

Building the “Sawbuck” Direct Conversion Receiver

Introduction

The “Sawbuck” is a simple to build direct conversion receiver for 40 meters. The Sawbuck is designed to work with the Woodchip transmitter, but also works well with other QRP transmitters. The Sawbuck is built on a double sided circuit board and mounted to a small wooden breadboard. The Sawbuck is a direct conversion design with a bandpass filter, mixer/oscillator and audio amplifier. A lowpass filter helps to attenuate high frequencies such as band noise and hiss. The audio output works well with ear buds or headphones. Speaker level audio is best obtained by an external amplifier like our Toothpick which also has a built-in CW filter. Provisions are made to accept Sidetone and receiver muting from the Woodchip transmitter. Antenna switching is available with our T/R switch kit.

Building Rules

1. Take your time. We recommend that you take at least three or four hours to complete your kit. If you take your time, in a few hours you can have a beautiful working project that you will be proud to own and operate.
2. If you don't know how to solder parts on a circuit board, get help. Learning to solder is not hard, but please do not start this kit if you have never soldered before!
3. Most of the parts are tiny. Please use a magnifying glass.
4. Build the kit by the instructions, one step at a time.
5. Use protective eyewear.
6. Be careful with the ICs and transistors to avoid damage from static.
7. All parts should be mounted flush or as close as possible to the circuit board keeping leads short. After soldering, clip all wires close to the board.

Finishing The Breadboard

The wooden breadboard furnished with your kit is your opportunity to express yourself. You get to finish it any way that you like...pick your color, pick your finish. MAY WE SUGGEST THE FOLLOWING?

1. Use fine grit sand paper to remove any roughness from the wood. The four 1/4 inch sides will need some light sanding to remove some of the dark color left by the laser cut, especially if you are using a light color paint. Otherwise, several coats of paint may be used to cover well.
2. You can use brush on or spray paint or stain or no finish at all...it's up to you.
3. You are in charge of getting the board ready. Three coats with light sanding between coats and about 24 hours of drying time will produce great results.
NOTE: The decals that will be placed on your breadboard at the end of kit construction are black and red on yellow.
4. When the board is finished, locate the circuit board and place it on top of the breadboard. Center the circuit board and using a small nail, phillips screwdriver or other small pointed object, push a small starter hole into the breadboard at each corner mounting hole. The starter hole will help you to then drill a 1/16th inch hole at each starter hole. The drilled holes will be used to mount the assembled circuit board in the proper location at the end of the project. Place the breadboard aside for now.

Building the Circuit Board

Tools and supplies needed to build the circuit board:

1. needle nose pliers
2. diagonal cutters
3. small flat blade and phillips screwdrivers
4. Magnifying glass
5. 20-40 watt soldering iron

Parts List

1/8 watt resistors

- R1 1000 ohm trim pot
- R2 3.3K ohm
- R3 100K ohm

R4 10k ohm

R5 1meg ohm

R6 470K ohm

R7 680 ohm

R8 50K ohm linear taper pot

R9 10K ohm audio taper pot

Capacitors

C1 60 pf. Trim pot

C2 82 pf ceramic disc npo

C3 .001 uf ceramic disc

C4 60 pf. Trim pot

C5 not used

C6 0.1 uf ceramic disc

C7 100 pf ceramic disc npo

C8 150 pf ceramic disc npo

C9 270 pf ceramic disc npo

C10 270 pf ceramic disc npo

C11 0.1 uf ceramic disc

C12. 0.1 uf ceramic disc

C13. 47 uf electrolytic

C14. 4.7uf electrolytic

C15 0.1 uf ceramic disc

C16 0.1 uf ceramic disc

C17 .01 uf ceramic disc

Other Parts

IC1 SA612AN

IC2 TL 431

IC3 L78L06

D1 1N4001

D2 1N4001

J1 RCA JACK

J2 2 pos. Terminal

J3 2 pos. Terminal

J4 2 pos. Terminal

J5 Phone Jack

SW1 SPDT slide switch

SW2 SPDT slide switch

Magnet Wire

Insulated wire (color varies)

