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Information technology — Radio frequency identification for item management — Unique identification for RF tags

Technologies de l'information — Identification par radiofréquence pour la gestion des objets — Identification unique des tags RF

Please see the administrative notes on page iii

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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.

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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.

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ISO/IEC 15963:2009 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 15963:2004), which has been technically revised.

Introduction

ISO/IEC 15963 is one of a series of International Standards and Technical Reports developed by ISO/IEC JTC 1/SC 31 for the identification of items (Item Management) using radio frequency identification (RFID) technology.

ISO/IEC 15963 describes numbering systems for the unique identification of RF tags.

It is intended for use in conjunction with other International Standards developed by SC 31 for "RFID for item management" and “Real time locating systems” such as ISO/IEC 18000 and ISO/IEC 24730.

Information technology — Radio frequency identification for item management — Unique identification for RF tags

1 Scope

This International Standard describes numbering systems that are available for the identification of RF tags.

The unique ID can be used

- for the traceability of the integrated circuit itself for quality control in its manufacturing process,
- for the traceability of the RF tag during its manufacturing process and along its lifetime,
- for the completion of the reading in a multi-antenna configuration,
- by the anti-collision mechanism to inventory multiple tags in the reader's field of view, and
- for the traceability of the Item to which the RF tag is attached.

2 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 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)*

3 Terms and definitions

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

3.1
RF tag
automatic identification and data capture device carrying data that can be queried by means of suitably modulated inductive or radiating electromagnetic carriers from an interrogator so as to transfer information to an information system

NOTE RF tags include both RFID and RTLS transponders.

3.2
RF tag unique identifier
number that uniquely identifies an RF tag

3.3
RF tag issuer
company or organization that allocates the RF tags to the items they identify

3.4
IC manufacturer
company that manufactures the RF tag integrated circuit

3.5
RF tag manufacturer
company that manufactures the RF tag in a ready-to-use configuration

3.6
allocation class
8-bit value used to classify companies or organizations allowed to allocate unique tag identification

3.7
IC manufacturer registration number
number allocated to IC manufacturers according to ISO/IEC 7816-6 or ANSI ASC INCITS T6

3.8
RF tag issuer registration number
number allocated to RF tag issuers according to ISO 6346, ISO/TS 14816, GS1, or ANSI ASC INCITS T6

3.9
chip ID
CID
unique permanent ID of the integrated circuit in an RF tag

NOTE The term unique identifier (UID) is deprecated. See **tag ID**, **unique item identifier** and **object identifier**.

3.10
tag ID
TID
unique permanent ID of the actual RF tag

NOTE 1 May or may not be the same as the Chip ID.

NOTE 2 There may be multiple chips within a tag.

NOTE 3 The tag ID may identify the manufacturer of a completed tag device and constituent parts of that tag

NOTE 4 The term unique identifier (UID) is deprecated. See **chip ID**, **unique item identifier** and **object identifier**.

3.11
unique item identifier
UII
identification that uniquely identifies a specific entity during its life

NOTE 1 An item ID may not change though the data carrier may be used to identify a different item. In that case, the Item ID within the data carrier would change.

NOTE 2 A DoD Unique Identifier “UID” and an “EPC” are both forms of Item ID. A GS1 SSCC is an example of a time limited Item ID (IID). A GS1 GRAI is an example of an Item ID (IID) assigned to a returnable asset. A GS1 sGTIN is an example of an Item ID (IID) assigned to a commercial product.

NOTE 3 The term unique identifier (UID) is deprecated. See **chip ID**, **tag ID** and **object identifier**.

3.12
object identifier
OID
unambiguous identifier for an “Informational Object” that can identify a product, an organization, a person, a standard, a drawing, a (computer) file, etc.

NOTE 1 In general an Object Identifier is associated with a type of object, and is used to label information on an instance of that type as such.

NOTE 2 The term unique identifier (UID) is deprecated. See **chip ID**, **tag ID** and **unique item identifier**.

