INTERNATIONAL STANDARD

ISO/IEC 18000-7

Third edition
2009-08-01

Information technology — Radio frequency identification for item management —

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

Technologies de l'information — Identification par radiofréquence pour la gestion d'objets —

Partie 7: Paramètres de communications actives d'une interface d'air à 433 MHz

Reference number
ISO/IEC 18000-7:2009(E)

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

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 18000-7 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 18000-7:2008), 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

This part of ISO/IEC 18000 is intended to address radio frequency identification (RFID) devices operating in the 433 MHz frequency band, providing an air interface implementation for wireless, non-contact information system equipment for item management applications. Typical applications operate at ranges greater than one metre.

The RFID system includes a host system and RFID equipment (interrogator and tags). The host system runs an application program, which controls interfaces with the RFID equipment. The RFID equipment is composed of two principal components: tags and interrogators. The tag is intended for attachment to an item, which a user wishes to manage. It is capable of storing a tag serial number and other data regarding the tag or item and of communicating this information to the interrogator. The interrogator is a device, which communicates to tags in its RF communication range. The interrogator controls the protocol, reads information from the tag, directs the tag to store data in some cases, and ensures message delivery and validity. This system uses an active tag.

RFID systems defined by this part of ISO/IEC 18000 provide the following minimum features:

— identify tag in range;

— read data;

— write data or handle read-only systems gracefully;

— selection by group or address;

— graceful handling of multiple tags in the field of view;

— error detection.

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 concerning radio frequency identification technology given in 6.2. 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 is willing to negotiate licenses 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 following.

Patent number	Patent title	Patent holder	Contact	Affected subclause
US 5640151	Communication system for communicating with tags	Savi Technology	Hurst Arthur, VP, General Counsel, Savi Technology, Inc., 351 East Evelyn Ave., Mountain View, CA 94041, USA	6.2.6
US 5686902	Communication system for communicating with tags	Savi Technology	Hurst Arthur, VP, General Counsel, Savi Technology, Inc., 351 East Evelyn Ave., Mountain View, CA 94041, USA	6.2.6
US 11/432684	Method and apparatus for efficient data transmission from a tag	Savi Technology	Hurst Arthur, VP, General Counsel, Savi Technology, Inc., 351 East Evelyn Ave., Mountain View, CA 94041, USA	

EP 0467036	Method and apparatus for radio identification and tracking	Savi Technology	Hurst Arthur, VP, General Counsel, Savi Technology, Inc., 351 East Evelyn Ave., Mountain View, CA 94041, USA	6.2.6
US 6002344	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
CA 2,310,623	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
CN 98812462.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
DE 98960332.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
EP 98960332.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
FR 98960332.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
GB 98960332.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
HK 01101416.3	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
IL 136.220	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
IT 98960332.9	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
JP 2000-521687	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
US 7,035,818	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
US 10/725,010	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
US 10,932,279	System and method for electronic inventory	Symbol Technologies	Aaron B. Bernstein, VP, Deputy General Counsel Intellectual Property, 1 Motorola Plaza, MS A6, Holtsville, NY 11561, USA	6.2
US 6,470,045	Communication protocol between a transceiver unit and transponders or transceiver associated with said unit	EM Microelectronic Marin SA	G. Meusburger, IP Manager, Rue des Sors, CH-2074, Marin, Switzerland	
JP 10-256493	Communication protocol between a transceiver unit and transponders or transceiver associated with said unit	EM Microelectronic Marin SA	G. Meusburger, IP Manager, Rue des Sors, CH-2074, Marin, Switzerland	

