UNDERSTANDING

# RADIO FREQUENCY IDENTIFICATION (RFID)

IN HEALTHCARE

## BENEFITS, LIMITATIONS, AND RECOMMENDATIONS


HEALTH INDUSTRY BUSINESS
COMMUNICATIONS COUNCIL

# UNDERSTANDING RFID IN HEALTHCARE

## Benefits, Limitations, and Recommendations

### Summary Paper

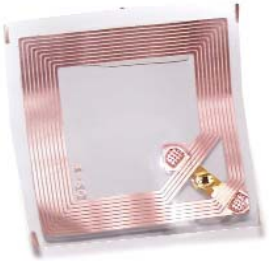
This document is intended to inform the global healthcare industry about the application, benefits and challenges of RFID in healthcare. It is a summary of the white paper "Application of RFID Technology in Healthcare: Benefits, Limitations, and Recommendations," which was created by individuals representing the global affiliates of the Health Industry Business Communications Council.

## WHAT IS RFID?

Radio Frequency Identification (RFID) is a technology that uses electronic chips embedded on tags to transmit radio waves. These tags can identify products, assets, medical records, and even individuals with embedded security cards or wristbands.

RFID may thus have the potential to help healthcare facilities improve patient safety and reduce costs. Early adopters of RFID are utilizing it to track medical devices, drugs, staff, and patients. A tag may contain information about products or people, their physical location in real time, and other information such as lot number and expiration date for medical supplies and drugs, patient allergies or blood type, and more. When transmitted to a reader within the facility, the information can be stored in a database or used by staff.

In the past, most healthcare facilities have kept track of their various resources and patients manually, or through the use of barcoding. RFID is a tool that can further enhance and augment these efforts.




## WHAT BENEFITS CAN RFID DELIVER IN HEALTHCARE?

Proponents of RFID cite many potential advantages over existing and conventional Auto-ID technologies, such as barcoding, that can improve supply chain and other processes. For example:

- Barcode labels are "read only," while RFID tags can have both read and write capability, making them more versatile.
- Unlike barcode scanning, which requires that labels be individually read, groups of RFID tags can be read simultaneously, thereby enhancing productivity.
- Using "smart shelves," which have RFID readers embedded within them, it will be possible to obtain real-time inventory status by using RFID tags.
- The U.S. Food and Drug Administration (FDA) is evaluating the use of RFID tags for verifying product pedigree. This can be accomplished by encrypting information in the tag to eliminate counterfeiting of products, such as drugs and high-cost medical devices.
- Critical data, such as temperature monitoring for sensitive products like blood, can be automatically logged using RFID tags.
- RFID tags allow for invisible and resistant marking for special applications, such as wristbands.
- Unlike barcoding, there is no line of sight required to read an RFID tag.
- The use of RFID tags permits reading orientation directly through materials like boxes and textiles.

Some proponents have suggested extremely broad possibilities for RFID, such as the creation of an "Internet of things," in which "every single object would be connected to the Internet through a wireless address and unique identifier." This approach is represented by the EPCglobal initiative, which is discussed later in this report.

Given the well-established track record of barcoding, a more realistic perspective for RFID is that its potential for productivity improvement will be greatest in those areas in which barcode technology has limitations.

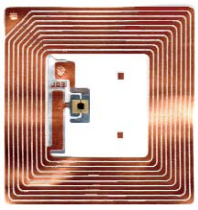
## WILL RFID LIVE UP TO EXPECTATIONS?

Although there are potential long-term benefits of RFID, it appears that widespread adoption of the technology for supply chain applications is still a long way off. This may even be true in the retail industry, where large companies, such as Wal Mart, have already invested considerable capital in RFID projects.

Several industry-wide investments will be necessary prior to wide-scale implementation. These include systems design and engineering, systems integration, business process redesign, and logical IT data management integration. Furthermore, given the current costs of the tags themselves, adequate return on investment is indicated in only select applications.

Nevertheless, there are some promising short-term applications for RFID, and successful implementation with business benefits is likely where certain conditions are met. For example:

- "Closed-system" applications where productivity and working capital improvements for an individual company's internal processes can result.
- Specialized, high-cost equipment, where reduced loss and obsolescence may lead to significant financial benefits.
- High-cost items or applications that require a high degree of traceability. These items include medical devices such as pacemakers, defibrillators, and other implanted prostheses.



