INTERNATIONAL STANDARD

ISO 17363

Second edition
2013-03-01

Supply chain applications of RFID — Freight containers

Applications RFID à la chaîne logistique — Conteneurs de fret

Reference number
ISO 17363:2013(E)

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Published in Switzerland

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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 ISO/TC 122, *Packaging*.

This second edition cancels and replaces the first edition (ISO 17363:2007), which has been technically revised.

ISO 17363 has two annexes, Annexes A and B, which provide normative information.

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 International Standards, *Supply chain applications of RFID.* Due to the different data structures in each of these International Standards they cannot take the form of interchangeability. However, these International 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) 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 supply chain management information required in each layer of the supply chain. Air interface and communication protocol standards supported within these International Standards are ISO/IEC 18000 and ISO/IEC/IEEE 8802; commands and messages are supported by ISO/IEC 15961 and ISO/IEC 15962. The semantics of these International Standards are defined in ISO/IEC 15418 and their syntax is defined in ISO/IEC 15434.

Excluded, though 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;

— ISO/TC 104 in the area of freight container security, including electronic seals (e-seals) (ISO 18185), 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 associated with containerized freight for supply chain management purposes ("manifest tags"). This International Standard defines the air interface communications, a common set of required data structures, and a commonly organized, through common syntax and semantics, set of optional data requirements.

This International Standard:

- makes recommendations about a second generation supply chain tag intended to monitor the condition and security of the freight resident within a freight container;
- specifies the implementation of sensors for freight resident in a freight container;
- makes specific recommendations about mandatory non-reprogrammable information on the shipment tag;
- makes specific recommendations about optional, re-programmable information on the shipment tag;
- makes specific recommendations about the data link interface for GPS or GLS services;
- specifies the reuse and recyclability of the RF tag;
- specifies the means by which the data in a compliant RF tag is "backed-up" by bar codes and two-dimensional symbols, as well as human-readable information.

2 Conformance and performance specifications

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 according to this International 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 International Standard if it meets, and supports, the following six 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 6346:1995, *Freight containers — Coding, identification and marking*

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 10374:1991, *Freight containers — Automatic identification*

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, *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 17364:2013, *Supply chain applications of RFID — Returnable transport items (RTIs)*

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

IEC 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762, ISO 17364, and the following apply.

4.1
mandatory shipment tag information
information consisting of two non-reprogrammable data elements, namely 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, namely the tag data routing code

Note 1 to entry: The non-reprogrammable data elements are to be imbedded in the shipment tag by the tag manufacturer.

4.2
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 1 to entry: The permanent, non-reprogrammable information elements are specified in ISO 10374.

4.3
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

4.4
integrity
designed such that any modification of the electronically stored information, without proper authorization, is not possible

4.5
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 re-programmable information

4.6
classified information
information which for reasons of national security is restricted to government authorized or approved persons

4.7
tag data routing code
data string that enables the system that reads the tag header to forward Intransit visibility data to the owner of the tag

5 Concepts

5.1 Differentiation between this layer and the preceding and following layers

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.

Figure 1 below provides a graphical representation of “supply chain layers”. The Item Level through Freight Container Level layers are addressed within the suite of standards for “supply chain applications of RFID” (see Introduction) and are intended to enhance supply chain visibility. The Movement Vehicle Level is the purview of ISO/TC 204/WG 7.

The Freight Container Level in Figure 1 is the subject of this International Standard.

