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

**Part 63:
Parameters for air interface
communications at 860 MHz to 960
MHz Type C**

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

*Partie 63: Paramètres de communications d'une interface radio entre
860 MHz et 960 MHz, Type C*



This document is a preview generated by EUS



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2021

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.....	v
Introduction.....	vi
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
4 Symbols, abbreviated terms and notation.....	5
4.1 Symbols.....	5
4.2 Abbreviated terms.....	7
4.3 Notation.....	8
5 Conformance.....	9
5.1 Claiming conformance.....	9
5.2 General conformance requirements.....	9
5.2.1 Interrogators.....	9
5.2.2 Tags.....	10
5.3 Command structure and extensibility.....	10
5.3.1 General.....	10
5.3.2 Mandatory commands.....	10
5.3.3 Optional commands.....	10
5.3.4 Proprietary commands.....	10
5.3.5 Custom commands.....	10
5.4 Reserved for Future Use (RFU).....	11
5.5 Cryptographic Suite Indicators.....	11
6 Protocol requirements.....	11
6.1 Protocol overview.....	11
6.1.1 Physical layer.....	11
6.1.2 Tag-identification layer.....	11
6.2 Protocol parameters.....	12
6.2.1 Signaling — Physical and media access control parameters.....	12
6.2.2 Logical — Operating procedure parameters.....	15
6.3 Description of operating procedure.....	15
6.3.1 Physical interface.....	16
6.3.2 Logical interface.....	37
7 Battery Assisted Passive (BAP) Interrogator Talks First systems (optional).....	112
7.1 Applicability.....	112
7.2 General overview, definitions, and requirements of BAP.....	113
7.3 BAP inventoried flag and state machine behaviour modifications.....	114
7.3.1 Modification to ready state and power-down support for BAP Tags.....	114
7.3.2 Signal loss tolerance via timer (mandatory).....	115
7.3.3 Modified persistence of BAP PIE inventory flags (optional).....	117
7.4 BAP PIE (optional).....	119
7.4.1 Flex_Query command (optional).....	119
7.4.2 BAP PIE detailed operation including optional Battery Saver Mode.....	121
7.5 Manchester mode Battery Assisted operation protocol extensions.....	126
7.5.1 General.....	126
7.5.2 Physical layer.....	127
7.5.3 Manchester activation.....	133
7.5.4 Commands summary.....	148
8 Sensor support (optional).....	163
8.1 Applicability.....	163
8.2 Overview.....	163
8.3 Real Time Clock (RTC).....	164

8.3.1	General	164
8.3.2	Setting the RTC	164
8.3.3	BroadcastSync command (optional)	165
8.3.4	Time synchronisation	165
8.4	HandleSensor command (optional)	166
8.5	Simple Sensors	167
8.5.1	Simple Sensor implementation	167
8.6	Full Function Sensors and Sensor Directory System	169
8.6.1	General	169
8.6.2	Sensor Access — General approach	170
8.7	Snapshot Sensors	176
8.7.1	General	176
8.7.2	Initiating Snapshot Sensor measurements	179
8.7.3	Reporting Snapshot Sensor Information	180
Annex A (normative) Extensible bit vectors (EBV)		182
Annex B (normative) State-transition tables		183
Annex C (normative) Command-response tables		240
Annex D (informative) Example slot-count (Q) selection algorithm		267
Annex E (informative) Example Tag inventory and access		268
Annex F (informative) Calculation of 5-bit and 16-bit cyclic redundancy checks		269
Annex G (normative) Multiple- and dense-Interrogator channelized signaling		271
Annex H (informative) Interrogator-to-Tag link modulation		274
Annex I (normative) Error codes		276
Annex J (normative) Slot counter		278
Annex K (informative) Example data-flow exchange		279
Annex L (informative) Optional Tag features		282
Annex M (informative) Cryptographic-Suite checklist		285
Annex N (informative) Battery Assisted Tag to Interrogator synchronization		286
Annex O (normative) Simple Sensors Data Block		289
Annex P (normative) Record structures and commands for Ported Simple Sensors		300
Annex Q (informative) Battery Assisted Passive (BAP) PIE and Manchester mode tutorial guide		316
Annex R (informative) Manchester mode RF power control		327
Bibliography		332

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 18000-63:2015), which has been technically revised.

The main changes are as follows:

- incorporation of the Technical Corrigendum;
- incorporation of a new sensor class for snapshot sensors.

