

RFID FOR COMMERCE & INDUSTRY

CREATING INNOVATIVE SUPPLY CHAIN SOLUTIONS

SOLUTION PAPER



RFID for Commerce & Industry

Creating sustainable supply chain solutions

Radio Frequency Identification (RFID) is starting to play an increasingly important role in many sectors of commerce and industry. Manufacturers, retailers, logistics companies, and government agencies are starting to make substantial use of RFID technology to track, secure, and manage items in production and distribution as well as throughout the product lifecycle. Manufacturers and retailers benefit from RFID because it can make internal processes more efficient and improve supply chain responsiveness. Accordingly, the technology currently has the most impact in the CPG, retail, automotive, and pharmaceutical sectors. In this paper, we demystify the technology, describe the current standards and compliance environment, and provide insights into the capabilities and commercial applications of RFID.

Introducing RFID

Radio frequency identification (RFID) is fast becoming the most rapidly growing segment of Automatic Identification Data Collection (AIDC). Wherever the technology is introduced most applications show significant process improvements. While often regarded as a complementary, RFID overcomes several of the limitations of barcode technology. Because it is not an optical system, RFID does not need a line of sight between the reader and the RFID-tagged object. Depending on the system used, RFID can read many object tags virtually simultaneously and it can support multiple “read-write” operations so that the data encoded in a tag can be updated or changed during

the tracking cycle. RFID uses ‘tags’ (or ‘transponders’) that electronically store and transmit information about the ‘tagged’ item. Tags are thin, low cost, wireless, real-time communication devices based on a microchip and an antenna. By using radio frequencies, RFID tags create a contactless system that is highly effective in manufacturing and environments where barcode labels are liable to damage or are simply ineffective. RFID microchips can be integrated in smart labeling that is easily affixed to items, packages and pallets, and can be built into packaging or products themselves to provide multiple read/write capabilities with reliable operation even in extremely harsh environments.

RFID has become the established identification method in a wide range of markets

RFID has become the established identification method in a wide range of markets because of its ability to track and identify moving objects in warehousing, high-value manufacturing processes, and product supply chains. The technology is already commonplace in transportation where vehicles are equipped with RFID transponders that trigger automatic payment of motorway tolls. Other applications include:

- > Identification of livestock and food to provide traceability
- > Consumer Packaged Goods (CPG) labeling in the retail environment
- > Authentication of drugs to prevent pharmaceutical counterfeiting
- > Security passes for hands-free access control in offices and factories

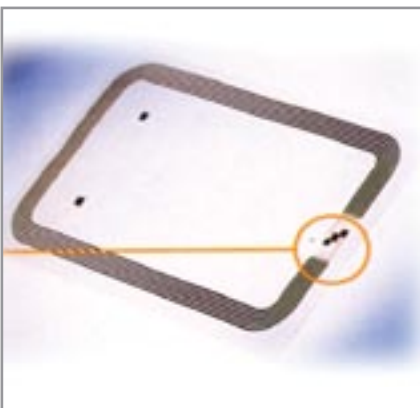
In commerce, RFID technology is used mainly to monitor inventory and identify pallets, containers, vehicles, tools, and other assets. In industry, it is used to route materials, components, and sub-assemblies through production processes. In either environment, RFID can provide immediate and tangible benefits throughout the supply chain. Research indicates that RFID will complement rather than displace barcodes and that supply chain logistics will be the key growth sector over the coming years.

Technology Overview

An RFID tag (or transponder) comprises a tiny integrated circuit (IC) microchip, no larger than a grain of sand, attached to an antenna that is typically printed or etched on thin plastic sheet known as an insert. Data is stored on the microchip and transmitted via the antenna. RFID tags are either passive (no battery) or active (battery powered) with the data transmission speed and range depending on the radio frequency, antenna size, power output, and level of any local radio frequency interference.



Tags can be read-only, read-write, or a combination of both where some memory provides permanent data storage (e.g. for a product serial number) while other memory is available for encoding or updating later during tracking and identification operations. Information is sent to and read from RFID tags using Radio Frequency (RF) signals. With passive tags, an RFID reader (also known as an 'interrogator' as it is capable of both read and write operations) "wakes up" the tag by transmitting radio waves that provide power to enable the tag to transmit or store new data. In an active tag a battery powers the microchip and boosts the RF signal to increase the effective operating range to 30 meters or more. Some active tags also transmit a signal periodically so that readers distributed throughout a facility can capture data. Special data transmission protocols and encryption algorithms are used to ensure the integrity and security of the data transmitted between the tag and reader.



RFID readers can be integrated into handheld terminals or located at fixed strategic positions such as entrances, dock doors, or at different points on an assembly line. The readers include a processor for decoding received signals and one or more antennas for transmitting and receiving signals. The reader then transfers the collected data via wired or wireless Local Area Network (LAN) to the host computer systems. A reader is also used to transmit data to the tag.



RFID tags can be read through packaging, shipping containers, and most materials except metal. Metal objects, such as parts for car assembly, are identified with specially modified RFID tags positioned to minimize interference. Unlike barcodes, a single reader can read tens of RFID tags in milliseconds. This, coupled with the ability to read and write tags through packaging materials, makes RFID highly suitable for unattended identification and tracking of the contents of pallets, transit containers, and the items inside them.





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Identify & Authenticate

RFID chips are extremely difficult to counterfeit and to do so would require specialized knowledge of wireless engineering and encryption techniques. In order that information can be readable at some points of the supply chain but not others, different security levels can be applied to specific data on the tag. Due to its high security, RFID is valuable for both authentication and identification applications. While some CPG manufacturers are embedding RFID chips into their products to provide authentication, by far the largest RFID authentication application, driven by recent FDA directives, is in pharmaceuticals to prevent counterfeit drugs entering the healthcare supply chain.

