

RFID vs. Barcodes: Pros, Cons, and How They Work Together

RAIN RFID is often described as a “digital barcode,” but the technology does so much more. Here’s a rundown of the differences and similarities between RFID and barcodes — including QR codes.

RAIN RFID and barcodes serve similar functions: to identify and manage items throughout factories, supply chains, distribution centers, retail stores, and many other places. In fact, RFID and barcodes are often used together. So, what sets these technologies apart?

For decades, organizations have gotten by with barcodes. Barcodes transformed nearly every industry by helping computerize inventory management, asset tracking, item verification, points of sale, and more. But today, with unprecedented supply-chain pressures and ever-growing consumer expectations, competing in today’s global economy requires something more.

Market-leading companies from UPS to Walmart [are embracing RFID](#). In fact, in a recent survey, [97% of supply chain professionals](#) said they are turning to RFID to address business challenges. It’s a new age for streamlining workflows, automating supply chains, maximizing labor efficiencies, and enabling retail experiences. By using RFID to track a wide range of items, organizations can gain an edge on the competition and fortify their operations against future disruptions.

That’s not to say RFID replaces barcodes. Each has advantages and disadvantages, and organizations can use the technologies together to achieve great benefits. Here’s a look at the differences and similarities between RAIN RFID and barcodes.

What are barcodes?

We’re all familiar with barcodes, the series of dark lines and bars that encode identifying information about an item. Barcodes are usually printed on packaging or labels and can be frustratingly hard to find when using self-checkout at the grocery store.

One-dimensional (1D) barcodes, like the Universal Product Code (UPC) used in retail, consist of vertical bars that represent alphanumeric data, with data limited by the barcode’s width. Two-dimensional (2D) barcodes, such as QR codes, can hold more data, including text, URLs, and images. These barcodes often look like stacked 1D barcodes or square grids.

All barcodes represent data that is “read” by computers optically, with 1D barcodes usually using laser scanners and 2D barcodes requiring camera-based systems with image processing.

What is RFID (and RAIN RFID)?

RFID is a form of wireless communication that uses radio waves to identify and find objects. RFID is a generic term that encompasses different frequencies and standards, [including RAIN RFID](#), which is sometimes referred to as [ultra-high frequency \(UHF\) RFID](#). All RFID systems operate on the same principle: An RFID tag stores information that can be read wirelessly by an RFID reader.

RAIN RFID tags consist of a tiny radio chip and an antenna, and don’t require a battery to function. Instead, RAIN RFID tags get their energy from the radio waves transmitted by RAIN RFID readers. When a RAIN RFID tag is energized, it reflects the data stored on its chip back to the reader.

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RAIN RFID tags come in many forms. Because they’re small and flat, they can be incorporated into labels. They can be sandwiched inside hangtags. They can even be embedded in a product itself, like an [automobile tire](#) or the [label on a T-shirt](#). Each RAIN RFID tag chip can be encoded with an identifier that’s associated with the tagged item’s information in a cloud database.

In many ways, a RAIN RFID tag is like a digital barcode.

But it’s also so much more. RAIN RFID systems enable businesses and consumers to identify, locate, authenticate, and engage with every item that’s tagged with a RAIN RFID tag, providing rich, real-time data and insights.

What are the capabilities of RFID and barcodes?

RAIN RFID offers several advanced capabilities compared to traditional barcodes, making it an increasingly popular choice across various industries. RAIN RFID solutions can automatically identify, track, and verify up to 1,000 tagged items a second from as far away as 30 feet (10 meters) without direct line-of-sight.

	RAIN RFID	QR Code	Barcode
Bulk reading capability	>1,000 items/sec	<25 items/sec	
Read distance	up to 10m	up to 3m	
Tag/barcode cost	\$.03+	<\$.01	
Reader/gateway cost	\$400+	low performance \$150+ high performance \$1,500+	
No battery requirement	✓	✓	✓
High data storage capacity (>1KB)	✓	✓	
Read without direct line of sight	✓		
Writable memory	✓		
Embeddable	✓		
No lighting requirement	✓		
Real-time location system (RTLS) capability	✓		
Privacy protection features	✓		
Flexible system architecture	✓		

Can barcodes and RFID coexist?

Barcodes and RAIN RFID often coexist where the different solutions are needed for multiple processes. Many businesses may use both technologies for redundancy — if a barcode is damaged, data is still accessible in the RFID tag, or vice versa.

