Electronic Tagging, RFID and EAS >>

Electronic tags are now used in a wide variety of retail and supply chain applications to curb theft, provide information about shopping trolley use, control access to store or office areas, transport, drive automated or semi-automated warehouse or transhipment facilities, manage inventories, and provide information about distribution systems. The market is divided into categories differentiated upon "traditional" lines by technology. Hence there are electronic article surveillance (EAS) products; radio frequency identification devices (RFID); and smart card devices which have developed in relation to different markets and technologies and are not generally seen as being part of the same family of products. There is no accepted phrase available which can be used to group this family: "intelligent tags" is one attempt but we use the term "electronic data tagging".

Main types of electronic data tag

The main types of electronic tag relevant to the retail industry:

- Electronic article surveillance tags (EAS)
- Radio frequency identification devices (RFID)
- Smart cards (contactless)
- Intelligent tags

These are all devices which signal their presence and transmit data, if only 1 bit (ie present or absent) as in most EAS tags. Although they are very different products, they are relatively compact electronic devices and have a wide variety of applications. They are low cost and are likely to fall further in price. They are robust in the sense they are designed to last as long as the application and are available in a number of housings, the choice of which will depend on the precise use intended for the device. They will also be affected by developments in other business sectors, which will encourage innovation and bring down prices.

In 2000, Nottingham City Transport became the first UK public transport undertaking to use RFID contactless cards as bus passes and season tickets. Reversing a 70% decline in

bus use since the 1950s, public transport use has increased 8% pa and the growth in private traffic has been zero.

The future is already here

RFID tags are not new but date from the 1960s. Many EAS tags themselves are highly engineered versions of products introduced in the 1970s. Smart cards and RFID devices have been used for access control for at least 14 years and contactless cards for transportation are now 'normal' in many cities. As everybody knows, the first computer ('The Difference Engine') was built in the mid-nineteenth century, so these products can be regarded as having a weight of tradition behind them that should increase their acceptability.

Some 'experts' predicted in 1992 that RFID would be common in grocery by 1995. Our own view (in A Retailer's Guide to Electronic Article Surveillance Systems, Beating the Thief, RMDP, 1992) was that it would take ten years - and we were over-optimistic.
But after several false RFID dawns, there are now signs that something major is happening:

- Wal-mart notified its suppliers in 2004 that it expected cartons (outers) to be shipped with RFID tags.
- The German retailer Metro has carried out a large number of trials with different technologies in its 'electronic store' including RFID for both consumer applications and logistics.
- many experiments are taking place all over the world to try out this technology particularly to deliver consumer benefits (see box on Japan)

2007 Japan's 'Futuristic Department Store Trial

With support from METI (Japan's DTI), several businesses will trial consumer RFID applications in Mitsukoshi's flagship store in Tokyo (Ginza) and the Shiseido counter of the Sakae (Nagoya) branch.

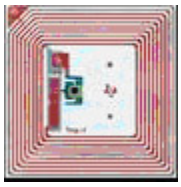
- Skincare testers with RFID tags will provide detailed product information on a touch-screen terminal;
- A demand forecasting system will monitor the use by customers of makeup testers to show which items are tired most frequently;

- E-Counselling of a small number of clients based on their use of products (data captured by RFID);
- Source tagging;
- RFID@home - exploring the use of RFID tags to give consumers product use information on goods they have bought.

The growth in the number of European retailers about to trial RFID. The *European Retail Theft Barometer 2006* showed that 15% of major retailers expected to pilot RFID in the following 12 months and a further 22% in the next two years.

When do you expect to Pilot RFID?

Within 6 months	4%
Within 1 year	11%
Within 2 years	22%
Within 4 years	18%
Within 6 years	9%
There are no plans for RFID	36%
Total	100%



(Source: European Retail Theft Barometer 2006, CRR)

In the UK, the best known trials of RFID involved Marks and Spencer's work with fashion. Tesco also conducted trials with what they call 'electronic bar codes' to test the system.

EAS source tagging

The take up of EAS source tagging (ie electronic surveillance tags are attached to products by manufacturers) by European retailers. Forty-four per cent of major European retailers already use source tagging to some degree, and a further 30% expact to be making use of this within the next two years. For those already using EAS source tagging, the average number of lines in the programme was 236, responsible for 16% of their retail sales.

