GS1 Germany

The Global Language of Business

GS1 Standards

EPC-based RFID Item Level Tagging

Implementation Guideline for Companies of the Apparel, Fashion and Footwear sector

Guideline

1 Introduction

1.1 Mission

EPC-based RFID Item Level Tagging (ILT) enables organisations to leverage a huge variety of use cases aiming at **increasing efficiency**, opening **new business opportunities** as well as **improving transparency**. Amongst other things, it especially provides a fast and accurate way to track and trace goods as well as manage inventory throughout the supply chain and at the Point of Sale (POS).

This document provides a **best practice guideline** in order to manage RFID ILT implementations in an international environment. The purpose of this guideline is to help the respective stakeholders along the supply chain to comply with GS1 standards as well as to handle all processes concerned with RFID item level tagging in an efficient manner.

Currently, the following **trends** can be observed in the apparel, fashion and footwear (AFF) sector:

- adoption of RFID ILT is gaining momentum
- more and more RFID pilots are leading to roll-outs
- ILT is used in more and more product categories

That being said, there is an increasing number of manufacturers, suppliers and solution providers which is involved in ILT-related processes (e.g., a manufacturer which is requested to attach RFID tags to the products by a brand owner placing an order). However, this is leading to a growing number of divergent adoption variants which impairs the overall efficiency and causes additional costs. For instance, RFID tags are placed at different positions, follow deviating encoding procedures and have varying backup approaches. Especially in supply chains of the AFF industry, which oftentimes are characterised by several hundred or thousand business partners, this is becoming a serious issue.

Thus, there is a strong need among end user companies and solution providers to **have a common understanding** and **alignment of ILT-related processes** in order to **reduce complexity** as well as **costs** along the entire value chain. In the same context, it is required to define the contents of an **EPC RFID ILT training program** enabling companies to **certify** that they have the know-how to manage **standard-compliant RFID item level tagging**.

1.2 Scope

1.2.1 In scope

This guideline supplements the GS1 standards by offering best practice solution approaches for the following subjects:

- **EPC Management** (including serial number management and exception handling)
- **Tag** and **Tagging** (including tag placement, general advise as to tag performance, and SGTIN back-up)
- **Quality Assurance** (e.g., as to verification of the encoding process, applying tags, and maintaining high tag readability)

Thereby, this guideline explicitly deals with one-way (i.e. not reusable) RFID tags.

The **audience** of this document is **stakeholders** (see chapter 1.3) **dealing with ILT processes**, i.e. organisations of the **AFF sector** involved in the handling of AFF products, which assign serialised identifiers at product item level (or intend to do so) while using inexpensive, low-capacity EPC RFID tags.

Apart from that, this document shall serve as a **conceptual basis for future user training material** aiming at putting this guideline into execution in practice.

1.2.2 Out of scope

This guideline will not address:

- solution approaches for business requirements from **sectors other than AFF** (though several approaches most likely will be transferable)
- technical specifications for **RFID tag performance** (for this purpose, please refer to the corresponding surveys/guidelines, see references)
- specifications for **business messages** of any kind
- specifications for the **encoding** of **barcodes/RFID tags** (for this purpose, please refer to the EPC Tag Data Standard and the GS1 General Specifications)
- **recommendations** as to **hardware/software solutions** and **vendors**
- **basic information on RFID** technology (frequencies, functional principle, ...)
- **EPC Data Sharing**
- **layout** and **print quality** of **labels**
- procedures for reusable **RFID hard tags**
- descriptions of specific **use cases** such as RFID-based counterfeit protection

In terms of usability, this guideline will refer to other relevant documents rather than unnecessarily duplicate their contents whenever it is appropriate.

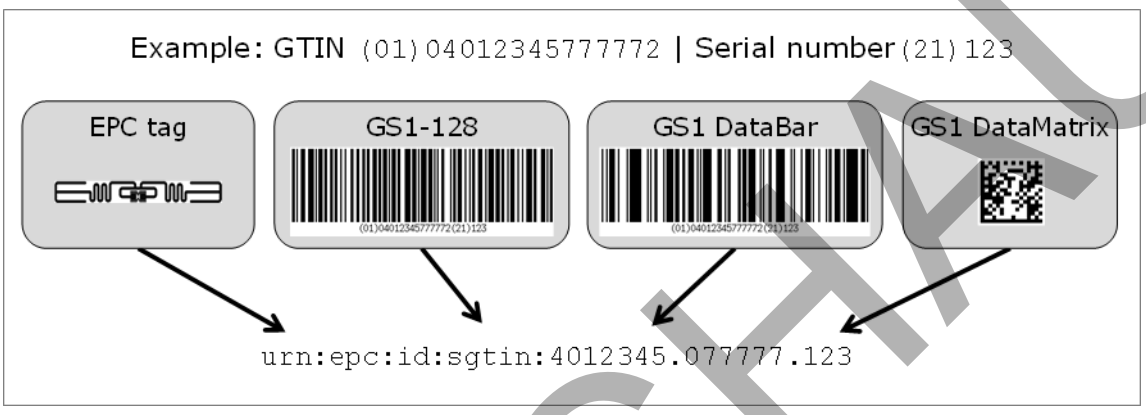
1.3 Stakeholders

The following table contains a brief description of the stakeholders involved. Thereby, it should be noted that a company can represent different roles. For instance, there is a growing number of retailers which have established private brands and thus can be considered as brand owner, producer and retailer at the same time. On the other hand, there are also suppliers which have set up their own retail stores and which operate their own warehouses and thus can simultaneously be seen as brand owner, producer, retailer and solution provider. This is why the roles are to be interpreted in a functional way (i.e., producer function, retailer function, freight forwarder function, etc.).

