



SIEGWERK

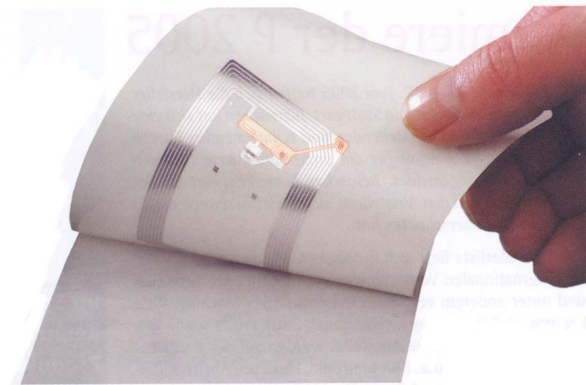
explicit

RFID

RFID (radio frequency identification) is an identification method by means of which **individual characteristics** can be written, read or changed over a distance of several meters contactlessly via **radio signal**. Data can be transmitted or retrieved without direct visual contact with the data carrier. RFID systems are used not only for the identification of an item of merchandise and for purposes of logistics, but also for the purpose of identification of individuals (contactless access monitoring), for the identification of animals and for the electronic calculation of road tolls. In the following, only the identification of merchandise items by means of RFID labels (referred to as “**smart labels**”) will be dealt with.

Principle of operation

The central element of RFID is the **transponder** (short for transmitter and responder) which consists of an electronic oscillation circuit (the antenna) and a microchip.



This microchip has a storage capacity of a few kilobytes. Transponders in RFID labels are passive, i.e. they are not equipped with an integrated power supply. They only become active after they approach the vicinity of a **detector or reader** (= a writing/reading unit connected with a computer). The radio signals of this unit activate the transponder through induction and therewith permit the storage or emission of data. The data will be transmitted to the transponder by means of electromagnetic waves. These waves will be received by the antenna and stored on the chip. The distance from which a transponder is readable depends on its transmission capacity and the frequency used.

RFID

In Europe, two frequency ranges are in the process of establishing themselves as standard:

- High frequency (HF) with 13.56 MHz (reading distance up to about one meter),
- Ultra-high frequency (UHF) with 868 MHz (reading distance three to six meters).

Low Frequency (LF)				High Frequency (HF)			Ultra High Frequency (UHF)			
30 kHz	125 kHz	134.2 kHz	300 kHz	3 MHz	13.56 MHz	30 MHz	300 MHz	868 MHz EU	915 MHz US	3 GHz
Production, Product tracing, Product tracking Access control, Animal ID, Authentication				Logistics, Warehouse management, Library management, Retail			Tracking, Baggage handling, Order picking, Logistics, Truck- car- train- ID, Retail			
Trovan		TIRIS®		ISO 15693			EPC Class 1 Gen 2		EPC Class 1 Gen 2	

Intelligent labels

RFID labels will certainly not replace the barcode in the near future. However, they will increasingly complement the barcode. By contrast to the visual marking, on the inside of the RFID label the transponder is largely insensitive to moisture, contamination or mechanical effects. And its information can be retrieved contactlessly, position-independently and from any given direction. Whereas the EAN barcode contains an item number (and possibly a batch number) which is identical with all items of a specific type, the products marked with RFID labels can be allocated **individual numbers**. Each individual product can therefore have its own number and is hence distinctly identifiable.

RFID

This circumstance is exploited in production operation in which the products run through various production steps and are identified at various gates. The status and location are transmitted by the gates to the company's EDP system and render the manufacturing process of the logistics procedures transparent.

The EPC code

Similar to the EAN barcode in earlier times efforts are currently being made to create a product numbering system which is uniform worldwide, the **Electronic Product Code** (EPC).

EPC global Network is the international standardization agency which assures that every product series can be allocated a succinctly identifiable serial number which is not repeated. The EPC number is stored in the transponder as a 96 bit-long code and contains enciphered the exact information on manufacturer and product. In the logistics sector such RFID labels can be recognized by their printed-on EPC logo.

Costs for chips and antennas

Whether RFID labels for primary packagings in the consumer goods sector establish themselves quickly is dependent on the purchase price of the chips and antennas. Efforts are being made to manufacture cheaper **conductive printing ink-based** antennas in place of etched copper antennas. These printing inks contain silver and carbon particles and enable conductive circuits to be manufactured cost-effectively in large quantities. As the printing method screen, rotogravure and flexographic printing are suitable. A film thickness of approx. 2 - 5 μ m is required. The costs for a RFID label with transponder (chip and antenna) are currently above 0.50 Euros. However, it can be assumed that these costs will soon decrease to a few cents, which will greatly increase the use of smart labels in the consumer goods sector.

RFID

RFID Components

A conventional RFID system is made up of three components:



RFID Reader Function

Depending on the frequency that is used and its performance, an RFID reader sends radio waves of between one centimetre and 30 meters or more. If a transponder enters this electromagnetic region, it detects the activating signal from the reader. The RFID reader decodes the data stored in the integrated circuit of the transponder (silicon chip), and communicates them, depending on the application, to a host system

RFID Transponder

The heart of an RFID system is a data carrier, referred to as the transponder, or simply the Tag. The designs and modes of function of the transponders also differ depending on the frequency range, just as with the antennas. In the LF and HF range, a unique, worldwide ID number is stored on the chip. This can be connected to information in a database. There are coil designs for these two frequencies in the transponders that are used in the magnetic near field of the antennas (inductive coupling).

RFID Antenna

An RFID antenna consists of a coil with one or more windings and a matching network. It radiates the electromagnetic waves generated by the reader, and receives the RF signals from the transponder.

An RFID system can be designed so that the electromagnetic field is constantly generated, or activated by a sensor.

Antennas also come in different sizes and designs, this depending very much on the environment into which a system is integrated. The required read and write range also play a role.