International RFID Congress

RFID Standards

applied to

Railroads, Automotive, Maritime and Aeronautics

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Contents

Foreword

International standards have to serve only to allow the harmonious deployment of different technologies. They have to serve as reference when these technologies are used in open loop and to allow the interoperability of the systems. An interrogator, compliant with a standard, must be able to communicate with any tag compliant with the same standard and conversely. For industrial applications, it is sometimes necessary to go farther than the interoperability, it is necessary to reach the interchangeability.

Before going more forward to the description of different standards dealing with RFID, it is important to make a distinction between the objectives which they have to reach.

A first category of standards is going to serve to make diverse systems sharing the same resource. For the RFID, this resource common to several systems is naturally the electromagnetic spectrum. In this case, we speak about regulation. In this document, you will only find regulation standards for the European region. These standards are edited by ETSI.

The second category is going to serve to make the technologies live with the citizens. It is about standards of protection against the possible effects of the electromagnetic radiations. The RFID being a technology of identification automatic, the problems connected to the security of the data (personal or not) and the privacy must be also sent by the standards. At this time, the European Commission has edited a Recommendation (May, 12th 2009). Three European Standard Organizations (CEN, CENELEC and ETSI) work together in response to the European Mandate M436. CNRFID is involved in this process. The chairman of the coordination group between the three ESOs is mandated by the CNRFID. Concerning the human exposure, CNRFID is going to set up an ad hoc group in charge of editing a "best practice" guide based on ICNIRP (International Commission on Non Ionizing Radiation Protection) recommendation and other European Standards.

Finally, the third category of standards is describing the functioning of the systems. We speak about technical standards which describe the methods of communication, access to radio spectrum as well as the way of encoding the information.

In this document, you will mainly find this third category of standards devoted to RFID technologies and applications in the aerospace, railways, maritime and automotive industries. All the presented standards are edited by different standard organizations. Presentation is made by alphabetic order.

Air Transport Association (www.spec2000.com/50.html)

Spec 2000 Chapter 9: Automated Identification and Data Capture

ATA Spec 2000 Chapter 9, Automated Identification and Data Capture (AIDC) extract is the commercial aviation industry standard for the permanent identification of parts, the identification of shipping/receiving information, and traceability. The permanent part-marking standards include barcoding, data matrix and Radio Frequency Identification (RFID). The traceability standard describes information that companies must keep in order to provide traceability records to their trading partners.

Spec 2000, Chapter 9 defines the following specifications:

Customer Receipt Process. Using Spec 2000 bar coding specifications, suppliers can provide bar coding on the document/label/tag for a shipment item and an external label for the box, to assist airlines in automating their receiving processes. With a quick scan at the loading dock, airlines can quickly and easily record and upload important information regarding the contents of a shipment.

Repair Agency Receipt Process. Repair agencies also can benefit from the automated processes afforded to them by receiving Spec 2000 bar-coded shipment labels designed especially for repair agencies and their suppliers.

Permanent Parts Identification. To allow for "cradle-to-grave" tracking of serialized parts and to facilitate the use of automated processes in parts handling, this specification allows the use of multiple bar code / 2d data matrix symbologies and/or RFID to permanently mark an aircraft part. The model for this specification was the license plate concept for automobile registration. License plates are simply pointers to a database of unlimited fields of tracked information. Similarly, the part number and serial number uniquely identify aircraft parts and become the pointer. Airlines use part numbers and serial numbers of repairable components in many daily business activities. These include provisioning, processing warranty claims, tracking part flight hours and landings, tracking part installation and removal time, and monitoring regulatory agency compliance. Airlines are now beginning to track the maintenance and repair history of parts using AIDC coded parts.

Bar code symbols may be printed on a variety of materials, such as plastic, aluminum, ceramic or steel. The requirements of the application will dictate which label material should be used. The bar code should remain on the part through the entire life of the part. It should also be readable with a commercially available standard contact or non-contact reader or scanner. Code 39 and code 128 are the preferred symbologies for permanent parts identification; however, in cases where the marking area is limited, Data Matrix may be used. Different symbologies are chosen depending on the application and trading partner agreements.

Radio Frequency Identification (RFID) has been recently introduced for parts identification in certain applications. Benefits of using this technology include the ability to read part information without direct line of site. For example, by using RFID chips on parts of the oxygen system stored in the overhead bins, an airline would be able to check expiration without having to open the bin. Currently, the standard dictates that the "permanent part marking" data will be identical to that used on bar codes and data matrices. However, it is anticipated that a further benefit to RFID will be the

ability to store additional information within the part, such as date of last removal, number of operating hours, etc.

Traceability Data. Chapter 9 has recently added a section which helps companies determine what steps and data are necessary to allow cradle-to-grave parts traceability. Although this is not yet a "data exchange" standard, it will be necessary for companies which produce, ship, receive, operate and repair parts all to maintain important information about these parts in order to achieve this goal. The Traceability section describes this information.

American National Standard Institute (www.ansi.org)

ANSI/MH 10.8.4

"Unit Loads and Transport Packages - RFID Tags for Returnable Containers"

The national standard ANSI/MH 10.8.4 was prepared by the working group ANSI MH 10/SC 8/WG 4.

ANSI MH 10/SC 8 defines the Radio Frequency Identification (RFID) standard for returnable containers. This standard is intended to allow compatibility and to encourage interoperability of products for the growing RFID market in the United States.

This standard defines a single Application Programming Interface (API), which will be shared by all compliant RFID implementations and provide a common interface to application programmes.

The applications for returnable containers addressed by this standard, including cable reels, typically require ranges greater than one meter.

The goal of this standard is to serve current and future users and manufacturers by encouraging the development of open, dynamic systems.

This standard supports national and international standards for data semantics, data syntax, transfer syntax, and a radiofrequency air interface.

The current version of document ANSI/MH 10.8.4 was published in 2002.

American Society for Testing and Materials (www.astm.org)

ASTM D7435-08

"Standard Test Method for Determining the Performance of Passive Radio Frequency Identification (RFID) Transponders on Loaded Containers"

1.1 This test method determines the readability of radio frequency identification (RFID) transponders placed on loaded containers that are manually handled or mechanically handled by material handling equipment such as fork trucks, pallet jacks, and automated guided vehicle systems. The results of these tests are intended to be used for qualitative purposes.

1.2 Test results solely reflect the performance of the specified RFID system and the specified loaded container. Results are not intended for performance analysis of the RFID system, in part or in whole.

1.3 This test method is intended for use in laboratory settings that simulate, as closely as is practicable, the distribution environment of the product being tested.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Association of American Railroads (www.aar.com)

STANDARD FOR AUTOMATIC EQUIPMENT IDENTIFICATION S-918 (2002)

This AAR standard specifies requirements for the automatic electronic identification of equipment used in rail transportation, such as railcars, locomotives, intermodal vehicles, and end-of-train devices (subsequently referred to as “equipment” in this document). The installation of this identification system on freight equipment is not a requirement for acceptance in railroad interchange service, except as specified in the AAR Field Manual of Interchange Rules.

This document describes a reflected energy system in which sensing equipment shall decode radio waves reflected by a tag mounted on equipment used in the transportation industry. The reflected radio waves shall indicate the identification code of the equipment as well as other information.

The system and data outputs described in this standard are compatible with ANSI Standard MH5.1.9-1990 and ISO Standard 10374 for the automatic identification of containers. This standard is also compatible with the standard of the American Trucking Association (ATA) for automatic identification of trailers and chassis. The ATA standard also covers other highway equipment such as tractors, straight trucks, and converter dollies. That standard is available from the ATA in Alexandria, VA.

Automotive Industry Action Group (www.aiag.org)

AIAG B-11:2008

“B-11: Item-Level Radio Frequency Identification (RFID) Standard”

This revision--Revision 7 of the B-11 standard--provides the global RFID user community with the technology to meet the needs of OEMs and the supply chain, including the retail segment, using a single tag throughout an item's life cycle.

Ecma International - European association for standardizing information and communication systems

ECMA-340

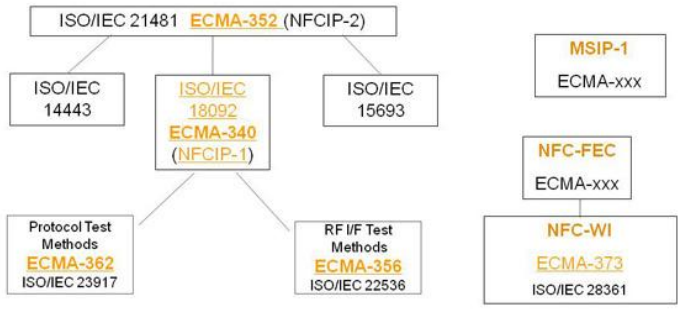
"Near Field Communication Interface and Protocol (NFCIP-1)"

This Standard defines communication modes for the Near Field Communication Interface and Protocol (NFCIP-1) using inductive coupled devices operating at the centre frequency of 13,56 MHz for interconnection of computer peripherals. It also defines both the Active and the Passive communication modes of Near Field Communication Interface and Protocol (NFCIP-1) to realize a communication network using Near Field Communication devices for networked products and also for consumer equipment. This Standard specifies, in particular, modulation schemes, codings, transfer speeds, and frame format of the RF interface, as well as initialization schemes and conditions required for data collision control during initialization. Furthermore, this Standard defines a transport protocol including protocol activation and data exchange methods. Information interchange between systems also requires, at a minimum, agreement between the interchange parties upon the interchange codes and the data structure.

This 2nd edition fully matches ISO/IEC 18092.

ECMA-356 "NFCIP-1 - RF Interface Test Methods", and ECMA-362 "NFCIP-1 - Protocol Test Methods" specify tests for ECMA-340.

