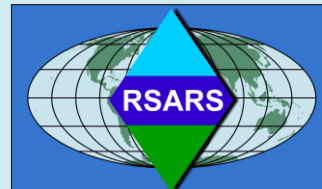


ALTAI CB SWR Meter Conversion for HF Bands



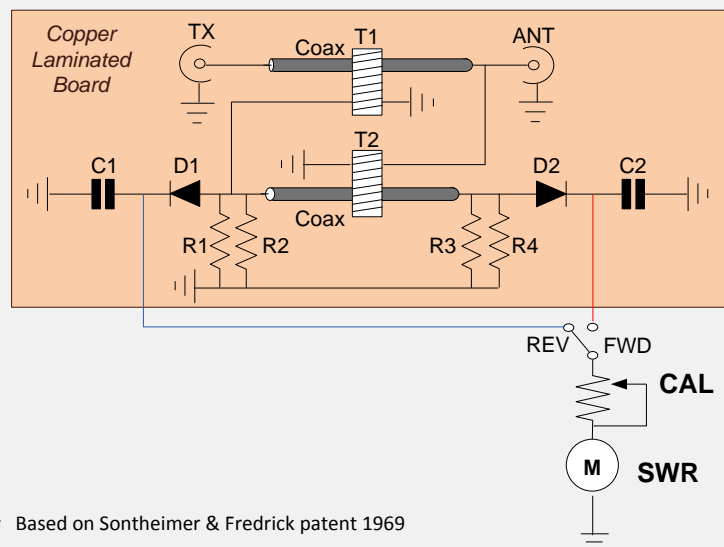
Following the purchase of a Yaesu FT817 rig it was decided to make an SWR meter to match a Breml BRL15 Tuner that had already been modified. The Altai is small and measures 84 x55 x 58 mm excluding the 15mm protrusion of the two rear SO239 sockets. The origin 27MHz CB sensing had to be scrapped and replaced with a wide band sensing circuit. The description that follows describes the final MK2 version.



How to create 50Ω Terminators

100 100	= 50 (0 %)
56 470	= 50.038 (0.076 %)
47 + 3.3	= 50.3 (0.6 %)
68 180	= 49.355 (-1.29 %)
39 + 12	= 51 (2 %)
33 + 18	= 51 (2 %)
27 + 22	= 49 (-2 %)

Broadband Tandem Coupler



Based on Sontheimer & Fredrick patent 1969

PARTS LIST

2 pieces 50 Ohm coax
 R1, R3 = 56R 1.0w Carbon Film
 R2, R4 = 470R 0.5w Carbon Film

D1, D2 = OA91 germanium
 D3+D4 = 1N4148 silicon
 C1-C3 = 0.047uF disc ceramic
 T1, T2 = 30 turns PTFE Covered
 0.5mm dia wire

M = original ALTAI meter
 # VR1 = original ALTAI

The original circuit used two Murata cores 18mm OD11mm and ID 8 mm thick. These are wound with 30 turns of 0.5mm PVC insulated wire, but enamelled wire can be used.

Suitable alternatives are Amidon FT50-61 which are slightly different in size

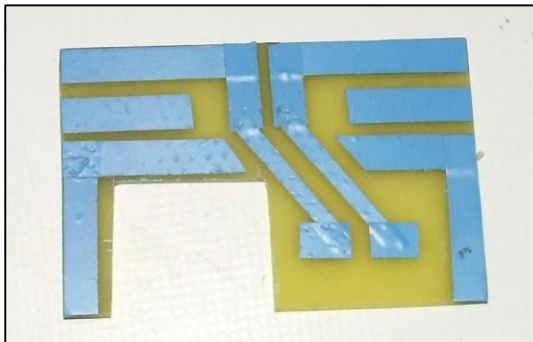
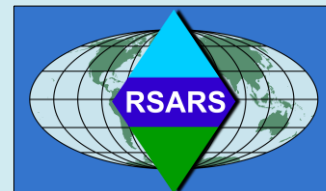
The coupler's accuracy is dependant on four main components.

1. Matched germanium diodes. A DVM is used to check the forward voltage drops of each diode are the same.
2. 50Ω terminating resistors. The table shows useful combinations of preferred value resistors to make these.
3. Two short pieces of good quality RG58 coax for the two short transmission lines.
4. Matched coupling transformers each with 30 turns wound on Amidon FT50-61 cores.

The coupler circuit has a voltage transformer connected to the antenna side of a short transmission line and a current transformer sensing the current flowing between the transmitter and antenna. The scaled samples from the two transformers are superimposed onto the second coax acting as the measuring transmission line. The voltages across R1//R2 and R3//R4 are proportional to the forward and reverse power levels, which are measured using the meter connected as a voltmeter. The 25k meter calibration resistor is used to set the full scale deflection on forward power and the switch allows the reverse voltage reading to read off as the SWR.

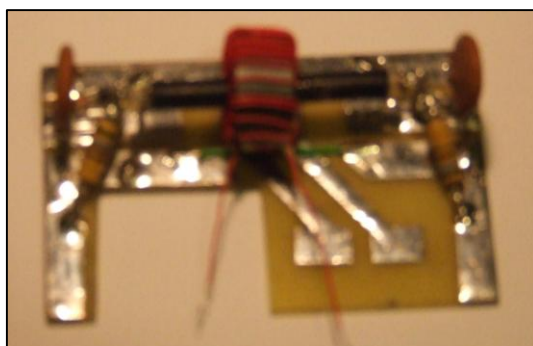
G8ODE

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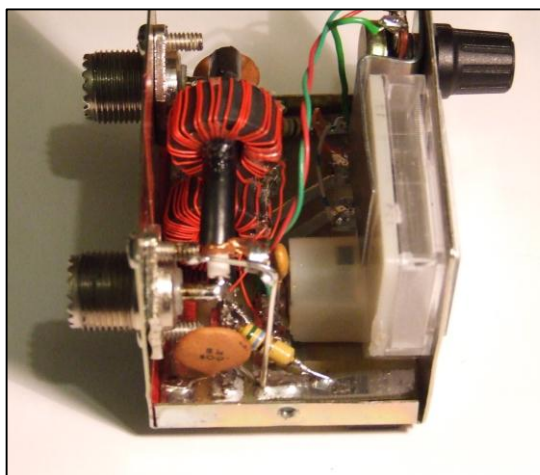