The technologies widely coexist in shipping and logistics, where some parts of the supply chain are set up for RAIN RFID, but others aren’t. Using both technologies enables an organization to enjoy the benefits of RAIN RFID without affecting the entire supply chain.

Enterprises may also need a gradual transition from barcodes to RAIN RFID. Businesses can adopt at their own pace, often by selecting a test group of items to tag with RAIN RFID. For instance, a logistics company may use RAIN RFID in sorting facilities and barcodes for last-mile deliveries, and seamlessly use both as it transitions all operations.

What is the future of RFID?

RAIN RFID is the fastest growing segment of the RFID market, and it’s gaining popularity across numerous industries.

Walmart mandates that suppliers for many types of products must tag their items with RAIN RFID, and the retail giant is expected to continue expanding its requirements to more categories. Walmart has [“seen dramatic results”](#) in not just inventory management, but also online fulfillment and customer satisfaction. Uniqlo is another retailer [wowing its customers](#) with shopping experiences powered by RAIN RFID.

Shipping giant UPS is pushing the logistics sector forward with RAIN RFID by placing tags on packages and using wearable RFID readers to eliminate manual scans, reduce errors, and increase throughput. [RAIN RFID can help logistics companies](#) automate the labor-intensive tasks they depend on to maximize shipping accuracy and speed.

Meanwhile, in Europe, lawmakers are drawing up legislation to require [Digital Product Passports](#) that enable everyday consumers to view the manufacturing history, carbon footprint, and recyclability of all kinds of products. [RAIN RFID is a great technology](#) that retailers and suppliers can use to record and track this product information, while also using barcodes so consumers can access the data.

That said, we at Impinj envision a future where every smartphone has RAIN RFID reading capabilities. A future where anyone can, for instance, scan a RAIN RFID tag [embedded in the seam of their T-shirt](#) and get care instructions, styling tips, and recycling info. RAIN RFID will expand beyond its business-to-business origins into consumers’ homes, enabling devices, apps, and products to connect and interact in exciting ways.

What is the Impinj platform based on RAIN RFID?

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. Impinj offers the only comprehensive RAIN RFID platform providing best-in-market tag chips, readers, reader chips, software, testing solutions, services, and global partner ecosystem. The highly integrated Impinj platform delivers advanced performance and capabilities that cannot be efficiently achieved with mix-and-match systems.

In addition to the benefits of any RAIN RFID deployment, solutions featuring Impinj tag chips and reader chips or readers provide several unique advantages, including:


- [Cryptographic authentication](#) to prevent counterfeits and ensure consumer safety
- [Unmatched performance features](#) that maximize inventory speed and efficiency
- [Consumer privacy protection](#) that’s flexible and easy to manage
- [Reader security safeguards](#) for preventing cyberattacks and business disruptions

With nearly 25 years of experience as an industry leader, Impinj is your go-to resource for everything RAIN RFID. We know digital transformation is difficult and requires complex cross-functional coordination within an enterprise. Impinj experts are here to help your organization modernize.

To learn more [about RAIN RFID](#) and [the Impinj platform](#), you can [contact us](#) or reach out to one of our partners. You can also read up on the [benefits of RAIN RFID in various industries](#), and check out [Impinj Insights](#) for [customer stories](#) and more [from our blog](#).

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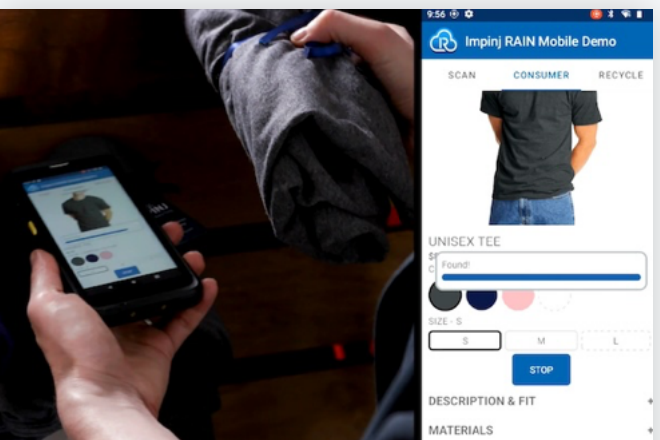
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