

# Radio Frequency IDentification RFID

## The Internet of things



**RFID – smart radio tags - are the keystone of the emerging ‘Internet of Things’ that will connect objects and places. They will create many new opportunities for business and society, but first there are a number of political and social issues to be considered.**

### RFID current and future trends

Current trends indicate that the RFID market will grow fast in the next 10 years. With 1.02 billion tags sold in 2006, the value of the market, including hardware, systems and services, is expected to increase by a factor of six between 2007 and 2017.

Business applications using RFID such as transport and logistics, access control, real time location, supply chain management, manufacturing and processing, agriculture, medicine and pharmaceuticals, are expected to grow strongly. But RFID devices will also influence Government (e.g. eGovernment, national defence and security), and consumer sectors (e.g. personal safety, sports and leisure, smart homes and smart cities). RFID and bar codes will coexist for many years, although the former technology is likely to gradually replace the latter in some sectors.

The widespread item-level tagging of products, though not imminent, is likely to progress as costs go down, standards for RFID frequency and power are defined, end-user knowledge about how the technology works improves and technical hitches (such as reader accuracy and interference from external substances) are overcome.

### Technical Basics

RFID tags are not a new technology – they have been around for some 50 years. The technology can be used to identify, track, sort or detect a wide variety of objects (e.g. pallets, cases, containers around factories or in warehouses).

The purpose of an RFID system is to enable data to be transmitted by a portable device (*tag*) which is read by an RFID reader and processed according to the needs of a particular application.

An RFID system consists of three basic components, namely the *tag*, the *reader* and the *middleware*. The tag uniquely identifies the item to which it is affixed and communicates with the reader via radio signals. The reader then converts the radio signals into data that can be passed onto the middleware (which determines what the specific RFID system does) to trigger further actions, based on the identifying information.

**The smart radio tag** consists of a powered or non-powered microchip and an antenna. *Passive tags* are the simplest, smallest and cheapest version of an RFID tag as they do not contain a built-in power source and consequently cannot initiate communication with a reader. As the available power from the reader field diminishes rapidly with distance, passive tags have practical read ranges that vary from about 10 mm up to about 5 metres.

*Semi-passive tags* have built-in batteries and do not require energy from the reader field to power the microchip. This allows them to function with much lower signal power levels and act over greater distances. *Active Tags* are bat-

tery powered devices that have an active transmitter onboard. They can communicate over longer distances (several kilometres) and have read/write capabilities allowing tag data to be rewritten or modified over the life-cycle.

**The reader** is a handheld or fixed device that uses "Radio" to activate and obtain data from RFIDs in the vicinity. It can be seen as the tags' gateway to the data processing system. It scans multiple tags without requiring line-of-sight and communicates the results to the middleware. The power output and the radio frequency determine the range at which the tags can be read. Readers can be distinguished by their storage and processing capacity, and by the frequencies at which they operate.

**RFID middleware** consists of computer hardware and data processing software that connects readers to computer systems and data repositories. It converts data from tags into tracking or identification information. It may also help filter data more effectively, and remotely monitor, control and maintain readers.

## Applications

There are many promising RFID applications. For example, medicinal products can be tagged and traced to combat drug counterfeiting. Logging tagged items into and out of your refrigerator can help you track when certain products are out of stock or whether certain products have gone beyond their date of expiry. Smart radio tags can provide useful information over the whole life-cycle of its tagged product. That is why RFID chips can improve customer relations through better after-sales services.

There is a large field of applications when it comes to medical services and services for people with additional needs. Even the tracking of criminals on parole from prison is imaginable.

Looking into the future, RFID and smart tags will allow the creation of an 'Internet of Things', where objects and locations may be directly related to one another. These objects will also be capable of increasingly "intelligent" interaction.

## Further Information:

**RFID web page:** [http://ec.europa.eu/information\\_society/policy/rfid](http://ec.europa.eu/information_society/policy/rfid)

**Europe's Information Society:** [http://europa.eu/information\\_society](http://europa.eu/information_society)

**Information Society and Media Directorate-General:**

Av. de Beaulieu 25, 1160 Brussels

[info-media@ec.europa.eu](mailto:info-media@ec.europa.eu)

[http://ec.europa.eu/dgs/information\\_society](http://ec.europa.eu/dgs/information_society)

**All fact sheets can be found at:** [http://ec.europa.eu/information\\_society/factsheets](http://ec.europa.eu/information_society/factsheets)

## Political and social issues

Apart from its expected benefits, the more intensive and extensive use of RFID also raises major issues in the areas of privacy, security, technological reliability, and international compatibility.

One key challenge for decision-makers is to create a common vision and a set of goals on how RFID can keep Europe more innovative and competitive in the world economy. At the same time citizens must have the tools and freedom of choice they need to protect their privacy and security.

To respond to these issues and challenges over the next two years, the Commission will continue to analyse the options to respond to the concerns and to address the issues at stake, taking into account the discussions with the relevant stakeholders. In some areas, such as radio spectrum, research and innovation, and standardisation, the Commission will pursue on-going initiatives in co-operation and dialogue with relevant stakeholders. In other areas, in particular security, privacy, and the other policy issues posed by the shift from RFID to the "Internet of Things", while it is possible to map out some concrete steps from now to the end of 2007, further more detailed debate between concerned stakeholders is necessary to deepen the analysis of follow-up actions.

In this respect, the Commission will establish as soon as possible a RFID Stakeholder Group with a balanced representation of stakeholders. This group will provide an open platform allowing a dialogue between consumer organisations, market actors, and national and European authorities, including data protection authorities, to fully understand and take co-ordinated action on the concerns that have been raised in relation to the issues mentioned above. It will also support the Commission in its efforts to promote awareness campaigns at Member State and citizen level about the opportunities and challenges of RFID.

The Commission will also strengthen its international contacts with third country administrations, particularly in the United States and Asia, with the objective to strive for global interoperability on the basis of open, fair and transparent international standards.