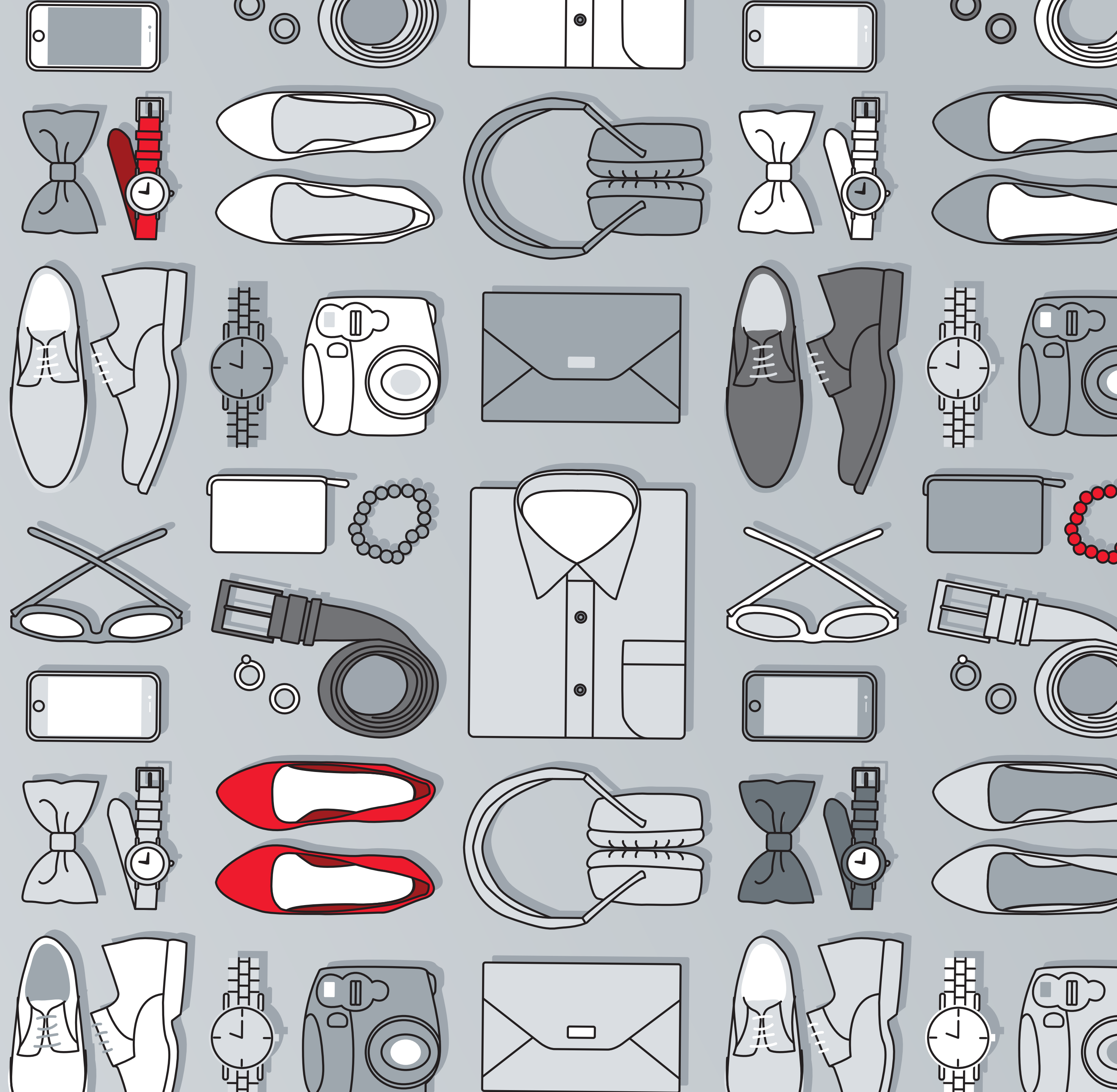# muRata
INNOVATOR IN ELECTRONICS

RFID tagging

How RFID solutions can support
the fight against fake goods

Introduction

Counterfeiting and piracy are a global epidemic, and over the past decade these criminal acts have been growing at an increasingly rapid rate.

By 2022, studies have estimated that goods worth up to $1.95 trillion (€1.57 trillion) could be circulating in the global market, costing the world economy up to $1.87 trillion (€1.51 trillion) and displacing more than 5 million legitimate jobs.

This trend of accelerated growth can be linked to increasingly complicated and lengthy supply chains, and the increasingly globalized nature of trade. With grey market trade thriving in numerous jurisdictions, brand owners are seeing their value undercut and their reputation diminished. To tackle these issues, industry should look to the future and find more effective and secure ways of identifying and tracking authentic goods.