ECMA-373 specifies the two-wire interface between a Transceiver and a Front-end.



NFC protocol arrangement

European Conference of Postal and Telecommunications Administrations (CEPT) / ECC

ERC RECOMMENDATION 70-03 RELATING TO THE USE OF SHORT RANGE DEVICES (SRD)

CEPT has adopted this Recommendation to deal with Short Range Devices and the European Telecommunications Standards Institute (ETSI) has now developed harmonised standards for the majority of these devices. Other standards or technical specifications will be applicable within the framework of the R&TTE Directive for placing on the market.

The term “Short Range Device” (SRD) is intended to cover the radio transmitters which provide either unidirectional or bi-directional communication and which have low capability of causing interference to other radio equipment. SRDs use either integral, dedicated or external antennas and all modes of modulation can be permitted subject to relevant standards. SRDs are not considered a “Radio Service” under the ITU Radio Regulations (Article 1). This Recommendation describes the spectrum management requirements for SRDs relating to allocated frequency bands, maximum power levels, channel spacing and duty cycle.

Annex 1 Non-specific Short Range Devices
Annex 2 Tracking, Tracing and Data Acquisition
Annex 3 Wideband Data Transmission systems
Annex 4 Railway applications
Annex 5 Road Transport and Traffic Telematics (RTTT)
Annex 6 Radiodetermination applications
Annex 7 Alarms.....
Annex 8 Model Control
Annex 9 Inductive applications
Annex 10 Radio microphones and Assistive Listening Devices
Annex 11 Radio frequency identification applications
Annex 12 Active Medical Implants and their associated peripherals
Annex 13 Wireless Audio Applications ...

European Telecommunication Standard Institute (www.etsi.org)

ETSI EN 300 220

“Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods, Part 2: Supplementary parameters not intended for conformity purposes, Part 3: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive”
”

The document applies to short range device radio transmitters and receivers:

1) transmitters in the range from 25 MHz to 1 000 MHz and with power levels ranging up to 500 mW;

2) receivers in the range from 25 MHz to 1 000 MHz.

The document applies to short range devices:

- either with a Radio Frequency (RF) output connection and/or with an integral antenna;

- for alarms, identification, telecommand, telemetry, etc., applications;

- with or without speech.

The document covers fixed stations, mobile stations and portable stations. In the present document requirements are given for the different frequency bands, channel separations etc., where appropriate. All types of modulation are covered, in the document, provided the requirements of

clauses 8.6 or 8.7, whichever is applicable, are met. The document does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable. It is a product family standard that may be completely or partially superseded by specific standards covering specific applications.

ETSI EN 300 330

"Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 1: Technical characteristics and test methods; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive"

The document applies to the following Short Range Device major equipment types:

1) Generic Short range Devices including transmitters operating in the range from 9 kHz to 25 MHz; and

2) inductive loop transmitters operating from 9 kHz to 30 MHz including Radio Frequency Identification (RFID) and EAS equipments;

3) receivers operating from 9 kHz to 30 MHz.

These radio equipment types are capable of operating in the permitted frequency bands within the 9 kHz to 30 MHz range as specified in table 1:

- either with a Radio Frequency (RF) output connection and dedicated antenna or with an integral antenna;

- for all types of modulation;

- with or without speech.

Table 1 shows a list of the frequency bands as designated to Short Range Devices and the CEPT/ERC/REC 70-03 [i.1] as known at the date of publication of the present document.

When selecting parameters for new SRDs, which may have inherent safety of human life implications, manufacturers and users should pay particular attention to the potential for interference from other systems operating in the same or adjacent bands.

The document covers fixed stations, mobile stations and portable stations. If a system includes transponders, these are measured together with the transmitter. All types of modulation for radio devices are covered by the present document, provided the requirements of clause 7.3 are met.

The radio equipment, covered by the classification SRD is divided into several classes based on the maximum radiated magnetic field strength. The field strength designation in the present document is based on CEPT/ERC/REC 70-03 [i.1] and National SRD-frequency designations.

Three types of measuring methods are defined in the document due to the varied nature of the antenna types for equipment used in this band. One method measures the RF carrier current, another measures the radiated H-field and the third the conducted power.

The document covers requirements for radiated emissions below as well as above 30 MHz.

Additional standards or specifications may be required for equipment such as that intended for connection to the Public Switched Telephone Network (PSTN).

Table 1: Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 135 kHz	Inductive devices, Generic use
Transmit and Receive	135 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148,5 kHz	Inductive devices, Generic use
Transmit and Receive	148,5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 kHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	4 234 kHz	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10,200 kHz to 11,000 MHz	Inductive devices, Generic use
Transmit and Receive	12,5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13,553 MHz to 13,567 MHz	Inductive devices, Generic use
Transmit and Receive	26,957 MHz to 27,283 MHz	Inductive devices, Generic use
Transmit and Receive	27,095 MHz	Inductive devices, Railway applications

The document covers fixed stations, mobile stations and portable stations. Applications using Ultra-WideBand (UWB) technology are not covered by the present document.

ETSI EN 300 440

"Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 1: Technical characteristics and test methods; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive"

The present document applies to Short Range Devices (SRDs) transmitters and receivers:

a) transmitters operating in range from 1 GHz to 40 GHz with power levels ranging up to 4W;

b) receivers operating in the range from 1 GHz to 40 GHz;

The document contains the technical characteristics for radio equipment and is referencing CEPT/ERC Recommendation for SRDs CEPT/ERC Recommendation 70-03 [1] and ERC Decisions.

The document does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable. It is a product family standard which may be completely or partially superseded by specific standards covering specific applications.

The document applies to generic SRDs:

- either with a Radio Frequency (RF) output connection and specified antenna, or with an integral antenna;

- for alarms, identification systems, radio-determination, telecommand, telemetry etc. applications;

- for all types of modulation;

- with or without speech.

When selecting parameters for new SRDs, which may have inherent safety of human life implications, manufacturers and users should pay particular attention to the potential for interference from other systems operating in the same or adjacent bands.

The document covers fixed stations, mobile stations and portable stations. If a system includes transponders, these are measured together with the transmitter. All types of modulation for radio devices are covered by the document, provided the requirements of clause 7.2 are met.

The radio equipment, covered by the classification SRD is divided into several power classes based on maximum output power (see table 1). The power class designation is based on CEPT/ERC Recommendation 70-03 [1] or ERC Decisions.

Table 1: Maximum radiated peak power (e.i.r.p.)

Power Class (see note 1)	Power level (conducted or radiated)
8	10 mW
9	25 mW
11	100 mW
12	500 mW (see note 2)
13	1 W
14	2 W
14a	4 W (see note 2)
NOTE 1: Class designation is based on CEPT/ERC Recommendation 70-03 [1].	
NOTE 2: For RFID applications, see annex C of the present document.	

On non-harmonized parameters, national administrations may impose conditions on the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated field strength/maximum output current to a defined antenna, duty cycle, equipment marking and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an individual or general licence, or as a condition for use under licence exemption.

The document does not require measurements for radiated emissions below 25 MHz.

ETSI EN 300 761

"Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Automatic Vehicle Identification (AVI) for Railways Operating in the 2,45 GHz Frequency Range; Part 1: Technical characteristics and methods of measurement; Part 2: Harmonized Standard Covering Essential Requirements under Article 3.2 of the R&TTE Directive"

The document applies to 2,45 GHz Short Range Devices (SRDs) for use in Railway AVI which fulfil the Union Internationale des Chemins de fer (UIC) specifications (annex E) and are interoperable with the

current UIC system except for the interrogator (Track Units (TU)) bandwidth. The Interrogator bandwidth is limited to 8 MHz shared within five channels:

- with a Radio Frequency (RF) output connection and specified antenna or with an integral antenna;

- for data transmission only;

- operating on radio frequencies in the 2,446 GHz to 2,454 GHz Industrial, Scientific and Medical (ISM) band,

with power levels up to 500 mW e.i.r.p as defined in the CEPT/ERC Recommendation T/R 70-03 [1].

It covers the minimum characteristics considered necessary in order to make the best use of the available frequencies. It does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable.

The document is based upon CEPT Recommendations T/R 70-03 [1]. It is a product standard covering various Railway applications where the data transmission of the system will be active only during the presence of the train. The document covers fixed installed interrogators (TUs) and transponders (mobile stations). For certain measurements the transponders are measured together with the whole interrogating system. The document includes specifications for methods of measurement for equipment fitted with antenna sockets and/or integral antennae. Additional standards or specifications may be required for equipment such as that intended for connection to the Public Switched Telephone Network (PSTN) or other systems.

ETSI EN 302 208

"Electromagnetic compatibility and Radio spectrum Matters (ERM); Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W; Part 1: Technical requirements and methods of measurement; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive"

The document covers the minimum characteristics considered necessary in order to make the best use of the available frequencies. It does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable. Radio frequency identification products covered within the present document are considered by definition short-range devices. Power limits up to a maximum e.r.p. of 2 W are specified for this equipment in the frequency range 865 MHz to 868 MHz.

The document applies to RFID interrogators and tags operating together as a system. The interrogators transmit within 200 kHz sub-bands using a modulated carrier. The tags respond with a modulated signal. Interrogators may be used with either integral or external antennas. Electromagnetic Compatibility (EMC) requirements are covered by EN 301 489-1 [4] and EN 301 489-3 [7]. The types of equipment covered by the present document are as follows:

• fixed interrogators;

• hand portable interrogators;

• batteryless tags;

• battery assisted tags;

• battery powered tags.

International Air Transport Association (www.iata.org)

IATA Baggage Services Manual (BSM)

IATA's BSM serves as a key industry reference concerning baggage handling at airports. It benefits airlines, airports and ground handling service providers with its comprehensive treatment of the acceptance handling and security to baggage.

