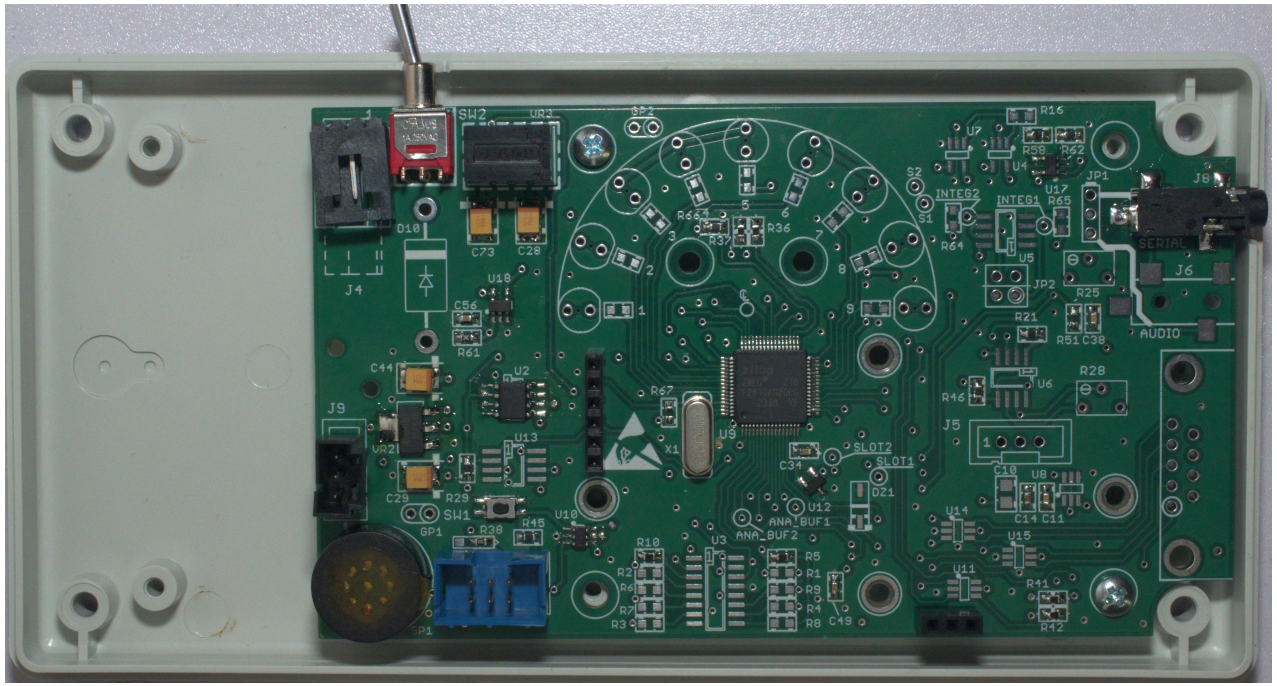

The ICARC FOX Tracker

Prototype FOX Tracker

KC0JFQ: William Robison

Job: fox˙present˙17
File: fox˙present˙17.tex

November 26, 2025

Iowa City Amateur Radio Club

Outline

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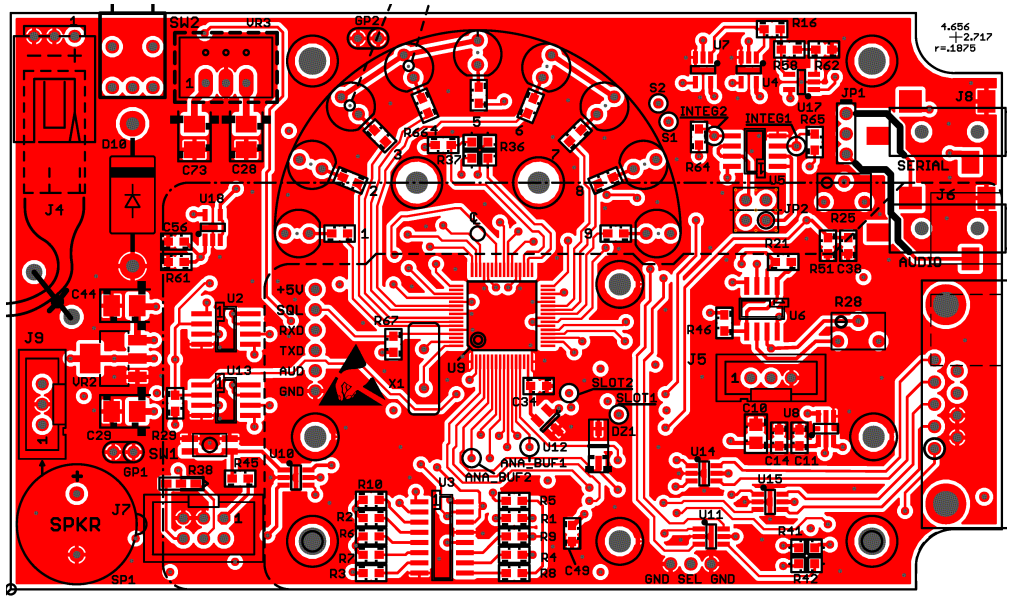
Overview

Yet another winter project is upon us...

TDOA direction finding (ICARC FOX Tracker)



