Impinj Announces Gen 2 Tags, Reader

The fabless silicon company unveils its Gen 2 tags and reader, saying it will sell the reader directly to customers and license its design and firmware to partners.

By Mary Catherine O'Connor and Mark Roberti

April 4, 2005—Impinj, a Seattle-based semiconductor company and manufacturer of passive RFID tags, has announced GrandPrix, its EPC Gen 2 UHF platform. That platform consists of RFID tags based on the Monza chip, the company's Gen 2 integrated circuit, and Speedway, its Gen 2 reader design.

The company, which previously has not sold RFID readers, says that it will sell Speedway readers directly to its customers, but it has also developed a reference design and firmware for the Speedway reader that it plans to share with select partners interested in licensing the reader design. Impinj will work with UPM Rafsec and other firms that offer tag-assembly services to produce tags using the Monza chip. The Monza tags will come in the same antenna designs as Impinj's Gen 1 tags, including the propeller and banjo tags.

Impinj will be demonstrating the tags and readers during next week's RFID Journal LIVE! conference in Chicago. The company says customers are already sampling the tags and readers, and that Monza and Speedway will commercially available in production quantities by the end of the second quarter.

"GrandPrix is our solution for Gen 2 readers and tags. They deliver the maximum read and write rate possible according to the Gen 2 spec. They are able to reject RF noise and interference so they get very robust performance, and they are capable of dense-reader operations," says Impinj president and CEO William Colleran.

Dense-reader mode, which is not a mandatory element of a Gen 2-compliant reader, allows many readers to operate in close proximity of each other without causing reader-to-reader RF interference. Colleran says achieving this functionality in a reader is difficult to do because it requires very high RF performance transmitted in a narrow frequency band. He says Impinj believes that other readers that are currently deployed will not be able to be upgraded via firmware to Gen 2's dense-reader mode because the firmware upgrade has no effect on a reader's RF capabilities (see Understanding the EPC Protocol). He adds that Impinj will be among the first companies to offer readers capable of dense-reader mode. "We wanted to introduce the first Gen 2 reader, and have it support all of the Gen 2 modes [single-reader, multi-reader and dense-reader], not some of them."

Colleran says Impinj spent much of its GrandPrix development time working on a problem called "ghost reads," the term that describes a phenomenon wherein an RFID reader says it has read a tag that is not there. It might show a read on tag 12345, for example, but tag 12345 does not exist or never entered the reader's interrogation zone. Sometimes, ghost reads are caused by RF interference from other RF devices, or they may be generated by activity within the reader that produces the ghost read. One of the ways Impinj combated ghost reads was to use the Viterbi algorithm (named after one of Impinj's founders, Andrew Viterbi) to optimize how the reader accepts signals and rejects interference to the reader.

The Monza chip uses Impinj's Self-Adaptive Silicon and AEON nonvolatile memory, both developed by Impinj to create low-cost chips. The Self-Adoptive Silicon allows the chip to control the amount of voltage needed to operate its transistors and its AEON nonvolatile memory allows users to write to and read from the chips with low power consumption (see Self-Tuning Chips Cut EPC Costs). "The more power your chip consumes, the closer it has to be to an RFID reader in order for it to function correctly. So low power translates into long range," says Colleran.

The Monza chip has an 8-meter read range and a 6-meter write range. Fifteen Monza tags can be written to per second, according to Colleran, and the chip was designed with onboard filtering capabilities that exceed the levels required by the Gen 2 standard, which he says makes the Monza chip perform better than other chips in environments with RF noise and interference.

Aside from offering dense-reader mode, the Gen 2 protocol has a number of others features and support for different methods of backscatter signaling by the EPC tags. It also includes a faster data transfer rate: A Gen 2 reader should be able to read up to 1,500 tags per second within the U.S. regulatory guidelines (600 per second in Europe). Colleran says the Speedway reader is capable of reading more than 1,500 tags per second. Also, the Speedway supports four antennas and is designed with single ports, one for each antenna, rather than two ports (one for transmit and one for receive) per antenna. Colleran says this can save the user a couple hundred dollars in cabling and installation costs compared with readers that use separate transmit and receive ports for each antenna.

Licensing Speedway

Colleran says Impinj is sharing the Speedway reader reference design with select partners that manufacture because it anticipates an industry-wide need for Gen 2 readers. "About six months ago, we foresaw that there would be a shortage of Gen 2 readers-full Gen 2 readers that support dense-reader mode and many of the other features in the protocol-in the second quarter of this year," he says. "We wanted to kick-start the industry, so to speak, which would help spur demand for our silicon."

"There's nothing exotic needed to make it work," says Colleran. "It's standard hardware with our firmware. The reader companies can add an optional onboard computer for networking functionality, as well as software for filtering data and running applications on the reader."

Colleran warns end users buying Gen 2 readers that the readers only need to be able to read a Gen 2 tag to be called a Gen 2 reader. They don't, at this point, need to support all the functionality of the Gen 2 protocol, which means that end users might not get all the benefits of the protocol.

"It's like buying a car," says Chris Diorio, founder and chairman of Impinj. "All cars have an engine, tires and a steering wheel. But there's a big difference between buying a Ferrari and Ford Escort." (Sue Hutchison, director of product development for EPCglobal US, in Lawrenceville, N.J., says compliance tests will be ready by the time Gen 2 readers hit the market and it will include testing whether readers support the features in the Gen 2 protocol.)

Diorio is cochair of the EPCglobal Hardware Action Group (HAG), which developed the Gen 2 protocol. He recently gave presentations to two of EPCglobal's Business Action Groups, saying that UHF readers could be manufactured in large volumes for under $100, if companies pay the money need to in shrink components down into chipsets.

"An RFID reader is no more complicated than an 802.11 Wi-Fi router," he says. "And we've seen the price of Wi-Fi routers fall from many hundreds of dollars to less than $100."

It's technically feasible to shrink many of the electronic components that now sit on a printed circuit board in

UHF readers to fit on a microchip. But companies will need to invest millions of dollars to do that, and they won't risk making that investment until it's clear that there will be a large demand for EPC readers. (Impinj's reader design doesn't include components on a chip.)

"It's not yet clear what the demand for readers will be, so the investments aren't being made yet," says Colleran. "It's technically feasible [to put the components on a chip]. But economics will determine when it will happen."