

RFID from A to Z: Everything You Need to Know

RFID - Advanced Training

October 11-14, 2021



Agenda

- Key Markets & Trends
- Effects of Material and Direction
- Encoding & Chip Capabilities
- RFID Delivery Formats
- Dry Inlay Conversion
- Wet Inlay Conversion
- Converting Tips
- RFID Applications



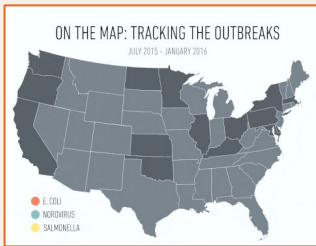
Frank Smits

Business Development
Manager

RFID Europe, Avery Dennison

Key Markets & Trends

Food Key Trends



Food safety



Consumer experience



Traceability



Labor efficiency



Sustainability / food waste



Legislation

Logistics & Transportation Key Trends



Shipment verification / cross dock operation



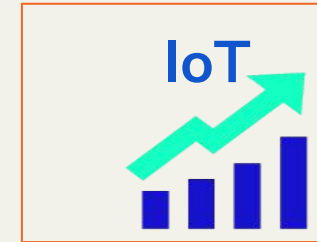
Omnichannel / inventory accuracy



Pallet level to item management



Distribution efficiency (inbound, pick / pack, outbound, returns)



Supply chain automation, labour efficiency & closing the IoT GAP

Key Markets & Trends

Pharmaceutical & Healthcare Key Trends



Inventory management



Patient safety & connected consumer



Brand protection & authentication



Labor & operational efficiency

Automotive Key Trends



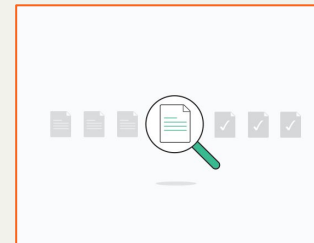
Part tracking, traceability & process automation



Customer safety



Authentication & anti-counterfeiting

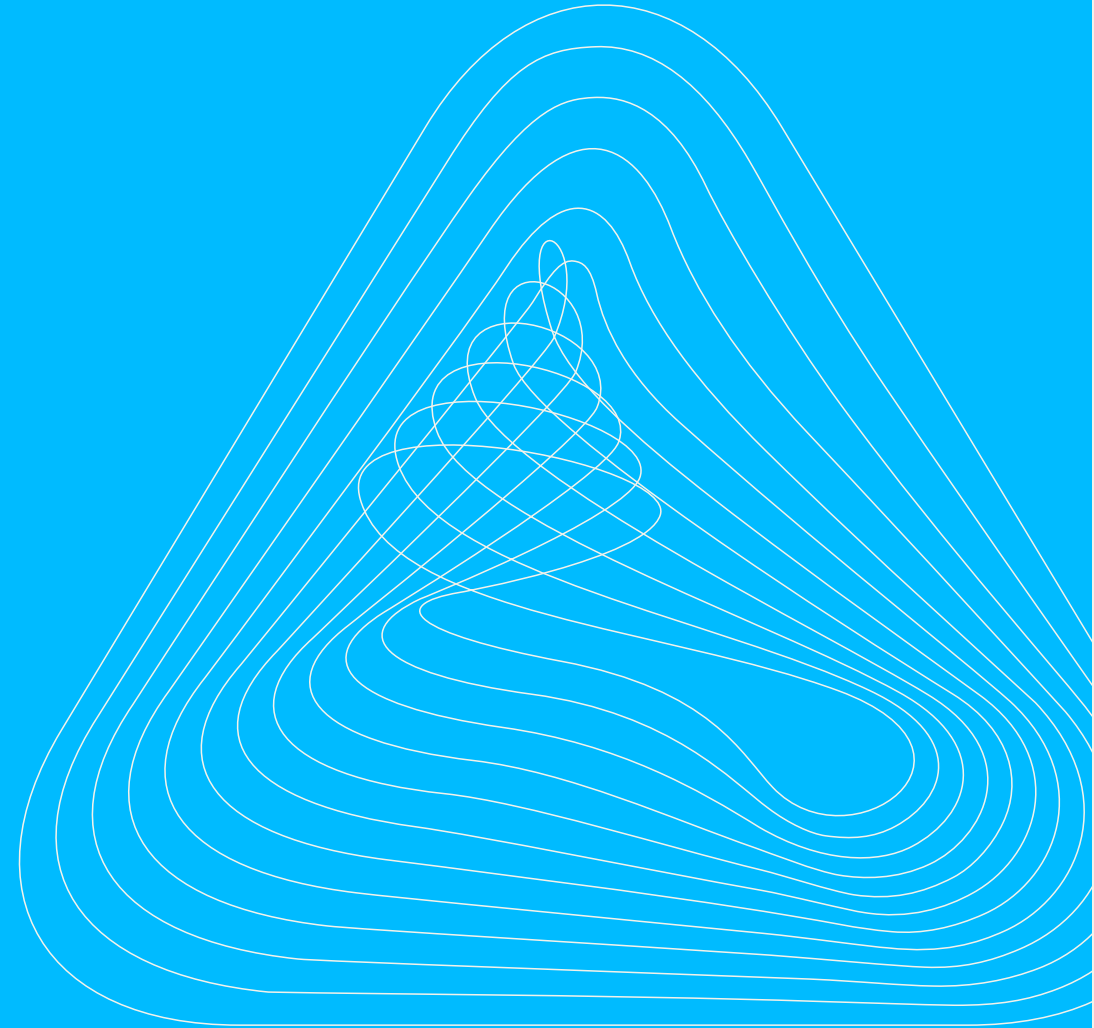


Brand protection



Labor & operations efficiency

Effects of Material and Direction



Item Material and Directionality for UHF



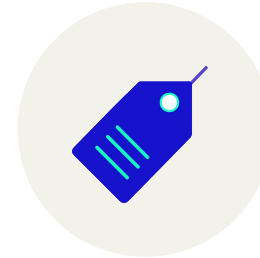
Metal: Conductive

- Tag applied to metal cannot respond unless an 'on-metal' tag is used
- Tag near metal detunes / shift performance
- Metal blocks / shields RFID signals from passing through



Liquid, Glass, Rubber: High Dielectrics

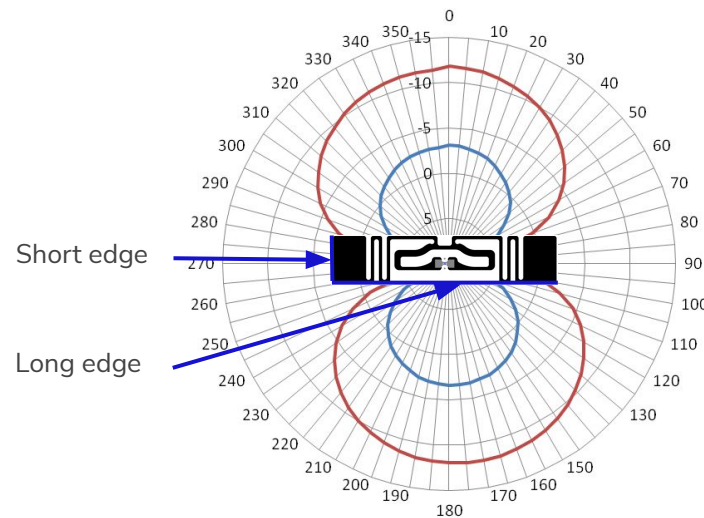
- High dielectric effect detunes tag / shifts performance
- Insulator effect: lossy. Greatly reduces signal passing through



