

Building a Ground Tuner (Artificial Earth) by ZS1JHG

By: John Howard Green , ZS1JHG

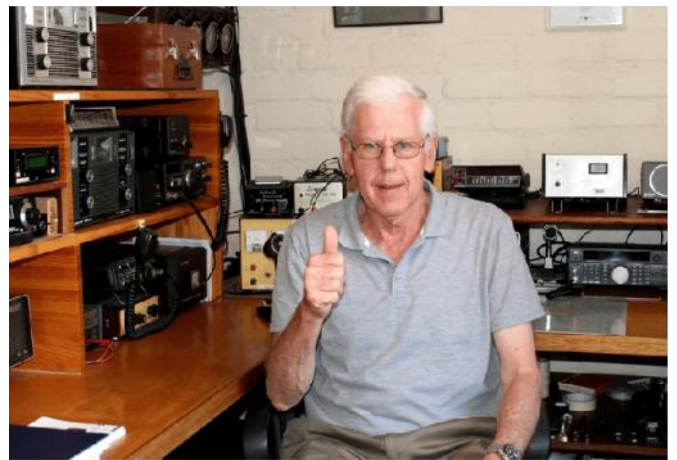
Very good article written by John (ZS1JHG) on application of the Artificial Earth.



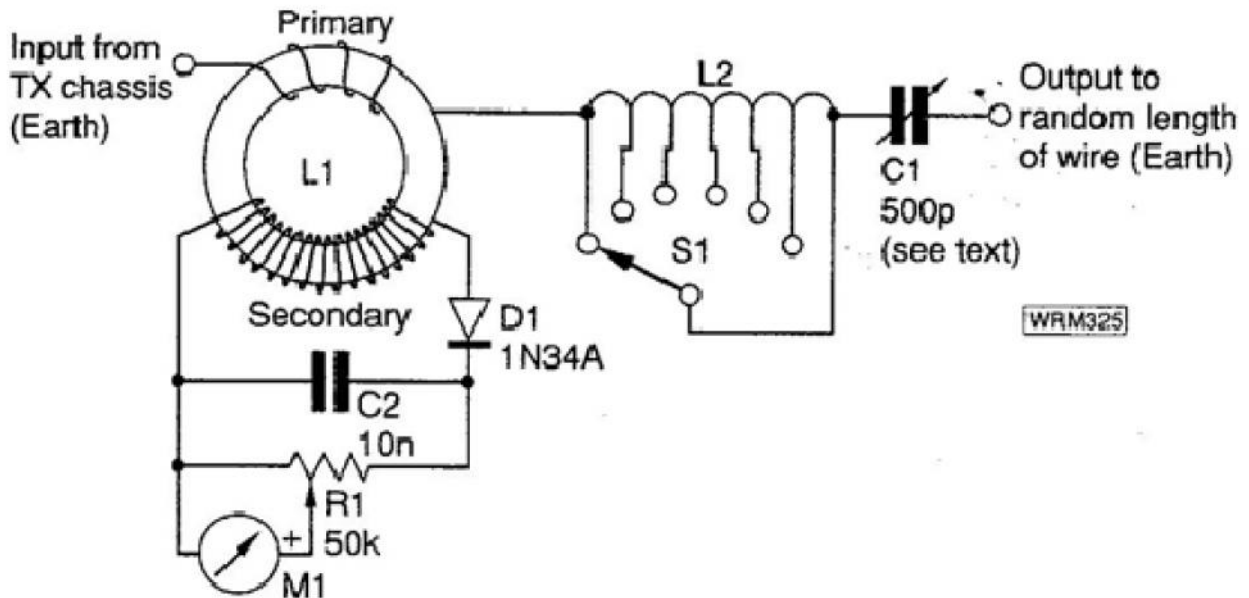
LHS of photo homebrew Earth Tuner and RHS modified commercial ATU to Ground Tuner.



Why must only a Bugatti look good in Red and black



ZS1JHG



Ground Tuner Circuit Diagram by GD4EIP – Practical Wireless Oct 1990

Why build a ground tuner?