The manual includes useful information related to RFID, prorate baggage claim profiles, baggage tag design guidelines, luggage construction standards and baggage message descriptions.

The IATA manuals normally will be revised and published annually.

IATA RP1640

"Use of Radio Frequency Technology for the automatic identification of unit load devices"

RP1640 recommends locations where the use of RF technology for the automatic identification of unit load devices (Olds) would be desired.

This recommended practice provides automatic identification of ULDs by using a RF tag and the electronic transfer of information contained in such a tag to data processing systems. The standard embodied in this recommended practice is not restricted. It is intended that one of the manufacturer's tags may be read by other manufacturer's sensing or reading equipment.

IATA RP1740c

"RFID Specifications For Interline Baggage"

RP1740c establishes a more efficiently handling (e.g. sortation, reconciliation, etc.) of baggage, utilising the license plate concept defined in Resolution 740. The compatibility of the RFID technology with airline data systems and the ability of RFID to be used in the interline baggage handling environment shall also be ensured.

The current version of document RP1740c Version 2.3 was published in 2005.

International Standard Organization (ISO) TC 58

ISO 21007-1:2005 (TC 58/SC4)

"Gas cylinders -- Identification and marking using radio frequency identification technology -- Part 1: Reference architecture and terminology"

ISO 21007-1:2005 establishes a common framework for data structure for unambiguous identification of single or manifolded gas cylinders and for other common data elements in this sector. It also serves as a terminology document in the area of radio frequency identification (RFID) technology.

The scheme and reference model architecture proposed is designed to be an enabling structure to allow some harmonization between different commercial systems and not prescriptive in determining any one system. It is not frequency or air interface protocol specific, provides maximum interoperability, has a high population capability and provides the possibility of upwards migration to more capable systems.

ISO 21007-1:2005 provides a reference structure within which the key core elements of the data structure form an unambiguous identification that may be used to identify the message as a message from a gas cylinder within an electronic data interchange (EDI) environment and provides an application reference identifying that different data structure is contained in the message. A wide variety of such systems can be supported within the structure determined in ISO 21007-1:2005 such as identification of specialty gases and different gas applications. Each such system may range from individual simple identification to identification of such factors as content, fill date, history of use, etc.

ISO 21007-1:2005 does not include the air interface or any aspect of the equipment, solely the data element structure. Subsequent parts of ISO 21007 will define the data structures for gas cylinders and for specific sectors of application.

The numbering scheme views the Identification (ID) as a data element, and the common basic data structure is defined as a data identifier code. The adoption of the Abstract Syntax Notification (ASN.1) structure in a form to meet the requirements of ISO 21007-1:2005 and subsequent subordinate parts of ISO 21007 enables the ISO 21007 series of standards to meet its objectives of

- being adaptable and expandable,
- providing a migration path to enhancement and future developments,
- avoiding carrying unnecessary information for irrelevant applications in any data construct,
- using existing standard codings wherever possible, and
- carrying a minimum of overhead in storage and transmission.

ISO 21007-2:2005 (TC 58/SC4)

"Gas cylinders -- Identification and marking using radio frequency identification technology -- Part 2: Numbering schemes for radio frequency identification"

ISO 21007-2:2005 establishes a common framework for data structure to enable the unambiguous identification in gas cylinder applications and for other common data elements in this sector.

ISO 21007-2:2005 enables a structure to allow some harmonization between different systems. However, it does not prescribe any one system and has been written in a non-mandatory style so as not to make it obsolete as technology changes.

The main body of ISO 21007-2:2005 excludes any data elements that form any part of transmission or storage protocols such as headers and checksums.

International Standard Organization (ISO) TC 104

ISO 6346: 1995 (TC 104/SC4)

"Freight containers -- Coding, identification and marking"

Provides a system for general application for the identification and presentation of information about freight containers. Specifies a identification system with mandatory marks for visual interpretation and optional features for automatic identification and electronic data interchange and a coding system for data on container size and type. Replaces the second edition, which has been technically revised.

La présente Norme internationale fournit un système pour l'identification et la présentation d'informations relatives aux conteneurs pour le transport de marchandises. Le système d'identification est prévu pour une application générale, par exemple pour la documentation, le contrôle et les communications (y compris les systèmes de traitement automatique des données), aussi bien que pour l'inscription sur les conteneurs eux-mêmes. Les méthodes d'inscription de l'identification et de certains autres renseignements (y compris les données opérationnelles) sur les conteneurs, au moyen de marques permanentes, sont incluses dans la présente Norme internationale.

La présente Norme internationale prescrit: a) un système d'identification des conteneurs incluant un dispositif pour vérifier l'exactitude de son utilisation, comprenant: des marques obligatoires pour la présentation du système d'identification aux fins d'interprétation visuelle, et des éléments à utiliser pour l'identification (facultative) automatique des équipements (AEI) et l'échange électronique de données (EDI); b) un système de codage des données relatives aux dimensions et au type de conteneur, et les marques correspondantes; c) des marques, obligatoires et facultatives, relatives à l'exploitation; d) une présentation physique des marques sur le conteneur.

Dans la présente Norme internationale, les termes «obligatoire» et «facultatif» sont utilisés pour différencier les prescriptions de marquage ISO, qui doivent nécessairement être suivies pour tous les conteneurs, des prescriptions qui ne sont pas exigées pour tous les conteneurs. Les marques facultatives sont incluses pour une meilleure compréhension et dans le but de promouvoir une application uniforme de ces marques. Si l'on a choisi d'afficher une marque facultative, les prescriptions fixées dans la présente Norme internationale relatives à cette marque s'appliquent.

ISO 10374:1991 (TC104/SC4)

"Freight containers -- Automatic identification"

Specifies all necessary user requirements. Includes: a container identification system, data coding systems, description of data, performance criteria and security features. Annex A forms an integral part of this standard. Annex B is for information only.

ISO/PAS 18186:2010 (TC104/SC4)

"Freight containers -- RFID cargo shipment tag system"

ISO/PAS 18186:2010 specifies how freight container logistic transparency and efficiency can be improved through use of an RFID cargo shipment tag system and an Internet-based software package. Such an RFID cargo shipment tag system can co-exist with, but is separate from, a container security and identification RFID framework using container "license plate" tags, as specified in ISO 10374 and ISO/TS 10891, and electronic seals ("e-seals"), as specified in ISO 18185. In all cases, operation of and information from ISO/TS 10891 and ISO 18185 devices must be independent from the operation and information of the cargo shipment tag and information from these devices must be passed in discrete messages that are not routed via the RFID cargo shipment tag.

ISO/TS 10891:2009 (TC 104/SC4)

"Freight containers -- Radio frequency identification (RFID) -- Licence plate tag"

ISO/TS 10891:2009 establishes: a set of requirements for container tags, which allow the transfer of information from a container to automatic processing systems by electronic means; a data coding system for container identification and permanent related information which resides within a container tag; a data coding system for the electronic transfer of both container identification and permanent related information from container tags to automatic data processing systems; the description of data to be included in container tags for transmission to automatic data processing systems; performance criteria necessary to ensure consistent and reliable operation of container tags within the international transportation community; the physical location of container tags on containers; features to inhibit malicious or unintentional alteration and/or deletion of the information content of container tags when installed on a freight container.

It is intended to be applicable to freight containers as defined in ISO 668 as well as to other containers not defined in ISO 668 and container ancillary equipment such as road and terminal chassis, generator sets and power packs .

The use of container tags and the equipping of containers for automatic identification are optional. The purpose of ISO/TS 10891:2009 is to optimize the efficiency of equipment control systems and to assist in container security initiatives and programs, including the optional usage of electronic seals in accordance with ISO 18185, and any subsequent International Standard. For this reason, any

container tag system used for identifying containers shall be non-proprietary and conform to and be compatible with ISO/TS 10891:2009.

ISO 18185-1:2007 (TC 104/SC4)

"Freight containers -- Electronic seals -- Part 1: Communication protocol"

ISO 18185-1:2007 provides a system for the identification and presentation of information about freight container electronic seals. The identification system provides an unambiguous and unique identification of the container seal, its status and related information.

The presentation of this information is provided through a radio-communications interface providing seal identification and a method for determining whether a freight container's seal has been opened.

ISO 18185-1:2007 specifies a read-only, non-reusable freight container seal identification system, with an associated system for verifying the accuracy of use, having:

- a seal status identification system,
- a battery status indicator,
- a unique seal identifier including the identification of the manufacturer,
- seal (tag) type.

ISO 18185-1:2007 is used in conjunction with the other parts of ISO 18185.

It applies to all electronic seals used on freight containers covered by ISO 668, ISO 1496-1 to ISO 1496-5, and ISO 8323. Wherever appropriate and practicable, it also applies to freight containers other than those covered by these International Standards.

ISO 18185-2:2007 (TC 104/SC4)

"Freight containers -- Electronic seals -- Part 2: Application requirements"

ISO 18185-2:2007 specifies a freight container seal identification system, with an associated system for verifying the accuracy of use, having:

- a seal status identification system;
- a battery status indicator;
- a unique seal identifier including the identification of the manufacturer;
- a seal (tag) type.

ISO 18185-2:2007 is used in conjunction with the other parts of ISO 18185.

ISO 18185-3:2006 (TC 104/SC4)

"Freight containers -- Electronic seals -- Part 3: Environmental characteristics"

ISO 18185-3:2006 specifies the minimum environmental characteristics for electronic seals.

