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Amateur Radio and Electronic Hobby Kits, Parts, and Accessories

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FOX HUNT OFFSET ATTENUATOR (V5d)

When your closing in on the fox you may find the signals to be so strong that you can no longer find a peak or null with your antenna. Sometimes the signal is so strong that the RF will leak straight into the radio, connections and other equipment making the antenna useless. The solution is to use an offset attenuator. The circuit consists of a small RF generator, in this case 4MHz, which will mix with the incoming fox signal, such as 146.52MHz, and produce new signals at plus and minus the fox signal (I.E. 142.52Mhz and 150.52Mhz). A potentiometer on the board changes the injection level of the RF generator which in turn attenuates the incoming mixed signal to your radio to a level where tracking can continue.

TIP: This project also makes a nice generic crystal oscillator for the basis of a QRP radio or other multiple uses. Before inserting the crystal, solder in a machine pin header (not included) in order to put in various crystal frequencies.

TOOLS AND OTHER SUPPLIES

- Soldering iron and solder
- Wire cutters & Wire Strippers
- Vice or circuit board holder
- Small screwdrivers (Jewelers set)
- 9V Battery
- Optional (not included):
  - Oscilloscope or an 80M (4.0Mhz) capable receiver
  - Enclosure, RF Connectors, and Small Coax Cable, such as RG-174
  - Tools for the Enclosure and cable (Screwdrives, wrenches, etc.)

PARTS LIST

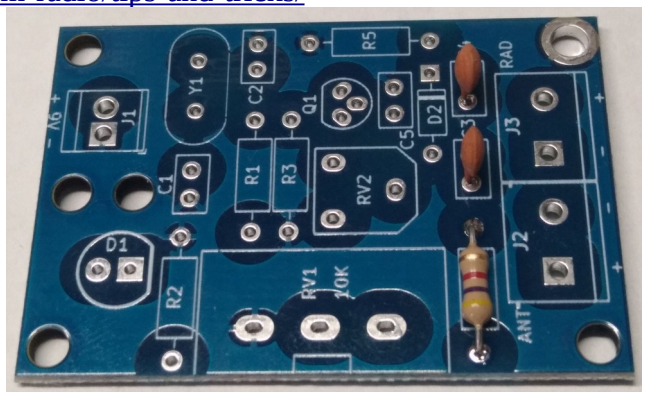
QTY	REFERENCE	DESCRIPTION	MARKINGS
1		Foxhunt PCB	
3	C2, C3, C4	Capacitor Disc 220pF	221
1	C1	Capacitor Disc .1uF	104
1	C5	Capacitor Disc 15pF or 18pF	15p or 18p
1	D1	LED 5mm	
1	D2	Diode 1N4148	
1	Q1	Transistor JFET J113	J113
1	Y1	Crystal 4.000MHz	4.000
1	R1	Resistor 1K	Brown-Black-Red-Gold
2	R2, R5	Resistor 2.2K	Red-Red-Red-Gold
1	R3	Resistor 1Meg	Brown-Black-Green-Gold
1	R4	Resistor 4.7K	Yellow-Violet-Red-Gold
1	RV2	Trimmer 20K	20K or 203
1	RV1	Potentiometer 10K Log	A10K
1	J1	Terminal Block 2 pin 2.5mm	Labled as Header 2 pin 2.54mm in some kits
1	J2, J3	Terminal Block 2 pin 5mm	
1		9V Battery Clip	
1		Toggle Switch	
1		Red Wire	
1		LED Bezel 5mm	
1		LED Spacer	
1		Knob	

