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Supply chain applications of RFID — Freight containers

Applications de chaîne d'approvisionnements de RFID — Récipients de fret

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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 17363 was prepared by Technical Committee TC 122, *Packaging*, in collaboration with Technical Committee TC 104, *Freight containers*.

Introduction

The supply chain 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. 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 with a vision of compatibility both at the physical and command level and the data level with the four other standards within the suite of standards, *Supply chain applications of RFID*, together with ISO 10374 and ISO 18185. Due to the different data structures in each of these standards, they cannot take the form of interchangeability. However, these standards are designed to be interoperable and non-interfering. They 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*,

⎯ ISO 17367, *Supply chain applications of RFID — Product tagging*, and

⎯ ISO 10374, *Freight containers — Automatic identification*

These International Standards define the technical aspects and data hierarchy of supply chain management information required in each layer of the supply chain. Air interface and communication protocol standards supported within these standards are the ISO/IEC 18000 series; commands and messages are supported by ISO/IEC 15961 and ISO/IEC 15962. The semantics of these standards are defined in ISO/IEC 15418 and their syntax is defined in ISO/IEC 15434.

Excluded, although embraced, is the work of

⎯ ISO/IEC JTC 1/SC 31 in the area of technical standards related to air interface, data semantic and syntax construction, and conformance standards, and

⎯ ISO/TC 104 in the area of freight container security, including electronic seals (e-seals) (ISO 18185 in multiple parts), and container identification.

Supply chain applications of RFID — Freight containers

1 Scope

This International Standard defines the usage of read/write radio-frequency identification technology (RFID) cargo shipment-specific tags on freight containers for supply chain management purposes ("shipment tags"). This International Standard, through reference to other standards within ISO/TC 122, ISO/TC 104 and ISO/IEC JTC 1/SC 31, defines the air-interface communications, a common set of required data structures, and a commonly organized set of optional data requirements (through common syntax and semantics).

It contains the following recommendations:

a) recommendations about a containerized cargo supply chain RFID system, based on shipment tags;

   NOTE   Such a containerized cargo supply chain RFID system would co-exist with, but be separate from, a container security and identification RFID framework using permanent container lifetime RFID tags ("container tags"), described in ISO 10374, and cargo shipment-specific electronic seals (e-seals) for which a standard in multiple parts (ISO 18185) is being developed. Specifically, readings for container security and identification purposes of the information in the container tags and e-seals are intended to be in separate messages and not through the shipment tag.

b) specific recommendations about mandatory non-reprogrammable information on the shipment tag;

c) specific recommendations about optional, reprogrammable information on the shipment tag.

Identified within this International Standard are the air-interface and communication parameters for active radio-frequency identification communications using ISO/IEC 18000-7.

This International Standard is applicable to freight containers as defined in ISO 668 and to freight containers that are not defined by other ISO standards. It complements ISO 10374 for permanent container license-plate tags (see 4.7), hereinafter referred to as "container tags".

This International Standard fully describes cargo shipment-specific tags (see 4.8), hereinafter referred to as "shipment tags".

It does not address "smart" container technologies affixed to, or inside, freight containers (e.g. sensors) for supply chain management purposes. These issues will be addressed in future revisions.

2 Conformance and performance specifications

All of the devices and equipment that claim compliance with this International Standard in either performance and/or conformance shall also conform to the appropriate sections and parameters specified in ISO/IEC 18046 for performance and ISO/IEC TR 18047-7 for conformance of active devices operating at 433,92 MHz.

The underlying conformance requirements of this International Standard are to provide the structure necessary to raise the level of interoperability of components and systems built to this standard, while leaving open opportunity for continued technical improvement and differentiation.

Implementation of a containerized cargo supply chain RFID system and its components shall be deemed in conformance with this standard provided that it meets, and supports, the following six (6) requirements:

a)   the required functional performance specified in Clause 6.

b)   the data requirements specified in Clause 7;

c)   the data security requirements specified in Clause 8;

d)   the tag location requirements specified in Clause 9;

e)   the tag operation requirements specified in Clause 10;

f)   the security and privacy requirements specified in Clause 11.