ISO 18185-3:2006 describes the environmental requirements for the ISO 18185 series, for ISO 10374 (Freight containers -- RF automatic identification) and for ISO 17363 (Supply chain applications of RFID -- Freight containers), since it is expected that the implementation of these International Standards will face the same environmental conditions. However, each of these International Standards has its own unique requirements other than environmental conditions.

ISO 18185-4:2007 (TC 104/SC4)

"Freight containers -- Electronic seals -- Part 4: Data protection"

ISO 18185-4:2007 specifies requirements for the data protection, device authentication and conformance capabilities of electronic seals for communication to and from a seal and its associated reader. These capabilities include the accessibility, confidentiality, data integrity, authentication and non-repudiation of stored data.

ISO 18185-5:2007 (TC 104/SC4)

"Freight containers -- Electronic seals -- Part 5: Physical layer"

ISO 18185-5:2007 specifies the air interface between electronic container seals and Reader/Interrogators of those seals.

It is to be used in conjunction with the other parts of ISO 18185.

ISO 18185-5:2007 describes the physical layer for supply chain applications of RFID for freight containers in accordance with the ISO 18185 series and ISO 17363, since it is expected that the implementation of these standards will face the same international conditions. However, each of these standards has its own unique requirements other than the physical layer. It is expected that RFID Freight Container Identification (as specified in ISO 10374 and ISO 17363), and electronic seals (as specified in the ISO 18185 series) will be able to use the same infrastructure, while recognizing that that there may be requirements for different frequencies for passive devices as opposed to the active devices identified in ISO 18185-5:2007.

International Standard Organization (ISO) TC 122

ISO 17363:2007 (TC122)

"Supply chain applications of RFID -- Freight containers"

ISO 17363:2007 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). It 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 recommendations about a containerized cargo supply chain RFID system, based on shipment tags; specific recommendations about mandatory non-reprogrammable information on the shipment tag; and specific recommendations about optional, re-programmable information on the shipment tag.

Identified within ISO 17363:2007 are the air-interface and communication parameters for active radio-frequency identification communications using ISO/IEC 18000-7.

ISO 17363:2007 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.

It fully describes cargo shipment-specific tags.

It does not address smart container technologies affixed to, or inside, freight containers (e.g. sensors) for supply chain management purposes.

ISO 17364:2009 (TC122)

"Supply chain applications of RFID -- Returnable transport items (RTIs)"

ISO 17364:2009 defines the basic features of RFID for the use in the supply chain when applied to returnable transport items. In particular it:

- provides specifications for the identification of the RTI,
- makes recommendations about additional information on the RF tag,
- specifies the semantics and data syntax to be used,
- specifies the data protocol to be used to interface with business applications and the RFID system,
- specifies the minimum performance requirements,
- specifies the air interface standards between the RF interrogator and RF tag, and
- specifies the reuse and recyclability of the RF tag.

ISO 17365:2009 (TC122)

"Supply chain applications of RFID -- Transport units"

ISO 17365:2009 defines the basic features of RFID for the use in the supply chain when applied to transport units. In particular it:

- provides specifications for the identification of the transport unit,
- makes recommendations about additional information on the RF tag,
- specifies the semantics and data syntax to be used,
- specifies the data protocol to be used to interface with business applications and the RFID system,
- specifies the minimum performance requirements,
- specifies the air interface standards between the RF interrogator and RF tag, and

- specifies the reuse and recyclability of the RF tag.

ISO 17366:2009 (TC122)

"Supply chain applications of RFID -- Product packaging"

ISO 17367:2009 (TC122)

"Supply chain applications of RFID -- Product tagging"

ISO 17367:2009 defines the basic features of RFID for the use in the supply chain when applied to product tagging. In particular it

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

It only addresses product tagging and does not address product packaging.

International Standard Organization (ISO) TC 204

ISO 14816:2005 (TC 204)

"Road transport and traffic telematics -- Automatic vehicle and equipment identification -- Numbering and data structure"

ISO 14816:2005 establishes a common framework data structure for unambiguous identification in RTTT/ITS systems. It excludes any physical aspects such as interfaces. It is neither frequency- nor air interface protocol-specific.

Data elements that form part of transmission or storage protocols such as headers, frame markers and checksums are thus excluded.

The specifications for protecting against changes, classifying and qualifying security aspects of the data structure elements are not included within ISO 14816:2005.

The principles of data element structure and description determined in ISO/IEC 8824, ISO/IEC 8825-1 and ISO/IEC 8825-2 have been adopted to provide an interoperable architecture within a standard framework according to guidelines from ISO/TC 204 and CEN/TC 278.

ISO 14816:2005 defines data structures based on the ISO/IEC 8824-1 ASN.1 UNIVERSAL CLASS types that may be directly IMPORTED to other application standards that would need only subsets of the

full APPLICATION CLASS types. These UNIVERSAL CLASS and APPLICATION CLASS types are uniquely defined as an ASN.1 module in Annex B. This module may be directly linked into an application data definition.

ISO 14816:2005 defines default encoding for simple AVI/AEI applications where no other relevant application standard exists. This definition forms Clause 4.

ISO/TS 13141:2010 (TC 204)

"Electronic fee collection -- Localisation augmentation communication for autonomous systems"

ISO/TS 13141:2010 establishes requirements for short-range communication for the purposes of augmenting the localisation in autonomous electronic fee collection (EFC) systems. Localisation augmentation serves to inform OBE about geographical location and the identification of a charge object. ISO/TS 13141:2010 specifies the provision of location and heading information and security means to protect from the manipulation of the OBE with false road-side equipment (RSE).

The localization augmentation communication takes place between an OBE in a vehicle and fixed road-side equipment. ISO/TS 13141:2010 is applicable to OBE in an autonomous mode of operation.

ISO/TS 13141:2010 defines attributes and functions for the purpose of localization augmentation, by making use of the DSRC communication services provided by DSRC Layer 7, and makes these LAC attributes and functions available to the LAC applications at the RSE and the OBE. Attributes and functions are defined on the level of Application Data Units.

ISO/TS 14907-1:2010 (TC 204)

"Road transport and traffic telematics -- Electronic fee collection -- Test procedures for user and fixed equipment -- Part 1: Description of test procedures"

ISO/TS 14907-1:2010 specifies the test procedures of EFC road-side equipment (RSE) and on-board equipment (OBE) with regard to the conformance to standards and requirements for type approval and acceptance testing which is within the realm of EFC application specifically.

ISO/TS 14907-1:2010 is restricted to systems operating within the radio emission, EMC regulations, traffic and other regulations of the countries in which they are operated and it is therefore a requirement that all required equipment approvals from an authenticated and accredited test house have been obtained in order to claim compliance.

ISO/TS 14907-1:2010 identifies a set of suitable parameter and provides test procedures to enable the proof of a complete EFC-system as well as components of an EFC-system e.g. OBE related to the defined requirements of an application. The defined parameter and tests are assigned to the following groups of parameters:

- functionality;
- quality;
- referenced pre-tests.

ISO/TS 14907-1:2010 describes procedures, methods and tools, and a test plan which shows the relation between all tests and the sequence of these tests. It lists all tests that are required to measure the performance of EFC equipment. It describes which EFC-equipment is covered by the test procedures; the values of the parameters to be tested are not included. It also describes how the tests are to be performed, and which tools and pre-requisites are necessary before this series of tests can be undertaken. It is assumed that the security of the system is inherent in the communications and EFC functionality tests, therefore they are not addressed here. All tests in ISO/TS 14907-1:2010 provide instructions to evaluate the test results.

The test procedures can be used for prototype testing, type approvals, test of installations and periodic inspections. ISO/TS 14907-1:2010 defines only the test and test procedures, not the benchmark figures that these are to be measured against.

EFC-systems for DSRC consist, in principle, of a group of technical components, which in combination fulfill the functions required for the collection of fees by electronic automatic means. These components comprise all, or most of, the following:

- on-board equipment (OBE) within a vehicle;
- on-board unit containing the communications and computing sub-functions;
- optional integrated circuit card which may carry electronic money, service rights and other secured information;
- communication between OBE and RSE based on DSRC;
- equipment for the fee collection at the road-side (RSE) containing the communications and computing sub-functions;
- equipment for the enforcement at the road-side;
- central equipment for the administration and operation of the system.

ISO/TS 14907-1:2010 relates solely to OBE and RSE and the DSRC interface between OBE and RSE including its functions to perform the fee collection. All the equipment used for enforcement (e.g. detection, classification, localization and registration) and central equipment are outside the scope of ISO/TS 14907-1:2010.

ISO/TS 14907-2:2006 (TC 204)

"Road transport and traffic telematics -- Electronic fee collection -- Test procedures for user and fixed equipment -- Part 2: Conformance test for the onboard unit application interface"

ISO TS 14907-2:2006 describes tests that verify OBU conformance of implementations of functions and data structures, as defined in the implementation conformance statement based on ISO 14906, for EFC applications.

ISO/TS 17575-1:2010 (TC 204)

"Electronic fee collection -- Application interface definition for autonomous systems -- Part 1: Charging"

ISO/TS 17575-1:2010 defines the format and semantic of the data exchange between a Front End (OBE plus optional proxy) and corresponding Back Ends in autonomous toll regimes. ISO/TS 17575-1:2010 deals with the definition of the data elements used to report charging details from the Front End to the CE and to receive data which can be used to re-configure the ongoing process of gathering charge relevant information in the Front End.

The data defined in ISO/TS 17575-1:2010 is used to generate charge reports that contain information about the road usage of a vehicle for certain time intervals. The contents of these charge reports might vary between toll regimes. A toll regime comprises a set of rules for charging, including the charged network, the charging principles, the liable vehicles and a definition of the required contents of the charge report.

The data defined in ISO/TS 17575-1:2010 are exchanged using an open definition of a communication stack as defined in ISO/TS 17575-2.

