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## Introduction

This document describes several techniques for building a bias tee into a Yaesu FT817. None of the information presented here is new but not all of it is available in the one place so this document aims to correct that problem.

The FT817 is one of the most popular low power radios in the ham world. It finds a role in QRP activities, portable activities, SOTA and as a transverter IF radio. There is no doubt that it has pushed nearly all other QRP rigs to one side. One thing that is important when operating this radio as a transverter IF is to have some way of getting the radio to switch the transverter between RX & TX.

The easiest way is to take advantage of the TX line on the ACC socket on the back of the radio. This line pulls low when the radio goes into TX. Most transverters (sequencers) will switch to TX this kind of PTT mechanism.

Notwithstanding, a more popular option is to impress DC onto the antenna coax line when the radio goes into TX. This is done with a bias tee. A bias tee comprises a DC blocking capacitor and some other simple circuitry to impress a DC voltage onto the coax inner conductor.

Some FT817 owners elect to build an external bias tee to use with their radio. While this certainly works it means an extra piece of equipment to remember to pack so better to try and build the function into the radio.

## Further reading

Add links here

## Disclaimer

This project is offered as is with no guarantees and with the understanding that it may contain errors.

Some owners may be concerned that a modification like this could void the warranty on their radio. No advice has been sought from the manufacturer in this matter. If this concerns you, contact the manufacturer and ask them.

I assume that most hams will understand the technical details and are capable of building and installing this modification without issue.

Should you break your radio, remember who took the covers off and started this activity. I am not responsible for you breaking your radio. Do not start this project unless you are sure you are capable of doing the work.

There are a number of things needed to ensure this modification is functional, safe and dependable.

- We need a DC supply
- We need a TX trigger
- We need to find an injection point to get DC into the coax.
- We might need some kind of switching circuit to supply the DC.

Couple these together correctly and a robust bias tee retrofit to the FT817 is the result.

It is important to remember that accidents do happen in the field so consideration to short circuits in particular should be given. There's nothing worse than making a simple mistake which takes a radio out of service temporarily or permanently.

Some transverters (sequencers) need more volts than others to switch reliably.

This document presents two bias tee solutions.

The first is very simple and requires a resistor, capacitor and a short length of wire.

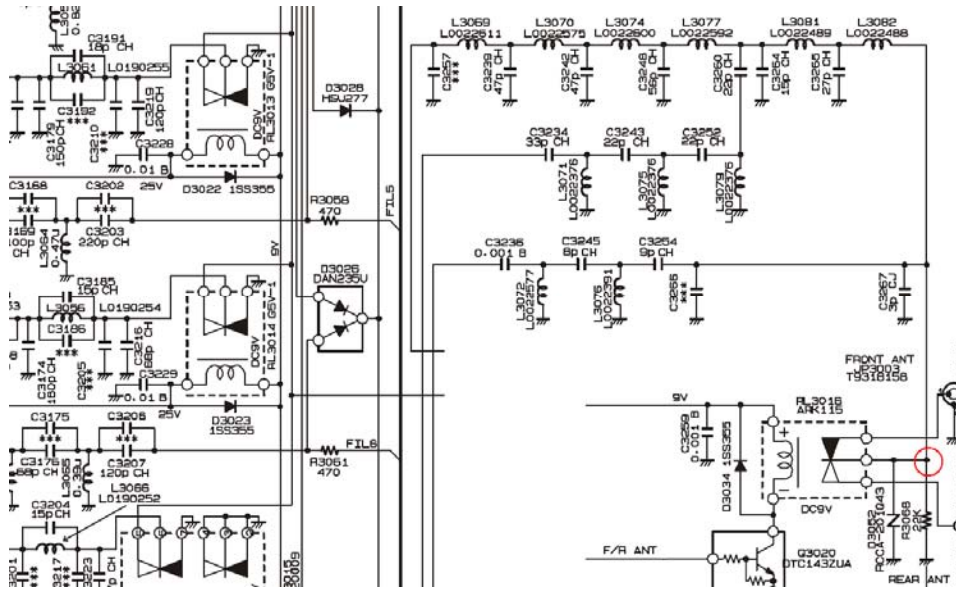
The second requires a switching circuit. Use this solution if the simple bias tee doesn't reliably switch your transverter (sequencer).

