Communications

Extended Range RFID and Sensor Tag

An energy-efficient method for increasing the range of SAW RF tags for passive RFID and sensor systems

NASA's Johnson Space Center has developed a novel technology that enhances the performance of surface acoustic wave radio frequency (SAW RF) tags for passive radio frequency identification (RFID) and sensor applications. This innovation significantly extends operational range without necessitating additional transmit power. Conversely, it can reduce transmit power requirements for shorter range passive RFID systems. The inherent temperature-and pressure-sensitive qualities of the SAW RF components also render this device ideal for remote sensing applications.

BENEFITS

- Extended range—provides an effective means of scaling the operational distance of RFID and passive wireless sensor capabilities
- Improved accuracy—offers enhanced range estimates and bearing angle (angle of arrival) measurements for real-time location systems
- High efficiency—delivers either greater range without a corresponding increase in required power or allows for substantially lower transmit power while operating in typical passive RFID ranges
- Inherently rugged—operates effectively in challenging conditions and at extreme temperatures

technology solution

THE TECHNOLOGY

This scalable technology uses a pair of phase-matched SAW RF tags coupled with a Van Atta antenna array. Typically composed of piezoelectric lithium niobate or quartz, SAW RF tags convert the interrogating signal into a surface acoustic wave, which is then encoded with the tag's unique identification number as the wave encounters a series of reflectors etched in the crystal. With the ID added, the modulated signal then converts back to electromagnetic energy and is transmitted back to the interrogator.

The Van Atta antenna component receives the interrogating signal and then, once the signal has been imprinted with the code from the SAW RF tags, reflects it in the direction of its arrival. The result is passive beam-steering and tracking of the interrogator without prior knowledge of its location. The increased gain provided by the array allows for extended range or for reduced transmit power from the interrogator within shorter distances.

In its simplest form, a basic two-element building block, this technology's innovative SAW-Van Atta array combination provides a 37% increase in free space range over existing passive RFID technologies—without need for additional power. The simplicity of the technology's design allows users to achieve this enhanced performance using commercially available SAW crystals—no modifications required—and the array is scalable to include additional coupled elements to further increase the directionality and thus range of the system.

The NASA developed technology could be used in hospitals to track patients, or in first response situations to track personnel and assets.

APPLICATIONS

The technology has several potential applications:

First responder – real-time location systems for first responder personnel and assets

Medical – hospital patient tracking

Logistics – vehicle and container tracking in harsh conditions

Food proccessing – remote temperature and pressure tracking for applications such as food processing and distribution

PUBLICATIONS

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More Information

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