



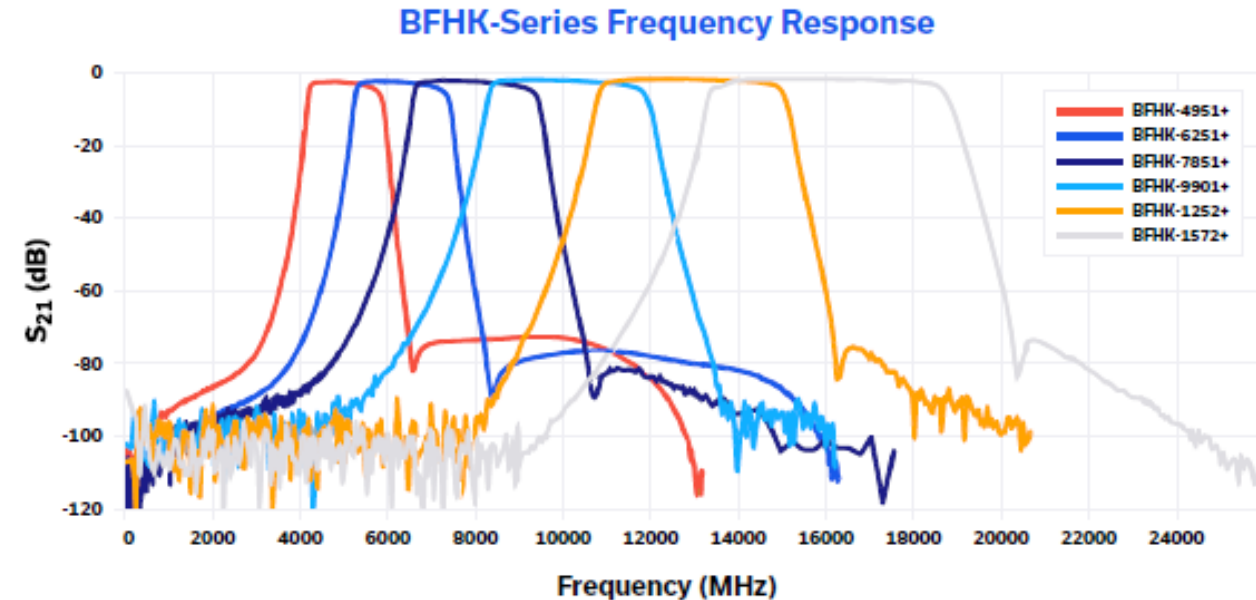
# A Novel Solution for Board Design Compatibility with High-Rejection LTCC Filters

Presented by William Yu

November 2024

# BFHK Series - Ultra High Rejection Filters

- New technology platform released to market in 2022
  - 18 BFHK Bandpass filters released to the catalog
    - Covers passbands between 4-36 GHz
  - 5 LFHK Lowpass filters to be released by the end of the year
  - Protected by US Patents 11,638,370 and 11,744,057
- Key Features
  - 2.5dB Typical mid-band Insertion Loss
  - 20-30% Typical percentage bandwidth
  - 80dB Typical Stopband rejection
    - Rejection bandwidth of 2.5x Center frequency
  - Small and Cost effective compared to alternatives
    - Case sizes: Range between 1008 and 1812
- Applications
  - Test and Measurement
  - Satellite Communications
  - Aerospace and Defense



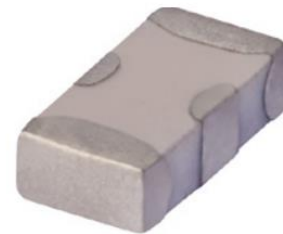
# BFHK Series - Ultra High Rejection Filters

- Best in Class LTCC Filter Performance
  - Distributed Filter topologies
  - Material systems with high Dk, low loss tangents
- Ultra High Rejection
  - Conformally Plated Case Style
    - Coaxial Launch
  - Internally isolating features to minimize crosstalk

