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Try a Little KISS

The Plain Jane Ground Plane For 20m

Ray Howes G4OWY is in love with his Plain–Jane vertical for the 14MHz band. Let him explain why!

There are probably many thousands of other like–minded souls who, like me, spend countless hours happily in the great outdoors (usually the back–garden) dreaming up or better still erecting what we hope is the launch–pad of our very own big signals. Once the antenna's up, we race indoors, excitedly plug the antenna feed–line into the antenna tuning unit (a.t.u.) – automatic or otherwise, cross our fingers and await the 5&9 reports to come rolling in.

If only it were that easy? So, over the past several months I've been busy as usual constructing loops, parallel dipoles, helically shortened dipoles, even, a portable inverted V antenna (put together with a few odd bits and pieces of plumbing pipe, etc., I found hidden in my garden shed).

Embracing KISS

Anyway, I really wanted something that embraced the Keep It Simple Stupid (KISS) approach. So, many antennas – especially those of the advanced type, either required a lot more space than I have or, involve winding coils for traps and so on. Besides, traps are invariably lossy and I didn't want my precious radio frequency (r.f.) warming up the traps instead of being propelled out into the great big blue yonder.

I decided to quickly skim through a few antenna related articles – both old and new. In doing so, it soon became apparent that there's little to suit the small modern garden so I came to the conclusion that the KISS approach would do just fine.

Besides, I wanted my antenna up and running as soon as possible! What I didn't want, are all the hassles that might accrue from cutting 'miles' of wire to the nearest inch and fabricating several traps. No, this antenna had to be without traps and not need 'miles' of wire running about all over the place.

Sore Thumb

The antenna also mustn't stick out like a proverbial sore thumb either. More importantly, I didn't want my neighbours who're overly curious (nosey) at the best of times, to latch on to the fact that yet another 'aerial' had miraculously sprouted–up overnight. Which, brings me neatly to the antenna described here – the vertically mounted 'Plain Jane Ground Plane'.

Some Radio Amateurs might conclude – perhaps rightly, that a vertical antenna radiates poorly in every conceivable direction, including ip!. However, you may be in for a surprise if you have not used one before. Because, not only does a vertical antenna radiate at low angles as opposed to a dipole for example, which radiates at a relatively high angle, it outperforms my 20m dipole (currently up at 15 metres) any day of the week!

In fact the other day, I overheard one W4 station telling another W station, that he'd not bothered to "re–assemble his 2–element Yagi as his ground–plane vertical works just as well and is far less visible." I hasten to add, that this particular vertical he described was commercially manufactured. But I did switch antennas whilst this QSO was in progress, if only to convince myself that my next antenna construction project was viable.

Anyway, on my 20m dipole the W4 station was S4 peaking to S6 – and on my vertical, S6 to S9. Quite a difference. Not surprisingly then, I got the tools out and began to bring together what would be necessary to construct my next antenna project – a vertical ground–plane.

Schools Of Thought

There are two schools of thought so far as the actual construction of antennas are concerned. The first one, is to build it in such a way that even if a seismological event of six on the Richter is unlikely to dislodge it from its anchoring point!

The second method is to build it in such a way that if it is needed to be taken down in a hurry. You may also wish to move it to some other part of your property, or a semi–portable version is preferable. Even if built in this way, it does present a fairly rigid structure to most outdoor elements – including the odd gale–force wind. And being portable, it can of course be taken down – just in case!

For the radiating portion – the important bit – I used a length of copper tubing that was at one time the other half of another dipole. This was cut to 5.2 metres long (165in) using the standard formula 295/f(MHz).

The radials – acting as the other half of what is essentially a vertical half-wave dipole, were each cut using the same formula. I used just three radials. And, of course, each

