The evaluation of The Lankford and WA1ION/Quantum Phasers

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I wanted to compare the design used by Gerry Thomas in his Quantum Phaser with the Lankford/Misek phasers that I have been building until now. Figure 1 is the schematic of the test jig that I used to evaluate the WA1ION Phaser, which was the basis for the Quantum Phaser. (The original design by Mark Connelly called for T1 and T2 to be a MiniCircuits MCL 16-6T (which is 16:1, or 50Ω/800Ω). Also in one of Mark's articles, his Passive Phaser used a BN73-202 core with 3T/12T, which is also a 16:1.) I wanted to use high quality potentiometers for the phaser because they get a lot of use, so I found some Clarostat potentiometers that are rated for 1 million cycles.

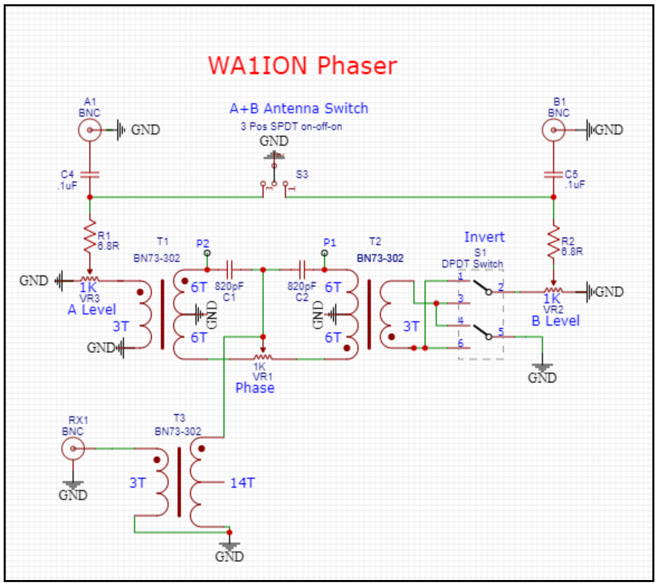

Figure 1 – test jig

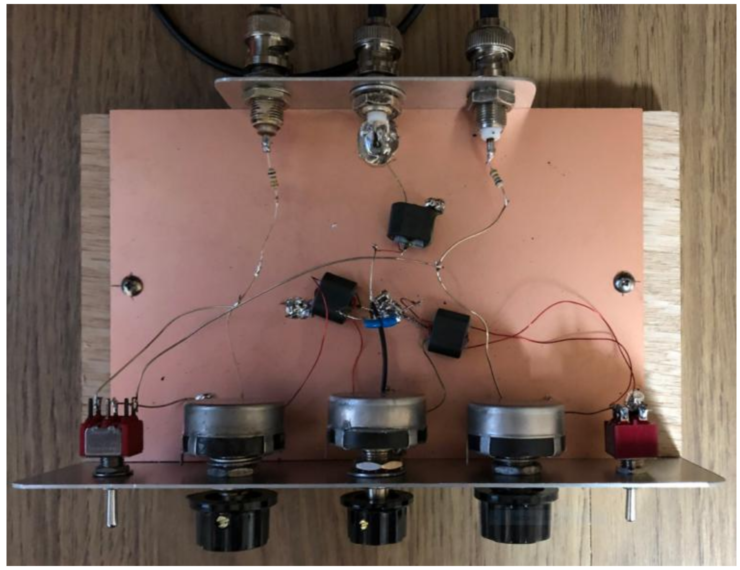

Figure 2

Figure 2 is a top view of the test jig, while Figure 3 is a schematic for the Norton Amplifier used to amplify the output from the phaser. The reason I decided to use a Norton amplifier is that it has excellent IMD properties and a high tolerance to overloading.