Time **D**ifference **O**f **A**rrival our 2-antenna switch with a processor added!

- Processor driving LEDs is less $$$ than a mechanical meter
- Implement a synchronous detector
- External of Internal Receiver
- Processor allows for an electronic antenna rotator

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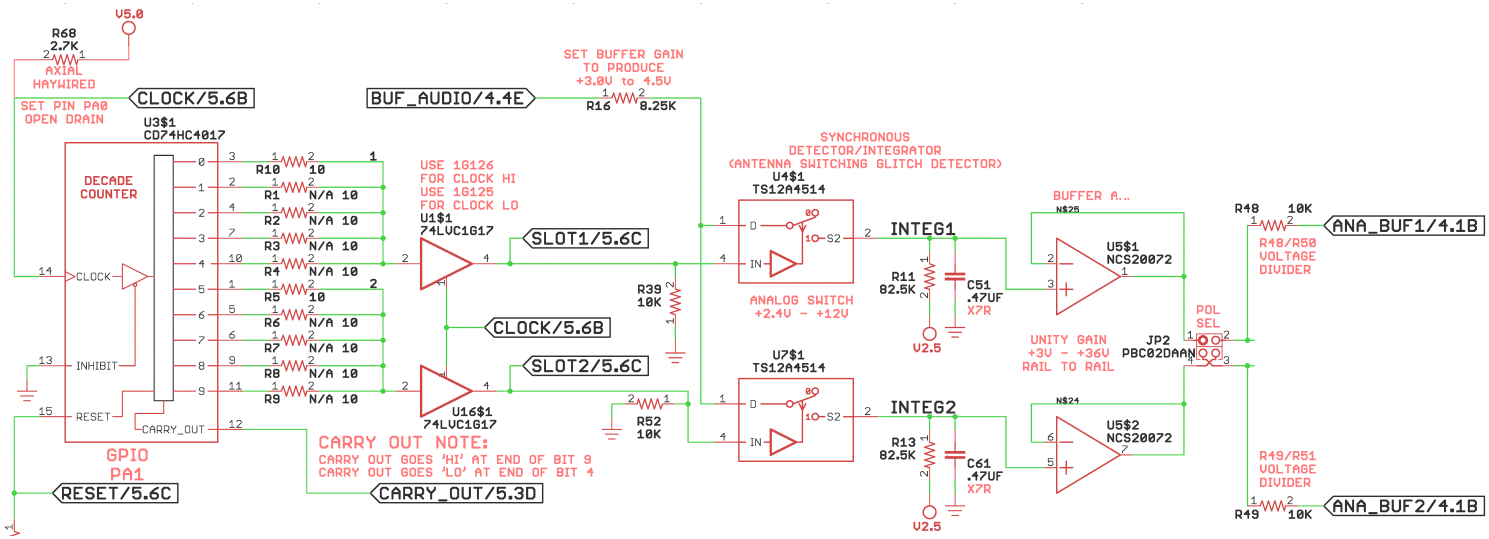
Synchronous Detector