L1 27uh choke (red/violet/gold/gold)(supplied) or (may use 25 turns #27 magnet wire on T37-2)

T1 T-37-2 primary 1 turn solid insulated wire over bottom of secondary. Secondary 29 turns green magnet wire

Decal

4 wood screws

4 black spacers

4 rubber feet

wooden breadboard

circuit board

2 knobs

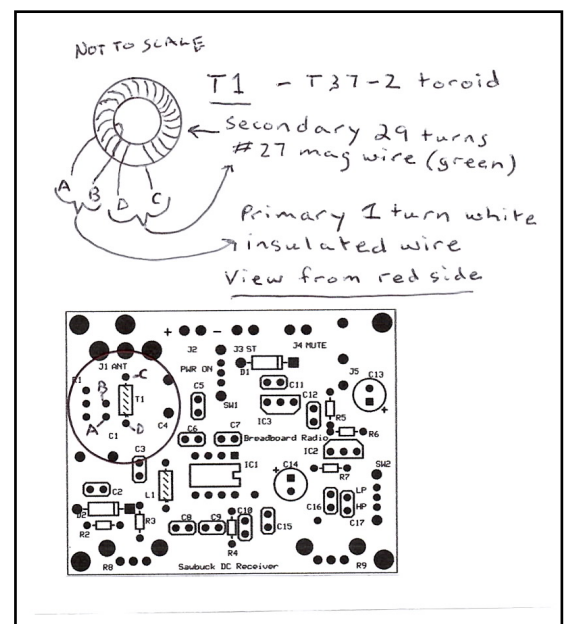
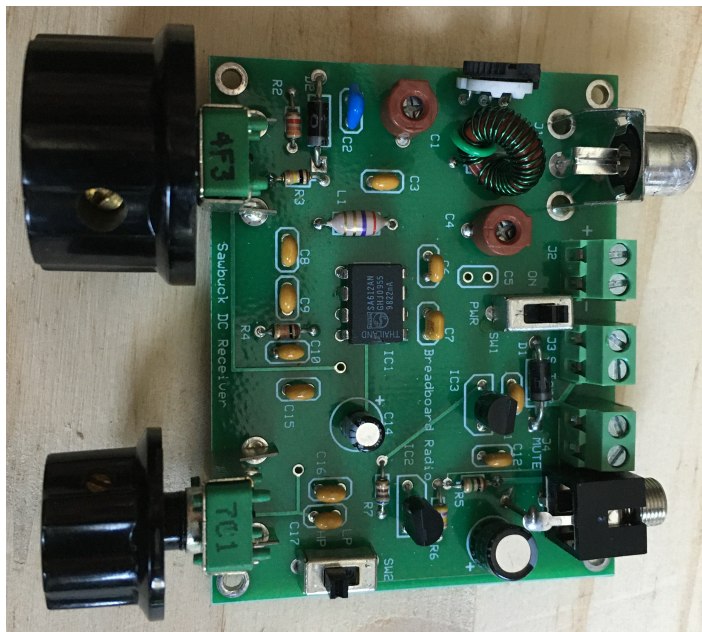
Building the Kit

Locate the parts bag. All of the parts required for circuit board construction are enclosed. You can work from the bag and find each part as it is called for, but placing all of the parts from the bag into a bowl or small plastic tray may make it easier to sort and properly identify the parts.

As each part is called for, be sure to identify it, then locate the proper mounting holes on the board. Insert the part and check its placement before soldering it in place. Cut all leads flush with the board. Photos of this kit on our website can usually be viewed and enlarged on your computer.