4 Abbreviated terms

AC	Allocation Class
AID	Application Identifier
ANS	American National Standard
ANSI	American National Standards Institute
ASC	Accredited Standards Committee
CID	Chip Identifier
GS1	a set of standards administered by GS1
IC	Integrated Circuit
ID	Identifier
INCITS	InterNational Committee for Information Technology Standards
LSB	Least Significant Bit
MSB	Most Significant Bit
OID	Object Identifier
RFU	Reserved for Future Use
RTLS	Real-Time Locating System
TID	Unique Tag Identifier
UID	Unique Identifier (as defined by the U.S. Department of Defense)
UII	Unique Item Identifier

5 Unique identifiers

There are several types of identifiers associated with an RF tag. The most basic form is a chip ID (CID), which is assigned by the integrated circuit (I.C.) manufacturer to a specific semiconductor device at the time of manufacture in a manner that prevents it from being changed. Multiple semiconductor devices may be associated with a single RF tag, though one I.C. per tag is common. In such a case, the identity of the RF tag (TID) might simply assume the CID as its identity or it may assign an identifier distinct from the I.C. In many cases, and as a recommendation of this standard, the TID is assigned at the time of RF tag manufacture in a manner that prevents the TID from being changed.

The RF tag is then attached to some item. In some implementations the TID might then become the unique item identifier (UII). In others, such as ISO/IEC 18000-6, Type C and ISO/IEC 18000-3, Mode 3 the UII is held in a separate part of memory and is written subsequent to being attached or associated with a specific item. The UII may either be locked or available for reprogramming.

Global uniqueness requires a central body (registration authority) to either assign manufacturer identities or to assign unique identities to various agencies that in turn assign manufacturer identities. Manufacturers then assign unique identification to the chip, tag, or item. This standard serves as the central body for assignment of unique identifiers to RF tags. This standard assigns various Allocation Classes to various agencies that issue manufacturer codes.

Some tags only have identity down to a specific lot, batch, or mask identifier. Other tags, and as recommended by this standard, are serialized so that all RF tags are globally unique from all other RF tags.

The combination of globally unique serialized tag (TID) programmed and locked at the time of manufacturer, with the unique item identifier (UII) programmed when attached or associated with a specific item and trusted trading partner communications are the cornerstones of several anti-counterfeiting techniques used within the supply chain.

For anti-collision, inventorying, reading from, and writing to an RF tag, techniques exist to utilize the TID, UII, or a randomly generated number. Neither the UII nor the randomly generated number provide life-cycle traceability for the RF tag. A TID does provide for such traceability.

6 Possible ways to uniquely identify an RF tag

When a unique identification of an RF tag is required, it can be done in several ways. The following sub-clauses list and explain some of them.

6.1 Virtual ID

A virtual tag ID is a temporary ID based on tag parameters that may vary over the life of the tag. It may take several forms. A virtual ID is also known as a logical ID or a session ID. Several tags could have the same virtual ID at different times, but all tags at the same time for the same interrogator should have a different virtual ID, allowing an unambiguous identification of each tag at any time relative to any given interrogator.

The technical means to achieve and guarantee such uniqueness is outside of the scope of this International Standard. However clauses 6.1.1, 6.1.2, and 6.1.3 discuss possible approaches.

6.1.1 Data as a unique ID

Data is a possible way to implement a virtual ID where the tag contains data that when read is unique in time and location to a single tag. An example is a tag that contains date and time information. The time information can be unique to a single tag from a manufacturer, but is not guaranteed to be unique over all tags at all times. Another situation is a closed application where tag data describes only one set of information. Taken globally, the tag bit pattern might be repeated, but in a closed application the tag data uniquely identifies a single tag.

6.1.2 Time as a unique ID

Time is a possible way to implement a virtual ID where bit patterns alone do not necessarily identify a single tag unambiguously. Tag response time slot can be part of a uniquely identifying parameter set. For example, some tags use time slots to differentiate between several tags appearing to a reader at the same time. If these time slots are fixed for a single interrogation exchange, then the time slot may be used to help define a single tag at a particular time.

NOTE If the time slots are randomly defined each time a tag responds, then time slots are not suitable for determining a unique tag ID.