Tag Orientation Performance

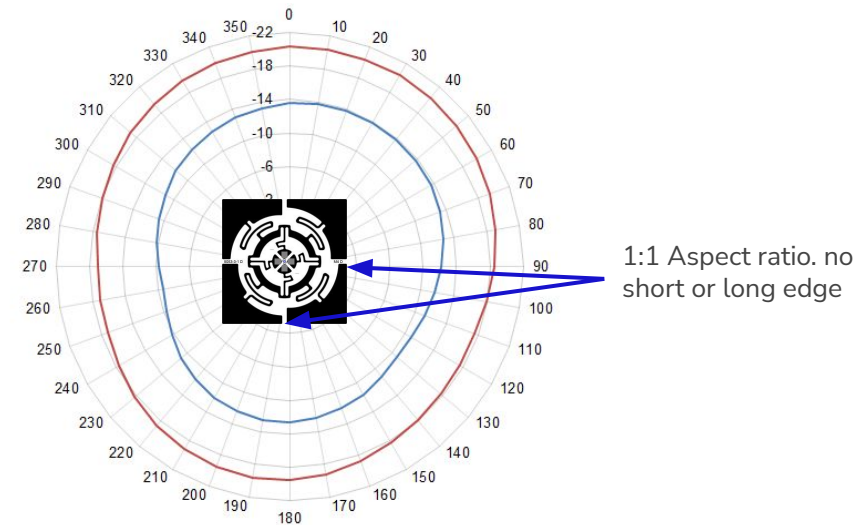
- Linear Tags - most tags have strong response from the long edge
- Dual Directional Tags (or Omni Directional Tags) - same performance from each edge, useful for RTLS
- Direction Insensitive Tags - short edge designed to have better than normal response

Directionality for UHF: Tag Orientation Performance



Linear tags

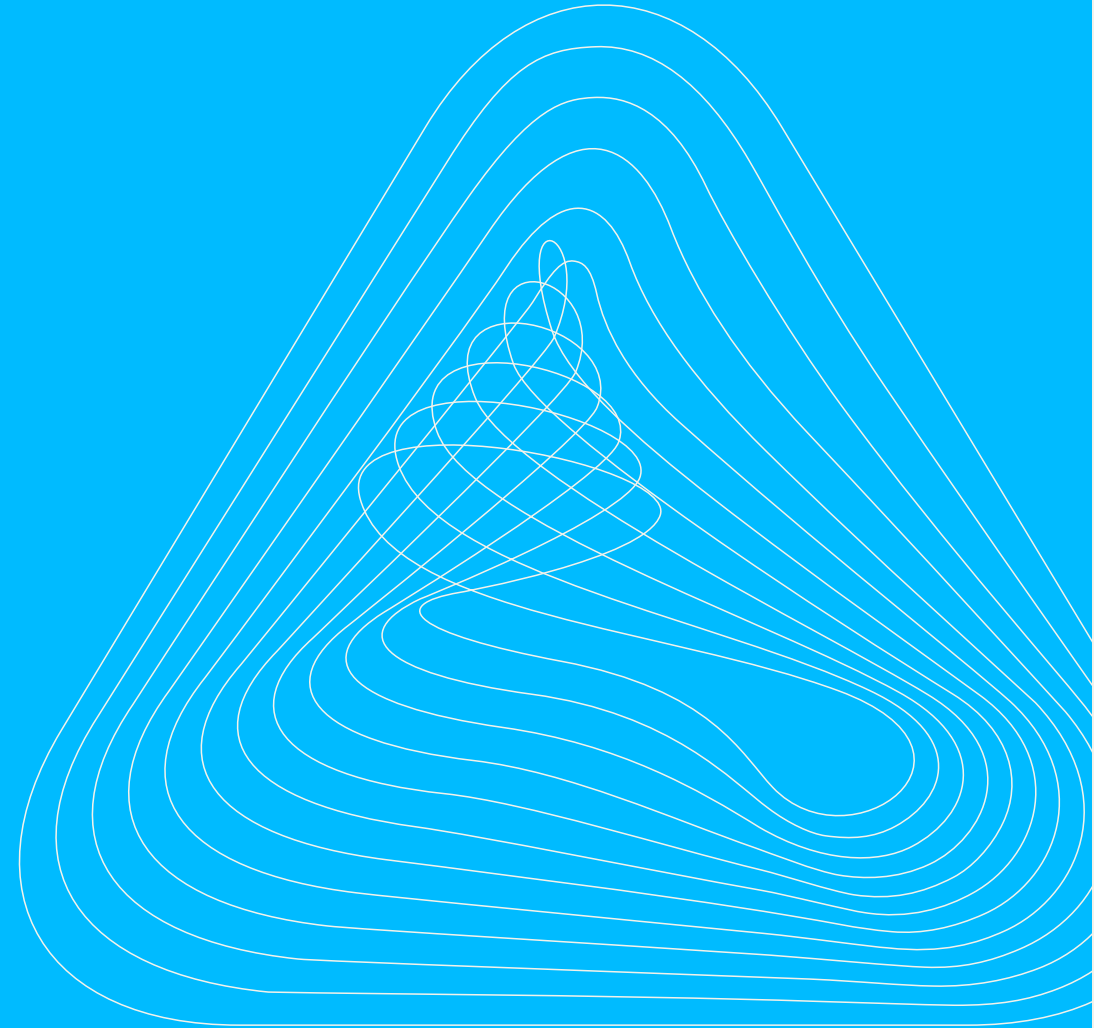
- Most tags have a strong response from the long edge
- Readers facing the long edge will read from further away, than when they face the short edge



Dual directional tags

- Dual Directional tags have strong response from the long edge
- Readers can read the tag from a similar distance from every side of the tag

Encoding & Chip Capabilities



What's Encoded in a Retail Tag?

SGTIN = GTIN ("Global Trade Item" UPC or EAN 13)
+ Unique Lot Number + Serial Number

Uniti Watermelon Chunks		Sell By Oct 25, 20	Batch/Lot 1022 Serial 5 Packed Oct 23, 20
Net Wt/lb 1.5	Price/lb 2.95	Total Price 4.43	
	(01) 0 0002802 82121 0 (15) 181024 (10) 1022 (21) 005	Uniti Cafe 170 Monarch Lane Miamisburg, OH 45342	Processed USA
urn:epc:tag:sgtin-96:0.0002802.08212110220010		Store below 40F	
Avery Dennison Uniti Foods LLF11968234 www.averydennison.com			

Example:
SGTIN (hexadecimal) 3014002BC8503240009BF1EF

0028028	82121	1022005
Company Prefix	Item Number	Lot Number + Serial

What's Encoded in a Retail Tag?

Inclusion of date code enables date enriched inventory scanning



Use By December 31 2019:
Code 12.31.9

EAN 13
5060279809402



GTIN

Date code

Serial number

302DE295FCC0EB1CAF4ACFF

SGTIN-96

urn:epc:id:sgtin:506027980.0940.0084.123199999999

● Company prefix ● Item preference ● EAN13

UHF Chip Capabilities

	EPC	User Memory	Additional Features	Example Chips	Type of Applications
Basic Memory	96 bits 128 bits	0 or 64 bits 0 or 32 bits	Simple Counter Anti-Tamper Range Reduction	Impinj M730/750 Impinj Monza R6/R6-P Impinj Monza 4D NXP UCODE 7 NXP UCODE 8	Item-Level Apparel Logistics WIP Majority of Applications
Additional Memory	128 bits 256 bits 496 bits	512 bits 480 bits 128 bits	Public / Private Range Reduction	Impinj R6-B Impinj Monza 4i/4QT NXP G2iM NXP UCODE 7XM	Industrial Applications WIP
Security High Memory	448 bits 224 bits	2 kbits 3 kbits	Untraceable Digital Signature AES-128 bit	NXP UCODE DNA	Security Applications Brand Authentication

Consider Inlay Data Sheets and Application Notes

AD-321 FCC Gen2 UHF RFID inlay

Avery Dennison is pleased to introduce AD-321, a versatile, Gen2 UHF RFID inlay suitable for a wide variety of RFID tagging applications. The global design is optimized for outstanding performance in the FCC frequency band (902-928 MHz) and is available in two chip formats: Monza R6 and Monza R6-P.

