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**Supply chain applications of RFID —  
Product tagging**

*Applications de chaîne d'approvisionnements de RFID — Étiquetage de produit*

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ISO 17367:2009

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17367 was prepared by Technical Committee ISO/TC 122, *Packaging*, in collaboration with Technical Committee ISO/TC 104, *Freight containers*.

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## Introduction

The *supply chain* is a multi-level concept that covers all aspects of taking a product from raw materials to a final product including shipping to a final place of sale, use and maintenance and potentially disposal. Each of these levels covers many aspects of dealing with products and the business process for each level is both unique and overlapping with other levels.

This International Standard has been created in order to ensure compatibility at the physical, command and data levels with the four other International Standards under the general title: *Supply chain applications of RFID*. Where possible, this compatibility takes the form of interchangeability. Where interchangeability is not feasible, the International Standards within this suite are interoperable and non-interfering. The International Standards within the complete series of *Supply chain applications of RFID* include

- ISO 17363, *Supply chain applications of RFID — Freight containers*,
- ISO 17364, *Supply chain applications of RFID — Returnable transport items (RTIs)*,
- ISO 17365, *Supply chain applications of RFID — Transport units*,
- ISO 17366, *Supply chain applications of RFID — Product packaging*, and
- ISO 17367, *Supply chain applications of RFID — Product tagging*.

These International Standards define the technical aspects and data hierarchy of information required in each layer of the supply chain. The air-interface and communications protocol standards supported within the *Supply chain applications of RFID* International Standards are ISO/IEC 18000: commands and messages are specified by ISO/IEC 15961 and ISO/IEC 15962; semantics are defined in ISO/IEC 15418; syntax is defined in ISO/IEC 15434.

Although not pertinent to this International Standard, the work of

- ISO/IEC JTC 1, *Information technology*, SC 31, *Automatic identification and data capture techniques*, in the areas of air interface, data semantic and syntax construction and conformance standards, and
- ISO/TC 104, *Freight containers*, in the area of freight container security, including electronic seals (e-seals) (i.e. ISO 18185) and container identification

is considered valuable.

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# Supply chain applications of RFID — Product tagging

## 1 Scope

This International Standard defines the basic features of RFID for the use in the supply chain when applied to product tagging. In particular it

- provides specific recommendations about the encoded identification of the product,
- makes recommendations about additional information about the product on the RF tag,
- makes recommendations about the semantics and data syntax to be used,
- makes recommendations about the data protocol to be used to interface with business applications and the RFID system, and
- makes recommendations about the air interface standards between the RF interrogator and RF tag.

This International Standard only addresses *product tagging* and does not address *product packaging*.

## 2 Conformance and performance specifications

All of the devices and equipment that claim conformance with this International Standard shall also conform to the appropriate sections and parameters specified in ISO/IEC TR 18046 for performance and ISO/IEC TR 18047-6 (for ISO/IEC 18000-6, Type C) and ISO/IEC TR 18047-3 (for the ASK interface of ISO/IEC 18000-3, Mode 3) for conformance.

NOTE Annex A gives an illustrative example of an industry-specific conformance/quality document.

## 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 445, *Pallets for materials handling — Vocabulary*

ISO 830, *Freight containers — Vocabulary*

ISO/IEC 15418, *Information technology — Automatic identification and data capture techniques — GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance*

ISO/IEC 15434, *Information technology — Automatic identification and data capture techniques — Syntax for high-capacity ADC media*

ISO/IEC 15459-4, *Information technology — Unique identifiers — Part 4: Individual items*

## ISO 17367:2009(E)

ISO/IEC 15961, *Information technology — Radio frequency identification (RFID) for item management — Data protocol: application interface*

ISO/IEC 15962, *Information technology — Radio frequency identification (RFID) for item management — Data protocol: data encoding rules and logical memory functions*

ISO/IEC 15963, *Information technology — Radio frequency identification for item management — Unique identification for RF tags*

ISO/IEC 16022, *Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification*

ISO 17364, *Supply chain applications of RFID — Returnable transport items (RTIs)*

ISO/IEC 18000-3, *Information technology — Radio frequency identification for item management — Part 3: Parameters for air interface communications at 13,56 MHz*

ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz*

ISO/IEC 18004, *Information technology — Automatic identification and data capture techniques — QR Code 2005 bar code symbology specification*