The synchronous detector



Decade counter allows integrating a small slice of audio

Clock Buffer reduces sampling window by half

Analog Switch plus R/C integrator

Follower unity gain buffer (Integrator is not loaded)

zNEO samples **ANA_BUF1** and **ANA_BUF2**

zNEO generates **CLOCK**

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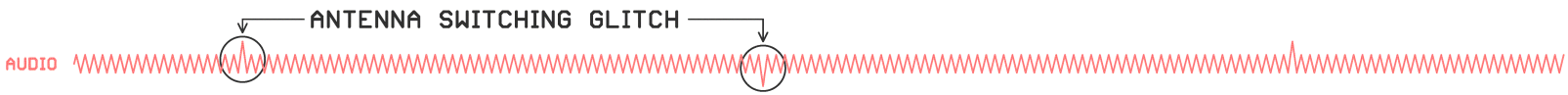
Synchronous Detector Action

What the synchronous detector *sees*:



Phase shifts (due to antenna switching) are in opposite direction

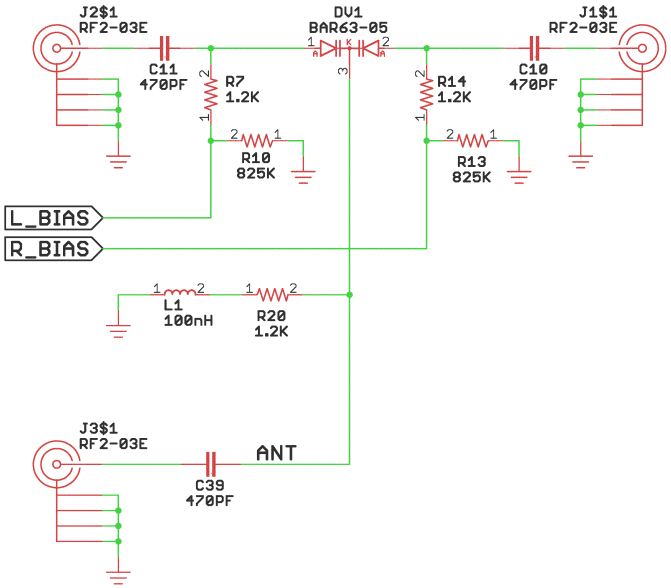
Integrator gated on only during antenna switching

Opposite polarity *glitch* on **INTEG1** and **INTEG2**

zNEO digitizes voltage at the integrator at end of the sampling period

Antenna Switching

Antenna switching using PIN diode:



L_BIAS and **R_BIAS** are opposite polarity

R10/R13 will be removed (not necessary in this design)