BFHK Conformally Plated  
Case Style



Wrap-Around  
Case style



LGA  
Case style



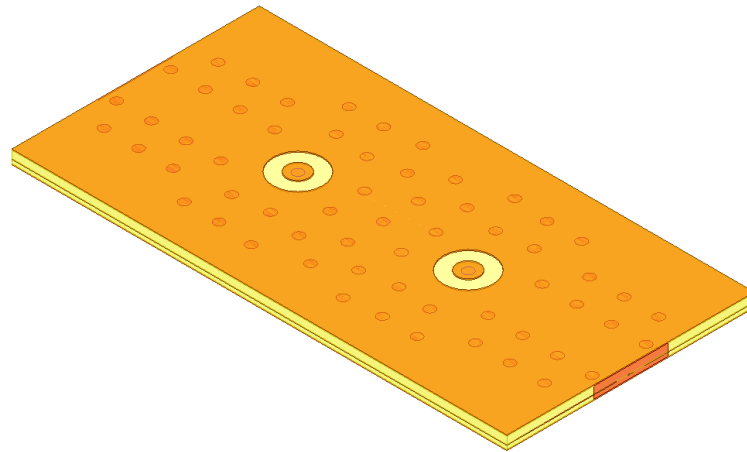
# BFHK Series - Ultra High Rejection Filters

- Pros
  - Ultra high rejection
  - No expensive channelization of system
  - Conformal Plating prevents interference by nearby components
- Con
  - Coaxial RF Pads require the use a multilayer Stripline PCB assembly

