

CICRESPI 

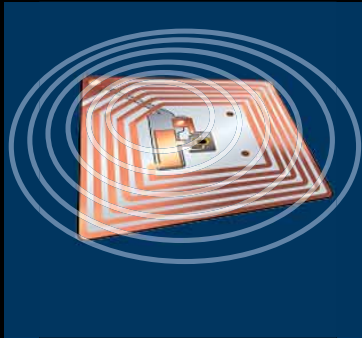
WE SHAPE THE FUTURE



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Introduction to RFID technology



OUR COMPANY

CICRESPI designs and manufactures, together with the Customer, total and innovative solutions, decentralized assistance services for identification, trackability and security of products, packaging and documents.

Our target is to be knowledge leader in developing and producing personalized techniques for the management of variable information on products and packaging through alphanumeric codes, barcodes, dot codes and routes traced with transponders and RFID technologies.

Within the solution creation process, we involve electronic technologies, computerized, radiofrequency, wireless, ink-jet, laser, thermal transfer, labelling and quality control.

CICRESPI Group allows and ensure to the Customer:

- access to its design service;
- interdisciplinary professionalism, exchange of experiences and competence to find the best, all-round tailor-made solution;
- operational flexibility, guaranteed results, continuity of the mutual relationship and constant monitoring of operations in time;
- territorial coverage of the technical service;
- RFID experimentation.

1. INTELLIGENT OBJECTS AND PRODUCTS

They are the physical goods containing information about themselves.

An intelligent product knows its own identity, position, quality.

- An intelligent banknote knows its own value and allows traceability to the banking system.
- An intelligent boarding card knows its passenger, the purchased ticket, its origin and destination, times.
- An intelligent parcel knows the sender, the consignee, the transit dates in the positions appointed to sorting.
- An intelligent sheet of paper knows to be part of a document, knows its author, composition and validity date.

INTELLIGENT PRODUCTS



INTELLIGENT SPACE

It is the physical place able to talk with the intelligent objects through appropriate devices.

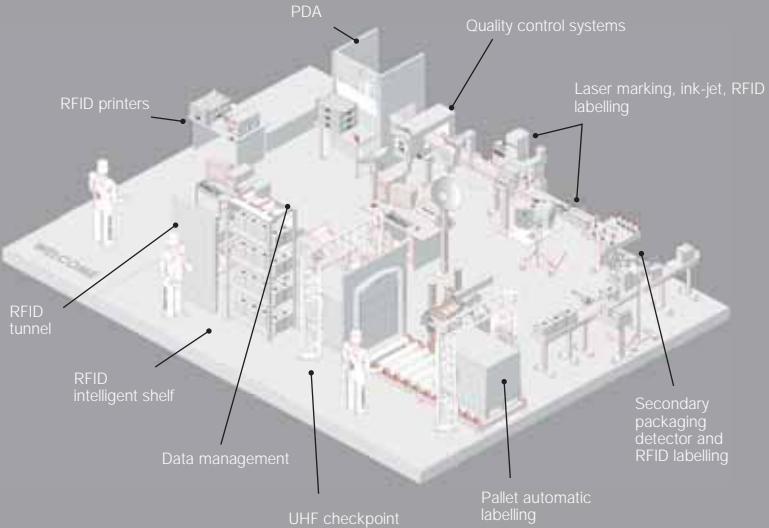
In order to have an intelligent object and space two things are needed: a support provided with information and a mean for its communication.

Intelligent objects and space, organized within a system, allow to achieve the Automatic Identification.

Automatic Identification (ID) refers to a system allowing:

- Automatic data acquisition
- Data organization and their transmission
- Possibility that the data can be identified more times during their life cycle, that is traceability

ORGANIZED OBJECTS AND EQUIPMENT WITHIN A RFID ENVIRONMENT



Technologies making automatic identification on the objects feasible are:

- Codified printing (barcodes, dotcodes, OCR);



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- Magnetic technologies (band and inks);



- Memory and microprocessor cards;



- Radiofrequency technologies (RFID).

