The W3EDP Antenna *Revisited*

Vince Lear G3TKN/ZL1VL has another look at an old favourite antenna - the W3EDP. He says it's cheap to create, and can still give many other antennas a run for their money!

The W3EDP antenna can be traced back to the mid-1930s. Mention of it appears in a number of antenna books and some interesting references to it are made on the Internet. Although the W3EDP antenna does not appear to have enjoyed the same popularity as some other multi-band antennas, its use can still be heard of on the Amateur bands from time-to-time.

Simplest design

The W3EDP antenna is probably one of the simplest antenna designs around. The antenna is nothing more than a 25.9m end-fed wire tuned against a 5.18m counterpoise. The original configuration (**Fig. 1**) shows the antenna and counterpoise coupled via a link coil to the power amplifier (p.a.) tuned circuit. In most older valved p.a. stage transmitters, the p.a. tuned circuit is usually able to accommodate a wide range of impedances. The length of 25.9m shows impedances that are neither too high nor too low on most bands and it is therefore reasonable to assume that this was a contributory factor in W3EDP's original choice of length for his design.

Tuning The W3EDP

Of course, because the antenna is not matched to 50Ω on any one band, users have to look to how they would tune the W3EDP antenna in normal use. The solid state p.a. stages in modern transceivers should be terminated in a 50Ω non-reactive load, if they are to deliver full output power.

The internal automatic antenna tuning units (a.t.u.s) incorporated into many modern transceivers, have only limited matching ranges. So, as with any end-fed wire, a separate a.t.u. capable of matching the rig to a wide range of impedances, should always be used.

Looking at the original W3EDP design (Fig. 1), you can see that the counterpoise is isolated from the earth. The antenna plus its counterpoise, may both be viewed as forming the radiating part of the antenna. As it's really one radiating elements, then the antenna may, in fact be viewed as a single 31.08m wire, that is fed 5.18m from one end.

With such an antenna and feed combination, if a conventional singled ended 'T' or 'L-match' network a.t.u. is used and the counterpoise connected to the earthy side, or the case of the a.t.u., the counterpoise will no longer be isolated from earth. Under these circumstances, the antenna will now function as a simple end-fed wire tuned against earth. There is nothing wrong with this and if a good earth system is used, results may be as good, or even perhaps better than just using the 5.18m counterpoise. There is obviously room for experimentation here!

Now to look at some of my experiments. When I erected the antenna at a temporary location, my operating position was in an upstairs bedroom where I did not have access to a good earth. I decided that I wanted to implement the W3EDP antenna design as shown in Fig. 1 and effectively isolate the 5.18m counterpoise from the mains earth. This can have advantages, which I proved later of reducing general noise pick up and in some cases TVI/AFI.

The a.t.u. available was a single ended 'Transmatch' design covering 1.8 to 30MHz. However, if I had connected the 5.18m counterpoise to the earth/case of the a.t.u., the counterpoise would have been effectively connected to mains earth via the coax outer sheath linking the a.t.u. to the transceiver.

The solution to the problem was to insert a current mode choke balun in the coax coupling the a.t.u. to the transceiver (**Fig. 2**). I used a commercial current mode choke balun (made by DX Engineering), but any suitably designed choke balun that offers effective choking

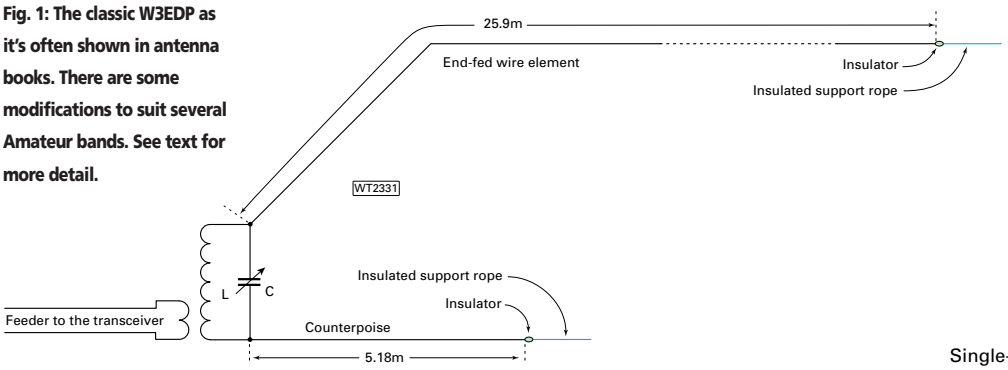

Fig. 1: The classic W3EDP as it's often shown in antenna books. There are some modifications to suit several Amateur bands. See text for more detail.

