

## RFID – SMART LABELS ON THE RISE

It happens so often, just when we think we've heard it all, new technologies sneak up on us. **Radio frequency identification (RFID)** is one of those that are gaining attention. RFID is destined to be one of those socially impacting technologies that will affect all of us and will give opportunity to some printers.

How will printers participate? Well, read on, as the question is, how will mass produced, ***inexpensive*** RFID's be made?

First, let's look at the fundamentals.

RFID is basically a method of ***storing and retrieving*** information from a tiny silicon chip on a tag attached to an object.



Photo Compu-Power, Inc.

An RFID system consists of three components:

1. An antenna
2. A transceiver (RFID reader)
3. A transponder (RF tag)

RFID was invented as long ago as 1969 and patented in 1973, and already has a history of commercialization. Where you say? Well, do you use EZPass, or have you seen autos zip through a toll road tollbooth without stopping? If you have, you've seen RFID at work. Do you perhaps use ExxonMobils' Speed Pass system of purchasing gas, or have you seen it in use? Well again, this is RFID at work. Do you own an auto that uses a special ignition key housing a transponder that contains specific information that must be identified before the engine will start? Again, this is an example of RFID at work where communication takes place between the autos electronic system and the key via radio waves. Also, the anti-theft hard plastic (store removable) tags attached to merchandise, such as clothing, are RFID tags.

RFID tags can be made to be active or passive. An active tag is typically internally battery powered, and can be both read and/or rewritten to by a remote transceiver through an antenna that both emits and receives radio frequency waves. Passive types of RFID tags are powered by radio waves to send a response. They can only be read and have a smaller memory than active RFID tags.

By definition the term transponder combines a transmitter and a responder. They typically consist of an antenna and a chip.



An RFID system works as follows:

An active RFID tag containing a battery powers the microchip's circuitry and broadcasts a signal to a reader. Passive tags have no battery and draw power from the reader. The transceiver or RFID reader sends out frequency specific electromagnetic radio waves that induce a current in a passive RFID tag's (transponder) antenna. The passive RFID draws power from a formed magnetic field and uses it to power and awaken its circuits. The RFID tag chip answers, transmitting back to the reader. The reader converts the received radio waves into digital data for computers, providing desired information.

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Passive tags are much lighter and much smaller (1/3-1 millimeter across) than active tags due to the lack of a contained battery. Passive tags are less expensive and offer a rather unlimited operational lifetime since there is no battery to wear out. Passive tags have a shorter read range and require a higher

powered reader. "Read only" tags are usually passive and are programmed with a limited amount of data, usually 32-128 bits.

Active tags by contrast are heavier and larger (due to the contained battery), and are significantly more expensive.

Mass produced RFID's will be required to supply the largest USA Corporation (Wal-mart) and others! Wal-Mart will move the market, just as they did in 1984 when they decided that they wanted to use bar-codes to manage their business better, tracking and tracing products. That change caused an explosion in the use of bar code technology that had languished for 20 years since patents were issued in 1952. Today the same is happening with RFID's since Wal-mart, and others have decided that this new technology is the way to go. Wal-Mart recently announced that it would require its top 100 suppliers to identify all product pallets with RFID chips by 2005. Further, they will require the remainder of its suppliers to RFID tag all pallets and cases by the end of 2006. It's said that a label micro processing capability of approximately 100 bits is required to supply information similar to current bar codes. This capability will allow bar code replacement on cases and pallets. In order to be economically feasible to tag all of the items in Wal-mart's inventory, the tags (labels) will have to be cheap. Recently, the required tags cost up to 50 cents each. They need to be reduced to 5 cents each, with a target of 3 cents each, which will make them cost efficient to eventually tag items that cost more than one dollar. Initially, the plan is to track all pallets and cases of goods, and later expensive individual items, such as DVDs, CDs, cigarettes, perfume, batteries, pharmaceuticals, etc. It's said it will take a tag price of less than 1 cent to see applications on currency, postage stamps, etc. The market stimulus is there, but it's any ones guess how fast development will come and how soon we'll see smart labels, smart cards, smart tickets as well as smart tags applied to virtually everything.

Radio frequency identification (RFID) smart labeling has the capability of creating a new major new market for printers and ink/coating manufacturers.

Printers it is felt will be called upon to print and produce the required inexpensive electronic devices. The largest cost reduction opportunity will be in the production of

integrated circuitry. Printing could play a heavy role in slashing cost. It's already been demonstrated that an antenna can be printed on RFID tags using conventional print methods and conductive inks.

Further, it is forecast that inks could be developed that would contain other elements required for these devices. These new sophisticated inks are envisioned to use nanoparticles of spherical, tubular and other shapes,

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as well as polymers featuring light-emitting and conductive properties. Printed display technology is already here with greeting cards being sold featuring electrochromic inks. In this technology inks are able to change color when exposed to a low power energy source. Printed batteries and integrated circuitry are expected to follow. Traditional printing techniques such as screen, litho, flexo and gravure should offer an avenue to high-speed low cost production. Printers of tag & label, flexible packaging and folding carton should be able to take advantage of the developing market for smart packaging and RFID.

The first of these printed, inexpensive, RFID's might feature laminate structures but in the interest of lowest cost, barrier coatings to replace films will become an increasingly important factor. One just has to look at a similar competitive movement today where printed/protective coatings are vying to replace some laminated packaging constructions.

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