A Future-Ready WEEE Directive for Circularity and Innovation

The revision of the **Waste from Electrical and Electronic Equipment (WEEE) Directive** provides an opportunity to ensure that EU waste and industrial legislation remain aligned with the Union's circular economy, digitalization and objectives for competitiveness. Since the recast of the Directive in 2012, European product value chains have undergone significant technological change. **Digital identification technologies** now play a key role in enabling use cases such as **efficient management of inventory, logistics and circular** business models by improving product identification, supply-chain transparency and resource management.

Across European industries, companies are increasingly deploying technologies that allow products to carry a **digital identity** and be tracked throughout their lifecycle. These technologies underpin several EU policy initiatives, including the **Circular Economy Act (CEA)**, the **Ecodesign for Sustainable Products Regulation (ESPR),** the **Packaging and Packaging Waste Regulation (PPWR)** and the **New Legislative Framework (NLF)** revision.

Among these technologies, **passive Radio Frequency Identification (RFID)** has emerged as a widely deployed solution for product identification and production efficiency across numerous sectors including textiles, logistics, retail and reusable packaging systems. However, passive RFID technologies differ fundamentally from conventional electrical or electronic equipment in their technical characteristics, their environmental footprint, and their positive sustainability impact on the environmental footprint of the items to which they are attached. **Clarifying the treatment of passive RFID technologies within the WEEE framework would therefore ensure that the Directive remains aligned with EU industrial competitiveness and circular economy policies while maintaining a proportionate regulatory approach.**

The revision of the WEEE Directive should ensure **that passive digital identifiers, such as passive RFID technology, are not subject to the Directive's scope. Their presence should also not trigger WEEE obligations for host products.** These technologies play a key role in enabling the achievement of the EU's circularity goals, notably through the implementation of ESPR, among other EU policy initiatives.

Excluding these technologies from the scope of the WEEE Directive would represent a **proportionate approach** while ensuring alignment with broader EU circular economy and industrial competitiveness objectives. In particular, it would reinforce the functioning of digital product identification systems, including the ESPR and the Digital Product Passport (DPP).

The need to address Single Market fragmentation

Passive RFID technologies are key enablers of the EU's circular economy objectives, supporting product traceability, DPPs, and more efficient reuse, repair, recycling and compliance across value chains. However, **Member States have adopted different practical approaches to determining how RFID tags attached, integrated or embedded into non-EEE products, should be treated under the WEEE framework.** While some Member States apply a function-based interpretation, others assess whether RFID is placed on the market as a standalone product or embedded within another product. In some Member States, RFID technology embedded in products already subject to Extended Producer Responsibility (EPR) schemes are covered by the host product regime and are not treated as separate electronic waste.

Furthermore, several Member States use the "end user functionality" principle to classify whether RFID falls under the scope of the Directive. The principle is not contained in the WEEE Directive itself but has been developed by certain national competent authorities and applied in classification decisions. Its application has resulted in differing interpretations across Member States, contributing to legal uncertainty and fragmentation in the Single Market. As product digitalization advances and DPPs are rolled out, the principle may become increasingly difficult to apply consistently. The revision of the WEEE Directive therefore provides

an opportunity to clarify the treatment of embedded RFID technologies directly in the legislation, ensuring a harmonized and future-proof approach across the EU.

Overall, this lack of harmonization creates legal uncertainty and additional compliance burdens for economic operators placing RFID-tagged products on the EU market, especially given that an estimated 11.57 billion passive RFID tags were expected to be placed on the EU market in 2025 alone. It risks overlapping regulatory requirements and duplicative EPR obligations, particularly as the EU increasingly promotes digital data carriers through initiatives such as the DPP and the Packaging and Packaging Waste Regulation (PPWR). The resulting complexity risks discouraging investment in RFID-enabled traceability solutions.

Proposed clarifications to the WEEE Directive

The RAIN Alliance proposes a targeted clarification via the introduction of a new definition under Article 3(1)(X) and a corresponding clarification under Article 2(3). This approach would enable RFID technologies to support the EU's transition from a linear to a circular economy, provide legal certainty, reduce fragmentation across Member States, avoid duplication of EPR obligations, and ensure coherence with the ESPR, the DPP framework, PPWR, and the EU's broader circular economy objectives.

Article	Proposed wording
Proposed Article 3(1)(X) – Definition of "Integrated Identification Component"	"'Integrated identification component' means a passive electronic device incorporated into, or affixed to, a host product or its packaging at the time of manufacture, during the supply chain, or prior to first placing on the market, which is designed and intended to enable wireless communication of data relating to or in connection with the host product, including but not limited to its identification, authentication, traceability, provenance, condition, or any other attribute, by means of passive electromagnetic interaction with an external reader, including through passive backscatter of the reader's radio frequency signal or through electromagnetic induction, and which is not designed or generally marketed as a standalone product."
Proposed Article 2(3) – Attribution of WEEE Obligations	"This Directive shall not impose standalone obligations on the producers of integrated identification components as defined in Article 3(1)(X). All obligations under this Directive in respect of integrated identification components shall be attributed to and borne by the producer of the host product in which or on which the integrated identification component is incorporated or affixed."

Beyond these amendments, the RAIN Alliance and NFC Forum note that the logic underpinning Article 2(3)(b) is also consistent with the Commission/JRC's preparatory work on DPPs for textile apparel under the ESPR. That study excludes e-textiles from the textile scope, while expressly recognising that passive UHF- and NFC-based information carriers may be used for the DPP without causing in-scope products to be considered e-textiles. This reflects an important regulatory principle already emerging in EU policy: passive digital identification technologies used to enable traceability and DPP functionality should not, by themselves, change the legal character of the host product. The same principle should apply under the WEEE Directive, which should make clear that integrated passive RFID components do not trigger standalone WEEE obligations.