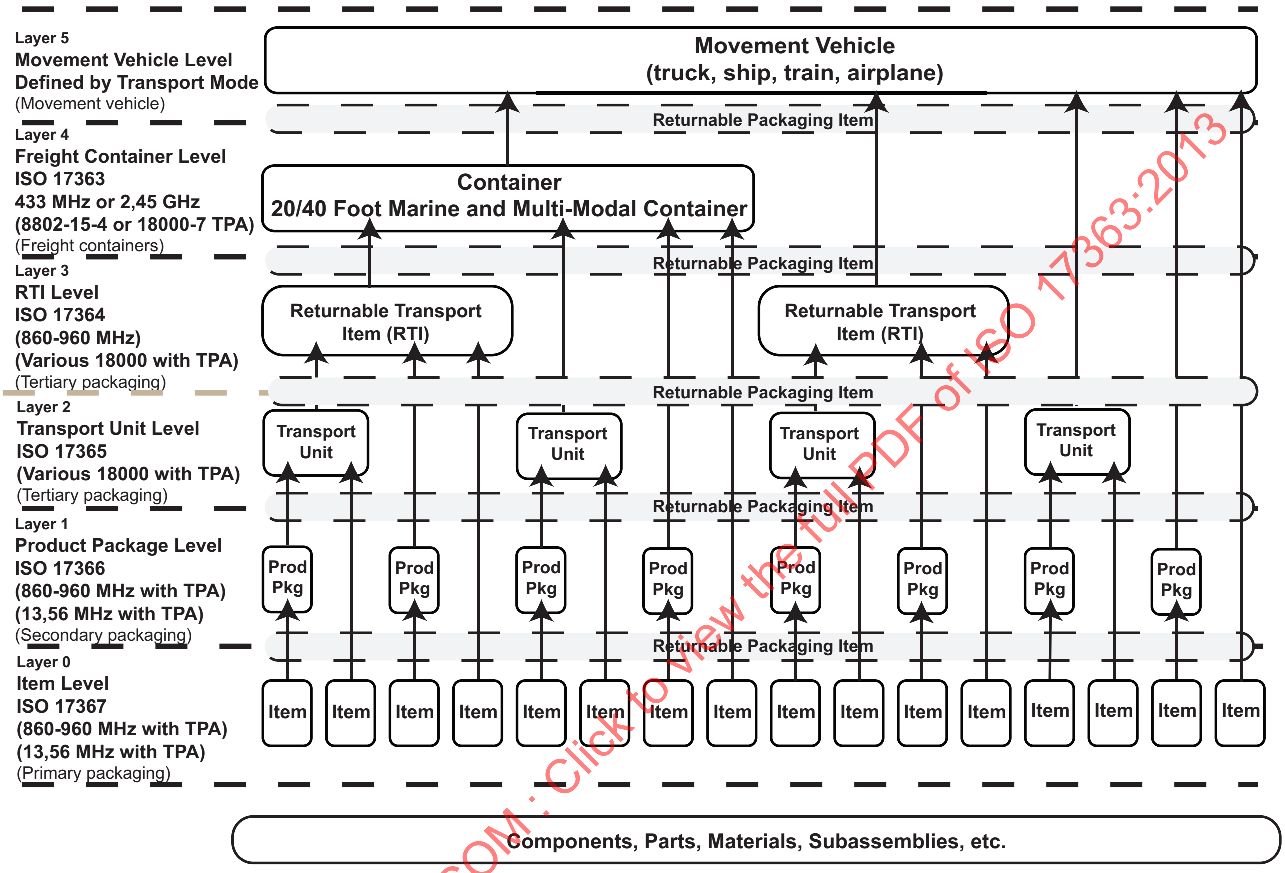

Figure 1 — Supply chain layers

Once tagged, product layer tags can be distinguished from the layer tags that follow 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 to the cargo resident in 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/IEC 15459, 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. The freight container identification structure in this International Standard shall be as defined in ISO 6346 and ISO 10374.

For the purposes of this International Standard, the following data structure is employed to uniquely identify the freight container. ISO tags include an Application Family Identifier (AFI) in front of the Unique Item Identifier.

The ANS MH10.8.2 Data Identifier “7B” followed by a three letter container owner code (OC) assigned in cooperation with the Bureau International des Containers et du Transport Intermodal (BIC), followed by a one letter equipment category identifier (EI), followed by a six digit serial number (CSN), followed by a one digit modulus 11 check digit (CD) calculated in accordance with Annex A of ISO 6346:1995.

7B AAA A NNNNNN N

5.3 International unique identification of freight containers

For unique item identification formats using multiple memory banks, the following AFI formats, specifically 0xA9 or 0xAA, should be used preceding the “7B” format above.

Table 1 — 1736x Application Family Identifiers (AFIs)

AFI	Assigned organization or function
0xA1	ISO 17367 product tagging
0xA2	ISO 17365 transport unit
0xA3	ISO 17364 returnable transport unit
0xA4	ISO 17367 product tagging, but for hazardous materials
0xA5	ISO 17366 product packaging
0xA6	ISO 17366 product packaging, but for hazardous materials
0xA7	ISO 17365 transport unit, but containing hazardous materials
0xA8	ISO 17364 returnable transport unit, but containing hazardous materials
0xA9	ISO 17363 freight containers
0xAA	ISO 17363 freight containers, but containing hazardous materials

5.4 Types of tags

There are four types of RF devices envisioned for use with freight containers. The individual uses of each of these devices are listed in 5.4.1 to 5.4.4.

5.4.1 Permanent container “license-plate” tag

This tag, referred to as the “container tag”, is mentioned in the Introduction to this International Standard and is fully described in ISO 10374.

5.4.2 Cargo shipment-specific tag

This tag, referred to as the “shipment tag”, is fully described in this International Standard.

5.4.3 Container intrusion detection

5.4.3.1 ISO 18185 electronic seal

A read-only, non-reusable freight container seal conforming to high-security seal defined in ISO 17712, and conforming to ISO 18185, that electronically evidences tampering or intrusion through the container doors.

5.4.3.2 ISO/IEC/IEEE 8802-15- 4 intrusion sensor

Sensor-equipped RFID tags shall conform to ISO/IEC/IEEE 21451-7 for the wired or wireless interface and either ISO/IEC 18000-7 or a combination of an ISO/IEC/IEEE 8802-15-4 2450 MHz DSSS PHY employing O-QPSK modulation and ISO/IEC/IEEE 21451-5 for the wireless interface between the tag or access point and the sensor. The choice of wireless air interface should be decided by trading partner agreement.

5.4.4 Item level tag

This tag 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, though in the case of returnable transport items, etc., it may be re-usable. Depending on the layer within the supply chain to which this tag is affixed (see Figure 1), the appropriate part of ISO/IEC 15459 shall be used.

5.4.5 Returnable Packaging Item tags

There exist items associated with a freight container, e.g., straps, bracing, ratchets, cores, loadlocks, etc., that are assets in their own right and are owned by the shipper. These assets shall be tracked and associated with the freight container through the use of Annex A of ISO 17364:2013.