Forward biased diode sits about 2V above ground

Same operating principle as 102-73170-20

Daughtercard rides on main board

2 antennas

External tranceiver

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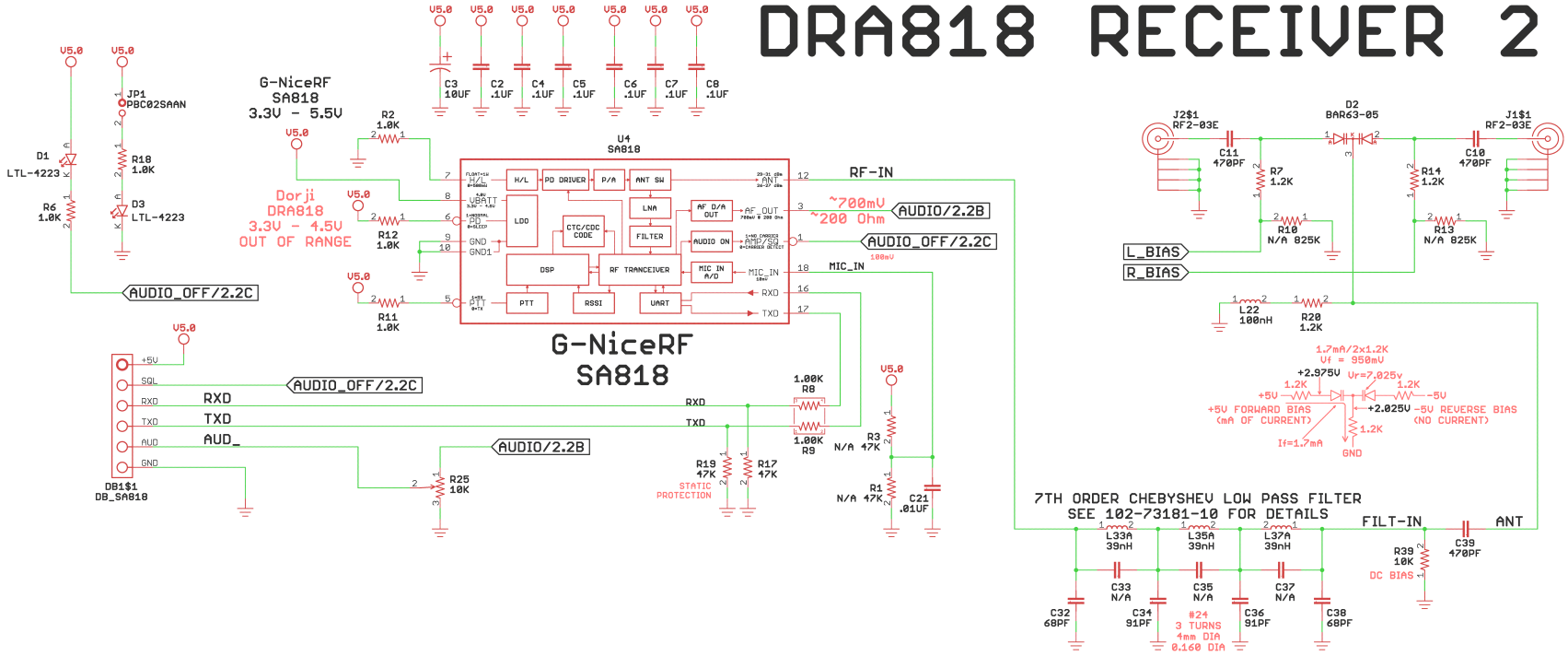
Internal Receiver Module

Using our SA818 RF module:



zNEO on mainboard controls SA818 (i.e. selects frequency)

Same PIN switch

Low Pass Filter from Fox Transmitter

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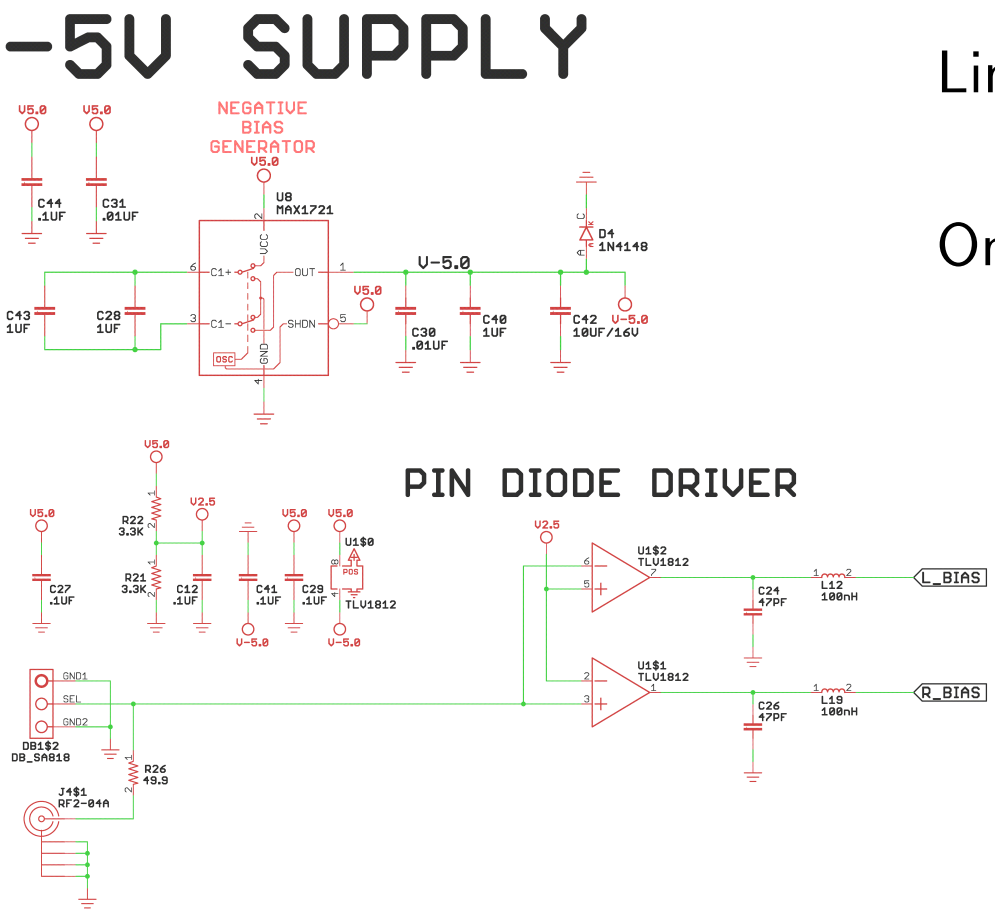
Internal Receiver Module

