Honeywell

RADIO FREQUENCY IDENTIFICATION (RFID)

Frequently Asked Questions

Table of Contents

Introduction

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 since evolved into many other uses, but it has not yet fully penetrated the supply chain and collaborative commerce arena to the levels of the barcode.

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 automatic vehicle identification, asset management, work in process, agriculture, yard management, maintenance, airline baggage tracking, supply chain management, logistics tracking, and retail point of sale. While the barcode is the form factor of choice for most data collection activities, RFID allows users to achieve higher accuracy and faster reads of encoded data. The increasing affordability of the RFID tags is leading to RFID replacing barcodes in some segments, and is leading to RFID being applied to all new applications in other segments.

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 since evolved into many other uses, but adoption has been, and continues to be, slow. To fully realize the potential of RFID over barcodes, technology infrastructures may need to be enhanced.

That being said, selective applications within the supply chain have been successful. Examples include:

- Reusable container tracking
- Automated Advance Ship Notices (ASN) for large items, particularly in the automotive industry
- DC movement by forklift (picking, putaway)
- Inventory visibility in apparel retail

In this white paper, you'll find basic answers to frequently asked questions about RFID, especially as they relate to current AIDC solutions.

Frequently Asked Questions

What is RFID?

Radio Frequency IDentification uses radio waves to communicate an identification number, such as an Electronic Product Code (EPC) 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. However, a higher frequency is also more sensitive to environmental factors such as liquid and metal, which can interfere with radio waves.

RFID systems currently operate in the Low Frequency (LF), High Frequency (HF), Ultra High 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. The tags tend to be more expensive, but are less sensitive to interference than higher frequency options. The readers tend to be far less expensive 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. The tags tend to be less expensive than LF tags, but more expensive than the higher frequency options. The readers tend to be the least expensive of the RFID alternatives.
- **Ultra High Frequency** systems operate in a range between 860 and 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 865 MHz. The rest of the world generally aligns with one of these options. UHF tags can be read from one meter to 10 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. The tags are the least expensive of all RFID options. The readers vary widely in price depending on capabilities.

- **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), an antenna and a package. The package can range from a simple label to a protective case. 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 substrate 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.”

Battery Assisted Passive (BAP) tags communicate in the same way as passive tags, but have a small battery on the inlay. This allows the tag to continue to function in the absence of RF. An example use of a BAP tag is for temperature monitoring.

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.

RFID standards are formed by two main groups:

- ISO
- GS1 (through its subgroup, EPCglobal)

Honeywell is a solution provider supplier to EPCglobal and ISO, and is a leading participant in GS1 and ISO standards development.

What is EPC?

The EPC contains a combination of the GS1 Global Trade Identification Number (GTIN) and a serial number, which together is called the SGTIN. The EPC also contains RFID-specific fields.

When the GTIN and serial number are encoded in barcode symbols, GS1 Application Identifiers (AI) are used to indicate the fields. The AI for the GTIN is (21) and the (AI) for Serial Number is (21). The major difference is that a serial number that can be used in a barcode can be alphanumeric whereas the serial number in an EPC is all numeric and a fixed length. An EPC encoded into an RFID tag and the same date encoded into a barcode using the SGTIN allows a user to use either or both technologies and select the appropriate encoding method (barcode or RFID) for the item being tracked.

Through a collaboration of multiple RFID vendors, including Honeywell, EPCglobal developed the protocol known as Class 1 Gen 2 (C1G2). ISO adopted the protocol and published it as ISO/IEC 18000-6C. The term C1G2 is rarely used today, and ISO

18000-6C was renamed to ISO/IEC 18000-63 with no changes to the standard.

In 2015, ISO/IEC 18000-63 was updated to include optional security commands that allow the use of crypto suites of ISO/IEC 29167. This important improvement offers many privacy and security features that are critical to certain applications, such as automobile tolling.

What are the current ISO RFID standards?

Several ISO standards now govern RFID for various applications.

Relative to smart labels, the existing ISO/IEC 15693 standard defines 13.56 MHz for use in Identification cards that are contactless integrated circuit cards or vicinity cards. There is also the ISO/IEC 18000 standard series, which offers several versions to address different frequencies for various applications.

Within ISO, there is a collaboration with the International Electrotechnical Commission (IEC) where there is a Joint Technical Committee (JTC1). JTC1 consists of various groups brought together to define and publish IT standards for computer, electronic and related technologies.

Within ISO/IEC JTC1, a subcommittee is responsible for RFID and barcode standards (SC31). The work group responsible for RFID standards is ISO/IEC JTC1 SC31 WG4, which includes responsibility for the ISO/IEC 18000 series. ISO/IEC 18000 has seven parts; ISO 18000-3 and ISO 18000-63 are relevant to smart labels.

- **ISO 18000-3** is the air interface standard for RFID operating at 13.56 MHz (HF).
- **ISO 18000-63** is the air interface standard for RFID operating at 860–930MHz (UHF), more recently referred to as “RAIN.”

Application standards developed by both ANSI and AIAG include the use of RFID for packages and automobile tires. The AIAG tire and wheel standard is based on 1800-63 and actually embeds a tag on the inside of a tire.

What is the Honeywell RFID solution?

Honeywell provides many tools for your RFID solution.

