INTERNATIONAL STANDARD

ISO 17367

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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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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*, Subcommittee SC , .

This second edition cancels and replaces the first edition (ISO 17367:2009), which has been technically revised.

This International Standard has three annexes: Annexes A and B, which are informative, and Annex C, which is normative.

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 S*upply 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) and returnable packaging items (RPIs);*

— ISO 17365, *Supply chain applications of RFID — Transport units;*

— ISO 17366, *Supply chain applications of RFID — Product packaging;*

— 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 following work is considered valuable:

— 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.

Supply chain applications of RFID — Product tagging

1 Scope

This International Standard defines the basic features of RFID for 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 18046 for performance and ISO/IEC 18047-6 (for ISO/IEC 18000-63, Type C) and ISO/IEC 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 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC/IEEE 8802-15-4, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)*

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 (all parts), *Information technology — Automatic identification and data capture techniques — Unique identification*

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

ISO/IEC 15962:—[1], *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 17364:2013, *Supply chain applications of RFID — Returnable transport items (RTIs) and Returnable packaging items (RPIs)*

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 18000-63, *Information technology — Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C*

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

ISO/IEC 18046 (all parts), *Information technology — Radio frequency identification device performance test methods*

ISO/IEC 18047 (all parts), *Information technology — Radio frequency identification device conformance test methods*

ISO/IEC 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISO 21067, *Packaging — Vocabulary*

ISO/IEC/IEEE 21451-5 [IEEE 1451.5], *Information technology — Smart Transducer Interface for Sensors and Actuators — Wireless Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats*

ISO/IEC/IEEE 21451-7, *Information technology — Smart transducer interface for sensors and actuators — Part 7: Transducer to radio frequency identification (RFID) systems communication protocols and Transducer Electronic Data Sheet (TEDS) formats*

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*

ISO/IEC 29160, *Information technology — Radio frequency identification for item management — RFID Emblem*

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

GS1 EPC *Tag Data Standard Version 1.6*

GS1 *General Specifications*

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

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

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1) To be published.

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 (all parts), and ISO 21067 apply.

For the purposes of this document, hexadecimal characters are represented as 0xnn, where "nn" is the hexadecimal value.

