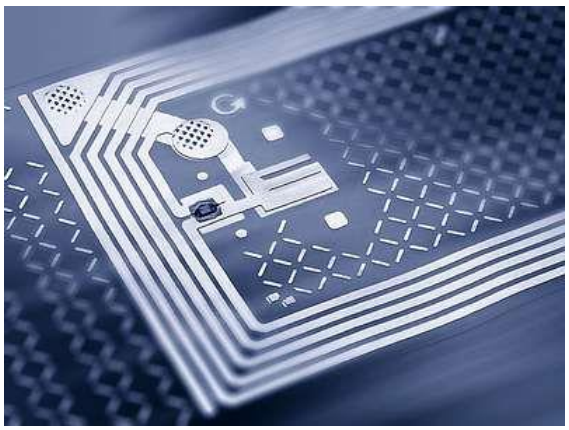
RFID
TECHNOLOGY



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RFID: Introduction

Radio Frequency Identification or RFID is the new generation Auto ID technology that uses radio or wireless communication to uniquely identify and transmit data relating to an item, object, or an individual.

Invented in 1948 and first-used during the IInd World War by the US Army for identification of friend or foe (IFF) aircrafts; RF technology gained commercial acceptance during the 1980s and 90s.

It has been widely used across a multitude of industry sectors, and applications as varied as access control, livestock identification, airline baggage tracking, automated vehicle identification & industrial automation.

With adoption of Gen2 EPC (UHF passive) standards (developed at the MIT Auto-ID Center and now managed by EPC Global), the adoption of RFID systems is set to explode as major retailers rely on the technology for 100% real time supply-chain visibility (up to item level).

RFID Technology: How it works?

An RFID system typically consists of following components:

- Tag: A transponder, also known as RFID Tag, uses a silicon microchip for storing unique data. The RFID tag or label is usually attached to an item, asset, or an individual and provide the means for case or item level identification.

- Reader: A reader (interrogator) is used primarily to read and write data to RFID tags. A reader can be either hand-held or work as a portable computer or mounted as a fixed device for access control purposes.

- Antenna: An antenna is used to radiate and or/ receive energy in the radio frequency spectrum, to and from the tag. It could be either stand-alone or packaged together with a reader.

- Software: Finally, an RFID system is usually a part of larger system or application software for collecting and managing data & information.

In an RFID system, the data is carried in suitable transponders, commonly known as RFID tags, and is retrieved at the appropriate place and time by means of an antenna & reader, in order to satisfy a particular application need.

A radio signal emitted by the antenna activates the tag allowing it to be read and in some instances data written onto it. The tag passing through the electromagnetic field detects this activation signal and the microchip reflects back an altered signal to an RFID reader and/or middleware which decodes and filters the tag's encoded data to be then used by enterprise applications for information management and decision making.

With the RFID network, companies can not only identify products in the supply chain, they can also share about the location of goods. Company A, for instance, could let Company B see-in real time-what is in Company's A warehouse. Or Company B could let Company A know that goods have arrived in Company's B facility in real time. It is this ability to share information about the location of products anywhere in the supply chain that makes RFID a potentially powerful technology.

Passive vs. Active Tags

Tags come in many form factors. The right tag depends on the application, end use (application) environment, performance, and the cost.

Passive tags are read only and gains its power from that generated by a reader and has no internal power source. The reading range is typically shorter up to 30 feet (10 meters) and the data storage capacity is comparatively less (96/512 bits) as compared to active tags.

Active tags have both read/write capability and are powered by means of battery, either internal or external. This battery-supplied power enables data to be read and written on to a tag and thus gives it a greater reading range up to 300 feet (100 meters) and large data storage capacity (128 KB).

Companies are increasingly focusing on 'passive UHF' tags. The standardized tags (96 bits) are cheaper to manufacture and are more useful for applications where the tag will be disposed of with the product packaging.

RFID Frequency and Uses

An RFID device requires a defined radio frequency and communication protocol to transmit and receive data from RFID tags.

