The Rev. George Dobb's

carrying on the practical way

The Rev. George Dobbs G3RJV describes a one knob a.t.u. system for the W3EDP antenna – after the quotation!

"The first rule of intelligent tinkering is to save all the parts."
Eugen Ehrlich (1862-1922)

This month's project provides one-knob antenna tuning for George G3RJV's W3EDP antenna at his new home.

Following our retirement, my wife **Jo** and I had to reduce all that we owned to less than a half of what we had in St. Aidan's Vicarage. This proved to be an interesting challenge in every facet of our lives after so many years in a large house!

The challenge sharpened when dealing with my Amateur Radio items. The available space at the new house suggested that I would have to reduce my accumulated Amateur Radio 'stuff' by about two-thirds. Naturally, over the years I had followed the advice of **Eugen Ehrlich** in his quotation and saved all the parts, and the half-built projects, and test equipment, and the cases, and cables and connectors and almost everything else!

When living space is generous many things are saved because they are simply interesting or might prove to be interesting. I remember the 'Month Rule'; throw anything away and a use for it will emerge within the month! Despite this, a whole set of new questions begin to be asked, such as "Why have I had this for 20 years and never used it?", or "How many of these do I really need?".

So, gradually a large proportion of my Amateur effects accrued over many years was sold, given away or thrown out. It was sad but good for the soul (as I reminded myself constantly!).

The Real Test!

I knew that the real test would come when I started setting up my new mini-workshop and operating space. What essential items would be missing? In fact, I set up the workshop area before the operating position mainly to keep *PW* readers happy because **Rob G3XFD** had asked me to recommence this column for the December 2008 issue. This was because readers were missing their regular dose of *COTPW* and this was when I described the 1932 'Mystery Crystal Set.'

As the 'Mystery Set' radio was completed, I thought I would put out a simple wire antenna around my rather small back garden to see what it could receive. For this purpose I have a large reel of heavy duty p.v.c. covered wire that has been my source of antenna wire for many years. Unfortunately, a lengthy search showed that it had not made the journey with me and I had to manage and make-do for that project – but it did leave the question of what I was going to do for an antenna at the new location.

Colin Turner G3VTT, has been an Amateur Radio friend of mine for well over 25 years. In fact I celebrated my 40th birthday in his garden in Kent! In recent times Colin has taken over the antenna column (*Antennas Anecdotes Awards*) in *Sprat*; the journal of the **G QRP Club**.

Colin was coming to stay with me prior to the G QRP Club mini-convention in Ripponden in October 2008 and promised to bring me suitable wire and other useful items, so that we could erect an antenna at the new location. His suggestion for an easy antenna option in my limited space was to use the W3EDP antenna. This was a pleasing idea, because I had already had good results with this simple antenna from our family's wooden lodge in mid-Wales.

The W3EDP Antenna

The W3EDP Antenna was first described by **Yardley Beers W3AWH** in his 'For the Experimenter' column in *QST* for March 1936 and I actually have a copy of the original article – if I can find it! In the article W3AWH tells how his friend **H. J. Seigel W3EDP**, consumed over a thousand feet of wire experimenting with unusual antennas.

The W3EDP antenna was the result of cut-and-try experiments to find a suitable simple antenna for a range of h.f. bands. After much experimentation W3EDP found that an 84ft long wire (I think this is best left in Imperial measurements *) with a 17ft counterpoise wire worked well on the 1.8, 3.5 and 7MHz (160, 80 and 40 metre bands).

**Okay George, as it's historic I*

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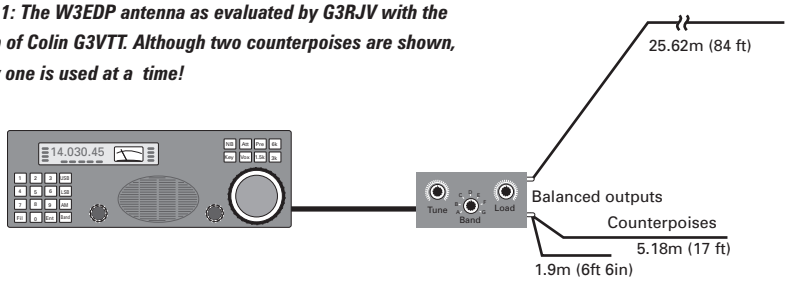


Fig. 1: The W3EDP antenna as evaluated by G3RJV with the help of Colin G3VTT. Although two counterpoises are shown, only one is used at a time!