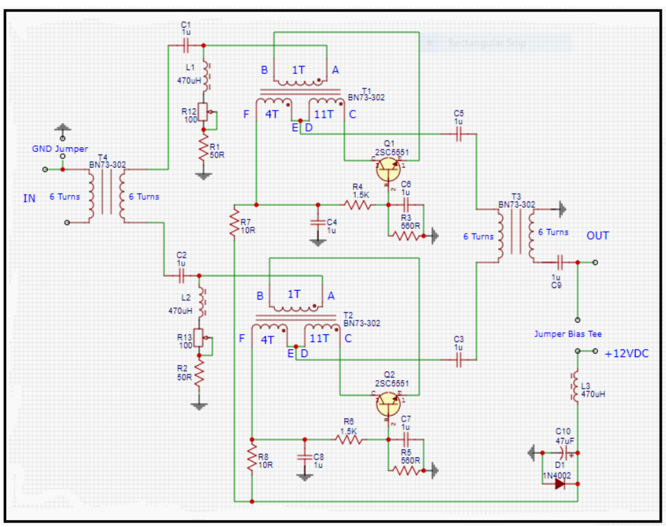

Figure 3

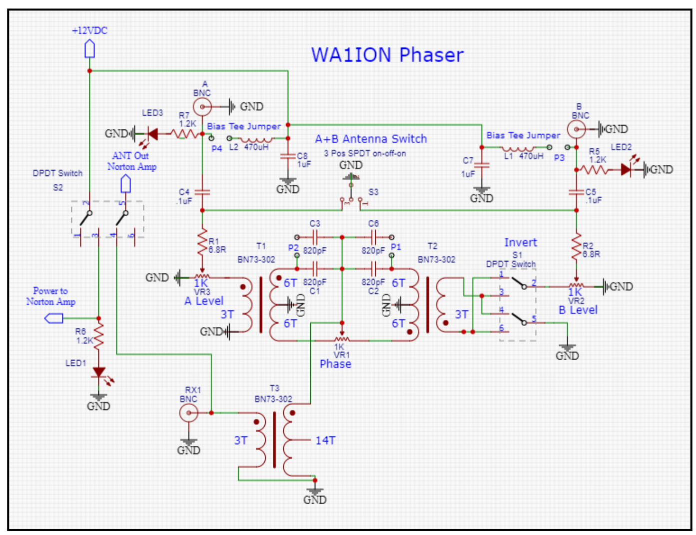

Figure 4

I found that the best way to adjust the WA1ION Phaser was to use the A/B switch and adjust one or both gain pots to give equal signal levels on each channel. Then, adjust the phasing pot for best null, checking for best side using the inverting switch. Do a final tune by going to either gain control and back and forth to the phasing control for deepest nulls.

In actual use, I found it as easy, if not easier, to find the null and to separate two or more stations on the same frequencies as with the Lankford or DXE NCC-2 phasing systems.

I have two Low Noise Vertical antennas that are spaced about 200' apart on an East/West line, and noticed that I was able to get a 3 to 4dB SNR gain using the phaser with 2 antennas vs either antenna by itself. One of the other things I like about this Phaser design is it works well above 15 MHz without having to add additional capacitors and inductors.

In this version of the phaser I am using a Norton amplifier on the output and have it set up so when the power is off it bypasses the Norton amp, thus the phaser will work in a passive state. The advantage of using a Norton amplifier is it has outstanding IMP properties, is very resistant to over load and is very low noise. I also added jumpers on the PCB so power can be supplied to the BNC connectors to feed power to active antennas. Figure 4 shows the final design of the WA1ION phaser.

Figures 5 and 6 show the Bud CU-3008-A 7" X 5" X 3" case that I used, which worked out for a nice compact design, while Figures 7, 8 and 9 show the interior design of the case.

