Null Steered QDFA's

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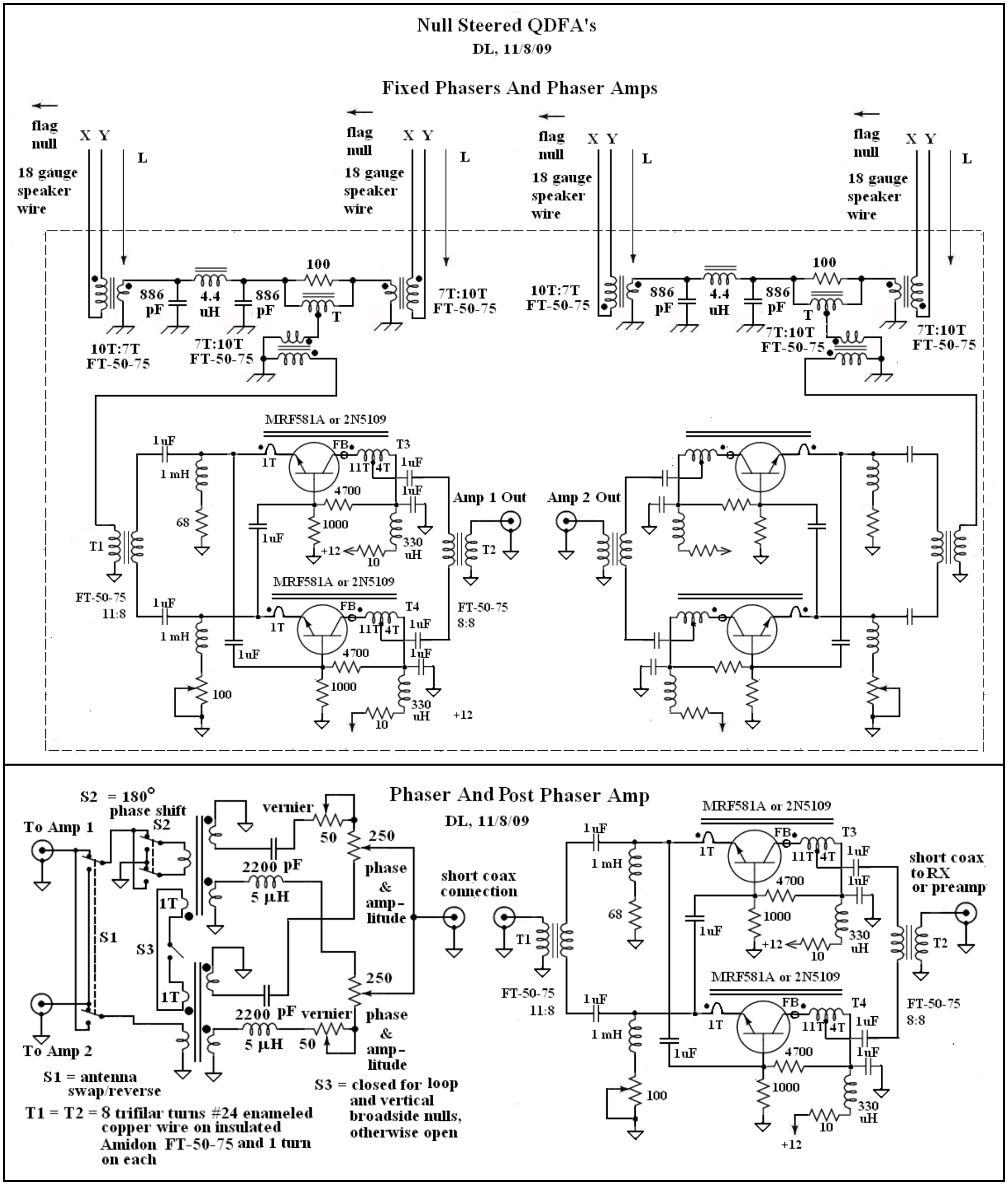
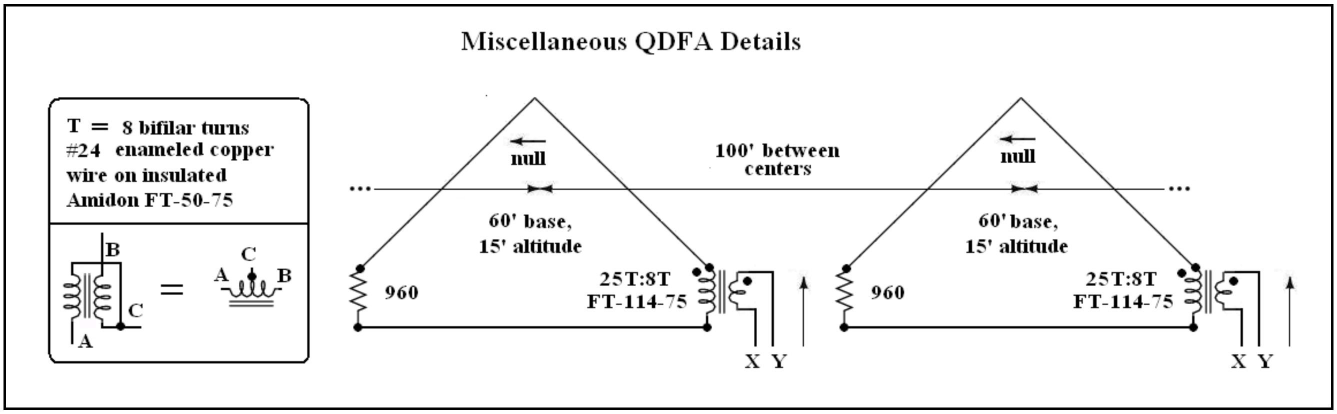
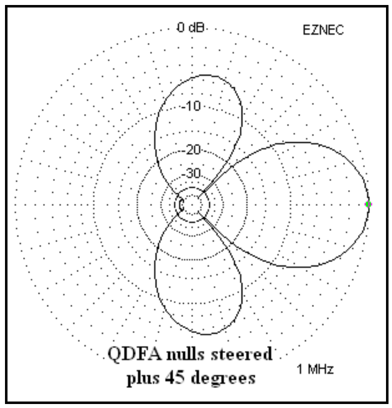
Despite what is said below, null steered QDFA's were never really meant to be null steered with a variable phaser because it is impossible to achieve the desired null steered pattern with a variable phaser. They were meant to be null steered by EZNEC, and then a fixed phaser implemented and used to achieve the desired pattern. These arrays were mere curiosities because of their high losses until the recent inventions of low noise methods for increasing the signal level outputs of flag and delta flag arrays by 20 dB or more.

