

## RADIO-FREQUENCY IDENTIFICATION

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### 1. What is RFID?

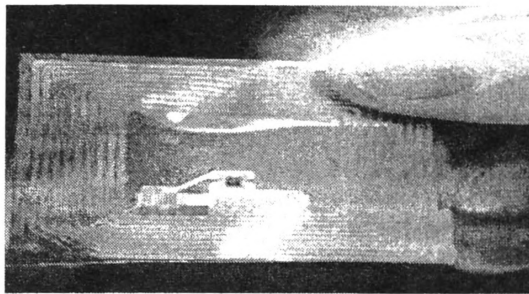


Figure 1. – RFID Tag

Radio frequency identification, or RFID, is a generic term for technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a serial number that identifies a person or object, and perhaps other information, on a microchip that is attached to an antenna (the chip and the antenna together are called an RFID transponder or an RFID tag). The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can make use of it.[1]

There are three types of tags: Active, Semi - passive. , Passive

Active and semi-passive RFID tags use internal batteries to power their circuits. An active tag also uses its battery to broadcast radio waves to a reader, whereas a semi-passive tag relies on the reader to supply its power for broadcasting. Because these tags contain more hardware than passive RFID tags, they are more expensive. Active and semi-passive tags are reserved for costly items that are read over greater distances -- they broadcast high frequencies from 850 to 950 MHz that can be read 100 feet or more away. If it is necessary to read the tags from even farther away, additional batteries can boost a tag's range to over 300 feet (100 meters).

Passive RFID tags rely entirely on the reader as their power source. These tags are read up to 20 feet away, and they have lower production costs, meaning that they can be applied to less expensive merchandise. These tags are manufactured to be disposable, along with the disposable consumer goods on which they are placed. Whereas a railway car would have an active RFID tag, a bottle of shampoo would have a passive tag.

### 2. RFID Works Better Than Barcodes

A significant advantage of RFID devices over the others mentioned above is that the RFID device does not need to be positioned precisely relative to the scanner. We're all familiar with the difficulty that store checkout clerks sometimes have in making sure that a barcode can be read. And obviously, credit cards and ATM cards must be swiped through a special reader.

In contrast, RFID devices will work within a few feet (up to 20 feet for high-frequency devices) of the scanner. For example, you could just put all of your groceries or purchases in a bag, and set the bag on the scanner. It would be able to query all of the RFID devices and total your purchase immediately.

RFID technology has been available for more than fifty years. It has only been recently that the ability to manufacture the RFID devices has fallen to the point where they can be used as a "throwaway" inventory or control device. Alien Technologies recently sold 500 million RFID tags to Gillette at a cost of about ten cents per tag.

One reason that it has taken so long for RFID to come into common use is the lack of standards in the industry. Most companies invested in RFID technology only use the tags to track items within their control; many of the benefits of RFID come when items are tracked from company to company or from country to country. [2]

### 3. How RFID Works?

The reader emits a radio signal that activates the tag and reads and writes data to it. As products are shipped, received or stored, the information (encoded on a bar code like tag) can be read and received by the reader, which is attached to a computer. RFID has been integrated into the EPCglobal network and uses the EPC (Electronic Product Code). The EPC is a unique number that identifies a specific item in the supply chain. The EPC is stored on a RFID tag, which combines a silicon chip and a reader. Once the EPC is retrieved from the tag, it can be associated with dynamic data such as the origin of an item or the date of its production. Much like a Global Trade Item Number (GTIN) or Vehicle Identification Number (VIN), the EPC is the key that unlocks the power of the information systems that are part of the EPCglobal Network. [3]

### 4. What can RFID be used for?

RFID tags come in a wide variety of shapes and sizes; they may be encased in a variety of materials:

- Animal tracking tags, inserted beneath the skin, can be rice-sized.
- Tags can be screw-shaped to identify trees or wooden items.
- Credit-card shaped for use in access applications.
- The anti-theft hard plastic tags attached to merchandise in stores are also RFID tags.
- Heavy-duty 120 by 100 by 50 millimeter rectangular transponders are used to track shipping containers, or heavy machinery, trucks, and railroad cars.

