

ISO/IEC JTC 1/SC 17
Cards and personal identification
Secretariat: BSI (United Kingdom)

Document type: Text for NP ballot

Title: Notification of ballot: ISO/IEC 14443-4:2008/AMENDMENT X: IDENTIFICATION CARDS —CONTACTLESS INTEGRATED CIRCUIT CARDS - PROXIMITY CARDS —PART 4: TRANSMISSION PROTOCOL —AMENDMENT X: FRAME WITH ERROR CORRECTION

Status: This ballot has been posted to the ISO Electronic balloting application and is available under the Balloting Portal, Committee Internal Balloting.

National bodies are reminded particularly to vote both for the proposal to be added to the SC17 work plan (Qu.2.), and also to indicate if they will be prepared to offer experts to contribute to the new work item (Qu.3.). These are the key questions upon which the success of the NP is determined.

This ballot has been sent to the secretariat of JTC1 for simultaneous ballot.

Date of document: 2012-04-23

Expected action: VOTE

Action due date: 2012-07-24

No. of pages: 22

Email of secretary: chris.starr@ukpayments.org.uk

Committee URL: <http://isotc.iso.org/livelink/livelink/open/jtc1sc17>



NEW WORK ITEM PROPOSAL	
DATE OF SUBMISSION	REFERENCE NUMBER (TO BE GIVEN BY THE SECRETARIAT)
Proposer	JTC1/SC17 N 4512
Secretariat	BSI (UK)

A PROPOSAL FOR A NEW WORK ITEM WITHIN THE SCOPE OF AN EXISTING COMMITTEE SHALL BE SUBMITTED TO THE SECRETARIAT OF THAT COMMITTEE WITH A COPY TO THE CENTRAL SECRETARIAT AND, IN THE CASE OF A SUBCOMMITTEE, A COPY TO THE SECRETARIAT OF THE PARENT TECHNICAL COMMITTEE. PROPOSALS NOT WITHIN THE SCOPE OF AN EXISTING COMMITTEE SHALL BE SUBMITTED TO THE ITTF.

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IMPORTANT NOTE: PROPOSALS WITHOUT ADEQUATE JUSTIFICATION RISK REJECTION OR REFERRAL TO ORIGINATOR. GUIDELINES FOR PROPOSING AND JUSTIFYING A NEW WORK ITEM ARE GIVEN OVERLEAF.

PROPOSAL (TO BE COMPLETED BY THE PROPOSER)

<p>TITLE OF PROPOSAL</p> <p>ENGLISH TITLE ISO/IEC 14443-4:2008/AMENDMENT X: IDENTIFICATION CARDS — CONTACTLESS INTEGRATED CIRCUIT CARDS - PROXIMITY CARDS — PART 4: TRANSMISSION PROTOCOL — AMENDMENT X: FRAME WITH ERROR CORRECTION</p>
<p>SCOPE OF PROPOSED PROJECT</p> <p>1- To define an error correction mechanism to avoid the retransmission of frames corrupted by transmission errors. 2- To provide alternative error detection mechanism to minimize the risk of having a correct error detection code while the frame is corrupted by more than one error.</p>
<p>PURPOSE AND JUSTIFICATION (ATTACH A SEPARATE PAGE AS ANNEX, IF NECESSARY)</p> <p>Frame size has been extended up to 4096 bytes. Depending on the RF environment and/or the bit rates used, the error rate may be such that the probability for a frame to be corrupted becomes high. The existing error detection mechanism implies a complete retransmission of any corrupted frame and therefore degrades a lot the performance when long frames are used. In addition the existing error detection mechanism may allow some long frames corrupted by more than one error to be accepted as non-corrupted frames.</p>
<p>ENVISAGED PUBLICATION TYPE (INDICATE ONE OF THE FOLLOWING, IF POSSIBLE)</p> <p><input checked="" type="checkbox"/> INTERNATIONAL STANDARD <input type="checkbox"/> TECHNICAL SPECIFICATION <input type="checkbox"/> TECHNICAL REPORT</p>
<p>DOES THE PROPOSED PROJECT CONCERN KNOWN PATENTED ITEMS (SEE ISO/IEC DIRECTIVES PART 1 FOR IMPORTANT GUIDANCE)</p> <p>YES <input type="checkbox"/> NO <input checked="" type="checkbox"/> IF "YES", PROVIDE FULL INFORMATION IN AN ANNEX.</p>
<p>ARE THERE ANY KNOWN ACCESSIBILITY REQUIREMENTS AND/OR DEPENDENCIES? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/></p> <p>IF YES, PLEASE SPECIFY IN A SEPARATE ANNEX.</p>
<p>ARE THERE ANY KNOWN REQUIREMENTS FOR CULTURAL AND LINGUISTIC ADAPTABILITY? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/></p> <p>IF YES, PLEASE SPECIFY IN A SEPARATE ANNEX.</p>
<p>TARGET DATES FOR AVAILABILITY</p> <p>FIRST CD: May 2012 PUBLICATION: 2014</p>