This paper looks at the benefits of RFID tagging and how the latest technology of micro-RFID tags can be integrated into products, enabling businesses to better track their entire operation during the supply chain. With secure authentication, real-time alerts and the potential to integrate trackers and sensors relaying crucial location and condition information, RFID can empower firms to fight back against a growing tide of counterfeit goods and the rampant and costly grey market.
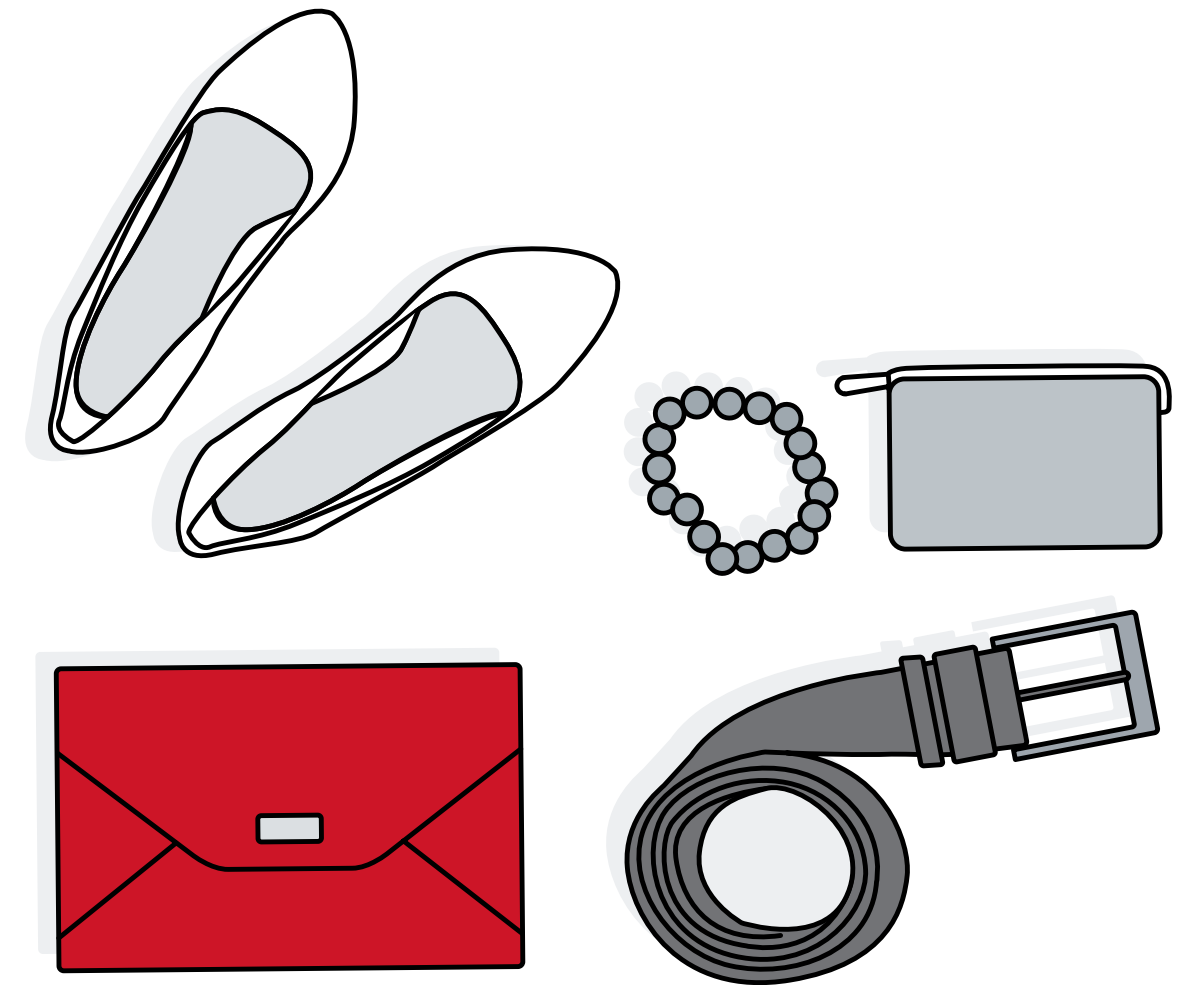
By 2022, studies have estimated that goods worth up to **$1.95 trillion**...could be circulating in the global market

The scale and cost of counterfeiting

Counterfeiting is a global issue - and one that appears to be on the rise.

While the underground nature of this type of theft can make the true scale of the issue difficult to measure, the figures that we do have paint a picture of a rapidly worsening problem.

Over the past half-decade, between 2013 and 2018, counterfeiting has been growing at an accelerated rate, with estimates suggesting that international trade in pirated or counterfeit goods will continue to increase by around 9% per annum. When counterfeiting increases, so too do its negative effects on businesses, individuals and the wider economy, bringing brands into disrepute and harming innovation.

### Almost $2 trillion in counterfıt goods in the market by 2022

As the scale of counterfeiting and privacy goes up, so does the level of damage done to the economy, the job market, private enterprise and consumer trust. In many cases, brands whose goods are counterfeited lose some of their reputation and market value, while in others - such as counterfeited food and medicine - lives can even be put at risk.

Recent estimates suggest that in 2013, the total value of counterfeited goods around the world was $710 - 917 billion (€572 - 740 billion) - with a volume of goods worth $461 billion (€372 billion) traded internationally and $249-456 billion (€201 - 368 billion) worth of goods produced and consumed within domestic borders.