5.5 Addition to other identification requirements

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

6 Differentiation within this layer

6.1 General

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

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 on 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 distances up to and including 35 m from the interrogator and when:

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

   2) operated and stored in the environmental conditions specified in Annex A,

3) it is presumed that the tag will not move beyond the range "A" in Figure 2 until the tag write is complete;

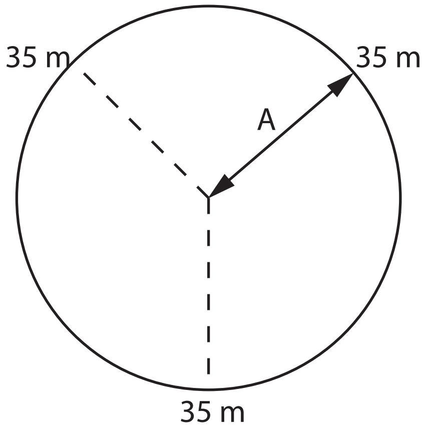

Figure 2 — 35 metre range

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 not to exceed 30 cm x 6 cm x 2 cm;

e) providing an indication of impending power source failure;

f) be able to read the Tag ID and selected Universal Data Block (UDB) from a distance of 100 m (see Figure 3) and when:

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

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

   3) operated and stored in the environmental conditions specified in ISO 18185-3, or

g) be able to read the Tag ID and selected Universal Data Block (UDB) when:

   1) a minimum requirement exists to read a node from a distance of 35 m and whose network shall have a minimum range of 100 m,

   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,

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

This is to permit a choice of using c) with either f) or g).

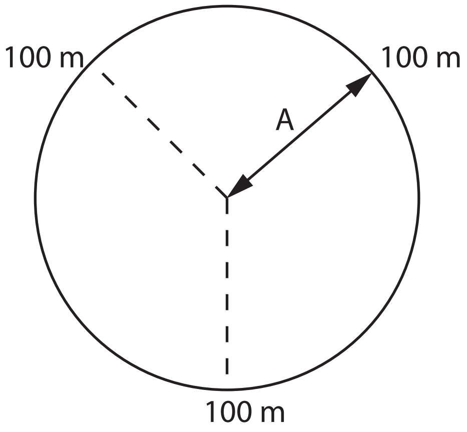

Figure 3 — 100 metre range

6.3 Business processes relevant for the standards suite 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 items can have different configurations or capabilities, such as with computer software loads that differentiate items with otherwise identical form, fit and function 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 can 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.

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 are used in lieu of reading the product tag.

e) 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.

f) 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.

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: Identification of items that have recycling or other disposal requirements.

i) Sortation: A process that places individual items into groups based upon some selection criteria, often performed at speed.

j) Identification: 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; however, they may be done through the shipment tag.

7.2 Mandatory data

The only mandatory data is the Tag ID, Tag Manufactured Date (DI='16D' in the format YYYYMMDD), and Sensor ID, if employed. The Tag ID shall be as described in ISO/IEC 15963 above. This mandatory data element is always non-reprogrammable and is embedded in the shipment tag by the tag manufacturer. The Sensor ID shall be as described in ISO/IEC/IEEE 21451-7. This mandatory data element is always non-reprogrammable and is embedded in the sensor by the sensor manufacturer.

7.3 Optional cargo shipment-specific (CSS) data

7.3.1 General

Optional CSS data is defined at the discretion and responsibility of the shipper, while following the semantics and syntax rules in 7.3.3 and 7.3.4, respectively.

Annex B contains a listing of typical customs data required for inbound freight. These data elements are shown with their associated ASC MH10 Data Identifier and metadata associated with the data element.

Under expressed trading partner agreements optional CSS data may be encrypted or otherwise secured at the point and time it is 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. The applicable customs-related data, the Data Identifiers, shall be as identified in Annex B.

7.3.4 Data syntax

The optional CSS data contained in the shipment tag shall conform to the syntax of ISO/IEC 15434 and ISO/IEC 15962.

7.3.5 Tag data structure

The tag will support multiple types of data including fixed Tag ID and Tag Manufactured Date, as well as user data memory for shipment summary, and raw data storage. Optionally, the tag can support database functions. The fixed user data will support simple read write commands and the selection of data elements. The user data memory for shipment summary will support transactional operations. The raw data storage is a user data area for additional data, e.g. sensor data in support of transactional operations. The database memory option supports flexible multiple element queries.

7.3.6 Tag character set

The RF tag shall employ characters from the character set 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, [, \,], :, ;, <, =, >, ?, @, (,), *, +, -, ., /, <GS>, <RS>, <EOT>, Space.

Tag ID and EPC are binary constructs and must be first handled as a single field and then parsed into sextets. If the Tag ID or EPC do not end on a six-bit boundary, the last sextet will be zero filled to complete the sextet.

7.3.7 Tag data compression

So as to minimize the memory size required, the data encoded on the tag shall be encoded in 6-bit ASCII as defined in Table 2.