“RFID” Radio Frequency Identification is based on radio signals exchange between readers and intelligent objects within an intelligent space.

2. RFID SYSTEM

RFID system is composed by three main objects:

- Tag or transponder, located on the object to be identified, is the support where data referring to the object are recorded. Transponder normally consists of a microchip and an antenna;
- Reader or transceiver, querying the tag, reading or writing data into the memory. Reader typically includes a radiofrequency module (transmitter and receiver), a control unit, an antenna and one or more interfaces to transmit data received from tag to PC and vice versa;
- Data processing system (software, PC, PLC, control system, etc.) processing data in the most useful way.

Identification through radiofrequency offers substantial advantages compared to other:

- It operates on a dynamic support (tag), its memory can be updated and rewritten during time, processes and space;
- Can be read and interpreted at interesting distances, out of the visual line, regardless of light conditions or positioning;
- Each object with a tag applied is unique, thanks to the univocal serial number (UID, Unique IDentifi cation number) of the memory chip assigned;
- More objects can be identi fi ed simultaneously.

Achievement of an efficient RFID system always comes from an accurate study about goods nature, their handling, communication requirements among the parts; that happens to maximize the advantages derived by technology and ensure a return on investment in acceptable times.



Range and frequencies	Reading distance	Advantages	Criticality	Applications
LF < 135 KHz	~10cm	Standard all over the world. High reading reliability. It works near metals and liquids. Largely widespread.	Low transmission speed. Action range extremely reduced.	Smart cards. Ticketing. Anti-theft. Animals identification.
HF 10/13,56 MHz	~1m	Standard all over the world. Good transmission speed. It works near metals and liquids. Largely widespread.	Reduced action range. Difficult transmission in proximity of metals.	Material goods identification. Antitheft. Access control. Persons identification.
UHF 850/950 MHz	~4/6m	Good reading distance. Growing commercial uses. High transmission speed.	Difficult transmission in proximity of liquids and metals. Working difficulties in humid environments. Standardization to be defined.	Logistics. Trackability. Vehicles identification.
Micro/wave 2,5/5,8 GHz	~15m	Excellent reading distance. High transmission speed.	Commercial licence denied in some Countries. Complicated development system.	Logistics. Trackability. Vehicles identification.

3. TAGS

Tags or Transponders can be classified according to technology:

Passive transponders:

For mass applications, at low speed, with transmission capacity only if queried by the reader and data transmission from distances from 0 to about 10 meters according to the involved frequency.

These transponders use radiofrequency wave, generated by the reader, both as energy source to feed integrated circuit and to transmit and receive data.

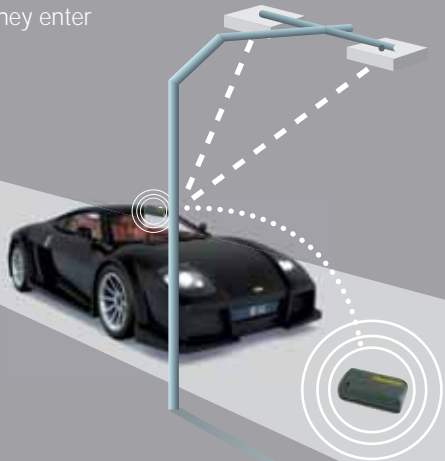
Typically they are used for applications such as smart labels or smart cards.

Semi-passive transponders:

They are supports having incorporated batteries and therefore they do not need any external energy to make the memory available. As they do not have an integrated transmitter, they are activated and communicate with the readers only when they enter their action field.

They are able to communicate at distances even reaching tens of meters.

A typical example of application is the motorway electronic toll system for cars (as the Italian Telepass), or transponders used for railroad convoys.



Active transponders:

These devices are self-fed by a battery and have an active transmitter on board, so that they can independently generate the radiofrequency energy necessary to communicate with the reader.