PCB Assembly

1. Install, solder, and clip the excess leads on the following components:

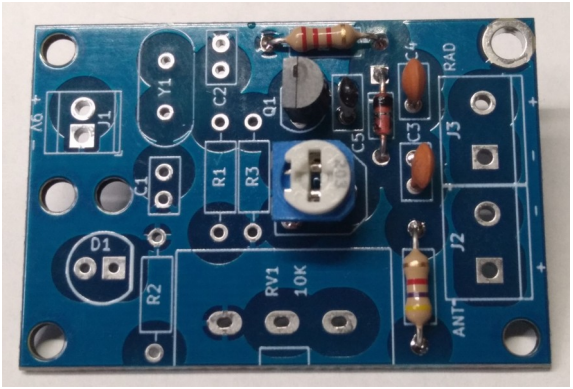
[ ] R4	Resistor 4.7K ohm	Yellow-Violet-Red-Gold
[ ] C3	Capacitor 220pF	221
[ ] C4	Capacitor 220pF	221

TIP: Did you know the PCB depth is the same distance needed between the resistor/diode body and the lead bend point? For that perfect resistor bend just place the body of the reistor against the PCB edge and bend the lead over! This and other tips and tricks at https://kc9on.com/ham-radio/tips-and-tricks/



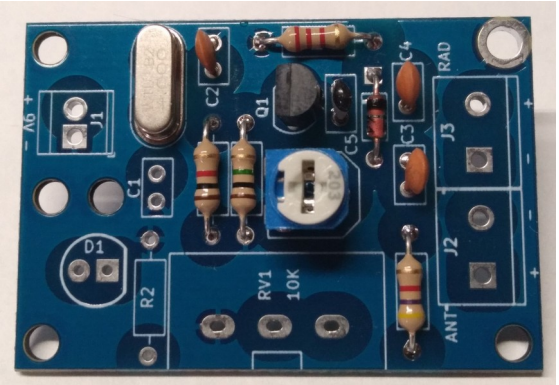
2. Install, solder, and clip the excess leads on the following components:

[ ] D2	Diode 1N4148	Observe the band position.
[ ] C5	Capacitor 15pF or 18pF	15p or 18p
[ ] Q1	Transistor J113	Align the flat side of the transistor to the flat side on the PCB. Substitutes: J112 or MPF102
[ ] R5	Resistor 2.2K ohm	Red-Red-Red-Gold
[ ] RV2	Trimmer 20K	Set trimmer to the center position.



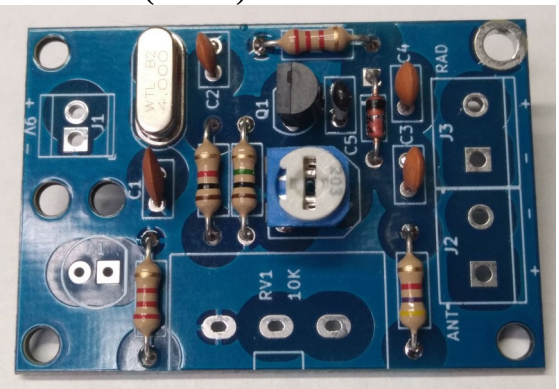
3. Install, solder, and clip the excess leads on the following components:

[ ] C2	Capacitor 220pF	221
[ ] R3	Resistor 1M ohm	Brown-Black-Green-Gold
[ ] R1	Resistor 1K ohm	Brown-Black-Red-Gold
[ ] Y1	Crystal 4.000MHz	



4. Install, solder, and clip the excess leads on the following components:

[ ] R2	Resistor 2.2K ohm	Red-Red-Red-Gold
[ ] C1	Capacitor .1uF (100nF)	104

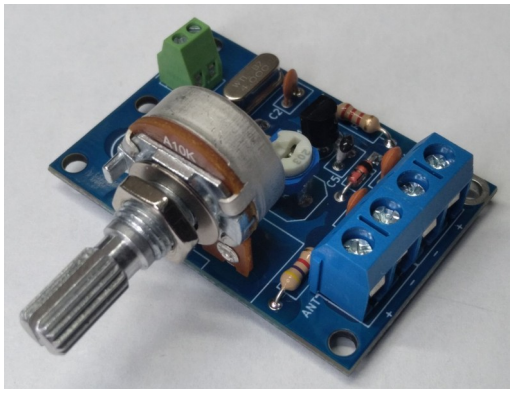


5. Install and solder the following components:

[ ] J2, J3 Slide 2 (large) 5mm terminal blocks together using the pins and grooves on the sides of the block. Make sure the wire insertion area is positioned AWAY from the board. Solder the combined block at J2 and J3. Once soldered, unscrew the screws until the wire openings are clear - for the larger blocks the screws are about flush to the top.