Negative bias and PIN driver:



Simple switched-capacitor voltage pump

Limited current capability

Only used to reverse bias the PIN diode

Comparator powered by +5V and -5V rail

Comparator output rail-to-rail

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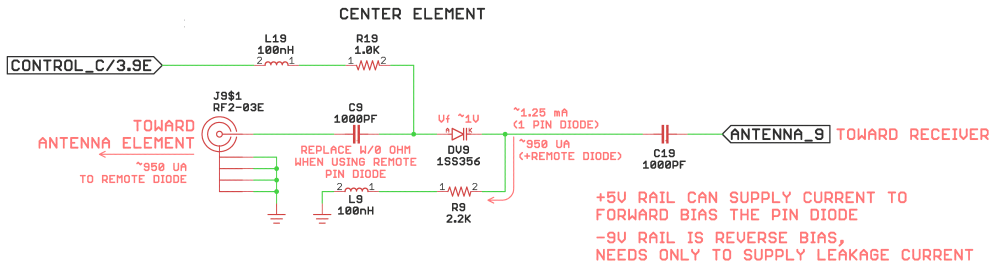
Electronic Antenna Rotator

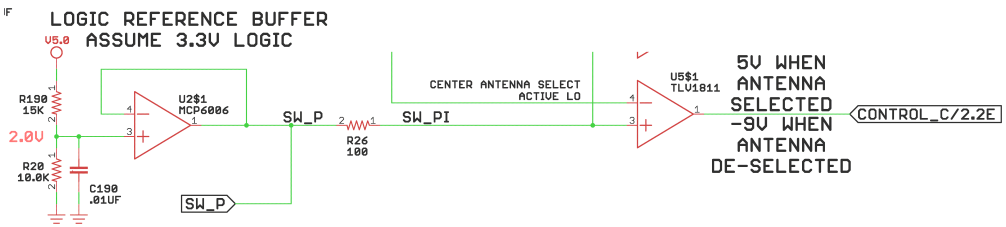
Switched Antenna Array:



