

Intel has shrunk many of an interrogator's critical components onto a single chip, which manufacturers can use to make more compact, power-efficient readers. Other chipmakers are also making reader chips.

By Mary Catherine O'Connor

March 6, 2007—The past few years have seen significant advancements in passive RFID tag performance and standards development, as use of the technology proliferated across a number of different industries and applications. Innovations on the interrogator (tag reader) side, however, have been slower. But a highly anticipated technology development could change that. [Intel](#), the Santa Clara, Calif., semiconductor firm whose processors have been used in RFID interrogators for a number of years, today unveiled the R1000, a highly integrated, application-specific integrated circuit (ASIC) that combines 90 percent of the discrete components found in a typical passive UHF RFID reader radio onto a single chip.

Integrating these components onto a chip allows RFID interrogator and printer-encoder manufacturers—a number of which Intel says have been testing the R1000—to reduce the size and improve the power efficiency of their products. Combining discrete components onto a single chip means that the separate components are not powered up individually, so the reader requires significantly less wattage to function. By using the R1000 or other similar reader chips that are also emerging on the market, RFID manufacturers should also be able to lower the price they charge for the interrogator and other equipment they make.

"The R1000 is definitely another sign of innovation in the UHF marketplace," says Mike Liard, RFID and contactless research director for market research firm [ABI Research](#). "Hopefully this will help enable larger RFID technology adoption and enable companies to build out and scale their deployments."

Onboard the R1000 are roughly 100 components that transmit, modulate, receive and process the radio communications performed with EPC Gen 2 tags. The R1000 also contains a power amplifier that enables it to encode and read tags at a close range, up to roughly 2 meters, depending on the type of reader antenna used, according to Intel. With an additional external power amplifier, a reader using the R1000 could have up to 10 meters of read range, it says. The R1000 must be linked to a separate microprocessor that can turn the raw data generated from the R1000's digital signal processor into an EPC or ISO 18000-6C code.

Intel is offering the R1000 with the firmware needed to comply with these standards. The firmware also enables the R1000 to support the dense-reader mode (DRM) specification of the Gen 2 standard, which improves reader performance in environments where multiple readers are deployed close to each other. The firmware also allows reader makers to create products that comply with regulatory requirements such as those made by the FCC in the United States or by ETSI in Europe, where readers currently must follow a listen-before-talk protocol in order to prevent RF interference in the UHF band.

"A number of reader manufacturers are building products with the R1000 today," explains Kerry Krause, marketing director for Intel's RFID business unit, "and we should have 20 customers [reader makers] by end of year."

Cambridge, Mass., RFID reader manufacturer [ThingMagic](#) announced today its Mercury5e—a reader module that uses the R1000 and is designed to be embedded into handheld computers or printer-encoders. The Mercury5e is set to be available in production quantities in early May and will be made available in products sold by ThingMagic's network of resellers, which include [NCR](#), [Omron](#) and [Zebra](#).

The Mercury5e is significantly smaller and consumes less energy than its predecessor, the Mercury4e, says Kevin Ashton, ThingMagic's vice president of marketing. When not being used for a predetermined length of time, the Mercury5e goes into a sleep mode, much like a PC, which enables it to conserve energy. Ashton says this function should enable a worker to use a handheld with the reader module for 8 to 10 hours, depending on how often it is used and whether the handheld also has other power-consuming functions, such as bar-code scanning.

[Alien Technology](#), an RFID hardware manufacturer based in Morgan Hill, Calif., says it, too, plans on incorporating the R1000 into variety of reader products. Alien's current product line does not include RFID-enabled handheld computers.

While the R1000 firmware does not support the ISO 18000-6B standard, Krause says some of the reader makers using the chip are adding their own support for this passive UHF air-interface protocol.

These products are likely to come in a number of form factors, he says, from compact handheld readers to fixed readers and reader modules for printer-encoders.

On Monday, [Starport Systems](#), a startup semiconductor company in Irvine, Calif., announced its SP7001 chip made for UHF Gen 2 readers, which is similar to the R1000, except that it also contains the processor needed to convert the tag data into an EPC format. However, the SP7001 does not support dense-reader mode and is not designed for supply chain applications, such as retailers and manufacturers using RFID to track shipments of consumer goods, for which the R1000 is geared. Instead, Starport envisions the SP7001 being used for future consumer applications. Its small footprint will enable cell phone manufacturers to incorporate Gen 2 readers into handsets, which consumers will use to access information on products by reading the EPC tags attached to them. This could help consumers decide which products to buy, says Armond Hairapetian, president and chief executive officer of Starport Systems.

After consumers access information about specific products, they could use the same phones—assuming those devices also contain near-field communications chips—to transact purchases of those same products. In the nearer term, Starport is marketing the SP7001 to manufacturers of handheld readers for asset-tracking applications, and Hairapetian says that the chip could support dense-reader mode in the future, which would make it suitable for use in large UHF supply chain

applications.

[The Institute of Microelectronics](#), a research institute funded by Singapore's Agency for Science Research and Technology (A*STAR), announced in January that it had also developed a reader chip. The IC can support EPC Gen2 and ISO18000-6B/C protocols, including dense-reader mode and listen before talk. It contains all of a reader's radio components but requires a separate processor to convert the tag data to EPC or ISO 18000-6B/C format. A*STAR is touting the chip for use in supply chain and retail applications inventory, authentication and tracking of goods and for integration in cell phones and other consumer devices.

According to Rajan Walia, business development manager at IME, a number of reader manufacturers are currently testing the chip, with is being licensed by Exploit Technologies, A*STAR's strategic marketing and commercialization arm. In late 2006, WJ Communications also announced a reader chip (see [RFID News Roundup](#)).

Starport is now selling the SP7001 in a starter kit, which includes the chip as well as a USB port and antenna, as well as a reference design for building the chip into a USB form factor and the software needed to create a user interface. The price of the starter kit has not been disclosed, but the SP7001 chip is selling for \$50 each in quantities of 10,000 units. IME says that its reader chip could cost reader manufacturers in the range of \$100. Intel would not reveal pricing information for the R1000, but Krause says the use of the chip could eventually drive reader costs down to half their present \$1,000 range. This will require economies of scale, however.