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How to Combat Counterfeits with Secure, Scalable RAIN RFID Product Authentication

Impinj Authenticity™ solution engine delivers product authentication that protects brands and consumers

Trust is at the heart of every brand. When counterfeit products reach customers, they erode a brand's value and put people at risk. A low-quality, fake watch will anger its new owner. A bogus auto part can cause a car to catch fire. Knockoff pharmaceuticals are responsible for the deaths of thousands of children every year.

Of course, companies also lose millions of dollars. Employees lose their jobs. Competitors gain an edge. And governments lose tax revenue.

Counterfeit items are a global problem. In its most recent report, the Organisation for Economic Co-operation and Development reported global economic damage from counterfeit goods surpassed $460 billion. In 2023, U.S. Customs and Border Patrol seized more than $2.7 billion worth of counterfeit goods, with fake pharmaceuticals accounting for nearly half of seized products flagged as hazardous to health and safety.

Counterfeit products can enter the market at various points in the supply chain. Counterfeiters have become very adept at overcoming traditional security technologies. One study found that counterfeiters "can consistently produce credible counterfeit security labels in less than six months from the time the legitimate product hits the market."

Such news is causing growing concern for supply chain leaders. According to a recent Impinj report, 65% of supply chain leaders agree that is it a challenge for their organization to reduce counterfeit goods entering the supply chain.

RAIN RFID offers a secure, reliable, and scalable method for authenticating products as they travel through a supply chain — verifying authenticity at many steps along the way. Using solutions from Impinj and Impinj partners, businesses can track and authenticate hundreds of items in little more than a blink of an eye. And, enterprises already using RAIN RFID for inventory management can add authentication capabilities to existing systems.

What is product authentication?

Product authentication solutions built on the Impinj platform employ RAIN RFID and secure cryptography, using a challenge-response protocol to determine with a high degree of certainty whether an item is genuine. A RAIN RFID-tagged item has certain information associated with it — data such as the manufacturer name, model number, serial number, date of manufacture, purchase date, customer name, and more.

That item-specific data can be stored in a product cloud. When that item is read at any point in the supply chain by a RAIN RFID reader, an Impinj-based authentication solution both checks the information stored in the product cloud and verifies the tag chip's authenticity using the Impinj Authentication Service. The Impinj Authenticity solution engine can enable reading of hundreds of connected items simultaneously and verify each tag chip's authenticity in milliseconds.

It's a process so revolutionary that it helped earn Impinj a spot on Fast Company's 2024 Most Innovative Companies list for helping weed out counterfeit goods.

How Impinj Enables RAIN RFID product authentication

Tag Products
Attach Impinj RAIN RFID tags with Impinj cryptographic keys to products and materials.

Read Products
Use Impinj-based RAIN RFID readers to identify items at various points in the supply chain. Tag information is verified against a product database in the cloud.

Authenticate Products
Automatically confirm the authenticity of every product. Prevent counterfeits from entering the supply chain, protect brand value, and ensure consumer safety.

What to consider in a product authentication solution

When implementing a product authentication solution, businesses must factor in the solution's accuracy, reliability, cost, complexity, flexibility, and scalability.

Accuracy and reliability

A product authentication solution must be effective at detecting items accurately and consistently. The solution cannot let counterfeit items pass as authentic or incorrectly identify authentic items as counterfeit. When counterfeits go undetected, consumer and retailer confidence is eroded. RAIN RFID provides a highly accurate and reliable method for authenticating tagged items in a broad variety of use cases.

Speed of authentication

Manually authenticating products packed on a pallet, for example, requires opening each box to view each individual item. A manual authentication process reduces throughput, adds complexity, and lengthens delivery times. Automating this process with RAIN RFID provides simultaneous authentication of all items on a pallet without compromising throughput or adding process steps.

Implementation cost and complexity

The cost and complexity of implementing a product authentication solution have traditionally been barriers to adoption. But what if businesses could use existing or planned infrastructure? In 2024, 76% of retailers said they either already use RAIN RFID or will implement it in the next two years for applications such as inventory management, loss prevention, or supply chain automation. Adding product authentication extends the use of RAIN RFID and can alleviate the cost and complexity of implementation. Other product authentication technologies are more likely to require significant capital, integration time, and employee training.

Flexibility to use with a variety of products

It's challenging to identify and authenticate things down to item-level; it requires a method of marking and reading every product. In retail, it's common to use labels with barcodes, which require a reading device to be in visual line-of-sight. Barcode labels sometimes need to be larger than the item itself and can become damaged, making them unusable. RAIN RFID tags, on the other hand, can be applied to a variety of surfaces, in exceedingly small physical spaces, and discreetly enough to not impact the aesthetics or performance of a product. RAIN tags can be integrated into fabrics, embedded into plastic or metal, and can fit in labels as small as 3 millimeters.

Scalability across the entire supply chain

Counterfeit or gray-market products can enter the supply chain at many different points. It's not enough to detect counterfeits only at the point of sale, which only protects the consumer. Manufacturers, retailers, and other businesses along the supply chain benefit from knowing where and how knockoffs enter the supply chain. RAIN RFID, already a prevalent and widely accepted identification technology, can check for item-level authenticity at various steps in a product's journey from factory to point of sale, helping pinpoint the source of counterfeits and minimizing the financial impact of quarantining and replacing counterfeit items.