The new coupler glass fibre PCB replaces the original circuitry inside the Altai SWR meter. It also requires a cut-out so that the PCB can slide under the front panel meter. It is relatively simple to make using a junior hacksaw, a metal file, electrician's insulation tape and bath of ferric chloride. See details below.

The photo shows the PCB prepared for etching. The tracks were kept simple so that the tape could be laid in straight lines as much as possible.



The coupler PCB with the measuring line installed. Two pieces of stiff silver plated wire were used to create "L" shaped supports at each of the 50 Ω coax. The bottom of each is soldered to each of the shorter copper lands on the PCB, creating a short metal support, used to solder together the two resistors, the decoupling capacitor and diode. The wires should be long enough to support the 50 Ω coax so that it passes centrally through the toroid.



The two SO239 sockets are connected using a short piece of 50 Ω coax which is connected only to ground and the Breml chassis at one end. This can be seen as the long silver plated vertical wire in the photo. The coax is inserted into the voltage transformer and is later secured with clear contact adhesive.



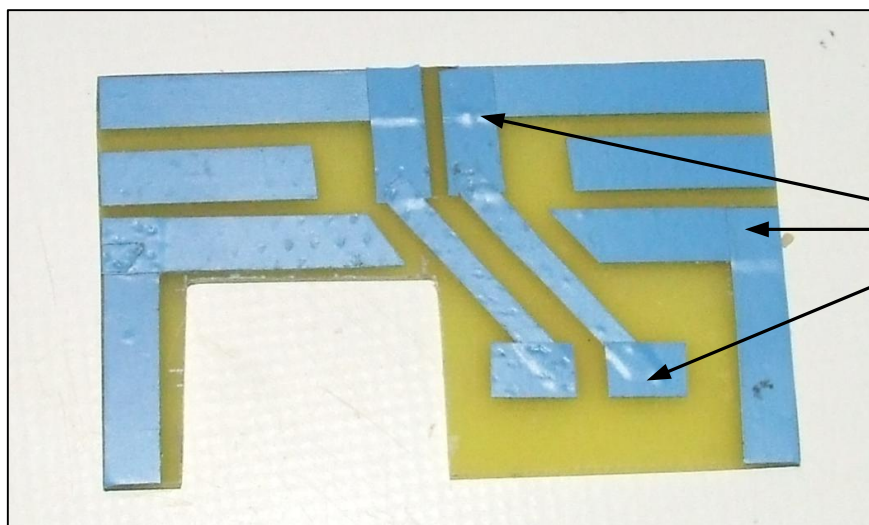
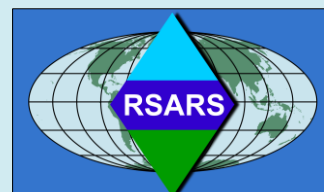
The photo shows the front view of the SWR meter after modification and the red and green wires that provide the forward and reverse voltages to the calibration potentiometer via the FWD-REF switch underneath the knob.

The PCB does not require any secondary fixing, since it is held in place at the front by the lower edge of the meter and at the rear by the vertical ground wire connected to the braid of the 50 Ω coax.

The modification is tested with a low power transmitter using <10w on each of the required HF bands

A 50 Ω dummy load is connected to the antenna socket and the SWR should read 1:1 if everything is working correctly.

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Electrician's tape is carefully overlapped to ensure that the etching solution is unable to "creep" under the tape to dissolve the copper and create unwanted hairline fractures.

How to make a single sided Printed Circuit Board (PCB).

The fibreglass printed circuit board (PCB) is easy to make. The copper side is cleaned using a soap impregnated wire wool pad normally used in the kitchen for scrubbing pans. The board is washed in water and again in alcohol to ensure the surface is degreased. This ensures that the ferric chloride solution is able to work on the exposed clean copper. The PCB is completely covered with white electrical insulation tape that is firmly pressed onto the copper surface. Using a ball point pen, the copper tracks are marked on the tape and the area to be removed is shaded to identify it.

Using a scalpel or sharp knife cut along the lines around the shaded areas. Press down on the tape again to ensure it is firmly stuck to the copper before putting the PCB into the etching solution. Remove the shaded white tape to expose the copper areas to be removed. The etching solution used for this is made by dissolving brown ferric chloride crystals in warm water in a plastic or glass dish (carefully follow the suppliers instructions when doing this).

Finally immerse the PCB face up in the solution and agitate from time to time to ensure that the copper is removed evenly. After about half an hour the etching process is usually completed and the PCB is removed and washed in warm water. The white electrical tape is removed to expose the PCB copper tracks as shown below. The tracks should be tinned to protect the copper using flux to help the solder to spread thinly and evenly over the copper.

WARNING:-

***Ferric chloride splashes will stain and cause skin irritation.
Read the instructions carefully before using the product***

This coupler, based on the Sontheimer & Fredrick patent has been reliably used twice, once for this project and for the Zetagi SWR & Power meter modification (available in RSARS e-Library) with the same sized toroid cores. The circuit is simple enough for homebrew SWR projects or for modifications to cheap CB type meters