They have a communication capacity varying from hundreds of meters to hundreds of kilometres.

More active transponders can communicate among themselves.

For examples they are used on the airplanes both for civil applications and for military purposes

4. PASSIVE TAGS

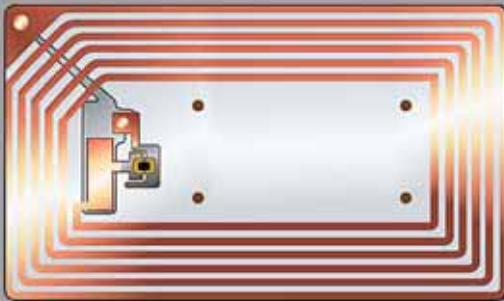
Passive transponder is a component a couple of microns thick composed by:

- A microchip storing data (from some tens to some thousands of BITS, up to 2000 characters);
- A coupling element (antenna) in conductive material (silver ink, aluminium, copper, etc.) representing the mean to “capture” the necessary energy for the transponder to work and at the same time to allow an exchange of information. Shape and dimensions of the antenna are essential to get a good reading result;
- A support receiving and protecting chip and antenna (inlay).

Thanks to its flexibility of realization and use, tag can be applied on or even inside a good number of supports.

Tag may be deposited on a substrate material (paper, PVC, etc.), and so it constitutes the family of the smart labels, that is intelligent labels for RFID writing and reading.

According to products nature and reading distance required, different frequencies standards worldwide characterized and organized may be utilized.



Tag RFID HF

5. RFID READERS

Systems allowing to read and/or write data featured on tags are called Readers (or also Transceivers).

They are generally composed by a control unit able to manage one or more reading antennas, provided of communication potential to a computer system and towards other equipment.

Control unit is calibrated on the specific frequencies of use and provides the reading antennas with the necessary power to create a limited electromagnetic field.

Tags located within the energy field exploit it to activate themselves and make themselves available to reading and writing.