The exact frequencies (and power levels) used in RFID systems vary by country or region; however, RFID systems typically utilize the following frequency ranges:

Frequency Range	*Characteristics*	*Applications*
Low Frequency 125 ~ 300 kHz	Short range (To 18 inches) Low reading speed	Livestock ID
High Frequency 13.56 MHz	Medium range (3~10 feet) Medium reading speed	Access Control Library automation Mass Transit Ticketing
Ultra High Frequency 400 MHz ~ 1 G Hz (primarily 860 – 930 MHz) (865 ~ 867 MHz approved in India*)	High range (10 ~ 30 feet) High reading speed Orientation sensitive	Supply chain management Industrial automation Vehicle Identification
Microwave Frequency > 1 GHz; primarily 2.45 (US) and 5.8 GHz (Europe)	Maximum range (300+ feet)	Pallet & Container Tracking

RFID tags of different frequencies and functionality are used together within overall supply chain operations. Low and High frequency systems are more easily controlled. UHF systems are harder to control as energy is sent over long distance and reading is a challenge around metal and water. However, the benefits include low cost (passive) and high read range.

Current logistics and supply chain tend to use the UHF band, either between 860 – 930 MHz (Passive). In India, 865~867 MHz is approved by DOT/ WPC for RFID usage.

RFID Standards

Standards are critical for many applications of RFID technology.

There are a number of existing (ISO) and proposed RFID standards (EPC Global) that deal with air interface protocol (how tag and readers communicate), data content (how data is organized and formatted), conformance (ways to test that products meet specifications) and applications (how standards are used on shipping labels etc).

Below is a summary of RFID standards of interest in supply chain and item tracking applications (list is not comprehensive):

Specification	*Description*	*Frequency*	*Sponsor*
ePC HF Class 1	EPC tag class	13.56 MHz	EPC Global
ePC UHF Gen 2	EPC tag class	860-960 MHz	EPC Global
ePC UHF Class 4	EPC tag class	860-960 MHz	EPC Global
ISO 14443/15693	Near Field	13.56 MHz	ISO
ISO 18000-3	RFID Air Interface	13.56 MHz	ISO
ISO 18000-4	RFID Air Interface	2.4 GHz	ISO
ISO 18000-6	RFID Air Interface	860-960 MHz	ISO

Electronic Product Code & The "Networked" RFID

The EPC is a simple, compact "license plate" that uniquely identifies objects (items, cases, pallets, locations, etc.) in the supply chain. Like many current numbering schemes used in commerce, the EPC is divided into numbers that identify the manufacturer and product type. But, the EPC uses an extra set of digits, a serial number, to identify unique items.

An EPC number contains:

1. Header, which identifies the length, type, structure, version and generation of EPC
2. Manager Number, which identifies the company or company entity
3. Object Class, refers to a stock keeping unit or product SKU
4. Serial Number, which identifies a specific item of the Object Class being tagged

Additional fields may also be used as part of the EPC in order to properly encode and decode information from different numbering systems into their native (human-readable) forms.

The concept of the RFID Network was conceived by the Auto-ID Center, a global research team directed through the Massachusetts Institute of Technology (MIT) with labs around the world. Their research effort was supported by more than 100 leading companies.

EPCglobal Network defines a framework that enables immediate, automatic identification and sharing of information on items in the supply chain.

The network is comprised of five fundamental elements: the Electronic Product Code (EPC), the ID System (EPC Tags and Readers), Object Name Service (ONS), Physical Markup Language (PML), and Savant software.

Essentially, the EPC is a unique 96 bit identifier attached to the physical object. A reader infrastructure of RFID antennas is able to identify the tagged items.

The reader then passes the number to a computer or local application system, known as the Object Name Service (ONS). ONS tells where to locate information on the network about the object carrying an EPC, such as when the item was produced.

Physical Markup Language (PML) is used as a common language in the EPCglobal Network to describe all product related information.

