



RAINTM
A L L I A N C E

E-Waste Disposal Regulations and RAIN RFID

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1. EXECUTIVE SUMMARY

Sustainability has become a popular topic today. Companies and governments are putting more emphasis on how to preserve the environment and regulate commercial activities ensuring nobody abuses natural resources or the environment to maximize their benefits.

Additionally, RAIN RFID is widely adopted in different applications and the consumption of RAIN tags has reached 20 billion units in 2020. It gives the user many advantages and improves efficiency. However, there is no specific regulation available to regulate RAIN tags' recyclability and/or disposal. Unlike typical electronics (such as printers and readers) which are handled under current e-waste regulations, RAIN tags are not clearly addressed in EU, US, and Asian regulations. It becomes a market challenge as RAIN tag disposal increases. It is not clear what regulations or guidelines to follow when handling RAIN tags.

For instance, European e-waste regulations don't address RAIN tag handling clearly. In the US, RAIN tags are treated differently in different states. The regulations focus more on active RFID tags while passive RFID tags (such as RAIN tags) are likely classified as universal waste. In Asia, each country has their own regulation without any specific alignment in the region. There is no one-solution-fits-all scenario whilst the regulations are not harmonized on a global scale. It leads to complexity for all the stakeholders to handle and dispose of RAIN tags properly to fulfill the requirements.

2. INTRODUCTION

The objective of this paper is to provide the reader basic information on the waste requirements for the RAIN industry. The issue of e-waste will be described to help the reader understand how to determine the minimum requirements for waste and recycling in the target market they wish to serve. This paper helps RAIN members to understand what type of regulations could potentially apply to their operations now and what they must constantly monitor in the future when there are regulatory changes.

3.SCOPE

Electronic waste, or e-waste, refers to all items of electrical and electronic equipment (EEE) and its parts that have been discarded by its owner as waste without the intent of re-use (Step Initiative 2014). E-waste is also referred to as WEEE (Waste Electrical and Electronic Equipment), electronic waste, or e-scrap in different regions and under different circumstances in the world. It includes a wide range of products – almost any household or business item with circuitry or electrical components with power or battery supply (Balde, et al, 2017).

RAIN is used extensively in various applications for inventory management and traceability in markets such as Drugs, Healthcare, Postal, Tires, Retail Apparel, etc. (Schindler et al, 2012). There are many nations, companies and parties highlighting the adoption of RAIN and its disposal. With this popularity, different industries and markets are gradually looking at how to handle the e-waste generated from RAIN and related goods and products.

The rules and regulations vary depending on the industries and regions; for instance, active and passive RFID tags are handled differently in each country. This paper gives an overview of current e-waste regulations and the e-waste management in different regions. It will focus on the physical aspect of the RAIN tags. The data stored on the RFID tags, or the network is not in this paper's scope. Note also, active RFID tags related e-waste regulations will be investigated separately in the future.

4.E-WASTE REGULATIONS IN DIFFERENT REGIONS

In general, e-waste regulations refer to the regulations for electronic waste. In a RAIN tags environment, it is inevitable to come across hardware such as RFID printer and readers. Due to the similarity of the functions and components (for example, RFID printer and normal printer), the users should handle and dispose of the RFID hardware in the same way as the normal non-RFID hardware according to the producers' advice and instructions. According to the Organization for Economic Co-operation and Development (OECD), the Extended Producer Responsibility (EPR) policy approach is implemented. It means the producers are given a significant responsibility for the treatment or disposal of post-consumer products (Condemi, Cucchiella & Schettini, 2019). Users should refer to the same e-waste

regulation and management practices for printers. To understand the current e-waste regulations, this paper categorizes them by geographic regions.

4.1. Europe:

The Management of Waste of Electric and Electronic Equipment (WEEE) is one of the market instruments used to protect the environment. In the EU, WEEE is the Directive that is widely adopted and followed in European countries and companies. As the Directive lists, RFID tags (active and passive) meet the definition of WEEE as set out in Article 3(1)(a) and thus fall within the scope of the Directive, unless they benefit from an exclusion. This exclusion (in the Directive Article 2) highlights the exclusion of military, space, medical and other specific professional purposes.

RAIN can be considered to fall under Category 3: IT and telecommunication equipment. Concerning the WEEE Directive, if RAIN tags are put on the packaging of the electrical and electronic equipment, they are considered to fall outside the scope of the Directive because they are part of a product that is not covered by the WEEE Directive. If they are put on equipment, the producer of the equipment is responsible for recycling. (FAQ article, Official Journal of the European Union, 2012).

Referring to WEEE documentation, it also states the scope of components as follows: "Components cover the range of items that, when assembled, enable an EEE to work properly. Components placed on the market separately to be used to manufacture and/or repair an EEE fall outside the scope of the Directive unless they have an independent function themselves." (Official Journal of the European Union, 2012).