6.1.3 Position as a unique ID

In some applications, tag position may define a unique tag ID at a particular time. For instance, some tags have a read and write distance of only a few millimetres. In this case it is difficult to have more than one or two tags in the interrogation zone at any time. Thus any tag continually in the reading zone may be considered unique at that single time and location. A common example of this case is the tag used for fare collection on public transportation or telecommunication charges.

6.2 Permanent unique ID

When a completely and globally unique ID is required, it shall be programmed into the tag, and therefore becomes permanent.

Methods of assigning permanent unique identifiers are given in Tables A.1 to A.7.

6.2.1 Benefits of permanent unique ID versus virtual ID

The advantage of a virtual (session) ID is the reduced number of identification bits required. The disadvantage is the absence of a unique ID, independent of the reader, application, time or data configuration used. The virtual ID is unique only at a specific time and location, and is sufficient to allow the identification of a singular tag relative to time and space.

The advantage of a permanent unique ID is that it guarantees a single ID over all application, space and time situations. It is the only identification method where a completely unique ID is guaranteed in all situations.

6.2.2 Selection of the size of a permanent unique ID

Several criteria must be taken into account when selecting the size (i.e. the number of bits) of a permanent unique ID:

a) To comply and coexist with existing ISO/IEC standards, so that the uniqueness is guaranteed globally, and that the objectives of the ISO standards are met.

b) To structure it such that it’s technical implementation is optimized. This results for RF tags in the selection of an "N power 2" number of bytes (1, 2, 4, 8).

c) To guarantee a number of combinations large enough to ensure that no two tags will be allocated the same ID within the maximum expected lifetime of a tag, under reasonable conditions, e.g. 10 years.

d) To ensure that individual ID assignments can be delegated to IC or tag manufacturers in an efficient manner.

e) To limit it to the absolute minimum size (i.e. number of bits) required to meet the above criteria, as its size might penalize the performance of the interrogator-to-tag communication by increasing the number of bits to transmit. As an example, a small number of bits (e.g. 32 bits) may be sufficient for applications with a small number of tags.

Annex A
(normative)

Numbering system of a permanent unique RF tag identifier (TID)

A.1 General

This annex contains the recommended numbering system for RF tags using permanent unique RF tag identifiers (TIDs). For the realization of such a numbering system it is necessary to incorporate the specification below and the specification of associated registration procedures in an international standard.

In order to ensure the uniqueness of the RF tag identifier, the following rules specify its structure and length.

A.2 TID issuer identifier

To ensure the uniqueness of each TID, each TID issuer must be uniquely identified. Five classes of issuer are defined.

The registration authorities identified below assign the length of the RF tag unique identifier. It consists of three fields, as shown in Table A.1.

Table A.1 — Structure of the permanent unique identifier (TID)

AC	TID issuer registration number	Serial number
8 bits	Size defined by AC value	Size defined by AC and TID issuer value

MSB LSB

A.3 Allocation class (AC)

The size of the allocation class is 8 bits. Five classes of TID issuer are defined as shown in Table A.2.

Table A.2 — Classes of unique tag ID (TID) issuer

Allocation class value	Class	TID issuer identifier size	Serial number size	Registration authority (of TID issuer registration number)
000xxxxx	INCITS 256	per ANS INCITS 256 & 371	per ANS INCITS 256 & 371	autoid.org (INCTIS 256 and 371 registration authority)
'001xxxxx' to 1101xxxx"	RFU	N/A	N/A	Reserved for use by ISO
'11100000'	ISO/IEC 7816-6	8 bits	48 bits	APACS (ISO/IEC 7816-6 registration authority)
'11100001'	ISO/TS 14816	per NEN	per NEN	NEN (ISO/TS 14816 registration authority)
'11100010'	GS1	per ISO/IEC 18000-6, Type C & 18000-3, Mode 3	per ISO/IEC 18000-6, Type C & 18000-3, Mode 3	GS1
'11100011'	ISO/IEC 7816-6	8 bits	48 bits	APACS (includes memory size and XTID Header)
'11100100' to '11111111'	RFU	N/A	N/A	Reserved for future use by ISO

A.4 TID issuer registration number

The TID issuer registration number is assigned by either the registration authority for ISO/IEC 7816-6 (for ISO/IEC 7816 I.C. card manufacturers), the registration authority for ISO/TS 14816 (for freight container and transport applications), the registration authority for GS1 standardized numbering, or the registration authority for ANS INCITS 256 and ANS INCITS 371.

