More Than Tracking: How RFID Protects Patients and Medtech Users

RFID technology provides life sciences applications with product and component traceability while safeguarding against human error, unsterilized tools, outdated materials and more.

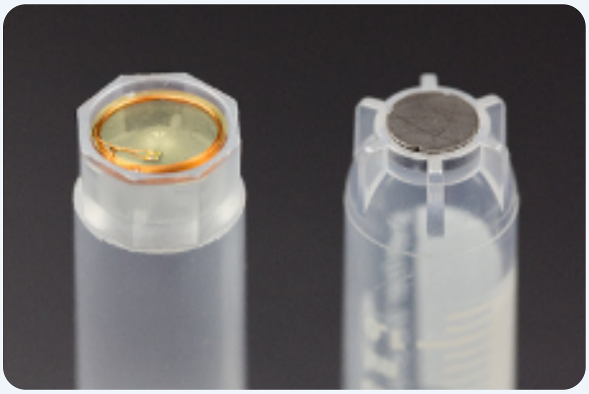
Over the past two decades, the use of radio frequency identification (RFID) technology in the life sciences has grown exponentially. Initially leveraged for product and component traceability, RFID's utility has expanded to safeguard both patients and care providers from the use of counterfeit components, incorrect medications or imprecise doses, unsterilized tools, and outdated materials. RFID also helps to ensure timely device maintenance and provides many additional benefits.

Understanding how RFID can provide this value to both the medtech and biopharmaceutical industries — and dispelling misconceptions surrounding the technology — is key to leveraging it effectively.

WHITE PAPER

HOW DOES RFID WORK?

RFID is composed of two elements: an RFID tag and a reader module. The tag, comprised of a silicon chip and an antenna (copper or another conductive material), typically is embedded in a device or a consumable — anything from hospital filters and tubes to surgical instruments and implantables. The reader module usually is integrated into a piece of equipment's motherboard by its OEM. The tag — a passive device containing no battery — provides pre-programmed information via radio frequency when scanned by the reader module, which then shares that information with a larger system or uploads it to the cloud.



While reader modules generally follow a standard composition, RFID tag construction depends on the application for which it is used. For example, a tag embedded in an implantable may differ in size and packaging material from a tag destined for a consumable component.

HOW RFID SERVES MEDTECH

Medical equipment/consumable manufacturers have an obligation for traceability related to their products. While scannable labels can be used for this purpose, labels generally are limited to a read-only text or barcode/QR-code and fail to deliver more granular details. In contrast, RFID does not require line-of-sight, can be read and written and is assigning a unique identifier, among other data, that allows users to trace the entire product lifetime back to production.

Additionally, RFID brings intelligence to a device. Beyond just assigning a number, it allows for autoregulation/auto setup, preventing accidents and promoting an optimal experience for patients. Also, whether in the dentist's office or in the surgical suite, constant RFID-enabled communication between the device and larger systems allows users to adapt device parameters to working conditions in real time, resulting in a host of benefits

AUTHENTICATE FINISHED PRODUCT CONSUMABLES

Counterfeit parts can void a device's warranty or maintenance agreement; worse, they can endanger patients. RFID protects users and devices from counterfeit parts by confirming whether a component is genuine when it is introduced into a system.

The OEM determines the system reaction. For example, the counterfeit component may trigger a warning, informing the user the part is not genuine or, in the case of a medication dispenser, the system may stop dispensing doses when a counterfeit part is detected. The RFID tracking capability then allows the OEM to examine the supply chain and determine where the component originated.

This utility also prevents the reuse of single-use components, whether their introduction into a system was inadvertent or deliberate. Its importance is amplified in small clinic or independent provider settings, where system details may not be as tightly controlled as in large hospital environments.

Hospitals with more than 1,000 beds contain 200,000 or more medical devices. In Europe, the majority of these products are subject to a regulation on safety control.

AUTOMATE DEVICE SETTING CONFIGURATION

Further insulating users and devices from improper usage is the RFID module's ability to automatically configure equipment to the proper settings. An RFID tag tells the system which product has been loaded and, in some cases, how many times it has been used — much the same way a printer is able to identify its ink cartridge, sensing the ink level and informing the user when the cartridge needs to be changed.

For example, when using a medication dispenser or loading therapeutic liquids stored in pipetting, an RFID-equipped system can identify the product installed and the number of times it has been used, and then adapt dispensing parameters accordingly. Interaction between the RFID tag and module allows for more granularity than just "full" or "empty," as well. If the initial product is swapped out for another, and then the user returns to the first product, the system will recover the information and adjust dispensation parameters for optimal usage. This intelligent system provides a consistent user experience, so dispensation is not heavy when the pipette is full (due to excess pressure) or weak when the product is nearly empty.

Automated device configuration also protects users from application/dispensation of the wrong treatment. Consider that a patient may have an allergy to a particular therapeutic. When that patient identifies themself to the device, it will know which product is appropriate for that patient and, if the wrong product is loaded, the system could trigger an alarm or temporarily disable dispensation. The system is able to build an ecosystem of users and therapies, eliminating human error, protecting patients and reducing risks and costs associated with malpractice for healthcare providers.