EP 0 902 546 Appl. No. 97115772.2	Communication protocol between a transceiver unit and transponders or transceiver associated with said unit	EM Microelectronic Marin SA	G. Meusburger, IP Manager, Rue des Sors, CH-2074, Marin, Switzerland	
US 6,784,787 Granted EP 1 031 046 Granted EP 1 291 671 Granted EP Appl 05 017 862.3 Pending	Identification systems	Zebra Technologies	Eric McAlpine, IP Counsel, Legal Department, 333 Corporate Woods Parkway, Vernon Hills, IL 60061-3109, USA	
US 6,480,143 Granted EP 1 001 366 Granted	Electronic identification systems	Zebra Technologies	Eric McAlpine, IP Counsel, Legal Department, 333 Corporate Woods Parkway, Vernon Hills, IL 60061-3109, USA	
US 5,680,459 Granted	Passive transponder	Zebra Technologies	Eric McAlpine, IP Counsel, Legal Department, 333 Corporate Woods Parkway, Vernon Hills, IL 60061-3109, USA	
US 6,198,381 Granted JP 10-272945 Pending	Delayed reset mode model for electronic identification system	Zebra Technologies	Eric McAlpine, IP Counsel, Legal Department, 333 Corporate Woods Parkway, Vernon Hills, IL 60061-3109, USA	
US 5,537,105 Granted US 5,966,083 Granted US 5,995,017 Granted	Electronic identification systems	Zebra Technologies	Eric McAlpine, IP Counsel, Legal Department, 333 Corporate Woods Parkway, Vernon Hills, IL 60061-3109, USA	
US 7375637 Granted	Methods and apparatus for reducing power consumption of an active transponder	University of Pittsburgh	Marc S. Malandro, Ph.D., CLP, University of Pittsburgh, 200 Gardner Steel Conference Center, Thackeray & O'Hara Streets, Pittsburgh, PA 15260, USA	
US 11/678296 Pending	Methods and apparatus for switching a transponder to an active state, and asset management systems employing same	University of Pittsburgh	Marc S. Malandro, Ph.D., CLP, University of Pittsburgh, 200 Gardner Steel Conference Center, Thackeray & O'Hara Streets, Pittsburgh, PA 15260, USA	
US 61/099977 Pending	System and method for real time asset location and tracking	University of Pittsburgh	Marc S. Malandro, Ph.D., CLP, University of Pittsburgh, 200 Gardner Steel Conference Center, Thackeray & O'Hara Streets, Pittsburgh, PA 15260, USA	
US 6563417 Granted US 6917291 Granted US 7053777 Granted	Interrogation, monitoring and data exchange using RFID Tags	Identec Solutions	Stefan Schwiers, CTO, R&D Department, Identec Solutions AG, Millennium Park 2, 6890 Lustenau, Austria	6.3.12

EP 99117640.5-2215 Granted DE 59904147.1-08 Granted GB/FR/CH/NL/AT 99117640.5-2215 Granted	System for monitoring, tracking, and handling of objects	Identec Solutions	Stefan Schwiers, CTO, R&D Department, Identec Solutions AG, Millennium Park 2, 6890 Lustenau, Austria	6.3.12
US 7345576 Granted	Method and apparatus for resolving RFID based object traffic transactions to single container in the presence of a plurality of containers	Identec Solutions	Stefan Schwiers, CTO, R&D Department, Identec Solutions AG, Millennium Park 2, 6890 Lustenau, Austria	6.3.12
		Impinj	Chris Diorio, CTO, 701 N. 34th Street, Suite 300, Seattle, WA 98103, USA	
		Intermec	Phyllis T. Turner-Brim, Esq., Legal Department, Intermec IP Corporation, 6001 36th Ave. W, Everett, WA 98203, USA	

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 or IEC shall not be held responsible for identifying any or all such patent rights.

Information technology — Radio frequency identification for item management —

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

1 Scope

This part of ISO/IEC 18000 defines the air interface for radio frequency identification (RFID) devices operating as an active RF tag in the 433 MHz band used in item management applications. It provides a common technical specification for RFID devices that can be used by ISO technical 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. This part of ISO/IEC 18000 defines the forward and return link parameters for technical attributes including, but not limited to, operating frequency, operating channel accuracy, occupied channel bandwidth, maximum power, 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. This part of ISO/IEC 18000 further defines the communications protocol used in the air interface.

2 Conformance

The rules for evaluation of RFID device conformity to this part of ISO/IEC 18000 are defined in ISO/IEC TR 18047-7.

