SOLUTION BRIEF

Survival Guide: From Surviving to Thriving

A Guide to RFID Mandates for Retail Suppliers

Retailers are keen on using RFID to reduce out-of-stock inventory and shrinkage due to theft, damage, expiration of perishable items, and to boost efficiency. Item-level RFID tagging directly contributes to the bottom line by reducing costs and increasing sales. RAIN RFID has become the benchmark technology for the retail industry thanks to efforts from Walmart, Macy's, Nordstrom and a host of other major retailers. All indicators point towards the continued adoption and increased use of RFID labels. As a supplier to major retailers, is your enterprise prepared? This survival guide will help your organization use RFID labels to support your customers' mandates and leverage the technology for your own bottom line.

Two Approaches to Comply with a Retailer's RFID Mandate

When faced with a customer mandate to deliver your products with RFID labels, you have two primary options:

- **Preprinted/Encoded Labels From a Service Bureau:** This option requires no major upfront investment. It means a higher initial cost per label and adds extra costs associated with managing the labels after you receive them.
- **Print On-Demand:** You will need blank RFID labels and RFID-capable printers to print and encode your labels in-house. You might also want an RFID reader or two to easily check the accuracy of the tags/labels (although it can be done with an RFID printer if needed). With your own readers, you can also begin looking at possibilities to improve your own inventory management. Long-term, you might want to bolster your in-house capabilities by adding hardware such as RFID-enabled forklifts and RFID portals to automate operations.

Why Printing RFID On-Demand Makes Good Sense

For high-mix, low-volume products, it usually makes sense to produce RFID labels on-demand. Before you get started, here is some general information about the costs to implement RFID technology.

Cost of RFID Implementation

Depending on the application, the size of the installation, the type of system and many other factors, the costs to implement RFID vary. Table 1 below provides a general overview of the costs involved, including what elements should be included and how much each element costs.

Table 1: Elements and Costs When Considering RFID

Element	Cost Range
RFID Tag/Label	Passive UHF RFID tags/labels cost around $0.10 to $0.20 each[1]. The cost per tag/label can get down as low as $0.5 (five) cents in large volumes.
RFID Handheld Reader	Most UHF handheld readers cost between $500 to $2,000[2], depending on the features in the device.
RFID Printer	The unit cost of RFID printers is approximately $3,000 to $5,000.
RFID Portal/Gate	RFID portal and gate prices vary as well. The price per portal can be as low as $5,000 for a low-cost unit such as Impinj's Xspan, including hardware, installation and configuration[3]. Most estimates for implementation of one RFID portal fall between $5,000 to $20,000[4].
RFID Antenna	Antennae are about $200 per unit and up[5].
RFID Software	RFID software vendors offer one-time installation, subscription, and/or customization. Depending on applications, the cost can be as low as $5,000 and as high as $150,000[6].
RFID Integration	RFID generates a flood of new data and data-points. Integrating this new data is usually done by a systems integrator, and the cost can vary widely based on the application and project scale.

Figure 1: A simple RFID system diagram when apply print on-demand.

Calculate the ROI for RFID Implementation

The below exercise provides a theoretical scenario to evaluate whether you should invest in RFID technology using a Service Bureau approach or investing in the equipment to support in-house, on-demand printing. Manufacturer XYZ annually ships 500,000 units of the Laptop X Series to its retailer customer. Two packing lines are dedicated to the Laptop X Series. Four personnel focus on packing, shipping and inventory management. Table 2 below summarizes costs per unit and required quantities to implement RFID labeling for the Laptop X Series. Table 3 provides the baseline assumptions to calculate potential savings and return on investment (ROI).

Table 2: Costs Per Unit and Required Quantities to Implement RFID Labels on the Laptop X Series

Item	Option	Unit Cost (USD)	Quantity	Total	Recurring Investment
Preprinted and Pre-Encoded RFID Label	Service Bureaus	$0.2	500,000	$100,000	Yes
Blank RFID Label	On-Demand	$0.1	500,000	$50,000	Yes
RFID Printers at Production Lines	On-Demand	$3,500	2	$7,000	No
RFID Handheld Readers at Production Lines and Shipping Area	Optional (included here)	$1,000	4	$4,000	No
Software: Annual Subscription	Optional (included here)	$5,000	1	$5,000	Yes

