INTERNATIONAL STANDARD

ISO/IEC 15961-3

First edition
2019-02

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

Part 3: RFID data constructs

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

Partie 3: Constructions de données RFID

Reference number
ISO/IEC 15961-3:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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 http://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.

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

This first edition of ISO/IEC 15961-3, together with ISO/IEC 15961-1, ISO/IEC 15961-2 and ISO/IEC 15961-4, cancels and replaces ISO/IEC 15961:2004, which has been technically revised.

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

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 RFID tag is invisible and accessible between the RFID tag and the interrogator only by the use of the appropriate air interface protocol, as specified in the appropriate part of ISO/IEC 18000. The transfer of data between the application and the interrogator in open systems requires data to be presented in a consistent manner on any RFID tag that is part of that open system. Application commands from the application and responses from the interrogator also require being processed in a standard way. This is not only to allow equipment to be interoperable, but in the special case of the data carrier, for the data to be encoded on the RFID tag in one system implementation for it to be read at a later time in a completely different and unknown system implementation. The data bits stored on each RFID tag must be formatted in such a way as to be reliably read at the point of use if the RFID tag is to fulfil its basic objective.

Manufacturers of RFID equipment (interrogators, RFID tags, etc.) and the users of RFID technology require a standard-based data protocol for RFID for item management. ISO/IEC 15961 and ISO/IEC 15962 specify this data protocol, which is independent of any of the air interface standards defined in ISO/IEC 18000. As such, the data protocol is a consistent component in the RFID system that may independently evolve to include additional air interface protocols. The International Standards that comprise the data protocol are as follows:

— ISO/IEC 15961-1 , which defines the transfer of data to and from the application, supported by appropriate application commands and responses;

— ISO/IEC 15961-2 , which defines the registration procedure of RFID data constructs to ensure that the data protocol supports new applications, in a relatively straightforward manner, as they adopt RFID technology. This can be achieved by the Registration Authority publishing regular updates of RFID data constructs that have been assigned, and as a means of incorporating these updates into the processes of ISO/IEC 15961-1;

— this document (ISO/IEC 15961-3), which defines the data constructs and the rules that govern their use;

— ISO/IEC 15961-4, which defines the transfer of data associated with sensors and batteries to and from the application, supported by appropriate application commands and responses;

— ISO/IEC 15962, which specifies the overall process and the methodologies developed to format the application data into a structure to store on the RFID tag.

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

Part 3: RFID data constructs

1 Scope

This document 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.

NOTE Conventionally in International Standards, long numbers are separated by a space character as a "thousands separator". This convention has not been followed in this document because the arcs of an Object Identifier are defined by a space separator (according to ISO/IEC 8824 and ISO/IEC 8825). As the correct representation of these arcs is vital to this document, all numeric values have no space separators except to denote a node between two arcs of an Object Identifier. For additional clarity, Object Identifiers are presented in **bold** text.

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 9834-1, *Information technology — Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree — Part 1*

ISO/IEC 15961-2[1)], *Information technology — Radio frequency identification (RFID) for item management: Data protocol — Part 2: Registration of RFID data constructs*

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

3 Terms, definitions and abbreviated terms

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

1) Under preparation. Stage at the time of publication: ISO/IEC/FDIS 15961-2:2018.

3.1 Terms and definitions

3.1.1
Application Family Identifier
mechanism used in the data protocol and the air interface protocol 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

3.1.2
arc
specific branch of a hierarchical Object Identifier tree

Note 1 to entry: The top three arcs of Object Identifiers relevant to RFID, compliant with ISO/IEC 9834-1, are defined in Annex A.

3.1.3
data format
mechanism used in the data protocol to identify how Object Identifiers are encoded on the RFID tag, and (where possible) identify a particular data dictionary for the set of relevant Object Identifiers for a specific application

3.1.4
Object
well-defined piece of information, definition or specification which requires a name in order to identify its use in an instance of communication

3.1.5
Object Identifier
value (distinguishable from all other such values) which is associated with an Object

3.1.6
Relative-OID
Object Identifier comprising the remaining arc or arcs positioned after a common Root-OID (for the first and subsequent arcs)

Note 1 to entry: The common Root-OID is often implied by other data constructs and not encoded in the RFID tag.

3.1.7
Root-OID
particular Object Identifier that constitutes the first, second and subsequent common arcs of a set of Object Identifiers (hence the common root)

Note 1 to entry: The Root-OID followed immediately by the Relative-OID equates to the complete Object Identifier.

3.1.8
Unique Item Identifier
mechanism that uniquely identifies a specific entity (e.g. a product, transport unit, returnable asset) during its life within a particular domain and scope of a code system

Note 1 to entry: When used with this data protocol, the particular Object Identifier that defines the Unique Item Identifier relies on the fact that each instance of its Object is required to be unique and unambiguous with respect to all other related Objects.

