Enhancing Circularity with RAIN RFID-Enabled Digital Product Passports

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The RAIN Alliance, a consortium of RAIN RFID industry leaders and experts, is actively supporting the Digital Product Passport (DPP) initiative in the European Union. Our mission is to create a smarter and more sustainable world by using RAIN RFID technology to connect trillions of everyday items across their entire lifecycle, simply and inexpensively. We firmly believe that RAIN is the best-positioned data carrier solution for DPPs and is necessary to support the EU's goal of unlocking a circular economy at scale. This document presents our case by highlighting RAIN's differentiating advantages and proposing specific regulatory considerations to ensure the successful implementation of RAIN in the DPP framework.

1. Widespread Industry Adoption and Future Advancements of RAIN

RAIN is an established solution built on global, widely adopted standards, protocols, and guidelines authored by ISO, GS1, and the RAIN Alliance for universal compatibility. It is important to consider the current essential uses of tens of billions of RAIN tags by enterprises today, the rapidly growing adoption of RAIN across various sectors, and the promising horizon shaped by future technological integrations.

- **Extensive integration across major companies worldwide:** Many leading global companies in diverse sectors such as retail, logistics, healthcare, and automotive have adopted RAIN systems as a core component of their operations and sustainability initiatives, underscoring RAIN's proven reliability and scalability.
- **Massive industry adoption in retail and beyond, positioned to scale:** RAIN adoption is surging. Market research from VDC reports 44.8 billion RAIN chips shipped globally in 2023—a 32% year-over-year increase—with projections exceeding 115 billion units by 2028.
- **RAIN RFID in mobile devices will continue to drive RAIN adoption:** As noted in a statement from Qualcomm: "The integration of RAIN RFID technology into mobile devices is rapidly progressing, with the initial rollouts focusing on enterprise mobile devices, expected within a few quarters. Consumer devices equipped with RFID technology are set to follow." This advancement is poised to further RAIN adoption in upcoming years, signaling a transformative shift in how consumers interact with and track products and opening the doors to entirely new RAIN use cases.

2. Unmatched Efficiency in Mass Reading Capabilities with RAIN

RAIN offers exceptional mass reading capabilities, which are essential for implementing large-scale circular economy initiatives such as recycling, reuse, and resale.

- **Long-range, near-simultaneous, bulk reading:** RAIN provides a read range of up to 10 meters and can read up to 1,000 items per second, enabling efficient, automated data capture without line-of-sight requirements.
- **Enables efficiency in mass-scaled sorting processes:** The ability to read multiple items simultaneously significantly reduces manual labor and increases efficiency and accuracy in sorting processes, making it easier and more economical to implement large-scale circular economy practices. For example, in textile and tyre recycling, RAIN tags enable automated identification and sorting by sharing details like brand, size, and material composition.

3. RAIN Enables Comprehensive Traceability

RAIN RFID enables comprehensive product traceability from a tagged item's manufacture to end-of-life through its ability to automatically capture data at every stage of the supply chain.

- **Traceability at the individual item level:** RAIN tags give each item a unique identity. Item-level tagging allows automated processes to capture detailed and accurate information about a single product at each level of the value chain.
- **Embedded tags enable tracking throughout a product's entire lifecycle:** The growing portfolio and adoption of embedded RAIN tags ensure seamless product tracking from item manufacture to end-of-life. Of the 115 billion tags forecasted to ship in 2028, embedded tags are projected to account for 17-18% of total tag shipments. In sectors like apparel/textiles, embedded tag adoption is projected to grow even further to 22-23%.
- **Durable tags ensure data integrity:** Through tailored tag design, RAIN tags can offer superior longevity, withstanding environmental stresses, heavy wear and tear, and harsh conditions. They can remain functional after exposure to extreme temperatures, 100+ textile wash cycles, or years of use on tyres, ensuring reliable tracking throughout a product's lifecycle.
- **End-to-end data collection capabilities help businesses meet Ecodesign requirements:** To adhere to the Ecodesign requirements, as outlined in the ESPR (Article 5), companies will need to navigate new strategies for tracking and reporting data. This marks a significant shift in how businesses approach product information management, and the capabilities of RAIN emerge as a pivotal tool for corporations to efficiently collect and manage the data required across all levels of the value chain, from manufacture to end of life.

4. A Circular Economy and Sustainable Businesses Powered by RAIN

RAIN is crucial for advancing the circular economy and meeting the sustainability goals set out by the ESPR effectively and at-scale.

- **Facilitates end-of-life recycling and material recovery:** Essential for recycling efforts, RAIN tags carry detailed information critical for the efficient sorting, resale, and recycling of materials at the end of a product's life. This capability supports automated processes that are key to a functional circular economy, ensuring materials are reused and repurposed effectively.
- **Extends product and component lifespans:** By enabling strategies like reuse, repair, refurbishing, remanufacturing, and repurposing, RAIN can prolong the operational lifecycle of individual products and their components.
- **Real-time inventory data minimizes waste and overproduction:** By maintaining accurate data on stock levels, locations, and movements with RAIN systems, businesses can significantly reduce overproduction and excess inventory. This helps in adhering to regulations like the ban on destroying unsold goods (ESPR, Chapter VI), fostering a more sustainable production and consumption model.
- **Enables sustainable business models:** RAIN is foundational in supporting sustainable business practices such as product rental or product-as-a-service models. RAIN simplifies product return and redistribution, facilitating efficient product take-back schemes and supporting the infrastructure needed for closed-loop supply chains.