## LIMITATIONS OF RFID

There are a number of challenges posed by RFID implementation in healthcare:

- **Cost.** RFID is still expensive, not plug-and-play, and has not yet proven its reliability in large-scale implementations.
- **Environmental conditions.** Tag reliability can be impacted by humidity, metal surfaces, and more. Current RFID tags cannot withstand extreme temperatures without temperature-resistant housing. For that reason, using them for items like surgical instruments is complicated.
- **Limited application.** It is difficult to apply and read RFID tags on metal and fluids. This currently limits tag application to cardboard, paper and plastic packaging.
- **Technology incompatibilities.** Interoperability between different RFID standards--for example, the ability for a single reader to read tags from multiple frequencies--is not available at this stage, and will be technologically difficult to achieve.

## APPLICATIONS OF RFID IN HEALTHCARE

RFID applications in healthcare could include:

- **Supply chain applications.** This includes high-cost items like pacemakers, defibrillators, and artificial joints. The supply chain for these items is complex, and they are often supplied on consignment. They also require a high degree of traceability from the supplier to the patient.
- **Patient safety applications.** This may include improved patient identification using RFID tags in patient wristbands.
- **Quality assurance applications.** This may include improved instrument tracking for infection control purposes. Some vendors supply RFID-enabled trays that can be tracked through central sterilizing departments.

## WILL BARCODING BE SUPERSEDED BY RFID?

Barcoding will continue to be used in the future, and will co-exist with RFID. As with all technologies, each will be utilized in the functions for which it offers the highest benefit/cost ratio and comparative advantage.

Consideration of the following will help determine which technology is used:

- The marginal cost of including a barcode on a product label. For low-cost items sold in high volumes, barcoding is still a viable and cost-effective option.
- There will always be applications that do not require many items to be read simultaneously. In these cases, RFID offers only a small benefit over barcoding.
- Barcoding is a mature technology, and its scanning reliability has proven to be high in broad-scale implementations. By contrast, RFID is relatively immature, and is yet to be proven in widespread usage.
- Because some members of the supply chain may not have the capability to implement RFID, a second means of identification would need to be applied to all RFID-tagged products. This is not necessary for barcoding or other 2D options.

## CURRENT RFID STANDARDS

RFID is a complex technology that includes many components, each requiring standardization to achieve interoperability. And, because there are numerous standards that are related to RFID, they can be confusing. However, they all fall into two broad categories:

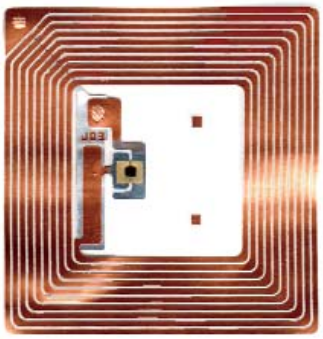
- Standards that relate to the **air interface**, or transmission frequencies and parameters for communication between the RFID reader and tag, and
- Standards that relate to **data and applications** for RFID systems.

The leading worldwide organization that oversees these standards is the ISO/IEC (International Organization for Standardization/International Eurotechnical Commission).

Air interface standards are detailed in the ISO/IEC “18000” series (“Information technology - Radio frequency identification for item management”). This series includes several parts: one for the specification of the reference architecture, and the others for different communication frequencies (135 kHz, 13.56 MHz, etc).

Data and application standards are detailed in the ISO/IEC 15961 (“Information technology - Radio frequency identification for item management - Data protocol: application interface”) and ISO/IEC 15962 (“Information technology - Radio frequency identification for item management - data encoding rules and logical memory functions”).

HIBCC RFID standards and recommendations are designed to be consistent with ISO/IEC standards.



# CONTRASTING APPROACHES TO RFID IMPLEMENTATION

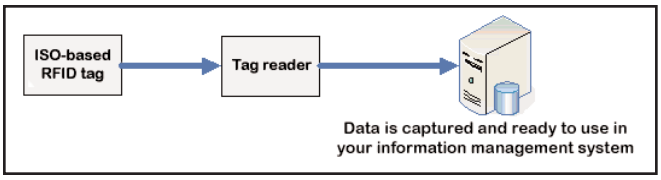
### The ISO Approach

The ISO approach to RFID implementation is based upon healthcare product supplier migration from existing barcode or 2-D symbologies to RFID. This can be accomplished by leveraging approved ISO standards and using Data Identifiers (DI) to code important medical supply chain data, such as lot/batch number, serial number, and expiration date. As the product moves through the supply chain, this important data can be captured directly from the product and used in information management systems. This approach is similar to that which has been used in barcoding applications, and has proven over time to be robust, reliable, safe and cost-effective.