Table 2 — Six-bit encoding for ISO/IEC 15434 direct method

Space	100000	0	110000	@	000000	P	010000
<EOT>	100001	1	110001	A	000001	Q	010001
<Reserved>	100010	2	110010	B	000010	R	010010
<FS>	100011	3	110011	C	000011	S	010011
<US>	100100	4	110100	D	000100	T	010100
<Reserved>	100101	5	110101	E	000101	U	010101
<Reserved>	100110	6	110110	F	000110	V	010110
<Reserved>	100111	7	110111	G	000111	W	010111
(	101000	8	111000	H	001000	X	011000
)	101001	9	111001	I	001001	Y	011001
*	101010	:	111010	J	001010	Z	011010
+	101011	;	111011	K	001011	[	011011
,	101100	<	111100	L	001100	\	011100
-	101101	=	111101	M	001101	]	011101
.	101110	>	111110	N	001110	<GS>	011110
/	101111	?	111111	O	001111	<RS>	011111

NOTE Table 2 is six-bit encoding created through the simple removal of the two high-order bits from the ISO/IEC 646-8-bit ASCII character set. The shaded values are re-assigned, as provided, to minimize the bit count when using the ISO/IEC 15434 envelope. The reserved blocks are there for future iterations of this International Standard. Shaded entries are for values different than ISO/IEC 646.

For binary constructs such as Tag ID and EPC the resulting sextets shall include the Table 3 shaded six-bit values represented as follows.

Table 3 — Alternative values for binary encodation

!	100001		
“	100010		
#	100011		
$	100100		
%	100101		
&	100110		
‘	100111		
		^	011110
		_	011111

8 Data security

8.1 General

For a containerized cargo supply chain RFID system to be compliant with this International Standard, it shall protect and secure the optional cargo shipment-specific data as defined in 7.3. The minimum level of data security and protection provided by the containerized cargo supply chain RFID system shall prevent any unplanned observability of cargo shipment-specific data. The minimum level of data security and protection shall be established no later than at the activity 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 from 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), which is with the network and systems themselves;

— 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 it is 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 — as 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 compliant with this International Standard shall have the ability to prevent the alteration or erasure of re-programmable cargo shipment-specific data commonly known as “locking” data. Locking data 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 compliant with this International Standard should 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 Encryption

Encryption and other data protection shall be mutually agreed upon between trading partners.

8.6 Non-repudiation/audit trail

All shipment tags compliant with 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 near proximity to the door of the container. 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 compliant with this International Standard, shall support the requirements in 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 compliant with 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), are as defined in 6.2.2.

10.3 Environmental requirements

In addition to the minimum environmental requirements as defined in 6.2.2, containerized cargo supply chain RFID systems compliant with this International Standard shall be capable of full operation in the electromagnetic environment typically found at transportation facilities. Annex A provides the environmental requirements for ISO 17363 RF tags. 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 compliant with this International Standard are as defined in either ISO/IEC 18000-7 or ISO/IEC/IEEE 8802-15-4 2450 MHz DSSS PHY employing O-QPSK modulation. The choice of which standard to use shall be mutually agreed between the trading partners.

10.5 Memory requirements

The minimum memory capacity for shipment tags compliant with 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. The representation of time shall be UTC ("Z" – Zulu) and formatted as described in ISO 8601, namely, yyyy-mm-ddThh:ssZ, for example 2012-01-01T14:55Z. When time is represented the character "T" serves as the delimiter between "dd" and "hh". Accuracy of time is within ± 5 seconds per day.

10.8 External communications

10.8.1 Sensor interface

Sensor-equipped RFID tags shall conform to ISO/IEC/IEEE 21451-7 andISO/IEC/IEEE 8802-15-4 2450 MHz DSSS PHY employing O-QPSK modulation for the wired or wireless interface between the tag/access point and the sensor. Sensors communicating directly to an external communications infrastructure shall conform to ISO/IEC/IEEE 8802-15-4 2450 MHz DSSS PHY employing O-QPSK modulation.

10.8.2 Infrastructure communications

ISO/IEC/IEEE 8802-15-4 provides the ability for the cargo, through the cargo shipment tag, to communicate directly or through mesh networking with other communication infrastructures. One example is for a cargo-laden container to be loaded onto a chassis and to then be transported in a tractor/trailer configuration. Here, the ISO/IEC/IEEE 8802-15-4 tag would communicate to the On Board Unit (OBU) resident in the tractor of the conveyance. The OBU would then communicate to the Road Side Unit (RSU), satellites, or other infrastructure as defined in the CALM standards of ISO/TC 204/WG 16. (See references[10] to[35] in the Bibliography). Conceptually, this would operate as shown in Figure 4.