IMPROVE STERILIZATION PROCESS RELIABILITY

For medical products designed for hundreds or thousands of uses within their lifetimes, RFID enables users to identify each product and trace its usage history to ensure the item has been sterilized and is within its designated service life. This utility improves process reliability and minimizes the threat of unprocessed devices/equipment in patient rotation. Different types of sterilization require different RFID tag constructions.

One of the most challenging (and common) scenarios is equipment sterilized via an autoclave — due to the repeated cycles of high temperature, moisture and pressure. RFID tag packaging must be robust enough to survive the process while preserving interconnection capabilities between the antenna and the chip. Gamma and X-ray sterilization, meanwhile, require a special chip resistant to radiation. Otherwise, that radiation will damage its integrated memory, resulting in non-functionality of the tag.

As a final example, consider STERRAD (hydrogen peroxide gas plasma technology) and chemical sterilization techniques, which attack less rugged plastics, and thus require the use of high-end plastics (e.g., PPSU materials) or glass tags. Hermetically sealed HID glass can resist the autoclave and nearly all sterilization chemicals.

4x34 4x22 3x15 2x12 2x9 1.4x8 mm

HID

A BAND FOR EVERY APPLICATION

Every RFID integration project begins with a discussion about band usage, even if an OEM already is integrating RFID. The impact of selecting one technology versus another — low frequency (LF), high frequency (HF) or ultra-high frequency (UHF) — is not well-understood in some cases, while other customers have a band in mind when they begin a project. The RFID provider should be able to explain in depth the pros and cons of each frequency range for a given application. The optimal range depends on the item to be tagged, its level of security, the utility required (i.e., single unit identification) and other factors.

LF (125 kHz) is a well-known technology developed more than 30 years ago. It has been applied to a multitude of applications, from animal IDs (injectable tags) to medical equipment tracking. One advantage of LF chips is their readability in all-metal environments (though the tag cannot be fully embedded) and immunity to liquids. Also, LF enables additional features that might not be available in other bands (e.g. sensors used to measure temperature within an implant).

Still, most current medical device projects use HF (13.56 MHz) as a starting point, as it is much broader in terms of chip possibilities. HF chips feature more memory, communication is faster, and more information can be registered inside the tag. HF chips also can implement cryptographic security measures not necessarily found in LF and they are well-suited to miniaturization.

Accordingly, this band is commonly adopted for medical applications centered around patient experience (e.g. counterfeit protection and consumable applications) where reliable communication and auto setup are desirable. Also, Near Field Communication (NFC), which enables interaction with mobile devices (e.g. cell phones) is part of HF technology.

UHF, also known as **RAIN® RFID** (865 – 928 MHz), meanwhile, is more appropriate for general traceability requirements and typically is leveraged more in the pharmaceutical industry. In such applications, additional information on the chip is a lesser concern than product tracking. Still, UHF is applied in the medical device industry for large-quantity applications (e.g. linens or uniforms) due to its low cost.

RAIN® RFID

Ultimately, a multitude of factors affect the band range used for an RFID project, from customer preference and sterilization type to the product ecosystem, level of security, type of information contained and distance at which the tag will be read.

RFID Solutions to Accommodate Any Medical Application RFID tag designers must create a novel design to accommodate a product's specific constraints — whether applying a different frequency to reduce size, changing packaging to survive the sterilization technique, or tweaking the antenna to adapt to a particular use environment. For example, environmental considerations for an implant-embedded RFID tag might include not only biocompatibility and a faultless packaging seal, but the ability to survive magnetic resonance imaging (MRI). In addition to surviving, the tag antenna must be designed so as not to create a shadow on the image, which could be misconstrued as cancer or another malady. Alternatively, the tag may have to endure a **cryogenic environment**.

HID Global boasts a strong product portfolio to support medical applications, accommodating the 80+ percent of our customers who require some sort of customization to optimize RFID tag usage to their needs. We offer the advantage of being chip and frequency agnostic (i.e. LF/HF/UHF capabilities) and can create special form factors or directly bond the antenna to the chip in order to achieve miniature form factors at the customer's request. Whatever your challenge — traceability, component authentication or device setting automation — HID Global can produce a solution that provides utility and protects the integrity of medical equipment while safeguarding users and patients.

ABOUT HID GLOBAL

HID Global powers the trusted identities of the world's people, places, and things through smart components and cloud services. We make it possible for people and organizations to transact safely, work productively, and travel freely. Our contactless identification and sensing (RFID, NFC, and BLE) components and solution-enabling technologies address the dynamic requirements across multiple industries to wirelessly connect, identify, collect, and manage data quickly and accurately across virtually any IoT application.

For more information, visit **hid.gl/medtech** or email **tagsales@hidglobal.com**.

HID
hidglobal.com

North America: +1 512 776 9000 | Toll Free: 1 800 237 7769
Europe, Middle East, Africa: +44 1440 714 850
Asia Pacific: +852 3160 9800 | Latin America: +52 (55) 9171-1108
For more global phone numbers click here

2021-06-29-idt-rfid-protecting-patients-and medtech-wp-en PLT-06076
Part of ASSA ABLOY