# RFID – The Future For Identification, Tracking, Payments And More

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As the industry continues to wait for the moment when RFID will cross over into the mainstream, we take an in-depth look at the penetration and evolution of Radio Frequency technologies across industries and applications

The identification of people and objects is a growing factor in our business and personal lives. We need to securely identify the people we let onto our premises and we need to know that, if our dog is found, the police can identify it as our pet and return it to us, and the same applies to our valuable goods. We need to combat the 'leakage' (theft by customers or staff) that costs places like London's Oxford Street millions each year and we need to fill warehouse picking lists quicker – to say nothing of tracking baggage when we fly! The simple answer for most of these demands is Radio Frequency (RF) chips but, increasingly, the application of this technology actually involves quite a lot of complex questions to determine exactly what you need and how it will be delivered.

*Figure 1 and 2 – The US military is one of the largest users of RFID systems*

Although we tend to group them all together under a broad heading of chips that use radio waves to communicate information, the RF chip technology for each application can be quite different addressing each application's unique data storage, readable range and security issues. As a general rule, RFID is used in applications that identify or track objects and contactless smart card technology is used in applications that identify people or store financial or personal information.

## RFID

RFID is emerging as a complementary technology to help overcome some of the drawbacks associated with barcode technology. Barcodes have one significant downfall – they require line-of-sight. That means the scanner has to 'see' the barcode to read it, which usually means items have to be manually oriented towards the scanner. RFID, on the other hand, can be read as long as the item is within range of the reader.

RFID tags have common characteristics, including low cost, high volume manufacture (to minimize investment required in implementation), disposable, one-time use, minimal data storage (comparable to bar code), a fixed format (written once when the tag is manufactured) and finally, a read range optimised to increase speed and utility.

RFID tags use a chip that typically stores a static number (an ID) and an antenna. When the reader comes within range, the tag is powered by the reader's RF field to transmit its ID. RFID middleware then provides the interface between the interrogating reader and existing company databases and information management systems.

There are many areas that benefit from the use of RFID. The technology is used in document tracking applications to improve the management of files in sectors such as insurance and the law, where the loss or misplacing of documents can be critical. For sports and music venues and all kinds of events, RFID systems streamline ticket

issue and validation, minimizing ticket fraud. Tickets can be created, on demand, with RFID-enabled barcode printers and then read remotely to increase throughput at entrances.

A hands-free access system for ski lifts, based on RFID, is used at many ski resorts in Europe, improving customer service and efficiency of operations by remote-operated gates detecting valid ski passes to open automatically. The credit-card sized pass can be read in the pocket, so never even has to be displayed.

The US military is currently one of the largest users of RFID systems, although the majority of their systems require/use expensive, active RFID tags, some with sensing capabilities.

The airport and airline industry are using RFID for a multitude of applications and currently piloting many more. Boeing is using RFID to track and manage serviceable parts for their aircrafts, whilst others, such as Hong Kong International Airport, are using an automated in-flight catering system for the routing of meals and the management of returnable containers. The application with the most potential within the industry is for baggage tagging. The airlines are reported to handle approximately 3 billion bags each year and, due in part to the limitations of barcode technology, it is estimated that about 2 % of bags get lost each year, representing 60 million missing bags. Each missing bag costs the airlines as much as $200 to replace; an annual bill of around $12 billion, on top off the dissatisfaction caused to customers. The implementation of RFID is changing this dramatically.

RFID is a mature technology within the automotive industry and has established itself as an integral part of flexible manufacturing systems and made significant penetration into vehicle security systems. The industry is also investigating use in supply chain management, following similar usage in other industries.


*Figure 3 – The airport and airline industry are using RFID to manage serviceable parts for their aircrafts, automate in-flight catering systems, manage returnable containers and baggage tagging*

The logistics industry is a late adopter of RFID worldwide, although this is currently changing rapidly. Postal services are taking an active interest in RFID, particularly for item management (auto-routing and more), as are logistics service providers. Driving factors include RFID becoming an integral link in eCommerce environments. The technology enhances and complements Electronic Data Interchanges to facilitate quick response and the generation of exception reports. This allows real time information to be transmitted to partners within the supply chain. Ultimately RFID provides the immediacy of data down to individual item level identification, bridging the gaps in the customer, order and order fulfillment process.

