

Second edition  
2009-10-01

---

---

## Information technology — Radio frequency identification for item management —

### Part 2: Parameters for air interface communications below 135 kHz

*Technologies de l'information — Identification par radiofréquence  
(RFID) pour la gestion d'objets —*

*Partie 2: Paramètres de communications d'une interface d'air à moins  
de 135 kHz*

---

---

Reference number  
ISO/IEC 18000-2:2009(E)



This is a preview of "ISO/IEC 18000-2:2009". [Click here to purchase the full version from the ANSI store.](#)

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.



**COPYRIGHT PROTECTED DOCUMENT**

© ISO/IEC 2009

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

This is a preview of "ISO/IEC 18000-2:2009". Click here to purchase the full version from the ANSI store.

## Contents

Page

Foreword .....	vi
Introduction.....	vii
1 Scope .....	1
2 Conformance .....	1
2.1 RF emissions general population.....	2
2.2 RF emissions and susceptibility health care setting.....	2
3 Normative references.....	2
4 Terms and definitions .....	2
5 Symbols and abbreviated terms .....	4
5.1 Symbols.....	4
5.2 Abbreviated terms .....	5
6 Physical layer.....	6
6.1 Type A (FDX).....	6
6.1.1 Power transfer .....	6
6.1.2 Frequency.....	6
6.1.3 Communication signal interface interrogator to tag .....	6
6.1.4 Communication signal interface tag to interrogator .....	9
6.1.5 General Protocol Timing Specifications .....	10
6.2 Type B (HDX).....	12
6.2.1 Power transfer .....	12
6.2.2 Communication signal interface interrogator to tag .....	12
6.2.3 Communication Signal Interface tag to interrogator .....	15
6.2.4 General protocol Timing Specification .....	17
6.3 Physical and Media Access Control (MAC) Parameters .....	19
6.3.1 Interrogator to tag link .....	19
6.3.2 Tag to interrogator link .....	21
6.3.3 Protocol parameters.....	24
6.3.4 Anti-collision parameters .....	25
7 Transmission Protocol.....	26
7.1 Basic elements .....	26
7.2 IC Identifier and Unique Item Identifier (UII) .....	26
7.3 Request format .....	27
7.4 Response format .....	27
7.5 Request flags .....	28
7.5.1 AFI flag.....	29
7.5.2 NOS flag.....	29
7.5.3 SEL flag and ADR flag.....	29
7.5.4 CRCT flag .....	30
7.5.5 PEXT flag.....	30
7.6 Error flag.....	30
7.7 Error handling .....	31
7.8 Block security status .....	32
7.9 Start of frame pattern (SOF) .....	32
7.9.1 Interrogator request .....	32
7.9.2 Tag response .....	32
7.10 End of frame pattern (EOF).....	32
7.10.1 Interrogator request .....	32
7.10.2 Tag response .....	32

This is a preview of "ISO/IEC 18000-2:2009". [Click here to purchase the full version from the ANSI store.](#)

7.11	CRC .....	32
7.12	Application family identifier (AFI) .....	33
7.13	Data storage format identifier (DSFID) .....	36
8	User memory organisation .....	36
8.1	User memory organisation (Page 0) .....	36
8.2	Extended User memory organisation (Page ≥ 1) .....	36
9	Tag states .....	37
9.1	RF-Off State .....	37
9.2	Ready State .....	37
9.3	Quiet State .....	37
9.4	Selected state .....	38
9.5	State diagram .....	38
10	Anti-collision .....	39
10.1	Request parameters .....	39
10.2	Request processing by the tag .....	39
10.3	Explanation of anti-collision sequences .....	42
10.3.1	Anti-collision sequence with 1 slot .....	42
10.3.2	Anti-collision sequence with 16 slots .....	42
10.3.3	Mixed population with tags of type A and B .....	44
11	Commands .....	44
11.1	Command classification .....	44
11.1.1	General .....	44
11.1.2	Mandatory commands .....	45
11.1.3	Optional commands .....	45
11.1.4	Custom commands .....	45
11.1.5	Proprietary commands .....	45
11.2	Command code structure .....	45
11.3	Command list .....	46
11.4	Mandatory commands .....	47
11.4.1	INVENTORY .....	47
11.4.2	READ U11 .....	47
11.4.3	READ MULTIPLE BLOCKS .....	48
11.4.4	STAY QUIET .....	48
11.4.5	WRITE SINGLE BLOCK .....	49
11.4.6	LOCK BLOCK .....	49
11.5	Optional commands .....	50
11.5.1	READ SINGLE BLOCK .....	50
11.5.2	READ SINGLE BLOCK WITH SECURITY STATUS .....	50
11.5.3	READ MULTIPLE BLOCKS WITH SECURITY STATUS .....	51
11.5.4	WRITE MULTIPLE BLOCKS .....	51
11.5.5	GET SYSTEM INFORMATION .....	52
11.5.6	SELECT .....	53
11.5.7	RESET TO READY .....	54
11.5.8	WRITE SYSTEM DATA .....	54
11.5.9	LOCK SYSTEM DATA .....	55
11.5.10	READ EXTENDED MULTIPLE BLOCKS .....	56
11.5.11	WRITE EXTENDED MULTIPLE BLOCK .....	56
11.5.12	LOCK EXTENDED BLOCK .....	57
11.5.13	Optional command execution in Inventory mode .....	58
11.6	Custom commands .....	59
11.7	Proprietary commands .....	59
Annex A	(informative) CRC Check for Error Detection .....	60
A.1	Description .....	60
A.2	CRC check source code example .....	61
Annex B	(informative) Description of a typical anti-collision sequence with tags of types A and B .....	62
Annex C	(informative) Optional anti-collision mechanism .....	63

