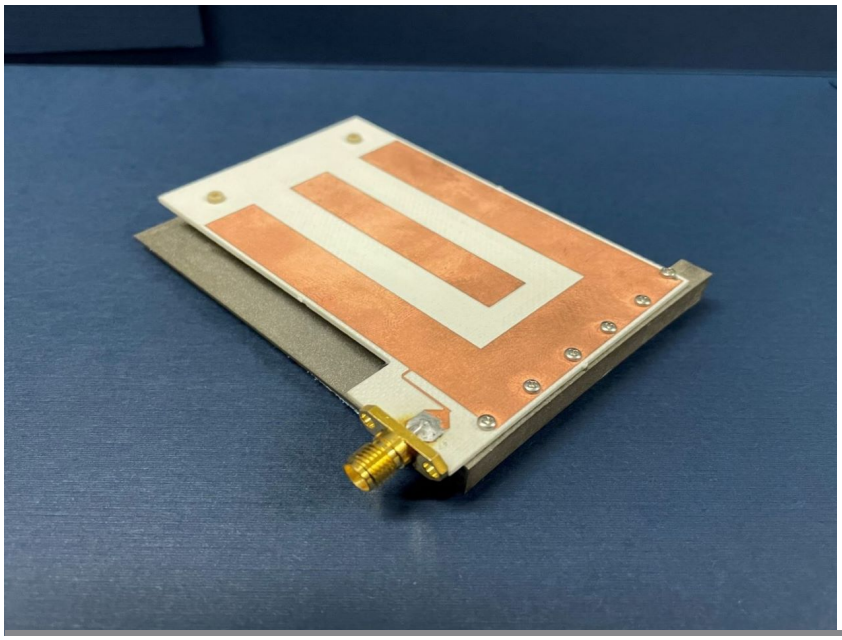


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Sensors

Low Mass Antenna Boosts RFID Device Performance

Antenna employs dual resonance modes to facilitate more accurate tag location

Innovators at NASA Johnson Space Center have developed a quarter-wavelength RFID dual mode antenna that provides polarization diversity and employs dual resonances, but in a form factor that is much smaller than other RFID antennas that provide similar functionality. Typically, antennas designed to provide this performance are on the order of half-wavelength structure which means a larger form factor.

Development of this antenna was motivated by the Hyper-Distributed RFID Antenna (HYDRA) system. The HYDRA design seeks a “barely visible” implementation, with a coaxial cable connecting a number of RFID antennas that are not much bigger than the coaxial cable itself. This reduced size should be useful in enclosed vehicles, office spaces, laboratories, etc.

Although this RFID dual mode antenna was originally developed for the HYDRA system, this antenna has other applications. For example, small antennas with polarization diversity in handheld RFID readers have long been a challenge. The industry standard is a ceramic half-wavelength puck that is somewhat heavy and leads to ergonomic problems with handheld RFID readers. This innovation could provide a substantial improvement in handheld readers, and similarly with drone-based readers, for applications in which mass is almost always a primary factor.

BENEFITS

- Improves functionality over conventional RFID antennas by extending the range of RFID readers and improving the reader’s accuracy in pinpointing location.
- Plug-and-play installation allows direct drop-in replacement for existing antennas in many RFID systems.
- Small form factor requires minimal space for implementation including the number of cables and connections.
- Saves weight over half-wavelength antennas, making it Ideal for handheld and drone-based readers.

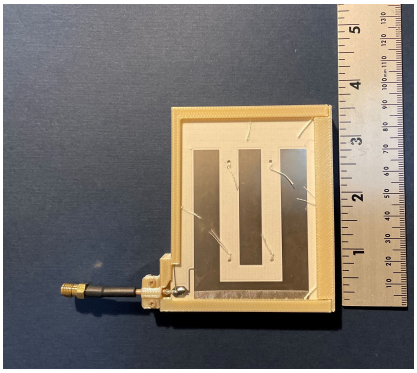
THE TECHNOLOGY

NASA's HYDRA system enables a new approach in routing the RFID signal, greatly increasing extensibility and the number of antennas that can be served by a single reader. However, increasing the number of antennas in any environment is often undesirable unless the antenna size is inconspicuous. Basing this RFID dual mode antenna on a quarter-wavelength structure allows it to be smaller than an antenna designed for half-wavelength structure, reducing overall mass.

NASA's RFID dual mode antenna is enabled by utilizing two different types of resonance modes – a "slot" mode and a microstrip "patch" mode. An innovative feed architecture allows for coupling from the RFID reader into both modes, with the impedance of each mode approximately equal at respective resonant frequencies. The antenna is designed such that each mode resonates at a different portion of the operating bandwidth, and further with each mode radiating an orthogonal polarization to the other. Frequency-hopping RFID protocols, used in conjunction with this antenna, result in the polarization diversity required for readers to reliably communicate with arbitrarily oriented RFID tags.

Numerous commercial applications exist for this RFID dual mode antenna. Examples may include usage in a multiple antenna architecture that is connected to a single reader in an open-air region, in a small, enclosed region such as a cabinet drawer, or through a combination of open and closed regions.

This RFID dual mode antenna has a technology readiness level (TRL) 7 (system prototype demonstrated in an operational environment) and is now available for patent licensing. Please note that NASA does not manufacture products itself for commercial sale.



Shown: NASA's quarter-wavelength crossed-slot antenna offers a form factor that is much smaller than other half-wavelength RFID antennas that provide similar functionality.

APPLICATIONS

The technology has several potential applications:

- Agriculture: tracking produce health and transport
- Enclosed vehicles and vessels: tracking hardware, devices, consumables and occupants
- Manufacturing: tracking workforce, equipment, supplies, merchandise, and shipments
- Medical: tracking supplies, devices, workforce, and patients
- Retail: tracking merchandise inventory and shipments

PUBLICATIONS

Patent Pending

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

MSC-26776-1, MSC-TOPS-117

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NP-2023-03-3111-HQ