

# WAXTENNA-PRD

## WAX Group Portable Rotatable Dipole Antenna

Al Duncan VE3RRD – updated 29 May 2021



Figure 1: The WAXTENNA-PRD antenna

The Wireless Amateur Experimenter Group (WAX Group) is a special interest group within the Barrie Amateur Radio Club. This is a “builders group” for those interested in making and designing things for their ham radio hobby. Visit us at <https://barriearc.com/builders-group>.

The WAXTENNA-PRD project came about as the result of several things occurring within the WAX Group. A number of us purchased the BITX40v3 transceiver from India (see <http://www.hfsigs.com/>), and started thinking about portable antennas that might be used with this low cost 40m SSB transceiver. Mike VE3MKX came upon a number of ex-US Army AT-271 PRC manpack folding whip antennas which he obtained for the group, and Andy VA3TNE purchased a low cost Monoprice Select Mini 3D printer.

The AT-271 A/PRC antenna consists of 7 plug-together sections and is about 17 inches when folded, and about 113 inches long when assembled. A spring in the bottom section is attached to a cord passing through all the sections to the tip which holds the sections together when the antenna is extended. Mounting is by a standard 3/8-24 stud approximately 3/8 inch long (Figure 5). In order to cover the 40m band we would need to add a loading coil of some kind which could provide an estimated 25 uH of inductance. A “wander lead” could be used to adjust the coil for other bands (similar to the Buddipole).

Andy VA3TNE designed and 3D printed a suitable coil form which is approximately 2-1/8 inches in diameter by about 4 inches long, and takes 30 turns of 16 gauge solid wire (Figure 2). Galvanized steel 16 gauge “tie wire” was found at both Princess Auto and the Canadian Tire store which was used to wind the coil.

Andy also designed and printed a centre T-hub with a standard “painters pole” thread mount to support the two coils and whips (Figure 3).



Figure 2: coil form parts and one with wire installed



Figure 3: Centre T-adapter

We also decided that using a common-mode choke balun would be a good idea, so that was also added to the project (Figure 4). We used a T200-2 toroid (FT types in a 43 mix would be better) wound with 12 to 14 turns of RG58 coax – one end of the coax connects to the coil mounting bolts inside the centre-T adapter and the other end can have a BNC or UHF style connector to add additional coax to reach your rig.



Figure 4: Choke balun

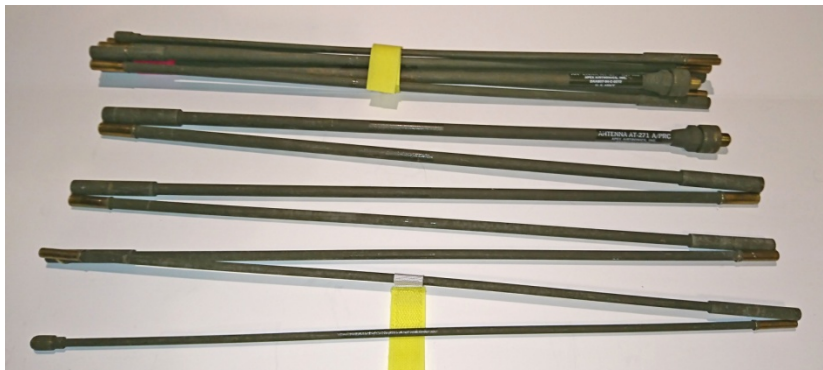


Figure 5: AT-271 A/PRC folding antenna

The centre T with loading coils attached (Figure 6) is only about 16 inches long which is slightly shorter than the folded antenna elements, so there is no need to keep removing the coils when disassembling the WAXTENNA-PRD.