Regarding the e-waste management and disposal, the handling is not the same if the RAIN tags are used for different purposes. In WEEE documentation, it clarifies that the Member States are required to promote the collection schemes or facilities for the separation at collection points of WEEE to be prepared for re-use and in-line with Annex IV (point 16) of the EU Waste Framework Directive 2008/98/EC. The member states shall ensure that collective and/or individual systems are set up, adequate and accessible collection points are established and action to increase collection is taken and promoted (e.g., Nationwide awareness campaigns). The national authorities must ensure that collection rates are achieved, considering all the channels. In addition, the minimum collection rate to be achieved annually shall be 65% of the average weight of EEE placed on the market in the three preceding years from 2019

onwards, or alternatively 85% of WEEE generated on the territory of the Member State as foreseen in Article 7(1).

To conclude, the RAIN tags on the packaging and/or the price ticket are not clearly seen as finished products, so the regulation is not applied but if the RAIN tags are on the electronic products, then the e-waste regulations are relevant.

4.2. U.S.:

The Environmental Protection Agency (EPA) sets US Federal requirements for e-waste. The EPA established the National Strategy for Electronics Stewardship (NSES) to provide recommendations to regulators, industry, and consumers, both domestically and for items exported to other countries¹.

The EPA allows states to set their own requirements for waste programs if they are equivalent to federal regulations, with a few exceptions (e.g., batteries). At least 25 US States have electronic recycling laws, according to the Electronics Recycling Coordination Clearinghouse (ERCC)².

Several states have established programs to specify collection and recycling of certain e-waste, notably California's "Electronic Waste Recycling Act of 2003 (EWRA)"³.

Restriction on use of certain Hazardous Substances (RoHS) applies in some states, for example, California's RoHS law⁴, and now California's Proposition 65, as well as New Jersey, New York, Illinois, Indiana, Minnesota, Rhode Island, and Wisconsin.

The EPA defines electronic waste, or e-waste, as used electronics that are nearing their end of useful life. Examples include computers and peripherals (monitors, keyboards, printers, scanners, fax machines);

¹ [EPA National Strategy for Electronics Stewardship](#)

² [Electronics Recycling Coordination Clearinghouse](#)

³ [CalRecycle Electronic Waste Recycling Act of 2003](#)

⁴ [California Legislative Information - Hazardous Waste Control](#)

televisions; small electronic equipment (VCRs, DVD players, portable digital music players, game consoles, etc.)

Universal waste is a broad category generally referring to waste generated by households and many different types of businesses that contain hazardous materials. Examples include fluorescent bulbs, batteries, pesticides, mercury-containing equipment⁵.

There is a similarity with the Europe regulations that e-waste is a specific type of universal waste (e.g., TVs, computers, cell phones, etc.), but not all universal waste may be considered e-waste (e.g., common batteries, mercury thermometers, musical greeting cards, non-empty aerosol cans that contain hazardous materials).

4.3. Asia:

The Asian countries use different international laws, regulations, and initiatives to guide and regulate how their countries arrange e-waste.

Those adopted include: Waste Electrical and Electronic Equipment (WEEE) Directive, Restriction of Hazardous Substances (RoHS) Directive, EU Directive on Energy-using-Products (EuP), EU Directive on Registration and Evaluation and Authorization of Chemicals (REACH), the Basel Convention Partnership on the ESM of E-waste in the Asia-Pacific region, StEP (Solving the E-Waste Problem) Initiative, and Regional 3R (Reduce, Reuse, Recycle) Forum in Asia.

The e-waste regulations in Japan, China and Korea are more comprehensive than in Southeast Asia but all are sufficient to get the public aware and alert on e-waste. In some countries, such as Indonesia, Malaysia and Singapore, the e-waste is covered under Hazardous waste regulations while others like Brunei, Lao PDR, and Myanmar don't have specified e-waste regulations. The e-waste regulation is less comprehensive in developing countries in Asia. Some of them may not even have a clear definition of e-waste. (Semarang, 2016).

For the e-waste disposal and management, Asia faces several challenges and difficulties. As a result of the rapidly increasing sales

⁵ [Great Forest Sustainability solutions Sustainability 101](#)

and trend of electronic goods in the world and the increase in the manufacturing of electrical and electronic goods and their trend, the public is becoming concerned about e-waste. (Khan, Shadman & Siddiqui, Shadab. 2020) There are concerns that e-waste generated in developed countries is ending up in developing countries especially in Asia resulting in adverse environmental and health impacts. Consequently, several countries in Asia are developing policy instruments to ensure the proper management of e-waste. These include e-waste regulatory frameworks, data and inventories, and infrastructure and capacity building. These trends indicate a positive development path towards sustainable e-waste management in Asia. Nevertheless, potential limiting obstacles for e-waste management in Asia may also include an over-reliance on legislation to drive e-waste management or the simplistic adoption of policies from developed countries without taking into context the local political, cultural, and socio-economic waste management issues. (Periathamby, Agamuthu & Victor, Dennis. 2013)

For instance, Hong Kong has the Producer Responsibility Scheme on Waste Electrical and Electronic Equipment (WPRS) covering the eight types of regulated electrical equipment (REE) (including air-conditioners, refrigerators, washing machines, televisions, computers, printers, scanners, and monitors). This came into effect in 2018 and marks another important milestone in Hong Kong's waste reduction and recycling efforts. Through the WPRS, relevant waste electrical and electronic equipment must be directed to licensed recycling facilities for proper treatment and recycling, turning waste into resources, thus offering a long-term solution to potential land contamination and environmental problems arising from mishandling during transfer, storage, and dismantling processes (Hong Kong Environmental Protection Department, 2021).