Accordingly, where the host product is already subject to an EPR regime, the embedded RFID component should be covered by that regime. This would not constitute a new policy principle, but rather provide legal

clarity and ensure consistency between the WEEE framework, the ESPR Digital Product Passport architecture and the existing rationale of Article 2(3)(b).

Passive RFID Technology Benefits

The following examples illustrate how digital traceability technologies have a **double positive effect**: on the one hand, they contribute to the **EU's broader policy objectives** of improving resource efficiency, reducing waste, and enabling competitive circular value chains; on the other hand, they offer **business potential** already leveraged today by businesses across many sectors and geographies.

Passive RFID and other digital identification technologies provide both business and environmental benefits. From an **environmental perspective**, these technologies contribute to more efficient and circular resource use. High identification accuracy in sectors such as textiles enables better sorting and recycling at-scale, while reducing manual processing. In reuse systems, passive RFID facilitates tracking across multiple use cycles, helping to cut waste and replace single-use models. In supply chains, improved inventory management reduces overproduction and excess stock, thereby limiting waste generation. In the food sector, passive RFID enables mature inventory management methods that enhance stock rotation, extend product shelf life and help prevent avoidable food waste. Together, these impacts support broader EU objectives on resource efficiency, waste reduction, and the development of sustainable circular value chains.

For businesses, they improve productivity, strengthen compliance, and help prevent counterfeit products from entering the EU Single Market, while also offering a cost-efficient solution through their battery-less design. Passive RFID enables businesses to identify, locate, and authenticate their items, unlocking a multitude of use cases across numerous industry sectors—from inventory management, automated checkout, and loss prevention in retail stores; to shipment verification and authentication in logistics. For example, passive RFID improves inventory accuracy to around 95-99% from 60-75% accuracy achieved with barcodes; plus, inventory cycle counts by passive RFID are 25 times faster than manual barcode scanning.

Finally, passive RFID technologies differ fundamentally from the electronic equipment traditionally regulated under WEEE. Passive RFID tags are **small, battery-free components** consisting primarily of a microchip and a thin antenna on a plastic or paper substrate, which is embedded in or attached to a host product. They contain **no independent power source** and function only when activated by an external reader.

About RAIN Alliance and NFC Forum

The **RAIN Alliance** is a global industry organization of more than 200 member companies dedicated to advancing the adoption of RAIN RFID technology through collaboration, standardization, and innovation. Its members represent the full RAIN ecosystem and are headquartered across Europe, the Americas, and the Asia-Pacific. Europe is home to some of the Alliance's largest and most diverse membership, spanning the full value chain – from semiconductor leaders such as EM Microelectronic to major consumer brands including Decathlon.

The **NFC Forum**, established in 2004, is a non-profit industry association comprised of over 800 leading mobile communications, semiconductor, and consumer electronics companies. Its mission is to advance the use of Near Field Communication technology by developing specifications, ensuring interoperability, and educating the market about NFC technology. Global member companies share skills, technical expertise and industry knowledge to develop specifications and protocols for interoperable data exchange, device-independent service delivery, and device capability. The Forum's supporting certification program and user marks enhance and promote a consistent, reliable, seamless and secure NFC user experience.

ANNEX

Evidence and Practical Experience

Research and industry deployments illustrate the environmental and operational benefits of digital identification technologies.

The **SMART TRASH research project** demonstrates that passive RFID technology can significantly improve recycling systems by increasing the transparency and traceability of waste streams and enabling more efficient material recovery.[1]

By enabling products to carry a unique digital identity linked to lifecycle data, passive digital identifiers support emerging EU frameworks such as the ESPR and the DPP. Industry pilots in textile recycling show that passive RFID identifiers can link garments to lifecycle information, enabling improved sorting, repair, resale and recycling processes in industrial-scale facilities.[2] Industry experience demonstrates the benefits of such technologies for efficient circular systems: textile sorting pilots conducted with recycling operators have demonstrated that passive RFID-based identification can achieve **up to 99% identification accuracy**, including difficult-to-identify garments such as black or mixed-fiber textiles. The pilots also showed up to 99% reductions in manual scanning time and around 90% faster garment check-in at high-volume facilities.[3]

The **CIRPASS-2 project**, funded under the Digital Europe Programme, is currently testing Digital Product Passport implementations across multiple sectors including textiles, electronics and batteries. The CIRPASS 2 textile pilot is using passive RFID as a data carrier to enable sorting accuracy and repair. These initiatives illustrate how interoperable digital identifiers can enable circular product systems and improve lifecycle transparency.[4]

Together, these initiatives demonstrate how digital identification technologies support EU objectives on resource efficiency, recycling performance and circular product systems. Ensuring that the WEEE framework reflects the specific characteristics of these technologies will help maintain regulatory coherence while allowing innovation to continue supporting Europe's circular economy transition.

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[1] SMART TRASH research project analyzing the role of RFID technology in improving waste stream transparency and recycling efficiency.

[2] Textile Loop project and Avery Dennison atma.io Digital Product Passport pilots enabling item-level identification to support sorting, repair, resale and recycling in circular textile systems: AUTOLOOP - To revolutionise how Europe handles textile waste, EU Digital Product Passport (DPP) | atma.io

[3] Avery Dennison textile sorting pilots with partners Texaid, Recircled and ACS demonstrating passive RFID-enabled identification accuracy of up to 99% and significant reductions in manual scanning time.

[4] CIRPASS and CIRPASS-2 Digital Product Passport projects, funded under the EU Digital Europe Programme, developing cross-sectoral frameworks and pilot deployments for interoperable Digital Product Passports: CIRPASS – Digital Product Passport, Cirpass2.