

WHITEPAPER



## ➤ Radio Frequency Identification (RFID) - Frequently Asked Questions



## Radio Frequency Identification (RFID) Frequently Asked Questions

Radio Frequency Identification is a technology tool that can be used to enhance data collection capabilities in a number of real-world system applications. RFID is not a new technology; it was first used in World War II to identify friendly aircraft to avoid accidental targets. Its use in tracking applications is not new either. Many toll road systems have successfully used RFID toll tags for years to accommodate traffic through busy gateways. All RFID applications thus far have been developed to track items that justify a high cost for the tracking device. RFID has not been extensively used in widespread tracking of individual items due to high infrastructure and component costs. Recent technology advances combined with concentrated efforts by various industry groups have increased the technology adoption rate in specific applications. The goal has been to lower costs so that RFID becomes feasible for tracking all items throughout a supply chain.

Current interest in RFID is being driven by recent announcements by very large corporations requiring RFID to be incorporated into vendor packaging in the near future. The RFID industry is quickly adapting to its potential uses, including some exaggeration of its potential capabilities. Like any technology, in order to achieve potential benefits from RFID the technology must be well understood by system integrators/developers. Goals and processes must be defined before project approval. RFID is a technology solution that is subject to the parameters and limitations inherent in all technology products. Potential users with limited technical capabilities and infrastructure, incorporating RFID for asset/warehouse/supply chain management systems will create efficiencies by orders of magnitude over current operations. However, users with very sophisticated technology and processes implementing RFID will achieve incremental advances of a smaller scale.

The Datamax RFID solution addresses **current** RFID market needs and opportunities, but is designed to evolve as standards and infrastructure changes occur - and they will. This document is a discussion for AIDC channel members. These questions are designed to assist Datamax sales personnel and Datamax Partners in providing information for customers interested in deploying the technology.

## What is RFID?

Radio Frequency Identification uses radio waves to communicate an identification number, such as an EPC (Electronic Product Code) number, between a reader (host) and a tag (item). This communication occurs through the air and most materials except some liquids and metal. RFID is instant, aided by identification algorithms in reader firmware that allow the reader to individually identify hundreds of items simultaneously. The identification number is defined by the standards of the implemented system.

## What is frequency?

Frequency refers to the size of the radio waves used to communicate between the RFID system components. It is generally safe to assume that a higher frequency equates to a faster data transfer rate and longer (greater distance) read ranges, but also more sensitivity to environmental factors such as liquid and metal that can interfere with radio waves. RFID systems currently operate in the Low Frequency (LF), High Frequency (HF) and Ultra-High Frequency (UHF) bands.

Low Frequency tags operate at or near 125 kHz and have a read range of less than half of a meter. They have a relatively slow data transfer rate and short read ranges of about half a meter, but are generally cheaper and less sensitive to interference than higher frequency options.

High Frequency systems operate throughout the world at 13.56 MHz, creating a truly global solution. Read ranges for HF systems are about one meter and they can transmit data faster than LF tags.

Ultra High Frequency systems operate in a range between 860-930 MHz depending on geographic location around the world. The North American market operates at or near 915 MHz, much of Western Europe is at the low end of the spectrum, and several Asian companies recently opened the higher end of the spectrum to RFID usage. UHF tags can be read up to three meters away, and generally operate at greater speeds than HF tags. However, UHF waves react severely to metal and liquid substances.

## What is a tag?

An RFID tag consists of an Integrated Circuit (IC) and an antenna. Some tags also incorporate a battery, but batteries are rare in smart label applications. Tags have many variable characteristics including power requirements, memory capacity, and read-write capabilities. Application standards such as ISO and EPC (see below for more information on these standards) specs define the characteristics of a tag for an individual application.

## What is the Datamax RFID solution?

For those end users that are interested in RFID, but have not yet completed the infrastructure work to implement the technology, Datamax offers the I-Class RFID Ready printer. This printer is based on a traditional I-Class printer, but with features that will allow for field installable RFID modules in the future. The available RFID modules will include HF and UHF options, as well as other standards that develop into viable smart label applications. Please contact a Datamax sales representative for information on the Datamax RFID Ready printer.

