WHITEPAPER

Radio Frequency Identification (RFID) - Frequently Asked Questions

DATAMAX®

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Radio Frequency IDentification (RFID)Automatic Identification and Data Collection (AIDC) technologies have been used for decades to increase accuracy and efficiency in the data collection process for many activities including supply chain management, logistics tracking, and retail point of sale. The bar code is the form factor of choice for data collection activities. It allows users to achieve highly accurate fast reads of encoded data. The bar code was developed as a data carrier that enables fast and accurate data collection. While the bar code has its limitations, it has done a remarkable job of remaining current as technology has evolved at its fastest rate ever in history.

The following technological evolutions have all been supported by the bar code: Mainframe to PC computing, Database development technology, Enterprise Resource Planning (ERP) systems and their derivatives Increased trading partner collaboration to streamline supply chains as a competitive advantage necessary to compete in today's hyper competitive commerce landscape RFID technology was first used to identify friend or foe aircrafts during WWII so that Allied forces could determine the status of approaching planes. RFID has evolved into many other uses but it has not yet fully penetrated the supply chain and collaborative commerce arena to the levels of the bar code. The technology infrastructure to support RFID tracking applications use is still in its infancy relative to bar code support.

The advantages of RFID and its technology infrastructure are developing to a point where its use can enhance supply chain and collaborative commerce purposes. Selecting RFID as the most appropriate technology solution for a given AIDC application will be a challenge for users. This white paper will offer basic answers to generally asked RFID related questions especially as they relate to current AIDC solutions.

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 through most materials, the exception being some liquids and metal. RFID is virtually instantaneous, aided by identification algorithms in reader firmware that allow readers 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), UltraHigh Frequency (UHF) and Microwave 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 860-960 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 at 868.5 MHz, and several Asian countries recently opened the higher end of the spectrum to RFID usage. UHF tags can be read from one meter to ten meters away, and generally operate at greater speeds than HF tags. However, UHF waves react to metal and liquid substances in a more volatile manner relative to HF tags.

Microwave frequency systems operate at above 1 GHz. Microwave tags can be read up to two and a half meters away with the use of specially designed antenna. The addition of a battery also increases their read distance. Microwave tags offer the greatest data transfer rate.

What is a tag?

An RFID tag consists of an Integrated Circuit (IC) and an antenna. Tags have many variable characteristics including power requirements, memory capacity, and read/write capabilities. Application standards such as those available from ISO and EPCglobal (see below for more information on these standards) define the characteristics of a tag for an individual application.

Tags used in smart label applications consist of the chip and an antenna (etched or printed) and a liner to create an inlay (also known as "inlet"). Inlays are provided to label converters who use inserting machines to incorporate one inlay per label, creating "smart labels". There is research underway to incorporate semi-passive tags into smart labels using ultrathin batteries, but this technology is still in development.

What are the standards for RFID?

RFID standards are constantly evolving depending on the chosen frequency, the technology application, and geographic locations. Some standards, such as the ISO 15693 standard for 13.56 MHz, are global and can be used without modification across the world. Others, such as EPC, are not yet global due to intra-country regulations concerning Radio Frequency allocations for other technologies and applications.

There are two main groups forming RFID standards, ISO and EPCglobal. EPCglobal developed out of a joint venture between EAN/UCC and the AutoID Center at MIT that developed the EPC. This venture is charged with the commercialization of the Electronic Product Code and its support network. Datamax is a solution provider supplier to EPCglobal and participates in standards development.

What is EPC?

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.

Matrics developed the Class 0 standard and originally featured read only tags. The Class 1 standard was developed by Alien and originally featured Write Once, Read Many (WORM) tags. Both of these companies and many others understand that the final EPC standard, being referred to as Class 1, Generation 2 or Gen2, requires read/write capabilities. Matrics, Alien, and other reader manufacturers have introduced many new products to incorporate read/write capabilities into their solutions. The Class 1 Gen 2 standard was finalized in December 2004, and has become the industry standard. A major goal of the Gen2 standard is to allow for interoperability among reader and tag devices regardless of the tag/reader manufacturer.

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 subsections 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.