[ ] J1 Insert the (small) 2.5mm terminal block at position J1 kaing sure the wire entrances are pointed AWAY from the board. Once soldered unscrew the screws until the wires openings are visible.

[ ] RV1 Insert the 10K potentiometer at RV1. Keep as perpendicular to the board as possible when soldering.



6. LED Installation:

If using an enclosure such as the 3D printed enclosures found on the internet or on the KC9ON fox hunting page (https://kc9on.com/ham-radio/fox-hunting/), use the included LED spacer and the following instructions. Otherwise use the below instructions as a guide to properly orient the LED into your enclosure. A bezel is provided for those which wish to place the unit inside a metal enclosure.

[ ] Position the LED with the flat spot (short lead) on the right. Slide the LED leads into the LED spacer holes then bend the leads down into the spacer.

[ ] Insert and solder the LED into position D1. Trim excess leads.

7. Battery Wiring:

   You will need to make measurements for wiring inside your enclosure before cutting and soldering. Add an extra 1.25" (32mm) of wire on the bettery connector for the strain relief holes. Use the following as a guide if using one of the 3D printed enclosures found on KC9ON or Thingiverse,

   [ ] Cut a piece of wire 1" (~25mm) in length. Strip and tin 1/8" (~3mm) on each end.

   [ ] Solder one end of the wire onto the center switch contact. Insert the other end into the +9V position of the J1 terminal block and screw down in place.

   NOTE: you may need to open the terminal block screws before putting the wire inside and secure the wire by tightening the screws just snug enough where the wire does not come out.

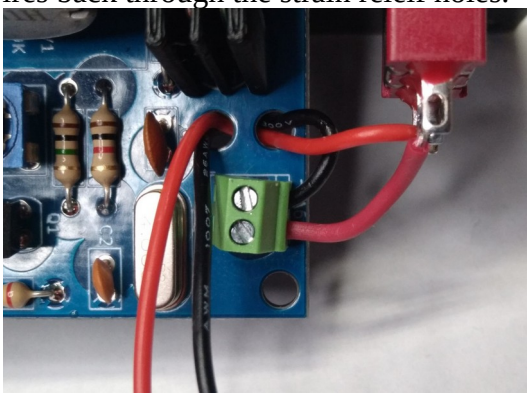
   [ ] Measure the distance between where your battery will be placed and the location of the board (- black wire) and switch (+ red wire). Don't forget to include an extra 1.25" (~32) of wire on each length for the strain relief. In the case of the 3D enclosures this lenth is almost the full length of the battery clip. Strip 1/8" (~3mm) and tin both wires.

   [ ] Slide the wires through the inside strain gauge hole from the top to the bottom of the PCB. Then slide the wires through the outside hole back to the top of the PCB. Leave plent y of wire lead space to work with.

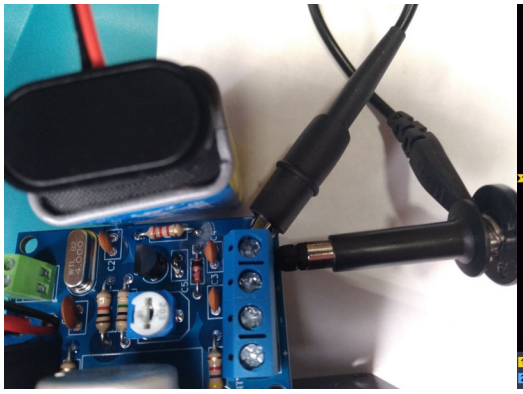
   [ ] Insert the black wire into the -9V position of terninal block J1 and tighten.