A list of all parts in the ISO/IEC 18000 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

This document defines the physical and logical requirements for a passive-backscatter, Interrogator-talks-first (ITF), radio-frequency identification (RFID) system operating in the 860 MHz to 960 MHz frequency range. The system comprises Interrogators, also known as Readers, and Tags, also known as Labels or Transponders.

An Interrogator transmits information to a Tag by modulating an RF signal in the 860 MHz to 960 MHz frequency range. The Tag receives both information and operating energy from this RF signal. Tags are passive, meaning that they receive all of their operating energy from the Interrogator's RF signal.

An Interrogator receives information from a Tag by transmitting a continuous-wave (CW) RF signal to the Tag; the Tag responds by modulating the reflection coefficient of its antenna, thereby backscattering an information signal to the Interrogator. The system is ITF, meaning that a Tag modulates its antenna reflection coefficient with an information signal only after being directed to do so by an Interrogator.

Interrogators and Tags are not required to talk simultaneously; rather, communications are half-duplex, i.e. Interrogators talk and Tags listen, or vice versa.

The described backscatter radio frequency identification (RFID) system that supports the following system capabilities:

- identification and communication with multiple tags in the field;
- selection of a subgroup of tags for identification or with which to communicate;
- reading from and writing to or rewriting data many times to individual tags;
- user-controlled permanently lockable memory;
- data integrity protection;
- Interrogator-to-tag communications link with error detection;
- tag-to-Interrogator communications link with error detection;
- support for both passive back-scatter tags with or without batteries.

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 a patent.

ISO and IEC take no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO and IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO and IEC. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Information on the declared patents may be obtained from:

Contact details
<p>Patent Holder: Legal Name Atmel Automotive GmbH</p> <p>Contact for license application: Name & Department Leo Merken, Legal Department, ATMEL Corporation Address 2325 Orchard Parkway Address San Jose, CA 95131 USA Tel. +1 408 436 4251 Fax +1 408 487 2615 E-mail leo.merken@atmel.com URL (optional)</p>
<p>Patent Holder: Legal Name CISC Semiconductor Design+Consulting GmbH</p> <p>Contact for license application: Name & Department Markus Pistauer, CEO Address Lakeside B07 Address 9020 Klagenfurt, Austria Tel. +43(463) 508 808 Fax +43(463) 508 808-18 E-mail m.pistauer@cisc.at URL (optional) www.cisc.at</p>
<p>Patent holder: ETRI (Electronics Telecommunication Research Institute)</p> <p>Contact for license application: Name & Department: Min-Sheo Choi, Intellectual Property Management Team Address: 138 Gajeongno, Yuseong-gu Address: Daejeon, 305-700, Korea Tel. +82-42-860-0756 Fax +82-42-860-3831 E-mail choims@etri.re.kr URL (optional) www.etri.re.kr</p>
<p>Patent Holder: Legal Name Impinj, Inc.</p> <p>Contact for license application: Name & Department Chris Diorio, CTO Address 701 N. 34th Street, Suite 300 Address Seattle, WA 98103, USA Tel. +1 206 834 1115 Fax +1 206 517.5262 E-mail diorio@impinj.com URL (optional) www.impinj.com</p>

Contact details
<p>Patent Holder: Legal Name: Magellan Technology Pty. Limited</p> <p>Contact for license application: Name & Department: Ms Jean Angus Address: 65 Johnston St Address: Annandale, NSW 2038, Australia Tel. +61 2 9562 9800 Fax +61 2 9518 7620 E-mail: license@magellan-technology.com URL (optional):</p>
<p>Patent Holder: Legal Name NXP B.V.</p> <p>Contact for license application: Name & Department Aaron Waxler – IP Licensing & Claims Address 411 East Plumeria, Address San Jose, CA 95134-1924, USA Tel. +1 914 860-4296 Fax E-mail Aaron.Waxler@nxp.com URL (optional)</p>
<p>Patent Holder: Legal Name SATO VICINITY Pty. Limited</p> <p>Contact for license application: Name & Department Mr. Hiromasa Konishi, Managing Director Address 8 Guihen Street, Annandale, NSW 2038, Australia Address Tel. +61 295 629 800 Fax +61 295 187 620 E-mail hiromasa.konishi@sato-global.com URL (optional) www.satovicinity.com</p>
<p>Patent Holder: Legal Name TAGSYS SAS</p> <p>Contact for license application: Name & Department Mr. Alain Fanet President Address 785 Voie Antiope, TI Athélia 3 Address F-13600 La Ciotat Tel. +33 332188900 Fax +33 332188900 E-mail alain.fanet@tagsysrfid.com URL (optional) www.mojix.com</p>