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 668, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 830, *Freight containers — Vocabulary*

ISO 6346, *Freight containers — Coding, identification and marking*

ISO 10374, *Freight containers — Automatic identification*

ISO 18185-3, *Freight containers — Electronic seals — Part 3: Environmental characteristics*

ISO/IEC 15418, *Information technology — Automatic identification and data capture techniques — GS1 application identifiers and ASC MH 10 data identifiers and maintenance*

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

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 18000-7, *Information technology — Radio frequency identification for item management — Part 7: Parameters for active air interface communications at 433 MHz*

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

ISO/IEC TR 18047-7, *Information technology — Radio frequency identification device conformance test methods — Part 7: Test methods for active air interface communications at 433 MHz*

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

IEEE 1451, *Smart Transducer Interface for Sensors and Actuators — Mixed-mode Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 830, ISO/IEC 19762 and the following apply.

4.1
transport unit
either a transport package or a unit load

[ISO 15394:2000, 4.2]

4.2
unit load
one or more transport packages or other items held together by means such as pallet, slip sheet, strapping, interlocking, glue, shrink wrap, or net wrap, making them suitable for transport, stacking, and storage as a unit

[ISO 15394:2000, 4.2]

4.3
transport package
package intended for the transportation and handling of one or more articles, smaller packages, or bulk material

[ISO 15394:2000, 4.2]

4.4
returnable transport item
RTI
all means to assemble goods for transportation, storage, handling and product protection in the supply chain which are returned for further usage, including for example pallets with and without cash deposits, as well as all forms of reusable crates, trays, boxes, roll pallets, barrels, trolleys, pallet collars and lids

NOTE 1   The term returnable transport item is usually allocated to secondary packaging. But in certain circumstances also primary packaging may be considered as a form of RTI.

NOTE 2   Freight containers, trailers and other similar enclosed modules are not covered by the term returnable transport item.

NOTE 3   The term returnable transport equipment is considered to have the same definition as the term returnable transport item within an electronic data interchange environment.

4.5
product package (primary)
first tie, wrap or container to a single item or quantity thereof that constitutes a complete identifiable pack

NOTE   A product package may be an item packaged singularly, multiple quantities of the same item packaged together or a group of parts packaged together.

[ISO 22742:2005, 3.32]

4.6
product
first level or higher assembly that is sold in a complete end-usable configuration

[EIA 802, 3.16]

4.7
permanent container license-plate tag
container tag
permanently affixed, read-only (including Write Once Read Many – WORM) tag containing limited data relating only to physical identification and description of the container to which it is affixed

NOTE   This tag, affixed by or on behalf of the container owner, should last the lifetime of its associated container (except in situations where the container changes ownership and/or equipment ID).

4.8
cargo shipment-specific tag
shipment tag
read-write tag into which data specific to a containerized cargo shipment can be stored

NOTE 1   The tag and the data uploaded in it are the responsibility of the shipper.

NOTE 2   The tag may be affixed to the container by the shipper or, per the shipper's instructions, by the party that physically performs the loading ("stuffing") of the container.

NOTE 3   Data capabilities are flexible and may, at the shipper's discretion, include destination, routing, conveyance or other transportation information, cargo information (including hazardous material information, where applicable) or other trip-specific information.

NOTE 4   The tag is intended to perform reliably from the point of stuffing of the container to delivery destination, and to be removed by the consignee upon final delivery. The tag may be re-usable.

4.9
mandatory shipment tag information
two non-reprogrammable data elements [i.e. a unique permanent ID of the integrated circuit (chip ID) and a unique permanent ID of the actual tag (tag ID)] and one reprogrammable data element (the tag data routing code)

NOTE   The non-reprogrammable data elements will be imbedded in the shipment tag by the tag manufacturer.

4.10
permanent container tag information
non-reprogrammable information that resides on the container tag for the duration of the lifetime of the container (or until the container changes ownership and/or equipment ID), and which is uploaded and maintained by, or on behalf of, the container owner and at its responsibility

NOTE   The permanent, non-reprogrammable information elements are specified in ISO 10374.