PROPOSED DEVELOPMENT TRACK 1 (24 MONTHS) 2 (36 MONTHS - DEFAULT) 3 (48 MONTHS)

MEETING INFORMATION

ESTIMATED NUMBER OF MEETINGS: 2 _____ FREQUENCY OF MEETINGS: 2 _____ PER YEAR

DATE AND PLACE OF FIRST MEETING (IF KNOWN): New Orleans, 2012-10

RELEVANT DOCUMENTS TO BE CONSIDERED

ISO/IEC 14443, ISO/IEC 10373-6

RELATIONSHIP OF PROJECT TO ACTIVITIES OF OTHER INTERNATIONAL BODIES

NONE

LIAISON ORGANIZATIONS

NONE

OTHER ORGANIZATIONS - EXCEPT LIAISON ORGANIZATIONS ABOVE- REQUIRING COORDINATION

NONE

PREPARATORY WORK (AT A MINIMUM AN OUTLINE SHOULD BE INCLUDED WITH THE PROPOSAL; ENSURE THAT ALL COPYRIGHT ISSUES ARE IDENTIFIED)

A DRAFT IS ATTACHED AN OUTLINE IS ATTACHED.
IT IS POSSIBLE TO SUPPLY A DRAFT BY _____

THE PROPOSER OR THE PROPOSER'S ORGANIZATION IS PREPARED TO UNDERTAKE THE PREPARATORY WORK REQUIRED YES NO

PROPOSER CONTACT DETAILS

WG8

COMMENTS OF THE JTC 1 OR SC SECRETARIAT (SUPPLEMENTARY INFORMATION RELATING TO THE PROPOSAL)

- THIS PROPOSAL RELATES TO A NEW PUBLICATION;
- THIS PROPOSAL RELATES TO THE AMENDMENT/REVISION OF AN EXISTING PUBLICATION;
- THIS PROPOSAL RELATES TO A MULTI-PART STANDARD CONSISTING OF _____ PARTS;
- THIS PROPOSAL RELATES TO THE ADOPTION AS AN ACTIVE PROJECT OF AN ITEM CURRENTLY REGISTERED AS A PRELIMINARY WORK ITEM;
- THIS PROPOSAL RELATES TO THE RE-ESTABLISHMENT OF A CANCELLED PROJECT AS AN ACTIVE PROJECT.
- THIS PROPOSAL REQUIRES THE SERVICE OF A MAINTENANCE AGENCY. IF YES, HAS A POTENTIAL CANDIDATE BEEN IDENTIFIED? PLEASE IDENTIFY _____
- THIS PROPOSAL REQUIRES THE SERVICE OF A REGISTRATION AUTHORITY. IF YES, HAS A POTENTIAL CANDIDATE BEEN IDENTIFIED? PLEASE IDENTIFY _____
- THIS PROPOSAL IS SUBMITTED WITH A CD FOR SIMULTANEOUS NP AND CD BALLOTING
- OTHER: _____

VOTING INFORMATION

THE BALLOT ASSOCIATED WITH THIS PROPOSAL COMPRISES A VOTE ON (CHECK ONLY ONE):

- ADOPTION OF THE PROPOSAL AS A NEW PROJECT (STAGE 10.99)
- ADOPTION OF THE PROPOSAL AS A NEW PROJECT AND THE ASSOCIATED DRAFT AS A WORKING DRAFT (WD) (STAGE 20.20)
- ADOPTION OF THE PROPOSAL AS A NEW PROJECT AND THE ASSOCIATED DRAFT AS A COMMITTEE DRAFT (CD) (STAGE 30.20)

OTHER: _____

IT IS PROPOSED TO ASSIGN THIS NEW ITEM TO JTC 1/SC 17/WG 8 NEW COMMITTEE

ANNEX(ES) ARE INCLUDED WITH THIS PROPOSAL (GIVE DETAILS)

Draft CD

DATE OF CIRCULATION	CLOSING DATE FOR VOTING	SIGNATURE OF THE JTC 1 OR SC SECRETARY

Use this form to propose:

- a) a new publication (including a new part to an existing publication), or the amendment/revision of an existing publication;
- b) the establishment as an active project of a preliminary work item, or the re-establishment of a cancelled project;
- c) the change in the type of an existing publication, e.g. conversion of a Technical Specification into an International Standard.

This form is not intended for use to propose an action following a systematic review - use ISO Form 21 for that purpose.

Proposals for correction (i.e. proposals for a Technical Corrigendum) should be submitted in writing directly to the secretariat concerned.