2.1 RF emissions general population

Device manufacturers claiming conformance to this part of ISO/IEC 18000 shall declare on their own responsibility that RF emissions do not exceed the maximum permitted exposure limits recommended by either IEEE C95.1:2005 or ICNIRP according to IEC 62369-1. If a device manufacturer is unsure which recommendation is to be cited for compliance, the manufacturer shall declare on their own responsibility to ICNIRP limits.

2.2 RF emissions and susceptibility health care setting

Device manufacturers claiming conformance to this part of ISO/IEC 18000 shall declare on their own responsibility that RF emissions and susceptibility comply with IEC 60601-1-2.

2.3 Command structure and extensibility

This part of ISO/IEC 18000 includes a definition of the structure of command codes between an interrogator and a tag and indicates how many positions are available for future extensions.

Command specification clauses provide a full definition of the command and its presentation.

Each command is labelled as being “mandatory” or “optional”.

The clauses of this part of ISO/IEC 18000 make provisions for “custom” and “proprietary” commands.

2.4 Mandatory commands

A mandatory command shall be supported by all tags that claim to be compliant and all interrogators which claim compliance shall support all mandatory commands.

2.5 Optional commands

Optional commands are commands that are specified as such within this part of ISO/IEC 18000. Interrogators shall be technically capable of performing all optional commands that are specified in this part of ISO/IEC 18000 (although they need not be set up to do so). Tags may or may not support optional commands.

If an optional command is used, it shall be implemented in the manner specified in this part of ISO/IEC 18000.

2.6 Custom commands

Custom commands may be permitted by those applying this part of ISO/IEC 18000, but they are not specified in this part of ISO/IEC 18000.

A custom command shall not solely duplicate the functionality of any mandatory or optional command defined in this part of ISO/IEC 18000 by a different method. An interrogator shall use a custom command only in accordance with the specifications of the tag manufacturer.

2.7 Proprietary commands

Proprietary commands may be permitted by those applying this part of ISO/IEC 18000, but they are not specified in this part of ISO/IEC 18000.

A proprietary command shall not solely duplicate the functionality of any mandatory or optional command defined in this part of ISO/IEC 18000 by a different method. All proprietary commands shall be disabled before the tag leaves the tag manufacturer. Proprietary commands are intended for manufacturing purposes and shall not be used in field-deployed RFID systems.

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 published edition of the referenced document (including any amendments) applies.

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ISO/IEC 15459 (all parts), *Information technology — Unique identifiers*

ISO/IEC 15963, *Information technology — Radio frequency identification for item management — Unique identification for RF tags*

ISO/IEC TR 18047-7 *Information technology — Radio frequency identification device conformance test methods — Part 7: Test methods for active air interface communications at 433 MHz*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*

IEC 62369-1, *Ed. 1.0, Evaluation of human exposure to electromagnetic fields from short range devices (SRDs) in various applications over the frequency range 0 GHz to 300 GHz — Part 1: Fields produced by devices used for electronic article surveillance, radio frequency identification and similar systems*

IEC 60601-1-2, *Medical electrical equipment — Part 1-2: General requirements for basic safety and essential performance — Collateral standard: Electromagnetic compatibility — Requirements and tests*

ICNIRP Guidelines, *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz),* International Commission on Non-Ionizing Radiation Protection

IEEE C95.1:2005, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1 and ISO/IEC 19762-3 apply.

5 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 19762-1 and ISO/IEC 19762-3 apply.

6 433,92 MHz active narrowband specification

6.1 Physical layer

The RF communication link between interrogator and tag shall utilize a narrow band UHF frequency with the following nominal characteristics:

Carrier Frequency	433,92 MHz
Modulation Type	FSK
Frequency Deviation	+/- 50 kHz
Symbol LOW	fc +50 kHz
Symbol HIGH	fc -50 kHz
Data Modulation Rate	27,7 kHz
Wake up Signal	Modulation with 31,25 kHz square wave signal followed by modulation with 10 kHz square wave signal

For detailed physical layer specifications, see section 6.6.

