

WAVE REFLECTOR

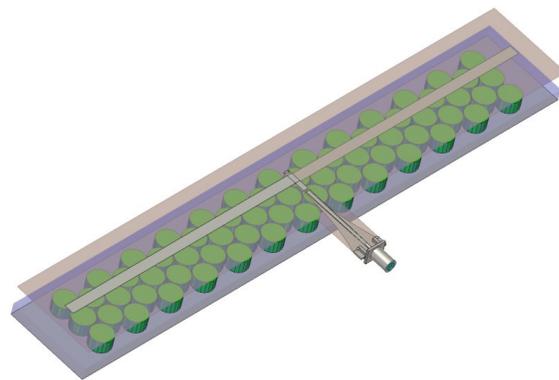
US Pat. No.: 9,147,931

Technology Readiness Level: 8

Actual technology completed and qualified through test and demonstration

The Sandia wave reflector is a magnetic conductor for wireless transmissions near 433 MHz. The device reflects perpendicular electromagnetic waves in-phase and suppresses surface waves resulting in improved gain performance and effective operation regardless of physical placement.

The reflector achieves gain improvement through a quarter-wave short phenomenon. The height of the ceramic rods is electrically equivalent to a quarter-wavelength near 433 MHz. The rods are able to provide this electrical delay in a small form factor due to their high dielectric constant. As an electromagnetic wave travels through the rods along their axes it receives a 1/4 period of phase delay before it reaches the conductive short. The conductive backing reflects electromagnetic waves with a +180° phase, and then the waves travel back through the rods along their axes to receive another 1/4 period of phase delay. This causes the waves to arrive at the antenna surface with a +180° phase and a 1/2 period delay, creating positive interference that effectively doubles the gain of the antenna.



Placement-immunity is achieved in the reflector through surface wave suppression. By preventing surface waves from propagating out of the substrate (perpendicular to the main beam direction), they cannot interact with the surrounding environment and affect the antenna's performance. Surface wave suppression is achieved through the magnetic dipole resonance of the ceramic rods. When an electromagnetic wave near 433 MHz excites the dielectric rods in the substrate with a transverse electric field polarization, the permeability of the dielectric rods skyrockets at that frequency due to the rod's resonance. The large permeability of the rods in resonance creates a high impedance surface for the incident electric field, which causes the wave to reflect off of the rod instead of propagating through it.

TECHNICAL BENEFITS

- Significantly smaller size
- Increased efficiency and power
- Reduced cost due to compact size
- Solution to startup flow issues

INDUSTRIES & APPLICATIONS

- Voice communications
- Mobile robots
- Tracking devices
- Inventory reconciliation
- Security alarms
- Wireless Information Storage