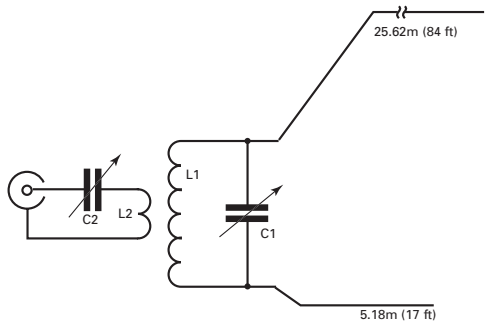


Fig. 2: A tuner design used by G3RJV at a former QTH.

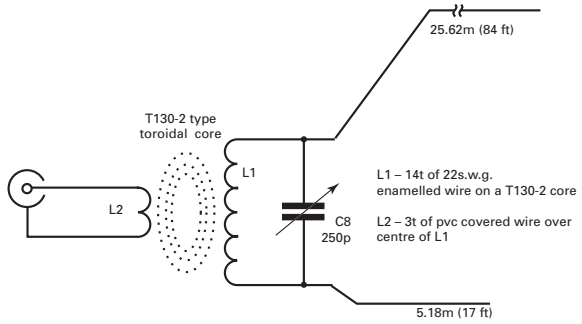


Fig. 3: The final design of the 'One-Knob' a.t.u. as built by G3RJV.

think we'll leave it in Imperial! ***Editor***.

Changing the 17ft counterpoise wire with a 6ft wire worked especially well on on 14MHz and the higher bands. Although, W3EDP found that on the 28MHz(10m) band the results were just as good without any counterpoise.

Incidentally, there's a delightful picture, published in *QST* for November of 2004, of Yardley Beers as W0JF in his latter years, taken as he operated his Amateur Radio station at the age of 92. He was a professor of physics for many years at New York University and died in October 2005.

Basic Configuration

I have often used the W3EDP in its basic configuration of the 84ft wire and 17ft counterpoise and found it possible to tune on all Amateur bands from 3.5 to 28MHz (80 metres to 10 metres). The usual explanation for the success of the W3EDP is that it functions like an end-fed Zepp antenna.

The Zepp antenna takes its name from the antennas that once trailed from Zeppelin airships. If this explanation is accurate, the counterpoise wire is part of the radiating system and is best not left trailing along the ground. The W3EDP antenna is shown in **Fig. 1**.

The W3EDP requires a balanced line antenna tuner and – fortunately – many commercial antenna tuner units (a.t.u.s) provide a balanced line input, often via a balun (balanced-to-unbalanced) transformer. The popular Z-Match antenna tuner should also provide a good match between the W3EDP and transceiver.

However, it's back to my own antenna saga now and Colin, as promised, did indeed, bring a collection of materials and wire to install a W3EDP antenna at my new QTH. We soon strung out the 84ft wire from the station, located upstairs at the front of the house, running it down the side of the house to a pole attached to my shed in the back garden.

In the shack I made use of my old Ten-Tec antenna coupler, which allows for a balanced input. Tests showed a reasonable match to be possible on all of the popular h.f. bands. Colin then ventured on to the 14MHz band on c.w. with 5W of r.f. power output. His first contact was with **Luther Lord N4DA**, in Cartersville, Georgia, USA, who gave an RST report of 579. Not bad for a bit of wire down the side of the house!

The Best Tuner?

Colin and I mused on the best way the tune the antenna and concluded that the best tuner circuit for a W3EDP would be a parallel tuned circuit link coupled to the transceiver. And in fact, I had used a version of this circuit several years ago for my portable version of the W3EDP.

The diagram, **Fig. 2**, shows my old W3EDP tuner where L1 and C1 provide a parallel tuned circuit for the required band. The inductor L2 is a link coupling wound over the centre of L1 and C2 adjusts the coupling to match the impedance of the transceiver.

I recalled that in most cases C2 did not have a great effect on matching the antenna to the transceiver; in fact it spent most of its time set to maximum capacitance. So, I lashed up a quick version of Fig. 2 and tried it without C2 – and this confirmed that I might be able to get away without C2 and have a single control knob antenna tuner.

My aim was to build a tuner that would cover the h.f. bands from 3.5 MHz upwards. The intended method was to place the link coupling winding in the centre of the parallel tuned inductor and to vary the inductance by switching the number of turns on the coil from either end of the tuned winding. I began by

winding a coil on a piece of plastic electrical conduit tuning and making tapping points at equal intervals at both ends of the coil. All I can say it that it wasn't an easy exercise!

However, I did manage to make two versions of a tapped coil with six tapped positions on each side and used a 2-pole, 6-way switch, to reduce the number of turns equally from each end of the coil. Sadly, my work led to disappointment as physics got in the way! The two-to-one frequency ratio between 3.5 and 7MHz made that range switch very difficult and the coupling turns ratio didn't allow for a single control tuner.

