

## RFID BASICS

### RADIO FREQUENCY IDENTIFICATION (RFID)

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If you have ever used an access card to get into a building, or passed through an automated toll collection system on a highway, you have used RFID. The definition of RFID is rather broad because it has so many uses.

RFID is a system of technologies that allows an object, person or animal to wirelessly identify itself to another object, person or animal. Hence the words RF (Radio Frequency) and ID (Identification).

To be able to do this in various usage scenarios, form factors, price points, thermal environments, etc., the technology used for enabling RFID takes many forms. The most common ways of subdividing the technology are by frequency and whether or not the tag is a passive device.

The lowest common frequency or **LF (Low Frequency)** spans the range of 58-148.5 kHz or 58-148.5 thousand cycles per second. This frequency allows for low cost tags and readers with short read range (several inches to several feet), but most importantly, this frequency allows the RF to transmit *through* metals a few mm thick as well as liquids. This makes this technology very suitable for implanting into animals, but also for access control and electronic article surveillance (EAS) or anti-theft applications. Because these applications are not appropriate for a battery along with the antenna and chip, the tags are read **passively** (*i.e. without a battery*). The behavior of the tag changes an incident RF field in a way that a reader can detect a unique ID. This ID may be a single bit, in the case of an EAS tag, or up to 10s of bits, for animal tags.

The next frequency range spans from 1.75-13.56 MHz and is the next most common use of the technology. This frequency range is called **HF (High Frequency)** and includes tags for use in building access, public transportation and electronic payment systems. The range of these systems is similar to LF: inches to feet, depending on the application. HF tags also work pretty well with metals and liquids. Except for electronic article surveillance, HF tags are usually used for proximity applications: a human gesture of moving one's arm, wallet or purse is used to provide access or payment.

**UHF (Ultra High Frequency)**, sometimes called Near Field UHF, allows RFID to be used ubiquitously, or where the technology can be used in every place and every time. UHF RFID spans the 433, 840-960 MHz and the 2.4 GHz range. At this frequency, the RF that is produced allows for relatively efficient wave-like propagation, similar to a radio station, but with reasonable amounts of power consumption for handhelds, laptops, trucks, printers, etc. Near field UHF RFID tags contain a small silicon chip and an antenna paired onto or into an object. This allows one to create tags which can be read from inches to tens of feet in a passive configuration, and 100s to 1000s of feet if used semi-passively (the tag still changes the RF that comes back to the reader rather than transmitting, but gets a battery to help it out) or actively (via an *active* transmitter). The tags can also be produced very inexpensively. The antennas can be etched with chemicals or printed with a printer that can print metals, such as copper or aluminum, or directly into the chip itself.

The low cost and long range of UHF RFID means that tags can be placed just about anywhere, and interrogators (or RFID readers) can read them. This allows computers attached to these interrogators to

see the world around them through the RF lens. This technology can be made to work very well and without human intervention. It can reduce some hard machine learning problems to simple observational ones. The technology is used in hospitals, law offices and courthouses as an ambient computer interface for objects. These applications point to a future where identification and sensing could become ubiquitously present in every object in a user environment. This would allow the creation of one of the ultimate ambient interfaces: each application would be created by filtering relevant data for a particular use case.

## A TRUSTED RFID PARTNER

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Many suppliers can offer a wide variety of RFID products to choose from but unlike most data collection manufacturers, JADAK has one of the broadest RFID product portfolios in the industry, backed by engineers with the resources and technical expertise to help customers implement solutions to meet their specific needs and requirements.

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### ABOUT JADAK:

JADAK, a business unit of Novanta, is a market leader in machine vision, RFID, barcode, printing, and color and light measurement products and services for original equipment manufacturers. The company designs and manufactures embedded detection and analysis solutions that help customers solve unique inspection, tracking, scanning and documenting challenges. The company is ISO 9001 and ISO 13485 registered.

Novanta is a trusted technology partner to OEMs in the medical and advanced industrial technology markets, with deep proprietary expertise in photonics, vision and precision motion technologies.

ThingMagic is JADAK's RFID line of products and services.

[www.jadaktech.com](http://www.jadaktech.com)



**JADAK**  
A Novanta Company

**USA Office**

phone: +1 315.701.0678  
email: [info@jadaktech.com](mailto:info@jadaktech.com)  
web: [jadaktech.com](http://jadaktech.com)

**European Office**

phone: +31 (0)76.522.5588

**Asia Pacific Office**

phone: +86 512.6283.7080