The Wake Up Signal shall be transmitted by the interrogator for a minimum of 2,45 seconds to wake up all tags within communication range. The Wake Up Signal shall consist of a 2,35 to 4,8-second 31,25 kHz square wave modulated signal called the “Wake Up Header” immediately followed by a 0,1-second 10 kHz square wave modulated signal called the “Co-Header.” Upon detection and by completion of the Wake Up Signal all tags shall enter into the Ready state awaiting a command from the interrogator. See Figure 1. A tag has two states, awake/ready and asleep. During the ready state, the tags will accept the valid commands from readers and respond accordingly. When the tag is asleep, it will ignore all commands.

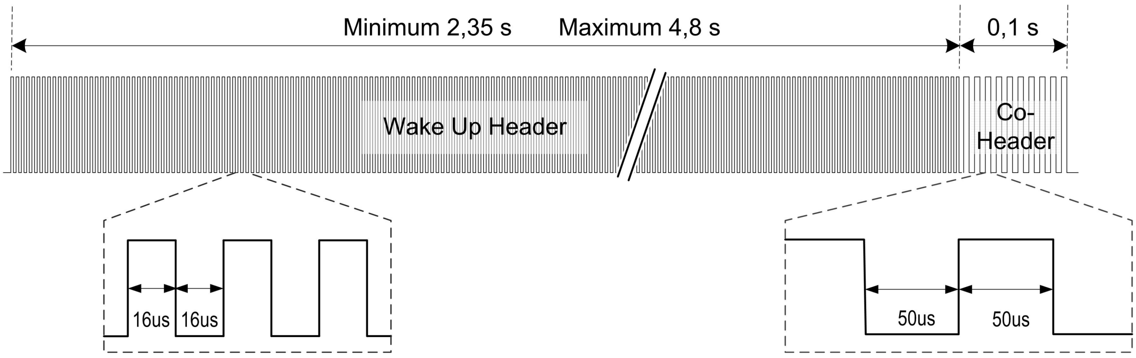


Figure 1 — Wake Up Signal

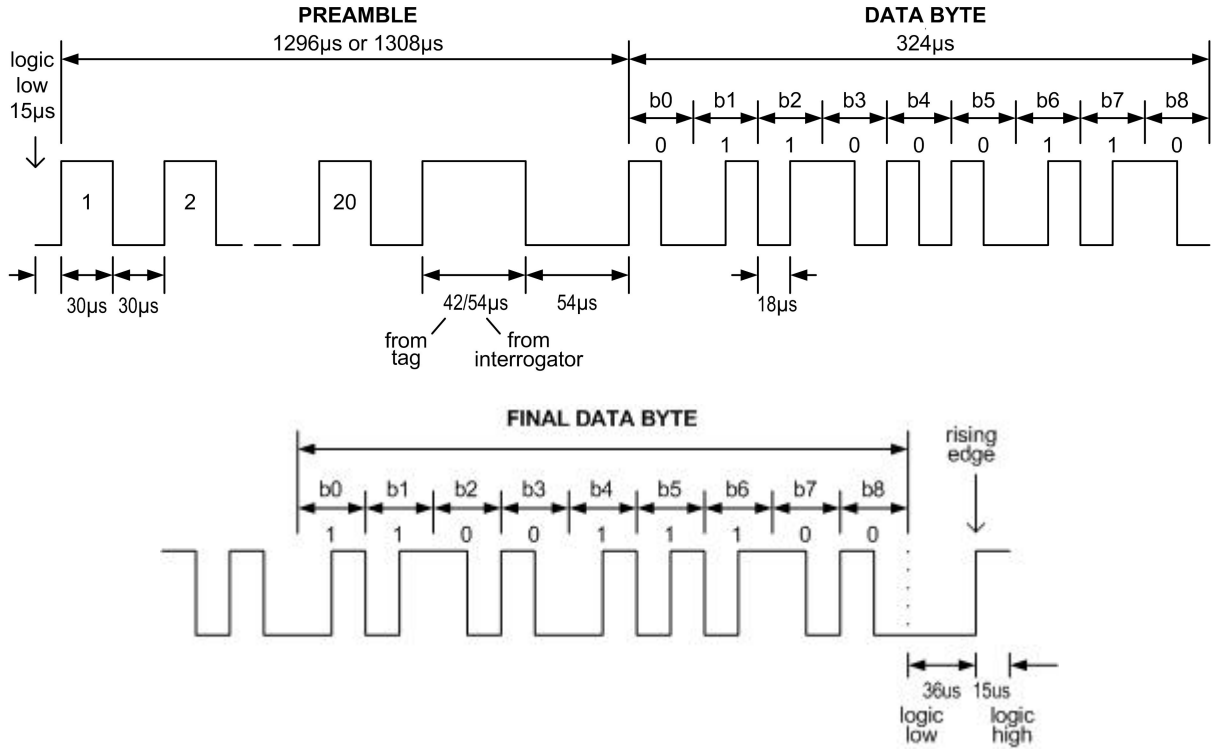
Once awoken, the tag shall stay awake for a minimum of 30 seconds after receipt of the last well-formed message packet consisting of a valid Protocol ID, command code, and CRC values, unless the interrogator otherwise commands the tag to sleep. If no well-formed command message is received within the 30 seconds, the tag will transition to the sleep state and SHALL no longer respond to command messages from Interrogators.