Proven benefits of RAIN RFID

RAIN RFID, or radio frequency identification, is a wireless technology that uses radio waves to identify and locate tagged items. RAIN RFID can identify and locate many items quickly — up to 1,000 items per second — from a range of a few centimeters to several meters. And it can identify items without direct line-of-sight.

RAIN RFID readers are available in a variety of form factors, including handheld devices and fixed readers. Handheld readers and tablets can be used to read products on store shelves and in boxes or on pallets. Fixed readers can be installed along conveyors, at shipping dock doors, or transition points within a warehouse, manufacturing operation, or retail store. Businesses in many industries drive efficiencies, reduce waste, and gain a competitive edge by using RAIN RFID in applications such as:

"95% of retailers say brand protection and authentication are important applications of IoT technologies like RFID."

– 2023 RSR Benchmark Report, The Digital Transformation of the Retail Business Model

- **Inventory management:** Companies can track items as they move through transition points, see their real-time location, take faster inventory counts, and use this data to make smarter stocking decisions and eliminate waste.
- **Shipment verification:** Logistics and manufacturing operations gain efficient error-free operations with accurate, real-time data — tracking shipments moving through supply chains or parts and goods going between plants.
- **Supply chain automation:** Supply chain managers enable smart inventory and agile supply management with systems that track thousands of items moving on high-speed conveyers or sortation systems.
- **Omnichannel fulfillment, loss prevention, and self-checkout:** Retailers use RAIN RFID to deliver best-in-class online operations, enable touch-free checkout with seamless returns, and gain advanced loss prevention. Accurate, real-time inventory data is driving retail digital transformation.

And with the launch of the European Union's Digital Product Passport initiative, with effects likely to ripple around the world, retailers can add compliance to their list of crucial RAIN RFID uses.

The capabilities of RAIN RFID combined with the low cost of RAIN RFID tags make it the ideal technology for large-scale IoT systems that connect thousands, millions, or billions of things.

Beyond authentication: Meeting Digital Product Passport requirements with RAIN RFID

Over the next few years, companies selling products in the European Union will have to comply with a new initiative requiring a Digital Product Passport — a digital record containing key information about a product's composition, origin, and lifecycle — for nearly every item.

By adding RAIN tags to products, companies can create digital records for every item they manufacture, transport, or sell — records that follow products from production to purchase to eventual disposal. RAIN-enabled enterprise mobile devices are available today, with consumer smartphones expected in the future.

RAIN can not only help support compliance with DPP regulations but also offer companies operational efficiencies elsewhere in their operations, including real-time visibility into their supply chains, automation of manual processes, and seamless product authentication.

Comparing product authentication technologies

While some companies use manual inspection to visually or physically test the authenticity of a product, there are several auto-identification technologies that are used for automated product authentication.

Each of these technologies relies on a "data carrier" (such as a barcode label or RAIN RFID tag), a reader or scanner, and a "product cloud" for checking data against a database to verify the item's authenticity. Complete authentication relies on cryptographically securing and verifying a tag's identity.

Every use case has its own needs and requirements, so one technology may fit better for a deployment over another. Multiple technologies may also be used if different ones are supported along various points of the supply chain.

Comparing authentication technologies

	Impinj Authenticity	NFC RFID	Barcode / Digital Watermark
Authenticate items at distance	✓ Up to 10 meters	✓ Up to 1.5 meters	✓ Up to 2 meters
Read without direct line-of-sight	✓ Reads through container walls	✓ Limited distances	✗ Requires line-of-sight
Operate at scale and speed	✓ Read up to 1,000 items/second	✗ Read less than 50 items/second	✗ Read less than 10 items/second
Versatility	Available in many sizes and shapes. Can be embedded into fabric, film, paper, ceramic, metal, and plastic.		Requires high contrast and a flat surface.
Used for retail loss prevention and inventory management	✓	✗	✗ (barcode used for inventory) management only)
Cryptographic, other standards	GS1 EPCglobal Gen2v2 ISO/IEC 29167-10, -11, -13 ISO/IEC 29192-2	GS1 Digital Link ISO/IEC 14443A ISO/IEC 15693	GS1 Digital Link proprietary barcodes
Prevalence of use across the supply chain	High	Low	High (barcode) / Low (watermark)

Using Impinj Authenticity for product authentication

The Impinj Authenticity™ solution engine provides a foundation that protects brand owners, retailers, and their customers by assuring that products are genuine. Impinj Authenticity includes the Impinj Authentication Service, Impinj M775 RAIN RFID tag chips, and Impinj readers . Impinj partners provide products, services and applications that form a complete enterprise authentication solution.

Authentication Tag Preparation

An Impinj M775 tag chip contains a cryptographic engine and a cryptographic key. The key is generated in a FIPS 140-2 certified high security module (HSM), unique to each tag chip and is programmed into the tag chip by Impinj. Tag chips are used by Impinj tag partners to build a variety of tags that can be embedded or externally attached to an item or its packaging.