PIN diode antenna select

Same design, back again

Very small current on -5V rail



PIN diode driver

Same Comparator design

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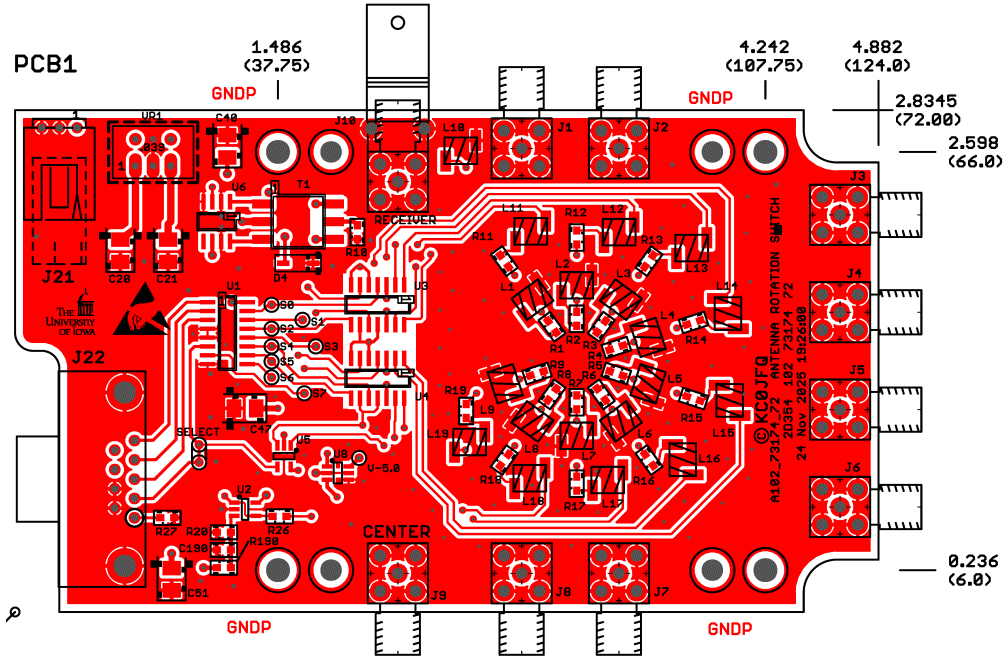
Antenna Rotator Artwork

The board (9 channels):



9 elements one center element, eight radial elements

DE9 control cable, SMA/BNC coax back to control board

Center/radial spacing slightly less than 1/2 wavelength

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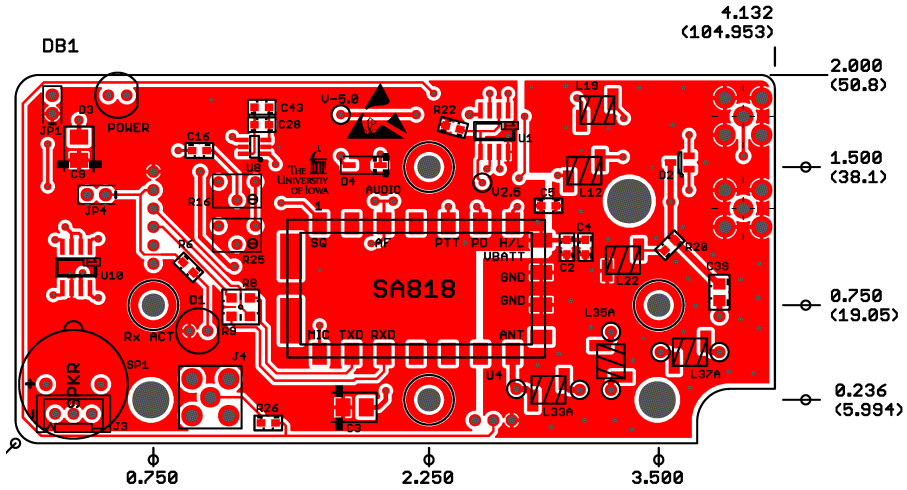
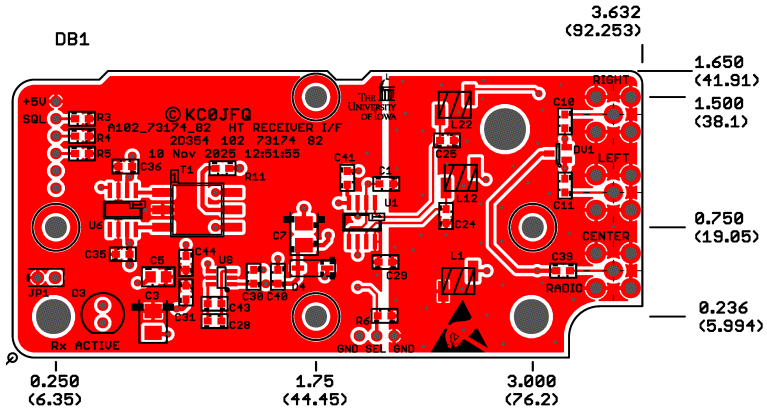
Daughtercard Images