4.11
cargo shipment-specific (CSS) tag information
optional information residing in the shipment tag for the duration of the containerized cargo shipment until its final delivery

4.12
integrity
designed such that any modification of the electronically stored information, without proper authorization, is not possible

4.13
originality
validity
designed such that a compromise of the shipment through misrepresentation of the information on the shipment tag is not possible under the following circumstances:

—   any modification of the mandatory non-reprogrammable information;

—   any unauthorized modification of optional reprogrammable information

4

4.14
freight container
ISO freight container as specified in ISO 668 as well as containers not defined by other ISO standards

4.15
classified information
information which for reasons of national security is restricted to government authorized or approved persons

4.16
tag data routing code
data string that enables the system that reads the tag header to forward in-transit visibility data to the owner of the tag

5 Concepts

5.1 Differentiation between a layer and its preceding and following layers

The supply chain 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 to disposal and return of 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.

Figure 1 provides a graphical representation of the "supply chain". Layers 0 through 4 are addressed within the suite of standards for "supply chain applications of RFID" and are intended to enhance supply chain visibility. Layer 5 is the purview of ISO/TC 204/WG 7.

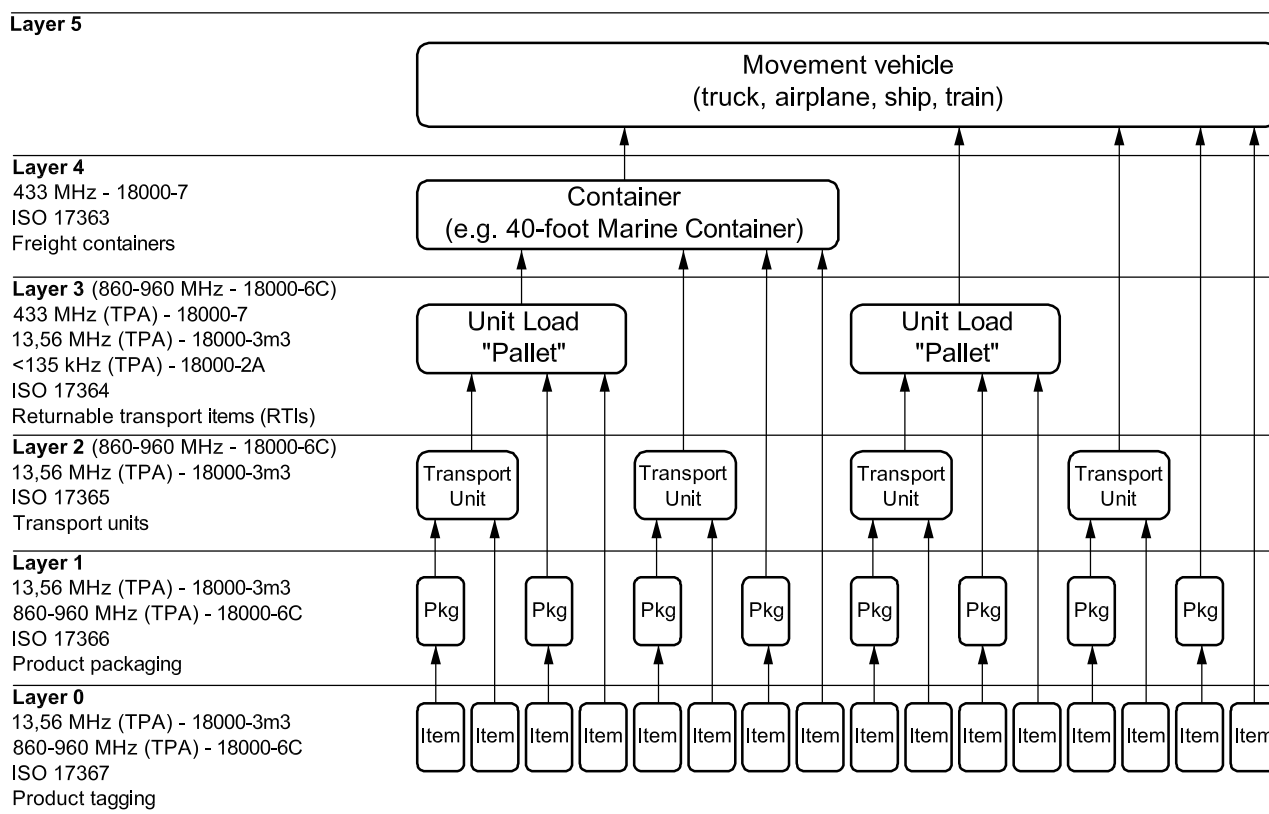Layer 4 in Figure 1 and the definition of a freight container in 4.14 are the subject of this International Standard.

