



# ARIANNA Multistage Amplifier for Neutrino Detection in Antarctica



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## Background

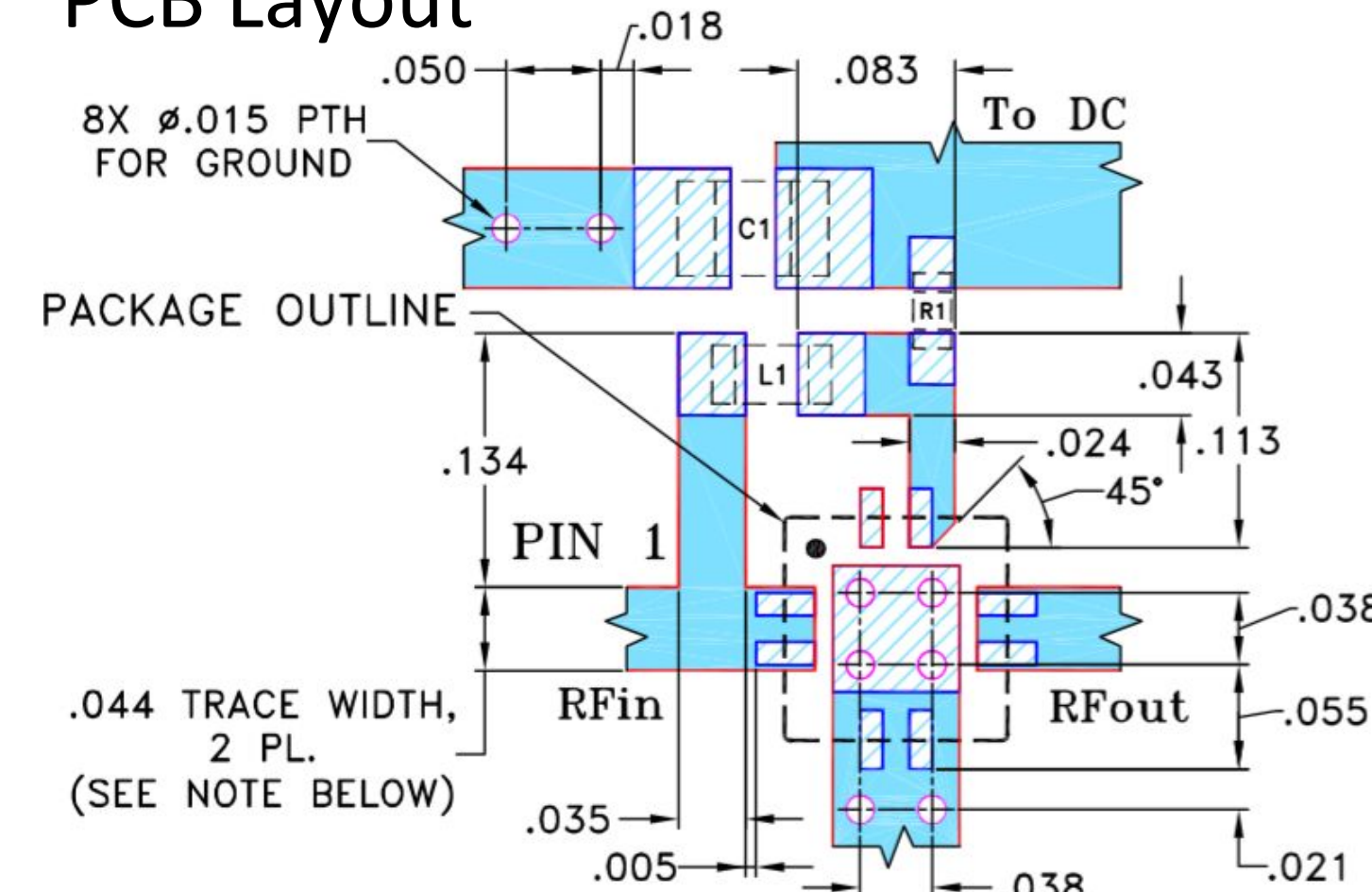
The Antarctica Ross Ice-Shelf ANtenna Neutrino Array (ARIANNA) is a neutrino detector located in Antarctica. The neutrino detector works by amplifying weak radio frequency signals generated by neutrino-ice molecule interactions. However, the current amplifier board used by ARIANNA is no longer in production and needs to be redesigned.