Table 3: Operation Costs

Item	Unit
Inventory level per year	50,000
Number of inventories taken per year	4
Number of personnel performing inventories	2
Number of personnel reading labels	4
Cost of reading per barcode	$0.08
Cost of reading per RFID label	$0.01
Labor cost per hour (manufacturing labor wage per hour in the U.S.[7])	$25.29

The most significant benefit of adopting RFID is to reduce labor costs in product tracking, counting, and inventory management. Based on the above assumptions, we calculated the ROI results in Table 4. If Manufacturer XYZ opts for using a Service Bureau, the cost is $100,000 per year with no savings on labor. **If Manufacturer XYZ takes the on-demand approach with in-house RFID printers, they can save up to $18,000 in labor costs and generate an ROI of 27.27%, all within the first year!**

Table 4: Comparison of ROI Between Service Bureau and On-Demand Approaches

	Unit: U.S. Dollars					
	1-Year RFID Label Cost	1-Year RFID Investment	1-Year Labor Cost Saved Switching from Barcode to RFID Tracking	Total Cost	1-Year Investment Gain	1-Year ROI
Service Bureau	$100,000	$0	$0	$100,000	$0	-100%
Print On-Demand	$50,000	$16,000	$84,000	$66,000	$18,000	27.27%

4 Considerations for Successful RFID Implementation

Retailer RFID requirements can provide a benefit to your own operation with successful implementation of the technology. Labeling your items can help you with inventory management, item-locationing, shipment accuracy, and many other internal processes.

Before getting started on your RFID investment, we recommend that you consider these four concepts—select the right RFID labels based on labels/inlays and material of the tagged item, the right RFID printers, the right RFID label software, and determine the right label design and encoding.

1 Selecting the Right RFID Label

When selecting RFID labels for a retailer mandate, five basic elements need to be evaluated including:

What Labels/Inlays Does the Mandate Specify?: Most retailer RFID mandates are based on documented inlays, label characteristics and label placement. You will need to carefully follow any instructions from your customer.

Surface and Internal Material of the Tagged Item: In general, RFID tags work well on plastic, wood and cardboard, but metal, glass and liquids can interfere with the communication between the RFID reader and tag. When searching for suitable RFID labels, you need to check whether a tag is suitable for the item that will be tagged.

Human and Machine-Readable Marks: As you need redundant identification in the event of an RFID failure, your RFID label must accommodate this additional (and usually required) information.

Size and Read-Range of the Tag: Generally the size of the tag is related to the read range: the larger the tag, the better the read range. You also need to consider the available surface area of the tagged item to select an appropriate RFID label shape and size.

Cost of RFID Label: The price of RFID tags range from about 5 cents to more than $1, which is quite a broad price range. With large-volume products, the retail industry has reduced the price of passive UHF RFID tags to a few cents in certain cases, whereas tags used in special applications are much more expensive due to special designs and functions.

Figure 2: When searching for suitable RFID labels, you need to check whether a tag is suitable for the item that will be tagged.

2 Selecting the Right RFID Printers

RFID Printers are devices that simultaneously print and encode information on RFID inlays or labels. These devices allow the user to not only print variable information on each label, they also save time by automating the manual process of encoding each tag. RFID printers have the ability to print human-readable numbers and information as well as high-quality barcodes and other graphics.

Figure 3: Depending on the application, you can select Industrial, Desktop, and Mobile RFID printers to suit your application needs.

Even for applications that do not require printing, RFID printers can add value by saving time on encoding. Industrial printers, for example, can encode up to 8 inches per second in certain operations, which generates almost 4 tags per second for 2-inch tags.

When selecting from the different types of RFID printers, it is common to evaluate needs by the printer usage and RFID tag compatibility. Depending on the application, you can select from various form factors such as Industrial, Desktop, and Mobile to suit your application needs. When it comes to evaluating RFID tag compatibility, tag frequency and construction are critical. The retail industry, for example, generally utilizes RAIN (UHF RFID) inlays embedded in standard paper or plastic labels.

3 Selecting the Right Software for RFID Encoding and RFID Labeling

RFID labels vary in size and even thickness, which means that printing without a What You See Is What You Get (WYSIWYG) software will typically result in formatting errors like incorrect spacing and alignment. Without printer software, encoding RFID tags with an RFID printer can only be done by communicating with the printer using "hard-coded" printer programming language, which can be extremely difficult to do, even for seemingly simple encodings.