Guidelines on the completion of a proposal for a new work item (see also the ISO/IEC Directives Part 1)

- a) **Title:** Indicate the subject of the proposed new work item.
- b) **Scope:** Give a clear indication of the coverage of the proposed new work item. Indicate, for example, if this is a proposal for a new publication, or a proposed change (amendment/revision). It is often helpful to indicate what is not covered (exclusions).
- c) **Envisaged publication type:** Details of the types of ISO/IEC deliverable available are given in the ISO/IEC Directives, Part 1 and/or the associated JTC 1 Supplement.
- d) **Purpose and justification:** Give details based on a critical study of the following elements wherever practicable. *Wherever possible reference should be made to information contained in the related Business Plan.*
- 1) The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.
 - 2) The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.
 - 3) Feasibility of the activity: Are there factors that could hinder the successful establishment or global application of the standard?
 - 4) Timeliness of the standard to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standard outdated? Is the proposed standard required as a basis for the future development of the technology in question, or for adoption in a future regulatory system?
 - 5) Urgency of the activity, considering the needs of other fields or organizations. Indicate target date and, when a series of standards is proposed, suggest priorities.
 - 6) The benefits to be gained by the implementation of the proposed standard; alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume or value of trade should be included and quantified.
 - 7) If the standardization activity is, or is likely to be, the subject of regulations or to require the harmonization of existing regulations, this should be indicated.
 - 8) If a series of new work items is proposed having a common purpose and justification, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.
- e) **Relevant documents and their effects on global relevancy:** List any known relevant documents (such as standards and regulations), regardless of their source.

NOTE: The following criteria f) and g) do not mandate any feature for adaptability to culture, language, human functioning or context of use. The following criteria require that if any features are provided for adapting to culture, language, human functioning or context of use by the new Work Item proposal, then the proposer is required to identify these features.

- f) **Accessibility:** Indicate here whether the proposed standard takes into account diverse human functioning and diverse contexts of use. If so, indicate how it is addressed in your project plan. Indicate how the guidelines of ISO/IEC Guide 71 (Guidelines for standards developers to address the needs of older persons and persons with disabilities), ISO/IEC TR 29138-1 (Information technology -- Accessibility considerations for people with disabilities -- Part 1: User needs summary), and ISO TR 22411 (Ergonomics data and guidelines for the application of ISO/IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities) have been implemented in the proposal, or why they are not deemed to be relevant.
- g) **Cultural and linguistic adaptability:** Indicate here if cultural and natural language adaptability is applicable to your project. If so, indicate how it is addressed in your project plan. Typical examples of requirements include:
- 1) for text or speech, the user shall be able to choose the natural language of input and output sentences and the language captured shall be identified;
 - 2) for character coding, the code shall be clearly identified for correct input and rendering;
 - 3) for sorted lists, linguistic user order expectations shall be respected (see ISO/IEC 14651 International string ordering and comparison);
 - 4) cultural variations in the way concepts are perceived in different countries shall be respected; and
 - 5) input methods used in a given country shall also be supported.
- For a list of what is required in most IT products, see ISO/IEC TR 19764 (Guidelines, methodology, and reference criteria for cultural and linguistic adaptability in information technology products) and ISO/IEC TR 11017 (Framework for internationalization).
- h) **Cooperation and liaison:** List relevant organizations or bodies with which cooperation and liaison exist or should exist (other organizations).
- i) **Preparatory Work:** When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendment), indicate this with appropriate justification and attach a copy to the proposal. In this case, provide the document publication date, implementation history and national/global adoption experience.

WG8N1891

ISO/IEC JTC 1/SC 17 N **XX**

Date: 2012-01-24

ISO/IEC 14443-4:2008/PDAM **XX**

ISO/IEC JTC 1/SC 17/WG 8

Secretariat: DIN

Identification cards — Contactless integrated circuit cards - Proximity cards — Part 4: Transmission Protocol

AMENDMENT X

Frame with error correction

Cartes d'identification — Cartes à circuit intégré - Cartes de proximité — Partie 4: Protocole de transmission

Amendement 3

Trame avec correction d'erreur

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Document language: E

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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.

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Amendment XX to ISO/IEC 14443-4:2008 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Card and personal identification*.

Identification cards — Contactless integrated circuit cards - Proximity cards — Part 4: Transmission Protocol

Amendment X: Frame with error correction

Page 2, NOTE in Clause 3.4

Replace NOTE with

“

NOTE The PICC independent from its type may use the frame with error correction defined in clause 10. Alternatively the PICC Type A may use one of the standard frames defined for Type A and the PICC Type B may use the frame defined for Type B. This Type B frame is called standard frame, too, within this specification.

