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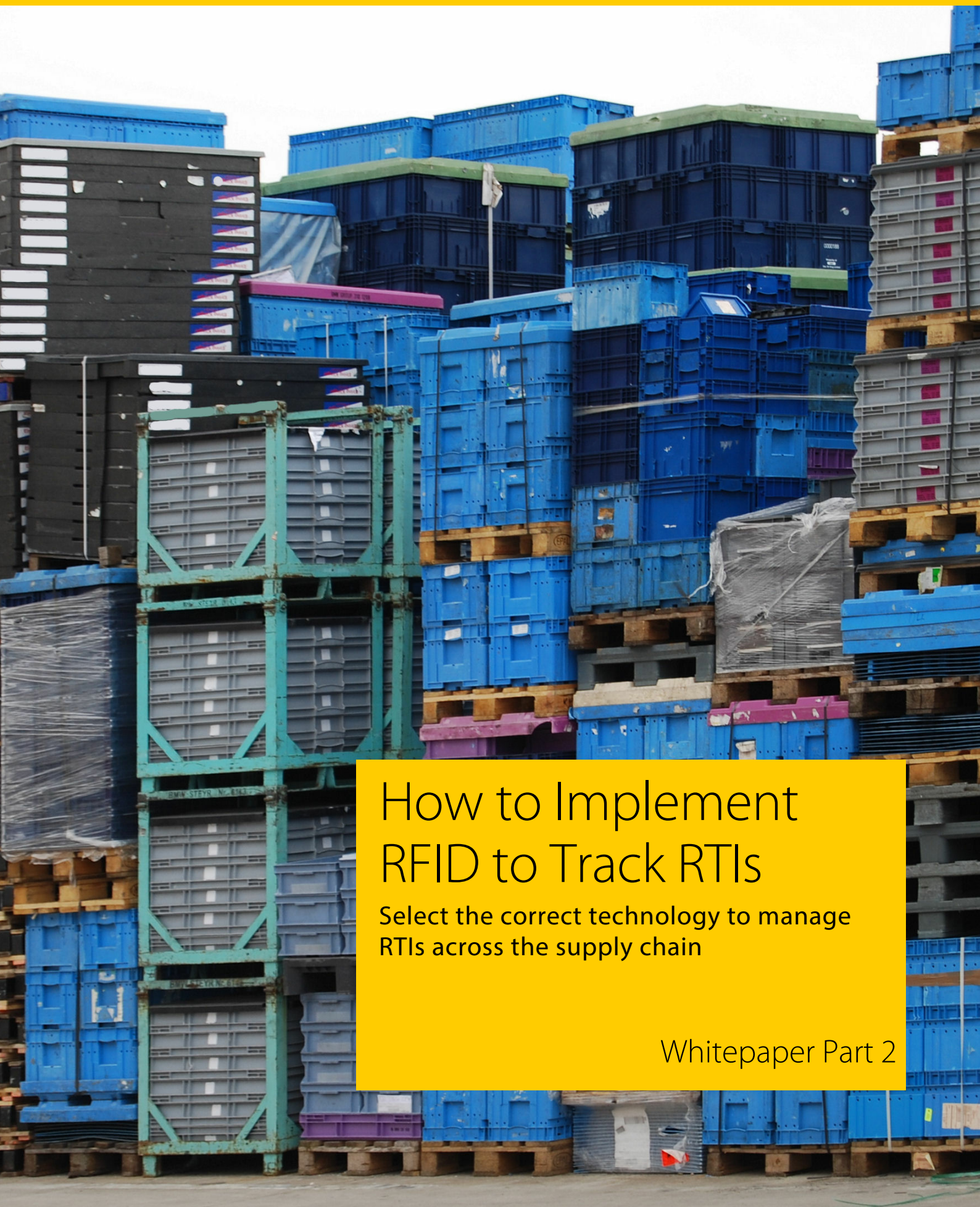


How to Implement RFID to Track RTIs

Select the correct technology to manage RTIs across the supply chain

Whitepaper Part 2

HOW TO TRACK RTIs WITH RFID

Determining the Suitable Identification Technology

There are different tracking technologies with their strengths and weaknesses, but which one is best suited for efficiently managing a fleet of RTIs across the entire process chain? In general, RFID, barcode, Wi-Fi and GPS technologies are the most commonly used. Since RFID offers a particularly large number of advantages in the management of RTI pools, the technical implementation options are discussed in particular.

Tracking technologies

Optical identification technologies: barcode (1D), data matrix code (2D), optical character recognition (OCR) and optical object recognition (OOR)

Optical identification technologies such as barcodes, 1D or 2D codes, are the most common way of identifying and tracking items today. They are a very accessible and relatively inexpensive way for marking items. The issue with barcodes, however, is that it is often difficult to automate barcode reading in high volumes – often each item must be scanned individually one by one. In tracking RTIs this kind of slow manual process steps are usually undesirable.