## Project Goal

- Redesign ARIANNA'S current amplifier using updated components in KiCad (PCB Software suite)
- Manufacture updated amplifier PCB with updated components
- Test manufactured amplifier board and evaluate performance

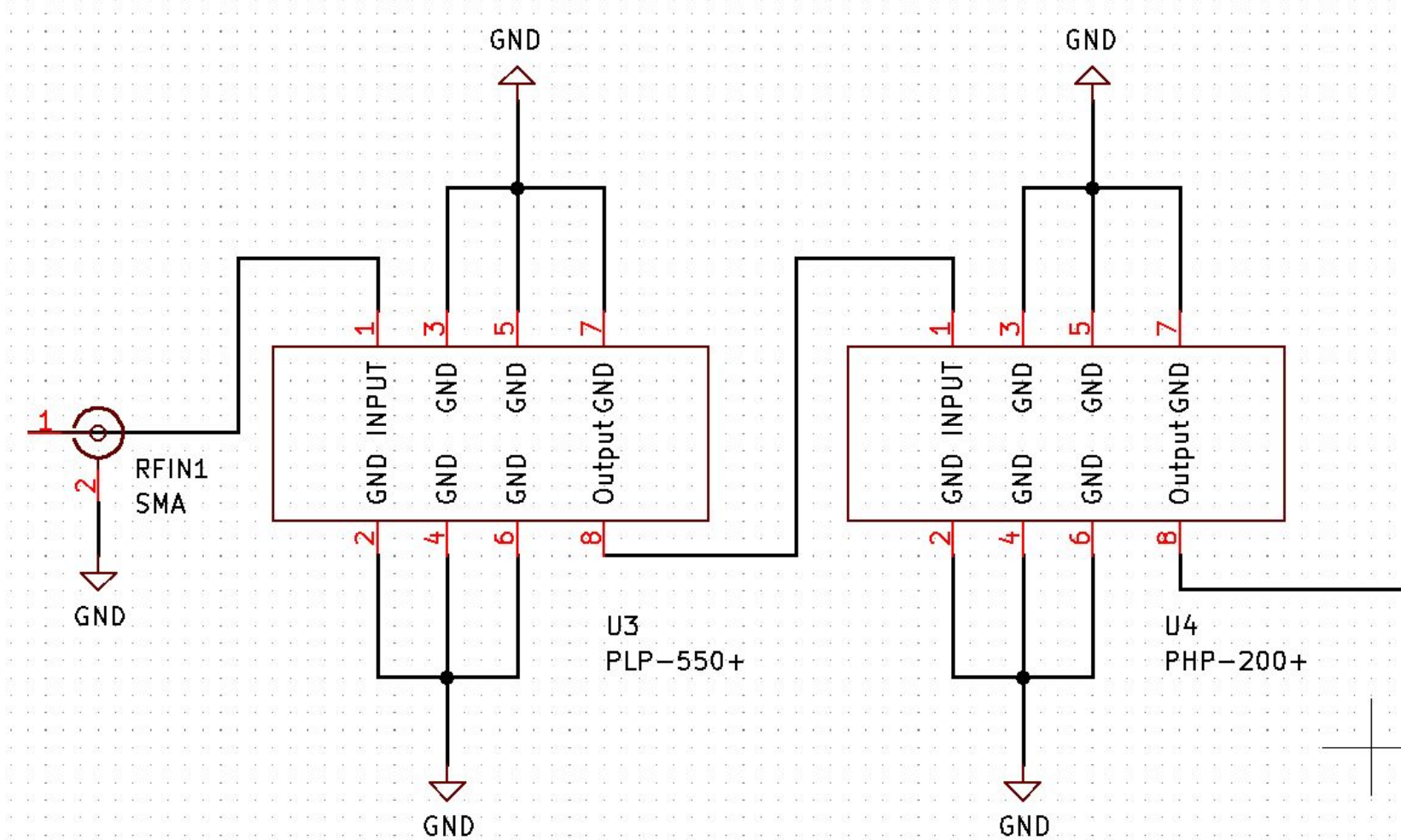
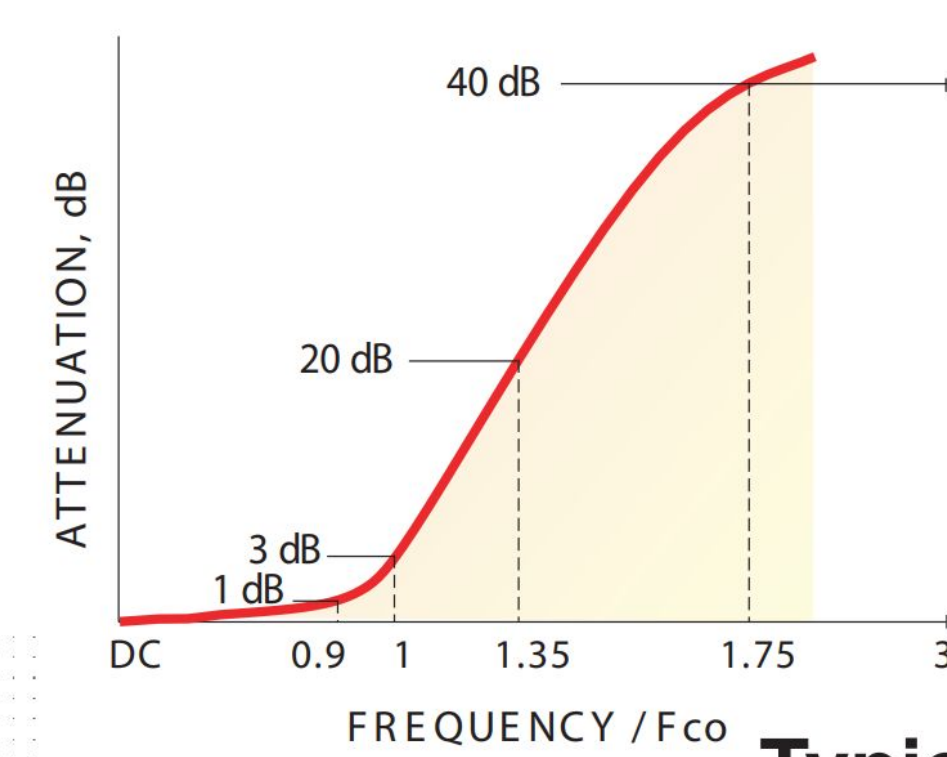
Evaluation Board TB-501-1+ Recommended