RFID Technologies

There is a wide range of RFID technologies from which to choose. To determine the most appropriate technology to be implemented, the operating frequency, system performance, and memory are the main characteristics to be considered. Active tags are generally only used for high value items in applications that require RF location, increased operating range and/or high-speed data transfer. The most common types of RFID tag are passive and their performance characteristics are:

- > Low Frequency systems operate at about 125 kHz with a typical read range of up to 50 cm
- > High Frequency (HF) systems operate at 13.56 MHz with a typical read range of up to 1 meter
- > Ultra-High Frequency (UHF) systems operate at multiple frequencies, including 868 MHz (Europe), and in bands centered at 915 MHz and 2.45 GHz (USA). Read range is typically 1 to 3 meters but some 915 MHz systems achieve up to 6 meters

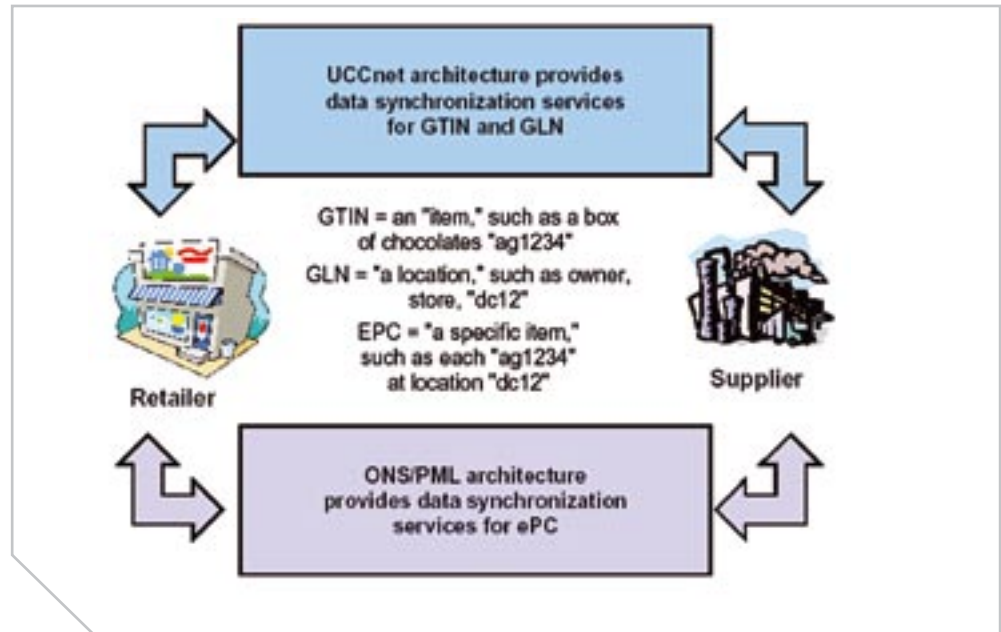
The latest standards comprise HF and UHF systems.

Developing Standards

RFID systems generally conform to the ISO 15693 and ISO 18000-3 international standards that are expected to be replaced by the emergent Electronic Product Code (EPC) specifications from EPCglobal. A joint venture of EAN and the Uniform Code Council (UCC), EPCglobal provides continuation of the Auto-ID Center and is the International Standards body tasked with maintaining the EPC specifications for global usage. As the new Global Trading Identification Number (GTIN)-based EPC standard is expected to become the dominant product and item coding standard in the CPG industry by 2006 (0.7 probability)* enterprises should begin to determine ways to implement remediation for EPC coding and start projects. * Gartner Group 2003

The development of a single global numbering scheme for products is a crucial step forward and the EPC represents the next step toward unique identification of individual products and objects. Given that the same product (identified by GTIN) can be stored at the same location (identified by Global Location Number (GLN)), each individual item to be read by a RFID reader or barcode scanner has a unique, traceable serial identification that can be referenced through its EPC. The EPC is not only relevant to RFID trials. EPCglobal has mapped a 13-digit GTIN item code into the 96-bit EPC standard and the EPC object-numbering scheme is thus designed to be the unifying numbering scheme for the CPG and retail sector. Because the EPC can contain multiple non-conflicting namespaces, it is likely that several variants of EPC will be interoperable. However, the U.S. Department of Defense (DOD) requirements for a 256-bit EPC based on Unique Identification (UID) could affect the approach that CPG manufacturers take to remediation.

The EPC has immediate relevance to all enterprises in the CPG and retail value chain and is important whether or not an enterprise pursues RFID. Although standards could still change, the EPC system is likely to become the dominant numbering scheme for CPG companies. CPG and retail enterprises should start to adopt EPC numbering schemes into all item master systems of record and RFID project plans. Users of a GTIN and GLNs should already begin planning



Integrating Middleware

RFID needs a new class of middleware that serves to direct RFID data traffic and, by helping to filter and aggregate the information, prevent it from overloading business networks and applications. Available from specialist startups and established vendors, the middleware has built-in business rules that monitor the steady stream of data RFID chips generate and direct it only to the systems that require it. For example, middleware could monitor signals from an RFID chip on a shipment of perishable goods and forward only the signal that indicates the pallet's goods have expired to a Warehouse Management System (WMS). The WMS would then alert employees to the problem.

Most middleware products under development are based on the Savant specifications developed by the Auto-ID Center, an organization that pioneered RFID standards and was incorporated in late 2003 into the nonprofit organization called EPCglobal Inc. The Savant middleware specification identifies three middleware groups: reader interfaces, core processing, and enterprise application adapters.

Reader Interfaces: The reader interfaces enable RFID systems to discover, control, and communicate with readers. By using RFID middleware with flexible reader interfaces, companies deploying RFID can choose the reader hardware best suited to their environment without having to commit to a vendor. For example, readers from one vendor might be specified at dock doors and from another vendor along conveyor belts.

Core Processing: These functions allow middleware to process the RFID data before it reaches any enterprise applications. By allowing information to be handled closer to the edge of the network, core processing functions reduce network congestion and potential bottlenecks in centralized enterprise applications. RFID implementations typically generate vast quantities of data, so core processing provides filtering and aggregation to reduce the amount of data transmitted upstream. As more and more data is generated from edge devices (RFID readers) and from edge information networks (EPCglobal), many companies are deploying an RFID middleware edge computing architecture for managing evolving technologies and standards.

Data management issues are critical in RFID deployments. The volume of data generated by RFID can be so large (terabytes of data each day) that many companies do not archive the data, but instead focus on exception handling where, for example, the data indicates a shipment error. Some RFID middleware also provides a platform for implementing business rules and process management to route data so that enterprise applications receive only the information that they require.

Enterprise Application Adapters: These adapters enable RFID information to be delivered to enterprise applications that analyze and process the information. The information interpreted by core processing functions is delivered via these adapters in a form that is compatible with each application. The adapters need to cover all the enterprise applications that are relevant to RFID deployments, including the most popular Supply Chain Management (SCM), Warehouse Management System (WMS), and Enterprise Resource Planning (ERP) applications. This approach ensures that enterprises do not have to upgrade their existing applications to handle EPC data and allows them leverage their prior investment in Supply Chain Execution (SCE) systems.

