

## SWITCH FILTER BANKS FOR AGILE RF RECEIVER DESIGN IN RADAR



Today, modern radar systems are expected to serve in a multi-mission capacity. For example, the [F-35 Joint Strike Fighter](#) uses a multi-function array, where the radar active electronically scanned array (AESA) in the aircraft nose cone is shared between the electronic warfare (EW) and communications systems.

# Designing Agile Radio Frequency (RF) Receivers with Nimble RF Components

Tunable bandwidth is becoming more and more desirable. Designers need to be able to balance radar range and resolution *and* optimize performance across missions. Further, these systems need to operate reliably in a congested spectrum where there are many blockers.

In RF communications systems, unwanted input signals, otherwise known as blockers, directly or indirectly degrade the gain and signal-to-noise ratio (SNR) of the signal of interest. Blockers take the form of intentional and unintentional interference. Other RF communications systems operating in the adjacent frequency spectrum can cause unintentional interference, but so can malicious EW systems.

Agile RF receivers can be optimized moment-to-moment to adjust to evolving parameters. This level of control is accomplished using fully digital receivers with analog filter protection to evade blockers and prevent receiver damage. Nimble analog RF components, like switch filter banks, are critical to accomplish this level of optimization.

Switch filter banks are traditionally associated with larger footprints, but Knowles Precision Devices is leveraging materials science innovations to shrink the size of each individual filter. We use high-precision lithographic processes to pattern microstrip filters on our custom ceramics, and we develop low-loss, temperature-stable dielectrics that allow us to significantly reduce filter form factors (Figure 1).

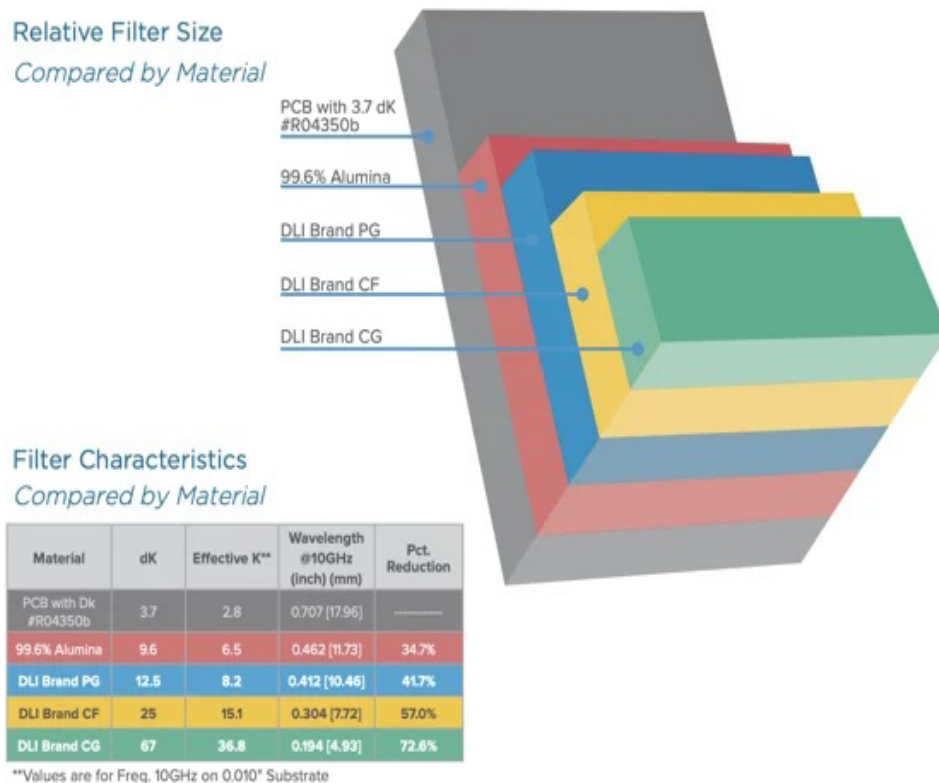


Figure 1. Relative DLI brand filter size with materials breakdown.

From there, our custom engineering team uses these miniature filters to create state-of-the-art multi-band filter structures that enable tiny switch filter banks.

Beyond miniaturizing filter components, there's an opportunity to innovate around packaging. In partnership with Criteria Labs, we've established a [small but reliable packaging concept](#) for switch filter banks (Figure 2). With consideration for input size and how narrow the output needs to be, a designer has room for more channels.

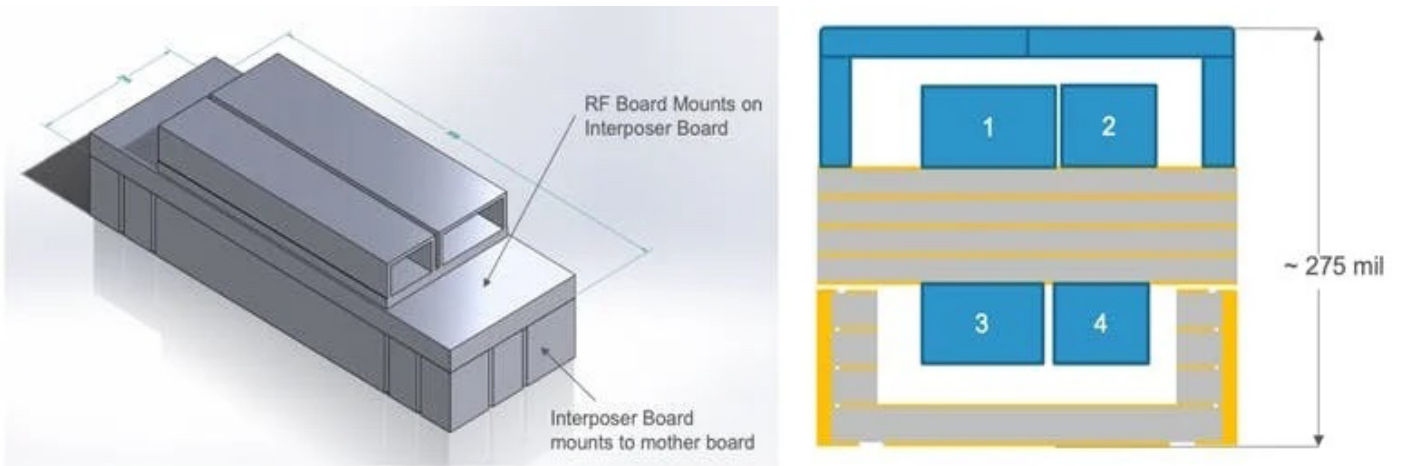


Figure 2. Knowles Precision Devices and Criteria Labs collaborated on a design to shrink a four-channel switch filter bank.

The design, based on a four-channel filter bank, features a 3D-stacked structure with alternating filters and interposer boards mounted directly to the printed circuit board (PCB). The result is a reduction in internal spacing that ultimately reduces the size of the filter bank.

Knowles Precision Devices produces a wide variety of high-reliability components for use in leading military programs. For more information or consulting on switch filter banks, [contact us](#).

[Learn More](#)

If you need help selecting from our portfolio please contact us and we can guide you through the selection process.



2777 Hwy 20  
Cazenovia, NY 13035



(315) 655-8710



Contact Knowles