A.5 Serial number

The TID issuer issues the serial number and has the responsibility to ensure its uniqueness.

It shall be unique in the sense that the issuer does not re-issue a number until a sufficient period of time has passed so that the first number has ceased to be of significance to any user.

The serial number is a binary value. The length of the unique tag ID is dependent upon the specific allocation class used.

A.6 Allocation classes

A.6.1 In support of ISO/IEC 7816-6

The I.C. manufacturer is registered in ISO/IEC 7816-6 through application to the registration authority.

If AC = '11100000', the unique identifier is allocated by an I.C. manufacturer, identified by an 8-bit (1 byte) number.

If AC = '11100011', the unique identifier is allocated by an I.C. manufacturer, identified by an 8-bit (1 byte) number.

The I.C. manufacturer shall be registered in ISO/IEC 7816-6 through application to the registration authority.

The AC is followed by the 8-bit I.C. manufacturer registration number and a 48-bit serial number allocated by the IC manufacturer. See Table A.3.

The E0 and E3 Allocation Class I.C. Manufacturer registration numbers assigned by the publication date of this standard can be found in Annex B. The E3 features distinguished from E0 are also found in Annex B.

Table A.3 — ISO/IEC 7816-6 unique TID

Allocation class	I.C. manufacturer registration number	Serial number
8 bits	8 bits	48 bits
'11100000'	As registered in ISO/IEC 7816-6	Allocated by the I.C. manufacturer

MSB **LSB**

A.6.2 In support of ISO 14816

If AC = '11100001', the unique identifier is issued by an RF tag manufacturer in support of ISO 14816, identified consistent with ISO 14816.

The RF tag manufacturer shall be registered in accordance with the procedures defined in ISO 14816.

The AC is followed by the convention shown in Annex C.

Table A.4 — ISO/TS 14816 Unique TID

AC	RF tag issuer registration number	Serial number
8 bits	As defined ISO/TS 14816	As defined ISO/TS 14816
'11100001'	As defined ISO/TS 14816	As defined ISO/TS 14816

MSB LSB

A.6.3 In support of GS1 standardized numbering

If AC = '11100010', the unique identifier is issued by an RF tag manufacturer in support of GS1 standardized number, consistent with the GS1 General Specifications and ISO/IEC 18000-6, Type C or ISO/IEC 18000-3, Mode 3.

The RF tag manufacturer shall be registered in accordance with the procedures defined in the GS1 General Specifications.

NOTE The Electronic Product Code (EPC) is a code structure, and part of the EPC Network, which is managed by EPCglobal. The EPC has been expressly designed to uniquely and unambiguously identify items using standardized, managed, serialized codes, with RFID tags as the data carriers. EPC structure(s) are standardized by GS1 and published in the *GS1 General Specifications*.

The AC is followed by the convention shown in ISO/IEC 18000-6, Type C or ISO/IEC 18000-3, Mode 3.

The E2 Allocation Class is further explained in Annex D.

Table A.5 — ISO/IEC 18000-6, Type C or ISO/IEC 18000-3, Mode 3 unique TID

AC	RF tag issuer registration number	Serial number
8 bits	As defined in the *GSI General Specifications*	As defined in the *GSI General Specifications*
'11100010'	As defined in the *GSI General Specifications*	As defined in the *GSI General Specifications*

MSB LSB

A.6.4 In support of ANS INCITS 256

If AC = '000xxxxx', the unique identifier is issued by an IC manufacturer in support of ANS INCITS 256.

The I.C. manufacturer shall be registered in accordance with the procedures defined in ANSI ASC INCITS T6.

The AC is followed by the convention shown in ANS INCITS 256. The total length of this unique identifier including allocation class (AC), I.C. manufacturer registration number, and serial number is 64 bits (or in the case of 18000-7: 32 bits).

