

## At a Glance

### What it is

- The wideband, UHF/VHF circulator is used as the enabling device in a monostatic communication system to direct signal energy from one port to another.

### How it works

- The circulator employs two saturated ferrite disks in conjunction with a crossover network and matching networks.
- The ferrite is a non-reciprocal material that can discriminate the signal direction. The crossover network has similar properties of a transformer to allow magnetic coupling between traces. The matching networks present the correct impedance to the crossover for circulation.
- The dimensions of the crossover network, the properties of the ferrite and the components of the matching networks are optimized to obtain the best tradeoff between isolation and bandwidth.

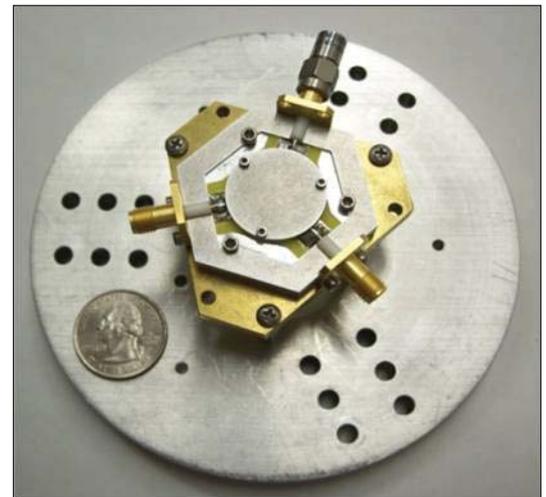
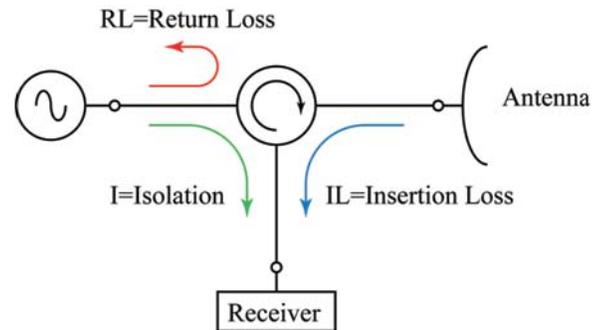
### What it will achieve

- Provide the USMC with a device that will interface with a wideband VHF or UHF antenna.
- The circulator antenna assembly will form the core subassembly in a monostatic communication system to reduce visual signature.

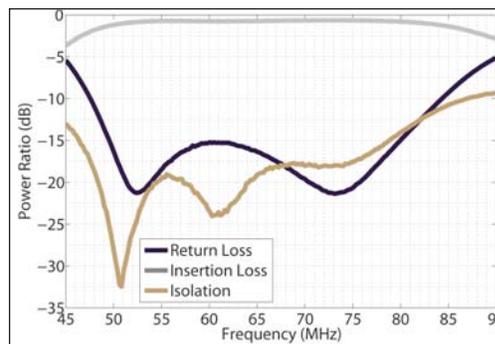
### Point of Contact

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Command, control, computers and communication (C4) activities on the battlefield require reliable, wideband communication links in the UHF and VHF bands. To reduce the visual signature of the command and control vehicle, it is desired that a single wideband antenna be used for both transmit and receive. The enabling device of such a system is the ferrite RF circulator which directs energy from the transmitter to the antenna and energy from the antenna to the receiver. The circulator must exhibit wideband and excellent isolation between the transmitter and the receiver.



The University of Idaho has recently developed hardware prototype, wideband, compact circulators that operate over the ranges 52-79 MHz and 170-400 MHz. In this band the isolation is 15 dB (min), return loss is 15 dB (min) and insertion losses on the order of 0.8 dB.



The developed circulators have been fully optimized to achieve the best tradeoff between isolation and bandwidth. Devices have been fabricated, tested and validated for proof-of-design. All parts are readily available. The device requires no specialized manufacturing equipment and can be easily mass produced.

### Research Challenge and Opportunities:

- Determination of bandwidth bounds to assure that the device is operating near its greatest bandwidth potential.