RFID White paper

Deciding for a fixed RFID infrastructure

It is every retailer's dream: push an (imaginary) button, and know exactly which products you have in all your stores, and know exactly where they are. RFID technology is rapidly making this dream a reality. While there is no doubt that RFID works to drastically improve in-store stock accuracy, it is not always easy to decide which RFID solution works best for which retailer.

The most successful RFID implementations we have seen in the past few years have involved phased approaches, in which the biggest business problem is solved first with the lowest possible investment and system complexity. For most implementations, this included performing a weekly cycle count with a handheld reader and using the collected data to update the stock information in the existing stock management / ERP systems.

The strength of the handheld solution can also be its weakness. It covers a limited number of use cases, and still requires manual labor to obtain the stock information. In the past few years, several solutions have been introduced to improve this situation. These solutions use "fixed infrastructures", in which RFID readers are mounted at specific points in the store and scan continuously. This white paper explores two of these solutions - transition and overhead readers. Transition readers are installed at all transition points in a store including the point of goods receipt, between the stock room and the sales floor and the point where goods leave the store. Overhead readers are installed throughout the entire store and cover all areas.

Fixed infrastructure use cases

When considering installation of a fixed infrastructure, retailers are mainly looking to solve the following use cases:

- Support the store employees with their in-store replenishment processes.
- Employees can instantly see which items are not on the sales floor, but still in the stock room, and replenish those items. This increases merchandise availability for customers.
- Know exactly where items are in the store.
- In some stores items are displayed at multiple locations (e.g. shoes not only in the shoe department, but also near clothing), which is a major challenge with regard to customer service. A real-time locating system can indicate where certain products are in the store to help store employees quickly find the items.
- Improve on inconsistent quality of cycle counts performed by non-engaged employees.
- In some cases, store employees are not motivated enough to conduct a reliable count. While a good user interface and an easy-to-use handheld reader often solve this problem, it is not always feasible to rely on handheld counts.
- Save costs on manual handheld operations by reducing the number of cycle counts.
- In countries with high costs of labor, overhead readers can be used to replace handheld cycle counts and thus save on labor costs.

Not all use cases can be covered by both solutions and, for some use cases, one solution offers a better return on investment than the other solution. This white paper outlines the pros and cons of both solutions to help you decide which might be best for you.

Transition readers

In this case, fixed RFID readers are used at transitions between zones to scan items as they move along in addition to cycle counts with a handheld reader.

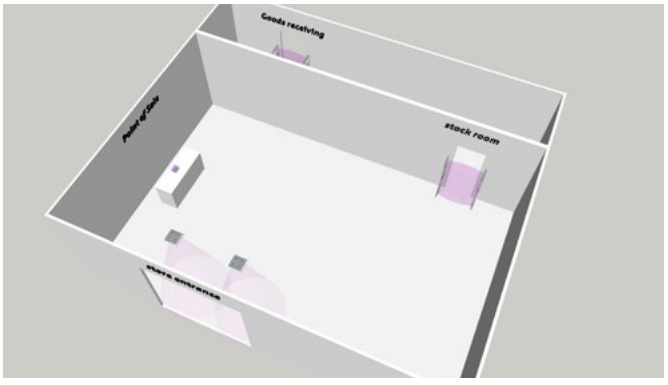
Fixed, floor-mounted RFID reader

Those transitions are:

- Goods receipt point: items are automatically scanned and added to the stock as they arrive at the store.
- Between stock room and sales floor: when items move from the stock room to the sales floor, or back again (optional if this transition is important).
- Point of sale: when an item is sold, it is removed from the store's stock.
- At the customer entrance/exit of the store: when an item leaves the store and has been paid for, the item is removed from the stock of the store; if an item leaves the store and has not been paid for, an alarm sounds.

The type of readers used can be either floor, wall or ceiling mounted readers. The best choice depends on the specific transition point and store layout.

The accuracy of a transition reading system largely depends on how the labels move along those transitions. This includes the way they are packed, how fast they are moved and the quantity that is moving together.



Store layout with transition readers

It is important that the reader recognizes the direction that the labels are moving towards in order to calculate stock as accurately as possible. Of course, the sensitivity and size of the RFID labels also have a big effect on system performance.

Labels densely stacked together

When RFID labels are stored close less than 2 centimeters away from each other, it can have a significant negative impact on readability. It is therefore important to always keep items separated at the greatest distance possible during storage and transport. This is true for all fixed infrastructure solutions.

One of the main disadvantages of transition readers, is that they have to balance their reading performance with minimizing the number of stray tags scanned. This is especially important when the readers are placed between the stock room and sales floor - a challenge in smaller stores. It is therefore recommended that readers be selected that provide a good balance in this regard.
Another disadvantage consists of the fact that transition reading systems cannot determine the exact location of an item, but only the "zone" that it is in (e.g. in the stock room or on the sales floor).

The cost of a transition reading system depends on the number of transitions in a store. Typically, this cost is lower than the investment that would be required to equip the whole store with overhead readers, except in the case of some small stores. In our experience, the best return on investment can be achieved when using transition readers to improve the "in-store replenishment" process, by informing store employees of which items are not on the sales floor, but still available in the stock room.