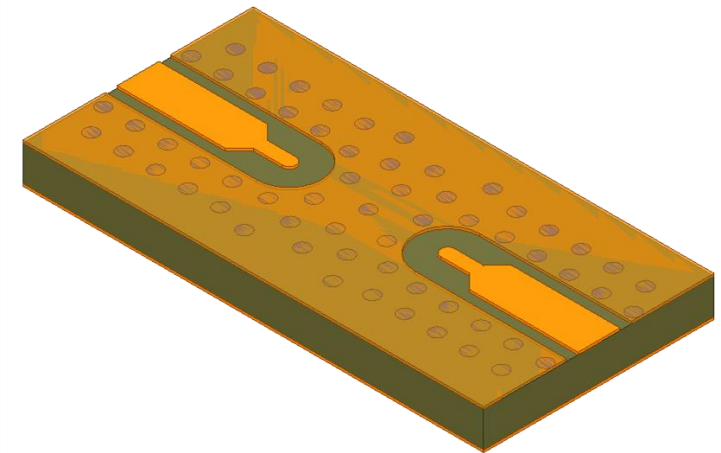
**BFHK Filter  
Bottom View**



**Recommended Layout**

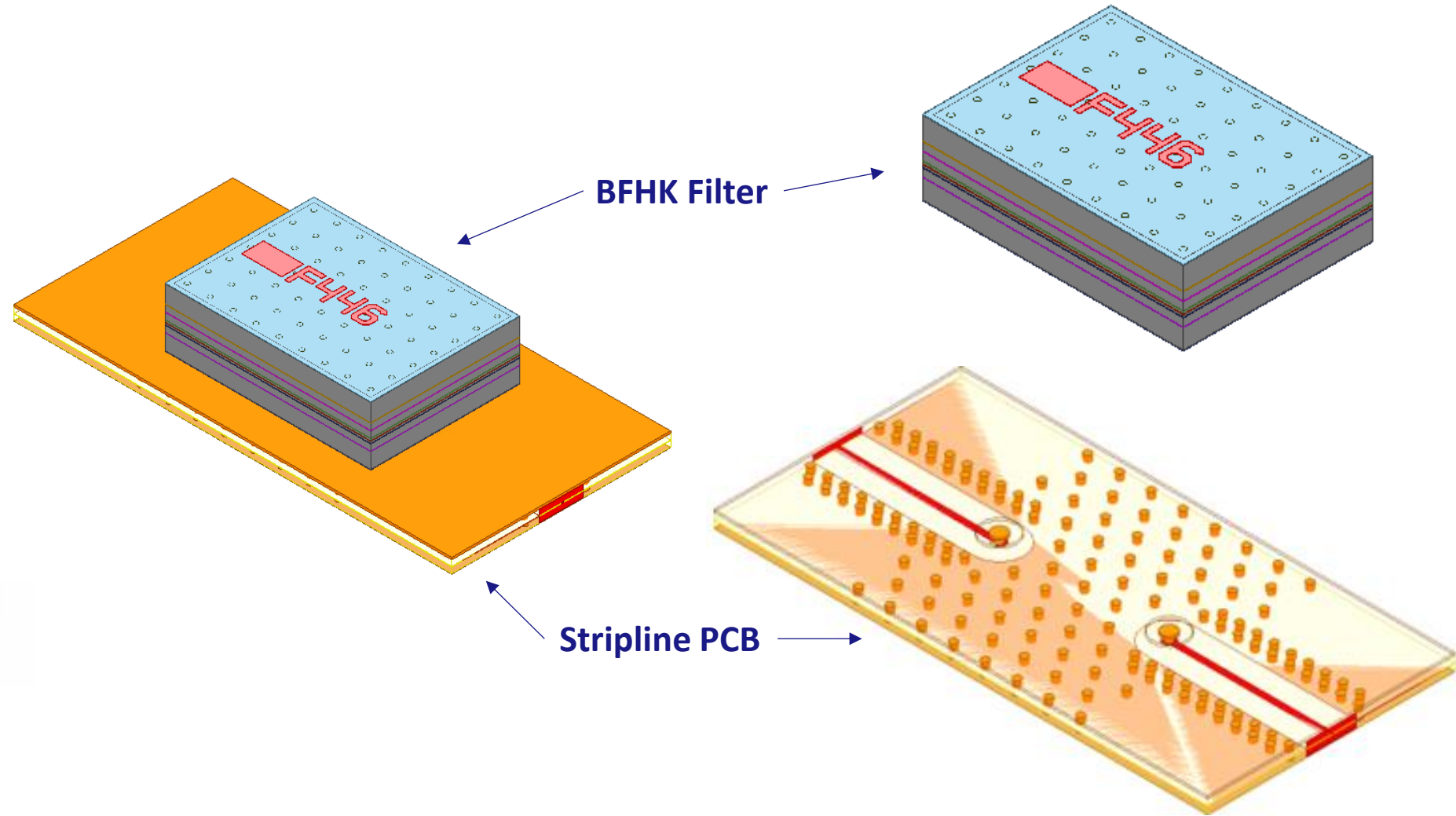


**Incompatible Layout**



# BFHK Assembly – Stripline