

Antenna tuning unit

Written by Hans Summers

Saturday, 20 June 2009 16:07 - Last Updated Saturday, 04 June 2011 00:00

This Antenna Tuning Unit also incorporates a 50-ohm QRP dummy load, power meter (1 or 10 Watts full scale), and SWR meter! I have used this ATU for a variety of longwire antennas, including outdoor antennas of various lengths and much shorter indoor (attic) antennas. I have used it on 80, 40, 30 and 20m. It has always had no difficulty providing a good match to the 50-ohm transmitter output.

Circuit Diagram and photos

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Notes on the Circuit Diagram

1. R1, R2, and R3 are 50 ohm resistances, each one is made by connecting five 2-watt carbon film 10 ohm resistors in series.

2. R4, the dummy load is a 50 ohm resistance made by connecting in series two 25 ohm resistances, each of which is constructed out of four 2-watt carbon film 100 ohm resistors connected in parallel. Therefore the dummy load consists of a total of eight 100 ohm resistors capable of safely dissipating 16W.

3. 0.1 Capacitors C1, C2 were in fact made from two 0.05 capacitors in parallel.

4. The inductor L is wound from 0.6mm insulated hookup wire on a piece of plastic pipe 35mm in diameter and approximately 90mm long. The Antenna side of the coil consists of 48 turns of wire with taps every 4 turns, one of which is selected by the switch S3. The TX winding consists of 16 turns of wire wound on top of the "cold" end of this coil. Holes were drilled in the plastic pipe to secure the ends of the windings, additionally a blob of epoxy glue was added. The coil former is mounted on the base of the box using a nut and bolt at each end.

5. The meter used was a result of the dismantling of some piece of home audio equipment.

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6. S1 is a 2-way 2-pole switch, to select between displaying forward (transmitted) power and reflected power.

7. S2 selects between the Antenna and Dummy loads.

8. S3 is a 12-way 1-pole switch selecting the size of the inductance.

9. S4 selects the full scale deflection range of the meter, between 1W and 10W. The resistors R5 and R6 have values which suit my meter, other meters could have a different full scale deflection current which would require different values.

10. S5 is a 2-way 2-pole switch allowing the variable capacitor to be connected in series with the inductance, or in parallel. With different antennas, one configuration or the other can sometimes give better results.

11. The variable capacitor is the result of the dismantling of some old radio. It has two sets of vanes, which I connected in parallel. I don't know the exact maximum capacitance but would estimate 350 pF. Because the capacitor can be connected in series or parallel, its chassis cannot be connected to the metal box. Insulating washers were used to mount the variable capacitor in the front panel.

12. On the rear of the ATU, two TV-aerial type coaxial sockets are used to connect to the transmitter and antenna.

13. The unit is enclosed in a metal box, which is connected to the transmitter earth. The antenna earth is insulated from the metal box.

Miniature version of the ATU

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This version of the ATU is essentially the same as the one above, but built using smaller components. I built it on a piece of plain un-etched copper PCB but it should be possible to build it into a small tin, e.g. an Altoids tin - everything just depends on the physical choice of components. It should be useful for a few watts of QRP. I hard-wired my ATU for the "parallel" mode, leaving out the series/parallel toggle switch on the original (above) - this is because I found when using the original ATU (above) I nearly always used parallel mode.

The tuning capacitor I used is a miniature 185pF type with plastic insulation. One of the common "polyvaricon" types used in small transistor radios would be suitable too. I added a toggle switch (the one to the left of the two knobs) to connect in an additional 150pF of fixed capacitance, so that effectively the total amount of variable capacitance available is 335pF. The miniature meter I used was from an old dismantled tiny bedside TV, it is labelled 21.68 which corresponds to the UK UHF TV channels. This meter would have been across the varicap voltage on the TV tuner module, and tunes backwards because the varicap voltage is inversely proportional to oscillator frequency. Hence in my ATU the meter is upside-down looking, if referring to the scale. I was planning when all was working, to open the meter and put in my own paper scale calibrated to watts, probably 0..2 Watts or so, in my build. The series resistors to the meter need to be chosen for the desired full scale deflection and the meter characteristics.

The inductor is a T50-6 toroid, with 18 turns primary (the red colour wire) wound on top of the main tapped winding, at the "earthy" end. The main winding is 60 turns (the orange coloured wire) with a tap every 5 turns. I made each tap by twisting a small tag, 5mm or so long, and tinning it in solder for a few moments to remove the enamel. This then connects very easily to the tags on the 12-way rotary switch (see photos below).

Note that I have not yet had the opportunity to try this mini ATU on air so it might need some experimenting with the component values e.g. the number of turns on the toroid, to get it exactly right.

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