

# Switchable Pre-Selector Bank of SAW Filters

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## BACKGROUND

Software-Defined Radios (SDRs) need flexible front-end filtering to reject unwanted signals while maintaining strong selectivity. Surface Acoustic Wave (SAW) filters are ideal for this purpose due to their stability and compact size.

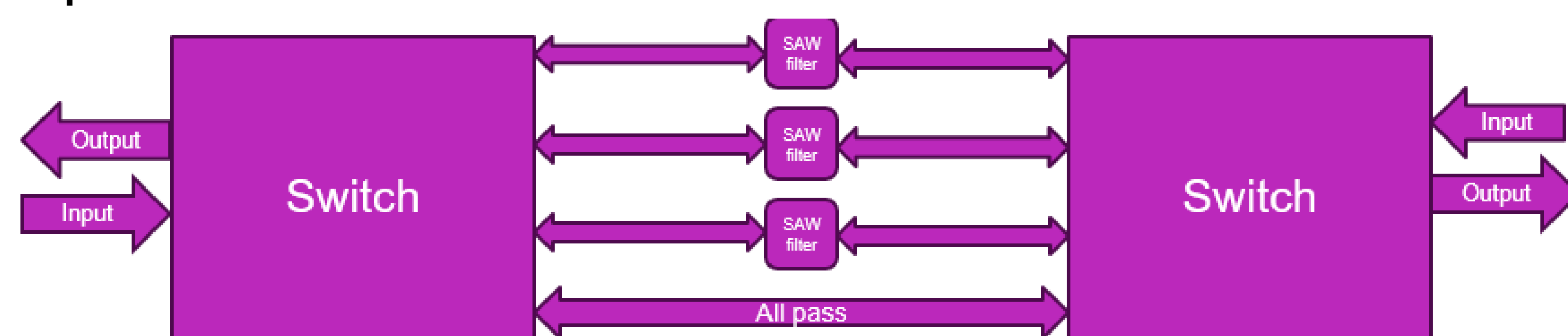
- Switchable SAW filter banks allow dynamic selection of frequency bands.
- They help improve SDR performance by reducing interference and loss.

## RESEARCH QUESTIONS

- How can a switchable SAW filter bank improve the front-end performance of a software-defined radio?
- How can we design a bank of SAW filters and switch between them?
- Why are SAW filters the best choice for this application?
- What happens to the SDR signal after passing through the SAW filters?
- How are reflection and insertion loss affected by the filtering?

