro. They had a 20-foot Black Widow fishing pole for $35 plus shipping.

My local home improvement store had 16-gauge stranded wire spools in 25-foot lengths. Less expensive speaker wire or ZIP cord would work, but could be too heavy for the Black Widow fishing pole's upper sections. I settled on the 16-gauge wire and bought 3 spools.

HARDWARE FOR THE BUILD

First step in the build was to decide on a center connector for the radiating element, radials and coax.

Dick used a BNC connector with dual binding posts. If I intended to use the ¼ wave 30-meter vertical antenna strictly for portable, I would have used the same type of connector. However, I planned to use the antenna at my home. Therefore, a waterproof box made more sense.

I generally use RG-8/u coax with PL-259 connectors for my backyard antennas. Looking in my junk box I found a SO-239 female socket connector that would work perfectly.

I also found the perfect solution for the waterproof box in my junk box. Some time ago I purchased a couple of low voltage poly wiring boxes from Habitat for Humanity Restore. (See photo on left.)

Each box has three IP68 waterproof wire connectors as well as a silicon lid gasket. After removing one of the connectors I found my SO-239 female socket connector would fit the hole perfectly. (See photo on right.)

WIRING THE RADIATING ELEMENT, COAX & RADIALS CONNECTOR

With the hardware selected, the next step was to wire the antenna radiating element, SO-239 coax socket and radials connector using the poly box. *(Note: Almost any box will work as long as it can be waterproofed.)* I determined that the best orientation for using the 3 existing holes in the poly box was to route the radiating element into the top, the coax cable on the bottom and the radials on the side.

I unspooled a small amount of 16-gauge insulated wire and pulled the end through the top connector making sure it was long enough to reach the SO-239. After tightening the IP68 exterior cap, the 16-gauge insulated wire still did not fit snuggly inside the connector. To make sure no moisture would enter through this connector I wrapped the wire with several turns of insulating electrical tape and finished with a piece of heat shrink tubing to keep the tape from slipping. I also added several pieces of heat shrink tubing to the interior length of the 16- gauge insulated wire.

I then removed the bottom IP68 connector and inserted the SO-239's base into the poly box's bottom hole. Next, I placed a pigtail washer and nut over the SO-239's screw base and tightened them securely. The pigtail washer would be used to connect the SO-239's ground to the radials connector bolt.

The poly box's 5/8" side hole was larger than the ¼" x 1-¼" stainless steel bolt for the radials. I slipped a pigtail washer (for connecting the SO-239 ground wire) over the bolt followed by a 1" flat washer with a ¼" diameter hole. I inserted the bolt into the box's hole from the inside. On the outside I slipped a stainless steel 1" washer with a ¼" diameter hole over the bolt, added a nut and tightened securely. Lastly, I added a star lock washer and a butterfly nut for attaching the radials. I used 3 wire ties to secure the poly box against the pole.

With the hardware installation completed I soldered a small length of 16-gauge wire to the SO-239's pigtail washer and the radials bolt pigtail washer. (See picture above.) I soldered the end of the radiating element's wire to the SO-239's center connector and used my DVM to verify the soldered connections. The poly box's lid had screw holes to insure the box would stay firmly closed and waterproof. I used them.

ANTENNA DESIGN

Hams use a ¼ wave vertical antenna formula of "*234/freq*" for calculating the radiating element and radial lengths. (Treasure Coast Hams website has a chart of calculated ¼ and ½ wavelength antenna lengths here.) Approximately 23' 1" (¼ wavelength for 10.1 MHz) length would be needed for the radiating element and radials.

I unspooled the 16-gauge insulated wire, stretched it on the ground and anchored it with 12" garden nails. Using a tape measure I marked the wire with blue painters tape at 22 feet and the remaining length in 1 inch intervals. Having the radiating element wire marked with 1" intervals would make any final tuning of the radiating element much easier.

ANTENNA LOADING COIL

The Black Widow telescopic fishing pole is approximately 3 feet shorter than what is needed for the ¼ wave 30- meter vertical antenna. To make up for the shorter length I chose to use a loading coil. The fishing pole's telescopic lower sections were sufficiently sturdy to support a loading coil, but less so in the upper sections.

The Black Widow's 2nd section from the top appeared capable of supporting a loading coil. Taking the 16-gauge radiating wire from the top of the poly box, I strung it vertically using wire ties to keep it in place. At the base of the 2nd section I wound a loading coil. It took several tries before I found the correct number of turns, which turned out to be 28. *(The number of turns will vary based on the telescopic pole length, the location of the coil and the gauge of the wire you use.)* A couple of wire ties at the coils top and bottom secured it in place. From the loading coil I ran the remaining radiating wire up to the top of the fishing pole and through the metal loop end connector. Another wire tie held it in place.

ELEVATED RADIALS

Elevated radials are different from ground mounted radials. Elevated radials need to be tuned to their intended frequency of use. Elevated radials should be kept a distance above ground and slightly sloped downward to meet their design criteria. This is a problem that ground radials do not have. An interesting fact is that 1 elevated radial is generally equal to 4 ground radials. Electrically, 4 ground radials are generally considered a minimum number, with 8 or more preferred.

Using my spool of 16-gauge wire I measured 23'-1" lengths of wire for each elevated radial for the 10.1 MHz frequency. Knowing that vertical or horizontal wire antennas don't always work using their calculated lengths after erecting in the operating environment, I added a little extra wire to each. It's easier to trim excess wire than it is to add additional length.