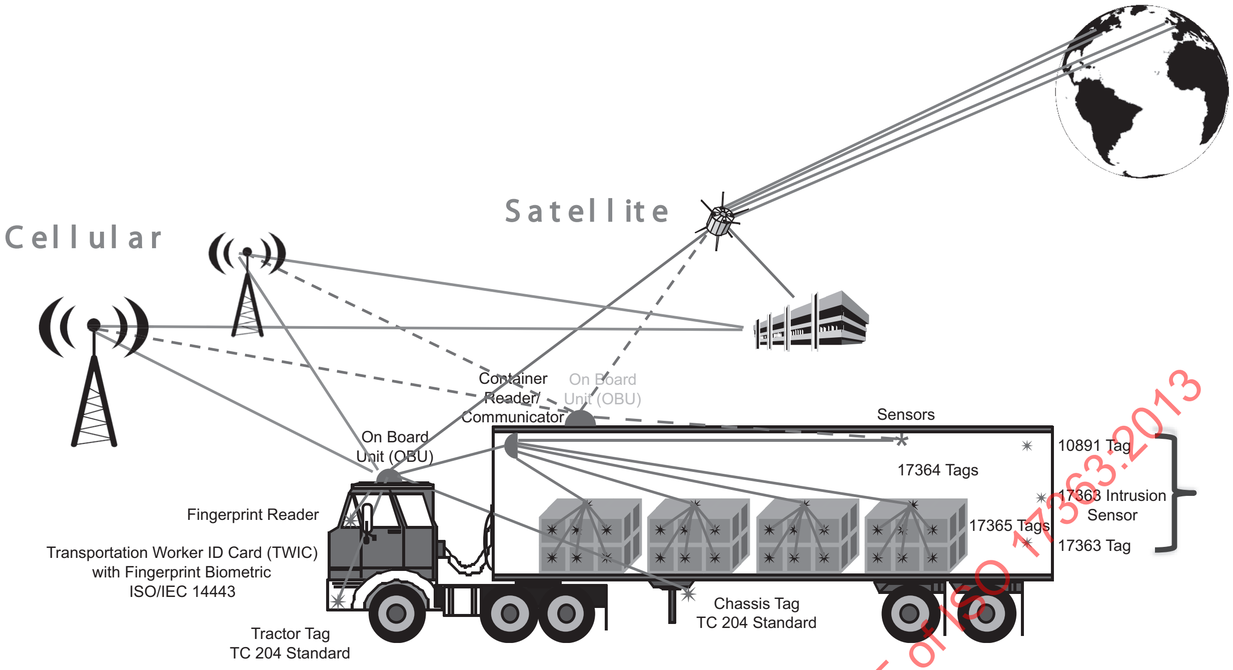
Cellular
Satellite
Container Reader/ Communicator
On Board Unit (OBU)
On Board Unit (OBU)
Sensors
10891 Tag
17364 Tags
17363 Intrusion Sensor
17365 Tags
17363 Tag
Fingerprint Reader
Transportation Worker ID Card (TWIC) with Fingerprint Biometric ISO/IEC 14443
Tractor Tag TC 204 Standard
Chassis Tag TC 204 Standard

Figure 4 — Container to infrastructure

10.9 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 the 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.

10.10 Minimum reliability and accuracy

Containerized cargo supply chain RFID systems, where tags are optimally positioned, programmed and presented to reading equipment in accordance with the provisions of ISO/IEC 18046, as well as 6.2.2 and Clauses 7, 8 and 9 above, 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.

10.11 Tag recyclability

The recyclability of RFID tags is dependent upon the component materials used in the individual tags used. 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 items to which they are attached. The tag manufacturer shall clearly mark product tags with recycling instructions or appropriate logo to assist in the proper disposal of the tag. Guidelines for tag recyclability can be found in ISO/IEC/TR 24729-2.

10.12 Tag reusability

Shipment tags may be reusable upon their removal by the consignee upon final delivery of the containerized cargo shipment. The shipper or, according to the shipper's instructions, the party that physically performs the stuffing of the container, shall clearly mark reusable 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 reuse, reusable tags should have their headers checked for data integrity and 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 8.3, 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 4.6.

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 designated.

13 Human readable information

13.1 Human readable interpretation

Human readable interpretation of the data is not required.

13.2 Human readable translation

Human readable translation of the data is not required.

Annex A
(normative)

Environmental parameters for ISO 17363 electronic devices

A.1 Radio frequency electromagnetic field (80 MHz to 2 700 MHz)

A.1.1 Definition

This test assesses the ability of the container tag to operate as intended in the presence of a radio-frequency electromagnetic field disturbance.

A.1.2 Frequency range and test level

Frequency range	Test level	Test method
80 MHz to 1 000 MHz	10 V/m	IEC 61000-4-3
1 000 MHz to 2 700 MHz	50 V/m	IEC 61000-4-3

A.1.2.1 IEC 61000-4-3

10 V/m is applied to the testing environment for moving or loading on the ground case according to IEC 61000-4-3:2006, Annex E, “Test levels related to general purposes”. The following is a description: “Class 3: Severe electromagnetic radiation environment. Portable transceivers (2 W rating or more) are in use relatively close to the equipment but not less than 1 m. High power broadcast transmitters are in close proximity to the equipment and ISM equipment may be located close by. A typical industrial environment.”

A.1.2.2 ISO 10374

50V/m is applied to the testing environment for loading on the ship case according to ISO 10374:1991, 4.6 “Performance specifications for the AEI system “ The following is a description: “The system shall be capable of full operation in the electromagnetic environment typically found at transportation facilities. The 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.1.3 Test method

The test method shall be in accordance with IEC 61000-4-3.

The following requirements and evaluation of test results shall apply:

- the test level shall be 10 V/m and 50 V/m(measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used;

  the test shall be performed over the frequency range 80 MHz to 1 000 MHz and 1 000 MHz to 2 700 MHz, with the exception of the exclusion band for container tag (see A.1.4), as appropriate;

  for receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency;

  the frequencies selected and used during the test shall be recorded in the test report.

