

WHITE PAPER

ABCs of RFID

Understanding and using Radio Frequency Identification

Basics - Part 1

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3	GCL/WP/RFID/0703	EPC standards – An overview
4	GCL/WP/RFID/0704	Applications of RFID in Supply chain environment
5	GCL/WP/RFID/0705	Applications of RFID in Retail Industry
6	GCL/WP/RFID/0706	Applications of RFID in Health care
7	GCL/WP/RFID/0707	Accurate Asset Tracking and management with RFID
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1. Abstract

This article is intended to expose the reader to Radio Frequency Identification (RFID) and is intended to provide an overview of the technology. This is not an exhaustive document on RFID technology and is limited in its scope. This paper aims to introduce the potential application areas where RFID technology would make a mark, and increase inventory visibility. This paper exposes different application areas and methods of simplifying inventory management thereby improving the bottom line.

2. Introduction

Use of Automatic Identification Technology (AIT) first began in 1966. Since then, the development of both standards and the proper utilization of the technology have become the focus of today's logistics professionals. With the advent of electronic product code (EPC), AIT matured into Radio Frequency Identification Technology (RFID). A global standard for use of RFID in inventory control and supply chain contexts is emerging in the form of 'EPC global'. EPC is a globally unique reference number found on an RFID tag. It is divided into numbers which identify the manufacturer, product type and unique item. "Gemini" opened up on RFID initiatives and was closely following the standards since its early entry in India.

Radio frequency identification, or RFID, is the name for a set of automation technologies that allow relatively large amounts of data to be associated with objects by attaching a tag to them. RFID is not actually a new technology, but it is being applied in new ways, spurred by technological advances and decreased costs. RFID technology has broad applicability across a variety of industries. RFID also provides for "sightless" or no line of sight identification of items.

RFID is a combination of radio-frequency-based technology and microchip technology. RFID is a wireless system that works in conjunction with an organization's information technology infrastructure to improve business processes such as inventory management and efficiency in supply chain management.

As the EPC/RFID technology becomes ubiquitous and the implementations mature, more and more demands will be made on the integration landscape leading to an increased complexity of business processes. Understanding the need for better supply chain visibility and advanced asset management requirements, "Gemini" driven by the urge to enable SMEs to exploit RFID in their business operations and true to its brand, has set up an RFID tag manufacturing unit in Chennai. Gemini has brought this new technology within the reach of retailers, health care units and supply chain enthusiast.

3. RFID Components

An RFID system consists of three components: the tag, the reader and the application or middle ware, that makes use of the data the reader reads on the tag. RFID facilitates the tracking of objects, primarily for inventory tracking, via a three part technology comprised of a reader, a transceiver with decoder and a transponder (RF tag). An RFID chip may also contain information other than an EPC, such as biometric data. The antenna attached to the chip is responsible for transmitting information from the chip to the reader, using radio waves. "Gemini" has established a research and development unit to better understand tag antennas. Gemini today has the capability to build antennas. Generally, the bigger the antenna, the longer the read range. The chip and antenna combination is referred to as a transponder or, more commonly, as a tag.

3.1 Tags

The RFID network begins with a tag, which carries an Electronic Product code (EPC). Tags are also called as a transponder. The tag consists of an antenna and an integrated circuit (IC) embedded silicon chip encapsulated in glass or plastic.

Table 1: Range of Antenna



The tag permits storage of information through external write devices. Tags can be Read Only (RO), Write Once Read Many (WORM) or Read Write (RW). In A read-only tag, records information during the manufacturing process and cannot be typically modified or erased. The data stored normally is used as a reference to lookup more details about a particular item in a host system database.

A read/write tag, permits recording and erasure of data on demand at the point of application. Since a rewriteable tag can be updated numerous times, its reusability can help to reduce the number of tags that need to be purchased and add greater flexibility and intelligence to the application. Additionally, data can be added as the item moves through the supply chain, providing better traceability and updated information.

Information stored in the memory of the RFID tag is transmitted by the antenna circuit embedded in the RFID inlay via radio frequencies, to an RFID reader. "Gemini's" product range includes desktop antenna (MLP-DTA), walk through antenna (MLP-WTA), loop antenna (MLP-BLA)

3.1.1 Types of Tag

Tags can be passive, active or semi-active based on the power source. Gemini's manufacturing plant has the capability to produce tags in high volumes. It also has the capability to produce different types of tags..

3.1.2 Passive Tags

Passive tags rely on the radio signal sent by the reader for power. Passive tags derive the energy to power up the micro-circuit from the interrogating RF field, and then use the same RF field to send back information, including the unique identity of the item. The information is sent back by reflecting the RF energy back to the interrogator. Passive tags are consequently much lighter than active tags, less expensive, and offer a virtually unlimited operational lifetime.

Most RFID applications today utilize passive tags because they are so much cheaper to manufacture. However, the lack of power poses significant restrictions on the tag's ability to perform computations and communicate with the reader. It must be within range of the reader to function.

3.1.3 Active Tags

Active tag on the tag, An active tag has a small battery attached to it, and can transmit information under its own power to a reading device. Active tags are often readable over much greater distances. They usually contain a cell that exhibits a high power-to-weight ratio and are usually capable of operating over a temperature range of -50°C to +70°C. The use of a battery means that a sealed active transponder has a finite lifetime.