MOUNTING THE ANTENNA

Determining the height to mount the 30-meter vertical antenna required several considerations. First, the elevated radials needed to be up in the air starting at the antenna's poly box and out 23' to their termination points in my yard. Secondly, I wanted to insure I could easily lift and remove the antenna from its mounting position. I had a pressure treated 2"x 4"x 8' available from a GAP Challenger antenna now at our vacation home. The pressure treated board extended about 4' above and 4' below the ground. The photo to the left shows the 2"x 4"x 8' mount.

Originally, I intended to attach the 30-meter vertical to the same 2x4, but ultimately voted against it. Instead I decided to use a piece of Schedule 80 PVC electrical conduit and secured it with two-hole plastic clamp fittings of the type I used for the

GAP. The PVC conduit's interior diameter would easily allow the Black Widow telescopic pole to slip inside. I drilled a ¼" hole in the PVC pipe about a foot from the top and inserted a bolt through the hole to keep the Black Widow 30-meter antenna from sliding down inside the pipe.

To have the pole's full 20-foot length available for the antenna, I add a wooden dowel about 2-feet in length to the bottom of the antenna. I did this by removing the pole's end cap. After inserting the wood dowel into the fishing pole's bottom section, I used 4 stainless steel screws to anchor the pole and dowel together. The exposed portion of the wood dowel was inserted inside the PVC conduit. The vertical antenna's base and poly connector box now sat approximately 5-feet in the air. The photo to the left shows the dowel attached to the Black Widow and inserted into the PVC mount.

TUNING THE ANTENNA

My tuning process started by connecting the elevated radials to the poly box and terminating them at their 23'1" length with fiberglass driveway markers. I kept the radials about 30-degrees apart. There is a slight downward slope in height (about 1 foot) at the driveway marker end.

I then attached the RG-8/u coax. While probably not necessary, I added 4 clamp-on cores to the RG-8/u to attenuate any stray RF on the outside of the coax. The photo to the right shows the coax connected to the poly box and the clamp-on cores.

In the shack I connected my antenna analyzer to the coax, turned on the analyzer and set it to 10.1 MHz. I expected to see something other than a reasonable SWR and did a double take when it showed an SWR of 1.1:1. I varied the analyzer's frequency down to 10.0 MHz and up to 10.14 MHz. I was delighted to see that the tuning did not vary much, indicating the antenna's "Q" factor was good.

A photo of the completed antenna is shown on the next page.

THE 30-METER BLACK WIDOW VERTICAL "L" IN OPERATION

Before building the Black Widow my 30-meter QSOs were virtually non-existent. I had a few USA contacts in my log, made by forcing my non-WARC vertical dipole to propagate on 30 meters. While the feedline matcher gave me a reasonable SWR, I suspected most of my power was wasted.

After building the Black Widow 30-meter performance has been nothing short of amazing. In just a few short operating sessions I logged the following QSOs:

COUNTRY	DX REGION	CALL
Antarctica:	Antarctica	DP0GVN
Aruba:	S. America	P40AA
Australia	Oceania	VK6DW
Azores:	Europe	CU2DX
Barbados:	N. America	8P6PD
Belgium:	Europe	OS4K

Brazil:	S. America	PY5EJ
Burundi:	Africa	9U1RU
Bulgaria:	Europe	LZ2PAJ
Canada:	N. America	VE9ZY, VY2DS
Chile:	S. America	CE4PRW
Columbia:	S. America	HK3W
Cameroon	Cameroon	TJ1GD
Croatia:	Europe	9A4AA, 9A4ZM
Dominican Republic:	N. America	HI8J
England:	Europe	M9XTY
France:	Europe	F5RRS, F6HRP
Germany:	Europe	DK7ZT
Greece:	Europe	SV0XAD
Grenada:	N. America	J38WG
Guadeloupe:	N. America	FG4AO
Italy:	Europe	I8OCA, IU4DAF, IU4RWW, IW0RLC, IW9FRA
Madagascar:	Africa	5R8IC
Martinique:	N. America	FM8BK
Poland:	Europe	SP7ATA
Portugal:	Europe	CR4WWA
Puerto Rico:	N. America	N7BPT
Rodriguez Island:	Africa	3B9FR
Russia:	Europe	RI0SP, RU7D
Saint Vincent	N. America	J88IH
Sardinia:	Europe	IS0KNG
Senegal	Africa	6W/DB1RUL
Slovak Republic:	Europe	OM0RX
Sweden:	Europe	SM2LIY, SN5J
The Gambia:	Africa	C5R
Trinidad & Tobago:	S. America	9Y4DG, 9Z4S
Uruguay:	S. America	CX8FB
USA:	N. America	AD8Y, K7CTV, K7HRT, KC3ZZ, KF9UG, KG5PNN & Others
USA: Big Foot SE		W7T
USA: /MM Frying Pan Tower		W0AAE/MM
USA: POTA		KF0MSJ, KG5FLJ

CONCLUSION

This home-grown Black Widow 30-meter antenna design has a lot going for it: low cost, easy to build, and proven to be a good performer. What else could you ask for? Build one and try it yourself. You will be pleasantly surprised with the results.

[NOTE TO READERS: You may have noticed that the title of this article is "Build a 30-Meter Black Widow Vertical "L" Antenna." So what does the "L" mean? My design strategy was for a single band vertical

antenna, but a funny thing occurred. I found this antenna worked extremely well making QSOs with a variety of countries using the vertical radiating element and a single horizontal elevated radial.

Is the antenna a vertical, absolutely! The vertical portion seemingly provides a good low take-off angle for DX, but with the single tuned elevated radial being nearly horizontal to the ground I believe it is also contributing to this antenna's good propagation properties. The telling part is that when I move the elevated radial's orientation to different degrees of a compass, I improve performance to different areas of the world, which suggests directivity.]

THE ANTENNA ALCHEMIST