With this type of theft rising at a rapid rate, estimates suggest that by 2022, the total value of pirated and counterfeit goods circulating in the global economy will be $1.52 - 1.95 trillion (€1.23-1.57 trillion). Of this, $991 billion (€799 billion) will be traded across borders, while $524 - $959 billion (€422 - 773 billion) will be produced and consumed in a single country.

Over the past half-decade, between 2013 and 2018, counterfeiting has been growing at an accelerated rate of **15.6%** each year

15.6%
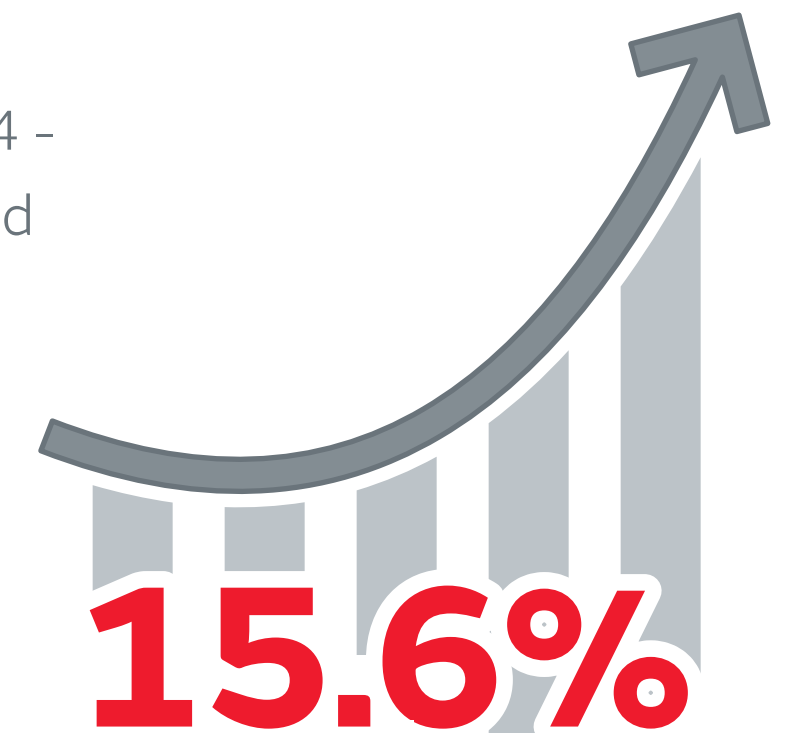
The cost of counterfeiting and the global grey market

41 Million goods were seized in Europe in 2016

In global terms, Europe sees particularly high levels of cross-border counterfeiting and piracy attempts. In 2016, European Union customs officials reported that 41 million counterfeit or fake articles had been seized by border officials - an increase of two percent against the previous year - with a total market value of **€670 billion.**

While counterfeit goods make up, on average, around **2.5% of global trade**, the proportion of counterfeit and pirated goods comprises around 5% of EU imports, making Europe a prime target for counterfeiters and the grey market.

Grey market goods are thriving internationally

In tandem with the growth of counterfeit goods, big name brands are increasingly having to contend with an ever-more powerful and persistent grey market. This grey market – comprising both counterfeit and genuine goods sold via unauthorized or unofficial channels – has been growing by around 15% per annum over the past few years and is estimated to soon be worth around $1.5 trillion globally.

The problem is increasingly severe for high-end and luxury brands, who can easily fall victim to undercutting in the grey market. In the case of designer watches, a wealth of online marketplaces has recently sprung up offering significant discounts on well-known designer brands, vastly undercutting the usual retail pricing for such products.

According to the estimates of one analyst, grey market goods currently account for around 20 percent of the global market for high-end watches, putting a significant dent in the industry's profits.

The grey market is estimated to soon be worth around $1.5 trillion globally

Grey market and fake goods damage investment, value and trust

When counterfeit goods and grey market goods enter circulation, company revenues can be hit dramatically - and the indirect effects of poor-quality counterfeit goods also lead to increased costs, reputational damage and potentially long-term reductions in sales.

If consumers unknowingly buy grey market or fake goods, it has a negative impact on their levels of trust in and loyalty to a brand. At worst, these products could potentially harm their health, as is often the case with counterfeit food products and ineffective pharmaceutical drugs.

Meanwhile, businesses often incur costs for repairs or replacements of faulty counterfeited items, as well as facing increased complaints about unsafe or ineffective products sold through unofficial channels. In severe cases, companies can face wrongful legal action, see their market share eroded and lose possession of valuable industry secrets.

