A description of the W3EDP antenna entitled An Unorthodox Antenna was published in the March 1936 edition of QST. The article was authored by Yardley Beers, W3AWH. The antenna described in the article was developed using “the cut and try method” by H. G. Siegel, W3EDP probably around 1934. W3EDP’s objective was to build a multi-band antenna. Today, the W3EDP antenna is a favorite of many QRP (low power operation) aficionados because it is simple, compact, and easy to deploy.

I decided to take a look at the W3EDP antenna as a possible multi-band antenna suitable for fixed location use and as an easily deployable portable antenna for events such as Field Days. After several hours of Internet searching, I collected and read a number of articles, explanations, and testimonials about the antenna. The most useful information was gleaned from the March 1936 QST W3EDP article available from the ARRL archives and a technical description of the W3EDP antenna [pp. 33-34] published in Practical Wire Antennas (ISBN 0 90061287 8) by John D. Heys, G3BDQ.

Undoubtedly W3EDP was aware of the much publicized Zepp(elin) antenna that was patented in 1909 by Hans Beggerow (German patent #225204). See figure-1a. Early Zepp antennas were 1/2 WL long (or multiple) and fed with a 1/4 WL (or multiple) open wire feed line which uses only one of the wires. The feed line acted as a matching section for the transmitter. The antenna was typically connected to the transmitter with a tuned link coupled network. As it turns out, the HF antenna on the dirigible Graf Hindenburg was 85’ long. W3EDP settled on a length of 84’ for the long leg of his antenna. Apparently much of his experimentation with wire lengths was centered on optimum counterpoise lengths for the U. S. amateur radio bands circa 1936.
What is the W3EDP antenna? The best way to answer that question is to provide a simple diagram of the original antenna and go from there. Figure-1b is a diagram of the original W3EDP antenna. W3EDP is reputed to have used over 1,000' of wire to come up with the dimensions shown in Figure-1b. Wire L1 is 84' long and attaches to one end of a parallel tuned tank. The distinguishing characteristic of the antenna is wire L2 that W3EDP referred to as a "counterpoise." L2 was attached to the other end of the parallel tuned tank. The use of the term counterpoise to describe L2 has been questioned by some who have studied the antenna. See the L. B. Cebik, W4RNL (SK) article entitled Counterpoise? On the Use and Abuse of a Word; AntenneX ~ December 2006 Online Issue #116. To avoid entanglements, I shall simply call it element L2.
Figure-1b. original W3EDP antenna

NOTE: W3EDP calculated that an L2 length of 17' gave the best results for the 160, 80, 40, and 10 meter bands. He selected an L2 value of 6.5' for the 20 meter band. According to the March 1936 QST article, W3EDP worked 75 countries in all continents within a two year period using his antenna with 50 watts input to the final P.A. (power amplifier) of his transmitter. The article doesn't specify the model of his transmitter or whether he operated using CW, AM, or both.

Construction Phase

I decided upon a W3EDP configuration in common use today for my antenna. The design uses one half of a 17' length of 450 ohm balanced line for element L2. The other half of the 17' balanced line is connected to a 67' length of wire to complete the 84' L1 element. L2 is left unconnected at the top but is connected at the bottom to the source. Figure-2 is a diagram of the configuration.
During the construction step, I marked the lower end of the half of the balanced line used for L2 with a distinctive color so it could be identified when connected to the source. After completing the antenna, I hoisted the balanced line end to a height of ~20’. The other end of the antenna was ~25’ above ground.

**Analysis I**

The lower end of L2 of was connected to the ground port of an LDG **RBA-4 4:1 balun** which is what I had available for use at the time. See the note below regarding baluns. The lower end of the L1 section of the antenna was connected to the antenna port of the RBA-4. Figure-3 shows the balun connection.

**NOTE:** For an unbalanced antenna like the W3EDP, you should use a **4:1 current balun** to provide the required impedance match as well as avoid ground/counterpoise losses associated with voltage baluns. At the time of the experiment, I only had a 4:1 voltage balun available.

The RBA-4 was directly connected with a **double-ended PL-259 coupler** to the input port of an **AIM-4170C analyzer**. The analyzer was used to calculate and store the SWR curves for the 80 through 6 meter bands. The curves for each band are displayed below. Click the images to see the full-size display.
Figure-4. 80 meter band SWR curve

Figure-5. 40 meter band SWR curve
Figure-6. 20 meter band SWR curve

Figure-7. 17 meter band SWR curve
Figure-8. 15 meter band SWR curve

Figure-9. 12 meter band SWR curve
Analysis I Summary

The antenna is multi-banded but not particularly efficient on any band. A tuner with wide-range impedance matching capability will be required to use the antenna. A 4:1 balun will definitely help with impedance matching.

