

ETSI Tests Show EPC Scaleable in Europe

In a final, large-scale test involving 20 full pallets of tagged cases moving through portal reading zones, all interrogators tested worked in sync while still observing ETSI regulations.

By Mary Catherine O'Connor

Oct. 10, 2006—Last month, an RFID-focused subgroup of the [European Telecommunications Standards Institute](#) (ETSI) conducted tests to determine the effectiveness of RF signal-synchronization schemes designed to enable large numbers of interrogators to function simultaneously under current ETSI regulations. Such rules require devices using the UHF band to listen before transmitting to ensure that a frequency channel is not already in use by another interrogator. If a reader can not find a free channel on which to transmit a signal, it could hamper a company's business processes, such as moving a pallet of goods through a portal reader.

During the summer, [ETSI's Electromagnetic Compatibility and Radio Spectrum Matters Task Group 34](#) (ERM TG34) set forth plans to test the RF signal-synchronization schemes, which are made possible by the dense-reader mode specification of the [EPCglobal](#) Gen 2 standard (see [ETSI Group Plans Dense-Reader Trial](#)).

"I felt this was a very significant set of results, and should act as a catalyst for encouraging companies to roll out RFID systems in Europe," says John Falck, chairman of the TG34 group.

RFID reader manufacturers [Feig Electronic](#), [Impinj](#), [Intermec](#), [Sirit](#) and [Symbol](#) tested their ETSI-compliant EPC Gen 2 interrogators, while [Reva Systems](#) tested its centralized reader controller device. [IBM](#) assisted TG34 in preparing the tests, collecting the read data and analyzing the results. Falck says more than 4.5 million read records were logged during the testing period. [Checkpoint System](#), which provides security and RFID label services to the retail industry, installed the portals and associated cabling needed for the tests. [Procter & Gamble](#) (P&G) provided the pallets full of tagged goods for part of the tests.

Interrogators can be synchronized via hardwired devices or wireless ones, says Falck, adding that both proved equally effective in the TG34 tests. Using a wired approach, TG34 tested two different methods. In one, a centralized device, called a controller, uses an RF receiver to listen for transmissions on each channel, then instructs each reader in a network, linked together via Ethernet, to operate on a specific channel. The controller approach was developed by Reva Systems, which sells a platform called the Tag Acquisition Network, featuring a device that serves as an interrogator controller.

The second hard-wired approach, which Falck calls the "floating master," uses no single centralized controller. When a tag enters the any of the interrogation fields of a bank of readers, the first one that senses the tag reads it and acts as the master for all the other interrogators to which it is linked, coordinating their transmissions to ensure they all use only available channels.

To synchronize readers wirelessly, Feig Electronics demonstrated a system by which the first reader to be triggered sends out a pre-pulse, a signal prior to its main transmission on an unoccupied channel. All other

readers in the vicinity that are programmed to decode this pre-pulse may join the group and transmit on the same channel, says Falck. The current proposal is to define a pre-pulse with fully specified parameters, thereby standardizing the signal and ensuring interoperability between vendors.

The readers all use the dense-reader mode of operation, which separates the interrogator's signals from the tag's backscatter replies onto separate but adjacent channels so that they don't interfere with each other. By coordinating a group of adjacent interrogators operating in dense-reader mode, a signal-synchronization scheme enables all the interrogators in that group to transmit simultaneously on the same frequency channel.

"We can run a lot of readers at once if we coordinate them such that in the aggregate, they obey the rules," says Reva Systems' cofounder and chief technology officer, David Husak. "Once a reader is on a channel, you can add more readers to that channel."

The TG34 tests were conducted over a two-week period at a distribution center operated by European retail giant and RFID user Metro Group, in Unna, Germany. The testing period consisted of three parts: First, TG34 needed to settle on which of two proposed channel-allocation schemes to use. There are 10 UHF channels—4 through 13—that ETSI says can carry 2-watt RF transmissions. One proposed channel-allocation scheme, called the four-channel approach, would let the interrogators use channels 4, 7, 10 and 13 to interrogate the tags, which would send their response signals over a pair of adjacent channels—either 5 and 6, 8 and 9 or 11 and 12—as instructed by the interrogator's signal.

The alternate scheme uses five channels: Interrogators would transmit their signals over channels 4, 6, 8, 10 and 12, while the tags could send responses over a single channel, either 5, 7, 9, 11 or 13—again, as instructed by the reader's signal. A mixture of these two schemes could not work, since they use conflicting channels. Thus, TG34 needed to settle on one.

The four-channel approach is optimized for high-tag performance, says Husak, since the tags would have two responding channels between each interrogator channel, whereas the five-channel approach gives more bandwidth to the readers, but less for the tags. Falck says the group debated the merits of each before settling on a four-channel approach, which is the one being written into the technical specification. Current users of RFID, however, will be grandfathered in rather than be subject to using a synchronized approach. They will and may continue to use all 10 channels within the UHF band for either interrogator or tag transmissions.

The second phase of testing was meant to determine if the hard-wired and wireless synchronization approaches worked, both on their own and in mixed environment, where readers would use a combination of hard-wired and wireless approaches to synchronization. The results indicate that both approaches did, say Falck and Husak. "For example," says Falck, "a central controller can initiate a pre-pulse at the same time that it instructs the hard-wired readers to transmit. This gives the system a capability to work with portable devices such as forklift trucks,"

Lastly, each hardware provider involved in the tests—Feig, Impinj, Intermec, Reva, Sirit and Symbol—was given an opportunity to test its products, using any of the approved synchronization schemes and employing software they each had newly developed to enable those synchronization schemes, in a large-scale deployment dock-door test. This meant establishing portal interrogation zones at 20 separate dock doors in the Metro DC, then having 20 forklift drivers each move a single pallet carrying 62 tagged cases through each dock door simultaneously. The results were "nothing short of miraculous," says Falck. "Typically, they got better than 1.5 percent missed tags, and in some instances, less than 1 percent missed." And the results might have been even better if the reader makers had more time to optimize the synchronization algorithms they used, he adds.

"On a whole, the reading performance [using the synchronized approach] is meeting the requirements of the end user, and it can probably only get better, because the reader makers say they did not have time to debug the new software," says Falck. "The manufacturers were under enormous pressure to get equipment ready for the test."

Falck presented the results of the tests at a policy meeting in Montegrotto Terme, Italy, late last month. The ERM TG34 will now write a technical specification to be added to ETSI TR 102 436. This document provides recommendations to system integrators and installers regarding the installation and commissioning of RFID systems operating at UHF and under the ETSI standard EN 302 208 for spectrum usage. The latter will describe the synchronization approaches and how they can be implemented. Falck hopes the specification will be approved by March of next year.

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