

Mono Band (80 Meters) Helically Wound Vertical Antenna **The 'Totem' Pole**

Having followed with interest, the articles published in RadCom by Mike Parkin (G0JMI) about his experiments with compact HF antenna's, I decided that it might be a bit of fun to throw my current crop of students & club training team members a bit of a curve ball and challenge them to build me a useable 80m vertical antenna! Previous similar activities have included the ubiquitous 'HF Antenna for a Tenner' (tin foil and brown paper) with which they all scored an European contact with, using less than 2 Watts SSB, as well as 'speed' kit building etc.

In my rush to get things sorted I failed to take note of some of the relevant dimensions of the required parts and substituted a 52mm diameter tube for a 70mm one! Not an auspicious start; anyway, having scrutinised the plans outlined in the article for themselves, the team decided to crack on and give it a go anyway!

Initial Construction:

I provided the team with approx 40m of white plastic covered double speaker wire (multi strand 1.5mm), a standard length 3m of 50mm waste tube from a Diy Store, a T200/2 toroid, plastic box, connectors, the usual tool kit and other miscellaneous items found in the shack junk box. The guys split into two teams, one working on the UnUn, the others working on constructing the actual antenna and windings.

Things went reasonably well, with plenty of measuring, marking out, scratching of heads, rubbing out and re-marking. It was also noted that due to the variation we'd (I) had introduced into the design in the form of the narrow tube, in all probability the number of turns in the coils and their spacing etc. along with the associated capacitance/inductances were going to produce some really odd results. It might be reasonable to suggest at this point that in the true spirit of experimentation, the team completely ignored this point and cracked on! However, they didn't and some in-depth discussion followed; most of which involved the calculation of the circumference of our pipe, the one used in the original article and the percentage difference between the two. From there it was surmised that using the same percentage to increase the number of turns making up the coils would give us a pretty good starting point.

Beer O'clock hove into view all too quickly that evening and the 'under construction' antenna was plonked in the rear of my truck as we set off for the ritualistic after club discussion over a cold beer.

Due to the club programme of events it wasn't until nearly a month later that we were able to return to the project, which needed little other than final assembly. The whole issue was then taken outside to the car park and carefully placed on a very handy 'Traffic Cone'. With approx 10m of coax connecting it, we plugged it into a Rig

Expert Analyser and waited..... The graphical display crept along the top of the screen and then made a steep dive for the bottom, accompanied by cheers of those gathered round! Well, that was a turn up for the books, closer inspection and a reconfigure of the analyser showed us that actually our 'antenna' was resonant at about 3.985MHz..... Hmm, the original design had called for a short piece of tubing to be attached to the top coil as a type of tuning rod. In response, the team somewhat optimistically attempted to suspend said alloy tube centrally in the plastic pipe using the tips of three screws!! Realistically, it was never going to work in the real world – even the greatest optimist of them all (Roger 2E0GHR) could see that! Buoyed up by another success we headed off for the usual, but not before Nic M6NXXB had dubbed it the 'Totem Pole' antenna!

Developments at Home

It was clear that the team had worked wonders, thought about what they were trying to achieve and worked in a reasonably methodical manner. However, some of it could be improved upon, even if it was only for aesthetic reasons. The coils had been covered in white Duct Tape, I'd included enough in the 'kit' for them to cover the tube completely three times over, however being a cautious lot, they'd only used just enough as necessary and bits were beginning to lift etc. The initial solution to me was to remove the tape from one coil at a time and carefully replace it with cable ties. Having also given it a wipe over (to remove grungy finger marks) I then decided it would be best to 'seal' each coil in turn using that last of my dwindling supply of large diameter heat shrink wrap – purchase from Ebay years ago. The overall appearance of the antenna was much improved; I am a firm believer in the saying 'something that look right, probably is!'

