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

*Technologies de l'information — Identification par radiofréquence
(RFID) pour la gestion d'objets — Protocole de données: règles
d'encodage des données et fonctions logiques de mémoire*





COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

Contents

Page

Foreword.....	ix
Introduction.....	x
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions and abbreviated terms.....	1
3.1 Terms and definitions.....	1
3.2 Abbreviated terms.....	2
4 Conformance.....	2
4.1 Conformance with the air interface.....	2
4.2 Conformance with the application interface.....	2
4.2.1 Encoders and the application interface.....	2
4.2.2 Decoders and the application interface.....	3
4.2.3 Comprehensive encoder/decoder devices and the application interface.....	3
4.3 Conformance with the Access-Method.....	3
4.3.1 Encoders and the Access-Method.....	3
4.3.2 Decoders and the Access-Method.....	3
4.3.3 Comprehensive encoder/decoder devices and the Access-Method.....	3
5 Protocol model.....	3
5.1 Overview.....	3
5.2 Layered protocol.....	4
5.2.1 Layers.....	4
5.2.2 Application layer as defined in the ISO/IEC 15961 series.....	4
5.2.3 Application interface as defined in ISO/IEC 15961-1.....	5
5.2.4 Data Protocol processing.....	5
5.2.5 Data Protocol interface.....	5
5.3 Flexible implementation configurations.....	6
5.4 Functional processes — Interrogator implementation.....	6
5.4.1 Logical functions and interfaces.....	6
5.4.2 Functional processes — Application interface.....	7
5.4.3 Functional processes — Interrogator.....	7
5.4.4 RFID tag.....	8
5.5 ISO/IEC 15962 and the Data Processor.....	9
6 Data and presentation conventions.....	9
6.1 Data types in ISO/IEC 15961-1 commands and responses.....	9
6.2 Extensible bit vector (EBV).....	9
6.3 Object Identifier presentation in the application interface.....	10
6.3.1 Object identifier structure to ISO/IEC 8824-1.....	10
6.3.2 Presenting the Object-Identifier in accordance with ISO/IEC 8824-1.....	11
6.3.3 Presenting the Object-Identifier as a Uniform Resource Name (URN).....	11
6.4 The Object.....	11
6.5 8-bit byte.....	11
6.6 N-bit encoding.....	11
7 Data Processor — High level processing.....	11
8 Data Processor and the application interface.....	12
8.1 Application commands — Overview.....	12
8.2 Application commands and responses — Write.....	14
8.2.1 Configure-AFI.....	14
8.2.2 Configure-DSFID.....	15
8.2.3 Write-Objects.....	15
8.2.4 Write-Objects-Segmented-Memory-Tag.....	19
8.2.5 Write-EPC-UII.....	22

8.2.6	Write-Password-Segmented-Memory-Tag.....	23
8.2.7	Write-Segments-6TypeD-Tag.....	24
8.2.8	Write-Monomorphic-UII.....	27
8.2.9	Configure-Extended-DSFID.....	30
8.2.10	Configure-Multiple-Records-Header.....	31
8.3	Application commands and responses — Read.....	33
8.3.1	Read-Object-Identifiers.....	33
8.3.2	Read-Logical-Memory-Map.....	34
8.3.3	Read-Objects.....	35
8.3.4	Inventory-ISO-UIImemory.....	36
8.3.5	Inventory-EPC-UIImemory.....	37
8.3.6	Read-Words-Segmented-Memory-Tag.....	38
8.3.7	Read-Segments-6TypeD-Tag.....	39
8.3.8	Read-Multiple-Records.....	40
8.4	Application commands and responses — Other.....	44
8.4.1	Inventory-Tags.....	44
8.4.2	Delete-Object.....	44
8.4.3	Modify-Object.....	46
8.4.4	Erase-Memory.....	48
8.4.5	Get-App-based-System-Info.....	49
8.4.6	Kill-Segmented-Memory-Tag.....	49
8.4.7	Delete-Packed-Object.....	50
8.4.8	Modify-Packed-Object-Structure.....	51
8.4.9	Delete-Multiple-Record.....	52
8.5	Air interface support for application commands.....	53
9	Data Processor and the air interface.....	53
9.1	Use.....	53
9.2	Air interface services.....	53
9.3	Defining the system information.....	54
9.3.1	System information elements.....	54
9.3.2	Singulation-Id.....	54
9.3.3	Physical block size.....	55
9.3.4	Number of blocks.....	55
9.3.5	AFI.....	55
9.3.6	DSFID.....	55
9.3.7	Encoding the Extended-Data-Format.....	56
9.3.8	Other extensions using the Extended Syntax indicator bit.....	56
9.3.9	Extended Syntax flag byte 1.....	56
9.3.10	Memory length indicator bits.....	56
9.3.11	Procedure for length encoding.....	58
9.3.12	Data CRC indicators.....	58
9.3.13	Data CRC.....	58
9.3.14	Extended Syntax flag byte 2.....	58
9.3.15	Simple Sensor indicator.....	59
9.3.16	Battery Assist indicator.....	59
9.3.17	Full-Function Sensor indicator.....	59
9.3.18	DSFID and Extended Syntax.....	59
9.4	Configuring the Logical Memory.....	63
10	Command/Response Unit — Processing of command and response arguments.....	63
10.1	Function.....	63
10.2	Process arguments.....	64
10.2.1	Access-Password.....	64
10.2.2	Additional-App-bits.....	64
10.2.3	AFI.....	64
10.2.4	AFI-Lock.....	64
10.2.5	Append-To-Existing-Multiple-Record.....	65
10.2.6	Application-Defined-Record-Capacity.....	65