Looking to the future, the displacement of legitimate and secure jobs is also a huge concern: by 2022, the net job losses from counterfeiting and piracy are estimated to reach 5.4 million - more than double the 2.6 million estimated losses in 2013.
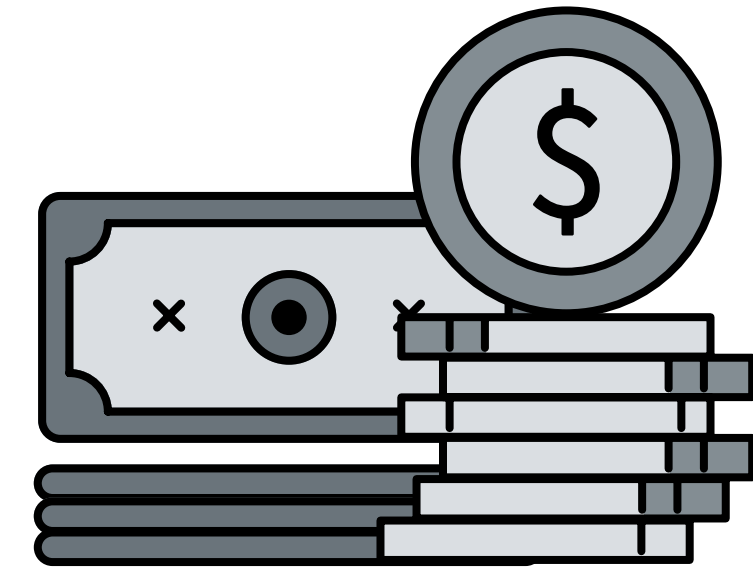
...businesses often incur costs for repairs or replacements of faulty counterfeited items...

In brief: The cost of counterfeiting

- The volume of counterfeit and pirated goods was estimated to be as much as $917 billion in 2013. In 2022, this could rise to $1.95 trillion (€1.57 trillion)
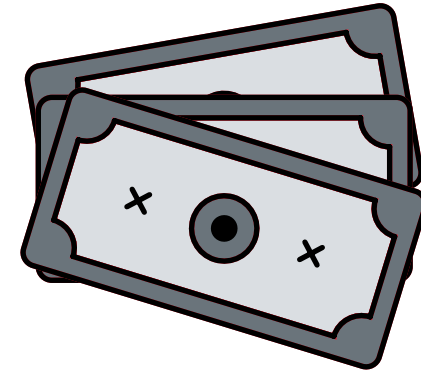
- The problem is particularly severe in the EU, where 41 million goods were seized at the border in 2016 with a total value of €670 billion

€670 billion
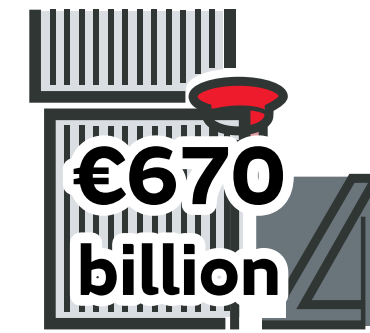
- Experts predict that, by 2022, counterfeiting will have led to up to 5.4 million job losses, and could cost the world economy up to $1.87 trillion (€1.51 trillion) annually
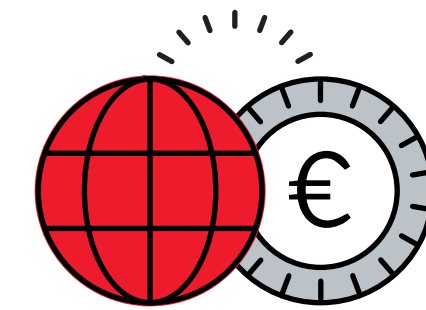
- The global grey market is growing by around 15 percent annually, undercutting brand value and putting immense pressure on company revenues

15% annually
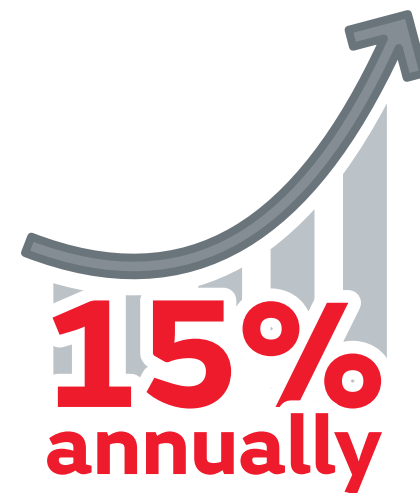
- Counterfeiting has wide-reaching effects on brand reputation, company value, innovation and the wider economy

REAL   FAKE

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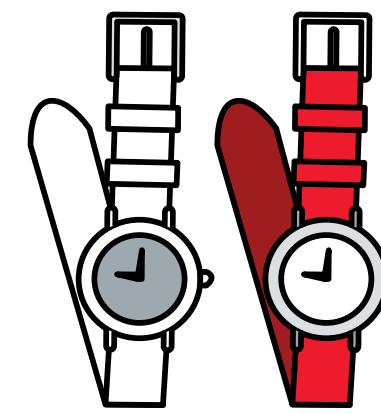
Most of the trade in grey market and counterfeit goods begins at some point in a firm's internal supply chain, where weaknesses in auditing and authenticating products leave rooms for unauthorized activity to occur.

Barcodes and holograms are vunerable to fraud

While special authentication features can be a key weapon in the fight against fraud, popular methods of verifying products have tended to be inadequate when matched against today's sophisticated counterfeiters. At present, holograms and 2D barcodes / Matrix digital codes tend to be among the most widely used forms of product authentication, while watermarks and color-change inks have also been utilized to tell legitimate branded products apart from their counterfeits.