Supporting Food Safety

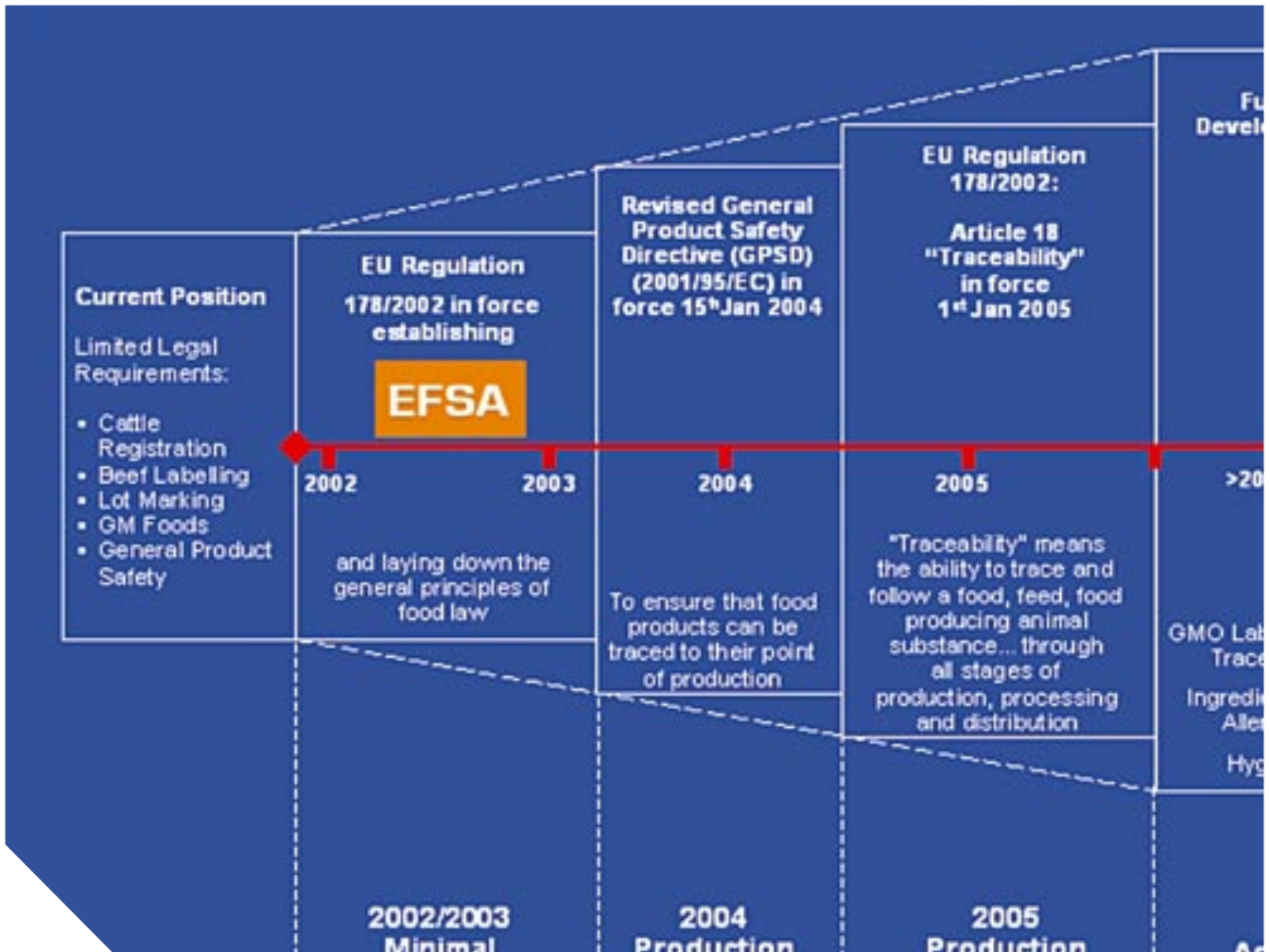
Following the BSE in cattle disaster, the scare of dioxin poisoning from fish and, more recently, the outbreak of avian influenza in several European countries, the driving force for implementing traceability solutions in Europe is food safety. With the introduction of new product coding standards from EPCGlobal, RFID is a key technology for implementing traceability in the supply chain.

In response to political pressures, more stringent food laws and new food safety standards have been established, including:

- > Under the EU's Revised General Product Safety Directive (GPSD), one down traceability, to ensure that food products can be traced to their point of production, or effectively one part of the General Food Law Regulation is effective from the 15th January 2004.

The development of a single global numbering scheme for products is a crucial step forward





- > By the 1st January, 2005, all European food and feed business operators, including primary producers, must have systems and procedures in place to identify from whom these businesses have been supplied and to whom their products have been supplied (i.e. one up, one down traceability).

Europe is not the only region introducing new traceability requirements. In the USA, the FDA has introduced CFR 21, Part 11 covering traceability of pharmaceuticals to prevent counterfeit drugs entering the supply chain. Whatever the regulations dictate, business reality means that brand owners must introduce greater levels of traceability across their supply chains.

By introducing RFID they can satisfy new regulations and retailer mandates, as well as benefit from the new efficiencies and process improvements that RFID can offer.

Market Potential

As supply chain-based RFID tags, readers, software, and EPC guidelines are changing rapidly to meet large retailer mandates, the integration of increasingly complex solutions becomes a significant challenge. According to technology research firm ABI, RFID integration revenue will surpass RFID product revenue by 2007. Full-scale RFID rollouts are likely to be extensions of the early-stage compliance-level solutions established to meet deadlines introduced by enterprises such as Wal-Mart, Metro AG, and the US Department of Defense (DoD) deadlines (2004-2007). As these systems are extended further into event and workflow management, RFID solutions will need to adapt to legacy IT and logistics system requirements.

Any changes to existing enterprise systems require architectural mapping, systems programming, testing, and company-wide change management

With the number of applications increasing rapidly, the global RFID market is projected to grow from USD 1 billion in 2003 to more than EUR 12 billion by 2012. The usage of RFID is steadily increasing and the number of RFID tags produced globally is expected to grow from 276 million in 2003 to nearly 7 billion in 2008*.

*Source: Forrester Research Inc. 2004

Warehouse Management Software (WMS) and Supply Chain Execution (SCE) companies, are actively extending their logistics solutions to incorporate RFID. Incorporating RFID into existing IT and logistics infrastructure affects multiple business processes and areas. Large-scale RFID solutions are not just for tracking out-bound supermarket inventory but also to create real-time tracking visibility, from customer through the warehouse domain and into the enterprise IT systems. Any changes to existing enterprise systems require architectural mapping, systems programming, testing, and company-wide change management implementations. The RFID supply chain integration market is forecast to surpass \$1 billion by 2006*.