Product Cloud Database Loading

At the time of product manufacture the item-specific product information for that item is associated with the unique Impinj M775 tag chip ID number. Tags are identified by a Unique Item Identifier (UII) or Tag ID (TID) and should use a standards-based numbering system such as the GS1 EPC Tag Data Standard or the RAIN Alliance ISO numbering system. This product information is loaded into the product cloud database.

Authentication Process

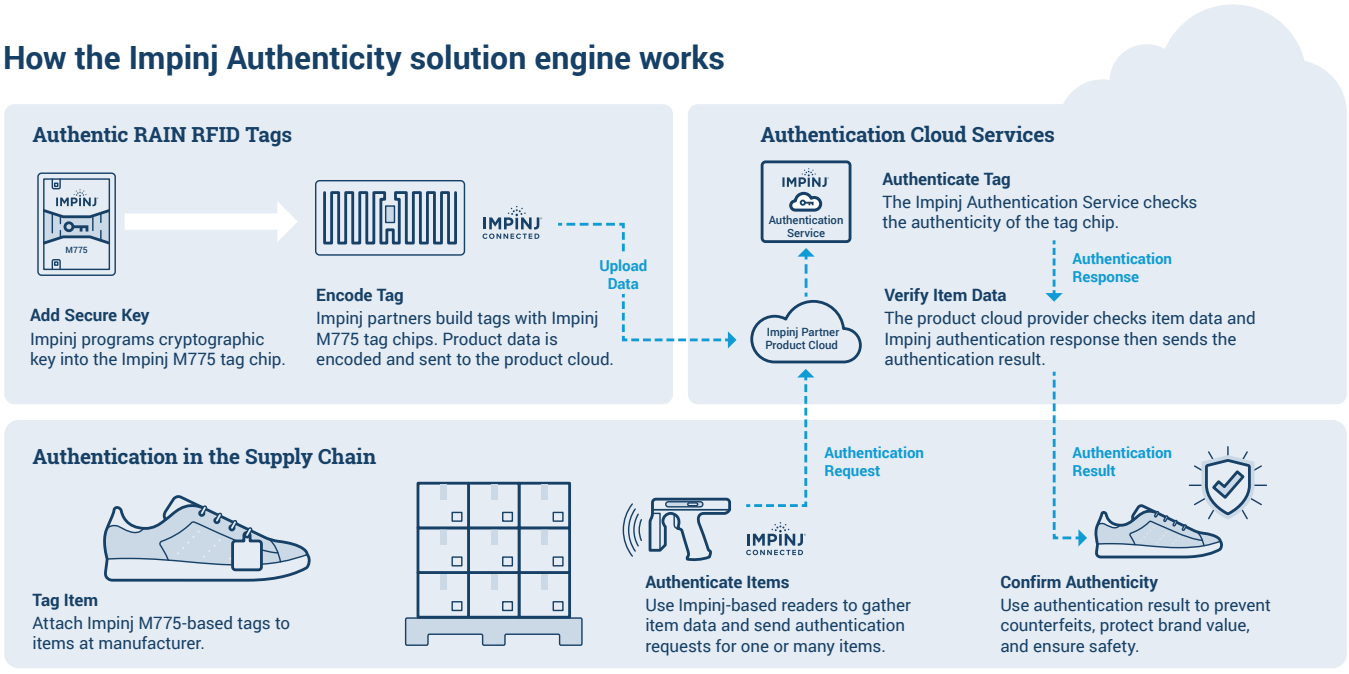
An Impinj-based or other RAIN RFID reader reads the tagged items at various points in the supply chain, automatically sending authentication requests to the tagged items as part of the normal inventory reading process. The response to the request is routed to the Impinj Authentication Service via the product cloud, and a response from the Impinj Authentication Service allows the requester to immediately determine whether there are any potential counterfeit items within the scanned products.

Use of fixed or mobile readers in a variety of locations including dock doors, forklifts, conveyors, mobile carts, stock rooms and other locations provide the flexibility and speed to efficiently authenticate thousands of items per day without disrupting normal operations.

Data Analytics and Reporting

Using data aggregation and analytics it is possible to identify trends and vulnerabilities, allowing for effective concentration of brand protection efforts.

How the Impinj Authenticity solution engine works



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To find out how Impinj can help you define, design, and deploy a product authentication solution, reach out to an Impinj expert.

The Impinj platform, built on RAIN RFID, offers retailers many advantages over barcode-based systems. And, with a broad partner ecosystem offering best-in-market products and capabilities, Impinj helps retailers connect every product, track it all the way through the supply chain, and gain insights for better inventory management.

These benefits, which extend far beyond automated self-checkout, make RAIN RFID the best choice for any retailer looking to improve their entire operation.

To learn more about Impinj, visit: **www.impinj.com**

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Impinj (NASDAQ: PI) helps businesses and people analyze, optimize, and innovate by wirelessly connecting billions of everyday things — such as apparel, automobile parts, luggage, and shipments — to the internet. The Impinj platform uses RAIN RFID to deliver timely data about these everyday things to business and consumer applications, enabling a boundless Internet of Things.