The definitions in ISO/TS 17575-1:2010 comprise:

- reporting data, i.e. data for transferring road usage data from Front End to Back End, including a response from the Back End towards the Front End;
- contract data, i.e. data for identifying contractually essential entities;
- road usage data, i.e. data for reporting the amount of road usage;
- account data for managing a payment account;
- versioning data;
- compliance checking data, i.e. data imported from ISO/TS 12813, which are required in Compliance Checking Communications.

ISO/TS 17575-2:2010 (TC 204)

"Electronic fee collection -- Application interface definition for autonomous systems -- Part 2: Communication and connection to the lower layers"

ISO/TS 17575-2:2010 defines how to convey all or parts of the data element structure defined in ISO/TS 17575-1 over any communication stack and media suitable for this application. It is focussed on mobile communication links. However, wired links shall use the same methodology.

The communication interface shall be implemented as an API in the programming environment of choice for the Front End (FE) system. The definition of this API in concrete terms is outside of the scope of ISO/TS 17575-2:2010. ISO/TS 17575-2:2010 specifies an abstract API that defines the semantics of the concrete API. An example concrete API is presented in Annex C. Where no distinction is made between the abstract and concrete communications APIs the term "communications API" or just "API", can be used.

International Standard Organization / International Electrotechnical Commission (ISO/IEC) JTC1/SC31

ISO/IEC 15459-1:2006 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 1: Unique identifiers for transport units"

Unique identification can occur at many different levels in the supply chain, at the transport unit, at the item level, and elsewhere. Such distinct entities are often handled by several parties: the sender, the receiver, one or more carriers, customs authorities, etc. Each of these parties must be able to identify and trace the item so that reference can be made to associated information such as address, order number, contents of the item, weight, sender, batch or lot number, etc.

The information is often held on computer systems, and may be exchanged between parties involved via EDI (Electronic Data Interchange) and XML (eXtensible Markup Language) messages.

There are considerable benefits if the identity of the item is represented in bar code format, or other AIDC (Automatic Identification and Data Capture) media and attached to or made a constituent part of that which is being uniquely identified so that

- it can be read electronically, thus minimizing errors;
- one identifier can be used by all parties;
- each party can use the identifier to look up its computer files to find the data associated with the item;
- the identifier is unique within the class and cannot appear on any other item of the class during the lifetime of the item.

The unique identifier for transport units defined in ISO/IEC 15459-1:2006 and represented in a bar code label, two-dimensional symbol, radio-frequency identification tag, or other AIDC media attached to the item meets these needs.

All AIDC technologies have the potential to encode a unique identifier. It is expected that application standards for items, using various automatic identification technologies, will be developed based upon the unique identifier as a prime key. These application standards may be made available from the Issuing Agency.

ISO/IEC 15459-1:2006 specifies a unique, non-significant, string of characters for the identification of transport units. The character string is intended to be represented in a bar code label or other AIDC media attached to the item to meet item management needs. To address management needs different classes of items are recognized in the various parts of ISO/IEC 15459, which allows different requirements to be met by the unique identifiers associated with each class. The rules for the unique identifier for transport units, to identify physical logistical transfers, with the identity relevant for the duration of one or more items in the load being held or transported as part of that load, are defined and supported by an example.

ISO/IEC 15459-2:2006 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 2: Registration procedures"

Unique identification can occur at many different levels in the supply chain, at the transport unit, at the item level, and elsewhere. Such distinct entities are often handled by several parties: the sender, the receiver, one or more carriers, customs authorities, etc. Each of these parties must be able to identify and trace the item so that reference can be made to associated information such as address, order number, contents of the item, weight, sender, batch or lot number, etc. There are considerable benefits if the identity of the item is common between all the relevant parties.

ISO/IEC 15459-2:2006 specifies the procedural requirements to maintain a non-significant, unique identifier for item management applications, and outlines the obligations of the Registration Authority and Issuing Agencies.

ISO/IEC 15459-2:2006 excludes those items where ISO has designated Maintenance Agencies or Registration Authorities to provide identification schemes. It does not apply to

- freight containers, because their unique coding is specified in ISO 6346, Freight containers -- Coding, identification and marking;
- vehicles, because their unique identification is specified in ISO 3779, Road vehicles -- Vehicle identification number (VIN) -- Content and structure;
- car radios, because their unique identification is specified in ISO 10486, Passenger cars -- Car radio identification number (CRIN).

The exclusion also applies to ISO 2108, Information and documentation -- International standard book number (ISBN) and ISO 3297, Information and documentation -- International standard serial number (ISSN).

NOTE The scope of each of ISO 2108 and ISO 3297 identifies the title rather than the individual copy of a book or periodical. As such, the level of identification achieved is at a level higher than the unique identity required to be compliant with ISO/IEC 15459-2:2006.

ISO/IEC 15459-3:2006 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 3: Common rules for unique identifiers"

Unique identification can occur at many different levels in the supply chain, at the transport unit, at the item level, and elsewhere. Such distinct entities are often handled by several parties - the sender, the receiver, one or more carriers, customs authorities, etc. Each of these parties must be able to identify and trace the item so that reference can be made to associated information such as configuration, maintenance history, address, order number, contents of the item, weight, sender, batch or lot number, etc.

The information is often held on computer systems, and may be exchanged between parties involved via EDI (Electronic Data Interchange) and XML (eXtensible Markup Language) messages.

There are considerable benefits if the identity of the item is represented in bar code format, or other AIDC (Automatic Identification and Data Capture) media and attached to or made a constituent part of that which is being uniquely identified so that

- it can be read electronically, thus minimising errors;
- one identity can be used by all parties;
- each party can use the identity to look up its computer files to find the data associated with the item;
- the identifier is unique within the class and cannot appear on any other item of the class during the lifetime of the item.

ISO/IEC 15459-3:2006 specifies the common rules that apply for unique identifiers for item management that are required to ensure full compatibility across classes of unique identifiers.

ISO/IEC 15459-4:2006 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 4: Unique identifiers for supply chain management"

Unique identification can occur at many different levels in the supply chain, at the transport unit, at the item level, and elsewhere. Such distinct entities are often handled by several parties: the sender, the receiver, one or more carriers, customs authorities, etc. Each of these parties must be able to identify and trace the item so that reference can be made to associated information such as configuration, maintenance history, address, order number, contents of the item, weight, sender, batch or lot number, etc.

The information is often held on computer systems, and may be exchanged between parties involved via EDI (Electronic Data Interchange) and XML (eXtensible Markup Language) messages.

There are considerable benefits if the identity of the item is represented in bar code format, or other AIDC (Automatic Identification and Data Capture) media and attached to or made a constituent part of that which is being uniquely identified so that

- it can be read electronically, thus minimising errors;
- one identity can be used by all parties;
- each party can use the identity to look up its computer files to find the data associated with the item;
- the identifier is unique within the class and cannot appear on any other item of the class during the lifetime of the item.

The unique identifier for supply chain management defined in ISO/IEC 15459-4:2006 and represented in a bar code label, two-dimensional symbol, radio-frequency identification tag, or other AIDC media attached to the item meets these needs.

All AIDC technologies have the potential to encode a unique identifier. It is expected that application standards for items, using various automatic identification technologies, will be developed based

upon the unique identifier as a prime key. These application standards may be made available from the Issuing Agency.

ISO/IEC 15459-4:2006 specifies a unique, non-significant string of characters for the unique identifier for supply chain management. The character string is intended to be represented in a bar code label or other AIDC media attached to the item to meet supply chain management needs. To address management needs different classes of items are recognized in the various parts of ISO/IEC 15459, which allows different requirements to be met by the unique identifiers associated with each class. The rules are defined for the unique identifiers for supply chain management to identify the unique occurrence of an item, understood to mean the layers zero and one as will be defined in two future International Standards (ISO 17367 and ISO 17366, respectively).

ISO/IEC FCD 15459-5 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 5: Unique identifier for returnable transport items (RTIs)"

ISO/IEC 15459-6:2007 (JTC1/SC31)

"Information technology -- Unique identifiers -- Part 6: Unique identifier for product groupings"

ISO/IEC 15459-6:2007 specifies a unique, non-significant string of characters for the unique identifier of product groupings. The character string is intended to be represented in linear bar code and two-dimensional symbols, radio frequency identification (RFID) transponder or other automatic identification and data capture (AIDC) media attached to the product and/or material to meet the management needs in a batch or lot unit. To address management needs, different classes of item are recognised in the various parts of ISO/IEC 15459. This allows different requirements to be met by the unique identifiers of each class.

The unique identifier for product grouping enables a product grouping defined by a batch or lot number to be uniquely identified from all other lots and batches compliant with ISO/IEC 15459-6:2007. Encoding this unique identifier in a data carrier enables information about the quality of product and end-of-life processing to be clearly identified.

The rules for the unique identifier for product grouping, to identify the unique occurrence of that quality, are defined and supported by an example.

ISO/IEC 15961:2004 (JTC1/SC31)

"Information technology -- Radio frequency identification (RFID) for item management -- Data protocol: application interface"

The data protocol used to exchange information in a radio-frequency identification (RFID) system for item management is specified in ISO/IEC 15961:2004 and in ISO/IEC 15962:2004. Both are required for a complete understanding of the data protocol in its entirety; but each focuses on one particular interface:

ISO/IEC 15961:2004 addresses the information interface with the application system.

ISO/IEC 15962:2004 deals with the processing of data and its presentation to the RF tag, and the initial processing of data captured from the RF tag.

ISO/IEC 15961:2004 focuses on the interface between the application and the data protocol processor, and includes the specification of the transfer syntax and definition of application commands and responses. It allows data and commands to be specified in a standardized way, independent of the particular air interface of ISO/IEC 18000.