Printer software provides an easy-to-use, visual interface that is the only accurate way to easily see what your RFID labels will look like before they are printed. RFID printer software will have different functionalities depending on which one you choose. The following items are the most important functionalities for RFID printing software:

- **Supports RFID Encoding:** RFID encoding can involve different "numbering systems" (formatting of the data to encode) and options. You should ensure that your software supports your needed numbering system. Serialization is also generally required, so this should be supported as well.
- **Enables Label Design:** For applications which require human- and machine-readable marks, your software should support creating, managing, and printing barcodes like UPC/EAN/JAN or SSCC. Ideally, these printed elements are linked to your encoding.
- **Easy-To-Use Interface:** A drag-and-drop interface with different object types makes the design process very easy.

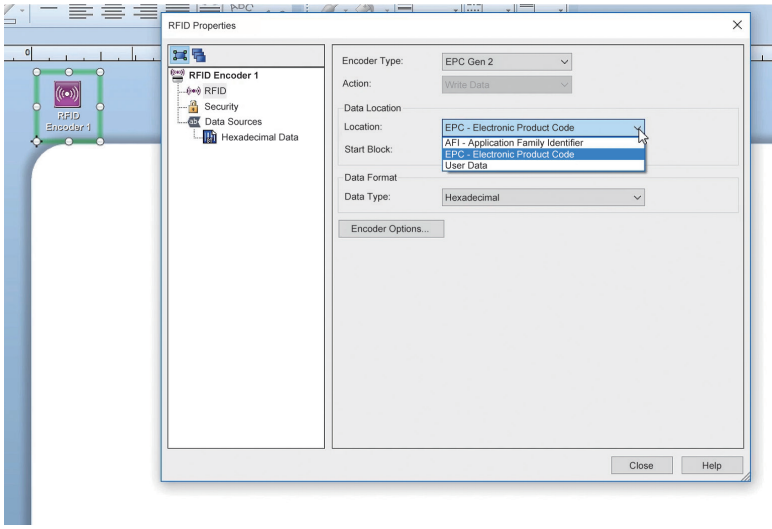

Figure 4: Printer software provides an easy-to-use, visual interface that is the only accurate way to easily see what your RFID labels will look like before they are printed.

4 Determine RFID Label Design and Encoding

RFID is used to uniquely identify items. When a tag is assigned to an asset, person, or item, each tag ID must be unique. For example, if two identical laptops are on a lot, each must have a tag with a unique EPC/UII number so they can be differentiated from one another.

Figure 5: For retail applications, generating an EPC number based on GS1 standards is ideal.

For retail applications, generating an EPC number based on GS1 standards is ideal. GS1 has devised specifications called Encoding Schemes in order for RAIN RFID to be globally compatible across trading partners. These schemes explain how to encode the EPC number depending on the application and industry. Each scheme defines the data elements to encode, in which sequence, and the bits to use. Different segments that form the EPC number generally include the Header, Filter Value, the GS1 Company Prefix, Item Reference, and Serial Number. The most commonly used Encoding Scheme in the retail industry is SGTIN-96 which stands for Serialized Global Trade Item Number, 96-bits.

Label design is usually part of the requirements to follow a retailer's request. If label design is not part of the mandate, it is still critical because you want to avoid printing barcodes and other critical information on your chip or inlay ridge.

Our Commitment to Help You Excel

RFID is emerging as a high-speed and low-cost method for tracking assets, especially for enterprises managing large product inventories and valuable property. The use of RFID spans multiple industries and applications, from retail to healthcare, manufacturing, shipping and logistics, and more.

TSC Printronix Auto ID works closely with multiple standards organizations, such as GS1, ISO/IEC, AIM, and the RAIN Alliance to ensure that our RFID printers correctly and adequately support the various encoding standards. These standards are evolving rapidly, so it is important to select a printer partner who is committed to supporting the current standards as they evolve.

We have an RFID family of printers that encompasses high performance enterprise designs, functional compact industrial models, lower-volume desktop, mobile and print engine models. The high-speed, advanced TSC Printronix Auto ID RFID printer options allow users to easily tag their inventory and locate equipment in real-time.

We also have the industry expertise and production capabilities to provide the RFID labels your customers need. Not only are we experts in RFID printers and encoders, but we also sell labels through trade only. Our label experts ensure that you receive the proper labels and RFID technology for your application. All our RAIN RFID labels are guaranteed to provide consistent, optimal performance with TSC Printronix Auto ID RFID printers, having been tested and certified in our RFID tag and label validation lab. For further information about our RFID labeling solutions, please visit our website or contact your local sales representative.

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