Recommended applications



Apparel

Avery Dennison has been a driving force in the apparel and footwear industry's adoption of RFID since 2004. When contemplating automation-based solutions for the Retail Apparel industry, for many companies, it is not a matter of 'why', but 'when' they will adopt this proven technology. Quickly and efficiently track clothing and other item-level retail items throughout the global supply chain: from source to store. Offering both automation and brand protection benefits, AD-321 is just one of many Avery Dennison inlay solutions to consider for your next apparel application.



Pharmaceutical and healthcare

The healthcare industry is always looking for a better way to monitor its pharmaceuticals throughout the supply chain to ensure patient safety and wellbeing. Counterfeit drugs, expired inventory and product recalls are some of the toughest challenges facing pharmaceutical companies today. AD-321 can help you with some of your frustrations. The 41.4 x 16mm antenna will fit inside a 1.75" x .75" label: a great fit for prescription bottles, glass vials, and other small to medium sized medical packages. Monza R6-P® chip is recommended for sensitive applications which require password protection.



Supply chain, inventory and logistics

Tracking inventory throughout the global supply chain can be a harrowing task; prompting companies across many industries to adopt RFID-based solutions for improved efficiencies and end-to-end visibility of valuable assets. These results can be attainable with the help of Avery Dennison's AD-321 inlay. Available in both Monza® R6 and R6-P chip formats, the latter version is loaded with additional features including "kill" and access password protection to increase user privacy.

Check expected performance

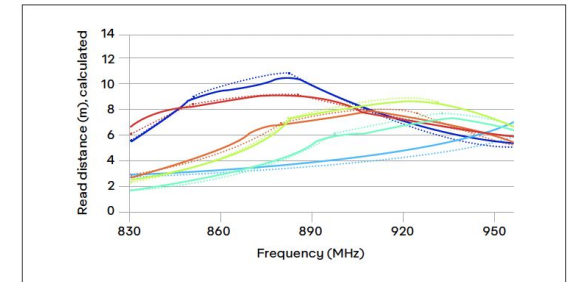
Look for description similar to your use case: item or material type

AD-321 FCC Gen2 UHF RFID inlay

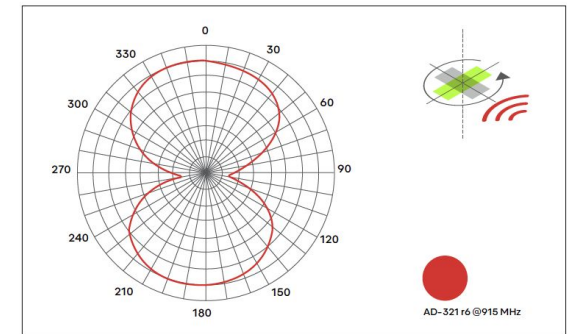
AD-321 delivers exceptional performance across a wide range of dielectrics

Tag power sensitivity Read distance (meters)

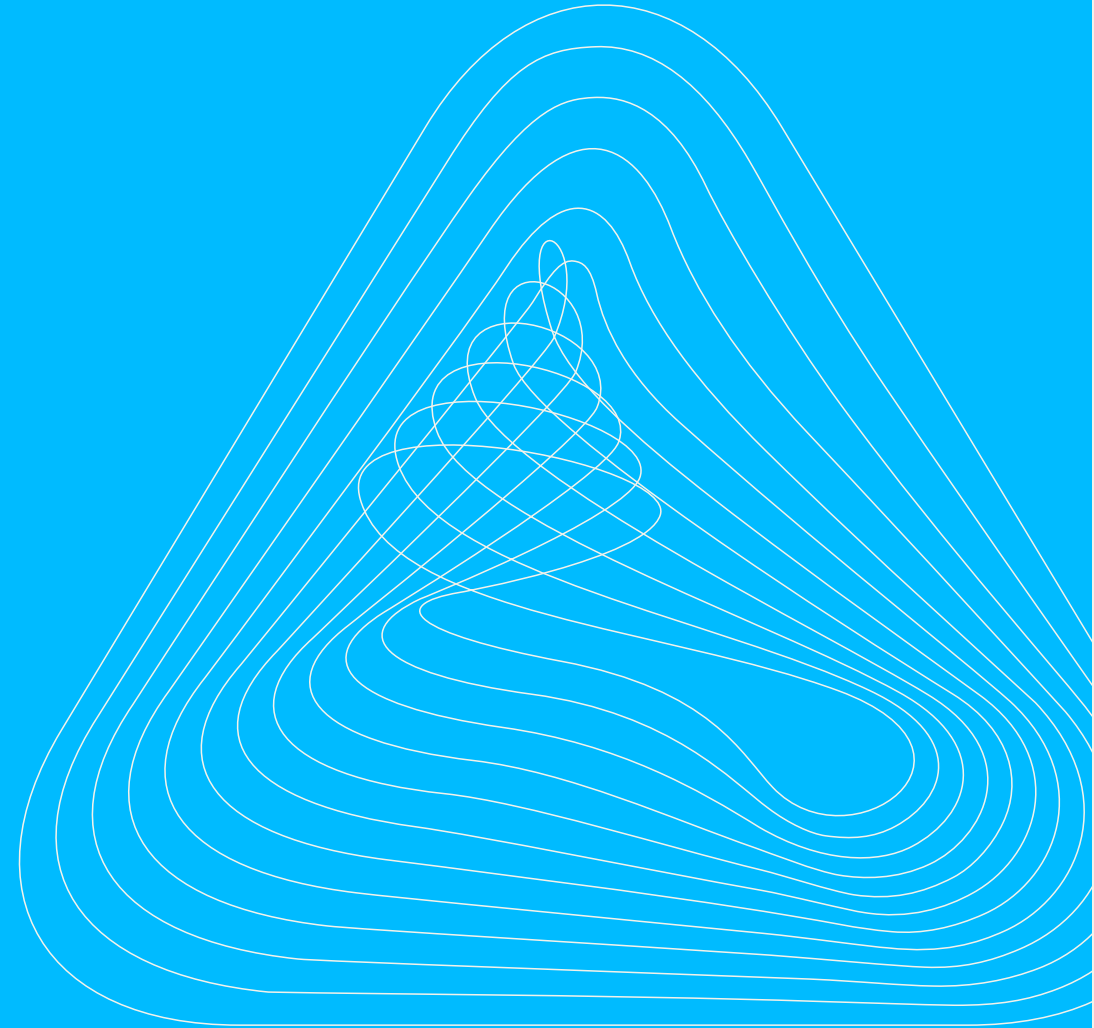
- AD-321 r6 cardstock
- AD-321 r6 2 t-shirts
- AD-321 r6 2 denim
- AD-321 r6 2 polybags
- AD-321 r6 PTFE plastic
- AD-321 r6 glass
- AD-321 r6-P cardstock
- AD-321 r6-P 2 t-shirts
- AD-321 r6-P 2 denim
- AD-321 r6-P 2 polybags
- AD-321 r6-P PTFE plastic
- AD-321 r6-P glass