ISO/IEC TR 18046, *Information technology — Automatic identification and data capture techniques — Radio frequency identification device performance test methods*

ISO/IEC TR 18047-3, *Information technology — Radio frequency identification device conformance test methods — Part 3: Test methods for air interface communications at 13,56 MHz*

ISO/IEC TR 18047-6, *Information technology — Radio frequency identification device conformance test methods — Part 6: Test methods for air interface communications at 860 MHz to 960 MHz*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*

ISO 21067, *Packaging — Vocabulary*

ISO/IEC TR 24729-1, *Information technology — Radio frequency identification for item management — Implementation guidelines — Part 1: RFID-enabled labels and packaging supporting ISO/IEC 18000-6C*

ANS MH10.8.2, *Data Identifiers and Application Identifiers*

EPCglobal, *Tag Data Standards, Version 1.3*

GS1 *General Specifications*

ICNIRP Guidelines, *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)*

IEEE 1451.7, *Smart Transducer Interface for Sensors and Actuators — Transducers to Radio Frequency Identification (RFID) Systems Communication Protocols and Transducer Electronic Data Sheet Formats*

IEEE C95-1, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*



## 4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 445, ISO 830, ISO 17364, ISO/IEC 19762-1, ISO/IEC 19762-3 and ISO 21067 apply.

## 5 Concepts

### 5.1 Differentiation between this layer and the preceding layers

Figure 1 gives a graphical representation of the supply chain. It shows a conceptual model of possible supply chain relationships, not a one-for-one representation of physical things. Although several layers in Figure 1 have clear physical counterparts, some common supply chain physical items fit in several layers depending on the use case. For example, a repetitively used pallet under constant ownership would be covered by ISO 17364 as an RTI; a pallet that is part of a consolidated unit load would be covered by ISO 17365 as a transport unit; and a pallet that is integral to a single item would be covered by ISO 17366 as product packaging.

Layers 0 to 4 are addressed within the series of International Standards *Supply chain applications of RFID* (see Introduction). Layer 5 is addressed by the work of ISO/TC 204/WG 7.

Layer 0 in Figure 1 and the definition of a product in ISO 17364:2009, 4.8 are the subject of this International Standard.

