RFID Systems at Gas Stations: What's the Difference?

When it comes to fueling dispensers, RFID technologies speak in different languages today. Can they say and do the same things? PE&T asks Texas Instruments’ Susy d’Hont and Micron Communications’ Stewart Johnson ten basic questions on their companies’ respective RFID technologies.

Answers to PE&T's Top Ten List of RFID Questions
With the introduction of Mobil's Speedpass, the technology of Radio Frequency Identification (RFID) has gained much popular public exposure in 1997. For consumers, the opportunity to purchase fuel faster, with the wave of a keyring or a vehicle tag (discretely mounted to the rear window), promises to be a popular venture. However, RFID experts claim that, far more than consumer retail station conveniences, RFID technology will significantly influence the electronic communication systems and equipment within the petroleum equipment industry. Is this claim true? You be the judge. RFID technology is not, by any means, limited to one manufacturer or one perspective. In the July/August and Sept./Oct. issues, we published articles on two distinct RFID technologies that work via dispensers for the retail service station market: one by Texas Instruments (TIRIS) and one by Micron Communications (Micron). To enable readers to learn more about the similarities and differences between two different RFID approaches, we have asked writers of the original two features, Susy d'Hont (TIRIS), and Stewart Johnson (Micron) to answer our questions on their respective technologies. This, however, does not mean that we plan to limit our coverage of RFID technologies to those used by either Texas Instruments or Micron. On the contrary, we will provide descriptions and analyses of other industry-related RFID applications through-out 1998. In the February '98 issue, Jim Gerdeman, the president of J.D. Gerdeman Associates (Gates Are Everywhere System), will report on how RFID technology is enabling fleet operation managers to expand their capacities, options and businesses.

This TIRIS vehicle tag goes in the rear window of a vehicle and automatically activates the gas pumps. On Nov. 7, 1997, Mobil expanded its program to 20 metropolitan areas.

What is radio frequency identification (RFID); how does your system operate within its framework? Susy d'Hont (TIRIS): RFID is a wireless method used to automatically and individually track vehicles, assets and people, using radio signals to transmit and capture data in a split second, and in a localized area.

TIRIS transponders and reader units are the RFID front-end to an automatic refueling system. The
factory-programmed transponders (or "tags") transmit their unique identification codes to reader units in the dispensers, which then relay the data to a central host computer for immediate verification. A database at the host computer contains detailed information and transaction records related to each ID number. Customers have a choice between a handheld keyring tag or a tag attached to their vehicle.

Stewart Johnson (MICRON): RFID technology is an automatic identification technology that uses electromagnetic energy as a medium for sending messages. Because the term "RFID" doesn't adequately convey the full performance range of MicroStamp technology, we describe it as remote intelligent communications (RIC). MicroStamp RIC tags/units differ from traditional RFID tags because they have the long range of microwave systems, the versatility of microprocessor systems and the small size of passive RFID tags. Thus, RIC units have a battery, a microprocessor, 256 bytes of user memory, a high-frequency radio and long range (50 foot read/write range for some products) capability.

How does your RFID technology function in a retail service station?

TIRIS: TIRIS provides a simple, standardized way for customers to establish a wireless link to their credit card account(s) of choice for automated payment. This payment method is fast, easy and highly accurate. The TIRIS tag's unique identification code is mated to a credit card account number. Purchases made using the tag are seamlessly reflected on regular billing statements.

TIRIS has most recently developed a patented low/high frequency system specifically to provide a vehicle tag for the automatic refueling solution--an application where there is no margin for error in accuracy (i.e., the correct customer must be billed every time). Mounted to the rear window, the compact vehicle tag activates as the car approaches the fuel dispenser.

MICRON: The system uses a MicroStamp key fob or car mount tag to communicate with gas pumps and initiate RFID-based pay-at-the-pump service. The key fob and car mount tags are optimized to read without interfering with surrounding pumps. The interrogator inside the fuel pump identifies the customer, authorizes the transaction and activates the pump.