5 Concepts

5.1 Differentiation between this layer and the preceding layers

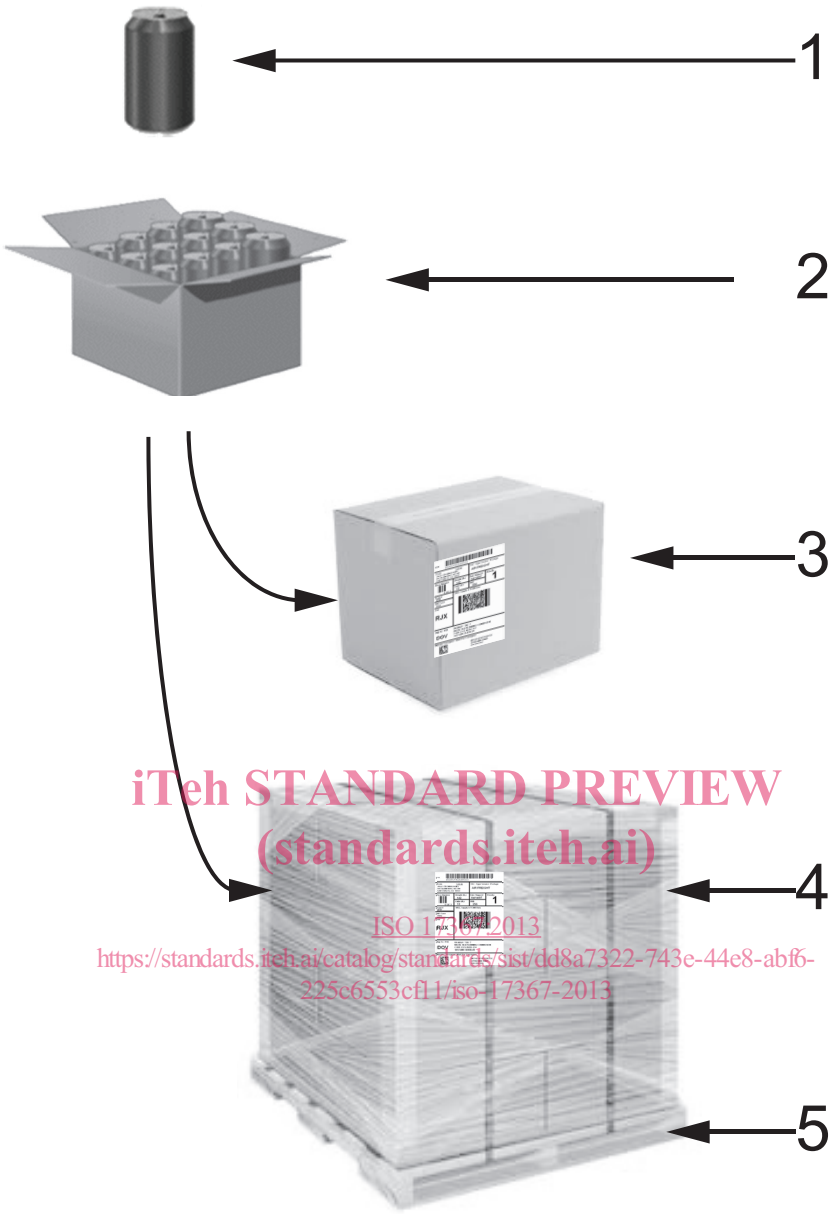
Figures 1 and 2 give a graphical representation of supply chain layers. They show a conceptual model of possible supply chain relationships, not a one-for-one representation of physical things. Although several layers in Figure 2 have clear physical counterparts, some common supply chain physical items fit in several layers depending on the use case. For example, as shown in Figure 2, 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 this International Standard as a transport unit; and a pallet that is integral to a single item would be covered by ISO 17366 as product packaging.

The term "supply chain layers" is a multi-level concept that covers all aspects of taking a product from raw materials to a final product to shipping to a final place of sale, use, maintenance and potentially disposal and returned goods. 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.

The Item Level through Freight Container Level layers are addressed within the suite of standards for "supply chain applications of RFID" and are intended to enhance supply chain visibility. The Movement Vehicle Level is the purview of ISO/TC 204/WG 7.

The Item Level in Figure 2, and specifically products, (as defined in ISO 17364:2013, 4.1) is the subject of this International Standard.

Item Level 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 Item Level tags.



Key

1 primary packaging – consumer packaging – *(product)*
2 secondary packaging – outer packaging – *(product package)*
3 tertiary packaging – transport packaging – *(transport unit)*
4 tertiary packaging – unitized transport packaging – *(transport unit)*
5 pallet – *(returnable transport item – RTI)*