These are both relatively simple modifications and with care and patience anyone should be able to make them work.

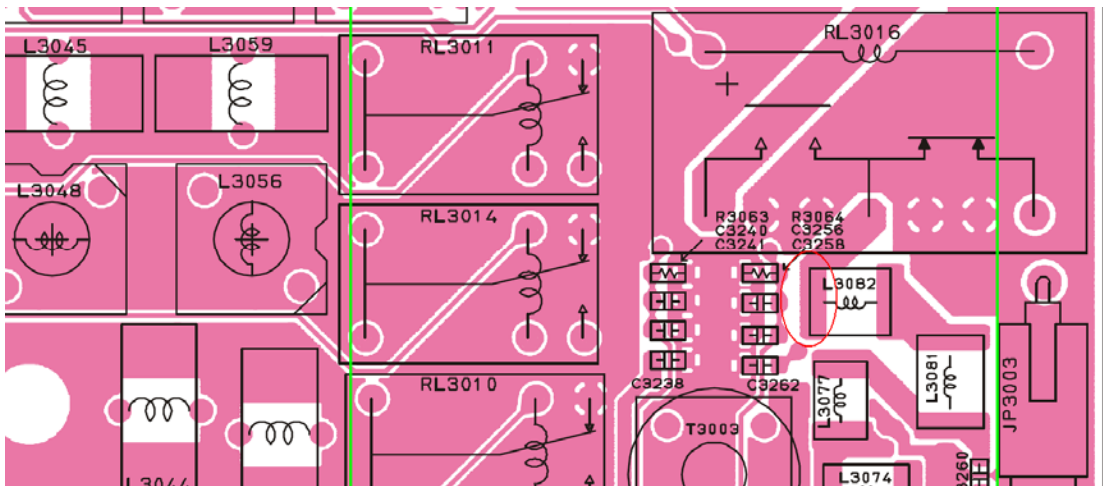


Injection point

Tim VK5ZT identified a suitable injection point on the RF board which has the added bonus of making the DC voltage available at either antenna socket.



This circuit has been edited for clarity and indicates the injection point at the common terminal of RL3016. Note also R3068 (22K) which is the only DC path to ground. This suggests a blocking capacitor will not be needed hence resolving the issue of reduced RF at 70cm.

