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Information and documentation — RFID in libraries —

Part 2: Encoding of RFID data elements based on rules from ISO/IEC 15962

Information et documentation — RFID dans les bibliothèques —

Partie 2: Encodage des éléments de données RFID fondé sur les règles de l'ISO/CEI 15962

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Foreword

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

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

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

ISO 28560-2 was prepared by Technical Committee ISO/TC 46, *Information and documentation*, Subcommittee SC 4, *Technical interoperability*.

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ISO 28560 consists of the following parts, under the general title *Information and documentation — RFID in libraries*:

— *Part 1: Data elements and general guidelines for implementation*

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— *Part 2: Encoding of RFID data elements based on rules from ISO/IEC 15962*

— *Part 3: Fixed length encoding*

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Introduction

Libraries are implementing RFID (radio frequency identification) as item identification to replace bar codes. RFID streamlines applications like user self-service, security, and materials handling. A standard data model for encoding information on RFID tags could increase the cost-effectiveness of the technology within libraries particularly through greater interoperability of RFID tags and equipment, and enhance support for resource sharing between libraries.

Several countries have undertaken preliminary work on standardization. The Netherlands developed a data model for public libraries and in Denmark “RFID Data Model for Libraries” has been published. Finland has adopted the Danish model, but with a few changes. There is a French data model that differs from the Danish and Dutch models. Other libraries in different parts of the world have installations based on various proprietary systems offered by technology and library system suppliers. All of these constitute the installed base of RFID systems, but only account for a small minority of the total of libraries globally.

There is an opportunity to develop a standard data model, taking into account the lessons learned from the national schemes and vendor solutions, and provide migration options for those libraries that have already invested in the technology. Because new items are continually being purchased, a number of migration options can be adopted based on factors relevant to each library.

This part of ISO 28560 deals with the encoding of data elements in a flexible manner using encoding rules that are specified in ISO/IEC 15962. ISO 28560-1 defines the set of mandatory and optional data elements.

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ISO 28560-3 and this part of ISO 28560 are mutually exclusive with respect to an RFID tag being applied to a loan item. In other words, the RFID tag is encoded according to the rules of this part of ISO 28560, or to the rules of ISO 28560-3, or to some proprietary rules. Depending on the technologies being used, and other features of tags that are claiming compliance with this part of ISO 28560, the reading system might achieve a degree of interoperability.

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ISO 28560 provides essential standards-based information about RFID in libraries. Ongoing advice needs to be provided because of the evolving nature of RFID technology, and the opportunities to migrate between different types of legacy system and encoding rules of ISO 28560.

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Information and documentation — RFID in libraries —

Part 2:
Encoding of RFID data elements based on rules from ISO/IEC 15962

1 Scope

This part of ISO 28560 specifies a data model and encoding rules for the use of radio frequency identification (RFID) tags for items appropriate for the needs of all types of libraries (including academic, public, corporate, special and school libraries). The rules for encoding a subset of data elements taken from the total set of data elements defined in ISO 28560-1 are based on ISO/IEC 15962, which uses an object identifier structure to identify data elements.

This part of ISO 28560 defines the technical characteristics required to encode the data elements defined in ISO 28560-1 in accordance with ISO/IEC 15962. These subsets of data elements can be different on different items in the same library. The encoding rules also enable the optional data to be organized on the RFID tag in any sequence. In addition, the encoding rules provide for flexible encoding of variable length and variable format data.

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This part of ISO 28560 provides essential standards-based information about RFID in libraries. A source of additional information about implementation issues is provided in Annex A.

2 Normative references

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

ISO/IEC 15961-1, *Information technology — Radio frequency identification (RFID) for item management: Data protocol — Part 1: Application interface*

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

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

ISO/IEC 18046-3, *Information technology — Radio frequency identification device performance test methods — Part 3: Test methods for tag performance*

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

ISO 28560-1, *Information and documentation — RFID in libraries — Part 1: Data elements and general guidelines for implementation*

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3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1
access method
component of the **DSFID** (3.8) that is responsible for declaring the ISO/IEC 15962 compaction and encoding rules on an RFID tag

3.2
air interface protocol
rules of communication between an RFID interrogator and the RFID tag of a particular type, covering: frequency, modulation, bit encoding and command sets

3.3
application command
instruction issued from the application to the ISO/IEC 15962 data protocol processor in order to initiate an action or operation with the RFID tag(s) via the interrogator

3.4
AFI
application family identifier
mechanism used in the data protocol and the **air interface protocol** (3.2) to select a class of RFID tags relevant to an application, or aspect of an application, and to ignore further communications with other classes of RFID tags with different identifiers

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3.5
arc
specific branch of an object identifier tree, with new arcs added as required to define a particular object

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NOTE The top three arcs of all object identifiers are compliant with ISO/IEC 9834-1, ensuring uniqueness.

