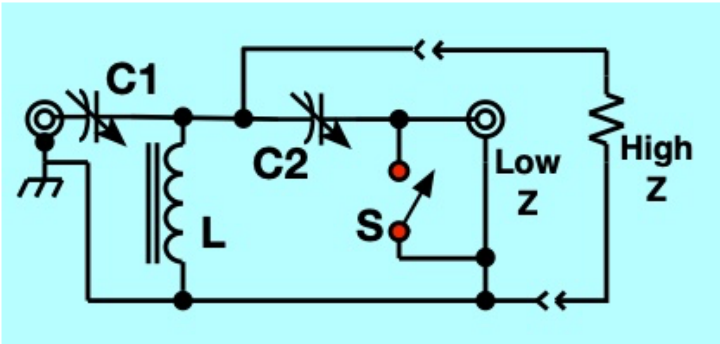

A Simple Modification to a Classic Transmatch

Wes Hayward, w7zoi, Nov 4, 2023

Most of us have, at one point or another, built a transmatch to guarantee that perfect match for our transmitter. A popular design is the so-called Ultimate Transmatch shown in Fig 1. See McCoy, QST, July 1970.

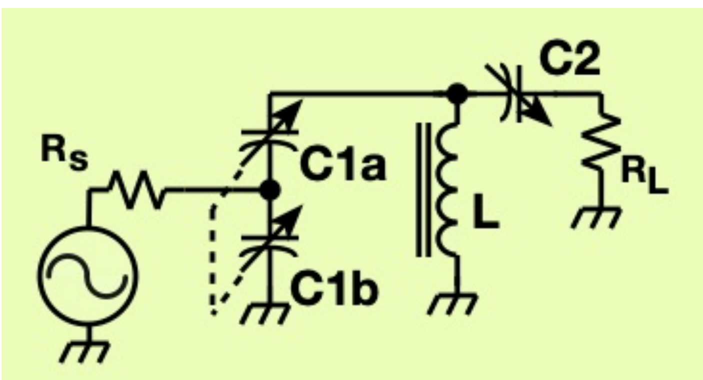

Fig 1. The Transmatch introduce in July 1970 QST.

Other versions were built and the design soon morphed into the CLC high pass form of Fig 2A. But this does not work well for high impedance values. A circuit that will, however, match high Z is a CLC topology using a bandpass circuit, shown in Fig 2B.

Fig 2. Two antenna tuner topologies. That at A works well with low and medium impedance levels while that a B works well for medium and high impedances.

Comparing the two circuits in Fig 2 is interesting. The two circuits differ in the way the load is attached. The load is in series with C2 in Fig 2A, but is in parallel with it in Fig 2B. All that is required to switch between the two forms is a switch that will short circuit the low Z output to ground and an additional connector that will allow a high impedance to be attached. The typical high Z load is an end fed antenna, so a simple binding post does the job.

The transmatch I built is shown in Figures 3,4 and 5. The exact design is not the point of this article. Rather, the goal is just to show a simple hack that can be applied to meet a design need. I don't claim that this is in any way original—I'm sure others have done it for their experiments.