Figure 1 — Supply chain layers

Once tagged, product layer tags can be distinguished from following 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 package layer tags.

5.2   Unique item identifier

Unique item identification is a process that assigns a unique data string to an individual freight container or, in this case, to an RFID tag that is associated with the freight container. For freight container tagging to be meaningful, it is necessary that each serialized RFID tag be unique worldwide. Unique serialization of freight containers allows data collection and management at a granular level. The benefits of granular level data are evident in such areas as maintenance and enabling electronic transactions of record. This granularity is possible only if each tagged freight container has a unique identification.

The Unique Item Identifier (UII), as defined by ISO 15459-2, 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.

There exists historical reference for the identification of freight containers, specifically ISO 6346, and for radio frequency identification, specifically ISO 10374. The freight container identification structure in this International Standard shall be as defined in ISO 6346 and encoded as in ISO 10374.

5.3   Types of tags

There are four types of RF device envisioned for use with freight containers. The individual uses of each of these devices are as given in 5.3.1 to 5.3.4.

5.3.1   Permanent container license-plate tag

This tag, referred to as the "container tag", is defined in 4.7 and is fully described in ISO 10374.

5.3.2   Cargo shipment-specific tag

This tag, referred to as the "shipment tag", defined in 4.8, is fully discussed in this International Standard.

5.3.3   Container electronic seal

This is a read-only, non-reusable freight container seal conforming to the specifications for a high security seal. It is defined in ISO/PAS 17712, and conforms to the ISO 18185 series; it electronically reveals tampering or intrusion through the container doors.

5.3.4   Item tag

This is typically a passive tag that is affixed to an item that is to be tracked. This item may be a product itself, the packaging around a product, or the transportation method used to convey the product (pallet, case, etc.). This tag is usually disposable, although in the case of returnable transport items, etc., it may be reusable.

5.4   Additive to other identification requirements

This International Standard does not supersede or replace any applicable safety or regulatory marking or labelling requirements, and shall be applied in addition to any other mandated labelling requirements.

6   Differentiation within Layer 4

6.1   General

This International Standard defines the requirements for Layer 4 as shown in Figure 1. This layer is differentiated from the other layers as follows.

6.2   Containerized cargo supply chain RFID system requirements

6.2.1   RFID system components

The containerized cargo supply chain RFID system shall consist of two basic components:

a)   a shipment tag affixed to the freight container, and

b)   equipment located apart from the freight container that reads from and writes to the shipment tag identified in this International Standard.

6.2.2   RFID system capabilities

The containerized cargo supply chain RFID system shall be capable of:

a)   maintaining the integrity of the information on the shipment tag;

b)   encoding its information into a form suitable for conveyance to reading equipment;

c)   being written to at a distance of 35 m as long as the tag remains within the 35 m range of the communicating interrogator, and when

   1)   sufficiently separated from other ISO 17363 tags by more than 3 m to allow discrimination, and

   2)   operated and stored under the environmental conditions specified in ISO 18185-3;

d)   having a shipment tag that is affixed to the container until final delivery (at which time the consignee shall remove the tag), and which is as small as possible but does not exceed a size of 30 cm × 6 cm × 2 cm;

e)   providing an indication of impending power source failure;

f)   being read when the shipment tag is

   1)   within range of 35 m or less,

   2)   moving in relation to the RFID reading system at a speed of 50 km/h or less,

   3)   sufficiently separated from other ISO 17363 tags by more than 3 m to allow discrimination, and

   4)   operated and stored under the environmental conditions specified in ISO 18185-3.