* Source: ABI

Application Benefits

RFID can provide a fast, flexible, and reliable electronic means to detect, identify, track, and manage different items and objects. Until recently, implementation has been limited by cost comparisons with barcode labeling, the lack of common standards, and a reluctance to invest in the infrastructure needed for RFID. In recent years, interoperable products have emerged that support new international standards and this, in turn, has resulted in an increase in usage and reduced the cost of RFID systems. Lower costs and increased reliability are now making RFID systems appropriate in many areas and the following table shows how RFID-EPC enabled systems offer significant benefits in a wide variety of supply chain oriented applications.

Retail

- > Lower Labor Costs
- > Out -of-Stock Triggers
- > Reducing Shrinkage
- > Reducing Inventories
- > Locating Products
- > Real-time supply/demand data
- > Smart Shelves
- > Reverse Logistics
- > Customer Convenience

Transportation & Logistics

- > Asset Utilization & tracking
- > Volume Planning
- > Automated Sorting
- > Automated Data Capture
- > Shipment Route Tracing
- > Delivery reliability/Efficiency
- > Contract Pricing Verification
- > Reduced Claim Costs

High Tech & Automotive

- > Quality Control
- > Lot Tracking
- > Recalls
- > Government Regulations
- > Inventory Accuracy and Visibility
- > Labor & Material Costs
- > Asset Utilization
- > Contact Manufacturing
- > Supplier Management

Healthcare & Pharma

- > Tracking Hospital Equipment
- > Patient ID and Tracking
- > Preventing Medication Errors
- > Tracking Samples, Vials etc.
- > Environmental Monitoring (e.g. Blood Samples)
- > Anti-Counterfeit Measures
- > Product Recalls

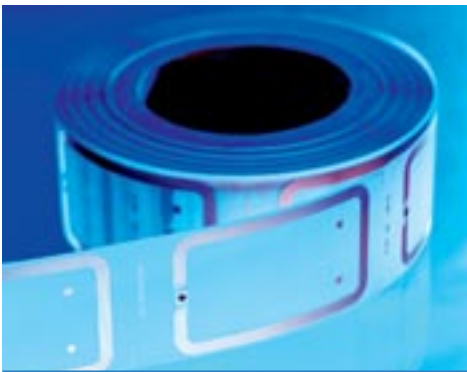
Defense & Construction

- > Location of Military Equipment
- > Maintenance of Sophisticated Assets
- > Asset Utilization & Tracking
- > Automated Data Capture
- > Yard Control
- > Safety Equipment Tracking

CPG

- > Quality Control
- > Lot Tracking
- > Recalls
- > Government Regulations
- > Inventory Accuracy and Visibility
- > Labor & Material Costs
- > Asset Utilization
- > Contact Manufacturing
- > Supplier Management

Source: EPCGlobal



The market for RFID-enabled systems is estimated to grow from \$1 billion (2003) to more than \$12 billion in 2012 for suppliers of RFID tags, readers and systems (excluding services)

(Source AMR)

CPG/Retail

The benefits RFID can bring are easy to identify in the CPG/Retail. In this sector RFID is effectively the starting point for the supply chain of the future with benefits leading right through to building customer loyalty. Enterprises are now beginning to invest in RFID to gain competitive advantage, achieve a measurable ROI, and increase their revenues through delivering a better consumer experience; an optimized supply chain; reduced shrinkage; greater visibility; and retail cost savings.

The interest in RFID intensified in summer 2003, when Wal-Mart announced that its top 100 suppliers would be required to use RFID technology for tagging their pallets and cases (requiring an estimated one billion RFID tags) by January 1, 2005. This has now evolved into a phased rollout plan that will start with pallet and case-level tracking for three of its distribution centers followed by additional deployments throughout 2005/6. Initially, Wal-Mart is likely to focus on assessing savings in labor costs for the goods receiving process, measuring speed and accuracy improvements in the WMS, and evaluating the increased efficiency in replenishing store inventory.

Transportation & Logistics

The largest and fastest growing application for RFID is expected to be global supply chain logistics where cases, cartons, and pallets can be tracked using smart labeling. One of the key benefits is the ability to read the entire contents of mixed pallets at one time during material handling operations such as truck loading or unloading. Incoming pallets or cartons with smart labels can be automatically routed for cross-docking or delivery directly to the manufacturing line. Fast-reading RFID enables instant identification of the shipping container plus all of the individual items inside. For shipping, RFID readers can help packers quickly locate and aggregate all the items needed to complete an order.

Managing pallets and other transit containers using RFID can introduce major cost-savings. As returnable containers are often never returned after shipment, companies are forced to carry costly additional inventory. Identifying returnable containers with smart labels or fixed tags enables companies to augment their legacy barcode shipping applications by automatically recording materials shipped to customers. Companies can then locate their pallets in shipping yards stacked with thousands of items belonging to many different companies.

Active RFID tags used in local area real-time location systems can pave the way to improved long-range wireless pallet location for Warehouse Management Systems (WMS). Such improved tracking enables shippers to lower their material costs and provides an audit trail for billing customers if materials are not returned. Many leading CPG manufacturers, retailers, logistics providers, and pallet producers are currently evaluating trials and implementations of active tagging.

High Tech & Automotive Manufacturing

When applied to subassemblies, smart labels can be integrated with an industrial control system to route items automatically through assembly processes and enable automated, unattended tracking of work in progress. Many automotive manufacturers apply RFID tags to chassis to track them through painting stations. RFID tags embedded within products are especially effective for routing and tracking materials in clean-room applications.

Active RFID tags used in local area real-time location systems can pave the way to improved long-range wireless pallet location for Warehouse Management Systems (WMS).



Product serial numbers and lot identification data can be securely encoded in read-only memory during manufacturing of personal computers to provide lifetime tracking and product authentication. Some manufacturers take advantage of this functionality to verify eligibility for returns and warranty repairs. The maintenance history can be stored on the tag and updated whenever service is performed.

Healthcare & Pharmaceutical

RFID is commonly used on patient wristbands to provide tamper-proof, accurate identification for facility access control and security in hospitals and other medical facilities. Many Alzheimer's disease facilities install RFID readers at all their doors to lock up and automatically sound alarms if patients try to wander through. Hospitals can also use RFID to track medication dispensing, laboratory samples, and blood bags in the same way that barcodes are used today. RFID saves time and improves accuracy because it automatically records all item movements and does not require human intervention.