ISO/IEC 15961:2004

- provides guidelines on how data shall be presented as objects;
- defines the structure of object identifiers, based on ISO/IEC 9834-1;
- specifies the commands that are supported for transferring data between the application and the RF tag;
- specifies the responses that are supported for transferring data between the RF tag and the application;
- provides a formal description of all the processes using ASN.1, as specified in ISO/IEC 8824-1;
- specifies the transfer syntax, based on the Basic Encoding Rules of ISO/IEC 8825-1, for data to be transferred from and to the application.

It is expected that ISO/IEC 15961:2004 will be used as a reference to develop software appropriate for particular applications, or for particular RF equipment.

ISO/IEC 15961-2 (JTC1/SC31)

"Information technology -- Radio frequency identification (RFID) for item management: Data protocol -- Part 2: Registration of RFID data constructs"

ISO/IEC 15961-2:2010 specifies the procedural requirements to maintain specific radio frequency identification (RFID) data constructs. The data constructs are associated with managing open and closed applications that utilize RFID systems that are conforming to the data protocol defined in other parts of ISO/IEC 15961 and ISO/IEC 15962, and the air interface protocols of ISO/IEC 18000.

It also outlines the obligations of the Registration Authority and the application administrators with respect to the following:

- the allocation of AFIs to particular applications defined by the application administrator;
- the allocation of data formats to particular applications defined by the application administrator;
- the registration of Root-OIDs, compliant with ISO/IEC 9834-1, to any Unique Item Identifiers used in applications defined by the application administrator;
- the registration of Root-OIDs, compliant with ISO/IEC 9834-1, to any other data used in applications defined by the application administrator;
- the registration of various table-driven encoding schemes.

ISO/IEC 15961-3 (JTC1/SC31)

"Information technology -- Radio frequency identification (RFID) for item management: Data protocol -- Part 3: RFID data constructs"

ISO/IEC 15961-3:2010 specifies rules and code structures associated with the data constructs for RFID for item management. In particular, it:

- defines the application family identifier (AFI), including the range of code values that are available to use for RFID for item management;
- defines the data format, including the range of code values that are available to use for RFID for item management;
- describes the Object Identifier structure used for RFID for item management;
- specifies the function of the Object Identifier for the Unique Item Identifier (UII);
- specifies the function of the Object Identifier for other item attendant data.

ISO/IEC 15962:2004 (JTC1/SC31)

"Information technology -- Radio frequency identification (RFID) for item management -- Data protocol: data encoding rules and logical memory functions"

The data protocol used to exchange information in a radio-frequency identification (RFID) system for item management is specified in ISO/IEC 15961:2004 and in ISO/IEC 15962:2004. Both are required for a complete understanding of the data protocol in its entirety; but each focuses on one particular interface:

ISO/IEC 15961:2004 addresses the interface with the application system.

ISO/IEC 15962:2004 deals with the processing of data and its presentation to the RF tag, and the initial processing of data captured from the RF tag.

ISO/IEC 15962:2004 focuses on encoding the transfer syntax, as defined in ISO/IEC 15961:2004 according to the application commands defined in that International Standard. The encodation is in a Logical Memory as a software analogue of the physical memory of the RF tag being addressed by the interrogator.

ISO/IEC 15962:2004

- defines the encoded structure of object identifiers;
- specifies the data compaction rules that apply to the encoded data;
- specifies a Precursor for encoding syntax features efficiently;
- specifies formatting rules for the data, e.g. depending on whether a directory is used or not;
- defines how application commands, e.g. to lock data, are transferred to the Tag Driver;
- defines other communication to the application.

ISO/IEC 15963:2009 (JTC1/SC31)

"Information technology -- Radio frequency identification for item management -- Unique identification for RF tags"

ISO/IEC 15963:2004 describes numbering systems that are available for the identification of RF tags.

A unique ID is required as part of the write operation to RFID tags. The unique ID guarantees that the information written to a tag is unambiguously written to the correct data carrier (tag). A unique ID is also required in many read situations where the contents of the tag are tied to a specific item and that item needs to be unambiguously identified.

The unique ID may also be used

- for the traceability of the integrated circuit itself for quality control in their manufacturing process;
- for the traceability of the RF tag during its manufacturing process and along its lifetime;
- for the completion of the reading in a multi-antenna configuration;
- by the anti-collision mechanism, to inventory multiple tags in the reader's field of view;
- for the traceability of the item to which the RF tag is attached.

ISO/IEC 18000-1:2008 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Part 1: Reference architecture and definition of parameters to be standardized"

ISO/IEC 18000-1:2008 defines the generic architecture concepts in which item identification may commonly be required within the logistics and supply chain and defines the parameters that need to be determined in any standardized air interface definition in the subsequent parts of ISO/IEC 18000. The subsequent parts of ISO/IEC 18000 provide the specific values for definition of the air interface parameters for a particular frequency/type of air interface from which compliance (or non-compliance) with ISO/IEC 18000-1:2008 can be established. ISO/IEC 18000-1:2008 also provides a description of example conceptual architectures in which these air interfaces are often to be utilized.

ISO/IEC 18000-1:2008 limits its scope to transactions and data exchanges across the air interface at reference point delta. The means of generating and managing such transactions, other than a requirement to achieve the transactional performance determined within ISO/IEC 18000-1:2008, are outside the scope of ISO/IEC 18000-1:2008, as is the definition or specification of any supporting hardware, firmware, software or associated equipment.

Standardization of other reference points is outside the scope of ISO/IEC 18000-1:2008.

ISO/IEC 18000-1:2008 is an enabling standard which supports and promotes several RFID implementations without making conclusions about the relative technical merits of any available option for any possible application.

ISO/IEC 18000-1:2008 also provides reference information in respect of patents that have been declared to the developers of ISO/IEC 18000 as pertinent and provides reference addresses in respect of regulations under which ISO/IEC 18000 must operate.

ISO/IEC 18000-2:2009 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Part 2: Parameters for air interface communications below 135 kHz"

ISO/IEC 18000-2:2009 defines the air interface for radio frequency identification (RFID) devices operating below 135 kHz. The purpose of ISO/IEC 18000-2:2009 is to provide a common technical specification for RFID devices that can be used by ISO committees developing RFID application standards. ISO/IEC 18000-2:2009 is intended to allow for compatibility and to encourage inter-operability of products in the international marketplace. ISO/IEC 18000-2:2009 defines the physical layer used for communication between the interrogator and the tag and further defines the communications protocol used in the air interface.

Two types of tag are defined by ISO/IEC 18000-2:2009: Type A and Type B, which differ only by their physical layer. Both support the same inventory (anti-collision) and protocol.

Type A tags are permanently powered by the interrogator, including during the tag-to-interrogator transmission, and operate at 125 kHz.

Type B tags are powered by the interrogator, except during the tag-to-interrogator transmission, and operate at 125 kHz or 134,2 kHz.

ISO/IEC 18000-3:2008 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Part 3: Parameters for air interface communications at 13,56 MHz"

ISO/IEC 18000 has been developed to provide a framework to define common communications protocols for Internationally useable frequencies for Radio Frequency Identification (RFID), and, where possible, to determine the use of the same protocols for all frequencies such that the problems of migrating from one to another are diminished; to minimize software and implementation costs; and to enable system management and control and information exchange to be common as far as is possible.

ISO/IEC 18000-3:2008 was prepared in accordance with the requirements determined in ISO/IEC 18000-1. ISO/IEC 18000-1 provides explanation of the concepts behind ISO/IEC 18000-3:2008.

ISO/IEC 18000-3:2008 has 2 MODES of operation, intended to address different applications. It summarizes the differences between MODE characteristics. The detailed technical differences between the modes are shown in the parameter tables.

ISO/IEC 18000-3:2008 relates solely to systems operating at 13,56 MHz.

ISO/IEC 18000-3:2008 provides physical layer, collision management system and protocol values for RFID systems for Item Identification operating at 13,56 MHz in accordance with the requirements of ISO/IEC 18000-1.

ISO/IEC 18000-3:2008 provides definitions for systems for each MODE determined in ISO/IEC 18000-3:2008.

ISO/IEC 18000-3:2008 defines two non-interfering MODES.

- The MODES are not interoperable.
- The MODES, whilst not interoperable, are non-interfering.

ISO/IEC 18000-4:2008 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Part 4: Parameters for air interface communications at 2,45 GHz"

ISO/IEC 18000-4:2008 is one of a series of International Standards and Technical Reports developed for the identification of items (Item Management) using radio frequency identification (RFID) technology.

ISO/IEC 18000-4:2008 defines the 2,45 GHz protocols that support ISO/IEC 18000-1. Each of the specific physical/data link configurations is defined in a separate sub-clause. The configuration descriptions include a Physical Layer and a Data Link Layer.

ISO/IEC 18000-4:2008 defines the air interface for radio frequency identification (RFID) devices operating in the 2,45 GHz Industrial, Scientific, and Medical (ISM) band used in item management applications. ISO/IEC 18000-4:2008 provides a common technical specification for RFID devices that can be used by ISO committees developing RFID application standards. ISO/IEC 18000-4:2008 is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace. ISO/IEC 18000-4:2008 defines the forward and return link parameters for technical attributes including, but not limited to, operating frequency, operating channel accuracy, occupied channel bandwidth, maximum equivalent isotropically radiated power (EIRP), spurious emissions, modulation, duty cycle, data coding, bit rate, bit rate accuracy, bit transmission order, and where appropriate operating channels, frequency hop rate, hop sequence, spreading sequence, and chip rate. ISO/IEC 18000-4:2008 further defines the communications protocol used in the air interface.