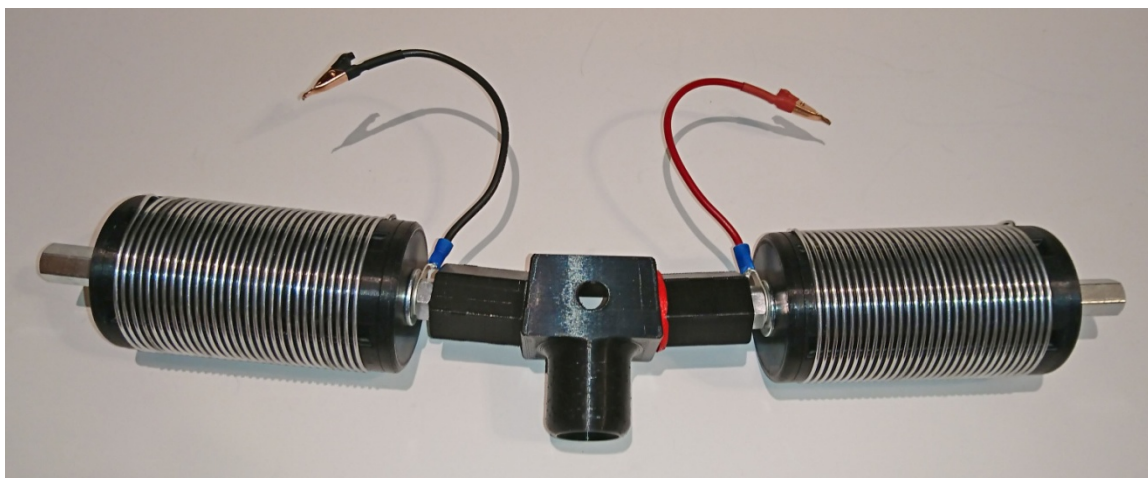


Figure 6: Centre T with loading coils attached

Notice the slight upward angle of the two sides of the centre T to compensate for the droop in the long whip antennas.

## Making a WAXTENNA-PRD for yourself

Note that this antenna was not designed for permanent or long term exposure to the sun and elements. Many 3D printer filaments break down in continuous strong sunlight. Possibly painting the plastic parts with an exterior grade (non conductive) enamel could prevent this, but no one here has tried this.

A “bill of materials” (BOM) is included at the end of this article. You will need to start by finding someone to 3D print the coil forms and centre T adapter if you don’t have access to a 3D printer yourself. The required files for these parts are found on [www.thingiverse.com](http://www.thingiverse.com) , search for the “thing” numbers given in the BOM.

Secure one end of the 20 foot length of wire and unroll it under tension. Attach the other end to the coil form and then slowly wind it on while keeping constant tension on the wire.

3/8 inch threaded rod, bolts and nuts with a 24 pitch thread are not carried by many of the larger box stores. We found them at the Bolts Plus store in Barrie, and Canadian Tire carries the 3/8-24 by 1 inch bolts needed for the centre T adapter.

Locating a pair of AT-271A antennas at a reasonable price can also be a problem. You can use a pair of Buddipole “long telescopic whips” instead (<http://www.buddipole.com/lotewh.html>). They have the same 3/8-24 threaded base and are approximately the same length.

The six-sided 3D printed part that fits inside the coil form needs a little preparation before using. Give the ends and all six sides a good coating of Krazy Glue (the watery type) and set aside to soak in and cure. Don’t put Krazy Glue into the threaded holes that are printed with the part, the threads will need to reform slightly when the threaded rod is screwed into them. This glue adds needed strength to the plastic.

The clips for the coil wander leads were formed by bending the tips of the “micro clip” inward slightly so it securely grabs one of the coil turns and doesn’t slip off (Figure 7). “Grabber” hook type test lead clips could also be used. I used a piece of 18 gauge stranded wire about 8 inches long with a terminal lug that fit over the 3/8 inch threaded rod.



Figure 7: loading coil clip or “grabber” style test clip

## Tuning the WAXTENNA-PRD

Some sort of SWR analyser is necessary for finding the coil shorting clip locations for each band, I use a YouKits FG-01 when in the field.

When counting turns from the whip end of the coil, I look at the hole where the wire enters the plastic coil body and when the wire makes it around and back to this point, it is the first turn. The clip would go in the closest groove to this. To get a half turn you have to follow the wire around to the opposite side of the coil so you are adding more wire length.

Here are some settings (number of turns from the whip end) I found that gave me a 1.0:1 SWR centered on the indicated frequency. The RED side is the coil connected to the coax centre conductor, and the BLACK side is the coil connected to the coax shield.

20m - RED = 6, BLACK = 6.5 (14.250)

40m - RED = 21, BLACK = 22 (7.190)

40m - RED = 21. BLACK = 21.5 (7.230)

On 20m, 6.5 and 6.5 might bring it down closer to the CW portion of the band.

## Bill of Materials

### Loading Coils:

- 2 loading coil forms - <https://www.thingiverse.com/thing:2352109>
  - 2 3/8 – 24 pieces of threaded rod 1-1/2 inches long
  - 2 3/8 – 24 pieces of threaded rod 2 inches long
  - 2 3/8 – 24 nuts (approx 7/32 in. thick)
  - 2 3/8 – 24 coupler nuts 1-1/8 inches long
  - 4 3/8 inch flat washers
  - 2 copper plated micro clips (or 2 “grabber” type hook clips)
  - 2 terminal lugs to fit 3/8 inch thread
  - 2 8 inch long pieces of 18 gauge stranded wire
  - 2 19 or 20 foot long lengths of 16 AWG galvanized “tie wire” to wind the coils
- 
- 2 AT-271A antennas (you can also use Buddipole long telescopic whips instead)

### Centre T:

- 1 form - <https://www.thingiverse.com/thing:2482607>
- 2 3/8 – 24 bolts, 1 inch
- 2 3/8 – 24 coupler nuts 1-1/8 inches long
- 2 3/8 inch flat washers