The simple and inspired I-Class RFID printer from Datamax facilitates the evolution from bar coding to more advanced data capture and tracking methodologies. Capable of printing and encoding simultaneously, the Datamax I-Class with RFID is a robust solution incorporating the ease, familiarity, and sophistication of the I-Class with RFID encoding capabilities.

The I-Class with RFID is available with a variety of encoding modules to support users' needs. There is an option that operates at 13.56 MHz and is ISO 15693 compliant. This solution is compatible with Texas Instruments Tag-It® and Philips I-Code® products, and will continue to include other tags that are introduced into the ISO 15693 standard.

The UHF market is developing at a pretty fast clip, and will likely produce higher volumes in RFID applications. Datamax offers an I-Class with RFID that operates in the UHF range for EPCglobal opportunities. This printer is compliant with the current Class 1 EPCglobal application standards. Datamax expects to introduce printers with multi-protocol UHF readers to accommodate Class 0 and Class 0+ readers as well as Class 1 by the end of 2004.

The Datamax A-Class is also now available with an RFID encoder option. This option creates the industry's first stainless steel RFID print engine for applications where the printer must be incorporated into an automatic print-and-apply system. The A-Class is compatible with the EPCglobal Class 1 standard currently, with the expected addition of Class 0 and Class 0+ support by the end of 2004.

As a Solution Provider Subscriber to EPCglobal, Datamax is keenly interested in the development of a globally accepted standard for EPCglobal users. As the work for the UHF Gen 2 standard has progressed, Datamax has been an active participant in the standards development process and has incorporated these issues into the design of Datamax RFID products. As RFID is a fast-evolving technology, Datamax is striving wherever possible for firmware upgradeability with all RFID products offered. Currently this is impossible to guarantee without a finalized standard in place, but Datamax is taking steps to understand the forward migration path with modules from all of our RFID vendors.

## What are current RFID standards?

The ISO 15693 standard for operation at 13.56 MHz is a global standard that has been developed and deployed in applications all over the world. This standard is ideal for many applications, including work-in-process, item level tracking, and other closed loop applications.

There are currently no universal standards for UHF RFID technology. This poses a potential risk for users in that current RFID hardware and software may or may not be compliant with future standards, or a universal standard may fail to emerge. The lack of unified standards also presents an adoption barrier as user communities sit on the sidelines to ensure that their technology investment is global, scalable, etc.

The Electronic Product Code is an item-level tracking system developed by the MIT Auto-ID Center and associated universities around the world. Many leading consumer products companies and technology providers sponsored the Auto-ID Center through its life cycle. The Center was founded to identify and develop new methods of advancing data capture technologies to assist sponsoring companies increase their competitive position through sophisticated supply chain management processes. The Center was taken over by EPCglobal, a joint venture between the Uniform Code Council, and the European Article Network. EPCglobal is responsible for the commercialization of the EPCglobal Network.

The Electronic Product Code is the result of this development effort. It is part of a system that uses RFID tags, readers, Physical Markup Language (PML), and a database known as Savant for tracking items. The EPC Network could eventually allow manufacturers to uniquely identify every individual item they produce; every can of soup would have a unique identifier, every tire, every pair of pants, etc. It is debatable as to whether this item-level identification capability is necessary, but the EPC network expands the current UCC/EAN capabilities for global identification.

Currently the EPCglobal standard operates in several classes. The Class 0 standard, developed and most often associated with Matrics Inc., began as a read-only tag that was programmed upon its manufacture. There is now a Class 0+ standard that offers users read/write capabilities based on the same performance of the original Class 0 (Matrics Inc.) standard. The Class 1 standard is most often associated with Alien Technologies, and this began as a Write-Once, Read Many (WORM) tag. Class 1 tags are now available with read-write capabilities based on the Class 1 (Alien Technologies) standard. There is a substantial amount of incompatibility with current EPCglobal standards. Users with a Class 0 reader cannot currently read a Class 1 tag, and vice versa. EPC will eventually have a set of standards, with an expected release in October that will govern its use worldwide and provide compatibility. These standards will define all aspects of the network and will be unique to EPC, managed by EPCGlobal. EPC is a subscriber-based system similar to the current UPC system.

