

## Technology Profile Fact Sheet

**Title:** Wideband Mixer-Circulator Retro-reflector

**Aliases:** None

**Technical Challenge:** Previous designs have used frequency multiplication or Field Effect Transistor (FET) mixing to modulate the reflection coefficient of an antenna and, therefore, the reflected amount of incident power to perform this function. These methods are limited by their instantaneous bandwidth to about 50 MHz, and tend to produce large amounts of harmonics.

**Description:** The two primary advantages of the Wideband Mixer-Circulator Retro-reflector are the wideband frequency response and the instantaneous bandwidth that exceeds the best previous design by an order of magnitude. This technology consists of a unique configuration of available components used for retro-reflector design that allows high-speed data transmission capability without the use of a local oscillator. The oscillator is physically remote and wirelessly connected to a geographically separate emitter. This is markedly different from optical retro-reflectors and RFID transponders. Optical retro-reflectors simply reflect the illuminating energy. RFID transponders use a fixed RF frequency with resonant circuits. The difference here is that this invention uses mixing of the incoming RF power as a substitute for the local oscillator as well as the properties of preferential power routing of a three port ferrite circulator to perform this function without running into the instantaneous bandwidth limits inherent with the switching speed of non-linear junctions.

The device is illuminated by a continuous wave of RF energy from 1-4 GHz. It takes an external input of signal data in the bandwidth of 5 kHz to 500 MHz, modulates the incoming radiation and transmits it back, thereby transmitting the baseband information without the use of a conventional transmitter or frequency source. This process permits the invention to exceed the frequency response of a FET transistor or PIN (positive-intrinsic-negative) diode, and the design is significantly more resistant to the production of harmonic related output and interference.

**Demonstration Capability:** A prototype is available.

**Potential Commercial Application(s):** Candidates for using this design include commercial shipping and tracking, remote sensing, intra- and inter-building industrial control automation, and ground-to-ground or ground-to-satellite communications.

**Patent Status:** A patent application filed with USPTO.

**Reference Number:** 1433