Modification and Analysis II
I decided to see what would happen if I connected a 32’ length of AWG #14 stranded THHN coated wire to the ground port of the RBA-4 and just let it lay on the ground. I inserted an insulated “spade type” connector at the half-way point (16’) so I could easily disconnect the last 16’ feet of wire. Figure-12 shows the Analysis II configuration.

Figure-12. Analysis II configuration

I used the AIM-4170C to analyze each band (80 – 6 meters) again with the configuration shown in Figure-12. For the 80 and 40 meter band analysis, the full 32’ length was used (L3 + L4). For the 20 – 6 meter band analysis, only the 16’ length (L3) was used.

The Analysis II curves are shown below with the light orange curve representing SWR with L3 or L3 + L4 connected. The Analysis I curves are displayed in red with embedded circles. Click the images to see the full-size display.
Figure-13. combined 80 meter band SWR curves

Figure-14. Combined 40 meter band SWR curves
Figure-15. combined 20 meter band SWR curves

Figure-16. combined 17 meter SWR curves
Figure-17. combined 15 meter SWR curves

Figure-18. combined 12 meter SWR curves
Analysis II Summary

Adding the L3 and L3 + L4 wires significantly improved the measured SWR curves on nearly all of the bands analyzed. You can decide what to call L3 and L3 + L4.

**NOTE:** Be sure to properly ground your equipment and follow applicable safety precautions when using the L3 or L3 + L4 wire configuration. In this configuration, L3 and L3 + L4 radiate and can
introduce RF at the station. If the equipment is not properly grounded, you may notice extraneous noise and possibly get “bitten” if you touch metal components when transmitting.

Operational Test

I hooked up my equipment and gave the modified antenna configuration an “on-the-air” test. I was curious to see how much impact the L3, and L3 + L4 wire element radiation losses would have on antenna performance. Figure-21 shows the station equipment used in the test. In the diagram, the AT-500 is a Palstar manual antenna tuner with wide-range impedance matching capability, the RBA-4 is an LDG RBA-4 4:1 voltage balun, and the IC-706MKIIG is an ICOM transceiver. All testing was done using 100 watts (SSB). My QTH is located in Cary, North Carolina.

![Diagram of station equipment](image)

Figure-21. “on-the-air test” station equipment configuration.

Operational Test Results

80 meters: the AT-500 tuned the antenna with no problem. However, no activity was heard on the 80 meter band which was not surprising given that the test was conducted around lunch time.

40 meters: the AT-500 tuned the antenna with no problem. The 40 meter band was “jumping” and I quickly made contacts in South Carolina and Connecticut with 59 signal reports. I have a 40 meter bowtie wire antenna that works very well. I used the coax port switch on the AT-500 to check the W3EDP antenna against the bowtie antenna. The bowtie proved to be better than the W3EDP but not by much.

17 meters: the AT-500 tuned the antenna with no problem. The 17 meter band was “jumping” and I quickly made contacts in California and Spain. I have a 17 meter N4GG antenna that works exceptionally well. I used the coax port switch on the AT-500 to check the W3EDP antenna against the N4GG antenna. The N4GG antenna proved to be better than the W3EDP but again not by much.

I ran out of time and terminated the operational test without trying the 20, 15, 12, 10 and 6 meter bands. I plan to test these other bands as time permits.
The modified W3EDP is definitely a multi-band antenna. However, an antenna tuner capable of matching a wide range of impedances is required. A 4:1 balun will definitely help with impedance matching. Undoubtedly, some autotuners will have difficulty handling the impedances presented by the antenna.

**TIP:** You may want to consider using a 3-position switch to control which “counterpoise/radial” wire is selected. Figure-22 shows a diagram of the switch.

![Figure-22. switching arrangement for the 16’ and 32’ wires](image)

**Analysis III**

I decided to configure and analyze an antenna that closely resembled the original W3EDP antenna. I removed the balanced line portion of the antenna used for Analysis I and II. For L1, I attached a single 17’ piece of AWG #14 copper stranded THHN coated wire to the existing 67’ piece of the same kind of wire using a spade connector. For L2, I used two different lengths of AWG #14 copper stranded THHN coated wire. A 17’ length for the 20 – 6 meter bands and a 33’ length for the 80 – 40 meter bands. I used a 3-position knife switch to select the appropriate length of L2. Figure-23 is a diagram of the Analysis III configuration.