## What are the current ISO RFID standards?

There are currently several ISO standards governing RFID for various applications. Relative to smart labels, there is the existing ISO 15693 standard that defines 13.56 MHz. There is also the ISO 18000 standard, which offers several sub-sections to address various applications. In the UHF arena, the EPC standard for air interface is not compatible with the ISO 18000 UHF standard. The ISO 18000 standard only deals with air interface protocols, whereas the EPC standard also includes data structure. The desire is for these two protocols not to be mutually exclusive.

Within ISO, there is a Joint Technical Committee (JTC1) that consists of various groups brought together to define and publish IT standards for electrical, electronic and related technologies. Within the JTC1 subcommittee responsible for RFID (SC31), there is a work group (WG4) that deals with RFID issues. A subgroup of WG4 is responsible for ISO 18000, which is a proposed standard dealing the air interface for frequencies used around the world. ISO 18000 has seven parts, the ones relevant to smart labels are ISO 18000-3 and ISO 18000-6.

ISO 18000-3 is the air interface standard for RFID operating at 13.56 MHz (HF). Publication expected in October 2003, but is not known whether this standard overwrites ISO 15693.

ISO 18000-6 is the air interface standard for RFID operating at 860-930MHz (UHF). Publication is expected in mid-2004.

There are other standards developed by both ANSI and AIAG that are in the process or already released. The ANSI standards include RFID standards for parcels, packages and flat mail. The AIAG standards include a tire and wheel identification standard. The AIAG standard is not developed for smart label applications, it calls for embedding a tag on the inside of a tire.

## How does the Datamax solution comply with existing standards?

The Datamax I-Class with RFID is an ISO 15693 compliant solution. This standard covers RFID for item management and the unique identification of the RF tag. The standard is currently available on tags from Texas Instruments and Philips and the Datamax I-Class with RFID works with both of these products. New tags in the market that are ISO 15693 compliant will also be available for use on the Datamax I-Class with RFID.

## What software can be used with the Datamax RFID solution?

Datamax has a working partnership with Seagull Scientific to develop drivers, as well as to distribute the seagull BarTender Special Edition for Datamax with our printers. As such, Datamax has worked closely with Seagull to add RFID encoding capabilities to BarTender, which are now available. Other software manufacturers will also be encouraged to develop RFID encoding capabilities in their product. The general consensus from the software community is that they are interested in developing solutions for RFID.

## Does Datamax provide smart labels?

Yes, Datamax does provide smart labels to customers and partners that would like to create demonstrations. We can supply labels with inlays from a variety of manufacturers, including Alien Technologies, Texas Instruments and Philips to any customer specifications.

## Are there current standard label sizes?

Datamax maintains a stock of 4" by 4" paper labels with TI Tag-It tags for demonstration purposes. It is recommended for expedition purposes that these tags be used for demonstrations. It should be understood that lead times on custom tags could be up to 6 weeks or more.

## Does Datamax have recommended label/ribbon combinations?

Almost any existing ribbon and label combination can become a smart label. It should be understood that in smart label applications, just as in thermal printing applications, the label should be developed with the application specifics in mind. Many RFID applications are developed for tracking goods, which simply requires a basic paper label, and that is the standard Datamax stock smart label. For other applications, such as costume tracking or asset management, customers might want a more durable product. It can be assumed that smart labels should not be constructed of a conductive medium, say metalized polyester, that would interfere with the inlay's radio wave communications.