Tag orientation sensitivity Read distance by angle



RFID Delivery Formats

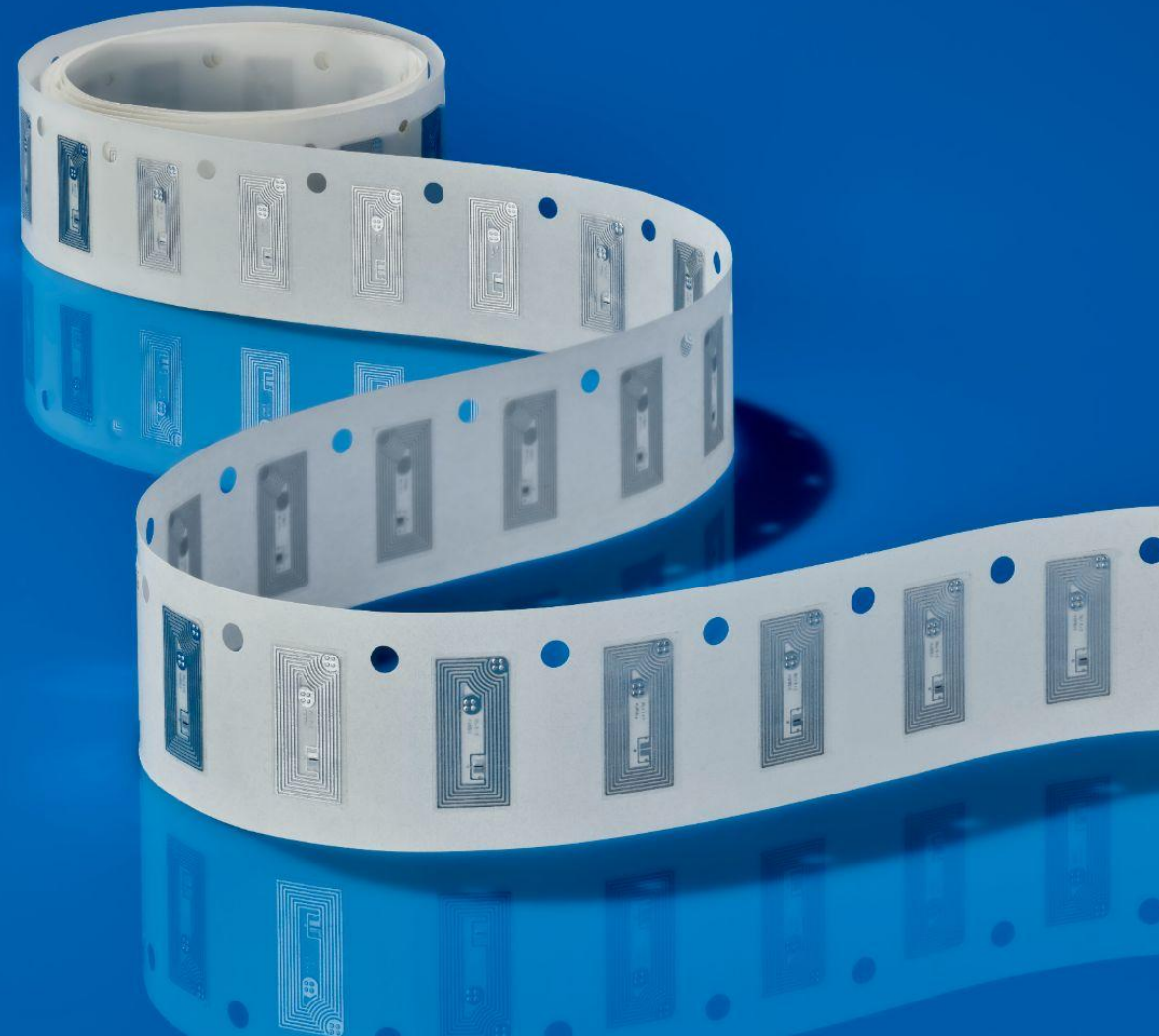


Converting RFID

Many converters can continue working with their preferred conversion equipment manufacturer to identify an efficient and scalable RFID solution.

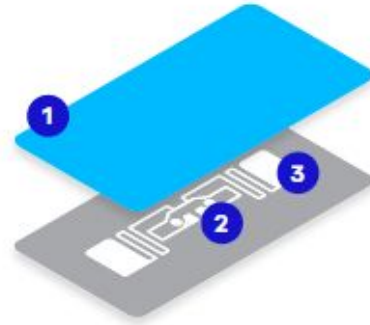
In addition, an experienced inlay supplier can also help identify important components and functions needed to deliver RFID inlays and tags for specific end uses. However, you must decide what delivery format to convert.

There are three main types of inlay delivery formats: dry, wet and label/sticker. Your equipment capabilities and long term goals in the RFID market will influence which one you'll focus on.



Which format to convert?

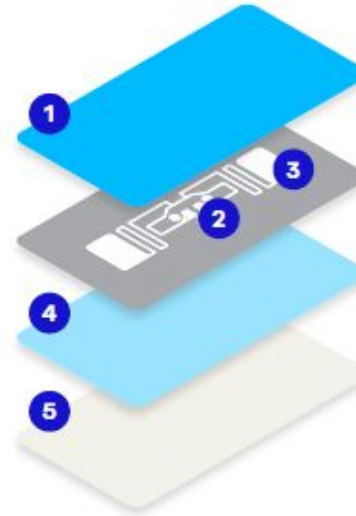
Dry inlay



1. Inlay carrier
2. Chip
3. Antenna

- Paper, film or fabric
- No adhesive
- Unconverted format
- Tight pitch
- Compatible with transfer tapes and gum twins, which add adhesive properties. See our [Custom Label Constructions guide](#) for more info.

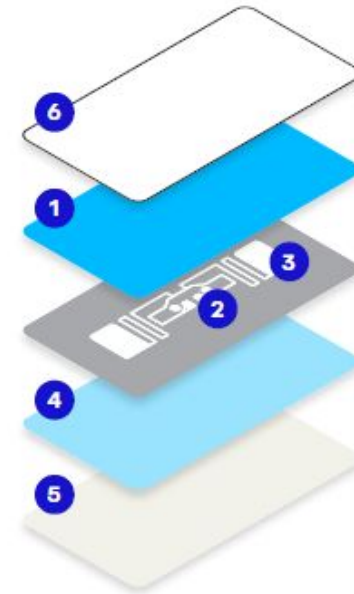
Wet inlay



1. Inlay carrier
2. Chip
3. Antenna
4. Pressure sensitive adhesive
5. Liner

- Paper or film
- Adhesive and liner
- Not intended for printing
- Tight pitch
- Die cut