![Figure-23. Analysis III configuration](image)
For L2, I draped both lengths of wires over a pair of plastic fold-up type sawhorses spaced so the wires remained roughly parallel to and ~3′ above ground. The wires were spaced ~2′ apart over the sawhorses. This arrangement aligned the wires at almost a right angle to L1 at the balun which was located on top of a portable work table. I analyzed the configuration for the 80 – 6 meter bands using my AIM-4170C. The SWR curves for each band are shown below. Click the images to see the full-size display.

Figure-24. Analysis III – 80 meter band SWR curve (L2 = 33′)

Figure-25. Analysis III – 40 meter band SWR curve (L2 = 33′)
Figure-26. Analysis III – 20 meter band SWR curve (L2 = 17’)

Figure-27. Analysis III – 17 meter band SWR curve (L2 = 17’)

Figure-28. Analysis III – 15 meter band SWR curve (L2 = 17’)

Figure-29. Analysis III – 12 meter band SWR curve (L2 = 17’)

Figure-30. Analysis III – 10 meter band SWR curve (L2 = 17’)

Figure-31. Analysis III – 6 meter band SWR curve (L2 = 17’)

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**Figure-29.** Analysis III – 12 meter band SWR curve (L2 = 17’)

**Figure-30.** Analysis III – 10 meter band SWR curve (L2 = 17’)

**Figure-31.** Analysis III – 6 meter band SWR curve (L2 = 17’)

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Analysis III Summary

I have to say that based on my Analysis III measurements, H. G Siegel, W3EDP did an excellent job of coming up with the dimensions for a multi-band HF wire antenna.

With some experimentation, employing optimized L2 lengths for each band of interest will significantly improve SWR curves over just switching between the fixed 33’ and 17’ lengths. As a test, I connected an old steel tape measure (33’ X 1”) to the ground port of the 4:1 balun and adjusted its length to obtain the best SWR curve for the 17 meter band. I was able to reduce the measured SWR from ~7:1 (L2 = 17’ of #14 AWG copper stranded THHN insulated wire) to slightly over 1:1 by adjusting the tape measure to a length of about 12’. See the combined measured SWR curves below. The light orange curve was produced with the tape measure attached to the ground port of the 4:1 balun. Click the image to see the full-size display.

![SWR Curve](image)

Figure-32. tape measure 17 meter band SWR curve

See Optimizing the W3EDP Antenna.

For fixed location operation, a rotary multi-position switch box to select the optimum length of L2 for each band would be fairly inexpensive to build. A light-weight portable non-conducting spreader bar arrangement could be made to suspend the L2 wire array ~3’ off the ground.

The W3EDP antenna is a good fixed location HF wire antenna as well as a fine portable antenna. You will need a tuner to match your rig to the impedances presented by the antenna. A 4:1 balun will also help.

4 Responses to “W3EDP Multi-band Antenna”

- Peter CT7ADL
  October 24, 2017 at 5:01 pm
Really helpful analysis, thank you; can’t wait to try it. Have you / anyone tried a multiple L3,4,5 configuration with three Ls of lengths : 33ft, 17 ft and 12 ft all connected to the 4:1 balun without any switching? I could be tempted to try this.

Reply

- Jim Flanders

December 31, 2015 at 3:29 pm

Yesterday, I put up an antenna for an old ham who on O2 100% of the time. When he described the antenna to the guys on the “Good ‘ol boys” net, and they pointed out your article as just what I put up. The only difference was that I didn’t actually measure the length of the 450 ohm down lead. It is probably a little less than 20 ft. I just ran it down to the base of his hustler 4btv, and connected the ground side of the 4:1 balun to his ground counterpoise. He checked all bands with his LDG tuner, and got considerably better than 2 to 1 on all bands. I will go back later after reading your article several times and try some improvements.

Reply

- VR2UU

February 25, 2015 at 4:45 am

Just what the doctor ordered for my W3EDP, a 4:1 unun (I have been experiencing high impedances on 30 meters). Thanks for the exhaustive testing. Now I will add a 33’ counterpoise (err, ‘L3’) to the repertoire here in Central HK. -73 Jeff

Reply

- Marco Túlio V. Alvarenga

November 2, 2013 at 9:58 pm

Nice job! I was looking for an "universal antenna", to complement my little antenna farm and I will try this one. I will let you know about the results. Coincidently I have already the counterpoises for 80, 40 and 20 meter bands, the last two very close to 33' and 17', because my shack is at the second floor and this was the way I found to avoid RF in the shack. Thanks for the publication of your experience.

73! Marco Túlio (PY2MTA)

Reply