Table A.6 — ANS INCITS 256 unique TID

AC	I.C. manufacturer registration number	Serial number
8 bits	As defined in ANS INCITS 256	As defined in ANS INCITS 256
'000xxxxx'	As defined in ANS INCITS 256	As defined in ANS INCITS 256

MSB LSB

The “00” to “1F” Allocation Classes are further explained in Annex E.

A.6.5 Reserved for future use

If AC = ‘11100100’ to ‘11101111’, the unique TID is reserved for future use (RFU) by this standard.

The tag manufacturer shall be registered in accordance with the procedures defined by the registration authority of that standard.

Table A.7 — Reserved for future use (RFU) unique identifier

AC	RF tag issuer registration number	Serial number
8 bits	RFU	RFU
‘11100100’ to ‘11101111’	RFU	RFU

MSB **LSB**

Annex B
(normative)

ISO/IEC 7816-6 numbering systems for RFID

B.1 ISO/IEC 7816-6 Issuer Codes

Within supply chain applications for RFID, there are several numbering structures that are used by JTC 1/SC 31, ISO TC 104, ISO TC 122, and ISO TC 204. At the time of the publication of this document ISO/IEC 7816-6 Issuer Codes are employed in ISO/IEC 18000-2, Type A; ISO/IEC 18000-3, Modes 1 and 3; ISO/IEC 18000-4, Modes 1 and 2; and ISO/IEC 18000-6, Types B and C. These structures are shown in Table B.1, below.

The current listing of issuer codes can be found at:
http://isotc.iso.org/livelink/livelink/fetch/2000/2122/327993/327971/7500839/Register_of_ICC_manufacturers.pdf?nodeid=7838647&vernum=0

At the time of publication of this document the following ISO/IEC I.C. Manufacturer ID assignments had been made:

Table B.1 – ISO/IEC 7816-6 issuer codes (published as of 2009-01-07)

Identifier	Company	Country
'01'	Motorola	UK
'02'	STMicroelectronics SA	France
'03'	Hitachi, Ltd	Japan
'04'	Philips Semiconductors	Germany
'05'	Infineon Technologies AG	Germany
'06'	Cylink	USA
'07'	Texas Instrument	France
'08'	Fujitsu Limited	Japan
'09'	Matsushita Electronics Corporation, Semiconductor Co.	Japan
'0A'	NEC	Japan
'0B'	Oki Electric Industry Co. Ltd	Japan
'0C'	Toshiba Corp.	Japan
'0D'	Mitsubishi Electric Corp.	Japan
'0E'	Samsung Electronics Co. Ltd	Korea
'0F'	Hynix	Korea
'10'	LG-Semiconductors Co. Ltd	Korea
'11'	Emosyn-EM Microelectronics	USA
'12'	INSIDE Technology	France
'13'	ORGA Kartensysteme GmbH	Germany
'14'	SHARP Corporation	Japan
'15'	ATMEL	France
'16'	EM Microelectronic-Marin SA	Switzerland
'17'	KSW Microtec GmbH	Germany
'18'	ZMD AG	Germany
'19'	XICOR, Inc.	USA
'1A'	Sony Corporation	Japan
'1B'	Malaysia Microelectronic Solutions Sdn. Bhd	Malaysia
'1C'	Emosyn	USA
'1D'	Shanghai Fudan Microelectronics Co. Ltd.	P.R. China
'1E'	Magellan Technology Pty Limited	Australia

Identifier	Company	Country
'1F'	Melexis NV BO	Switzerland
'20'	Renesas Technology Corp.	Japan
'21'	TAGSYS	France
22'	Transcore	USA
'23'	Shanghai belling corp., ltd.	China
'24'	Masktech Germany Gmbh	Germany
'25'	Innovision Research and Techology Plc	UK
'26'	Hitachi ULSI Systems Co., Ltd.	Japan
'27'	Cypak AB	Sweden
'28'	Ricoh	Japan
'29'	ASK	France
'2A'	Unicore Microsystems, LLC	Russian Federation
'2B'	Dallas Semiconductor/Maxim	USA
'2C'	Impinj, Inc.	USA
'2D'	RightPlug Alliance	USA
'2E'	Broadcom Corporation	USA
'2F'	MStar Semiconductor, Inc	Taiwan, ROC
'30'	eeDar Technology Inc.	USA
‘31’	RFIDsec	Denmark
‘32’	Schweizer Electronic AG	Germany
‘33’	AMIC Technology Corp	Taiwan
‘34’	Mikron JSC	Russia
‘35’	Frauhofer Institute of Photonic Microsystems	Germany
‘36’	IDS Microchip AG	Switzerland
‘37’	Kovo	USA
‘38’	HMT Microelectronic	Switzerland
‘39’	Silicon Craft Technology	Thailand