PCB Layout

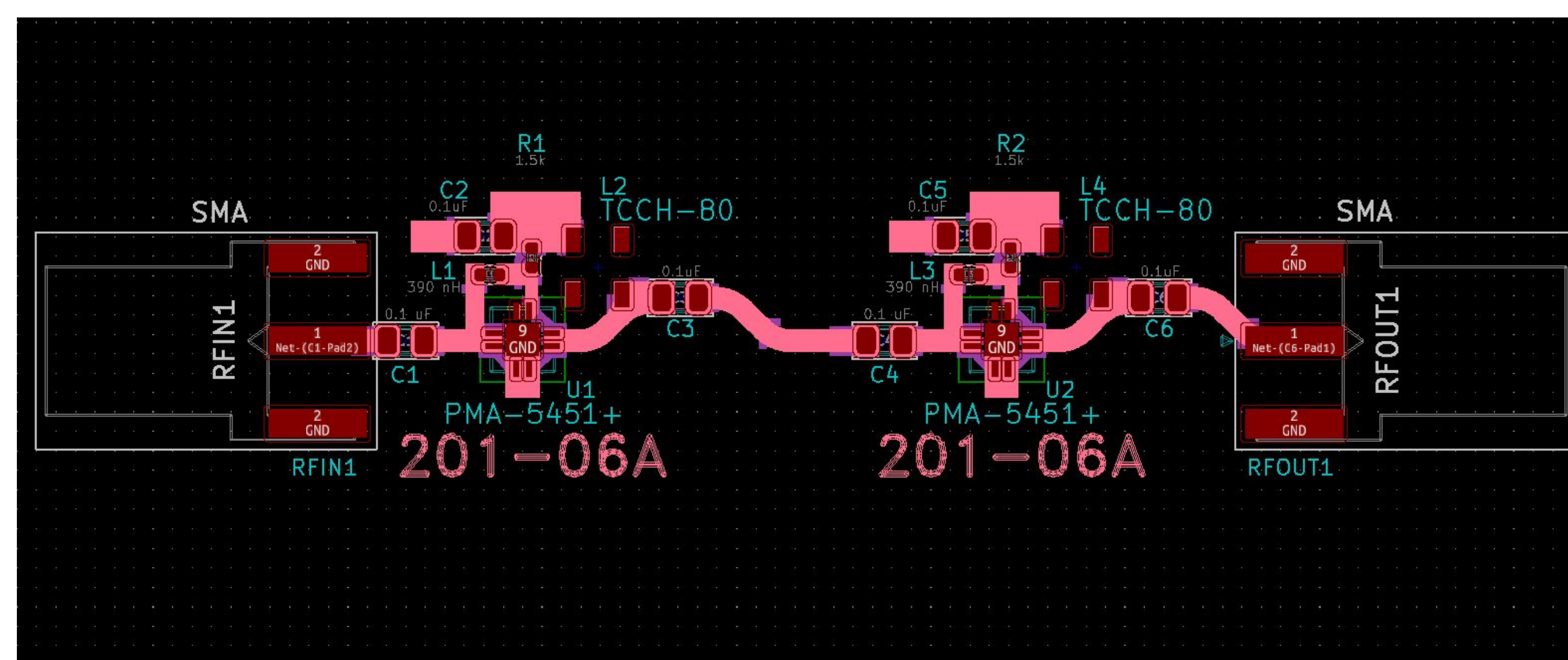
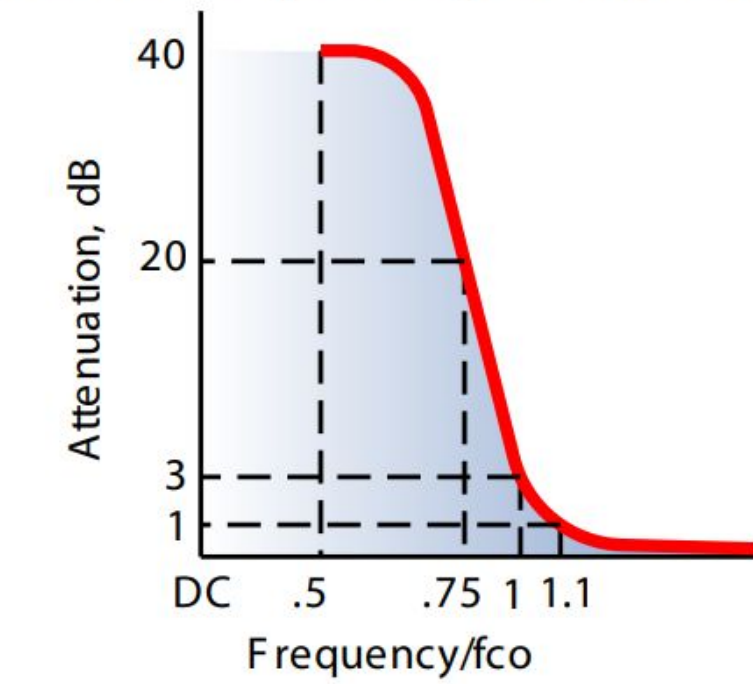


Bandpass filtering used in amplifier design

typical frequency response



typical frequency response



Cascaded amplifier based on TB-501-1+ evaluation board using PMA-5451+

## Materials Needed

- PMA-5451+ (LNA)
- TCCH-80+ (RF Choke)
- 50 Ohm SMA Female Connectors
- Inductors (390 nH)
- Capacitors (0.1 uF)
- Resistors (1.5k Ohm)
- R04350 (PCB Material)
- PLP-550+ (Low Pass Filter)
- PHP-200+ (High Pass Filter)

## Milestones

### Current Progress

- Recreated PCB Layout for Evaluation Board TB-501-1+ (layout of unit-cell amplifier)
- Cascaded unit-cell amplifier and implemented bandpass filtering in netlist

### Future Goals

- Import bandpass filtering design to PCB layout
- Finish power rail design/filtering in PCB design and netlist
- Produce finalized Gerber files and manufacture amplifier design

## References

- [1] Barwick, S et al., (2015). Design and Performance of the ARIANNA HRA-3 Neutrino Detector Systems. *IEEE Transactions on Nuclear Science*, 62(5), pp.2202-2215.
- [2] Ho, W. (2019). Application Note: PCB Design Using KiCad [online] Dart.ece.ucdavis.edu.
- [3] Hymel, S. (2019). An Intro to KiCad – Part 1: How PCBs Are Made | DigiKey. [online] YouTube.