BS ISO/IEC 18000-64:2012

BSI Standards Publication

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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National foreword

This British Standard is the UK implementation of ISO/IEC 18000-64:2012. Together with BS ISO/IEC 18000-6:2013, BS ISO/IEC 18000-61:2012, BS ISO/IEC 18000-62:2012, and BS ISO/IEC 18000-63:2012, it supersedes BS ISO/IEC 18000-6:2010, which is withdrawn.

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A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D

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Partie 64: Paramètres de communications d'une interface radio entre 860 MHz et 960 MHz, Type D

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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. 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 18000-64 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

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 General*

— *Part 61: Parameters for air interface communications at 860 MHz to 960 MHz Type A*

— *Part 62: Parameters for air interface communications at 860 MHz to 960 MHz Type B*

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

— *Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D*

— *Part 7: Parameters for active air interface communications at 433 MHz*

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Introduction

This part of ISO/IEC 18000 describes a passive backscatter radio frequency identification (RFID) system that supports the following system capabilities:

- identification and communication with multiple tags in the field;
- reading from individual tags;
- data integrity protection;
- tag-to-Interrogator communications link with error detection;
- support for both passive back-scatter tags with or without batteries.

This part of ISO/IEC 18000 specifies the physical and logical requirements for a passive-backscatter, 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.

An Interrogator transmits a continuous-wave (CW) RF signal in the 860 MHz to 960 MHz frequency range. The tag receives operating energy from this RF signal and responds by modulating the reflection coefficient of its antenna, thereby backscattering an information signal to the Interrogator. 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.

This part of ISO/IEC 18000 contains an optional Tag Only Talks After Listening (TOTAL), an enhanced Tag Talks Only (TTO) technique. A Type D tag shall announce itself when it detects CW emitted by an Interrogator, only after it has detected the absence of ITF modulation as defined in ISO/IEC 18000 part 6. Type D uses Pulse-Position Encoding (PPE) or Miller encoding in the return link and does not define a dedicated forward link. Tags may implement a forward link of one of the types defined in ISO/IEC 18000 part 6 in order to allow enhanced tag access techniques.

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 concerning radio frequency identification technology.

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.

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INTERNATIONAL STANDARD ISO/IEC 18000-64:2012(E)

Information technology — Radio frequency identification for item management —

Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D

1 Scope

This part of ISO/IEC 18000 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 by ISO committees developing RFID application standards. This part of ISO/IEC 18000 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 part of ISO/IEC 18000 specifies the physical and logical requirements for a passive-backscatter, Tag Only Talks After Listening (TOTAL) RFID system. 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 TOTAL, meaning that a tag modulates 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.

In detail, this part of ISO/IEC 18000 contains Type D.

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

This part of ISO/IEC 18000 specifies

— physical interactions (the signalling layer of the communication link) between Interrogators and tags,

— Interrogator and tag operating procedures,

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

2 Conformance

2.1 Claiming conformance

To claim conformance with this part of ISO/IEC 18000, an Interrogator or tag shall comply with all relevant clauses of this part of ISO/IEC 18000, except those marked as “optional”. The Interrogator or tag shall also operate within local radio regulations, which can further restrict operation.

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Relevant conformance test methods are provided in ISO/IEC TR 18047-6.

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

2.2 Interrogator conformance and obligations

To conform to this part of ISO/IEC 18000, an Interrogator shall

— support Type D;

— receive/demodulate a sufficient set of the electrical signals defined in the signalling layer of this part of ISO/IEC 18000 to communicate with conformant tags; and

— operate within the applicable local regulations.

To conform to this part of ISO/IEC 18000, an Interrogator may

— implement one of the types defined in ISO/IEC 18000 part 6 or proprietary commands in order to allow enhanced tag access techniques.

2.3 Tag conformance and obligations

To conform to this part of ISO/IEC 18000, a tag shall:

— support Type D;

— operate over the frequency range from 860 MHz to 960 MHz, inclusive;

— modulate a backscatter signal only after listening for the absence of ITF modulation; and

— conform to local radio regulations.

To conform to this part of ISO/IEC 18000, a tag may

— implement one of the types defined ISO/IEC 18000 part 6 or proprietary commands in order to allow enhanced tag access techniques.

To conform to this part of ISO/IEC 18000, a tag shall not:

— modulate a backscatter signal before listening for the absence of ITF modulation as defined in ISO/IEC 18000 part 6.