“

Page 2, Clause 4

Add new symbols and abbreviations

“

A	Hamming control bits generation matrix (6 rows, 56 columns)
CRC_32	Cyclic Redundancy Check error detection code used within enhanced block
\underline{c}	Vector containing 6 Hamming control bits
c_n	Hamming control bits
\underline{d}	Vector containing 56 data bits
d_n	data bits
H	matrix needed to calculate Hamming syndrome \underline{s} (6 rows, 62 columns)
$h_{m,n}$	element in row m and column n of matrix H
H'	matrix needed to get matrix A (6 rows, 62 columns)
\underline{h}'_n	column vector of matrix H'
$I_{6 \times 6}$	6 by 6 Identity Matrix
LEN	two bytes Length field used within enhanced block
n	column index
m	row index

\underline{s}	6-bit vector containing Hamming syndrome
s'	error position code
s	error position
\underline{y}	62-bit vector (\underline{y}' with no padding bits)
\underline{y}'	64-bit vector containing received modified Hamming sub-block
\underline{y}'_n	received bits in each modified Hamming sub-block
"	

Page 14, Clause 7.1

Replace first chapter with

"

The block format depends on the frame format used for its transmission.

The standard block format as specified in Figure 14 shall be used in standard frames as defined in ISO/IEC 14443-3 and consists of:

- a prologue field (mandatory),
- an information field (optional)
- and a two-byte epilogue field (mandatory).

The enhanced block format specified in Figure 15 shall be used in frames with error correction as defined in Clause 10 and consists of:

- a length field (mandatory)
- a prologue field (mandatory),
- an information field (optional)
- and a four-byte epilogue field.

"

Page 15, after Figure 14

Add a new figure 15 and renumber all figures and add new clause 7.1.1 and renumber all clauses.

"

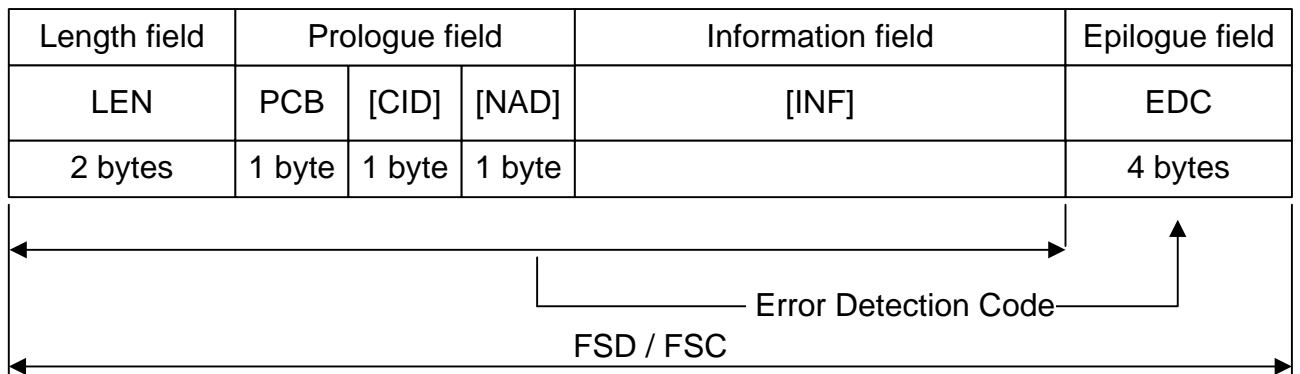


Figure 15 — Enhanced block format

7.1.1 Length field

The two-byte length field shall contain the sum of lengths of:

- Length field,
- Prologue field and
- Information field.

Least significant byte is transmitted first, then most significant byte.

"

Page 18, Clause 7.1.3

Replace 7.1.3 with

"

7.1.3 Epilogue field

The epilogue field contains the EDC of the transmitted block. A transmitted block shall be considered correct if it is received with a valid EDC value.

The EDC of standard blocks shall be the CRC defined in ISO/IEC 14443-3.

The EDC of enhanced blocks shall be CRC_32 as defined below.

The CRC_32 uses polynomial = '04C11DB7' with initial value = 'FFFFFFFF' and reflected bit order (LSB first). The final CRC value is bit-inverted before transmission and the least significant byte is transmitted first. Refer to ISO/IEC 13239 for further details. A code sample and an example are given in Annex D.

"

Page 25, before Annex A

Add a new clause 10 with the following:

"

10 Frame with error correction

10.1 General

Frames with error correction as specified in 10.2 and 10.3 shall be used after their activation specified in 10.4. An example is given in Annex E.

10.2 Type A PCD frame format for bit rates up to $f_c/16$ and Type A PICC extended frame format for all bit rates

Frames with error correction, as defined in Figure 33, shall be used for data exchange and consist of, in the following order:

- start of communication;
- SYNC sequence;
- enhanced block with error correction (see 10.4);
- end of communication.

SYNC sequence consists of 6 dedicated bytes with the value '555574747474' transmitted in this order.

SYNC and enhanced blocks with error correction shall be transmitted as bytes consisting of 8 bits without parity bit.