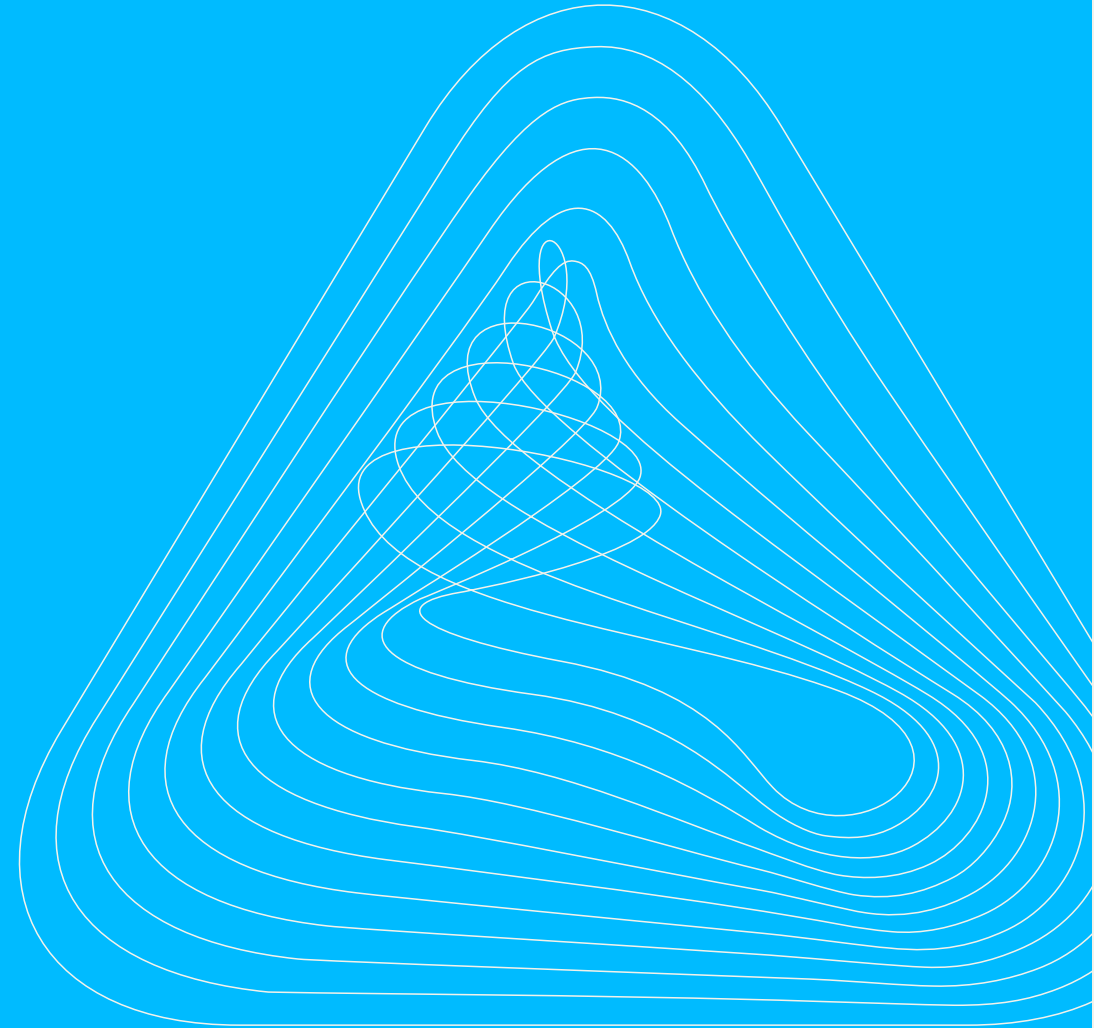
Label/sticker inlay



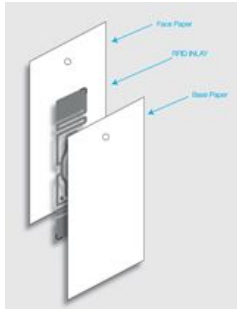
1. Inlay carrier
2. Chip
3. Antenna
4. Pressure sensitive adhesive
5. Liner
6. Printable facestock

- Paper or film facestock
- Adhesive and liner
- Printable label
- Die cut
- Facestock can be with our sustainable product Smartface™

Dry Inlay Conversion

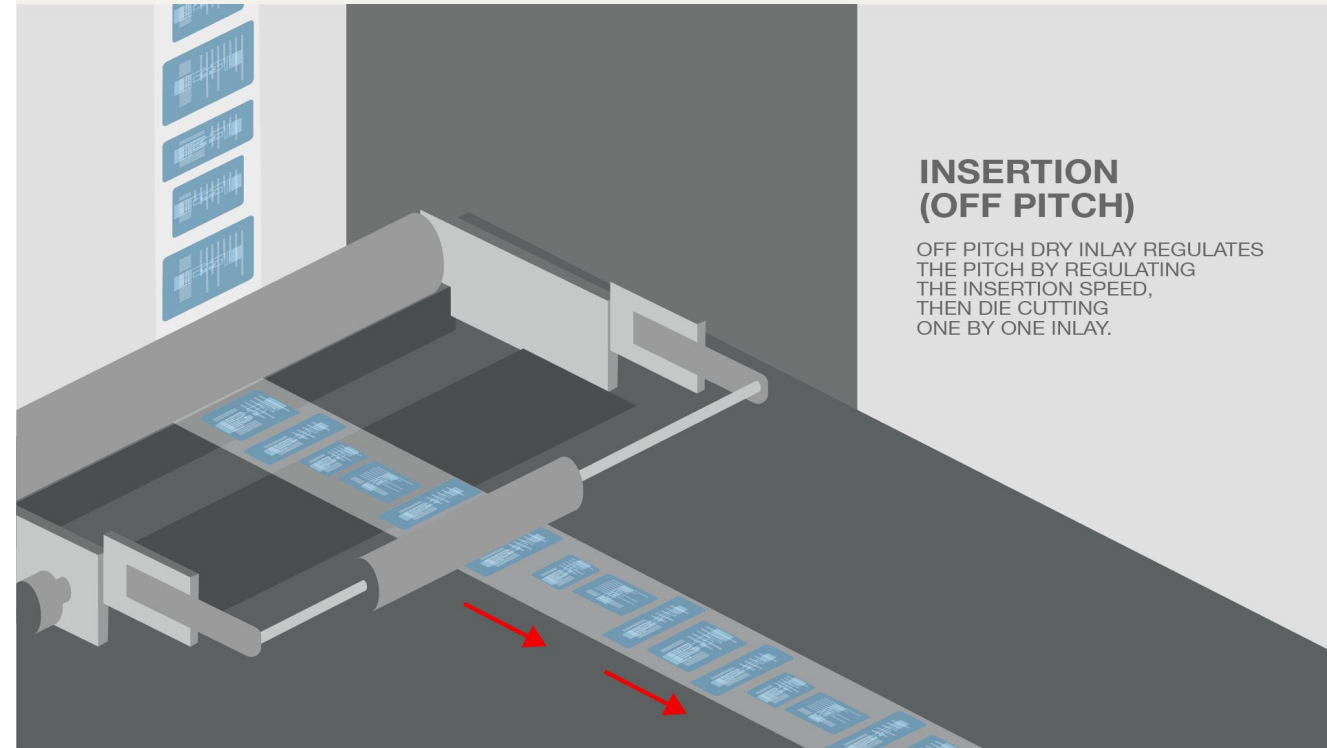


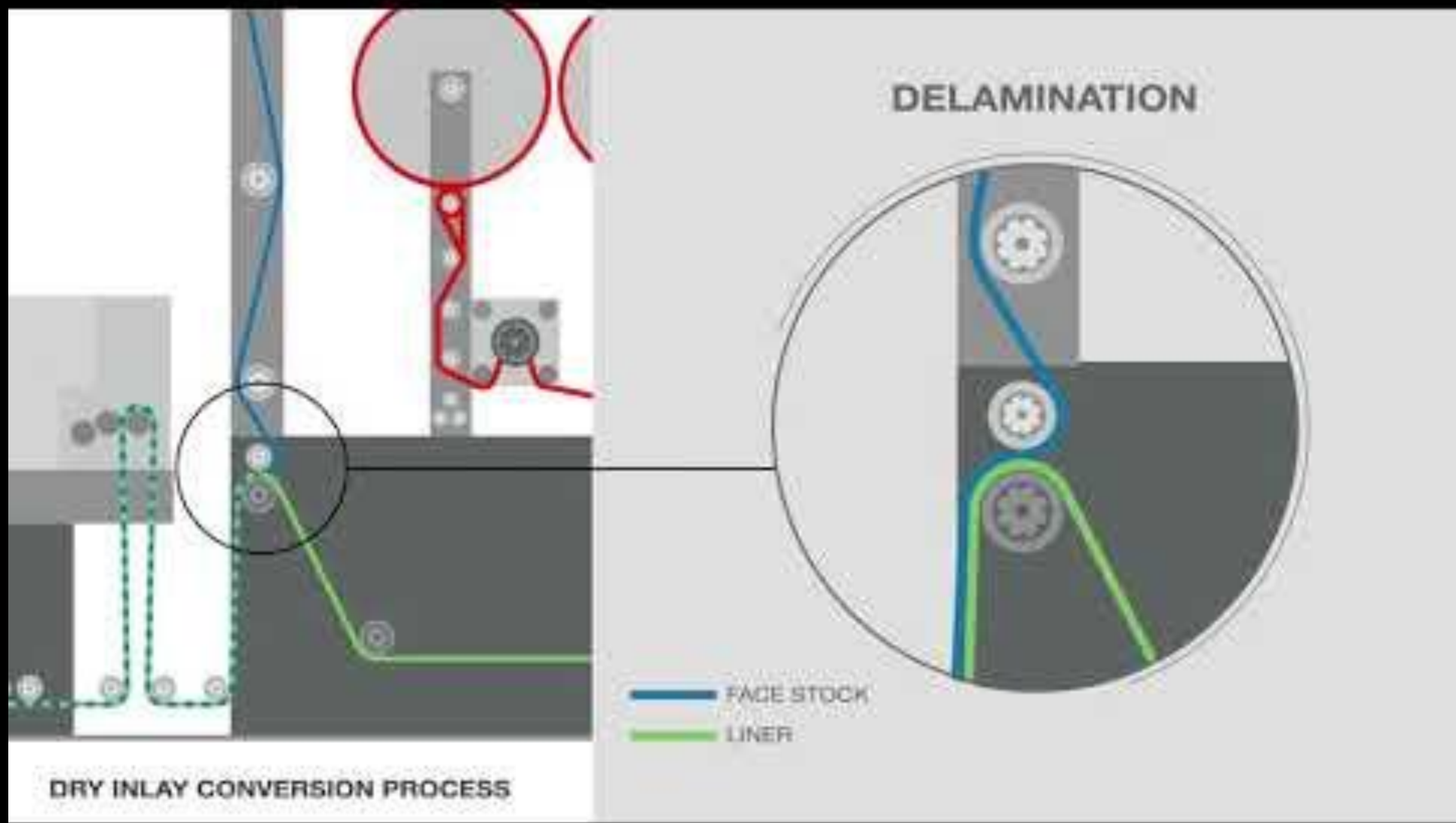
Which Inlay to Convert?