Pharmaceutical companies can use RFID to manage the movement of medications and containers through assembly and packaging lines to ensure medicines are put into correctly labeled packages. In addition to controlling production flow, this type of system can automatically build a paperless trail to provide a high integrity supply chain offering a detailed audit trail. Tagging pharmaceutical products enables manufacturers to comply with the FDA's recent directive to control the spread of counterfeit pharmaceuticals.

Defense & Construction

Personal badge and tracking systems are very widespread RFID applications to ensure security and safeguard government and corporate property. RFID transponders embedded in employee personnel ID tags provide hands-free access to secured buildings and a tamper-proof form of identification that ensures only authorized personnel are admitted entry. Smart labels can be applied to military equipment, safety equipment, and other objects for asset tracking, utilization monitoring, and determining asset location.

Supply Chain Solutions

More and more enterprises are witnessing an RFID technology revolution in their supply chains that enables fundamental improvements to fulfillment and distribution processes. Organizations have a variety of reasons for implementing RFID, ranging from meeting major retailer mandates to reorganizing logistics operations to improve efficiency and increase operational performance.

While the benefits of RFID in the supply chain will become more apparent in years to come, adopting an incremental approach today will prove most effective, provided there is sufficient adaptability to accommodate new requirements as the technology evolves. Such solutions must enable incremental adoption of RFID to support new compliance mandates and choke-point applications, while continuing to support bar coding of items according to the individual business and customer requirements. This approach allows RFID to be introduced only where it makes sense in the supply chain today, and provides an adaptable platform that can be extended, as required, to meet future compliance requirements.

Implementing RFID, with or without barcodes, at multiple points within the supply chain can enable:

- > Warehouse management
- > Supply chain visibility
- > Collaborative inventory management
- > Yard management
- > Supply chain event management
- > ERP data collection
- > Transportation management
- > Supplier execution enablement

RFID supply chain solutions need to offer robust functionality; enable compliance with ASN, EPC, and shipping mandates; integrate seamlessly with existing business systems (WMS, ERP data collection, etc.); provide configurability according to customer and/or process; and provide reliable exception management and event notification.

Benefits of RFID in the Supply Chain				
Security	Track & Trace	Payment	Smart Info	Main Benefits
<ul style="list-style-type: none"> > Shrinkage control 	<ul style="list-style-type: none"> > Inventory control > Goods flow control > Warehouse automation > In-line process tracking 	<ul style="list-style-type: none"> > Custom handling > Real-time invoicing 	<ul style="list-style-type: none"> > Product information > Product recall > Maintenance data 	<ul style="list-style-type: none"> > Inventory visibility > Supply chain security > Labor efficiency > Higher fulfillment performance > Increased customer lock-in and loyalty

Implementing RFID in the supply chain should only be considered for applications that can realize clear benefits in terms of increased efficiency, reduced shrinkage, or improved customer service.

Warehouse Management Solutions

Enabling RFID-based Warehouse Management System (WMS) solutions is not a trivial task as fundamental changes are required in logistics software to support RFID. Most manufacturers will not see early ROI from RFID projects unless the technology is used end-to-end across the complete supply chain. One exception is manufacturers that produce large, bulky products and do not have enough pre-existing warehouse slots to store their goods. The use of active tags and an RF locator system can provide early payback for these companies.

The same principle can also improve warehouse picking. Workers scan shelves and bins with an RFID reader that automatically detects the storage location of the sought-after items. The system can also detect items that are stored in the wrong location and alert operators to the problem. Using RFID for these applications enables items to “self-report” their locations, rather than requiring human intervention to find them, thus reducing errors, saving labor and lowering costs.

For many CPG manufacturers, investing in RFID is the price of doing business with large retail chains such as Metro Group, Wal-Mart, Tesco, and Target. As a result, Supply Chain Execution (SCE) suppliers must provide solutions that help manufacturers meet these new tag requirements at the shipping dock, facilitate receiving for the retailers, and provide additional support for other warehouse activities down the road. WMS solutions should allow manufacturers to conduct pilot tests before full deployment and should support inexpensive extensions or upgrades to existing WMS software as requirements evolve.

Compliance Labeling

Manufacturers will be expected to provide smart labeling that includes compliant barcode labels and RFID tags. Some suppliers design a gateway of RFID readers that forklifts drive through with the pallets. The information on the tags is read into a software application that in turn sends an Advance Ship Notice (ASN) to the appropriate retailer.

Other suppliers are thinking about this process in a different way, and have built and deployed Trading Partner Management (TPM) solutions. TPM solutions are hosted at the retailer’s site. When an order is ready to ship, manufacturers use an Internet portal to access the order and they follow a checklist to verify that it is complete. Once verified, the system allows compliant barcodes to be printed at the shipping dock with embedded RFID tags containing the appropriate identification number. The printing of the barcode is verification that an order is ready to ship and serves as an ASN. TPM is a good method for retailers that want to insure compliance across their supplier base, especially small suppliers that have not sent ASNs via EDI. For manufacturers that must comply with the different requirements of multiple retailers, a solution that facilitates sending RFID ASNs to all of their customers will be more effective.

Reducing Errors

RFID projects require a fair amount of engineering effort. For example, an RFID reader on a forklift truck may unintentionally read an adjacent pallet instead of the one being picked up. Therefore, readers have to be carefully shielded to prevent the reading of adjacent tags. Different materials, such as liquids and metals, can also interfere with reads. When reading cases on a pallet, the center cases may be difficult to detect and those pallet positions may need to be kept empty. Scaling an RFID implementation to full production in a supermarket environment is still a challenging project.



Scaling an RFID implementation to full production in a supermarket environment is still a challenging project.

Workflows need to be developed based on the assumption that not all RFID reads will be perfect. Stopping processes like shipping and receiving every time a read fails is not desirable. If a forklift drives past a reader and only 9 out of 10 cases are detected but the driver can see the tenth, the system should be capable of being overwritten. Similarly, if a retailer receives a shipment from a highly reliable and compliant supplier and several cases are not detected, the user should be able to configure the system so that it accepts a certain level of non-detects.

Location Detection

Some manufacturers have warehouses with no set or static slotting logic. RF Locator suppliers solve this problem by putting readers in the ceiling and triangulating on an active tag to determine the exact location of an item. RF location systems are well suited for large truck and container yards at ports or distribution hubs.