Figure 1 — Packaging

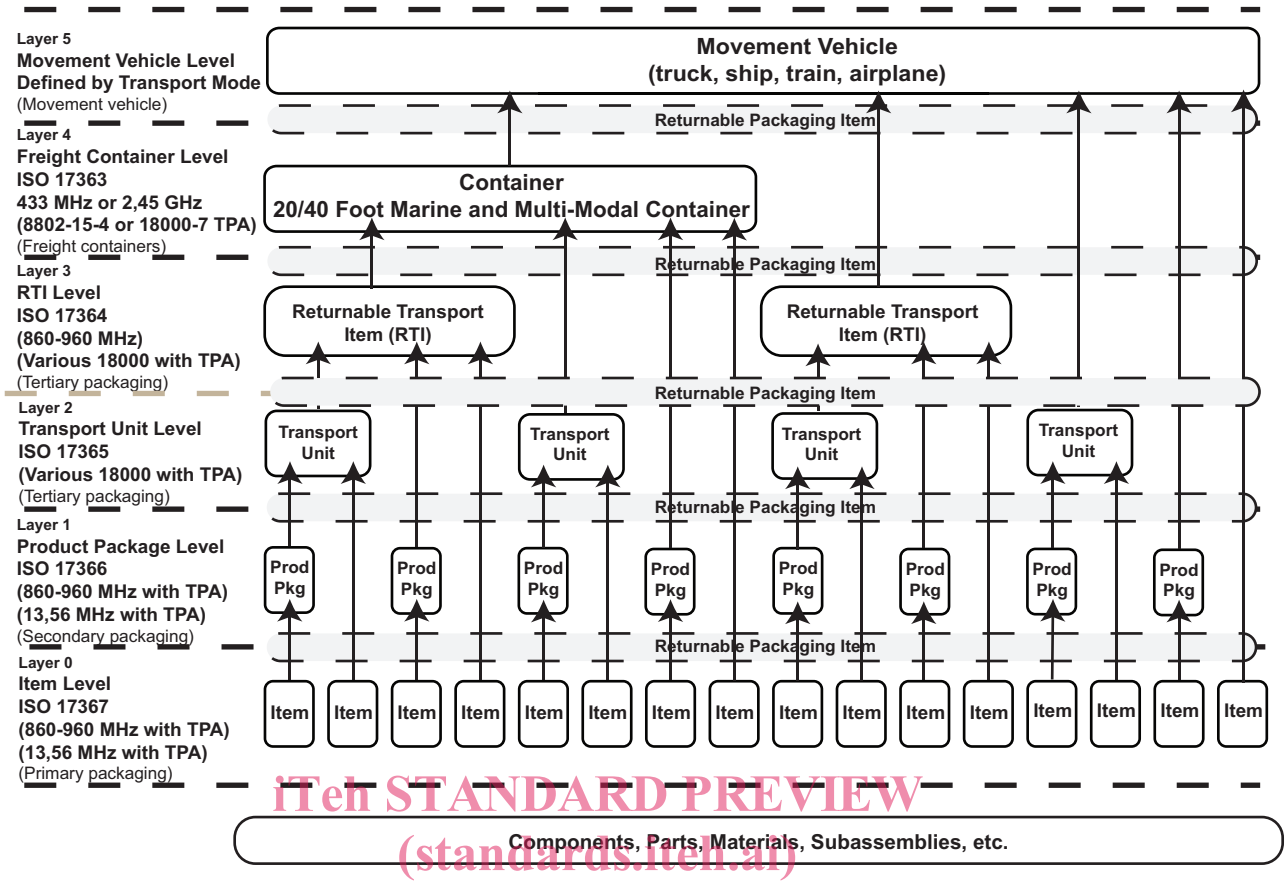


Figure 2 — Supply chain layers

5.2 Returnable packaging item

At all layers within the supply chain are devices that are shipped to a customer with full expectation that such devices will be returned to the supplier. These returnable packaging items (RPIs) are assets of value as well as potentially the physical transport unit. RPIs and their identification are well addressed in Annex A of ISO 17364:2013 and Annex A of ISO 17365:2013.

5.3 Unique item identifier

5.3.1 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 shall be the 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).

5.3.2 International Unique Identification for Items

The unique identifier of ISO/IEC 15459 provides identification schemes for various layers of the supply chain, from layer 1 (products) up to layer 4 (returnable transport items). The unique identification of product packages shall use ISO/IEC 15459-4. Unique identification is provided contextually 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 15961-3, Data Constructs Register and shown below in Table 1 permits identification of the supply chain layer, i.e. product = 0xA1, transport unit = 0xA2, returnable transport item = 0xA3, and product package = 0xA5.

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 should be no longer than 20 alphanumeric characters.