Next, that tuning rod. The three screws were removed forthwith and the tube end tidied up. Casting my eye around the garage lead me to the sheet of 10mm acrylic sheeting sitting on the bench that I was using to make spacers for a VHF/UHF antenna project. A quick check to ascertain the internal bore of the plastic pipe and out came a hole cutter (normally used to cut the right size holes in doors to fit Yale Locks). Shortly, I had a pile of 10mm thick, clear acrylic discs sitting on the bench next to me. Some where along the way I got the inkling that the original metal tube we'd used wasn't going to cut the mustard on this job and I rummaged through my small stock of alloy tubing and came up with a 1m long thick wall, 12mm diameter Aluminium tube – perfect! I opted to use three of the spacers I'd just cut, one secured to the end of the ally tube, another fixed to the top of the plastic tube to act as a bung and the third to be a 'tight sliding' spacer, just below the top one to keep everything in place. As it turned out the third spacer was totally unnecessary as it tended to jam the tube during adjustment. Having sorted that issue out, I then began testing in Earnest.

Test Experiments:

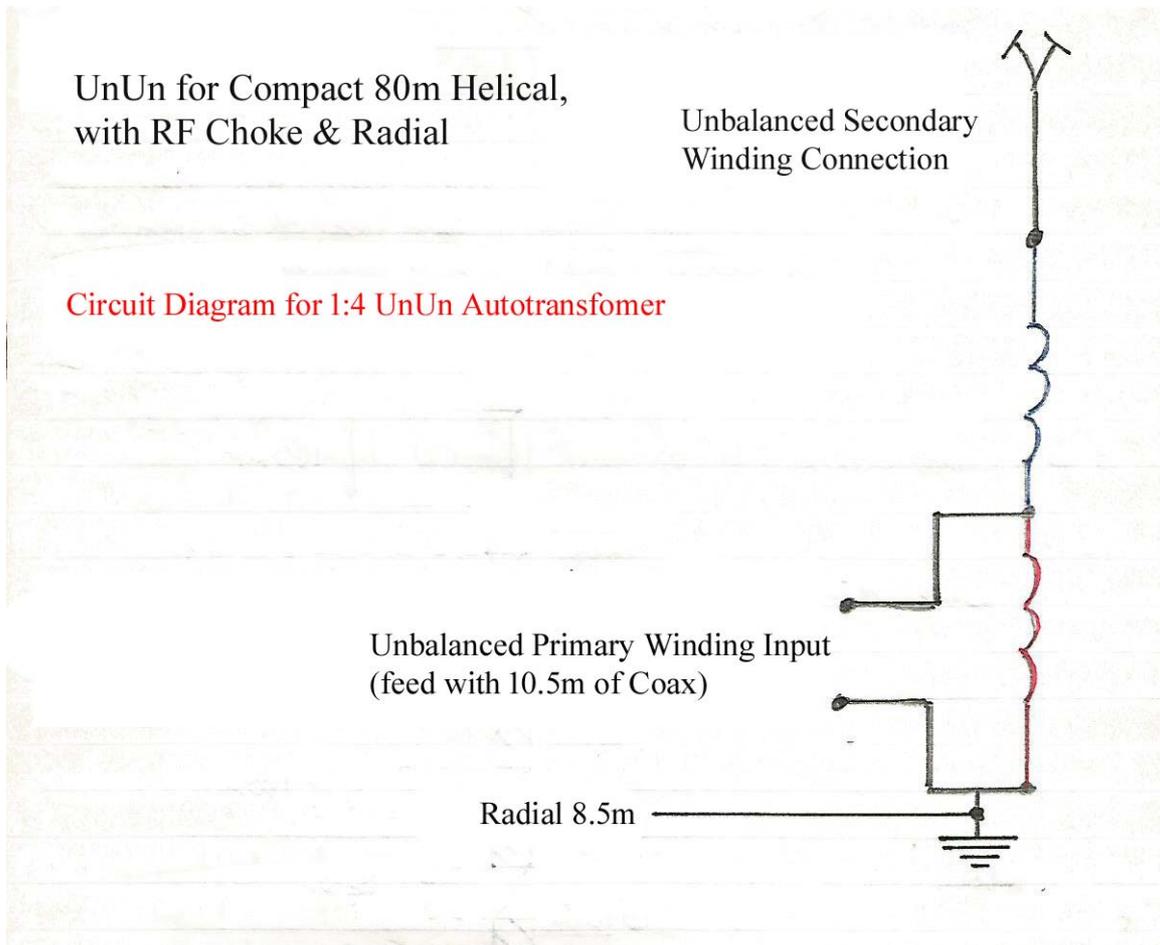
I returned to the club a third time and we spent a short period in the car park giving the antenna a good tweaking on the test rig. Purely by chance, it seemed that the antenna was now a lot closer to our target resonant frequency (3.663 MHz – TARS Club Net Freq) due to the meter long alloy tube now inserted two thirds of its length down inside the plastic tube. Further adjustments, easing the tube up and down gave us eventually, an SWR reading of 1.3/4 at 3.655 MHz close enough for now! It also became clear early on that it didn't like being placed next to large metal objects (cars, skips, railings etc) which de-tuned it out of hand.