Recommendations

Supply chains and warehouse management based on RFID must undergo extensive pilots before going live. Following a successful pilot implementation, the effort required to scale up to a full production environment should not be underestimated. For most manufacturers, getting ROI requires RFID to be used across the complete extended supply chain. SCE solutions need to track GPS, passive tags, active tags, and barcodes depending on where the goods are in the supply chain.

Conclusions

RFID is a technology that holds great promise for improving business processes and its use is becoming increasingly widespread. Some early adopter companies have observed that the introduction of RFID gives them new opportunities to perform efficient goods handling processes in entirely different ways.

RFID tags can improve efficiency in many operations by reducing labor and materials costs because of their reusability. They do not require line of sight, enable unattended operation, offer read/write capabilities, and provide extended data storage. Companies considering RFID must look beyond initial investments and evaluate carefully the long-term impact and the Total Cost of Ownership (TCO). The technology provides clear benefits including supply chain visibility, faster response times and better physical asset control by building linkages through an extended Internet that can, in turn, increase customer loyalty and drive up margins.

To reduce the costs of RFID projects enterprises should:

- > Select and use a tag to match a single specific scenario (e.g. theft prevention or inventory control)
- > Use simple non feature-rich tags with less memory and a shorter product code to optimize the flow of goods between distribution centers and retail outlets
- > Consider employing reusable Class 2 tags for improved operating efficiency and lower long-term costs

Implementing RFID in the supply chain should only be considered for applications that can realize clear benefits in terms of increased efficiency, reduced shrinkage, or improved customer service. In order to benefit fully from RFID, enterprises need to address potential issues in business process redesign, cross-company collaboration, and systems integration.



Atos Origin has an extensive record of accomplishment in implementing RFID technology.

How Atos Origin Can Help

Realizing Business Potential

As a leading international systems integrator, Atos Origin brings together best-in-class technologies and partners to provide fully integrated, secure end-to-end solutions for our customers. Our focus is business process optimization and through our consulting services, we work closely with you to determine the suitability of RFID or other enterprise solutions as part of a complete IT strategy. We have a well-proven implementation record and our solid partnerships with best-of-breed component providers allow us to provide secure, fully integrated end-to-end solutions. We are accomplished in implementing RFID systems and share our expertise in optimizing customer processes and systems through our consult, build, operate methodology.

Building the Business Case

With all the hype surrounding RFID, many companies are being understandably cautious about introducing the technology and are trying to understand the business implications of complying with emerging EPC specifications and the supplier mandates coming from companies such as Wal-Mart, Metro Group, and Tesco. Some leading companies may even regard these changes and requirements as an opportunity to increase their competitive advantage by operating more efficiently, offering higher service levels, or even creating new traceability-based products that can attract premium pricing.

Atos Origin is uniquely qualified to help companies understand what they need to implement and when. Our SCM solutions can be individually tailored to specific business requirements, based on an implementation plan ranging from initial pilot, through production rollout, to future RFID asset enhancement. Following successful piloting, we provide tight systems integration of RFID middleware with core enterprise applications to deliver high performance business capabilities.

We start by reviewing the business processes and workflow of our clients and work with them to develop a business strategy and pilot implementation plan to allow process improvements to be evaluated. Our approach to RFID implementation is entirely business-driven with a focus on the business benefits that can be obtained according to the value of customer business and increases in supply chain operational efficiency. Our evaluation takes a host of factors into account, including product prices, margins, volumes, out-of-stock frequency, traceability, inventory, shrinkage, security, and susceptibility to counterfeiting. The result may be a baseline compliance project or we may recommend a highly integrated, RFID-enabled supply chain in order to realize business benefits such as increased productivity, better availability, reduced inventory, and improved visibility.

Implementing RFID

Atos Origin has an extensive record of accomplishment in implementing RFID technology. For example, we designed and built RFID-based WMS software for a large German retailer managing the goods-flow from 11 Distribution Centers (DCs) to 850 retail outlets. We have also implemented a number of RFID Systems in manufacturing as well as security and traceability implementations. As a Systems Integrator, we focus on integrating RFID with your IT infrastructure and providing the relevant data to your enterprise applications to ensure you realize the full business benefits.

At our RFID testing and integration laboratory in Brussels, we address systems integration issues with various RFID reader systems and SAP software. Our R&D focuses on supporting the following business scenarios:

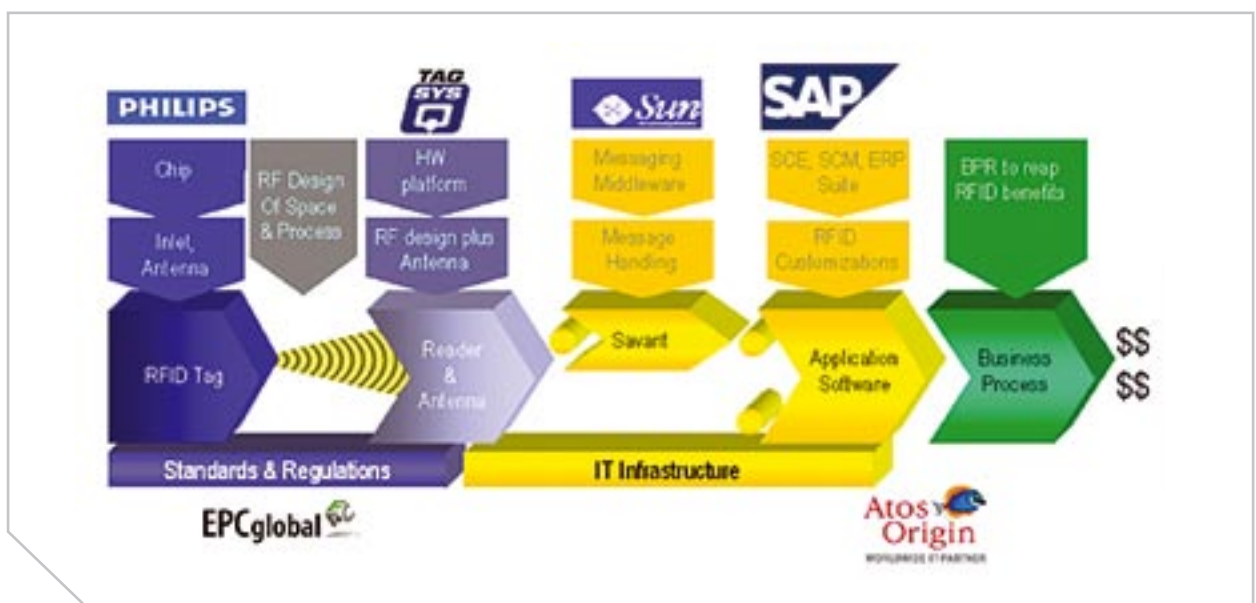
1. Basic: Slap and Ship
2. Medium: With EDI integration, provide standard message compliance to Wal-Mart / EPCglobal standards
3. Complex: With Tracking and Advanced Reporting & Analysis

Atos Origin is a global leader in providing adaptable, best of breed RFID solutions that streamline supply chains for manufacturing and distribution processes. Our tightly integrated solutions enable warehouse operational excellence and optimize supply chains by facilitating collaboration with customers, suppliers and trading partners. Working with leading industry partners such as Philips, we can offer end-to-end solutions that combine robustness, best practice-based implementation methodology, and flexible architectures that enable cost-effective future enhancements.