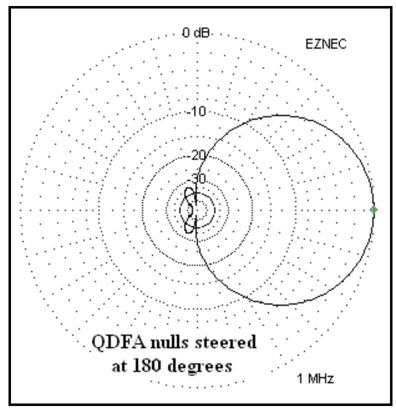




I knew that a dual flag or delta flag (or flag) array could not be null steered without ruining its splatter reducing property, so I assumed the same was true for a quad delta flag (or flag) array. However, I neglected to consider that a QDFA is (in effect) a pair of DDFA's phased in a particular manner, and so I did not consider null steering a pair of DDFA's. The reason a DDFA does not null steer well is because the null aperture of a DDFA reverts the the null aperture of a single flag when steered, which is poor, plus two narrow (poor) nulls off the side of the DDFA plane of symmetry. The same effect occurs for a pair of null steered DDFA's, but in this case the null reverts to a DDFA null (which is excellent, typically 90 degree or more null aperture), plus two narrow nulls off the side of the QDFA plane of symmetry. This allows the formation of patterns heretofore not possible, including a QDFA-like pattern with 30 dB aperture of 180 degrees (compared to the fixed QDFA null aperture of 150 degrees) and patterns with the two side nulls at varying angles of the front lobe of the pattern, which in effect is like a very long narrow beam width beverage but with a much better front to back ratio. Two such patterns are shown at right.



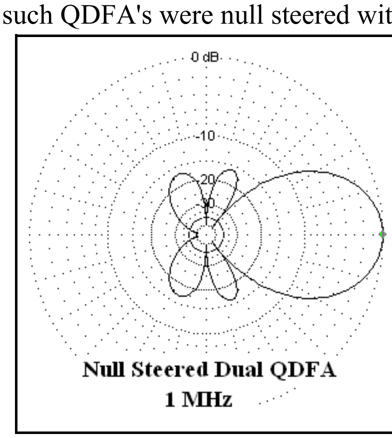
QDFA nulls steered plus 45 degrees



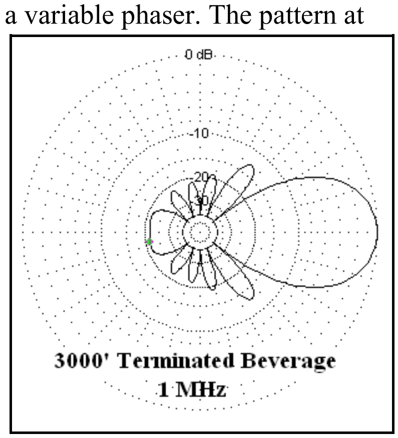
QDFA nulls steered at 180 degrees

The null steered QDFA has not been tested, and I have not yet decided how to interface the variable phaser with amplified DDFA pair, how far to place the fixed phaser from the delta flag elements, or whether the variable phaser should be my passive phaser or modified Misek phaser. There are several options, and the ones shown are not necessarily the ones I will implement. This is clearly a work in progress. Stay tuned. Remember especially that the patterns predicted by EZNEC are not always the patterns we get in the real world.

It is possible that the concept of QDFA null steering can be used to customize the pattern of more complex arrays. For example, suppose the QDFA pattern above with 45 degree forward nulls was made with a fixed LC delay phaser instead of a variable phaser. And suppose two such QDFA's were null steered with a variable phaser. The pattern at right shows such a dual QDFA array with variable nulls at about 90 degrees. The variable nulls can be steered through the two symmetric side lobes, which generates four smaller side lobes and two additional very deep nulls This pattern is similar to a very long (3000' +) beverage at 1 MHz; see the patterns at right. Notice, however, that the front to back ratio of the null steered dual QDFA array is much better than the beverage, which means that the splatter reduction of the null steered QDFA will be better than the



Null Steered Dual QDFA
1 MHz



3000' Terminated Beverage
1 MHz

beverage. The 1 MHz NSDQDFA pattern above also gets progressively better than the beverage, especially if appropriate size flag elements are used in place of the delta flag elements. Furthermore, it is difficult to find a coastal site where you can put up a 3000' beverage pointed in the direction which you want to listen. A null steered dual QDFA array requires less than 800 feet of linear space.

A single QDFA with fixed null steering can be designed with a pattern which is much better than a 1000' terminated beverage in the MW band. It requires less than 400 linear feet of space. Below are low band, mid band, and high band patterns for both the null steered single QDFA above and a 1000' terminated beverage. If a picture is worth a 1000 words, then the 6 pictures below are worth 6000 words.