Figure 5

Figure 6

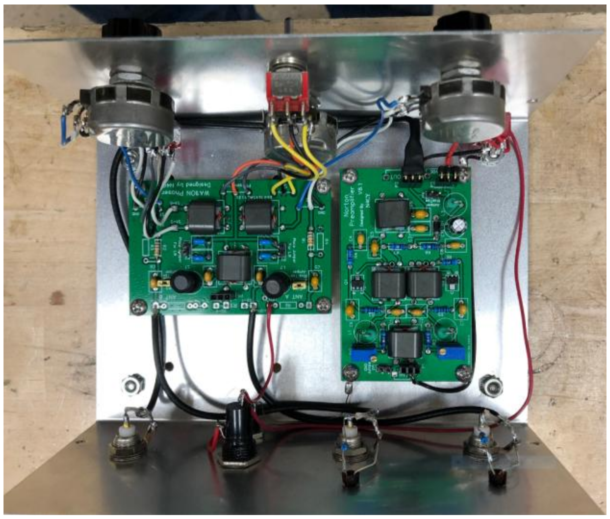

Figure 7

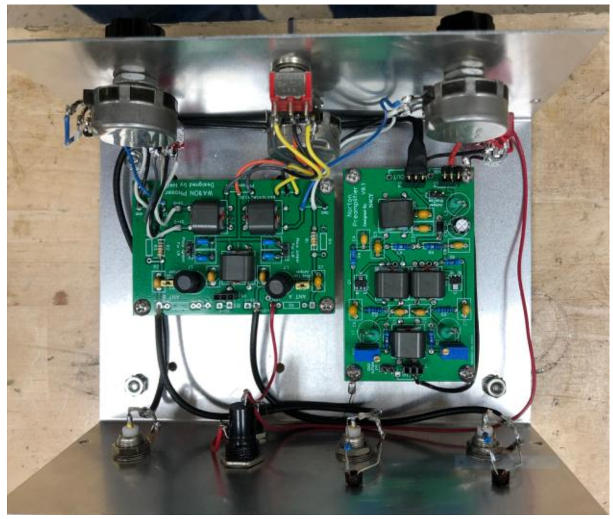

Figure 8

Figure 9

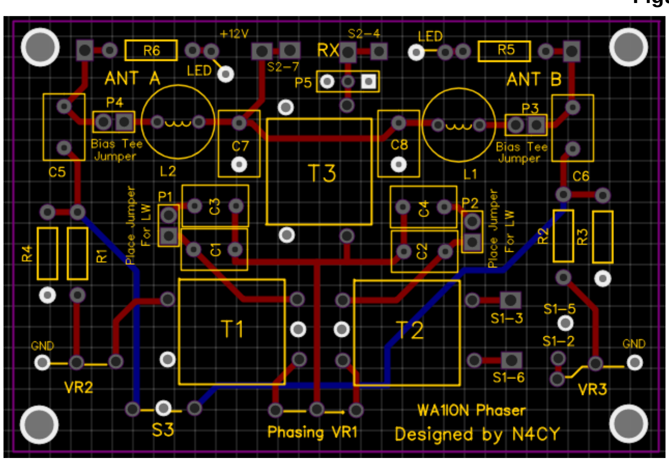

Figure 10

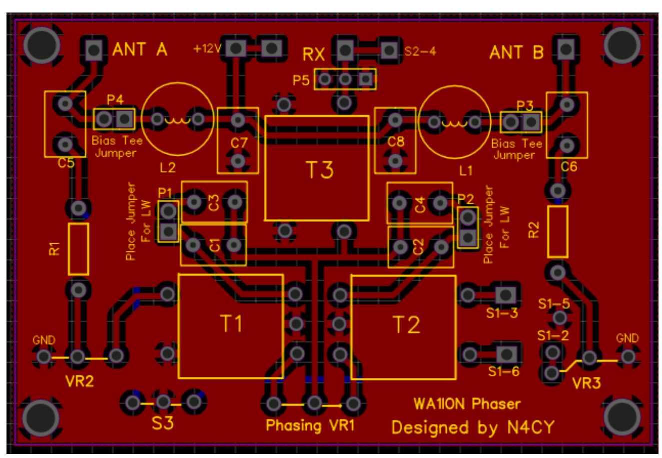

Figure 11

Figures 10 and 11 show the circuit board layout for the WA1ION phaser.

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While I was evaluating the design, I ran a test to find out how deep a null I could get with the WA1ION Phaser vs the Lankford, as I was always told that the Lankford could get deeper nulls. So I thought that a test bench approach would be better than trying to do it connected to my antennas, with static and QSB making the null difficult to find.

I set up my Dual Channel signal generator to output both channels at 1,000 kHz with -50dBm sine wave. The WA1ION Phaser had a Norton Amp between the phaser and my NetSDR Receiver. In the test below, both signal inputs were in phase for one of the tests and then I set one of the inputs 180° out of phase.

WA1ION Passive Phaser + Norton	180® Out phase	In Phase
Null	-101.6dBm	-100.1.6dB
inverted	-42.0dBm	-42.0dBm

During this test, I noticed that the signal levels were very close to each other at the end of rotation of the pot. Also, both the in-phase and out of phase nulls were at the center of the Phase pot rotation.

Based on the data, I found that you can get as deep nulls with the WA1ION/Quantum Phaser as with any of the Lankford designs I've tried.