Planning a successful RFID implementation requires more than extensive knowledge of RFID technology. Atos Origin has a wealth of experience in providing SCE and WMS solutions that are tightly integrated with enterprise software. Our systems integration skills are supported by expertise in data collection technologies, mobile computing, industrial and wireless networking, and in-depth knowledge of manufacturing and distribution processes. Because RFID can read and write to tags automatically, large streams of data are created that can easily overwhelm information systems. Because of this, a detailed understanding of how data needs to be analyzed for different processes is vital. A complete understanding of the data collection element (i.e. polling, filtering, and directing), best practice middleware implementation and the ability to provide full systems integration are all critical to a successful RFID implementation.

Atos Origin's RFID Value Chain

As shown in the illustration above, there are many different sub-industries within RFID. Based on standards from EPCglobal, chip manufacturers, such as Philips, produce RFID microchips. These are then provided to Intel and Tag/Label



manufacturers who manufacture both the RFID tags and the readers needed to interoperate with them. The readers must interface with filtering middleware that provide 'edge' processing to ensure that a tag is recognized only a single time and provide the right information to enterprise applications. Middleware enterprise application adapters interface with Supply Chain and Enterprise Resource Planning (ERP) applications, like those from SAP, that enable RFID customizations and link to WMS solutions and business process applications.

In the area of strategic relationships, Atos Origin has a key relationship with Philips Semiconductors, one of the world's major manufacturers of RFID microchips. Because of our close collaboration, Atos Origin is in a strong position to help Philips' customers with their RFID deployments. Working with our strategic industry partners, Atos Origin plays a pivotal role in redesigning workflow, distribution, and business processes; providing RFID system implementation; and enabling tight integration of RFID solutions with enterprise systems.

Why Choose Atos Origin?

SCM excellence

Atos Origin is a leading global systems integrator, with SCM revenues of around 575 million euros per year. We have an outstanding record of accomplishment in implementing RFID solutions and many case-study references from our blue-chip clients. Whilst the majority of our business is based in Europe, we have international operations that offer truly global delivery. Our application specific, end-to-end solutions are adapted to customer needs and we provide full life cycle evolution support using our global Design, Build, and Operate competencies.

Atos Origin has excellent customer references and supply chain related SI capabilities in the following industries:

CPG/Retail: Carrefour, Auchan, PPR, Avis, Heineken, Unilever, P&G, BAT, United Biscuits, Boots, Carlsberg, Campari, Coca-Cola, Ferrero, Hasbro, Nestle, Philip Morris

Transportation & Logistics: La Poste, Schenker, Iberia, TPG, Air France, KLM, Alitalia

High Tech & Automotive: Philips, Renault, Nissan, Fiat, PSA, BMW, Ericsson, Whirlpool, Infineon, Lucent, Alcatel, Canon, Océ

Healthcare & Pharmaceutical: Azko, Janssen, Bayer

Defense & Construction: Alstom, Janssen Transm., ESA/Airbus/EADS/Snecma, Ansaldo, KBR, Metso, ABB, Liebherr, Eurofighter, VW Network Bouw, Dutch Army

We understand it is vital that IT services and solutions add value across an enterprise and become a positive enabler for the future. Therefore, we aim to develop long-term relationships with our clients and become fully involved in their strategic planning and implementation processes. This can be through outsourcing, joint ventures, or other forms of long-term associations. We believe that this is the most productive way of developing business today, with both parties sharing the risks and rewards of the association, and helping to develop and shape the future together.

Compelling RFID Value Proposition

- > Atos Origin is a leader in supply chain management and has a wealth of RFID knowledge and supply chain expertise
- > With more than 700 supply chain experts, we have the skills and the resources for large scale implementations of RFID enabled Supply Chain solutions
- > We have real life experience with RFID
- > We have a Test & Integration Laboratory
- > Long established relationships with our strategic partners

- > Our investments mean that we can offer the best 'state of the art' technology available
- > Our experience guarantees a 'reality proof' implementation of RFID
- > Working to world RFID standards
- > Delivering reliable, tested solutions that are highly adaptable ensures lower initial costs and future-proof investments
- > As a subscriber of EPCglobal, Atos Origin is fully involved in setting future EPCglobal RFID standards

Consulting & SI Methodology

We have developed a Consulting and Systems Integration Methodology specifically for RFID solutions, which accommodates different levels of customer adoption. This begins with a feasibility study and business case development. We then carry out an assessment of the impact that introducing RFID will have on business processes, the IT infrastructure, and the workforce, before developing a solution that fits with company goals and strategy. This is then rolled-out and implemented across the entire supply chain using a toolset that covers all aspects of people, processes, and technology.

Case Studies

German Retail Customer

Atos Origin has implemented its ICAM WMS system for a large German retail group. This system controls the flow of goods between 11 Distribution Centers (including the largest Frozen foods warehouse in Europe) and 850 retail outlets. The retailer has implemented RFID at pallet level (November 2004) and will move to carton and possibly item level RFID in the future. Atos Origin RFID enabled their ICAM WMS system.

Philips DAP

Philips DAP, the Domestic Appliances and Personal Care division of Philips, wanted to take advantage of new technologies to make further improvements to the internal supply chain at its factory in Drachten, the Netherlands. This is the world's largest and most modern factory for the manufacture of electric shavers.

Business Challenge: Producing domestic appliances, such as electric shavers requires managing the supply and stocks of an important number of small components during assembly. If the process is not managed efficiently, this can lead to high labor costs, fluctuations in the component delivery times and an inefficient component replenishment system. With a major, world-class facility to manage, Philips was continuously looking at ways to reduce costs and improve performance.