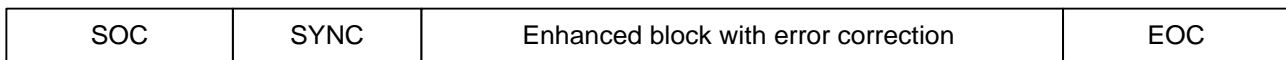


Figure 33 —Frame with error correction

10.3 Type A PCD frame format for bit rates greater than $f_c/16$ and Type B extended frame format for all bit rates

Frames with error correction, as defined in Figure 34, shall be used for data exchange and consist of, in the following order:

- SOF
- SYNC sequence as defined in 10.2 transmitted as characters as defined in ISO/IEC 14443-3;
- bytes of enhanced block with error correction (see 10.4) transmitted as characters as defined in ISO/IEC 14443-3;
- EOF.

EGT shall be 0 etu in frames with error correction.

SOF, EOF, start bit, stop bit and SYNC may be suppressed in accordance with 10.4.

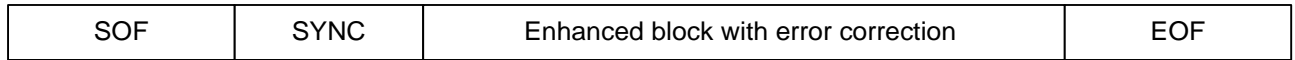


Figure 34 — Frame with error correction

10.4 Enhanced block with error correction

10.4.1 General

Enhanced block with error correction shall be composed of one or several 8-byte modified Hamming sub-blocks, each of them being calculated from 7-byte sub-blocks from enhanced block (see figure 35).

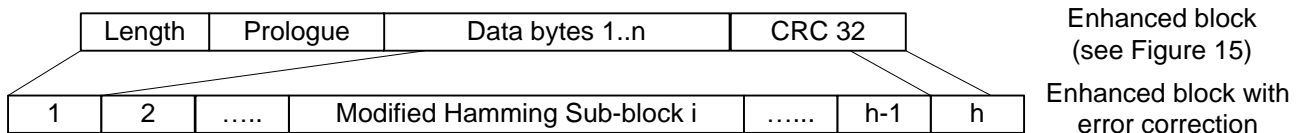


Figure 35 — Enhanced block with error correction

10.4.2 Modified Hamming Sub-block format

Each modified Hamming sub-block shall consist of 7 bytes from enhanced block, followed by one Hamming control byte used to correct one single-bit error on the Hamming sub-block.

Modified Hamming sub-blocks shall always be complete. If necessary, 'FF' bytes shall be added to complete the last bytes from enhanced block to get 7 bytes.

10.4.3 Hamming control byte

The Hamming control byte shall contain the Hamming control bits c_m and logical "1" padding bits in the following order:

- 1 logical "1" padding bit,
- 6 Hamming control bits c_m in the order $c_1, c_2, c_3, c_4, c_5, c_6$,
- 1 logical "1" padding bit.

10.4.4 Hamming control generation matrix A

Parity generation matrix A (see Figure 38) shall be generated by following steps:

- generate Matrix H' (see Figure 37) using equation in Figure 36;
- remove column vectors h'_n , with $n = 1, 2, 4, 8, 16$ and 32, of H'.

$$H'_{m,n} = \begin{cases} 1 & \text{for } (n \wedge 2^{m-1}) \neq 0 \\ 0 & \text{otherwise} \end{cases} \text{ with } 1 \leq m \leq 6 \text{ and } 1 \leq n \leq 62$$

Figure 36 — Matrix H' generation

NOTE ^ stands for a logical AND operation

$$H' = \begin{pmatrix} 1 & 0 & 1 & 0 & \dots & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & \dots & 1 & 1 & 1 \end{pmatrix}$$

Figure 37 — Matrix H'

$$A = \begin{pmatrix} 1 & 1 & 0 & 1 & \dots & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & \dots & 1 & 1 & 1 \end{pmatrix}$$

Figure 38 — Hamming control generation matrix A

10.4.5 Hamming control bits calculation

Hamming control bits c_m ($m = 1..6$) shall be calculated over data d_n ($n = 1..56$) using equation in Figure 39.

$$\underline{c} = A \times \underline{d}$$

Figure 39 — Parity bits generation

10.4.6 Hamming control check matrix H

The parity check matrix H (illustrated in Figure 40) is a concatenation of matrix A and matrix $I_{6 \times 6}$.

$$H = A|I_{6,6} = \begin{pmatrix} 1 & 1 & 0 & 1 & \dots & 0 & 1 & 0 & 1 & 0 & \dots & 0 & 0 \\ 1 & 0 & 1 & 1 & & 0 & 0 & 1 & 0 & 1 & & 0 & 0 \\ 0 & 1 & 1 & 1 & & 1 & 1 & 1 & 0 & 0 & & 0 & 0 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 & 0 & 0 & & 0 & 0 \\ 0 & 0 & 0 & 0 & & 1 & 1 & 1 & 0 & 0 & & 1 & 0 \\ 0 & 0 & 0 & 0 & \dots & 1 & 1 & 1 & 0 & 0 & \dots & 0 & 1 \end{pmatrix}$$

Figure 40 — Hamming control check matrix H

10.4.7 Error correction

Hamming control bits shall be used to detect and correct any single bit error in modified Hamming sub-blocks.