Reader with UHF antennas

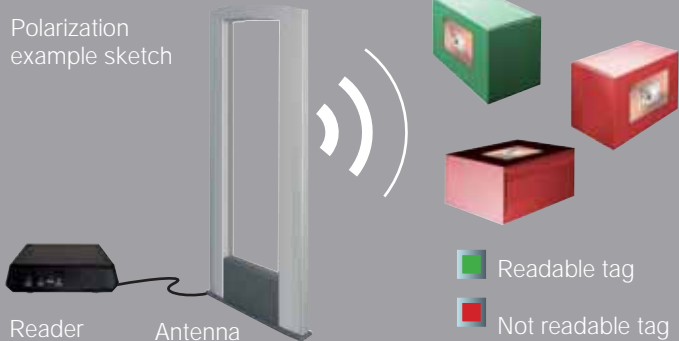


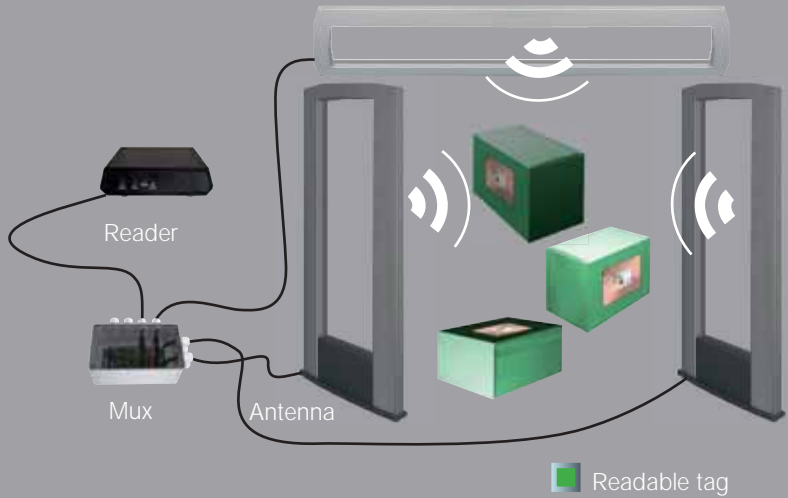
Palm terminal Workabout PRO RFID HF

Tag polarization

Tag positioning compared to readers field polarization is essential for the correct system functioning; on the opposite there may be significant changes on the communication distance with subsequent reduction of the action range. Polarization problem can be overcome through the installation of more reading antennas placed in different positions and orientations: this case is defined "gate" or access.

Polarization
example sketch





Polarization – example sketch with more antennas

Anticollision

If many tags are within the field, all will answer simultaneously. Reader detects a signal collision and this indicates a multiple presence of tags.

In this case the reader uses an anticollision procedure to communicate with the single tags, that is, it organizes communication through an ordered list so that they can be singularly selected.

The number of tags that can be identified depends on the frequency and the protocol involved in the communication, typically it varies from 50 to 200 tags/sec. Once the tag has been selected, reader can perform all the permitted operations.

Integrity of the transmitted data (Redundancy):

When data packs are transmitted using a wireless technology, it is impossible to avoid some noise within the transmission channel that, together with the useful signal may lead to errors during transmission.

There are mainly two methods to minimize an error risk: transmitting two times the same datum and compare the readings, that is a very slow process, or adding to the packet a few bits appropriately chosen.

This last technique is known as redundancy.

The receiver device submits the whole data flow to a control procedure. In the event that control procedure gives a positive outcome, the recipient acquires the part of data of the whole pack and destroys the redundant control code.

6. TYPOLOGY OF READERS

Readers technology has developed to allow a use flexibility according to conditions of application. Readers can be ranged, further to frequency of use, in:

- Printing and coding;
- Static reading (tag on stationary product);
- Dynamic reading (tag on moving product).



RFID printing
head



RFID HF thermal transfer
printer
Tags printing, reading and
coding

A further classification can be:

- Single reading (one tag at a time);
- Multiple reading (more tags within the field, with anticollision procedure);
- Selective reading (research of a particular tag within a set).



Tunnel for multiple reading (with anticollision).

Furthermore there are:

- Mobile readers (palm terminals, PDA, paddle readers);
- Stationary readers (desktop, on line, access systems).



UHF gate structure



Palm terminal
Workabout PRO RFID HF

In a RFID structured system all the necessary operating variables should be foreseen.

7. DATA PROCESSING SYSTEM

It is the less visible part of the RFID system.

A good system cannot give up a correct, certain and reliable architecture in data collecting, transmitting and managing.

RFID technology was born to use strings of codified data and therefore "light" from an electronic point of view. This is enough to allow short time acquisition of remarkable quantities of information and its transmission at a very high speed.

At the same time redundancy procedures ensure certainty on the acquired data.

Data management follows the sketch:

Tag = → Reader= → Hardware = → Middleware = →
Management software and Management Software= → Middleware
= → Hardware = → Reader= → Tag exploiting an internal
and/or external network as communication tool.

8. NORMS AND STANDARDS OF RFID TECHNOLOGY:

Very important issues for RFID technology are norms and standards.

They are needed to:

- Ascertain the correct functioning of the systems respecting the other electric and radioelectrical systems;
- Ensure public health and inalterability of the products;
- Uniform functioning and coding protocols among the different producers of tags and readers in order to ensure a rapid development of the technology;
- Make the exchange of tags information among the different users simple and efficient.

Norms mainly concern reader emissions powers and assignment of the transmission frequency bands, while standards as ISO (International Standards Organizations) or EPCGlobal™ define the communication interface between reader•tag, tag•reader, communication protocols, data coding and structure, and more

Territorial legislation and frequencies assignment

As RFID systems generate and radiate electromagnetic waves, they are classified according to law as radio systems. Use of RFID systems should not alter functions of other radio services in any way.