Contact details	
Patent Holder:	
Legal Name	University of Pittsburgh - Of the Commonwealth of Pennsylvania
Contact for license application:	
Name & Department	Marc S. Malandro, PhD, CLP, RTIP
Address	University of Pittsburgh, 200 Gardner Steel Conference Center
Address	Thackeray & O'Hara Streets, Pittsburgh, PA 15260
Tel.	412-624-8787
Fax	412-648-2259
E-mail	mmalandro@innovation.pitt.edu
URL (optional)	
Patent Holder:	
Legal Name	Zebra Technologies Corporation
Contact for license application:	
Name & Department	Glenn Frankenberger, Sr. IP Counsel, Legal Department
Address	One Motorola Plaza
Address	Holtsville, NY 11742
Tel.	631-738-5570
Fax	631-738-4110
E-mail	glenn.frankenberger@zebra.com
URL (optional)	

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 information on IP that may be applicable to this document can be found at www.iso.org/patents

Information technology — Radio frequency identification for item management —

Part 63:

Parameters for air interface communications at 860 MHz to 960 MHz Type C

1 Scope

This document defines the air interface for radio frequency identification (RFID) devices operating in the 860 MHz to 960 MHz industrial, scientific, and medical (ISM) band used in item management applications. It provides a common technical specification for RFID devices that can be used to develop RFID application standards. This document is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace.

It defines the forward and return link parameters for technical attributes including, but not limited to, operating frequency, operating channel accuracy, occupied channel bandwidth, maximum effective isotropic radiated power (EIRP), spurious emissions, modulation, duty cycle, data coding, bit rate, bit rate accuracy, bit transmission order, and, where appropriate, operating channels, frequency hop rate, hop sequence, spreading sequence, and chip rate. It further defines the communications protocol used in the air interface.

This document specifies the physical and logical requirements for a passive-backscatter, Interrogator-Talks-First (ITF) systems. The system comprises Interrogators, also known as readers, and tags, also known as labels. An Interrogator receives information from a tag by transmitting a continuous-wave (CW) RF signal to the tag; the tag responds by modulating the reflection coefficient of its antenna, thereby backscattering an information signal to the Interrogator. The system is ITF, i.e. a tag modulates its antenna reflection coefficient with an information signal only after being directed to do so by an Interrogator.

This document specifies

- physical interactions (the signalling layer of the communication link) between Interrogators and tags;
- logical operating procedures and commands between Interrogators and Tags;
- the collision arbitration scheme used to identify a specific tag in a multiple-tag environment;
- optional security commands that allow the use of crypto suites of ISO/IEC 29167.

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 (all parts), *Information technology — Data protocol for radio frequency identification (RFID) for item management*

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

ISO/IEC 15963-1, *Information technology — Radio frequency identification for item management — Part 1: Unique identification for RF tags numbering systems*

ISO/IEC 18000-61, *Information technology — Radio frequency identification for item management — Part 61: Parameters for air interface communications at 860 MHz to 960 MHz Type A*

ISO/IEC 18000-62, *Information technology — Radio frequency identification for item management — Part 62: Parameters for air interface communications at 860 MHz to 960 MHz Type B*

ISO/IEC 18000-64, *Information technology — Radio frequency identification for item management — Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D*

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

EPC Tag Data Standard available at <https://www.gs1.org/standards/epc-rfid/tds>

3 Terms and definitions

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

ISO and IEC maintain terminology 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 air interface

complete communication link between an Interrogator and a Tag including the physical layer, collision-arbitration algorithm, command and response structure, and data-coding methodology

3.2 authenticated communication

communication in which message integrity is protected

3.3 battery assisted mode

working mode of battery assisted tags with non-empty battery

3.4 crypto superuser

key with an asserted CryptoSuperuser privilege

3.5 data element

low-level, indivisible data construct

3.6 XTID extended tag identifier

memory construct that defines a Tag's capabilities and which may include a Tag serial number

Note 1 to entry: Further specified in the EPC Tag Data Standard.

3.7 extended temperature range

temperature range between -40 °C to $+65\text{ °C}$

Note 1 to entry: See *nominal temperature range* (3.18).