The conductivity of your ground varies from one location to the next. This is of particular note to the mobile or portable radio station. Using short vertical or end fed antennas a good low resistance ground is required for efficient operation as you are tuning your antenna against this ground often shown illustrated as a dotted line representing the missing half of the earth side of the dipole.

If your radio station is located in an apartment or double story building then the Ground tuner attached to a suitable counterpoise can act as an Artificial Earth.

Construction Notes

Building the coil

Locate a wood dowel or hollow object 37mm in diameter and fasten one end of the copper wire by screw or self tapper and close wind on 13 turns . Then space the turns evenly apart about 3mm by stretching out the coil on the former and fasten the end with another screw.

Next cut some acrylic (Perspex) to 37mm width and length 110mm. Measure the distance between the screws on your former and centre on the acrylic and drill two mounting holes 3mm.

Parts List

- R1: Variable resistor 50k/ohm
- S1: Switch single pole 12 way
- C1: Capacitor variable 500pf air spaced (1mm recommended), insulated shaft extension
- C2: Capacitor 10nF (103)
- D1: Diode point contact germanium diode 1N34 OA91
- L1: Toroid T50-2
- M1: Meter 50 or 100ma
- Montage: Enamelled copper wire 1.8 or 2mm (14swg)and 0.5mm(24swg)
- L2: See below

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Remove the coil from the former and slide onto the acrylic and secure with two bolts.

See photo for method I used to attach to the case

Recommended to mount the coil in the case close to the rotary 12 way switch to minimise the connecting wire length. Also use heavy 1.5mm insulated wire.

Air Spaced Variable Capacitor

The variable capacitor needs to be insulated from the case and the shaft fitted with an insulated extension. Plastic tubing can be used and a cut-off piece from the plastic shaft of a switch or variable resistor. A piece of acrylic (Perspex) can be inserted under the variable capacitor and the acrylic attached to the case with short standoff mounts

This is so you can bolt the variable capacitor to the acrylic without the mounting bolts touching the case . Remember to make the acrylic long enough to take the capacitor mounting hardware and standoff mounts to the casing.

Toroid winding

As can be seen from the photos I used an alternative method of winding the toroid.

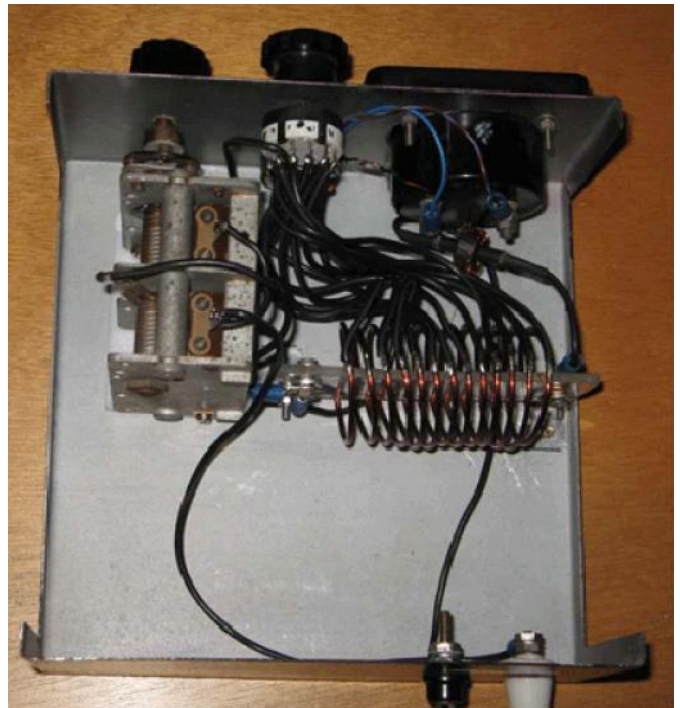
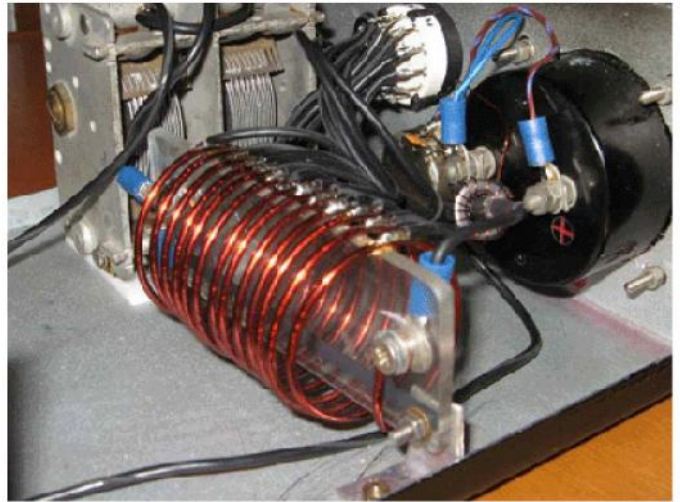
I used 20 turns of 0.5mm (24swg)enamelled copper wire which are spaced evenly around the toroid. The centre primary winding consists of a short piece of RG58 coax passing through the toroid with the centre conductor only connected.