A.1.4 Exclusion bands

The frequency band in which the container tag is intended to operate, 2 450 MHz and 433 MHz, shall be excluded from the radiated RF immunity test.

NOTE Most EMC (Electromagnetic Compatibility) testing standards (ETSI EN 301 489-3:2002, 4.3) of the wireless product specify rules for not applying "RF immunity test" in operating frequency band.

A.1.5 Performance criteria

The performance status of the container tag during testing is checked by ensuring that the information of the tag is read normally under the condition of RFID Reader sending signal to tag and reading tag information periodically ("survive and maintain the integrity of stored data", which is addressed in ETSI EN 301 489-3:2002).

The RFID Reader is established outside of the shielded room, as shown in Figure A.1, to avoid affection from RF electromagnetic. Absorbing material and optical cables are used for isolation of the RF if necessary.

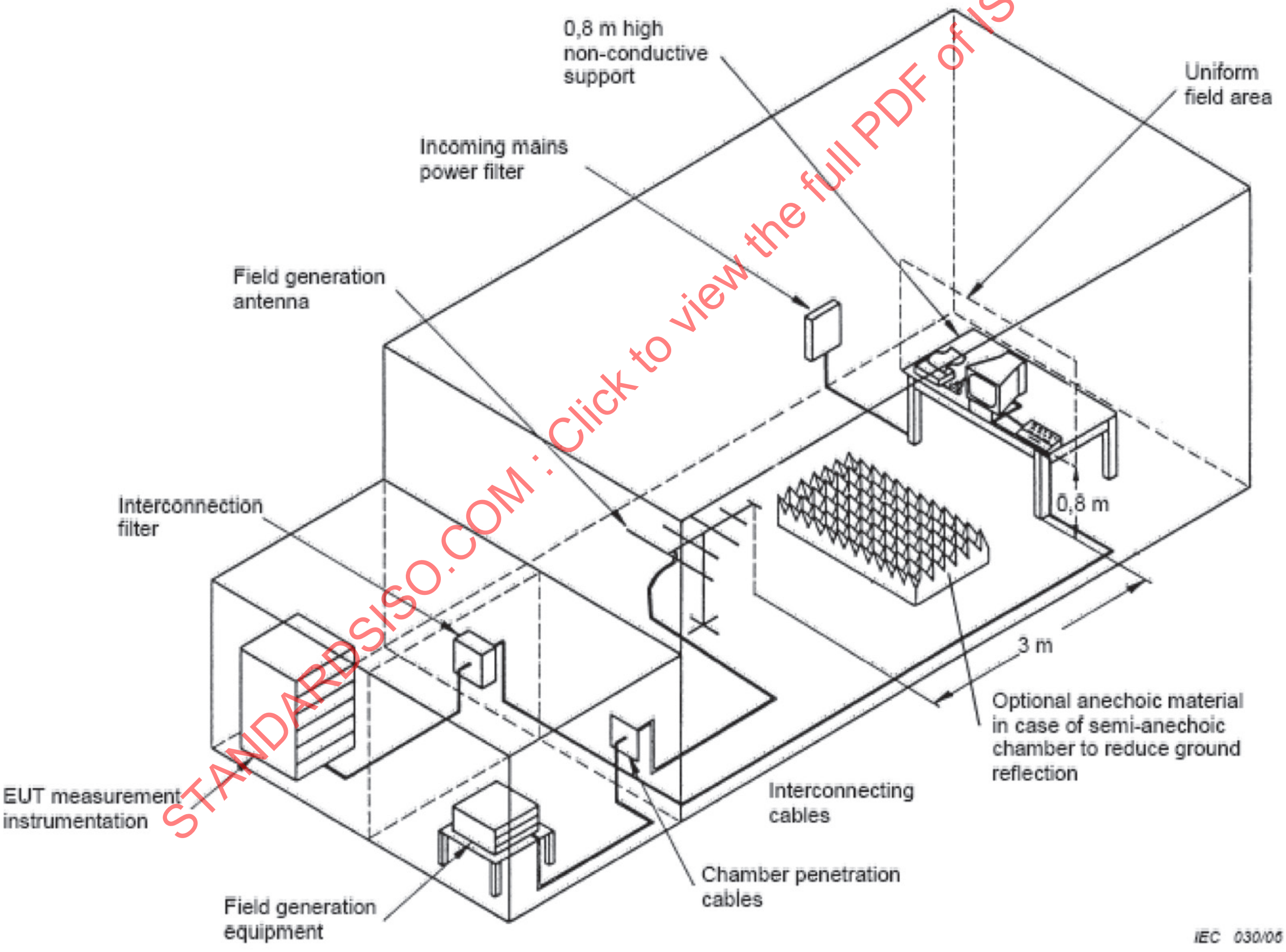

Figure A.1 — Radio frequency electromagnetic field testing configuration

A.2 Electrostatic discharge

A.2.1 Definition

This test assesses the ability of the container electronic devices to operate as intended in the event of an electrostatic discharge.

A.2.2 Test method

The test method shall be in accordance with IEC 61000-4-2.

The test severity level for contact discharge shall be 25 kV and for air discharge 25 kV. All other details, including intermediate test levels, are contained within IEC 61000-4-2.