Part of the problem with the use of holograms and barcodes is that they must be clearly visible on the packaging, taking up valuable design space and offering an easily accessible target for counterfeiters to forge. Due to the ease of replication for many of today's counterfeiters, it can be difficult for customs officials and retailers to verify that the barcode or hologram is genuine and has been produced by the official manufacturer or retailer of a branded product.

# RFID solutions could be future of asset idnetification

While solutions like holograms and barcodes are still commonly used for authentication, the truly secure solutions of the future can be more readily found in the world of electronics. Radio-frequency identification - otherwise known as RFID - allows key information to be stored in an object-tag and transferred wirelessly and automatically to nearby readers, providing a natural option for secure product authentication.

Compared with barcodes and holograms, RFID tags have the distinct advantage of being a covert mode of authentication, making it much more difficult for potential fraudsters to uncover how an item is being identified and attempt to replicate or tamper with it. With each RFID tag

containing a unique serial identifier (UID/TID), handlers at every stage at the supply chain could instantly verify the authenticity of the item and find out other key data such as the country of origin and the country of sale.

An enormous amount of information can be stored on certain types of RFID tag or stored in their data servers by their UID/TID, allowing for a potentially large data set relating to the product's materials/ingredients, manufacturing process and intended country of sale which could also be used to confirm that the item has genuinely been produced by a certain brand or company, and is being sold in the correct regulated markets.

Equally, using secure cryptography makes unique RFID tags incredibly hard to reproduce - creating yet another barrier for counterfeiters trying to enter the supply chain or suppliers looking to sell products in grey markets. With all these benefits - and the elimination of a large amount of human effort and error - RFID remains a low-cost, high-value option for firms looking to future-proof their authentication methods.
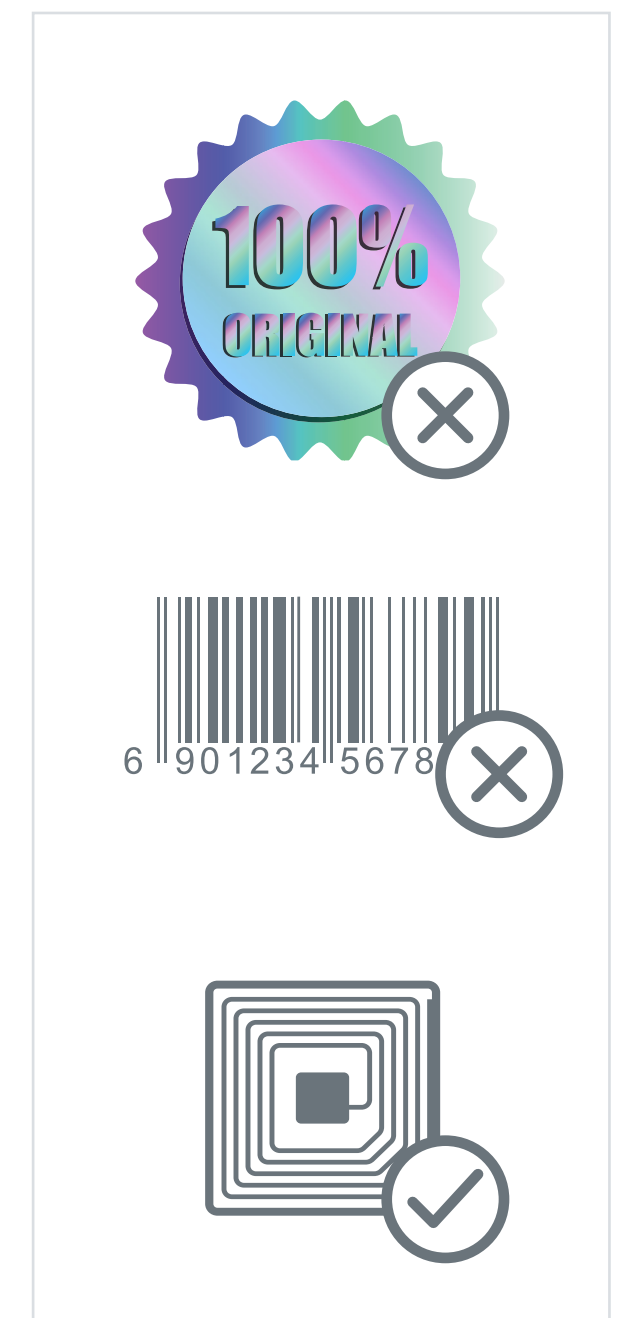
# In brief: benifits of RFID for authentification

- As a method of authentication, barcodes and holograms are highly vulnerable to replication and tampering due to their visibility and ease of replication