Cutting the hole for the meter

This is a pain if you do not have a chassis punch or Nibbler, I Scribed a 50mm circle (the size of my meter)on the face plate and drilled a circle of 2mm and then enlarged to 3mm holes ,a cold chisel was used to join two of the hole and the rest cut out with a mini hacksaw. File to a nice smooth round 50mm hole, make a template for the four meter mounting holes and transfer to the faceplate punch and drill. Take care with this as you want your meter to be square with the edges of your box.

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How to Operate your Ground Tuner (with input from the MFJ-931 manual)

Connect your transmitters Earth (or Ground) post to the binding post of the Ground tuner marked Input from TX Chassis (Earth).

Note: This wire needs to be as short as practically possible, ie place the Ground Tuner side by side or on top of the Transmitter.

The Black Commercial ATU to Ground Tuner mod

Attach a length of random wire to the binding post marked Output to random length of wire (Counterpoise Wire or Ground Connection Wire). **Be careful not to reverse these wires.**

The Commercial ATU an FC-125 consisted of an RF sensing circuit a large coil a 11 position ceramic switch prewired to the switch but not the coil.

The random wire should be a quarter-wave length or less at the operating frequency. Place the random length of wire on the floor and tape up the open end of the wire to avoid any RF burns.

I added a 180 Pf wide spaced Variable Capacitor the largest size I could fit into the ATU Case and altered the wiring to the circuit shown above.

To obtain maximum RF ground current for a low impedance RF ground, alternately adjust the two controls on the front panel, the Switch for Inductance and the Variable Capacitor. Turn the Inductance Switch first until the highest amount of current can be seen on the RF Ammeter. Then adjust the Variable Capacitor control to peak the amount of RF current.

As the coil was large I reduced it to 43 Mh inductance and tapped the coil as per the MFJ-931 which uses a similar sized coil/variable capacitor combination.

Try several inductance setting for the highest readings. What if the needle goes off the scale or doesn't move at all? Then the sensitivity of the Ammeter needs to be adjusted. Turn the Sensitivity pot control until the needle is in the middle of the scale. Then readjust the Switch for Inductance until you get the highest amount of RF current and use the Variable Capacitor to peak the RF current. If the needle is still off scale or zero, readjust the Sensitivity control and repeat the tuning process.

For the lucky builder who might have or be able to acquire an FC-125 the coil tapings are as follows Turns 1 to 6 tap every turn, Turns 7 to 12 tap every second turn, tap turn 20 and the last turn turn 23 (ie 1,2,3,4,5,6,8,10,12,20,23). Note the Variable Capacitor must be insulated from the FC-125 casing .

For those inquiring minds the meter trim pot is located on the RF sensing board and can be adjusted by drilling a small hole on the top case cover otherwise the top cover needs to be removed each time.

73! de ZS1JHG