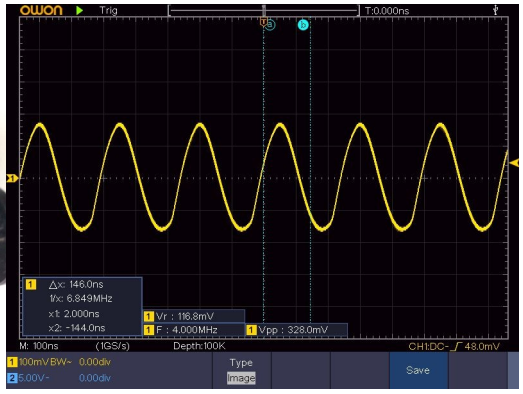
   [ ] Solder the red wire onto the switch. Use the lug opposite lug in which your ON position is.

   [ ] Tighten up your wires back through the strain releif holes.



8. Initial Power and optional Testing: Connect a 9V batttery to the battery clip and turn the power switch on. The LED should be lit. Using an Oscilloscope with the ground wire connected to chassis hole on the PCB which is plated. Set the potentiometer RV1 to fully clockwise. A 4MHz signal between 250-400mV can be seen at the outside Antenna and Radio temrinals of J2 and J3. You should also be able to adjust the signal with both the potentiometer and trimmer. If an oscilloscope is not availble, a signal should be heard when placing the unit near an HF (SSB preferred) radio tuned to 4.00MHz using a short piece of wire attached to either the radio or antenna terminals.



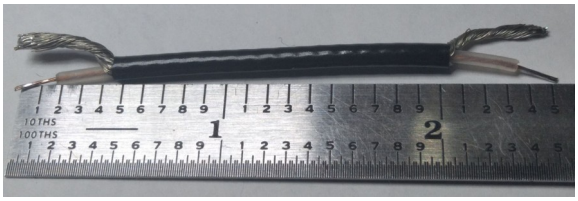


9. Coax and Connector Example:

   Your choice of coax, connectors, enclosure, etc. are not included in the kit. Some will wire the coax directly to the antenna where others may use a choice of BNC or SMA connectors going to both the antenna and raido. In this example guide below we are using Chassis mount BNC connectors and a 3D printed enclosure.

   [ ] Add your Connectors or Coax to antenna and radio.

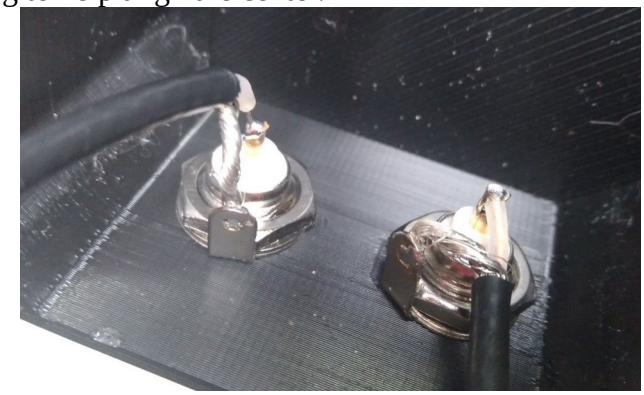
   [ ] Cut 2 pieces of 2-1/2" (~64mm) coax. Remove the outser jacket on 1/2" on each end. Then de-braid the outer shield. Remove 1/4" of the inside insulation. Finally lightely tin the ends, both center and shield.



