LABEL ACADEMY

WORKSHOP

RFID IN LABELS AND PACKAGE PRINTING

Exploring RFID Chip Technology

12 September

GARY STEGALL, TECHNICAL SALES SPECIALIST AT AVERY DENNISON

Agenda

- RFID Tag Essentials
- Understanding Tag Frequencies and Behaviours
- RFID Solutions

Who we are

AVERY DENNISON

Avery Dennison is a global materials science and manufacturing company specializing in the design and manufacture of a wide variety of labeling and functional materials. Our products are used in nearly every major industry.

About us

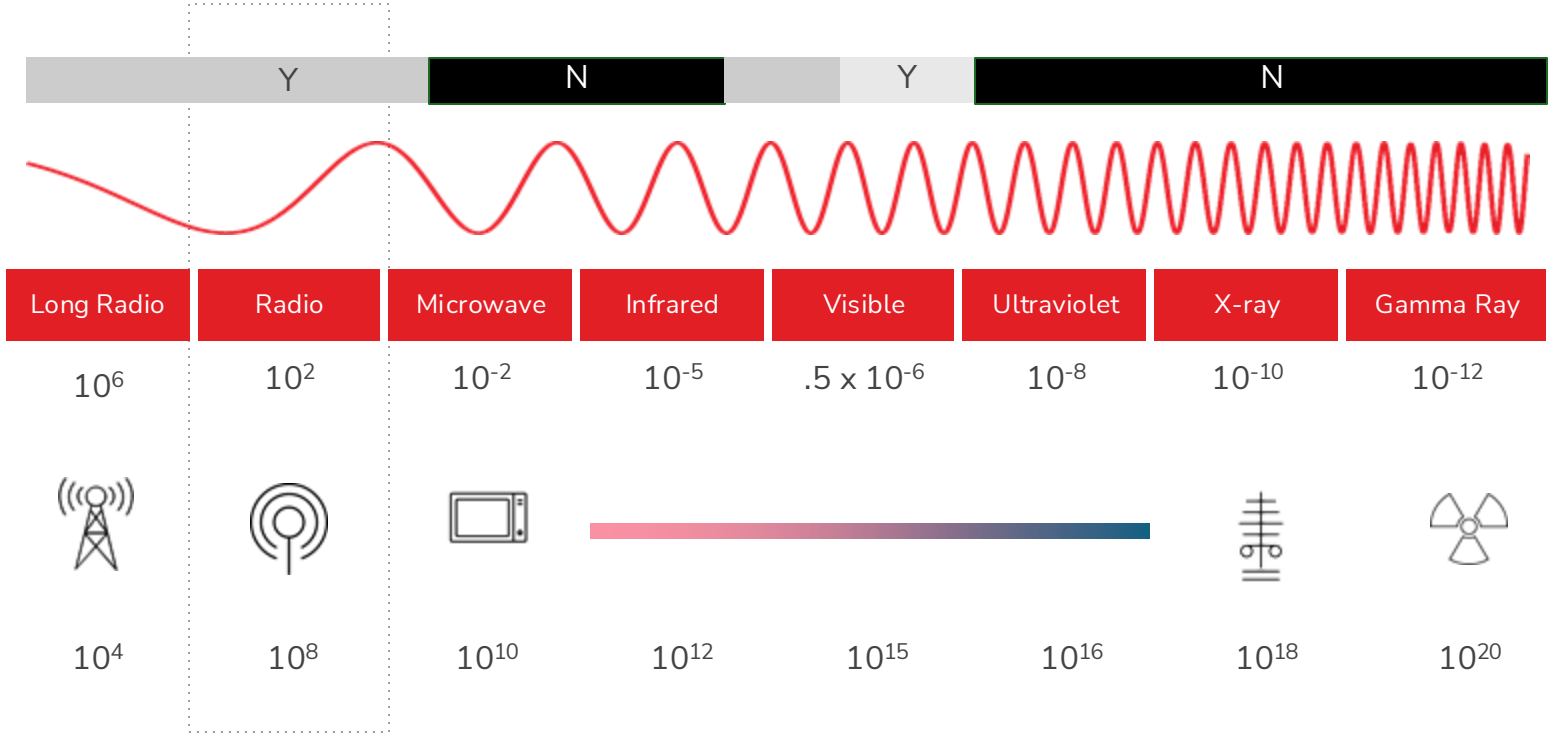
$8.4B	2023 sales reported
50+	operating countries
~34,000	global employees
#421	fortune rank as of the end of 2023

Corporate headquarters in Mentor, Ohio

RFID Tag Essentials

The wireless world we live in...