Layout

## BFHK Filter Bottom View

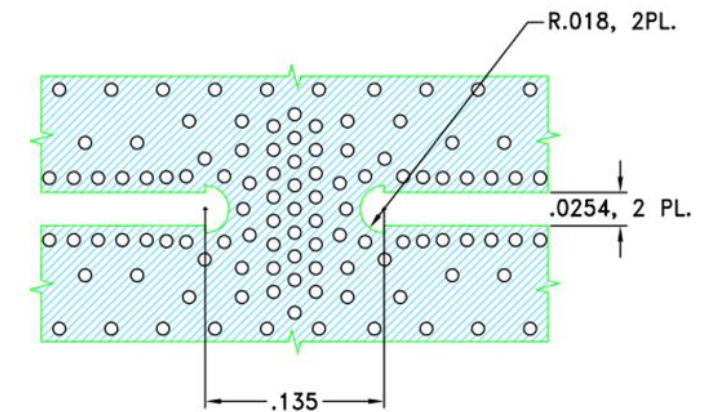
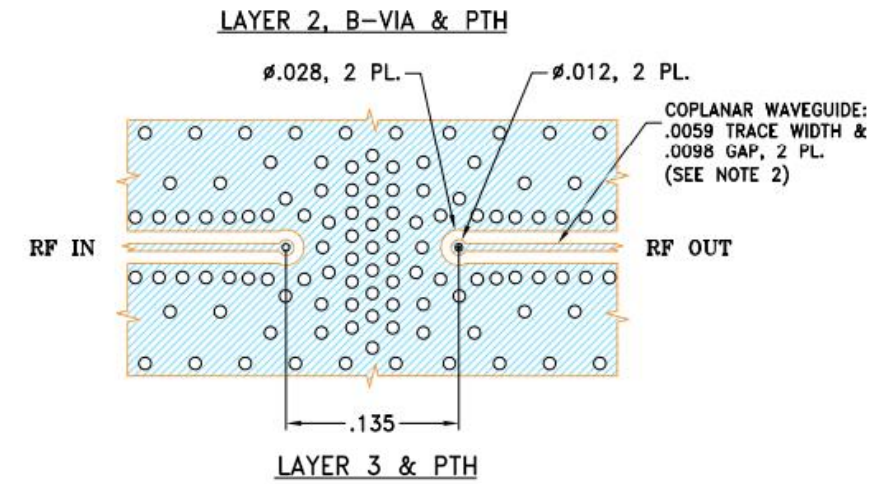
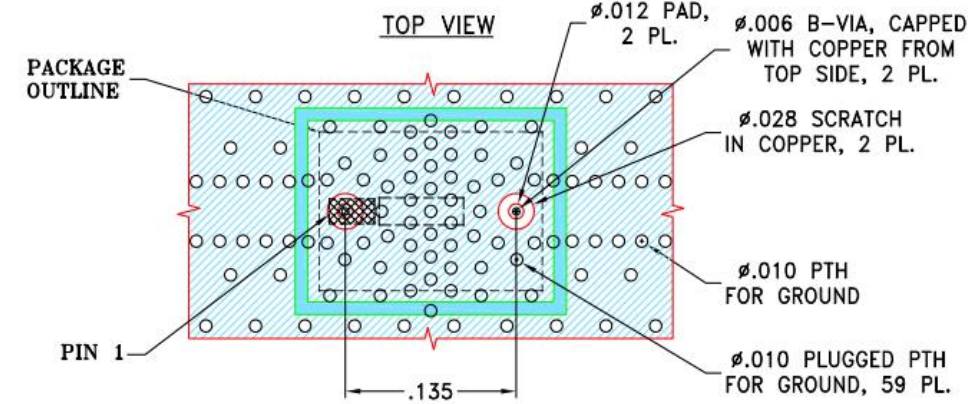
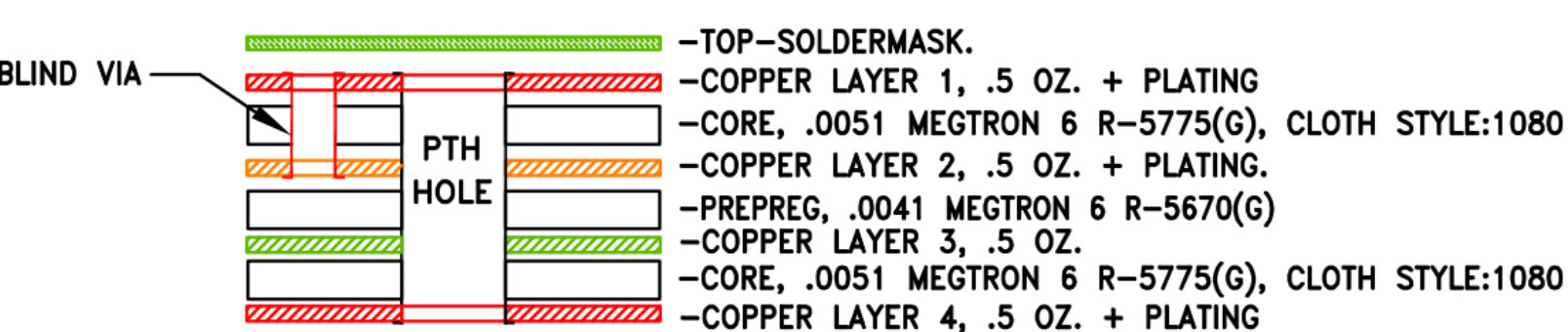