6.3   Business processes relevant to the suite of standards for supply chain applications of RFID

a)   **Procurement/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.

b)   **Shipping**: Where an item can have different configurations or capabilities, such as with computer software loads that differentiate items with otherwise identical form, fit and function, it 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 the higher level RFID applications detailed in the other standards in this suite.

c) **Receiving**: Non-intrusive collection of receipt data can shorten data collection times in support of automated inventory management systems and provide an electronic record of transaction much earlier in the process. Earlier knowledge of on-hand inventory can reduce stock outs and the need for expedited premium transportation.

d) **Cross docking**: In addition to recording inbound receipts and outbound shipments, tagged items can be sorted. Many items will have exterior marking (tagging) that is used in lieu of reading the product tag.

e) **Work in process**: This is used to track individual components and the final assembly (bill of material) and to monitor any item through a fabrication or manufacturing process.

f) **Maintenance**: This is 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.

g) **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.

h) **Disposal**: This is the identification of items that have recycling or other disposal requirements

i) **Sortation**: This is a process that places individual items into groups based upon some selection criteria, and is often performed at speed.

j) **Identification**: This is a process that is an inherent part of each of the functions set out above.

7 Data content

7.1 General

There are two types of data that may be present in a shipment tag compliant with this International Standard:

a) mandatory, non-reprogrammable data as defined in 7.2, and

b) optional, reprogrammable cargo shipment-specific (CSS) data as defined in 7.3.

Should the shipper, at its discretion and responsibility, upload into the shipment tag information that resides in the container tag and/or the e-seal, such information would be accessed and read as part of the containerized cargo supply chain RFID system. Readings for container security and identification purposes of the information in the container tags and e-seals should be done in separate messages and, further, should not be done through the shipment tag.

7.2 Mandatory data

The tag ID shall be as described in ISO/IEC 15963. This mandatory data element is always non-reprogrammable and is embedded in the shipment tag by the tag manufacturer.

7.3 Optional cargo shipment-specific (CSS) data

7.3.1 General

Optional CSS data are defined at the discretion and responsibility of the shipper while following the semantics and syntax rules given in 7.3.2 and 7.3.3 respectively.

Under expressed trading partner agreements, optional CSS data may be encrypted or otherwise secured at the point and time they are first written into the shipment tag and during any subsequent modifications, alterations, changes and/or erasures.

7.3.2   Tag data routing code

The tag data routing code (known simply as the routing code in ISO/IEC 18000-7) enables the system that reads the tag header to forward the tag ID to a designated recipient. The routing code is a byte-oriented code consisting of n bytes in the following format: Issuing Agency Code (from ISO/IEC 15459-2), followed by the appropriate identifier as specified by the issuing agency.

7.3.3   Data semantics

The optional CSS data contained in the shipment tag shall conform to the semantics of ISO/IEC 15418.

7.3.4   Data syntax

The optional CSS data contained in the shipment tag shall conform to the syntax of ISO/IEC 15434.

7.3.5   Tag data structure

The tag will support multiple types of data, including fixed user data memory for shipment summary, database and raw data storage. The fixed user data will support simple read write commands and the selection of data elements. The database memory supports flexible multiple-element queries. The raw data storage is a user data area for additional data in support of transactional operations.

8   Data security

8.1   General

For a containerized cargo supply chain RFID system to conform to this International Standard, it shall protect and secure the optional cargo shipment-specific data as defined in 4.11 and 7.3. The minimum level of data security and protection provided by the containerized cargo supply chain RFID system shall prevent any unplanned observation of cargo shipment-specific data. The minimum level of data security and protection shall be established no later than at the activity of first writing to the shipment tag. Such levels include:

⎯ prevention of the unplanned identification of cargo either directly or indirectly;

⎯ prevention of supply chain information being identified, accessed, altered, amended, changed and deleted by anyone not authorized by the shipper or any agent, representative or entity acting on its behalf;

⎯ protection of the network and associated information systems from hostile attacks (hacking, viruses and denial of service);

⎯ ensuring the validity and integrity of the data accepted, processed and stored by the system.

8.2   Confidentiality

The optional CSS data stored in or communicated to or from the tag shall be secured by the shipper to meet the requirements of 8.1. The technique of securing the data shall be identified in trading partner communications, e.g. EDI. CSS data shall be encrypted or otherwise secured at the point and time when they are first written into the shipment tag and during any subsequent modifications, alterations, changes and/or erasures. If encryption is chosen as a method of CSS data security, the level and type of encryption shall be at the discretion and responsibility of the shipper. The tag shall be capable of having encrypted or otherwise secured data written to it and read from it without interference from the tag design or structure.