The electromagnetic spectrum



RFID (Radio Frequency Identification) Technology

RFID is a wireless communication technology, bridging the gap from the physical to the digital

Connection to digital twin

Automated read - open standard, no operational dependency

Fast speed, simultaneous to one at a time - no line of sight

Uniquely identifies and verifies physical items

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Basics of RFID

RFID systems consist of three components

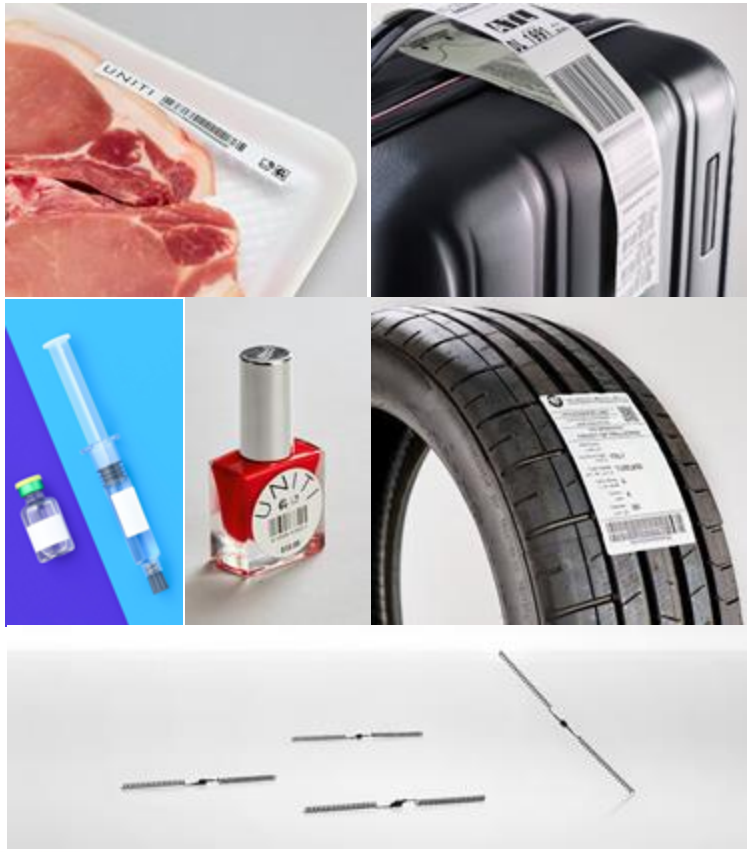
01
An RFID enabled tag, ticket or label

02
An RFID reader (fixed or mobile)

03
Software, on premise or cloud based

What is RFID technology?

UHF RFID



HF and NFC RFID

LF RFID

RFID: Comparison by frequency band

RFID

- LF
  - 120 to 150 kHz frequency
  - Near touch scanning
- HF / NFC
  - 13.56 MHz Frequency
  - Centimeters type read distance
- UHF (RAIN)
  - 860 to 960 MHz frequency
  - Long read ranges (several meters)