ISO/IEC 18000-4:2008 contains two modes. The first is a passive tag operating as an interrogator talks first while the second is a battery assisted tag operating as a tag talks first. The detailed technical differences between the modes are shown in the parameter tables.

ISO/IEC 18000-6:2004 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Part 6: Parameters for air interface communications at 860 MHz to 960 MHz"

ISO/IEC 18000-6:2004 defines the air interface for radio-frequency identification (RFID) devices operating in the 860 MHz to 960 MHz Industrial, Scientific, and Medical (ISM) band used in item management applications. Its purpose is to provide a common technical specification for RFID devices that may be used by ISO committees developing RFID application standards. ISO/IEC 18000-6:2004 is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace. ISO/IEC 18000-6:2004 defines the forward and return link parameters for technical attributes including, but not limited to, operating frequency, operating channel accuracy, occupied channel bandwidth, maximum EIRP, spurious emissions, modulation, duty cycle, data coding, bit rate, bit rate accuracy, bit transmission order, and where appropriate operating channels, frequency hop rate, hop sequence, spreading sequence, and chip rate. It further defines the communications protocol used in the air interface.

ISO/IEC 18000-6:2004 contains one mode with two types. Both types use a common return link and are reader talks first. Type A uses Pulse Interval Encoding (PIE) in the forward link, and an adaptive ALOHA collision arbitration algorithm. Type B uses Manchester in the forward link and an adaptive binary tree collision arbitration algorithm. The detailed technical differences between the two types are shown in the parameter tables.

ISO/IEC 18000-6:2004/Amd 1:2006 (JTC 1/SC31)

"Extension with Type C and update of Types A and B"

ISO/IEC 18000-7:2009 (JTC 1/SC31)

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

ISO/IEC 18000-7:2009 defines the air interface for radio frequency identification (RFID) devices operating as an active RF tag in the 433 MHz band used in item management applications. It provides a common technical specification for RFID devices that can be used by ISO technical committees developing RFID application standards. ISO/IEC 18000-7:2009 is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace. ISO/IEC 18000-7:2009 defines the forward and return link parameters for technical attributes including, but not limited to, operating frequency, operating channel accuracy, occupied channel bandwidth, maximum power, spurious emissions, modulation, duty cycle, data coding, bit rate, bit rate accuracy, bit transmission order, and, where appropriate, operating channels, frequency hop rate, hop sequence, spreading sequence, and chip rate. ISO/IEC 18000-7:2009 further defines the communications protocol used in the air interface.

ISO/IEC CD 18046-1 (JTC 1/SC31)

"Information technology -- Radio frequency identification device performance test methods -- Part 1: Test methods for system performance"

ISO/IEC FCD 18046-2 (JTC 1/SC31)

"Information technology -- Radio frequency identification device performance test methods -- Part 2: Test methods for interrogator performance"

ISO/IEC 18046-3:2007 (JTC 1/SC31)

"Information technology -- Radio frequency identification device performance test methods -- Part 3: Test methods for tag performance"

Radio frequency identification (RFID) technology has broad applicability to the Automatic Identification and Data Capture (AIDC) industry in item management. As a wireless communication technique based on radio frequency technology, the applications cover multiple levels of the industrial, commercial and retail supply chains. These can include

- freight containers,
- returnable transport items (RTIs),
- transport units,
- product packaging,
- product tagging.

Performance tests define test methods that deliver results that allow the comparison of different RFID systems, interrogator and tags in order to select among them for use in a particular application.

The performance characteristics of devices (tags and interrogation equipment) can vary drastically due to application factors as well as the particular RFID air interface (frequency, modulation, protocol, etc.) being supported. Of key concern is the matching of the various performance characteristics to the user application. Additionally, in an open environment users of such technology demand multiple sources for these devices from technology providers. A key challenge is a method of evaluating the differences between various technology providers' products in a consistent and equitable manner.

ISO/IEC 18046-3:2007 provides a framework for meeting the above-noted concern and challenges. To this end, clear definitions of performance as related to user applications of RFID technology in the supply chain are provided. Based on such application-based definitions, test methods are defined with attention to the test parameters required for a consistent evaluation of RFID devices.

Of particular significance, these tests are defined for RFID devices having one antenna. It is common practice to have products with both single and multiple antennas to define an RFID transaction zone sufficient for the application. The defined methods can easily be extended from equipment with a single antenna to apply to equipment with multiple antennas, in order to evaluate performance under conditions more closely matching those of a particular application.

ISO/IEC 18046-3:2007 defines test methods for performance characteristics of RFID tags for item management, and specifies the general requirements and test requirements for tags which are applicable to the selection of the devices for an application. The summary of the test reports form a unified tag datasheet. It does not apply to testing in relation to regulatory or similar requirements.

ISO/IEC TR 18047-2:2006 (JTC 1/SC31)

"Information technology -- Radio frequency identification device conformance test methods -- Part 2: Test methods for air interface communications below 135 kHz"

ISO/IEC 18000 defines the air interfaces for radio frequency identification (RFID) devices used in item management applications. ISO/IEC 18000-2 defines the air interface for these devices operating in frequencies below 135 kHz.

The purpose of ISO/IEC TR 18047 is to provide test methods for conformance with the various parts of ISO/IEC 18000.

Each part of ISO/IEC TR 18047 contains all measurements required to be made on a product in order to establish whether it conforms with the corresponding part of ISO/IEC 18000. For ISO/IEC TR 18047-2:2006, each interrogator needs to be assessed with tags of both type A (FDX) and type B (HDX), while each tag needs to be assessed either with type A (FDX) or type B (HDX).

It should be noted that measurement of tag and interrogator performance is covered by ISO/IEC TR 18046. ISO/IEC TR 18047-2:2006 defines test methods for determining the conformance of radio frequency identification devices (tags and interrogators) for item management with the specifications given in ISO/IEC 18000-2, but does not apply to the testing of conformity with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further, application-specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in ISO/IEC TR 18047-2:2006 are the following:

- mode-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

The following are not included in ISO/IEC TR 18047-2:2006:

- parameters that are already included in regulatory test requirements;
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

Unless otherwise specified, the tests in this part of ISO/IEC TR 18047-2:2006 are to be applied exclusively to RFID tags and interrogators defined in ISO/IEC 18000-2.

ISO/IEC TR 18047-2:2006 also describes all necessary conformance tests.

ISO/IEC TR 18047-3:2004 (JTC 1/SC31)

"Information technology -- Radio frequency identification device conformance test methods -- Part 3: Test methods for air interface communications at 13,56 MHz"

ISO/IEC TR 18047-3:2004 defines test methods for determining the conformance of radio-frequency identification devices (tags and interrogators) for item management with the specifications given in the corresponding part of ISO/IEC 18000, but does not apply to the testing of conformity with regulatory or similar requirements. The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further, application-specific functionality criteria that are not available in the general case.

ISO/IEC TR 18047-3:2004 includes the following interrogator and tag conformance parameters:

- mode-specific conformance parameters including nominal values and tolerances; and
- parameters that apply directly affecting system functionality and inter-operability.

ISO/IEC TR 18047-3:2004 does not include the following:

- parameters that are already included in regulatory test requirements; and
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

ISO/IEC TR 18047-4:2004 (JTC 1/SC31)

"Information technology -- Radio frequency identification device conformance test methods -- Part 4: Test methods for air interface communications at 2,45 GHz"

ISO/IEC TR 18047-4:2004 defines test methods for determining the conformance of radio frequency identification (RFID) devices (tags and interrogators) for item management with the specifications given in the corresponding part of ISO/IEC 18000, but does not apply to the testing of conformity with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further, application specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in ISO/IEC TR 18047-4:2004 are:

- mode-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

The following are not included in ISO/IEC TR 18047-4:2004:

- parameters that are already included in regulatory test requirements;
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

Unless otherwise specified, the tests in ISO/IEC TR 18047-4:2004 apply exclusively to RFID tags and interrogator defined in ISO/IEC 18000-4 Mode 2.

ISO/IEC TR 18047-6:2008 (JTC 1/SC31)

"Information technology -- Radio frequency identification device conformance test methods -- Part 6: Test methods for air interface communications at 860 MHz to 960 MHz"

ISO/IEC 18000 defines the air interfaces for radio frequency identification (RFID) devices used in item management applications. ISO/IEC 18000-6 defines the air interface for these devices operating at frequencies from 860 MHz to 960 MHz.

ISO/IEC TR 18047 provides test methods for conformance with the various parts of ISO/IEC 18000.

Each part of ISO/IEC TR 18047 contains all measurements required to be made on a product in order to establish whether it conforms to the corresponding part of ISO/IEC 18000. For ISO/IEC TR 18047-6:2008, each interrogator needs to be assessed for operation with both types A and B, while each tag is only required to support at least one of the types A or B or C.

Measurement of tag and interrogator performance is covered by ISO/IEC 18046.

ISO/IEC TR 18047-6:2008 defines test methods for determining the conformance of radio frequency identification devices (tags and interrogators) for item management with the specifications given in ISO/IEC 18000-6, but does not apply to the testing of conformity with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further application-specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in ISO/IEC TR 18047-6:2008 are the following:

- type-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

The following are not included in ISO/IEC TR 18047-6:2008:

- parameters that are already included in regulatory test requirements;
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

Unless otherwise specified, the tests in ISO/IEC TR 18047-6:2008 are to be applied exclusively to RFID tags and interrogators defined in ISO/IEC 18000-6.

ISO/IEC TR 18047-6:2008 also describes all necessary conformance tests.