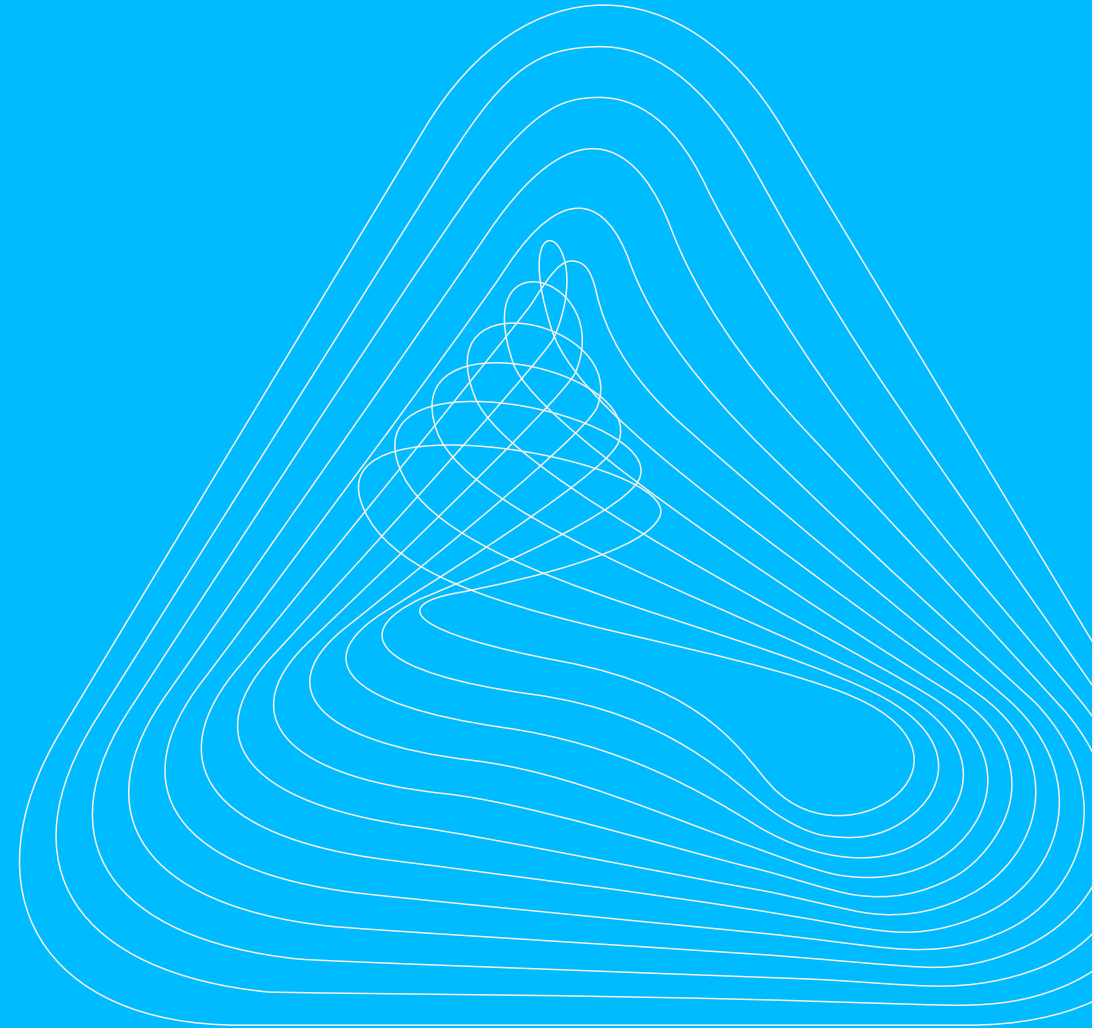
Dry Inlay

- RFID inlay material, requires adhesive and cutting at point of application
- Aimed at mid-high volume
- Requires dedicated island placement equipment
- More expensive to incorporate into current converting / production operation
- Web based applications
- Typically 1up
- Multi up adds complexity

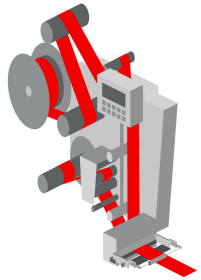




Wet Inlay Conversion



Which Inlay to Convert?

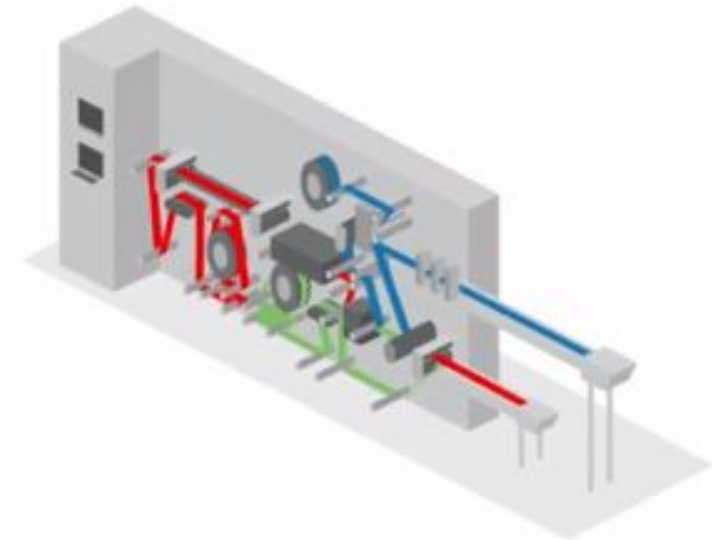


Wet Inlays

- Self adhesive die cut RFID inlay supplied on a liner / could also be a plain label
- Ideal for short-mid run volume
- Simple process to incorporate into current converting / production operation
- Highly flexible / fast change over process
- Typically 1up - Can be multi up
- Ideal for web or sheet / single piece application
- RFID inlays edited to meet your processing / customer yield needs.

