Ultralinear LF Active Whip Antenna

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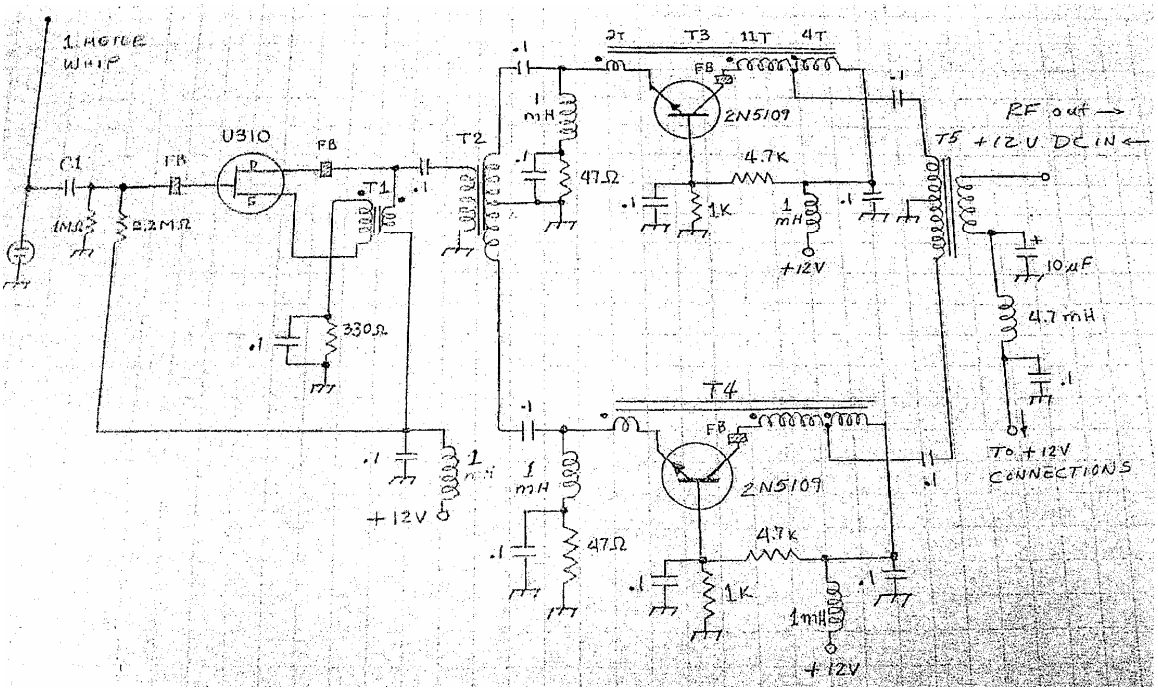
After looking for an active whip antenna to use for both LF and shortwave DXing for some time this is the antenna that I ended up using. I tried several active whip antennas previous to this one but with less than satisfactory results. The problems I have at my location are limited space to locate the antenna, several strong MW broadcast stations, one about one-half mile from me and strong electrical noise interference.

I started with an MFJ-1024 active whip antenna. It worked and was quite sensitive, but those strong broadcast stations gave mixing products all over the spectrum. Next I bought a Dressler ARA 60 active whip. It is rated with a coverage of 40 KHz to 60 MHz, a gain of 12-15 dB and a 3rd order intercept of +50 dBm. The sensitivity should be good at about 4 dB noise figure. In practice, the Dressler was no better than the MFJ, in fact somewhat worse. From this experience I learned to pay attention to the 2nd order intercept in antenna specs. That's where most of the BCB interference comes from. The Dressler does not include this spec. There are other active whips on the market, but expense goes up rapidly with increasing performance. For example, the top rated DX One active antenna sells for $699. Dallas tells me he has tested the DX-One against his original version of this antenna, and the Ultralinear was better. Time to home-brew!

I dug through some of the literature I have accumulated on antennas, and found several. One (AMRAD) was written up in QST, September 2001, and uses a high performance FET, a Crystalonics CP-666. This FET is available only on special order, and requires a heavy duty heat sink. I decided to try building an antenna with components I had on hand using some ideas that were written up in the National Radio Club newsletter by Dallas Lankford. The title of this article is **Ultralinear Amplified One-Meter Whip Antennas** and should be available in the NRC archives.

This antenna was designed for the MW band and consisted of two stages. The first stage was a FET (U310) with high negative feedback followed by a Norton common base amplifier with negative feedback. I built this antenna and its performance was better than either the MFJ or Dressler units, but there were still 2nd order mixing products present. Further investigation showed that most of these products were originating in the second stage. A balanced second stage amp fixed this problem. There are still one or two products, but they are low in amplitude and I have to hunt for them. The gain of this antenna is less than either the MFJ or Dressler units, but sensitivity is equal or better than either of these. Lower gain is an advantage since too much gain means that the receiver will have to handle larger signals leading to intermodulation distortion in the receiver mixer stage.



I have included a schematic for those wanting to try this antenna. Here are some construction notes for building it:

C1 is a 0.1 μF capacitor with 500 volt rating to handle nearby lightning strikes. NE indicates a neon bulb. Dallas tells me that surge suppressers, available from Mouser, are better and last longer. In two years of operation I have not had any problems with lightning.

The two 47Ω resistors in the 2N5109 circuits control bias current. They should be selected to give a bias current of about 25 mA. With this bias current, heat sinks should be used on the two 2N5109s. Mouser has a good selection of these. If possible these two transistors should be matched to provide the best balance.

FB indicates ferrite bead. Amidon FB-101-43 will work.

All transformers are wound on Amidon FT-50-75 ferrite cores. Carefully check to make sure the transformer polarity is correct. The windings should all start at the dot indications with the same winding direction. Here is the coil winding data:

T1: 24 turn primary, 8 turn secondary
T2, T5: 8 turn trifiler wound
T3, T4: 3 windings, 2 turns, 11 turns, 4 turns.

For the power supply/signal coupler, I use one of my other whip antenna power supplies. It should be simple to build one using chokes and bypass capacitors with a plug in 12 V wall power supply.

I built this antenna in the box originally supplied with the MFJ antenna. For your antenna, make sure the box and connectors are weatherproof . I have included a photo of the completed unit, ready for installation outdoors after the cover is bolted on.