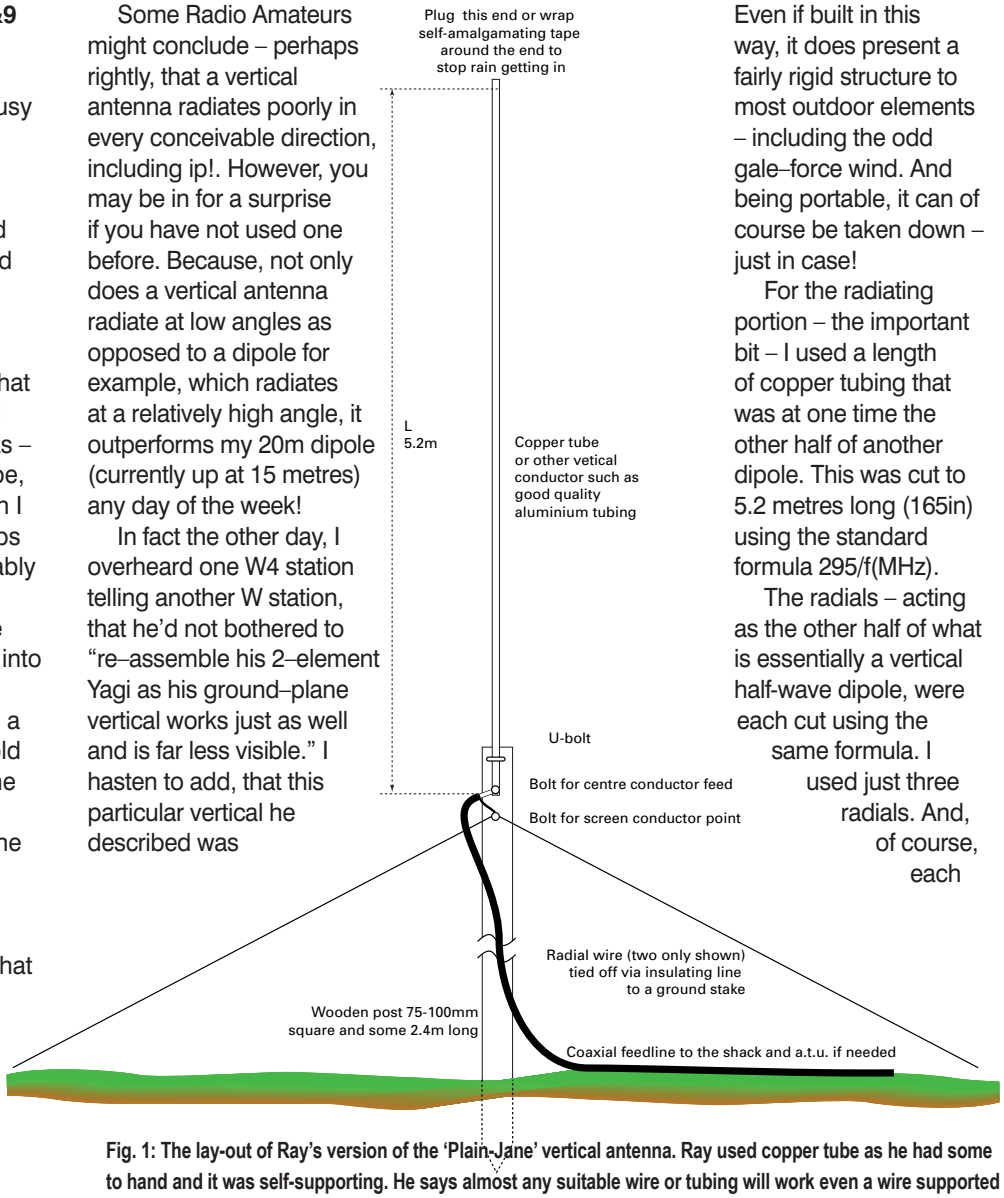

Fig. 1: The lay-out of Ray's version of the 'Plain-Jane' vertical antenna. Ray used copper tube as he had some to hand and it was self-supporting. He says almost any suitable wire or tubing will work even a wire supported by a suitable length fishing rod.

one measured 5.2 metres long. Yes, four radials would be better. At my QTH, three radials worked fine. So I didn't add more.

Mechanical Rigidity

Next, what sort of support to use? Not only must this provide a degree of mechanical rigidity for the copper radiator – or perhaps a length of aluminium tubing if you choose to use this instead, it must also be weatherproof and insulate the metal radiator from the support section. So the obvious choice mainly because I prefer it, is a 2.44m long wooden stake 40mm x 40mm of the type used for supporting young trees, etc.

These stakes usually come conveniently pressure treated so should last a considerable time deep in the ground. Most garden centres stock them at a cost of several pounds each. There again, you could as I did for a different antenna project, use one of those 20 foot (6m) scaffolding poles, however my ever-suffering partner completely disagrees.

My chosen antenna support (the wooden one) was driven 610mm (2 feet) into the ground. This wooden pole will also be used to secure the three radial wires (Or four if you really have to). For these I used bell–wire.

The copper tubing was affixed to the wooden support using a couple of U-bolts. It's not really necessary to use any insulation between the juncture of the U-bolts and the wooden mast as the r.f. voltage here will be extremely low.

However, if you use a metal support however this will, of course, have to be insulated from the metal radiator. And if you're using an untreated wooden pole it will need a liberal coat of varnish.