- H-Class high-performance industrial RFID printers
- I-Class Mark II industrial RFID printers
- A-Class RFID print engines
- Smart label supplies
- Rigid passive tags
- Secure passive tags
- Fixed RFID readers
- Handheld RFID readers
- Forklift RFID readers

Honeywell RFID Printers

The Honeywell Datamax-O’Neil RFID printers feature all of the electronic components and encoding read/write devices to support RFID. Users who purchase these RFID printers can incorporate various RFID modules. For example, ISO 13.56 MHz and UHF modules are currently available. The RFID printers will continue to provide industrial performance for traditional label and barcode printing requirement. Honeywell Datamax-O’Neil RFID printers also allow users to standardize on one printer platform, whether they are using UHF in the supply chain, or incorporating HF tags into internal applications.

The heavy-duty H-Class RFID printer facilitates the evolution from simple barcoding to more advanced data capture and tracking methodologies. Capable of printing and encoding simultaneously, the H-Class RFID printer is a robust solution that combines the 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, Honeywell has several models – H-Class, M-Class, PD43 and PC23 – available with a HF module that operates at 13.56 MHz and is ISO 15693 compliant. Honeywell also supports the more popular UHF 860–930 MHZ range with the following models: A-Class, H-Class, M-Class, PX6i/4i, PM43, PM43c, PD43, and PC43.

Honeywell RFID Readers and Antennas

Honeywell offers mobile readers, fixed readers, vehicle-mounted readers and a comprehensive line of RFID antennas.

Honeywell **mobile RFID readers** include mobile computers with integrated RFID reading capability and a separate RFID sled that attaches to several models of Honeywell mobile computers. The mobile readers are appropriate for a wide variety of applications, including inventory management, baggage tag reading, maintenance and inspection, tool management and others. Mobile RFID readers include a variety of connectivity options to allow on-the-go reading of RFID tags.

Honeywell **fixed RFID** readers provide high performance RFID tag reading for applications such as electronic highway tolling, warehouse portals, inventory management and border crossings.

The Honeywell **vehicle-mounted RFID reader** provides a unique capability for RFID reading applications directly from forklifts, garbage trucks and other moving conveyances.

Honeywell RFID readers reduce network traffic by filtering data to transmit only what is required. Most models support application development that allows customized treatment of RFID data before putting it on the network.

Honeywell also provides a full line of **antennas** suitable for most applications. Several combinations of gain, polarization and radiation patterns are available.

All Honeywell RFID readers support the EPC Gen 2 standard.

What software can be used with the Honeywell RFID solution?

Honeywell Datamax-O'Neil has partnered with Seagull Scientific to develop Windows® printer drivers. As such, Honeywell Datamax-O'Neil has worked closely with Seagull to add RFID encoding capabilities. Honeywell 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 Honeywell Datamax-O'Neil Programming Language (DPL) to send RFID commands to the printer.

For readers, Honeywell has developed a simple interface named Basic Reader Interface (BRI). Honeywell readers also support EPCglobal's Low-Level Reader Protocol (LLRP). Multiple partners have developed packages utilizing both protocols to address a wide range of applications.

Does Honeywell offer smart labels?

Yes, we offer smart labels to customers and partners. We can supply labels with inlays from a variety of manufacturers, including Avery Dennison, SmarTrac, and Alien Technology to name a few. We also stock RFID Starter Kits with two rolls of RFID labels and matching a ribbon. The kit contains a total of 300 labels.

Are there industry-standard label sizes?

Yes. Honeywell maintains a stock of 101.6 mm x 50.8 mm (4 in x 2 in), 101.6 mm x 101.6 mm (4 in x 4 in) and 101.6 mm x 152.4 mm (4 in x 6 in) paper labels with various inlay types. Custom sizes are also available and have a lead-time associated with them.

Does Honeywell recommend 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 Honeywell stock smart label. For other applications, such as costume tracking or asset management, customers might want a more durable product. And it makes sense that smart labels should not be constructed of a conductive medium – metalized polyester, for example – that would interfere with the inlay's radio wave communications.

How much do smart labels cost?

The price of smart labels depends on a variety of factors, including:

- Type of tags
- Label material
- Size
- Quantity ordered

At quantities of 10,000, labels are priced anywhere from $0.25 to $0.30. At higher quantities, prices can be reduced, but $0.065 is generally considered the bottom for a simple tag in quantities of hundreds of millions per year. 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?

For 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.

Permanent and semi-permanent smart labels for asset management applications can be expected to have a longer life span – usually the life of the asset tagged.

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.

Where are the opportunities for RFID now?

While much of the spotlight on RFID is focused on retail and Department of Defense (DoD) supply chains, 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.

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
- Reusable container tracking
- Vehicle tracking
- Gate access
- Border crossing
- Yard management

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 standards.

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. However, early enthusiasm and misleading promises have led to some false starts and wrong information. For example Wal-Mart announced in June 2003 that they would require their top 100 suppliers to incorporate RFID into pallets by January 2005. Multiple large vendors refused to cooperate and the effort died. However, many retailers, including Wal-Mart, are proceeding on a smaller, more focused scale. 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 to fully realize the benefits of RFID, infrastructure and processes must be modified. While many companies are making the required transitions, these are still seen as barriers to the technology's broad adoption.

What is Honeywell doing to help me prepare for those opportunities?

Honeywell 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 Honeywell partners are prepared for future opportunities is to get experience before the demand accelerates. Honeywell continues to participate in the various RFID standards meetings and to share this information with our customers.

We actively participate in the EPCglobal Hardware Action Group that is tasked with standards development. Within EPCglobal there are three groups:

- Hardware Action Group (HAG)
- Software Action Group (SAG)
- User Groups

Members of the User Groups meet regularly to identify issues with current technology. This information is then distributed to members of the HAG and SAG. Honeywell 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.

For more information
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