

Printed RFID Tags Still Several Years Away

Industry leaders at the Printed RFID conference agreed that much research remains to be done before printed tags become commercially available and can be printed directly on packaging.

By Rhea Wessel

June 12, 2007—At [IntertechPira's](#) Printed RFID conference, held earlier this month in Frankfurt, Germany, industry leaders said that although the technology required for printing RFID tags is slowly maturing, a good deal of research still remains to be done before printed tags can be offered commercially—and before they can be printed directly onto packaging. Once these two milestones are achieved—at a reasonable price—analysts believe RFID tagging will become pervasive throughout supply chains for almost every type of good.

Klaus Dimmler, conference chairman and founder of [OrganicID](#)—which is working to develop a low-cost technology to produce printable electronic RFID tags made with organic inks—summed up the feeling in the air by saying, "The industry is making good progress on materials. They're looking better and better." Dimmler added that printed antennas are now standard fare, with some companies beginning to demonstrate circuits created with polymers in clean-room environments.

Another company developing printed RFID tags is [PolyIC](#). The firm's managing director, Wolfgang Mildner, told conference attendees that PolyIC has created two organic 13.56 MHz RFID tags in a clean room: one with 32 bits of memory, the other with 64 bits. The company says it is the first to produce such tags made of polymers.

"We have shown that we can produce high-memory circuits—up to 64 bits—with polymer materials in a clean-room process," said Bettina Bergbauer, a company spokesperson. For PolyIC and others, she explained, the problem remains how to use printing technology to manufacture these circuits in high volumes, at low costs.

"The printing methodology will make or break the industry," Dimmler said, "because you've got to get that low cost." He added that researchers have not yet even agreed which printing method offers the most promise.

Raghu Das, an analyst for [IDTechEx](#), also spoke at the conference. Das predicted that most of the 1.91 billion passive and active tags purchased in 2007 will not be printed at all, though antennas and other UHF tag parts might be. However, he claimed, nearly 50 percent of the 670 billion tags purchased in 2017 will be fully printed.

Rudimentary printed RFID tags can already be found in some commercial products. [HurraFussball](#), a game created by Germany's [Menippos](#), includes trading cards each bearing a printed RF tag encoded with a 16-bit ID number. Menippos purchased the technology from [Printed Systems](#), based in Chemnitz, Germany. Das and Printed Systems are calling the tag a printed RFID tag despite its limited memory capability; the tags have just 16 bits of read-only memory, so the number of unique numbers available for encoding a tag's ID is limited to 65,536. Printed Systems sells the tags together with low-cost interrogators.

"The biggest potential [for printed RFID]," Das said, "is in open-loop supply chains. Standards and performance issues will be ironed out by 10 years from now." At present, there are no standards for printed RFID tags, and no organization is working to create them.

Speaking at the conference, Andreas Fuessler, a senior project manager for GS1 Germany, urged attendees to establish standards. He noted, however, that EPCglobal, a division of GS1, is not presently working toward such a goal, due to a lack of interest from its members.

In his presentation, Das cited printed thin-film transistor circuits (TFTCs) as one of the most promising technologies for low-cost RFID tags. TFTCs would support RFID tags operating at frequencies of up to 13.56 MHz, he said. Rugged, thin and robust, they could cost less than 3 cents per tag and would allow for a rapid design and production turnaround.

"TFTCs can go higher than 13.56 MHz," Das explained. "Today, that is the highest frequency demonstrated, but we know some may be able to achieve UHF and higher. [The] cost is our very rough estimate, as you need high capital installation. Taking into account yield issues, etc., 3 cents is what we think it may be, but it could be higher or lower initially. We do see it getting much cheaper than that, as it becomes more robust."

"Ultimately," Das stated, "we see printed as the biggest in volume of all RFID, but it will take a while. I don't see this ramping up until 2011 or 2012." He added that he does not believe printed RFID tags will ultimately replace those made from silicon. "Both will coexist for a long time," Das predicted. "Silicon, being developed for many decades, is very robust and has a great deal of sophistication. Printed TFTCs are just starting on that curve, and will initially be suited only for very simple, low-memory devices with short range. They will improve, though, and with time, will eat increasingly into silicon RFID. But this is at least 10 years away, and could be much longer."

RELATED_ARTICLES Asked to list the major challenges of getting to a fully printed RFID tag, Das said there are dozens—among them the mobility of a printed transistor's electrons, print resolution, yield and encapsulation—all of which affect the frequency of operation, lifetime, memory capacity, read range, read speed, tag size and other parameters. He noted that hundreds of organic electronics companies are currently working to address such issues. "It will take another three to four years," he said, "to get a commercial product." Once the printed RFID tag has arrived, however, an additional challenge will surface—namely, how to print a tag directly onto product packaging.

Bruce Lyne, president of Sweden's Institute for Surface Chemistry (YKI) spoke at the conference as well, focusing on how to improve paper and packaging surfaces for printing RFID. His conclusion: Before tags can be printed on packaging, much research needs to be done. In addition, Lyne advised that developers looking to build printed RFID tags determine which tag design offers the most promise before worrying about standards (see VTT Is Developing Printed Sensors).

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