The so called syndrome \underline{s} shall be calculated using equation in Figure 41. To get \underline{y} from \underline{y}' , the padding bits of the received data y'_n on position 57 and 64 shall be removed. y'_1 is bit b1 of the first received byte and y'_{64} is bit b8 of the eighth received byte of any 8-byte sub-block from enhanced block with error correction.

$$\underline{s} = H \times \underline{y}$$

Figure 41 — Syndrome calculation

The numerical interpretation s' of the syndrome \underline{s} shall be used for error correction:

- if $s' = 0, 1, 2, 4, 8, 16, 32$ or 63 no change in received bits y'_1 to y'_{56}
- else
 - calculate error position s by reducing s' by the amount of powers of 2 (1, 2, 4, 8, 16, 32) which are smaller than s'
 - invert the received bit y'_s

NOTE More than one bit error cannot be corrected by this method. EDC will detect these multiple errors with very high probability.

10.5 Activation of frame with error correction in the PROTOCOL state

S(PARAMETERS) blocks shall be used to negotiate the used frame and communication parameters in PROTOCOL state. The following rules shall be applied to negotiate those parameters:

- The information field shall contain tags and values as defined in Tables 4 and 6 and Figures 35 and 36.
- The PCD shall send an S(PARAMETERS) block to request frame format parameters.
- If the PICC supports S(PARAMETERS) blocks, the PICC shall respond with an S(PARAMETERS) block containing values for all supported frame format parameters. If the PICC does not support S(PARAMETERS) it shall stay mute.

After the PICC has sent its response and has indicated its parameters the PCD may activate the desired options for each communication direction with following rules:

- The information field shall contain tags and values as defined in Tables 4 and 6 and Figures 42 and 43.

- The PCD shall send an S(PARAMETERS) block to activate selected frame format parameters.
- The PICC shall acknowledge the activated frame format parameters with an S(PARAMETERS) block and then shall activate the negotiated frame format parameters.
- The PCD shall activate the negotiated frame format parameters.

NOTE S(PARAMETERS) block is defined in ISO/IEC 14443-4:2008/Amd.1:2012

Table 6 — Frame format function tags identifier definition

Tags (Hex)	Description	Length	Value		
'A5'	Frame Format Request	0			
'A6'	Frame Format Indication	L	Tags	Length	Value
			'80'	'01'	list of supported frames PCD to PICC (see Figure 35) ^a
			'81'	'01'	list of supported frames PICC to PCD (see Figure 35) ^a
			'82'	'01'	supported framing options PCD to PICC (see Figure 36) ^b
			'83'	'01'	supported framing options PICC to PCD (see Figure 36) ^c
'A7'	Frame Format Activation	L	Tags	Length	Value
			'84'	'01'	selected frame PCD to PICC (see Figure 42) ^d
			'85'	'01'	selected frame PICC to PCD (see Figure 42) ^d
			'86'	'01'	selected framing options from PCD to PICC (see Figure 43) ^{b e}
			'87'	'01'	selected framing options from PICC to PCD (see Figure 43) ^{c e}
'A8'	Frame Format Acknowledgement	0			
<p>^a Bit 8 shall be set to the same value in both cases</p> <p>^b Shall be omitted for Type A PICCs for bit rates up to $fd/16$</p> <p>^c Shall be omitted for Type A PICCs</p> <p>^d Bit 8 shall be set to (0)b</p> <p>^e The PCD shall not select both start bit and stop bit suppression and SOF and EOF suppression. If start bit and stop bit suppression is selected, SOF and EOF low time of 10 etu and SOF high time of 2 etu shall be used.</p> <p>NOTE The length field is in accordance with the full range of BER-TLV (see ISO/IEC 7816-4:2005)</p>					