- RFID tags offer an ideal alternative with greater protection from counterfeiting via a unique serial identifier and other key product information, such as country of origin and country of sale
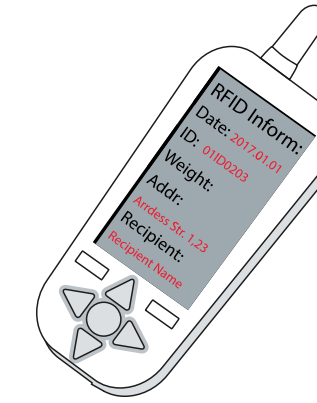
- RFID tags use secure cryptography and can be used covertly, making them incredibly difficult to identify and counterfeit
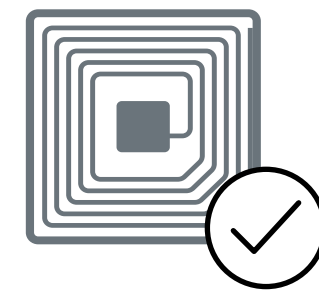
- RFID requires little human labor, and represents a low-cost, high-value option for product authentication
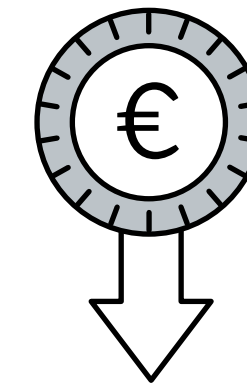
One of the major challenges faced by modern global firms is the difficulty of accurately and efficiently tracking the delivery of products through an extensive distribution chain and across long distances.

Not only does this cause problems for suppliers and manufacturers of products who struggle to track their own goods during transit; it also creates difficulties for inspectors and retailers at POS to work out whether they are handling grey market or counterfeit goods.

Blind spots in the distribution process leave a window of opportunity for counterfeiting and tampering to occur, resulting in financial losses and diminished brand trust.
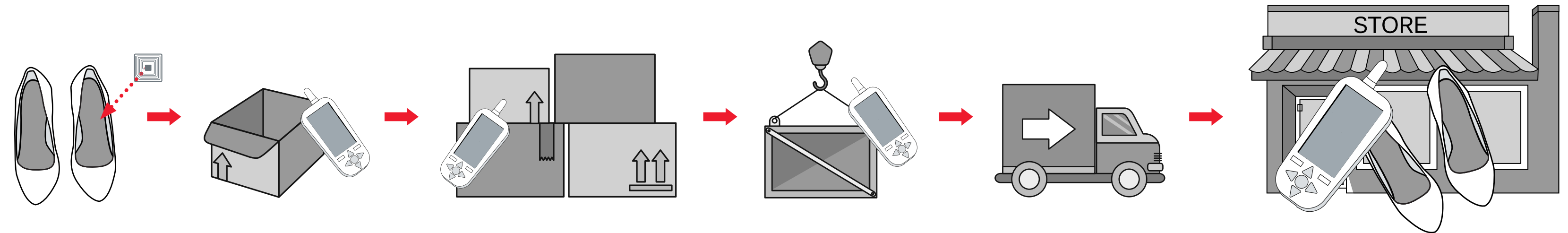
Electronic asset control systems

Electronic asset control systems utilizing RFID tags and collected accurate and real time big data can help to fill in these blind spots, allowing for easy monitoring and inspection at each stage in the supply chain. By integrating RFID tags, product owners can easily keep track of crucial product information such as transit trail, recent handlers/owners and identity. Moreover, the item's condition and a current location can also be determined with the use of additional sensors and GPS trackers.

Successfully handled, big data can be a hugely effective tool in the fight against counterfeiting and grey market sales. In fact, recent advances in the way we accumulate, store, analyse and deliver data have revolutionized our ability to combat fraud on a large scale.

Starting with crucial information contained on RFID tags, big data algorithms can be utilized at all stages of the distribution and sales process to provide detailed information about the history, characteristics and location of products, as well as flagging up any anomalies in the stock distribution process.

Instant feedback helps businesses act fast

In the fight against counterfeiting and the grey market, rapid action is crucial. A good asset management / track-and-trace system should be able to deliver instant feedback and real-time updates to allow businesses to chart problems at any step in the supply chain.

Due to anti-collision technology, RFID readers can process information from a significant number of items simultaneously, allowing for efficient and accurate processing of vast amounts of stock. While barcodes traditionally require a degree of manual labor due to the fact that scanners must be pointed directly at each label individually, several RFID tags can be read instantly without requiring any line of sight between the tag and the equipment. This means that an entire room of

stock can be read in minutes, cutting down on inventory time and giving businesses the edge over potential criminals.

With a RFID solution connected to the Internet, assets can be easily managed and tracked remotely. Alarm systems can also be integrated for improved security, generating real-time alerts if an item's location changes without authorization or unexpected items are detected.

Equally, by using cloud-enabled platforms, updates and information gathered during inspections can be delivered in real-time back to a firm's anti-fraud departments and used to better manage the supply process and monitor stock levels at all time.