CSS information is defined at the discretion of the shipper and is its responsibility. The information is uploaded into the tag and modified, altered, changed or deleted, as necessitated by commercial business processes and practices in the commercial international supply chain, by the shipper itself or (per its instructions) by any agent, representative or entity authorized by the shipper to do so. Cargo shipment-specific information is always optional.

8.3 Data integrity

All shipment tags conforming to this International Standard shall have the ability to prevent the alteration or erasure of reprogrammable cargo shipment-specific data commonly known as "locking" data. This shall be at the discretion and responsibility of the shipper. Tag manufacturers shall have the option of locking a portion of the tag data for identification and storage of data related solely to the manufacturer.

8.4 Authentication

The data storage and transfer protocols of all shipment tags conforming to this International Standard shall require authentication of the interrogator's authorization prior to reading the tag data. Reading of only the tag ID and chip ID shall not require authentication.

8.5 Non-repudiation/audit trail

Shipment tags conforming to this International Standard shall not intentionally provide incorrect or misleading data. Tags shall be capable of identifying their manufacturer, size and type of data content when properly interrogated.

9 Tag location

The shipment tag shall be located in close proximity to the location of the container tag as prescribed in ISO 10374. The shipment tag with its cargo shipment-specific information shall be removed by the consignee upon final delivery.

10 Tag operation

10.1 Data protocol

The data protocol, i.e. commands and messages to and from shipment tags conforming to this International Standard, shall support the requirements of ISO/IEC 15961 and ISO/IEC 15962. The data syntax and semantics shall be as identified in 7.3.3 and 7.3.4.

10.2 Minimum performance requirements

The performance for shipment tags conforming to this International Standard shall be measured in accordance with ISO/IEC 18046. The containerized cargo supply chain RFID system minimum performance requirements, including passing speed, range and discrimination (tag separation), shall be as defined in 6.2.2.

10.3 Environmental requirements

In addition to the minimum environmental requirements defined in 6.2.2, containerized cargo supply chain RFID systems conforming to this International Standard shall be capable of full operation in the electromagnetic environment typically found at transportation facilities. The shipment tag shall survive and maintain the integrity of stored data in a maximum peak field strength of 50 V/m for 60 s, as may be encountered from any radio-frequency source such as a ship-borne radar under normal operation or other such devices. A description of various environmental factors associated with RFID can be found in ISO/IEC TR 18001.

10.4 Air interface

The air interface parameters for shipment tags conforming to this International Standard shall be as defined in ISO/IEC 18000-7.

10.5 Memory requirements

The minimum memory capacity for shipment tags conforming to this International Standard is 256 bytes.

10.6 Indication of impending power source failure

The shipment tag shall provide an indication of whether there is sufficient battery power to last for a trip of 60 days and a minimum of 20 readings per trip. In addition, the tag shall have a battery life countdown timer that, when interrogated, can indicate remaining battery life.

10.7 Real time clock option

The shipment tag shall not be required to have, but may be equipped with, a date and time counter that increments every second. If included in the shipment tag, the counter shall be programmed to the number of seconds elapsed since midnight 1 January, 1999, UTC. This is initialized at time of manufacture and is unchangeable thereafter. The accuracy of time shall be within $\pm$ 5 s per day.

10.8 External communications

Future iterations of this International Standard incorporating "smart" container technologies, e.g. sensors, for containerized cargo supply chain management purposes would need to address the inclusion of external communications with shipment tags.

10.9 Sensor interface, if applicable

Future revisions of this International Standard incorporating "smart" container technologies, e.g. sensors, for containerized cargo supply chain management purposes will address the standardization of the sensor interface. Sensor-equipped RFID tags shall conform to IEEE 1451 for the physical interface between the tag and the sensor.

10.10 Safety and regulatory considerations

All tags, interrogators and antennas conforming to this International Standard shall meet the safety and regulatory requirements of the country where the technology is used. The use of passive or semi-passive (battery-assisted) RFID tags shall also be restricted in hazardous environments, such as near or around explosives or flammable gasses, unless these devices have been certified as safe for such use by appropriate authorities.

Furthermore, the use of these devices shall be restricted in hazardous environments, such as near or around explosives or flammable gasses, unless they have been certified as safe for such use by the appropriate authorities.