# BFHK Implementation – Stripline Launch

- Layout
  - Launch from a stripline PCB
  - Not compatible with Microstrip/CPW (top layer signal traces)
- Stack-Up
  - 4 Copper Layers
  - Megtron 6 substrate
  - Blind Via to the signal layer

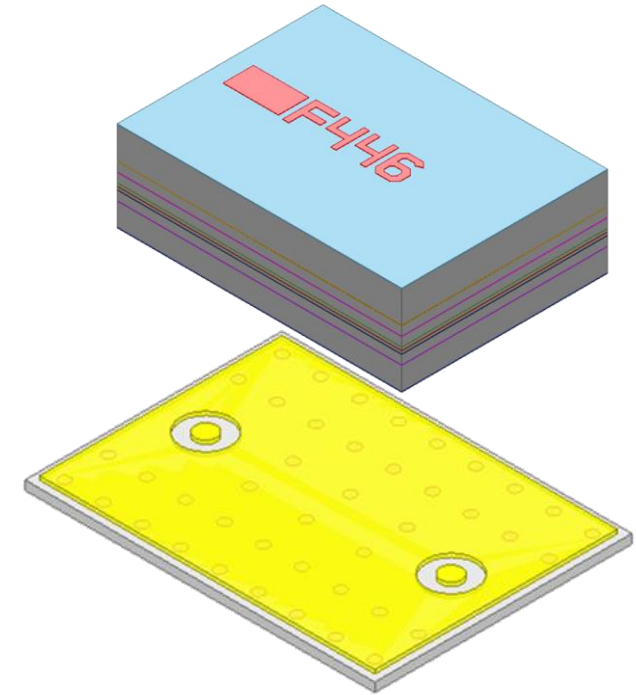
## STACK-UP DIAGRAM



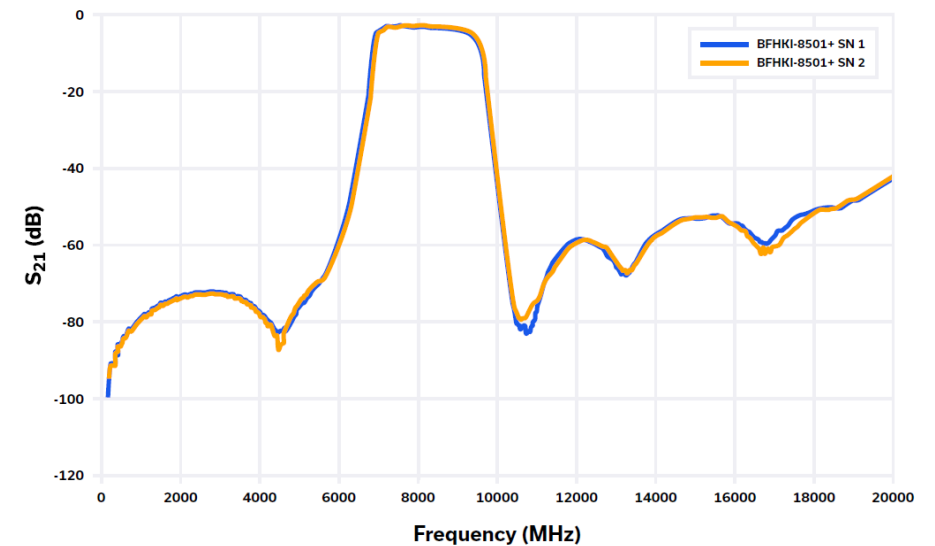
# BFHFI Series – BFHK on Universal Interposer

- BFHFI Series
  - BFHK mounted on an interposer board
  - No longer coaxial RF Pad
- Pros
  - Compatible with CPW and Microstrip PCBs
  - Conformal Plating prevents interference by nearby components
  - Similar Size to the BFHK
    - ~10% larger case size
- Cons
  - Lower stopband rejection when mounted on CPW/Microstrip Platforms
    - Comparable to other LTCC filters
  - Increased cost due to additional assembly step