Passive vs. Active: UHF

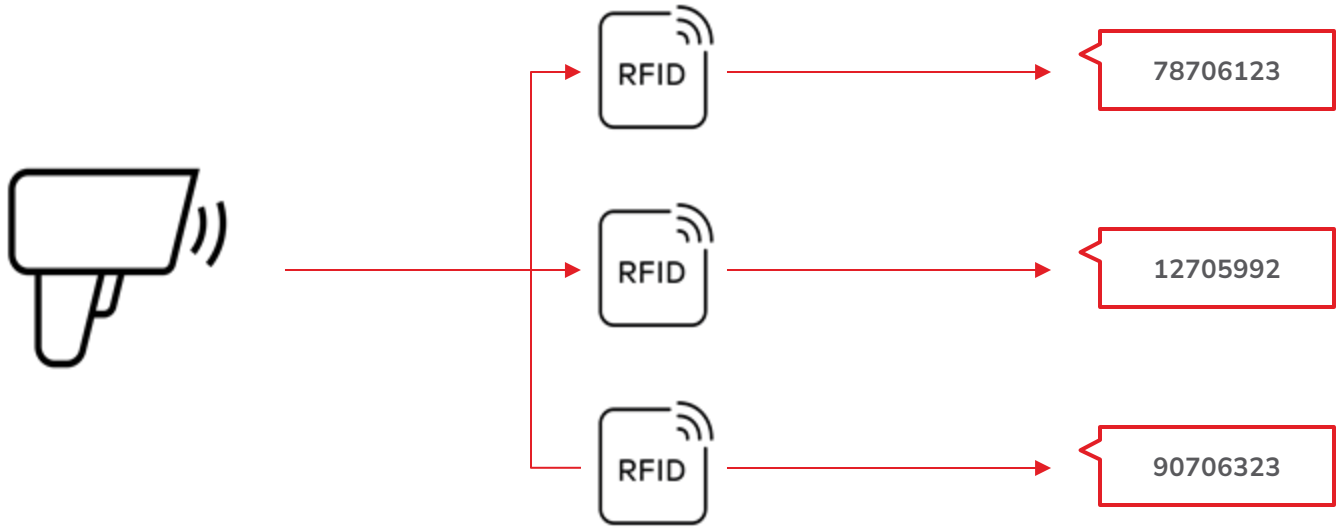
	Passive	Active
Battery	No	Yes
Reading Range	Up to 12 metres	Up to 100 metres
Memory, Functions	Memory limited to RFID Chip Reader logs reads	May have larger Memory May self log data to Memory
Cost	Low	High

How Passive RAIN RFID works

Reader sends radio signal (prompt) to the tags

Tags wake up from their sleep! Tags acknowledge the scanner's prompt for ID

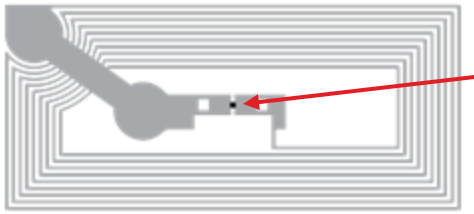
Each tag responds with a unique number

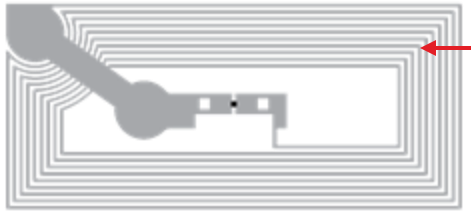


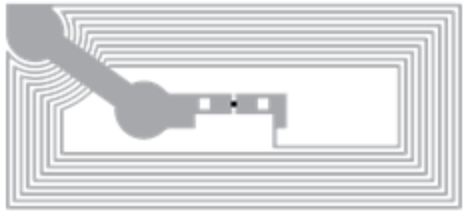
Parts of an RFID inlay

HF (NFC) inlay

UHF inlay



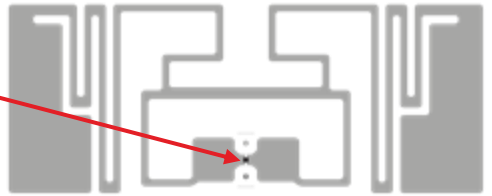




Chip or IC (Integrated Circuit)

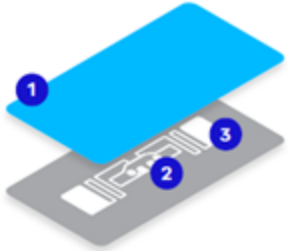
Antenna (Conductive geometric shape)