Term	Definition
Agency	The party responsible for organising the sourcing, quality assurance and other connected services on behalf of the brand owner.
Brand Owner	The party that is responsible for allocating GS1 System Identification Keys. The administrator of a GS1 Company Prefix. [GenSpec 2015, 475] In the AFF sector, the brand owner oftentimes corresponds with the term 'supplier'.
Freight Forwarder	The party that arranges the carriage of goods including connected services and/or associated formalities on behalf of the shipper (consignor) or consignee. [GenSpec 2015, 477]
Logistics Service Provider	Party providing logistic services such as warehousing, re-packing products, distribution and assembly. Synonym: Third-party logistics provider (3PL) [GS1 LIM 2007, 84]
Producer	The party that produces, provides, or furnishes an item or service. In the AFF sector, the producer oftentimes corresponds with the term 'manufacturer' and/or 'vendor'.
Retailer	The party that sells directly to the consumer. [GDD GDSN]
Solution Provider	An organisation that develops and implements systems for end users that are based on or implement the GS1 system of standards in its various business processes. [GDD GS1 Architecture] In the context of this document, a solution provider is for instance a service bureau printing and/or encoding tags.

1.4 Basics as to EPC and RFID

It is vital to comprehend that **'EPC'** and **'RFID'** are **no synonymous terms** at all. An **Electronic Product Code** is a **universal identifier** for a given physical or digital object (a product, a shipment, a document, etc.). It is used in information systems that need to track or otherwise refer to these objects. **RFID** on the other hand is just a **data carrier** that is able to convey an EPC. However, an EPC can also be derived from appropriate 1d/2d codes (such as a GS1 DataBar or a GS1 DataMatrix). The latter is illustrated in the following figure.



As this guideline is specifically concerned with RFID item level tagging, we consider an 'EPC tag' to be an RFID tag that complies with the GS1 EPC Tag Data Standard.

2 EPC Management

In a nutshell, this paragraph paves the way for a successful and effective EPC management. Thereby, it explains the major challenges, describes general serialisation strategies, and gives advice for the most common scenarios in which organisations have to assign serial numbers.

2.1 General remarks

The **owner of the GS1 Company Prefix (GCP)** bears the **overall responsibility for EPC management**. This is usually the brand owner. A proper EPC management is of utmost importance for the overall success of RFID ILT. Above all, it must be ensured that:

(a) there are **never any overlapping (i.e. double) EPCs**,

(b) the encoding procedure is **compliant with** the **GS1 EPC Tag Data Standard**, and

(c) the **length of the GCP** (which is always an inherent element of any EPC) is correct.

As to (a), it is key that a combination consisting of a GTIN and a serial number is assigned only once. Otherwise, data inconsistencies are pre-programmed.

Item (b) is based on the fact that all supply chain partners trust that each and every RFID tag can be read and interpreted according to the procedures described in the respective GS1 standards.

Last but not least, item (c) is referring to the issue that the length of the GS1 company prefix can vary between 6 and 12 digits. Thus, its value has to be known before the encoding procedure. Otherwise, information systems would be unable to filter/query for items of a specific brand owner or identify the respective items in the first place.

The following table provides two examples of how a GTIN (one with a GCP length of 7, the other with a GCP length of 9 digits) along with a serial number is converted into an SGTIN (Serialised Global Trade Item Number) EPC. Thereby, the EPC URI represents the format which, e.g., is used in EPCIS, whereas the EPC binary code would be encoded onto an EPC transponder (the depicted binary code was created based on the presumption of using low-capacity EPC tags encoding an SGTIN destined for retail POS).

For further details as to the correspondence between GS1 keys and EPCs or the encoding procedure, please refer to the Tag Data Standard, section 7 and 14, respectively.

GTIN + serial number	GCP length	EPC URI	EPC binary code (hexadecimal)
04012345123456 + 9999	7	urn:epc:id:sgtin:4012345.012345.9999	3034F4E4E40C0E400000270F
05391505378882 + 321	9	urn:epc:id:sgtin:539150537.0888.321	302E022C8C90DE0000000141

Legend:

Indicator Digit: the leftmost digit of a GTIN-14. In the case of GTIN-12 or GTIN-13, a zero pad character takes the place of the Indicator Digit and is usually applicable for all apparel/fashion products. While '9' is reserved to identify variable measure trade items, '1' to '8' may be used to define trade item groupings.

GS1 Company Prefix: a unique string of variable length, allocated by a GS1 Member Organisation, to issue GS1 identification keys (e.g. GTINs).

Item Reference: a number allocated by a user company to identify a trade item varying in length as a function of the GCP's length.

Check Digit: a mod-10 algorithm digit that is used to check whether the number has been correctly composed.

Serial Number: a code assigned to an individual instance of an entity for its lifetime.