Savant is a software tool that manages the data as it is collected and provides it in real-time to business software systems e.g. ERP systems or to the Internet.

The EPC Global Network can virtually connect physical object and data via the internet. Data about every product – its history or other product related information can be made available through a standardized infrastructure anywhere and anytime.

RFID: Business Applications

RFID systems allow for non-contact reading or writing of data and are highly effective in manufacturing and other hostile environments where barcode labels cannot survive.

Common applications that are in use today:

- Asset tracking/ Security: RFID is increasingly being used in Energy & IT companies to track and control the movement of valuable assets and/or personnel resources in real-time. In India, emerging application includes tagging & tracking of solar/ PV modules as per MNRE (Govt.) requirements.

- Manufacturing/Automation: Manufacturers are using RFID for identification and tracking of cases (items) through an assembly line in harsh manufacturing environments. Early adopters include Automotive, Aviation & Electronics manufacturers.

- Retail/ Supply chain management: RFID technology is enabling retailers to improve supply chain efficiency and make sure the products are on the shelf when customers want to buy it (fewer stock outs). In addition, it is being used for real-time inventory control and enabling 100% supply chain visibility. While global tag volume (Retail/ apparel) crossed 1 billion tags in 2011, RFID in retail is yet to be embraced in India.

- Airline Baggage Identification/ Ticketing: RFID is enabling airlines to secure, track and speed up the movement of baggage at the world's busiest airports. Some of the world's leading Airports including Hong Kong use RFID for baggage tracking.

- Automated Vehicle Identification/ Toll Collection: RFID is being used for automatic identification of vehicles & toll collection at highways without the need for stopping at tollbooths. Recently, UHF passive standards were adopted for Electronic Toll Collection & integration of National Highways in India.

Benefits: The Case for RFID technology

RFID provides considerable benefits over conventional Auto ID technologies like barcode, and helps to provide a more robust solution to critical business needs.

- RFID creates a truly automatic way, without any human interface, to collect information about a product, place, time, or transaction quickly, easily and without human error.

- It provides a contact less data link, without need for line of sight or concerns about harsh or dirty environments

- RFID can be used as a data carrier, with information being written to and updated on the tag on the fly.

- It provides for multiple, and simultaneous collection of data

- RFID enables for track and trace of unique items in the supply chain

In addition, RFID is providing real and tangible benefits to organizations and consumers in the form of:

- Faster, more accurate, and effective data collection
- Reduced cost, time, and work-processes
- Increased speed, productivity, and business efficiency
- Better security, convenience, and customer service

Early adopters in the consumer goods industry reduced supply chain costs between 3~5 percent and grew revenue between 2~7 percent because of the added visibility RFID provided, according to a study by AMR research (US).

Companies that begin to prepare today will be best positioned to capture the value of the RFID technology. Now, rapidly falling costs and the emergence of open standards are bringing the benefits of this enabling technology within the reach of industry and consumers worldwide.

Great Eastern Impex Pvt. Ltd., established 1983, is India's leading systems integrator & solution provider in Automatic Identification & Data Capture (AIDC) technologies to help businesses identify & track goods or information across the supply chain and improve business productivity, and profits.

Core capabilities

- Standards driven, custom built solutions (Barcode, RFID & Labeling) that includes hardware, supplies, software & integration services for large & SMB companies.
- RFID & barcode label, tickets (tags) & printing ribbon manufacturer (converter) with manufacturing operations at Gurgaon (ISO 9001: 2000 certified facility)
- Nationwide service support with strategically located regional offices at New Delhi/ NCR, Ludhiana, Mumbai, Pune, Bangalore, Chennai, Hyderabad & Kolkata
- Partnership with industry leaders - Toshiba TEC Corp., Denso Wave Corp.; ThingMagic Inc.; Alien Technologies Inc., Century Inc., & Avery Dennison Inc.
- Domain expertise of over 30 years in delivering value to Manufacturing, Logistics, Retail and Healthcare enterprises.

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