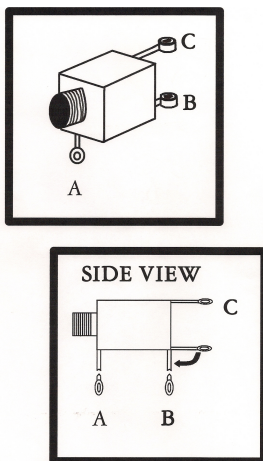
1. Mount and solder SW1 (may require some force to seat)
2. Mount and solder SW2 (may require some force to seat)
3. Mount and solder J1 RCA jack
4. Mount and solder J2, J3 and J4 screw terminals
5. Mount and solder IC1, SA612AN
6. Mount and solder R2, 3.3k ohm (orange, orange, red)
7. Mount and solder R3, 100K ohm (brown, black, yellow)
8. Mount and solder R4, 10K ohm (brown, black, orange)
9. Mount and solder R5, 1meg ohm (brown, black, green)
10. Mount and solder R6, 470K ohm (yellow, purple, yellow)
11. Mount and solder R7, 680 ohm (blue, gray, brown)
12. Mount and solder C1, 60 pf. Trim cap
13. Mount and solder C2, 82 pf. (820) ceramic disc npo
14. Mount and solder C3, .001 uf. (102) ceramic disc
15. Mount and solder C4, 60 pf. Trim cap
16. C5 is not used in this version

17. Mount and solder C6, 0.1 uf. (104)ceramic disc
18. Mount and solder C7, 100 pf. (101)ceramic disc npo
19. Mount and solder C8, 150 pf. (104) ceramic disc npo
20. Mount and solder C9, 270f. (271) ceramic disc npo
21. Mount and solder C10, 270 pf. (271) ceramic disc npo
22. Mount and solder C11, 0.1 uf. (104) ceramic disc
23. Mount and solder C12, 0.1 uf. (104) ceramic disc
24. Mount and solder C13, 47uf. (391) electrolytic
25. Mount and solder C14, 4.7 uf. electrolytic
26. Mount and solder C15, 0.1 uf. (104) ceramic disc
27. Mount and solder C16, 0.1 uf. (104) ceramic disc
28. Mount and solder C17, .01 uf. (103) ceramic disc
29. Mount and solder IC2 TL431
30. Mount and solder IC3 L78L06
31. Mount and solder D1, 1N4001
32. Mount and solder L1, 27uh molded choke (red/violet/gold/gold)
33. Mount and solder T1, 29 turns magnet wire on T-37-2 toroid with one turn of supplied insulated wire over bottom of toroid



34. Mount and solder R1, 1000 ohm trim pot
35. Mount and solder R8, 10K ohm linear taper pot
36. Mount and solder R9, 10K ohm audio taper pot
37. Locate J5 a 1/8th inch phone jack and it's mounting position on the right rear side of the circuit board. Refer to diagram 1 and modify the two lower soldering lugs to fit in the two mounting holes closest to the right rear side of the board. Bend the lower back lug (lug B) 90 degrees so that it points down like the front lug. Using diagonal cutters, clip off the ends of lugs A and B as close as possible to the soldering hole. The remaining lugs should be as long as possible so that they will fit through the mounting holes in the circuit board. Place J5 into position with lug A and B in the mounting holes and solder with J5 flush against the board. The lugs may need slight trimming with the diagonal cutters to fit the holes. Lug B may not come all the way through the hole, but a little extra solder to fill the hole will sufficiently hold it in place. Use one of the wire leads saved from mounted resistors to complete mounting J5. Pass one end of the wire through lug C of J5 and into the circuit board mounting hole. Secure the top end of the wire to lug C of J5 and solder in place. Solder the other end of the wire on the bottom of the board and clip the excess wire.

Diagram 1.



This completes construction of the circuit board. Inspect the board for proper parts placement. Make sure that solder connections are good and that there are no solder bridges.

Final Assembly

1. Mount the circuit board to the wooden breadboard with the black spacers and brass wood screws.
2. The peel and stick-on decal should be place on the front of the bread board.
3. Place the four rubber feet on the bottom of the breadboard (one in each corner).

