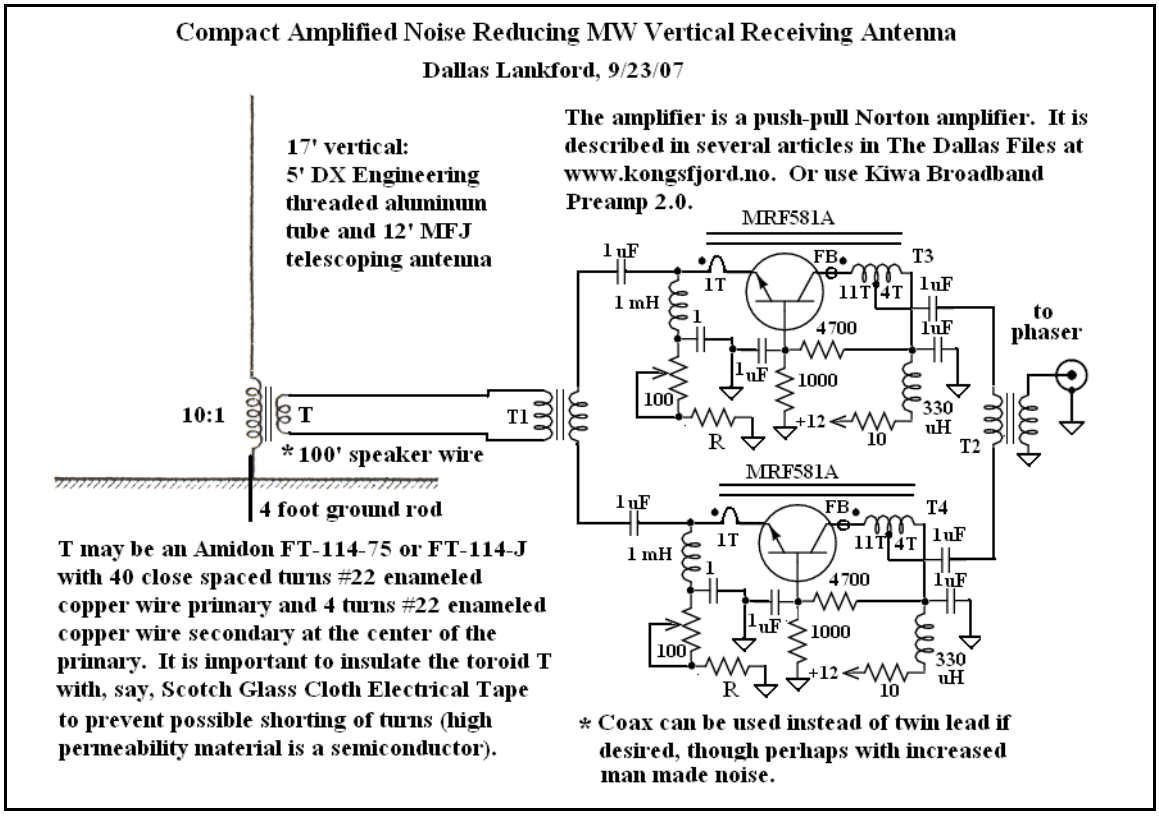
Close Spaced Phased MW Vertical Receiving Antennas

Dallas Lankford, 9/22/07, rev. 1/7/08

In order to have good nulls throughout the entire MW band, it has been commonly believed that phased receiving antenna arrays consisting of two inverted L's, two verticals, two loops, or generally any two identical antennas suitable for MW reception should be separated by about 0.1 λ at the low end of the MW band (about 150'). I do not know the origin of the 0.1 λ separation condition, but measurements I made in the 1990's with inverted L antennas agreed with it. I found that separations of inverted L antennas significantly less than 0.1 λ gave lower "left over" signals after nulling, especially at the low end of the MW band. At that time I did not make measurements for other pairs of antennas, such as verticals, but merely assumed that the 0.1 λ separation condition applied to all other MW phased receiving arrays which used pairs of identical antennas.

A few months ago some new man made noise originating from my next door neighbor's house made it necessary to move one of my 15' (nominal) amplified noise reducing vertical receiving antennas and reduce the separation to 105'. The reduced separation concerned me, but fortunately "left over" signals after nulling were not decreased. There matters remained until a few days ago when it occurred to me that perhaps the 105' separation between the verticals could be further reduced without degrading the nulls. The vertical antennas used for these tests are described in the figure below. The phasers used for these tests were a MW Phaser #2 and a 100 kHz – 30 MHz Passive Phaser; see The Dallas Files .