In brief: improving the track-and-trace process

- Effective asset control / track-and-trace systems are crucial in the fight against crime and the grey market - particularly with the increasing complexity of modern supply chains

- RFID tags can revolutionize the way a business operates, allowing for instantaneous remote monitoring, rapid stocktaking and real-time security updates

- GPS systems and sensors can be easily integrated with RFID tags to offer important information on location or item condition

- Big data and machine learning allow for rapid processing and analysis of large amounts of stock information at every stage of the supply chain
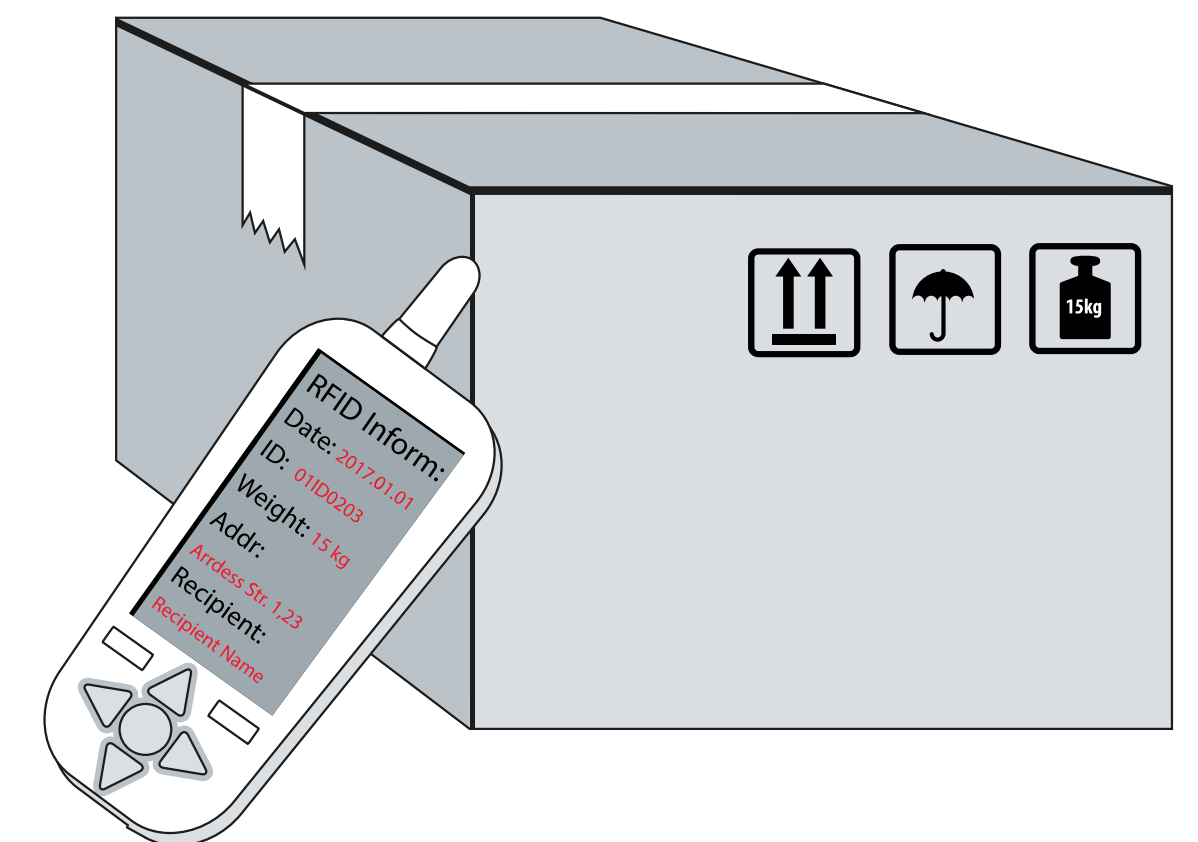
IV: Consumers to check brand authenticity

Until now, it has been incredibly difficult for consumers to spot fakes in the market - a problem that has only got worse...

Mobile solutions allow consumers to verify authenticity

...as counterfeiters and pirates have become increasingly successful at imitating the trademarks of key brands. Research carried out in 2017 found that 45% of shoppers were concerned about buying counterfeit goods over the winter holidays. While 91% of respondents said they would not knowingly buy a fake product as a present, around a third said they had been tricked into purchasing fakes in the past.

There is strong evidence to suggest that a significant proportion of consumers who buy counterfeit products do so accidentally, believing that they are buying the real thing. To bring these consumers on-side in the battle against counterfeits, firms must give them the tools they need to quickly identify whether a product is fake or genuine.

With an RFID-tag authentication system, brands can easily set up mobile apps that allow customers to verify the authenticity of an item on their mobile phone. These proprietary apps work in conjunction with the unique serial identifier contained in a product's RFID tag, enabling the consumer to rapidly verify whether an item they plan to purchase is genuine.

When considering a purchase, the customer can now use their smartphone to read the product's unique identification number; data which is then sent to a company database held on a secure centralized server for authentication. An alternative, more secure verification process could also be achieved

via a decryption process built into the app itself, meaning that authentication could occur using the smartphone alone.

Once this process is complete, the consumer will receive an instant notification informing them whether the product is genuine or not. If it is genuine, they will have assurance of the quality and regulatory compliance features that are associated with branded products. If not, data relating to the location of the fake item could be delivered directly to the firm, offering further opportunities for identifying intellectual property violations and stamping it out for good.

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Improving customer relationships through communication

As well as giving consumers more control over the goods they purchase, mobile verification apps can be an effective customer relationship management (CRM) tool, fostering greater trust and better communication between brands and consumers.

Customers who use these apps can have access to a wide number of incentives, such as rewards and warranties when they purchase genuine branded products. Based on their purchase history and account activity, firms would also be able to provide targeted recommendations and offers, as well as giving them easy access to full, in-depth product information including compliance and health and safety details.