Therefore it is particularly important to be certain that RFID system could not interfere with near radio and television stations, mobile radio stations (police, security services, industry), navy and aeronautics radio services, mobile phones.

Tags and RFID passive readers generally are included in the class of short ray devices (SRD) that, even if they do not require an authorization normally, are ruled by legislations and norms changing from Country to Country. Nowadays, the only frequency band totally accepted is HF 13.56 MHz.

Reference standard is ISO 18000•3.

Reference EU norm is EN 300•330 that presently contemplates as limit to fi eld intensity 42 dBA/m.

This norm has been transposed also in Italy.

For passive tags of UHF RFID system the issue is more complicated, as it is not possible to get a unique frequency range worldwide. This discontinuity has brought to the creation of ITU (International Telecommunications Union) which divides the world in three ruling regions:

REGION 1: Europe, Middle East, Africa and North Asia

UHF band assigned: 865,00 – 868,00 MHz;

Maximum power emission: 2W ERP.

REGION 2: North and South America and Pacific east of the international date line

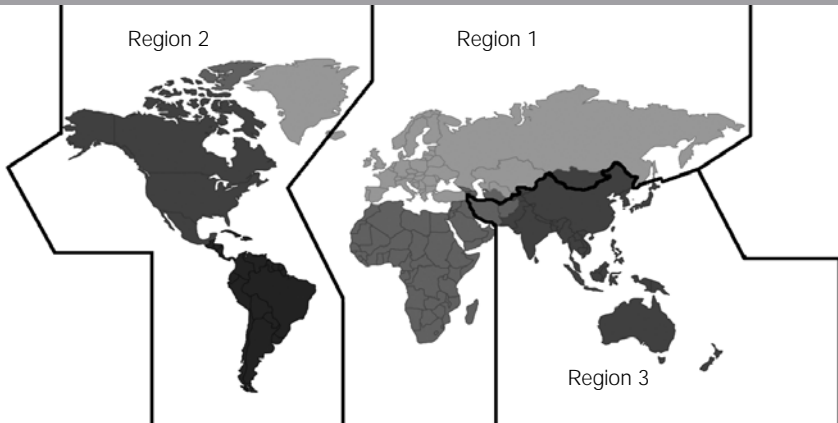
UHF band assigned: 902 – 928 MHz;

Maximum power emission: 4W EIRP.

REGION 3: Central and South Asia, Australia and Pacific west of the international date line

UHF frequency assigned: 950 MHz.

UHF worldwide reference standard is ISO 18000-6



9. FUTURE: OBJECTS CONNECTING TO THE INTERNET

If there will be the intention to make also basic commodities intelligent, passive tags to be applied should be cheap, and therefore they will have a limited but sufficient memory to identify univocally each single product.

For example EPCGlobal, an organization for development and standardization of the codified information, suggest a coding standard through EPC™ (electronic product code).

As already happens with barcodes EAN/UCC, in each Country joining the EPCGlobal network there is an organization for attribution of codes composing EPC™. In Italy the organization is INDICOD-ECR.

EPC™ identifies in an univocal, certain and concise way all the necessary information for identification, such as:

- Economic subject who codified the tag;
- Reference typology;
- Reference serial number.

Basically it is a 96 bits numeration system, sufficient to contain the necessary information and light enough to favour a rapid cycle of reading / storing / research at IT flow level.

A global network will manage this information, allowing to follow the single product in its life cycle through the supply chain.

10. CONCLUSION

Intelligent products are radically transforming industrial production, automating planning, components assembling, routing of parts and products, distribution, disposal. Intelligent products will improve the link between physical and virtual reality.

Intelligent objects will simplify logistics and transports.

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most convenient day and time
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Our specialists will be at your disposal.

In Italy the application of RFID technology is possible within the following parameters.

Frequency	Maximum power
869,525 MHz	25mW ERP