Electrostatic discharges shall be applied to all exposed surfaces of the container tag, except where the user documentation specifically indicates a requirement for appropriate protective measures (see IEC 61000-4-2).

A.2.3 Performance criteria

Functional error for reading tag information (without data loss) appears when the RFID Reader sends signal to Tag and reads Tag information periodically, but this shall be recovered (self-recovery) automatically after the testing.

Contents are specified clearly on condition of normal operation without data loss, because normal operation during ESD testing is almost impossible as described in "survive and maintain the integrity of stored data".

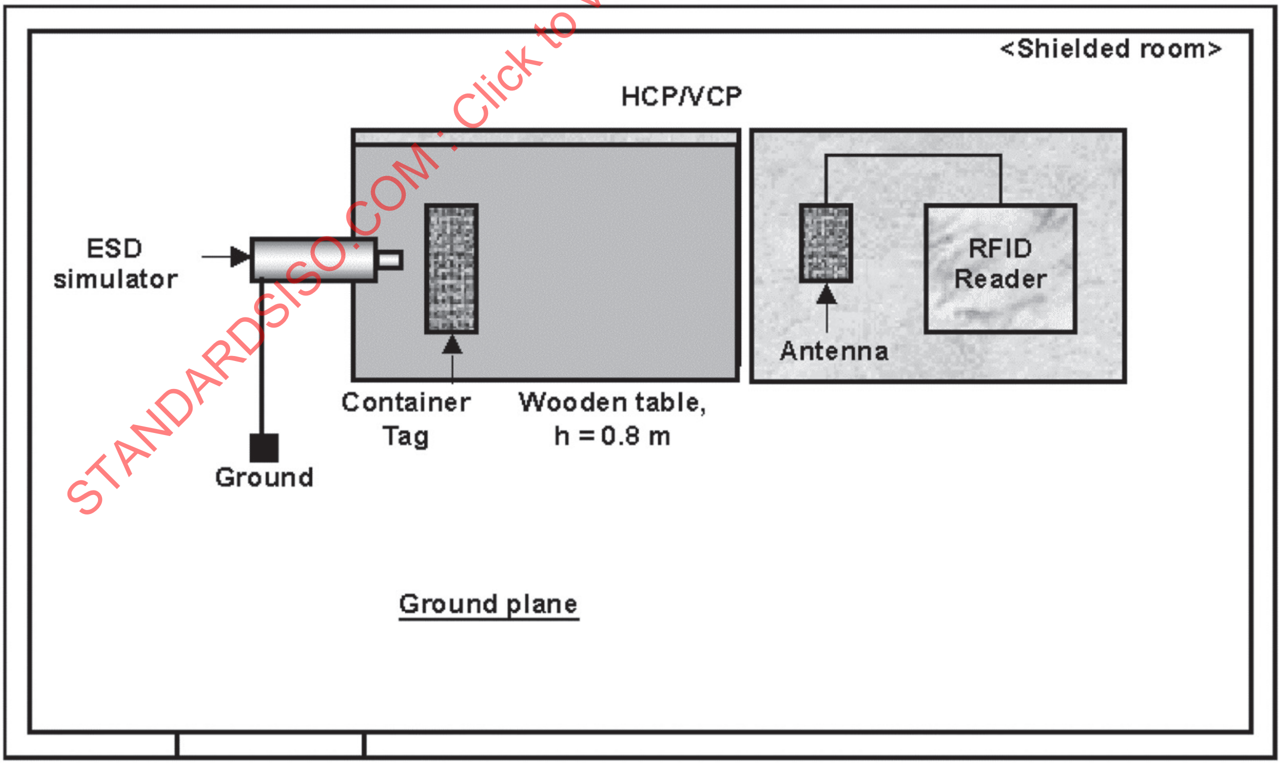

Figure A.2 — Electrostatic discharge testing configuration

A.3 Low temperature

Tags shall fully operate at a minimum low temperature of -40°C. Electronic devices shall fully operate at such minimum temperatures after having been stored at a minimum low temperature of -51°C with an exposure time up to 60 days. Testing will be accomplished in accordance with IEC 60068-2-1 (MIL-STD-810F, Method 502.4).

A.4 High temperature

Tags shall fully operate after having been cycled between +70°C and +38°C, as specified in 4.1. Electronic devices shall fully operate at such temperature extremes after having been stored at a minimum high temperature of +85°C with an exposure time up to 60 days. Testing will be accomplished in accordance with IEC 60068-2-2 (MIL-STD-810F, Method 501.4).

A.5 Mechanical shock

Tags shall fully operate after having been subjected to a mechanical shock of 30 g rms for 11 ms, using a half-sine pulse at least 3 times in each of the following orientations: *x*, *y*, and *z* axis. Testing will be accomplished in accordance with IEC 60068-2-2 (MIL-STD-810F, Method 516.5).

A.6 Random vibration

Tags shall fully operate after having been subjected to a random vibration of a duration of 2 h, on all axes up to 3 g rms between -40°C and +70°C and vibration frequency range from 5 Hz to 100 Hz. Testing will be accomplished in accordance with IEC 60068-2-53 (MIL-STD-810F, Method 514.5).