Fundamentally, mobile authentication apps linked with RFID tags can open better channels of communication between a brand and its customers, allowing for mutual sharing of data. To enable even better CRM activity, the apps can also be linked up with existing marketing schemes and social media accounts, giving firms a wealth of data to work with to improve the customer experience.

In brief: RFID puts authentication in the hands of the consumers

- A large proportion of consumers who buy counterfeit products do so unknowingly, having been fooled by authentic-looking branding and the characteristics of the fake item

- By combining RFID tag information with branded authentication apps, companies can empower consumers to make more knowledgeable purchases

- Using a smartphone, customers can quickly read the unique serial identifier contained on the RFID, authenticating the product via an in-app decryption process or a central company database

- As well as giving consumers more choice, these apps can be used to keep track of consumer purchasing preferences, provide incentives for purchasing authentic products, and streamline marketing communications

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V. Latest developments: discreet RFID tag solutions

Design considerations have been a major factor holding back the widespread use of RFID solutions in authentication and track-and-trace systems

In particular, the size and appearance of bulky RFID tags can have a negative impact on the look of a product, making it less appealing to consumers and placing greater demands on marketing and design departments.

Clip-on RFID tags tend to be highly secure and are well known as an anti-theft protection device in retail environments, but obtrusive tags can occasionally have a negative impact on customer experience and efficiency, potentially making repeat custom less likely. On the other side of the coin, RFID-tagged labels can be easily applied and removed - so while efficiency and design is improved, items may still be vulnerable to tampering and theft.

Fortunately, the latest developments in the development of RFID technology have meant that a much wider range of tag sizes are now available on the market. With components manufacturers finding groundbreaking ways of miniaturizing RFID tags, RFID can be seamlessly integrated into existing product design and be used as an authentication method on small and medium-sized items.

Equally, with RFID technology working well over potentially long distances - and with no need for the tags to be in the line of sight of the reader - there is no reason why RFID

> "...micro-tags can be hidden in the product itself..."

tags should always be placed on the packaging of products. To deliver on even better security without compromising on customer experience, micro-tags can be hidden in the product itself, enabling covert authentication that is far less susceptible to tampering.

So while RFID had previously offered better customer protection at the expense of aesthetic value and experience, several vendors now offer miniaturized tags that are both durable, discreet and easily integrated into existing product design - delivering on both counts.

In brief: tackling design challenges

- Previous manifestations of RFID tags have posed design challenges for manufacturers and have had a negative impact on the look of a brand and customer experience
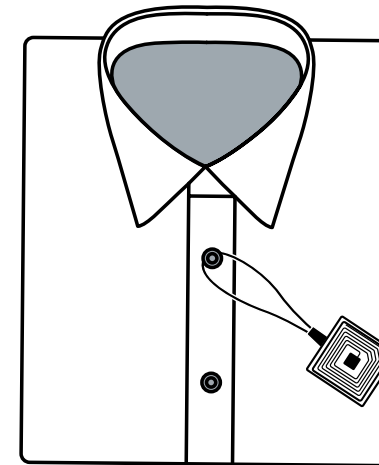
- RFID can deliver on better customer protection, while also offering a high level of customer experience

- Improvements in methods of miniaturizing RFID tags means that a wide ranges of tag sizes are now available on the market
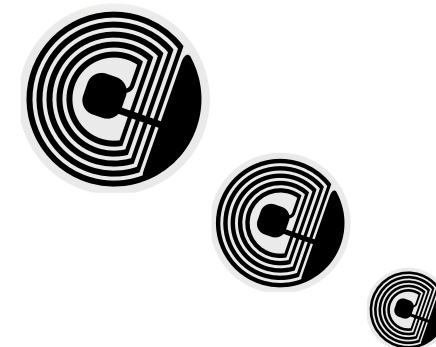
- Micro-RFID tags can now be integrated seamlessly into existing product design and even hidden inside the product for greater security

Conclusion

The status quo of product authentication is no longer working for today's globalized and complex market. wIf industry is to reverse the trend of growing counterfeiting and the thriving grey market, a new system is needed that offers greater efficiency and highly accurate tracking of large volumes of goods. With their high-grade security features and ability to store large amounts of key data such as a unique serial identifier, RFID tags could represent the future of authentication, and a key weapon in the fight against fraud.

Together, RFID tags and accurate big data represent a vastly improved method of authenticating and tracking products over whole operation, replacing the time-consuming and insecure barcodes and spreadsheets of the past. With the latest technology in play, manufacturers are now able to receive real-time alerts delivering information on a product's whereabouts and condition - information

that can be processed and handled rapidly with the latest machine learning algorithms. With branded mobile apps for reading RFID tags, brands can also empower consumers to verify the authenticity of products for themselves.

Now, advancements in miniaturizing RFID tags means that brands no longer have to compromise on customer experience or appearance. Durable micro-tags with powerful data-storage capacities can be placed inside the products themselves, offering a secret weapon against would-be counterfeiters and seal of quality for customers.

With these technologies, firms will be better equipped than ever to foster brand trust and loyalty, regain revenues lost to counterfeiting and hinder the work of criminals who attempt undermine their intellectual property rights.