One objection to RFID is the lack of data security. There is little to no security on the RFID tag or during communication with the reader, as any reader using the appropriate RF signal can trigger the RFID tag to communicate its contents. Typically RFID tags are read from distances of a few inches / centimeters up to several yards / meters to allow easy tracking of goods.

In some quarters, there is still a suspicious view of RFID as 'spy-chip' technology. However, there are security measures being put in place to tackle the issue of data security. Both EPCglobal, the industry standards body, and AIM Global, the trade association representing RFID manufacturers, have issued policy statements on RFID and privacy. AIM's policy states that policies and procedures should be put into place to ensure consumer rights. For example, the right to know whether products contain RFID tags, the right to have RFID tags removed or deactivated when they purchase products, the right to opt out of RFID- enabled services, the right to access an RFID tag's stored data and finally the right to know when, where and why the tags are being read.

**Smart cards**

Another very significant area for RF technology is in transactions and identification for payment, where contactless smart cards are extremely important tools. Despite having a reputation for being a complex technology, smart cards have delivered huge benefits already across a wide range of diverse applications. The deployment of smart cards has proved their worth in secure access, transport, financial services and several areas of government among others.

Vendors of smart cards would like to find a way of getting everyone to adopt them immediately, in order to recoup their development costs and get returns on investment. There are certain issues; the creation of a smart card to do one thing is comparatively cheap; getting it to do two or more things is incrementally more expensive. Most often smart cards therefore have 'single function thinking' behind them. Smart card prices continue to fall and competitive pressure to deliver greater value and functionality increase, especially in the financial services sector.

'Contactless' smart card technology is used in applications that need to protect personal information or deliver secure transactions. The earlier 'contact' smart card technology provides similar capabilities but does not have the RF interface that allows the cards to be conveniently read at a short distance from the reading mechanism. There are an increasing number of contactless smart card technology implementations that capitalize on its ability to enable fast, convenient transactions and its availability in forms other than plastic cards – for example the inside of a watch, key fob or document. Current and emerging applications using contactless smart card technology include transit fare payment cards, government and corporate identification cards, documents, such as electronic passports and visas, and contactless financial payment cards. The contactless device includes a secure microcontroller, or equivalent intelligence, and internal memory that create the unique ability to securely manage, store and provide access to data on the card, perform complex functions (for example, encryption or other security functions) and interact intelligently via RF with a contactless reader.

Applications using contactless smart cards support many security features that ensure the integrity, confidentiality and privacy of information stored or transmitted, including the following:

- Mutual authentication: for applications requiring secure card access, the contactless smart card-based device can verify that the reader is authentic and can prove its own authenticity to the reader before starting a secure transaction;
- Strong information security: for applications requiring complete data protection, information stored on cards or documents can be encrypted and communication between the card-based device and the reader can be encrypted to prevent eavesdropping;
- Strong contactless device security: like contact smart cards, contactless smart card technology is extremely difficult to duplicate or forge and has built-in tamper-resistance. Smart card chips include a variety of hardware and software capabilities that detect and react to tampering attempts and help counter possible attacks;
- Authenticated and authorized information access: the contactless smart card's ability to process information and react to its environment allows it to uniquely provide authenticated information access, verifying the authority of the information requestor and then allowing access only to the appropriate information. Access to stored information can be further protected by a personal identification number (PIN) or biometric;
- Strong support for information privacy: the use of smart card technology strengthens the ability of a system to protect individual privacy. Unlike other technologies, smart card-based devices can implement a personal firewall, releasing only the information required and only when it is required.