Table 1 — 1736x AFI Assignments

AFI	Assignment	ISO Standard
0xA1	17367_ISO	ISO 17367, Supply chain applications of RFID — Product tagging
0xA2	17365_ ISO	ISO 17365, Supply chain applications of RFID — Transport unit
0xA3	17364_ ISO	ISO 17364, Supply chain applications of RFID — Returnable transport item
0xA4	17367_HazMat	ISO 17367, Supply chain applications of RFID — Product tagging (HazMat)
0xA5	17366_ ISO	ISO 17366, Supply chain applications of RFID — Product packaging
0xA6	17366_HazMat	ISO 17366, Supply chain applications of RFID — Product packaging (HazMat)
0xA7	17365_HazMat	ISO 17365, Supply chain applications of RFID — Transport unit (HazMat)
0xA8	17364_HazMat	ISO 17364, Supply chain applications of RFID — Returnable transport item (HazMat)
0xA9	17363_ ISO	ISO 17363, Supply chain applications of RFID — Freight container
0xAA	17363_HazMat	ISO 17363, Supply chain applications of RFID — Freight container (HazMat)

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 product tagging employed in retail applications using EPC. AFI 0xA1 may be used for products intended solely for commodities other than consumer goods. Annex C provides an in-depth discussion of the ISO approach to encoding.

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 should be no longer than 35 alphanumeric characters in length, excluding the Data Identifier (an3+an..35). See Table 2. With the mutual agreement of the trading partners this length can be extended to 50 characters (an3+an..50).

Table 2 — ISO UII element string

Format of the License Plate	
Data Identifier	IAC Company Identification Number (CIN) Serial Reference
25S	N_1 N_2 N_3 N_4 N_5 N_6 N_7 N_8 N_9 N_{10} N_{11} N_{12} N_{13} N_{14} N_{15} N_{16} N_{17} . . . N_{35}

5.3.3 Serialised Global Trade Identification Number (SGTIN)

The GS1 EPC Serialised Global Trade Item Number (SGTIN) is a Unique Item Identifier (UII) capable of providing unique item identification of products.

Table 3 — SGTIN-96 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[a]	—[b]	—[b]	999 999 to 999 999 999 999[c]	9 999 999 to 9[c]	274 877 906 943[d]

NOTE Maximum decimal value range of Company Prefix and Item Reference fields vary according to the contents of the partition field.

[a] Binary value.

[b] Refer to GS1 EPC, Tag Data Standard Version 1.6 for values

[c] Maximum decimal range.

[d] Maximum decimal value.

The SGTIN consists of the following information elements:

a) The *Header*, which is defined in GS1 EPC, *Tag Data Standard,* Version 1.6. It is eight (8) bits long and for an SGTIN-96 is the value 0x30. While the remainder of the document describes an SGTIN-96 the GS1 EPC Tag Data Standard also describes a longer version.

b) The *Filter Value*, which is defined in the *GS1 EPC Tag Data Standard Version 1.6.* The *Filter Value* 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*, defined in the *GS1 EPC Tag Data Standard Version 1.6.* The *Partition* 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. 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.

5.4 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 this 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.

Medicines are typical of the type of item that is manufactured and managed at the lot level but sold and used at the item level. Thus, a particular dosage of medicine will require unique identification of that dose and the ability to reference that back to the original manufacturing lot. Looking up associated information on the information system may accomplish this reference.

6.3 Consumer products vs. industrial/government

Personal privacy considerations present a unique set of considerations for consumer products as opposed to products that remain exclusively in the industrial/government sectors. Consumer privacy regulations shall be considered in the design and operation of every consumer level product scenario. Encryption and data security are addressed in Clause 8.

7 Data content

7.1 Introduction

Subclauses 7.2 to 7.7 describe the data content of RFID tags for the product layer. They identify, amongst others,

— the data elements that shall or may be present on the tag,

— the way in which the data elements are identified (semantics),

— the representation of data elements in tag memory, and