Ultra-lightweight, Compact Magnet-less Circulators

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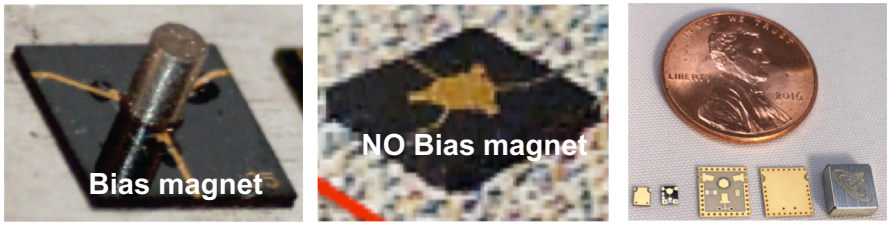
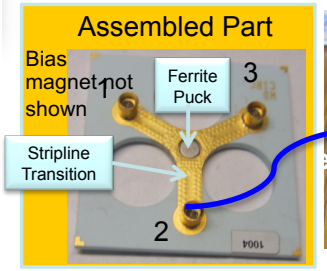
Objective

- Develop advanced “magnet-less” ferrite circulators for use in space-based phased arrays applying Metamagnetics’ recent materials science breakthrough funded in part by NASA’s SBIR program
- Demonstrate self-biased components > 90% smaller and lighter than traditional circulators largely due to lack of permanent biasing magnets
- Develop customized packaging for system integration
- Demonstrate increased ruggedness (by monolithic construction) in high shock and vibration environments

Conventional Circulators **Metamagnetics Self-biased Circulators**



Metamagnetics self-biased circulators offer as good or better performance compared to State of the Art in a far smaller, more robust, magnet-less device



Accomplishments

- Developed conceptual compact magnet-less circulator designs for tri-frequency radar (Ku/Ka/W Band) for potential next generation cloud and precipitation missions.
- Demonstrated improvements over existing self-biased ferrite material
  - More than 60% dielectric loss reduction at room temperature
  - More than 40% dielectric loss reduction at 100 ° C
- Developed miniature magnet-less Ka-band circulator design
  - Demonstrated approximately 25% thermal drift reduction
  - Electrical performance metrics exceed existing SOA based on published literature
  - Smallest known Ka-band ferrite circulator ever demonstrated
    - State of Art - Conventional Circulator (35.55 Ghz) size : 5.0 x 5.0 x 4.0 mm
    - Magnet-less Circulator (35.55 Ghz) Size: 2.4 x 0.7 mm

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TRL_{in} = 2 **TRL_{out} = 4**