The communication between interrogator and tag shall be of the Master-Slave type, where the interrogator shall initiate communications and then listen for a response from a tag. Multiple response transmissions from tags shall be controlled by the collection algorithm described in 6.4.

6.2 Data Link layer

6.2.1 General

Data between interrogator and tag shall be transmitted in packet format. A packet shall be comprised of a preamble, data bytes and a final end period. The last two level changes of the preamble shall indicate the end of the preamble and beginning of the first data byte. The same two level changes of the preamble also indicate the originator of the data packet. Data bytes shall be sent in Manchester code format. Transmission order shall be most significant byte first; within a byte, the order shall be least significant bit first. Figure 2 illustrates the logic levels for the data communication timing of the preamble and the first byte of a packet.



Note: Data byte transmitted order is most significant byte first; within each byte the order is least significant bit first. A 15 µs logic low level precedes the first preamble cycle. Byte shown is code 0xC6.

Figure 2 — Data communication timing

6.2.2 Preamble

The preamble shall be comprised of twenty (20) cycles of 60 µs period, 30 µs high and 30 µs low, followed by two final level changes which identifies the communication direction: 42 µs high, 54 µs low (tag to interrogator); or 54 µs high, 54 µs low (interrogator to tag). Refer to Figure 2 above.

6.2.3 Data bytes

Data bytes shall be in Manchester code format, each byte is comprised of 8 data bits and one stop bit. The bit period shall be 36 µs, the total byte period shall be 324 µs. A falling edge in the centre of the bit-time indicates a 0 bit, a rising edge indicates a 1 bit. The stop bit is coded as a zero bit.

6.2.4 Packet end period

A final period of 36 µs of continuous logic low, followed by a logic low to logic high transition, followed by continuous logic high for a minimum of 15 µs shall be transmitted after the last Manchester encoded bit within the packet.

6.2.5 Interrogator-to-tag message format

Tags shall recognize the interrogator-to-tag message format described in Table 1 and Table 2:

Table 1 — Interrogator-to-tag command format (broadcast)

Protocol ID	Packet Options	Packet Length	Session ID	Command Code	Command Arguments	CRC
0x40	1 byte	1 byte	2 bytes	1 byte	N bytes	2 bytes

Table 2 — Interrogator-to-tag command format (point-to-point)

Protocol ID	Packet Options	Packet Length	Tag Manufacturer ID	Tag Serial Number	Session ID	Command Code	Command Arguments	CRC
0x40	1 byte	1 byte	2 bytes	4 bytes	2 Bytes	1 byte	N bytes	2 bytes

6.2.5.1 Protocol ID

The protocol ID field allows different application standards based on this part of ISO/IEC 18000 ("derived application standards") to be developed. All derived application standards shall share the same physical layer protocols, but their command/response structure/field and command sets may vary depending on the application. The three basic commands ("Collection with Universal Data Block", "Sleep" and "Sleep All But") defined in this part of ISO/IEC 18000 shall be supported by all derived application standards. All other commands required by this part of ISO/IEC 18000 shall be supported by this part of ISO/IEC 18000 compliant products, but not necessarily by products compliant with derived application standards.

When the interrogator sends out a Wake Up Signal all tags based on the air interface of this part of ISO/IEC 18000 and derived standards shall wake up.

