R&D Firm Developing Passive Ultra-Wideband RFID

Martec says its system will offer improved read range and other benefits compared with traditional passive RFID tags, and cost less than systems using active tags.

By Dave Friedlos

April 8, 2008—Martec, a research and development firm based in Las Vegas, says it is developing an RFID system that uses ultra-wideband (UWB), that employs passive or semi-active tags instead of the active tags traditionally used in UWB systems. The company is currently testing the technology, called Passpulse, at its Australia-based research lab, and plans to commercially release the system next year.

A passive tag has no internal battery and instead is powered entirely by incoming radio frequency signals from an interrogator. A semi-active tag, also known as a battery-assisted passive (BAP) tag, contains a battery to operate its microchip, but still depends on the reader's incoming radio frequency signals to power its outgoing signal.

Martec's head of research, Artem Muchkaev, says that by eliminating the need for a battery and instead drawing all their energy from an interrogator's signal, Passpulse passive tags will cost less than active tags. The Passpulse design also allows for charging of the battery in the semi-active tag through pulses from the interrogator, thereby prolonging battery life. Consequently, the battery can be cheaper because it is of a smaller capacity and its lifetime is extended through recharging.

The Passpulse semi-active tag will be more expensive than the passive version, Muchkaev says, depending on read range, storage type and quantity, but will still be cheaper than active tags. "Most UWB systems in the market today use active tags that cost anything from $20 to $100," he states. "Our goal is to bring the cost of Passpulse [passive] tags down initially to just $2, and eventually, maybe even $1."

According to Muchkaev, UWB technology offers several advantages over traditional RFID systems. For one thing, UWB operates by emitting a series of short encoded pulses across a band of frequencies simultaneously, reducing the potential for interference caused by the reflection of RF frequencies between tags and readers. The signal's large bandwidth, he notes, makes it harder to eavesdrop on UWB transmissions.

All UWB systems utilize what's known as pulse position modulation (PPM) to transmit data, Muchkaev says. "As the pulses are short, they can have larger amplitudes, which charges the capacitor in the tag faster to increase the tag's power supply efficiency that allows longer reading range," he explains.

UWB transmissions have greater range than traditional radio frequency communications, Muchkaev says, and are less prone to inaccurate read results. Semi-active tags will provide even more accurate read rates, he says, because the battery feeding the circuits allows for shorter pulses.

"We are still testing Passpulse, so we can not provide the real technical performance at the moment,"

Muchkaev says. "But we estimate the reading range to be more than 15 meters." Passpulse, he adds, could be used in a range of applications, from electronic payment systems to the tracking of items in transport or supermarket supply chains.

But Martec is also working to ensure the tags can be deployed in a low-power wireless sensor network capable of detecting a tag in real time. A real-time location system (RTLS) would enable Passpulse to be used to monitor and track materials with limited shelf life or specific storage requirements, by constantly monitoring the status of items in transport in real time.

Muchkaev says Passpulse will be tested in three stages, ahead of a potential launch in late 2009. The first stage will be the evaluation and verification of the technology. The second stage will comprise testing the secure communication between the reader and tag for identification and access, while the final stage will involve a prototype RTLS using Passpulse technology.

In a separate development, the company is designing an RFID reader, also planned for a late 2009 release, that it says will increase the reliability and read rate accuracy of traditional ultrahigh-frequency (UHF) RFID systems. The Multiport RFID interrogator utilizes the six-port measurement technique, currently used to improve radio and satellite communications. Muchkaev says traditional UHF passive RFID tags use backscatter and amplitude modulation to transmit data to the reader.

The tag's backscatter signal travels into the reader's antenna connection and is decoupled before being transferred to the interrogator's receiver input. However, any mismatch between the directional coupler and the antenna connection can cause problems with signal reception. The six-port technique allows for precise calculation of the amplitude and phase of the received signal, regardless of antenna mismatching, environmental influences or interference.

RELATED_ARTICLES "Multiport RFID technology allows a significant improvement in performance, even if the directional coupler has high coupling loss," Muchkaev says. "Any antenna mismatching does not have a tangible effect on the RFID system performance. The reading range, security and data rate are all improved."

The Multiport reader, Muchkaev notes, can be installed on a single chip, making it cheaper to produce, as well as capable of being installed on phones, PDAs, smart cards or other mobile devices. "This would make it ideal for e-commerce, asset control, digital rights management and even gaming," he says.