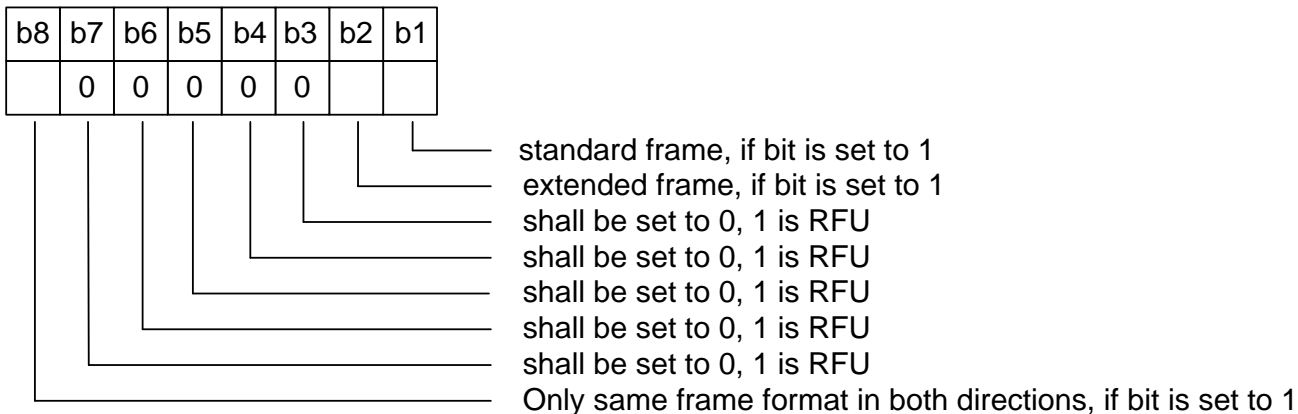


Figure 42 — Frame Formats

NOTE 1 Standard frame support is mandatory

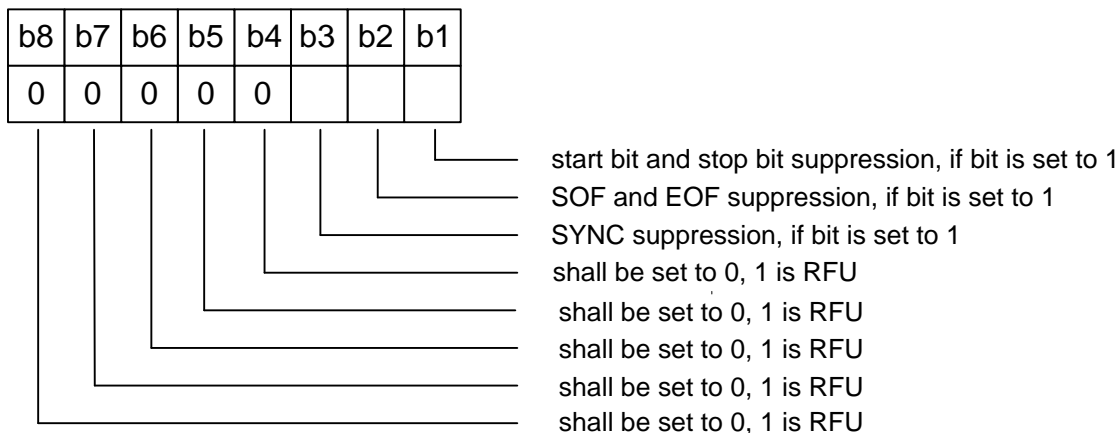


Figure 43 — Framing Options

As an example the sequence for an activation of extended frame in both directions with

- no SYNC suppression in both directions
 - no SOF and EOF suppression in both directions
 - start bit and stop bit suppression in both directions and
- with a PICC indicating to support
- Standard and extended frame in both directions independent of each direction
 - SYNC suppression in both directions
 - SOF and EOF suppression in both directions and
 - start bit and stop bit suppression in both directions

is illustrated in Figure 44.

Step	PCD	PICC
1	S(PARAMETERS)('A0 02 A5 00' CRC)	→
2		← S(PARAMETERS) ('A0 0E' 'A6 0C' '80 01 03' '81 01 03' '82 01 07' '83 01 07' CRC)
3	S(PARAMETERS) ('A0 0E' 'A7 0C' '84 01 02' '85 01 02' '86 01 04' '87 01 04' CRC)	→
4		← S(PARAMETERS)('A0 02 A8 00' CRC)

Figure 44 — Frame activation example

NOTE For Type A PICCs, tags '82' and '86' are omitted in certain cases (see table foot note b in Table 6) and tags '83' and '87' are always omitted (see table foot note c in Table 6).

“

Page 36, after Annex C

Add a new Annex D and Annex E with the following:

Annex D (informative)

CRC_32 encoding

D.1 CRC_32 encoding

This Annex is provided for explanatory purposes and indicates the bit patterns in enhanced block. It is included for the purpose of checking a CRC_32 encoding.