SA818 Receiver:



Antenna Switch:



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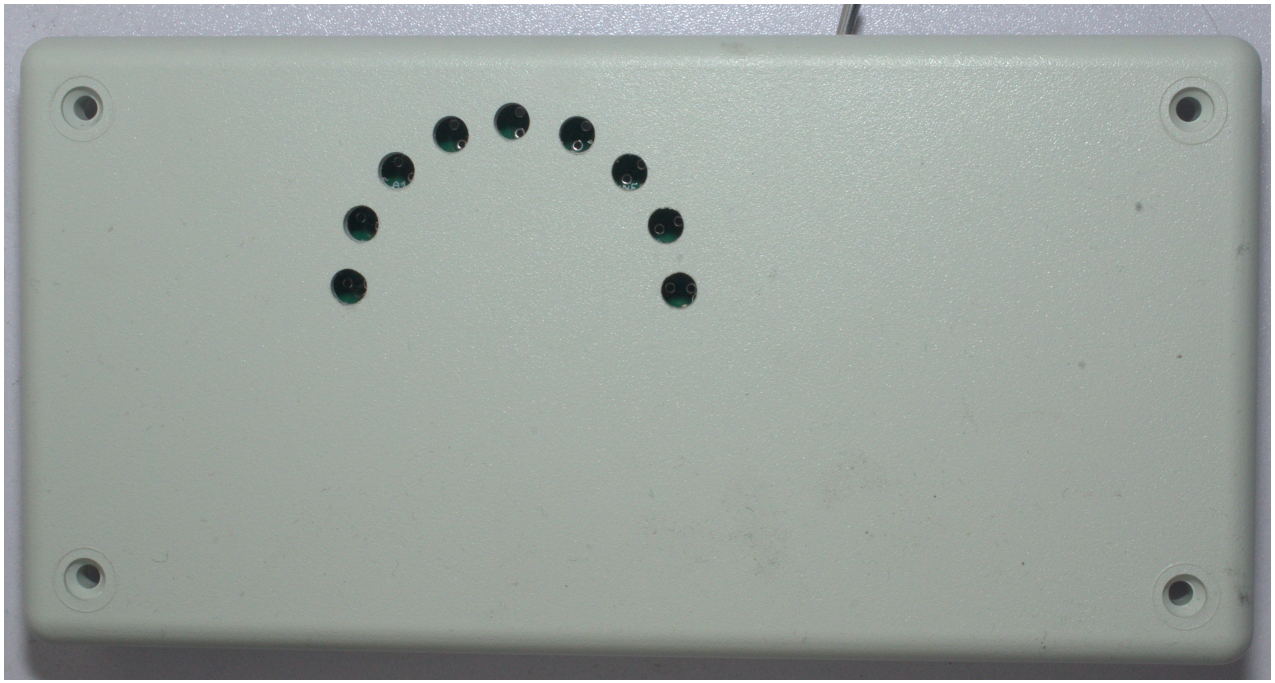
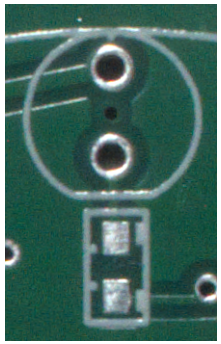
Imitation Panel Meter

Almost Done...





LED array on main board sticks out through bottom panel

Use extra circuit board as drill jig

LEDs just fit between housing and circuit board

LEDs just fit between housing and circuit board

LEDs protrude only about 1mm through panel

Done

We are finished!

- Indented Line

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Scary Notes for the Presenter

These are my crib notes. I sure hop I rememberd to print them off and bring them along...