Introduction: Exploring RAIN RFID in Label Production

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Mike Weinhammer, Global Product Manager RFID Supplies

ZEBRA TECHNOLOGIES

Agenda

- RFID Basics
- Where is RFID used?
- RFID Ecosystem
- The Role of the Converter

Types of RFID (**R**adio **F**requency **Id**entification)

Low Frequency
125 kHz

High Frequency
13.56 MHz

Passive
Ultra High Frequency
860 - 920 MHz
"RAIN RFID"

Active
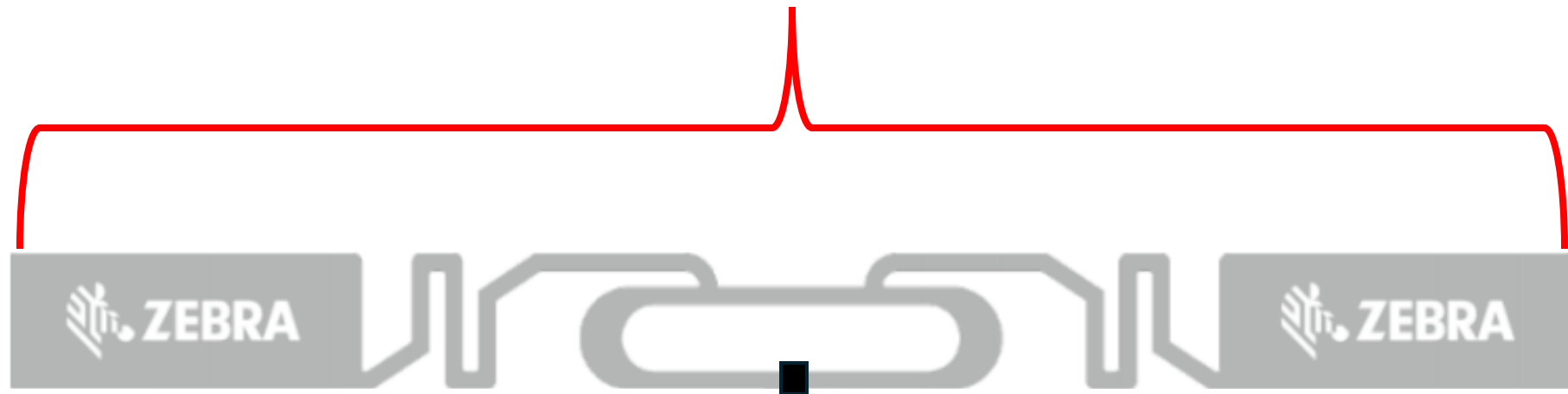**Ultra High Frequency**
860 - 920 MHz

How Does RFID Work?

Inlay Elements

Antenna

Shape determines read performance

Chip or IC

Contains data

Technology Comparison

BARCODE

One to One
Scan one item at a time

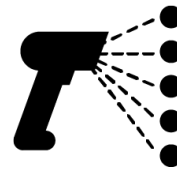**Line-of-Sight**
Scan items within view

Read Only
Once printed, can't change,
no opportunity to update
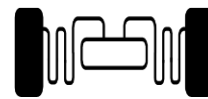
Easy to Copy
Take a picture, print and rescan

RFID

One to Many
Scan a large number of tags simultaneously

Non-Line-of-Sight
Scan items inside a box or hidden from view

Read & Write
Easily update printed tags with new information

Difficult to Copy
RFID chip contains unique identifying number

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WORKSHOP
RFID IN LABELS AND PACKAGE PRINTING

RAIN RFID Market Growth Drivers

~45B UHF RFID tags sold in 2023 (+32%)

Retail inventory accuracy is still the top use case

- ~75% of tag volume is for retail item-level
- Category expansion beyond apparel
- Loss prevention and self-checkout use cases emerging