A.7 Humidity

Tags shall fully operate during and after having been subjected to humidity of up to 95 % non-condensing at a temperature cycle between 30°C and 60°C and an exposure time of five 48-hour cycles as defined in MIL-STD-810F, 4.5.2 and Figure 507.4-1, *Aggravated temperature-humidity cycle*. Testing will be accomplished in accordance with IEC 60068-2-38 (MIL-STD-810F, Method 507.4).

A.8 Immersion

Tags shall fully operate during and after having been subjected to rain and snow, as well as surviving submersion under 1 m of 5 % salt water. Testing will be accomplished in accordance with IEC 60068-2-18 (MIL-STD-810F, Method 506.4 / 512.4).

A.9 Salt fog

Tags shall fully operate during and after having been subjected to 5 % salt fog at a temperature of 33°C to 37°C. Testing will be accomplished in accordance with IEC 60068-2-11 (MIL-STD-810F, Method 509.4).

A.10 Drop shock

Tags shall fully operate during and after having been subjected to a drop shock from a height of 3,3 m onto an impact surface of concrete or steel at least 3 times in each of the following orientations: *x*, *y*, and *z* axis. Testing will be accomplished in accordance with IEC 60068-2-31 and IEC 60068-2-32 (MIL-STD-810F, Method 516.5), although the distance and impact surface will be as defined in this clause.

A.11 Sand and dust

Tags shall fully operate during and after having been subjected to exposure of sand and dust. Testing will be accomplished in accordance with IEC 60068-2-68 (MIL-STD-810F, Method 510.4 – 4.4.3 Procedure II – Blowing sand).

A.12 Electromagnetic environment

During and after the test, the RF tag shall continue to operate as intended under maximum peak field strength of 10 V/m over the frequency range from 80 MHz to 2 700 MHz without operating frequency band. The test signal shall be based on the 80 % of amplitude modulation of 1 kHz sinusoidal signal, and the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency. Testing will be accomplished in accordance with IEC 61000-4-3.

The RF tag shall continue to operate as intended after having been subjected to a ±8 kilovolt electrostatic air discharge and ±15 kilovolt contact discharge. Electrostatic discharges shall be applied to all exposed surfaces of the tag except a special case where user documentation specifically indicates a requirement for appropriate protective measures. Testing will be accomplished in accordance with IEC 61000-4-2.

Annex B
(normative)

Metadata of commonly used Data Identifiers

Data Identifier	DI Name	DI Length	DI Description
7B	Container serial number	an11	According to ISO 6346. OC EI CSN CD, where the OC is the three-letter owner code assigned in cooperation with BIC, the EI is the one letter equipment category identifier, the CSN is the 6-digit unique container identification assigned by the equipment owner, and CD is a modulus 11 check digit calculated in accordance with Annex A of ISO 6346:1995.
9B	Container size/type code	an4	According to ISO 6346:1995, 4.2.
14B	Tag status	a1	Y=Authorized/N=Unauthorized
15B	Dangerous cargo class	an1-4	IMDG Class in the format “n.na” where n = numeric, decimal point expressly encoded, and a = conditional alphabetic qualifier http://docs.imo.org/
16B	UN Code for Dangerous Goods	an4	For dangerous cargo provided by shipper in accordance with UN Code www.unece.org/trans/danger/publi/unrec/English/part3.pdf
17B	Name of transportation subject	an1-35	Vessel name or vehicle code/train trip number in English
18B	Vessel registration number	an3+n7	The three letters “IMO” followed by the seven-digit number assigned to all ships by IHS Fairplay when constructed http://www.imonumbers.lrfairplay.com/
19B	Voyage number/Trip number	an1-8	Letter and number
20B	Vessel Country	a2	ISO 3166-1 Alpha 2 Code
21B	Seal Numbers	6 (ISO/IEC 646)	Comprised of the ISO 18185-1 seal tag ID - 32 bits and the ISO 14816-16-bit manufacturer’s ID
22B	Entry Number/Type	an11+n2	Comprised of the three-digit filer code, followed by the seven-digit entry number, and completed with the one-digit check digit. Entry Filer Code represents the three-character alphanumeric filer code assigned to the filer or importer by CBP. Entry Number represents the seven-digit number assigned by the filer. The number may be assigned in any manner convenient, provided that the same number is not assigned to more than one CBP Form 7501. Leading zeros must be shown. Check Digit is computed on the previous 10 characters. The formula for calculating the check digit can be found in Appendix 1, CBP 7501 Instructions. Entry type is a two-digit code compliant to Block 2, CBP 7501 Instructions
23B	Number Surety Number	n3	The three-digit numeric code that identifies the surety company on the Customs Bond. This code can be found in block 7 of the CBP Form 301, or is available through CBP’s automated system to ABI filers, via the importer bond query transaction. For US Government importations and entry types not requiring surety, code 999 should appear in this block. When cash or Government securities are used in lieu of surety, use code 998.
24B	Foreign Port of Lading	n5	“Schedule K” (Classification of Foreign Ports by Geographic Trade Area and Country) for the foreign port at which the merchandise was actually laden on the vessel that carried the merchandise to the US http://www.iwr.usace.army.mil/ndc/wcsc/scheduleK/schedulek.htm