ISO/IEC TR 18047-7:2010 (JTC 1/SC31)

"Information technology -- Radio frequency identification device conformance test methods -- Part 7: Test methods for active air interface communications at 433 MHz"

ISO/IEC 18000 defines the air interfaces for radio frequency identification (RFID) devices used in item management applications. ISO/IEC 18000-7:2009 defines the active air interface for these devices operating in the 433,92 MHz Industrial, Scientific, and Medical (ISM) band.

ISO/IEC TR 18047 provides test methods for conformance with the various parts of ISO/IEC 18000. ISO/IEC TR 18047-7:2010 contains the compliance measurements required to be fulfilled by a product in order to be compliant to ISO/IEC 18000-7:2009.

ISO/IEC TR 18047-7:2010 defines test methods for determining the conformance of radio frequency identification devices (tags and interrogators) for item management with the specifications given in ISO/IEC 18000-7:2009, but does not apply to the testing of conformity with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further, application-specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in ISO/IEC TR 18047-7:2010 are the following:

- mode-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

The following are not included in ISO/IEC TR 18047-7:2010:

- parameters that are already included in regulatory test requirements;
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

Unless otherwise specified, the tests in ISO/IEC TR 18047-7:2010 are to be applied exclusively to RFID tags and interrogators defined in ISO/IEC 18000-7.

ISO/IEC TR 24710:2005 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Elementary tag licence plate functionality for ISO/IEC 18000 air interface definitions"

ISO/IEC 18000 defines the operation of radio frequency identification (RFID) air interfaces for item identification and management.

ISO/IEC 18000 has been designed to encompass a full range of data capture and carrier functionality. Both read and write operations are enabled, and the interfaces can efficiently support both simple and complex data transactions.

This approach facilitates user implementation by providing consistency between differing types of RFID data transactions. Equally it provides architecture to guide future RFID development whilst maintaining the backward compatibility necessary to sustain market confidence.

Recent developments in the design and management of distributed databases holding item level information have focused attention on 'identification data element' operation of RFID systems. In

this application, the RFID tag carries only sufficient data to permit reference to attribute information held elsewhere. Typically this data does not change during the validity of the 'licence' and is of relatively low bit count.

ISO/IEC TR 24710:2005 has been prepared to assist users intending to implement ISO/IEC 18000 RFID air interface standards, with particular focus on so-called elementary tags, i.e. tags possessing limited memory - typically but not exclusively 256 bits or less - and lacking write capability (but not excluding WORM devices).

The annexes to ISO/IEC TR 24710:2005 describe the implementation of ISO/IEC 18000-2, -3, -4, -6 and -7 in such an application.

Users are strongly advised to refer to ISO/IEC 15961 and ISO/IEC 15962 for a full exposition of the management issues relating to data strings used for identification data element purposes.

Bodies external to ISO also specify identification data element length and structure for particular applications.

ISO/IEC TR 24710:2005 defines for each of ISO/IEC 18000-2, -3, -4, -6 and -7, and, where relevant, for each Mode within each part, a transaction that achieves an elementary tag 'identification data element' for item identification and management.

The transaction uses the existing air interface protocols defined in the corresponding parts of ISO/IEC 18000 or a subset thereof.

ISO/IEC TR 24729-1:2008 (JTC 1/SC31)

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

ISO/IEC TR 24729-1:2008 provides guidance on the use of radio frequency identification (RFID) enabled labels and packaging in the supply chain. Guidance is provided for transponder selection, as well as the selection of media, adhesives, facestocks, and inks. Techniques are described to minimize electrostatic discharge and transponder damage.

Methods are described to verify transponder data. Placement and attachment guidance is provided for inlays, conveyable cases and containers, palletized/unit load material, as well as non-conveyables and non-palletized materials.

One type of RFID referred to within ISO/IEC TR 24729-1:2008 is the EPCglobal Class 1 Generation 2 technology. The“Class” structure originally embraced by EPCglobal has, for the most part, been overtaken by events. Consequently, this technology may be referred to as UHF Gen 2 or by its ISO designation, ISO/IEC 18000,Part 6C.

ISO/IEC TR 24729-2:2008 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Implementation guidelines -- Part 2: Recycling and RFID tags"

ISO/IEC TR 24729-2:2008 describes the potential for use of radio-frequency identification (RFID) as a significant enabler in the recycling of various types of products; notably home appliances and electronics. It identifies various recycling streams that are challenged by the possibility of RF tags being attached to recycled material, notably glass and steel.

ISO/IEC TR 24729-3:2009 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Implementation guidelines -- Part 3: Implementation and operation of UHF RFID Interrogator systems in logistics applications"

ISO/IEC TR 24729-3:2009 provides reference information and practical knowledge in the selection, installation and application of ISO/IEC 18000-6C RFID Readers. RFID Readers include fixed mounted (such as portal, conveyor, and wrap stations), handheld (tethered and wireless), and mobile mounted (such as those found on forklifts). ISO/IEC TR 24729-3:2009 presents guidelines to improve the performance of RFID data collection systems for more successful applications and to cover the approaches necessary to ensure that the operational requirements of the end user are met. Many of the techniques recommended are the result of practical tests in working environments. However, each application is different and thus the techniques recommended herein might not be applicable in all situations.

ISO/IEC TR 24729-4:2009 (JTC 1/SC31)

"Information technology -- Radio frequency identification for item management -- Implementation guidelines -- Part 4: Tag data security"

ISO/IEC TR 24729-4:2009 provides guidance to systems designers to help them determine potential threats to data security of the tag and tag-to-reader communication in an RFID system, and appropriate countermeasures to provide data security. Although important, it is beyond the scope of ISO/IEC TR 24729-4:2009 to address security aspects of the reader-to-host and back-end enterprise modules.

ISO/IEC TR 24729-4:2009 is not intended to specifically address consumer privacy concerns; however, since data and personal privacy depend on the use of appropriate security measures, privacy is addressed in general terms. Data access security provides a measure of personal privacy protection by mitigating the potential for unauthorized reading of data on a tag. However, not all data access security countermeasures provide the same level of protection.

North Atlantic Treaty Organization (www.nato.int)

NATO STANAG 2233

"NATO consignment and asset tracking by Radiofrequency Identification"

STANAG 2233 references existing ISO standards for both active and passive RFID utilizing the infrastructures of nations involved. Changes to the edition already in progress reflect the rapidly evolving RFID market, and the applicable ISO standards.

This STANAG only applies to NATO operations while nations (including NATO agencies) are also encouraged to utilize the provisions of this STANAG internally. This STANAG excludes radio frequency data communications and the application of RF tracking using satellite tracking capabilities and Real Time Locating Systems (RTLS). This STANAG supplements the requirements of STANAGs 2494 and 4281.

The current version of the document NATO STANAG 2233 was published in 2005.

Society of Automotive Engineers (www.sae.org)

SAE AS 5678-2006

"Passive RFID Tags Intended for Aircraft Use"

The scope of this document is to: 1. Provide a requirements document for RFID Tag Manufacturers to produce passive-only UHF RFID tags for the Aerospace industry; 2. Identify the minimum performance requirements specfic to the Passive UHF RFID Tag to be used on aircraft parts, to be accessed only during ground operations; 3. Specify the test requirements specific to Passive UHF RFID tags for airborne use, in addition to RTCA DO-160E compliance requirements separately called out in this document; 4. Identify existing standards applicable to Passive UHF RFID Tag; 5. Provide a certification standard for RFID tags which will use permanently-affixed installation on aircraft and aircraft parts.

SAE AS 5677

"Passive Radio Frequency Identification (RFID) for Aerospace Applications"

Develop standards and specifications for PASSIVE Radio Frequency Identification (RFID),smart labels, used for identifying aerospace parts and systems that will be used in airborne applications.

Increased use of Radio Frequency Identification in logistics and security/banking industries has led to technology divergence. Aerospace use of such technologies carries with it increased requirements for qualification and regulatory compliance (e.g., FAA, EASA, etc.). Higher per-part costs due to these additional aerospace requirements, low manufacturing volumes (compared to other industries), and the longer lifespans of aerospace processes, technologies, and implementations, it makes sense for

industry participants to standardize parts and use cases to minimize maintenance and operational disruptions by aircraft operators whose equipment comes from multiple manufacturers and eras.

SAE AS 6023

"Active and battery assisted RFID Tags Intended for Aircraft Use"

This standard is to provide guidance for the certification of Active RFID tags to meet the criteria established in the FAA Advisory Circular AC No: 20-162 - AIRWORTHINESS APPROVAL AND OPERATIONAL ALLOWANCE OF RFID SYSTEMS 09/22/08

Active RFID tags (those with a battery) are being widely promoted for aircraft applications. Some of the applications include, sensing temperature, vibration, stress, fatigue, cargo handling, etc. Because these tags have a battery and transmit RF there is a possibility they could interfere with safety of flight.

SAE AIR 5747-2008

"EMC Laboratory RF Radiated Emission Report for Passive Radio Frequency Identification (RFID) Tags"

This paper contains RF radiated emission and susceptibility data from passive Radio Frequency Identification (RFID) tags and readers operating at 13.56 MHz, 915 MHz, and 2.45 GHz. Laboratory test procedures incorporated the methods of RTCA DO-160D (test procedures for aviation electrical/electronic equipment) and DO-233 (test procedures for consumer portable electronic devices (PEDs)). Only one commercially available system was evaluated per established operating frequencies.

United State Department of Defense

MIL-STD-129

"Military Marking for Shipment and Storage"

The objective of MIL-STD-129 is to provide background, reference information, and practical knowledge concerning the selection and application of "RFID enabled" media – i.e. conventional labels, tickets and tags with embedded or attached RFID transponders – to the labelling of military goods and assets.

This standard does not address "smart packaging", where the transponder is embedded in the container itself.

The current version of document MIL-STD-129 was published in 2004.