Supply Chain and Logistics applications accelerating

- UPS CEO - April 2024: "We are moving from a scanning network to a sensing network...installing RFID readers in over 40,000 U.S. package cards"...realizing a 67% misload reduction since SPSF go-live.
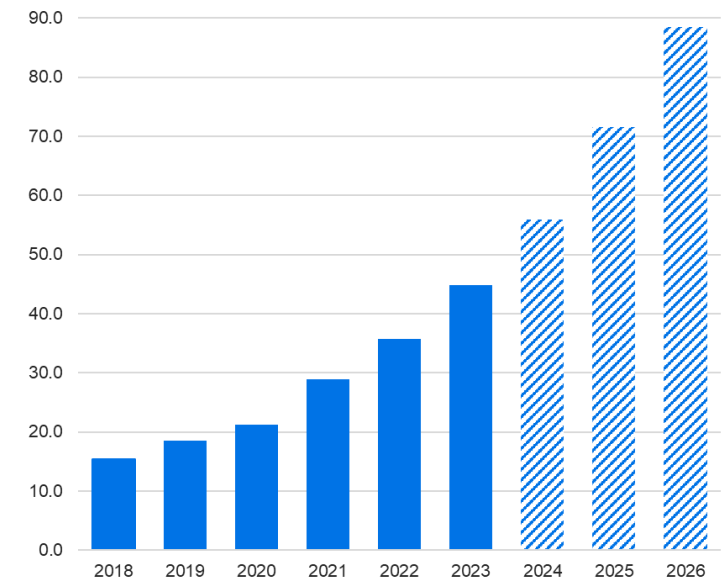
Food Traceability, Pharma, and Automotive next

Collision of use-cases and Tag Data Standards

- Threat to scale tag volumes to 100s of Billions of tags/year

Tag IC Shipments in Billions

Source: VDC Research and RAIN RFID Alliance

RFID Use Cases

Retail

Boosts sales, reduces out of stocks and improves productivity

- Inventory Visibility
- Order Fulfillment
- Customer Engagement
- Asset Tracking
- Authentication
- Loss Prevention

Healthcare

Increases efficiency, reduces costs and elevates patient care

- Specimen, Laboratory and Pharmacy Labeling
- DSCSA Compliance
- Records Management
- Asset Tracking
- Patient Identification

Manufacturing

Improves asset visibility, data quality and inventory management

- Work-In-Process
- Product Identification
- Shipment Accuracy
- Automated Receiving
- Asset Tracking
- Product Lifecycle

T&L

Enables smarter decisions with real-time tracking

- Distribution, Shipping and Receiving
- Warehouse Operations (Case, Pallet and Cross-Docking Applications)
- Asset Tracking
- Baggage Tagging

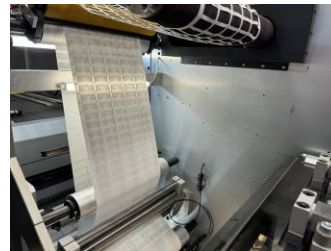Source: Zebra Technologies

RAIN RFID Ecosystem

The Converter's Role

- Understand the Application
  - Ask all the label questions + RFID specific ones
  - Be aware of metal or liquids
  - Any Specs?
- Advise on Best Practices
- Select materials and inlays that meet the use case
- Focus on Inlay Quality during Converting
  - Control static
  - Read inlays
  - Partner with capable suppliers

M – Memory
R – Read Range

P – Printer
R – Resistance
E – Environment
S – Surface
S – Size

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LABEL ACADEMY WORKSHOP
RFID IN LABELS AND PACKAGE PRINTING

Summary

- RAIN RFID is a **proven**, **cost-effective** technology, providing its users with significant improvements to their inventory accuracy

- As use cases **expand** and the **technology progresses**, converters will be asked to put RFID inlays into **all** label and tag products

- Understanding **RFID technology** and focusing on **quality** will be a key differentiator for converters looking to build RFID labels

Thank You