

# RFID TECHNOLOGY



Great Eastern Impex Pvt. Ltd.  
India

## 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 II<sup>nd</sup> 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 and security control, livestock identification, airline baggage tracking, automated vehicle identification and toll collection.

With the recent ratification of Gen 2 ePC (UHF) standards, the adoption of RFID systems is set to explode as manufacturer, distributors and retailers rely on the technology for 100% real time supply-chain visibility up to item level. Benefits include significant improvements and increase in productivity, efficiency and ROI to businesses and consumers across the globe.

## RFID Technology: How it works?

An RFID system typically consists of following components:

- Tag: A transponder, also known as RF Tag, uses a silicon microchip for storing large amounts of data. The 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 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.

In an RFID system, the data is carried in suitable transponders, commonly known as RF tags, and is retrieved at the appropriate place and time by means of an antenna and a transceiver/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 (active tags). 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 A could let Company B know automatically that goods were scanned leaving the warehouse and will arrive in Company's B facility the next day. 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 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 (3 meters) and the data storage capacity is comparatively less (96/128 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 simple 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:

<i>Frequency Range</i>	<i>Characteristics</i>	<i>Applications</i>
<u>Low Frequency</u> 125 – 300 kHz	Short range (To 18 inches) Low reading speed	Livestock ID Reusable containers
<u>High Frequency</u> 13.56 MHz	Medium range (3-10 feet) Medium reading speed	Access Control Airline Baggage ID Library automation
<u>Ultra High Frequency</u> 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 applications Pallet & Container Tracking
<u>Microwave Frequency</u> > 1 GHz; primarily 2.45 (US) and 5.8 GHz (Europe)	Medium range (10+ feet)	Automated Toll Collection Vehicle Identification

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 in favor of UHF adoption.

Current logistics and supply chain tend to use the UHF band, either between 860 – 930 MHz (Passive) or 13.56 MHz (Active).

## 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 (the way tag and readers communicate), data content (the way 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:

<i>Specification</i>	<i>Description</i>	<i>Sponsor</i>	<i>Frequency</i>
ePC UHF Class 0	64-bit factory programmed	ePC Global	900 MHz
ePC UHF Class 1	96/128 bit one-time-programmable	ePC Global	860-930 MHz
ePC HF Class 1	96/128 bit one-time-programmable	ePC Global	13.56 MHz
ePC UHF Gen 2	96/128 bit one-time-Programmable	ePC Global	860-960 MHz
ISO 18000-3	Item Management	ISO	13.56 MHz
ISO 18000-4	Item Management	ISO	2.4 GHz
ISO 18000-6	Item Management	ISO	860-960 MHz

## Electronic Product Code & The "Networked" RFID

Major retailers are using Electronic Product Code (EPC) specifications that were developed at the MIT Auto-ID Center and are now managed by EPC Global, a joint venture between the EAN International and the UCC- Uniform Code Council.

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 64-96 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:

- Access Control/Security: RFID is increasingly being used as means for secure and hands-free access to a building or premises. It is also being widely used to track and control the movement of valuable equipments and/or personnel resources in real-time.
- Airline Baggage Identification/Ticketing: RFID is enabling airlines to secure, track and speed up the movement of baggage at the world's busiest airports. It is being used to streamline passenger ticketing and boarding while maintaining a high level of security.
- Automated Vehicle Identification/Toll Collection: RFID is being used for automatic identification of vehicles and toll collection at highways without the need for stopping at tollbooths. It is also being used for auto-refueling of vehicles and to provide contact less payments at gas stations.
- Manufacturing/Supply Chain Management: Manufacturers are increasingly using RFID for identification and tracking of cases (items) through an assembly line in harsh manufacturing environments. In addition, it is being used for real-time inventory control and enabling 100% supply chain visibility – the ability to know the precise location of any product anywhere in the supply chain at any time.
- Retailing: Major retailers are in the forefront of RFID adoption. 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).

## 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 to 5 percent and grew revenue between 2 and 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.

## About Great Eastern Impex Pvt. Ltd.

Great Eastern Impex Pvt. Ltd., est. 1983, is a leading provider of barcode solutions & next generation Auto ID technologies to every segment of the supply chain from manufacturing to distribution to retail.

With a proven track-record in barcode printing solutions (an installed base of over 3, 000 barcode printers), the company now offers end-to-end RFID solutions - RFID printer/encoders, readers, antennas, middleware, application software and RFID supplies - for enabling compliance labeling, supply chain management, and manufacturing automation.

The company has a state-of-the-art label manufacturing operations at Gurgaon (ISO 9001:2000 Certified) and a nationwide network of offices for sale, service & support

To find out more on how RFID, and barcode technology can help improve business productivity and profits, please contact:

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