Alignment

Attach 9 to 13.8 volts at J2, an antenna at J1 and ear/head phones at J5. Turn on power with SW1. With the audio turned all the way up, you should be able to hear noise and perhaps signals. Set the tuning dial to mid-way. Turn the attenuator all the way towards the rear. Adjust trimmer C4 for the loudest volume (signals or noise). Using a signal generator set to 7040 KHz, adjust trimmer C1 until the 7040 KHz signal is heard. If no signal generator is available, you can use a signal from a transmitter or transceiver on 7040 KHz. It is also possible to use a receiver or transceivers receiver tuned to 7040 KHz with a wire running from it's antenna jack to nearby the Sawbuck and listen for the Sawbuck's signal as you tune C1. EASY WAY: Wait til early evening when there is plenty of activity on the band. Connect a good antenna to the Sawbuck and very slowly tune C1 until ham band signals are heard. Once you have signals approximately where you want, readjust C4 for maximum signal strength.

Note: if you have a Woodchip transmitter, the Sawbuck can be easily aligned by using the spot function of the Woodchip to put the Sawbuck on the exact frequency.

Using The Sawbuck

It is assumed that the operator has an understanding of antennas, DC power and general receiver operation.

Antenna: The antenna must be suitable for 40 meter operation. The antenna should be near resonance or attached to an antenna tuner. When using the Woodchip with this receiver, the easiest way to provide a signal to the receiver is to use a separate antenna to the receiver, which can be as simple as a 20-30 foot wire. A better option is our external T/R switch that can provide a means to switch the transmitter antenna as well as simultaneously mute the receiver via ground short or open circuit. It will also allow the use of a foot switch for semi break-in operation.

Power: The power supply must be D.C. 9.0 to 14.0 volts. (battery or filtered supply) NOTE: When using the Woodchip with the Sawbuck receiver, the same

12-14 volt d.c. source may be used. You may run separate supply lines or use jumpers between the transmitter and receiver. A 9.0 volt battery works well with the Sawbuck and 12 to 14 volt supplies should be used with the Woodchip.

Sidetone from the Woodchip or other transmitter is applied at J3. When using the Woodchip, use the right side of the mute terminal connectors on both the Woodchip and Sawbuck. The left side of the mute terminal connectors on both the Woodchip and Sawbuck is not used if the negative power source is common to the Woodchip and Sawbuck. The receiver does not amplify the sidetone.

Muting is accomplished when J4 is closed to ground. This action causes the receiver audio to be shorted to ground. The Woodchip transmitter supplies this action when it is switched from “receive” to “transmit”.

By adding the Timber T/R switch, the transmit antenna will be automatically switched from the transmitter to the receiver as well as handling the receiver mute whenever the transmitter is switched to transmit. A foot switch, such as our “QLF” may be used with the T/R switch to provide a quick and easy alternative to using the slide switch on the Woodchip.

The LP—HP switch (SW2) will aid in blocking interfering high frequency signals and band noises (especially hissing). It works best with strong signals since the lowpass also attenuates the desired signal (but not as much as high frequency signals.) Try both positions for best results.