B.2 E0 as the basic allocation class for ISO/IEC 7816-6 TIDs

"E0" is the allocation class for the basic 7816-6 company issuer identifier codes consisting of the 8-bit identifier followed by a 48-bit serial number.

B.3 E3 as the extended allocation class for ISO/IEC 7816-6 TIDs

"E3" builds on an existing Allocation Class "E0" for compatibility. The AC is followed by the 8-bit I.C. manufacturer registration number, the 2-byte User Memory present and size data, the 48-bit unique tag ID, the 1-byte XTID and 15-byte XTID Header data. Table B.2 shows the TID format of allocation class of “E3”:

Table B.2 – ISO/IEC 7816-6 Extended TID

<table>
<tr><th rowspan="2">TID MEM BANK BIT ADDRESS</th><th colspan="16">BIT ADDRESS</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td></td><td colspan="8">MSB</td><td colspan="8" align="right">LSB</td></tr>
<tr><td>50_h-$5F_h$</td><td>XTID</td><td colspan="15">XTID Header [14:0]</td></tr>
<tr><td>40_h-$4F_h$</td><td colspan="16">Serial Number [15:0]</td></tr>
<tr><td>30_h-$3F_h$</td><td colspan="16">Serial Number [31:16]</td></tr>
<tr><td>20_h-$2F_h$</td><td colspan="16">Serial Number [47:32]</td></tr>
<tr><td>10_h-$1F_h$</td><td colspan="16">User memory and size [15:0]</td></tr>
<tr><td>00_h-$0F_h$</td><td colspan="8">$E3_h$</td><td colspan="8">I.C. manufacturer identification</td></tr>
</table>

B.3.1 User memory and size

The MSB will declare whether User Memory (logical or physical) is on the tag;

“0_2” = User Memory is not resident on the tag.

“1_2” = User Memory is resident on the tag.

NOTE: The above binary statements make no declaration concerning User DATA. They only declare whether or not logical or physical User Memory is present on the tag. The remaining 15 bits will declare the size of User Memory in bits:

User Memory Size Examples;

x000000001000000_2 = 64 bits.
x000001000000000_2 = 512 bits.
x000100000000000_2 = 2048 bits.
x111111111111111_2 = 32767 bits.

User Memory & Size Examples:

0000000000000000_2 = No User Memory
1000000001000000_2 = User Memory; 64 bits.

B.3.2 Locking of serial number

A 48-bit serial number shall be allocated and permanently locked by the IC manufacturer.

B.3.3 Extended TID (XTID) Header

The MSB will declare whether there is an XTID Header:

0_2 = no XTID Header data.
1_2 = XTID Header data.

XTID Header data beyond the MSB is to be determined.

Annex C
(normative)

ISO 14816 – Numbering and data structures

Within supply chain applications for RFID, there are several numbering structures that are used by ISO/IEC JTC 1/SC 31, ISO TC 104, ISO TC 122, and ISO TC 204. These structures are shown in Table C.1, below.

Table C.1 — Coding structure identifiers (CSI)

