

- 1 Complete system of reader and "in/on metal" tag
- 2 Customized transponder integration in metal

## NEXT GENERATION OF INDUSTRIAL RFID

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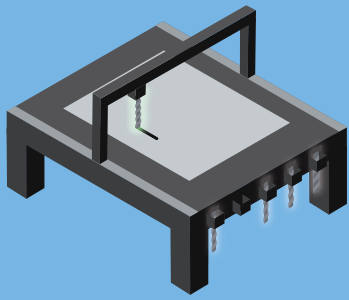
For the RFID technology to continue to provide solutions for different applications in the future, it is necessary to approach the new challenges by efficiently adapting the existing solutions to them or by developing new technologies. The conventional RFID systems cannot cope with the problems within the industrial and the medical fields. Therefore, one has to break away from the known RFID solutions and develop new technologies or further improve existing ones. The use of RFID technology in metallic environments for industrial as well as in medical applications is even more challenging. Here, a distinction can be made between two possible scenarios:

1. The transponder (tag) is located in a metallic environment, e.g. in a metallic container.
2. The tag is attached directly in/on a metallic substrate.

Both the cases pose different difficulties. In the first case it is difficult to read out the tags due to the formation of standing waves.

While, in the second case the performance of the tag on a metallic background is particularly problematic. In many scenarios the size of the tag is very limited. The tag must be applied to small areas without affecting its performance and usability. Especially in case of tracking of tools or sterile goods, the visibility of the tags remains imperative. Fraunhofer IMS is developing new RFID technologies in this area that are suitable for use on or inlayed in a metallic surface (RFID in/on metal). SHF (Super High Frequency) band is used to increase the performance of RFID tags on or in metal. The use of the SHF band provides many advantages over conventional and well-known RFID solutions with respect to the size of the RFID tag and above all the possible use in a metallic environment. So far, no RFID solution in the SHF band is available on the market. Fraunhofer IMS is therefore also actively working on the communication protocols for this range to be established as a standard.

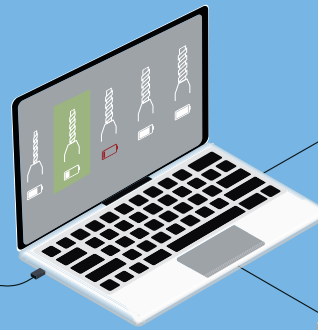




- Automatic tool handling**
- in metallic environment
  - robust passive transponder integrable in metallic tools



- Reader**
- high performance multi-tag reader
  - circular polarized antenna and beam forming options



- Alarming**
- wrong tool in use
  - tool missing
  - tool in wrong slot
  - multiple tools in use



- Predictive Maintenance**
- reduced downtimes
  - in-depth maintenance insights
  - improved product quality
  - optimized supply chain

## Reader

An important part of these new RFID systems is the reader. The reader modulates the information on the carrier frequency and sends it to the tag. The response is received by the reader, converted into the baseband and then interpreted according to the communication protocol. This information is then made available to the user.

In recent years, Fraunhofer IMS has developed a baseband board in various projects that performs signal processing in the baseband according to the ISO 18000-6 EPC Gen 2 standard. Based on this standard, a UHF or SHF frontend can be used to modulate the baseband signals to a carrier frequency. The output power and the carrier frequency are adjustable.

For interested parties it is possible to set up exact requirements from the intended use and to select the suitable RFID technology (UHF/SHF). A reader is realized accordingly. Additional technologies such as carrier suppression against crosstalk of the transmitted signal on the receive path or the mode vortex patented by Fraunhofer IMS for optimal illumination of the target area by the transmitted signal are also possible. This can also be combined with our RFID in/on metal technology. Fraunhofer IMS can even take over the individual system integration to your application via a gateway directly. The result is a reader which is tailored to your needs.

At the moment, optimization of the reader size is being carried out in further projects in order to develop a reader that is as compact as possible.

## Transponder

The developed system operates in the SHF band and the communication protocol has been designed to match the ISO 18000-6 EPC Gen 2 standard in accordance with the reader. A key feature is the reliable operation of multiple tags due to advanced anti-collision. The chip has an Electronic Product Code (EPC) up to 448-bit and a 96-bit Tag Identifier (TID) including 48-bit factory locked unique serial number. Due to the very small form factor package and battery-free operation it is well suited for applications in metal. Further characteristics include the private user memory area protected by special user password. The transponders allow for operation within a wide specified temperature range from -40 °C up to +85 °C.

The overall size of the transponder depends largely on the performance and the exact installation situation. A current version with the dimensions 9.4 mm x 5 mm x 1.5 mm, shows good properties in a variety of applications. Is very robust with respect to cross interference from nearby metal parts. This transponder can be recessed flush in the metal. For size-critical applications a reduced version with dimensions of 5 mm x 3 mm x 1.5 mm will be available depending on applications with less metal and shorter ranges. Therefore, the exact installation situation has to be simulated and analyzed thoroughly in order to guarantee high reliability. Furthermore, even smaller antenna designs and additional functions such as temperature measurement are currently being investigated.

## Features

- RFID in/on metal
- Multiple tag reading
- Optionally flush mounting or surface mounting on metallic instruments

## Services

The RFID in/on metal technology developed by Fraunhofer IMS includes the entire RFID system, from the reader to the transponder. We provide support with the specification of the system parameters, the conception as well as the realization. A system is developed especially for your needs and the antennas are adapted especially for the respective environment. The RFID in/on metal technology has been used so far in the field of tool tracking and sterile goods tracking and is constantly being further developed in corresponding projects.

- Customized reader antenna (linear, cross, circular polarization)
- Reader antenna with beam forming
- Customized tag antenna for in/on metal
- Integration and assembling technologies
- Simulation

## Smart Factory Applications

- Implementing condition-based maintenance
- Real-time monitoring of production flow
- In-depth maintenance insights
- Reduce in-process inventory
- Autonomous material handling