Initial Value = 'FFFFFFFF'

EXAMPLE In Figure D.1 transmission of first byte = '06', second byte = '00', third byte = '0A', fourth byte = '01', fifth byte = '11', sixth byte = '22', and appended CRC_32 is illustrated. Calculated CRC_32 = '8F5DAA19'

1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	CRC_32			
06	00	0A	01	11	22	8F	5D	AA	19

Figure D.1 — Enhanced frame including CRC_32

D.2 Code sample written in C language for CRC_32 calculation

```
// ComputeCrc32.cpp : Defines the entry point for the console application.

#include <stdio.h>

unsigned int ComputeCrc32(unsigned char *Data) {

    unsigned int c;
    unsigned char d, e, f;

    unsigned int i;

    unsigned int Length = 6;
    // initial value
    c = 0xffffffff;
    // compute CRC
    for (i = 0; i < Length; i++) {
        d = Data[i];

        e = c ^ d;
        f = e ^ (e << 6);
        c = (c >> 8) ^ (f << 24) ^ (f << 23) ^ (f << 22) ^
            (f << 20) ^ (f << 19) ^ (f << 17) ^ (f << 16) ^
            (f << 14) ^ (f << 13) ^ (f << 12) ^ (f << 8) ^
            (f << 2) ^ (f << 1) ^ (f >> 2);
    }
    // invert result
    c = c ^ 0xffffffff;
    // revert byte order to get least significant byte first
    c = (c >> 24) |
        ((c << 8) & 0x00FF0000) |
        ((c >> 8) & 0x0000FF00) |
        (c << 24);

    return c;
}

int main(void)
{
```

```

unsigned char BuffCRC_32[6] = {0x06, 0x00, 0x0A, 0x01, 0x11, 0x22};
unsigned int  Crc32;
int i;

printf("\n");
printf("CRC-32 reference results ISO/IEC 14443-4\n");
printf("Crc-32 G(x) = x^32 + x^26 + x^23 + x^22 + x^16 + x^12 + x^11 +
        x^10 + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1\n\n");
printf("CRC_32 of [ ");
for(i=0; i<6; i++) printf("%02X ",BuffCRC_32[i]);
Crc32 = ComputeCrc32(BuffCRC_32);
printf("] Transmitted: %02X then %02X then %02X then %02X.\n",
       (Crc32 & 0xFF), ((Crc32 >> 8) & 0xFF), ((Crc32 >> 16) & 0xFF), ((Crc32 >> 24) & 0xFF));

return 0;
}

```

Annex E (informative)

Frame with error correction

E.1 Frame with error correction

This Annex is provided for explanatory purposes and shows how an I-block in using enhanced block format is transmitted. The example in Figure E.1 uses CID = '01' and INF-field = '1122'

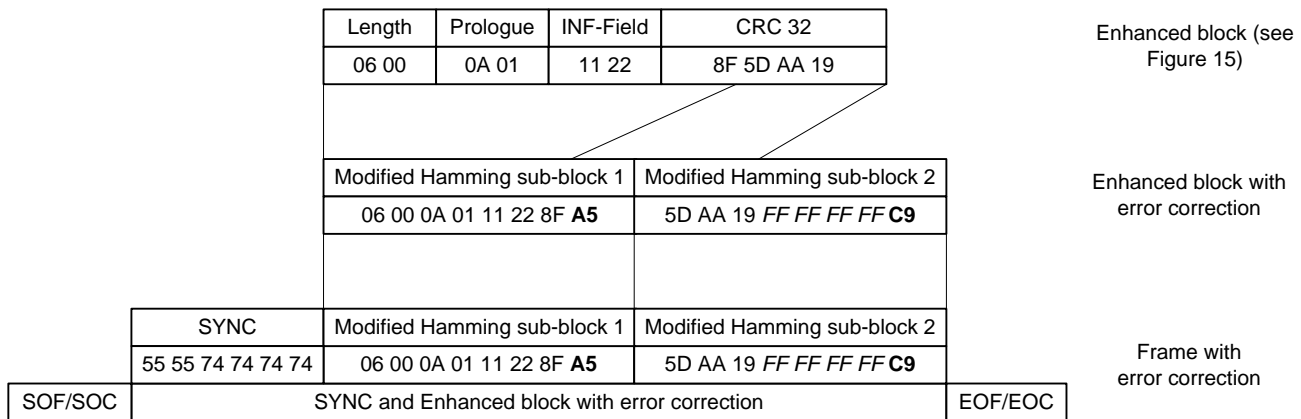


Figure E.1 — Composition of frame with error correction

The enhanced block is divided into 7-byte blocks. In our example there are two blocks. The second block needs to be padded with 4 'FF' bytes, illustrated in italic letters in Figure E.1. Each block has appended the Hamming control byte (bold letters in Figure E.1). These two blocks are called enhanced block with error correction. Before this enhanced block with error correction the dedicated SYNC bytes are prepended. Up to here everything is the same for all communication types.

When using the frame format defined in 10.2 the frame with error correction starts with SOC and ends with EOC. The SYNC bytes (which cannot be suppressed) and the enhanced block with error correction are sent without parity bits.

When using the frame format defined in 10.3 the frame with error correction starts with SOF and ends with EOF. The SYNC bytes and the enhanced block with error correction are sent in the character transmission format defined in ISO/IEC 14443-3, 7.1.1. Start bit, stop bit, SOF, EOF and SYNC may be suppressed in accordance to 10.5.

"