

Modifying a 75m Four Square Array for 80m operation

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In the summer of 2000, I installed my 75m four square array. The array uses four Force12 #EF-180BV shortened verticals fed from a Comtek hybrid coupler. The verticals are approximately 34-feet high and use linear loading. The array is centered at 3.795 MHz and because of the use of shortened verticals the useable bandwidth (<10 kHz) dump power is a little more than 110 KHz. Over the years I have made many modifications to the array in order to improve its performance but was never able to use the array down on the CW end of the band.

Finally during the summer of 2006, I decided to modify the array so that I could also use it in the bottom of the 80m band below 3.550 MHz. To do this I installed a relay and a loading coil at the feed point of each antenna so that each vertical could also resonate at 3.505 MHz. I also built a new phasing network that was designed to switch in the correct phasing line for either the SSB or CW area of the band. Four $\frac{1}{4}$ wavelength phasing lines were cut from RG6 each resonant at 3.795 MHz. Four shorter phasing lines were also cut that when added to the longer ones would resonate the two at 3.505 MHz. Control lines were run back to the shack from the array and the Comtek control box was modified with a SPDT switch so that both the verticals and phasing network could be controlled from the shack. A block diagram of one of the verticals is shown in Figure 1.

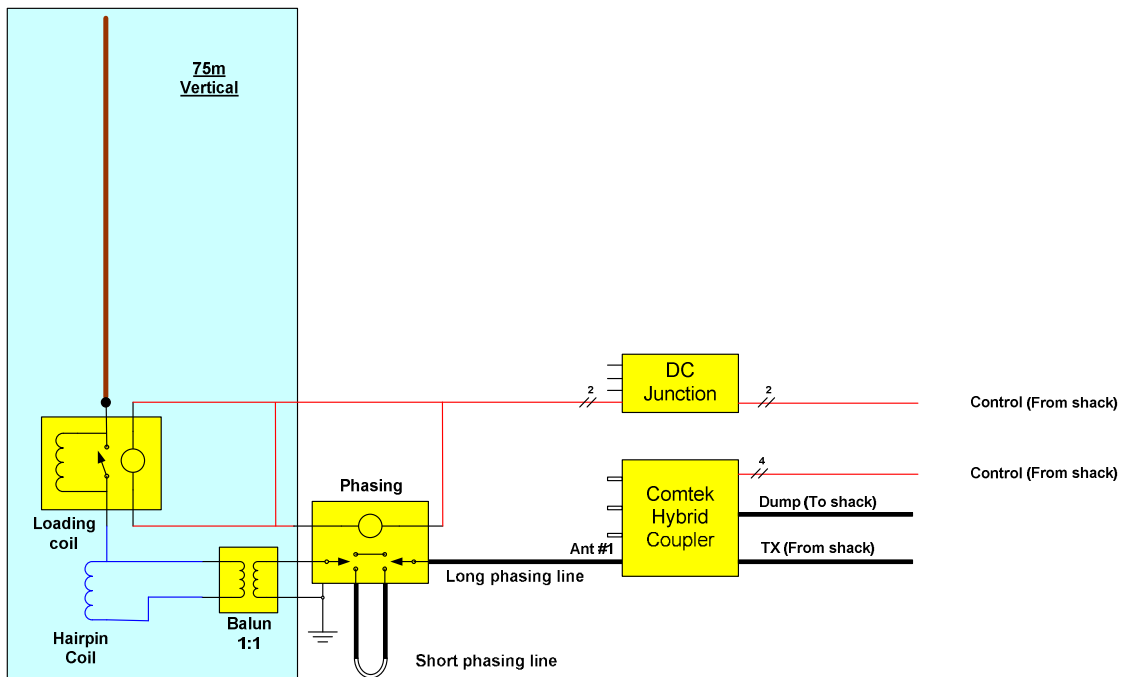


Figure 1 – 75/80m Four Square Array (Single vertical)

While the relay and loading coil were purchased from Force12, I put together the new phasing network myself. The relays were purchased from Comtek Systems (the same ones used in the hybrid coupler) with the remaining parts either already on hand or purchased from local sources. Figure 2 shows a close-up of one of the new phasing network switch boxes installed with the cover removed. The phasing lines were cut using a MFJ-259B and all RF paths to / from the relay use heavy gauge solid copper wire removed from standard Romex house wire.