In Japan, the regulations require the users to take the responsibility to handle the RFID tagged items and goods into different types of industrial waste. For example, the users are advised to remove and handle RFID inlay, labels, product tags and molded tags separately with certain industrial waste. It also applies to the residential waste scenarios. Apart from global requirements, the waste disposal operation must achieve all the limits, and local requirements, and quality standards and quality objectives prescribed in the Air Pollution Control Ordinance, Water Pollution Control Ordinance, and Noise Control Ordinance. Its emission or discharge arising from the disposal operation would not be likely to be a danger to public health, a source of pollution to the environment or a source of nuisance to the

neighboring areas. (Japan Automatic Identification Systems Association, 2018).

In general, the common practices of e-waste end of life management are as shown below (Sunil, 2009):

- Reuse: the recovery and trade of used products or their components as originally designed
- Servicing: a strategy aimed at extending the usage stage of a product by repair or maintenance
- Remanufacturing: the process of removing specific parts of the waste product for further reuse in new products
- Recycling: Recycling can be done with or without disassembly, including the treatment, recovery, and reprocessing of materials contained in the used products or components to replace the virgin materials in the production of new goods
- Disposal: the processes of incineration with or without energy recovery or landfill.

4.4 Worldwide

Table 1: Summary of e-waste regulations in Europe, US & Asia

	Related regulations	Organizations	Remark
Europe	<p>Waste of Electric and Electronic Equipment (WEEE)</p> <p>Restriction on use of certain Hazardous Substances (RoHS)</p> <p>Registration and Evaluation and Authorization of Chemicals (REACH)</p>	European Union	
US	<p>National Strategy for Electronics Stewardship (NSES)</p> <p>Electronics Recycling Coordination Clearinghouse (ERCC)</p> <p>Electronic Waste Recycling Act of 2003 (EWRA)</p> <p>Restriction on use of certain Hazardous Substances (RoHS)</p>	Environmental Protection Agency (EPA)	x
Asia	<p>Waste of Electric and Electronic Equipment (WEEE)</p> <p>Restriction on use of certain Hazardous Substances (RoHS)</p> <p>Registration and Evaluation and Authorization of Chemicals (REACH)</p>	---	<p>No specific centralized organization in this region</p> <p>Each countries take reference of global standard and regulations to adopt and execute individually</p>

	Energy-using-Products (EuP) Basel Convention		
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5. SUMMARY

This white paper shows the e-waste regulations like in different regions in the world.

It shows that Europe and the US lead and have comprehensive rules for different parties to follow while Asia is picking up the pace and taking those rules for reference and trying to implement them respectively without a centralized third party involved. There does not appear to be a one-fits-all standard and guidelines being set and adopted globally.

With more and more countries looking at the sustainability topic, we expect this paper shall be revisited soon by supplementing more information and regulation updates. Despite how the countries will regulate RAIN tags and associated hardware, the stakeholders shall educate and improve the consumers’ knowledge of the goods and products. Then, they can handle the e-waste properly.

It is important for RAIN RFID members and your organization’s compliance team to constantly monitor this landscape for recent updates in different regions. Furthermore, the scope of this paper is limited to RAIN. Active RFID tags, different hardware equipment and data storage of the RFID tags are not included. Those topics are important, but the scope is broad, so separate research will need to be held to cover them in the future.

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7. BACKGROUND AND CONTRIBUTORS

This white paper was created by the RAIN Alliance Sustainability Workgroup. The main contributors were:

Frederic Vicentini	(NXP® Semiconductors)
Francis Au	(Nedap)
Shawn Chen	(GS1)

ABOUT RAIN RFID ALLIANCE

The RAIN RFID Alliance is an organization supporting the universal adoption of RAIN UHF RFID technology. A wireless technology that connects billions of everyday items to the internet, enabling businesses and consumers to identify, locate, authenticate, and engage each item. The technology is based on the EPC Gen2 UHF RFID specification, incorporated into the ISO/IEC 18000-63 standard.

Join the RAIN RFID Alliance to enable connectivity for your business and consumers: identify, locate, authenticate, and engage items in our everyday world. For more information, please visit www.RAINRFID.org.

RAIN RFID Alliance

**401 Edgewater Place, Suite 600
Wakefield, MA, 01880, USA**

Stichting RAIN Alliance

**Amerstam Sloterdijk Towers
Kingsfordweg 151
Amsterdam 1043GR
The Netherlands**

Visit the RAIN RFID website – RAINRFID.org.

If you are interested in learning more about the RAIN RFID Alliance, contact us at info@rainrfid.org. Or call +1 (412) 368 6850.