10.2.7	Avoid-Duplicate	65
10.2.8	Check-Duplicate	65
10.2.9	Compact-Parameter	66
10.2.10		
	Data-Length-Of-Record	66
10.2.11		
	DSFID	67
10.2.12		
	DSFID-Lock	67
10.2.13		
	Directory-Length-EBV8-Indicator	67
10.2.14		
	Encoded-Memory-Capacity	67
10.2.15		
	EPC-Code	67
10.2.16		
	Hierarchical-Identifier-Arc	67
10.2.17		
	Identifier-Of-My-Parent	68
10.2.18		
	Identify-Method and Number-Of-Tags	68
10.2.19		
	Instance-Of-Arc	68
10.2.20		
	Item-Related-DSFID	69
10.2.21		
	Item-Related-Segment-Map	69
10.2.22		
	Kill-Password	69
10.2.23		
	Length-Of-Mask	69
10.2.24		
	Lock-Directory-Entry	69
10.2.25		
	Lock-Multiple-Records-Header	69
10.2.26		
	Lock-Record-Preamble	69
10.2.27		
	Lock-UII-Segment-Arguments	70
10.2.28		
	Max-App-Length	70
10.2.29		
	Memory-Bank	70
10.2.30		
	Memory-Bank-Lock	70
10.2.31		
	Memory-Segment	70
10.2.32		
	Memory-Type	70
10.2.33		
	Multiple-Records-Directory-Length	70
10.2.34		
	Multiple-Records-Features-Indicator	71
10.2.35		
	NSI-bits	71
10.2.36		
	Number-In-Data-Element-List	71

10.2.37	Number-Of-Records	71
10.2.38	Object-Lock	71
10.2.39	Packed-Object-Directory-Type	71
10.2.40	Password	72
10.2.41	Password-Type	72
10.2.42	Pointer	72
10.2.43	Pointer-To-Multiple-Records-Directory	72
10.2.44	Read-Record-Type	73
10.2.45	Read-Type	73
10.2.46	Record-Memory-Capacity	73
10.2.47	Record-Type-Arc	74
10.2.48	Record-Type-Classification	74
10.2.49	Sector-Identifier	74
10.2.50	Segment-Read-Type	74
10.2.51	Simple-Sensor-Data-Block	75
10.2.52	Start-Address-Of-Record	75
10.2.53	Tag-Data-Profile-ID-Table	75
10.2.54	Tag-Mask	75
10.2.55	TID-Segment-Map	75
10.2.56	UII-DSFID	75
10.2.57	UII-Segment-Map	75
10.2.58	Update-Multiple-Records-Directory	75
10.2.59	Word-Count	76
10.2.60	Word-Pointer	76
10.3	Completion-Codes	76
10.4	Execution-Codes	79
11	Access-Method	80
11.1	Methods	80
11.2	No-Directory structure	81
11.2.1	Structure	81
11.2.2	Restrictions to air interfaces	82
11.2.3	The dataset	82
11.2.4	Encoding rules	82
11.3	Directory structure	83