3.6
data format
mechanism used in the data protocol to identify how **object identifier**s (3.11) are encoded on the RFID tag, and (where possible) identify a particular data dictionary for the set of relevant object identifiers for that application

NOTE The data format declares the **Root-OID** (3.13) in an efficient manner, so that a complete **object identifier** (3.11) can be reconstructed for external communications.

3.7
data protocol process
implementation of the processes defined in ISO/IEC 15962, including data compaction, formatting, support of the command/response unit, and an interface to the tag driver

3.8
DSFID
data storage format identifier
code that consists of, at least, the **access method** (3.1) and **data format** (3.6)

3.9
digital vandalism
unauthorized modification of data on an RFID tag that either renders it unusable or falsely represents another identifier

3.10
metadata
type of data or information about data

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NOTE In the context of this part of ISO 28560, **metadata** (3.10) can be the **Relative-OID** (3.12) in relation to the data, the precursor in relation to the compacted and encoded bytes, or the **AFI** (3.4) and **DSFID** (3.8) in relation to the data.

3.11
object identifier
value (distinguishable from all other such values), which is associated with an object

3.12
Relative-OID
particular **object identifier** (3.11) that constitutes the remaining **arc**s (3.5) after the **Root-OID** (3.13)

3.13
Root-OID
particular **object identifier** (3.11) that constitutes the first, second and subsequent common **arc**s (3.5) of a set of object identifiers (hence the common root)

3.14
tag driver
implementation of the process to transfer data between the data protocol processor and the RFID tag

4 Applicability and relationship with other systems

4.1 Figure 1 gives an overview of the relationship of this part of ISO 28560 with other systems. This part of ISO 28560 defines a set of technical features while addressing a number of operational issues. This part of ISO 28560 interfaces with four other activities, but with a clearly defined overlap. These other activities are

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— the circulation of library materials,

— the data requirements of publishers, printers and other suppliers,

— the inter-library loan processes, and

— the details of borrowers, including membership cards.

4.2 Figure 1 also shows that there is a direct relationship with supply chain activities, and internally within the library with RFID circulation devices and the library management system including interfaces such as SIP2 and NCIP.

As the use of RFID in libraries moves towards a more standardized approach as defined in this part of ISO 28560, the characteristics and architecture systems will change compared to those already established.

To achieve interoperability with equipment and software, the required features include

— the air interface protocol, which defines the way readers and tags communicate with one another,

— the data protocol, which defines the encoding rules that convert application-based data to the encoded bytes on the RFID tag; the data protocol also defines metadata features in the RFID tag to protect the integrity of RFID for library systems in relation to other RFID applications,

— the set of data elements that form the dictionary from which individual libraries may choose those that are most appropriate for their operation.

4.3 By adopting this part of ISO 28560, libraries will have increased flexibility with a number of features as follows.

— Beyond the minimum of mandatory data elements defined in the standard, libraries will be able to choose from the optional data elements those that are more appropriate to its application, even varying these for different types of item.

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— Libraries should be able to rank the optional data elements into an appropriate order for encoding on the RFID tag to support fast transactions across the air interface.

— Libraries will have a greater choice of interoperable RFID equipment, and should be able to select RFID tags with an appropriate size of memory.

— Some degree of choice in the types of security system will become a library responsibility.

— Libraries with an installed base of RFID data capture will be offered options on how to migrate to the more open standard solution.

— The library community, as a whole and through developments of this part of ISO 28560, will be provided with future options to cope with changes within the RFID equipment as the technology develops. This includes ensuring that new open systems applications do not corrupt the established base of RFID systems in libraries.