Solution: The response to this challenge was to automate the ordering and delivery of materials by implementing an RFID solution. The implemented system was linked to a real-time interface with the back-office SAP ERP system. Atos Origin handled the systems integration and helped to manage the partners responsible for system elements such as the RFID chips, chip readers, the network, and the information database.

Benefits: The successfully implemented RFID system has delivered real benefits to Philips DAP. The ordering process has been smoothed out and the delivery times have been reduced for the internal supply chain. By automating and simplifying of the old manual ordering process, labor costs have also been reduced significantly. Philips is now looking to expand the rollout of this system within the company and to extend it internationally and to its external suppliers.



“We have successfully implemented RFID, proving that RFID can deliver real value and benefits. This has put us in an excellent position to gain even greater benefits as the global RFID market develops. Atos Origin played a key role as systems integrator in the implementation of this emerging technology.”

Patrick A. Edwards, Logistics Manager, Philips DAP

Large Italian Car Manufacturer

Business Challenge: Effective quality management and reduction of production costs for Powertrain manufacturing operation for Multi-Jet Diesel Engines

Solution: The RFID Mobile Data Store creates a direct link between the work-piece on the transportation pallet (using RFID) and the Manufacturing Execution System (MES). Production information for every pallet is loaded on the RFID Mobile Data Store. During the manufacturing process, the workstations automatically update material consumption and process information. The RFID tag technology implemented was active read/write tags containing up to 32Kb of process information, communicating at 1.81MHz.

Benefits: The solution is now deployed in Italy, Brazil, Poland, and Austria. The results include:

- > Improved processing and production line monitoring
- > Faster detection of errors and problems which improves production line yield
- > Better MES data to facilitate analysis and statistic process control
- > Integration with other factory IT systems

Air Liquide

Business Challenge: Addressing increasing costs to supply and maintain medical gas bottles, the safety hazards due to misplaced bottles with wrong content, and the inability to trace gas bottle content and maintenance data.

Solution: Atos Origin developed custom software to manage gas bottle RFID data during the complete lifecycle. The software also provides ongoing Help Desk Support and Maintenance.

Benefits: The total cost of the supply chain is reduced, safety is increased by knowing the exact contents of gas bottles at all times, and Air Liquide's brand image is improved.

Network Rail

Business Challenge: A UK railway operator needed a solution to ensure that physical inspections of the furthest reaches of its railway stations were occurring as and when required.

Solution: RFID tags were installed in specific locations throughout the pilot railway station. Security personnel with iPAQ PDAs equipped with RFID sensors scan these tags and the iPAQ wirelessly notifies central command of the scanned tag. This verifies that the particular area of the station has been inspected.

Benefits: This pilot station program has increased public safety. It is currently being evaluated for introduction in other railway stations.

Dutch Ministry of Defense

Business Challenge: The Royal Netherlands Army required a system for tracking and tracing small caliber weapons. It is very important to know where all small caliber weapons are and who has responsibility for them at all times. The objective is to minimize the chance of misplacement, loss, or misuse.

Solution: All small weapons were fitted with RFID tags for identification. Each time a weapon is issued or checked in, the tag is scanned by an administrator using a handheld reader.

Benefits: Data from the issuing centers is downloaded to a central computer, so the Dutch Ministry of Defense knows the location and employee responsible for every registered weapon at any time.

About Atos Origin

Atos Origin is an international IT services company. Our business is turning client vision into results through the application of consulting, systems integration, and managed operations. The company's annual revenues are more than EUR 5 billion and it employs 47,000 people in 50 countries.

Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and its clients include ABN AMRO, Akzo Nobel, Alstom, BNP Paribas, BP, Ericsson, EDF, Euronext, Fiat, France Telecom, ICI, ING, KPN, Lucent, Philips, Renault, Royal Bank of Scotland, Saudi Aramco, Schlumberger, Shell, Telecom Italia, UBS, UK Department for Work and Pensions, Unilever, Vivendi Universal, and Vodafone.

Atos Origin is quoted on the Paris Euronext Premier Marché and trades as Atos Origin, AtosEuronext, Atos Worldline, Atos KPMG Consulting, and Atos Odyssee.

For more information email more-info@atosorigin.com, or visit the company's web site www.atosorigin.com.

Glossary

ADC:	Automatic Data Capture - Includes barcodes, biometrics, RFID, and voice recognition.
AIDC:	Automatic Identification Data Collection
ASN:	Advance Ship Notice
Chipless RFID tag:	An RFID tag that does not have a microchip but uses materials that modulate and reflect back the radio waves beamed at them in order to identify the tagged object.
CPG:	Consumer Packaged Goods
DC:	Distribution Center
DOD:	U.S. Department of Defense
EAN:	European Article Numbering - The barcode standard used throughout Europe, Asia, and South America.
EAS:	Electronic Article Surveillance - Simple electronic tags that can be turned on and off. An alarm sounds when someone passes a gate area with an item with a tag that has not been turned off.
EDI:	Electronic Data Interchange
EPC:	Electronic Product Code - A 96-bit code created by the Auto-ID Center with digits to identify the manufacturer, product category and the individual item. It is backed by the United Code Council and EAN International.
ERP:	Enterprise Resource Planning
ECC:	Error Correcting Code - A code stored on an RFID tag to enable the reader to determine the value of missing or garbled bits of data. It ensures that data is not misinterpreted.
ECP:	Error correcting protocol - A set of rules used by readers to interpret data correctly from the tag.
GLN:	Global Location Number
GPS:	Global Positioning System
GTAG:	Global Tag - A standardization initiative of the Uniform Code Council (UCC) and the European Article Numbering Association (EAN) for asset tracking and logistics based on RFID.
GTIN:	Global Trade Identification Number
ONS:	Object Name Service - An Auto-ID Center-designed system for looking up unique Electronic Product Codes.
PDA:	Personal Digital Assistant
PML:	Physical Markup Language - PML is based on eXtensible Markup Language used to share data over the Internet.
Reader (also called an interrogator):	A reader communicates with the RFID tag via radio waves and passes the digital information to and from a computer system.
RFID:	Radio Frequency Identification
SCE:	Supply Chain Execution
SCM:	Supply Chain Management
SCP:	Supply Chain Planning
UCC:	Uniform Code Council - The nonprofit organization that oversees the UPC barcode standard in the USA.
UID:	Unique Identification
UPC:	Uniform Product Code - The barcode standard used in North America.
WMS:	Warehouse Management System
XML Query Language (XQL):	A method of querying a database based on XML. Files created using the Auto-ID Center's Physical Markup Language (PML) can be searched using XQL.