3.2 Abbreviated terms

AFI Application Family Identifier

DSFID Data Storage Format Identifier

OID Object Identifier

RA Registration Authority

UII Unique Item Identifier

4 Conformance

4.1 Conformance of encoders

In addition to the conformance requirements for encoders as defined in ISO/IEC 15962, an encoder claiming conformance to this document shall access the data constructs register and provide the necessary additional encoding rules are defined by the particular data construct(s). These include:

— the recognition of a valid AFI;

— the recognition of a valid data format, including the capability to construct the DSFID, or extended DSFID if appropriate;

— the recognition of the common Root-OID for data to be encoded so that only the Relative-OID is encoded;

— the use of relevant tables for encoding as defined by the data format and registration of the data constructs, including Packed Objects, Tag Data Profiles and encoding that is declared in the data constructs register;

— the recognition of AFIs associated with Monomorphic-UIIs that require explicitly defined encoding rules.

Declarations of conformance shall be based on one of the following:

— for all registrations up to a particular publication date of the data constructs register;

— for one or more specific registrations, in which case the declaration shall refer to the specific registration(s).

4.2 Conformance of decoders

In addition to the conformance requirements for decoders as defined in ISO/IEC 15962, a decoder claiming conformance to this document shall access the data constructs register and provide the necessary additional encoding rules are defined by the particular data construct(s). These include:

— the recognition of a valid AFI;

— the recognition of a valid data format, including the capability to de-construct the DSFID, or extended DSFID if appropriate;

— the recognition of the common Root-OID for data to be pre-pended to the Relative-OID that is encoded;

— the use of relevant tables for decoding as defined by the data format and registration of the data constructs, including Packed Objects, Tag Data Profiles and encoding that is declared in the data constructs register;

— the recognition of AFIs associated with Monomorphic-UIIs that require explicitly defined decoding rules.

Declarations of conformance shall be based on one of the following:

— for all registrations up to a particular publication date of the data constructs register;

— for one or more specific registrations, in which case the declaration shall refer to the specific registration(s).

5 Application Family Identifier (AFI)

5.1 General

The Application Family Identifier (AFI) is a data protocol mechanism that enables selective addressing of RFID tags to achieve an efficient use of radio communications. The AFI is generally supported by a mechanism at the air interface, enabling the use of the AFI in application commands defined in ISO/IEC 15961-1 to be converted into air interface commands. Such commands maintain communication with RFID tags with the selected AFI and generally ignore RFID tags with different encoded AFIs.

The value of the AFI for RFID for item management can be stored on the RFID tag in some form, or can be determined by the air interface services if these are sufficiently specific. It is a single byte value, although provisions are made below for an extension mechanism in case the set of single byte AFIs becomes fully utilised.

5.2 AFI values

The AFI is encoded as a byte value, with possible extensions to multiple bytes to meet future application needs. The commands and responses of ISO/IEC 15961-1 require the AFI to be represented as decimal values, whereas the processes of ISO/IEC 15962 and the air interface protocols (ISO/IEC 18000) require the AFI to be represented as hexadecimal values. Both forms are used in Table 1.

For compatibility with other RFID protocols and standards, the AFIs assigned in accordance with ISO/IEC 15961-2 are restricted to:

— AFIs 0 to 15 (00_{16} to $0F_{16}$);

— AFIs 144 to 206 (90_{16} to CE_{16}).

5.3 AFI assignment

AFIs in the range 144 to 206 (90_{16} to CE_{16}) shall be assigned in accordance with ISO/IEC 15961-2. The RA is also responsible for assigning AFIs in the range 1 to 15 (01_{16} to $0F_{16}$) for closed system applications. Details of assigned AFIs, together with the other data constructs associated with particular application standards, are available on the data constructs register published by the RA. A copy of the register of RFID data constructs can be obtained from the dedicated website of the RA for ISO/IEC 15961-2 at: https://www.iso.org/iso/maintenance_agencies.htm.

5.4 Monomorphic-UIIs and AFI

There is a class of UII that is declared directly by the AFI without reference to a data format. A UII that is declared in this manner is defined as a Monomorphic-UII, and needs to be properly registered in accordance with ISO/IEC 15961-2. A Monomorphic-UII shall either be the only encoded data in a dedicated UII memory bank, or be the only data element encoded on an RFID tag with a single encoding memory.

The encoding process uses the rules that are defined for a specific AFI on the data constructs register to carry out the encoding, resulting in the absence of a DSFID and other syntactical components. The decoding process, on recognising the specific AFI, interprets the bytes on the tag without the need for a DSFID in the first byte.