<table>
<tr><th>CSI</th><th>Length</th><th colspan="12">Coding structure data field</th></tr>
<tr><td rowspan="2">0</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">7 octets / 56 bits</td><td colspan="4">Country code[a]</td><td colspan="4">Issuer identifier</td><td colspan="4">Service number</td></tr>
<tr><td colspan="4">10</td><td colspan="4">14</td><td colspan="4">32</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">6 octets / 48 bits</td><td colspan="6">Manufacturer identifier</td><td colspan="6">Service number</td></tr>
<tr><td colspan="6">16</td><td colspan="6">32</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">22 octets / 176 bits</td><td colspan="3">Start time</td><td colspan="3">Stop time</td><td colspan="3">Geographic limit</td><td colspan="3">Application limit</td></tr>
<tr><td colspan="3">80</td><td colspan="3">80</td><td colspan="3">8</td><td colspan="3">8</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Variable</td><td colspan="4">Country code[a]</td><td colspan="4">Alphabet indicator</td><td colspan="4">License plate #</td></tr>
<tr><td colspan="4">10</td><td colspan="4">8</td><td colspan="4">Not defined</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">17 octets / 136 bits</td><td colspan="12">Vehicle identification (chassis) number</td></tr>
<tr><td colspan="12">126</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">93 bits</td><td colspan="12">Freight container numbering</td></tr>
<tr><td colspan="12">93</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Variable</td><td colspan="6">Country code[a]</td><td colspan="6">Tax code</td></tr>
<tr><td colspan="6">10</td><td colspan="6">Not defined</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td rowspan="2">…</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td rowspan="2">31</td><td rowspan="2">Variable</td><td colspan="12">Reserved for CEN/ISO (extension)</td></tr>
<tr><td colspan="12">Not defined</td></tr>
<tr><td colspan="14">[a] Country code is in accordance with ISO 3166-1.</td></tr>
</table>

Maintenance of CSI-1 and CSI-2 in ISO/TS 14816 is managed by NEN.

Current assignments can be found at the following URL:

http://www.nen.nl/cen278/

Maintenance of CSI-7 is in accordance with ISO 6346, whose Registration Authority is the International Container Bureau (BIC).

Registration Authority
c/o International Container Bureau
167, rue de Courcelles
F-75017 Paris
France
Tel: +33 1 47 66 03 90
Fax: +33 1 47 66 08 91
E-mail: bic@bic-code.org

Annex D
(normative)

ISO/IEC 18000-6C or ISO/IEC 18000-3m3 numbering systems for RFID

The EPCglobal Tag Data Standard describes how to encode an Allocation Class “E2” TID. Table D.1 shows the existing EPC TID format. Table D.2 shows the proposed EPC TID format. The first field after the Allocation Class is the TID issuer code. Table D.3 shows the EPCglobal Tag mask-designer identifier code assignments. Current assignments can be found at http://www.epcglobalinc.org/standards/mdid/.

Table D.1 — EPCglobal Short TID

TID MEM BANK BIT ADDRESS	BIT ADDRESS (In Hex)															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
10_h-$1F_h$	**TAG MDID [3:0]**				**TAG MODEL NUMBER [11:0]**											
00_h-$0F_h$	**$E2_h$**								**TAG MDID [11:4]**							

Table D.2 — EPCglobal Extended TID (TDS 1.5)

TID MEM BANK BIT ADDRESS	BIT ADDRESS (In Hex)															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
$C0_h$-CF_h	**User Memory and BlockPermaLock Segment [15:0]**															
$B0_h$-BF_h	**User Memory and BlockPermaLock Segment [31:16]**															
$A0_h$-AF_h	**BlockWrite and BlockErase Segment [15:0]**															
90_h-$9F_h$	**BlockWrite and BlockErase Segment [31:16]**															
80_h-$8F_h$	**BlockWrite and BlockErase Segment [47:32]**															
70_h-$7F_h$	**BlockWrite and BlockErase Segment [63:48]**															
60_h-$6F_h$	**Optional Command Support Segment [15:0]**															
50_h-$5F_h$	**Serial Number Segment [15:0]**															
40_h-$4F_h$	**Serial Number Segment [31:16]**															
30_h-$3F_h$	**Serial Number Segment [47:32]**															
20_h-$2F_h$	**XTID Header [15:0]**															
10_h-$1F_h$	**TAG MDID [3:0]**				**TAG MODEL NUMBER [11:0]**											
00_h-$0F_h$	**$E2_h$**								**TAG MDID [11:4]**							

Note: TID with an **$E2_h$** allocation class will contain serialization if both of the following conditions are met.

1. Bit 08_h of the TID memory bank (the MSB of the TAG MDID) has a value of one.
2. Bits 20_h-22_h do not equal zero when treated as a three bit unsigned number. The MSB of this number is bit 20_h.