Contactless smart card technology is an excellent privacy-enabling solution for applications that need to protect personal information and ensure that communication with the reader device is secure. This combination of features is leading governments, corporations, financial service providers and transit agencies to choose contactless smart card technology.

### Wireless technology

The first breakthrough in wireless communication for Personal Area Networks (PAN) was the use of infrared communications and the establishment of a universal standard, IrDA. This is used for simple short-range (up to 1 meter) point-to-point transmissions. Use is still especially strong in Japan but Bluetooth has really taken over, since 2007, in Europe and the US, especially as many handheld computers no longer have infrared ports installed.

Bluetooth solutions are still relatively more expensive than IrDA, but there is an industry promise of

*Figure 4 – Transit fare payment cards are one current application of contactless smart card technology*

a low cost of ownership, ease of use and a fully interoperable system. Wireless PANs, connecting handheld computers with a range of peripheral equipment with either IrDA or Bluetooth will dominate in mobile computing applications. Connectivity to Wireless Local Area Networks (WLAN) and Wireless Area Networks will mainly be handled by radios in the computer system. The ability to seamlessly switch from a WLAN running 802.11b to peer-to-peer WPAN using Bluetooth will be a defining requirement for the future.

There are a growing number of applications where a form of very short-range communications is needed. One technology that meets this need is Near Field Communications (NFC). While it does not have the hype of Bluetooth, WiFi, WiMax, Zigbee, RFID or others, NFC appears to be set to become a major presence in the wireless communications arena. NFC technology has evolved from a combination of contactless identification and interconnection technologies including RFID. It allows connectivity to be achieved very easily over distances of a few centimetres simply by bringing two electronic devices close together, greatly simplifying the issues of identification and security.

Security in the WiFi arena is always an issue. The IEEE and IETF specify 802.1X and Extensible Authentication Protocol (EAP) as the standard for secure wireless networking. PEAP, a form of protected-EAP developed by RSA, Microsoft, and Cisco, uses server-side Public Key Infrastructure (PKI) to build an encrypted EAP to Transport Layer Security (TLS) tunnel between the client and server, prior to the client transmitting its authentication credentials, such as username, password and certificates. PEAP is used to overcome some of the scalability problems associated with TLS.

Cisco's LEAP, an earlier version of EAP uses Temporal Key Integrity Protocol and dynamic Wired Equivalency Privacy keys rather than PKI and TLS for authentication confidentiality. PEAP has largely replaced LEAP due to its advantages of providing mutual authentication and using a server certificate for server authentication by the client. Users also have the convenience of entering password-based credentials.

### Global growth

There is no doubt that RF is a hugely significant technology in most industries, with a projected global market value for RFID systems to hit $3.1 billion during 2008, according to research by ABI, while IDTechEx predicts the global market will be worth approximately $10 billion by 2013.

The use of RF for communication, including IRDA, Bluetooth and WiFi, is expanding very rapidly. RF is a flexible technology and has potential for applications across all industry sectors. It has moved beyond traditional application niches such as baggage handling, rental item tagging, point of sales, Real Time Location Systems and Supply Chain Management.

RF technology, with its fast registration, wireless data collection and communication abilities, brings far-reaching benefits that ensure its ever increasing place in our lives.

## Direct "Chip-To-Antenna" Attach For High Speed RFID Inlay Assembly

Muehlbauer, an international and independent consultant and manufacturer of innovative solutions for the semiconductor related products market, announces the market launch of its new high speed RFID inlay production system FCM XXL.

This reel-to-reel direct chip attach equipment guarantees high assembly yield for HF and UHF inlays due to proven ACP/NCP assembly technology in a continuous process. Jetting dispense technology minimizes glue consumption. Chip placement accuracy is ± 30 µm and web width up to 350 mm. The FCM XXL is able to handle the latest chip types and sizes from 3.0 x 3.0 mm down to 0.3 x 0.3 mm and wafers with a diameter of up to 12 inches. High quality thermodes and an extended vision capability in combination with a throughput of up to 15,000 UPH ensure high yield rates and low possible label costs.

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