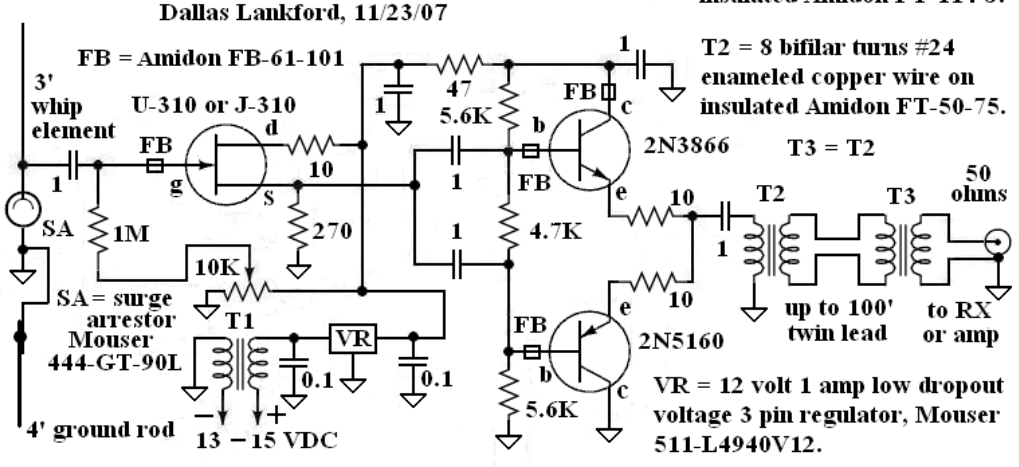
First, 60' separation was tried, and the nulls were just as good as for 105' separation. Some nulls were more difficult to adjust, but that was not a problem for my modified Misek phasers which have vernier "phase" controls. Next, 30' spacing was tried, but nulls at lower MW frequencies were not good; "left over" signals after nulling were much weaker and in some cases virtually nonexistent compared to 60' (or 150') spacing of the verticals. Then 45' (15' vertical and 30' horizontal) inverted L antennas were tried with 60' separation, but "left over" signals after nulling at were considerably weaker than with 150' spaced inverted L antennas, especially at the low end of the MW band.

Later I tried active whip antennas with 3 foot whip elements, including regular and simplified complementary push-pull output active whip antennas, spaced 60 feet apart and their nulls were excellent throughout the MW band. A brief description of one of the active whip antennas used for these tests is given below; see The Dallas Files for additional information about active whip antennas. Be sure to read the parts about low noise AC-DC power supplies for active whip antennas, especially if you are a MW or LW DXer.

In conclusion, short verticals spaced 60' apart make excellent MW phased arrays, but inverted L's spaced 60' apart do not, and short verticals spaced 30' apart do not. I recommend against phased pairs of loops for several reasons, including that they cannot be spaced closer than about 132 feet apart which is the spacing required by delay line phased arrays using two ALA-100 loop antennas. Moreover, claims that phased loops or any other kinds of phased arrays are equal to beverages are simply nonsense. Nevertheless, now we can enjoy excellent phased MW receiving array with considerably less real estate than before!

Simple IIP2 Adjustment For Revised Simplified Complementary Push-Pull Output Active Whip Antennas

Dallas Lankford, 11/23/07



T1 = 30 bifilar turns #22 enameled copper wire on insulated Amidon FT-114-J.

T2 = 8 bifilar turns #24 enameled copper wire on insulated Amidon FT-50-75.

VR = 12 volt 1 amp low dropout voltage 3 pin regulator, Mouser 511-L4940V12.

10 ohm drain resistor should be 1% all other resistors 5% or better, adjust 10K ohm pot for 0.200 volts across 10 ohm resistor using 2% accuracy or better DVM.

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While this method of adjusting IIP2 is not ideal, it does have the advantage of being simple. A 12 volt voltage regulator is used to establish a constant DC supply voltage because IIP2 of the active whip is sensitive to changes in its DC supply voltage. A number of FET's were installed one at a time in a given active whip circuit and several parameters for each of the FET's were measured. No components other than the FET's of the active whip were changed. A 10 ohm 1% resistor was inserted in series with the FET drain to simplify measuring the total FET current. The FET current was found to be the most accurate measure of IIP2. For U-310's maximum IIP2 was 19.5 mA ± 0.1 mA (0.195 ± 0.001 VDC). For Motorola J-310's maximum IIP2 was 20.0 mA ± 0.1 mA. For Fairchild J-310's maximum IIP2 was 20.7 ± 0.1 mA. Measurements were made with a DVM having 2% accuracy. The voltage regulator output was measured as 12.04 VDC. The 511-L4940V12 regulator is rated as 12.00 ± 0.25 VDC. We picked 0.200 VDC as the adjustment voltage because it is approximately the mean of the voltages we measured. You can use the voltage for the particular FET you use. However our sample was not large enough to determine if that is a better strategy.