Use of EAS source tagging

We already use Source tagging	44%
We will use it within 2 years	30%
We have no plans to use Source tagging	26%
Total	100%

(Source: European Retail Theft

Barometer 2006, CRR)

RFID Standards

GSI UK is the organisation responsible for administration and standards of product numbering and labelling and electronic commerce (a merger of the Article Number Association [the father of the barcode system EAN-13 and EDI] and the Electronic Commerce Association). Amongst other things it will look after RFID standards and identification instead of fighting it.

There are now many RFID/contactless card applications from bus passes to rubbish bins, doing a sterling if not revolutionary job of data collection. We are still some way from using RFID tags as barcodes in a supermarket or selling electronic equipment containing programmable security tags to prevent access by minors or which shriek if burglars attempt to take them outside the house.

The attack on RFID tags

Another straw in the wind was that by 2005, RFID tags were regarded as important enough to have their own opposition groups, CASPIAN (Consumers against supermarket privacy invasion and numbering) and 'No Tags'. **CASPIAN** is a US organisation that started as a protest again loyalty cards and **No Tags** is a UK version that focuses primarily upon RFID devices. No Tags has organised a few demos in England against Tesco experiments and M&S, but although the organisation got a lot of publicity, turn-out was poor, suggesting that membership is a little sparse. Nonetheless the points they make about the need to safeguard customer data against theft and misuse are important even though they exaggerate the dangers.

The retail agenda is long term as well as short term

There are many potential applications for electronic data tags. Current possibilities are, of course, limited by what is commercially available. Future possibilities will be limited by commercial requirements and the laws of physics. Hence, we can say on the basis of what is known to be available, technological and economic (scale) factors have prevented a cheap and reliable intelligent tag being available in a form which interests supermarkets for low-cost fmcg until recently. Similarly, whilst electronic tags can now perform an identical role to that of product bar codes, this is a long way off in most sectors and there are logistical issues to be faced if the transition from bar codes is to be made. Moreover, the state of current knowledge about electronic tags suggests that it seems unlikely that one single technology or type of tag will wipe out the alternative products in the next 10-15 years. The normal EAS paper tag cannot be converted to hold and transmit additional data in its present form.

Much discussion about intelligent tags assumes that all tags will have a high level of functionality. There is no reason why this should be so. Cost reasons alone may mean that 'chipless' data tags or extensions of EAS may well be more attractive to the general retailer. There is plenty of evidence that whilst retailers are committed to change, they are very careful about the take-up of new technologies. There is a price-technology trade-off such that high functionality will require a high price. The only way to reduce prices would be for the industry to agree on a single system and commit to it. As this is not going to happen in the near future, high-ish prices will tend to predominate for all except low functionality tags.

Retailing's agenda for electronic data tags: the vision

The principle of electronic tagging as a means of controlling merchandise or the distribution system has become widely accepted. The vision is, therefore, to develop a range of low-cost electronic data tags which can hold information about merchandise (including product number, price, date, batch, sale/no sale), which can be fixed to merchandise and provide many, not one, functions in controlling retail operations in-store and along the distribution channel. This would not be an extended EAS tag, but a radically new method of data collection in retailing. Potentially it would have the same impact upon in-store and distribution data collection as bar codes have had over the past 15 years.

The range of applications for which electronic data tags would be suitable is for retail merchandise applications:

- Retail theft - a variety of applications such as fashion, clothing, grocery, electricals, recorded music. A much more practical tag for clothing than is available at present.
- Supply chain control - tags can be used to control the movement of goods from one process to another, be used for routing goods through the warehouse, delivery control, and to assess the effectiveness of the supply chain itself.
- Stockless transhipment depots, transferring goods automatically between points.
- Inventory control - every tag can be read to give information concerning batch number/unit, the number of items in store, or information on category and colour which may not be held by the normal retail computing system.
- Intelligent packaging - a tag linked to a sensor would provide data on whether the product has been tampered with at any stage, the status of the merchandise (eg whether fresh meat has been held at the correct temperature), and provide in-store information to customers and at home.

