International Standard

ISO/IEC 18000-6

# Information technology — Radio frequency identification for item management —

## Part 6: General parameters for air interface communications at 860 MHz to 930 MHz

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

*Partie 6: Paramètres de communications d'une interface radio entre 860 MHz et 960 MHz*

Fourth edition
2025-10

Reference number
ISO/IEC 18000-6:2025(en)

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Published in Switzerland

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# 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).

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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 fourth edition cancels and replaces the third edition (ISO/IEC 18000-6:2013), which has been technically revised.

The main changes are as follows:

— the frequency range has been changed from “860 MHz to 960 MHz” to “860 MHz to 930 MHz”;

ISO/IEC 18000-65 has been added as an optional extension for streaming 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.

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# Introduction

This document describes a passive 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.

This document provides an overview for a passive-backscatter, RFID system operating in the 860 MHz to 930 MHz frequency range. The system comprises interrogators, also known as readers, and tags, also known as labels. The general overview describes four types called Type A, Type B, Type C and Type D. Details for each type are defined in the following documents and described in detail in the following paragraphs:

— Type A: ISO/IEC 18000-61

— Type B: ISO/IEC 18000-62

— Type C: ISO/IEC 18000-63

— Type D: ISO/IEC 18000-64

This document, together with ISO/IEC 18000-61, ISO/IEC 18000-62, ISO/IEC 18000-63 and ISO/IEC 18000-64, specifies the physical and logical requirements for a passive-backscatter, RFID system operating in the 860 MHz to 930 MHz frequency range.

NOTE The titles of ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64 list an upper frequency range of 960 MHz, which is intended to be modified at their next revision.

An interrogator transmits information to a tag by modulating an RF signal in the given frequency range. The tag receives both information and operating energy from this RF signal. Passive tags are those which receive all of their operating energy from the interrogator's RF waveform. If tags maintain a battery then they may operate using some passive principles; however, they do not necessarily get all their operating energy from the interrogator's RF waveform.

An interrogator receives information from a tag by transmitting a continuous-wave (CW) RF signal to the tag; the tag responds by modifying the reflection coefficient of its antenna, thereby backscattering and modulating an information signal to the interrogator. The system is Interrogator-Talks-First (ITF) for Types A, B and C, meaning that a tag modulates its antenna reflection coefficient with an information signal only after being directed to do so by an interrogator, or TOTAL, meaning that a tag modifies its antenna reflection coefficient with an information signal upon entering an interrogator's field after first listening for interrogator modulation in order to determine if the system is ITF or not. Interrogators and tags are not required to talk simultaneously; rather, communications are half-duplex, meaning that interrogators talk and tags listen, or vice versa.

This document further contains an optional “tag only talks after listening” Type D, an enhanced Tag Talks Only (TTO) technique. Type D uses Pulse-Position Encoding (PPE) or Miller encoding in the return link and does not define a dedicated forward link. In fact, tags may implement one of the types defined in this document (A, B, or C) besides Type D in order to allow enhanced tag access techniques.

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Types A, B and C are ITF. Type A uses Pulse-Interval Encoding (PIE) in the forward link and an adaptive ALOHA collision-arbitration algorithm. Type B uses Manchester in the forward link and an adaptive binary-tree collision-arbitration algorithm. Type C uses PIE in the forward link and a random slotted collision-arbitration algorithm.

Type D is TOTAL based on Pulse Position Encoding or Miller $M = 2$ encoded subcarrier.

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# Information technology — Radio frequency identification for item management —

# Part 6: General parameters for air interface communications at 860 MHz to 930 MHz

## 1 Scope

This document specifies the air interface for radio frequency identification (RFID) devices operating in the 860 MHz to 930 MHz Industrial, Scientific, and Medical (ISM) band used in item management applications. This document is intended to allow for compatibility and to encourage inter-operability of products for the growing RFID market in the international marketplace.

This document 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) or tag-only-talks-after-listening (TOTAL) RFID system.

This document, together with ISO/IEC 18000-61, ISO/IEC 18000-62, ISO/IEC 18000-63 and ISO/IEC 18000-64 specifies the following for the 860 MHz to 930 MHz range:

— physical interactions (the signalling layer of the communication link) between interrogators and tags;

— interrogator and tag operating procedures and commands;

— the collision-arbitration scheme used to identify a specific tag in a multiple-tag environment.

## 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 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 18000-63, *Information technology — Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 930 MHz Type C*

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*

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

# 3 Terms, definitions, symbols and abbreviated terms

## 3.1 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/

**3.1.1**
**slotted random collision-arbitration**
collision-arbitration algorithm where tags load a random (or pseudo-random) number into a slot counter, decrement this slot counter based on Interrogator commands, and reply to the Interrogator when their slot counter reaches zero

## 3.2 Symbols

| | |
|---|---|
| *M* | number of subcarrier cycles per symbol |

## 3.3 Abbreviated terms

| | |
|---|---|
| CW | continuous wave |
| CRC | cyclic redundancy check |
| CRC-16 | sixteen bit CRC |
| CRC-5 | five bit CRC |
| DSB | double sideband |
| DSB-ASK | double-sideband amplitude-shift keying |
| FHSS | frequency hopping spread spectrum |
| FM0 | frequency modulation encoding with modulated zero |
| FST | fast slot |
| ITF | interrogator-talks-first |
| | NOTE The common usage is RTF (reader-talks-first) but the more precise term is ITF, which is used throughout this document. |
| MSB | most significant bit |
| PIE | pulse interval encoding |
| PPE | pulse position encoding |
| ppm | parts per million |
| PR-ASK | phase-reversal amplitude shift keying |

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| | |
|---|---|
| PSK | phase shift keying |
| RCS | radar cross-sectional |
| RN16 | random number 16 bit |
| SSB-ASK | single-sideband amplitude-shift keying |
| SUID | sub unique identifier |
| TID | tag-identification or tag identifier, depending on context |
| TOTAL | tag only talks after listening |
| UII | unique item identifier |

# 4 Conformance

## 4.1 Claiming conformance

To conform with this document, an interrogator or tag shall comply with all relevant clauses of this document, except those marked as “optional”.

Relevant conformance test methods are provided in ISO/IEC 18047-6 for ISO/IEC 18000-61, ISO/IEC 18000-62 and ISO/IEC 18000-64; furthermore in ISO/IEC 18047-63 for ISO/IEC 18000-63.

Conformance can also require a license from the owner of any intellectual property utilized by said device.

## 4.2 Interrogator conformance and obligations

To conform to this document, an interrogator shall:

— support at least one Type of A, B, C or D – it can optionally support two, three or all four;

— implement the mandatory commands defined in this document;

— modulate/transmit and receive/demodulate a sufficient set of the electrical signals defined in the signalling layer of this document to communicate with conformant tags.

To conform to this document, an interrogator may:

— implement any subset of the optional commands defined in this document, and

— implement any proprietary and/or custom commands in conformance with this document.

To conform to this document, the interrogator shall not:

— implement any command that conflicts with this document, or

— require the use of an optional, proprietary, or custom command to meet the requirements of this document.

## 4.3 Tag conformance and obligations

To conform to this document, a tag shall:

— support at least one Type of A, B, C or D;

— operate over the frequency range from 860 MHz to 930 MHz, inclusive;

— implement the mandatory commands defined in this document for the supported types;

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