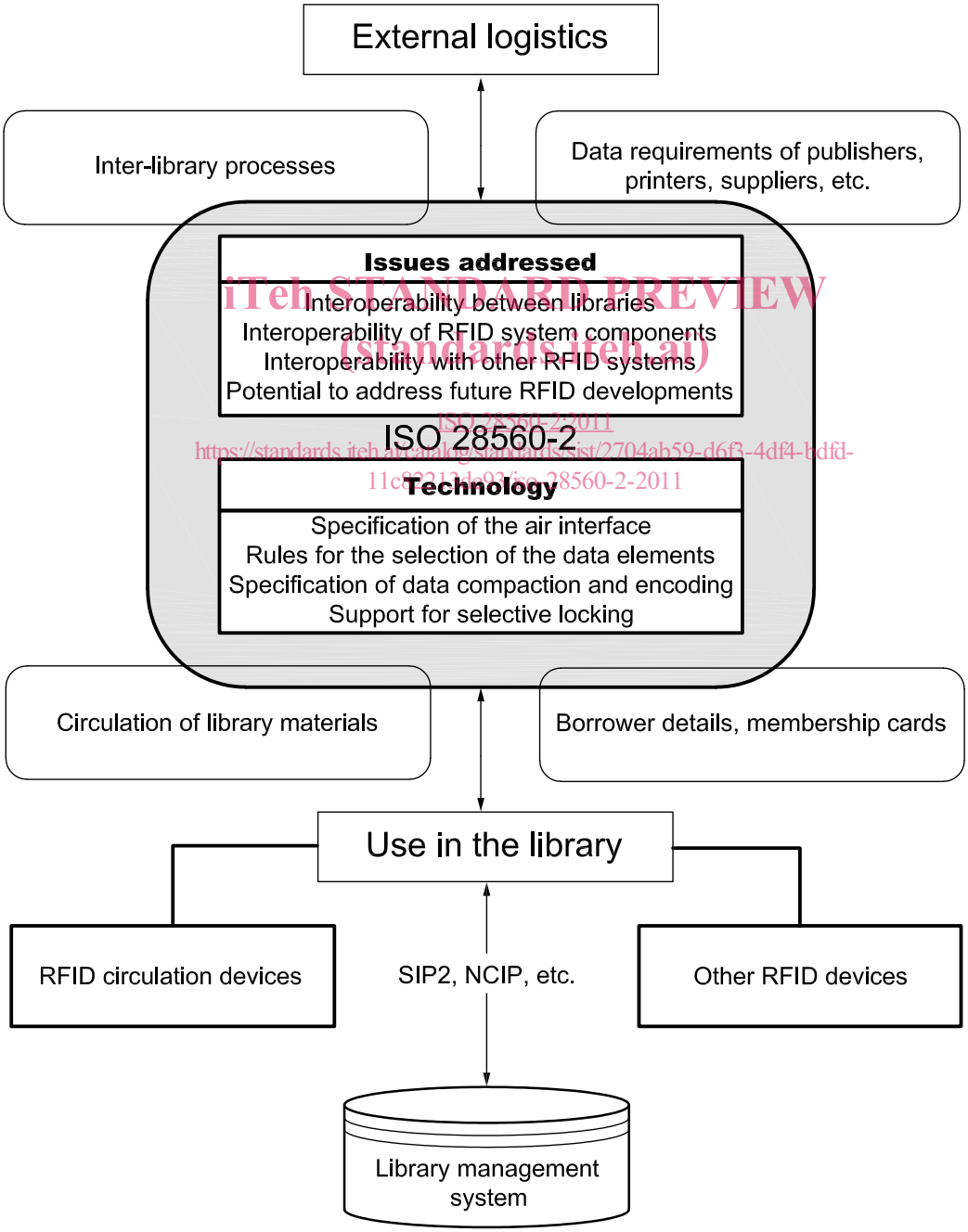

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Figure 1 — Relationship of this part of ISO 28560 with other systems

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5 Requirements

5.1 Data elements

The data elements shall be compliant with ISO 28560-1.

NOTE There is a degree of flexibility in using locally defined codes that enable enhancements and variations to be implemented whilst still complying with the basic set of data elements.

5.2 RFID air interface

5.2.1 General

The air interface for compliant tags is specified in ISO/IEC 18000-3, specifically the specification for Mode 1.

For migration purposes, additional non-compliant air interfaces used in legacy systems may be supported during a transition period, which is permitted to remain in place for years as necessary.

5.2.2 Air interface conformance

The air interface conformance shall be tested in accordance with the procedures of ISO/IEC TR 18047-3.

5.2.3 Tag performance

Where there are requirements for test tag performance, these shall be done in accordance with ISO/IEC 18046-3.

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5.3 Data protocol

ISO/IEC 15961-1 specifies the application commands that are used to define the communication requirements between the application and the RFID tag. The relevant commands are described in Annex B.

