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

**Part 3:
Parameters for air interface
communications at 13,56 MHz**

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

*Partie 3: Paramètres de communications d'une interface d'air
à 13,56 MHz*

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 2008

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
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword.....	v
Introduction.....	vi
1 Scope	1
2 Conformance.....	1
2.1 Claiming conformance	1
3 Normative references	1
4 Terms and definitions.....	2
5 Symbols and abbreviated terms	2
6 Requirements: Physical layer, collision management system and protocol values for 13,56 MHz systems	2
6.0 General and applicable to both Modes of this part of ISO/IEC 18000	2
6.0.1 Presentation as determined in ISO/IEC 18000-1	2
6.0.2 ISO/IEC 18000-3 Interoperability	2
6.0.3 ISO/IEC 18000-3 reader conformance/compliance	3
6.0.4 ISO/IEC 18000-3 tag compliance	3
6.0.5 Command structure and extensibility	3
6.0.6 Mandatory commands.....	3
6.0.7 Optional commands	3
6.0.8 Custom commands.....	3
6.0.9 Proprietary commands.....	3
6.1 Physical layer, collision management system and protocols for MODE 1 of this part of ISO/IEC 18000	4
6.1.1 Read/Write system.....	4
6.1.2 Normative Aspects	4
6.1.3 Conformance and performance measurement aspects	4
6.1.4 Physical Layer.....	4
6.1.5 Protocol and collision management operating method	4
6.1.6 Commands	4
6.1.7 Parameter tables for interrogator to tag link	4
6.1.8 Parameter tables for tag to interrogator link	4
6.2 MODE 2: Physical layer, collision management system and protocols for MODE 2 of this part of ISO/IEC 18000.....	4
6.2.1 Normative aspects: physical and media access control (MAC) parameters: interrogator to tag link	5
6.2.2 Tag to interrogator link.....	7
6.2.3 Description of operating method	10
6.2.4 Protocol parameters	16
6.2.5 Description of protocol operating method.....	16
6.2.6 Collision management parameters	33
6.2.7 Description of collision management parameters operating method (informative).....	33
6.2.8 Tag order sequencing	41
6.2.9 Commands	41
6.2.10 Air interface application layer	41
6.2.11 Optional Functionality	41
7 Marking of equipment.....	44
8 Table of characteristic differences between the MODES specified in this part of ISO/IEC 18000	44

Annex A (normative) Phase jitter modulation (PJM)	45
Annex B (informative) Known possible interferences between the MODES determined in this part of ISO/IEC 18000	49
Annex C (informative) Interrogator pseudo-code for collision management (Mode 1)	50
Annex D (informative) Cyclic Redundancy Check (CRC) (16 bit)	51
D.1 The CRC error detection method.....	51
C.2 CRC calculation example	51
Annex E (informative) Cyclic redundancy check (CRC) mode 2 (32 bit)	53
E.1 The CRC 32 error detection method	53
E.2 CRC 32 calculation example	53
E.3 Practical example of CRC 32 calculation.....	55
Annex F (informative) Mode 1 IC reference	56
Annex G (informative) A description of Mode 1 based on the ISO/IEC 15693 protocol as used for Item Management	57
G.1 Parameter tables for interrogator to tag link.....	57
G.2 Parameter tables for tag to interrogator link.....	62
G.3 Description of operating method.....	66
G.3.1 Communications signal interface interrogator to tag	66
G.3.2 Modulation	66
G.3.3 Data rate and data coding	67
G.3.4 Interrogator to tag frames	70
G.3.5 Communications signal interface tag to interrogator	71
G.4 Protocol parameters	75
G.4.1 Table of protocol parameters.....	75
G.5 Description of protocol operating method	80
G.5.1 Definition of data elements	80
G.5.2 Data storage format identifier (DSFID).....	82
G.5.3 CRC.....	82
G.5.4 Overall protocol description	83
G.5.5 Modes	84
G.5.6 Response format	86
G.5.7 RF tag states.....	88
G.6 Collision management.....	90
G.7 Description of collision management operating method (Informative)	95
G.7.1 Request parameters.....	95
G.7.2 Request processing by the RF tag.....	96
G.7.3 Explanation of a collision management sequence.....	98
G.7.4 Timing specifications	100
G.8 Commands.....	102
G.8.1 Command types	102
G.8.2 Command codes	103
G.8.3 Mandatory commands	104
G.8.4 Optional commands.....	105
G.8.5 Custom commands.....	120
G.8.6 Proprietary commands	121
Bibliography	122

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 18000-3 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 18000-3:2004), 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*

Introduction

ISO/IEC 18000 has been developed by ISO/IEC JTC 1, SC 31, WG 4, *Radio frequency identification for item management*, in order to provide a framework to define common communications protocols for Internationally useable frequencies for Radio Frequency Identification (RFID), and, where possible, to determine the use of the same protocols for ALL frequencies such that the problems of migrating from one to another are diminished; to minimise software and implementation costs; and to enable system management and control and information exchange to be common as far as is possible.

This part of ISO/IEC 18000 has been prepared in accordance with the requirements determined in ISO/IEC 18000-1.

ISO/IEC 18000-1 provides explanation of the concepts behind this part of ISO/IEC 18000.

This part of ISO/IEC 18000 has 2 MODES of operation, intended to address different applications. Clause 8 of this part of ISO/IEC 18000 summarises the differences between MODE characteristics. The detailed technical differences between the modes are shown in the parameter tables.

This part of ISO/IEC 18000 relates solely to systems operating at 13,56 MHz.