Revert to Fixed Value

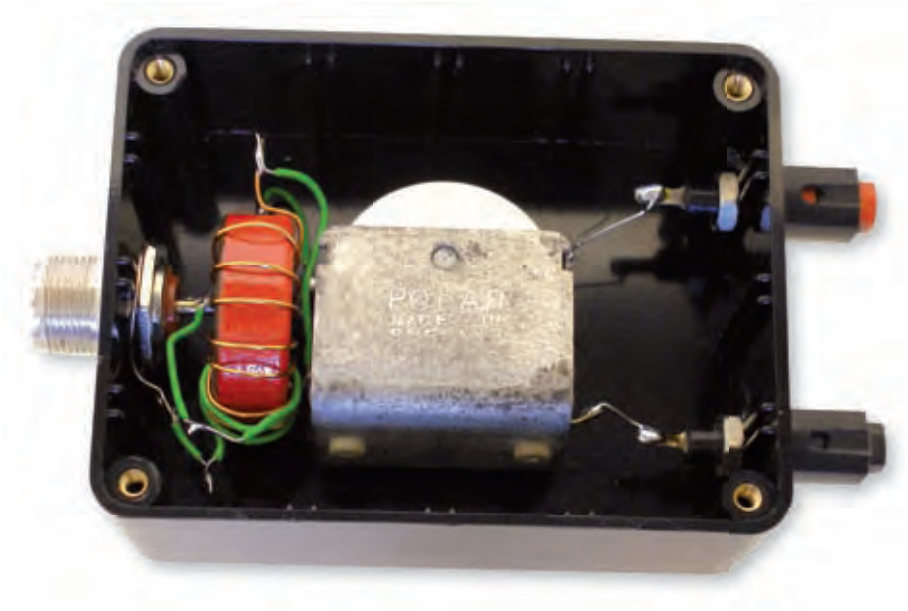
So, I decided to revert to a fixed value of inductance and a simple link coupling and see how many bands I could cover from 7MHz upwards with the basic circuit. At this stage I laid aside my plastic tube coil formers and decided to wind the single coil on a T130-2 toroidal former. This would allow for a smaller tuner and gave me to opportunity to calculate the inductance of the coil before it was wound.

I also located a compact 250pF air-spaced variable capacitor which would allow me a useful tuning range. To complete the tuner parts, I rummaged around and found a plastic box 10 x 75 x 40mm. (There's merit in not building an antenna tuner in a metal case). **Note:** Both sides of the tuned circuit are isolated from ground so the shaft and casing of the variable capacitor should not come into contact with metal casing which would be connected to ground.

One Knob Tuner Circuit

The circuit for the final version of my 'One Knob Tuner' is shown in **Fig. 3**. The inductor L1 is 14 turns of 22s. w.g. enamelled copper wire wound on the T130-2 core. The link winding, L2, is three turns of p.v.c. covered solid copper wire wound over the centre of L1.

Using three turns for L2 worked out as a good compromise over a range of h.f. bands. The capacitor, C1, is the 250pF variable capacitor. Naturally nowadays, not many readers may have a 250pF air-spaced variable capacitor to hand as they are becoming quite rare unless you've removed them from older valved receivers.



The assembled tuner (a plastic case is recommended).

Close-up look at the inductor wound on a T130-2 toroid.

A good alternative to an air-spaced variable may be to use a polyvaricon variable capacitor of the type often found in cheap a.m./f.m. broadcast receivers. These can be culled from old radios or even bought from electronic component outlets.

Notes: They would be suitable if the tuner is only to be used with powers of less than about 10W of r.f. output. Remember also that if the components are to be mounted in a metal case, neither the frame nor the shaft of the variable capacitor should be connected to ground.

Winding L1 and L2 is very simple. The designation 'T130' indicates that the outer diameter of the core is 1.30in. So, this is a very generous area for only 14 turns. About 28 inches (a little over 700mm) of wire will be required to the wind L1.

Each time the wire passes through the centre of the core counts as one turn. Winding the turns side by side would occupy less than half of the circumference of the core. So, after adding all 14 turns open up the spacing so that the winding occupies about three-quarters of the circumference. The wire is thick enough to hold itself in place. The link winding (L2) can then be added in the centre of the L1 winding. Simply count turns to find the centre and wind three turns of p.v.c. covered wire over L1.

Acceptable Matches

The original tuner was initially tested using an standing wave ratio (s.w.r.) analyser and the results suggested that the tuner would probably work from 7 to 21 MHz. When connected between a low power transceiver giving about 5W of r.f. output and the W3EDP antenna I was able to obtain good, or acceptable, matches in the 7 to 21MHz range.

The purists would probably want to add the series capacitor L2. If so, this should have a value of 500pF or more. When used in conjunction with an s.w.r. meter the tuning is quite sharp so a large control knob – or even a reduction drive – is very useful. The tuner would serve well for portable work with a W3EDP antenna strung between trees and I must try that next summer at our Welsh lodge! ●