10.11 Minimum reliability and accuracy

Containerized cargo supply chain RFID systems, where tags are positioned, programmed and presented to reading equipment in accordance with the provisions of ISO/IEC 18046 and with 6.2.2 and Clauses 7, 8 and 9 of this International Standard, shall have a minimum read reliability of 99,99 %, i.e. no more than one no-read in 10 000 readings, and a read accuracy of 99,998 %, i.e. two undetected incorrect readings in 100 000 readings.

10.12 Tag recyclability

The recyclability of RFID tags is dependent upon the component materials used in the individual tags. Items marked with RFID tags that require recycling shall be marked with an appropriate logo or other visible symbol that indicates the required recycling.

Tags that should be recycled, but for which such recycling is not mandated by regulation, statute or operating condition, shall be marked with an appropriate recycling symbol to assist the user in the proper disposal of the tag. Tags should not be an impediment to the recycling of the RTIs. The tag manufacturer shall clearly mark product tags with recycling instructions or an appropriate logo to assist in the proper disposal of the tag. Guidelines for tag recyclability can be found in ISO/IEC TR 24729-2.

10.13 Tag re-usability

Shipment tags may be re-usable upon their removal by the consignee upon final delivery of the containerized cargo shipment. The shipper or, on the shipper's instructions, the party that physically performs the filling of the container shall clearly mark re-usable shipment tags with appropriate human-readable characters or logos to enable their identification, reclamation and return by the consignee to the party identified by the shipper or its agent, representative or entity authorized by the shipper. Prior to re-use, re-usable tags should have their headers checked for data integrity and the user memory cleared.

11 Privacy of cargo shipment-specific (CSS) data

11.1 Data privacy

The sensitive nature of the CSS data that a shipper, at its discretion and responsibility, may decide to upload and store in the shipment tag is such that the shipper, in addition to the data security requirements mentioned in Clause 8, may choose to implement data privacy measures. The containerized cargo supply chain RFID system shall accommodate such data privacy measures provided that they do nothing to impact on, interfere with, or deteriorate the operation of other RFID devices that may be affixed to the same or other containerized shipments.

11.2 Personal data privacy

Security of aggregated data shall be the responsibility of the collector. Collectors and storage operators of cargo shipment-specific data from shipment tags shall comply with all relevant personal data privacy regulations and requirements of the country where the data collection and/or storage is being undertaken. Personal data collected and/or stored by, or incident to, the reading of a shipment tag shall be accorded the same protection and security as personal data collected and/or stored by any other means.

11.3 Authentication and identification

11.3.1 In addition to authentication of the interrogator's authorization in accordance with 8.4, any information system that collects, stores, processes, shares, disseminates or otherwise handles cargo shipment-specific data as part of the containerized cargo supply chain RFID system defined in this International Standard shall use non-repudiation and personal identification access control measures. Such personal identification and non-repudiation measures shall be implemented at both the device and network level.

11.3.2 Wireless devices shall not be used for storing, processing or transmitting classified information as defined in 4.15.

12 Interoperability, compatibility and non-interference with other RF systems

All containerized cargo supply chain RFID systems, including their shipment tags, antennas and interrogators, claiming conformance with this International Standard shall operate on a strict non-interference basis with all other RFID systems operating in the same spectrum, and shall be interoperable and compatible at the specific frequency designed.

Bibliography

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[2]   ISO 15394:2000, *Packaging — Bar code and two-dimensional symbols for shipping, transport and receiving labels*

[3]   ISO 22742:2005, *Packaging — Linear bar code and two-dimensional symbols for product packaging*

[4]   ISO/IEC 15459-2, *Information technology — Unique identifiers — Part 2: Registration procedures*

[5]   ISO/PAS 17712, *Freight containers — Mechanical seals*

[6]   ISO/IEC 18000-1, *Information technology — Radio frequency identification for item management — Part 1: Reference architecture and definition of parameters to be standardized*

[7]   ISO/IEC TR 18001, *Information technology — Radio frequency identification for item management — Application requirements profiles*

[8]   ISO/IEC TR 24729-2, *Information technology — Radio frequency identification for item management — Implementation guidelines — Part 2: Recyclability of RF tags*

[9]   ANS MH10.8.2, *Data Identifiers and Application Identifiers*

[10]   GS1 General Specifications

[11]   EIA 802, *Product marking*