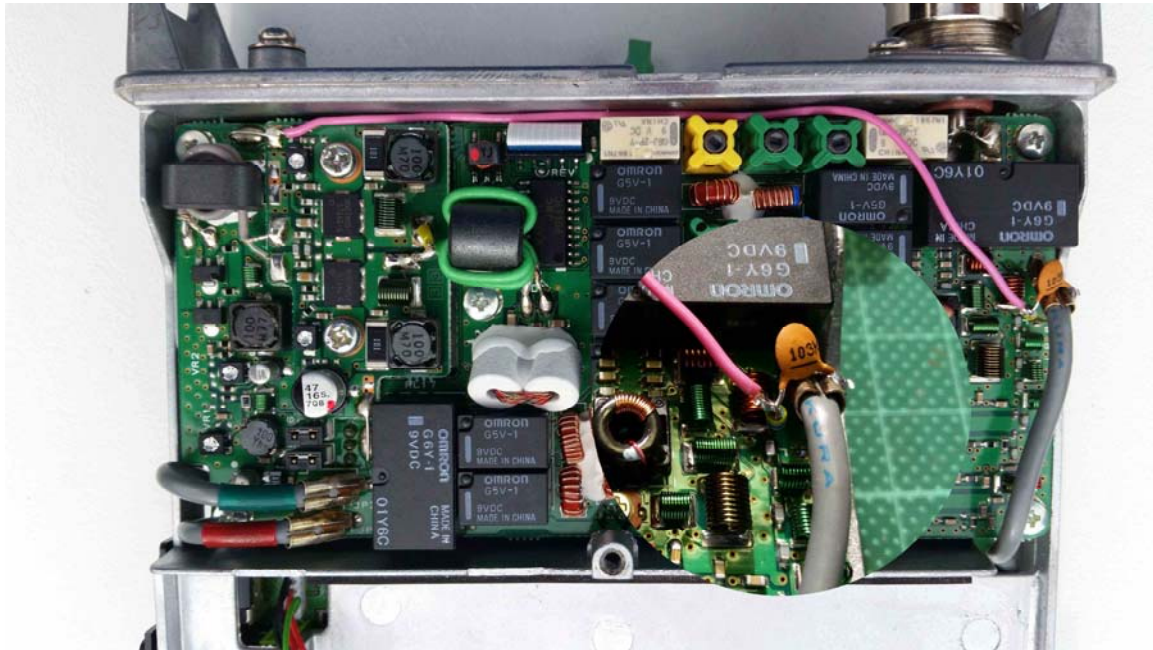


**Warning!** Components are very tightly packed on the PA and it is easiest to solder the resistor to L3081. Be careful not to melt the case of RL3016 or other components with your soldering iron.

### Simple bias tee modification

The simple bias tee modification requires few components and is easy to implement.

Pull the bottom cover off the radio and orient it with the front panel towards you. Identify the PA module PCB to the rear left of the radio and L3081 near the SO239.



Here you can see the completed simple modification. It is current limited by virtue of the series resistor.

Examine the image carefully. Be neat and keep the wires as short as possible. Work carefully as space is tight and your iron could easily melt nearby components.

Join a 4k7 resistor to a 10 nano farad ceramic cap and solder a wire to that junction.

Next solder the other end of the resistor to the bottom end of L3081.

Solder the free end of the capacitor to the frame of J3003. Prepare the frame by gently scraping an area clean with a hobby knife and tinning first.

Solder the other end of the wire to the TX5V point on the PA module PCB.

If all is well you should measure about 3.6V at the SO239 during TX. With a 4k7 series resistor you will have almost 800uA of drive current.

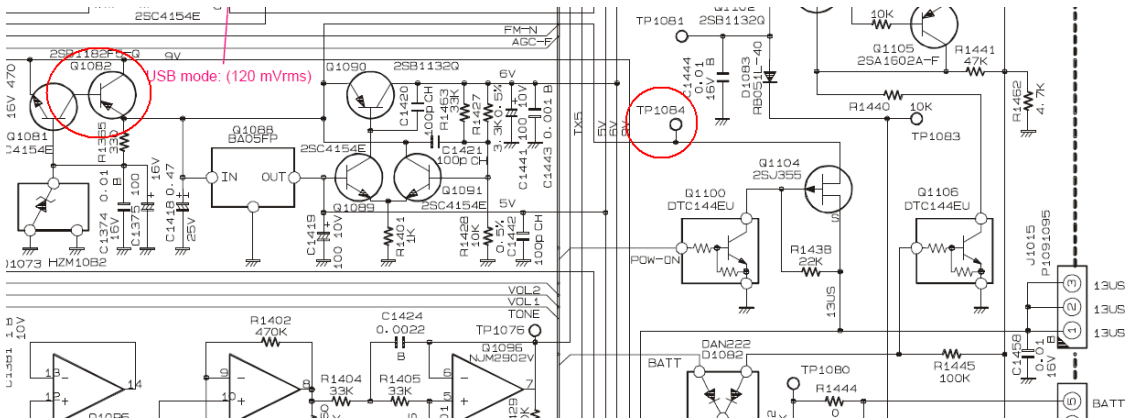
If your transverter (sequencer) doesn't switch reliably and you can't modify it to do so, you'll have to consider the second bias tee solution.

## Second Bias tee modification

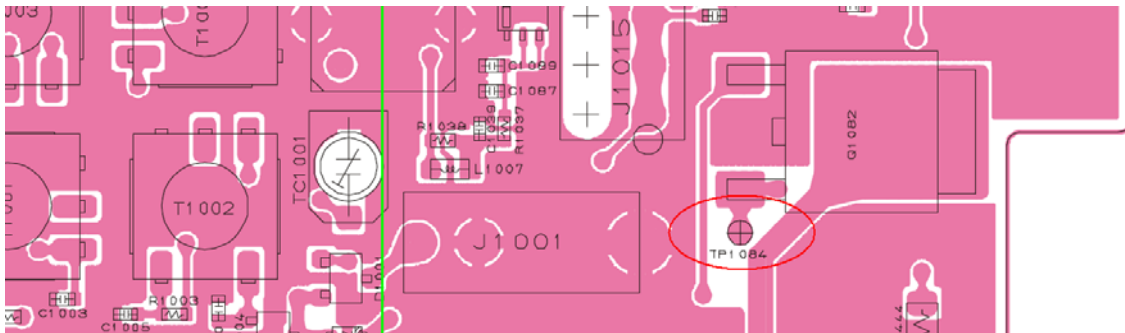
This modification uses a simple switching circuit and radio supply to feed the bias tee supply. We will still use TX5V as the trigger. Injection into the coax is exactly the same as for the simple bias tee.

