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Information technology — Data protocol for radio frequency identification (RFID) for item management —

Part 1:
Application interface

Technologies de l'information — Protocole de données relatif à l'identification par radiofréquence (RFID) pour la gestion d'objets —

Partie 1: Interface d'application

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 15961-1:2013), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clauses from ISO/IEC 15962 which had been reproduced in this document have been removed and replaced by references to these clauses.

— The requirement for backwards compatibility with the 2004 version of this document (ISO/IEC 15961:2004) has been clarified.

— The document was edited for clarity and conformity with ISO/IEC Directives Part 2 drafting rules.

A list of all parts in the ISO/IEC 15961 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The technology of radio frequency identification (RFID) is based on non-contact electronic communication across an air interface. The structure of the bits stored on the memory of the tag is invisible and accessible between the tag and the interrogator only using an air interface protocol, as specified in the appropriate part of ISO/IEC 18000. The result of the transfer of data between an application and an interrogator in open systems requires data to be encoded in a consistent manner on any tag that is part of that open system. This is not only to allow equipment to be interoperable, but in the special case of data carriers, for the data to be encoded on the tag in one system's implementation and to be read at a later time in a completely different and unknown system's implementation. The data bits stored on each tag must be formatted in such a way as to be reliably read at the point of use if the tag is to fulfil its basic objective. This reliability is achieved through the specification of a Data Protocol in this document and the data encoding rules of ISO/IEC 15962. Additionally, ISO/IEC 24791-1 specifies a software system infrastructure architecture that enables RFID system operations between business applications and RFID interrogators. Specific parts of the infrastructure standards address data management requirements (ISO/IEC 24791-2) and device interface requirements (ISO/IEC 24791-5). These support defined implementations that incorporate the encoding rules of ISO/IEC 15962 and the functional rules of the commands and responses in this document.

Manufacturers of RFID equipment (e.g. interrogators, tags) and users of RFID technology require standards-based Data Protocols for RFID for item management. This document, ISO/IEC 15962, and the ISO/IEC 24791 series, specify these protocols, which are layered above the air interface standards defined in ISO/IEC 18000.

The transfer of data to and from an application, supported by appropriate application commands, is the subject of this document. This document is intended to be used as a reference to develop software appropriate for RFID applications and equipment. ISO/IEC 15962, which is intended to be used with this document, specifies the overall process and the methodologies developed to format the application data into a structure to store on the tag.

NOTE ISO/IEC 15961:2004 is a withdrawn standard, replaced by ISO/IEC 15961-1, ISO/IEC 15961-2, ISO/IEC 15961-3 and ISO/IEC 15961-4. ISO/IEC 15961:2004 is referenced to point out the differences with this document because some systems still use the withdrawn version. All information pertaining to the use of the withdrawn ISO/IEC 15961:2004 is contained in this document. The intention is to remove reference to the withdrawn standard in the next version of this document.

Information technology — Data protocol for radio frequency identification (RFID) for item management —

Part 1: Application interface

1 Scope

This document focuses on the abstract interface between an application and the data processor and includes the specification and definition of application commands and responses. It allows data and commands to be specified in a standardised way, independent of the ISO/IEC 18000 series air interfaces.

This document:

— provides guidelines on presenting data as objects;

— defines the structure of Object Identifiers, based on ISO/IEC 9834-1;

— specifies the commands that are supported for transferring data between an application and the radio frequency identification (RFID) tag;

— specifies the responses that are supported for transferring data between the tag and the application;

— does not specify any required transfer syntax with ISO/IEC 15962, but provides the non-normative information in Annex A for backward compatibility with the 2004 version of this document (ISO/IEC 15961:2004[1]).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 15961-3, *Information technology — Data protocol for radio frequency identification (RFID) for item management — Part 3: RFID data constructs*

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

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

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

1) Withdrawn standard. Replaced by ISO/IEC 15961-1, ISO/IEC 15961-2, ISO/IEC 15961-3 and ISO/IEC 15961-4.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
application
software component that issues commands and receives responses to the commands within a system

3.1.2
data processor
implementation of the processes defined in ISO/IEC 15962, including the data compactor, formatter, logical memory, and command/response unit

Note 1 to entry: This was called "data protocol processor" in ISO/IEC 15961:2004[2)].