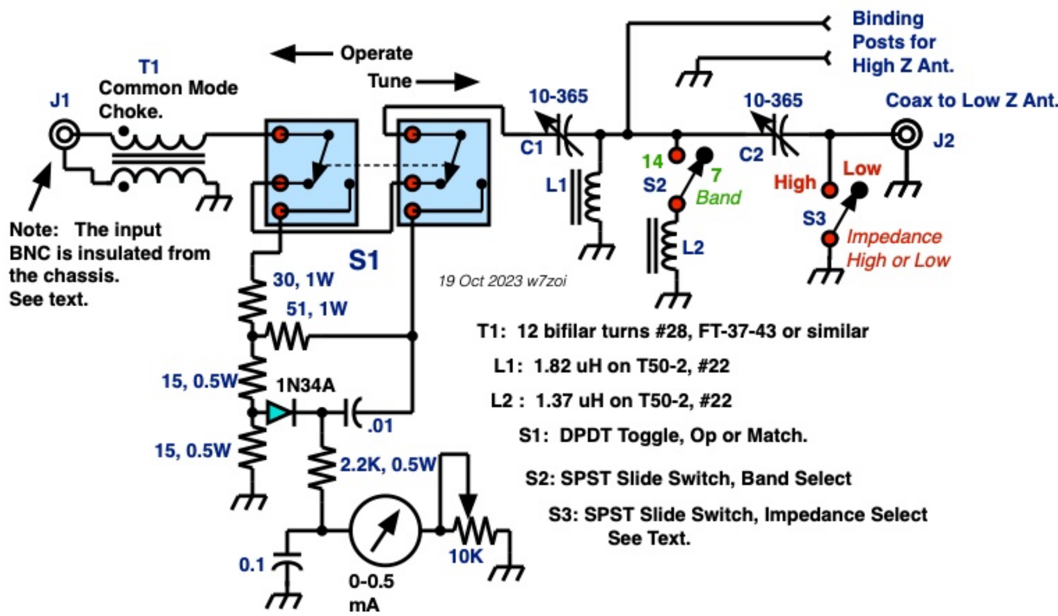

Fig 3. The schematic for my transmatch. This unit is probably good up to 20 watts, or would be with larger inductors and higher dissipation resistors in the bridge.

I didn't have room for an actual switch in the transmatch being hacked, so I used an external shorted male BNC connector. This is placed on a normal chassis BNC connector when matching low Z or near 50 ohm loads.

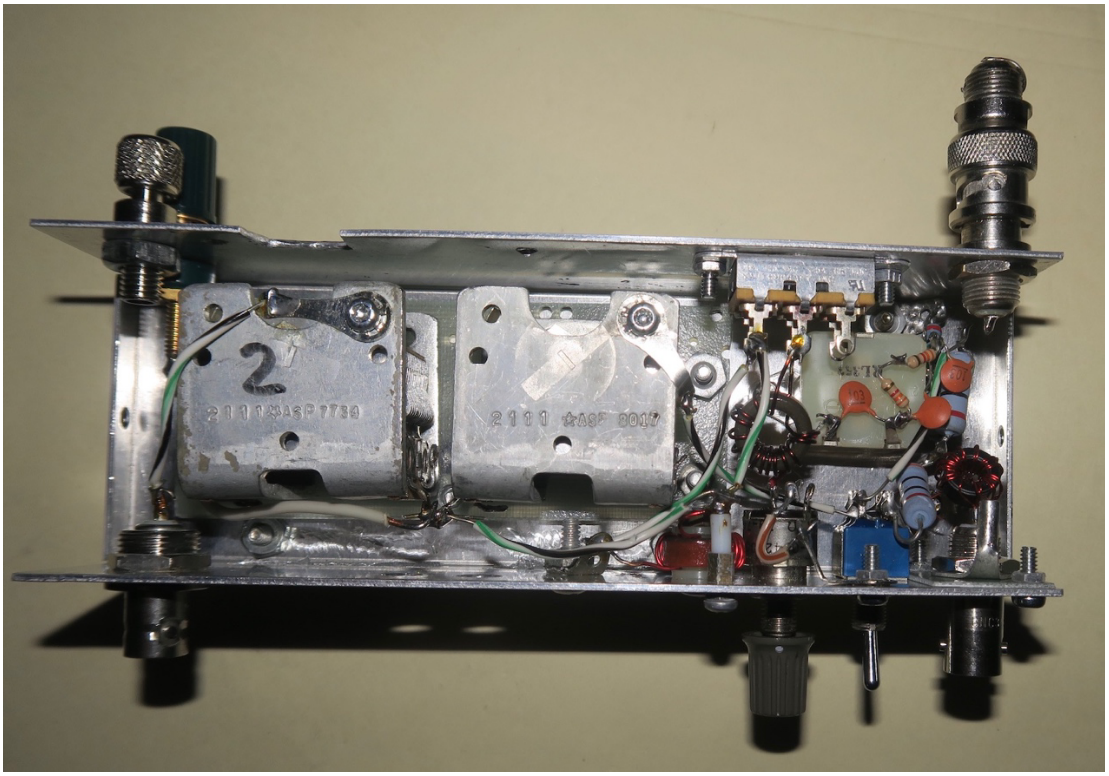

Fig 4. Inside view of the wide Z range transmatch. The isolated input is at the lower right along with the common mode choke. Binding posts are at the upper left while the low Z load port is at the lower left. The BNC connector at the upper right is not part of the circuit, but holds the male BNC that will short circuit the low Z output port when a high Z is to be matched.