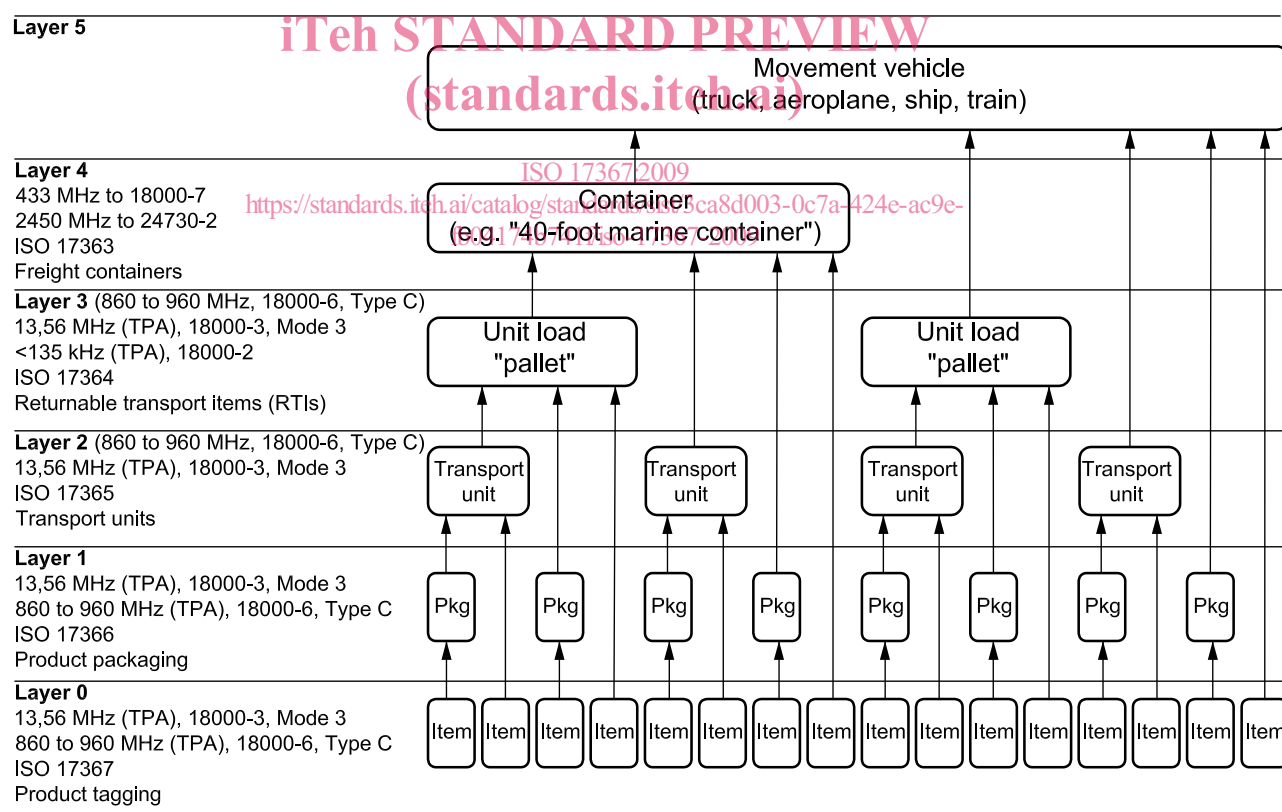


Figure 1 — Supply chain layers

Once tagged, product layer tags can be distinguished from following or preceding layer tags by use of a *group select* methodology contained in the RFID interrogator/reader. This group select function allows the interrogator and supporting automated information systems (AIS) to quickly identify product layer tags. As indicated in 5.2.2, the group select methodology is further elaborated in ISO/IEC 15961.

## 5.2 Unique item identifier

### 5.2.1 General

Unique item identification is a process that assigns a unique data string to an individual item, or in this case to an RFID tag that is associated to the item. The unique data string is called the unique item identifier. Unique item identification of items allows data collection and management at a granular level. The benefits of granular level data are evident in such areas as maintenance, retail warranties and enabling electronic transactions of record. This granularity is possible only if each tagged item has a unique identification. Items that are not uniquely identified would not normally be tagged at the item level. Items to which unique item identifiers have been assigned are said to be serialized items. Low cost consumable items would normally be tagged at the package level or higher as a standard assortment.

Product layer tagging can uniquely identify items, thus providing differentiation between like items and between like and unlike items. Product layer tagging can also be used to identify items by differentiating unlike items but not differentiating between like items. This is used for commodity where individualization is not practical or desired.

The unique product identifier described above is a unique identifier as described in ISO/IEC 15459-4. The unique item identifier (UII) provides granular discrimination between like items that are identified with RFID tags. The unique tag ID (as defined by ISO/IEC 15963) is a mechanism to uniquely identify RFID tags and is not the unique product identifier defined in this International Standard.

The minimum data elements required for unique identification are an enterprise identifier and a serial number that is unique within that enterprise identifier. Commonly, a part or model number is also required to achieve unique identification.

This International Standard uses the following identification mechanisms for unique product identification:

- unique identifiers for supply chain items (ISO/IEC 15459-4);
- GS1 Serialized Global Trade Item Number (SGTIN).

### 5.2.2 International unique identification for items

The unique identifier of ISO/IEC 15459 provides identification schemes for various layers of the supply chain, from layer 0 (products) up to layer 3 (returnable transport items). The unique identification of product packages shall use ISO/IEC 15459-4. Unique identification is provided by three components:

- a) issuing agency code (IAC),
- b) company identification number (CIN),
- c) serial number (SN),

preceded by an AFI and Data Identifier (DI). The AFI code assignments table in ISO/IEC 15961:2004, Annex B, permits identification of the supply chain layer, i.e. product = A1<sub>HEX</sub>, transport unit = A2<sub>HEX</sub>, returnable transport item = A3<sub>HEX</sub> and product package = A5<sub>HEX</sub>.

The Data Identifier shall be "25S". The ISO/IEC 15459 registration authority assigns the IAC. The CIN is assigned by the issuing agency. The company registered with the issuing agency assigns the serial number. The serial number shall be no longer than 20 alphanumeric characters.