The process rules of ISO/IEC 15962 shall be used to encode and decode data from the RFID tag. In particular, the following constraints shall apply.

— The only encoding rules shall be based on the No-directory access method. No alternative access method shall be supported until this part of ISO 28560 is revised.

— Both the hard coded and software encoded DSFID shall be supported, depending on the capabilities of the RFID tag.

5.4 RFID readers

In order to achieve interoperability, RFID readers shall be based on open architecture RFID standards defined by ISO/IEC Joint Technical Committee JTC 1/SC 31, *Automatic identification and data capture techniques*. Particular standards are specified in this part of ISO 28560. This means that any one manufacturer's reading/writing equipment shall be able to read or write to any other manufacturer's RFID tags, and that any manufacturer's RFID tags shall be able to be read and/or programmed by any other manufacturer's reader/writer.

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6 Data elements

6.1 General

The set of data elements that comprises the data dictionary for this part of ISO 28560 is fully described in ISO 28560-1 and repeated in outline in Table 1. Only one data element is mandatory, the primary item identifier. All others are optional, but may be selected to meet the requirements of individual libraries, and/or for particular items.

Table 1 shows the Relative-OID value, the format for input data and advice about locking the data element as an encoded data set on the RFID tag. A maximum length of 255 characters should apply to all data elements that have a variable length display format.

Table 1 — List of data elements

N[a]	Name of the data element	Status	Display format	Lock
1	Primary item identifier	Mandatory	Variable length alphanumeric Character set = ISO/IEC 646 International Reference Version (IRV)	Should be locked
2	Content parameter	Optional	Bit mapped code (see 6.3)	Optional
3[b]	Owner institution (ISIL)	Optional	Variable length field (maximum of 16 characters) based on ISO 15511	Optional
4	Set information	Optional	{Total in set / part number} structure (maximum ≤ 255)	Optional
5	Type of usage	Optional	Single octet (coded list)	Optional
6	Shelf location	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
7	ONIX media format	Optional	Two uppercase alphabetic characters	Optional
8	MARC media format	Optional	Two lowercase alphabetic characters	Optional
9	Supplier identifier	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
10	Order number	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
11[b]	ILL borrowing institution (ISIL)	Optional	Variable length field (maximum of 16 characters) based on ISO 15511	Not locked
12	ILL borrowing transaction number	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Not locked
13	GS1 product identifier	Optional	Fixed length 13 numeric digit field	Optional
14	Alternative unique item identifier	Reserved for future use	—	—
15	Local data A	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV, or ISO/IEC 8859-1, or UTF-8	Optional
16	Local data B	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV, or ISO/IEC 8859-1, or UTF-8	Optional

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Table 1 (*continued*)

N[a]	Name of the data element	Status	Display format	Lock
17	Title	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV, or ISO/IEC 8859-1, or UTF-8	Optional
18	Product identifier local	Optional	Variable length Alphanumeric Char set = ISO/IEC 646 IRV	Optional
19	Media format (other)	Optional	Single octet (coded list)	Optional
20	Supply chain stage	Optional	Single octet (coded list)	Optional
21	Supplier invoice number	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
22	Alternative item identifier	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
23	Alternative owner institution	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
24	Subsidiary of an owner institution	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Optional
25	Alternative ILL borrowing institution	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV	Not locked
26	Local data C	Optional	Variable length alphanumeric Character set = ISO/IEC 646 IRV, or ISO/IEC 8859-1, or UTF-8	Optional
27	Not defined	Reserved for future use	—	—
28	Not defined	Reserved for future use	—	—
29	Not defined	Reserved for future use	—	—
30	Not defined	Reserved for future use	—	—
31	Not defined	Reserved for future use	—	—

[a] This column specifies the data element number (*N*) or the Relative-OID value, i.e. the number identifying the data element, as defined in ISO 28560-1.

[b] The ISIL, as used for Relative-OID values 3 and 11, is presented and displayed according to the characters defined in ISO 15511. A special encoding scheme, as defined in 6.4, is used to compact efficiently the complex ISIL character string.

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6.2 Primary item identifier

The primary item identifier is a mandatory data element defined in ISO 28560-1.

This is the only mandatory data element that is required to be encoded to be compliant with this part of ISO 28560. The format is variable length, and the alphanumeric characters can be any from ISO/IEC 646 International Reference Version (also known as US-ASCII). Although the encoding rules will support any length of primary item identifier, shorter codes and all-numeric codes will encode more efficiently, requiring

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