5. Ensuring Authenticity and Privacy with RAIN

RAIN tags can be a valuable tool for ensuring product authenticity and protecting consumer privacy, assisting enterprises, consumers, and governments alike.

- **Anti-counterfeiting measures ensure authenticity:** Embedded cryptographic RAIN tags can be used to guarantee that each DPP is linked to a genuine item. This prevents counterfeiting and maintains the authenticity and integrity of product information, thus protecting brand value, ensuring consumer safety, and securing the supply chain.
- **Multi-layered security protects data and user privacy:** RAIN tags are designed with robust privacy protection features. Standardized methods exist today for short-range mode, which only allows data transmission within a certain range, or to kill the tag entirely.

Specific Regulatory Asks

The RAIN Alliance firmly believes that RAIN RFID is uniquely positioned to meet the EU's goals for Digital Product Passports with its unparalleled advantages in traceability and circularity. As EU legislators continue developing the DPP framework, we urge the adoption of technology-neutral, forward-thinking policies that recognize RAIN's proven capabilities, build on industry legacy systems that support the tens of billions of RAIN tags already in the market and do not block their growth and future innovations.

- **Allow a flexible, multi-carrier approach to maximize DPP effectiveness:** We urge the use of multiple data carriers on a product for DPP, recognizing that different carriers have their own strengths across the value chain. Considering a flexible approach that allows for both RAIN RFID tags and other data carrier(s) will ensure comprehensive product tracking and critical end-of-life instructions for sorters and recyclers, while also providing consumers with easy access to comprehensive product information while RAIN-enabled mobile devices ramp in the market.
- **Implement item-level serialization to enhance product traceability:** Rather than requiring DPPs on a SKU or batch level, the RAIN Alliance advocates item-level serialization to enable precise tracking and management of individual products throughout their lifecycle.
- **Optimize data storage to balance performance and cost-effectiveness:** The vast majority (> 95%) of RAIN RFID tags in the retail industry utilize numbering systems that are either 96 bits or 128 bits in length (e.g., GS1 SGTIN). To optimize tag performance, reduce costs, and ensure flexibility, we recommend limiting on-tag data to the unique identifier and leveraging cloud-based systems for additional product information to conform to these existing memory bank sizes.
- **Require information necessary to unlock a circular economy:** We urge policymakers to mandate that DPPs include end-of-life and sorting information, which is important for consumers, and especially vital to sorters and recyclers. We believe effective large-scale sorting will depend heavily on RAIN RFID, but businesses must supply the necessary data to ensure efficient recycling processes and unlock a scalable circular economy.
- **Adopt a future-proof DPP system that allows for innovation, such as item ownership data models:** We urge that DPP standards remain flexible and adaptable, ensuring they support, rather than hinder, the discovery of new use cases and market innovations for DPP. Item ownership is a key use case adjacent to DPP's circularity focus that we believe will provide value to consumers in the future For example, a lost dog wearing a DPP-enabled collar should be identifiable by the collar's unique identifier, linking to the owner rather than the manufacturer or retail location. As envisioned by the ESPR, the DPP system should be agile and market-driven, evolving in line with emerging business models, markets, and innovations to maximize benefits.

A Joint Vision for a Smarter, More Sustainable World

The implementation of Digital Product Passports in the EU represents an exciting and pivotal moment in the global push towards sustainability and circular economy principles – a vision that aligns with the core mission of the RAIN Alliance. As we collectively strive for a future where products are designed, manufactured, used, and recycled with maximum efficiency and minimal environmental impact, the role of RAIN RFID becomes increasingly critical. Its thoughtful adoption in the DPP framework will empower consumers, businesses, and regulators with real-time, accurate data, fostering informed decision-making and enabling innovative circular economy solutions at scale.

We at the RAIN Alliance are committed to collaborating with policymakers, industry leaders, and stakeholders to ensure that RAIN RFID's full potential is realized in the DPP initiative, paving the way for a more transparent, efficient, and sustainable global economy, together.

About the RAIN Alliance

The RAIN RFID brand name represents passive ultra-high frequency (UHF) RFID technology.

The RAIN Alliance is a consortium of companies that together want to create a smarter and more sustainable world by using RAIN RFID technology to connect trillions of everyday items across their entire lifecycle, simply and inexpensively.

The RAIN Alliance drives awareness and fosters market adoption of RAIN technology and supports the development of the RAIN brand.

The RAIN Alliance offers various membership benefits, including industry research, educational sessions, promotion, and networking opportunities that connect industry members and end-users.

For more information, please visit www.RAINRFID.org