## How much are smart labels?

The price of smart labels depends on a variety of factors, including type of tags, label material, size, and quantity ordered. At quantities of 10,000 labels are priced anywhere from \$0.90 to \$1.50. At higher quantities, prices can be reduced to around \$0.80 per label. A large portion of this cost is due to the price of the tag. As those prices fall - and they have been falling steadily - smart label prices will also fall.

## What is the reasonable life span of a smart label?

In terms of the labels themselves, life span is based on conditions of the environment and material use. The majority of RFID applications for smart labels will create disposable labels, which is why it's so important that the tag cost drops. Permanent and semi-permanent smart labels for asset management applications can be expected to have a longer life span. The chip itself is also vulnerable to environmental conditions such as impact, moisture, etc., but will continue to be read in perpetuity as long as it is in undamaged condition.

## Does Datamax provide RFID readers or antennae?

Datamax has strong working relationships with a variety of companies that provide readers, including HHP and Datalogic. Our relationship with these companies extends beyond traditional bar coding and into total AIDC solutions. As the RFID market continues to develop, Datamax will work with leading equipment providers to facilitate smooth equipment procurement where possible. Virtually any ISO 15693 compliant RFID reader could be used in conjunction with the Datamax I-Class with RFID.

## Where are the opportunities for RFID now?

While much of the spotlight on RFID is focused on future applications such as the Wal-Mart January 2005 deadline, there are current RFID applications that are being developed outside the supply chain realm. These applications are considered "closed loop" applications, where the standards and protocols need to be shared amongst one to only a few trading partners and the technology can be developed in-house. These applications can certainly offer some of the extreme benefits of RFID to companies that are willing to invest in the technology. Some examples of current applications include

- Library tracking systems
- Patient identification and accounting
- Corpse tracking (yes, apparently it's a big issue)
- Inventory Management
- Baggage handling
- Costume/apparel rental and return
- Movie/DVD rental

These applications all have a closed loop in common. The application does not have to be distributed among a multitude of trading partners or through large geographic locations. These limitations allow companies to invest in the technology and receive the benefits while limiting their exposure risk created by the lack of standard.

## What opportunities are developing for RFID?

The future looks bright for RFID based on major companies' interest in the technology and the press coverage it has received. Wal-Mart announced in June 2003 that they would require their top 100 suppliers to incorporate RFID into pallets by January 2005, and over 137 suppliers are currently on track to achieve compliance with this mandate in the required timeframe. The Department of Defense also announced a similar mandate, but expanded their tagging requirement to include all suppliers by 2005. While there is a lot of momentum surrounding RFID technology, involved companies are seeing that the lack of infrastructure and standards, and high tag prices (\$1.00 per label as opposed to \$0.009 per label is a tough pill to swallow!) are still substantial barriers to the technology's adoption. However, many of these barriers are being addressed through increased interest and standards development efforts. It remains to be seen how the standards game will play out, and whether politics will prevent a global standard from emerging. If all goes to plan, though, RFID could be the next compliance labeling initiative for supply chain management operations. Large, global corporations will be investing in equipment to increase their supply chain visibility and gain a competitive edge.

## What is Datamax going to do to help me prepare for those opportunities?

Datamax offers an RFID solution right now that is relevant for applications that can be developed under current standards and infrastructure capabilities. One of the best ways to ensure that Datamax partners are prepared for the future opportunities is to get experience before the demand accelerates. Datamax will offer RFID training in Fall 2004 and partner companies will be encouraged to participate in training sessions prior to developing applications. Training sessions will focus on understanding the technology, understanding the Datamax product, and developing the tools to assess an application's relevance for RFID.

**Please visit [www.datamaxcorp.com](http://www.datamaxcorp.com) for more information on Datamax products and solutions.**

Datamax specializes in the design, manufacture, and marketing of products for bar code and RFID labeling including thermal demand printers, label, ticket and tag materials, and thermal transfer ribbons. Headquartered in Orlando, Florida, Datamax has sales representative offices in Singapore, China, and Harlow, England, as well as label converting and preprinting facilities in Robinson, Illinois. Datamax markets its products exclusively through a network of resellers in more than 100 countries worldwide.

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