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## Beyond Passive RFID Tags

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RFID technology, in combination with electronic product codes (ePC's), promises to revolutionize supply chain logistics by improving inventory management, reducing shrink, making recalls more efficient and providing the means to authenticate products. EPCglobal, the not-for-profit standards organization, is driving the development of a universal electronic product code system and a global information network to enable automatic identification of items in the supply chain. Wal-Mart, in particular, will drive the commercial adoption of this technology. Wal-Mart as well as Target, Albertson's, Metro, Tesco and the Department of Defense have all mandated the use of EPC-compliant RFID tags in 2005. The FDA has also cited RFID technology as instrumental in the battle against counterfeit drugs.

A number of world-class supply chain companies have already begun to pilot RFID technology to gain a more complete understanding of the related benefits and challenges. Early reports indicate that the promise of massive cost savings and unprecedented visibility may be tempered by the challenges of working with a rapidly developing technology. Specific implementation issues include:

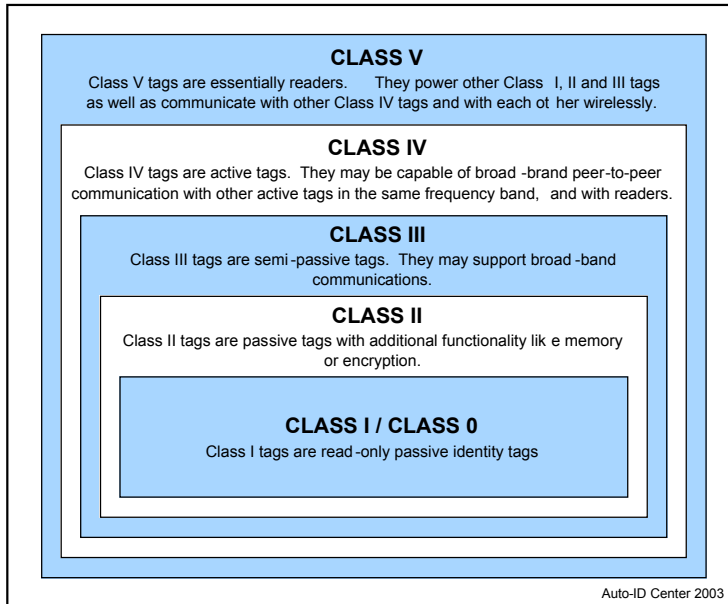
- Tag read range and read reliability have not met original expectations and/or requirements
- Supply chain partners continue to struggle to justify the significant expense
- Emerging standards and growing demand will constrain short term supply of tags, readers and experienced staff
- IT departments are not yet equipped to manage or mine the vast quantity of information compiled by RFID tags

Most of the hype, standards efforts, and pilot testing to date have been directed towards passive RFID tags. There are currently two different passive tag protocols in use - Class 0 and Class 1 - although they are not interoperable. A unified Class 1, Generation 2 standard is expected to be ratified by the EPCglobal technical steering committee in September 2004. Compliant passive tags and readers should be commercially available in early 2005.

In their 2003 Technical Report on [The Future of RFID Tags and Protocols](#), the Auto-ID Center originally specified a modular class structure where Class 1 tags represent only basic RFID capabilities. The class structure identifies a range of higher order RFID tags that are more fully featured. The additional capabilities/functionality envisioned in each of the higher order RFID tag classes is outlined on page two. The modular approach to RFID tags should prevent the proliferation of protocols and readers.

Active RFID tags have a battery on board and as a result have improved range and data handling. They may eliminate many of the problems inherent in passive tags. Active tags typically have an operating range in excess of 100 feet, have read reliability rates that approach 100% and may have additional data storage as well as the ability to add a sensor (i.e., temperature, humidity, shock, etc.). Active tags will, however, be more expensive, have a larger footprint, and a shorter operating life than the passive tags.

## CLASSES OF RFID TAGS



Class IV RFID technology will provide significant advancements in the ability to manage temperature sensitive products in the cold chain. Most best in class food and pharmaceutical suppliers of perishable goods are already tracking temperature through the major segments of their cold chains. RFID will have the ability to complement the existing temperature data with specific location detail. The network knows the location of each component/reader and then assigns that location to the tag data when it is detected. This richer data set will allow partners in the cold chain to more effectively identify and eliminate inefficiencies in their supply chain operations.

Systems that combine passive and active tags will be able to deliver capabilities that go beyond what each technology can accomplish on its own. As indicated, each type of tag has strengths and weaknesses. Where passive tags offer cost effectiveness and high levels of data granularity; read range and reliability can be issues. Active tags offer much improved read range/reliability, as well as sensors and memory, but they use batteries that may need maintenance, and will be available at a higher cost. New capabilities emerge when a system makes use of the best of both technologies. Some examples follow:

### **The Enhanced Manifest Tag**

Active tags have the capability to hold and reliably transmit large amounts of data. With an extended over-the-air requirement, a battery-run radio is needed, rather than the passive tag's backscatter technology. It is possible to "associate" the ePC's of a given shipment or pallet with an active tag. This could be accomplished by writing to the tag all of the ePC information of the individual items in a container, on a pallet or within a load. That same association may also be made in software. The greater read range and reliability of the active tag assures that a complete listing of the associated ePC's is conveyed. This can also serve as a checkpoint in the system, comparing the manifest tag to the individual passive tags that were read. With further development, the active tag can also be incremented and decremented as product is added or removed, creating an automated record of shipment deliveries. Further, by combining sensor data, such as temperature or shock, and the associated location data, the resulting data stream is a complete record of the activity associated with that pallet.

### **Track/Trace/Authenticate**

The FDA has announced its desire to see RFID employed as a major component in the campaign against counterfeiting and the misdirection of product that can allow the entry of false goods into the supply chain. The Agency also intends that members of any food supply chain maintain records from whom product is received and to whom that product is shipped. For both pharmaceuticals and food, the ability to execute a product recall is critical. The combination of active and passive tags presents a unique system design that enhances the performance of all of these critical functions.

Extending the manifest tag scenario provides an interesting solution. The passive tag provides the item-level identification for the lowest level of packaging. The active tag can provide trip history by recognizing specifically identified network components, providing near-real time location information. These data are conveyed along with critical information about the environment to which goods are exposed.

With the active tag providing the details of shipment location and condition, the receiving system will be able to compare the manifest associated with the tag to the ePC's read at receiving, along with knowing through what locations that shipment has passed, even if the goods were not unloaded. This may prove to be extremely valuable for containerized material, with the active tag being able to transmit a long distance, and to provide detailed information about the container's contents and condition.

Sensitech partnered with Ember Corporation to jointly develop a Class IV RFID temperature monitor. The RF-enabled temperature monitor will allow the receiver of temperature sensitive goods to capture the temperature data from the monitor without physically retrieving the monitor from the load. More importantly, the active tag will provide more detailed information regarding the location of the device as it moved through the cold chain. Sensitech is currently piloting this new technology with a limited number of key customers, in each of our vertical markets.

### **About Sensitech**

Sensitech is the leading independent provider of cold-chain information and analysis that enable global leaders in food and pharmaceuticals to protect the integrity, freshness and efficacy of their temperature-sensitive products. In the past decade, Sensitech has protected more than \$200 billion of its customers' assets around the globe. The company is based in Beverly, Massachusetts, and has offices in Redmond, Washington, and Fresno, California, with service and distribution offices around the world. For additional information about Sensitech, call 978-927-7033 or visit [www.sensitech.com](http://www.sensitech.com).