Antenna Carrier



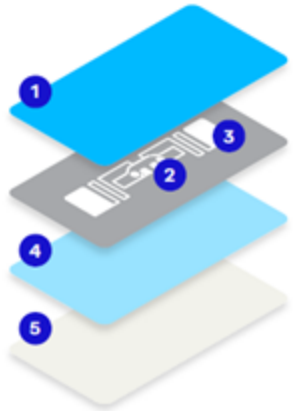
3 basic inlay format types

Dry inlay



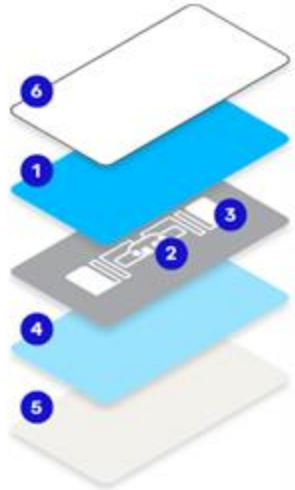
1. Inlay carrier
2. Chip
3. Antenna

Wet inlay



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

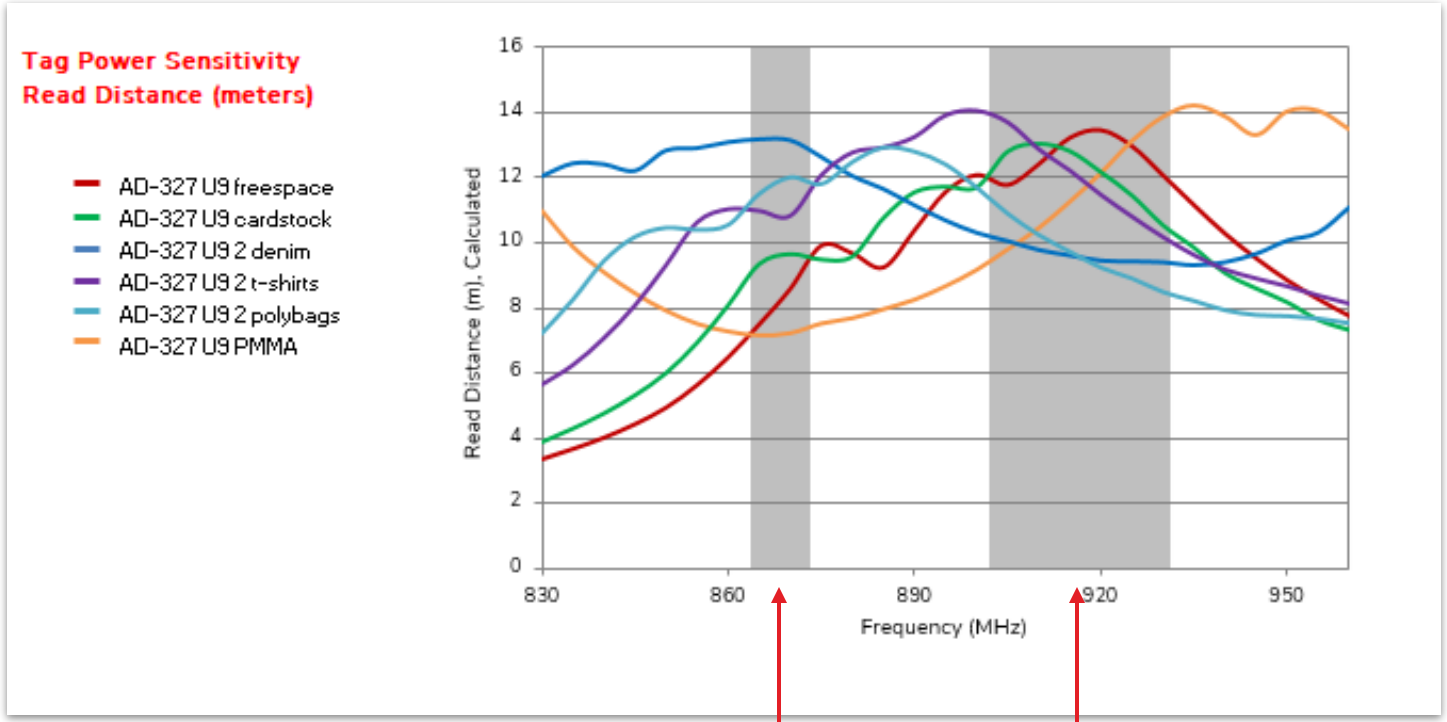
Label/ sticker inlay



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

Understanding Tag Frequencies and Behaviours

UHF RAIN across the world



Some RFID tags will be “ETSI” or “FCC” focused to work best at those regions’ frequencies. Most regions use “ETSI” “865 MHz” or “FCC” “915 MHz”

FCC (NA)	902 - 928 MHz
Lower ETSI (EU)	865 - 868 MHz
Upper ETSI (EU)	915 - 921 MHz
Brazil	902-907, 915-928 MHz
Turkey	865 - 868 MHz
China	920 - 924 MHz
Japan	916 - 920 MHz