RFID devices have been used for years to identify dogs, for a means of permanent identification. Dog owners had long used tattoos, permanent ink markings, typically on the ears. However, these can fade with age and it may be difficult to get the animal to sit still while you examine him for markings.

Many musical instruments are stolen every year. For example, custom-built or vintage guitars are worth as much as \$50,000 each. Snag, a California company specializing in RFID microchips for instruments, has embedded tiny chips in 30,000 Fender guitars already. The database of RFID chip IDs is made available to law enforcement officials, dealers, repair shops. [2]

### 5. Next-Generation Uses of RFID?

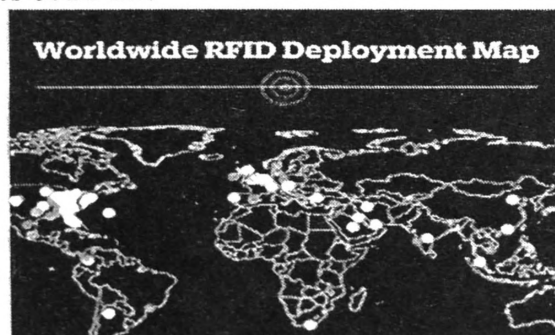


Figure 2. – Worldwide RFID Deployment Map.

Some vendors have been combining RFID tags with sensors of different kinds. This would allow the tag to report not simply the same information over and over, but identifying information along with

current data picked up by the sensor. For example, an RFID tag attached to a leg of lamb could report on the temperature readings of the past 24 hours, to ensure that the meat was properly kept cool. Over time, the proportion of "scan-it-yourself" aisles in retail stores will increase. Eventually, we may wind up with stores that have mostly "scan-it-yourself" aisles and only a few checkout stations for people who are disabled or unwilling. [2]

## 6. Problems With RFID

Some common problems with RFID are reader\_collision and tag collision. Reader collision occurs when the signals from two or more readers overlap. The tag is unable to respond to simultaneous queries. Systems must be carefully set up to avoid this problem. Tag collision occurs when many tags are present in a small area; but since the read time is very fast, it is easier for vendors to develop systems that ensure that tags respond one at a time. [2]

## 7. Advantages of RFID Versus Barcodes

RFID tags and barcodes both carry information about products. However, there are important differences between these two technologies:

- Barcode readers require a direct line of sight to the printed barcode; RFID readers do not require a direct line of sight to either active RFID tags or passive RFID tags.
- RFID tags can be read at much greater distances; an RFID reader can pull information from a tag at distances up to 300 feet. The range to read a barcode is much less, typically no more than fifteen feet.
- RFID readers can interrogate, or read, RFID tags much faster; read rates of forty or more tags per second are possible. Reading barcodes is much more time-consuming; due to the fact that a direct line of sight is required, if the items are not properly oriented to the reader it may take seconds to read an individual tag. Barcode readers usually take a half-second or more to successfully complete a read.
- Line of sight requirements also limit the ruggedness of barcodes as well as the reusability of barcodes. (Since line of sight is required for barcodes, the printed barcode must be exposed on the outside of the product, where it is subject to greater wear and tear.) RFID tags are typically more rugged, since the electronic components are better protected in a plastic cover. RFID tags can also be implanted within the product itself, guaranteeing greater ruggedness and reusability.
- Barcodes have no read/write capability; that is, you cannot add to the information written on a printed barcode. RFID tags, however, can be read/write devices; the RFID reader can communicate with the tag, and alter as much of the information as the tag design will allow.
- RFID tags are typically more expensive than barcodes, in some cases, much more so.[2]

## References

- 1). <http://www.rfidjournal.com>
- 2). <http://www.technovelgy.com/ct/Technology-Article.asp>
- 3). <http://www.itaa.org/rfid/docs/rfid.pdf>