Barcodes are a relatively inexpensive method of marking items but it is difficult to automate barcode reading in high volumes.

Also, in some cases, the barcodes are susceptible to damage, dust or dirt – a problem with RTIs, which have a long life and are heavily used during their lifecycle. Several performance tests showed that RFID readers have a significantly higher read rate and read reliability over automatic barcode scanners for bulk reading of RTIs in a gate setting.

Passive, radio-based Identification: Low Frequency (LF), High Frequency (HF) and Ultra High Frequency (UHF) RFID

Passive RFID tags do not require a battery, so their lifetime can be extremely long, especially if they are made from a durable material. LF and HF tags are intended for reading over short distances and are therefore not usually suitable for reading large quantities on gates or forklifts. They are mainly used in internal processes on conveyor belt systems. In contrast, UHF RFID solutions offer the added advantage of longer read ranges and lower cost tags, which is one of the main advantages compared to any other radio-based technology, such as active tags, Bluetooth Low Energy (BLE), and Ultra-Wideband (UWB). Nevertheless, with reading ranges between 10 and 20 meters and high reading accuracy that can be achieved with passive UHF tags nowadays, the requirements of automatic gate reading are easily met. The speed at which hundreds of goods can be scanned simultaneously enables fast processes, making UHF readers a standard equipment in logistics operations

Active, radio-based identification: BLE and UWB

Active BLE and/or UWB tags are more suitable for accurate location tracking of objects at a site equipped with a network of base stations or locators. However, most of the benefits of RTI tracking do not require accurate location data. Active devices also require a battery that must be replaced periodically, even if it has a long life. This means that the higher cost per device and the need to account for battery life can make this option very expensive in terms of total cost – even several orders of magnitude more expensive than passive technologies.

GPS-based Identification

This technology requires an active GPS device, i.e. either an online device with a mobile connection or a GPS logger. The GPS device is paired with the tracked object, so it is only suitable for temporary, short-term use with lower volume tracking typically. GPS trackers cannot be attached to every RTI if the volume of the container is large. The relatively high cost of the device and the need for a battery and recharging make this technology less suitable for RTI tracking. In addition, GPS only works outdoors, which precludes many of the use cases and benefits of RTI tracking.

	Works without line of sight	Passively powered	Robust and immune to dust and light	Bulk reading
Passive, radio-based Identification (RFID LF, HF, UHF)	✓	✓	✓	✓
Optical identification technologies (1D, 2D, OCR, OOR)	✗	✓	✗	✗
Active, radio-based identification (BLE, UWB)	✓	✗	✓	✓
GPS-based Identification	✓	✗	✓	✓

Why passive UHF RFID is the ideal solution for RTI tracking?

Crucial to answering this question are the actual needs of customers and their requirements for efficient RTI tracking. What do they want to achieve? For example, traceability requirements may be about improving process efficiency or preventing losses. In all cases, however, customers are usually interested in the return on investment – and the largest part of the cost is usually the cost of labeling the RTIs, which can be significant depending on the volume. With this in mind, passive UHF RFID systems are quickly becoming the standard for tracking RTIs around the world. They offer customers all the benefits of automatic tracking and the best return on investment.

Compared to barcode-based systems, it enables faster and more accurate processes with automatic gate reading. Typically, the cost of tagging assets makes up the largest portion of the capital cost of many RTI tracking projects. Compared to active tag solutions or GPS tracking, the cost of passive UHF RFID tags is the lowest – with low-cost UHF RFID label tags, it is even very close to the cost of barcode solutions.

Attaching the RFID Tag on your RTI

Embedded or attached after the production of the RTI

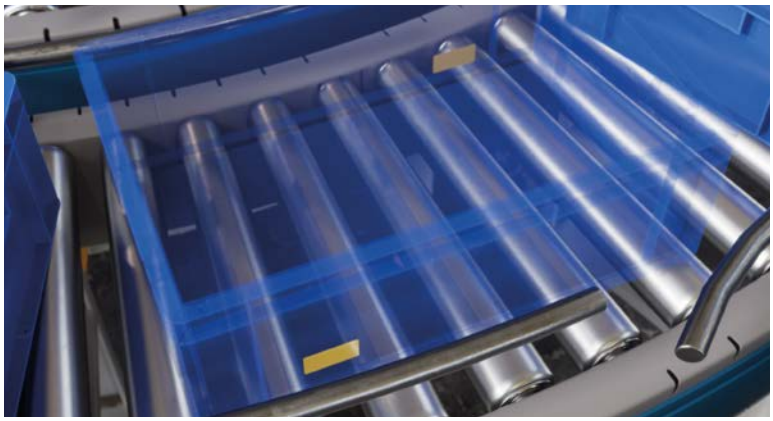
Optimally, the RTIs are tagged at the beginning of their life cycle, namely during production. In this context, the suitable locations for attaching the RFID tags during production should already be considered in the design phase of the RTI. For example, the tag can be molded into the interior of a plastic RTI or permanently attached to the finished RTI. The durability for the tag can best be ensured at this point. Testing should verify a read range of the tag of, for example, at least 5 meters to ensure that it is sufficient for reading at the gate. Before attachment, tags should be tested for 100 % functionality – both in the near field and far field. Automatic testing equipment should be installed in the production line, capable of rejecting or repairing non-functional RFID tags in the RTIs.