### DC Supply

[Adam VK4GHZ](#) described a modification that converts the “always on” supply at the ACC socket to a supply that only comes on when the radio is powered up. For this he takes the switched supply from the emitter of Q1082 (TP1084) and wires it to the ACC socket. We can use this voltage as the supply for our bias tee switching circuit.



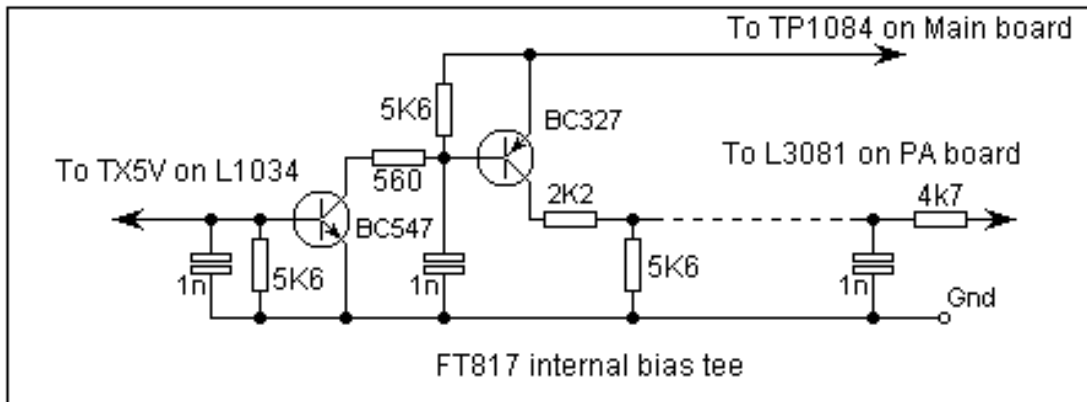
The board overlay shows the location of Q1082 adjacent the speaker connector on the main board. TP1084 is a convenient connection point.



### Switching circuit

This switching circuit takes its trigger from the TX5V line and the DC supply at TP1084 to produce a higher DC voltage for the bias tee. This circuit is tolerant of inadvertent short circuits but care should still be taken during use.

Build the circuit as small as you possibly can as there is not much room in the radio. Don't forget the speaker takes up a substantial part of the empty area on the main board. Using 1/8W resistors or even SMD components will help reduce the size of the circuit.



## Testing

It is vitally important to test any modifications you make BEFORE you take them out in the field. Most importantly you should ensure that the DC level reliably triggers the transverter. Incomplete testing or no testing at all could put an end to a weekend of activity.

### Supply level testing

The FT817 will work reliably with a supply as low as 9 VDC and even less. Adjust the supply to 9VDC then measure and record the output voltage of the bias tee.

Measure and record the lowest voltage at which each of your transverters will work and the lowest DC voltage required to trigger each of your transverters into transmit.

Compare the results carefully and make whatever changes are required either at the FT817 or your transverters to ensure all your radios trigger all your transverters even under the worst possible supply conditions.

If you have more than one radio make sure you fully test each of them with all your transverters using whatever cables, supplies and equipment you normally use or intend to use out in the field.

### Get out of jail card

Consider what other options are available to you if after all your testing something was to go awry when you get out in the field. Perhaps carry some proven bias tees in the car – just in case.

### What about the FT818?

I don't have an FT818 but I think the internals are basically the same. At the time of writing the FT818 had just been released and there is talk that the relays are different between the models. I don't think this will impact the way this modification is applied. I'm happy to hear from FT818 owners that try this modification.