What other applications do you have?

TIRIS: Other major TIRIS applications include: automotive anti-theft immobilizer systems for such leading manufacturers as Ford, Chrysler and Toyota; Electronic Toll Collection, installed in California; parking and people access systems worldwide; and warehouse automation and logistics management. Some well known companies working with or using TIRIS include Sensormatic, Heinz, Siemens, Swissair and SGS Thomson.

MICRON: MicroStamp RIC technology is also a platform for tollways, fare collection, asset management and security industries. It has many specific applications, which include: automated vehicle identification (AVI) systems; automated material handling and tracking systems; oil container tracking; automated truck weighing systems; financial transaction automation; and personnel
identification and access control.

What are the primary two or three advantages of your RFID system?

**TIRIS:** (1) Our system is based on years of experience in designing RFID systems for a wide variety of different applications. We have thousands of working installations throughout the world. (2) The system that we are offering to oil companies has been tailor-made for the retail refueling application. (3) A "well-defined" read zone is ensured so the correct customer is always billed for the transaction.

**MICRON:** (1) The versatility of the MicroStamp RIC infrastructure opens the door to multiple functions. A simple application, such as automatic fuel pump authorization, only uses a small amount of Micro-Stamp's 256 bytes of on-board memory; the rest of the memory can be used for add-on applications, such as merchandising at the dispenser and customer loyalty programs. (2) We are working toward our goal to create "plug and play" interoperability for RFID. The RFID standard under development by the American National Standards Institute (ANSI) promotes 2.45 GHz, a frequency now used for worldwide applications. Our technology operates at 2.45 GHz. (3) MicroStamp car mount and key fob tags work economically within the same system by using a single in-dispenser reader. Other systems often require separate readers for each type of tag they use.

What are the main differences between your two RFID technologies?

**TIRIS:** (1) Our readers emit only low frequency signals, not microwave signals. (2) We provide a customized RFID solution with significant operational experience that meets the needs of this application. (3) It is a very economical solution in relationship to other RFID systems for the service station market.

**MICRON:** We believe our MicroStamp RIC integrated circuit is the world's first wireless communications technology to integrate memory, a high frequency microwave radio and a microcontroller on a single chip. By combining a battery and an antenna with the chip, we get the MicroStamp RIC tag. All these features allow us to send information to the RIC tag, store it in memory and retrieve or modify it later.

However, when it comes to differences, we would like to focus on another issue, as well. We believe that all companies involved in the automated fueling industry need to work together to create an industry standard that will lead to interoperability and compatibility. Over time, accepted standards will help drive costs down and create benefits that proprietary systems cannot offer. MicroStamp RIC technology aims to meet the final industry standard.

The Micron key fob activates gas pumps and initiates a pay-at-the-pump service.

How does your system guarantee that the wrong person is not charged? In addition, what are your safeguards against fraud?

**TIRIS:** Both the keyring and vehicle tags utilize the magnetic field characteristics of low-frequency radio signals to establish clearly defined and tightly controlled read zones. This means there is no chance for a signal to travel beyond a defined area around the dispenser and its associated vehicle
to accidentally read someone else's tag. Plus, low-frequency signals do not reflect like high-frequency radio signals. There are several other software safeguards built into the transmission process to correlate a tag to a dispenser.

Duplicating a TIRIS tag is too expensive and complex to be attractive to thieves. TIRIS is fortified with an additional fraud barrier in the form of a challenge/response authentication feature. This technique protects against even the most sophisticated RFID eavesdropping by guaranteeing that account information is never transmitted, and that the transmitted data changes every time you use the system. If someone were to capture the signal, it would be of no value to them.