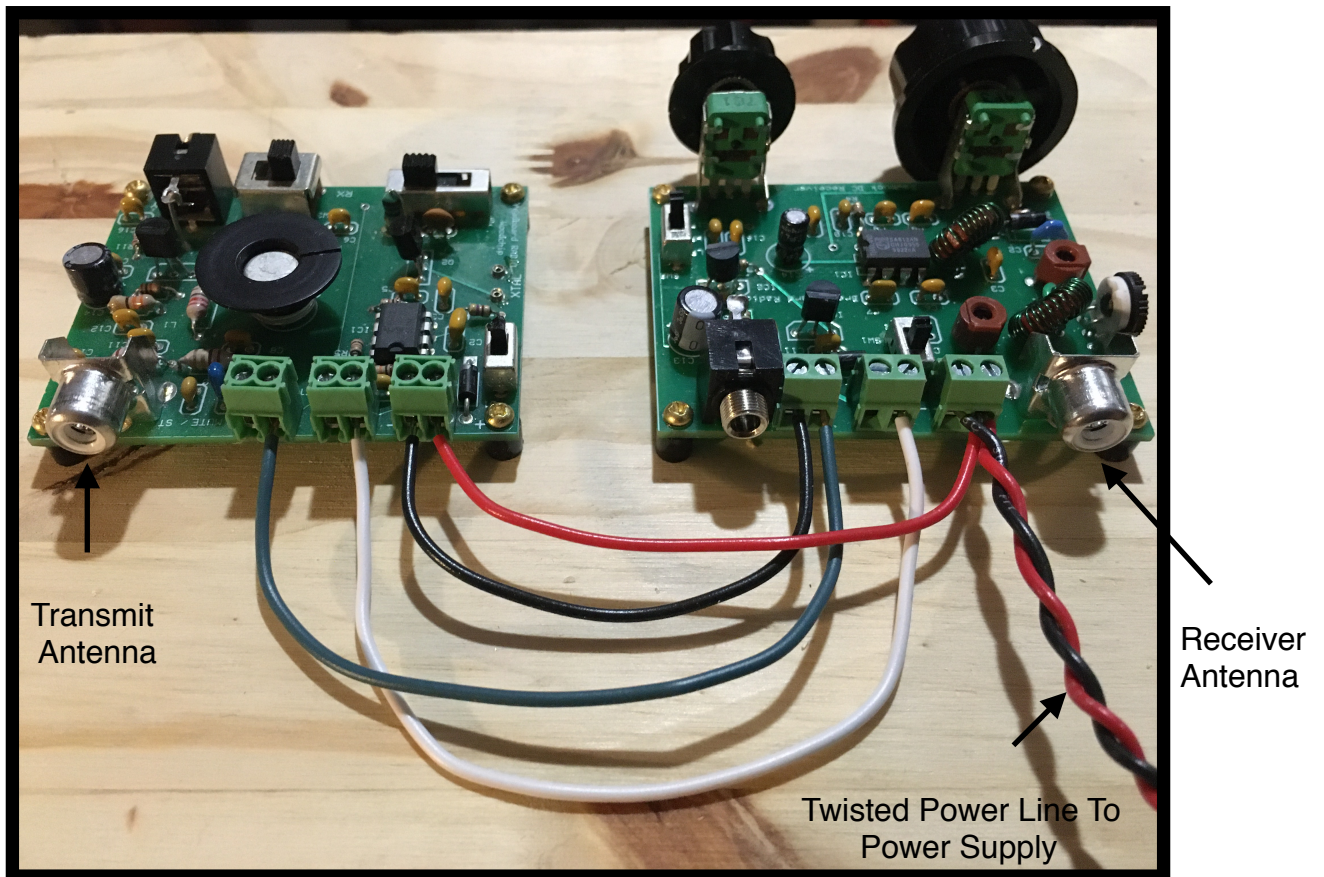
R1 functions as an R.F. attenuator. When signals on the band are loud (especially at night) the mixer can be overloaded and distort. Also strong shortwave broadcast stations can compete with desired amateur radio stations. This is effectively dealt with by adding attenuation. Turning the thumbwheel towards the front until signals are clearer and broadcast stations are gone or nearly gone will make desired amateur stations more readable.

Unfortunately, many digital operators are using much more than the recommended 20 watts operating digital modes. These signals are strong and wide and create a challenge to simple QRP and QRPp receivers. Some signals can cause trouble up 10 or more KHz away. Use of the attenuator and low pass filter may help to tame the interference.

If you have any problems with your kit, please email us at:
w4fsv@breadboardradio.com You can also refer to our website at:
www.breadboardradio.com