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.

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

The holders of these patent rights have assured the 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 the ISO and IEC. Information may be obtained from the following companies.

Contact details	Patent number
NXP BV	EP 0669591B
Harald Roeggla	AT-PS 401127
Intellectual Property & Licensing	EP 1038257B
Gutheil-Schoder-Gasse 8-12	CN 1143237
1102 Vienna Austria	INPCT/00/00344
(t) +43 1 60 870 1469	JP 00-561579
(f) +43 1 60 870 1101	US 6559754
Herald.roeggla.mxp.com	WO 00/05673
	EP 0998792B
	JP 00-551498
	US 6563882
	WO 99/62196

Contact details	Patent number
Texas Instruments Inc. Robby Holland, Licensing Manager P.O. Box 655464, MS 3999 Dallas TX 75256 (T) +1 972 917 4367 (F) +1 972 917 4418 r-holland3@ti.com	EP1 038257 US 09/315708 JP 00-560700 EP 1 034644 US 6442215 CN 1273730A WO00/04686 EP 0669591B AT-PS 401127
Zebra Technologies Corporation Eric McAlpine, IP Counsel Legal Department 333 Corporate Woods Parkway Vernon Hills, IL 60061-3109 (T) +1 847 793 5640 (F) +1 847 955 4514 emcalpine@zebra.com	US 6784787 EP 1031046 EP 1291671 EP 05017862.3 US 5680459 US 5557280 US 5699066 EP 0585132 US 6198381 JP 10-272945 US 5537105 US 5966083 US 5995017

Contact details	Patent number
Magellan Technology Pty. Limited	US5302954
Mr. Ken Laing	SG37971
65 Johnston St	DE3854478D
Annandale, NSW 2038, Australia	EP0390822
(T) +61 2 9562 9800	US5485154
(F) +61 2 9518 7620	US10/927,957
kenl@magellan-technology.com	US6967573
	JP2002500465T
	JP2006-180816
	DE69835452
	EP1048126
	AU2006202886
	AU785098
	US7248145
	US7259654
	US11/538,271
	US11/538/242
	JP2003 526148
	JP2006 344227
	DE60119910
	EP1266458
	EP07013773
	EP1544782
	EP1544788
	EP1679635

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. The latest IP submissions to ISO can be found at:

<http://www.iso.org/patents>

Information technology — Radio frequency identification for item management —

Part 3: Parameters for air interface communications at 13,56 MHz

1 Scope

This part of ISO/IEC 18000 provides physical layer, collision management system and protocol values for RFID systems for Item Identification operating at 13,56 MHz in accordance with the requirements of ISO/IEC 18000-1.

This part of ISO/IEC 18000 provides definitions for systems for each MODE determined in Clause 6 below.

This part of ISO/IEC 18000 defines two non-interfering MODES.

- The MODES are NOT interoperable.
- The MODES, whilst not interoperable, are non-interfering.

2 Conformance

2.1 Claiming conformance

In order to claim conformance with this part of ISO/IEC 18000, it is necessary to comply with all of the relevant clauses of this part of ISO/IEC 18000 except those marked 'optional'. It is also necessary to operate within the local national radio regulations (which may require further restrictions).

Relevant conformance test methods are defined in ISO/IEC TR 18047-3.

3 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 7816-6, *Identification cards — Integrated circuit cards — Part 6: Interindustry data elements for interchange*

ISO/IEC 15693 (all parts), *Identification cards — Contactless integrated circuit cards — Vicinity cards*

ISO/IEC 15961, *Information technology — Radio frequency identification (RFID) for item management — Data protocol: 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 15963, *Information technology — Radio frequency identification for item management — Unique identification for RF tags*

ISO/IEC 18000-1, *Information technology — Radio frequency identification for item management — Reference architecture and definition of parameters to be standardized*

ISO/IEC TR 18046, *Information technology — Automatic identification and data capture techniques — Radio frequency identification device performance test methods*

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

4 Terms and definitions

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

4.1

Phase Jitter Modulation

PJM

modulation technique that transmits data as very small phase changes in the powering field

5 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 18000-1, ISO/IEC 19762 and the following apply.

≈ MODE 1 - the value is a rounded value (e.g. $\approx 75,52 \mu\text{s}$)

6 Requirements: Physical layer, collision management system and protocol values for 13,56 MHz systems

6.0 General and applicable to both Modes of this part of ISO/IEC 18000

6.0.1 Presentation as determined in ISO/IEC 18000-1

The context, form and presentation of this part, which provides physical layer, collision management system and protocol value definitions for RFID systems for item identification operating at 13,56 MHz are in accordance with the requirements of ISO/IEC 18000-1.

6.0.2 ISO/IEC 18000-3 Interoperability

This part of ISO/IEC 18000 specifies two MODES of operation at 13,56 MHz

These MODES are not interoperable, but they are expected to operate without causing any significant interference with each other. Any known causes of interference are listed in Annex B.

NOTE It is recommended that users select one MODE for any specific application.

NOTE Local national regulations may further limit either power, frequency or bandwidth allocations and such limitations may reduce the capability of a system within that country. Users shall have the responsibility to ensure that they use only systems that comply with these regulations. This implies a user responsibility to obtain proofs from manufacturers, and where appropriate have adequate tests carried out to assure that systems are in compliance.

Informative Comment: At the time of preparation of this part of ISO/IEC 18000, the interrogator to tag link and tag to interrogator link physical layer emissions may be subject to type approval or certification. It is therefore necessary to make