The interrogator may send out various commands as specified by the application. In the event that the interrogator wants to inventory all the active tags within its range, it shall send out a Collection command as defined in this part of ISO/IEC 18000. All tags adhering to this part of ISO/IEC 18000 or derived application standards shall respond to this basic Collection command. A tag shall respond with the collection response defined by the tag's own application data link layer standard (this part of ISO/IEC 18000 or derived standard). The tags shall also accept the Sleep commands ("Sleep" and "Sleep All But") defined in this part of ISO/IEC 18000. The co-existence of this part of ISO/IEC 18000 and derived standards is illustrated in Annex A.

6.2.5.2 Packet Options

Table 3 — Packet options field

Bit							
7	6	5	4	3	2	1	0
Reserved	Reserved	Reserved	Reserved	Reserved	1[1)]	0= Broadcast (Tag serial number and Tag manufacturer ID not present) 1= Point to Point (Tag serial number and tag manufacturer ID present)	Reserved

1) Bit 2 of the "packet options field" has a fixed value of "1" for backwards compatibility.

The Packet Options field, described in Table 3, shall be used to indicate the presence of the Tag serial number and Tag manufacturer ID fields within the command message (packet). As indicated in Table 4, a particular command can be point-to-point or broadcast. The command type is indicated as follows:

— Point-to-point only, Packet Option field Bit 1 must be set to 1.

— Broadcast only and Packet Option field Bit 1 must be set to 0.

Reserved bits are for future use. The default value shall be “0”.

6.2.5.3 Packet Length

The packet length field shall be used to indicate the full length of the message in bytes, from the Protocol ID up to and including the CRC field.

6.2.5.4 Tag Manufacturer ID

The Tag Manufacturer ID is a unique identifier that is issued to each tag manufacturer. The Tag Manufacturer ID is a 16-bit code assigned by the Registration Authority as called out in ISO/IEC 15963. This 16-bit code is a combination of the ISO/IEC15963 Allocation Class “0001 0001” (most significant byte) and the 8-bit Issuer UID “xxxxxxxx” (least significant byte). For example, if the Issuer UID is assigned as 00000100, the Tag Manufacturer ID would be 00010001 00000100.

The Tag Manufacturer ID format and content shall follow the requirements of unique identifiers as defined in ISO/IEC 15459-1.

The structure and allocation of the Tag Manufacturer ID is described in ISO/IEC 15963 and INCITS 256.

autoid.org is the ISO/IEC 18000-7 Registration Authority.

6.2.5.5 Tag Serial Number

The Tag Serial Number is a 32-bit integer that is uniquely assigned to each individual tag during manufacturing. This number cannot be changed and is read only. The Tag Serial Number has no structure and does not contain any information besides uniquely identifying a tag. The Tag Serial Number cannot be reused. Issuance of Tag Serial Numbers may be managed and administered by each manufacturer. The Tag Manufacturer ID and Tag Serial Number together uniquely identify a tag as defined in ISO/IEC 15963. This six-byte combination includes the two-byte Tag Manufacturer ID followed by the Tag Serial Number. An example of the combined data structure for Tag Manufacturer ID and Tag Serial Number is:

00010001 00000100 xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx

6.2.5.6 Session ID

The Session ID is a 16-bit integer value that uniquely identifies an interrogator from any other interrogator compliant with this part of ISO/IEC 18000 in the local vicinity. The Session ID of an individual interrogator may be changed without restriction, but its value shall be set to a value not in use by other interrogators compliant with this part of ISO/IEC 18000 in the local vicinity. No two interrogators compliant with this part of ISO/IEC 18000 within RF range of the same tag shall have the same Session ID. At the moment the Session ID is changed in an interrogator, any ongoing communication between that interrogator and any tag shall be terminated. An interrogator that receives a tag message containing a Session ID not equal to its own Session ID shall not transmit any packets over the UHF interface regarding the contents of the tag message. The Session ID 0x0000 is reserved and shall not be used.

6.2.5.7 Command Codes

The Command codes and their function as a Read and/or Write command shall be as listed in Table 4, below. Codes not identified are reserved.