3.2 Abbreviated terms and designations

URN uniform resource name

Since "TDS", "Type C" and "Type D" are commonly used in the industry to refer to the technology components as specified by these standards, the following designations are used in this document:

Type C ISO/IEC 18000-63

Type D ISO/IEC 18000-64

TDS GS1 EPC Tag Data Standard

4 Conformance

4.1 General

The commands and responses in this document are expressed in an abstract syntax; transfer encoding, as specified by ISO/IEC 15961 (the superseded 2004 version of this document) is no longer required. As such, conformance to this document is specifically indicated by the resultant proper encoding of tags according to ISO/IEC 15962.

The arguments and fields contained in individual commands and responses identify what needs to be considered for correct input to the Data Processor to achieve a valid encoding. Also, they identify what an application expects to have returned following access to a tag. Because of the way the Data Protocol is structured, the commands and responses specified in this document are, to a large extent, independent of particular tag types that are only known to the Data Processor through the Tag Driver. The result is that ISO/IEC 15962 can specify conformance requirements for valid encoding, which this document cannot.

This clause provides conformance best practice advice to achieve an integrated data communication channel between the application and the tag.

4.2 Application conformance

An application is expected to support the commands and responses that are meaningful to the application. For every command considered relevant for an application, all the constituent components shall be considered in transfers between the application and the Data Processor.

2) Withdrawn standard. Replaced by ISO/IEC 15961-1, ISO/IEC 15961-2, ISO/IEC 15961-3 and ISO/IEC 15961-4.

In particular, application standards shall take into consideration the various arguments in the command as defined in Clause 7 (e.g. Object-Lock, Compact-Parameter). These determine the requirements of what is encoded on the tag, and the necessary processes that the Data Processor shall invoke to achieve a valid encoding.

4.3 Conformance of the Data Processor

The Data Processor is, effectively, the implementation of ISO/IEC 15962. Depending on the scope of the Data Processor (ranging from being specific to an industry, to being generic to the entire RFID Data Protocol) various arguments included in the commands can be processed in different manners (e.g. data can be identified with a full Object-Identifier or a Relative-OID). This document imposes no constraints on the design of the Data Processor, other than a requirement to support all the functionality specified by the arguments in the commands that are necessary to achieve proper encoding.

5 Protocol model

The ISO/IEC 15962 protocol model applies for this document.

6 Presentation conventions

6.1 Commands, responses, and arguments

6.1.1 General

Commands and responses are defined within a box format, such as is shown in Figure 1.

Each command or response contains an ordered list of fields or arguments. When necessary, the field/argument name is followed by the data type and a brief description. Fields with values that are restricted to a subset of the range of their data types have their possible and legal values shown in *italics* below the field name.

NOTE None of this applies to the original commands and responses when presented in the ASN.1 abstract syntax as in ISO/IEC 15961:2004.

Figure 1 — Box format for commands, responses and complex arguments

6.1.2 Data types

The following data types are used in the commands and responses:

— BOOLEAN: An argument that can have the values TRUE or FALSE.

— BIT STRING: A sequence of bits.

— BYTE: An integer with the possible values 0 to 255, usually expressed as a hexadecimal value 00_{16} to FF_{16}.

— BYTE STRING: A sequence of bytes. (Equivalent to OCTET STRING).

— EBV-8: A binary method to encode variable size numbers in the same field by using a leading indicator bit preceding a 7-bit value. The final EBV-8 component begins with a 0, all preceding components begin with a 1. For example, 69_{10} = **0**1000101, whereas 369_{10} = 101110001_2 whose EBV-8 representation is **1**0000010 **0**1110001 (i.e. separated into 7-bit stings and then the indicator added as a prefix. The only requirement for using an EBV-8 code in a command is where this type of value is returned in an air interface response.

— HEXADECIMAL ADDRESS: A location (on the memory of a tag), expressed as a hexadecimal value.

— INTEGER: An integer can take any whole number. In the context of this document, the values are all positive.

— OBJECT IDENTIFIER: An Object Identifier as defined in 6.2.1.

6.2 Object Identifier presentation in the application interface

6.2.1 Object identifier structure to ISO/IEC 8824-1

This document uses the OBJECT IDENTIFIER type as defined in ISO/IEC 8824-1 with identifiers assigned as specified in ISO/IEC 9834-1. This uses a registration tree with a common implied root node (ISO/IEC 9834-1), a series of arcs from each node, with new arcs added as required to define a particular Object (see Figure 2). Thus, the body responsible for a particular node:

— has a defined set of arcs to identify itself;

— can manage the allocation of arcs under its node, independently of other bodies;

— is assured of uniqueness from all other arcs in the registration tree.