This is a preview of "ISO/IEC 18000-2:2009". [Click here to purchase the full version from the ANSI store.](#)

<b>C.1</b>	<b>Introduction.....</b>	<b>63</b>
<b>C.2</b>	<b>Description.....</b>	<b>63</b>
<b>C.3</b>	<b>Physical layer for the Multi-read command.....</b>	<b>63</b>
<b>C.3.1</b>	<b>Power transfer.....</b>	<b>64</b>
<b>C.3.2</b>	<b>Frequency.....</b>	<b>64</b>
<b>C.3.3</b>	<b>Interrogator to tag.....</b>	<b>64</b>
<b>C.3.4</b>	<b>Tag to interrogator.....</b>	<b>64</b>
<b>C.3.5</b>	<b>Parameters for optional Multi-read command.....</b>	<b>65</b>
<b>C.4</b>	<b>Multi-read command.....</b>	<b>68</b>
<b>C.4.1</b>	<b>Multi-read request format.....</b>	<b>68</b>
<b>C.4.2</b>	<b>Request flags.....</b>	<b>69</b>
<b>C.5</b>	<b>Anti-collision mechanism.....</b>	<b>70</b>
<b>C.5.1</b>	<b>Acknowledgement by the interrogator.....</b>	<b>70</b>
<b>C.5.2</b>	<b>Acknowledgement by the tag.....</b>	<b>70</b>
<b>C.5.3</b>	<b>Timing.....</b>	<b>70</b>
<b>C.5.4</b>	<b>Explanation of an anti-collision sequence.....</b>	<b>71</b>
<b>C.6</b>	<b>Protocol and anti-collision Parameters.....</b>	<b>76</b>
<b>C.6.1</b>	<b>Protocol Parameters.....</b>	<b>76</b>
<b>C.6.2</b>	<b>Anti-collision Protocol.....</b>	<b>78</b>
	<b>Bibliography.....</b>	<b>79</b>

## 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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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

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

ISO/IEC 18000-2 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 18000-2:2004), which has been technically revised.

ISO/IEC 18000 consists of the following parts, under the general title *Information technology — Radio frequency identification for item management*:

- *Part 1: Reference architecture and definition of parameters to be standardized*
- *Part 2: Parameters for air interface communications below 135 kHz*
- *Part 3: Parameters for air interface communications at 13,56 MHz*
- *Part 4: Parameters for air interface communications at 2,45 GHz*
- *Part 6: Parameters for air interface communications at 860 MHz to 960 MHz*
- *Part 7: Parameters for active air interface communications at 433 MHz*

This is a preview of "ISO/IEC 18000-2:2009". Click here to purchase the full version from the ANSI store.

## Introduction

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holders of these patent rights have assured ISO and IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and IEC. Information may be obtained from the following companies.

Patent number	Patent title	Patent holder	Contact	Affected sub clause
		ATMEL Germany GmbH	Leo Merken, Director of Intellectual Property 2325 Orchard Parkway, San Jose, CA, 95131 USA Phone 408-436-4251 Fax 408-487-2615 Email leo.merken@atmel.com	
		NXP B.V.	Harald Roeggla, Intellectual Property & Licensing Gutheil-Schoder-Gasse 8-12 1102 Vienna, Austria Phone 43-1-60-970-1469 Fax 43-1-60-870-1101 harald.roeggla@nxp.com	
US 6 177 858 Application 96 402556.3-Patent EP 0 777 194 CA 2 191 787 CA 2 191 788 US 5 923 251 Application 96 402554.8 Patent EP 0 777 192 US 5 808 550 Appication 96 402555.5- Patent EP 0 777 193		Winstead Assets Ltd	Craig Cook, director 12, rue des Petits Ruisseaux, 91370 Verrières le Buisson, France Phone +33(0) 169 752 170 Fax +33(0) 160 110 031 contact@spacecode-rfid.com	

This is a preview of "ISO/IEC 18000-2:2009". Click here to purchase the full version from the ANSI store.

<p>CA 2 191 794 Application 90 909459.1-Patent EP 0 476 026  US 5426423  CA 2058 947</p>				
<p>EP 0640939,US 5430447,DE P69428309  EP831618, US5929801 (claims 1-15 and corresponding claims of other patents based on this patent)  US 5793324  US 5053774 excluding claims 14-17 and 20 (and corresponding claims of other patents based on this patent)</p>	<p>Protection Against Manipulation of Batteryless Read/Write Transponders  Method for Repeating Interrogations Until Failing to Receive Unintelligible Responses to Identify Plurality of Transponders by an Interrogator  Transponder Signal Collision Avoidance System  Transponder Arrangement</p>	<p>Texas Instruments Inc</p>	<p>Robby Holland Licensing Manager, Law Department P.o. Box 660199, MS 3999 Dallas, TX 75266-0199 Phone 1-972-917-4367 Fax 1-972-917-4418 Email r-holland3@ti.com</p>	

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