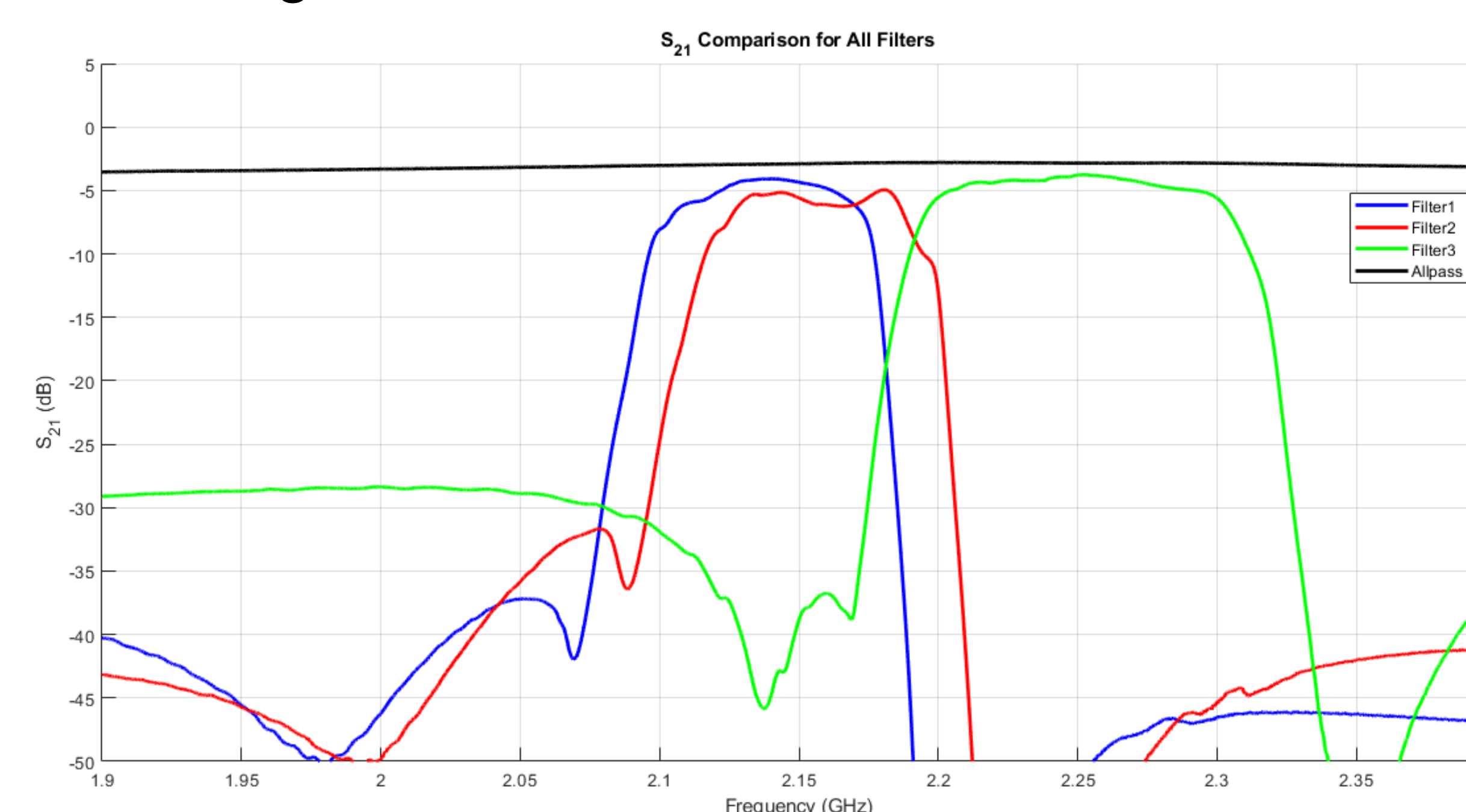
## METHODS AND MATERIALS

A switchable SAW filter bank was implemented to optimize the SDR front end. Two SP4T RF switches controlled the filters, which were managed digitally via an Arduino. The PCB was designed in KiCad with coplanar waveguide RF lines optimized for 50  $\Omega$  impedance.



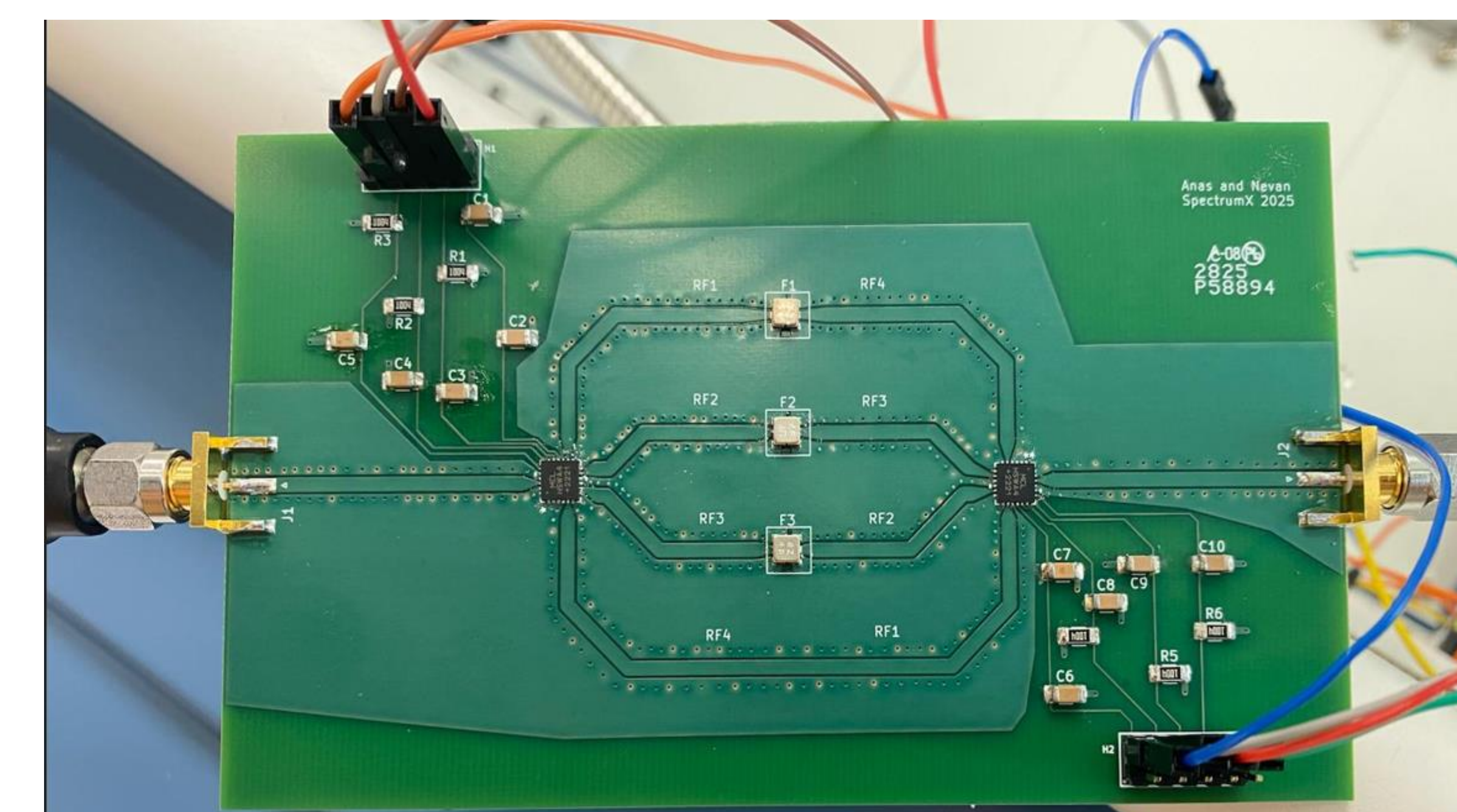
## RESULTS

The S21 measurements clearly show the three filter bands and the unfiltered signal, demonstrating effective switching and minimal insertion loss.



## CONCLUSION

- The switchable SAW filter bank successfully filters multiple SDR frequency bands using two SP4T switches controlled by an Arduino.
- PCB designed in KiCad with coplanar waveguide RF lines optimized for 50  $\Omega$  impedance, maintaining low insertion loss and minimal reflection.
- S21 measurements confirm the performance of each filter and the unfiltered signal, showing clear band separation.
- The project demonstrates that a custom switchable preselector bank can enhance SDR front-end performance with commercially available components.
- Future improvements: automated band selection, additional frequency bands, and PCB miniaturization for embedded SDR modules.
- Switching between filters is fast and reliable, enabling real-time SDR operation.



## ACKNOWLEDGEMENTS

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## REFERENCES

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2. Specifications from TST, TA0733A SAW Filter datasheet (Digi-Key, 2025).
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