### The EPCglobal Approach

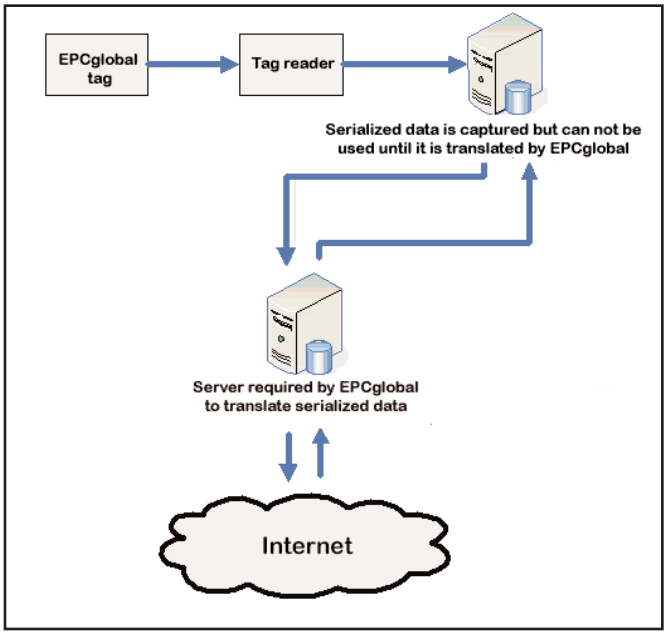
A contrasting approach being promoted by EPCglobal requires placing a fee-based, coded serial number on every RFID tag, which would replace the actual information. Important supply chain information would therefore not reside directly on the tag, but on databases that would be connected via EPCglobal's network that mimics the World Wide Web. This proposed service, called the Object Naming Service (ONS), would require that variable data such as lot/batch and expiration data be referenced and maintained on databases that would have to be continually accessed via ONS.

The ISO Approach




The ISO approach is based on simplicity and direct access to information. The ISO tag is self-contained with all required information.

The EPCglobal Approach




The EPCglobal approach requires numerous steps to access information. Because the EPCglobal tag contains a coded serial number, it must be cross-referenced to yield the required data.

The complexity and cost of the EPCglobal approach has recently led to its rejection by the Joint Automotive Industry Organization (JAI), which is composed of the major automotive industry associations in the United States, Europe, United Kingdom and Japan. The group announced its intention to support alphanumeric data and open standard symbologies, like those utilized in the ISO-based approach.

## FINAL COMMENTS

In healthcare, RFID has the potential to achieve improvements in both supply chain productivity and patient safety applications. However, the technology is more likely to be successful if evaluated for closed-system applications first, where deployment and subsequent changes are within the control of the individual organization.

The introduction of a new technology like RFID often causes a stir of interest and excitement about its capabilities. However, RFID will likely go through a stage where initial enthusiasm is tempered by practical cost-benefit considerations. The outcome of these will be appropriate deployment of the technology.

Well-developed standards already exist at different technology levels, including the protocol, communication, and data levels. Using the existing ISO specifications, data can be encoded to RFID tags to guarantee continuity worldwide. This approach also ensures that RFID will be able to co-exist with current barcode standards, which will likely be required for the foreseeable future. The ISO-based RFID standard is also independent of technology, so the data structure can be coded to any of the accepted frequencies and protocols under ISO 18000.

Healthcare organizations considering RFID-enabled solutions should carefully address the following questions:

- Do you have needs for automatic data capture that barcoding does not address?
- Will RFID deliver greater benefits than existing, more mature technologies like barcoding?
- The key benefit of RFID that will deliver productivity and inventory improvements is the ability to read multiple tags instantaneously. Will your organization benefit from this important feature? If not, then barcoding or 2-D symbologies may present a less expensive alternative.
- Are there environmental and other factors that may impact the reliability or success of your RFID implementation?

## ABOUT HIBCC

The Health Industry Business Communications Council (HIBCC) is an industry-sponsored and supported nonprofit organization. As an ANSI-accredited organization, our primary function is to facilitate electronic communications by developing appropriate standards for information exchange among all healthcare trading partners.

Our broad mission has consistently expanded to meet industry requirements and has involved HIBCC in a number of critical areas, including electronic data interchange message formats, barcode labeling data standards, universal numbering systems, and the provision of databases that ensure common identifiers.

Our current major activities have emerged as a result of this broadening focus:

- Standardized manufacturer, customer, and product identification codes, including the Labeler Identification Code (LIC), Health Industry Number (HIN), and Universal Product Number (UPN) and the Health Industry Bar Code (HIBC) Standards.
- Computerized EDI protocols in ASC X12 approved message formats.
- Participation in national and international organizations working to further enhance electronic communications standards.

Perhaps most important, HIBCC plays a major advocacy and educational role in the healthcare industry and serves as the forum through which consensus can be reached as it electronically transforms itself for 21st century commerce.

## Key Contributors

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