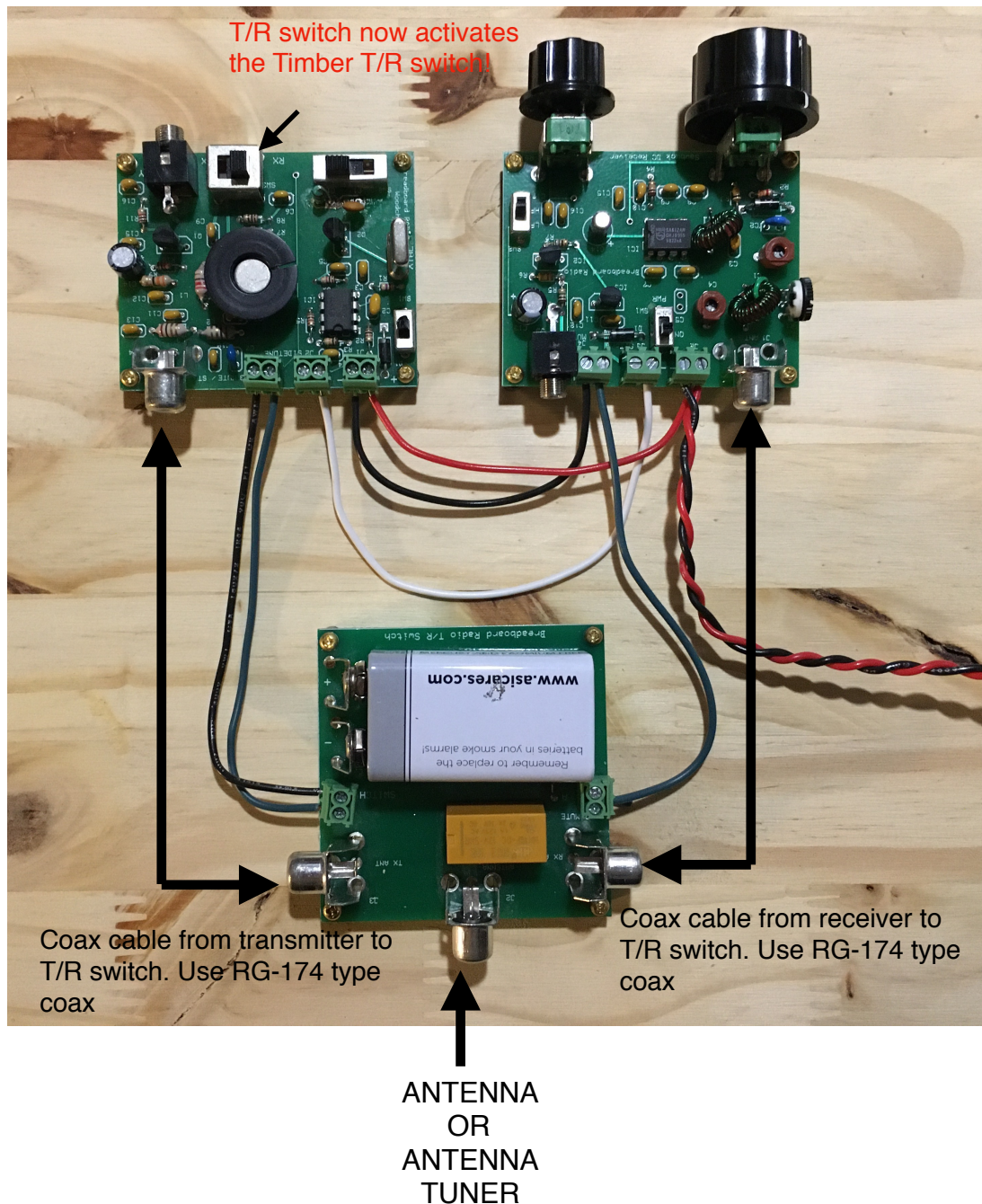
Sawbuck / Woodchip Set-up

The picture below shows how to interconnect the Sawbuck receiver with the Woodchip transmitter for mute, sidetone and power supply sharing. Use of colored wires is for clarity only, but is a good idea with any setup. In this example: Green is mute, White is sidetone, Black is ground and Red is Positive DC. Note: Black is also used for Negative DC and is electrically connected to Ground.