BFHFI Filter  
Bottom View

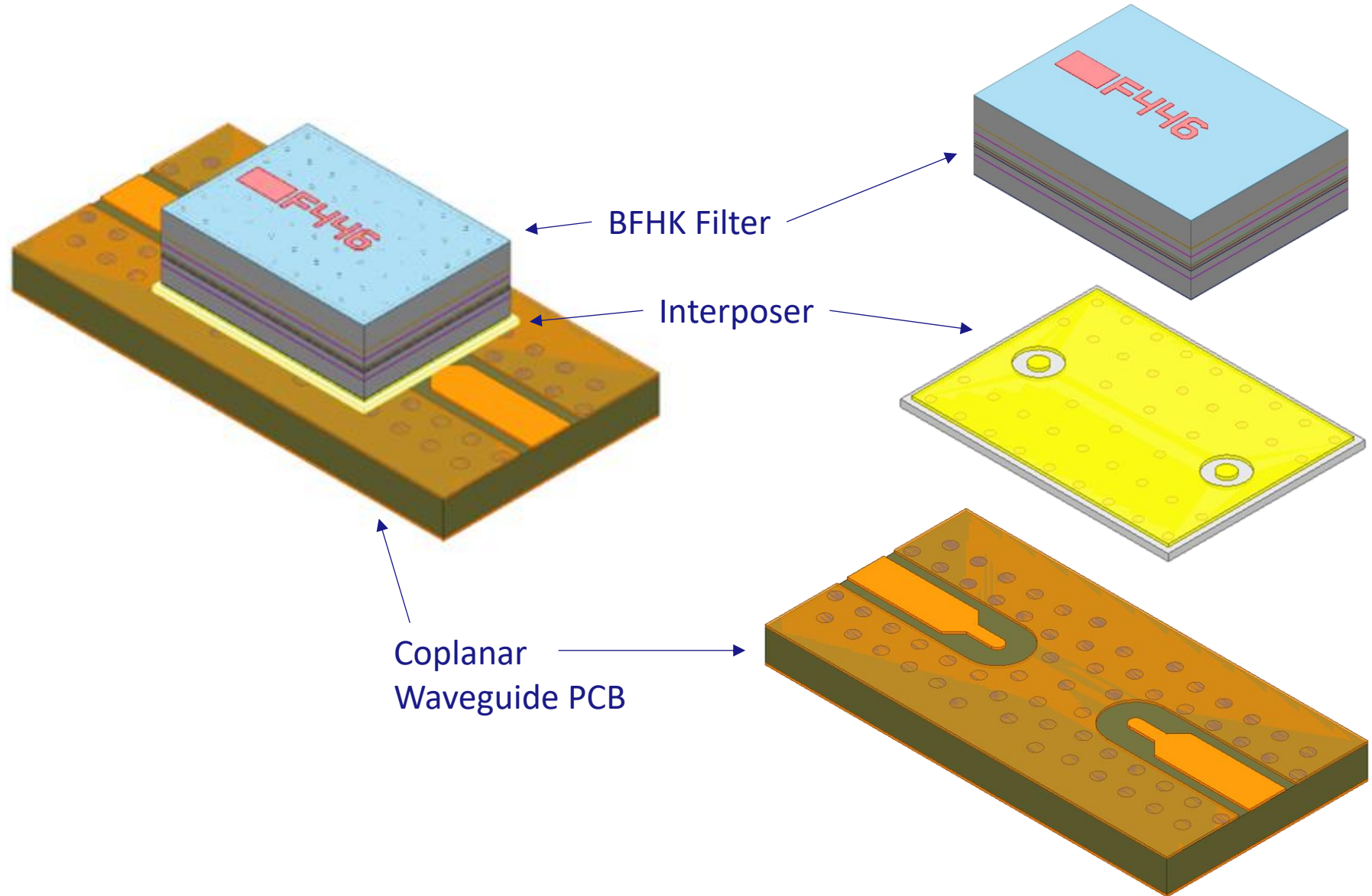


BFHK-8501+ Frequency Response CPWG



# BFHKI Assembly – CPW Layout

## BFHKI Filter