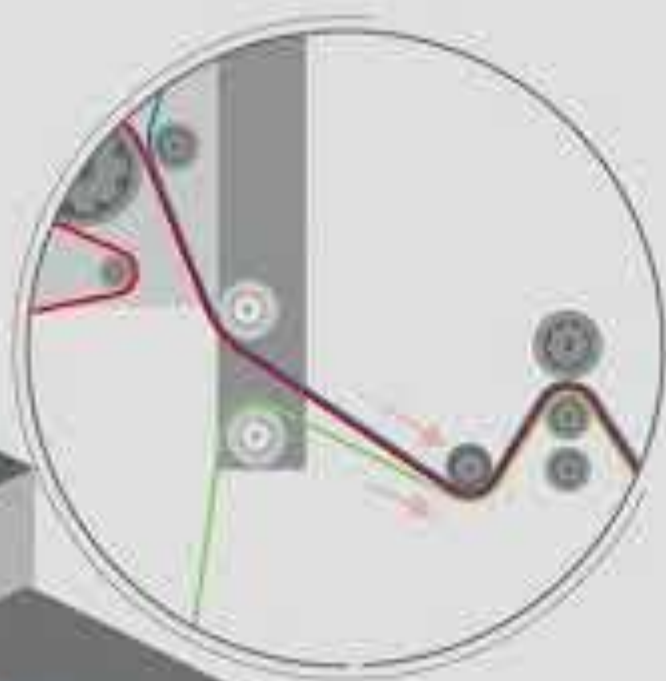
A simple label applicator can be incorporated on to current platform.
Low cost entry to the RFID market.

Add either via a delamination / relamination process for web applications or into a sheet fed / single piece process to apply onto products.



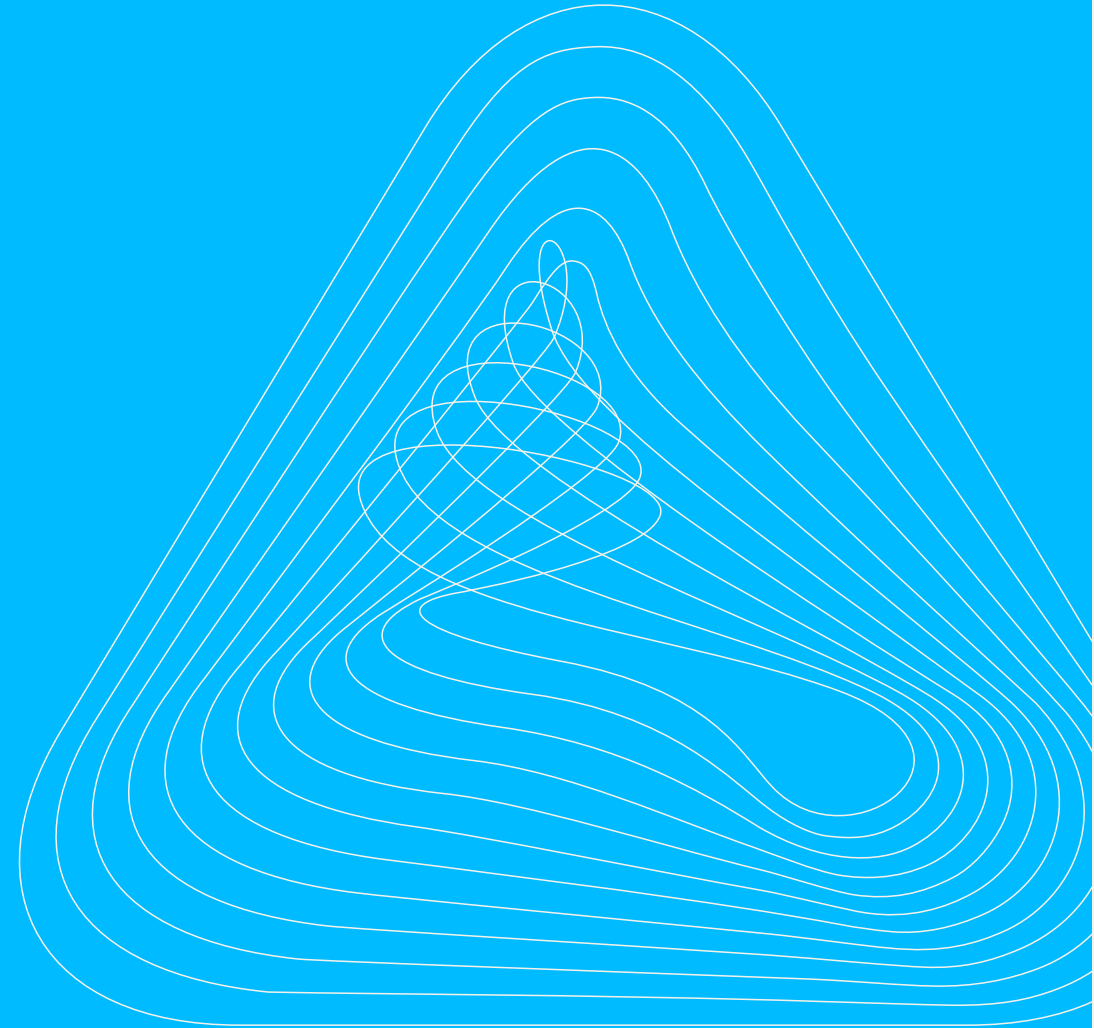
WET INLAY CONVERSION PROCESS

LAMINATION



WET INLAY CONVERSION PROCESS

Converting Tips



Converting Tips: Chip Protection

RFID inlays / tags are electronic devices must be handled accordingly

RFID Work Environment

- Floors with antistatic layer coating
- Proper air-conditioning and air humidity
- ESD (Electro-Static Discharge) protection for employees

Handling

- Avoid touching IC (chip) side of an inlay
- Avoid laying rolls on top of inlays; always keep inlay reels on their side
- Roll inspection prior to converting

Packing

- Packaging material must not create static electricity when handled
- Finish and pack directly after inserting
- In general do not stack RFID products on top of each other