Weather Conditions

Depending on where you live and the prevailing weather conditions, you could use the radial wires as guys – if only to allay the fear that in a very exposed area, the whole antenna might end up decorating your next door neighbour's garden. If so, one end of each strain insulator can be attached to a stake and the other to the radial wire. This will give added insurance should severe gale force winds at your QTH be forecast.

After the vertical radiator has been securely attached to the wooden pole via the two U-bolts, drill a small hole at the bottom of it to which an appropriate sized nut and bolt (using two metal washers) can fit through the hole. The coaxial feed–line centre conductor is tinned and soldered to a metal lug which slips between one of the washers and then the nut is securely tightened at the bottom of the tubing. When all three radials have been cut to size, twist all the ends together at one end and just like the feed-line, tin them along with the coaxial cable braid.

Next, drill a hole in the wooden pole about one inch or so below the metal tubing. The radial ends and the coaxial braid, which nows forms one whole, are bolted together in exactly the same manner as for the vertical section.

What needs to be done then, is to simply tie off all three radials at about a 45° angle via the insulators and the ground stakes. I say about 45°, simply because the actual radiation resistance of a typical textbook ground-plane is somewhere around 30Ω.

As the feedline I used is 50Ω, allowing the radials to droop a bit changes the radiation resistance to match the impedance of my 50Ω feedline. But it also helps to reduce the standing wave ratio (s.w.r.), more importantly, maximum 'smoke' should then be transferred to the antenna – and hopefully, radiated out to all points of the compass and beyond.

Lastly, both connections – the radials and the feed–line itself – will eventually have to be waterproofed. I say eventually, because you will want to make sure everything is working okay before you seal up both soldered ends. In my haste, I got carried away and didn't do this, before actually making sure it worked.

So, I had the job of removing all the weatherproof sealant I'd lovingly applied and had to redo it all over again. Oh, and don't forget to plug up the hole at the top of the vertical radiator!

The dimensions given for the vertical section cover the whole 14MHz band. The s.w.r. is about 1.5:1 to 1.8:1 from one end of the band to the other. To be absolutely honest though, I do have to bring in reinforcements occasionally, by way of my auto–tuner at the top end of the band.

As far as the DX potential of this antenna is concerned, it works as is. With a few stations expressing surprise that that my r.f. output is only ever around 5 to 10W.

Extremely Helpful

Obviously, a good ground system is extremely helpful – especially, if you're using a vertical antenna like the one described here. But I've found that even using many times as many radials seems to make no significant improvement on reports received. Not even a few buckets of salt water sloshed about makes any real difference.

I guess what might be the reason for this, is that the reflections off the ground – those producing the all-important low-angle of radiation, happen a long way off from the actual antenna site. One way to off-set this problem, could be to provide a huge mat of better than average conductivity surrounding the circumference of the antenna stretching out several hundred metres or more! Not an undertaking I wish to contemplate. After all, this project is meant to be quick and easy.

In case you are wondering, the vertical I used for comparison tests earlier with the W4 station, was just a very quick lash–up just for receiving purposes – using another length of copper tubing I strapped to my dipole support pole.

Does It Work?

The answer to the question "does it work?" – is a resounding yes! I've worked HB9AON, EA3AYQ, SP1PEA, F5UJG, PF16SDT, OZ7X, S58MU and CQ00DX, plus all the other usual suspects who 'roam' about on 14MHz. With the exception of the Pacific area, most stations are raised by a first or second call, all things being equal. In comparison with my 20m dipole, with the Plane-Jane vertical I can work many more stations which were marginal on the dipole. But I'm still using only a maximum of 10W.

Simple antennas always work. And if they are resonant solely for a specific band of choice and as high as you can get them, I recommend them wholeheartedly as I always prefer simple antenna to almost anything else.

However, the strange thing is, barring the odd exception, most of the antennas we use now are really no better than they were decades ago. The 'openness' we had then gave more space for phased arrays and 'small' rhombics instead of trapped dipoles, end-feds and miniaturised beams, etc.

Now you've read my article perhaps you'll realise the need for the type of antenna I've described. Slim and unobtrusive it shouldn't take more than a couple of hours to assemble if, of course, you have all the required bits to hand. And with propagation permitting, you could be working more DX than you'd expect!

Multi-Band Version

Finally, because the vertical worked so well, my next project (I'm working on it right now) is a multi-band version for 14, 21 and 28MHz (20, 15 and 10m) – all on the same pole, but with a few extra radials. Or maybe, 18, 21 or 24MHz (17m, 15m, and 12m)?

So instead of using the copper tubing, I could use three separate lengths of bell wire or whatever for the actual radiators? Much lighter and much cheaper. Should work a treat. We'll see and I'll let you know in another article. ●