Combination with handheld reading

RFID handheld reader

Typically, retailers that use transition readers do an additional cycle count with a handheld RFID reader every two weeks

to correct the location of items missed during a scanned or allocated to the wrong location as a "stray tag". This happens less often than when a retailer uses no fixed infrastructure.

Table 1: Use cases that can be covered using transition reading

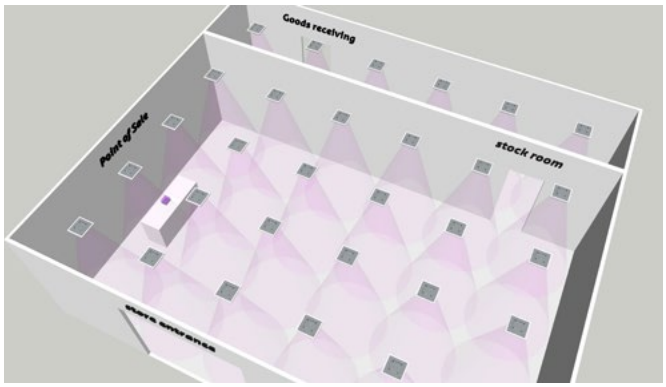
Use case	Works with transition reading
In-store replenishment	Yes, the systems knows exactly what is in the stock room and what is on the sales floor
Exact location of items	No, only determines the zone
Improve consistency of counts	Yes, by automatically receiving and moving items from zone to zone
Save cost on handheld counts	Yes, requires less handheld cycle counts

Overhead readers

When using overhead readers, approximately one reader is installed for every 50 to 100 square meters throughout the store depending on ceiling height. The readers continuously read the RFID tags in the store, updating the location of tags on an ongoing basis.

RFID overhead reader

The accuracy of an overhead reader solution depends on how tags are stored, both on the sales floor and in the stock room. This includes issues such as how many tags are stored in a certain area, how densely the products are packed, the sensitivity and size of the RFID labels, and of course how many readers are installed. When people are moving around in the store, they reflect the wireless signals, which results in greater accuracy than at night when the store is empty. Not only the accuracy itself is influenced by such factors, but also how fast this accuracy is achieved. In optimal conditions, an accuracy of 98% can be achieved within minutes, in other situations this can take several hours.



Store layout with overhead readers

The disadvantage of using overhead readers is that there can be "black spots" with limited or no reader coverage. Metallic objects between the reader and the tags can "shield" those tags from being read. This can introduce lower stock accuracies in certain categories or shelving space. A handheld reader can be used to increase stock accuracy in these locations.

Real-time data

It can take several hours before all items in the store are read. This long reading cycle makes it a challenge to figure out when an item has left the store. Therefore, true real time stock keeping can only be achieved when sales data is integrated with the data from the overhead readers.

The cost of an overhead reading system depends on the store's surface area, and is typically higher than the cost for a transition reading system.

Table 2: Use cases that can be covered with overhead reading

Use case	Works with overhead reading
In-store replenishment	Yes, the systems knows exactly what is in the stock room and on the sales floor
Exact location of items	Yes, the system is able to report with an accuracy of +/- 5m
Improve consistency of counts	Yes, by automatically receiving and moving items from zone to zone
Save cost on handheld counts	Yes, almost completely eliminates the need for handheld cycle counts

Comparison table

	Handhelds only	Transition reading	Overhead readers
Stock accuracy	98%+ after the handheld count	98%+ after the handheld count 0.2% accuracy drift per day	98%+ after a full day count
Accuracy depends on	How well the cycle count is executed	How items move from one zone to another	How items are stored, reader coverage and black spots
RFID label type required	Works with almost all RFID labels	Requires a certain performance level	Requires top-of-line performance
System cost	Very low	Medium, depends on number of transition points	High, depends on size of the store
Item localisation	Per zone, can be extended with handheld search	Per zone, can be extended with handheld search	+/- 5m accuracy
Real-time stock	Only in combination with point-of-sale data	Only in combination with point-of-sale data	Only in combination with point-of-sale data
Suitable for RFID-based EAS	No	Yes, already part of the concept	Yes, when specific readers are added for EAS

Conclusion

The magic button that provides instant stock visibility is still largely a dream, but recent RFID roll-outs have shown that a 98+% stock accuracy can quite easily be achieved with handheld, transition and overhead readers. The main difference between these types of RFID deployments lies in the stock accuracy over time, the complexity and the costs involved - and of course the use cases that can be covered.

A handheld-only solution is very cost-effective and simple to deploy, but can not cover some of the more advanced use cases described in this document. We have learned in the past few years that the best and most successful RFID deployments, are the least complex ones. Therefore, we always recommend starting with handheld-only counts in order to gain experience with RFID and get the products tagged. After this has been completed and the initial business case is fulfilled, it is time to start looking at more sophisticated use cases with a fixed infrastructure involving either transition readers or overhead readers.

While transition reading provides great benefits and requires less investment, it does not provide insight into the exact location of items and still requires handheld cycle counts. This is the main advantage of using overhead readers, but they do involve higher costs.

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