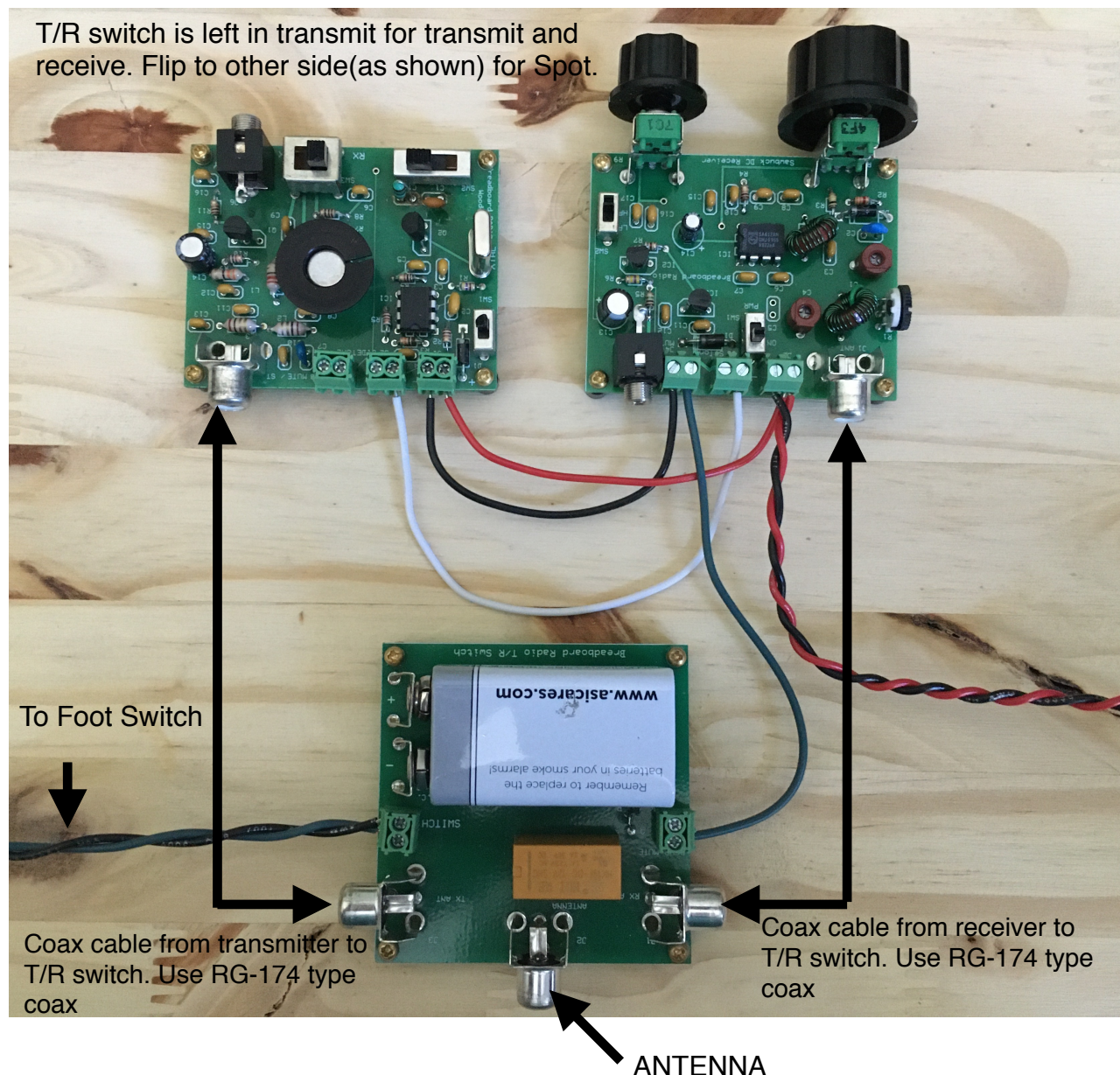
Sawbuck / Woodchip Set-up

The picture below shows how to interconnect the Sawbuck receiver with the Woodchip transmitter and Timber T/R switch for mute, sidetone and power supply sharing. Use of colored wires is for clarity only, but is a good idea with any setup. In this example: Green is mute, White is sidetone, Black is ground and Red is Positive DC. Note: Black is also used for Negative DC and is electrically connected to Ground.