Bottom View

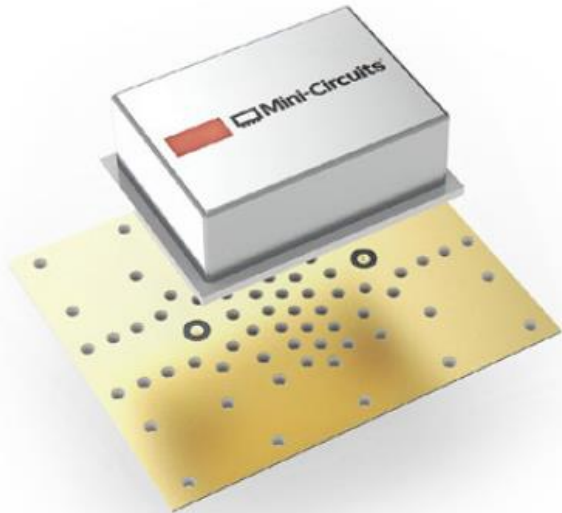




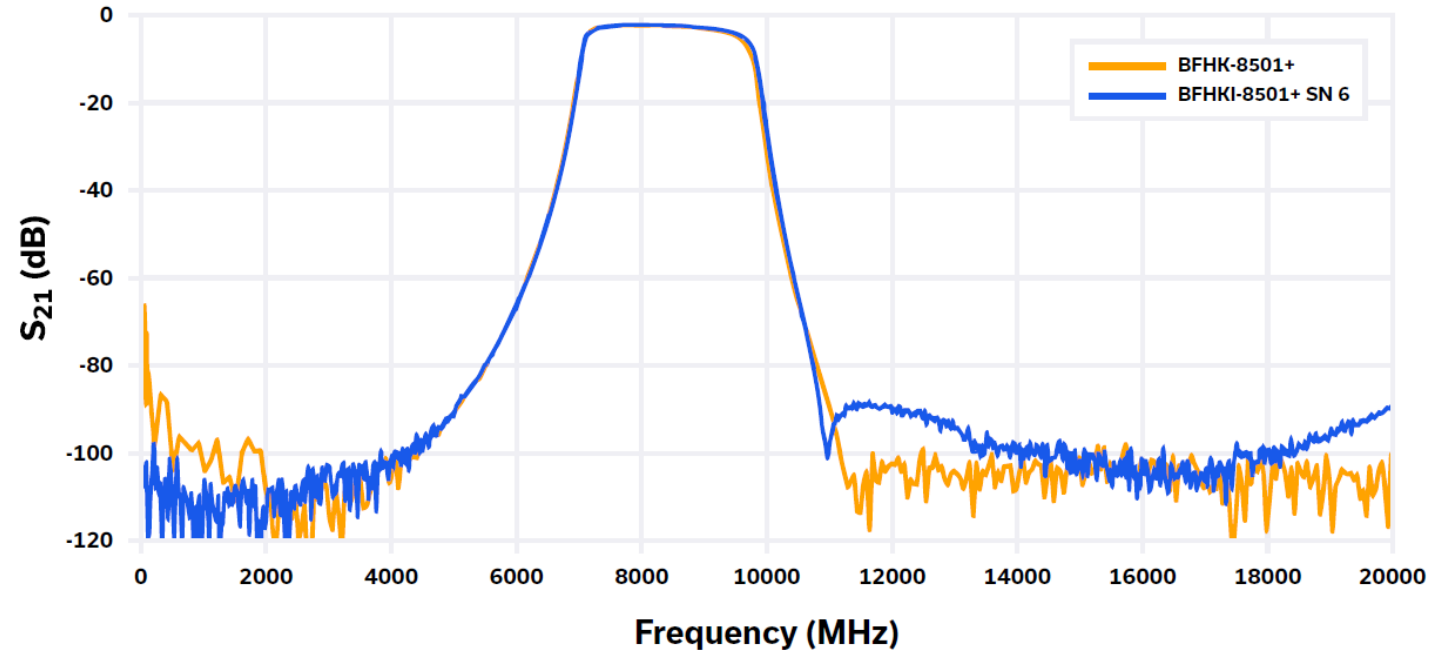
# BFHKI Series – Implementations for Ultra High Rejection