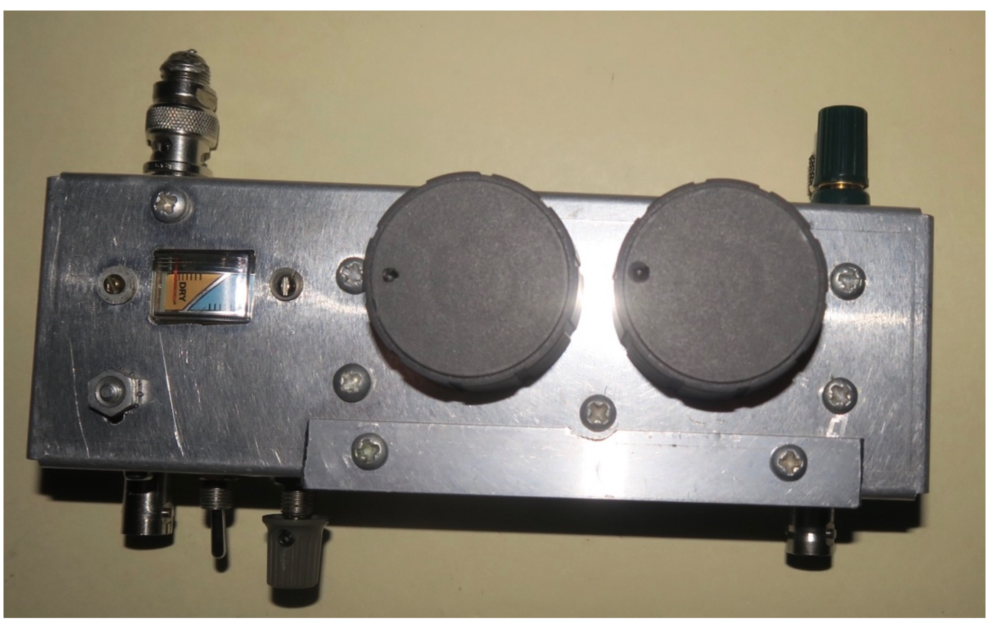

Fig 5. Outside view of the wide Z range transmatch.

The common-mode choke at the input requires a floating coax connector, realized by mounting the connector on a piece of unclad PC board material.   This choke is vital when matching to some very high Z loads such as a EFnHW wire antenna, a cascade of n End Fed Half Waves.   An example would be a 40-meter EFHW that is also used on 20 and 15 meters, n=2 or 3.

There are some special precautions when using the transmatch with a high impedance load. First, there should be NO CONNECTION between the transmatch chassis and the rest of the station ground. The tuner should be on an insulated surface.   If an end fed antenna is to be matched, there should be a short counterpoise attached to the transmatch ground binding post. My QRP buddy Bob, N7FKI, has found that a 3 ft piece of wire is enough for his 20 Meter EFHW antenna.   If the common mode choke is not used, the match will change with hand capacitance.

Impedance Range

Some experiments were done at 14 MHz to evaluate the impedances that can be matched.   A spectrum analyzer with built-in tracking generator and an external return-loss bridge were used. This setup provides information about the bandwidth of the match and makes it very quick to get the set up tuned.   The simple bridge is adequate for field use.

The initial experiments used the classic form.   This is the one that works best for a 50 ohm load. A 10 ohm load was easily matched.   Higher impedances of 300 and 680 ohms could be matched, but only when the 7 MHz inductor was used.   Indeed, placing a short circuit on the output still allowed tuning to an excellent, but narrow bandwidth match.   This was, of course, an anomolus result.   The loss resistance of the transmatch components were being matched.

The circuit was changed to the high impedance mode with a short at the low impedance output.   Various resistors were placed between the binding posts.   680, 300, and even 100 ohm loads were matched with relatively wide bandwidths.   A 51 ohm resistor could be matched, but only to a 20 dB return loss.   (All other experiments produced 50 dB return loss or better).   1.5K and 3.3K loads could be matched, but the bandwidths were becoming narrow. The highest resistance tried was 6.8K and it could still be matched.   In the final extreme, an open circuit was tried and it could be matched, but with a very narrow bandwidth.   As in the earlier short circuit experiment, this match was to the loss in the circuitry.

These experiments were limited to purely resistive loads.   A better experiment (or set of simulations) would show the parts of the Smith Chart that could and could not be matched with each configuration.   These efforts are on that seemingly endless list of things yet to be done.