Given that it had no ground as such, the whole lot being 'unbalanced' we decided to bang an RF choke (a few coils of the coax) next to the UnUn to stop any common mode currents etc. That improved things slightly, so on a hunch I reversed the coax connections (the choke now being at the 'rig' end) and indeed a greater improvement in SWR etc. was again noted. After this further improvement the call came to test it on the club rig! Problem: Club President was running the evening net... Even better, it would give us a chance to compare it to the usual club antenna live on the air, with numerous operators. After a brief interruption the game was on and I retired to the kitchen to make us a brew up (it was freezing cold in that car park). After the net, Club President (G3LHJ) Derrick gave a favourable response to our enquiry 'well'?? 'An S point up on receive and noticeably less background noise' was his summary – Can't say fairer than that we agreed.

A bit more besides: As this really is a experiment (with possible commercial aspirations) I decided to push things a bit and on a fine December afternoon set the antenna up and at the suggestion of an online contact, connected a single 8.5m radial to the UnUn – the SWR lurched lower still – bonus! Next I lowered a 6mm aluminium rod (approx 80cm in length) down inside the 12mm alloy tube, to act as a method of fine tuning, again the SWR shot down and with a little adjustment hit 1:1 – however, I noticed that the usable bandwidth had reduced somewhat.

At its best, the antenna exhibited a very narrow bandwidth, some 70-80khz at most – I take an SWR of 2-1 as the least acceptable, esp for today's modern radio's. However, with the added tuning rod, the SWR bottomed out nicely, but the bandwidth was exponentially reduce also! I removed the rod, deciding to accept a marginally higher SWR and the increased band width it accorded, besides how many adverts for antennas do you see today which say 'SWR better than 1.5:1'? Nobody is going to claim to build a 'unity' radiator, least of all me!