Table 1 — 1736x AFI Assignments

AFI (HEX)	Assignment	International Standard
A1	17367_Non-EPC	ISO 17367 — <i>Supply chain applications of RFID — Product tagging</i>
A2	17365_Non-EPC	ISO 17365 — <i>Supply chain applications of RFID — Transport units</i>
A3	17364_Non-EPC	ISO 17364 — <i>Supply chain applications of RFID — Returnable transport items (RTIs)</i>
A4	17367_HazMat	ISO 17367 — <i>Supply chain applications of RFID — Product tagging (HazMat)</i>
A5	17366_Non-EPC	ISO 17366 — <i>Supply chain applications of RFID — Product packaging</i>
A6	17366_HazMat	ISO 17366 — <i>Supply chain applications of RFID — Product packaging (HazMat)</i>
A7	17365_HazMat	ISO 17365 — <i>Supply chain applications of RFID — Transport units (HazMat)</i>
A8	17364_HazMat	ISO 17364 — <i>Supply chain applications of RFID — Returnable transport items (RTIs) (HazMat)</i>
A9	17363_Non-EPC	ISO 17363 — <i>Supply chain applications of RFID — Freight containers</i>
AA	17363_HazMat	ISO 17363 — <i>Supply chain applications of RFID — Freight containers (HazMat)</i>

When stored on a tag with a technology that supports AFIs, the unique identifier shall also be associated with an AFI. EPC does not use AFIs; consequently, there are no AFIs used for products employed in retail applications using EPCglobal.

To define its class (in the ISO/IEC 15459 sense), the unique identifier shall have an associated class identifier, which is the Data Identifier “25S”. For the purposes of this International Standard, a unique identifier of products can be up to 35 alphanumeric characters in length, including the Data Identifier (an3+an..32). See Table 2.

Table 2 — UUI element string

Format of the license plate	
Data Identifier	IAC, company identification number (CIN), serial number
25S	N <sub>1</sub> N <sub>2</sub> N <sub>3</sub> N <sub>4</sub> N <sub>5</sub> N <sub>6</sub> N <sub>7</sub> N <sub>8</sub> N <sub>9</sub> N <sub>10</sub> N <sub>11</sub> N <sub>12</sub> N <sub>13</sub> N <sub>14</sub> N <sub>15</sub> N <sub>16</sub> N <sub>17</sub> . . . N <sub>32</sub>

### 5.2.3 Serialized global trade identification number (SGTIN)

The EPCglobal serialized global trade identification number (SGTIN) is a unique item identifier (UII) capable of providing unique item identification of product packages.

Table 3 — SGTIN element string

	Header	Filter Value	Partition	Company Prefix	Item Reference	Serial Number
Number of bits	8	3	3	20 to 40	24 to 4	38
Reference	0011 0000 <sup>a</sup>	— <sup>b</sup>	— <sup>b</sup>	999 999 to 999 999 999 999 <sup>c</sup>	9 999 999 to 9 <sup>c</sup>	274 877 906 943 <sup>d</sup>
NOTE Maximum decimal value range of Company Prefix and Item Reference fields vary according to the contents of the partition field.						
<sup>a</sup> Binary value.						
<sup>b</sup> Refer to EPCglobal, <i>Tag Data Standards</i> , Version 1.3 for values.						
<sup>c</sup> Maximum decimal range.						
<sup>d</sup> Maximum decimal value.						

The SGTIN consists of the following information elements:

- a) The *Header*, which is defined in EPCglobal, *Tag Data Standards*, Version 1.3. It is eight (8) bits long and for an SGTIN-96 is the value 30<sub>HEX</sub>.
- b) The *Filter Value*, which is defined in EPCglobal, *Tag Data Standards*, Version 1.3. It is three (3) bits long and identifies whether an EPC is for a retail trade item, a standard trade item grouping, or a single shipping/consumer trade item.
- c) The *Partition*, which is defined in EPCglobal, *Tag Data Standards*, Version 1.3. It is three (3) bits long, carries one of seven (7) values, and identifies where the subsequent *Company Prefix* and *Item Reference* numbers are divided.
- d) The *Company Prefix*, assigned by GS1 to an organization. The Company Prefix is the same as the Company Prefix digits within a GS1 GTIN decimal code. The combined Company Prefix and Item Reference are 44 bits long (13 decimal digits).
- e) The *Item Reference*, assigned by the “Company” entity to a particular product package. The combined Company Prefix and Item Reference are 44 bits long (13 decimal digits).
- f) The *Serial Number* assigned by the managing entity to an individual object. The EPC representation is only capable of representing a subset of serial numbers allowed in the GS1 *General Specifications*. Specifically, only those Serial Numbers consisting of one or more digits, with no leading zeros, are permitted. The length of the Serial Number is 38 bits.