If condition one is met above there is a 16-bit XTID header present from address 20_h-$2F_h$ of the TID memory bank. In addition there may be more data present in the TID, which is not covered by this specification.

An EPCglobal Tag Identification memory bank shall contain an 8-bit ISO/IEC 15963-allocation class identifier of E2h at memory locations 00h to 07h for EPCglobal Applications. TID memory locations 08h to 13h contain a 12-bit Tag mask designer identifier (MDID) obtainable from EPCglobal. EPCglobal will assign two MDIDs to each mask designer, one with bit 08h set to one and one with it set to zero. Readers that are not configured to handle the extended TID will treat both of these numbers as a 12 bit MDID. Readers that are configured to handle the extended TID will recognize the TID memory location 08h as the Extended Tag Identification bit. The value of this bit indicates the format of the rest of the TID. A value of zero indicates a short TID in which the values beyond address 1Fh are not defined. A value of one indicates an Extended Tag Identification (XTID) in which the values beyond 1Fh contain additional data as specified here. Tag manufacturers should *write permalock* the fields in both the short and extended TIDs at the time of manufacture.

Table D.3 – EPCglobal task mask-designer codes (as published on 2009-03-12)

Company	Address 08h=0 (no XTID)	Address 08h=1 (with XTID)
Impinj	001	801
Texas Instruments	002	802
Alien Technology	003	803
Intelleflex	004	804
Atmel	005	805
NXP (formerly Philips)	006	806
ST Microelectronics	007	807
EP Microelectronics	008	808
Motorola (formerly Symbol Technologies)	009	809
Sentech Snd Bhd	00A	80A
EM Microelectronics	00B	80B
Renesas Technology Corp.	00C	80C
Mstar	00D	80D
Tyco International	00E	80E
Quanray Electronics	00F	80F
Fujitsu	010	810
LSIS	011	811

Annex E
(normative)

INCITS 256 and INCITS 371 numbering systems

As the INCITS 256:2001 standard was being developed, it became apparent that a unique tag ID (TID) was required. autoid.org is the Registration Authority for INCITS 256 and INCITS 371. Many of the INCTIS 256 and INCITS 371 air interfaces have become various parts of the ISO/IEC 18000 series.

This standard defines Allocation Classes “00” to “1F” for the INCITS TID. Any manufacturer whose products comply with an ISO/IEC or ITU standard may apply for an INCITS TID manufacturer code.

Current assignments can be found at

http://www.autoid.org/INCITS/INCITS_256_371_Manufacturer_ID_Registration.htm

Table E.1 – INCITS TID Allocation Class and Manufacturer codes (as published on 2009-03-12)

Allocation Class	Manufacturer ID	Company
0000 0000	0000 0000	WhereNet
0001 0001	0000 0100	Savi Technology
0001 0001	0000 0101	Evigia Systems
0001 0001	0000 0110	Identec Solutions
0001 0001	0000 0111	Hi-G-Tek

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[2] ISO 690-2, *Information and documentation — Bibliographic references — Part 2: Electronic documents or parts thereof*

[3] ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

[4] ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

[5] ISO 6346, *Freight containers — Coding, identification and marking*

[6] ISO/IEC 7816-6, *Identification cards — Integrated circuit cards — Part 6: Interindustry data elements for interchange*

[7] ISO/IEC TR 10000-1, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 1: General principles and documentation framework*

[8] ISO 10241, *International terminology standards — Preparation and layout*

[9] ISO/TS 14816, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

[10] ISO/IEC 18000-3, *Information technology — Radio frequency identification for item management — Part 3: Parameters for air interface communications at 13,56 MHz*

[11] ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz*

[12] ISO/IEC 24730 (all parts), *Information technology — Real-time locating systems (RTLS)*

[13] ISO/IEC Directives, Part 2, *Rules for the structure and drafting of International Standards*, 2001

[14] ANS INCITS 256, *Radio Frequency Identification (RFID)*

[15] ANS INCITS 371, *Real Time Locating Systems (RTLS)*

[16] *GS1 General Specifications* (GS1, Brussels)

[17] *EPCglobal Tag Data Standards* (GS1, Brussels)

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