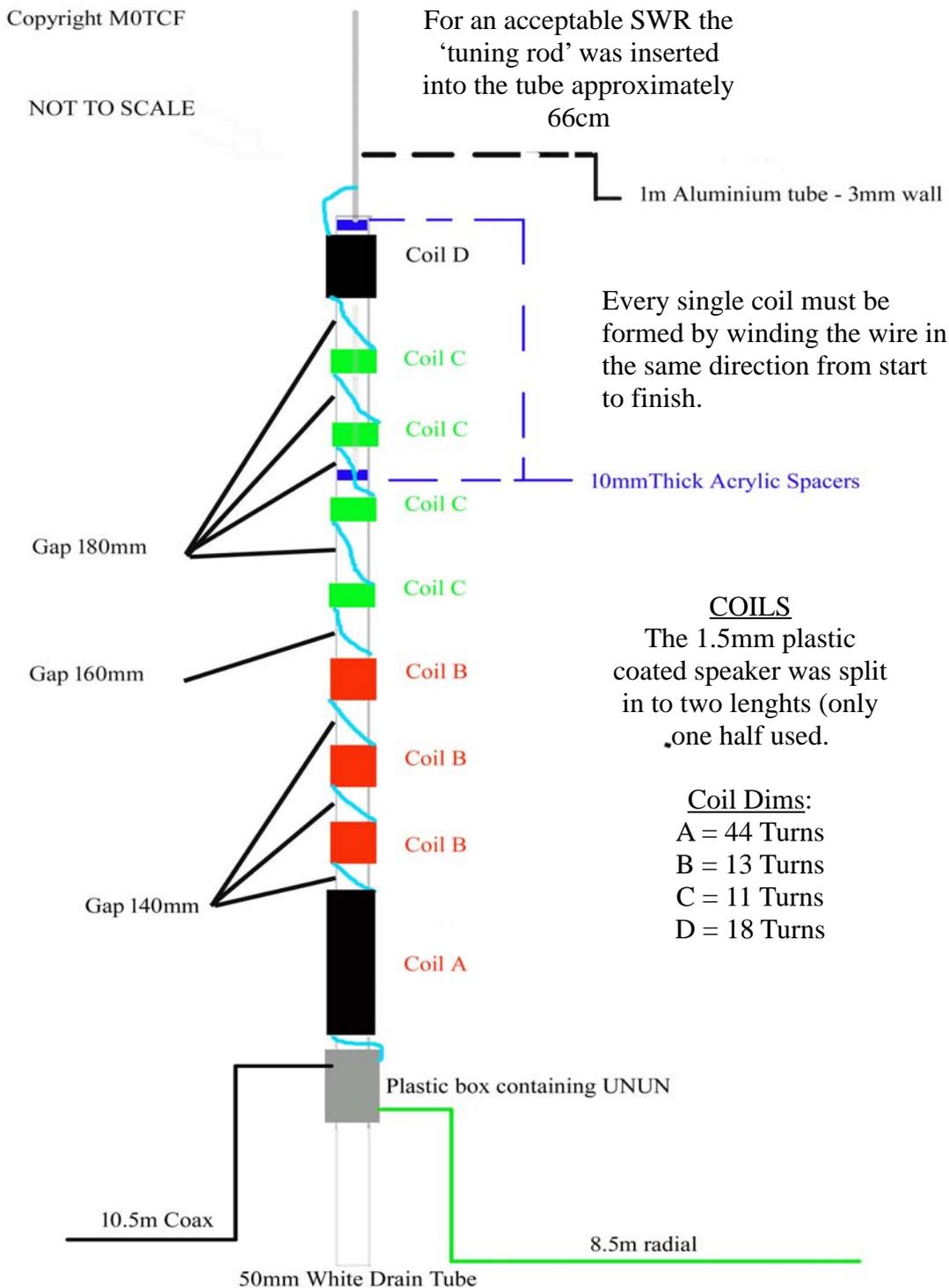
1:4 UnUn wiring diagram (scan from my notebook) :



The UnUn, in position on the bottom of the antenna tube, but without the radial attached to the 'earthing' point visible on the right hand side of the box.



Layout plan for Coils etc. The gap between the UnUn and the first coil is unspecified, but should be negligible.



The dimensions given for the coils are suggested starting points only! Some variation of overall measurements should be expected due to differing materials and construction techniques used.

The completed project (Less coax & radial).



Concluding thoughts.

Firstly, I'd like to express my gratitude and thanks to Mike Parkin G0JMI for the inspiration behind this experiment – I'm the first to admit that 'I don't do the math' very much! Also huge thanks to the students and training team members of TARS who's enthusiasm for the whole project has been infectious!

One of the many reasons I chose to start this project was the result of a plea by a fellow club member who's driving job took him all over the SW of UK and further afield on occasion. Having had little success in the past, he was desperate for an antenna he could take with him, that would allow him to join in the club's 80 meter band nets. It appears that our success has inspired him to 'give building the Totem Pole a go'! We don't claim this is a new and unique design by any means (most of us know there is very little that is altogether new in amateur radio) rather more we regard our variation on the original design as a Mk2 development – esp the large tuning rod, which makes SWR adjustment so easy!! We're happy with that!

If you give the 'Totem Pole' a try, then please call in on the 80m band TARS Net and say hello – net timings & details on our website. 73's Lin M0TCF – TARS Training Team.