MICRON: Our retail service station system includes custom antenna designs, whereby antennas are positioned to read both car mount and key fob tags within very specific radii of each gas pump. In addition, multiple secure-transaction features are part of every MicroStamp RIC application, including on-tag password protection, authentication codes, on-tag partitionable memory, frequency hopping and direct sequence spread spectrum (which uses pseudo-random codes). Moreover, software ensures that a tag is read and re-verified within a designated pump read area for a set time before activating the pump. This software is configurable for the security needs of each petroleum company.

The TIRIS keyring tag allows customers to link their credit card accounts for automatic payment at the gas pump.

How small are your tags, and how much do they cost?

TIRIS: Our keyring tag is like a 1 and 1/2 inch-long pencil and costs around $4 in large volume. Our vehicle tag fits comfortably in the palm of your hand and costs under $15 in large volume.

MICRON: The size of the units used for automated fuel pump authorizations are: (1) MicroStamp 10E (key fob) --1.9 inches x 1.54 inches x .2 inches; and (2) 10ML (car mount or key fob) -- 2.2 inches x 1.3 inches x .28 inches. Prices for MicroStamp units are on a contract basis with the customer.

How does your system interact with the dispenser? Can it interact with all dispensers?

What are the system's limitations?

TIRIS: TIRIS electronics are integrated directly into the dispenser and piggyback on the installed credit card system. TIRIS can be integrated into any suppliers' dispenser products. The protocol interface is designed for simplicity and ease of use in connecting with end users' software systems. It is even possible to install the keyring tag system first and later upgrade to include the vehicle tag system. Piggybacking on the installed credit card system can be considered a limitation.

MICRON: The reader developed for the dispenser allows for a variety of standard communication protocols, including RS-232, RS-422, RS-485 and TTL. Once a RIC system is in place, Micro-Stamp technology is fully operable with all dispensers. For example, at PEI's Convex '97 in Minneapolis, the same MicroStamp key fobs worked with the fuel dispensers of three major vendors, Gilbarco, Tokheim and Schlumberger.

The most identifiable limitation of MicroStamp RIC technology in a pay-at-the-pump application is that
the key fob or car mount products only have a shelf life expectancy of five years (due to battery limitations). Micron Communications also manufactures battery-less tags.

**Do the signals from RFID systems interfere with other electronics and communications devices in the proximate area?**

**TIRIS:** The FCC plays an integral role in designating radio bands for various applications precisely to lessen the risk of interference. The operating band of TIRIS components is FCC-approved for commercial use. Texas Instruments TIRIS products are precision engineered to avoid band conflicts, taking into account all sources of potential interference. With 30 million TIRIS transponders in circulation, we are well aware of how to deal with this threat.

**MICRON:** Having our RIC system in place will not interfere with any existing equipment or systems, nor do the equipment or systems interfere with existing RIC equipment. Our technology complies with all Federal Communications Commission non-interference regulations. We selected the 2.400-2.4835 GHz frequency band in part because of its availability for unlicensed industrial, scientific and medical devices. Any devices operating in this band must accommodate interference from other devices operating at this band. Also, Micron uses spread spectrum techniques that protects against interfering with, or from, equipment in the surrounding environment. For these reasons RIC technology should not encounter any interference issues with other FCC-compliant devices.

In addition, after extensive testing in and around fueling stations, our technology has experienced no interference problems from pumps, motors, diesel engines, car washes, cell phones, wireless LANs, remote car alarms or auto keyless entry systems.

**Please describe the extent of proven experience, or testing results, that your system had in the field.**

**TIRIS:** The keyring tag uses a transponder of which there are already around 30 million in use worldwide. It meets the rigorous quality standards of customers like Ford and Toyota. Hundreds of thousands are already in the hands of Mobil customers. It is well-proven technology.

We have 18 months real world experience; with real people, real gas, and real credit cards. Twenty major U.S. markets are using both the keyring tag and the vehicle tag at Mobil stations.

**MICRON:** For automatic fuel pump authorization, MicroStamp has worked successfully during domestic and international field and customer tests conducted by Gilbarco, Inc., and Tokheim Corporation, and for major oil companies, such as Shell.

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