Source: www.gs1.org/docs/epcglobal/UHF_Regulations.pdf

Performance of UHF: Influenced by product

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

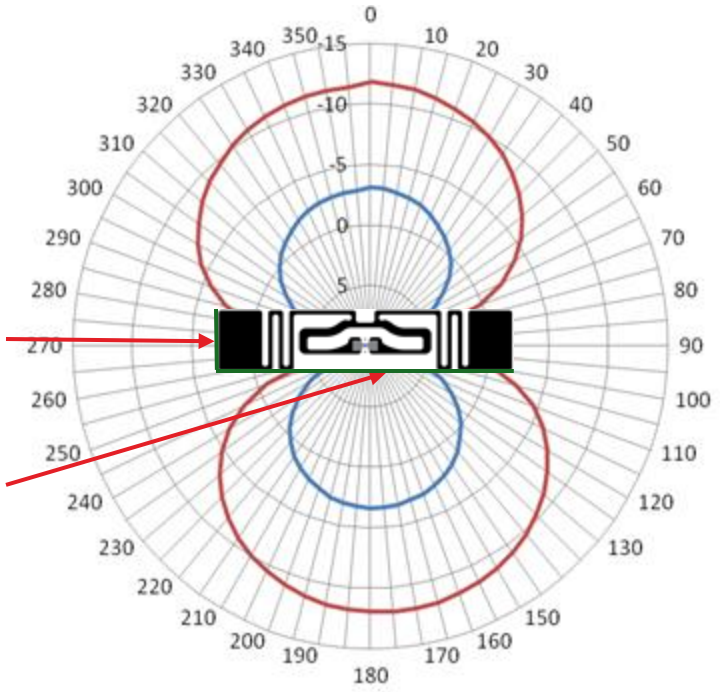
Liquid, Glass, Rubber: High Dielectrics

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

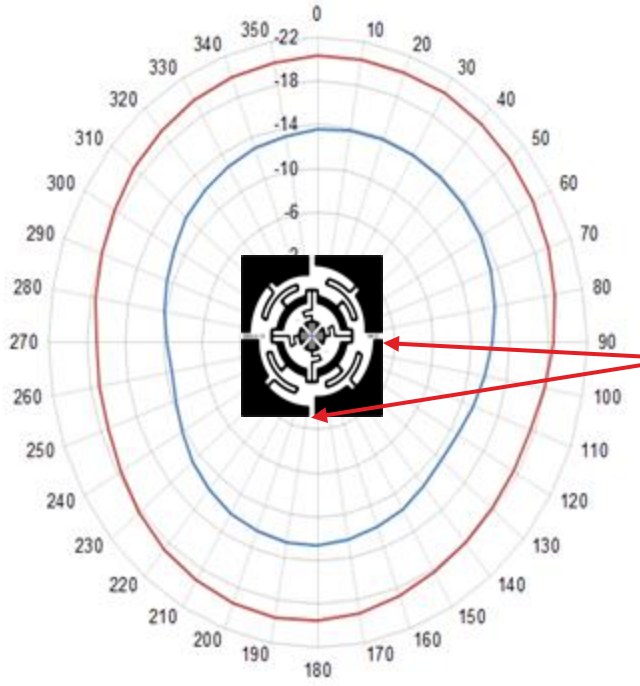
Directionality for UHF: Tag orientation performance

Short edge

Long edge



Linear tags



1:1 Aspect ratio. no short or long edge

Dual directional tags

RFID Solutions

Printers
Handheld Readers
Fixed Readers
High Speed Encoding
In-line Encoding

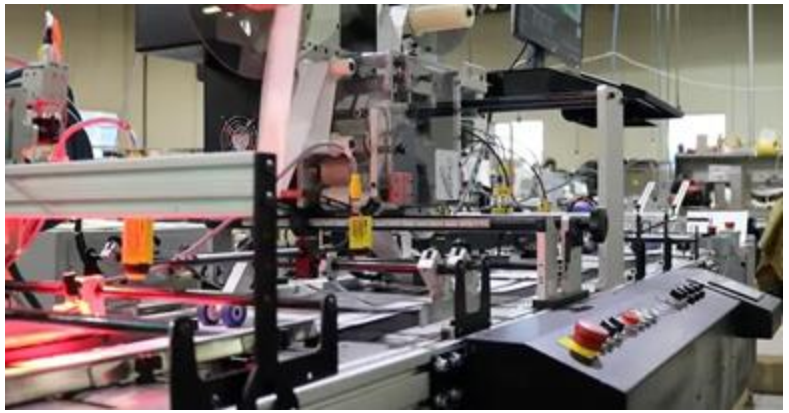
RFID Solutions

RFID Printers

Handheld Readers

Fixed Readers and Antennas

High Speed Encoding



In-line Encoding

Verification Tunnels

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Thank you!

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