The performance characteristics of the RFID tag will then be determined by factors such as the type of IC used, the read/write capability, the radio frequency, power settings, environment, etc.

3.2 Reader

A system requires, in addition to tags, a means of reading or interrogating the tags and some means of communicating the data to a host computer or information management system. RFID readers or receivers are composed of a radio frequency module, a control unit and an antenna to interrogate electronic tags via radio frequency (RF) communication. Readers vary in size, weight, and power, and may be mobile or stationary. Many also include an interface that communicates with an application. Reading tags refers to the communication between the tag and reader via radio waves operating at a certain frequency.

Readers can be hand-held or mounted in strategic locations so as to ensure they are able to read the tags as the tags pass through an “**Interrogation Zone**.” The interrogation zone is the area within which a reader can read the tag. The size of the interrogation zone varies depending on the type of tag and the power of the reader.

Table 2: RFID range of Readers



The RFID reader sends out electromagnetic waves and the tag antenna is enabled to receive these waves. “When the tag antenna enters the RF (radio frequency) field, the tag's microchip circuits are powered by signals from this RF field created by the reader. The chip then modulates the waves and the tag sends them back to the reader. The reader converts the signals received from the tag into digital data and sends it to a computer. “**Gemini**” has a range of readers to its portfolio which includes

mullion reader (DTS-100), multi functional reader (DTS-PK), finger print reader (RTS-FP) Desktop reader (DTS-DR), hand held reader (DS-HHR), long range reader (FLR-100), mid range reader (FMR-101A)

4. RFID Application Domains

RFID has the potential to improve the productivity of a business. RFID offers greater flexibility, higher data storage capacities, increased data collection throughput, and greater immediacy and accuracy of data collection. RFID's ability to increase data collection throughput and accuracy enable companies to identify materials, products and trends in supply chain with greater accuracy in real-time, compared to data collection technologies utilized to date. Once RFID technology is fully integrated, minimal human effort is required in this process thus reducing errors and costs. By providing accurate, real-time data and information, RFID solutions enable companies to capture “live” data, converting it to meaningful information and automating all associated transactions and processes. RFID technology itself can be used for a variety of applications, from contact less identification cards that can be scanned no farther than inches away from a reader, to highway systems utilizing “active” RFID tags that can initiate communication with a scanner 100 feet away. RFID holds great promise for all parties in the extended supply chain.

- ❖ **For manufacturers**, RFID enables detailed, automated monitoring of parts as they move through a facility, and quickly identifies the origin of defective components or products, even after they have been sold.
- ❖ **For distributors**, RFID manages inventories and fleets so effectively that manual task can be eliminated, processes can be dramatically accelerated and shipping errors can be reduced.
- ❖ **For retailers**, RFID ensures appropriate stocking levels, tracks the origin and history of products; prevent theft or misplacement of goods and speeds up checkout lines.

4.1 Applications classified on Tags

Low-frequency tags: These tags are typically used for access control & security, manufacturing processes, harsh environments, and animal identification applications in a variety of industries which require short read ranges. Passive tags are used for a wide array of applications, including building-access cards, mass transit tickets, and, increasingly, tracking consumer products through the supply chain.

High frequency tags: Popular applications include: library tracking and identification, healthcare patient identification, access control, laundry identification, item level tracking, etc.

UHF tags: These tags are targeted towards supply chain tracking. UHF tags have the ability to identify large numbers of objects as they are moving through a facility and later through the supply chain. There are large numbers of additional markets with demand for UHF RFID technology such as transportation, healthcare, aerospace, etc.

Microwave tags are mostly used in active RFID systems. Offering long range and high data transfer speeds at significantly higher cost per tag making them suitable for railroad car tracking, container tracking, and automated toll collection type applications as a re-usable asset.

Table 3: Potential Application areas

Process Area	RFID Will Enable	Potential Applications
Supply Chain Management	Real time Visibility into the location and movement of inventory, stock levels, and consumer demand.	Inventory visibility and movements across trading relationships, product pedigree/lifecycle history tracking, process exception triggers.
Work In Process Manufacturing	Visibility and control of Work In Process (WIP) manufacturing operations and production line and transaction recording efficiencies, and JIT manufacturing triggers	Automation of assembly, WIP inventory management, component production
Consumer Applications	Improved consumer shopping experienced through dynamic and interactive sales floor applications and more accurate insight into consumer preferences.	Real time merchandising and shelf replenishment, automated payment, returns management, personal identification and authentication, personal security and safety, patient identification and security
Asset Management	Visibility to the location, movement and maintenance history of physical assets -- trailers, dollies, fixtures, parts	Vehicle management and maintenance, fleet management, financial asset reporting
Security & Access Control	Authentication and tracking of products at risk of counterfeiting, as well as valuable assets and potential personnel resources	Counterfeiting and fraud prevention, animal tracking, protein tracking, baggage tracking and handling

Conclusion

The paper introduces the reader to some of the basic technical terminologies being used in the contact less inventory management space. This paper also provides a brief overview on RFID technology and its applications.

Call On Us

Learn more about how Gemini can help you develop and implement business use cases. Gemini can help you build an RFID solution that meets your unique business requirements. Find a business solution that is right for your company, contact Gemini representative near your location OR reach us at info@gcl.in, URL:www.gcl.in.

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