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 180003 and ISO 180006.

> ISO 180003 is the air interface standard for RFID operating at 13.56 MHz (HF).ISO 180006 is the air interface standard for RFID operating at 860930MHz (UHF).
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> *On July 11,2006 EPCglobal announced that its UHF Gen2 air interface protocol has been incorporated into the ISO/IEC 18000-6 Amendment 1 as Type C on UHF RFID by ISO.*

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.

What is the Datamax RFID solution?

Datamax provides many tools for your RFID solution. Datamax H-Class RFID printers, I-Class RFID printers, the A-Class RFID print engine, and smart label supplies from Datamax Media.

The Datamax RFID printers feature all of the electronic components and encoding read/write devices to support RFID. Users who purchase Datamax RFID printers can incorporate various RFID modules. For example, ISO 13.56 MHz and multi-protocol UHF(Class 0+,Class 1 and Gen2)modules are currently available. . The RFID printers will continue to provide industrial performance for traditional label and bar code printing requirement, which have not been made obsolete by recent RFID mandates. Datamax RFID printers also allow users to standardize on one printer platform whether they are achieving UHF compliance out the dock doors, or incorporating HF tags into internal applications such as WIP and inventory/asset management.

The heavy duty H-Class RFID printer from Datamax facilitates the evolution from simple bar coding to more advanced data capture and tracking methodologies. Capable of printing and encoding simultaneously, the Datamax H-Class RFID printer is a robust solution incorporating reliability and performance of the H-Class with RFID encoding capabilities. The H-Class with RFID offers users the flexibility to create a printer that accommodates their current and future printing requirements. Currently, the H Class is available with a module that operates at 13.56 MHz and is ISO 15693 compliant, or a multi-protocol (Class 0, Class 0+ and Class 1) module that operates at 915 MHz and is EPC Gen 2 compliant.

What software can be used with the Datamax RFID solution?

Datamax has a partnership with Seagull Scientific to develop Windows® printer drivers. As such, Datamax has worked closely with Seagull to add RFID encoding capabilities. Datamax also has ongoing relationships with all of the leading AIDC label generation software vendors who have added RFID capabilities to their products. There are also commands established with the Datamax Programming Language (DPL) to send RFID commands to the printer.

Does Datamax provide smart labels?

Yes, Datamax does provide smart labels to customers and partners. We can supply labels with inlays from a variety of manufacturers including Texas Instruments, Avery Dennison, Rafsec, and Alien to name a few. Datamax also stocks RFID Starter Kits with 2 rolls of RFID labels and matching a ribbon. The kit contains a total of 300 labels.

Are there current standard label sizes?

Datamax maintains a stock of 4" x 2", 4" x 4" x4" and 4" x 6" paper labels with various inlay types . Custom sizes are also available and have a lead-time associated with them.

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 $0.25 to $.30. At higher quantities, prices can be reduced. 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 antenna?

No. Datamax does not manufacture or distribute RFID readers or antenna. However Datamax is always willing to assist our dealers and channel partners in identifying appropriate suppliers of RFID system components.

Where are the opportunities for RFID now?

While much of the spotlight on RFID is focused on applications such as the WalMart and Department of Defense (DoD), there are also current RFID applications that exist outside the retail 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
Accounting
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. WalMart announced in June 2003 that they would require their top 100 suppliers to incorporate RFID into pallets by January 2005. 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 ($0.50 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. Gen2 is a clear example of standards evolvement, and it is possible that 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 a range of RFID solutions right now that are 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 continues to participate in the various RFID standards meetings and to share this information with our customers.

Datamax actively participates in the EPCglobal Hardware Action Group that is tasked with standards development. Within EPCglobal there are three groups; the Hardware Action Group (HAG), the Software Action Group (SAG) and the User Groups. Members of the user groups meet regularly to identify issues with the technology currently available. This information is then distributed to members of the HAG and SAG. Datamax is involved in the EPCglobal HAG to be able to fully understand these user needs and pass that information along to those tasked with creating the right solutions.

Please visit www.datamaxcorp.com for more information on Datamax products and solutions.

Datamax, a Dover company, 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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