Converting Tips: Encoding and Testing

Encoding

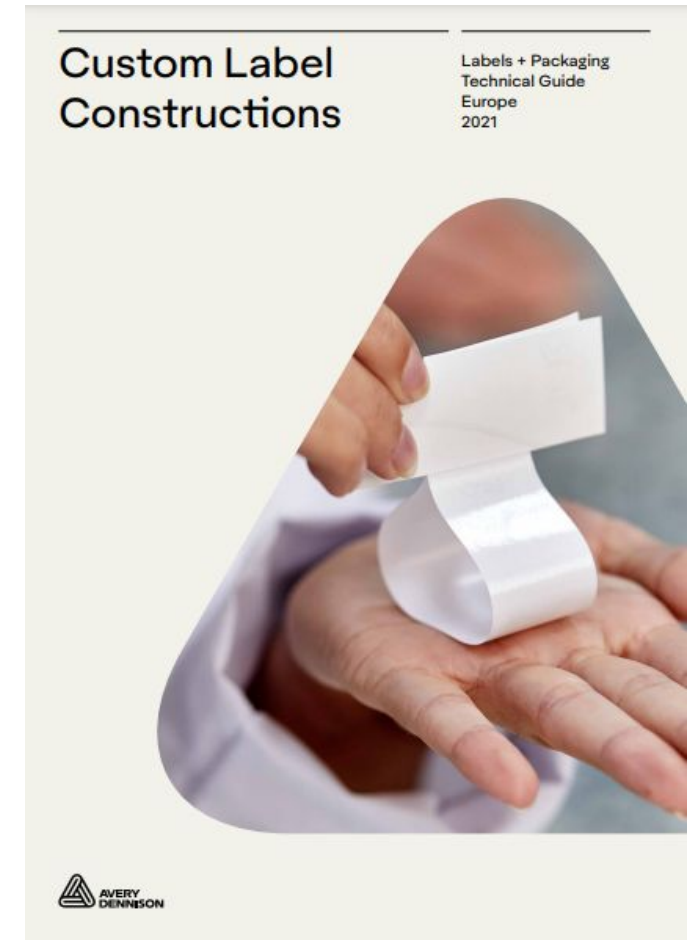
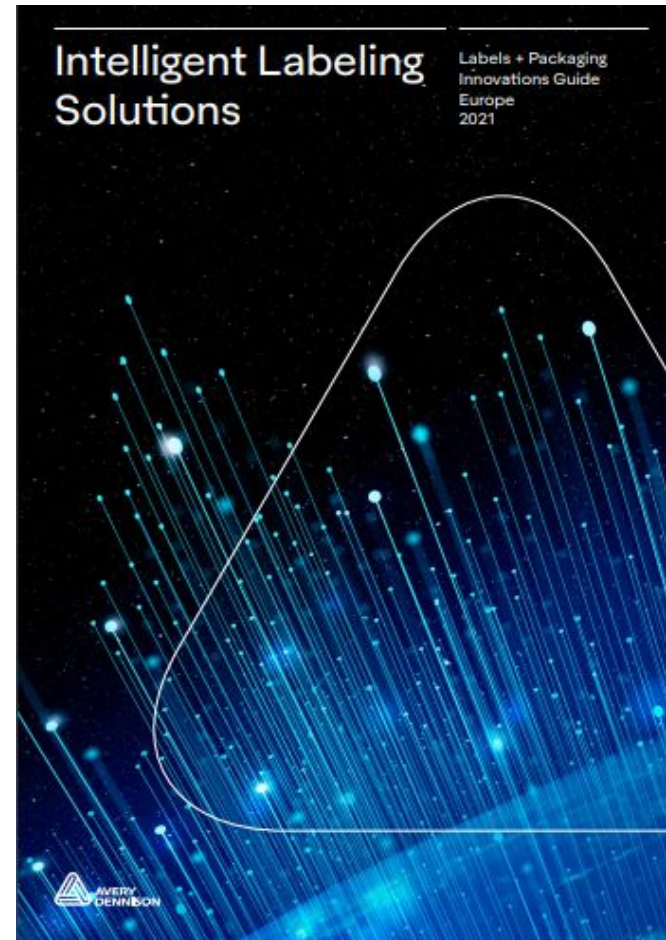
- Encoding the IC can be done during the imprinting process or in a separate unit
- Avoid laser printers due to high corona and sharp bending around small diameter rollers unless machine has been designed for RFID printing
- Avoid variable information printers with high nip pressure if rollers are not grooved



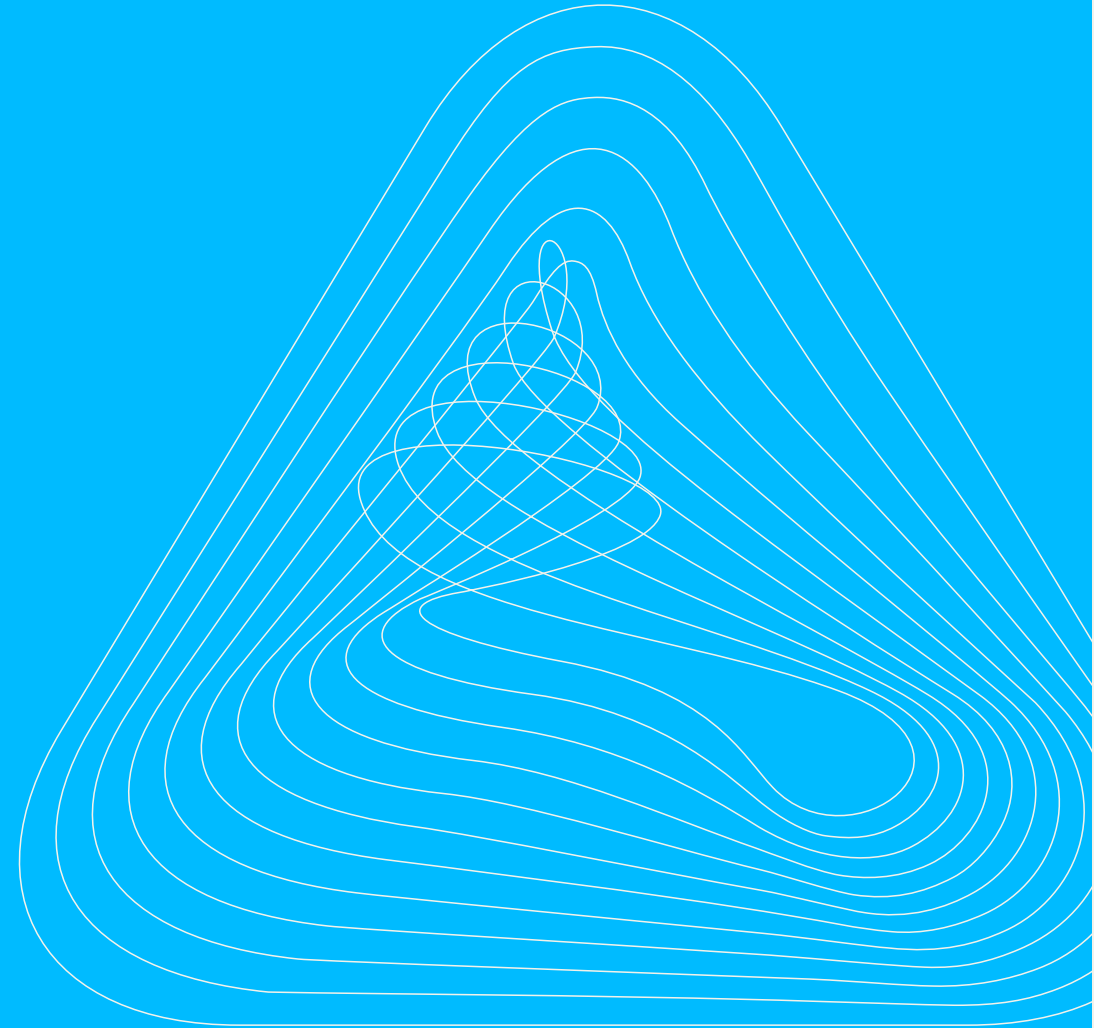
Testing

- It is recommended to have two inline testing points: one before and one after converting
- Yield loss due to mechanical stress, ESD, etc. can be calculated using these points
- The test system needs to ensure that only the desired inlay is read one at a time
- Failed inlays/tags can be marked or replaced depending on customer service level agreements

Intelligent Labeling + Custom Label Constructions Guide



RFID Application Cases



Case study UHF: Inventory Management Medline Surgical

Medline is a leading global company providing quality medical and surgical supplies in North America, Europe, Asia, and the Middle East. They partnered with Dipole to find the right RFID solution for their inventory software MedStock

Each surgical kit contains an RFID tag with the item number, lot number and expiration date. An RFID reader installed at the warehouse entrance tracks the inputs and outputs of the equipment providing inventory control in real time. With this hands-free solution, manual stock counting or barcode scanning is gone.

RFID from A to Z - October 2021

Benefits



Cost savings



Precise analysis of the procedure per patient



Improved picking time and faster preparation for surgery



Increase staff satisfaction



Reduced human error



Easier consumption reporting and efficient purchasing





RFID



Logistics & Transportation

Returnable Transport Items (RTIs)

Utilized in all industries that rely on a supply chain — it provides a method for moving materials, parts, tools, and finished goods from one location to another.

- Reduce over-buying of RTIs by having accurate inventory visibility across your supply chain
- Execute timely maintenance and cleaning schedules with accurate RTI inventory location
- Prevent operational line-downs with adequate RTI supply levels



Reynolds Increases Sustainability by Enabling UHF RFID

The Challenge

- 60,000 disposable cardboard cartons weekly to 4,000 different customer sites

The Results

- £46k annual labour cost saving on assembling and managing cardboard boxes vs reusable trays
- 40% reduction of storage space when storing nested plastic crates versus stacked cardboard
- 92% return rates in the first year of RFID deployment



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Thank you

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Avery Dennison Smartrac



**AVERY
DENNISON**