The correct placement for the RFID tag

Any industry standards that apply to the particular type of RTI in the industry concerned should be followed. There may already be standards for many industries that specify exactly how the RTI should be tagged. The placement of the tags should also take into account the stacking of the RTIs so that the tags of stacked RTIs are also readable. In addition, proper placement also ensures the durability of the labeling.

How many RFID tags per RTI?

In general, it is common to have at least two transponders per RTI, with the two tags typically placed in opposite corners. However, this does not always have to be the case. In some cases, only one tag is attached to an asset, while in others there are as many as four tags. The most important point, however, is that the tag can be read with sufficient reading range from any direction - left or right, or front or back.



RFID tag pairs adhered diagonally on opposite sides ensure that at least one tag is in communication range with a reader, which results in consistently optimal reading results.

RFID Tag Content

What to write into the memory of the RFID tag and what in the database?

Industry standards should primarily be followed, if applicable. This can be GS1 coding, ISO standard coding or standards from other standardization organizations. When encoding tags, it is important to keep in mind that the EPC code of the tag should always be unique.

When you use several tags per RTI

Typically, two or more tags per RTI are required to ensure readability from all angles with long read range. As already mentioned, when coding tags, it should be noted that the EPC code of the label should always be unique. This is true even when multiple tags are applied to the same asset. For example, part of the serial number can be reserved as a variable part for each tag in the same asset. A best practice is to always store only the unique identifier of the asset and to keep track of all other data and history in the databases of the RFID system, from where it can be retrieved anytime and anywhere.

Ensuring RFID Tags Work on Different Read Points

RFID gates

Gate readers can be used to read high volume of assets in short amount of time when assets are passing by. They are typically used at warehouse doors to read RTIs during the loading or unloading process. Another area of use is doorways and open areas to create tracking points

High-frequency (HF) and especially ultrahigh-frequency (UHF) readers are designed to read multiple RFID tags simultaneously, such as a pallet of RTIs moving through a reading gate.

RFID forklifts

In some cases it makes sense to equip forklifts with RFID readers if the RTI's are mainly handled and moved with a forklift. If the number of gate readers in a warehouse is much higher than the number of forklifts, it may be more cost-effective to equip the forklifts with readers instead of building gates. Using forklift readers also has the advantage that tags can be read during stock transfers and other process steps in the warehouse or in production.

Forklift trucks equipped with RFID readers achieve high reliability and speed in identifying and tracking pallets, and containers.

Handheld RFID readers

Handheld readers are generally only used in processes that cannot be easily automated with conveyor, gate or forklift readers. These may be off-site operations, maintenance or repair. In many cases, a certain number of handheld readers are used as a backup for the automatic readers and in case a process step requires accurate identification of a single RTI unit - for example, in addition to a manual handling process.

Handheld RFID readers are ideal for reading tags on the go and in processes that cannot be easily automated with conveyor, gate or forklift readers.

Tunnels

Tunnels are used quite seldomly, typically only in case where the conveyor reading requires an accurate reading of a single asset or reading the contents of an RTI in a conveyor setting. The purpose of the tunnel is only to separate tags from each other as they move along the same conveyor system – this can be achieved in many ways today, of which the construction of a tunnel structure is one possibility.

Summary and Conclusion

RTIs are a critical factor in ensuring the quality of production operations. RFID-based container management ensures that they are always in the right place at the right time in the right quantity and quality. This way, the cost of an RFID-based system is quickly recouped by the huge savings achieved through efficient container management, as there is no need any more to hire couriers or buy replacement containers to procure missing RTIs at short notice.

RFID offers decisive advantages over comparative technologies in the identification of RTIs, including barcodes in particular. For example, there are hardly any limitations in the use of RFID-based systems, as there are RFID tags suitable for almost all cases and environmental conditions. Furthermore, in an RFID-based system, high-volume reading can be easily automated without slow and error-prone manual steps.

To ensure a smooth RFID RTI loop, special management tools offer the possibility to display all RTI information on one platform. Thus, the RFID system closes the gap between the physical production world and IT-based MES and ERP systems. By linking objects with data from IT systems, RFID systems generate the transparency needed for lean processes and digitized supply chains. This information enables both, systems and decision-makers, to draw more informed conclusions, which leads to increased efficiency in RTI management and high resilience to seemingly unpredictable events in the loop.

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