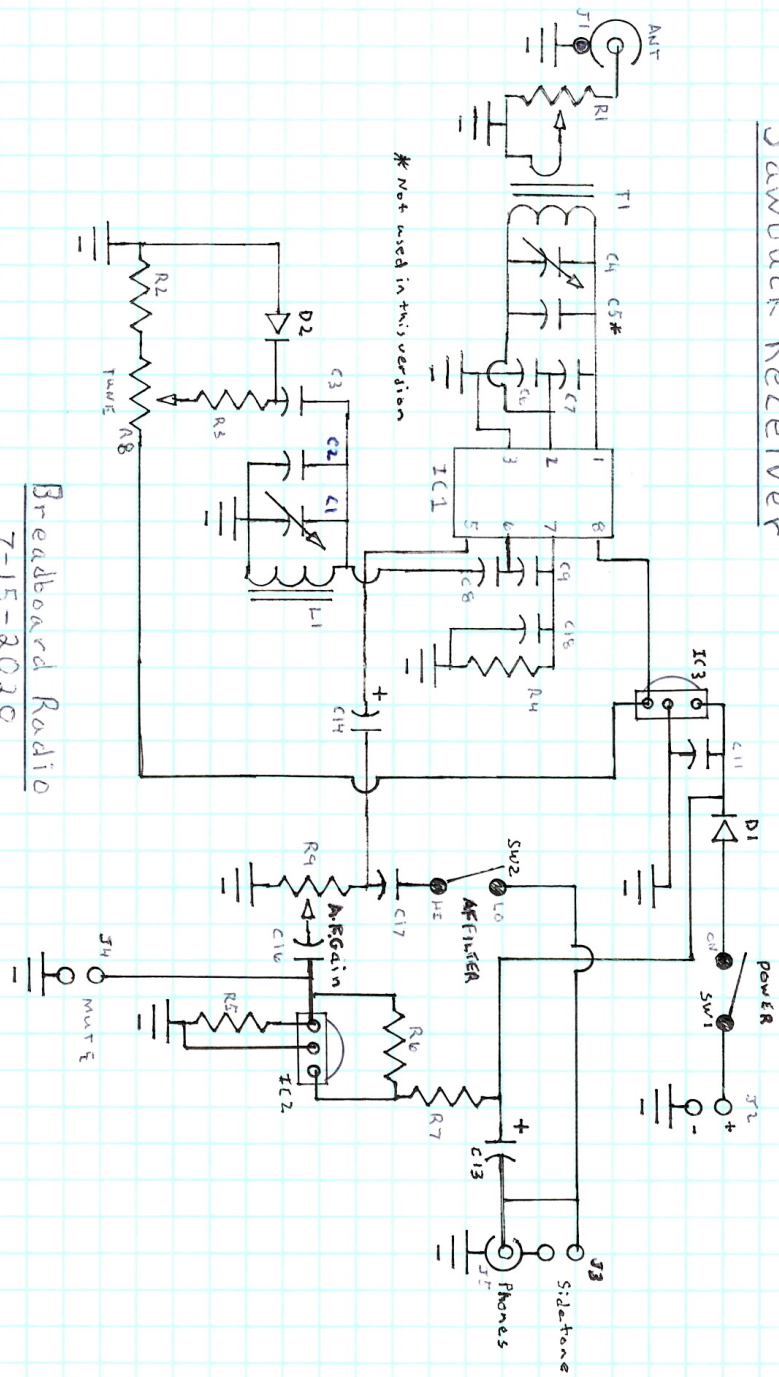
Sawbuck / Woodchip Set-up *WITH* Foot Switch

The picture below shows how to interconnect the Sawbuck receiver with the Woodchip transmitter and Timber T/R switch for mute, sidetone and power supply sharing. Use of colored wires is for clarity only, but is a good idea with any setup. In this example: Green is mute, White is sidetone, Black is ground and Red is Positive DC. Note: Black is also used for Negative DC and is electrically connected to Ground.



Foot Switch (like our QLF) can be connected as shown above. Coax must be connected for ground between Woodchip and Timber. Transmit/Receive is now controlled by foot switch.

Sawbuck Receiver



Breadboard Radio
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