- Asset control - tags could be used to determine the location of an asset, or to ensure the asset was not moved out of a defined zone

RFID tags in logistics can manage consignments, protect against counterfeiting and theft, and monitor and control the flow of goods through depots making for faster shipments, lower costs, and greater accuracy.

- Customer benefits - sophisticated tags can continue to provide information after PoS for customers. RFID tags are already used for asset control by automobile manufacturers, tracker systems, and for household antiques. Tags can be used for household inventory control including product rotation and reordering merchandise. For some high cost devices, the electronic data tag could be made a functional part of the equipment, controlling use of the equipment (eg by children) and disabling the product if it were stolen. A household tag reader would join the Alessi kettle and the Dyson vacuum cleaner as the domestic status symbol, purchased presumably from Dixons or Argos. No one device will be able to meet all these different requirements. There will be considerable technological and logistical issues to be overcome with all of them. What is under consideration is the use of a range of tags which meet a common core specification to provide value added benefits to retailers through the collection of data.

Main issues:

- Technologies: There are several available technologies used at present. For EAS, electro-magnetic, radio frequency, and acoustic magnetic are used. Devices are detected in several ways, including their resonance (and Q) in response to a signal, a split signal with precise characteristics returned by the tag to the detector antennae, or signal disturbance from their presence in the detection radio field. They do not transmit data. Most RFID and contactless smart cards use semiconductor integrated circuits and should be able routinely to hold and transmit around 128-150 bits for batteryless systems over short distances (with a maximum capacity

currently around 1k+). To maximise performance, passive systems use low frequencies.

- Core specification: However, a core specification or set of requirements is needed covering four main areas: interface/communications; control; data storage; and energy source. It is possible to argue that getting data into the tag is the simplest problem. The key issue is how to access the data consistently, accurately, and read over a distance suitable for normal retail operations.
- Frequency and power: A range of frequencies are used currently by tags. The frequencies and power that can be used are set out by Government: unlike radio stations, which are given exclusive right to a particular frequency, there may be several users of an electronic tag frequency. Passive (batteryless) RFID tags usually are low frequency - around 134.2 kHz. EAS tag suppliers use a range of frequencies, the only standardisation being around 8.2 mHz for swept frequency RF. Because many systems sweep across a frequency range to pick up tags which are slightly detuned, EAS in particular can be a potentially broad brush approach towards frequencies. One way of avoiding this problem is to use infra-red which is not similarly restricted: however this has low penetration power. Security error detection: Semiconductor devices such as RFID are much less prone to data error or false positives. Suppliers have put increasing focus upon security and error detection issues. Methods such as redundancy checking, signal splitting, and synchronisation procedures help to eliminate incorrect recognition or reading data incorrectly.
- Economics/price issues: Tag price will have a major bearing upon the speed at which electronic data tags are adopted by retailers. However, the important issue is not the tag cost, but tag performance or retail added value that results from the use of the tag. A retailer selling expensive products (for example fashion or electrical goods) may well be an early adopter of electronic data tags, both because of higher £net per item and the increased inventory control provided by the devices.
- The scale of production of tags is still relatively small. It can be expected that companies such as General Dynamics, GE, AEG, and Motorolla will enter the market on a large scale driving down prices. Label companies will also join the market, perhaps bringing some newer approaches to the industry. Using present technology, there are minimum prices set in relation to the price and amount of silicon used, the housing containing the electronic components, and the means of attaching it to the product. Tags could be read only or

read/write. The most satisfactory means of dealing with different types of information seems to involve partitioning, which would help to ensure data integrity.

It is likely that tags will both be integrated with the product at time of manufacture and attached to packaging or the article, much as EAS tags are now. Tags which are to form a functional part of the merchandise will need to be integrated. Retailers will need to determine by trial and error which is the best solution for them; hence they will need to keep their options open.

Conclusions

Electronic data tagging is now increasingly being used to meet the agenda of retailers, transportation and logistics. Its full potential may not be achieved within 10 years. The issues now are not so much about technology as consistency, standards, tag cost, project management, and paying for infrastructure.