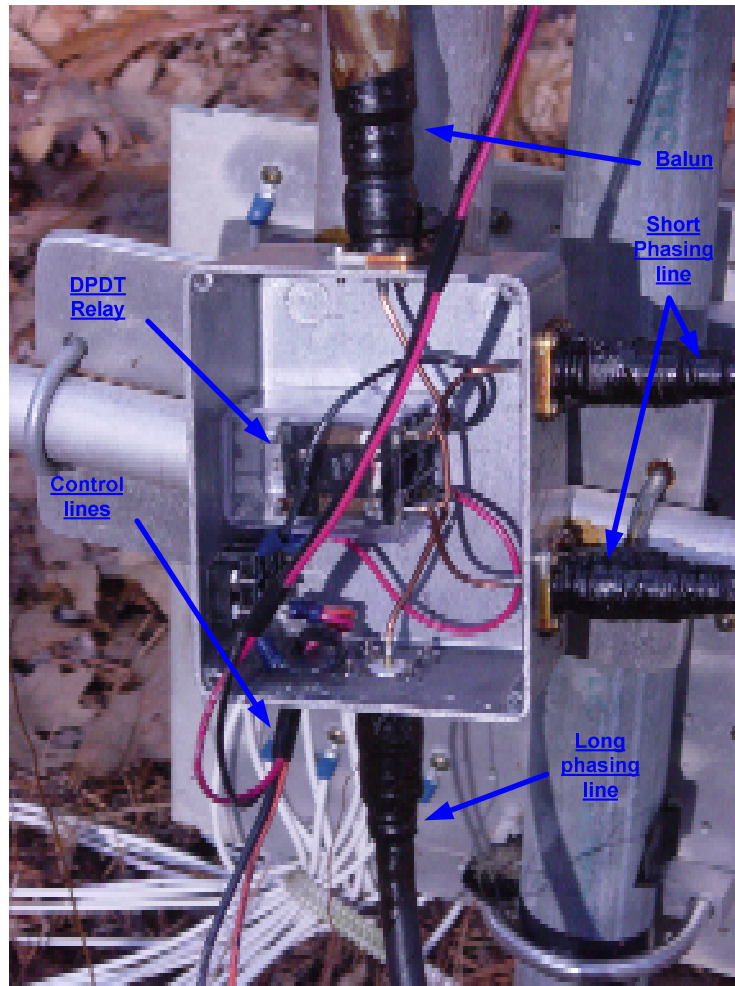


Figure 2 – Close-up of one of the phasing network boxes

After installing the loading coils and phasing networks, the array was realigned. Each vertical was adjusted to resonate at 3.795 MHz. Then the loading coil is switched in and adjusted to resonate at 3.505 MHz. Once all four verticals had been adjusted the array was balanced first at 3.795 Mhz and then at 3.505 MHz. I used my 100w transceiver and a QRP power meter initially then made final adjustments with 1KW of drive and a Bird #43 with a 50H slug. Refer to table 1 for test data both in the SSB DX window and the CW DX window.

SSB BAND

	Min Dump	10% Dump (low)	10% Dump (high)	Useable BW
NE	1.8% (3.798 MHz)	< 3.750 MHz	3.865 MHz	115 KHz
SE	1.7% (3.798 MHz)	< 3.750 MHz	3.878 MHz	128 KHz
SW	1.8% (3.798 MHz)	< 3.750 MHz	3.862 MHz	112 KHz
NW	1.8% (3.798 MHz)	< 3.750 MHz	3.875 MHz	125 KHz

CW BAND

	Min Dump	10% Dump (low)	10% Dump (high)	Useable BW
NE	2.0% (3.505 MHz)	< 3.500 MHz	3.551 MHz	51 KHz
SE	2.6% (3.505 MHz)	< 3.500 MHz	3.547 MHz	47 KHz
SW	1.8% (3.505 MHz)	< 3.500 MHz	3.552 MHz	52 KHz
NW	2.4% (3.505 MHz)	< 3.500 MHz	3.548 MHz	48 KHz

Table 1 – Test data from modified Four Square array

About the only thing I regret besides waiting so many years to make this modification is not centering the array a little in the CW band to increase the useable bandwidth. In the end the array performs just as well down on the CW end (Gain & F/B) as it does up in the SSB end. While in general four square arrays consisting of shortened verticals are less efficient than those using full-size elements, they hear just as well.