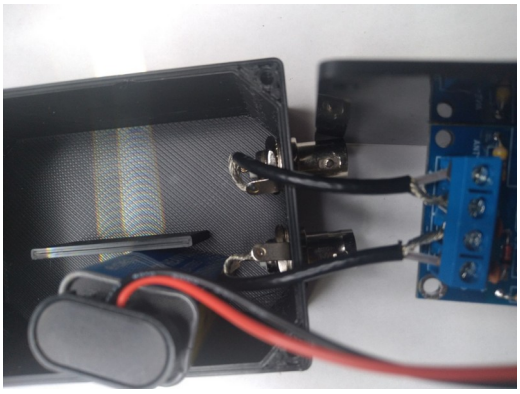
   [ ] On each wire solder the BNC ground ring onto a shield.

   [ ] Slide the BNC chassis connectors into your enclosure. Place the ground lug soldered above followed by the lock washer and nut. Tighten the nut. (Note: This is harder than it sounds!).

   [ ] Solder the center conductor of the coax onto the center of the BNC. You can bend the ground lug to help align the center.



   [ ] Connect the free ends of the coax to the Attenuator, with shields toward the inside terminal block and center conductors to the outside of the terminal block. Snug the terminal block screws but do not over-tighten.



[ ] Connect a 9V battery (a small piece of foam will beep the battery from moving around) and carefully tucke the wires into the enclosure and secure the cover with screws. Place knob on the potentiometer. Enjoy using your offset attenuator!

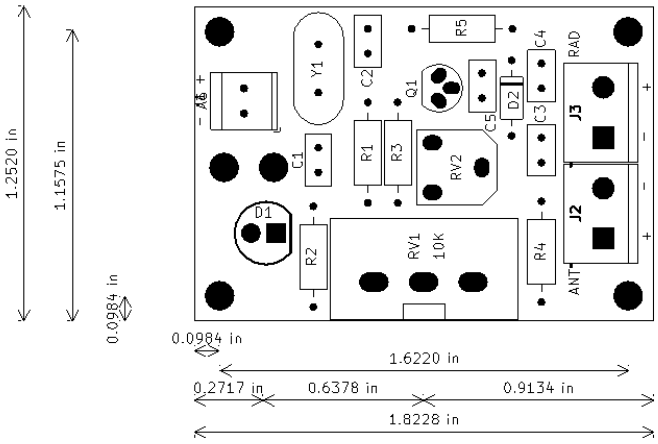
Using the Offset Attenuator

WARNING!! DO NOT TRANSMIT with the offset antennuator in place! Damage to your radio and attenuator may occur!

For tips and tricks on learning and using the offset attenuator please visit
https://kc9on.com/ham-radio/fox-hunting/

TIP: Practice, adjust, and set up your equipment using a fixed frequency, like the National Weather Service. It's a great way to find your beam antenna peaks and nulls.

1. Connect a directional antenna, such as a tape measure beam, to the Antenna jack on the offset attenuator.
2. Connect a receiver to the Radio jack on the offset attenuator.
3. Tune the radio 4MHz ABOVE OR BELOW the fox frequency. For example, if the fox is on 146.52MHz then tune the radio to either 150.52MHz or 142.52MHz. It is suggsted to leave the radio squelch open (always hearing noise), many squelch circuits will not open fast enough when sweeping your antenna back and forth.
4. Adjust the RV1 pot until the fox is barely audible. Sweep the antenna to look for a peak or null to find the fox.
5. You may find the RV1 pot to sensitive or not sensitive enough to attenuate depending on your equipment, fox, etc. In these cases set the RV1 pot to mid position. Then adjust trimmer RV2 clockwise where desired attenuation occurs.
6. Right on top of the fox and need even more attenuation? Try higher multiples of 4MHz. For the example above use 154.520MHz 158.520MHz, 162.520Mhz, etc.



Pot Drill: 9/32"
Pot Tab hole: 7/64"
LED Hole: 13/64 or 7/32

Bottom of PCB to
Center of POT&LED: ~.560" or 9/16"

Mounting holes are #4

Toggle Switch hole size: 15/64"

Height including clip leads: ~1.05"