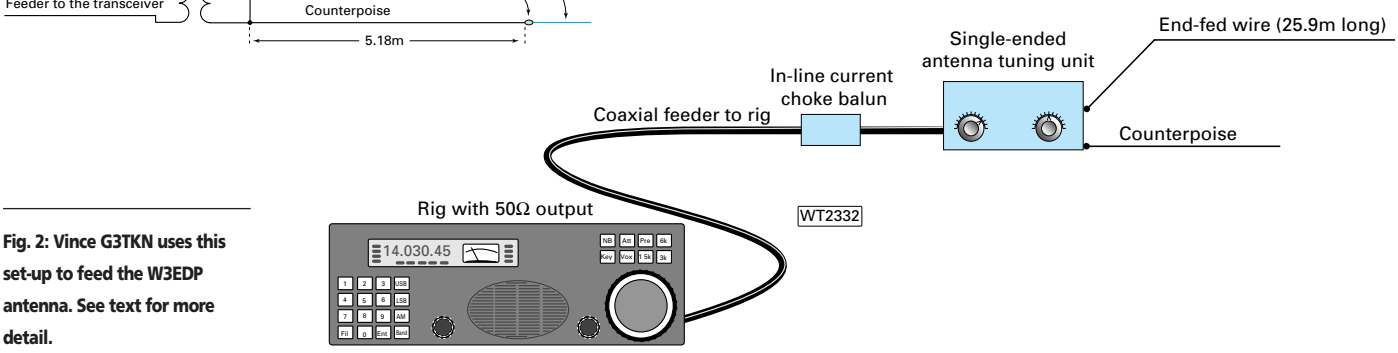

Fig. 2: Vince G3TKN uses this set-up to feed the W3EDP antenna. See text for more detail.

action on the frequencies to be used would suffice.

Note: It's important that the a.t.u. should be physically separated from the transceiver. The choke balun serves to electrically isolate the a.t.u. case at r.f. from the rig too. As the case of the a.t.u. is slightly 'hot' at r.f. frequencies, it's important that its case and that of the transceiver are 'separated' at r.f.

Fig. 3: The commercial and physically small choke balun should be fitted close to the single-ended a.t.u. to be effective. A simple multi-turn coil made up of extra coaxial cable could be just as effective. See text for more detail.

The Choke Balun

An alternative to a commercial choke balun, **Fig. 3**, could be about 10 or 11 turns of RG58/UR43 (5mm diameter) 50Ω coaxial cable wound with a diameter of about 140mm. I also found that about 10 turns of RG58/UR43 coaxial cable wound on a pair of stacked FT240-61 ferrite cores worked well too.

The Z-Match

The Z-match a.t.u. is in some ways better suited to use with the W3EDP antenna, since the antenna and counterpoise are connected to a link coupled coil (similar to Fig. 1) in this type of a.t.u.. The antenna and counterpoise are therefore isolated from d.c. earth, and no choke balun is required. An efficient Z-match design by the late **Louis Varney G5RV** can be found in [1].

Impedance Measurements

It's important to realise that antenna height and general layout will always affect feed-point impedance. At my temporary location, the 25.9m wire ran from an upstairs window at around 6m height to an 8m temporary mast at the bottom of the garden, with the last 5m of the antenna running off at an angle from the mast. The 5.18m counterpoise was allowed to hang out of the window.

When I connected my MF-J259 antenna analyser between the 25.9m end-fed wire and 5.18m counterpoise it showed resonance points at 3.7, 8.89 and 13.9MHz with resistive impedances of 195, 174 and 97 ohms respectively. On 7 and 14MHz the impedances were slightly reactive, but all were easily matched with my Transmatch a.t.u.

Earths & Counterpoises

Now let's look at some alternative earth and or counterpoise connections.. The 5.18m counterpoise worked very well on the bands between 3.5 to 14MHz. When the central heating system was connected as an earth in place of the 5.18m counterpoise, there appeared to be an increase of noise introduced into the system without any noticeable improvement in transmitted signal.

The use of a central heating system as an earth may cause interference in some circumstances and is not an ideal solution. However, for temporary portable operation, it may suffice so long as no TVI/AFI is caused. My maximum power on any band never exceeded 100W.

I've used the W3EDP successfully on 1.8MHz by tuning it against a separate 36.57m counterpoise some 600mm off the ground. This element was run around the perimeter of the garden. The original 5.18m counterpoise is too short for 160m operation, although it can be left connected to the a.t.u. when the 36.57m counterpoise is used.

The use of the 36.57m counterpoise on 1.8MHz actually resulted in a couple of S-points reduction in local noise on reception. In some cases this made it possible to hear weak signals that were otherwise inaudible when I used the central heating system in place of the counterpoise.

I did not use the antenna on frequencies higher than 14MHz. However, it has been suggested in *Antenna Topics*[2], that a counterpoise length of 1.02m gives good results on 21MHz. Bearing this in mind, there's obviously still some room for further experimentation in this respect.

Results

How well any end-fed wire antenna performs will depend on its height above ground, general configuration and how well it is matched.

At my temporary location and with the configuration described, results were very good on 3.5 and 7MHz in terms of inter-G contacts. A low wire such as this is to be preferred for high angle inter G and European working.

On 1.8MHz I was able to work around the UK with signal reports varying from S6 to S9. One contact of note on 160m was a 57 report from G3OLB/M at Saint Austell, Cornwall, who was using a 3.05m whip at 1700hrs (still daylight in September) from my temporary location in Coventry!

I was able to maintain a regular 'sked' with VO1MP on 14MHz, although signals varied in QSB from S6 to S9. I don't feel that the antenna performed as well on 14MHz as a dedicated dipole I had used on that band on previous occasions, but results were still very satisfactory.

Effective Antenna

I was surprised at how effective the antenna was on 3.5, 7 and 14MHz with just the 5.18m counterpoise, while the addition of the 36.57m counterpoise enabled the antenna to work on 1.8MHz. The W3EDP (as with any end-fed wire) offers simplicity and a high degree of flexibility in terms of band coverage, provided a suitable a.t.u. is used.

However, if you is to implement a W3EDP antenna, care should be taken to d.c. isolate the counterpoise system as described unless a Z-match a.t.u. is used. The W3EDP is an ideal antenna for temporary or portable operation, although it would also make a very effective all band system if sited in the open at a permanent location.

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