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 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*

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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 — Part 1: Reference architecture and definition of parameters to be standardized*

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

EPCglobal Tag Data Standards version 1.5 and above, EPCglobal Inc.

4 Terms, definitions, symbols and abbreviated terms

4.1 Terms and definitions

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

4.1.1
collision arbitration
algorithm used to prepare for and handle a dialogue between an Interrogator and a tag

4.1.2
physical layer
data coding and modulation waveforms used in Interrogator-to-tag and tag-to-Interrogator signalling

4.1.3
battery assistance
battery support for radio frequency communication

4.1.4
battery assisted mode
working mode of battery-assisted tags with non-empty battery

4.1.5
passive mode
working mode of passive tags or battery assisted tags with battery drained below a manufacturer-specific threshold

4.1.6
Simple Sensors
sensors that are factory programmed and not user configurable, producing a single output observation such as a fail/pass condition or simple measurement of a particular sensor activity

4.1.7
Simple Sensor functionality
functionality whereby sensors provide a valid Simple Sensor data address and transmit Simple Sensor data subsequent to the UII as part of the reply to the *ACK* command (Type C) or as part of the TagMsg (Type D)

4.2 Symbols

BAP	battery assisted passive
BLF	backscatter-link frequency
Cht	carrier high-level tolerance

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Clt	carrier low-level tolerance
Tcf	carrier fall time
Tcr	carrier rise time
Tfhf	carrier FHSS fall time
Tfhr	carrier FHSS rise time
Tfhs	carrier FHSS steady time
UII	unique item identifier
$xxxx_2$	binary notation
$xxxx_h$	hexadecimal notation

4.3 Abbreviated terms

AFI	application family identifier
BAP	battery assisted passive
CRC	cyclic redundancy check
CRC-16	sixteen bit CRC
CRC-5	five bit CRC
CW	continuous wave
DSFID	data storage format identifier
DSSS	direct sequence spread spectrum
EPC™	electronic product code
FCC	Federal Communications Commission
FHSS	frequency hopping spread spectrum
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 part of ISO/IEC 18000.
LSB	least significant bit
MSB	most significant bit
PPE	pulse position encoding
RFU	reserved for future use
SDT	symbol detect time
SS	Simple Sensor
SSD	simple sensor data
TID	tag-identification or tag identifier, depending on context
TOTAL	tag only talks after listening
TTF	tag talks first
TTO	tag talks only
Word	16 bits

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5 Overview

5.1 Parameter tables

Table 1, Table 2, Table 3 and Table 4 contain the parameters for Type D in accordance with ISO/IEC 18000-1. Detailed description of the operating modes and parameters are specified in the subsequent clauses.

Table 1 — Interrogator to tag link parameters

Ref.	Parameter Name	Description
Int:1	Operating Frequency Range	860 MHz – 960 MHz, as required by the local regulations
Int:1a	Default Operating Frequency	In accordance with the local radio regulations.
Int:1b	Operating Channels (spread-spectrum systems)	In accordance with the local radio regulations.
Int:1c	Operating Frequency Accuracy	In accordance with the local radio regulations.
Int:1d	Frequency Hop Rate (frequency-hopping [FHSS] systems)	In accordance with the local radio regulations.
Int:1e	Frequency Hop Sequence (frequency-hopping [FHSS] systems)	In accordance with the local radio regulations.
Int:2	Occupied Channel Bandwidth	In accordance with the local regulations
Int:2a	Minimum Receiver Bandwidth	In accordance with the local regulations
Int:3	Interrogator Transmit Maximum EIRP	In accordance with the local regulations
Int:4	Interrogator Transmit Spurious Emissions	In accordance with the local radio regulations.
Int:4a	Interrogator Transmit Spurious Emissions, In-Band (spread-spectrum systems)	Not applicable.
Int:4b	Interrogator Transmit Spurious Emissions, Out-of-Band	In accordance with the local radio regulations.
Int:5	Interrogator Transmitter Spectrum Mask	Not applicable.
Int:6	Timing	Not applicable.
Int:6a	Transmit-to-Receive Turn-Around Time	Not applicable.
Int:6b	Receive-to-Transmit Turn-Around Time	Not applicable.
Int:6c	Dwell Time or Interrogator Transmit Power-On Ramp	1500 µs, maximum settling time
Int:6d	Decay Time or Interrogator Transmit Power-Down Ramp	Not applicable.
Int:7	Modulation	Not applicable.
Int:7a	Spreading Sequence (direct-sequence [DSSS] systems)	Not applicable.
Int:7b	Chip Rate (spread-spectrum systems)	Not applicable.
Int:7c	Chip Rate Accuracy (spread-spectrum systems)	Not applicable.
Int:7d	Modulation Depth	Not applicable.