- BFHKI is still compatible with a stripline PCB, like the original BFHK
  - At lower frequencies (<20GHz), 80+ dB rejection can still be achieved

## BFHKI Filter Launching to Stripline



BFHK-8501+ and BFHKI-8501+ Frequency Response Stripline Launch no Epoxy



## BFHKI Series – Additional Implementation for Ultra High Rejection

- Silver epoxy isolates the opening in the ground around the BFHKI RF pad, for maximum Rejection performance
- Can be automated in assembly with automated epoxy dispensing

### BFHKI Filter Bottom View



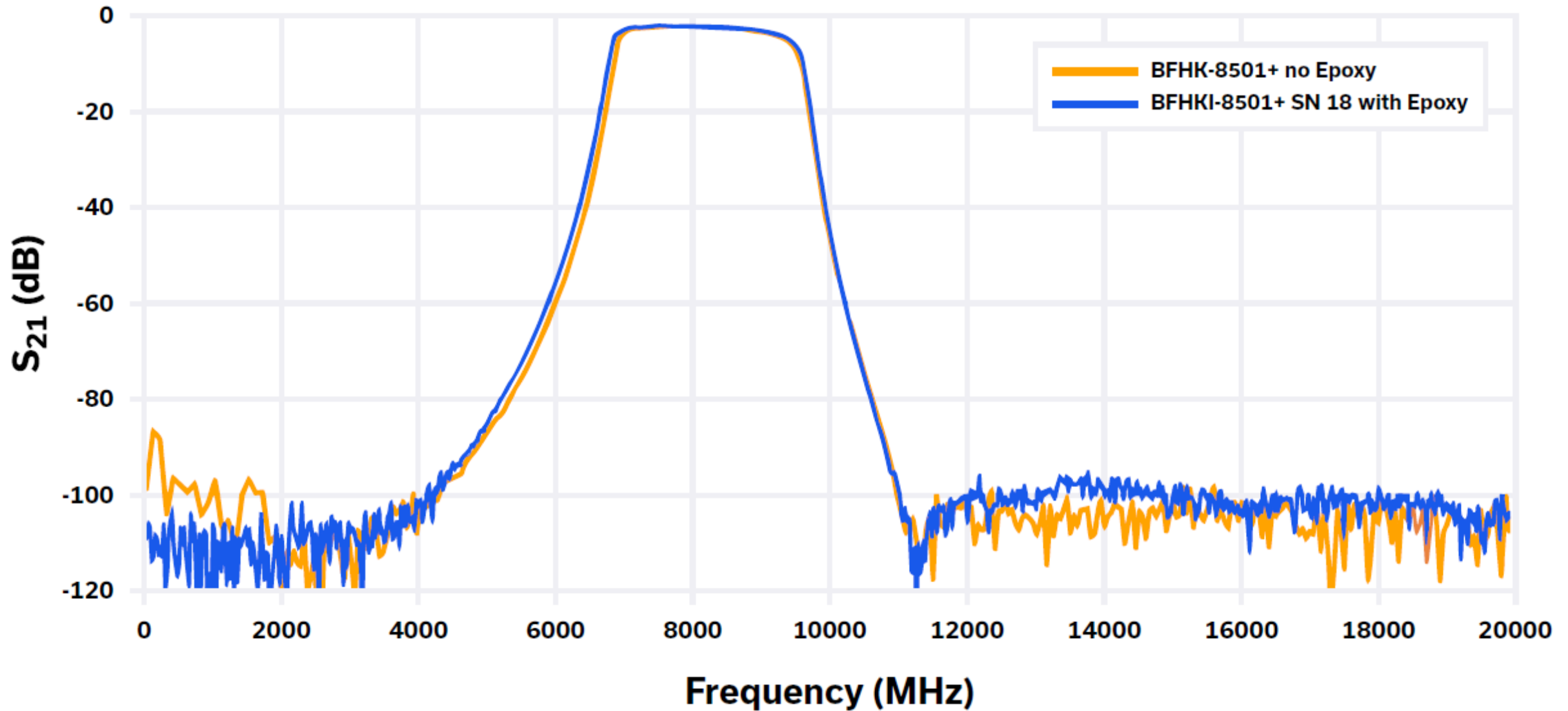
### BFHKI Mounted without silver epoxy



### BFHKI Mounted with silver epoxy sealing



# BFHK-8501+ no Epoxy vs. BFHKI-8501+ with Epoxy - Stripline Launch



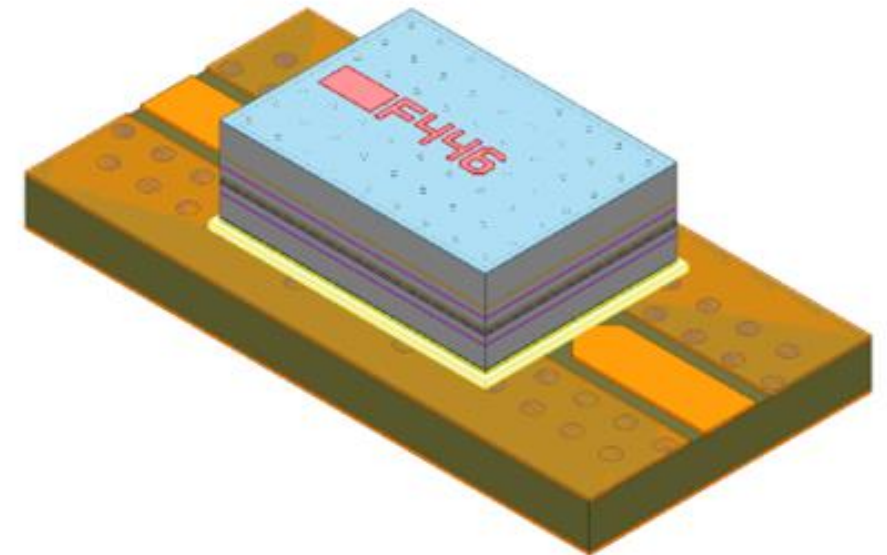
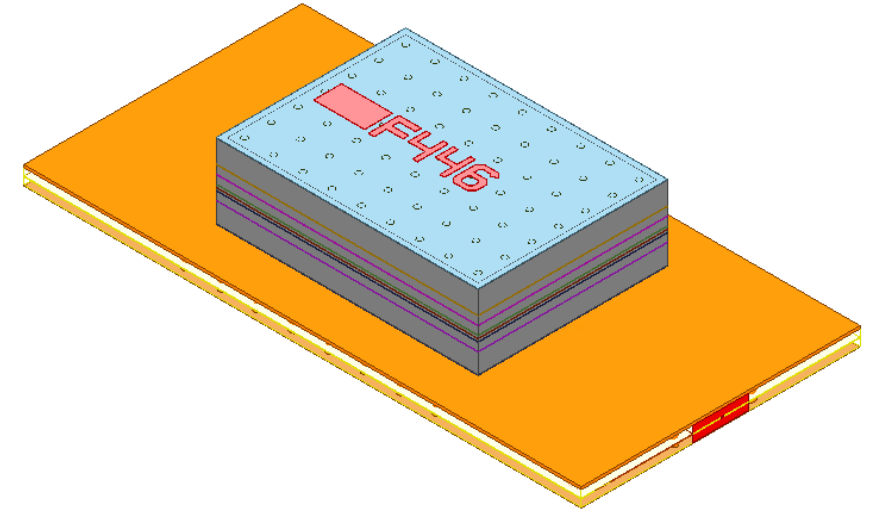
## Conclusion

### BFHK-series

- Surface Mountable, Ultra high rejection filters
- Small footprint, cost efficient
- Limited to stripline PCB

### BFHKI-series

- Same benefits as BFHK-series
- Flexibility in mounting
- Rejection limited by implementation
  - Limited rejection performance on CPW/Microstrip
  - Full rejection performance achieved on Stripline





# Questions

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# Thank you

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