11.3.1	Structure	83
11.3.2	Restrictions to air interfaces	83
11.3.3	Directory structure for Data-Format = "3 ...287"	84
11.3.4	Directory structure for Data-Format = 2	84
11.3.5	Encoding the address of the dataset	84
11.3.6	Encoding example	84
11.4	Packed-Objects structure	84
11.5	Tag Data Profile	85
11.5.1	Use	85
11.5.2	Restrictions to air interfaces	86
11.5.3	Defining the Tag-Data-Profile	86
11.5.4	Encoding Rules	86
11.6	Multiple-Records	86
11.6.1	Structure	86
11.6.2	Categories of multiple records	87
11.6.3	Object-Identifier structure	89
11.6.4	Sector identifier	91
11.6.5	Restrictions to air interfaces	91
11.6.6	Encoding rules	91
12	ISO/IEC 15434 direct encoding and transmission method using Access-Method 0 and Data-Format 3	91
12.1	Use	91
12.2	General rules for ISO/IEC 15434 direct encoding	92
12.3	Specific support for ISO 17364, ISO 17365, ISO 17366 and ISO 17367	92
13	Monomorphic-UII encoding	92
13.1	Use	92
13.2	6-bit encoding	93
13.3	7-bit encoding	93
13.4	URN Code 40 encoding	94
13.5	8859-1 octet encoding	94
13.6	Application-defined 8-bit coding	94
	Annex A (informative) Air interface support for application commands	95
	Annex B (normative) Pro forma description for the Tag Driver	101
	Annex C (normative) ISO/IEC 18000 Series Tag Driver Descriptions	103
	Annex D (normative) Encoding rules for No-Directory Access-Method	115
	Annex E (normative) Basic data compaction schemes	128
	Annex F (normative) ISO/IEC 646 characters supported by the compaction schemes	133
	Annex G (informative) Encoding example for No-Directory structure	137
	Annex H (informative) Encoding example for a directory structure	140
	Annex I (normative) Packed-Objects structure	143
	Annex J (normative) Packed Objects ID tables	165
	Annex K (normative) Packed Objects Encoding tables	175
	Annex L (informative) Encoding example for Packed Objects	180
	Annex M (informative) Decoding Packed Objects	184
	Annex N (normative) Tag Data Profile encoding	188
	Annex O (normative) Tag Data Profile ID tables	193
	Annex P (informative) Encoding example for Tag Data Profile	197
	Annex Q (normative) Basic encoding rules for Multiple-Records Access-Method	201
	Annex R (normative) Multiple-Records encoding rules for hierarchical records	218

This is a preview - [click here to buy the full publication](#)

Annex S (informative) Encoding example for the Multiple-Records Access-Method	225
Annex T (normative) ISO/IEC 15434 direct encoding and transmission	237
Annex U (informative) ISO/IEC 15434 direct DI encoding and transmission for ISO 17364, ISO 17365, ISO 17366 and ISO 17367	243
Annex V (normative) URN Code 40 encoding	248
Bibliography	251

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 third edition cancels and replaces the second edition (ISO/IEC 15962:2013), which has been technically revised.

The main changes are as follows:

- editorial changes were made;
- references have been updated.

A list of all parts in the ISO/IEC 15962 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 and www.iec.ch/national-committees.

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 an air interface protocol, as specified in the appropriate part of the ISO/IEC 18000 series. 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 RFID 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 RFID tag in one system's implementation for it to be read at a later time in a completely different and unknown system's 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. This reliability is achieved through the specification of a Data Protocol using the application-defined arguments defined in ISO/IEC 15961-1 and the data encoding rules of this document. 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 ISO/IEC 24791 series 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 this document and the functional rules of the commands and responses in ISO/IEC 15961-1.

Manufacturers of RFID equipment (e.g. interrogators, RFID tags) and the users of RFID technology require a standards-based Data Protocol for RFID for item management. ISO/IEC 15961-1, ISO/IEC 15961-2, ISO/IEC 15961-3, this document and the ISO/IEC 24791 series specify this protocol, which is layered above the air interface standards defined in the ISO/IEC 18000 series.

The Data Protocol used to exchange information in an RFID system for item management is specified in ISO/IEC 15961-1 and in this document. Both documents are required for a complete understanding of the Data Protocol in its entirety, but each focuses on one particular interface:

- ISO/IEC 15961-1 addresses the interface with the application system.
- This document deals with the processing of data and its presentation to the RF tag, and the initial processing of data captured from the RF tag.

The transfer of data to and from an application, supported by appropriate application commands, is the subject of ISO/IEC 15961-1. This document specifies the overall process and the methodologies developed to format the application data into a structure to store on the RFID tag.

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

1 Scope

This document focuses on encoding the transfer syntax of the application commands defined in ISO/IEC 15961-1. The encodation is in a Logical Memory as a software analogue of the physical memory of the RFID tag being addressed by the interrogator.

This document

- 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;
- specifies processes associated with sensory information and the transfers to the Tag Driver;
- defines other communication to the application.

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

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