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Ref.	Parameter Name	Description
Int:7e	Duty Cycle	Not applicable.
Int:7f	FM Deviation	Not applicable.
Int:8	Data Coding	Not applicable.
Int:9	Bit Rate	Not applicable.
Int:9a	Bit Rate Accuracy	Not applicable.
Int:10	Interrogator Transmit Modulation Accuracy	Not applicable.
Int:11	Preamble	Not applicable.
Int:11a	Preamble Length	Not applicable.
Int:11b	Preamble Waveform(s)	Not applicable.
Int:11c	Bit Sync Sequence	Not applicable.
Int:11d	Frame Sync Sequence	Not applicable.
Int:12	Scrambling (spread-spectrum systems)	Not applicable.
Int:13	Bit Transmission Order	Not applicable.
Int:14	Wake-up process	Not applicable.
Int:15	Polarization	Not applicable.

Table 2 — Tag to Interrogator link parameters

Ref.	Parameter Name	Description
Tag:1	Operating Frequency Range	860 MHz – 960 MHz, inclusive
Tag:1a	Default Operating Frequency	The tag shall respond to an Interrogator signal within the frequency range specified in Tag: 1.
Tag:1b	Operating Channels (spread-spectrum systems)	The tag shall respond to an Interrogator signal within the frequency range specified in Tag: 1.
Tag:1c	Operating Frequency Accuracy	The tag shall respond to an Interrogator signal within the frequency range specified in Tag: 1.
Tag:1d	Frequency Hop Rate (frequency-hopping [FHSS] systems)	Not applicable.
Tag:1e	Frequency Hop Sequence (frequency-hopping [FHSS] systems)	Not applicable.
Tag:2	Occupied Channel Bandwidth	In accordance with the local regulations
Tag:3	Transmit Maximum EIRP	In accordance with the local regulations
Tag:4	Transmit Spurious Emissions	In accordance with the local regulations
Tag:4a	Transmit Spurious Emissions, In-Band (spread spectrum systems)	In accordance with the local regulations
Tag:4b	Transmit Spurious Emissions, Out-of-Band	In accordance with the local regulations
Tag:5	Transmit Spectrum Mask	In accordance with the local regulations
Tag:6a	Transmit-to-Receive Turn-Around Time	Not applicable.
Tag:6b	Receive-to-Transmit Turn-Around Time	Not applicable.

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Ref.	Parameter Name	Description
Tag:6c	Dwell Time or Transmit Power-On Ramp	Not applicable.
Tag:6d	Decay Time or Transmit Power-Down Ramp	Not applicable.
Tag:7	Modulation	ASK
Tag:7a	Spreading Sequence (direct sequence [DSSS] systems)	Not applicable.
Tag:7b	Chip Rate (spread spectrum systems)	Not applicable.
Tag:7c	Chip Rate Accuracy (spread spectrum systems)	Not applicable.
Tag:7d	On-Off Ratio	Not specified.
Tag:7e	Subcarrier Frequency	512 kHz
Tag:7f	Subcarrier Frequency Accuracy	+/- 20%
Tag:7g	Subcarrier Modulation	Miller, at the data rate
Tag:7h	Duty Cycle	Random hold-off as specified
Tag:7i	FM Deviation	Not applicable.
Tag:8	Data Coding	PPE or Miller (M=2)
Tag:9	Bit Rate	256 kbit/s
Tag:9a	Bit Rate Accuracy	+/- 20%
Tag:10	Tag Transmit Modulation Accuracy (frequency-hopping [FHSS] systems	Not applicable.
Tag:11	Preamble	Required
Tag:11a	Preamble Length	As specified
Tag:11b	Preamble Waveform	As specified
Tag:11c	Bit-Sync Sequence	None
Tag:11d	Frame-Sync Sequence	Not applicable.
Tag:12	Scrambling (spread-spectrum systems)	Not applicable.
Tag:13	Bit Transmission Order	MSB is transmitted first
Tag:14	Reserved	Deliberately left blank.
Tag:15	Polarization	Tag dependent; not specified by this document
Tag:16	Minimum Tag Receiver Bandwidth	Tag dependent; not specified by this document.

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