### 5.3 Other identification requirements

This International Standard does not supersede or replace any applicable safety or regulatory marking or labelling requirements.

This International Standard is meant to satisfy the minimum product identification requirements of numerous applications and industry groups. As such, its applicability is to a wide range of industries, each of which may have specific implementation guidelines for this International Standard. This International Standard is to be applied in addition to any other mandated labelling requirements.

## 6 Differentiation within the layer

### 6.1 Business processes

Business processes such as those described below are illustrative of the applications envisioned by this International Standard.

- Acquisition: ordering, including the identification of relevant specifications and requirements, can be facilitated by referencing the item's original acquisition data using the RFID tag's unique ID as a database key.
- Shipping: where items can have different configurations or capabilities, such as with computer software loads that differentiate items with otherwise identical form, fit and function, such items can be issued and shipped with the tag read providing assurance that the correct item was shipped. This level of non-intrusive tracking and tracing can serve as a front end to higher level in-transit visibility RFID applications detailed in the other standards of this series.
- Receiving: non-intrusive collection of receipt data can shorten data collection times, in support of automated inventory management systems and provide an electronic *transaction of record* much earlier in the process. Earlier knowledge of on-hand inventory can reduce stock outs and the need for expedited premium transportation.

- Cross docking: in addition to recording inbound receipts and outbound shipments, tagged items can be sorted. Many items will have exterior marking (tagging) that are used in lieu of reading the product tag.
- Work in process: used to track individual components and the final assembly (bill of material) and to monitor any item through a fabrication or manufacturing process.
- Maintenance: related to work in progress and differentiated in that it covers functions prior to and subsequent to the actual work. This includes fault analysis, identification, preparation of packing and packaging.
- Inventory control: item level serialization yields a granularity of visibility that supports the management of individual items. This allows data collection, tracking and tracing of individual items and selection at point of issue.
- Disposal: identification of items that have recycling or other disposal requirements.
- Picking and put-away: selection of items from a package or transport unit prior to placement into shelf stock in a warehouse situation or other storage situation where a specific asset is desired or knowledge of the specific item selected is required for issue.
- Pick and place: selection of items from shelf stock in a warehouse situation or other storage situation where a specific asset is desired or knowledge of the specific item selected is required incident to the placement of the item into or onto another asset incident to a manufacturing or assembly process.
- Sortation: process that places individual items into groups based upon some selection criteria, often performed at speed.
- Identification: process that is an inherent part of each of the functions set out above. It allows the positive differentiation of an item consistent with the business process in use. Identification can be at the discrete item level for serialized products or by commodity for non-serialized products. Identification is often the underlying base process that enables the other uses of the tag.
- Network topology: can be used to identify discrete nodes or locations on a network.
- Configuration management: discrete identification of the individual component items that comprise a higher assembly. This component data can be tiered to cover each of the multiple levels of configuration (e.g. the circuit board inside the radio installed in the communications suite of an aircraft).

The multitude of different business processes circumscribed by the supply chain will employ distinctly different groupings of functions and processes outlined above. The reading, writing or erasing of data to/from a tag is intended to effect identification and data capture about the product and the process involved and shall be integrated into business processes as required by the business process owner.

## 6.2 Lot/batch vs. serial number vs. product identification only

Just as different business processes have varying data requirements, different items will have varying identification requirements. Use of structured or intelligent serialization schemes include additional data such as part number or lot number in the serialization scheme and should be avoided whenever possible. This means ideally that the serialization is unique within the enterprise.

The lowest level of identification would be product ID only. Lot and batch type items shall be marked with the product ID of the item and the lot or batch of that item that this particular item belongs to. Serialized items shall be marked with a unique serial number in conformance with the appropriate part of ISO/IEC 15459, which details the differing methods of serialization that provide unique identification.

The need to identify an item at each level is not absolute. Many items are manufactured, sold, and used at the commodity level. Examples are sand, coal and bulk liquids. These items may be marked at the lot level or simply as a generic commodity.