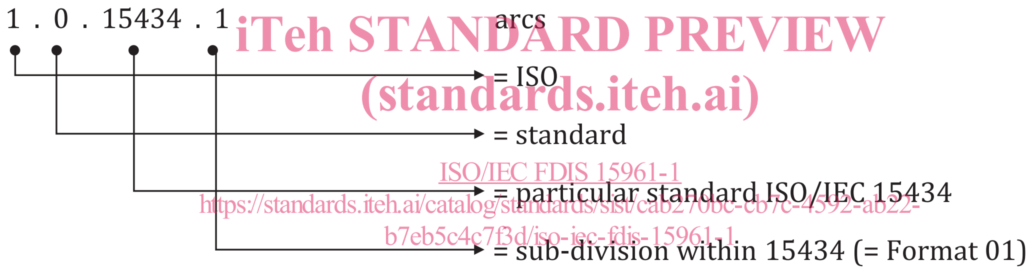

Figure 2 — Example object identifier arcs

The only top arcs permitted for all Object Identifiers are shown in Table 1.

Table 1 — Object Identifier top arcs

Identifier arc name	Numerical value
itu-t	0
iso	1
joint-iso-itu-t	2

NOTE 1 Any ISO/IEC standard, e.g. this document, has Object Identifiers under the ISO top arc.

The second arc is administered by the relevant organisation named for the top arc. The current list of top and second arcs is given in ISO/IEC 15961-3.

The third arc is controlled by the system or body defined for the second arc; sometimes this is a registration authority. The hierarchical structure continues until the Object is identified uniquely. The procedure of naming Object Identifiers ensures that each Object is unique within its "parent" arc and that each parent arc is unique within its previous level, right back to the top three arcs.

NOTE 2 This structure enables Object Identifiers from different domains (e.g. open and closed systems) to be encoded unambiguously on a tag memory.

Three forms of Object Identifier are used with the RFID Data Protocol:

— Object-Identifier: This full structure is used for communications between the application and the Data Processor defined by the scope of this document.

— Root-OID: The Root-OID is the common part of a set of encoded Object Identifiers. It acts as a common prefix to the Relative-OID values encoded on the tag. This structure is particularly important in applications that require a variety of data from a common data dictionary to be encoded on a tag. The Root-OID is either explicitly encoded or declared according to the encoding rules of ISO/IEC 15962.

— Relative-OID: This structure is used in conjunction with the Root-OID (see below) for communication between the application and the Data Processor defined by this document. These structures are applied in situations where a common root applies to the set of Object Identifiers to be encoded on the tag. For example, if all the Object Identifiers have the common root 1 0 15961 12 encoding spaces can be saved on the tag if this common Root-OID does not have to be encoded for each Object Identifier. The Relative-OID is a suffix to a common RootOID, which is either encoded or declared in some other way.

NOTE 3 Except in the command and response abstract forms (see Clause 10) and places where the distinction is vital, the term Object-Identifier applies also to the Relative-OID.

6.2.2 Presenting the Object-Identifier in accordance with ISO/IEC 8824-1

When the Object-Identifier is presented in accordance with ISO/IEC 8824-1, spaces are inserted between each arc as follows:

1 0 15961 12 1

NOTE The more formal representation of this in ASN.1 is: {iso(1) standard(0) rfid-data-protocol(15961) iata(12) baggage-id (1)}.

6.2.3 Presenting the Object-Identifier as a Uniform Resource Name (URN)

The Object-Identifier may also be presented in the URN in the following format, based on IETF RFC 3061, with the decimal point character between each arc:

urn:oid:1.0.15961.12.1

6.3 Byte notation

6.3.1 Byte — Basic unit for 8-bit coding

This document supports binary, 6-bit, 7-bit, 8-bit, and user data that can exceed 8-bits per character. The common unit of coding is the 8-bit byte (also known as the octet).

Binary data shall be padded with leading zero bits until the binary value is octet aligned; 7-bit data shall be represented as bytes with bit 8 (see 6.3.2) set to a zero value. Data exceeding 8-bits shall be encoded in multiple bytes.

An 8-bit byte is represented by two hexadecimal values, using the characters 0-9, and A-F.

6.3.2 Bit ordering

Within each byte, the most significant bit is bit 8 and the least significant is bit 1. Accordingly, the weight allocated to each bit is as shown in Table 2.

