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Information technology — Telecommunications and information exchange between systems — High-level data link control procedures — Description of the X.25 LAPB-compatible DTE data link procedures

AMENDMENT 1: Modulo 32 768 and multi-selective reject option

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Procédures de commande de liaison de données à haut niveau — Description des procédures de liaison d'équipement terminal de transmission de données ETTD compatible X.25 LAPB

AMENDEMENT 1: Option de rejet modulo 32 768 et multisélective

Reference number
ISO/IEC 7776:1995/Amd.1:1996(E)

Foreword

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Amendment 1 to International Standard ISO/IEC 7776:1995 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

Introduction

This amendment to ISO/IEC 7776:1995 adds the multi-selective reject option (option 3.3) and modulo 32 768 (option 10.2) from ISO/IEC 7809:1993. This amendment enhances ISO/IEC 7776:1995 in the following areas:

- it allows more efficient recovery of errored or lost I frames by selectively requesting retransmissions of one or more I frames with a single request; this improved efficiency is especially beneficial over links that have high data rates or large propagation delays.
- link efficiency is improved by retransmitting only errored or lost I frames; correctly received I frames are saved by the DTE for deferred delivery;
- allows for a much larger modulo for operation over links that have high data rates or large propagation delays;
- the maximum number of outstanding frames k can be as large as the modulus number minus 1;
- the additional procedures are fairly simple to implement.

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Information technology — Telecommunications and information exchange between systems — High-level data link control procedures — Description of the X.25 LAPB-compatible DTE data link procedures

AMENDMENT 1: Modulo 32 768 and multi-selective reject option

Page 1

Clause 1

Replace paragraph 2 with the following:

Clause 3 describes three frame structures: one for basic (modulo 8) operation, one for extended (modulo 128) operation, and the third for modulo 32 768. Basic (modulo 8) operation is the ISO/IEC balanced asynchronous class of procedure with optional functions 2 and 8 (BAC, 2, 8). Extended (modulo 128) operation is the ISO/IEC balanced asynchronous class of procedure with optional functions 2, 8, and 10.1 (BAC, 2, 8, 10.1) or 3.3, 8 and 10.1 (BAC, 3.3, 8, 10.1). Modulo 32 768 operation is the ISO/IEC balanced asynchronous class of procedure with optional functions 3.3, 8 and 10.2 (BAC, 3.3, 8, 10.2).

The following pertains to the selection of the above combinations:

a. basic (modulo 8) operation may optionally be supported — if supported, then the REJ recovery mechanism shall be supported with this operating mode; support of SREJ-with-span-list recovery mechanism is prohibited;

b. extended (modulo 128) operation may optionally be supported — if supported, then either or both of the REJ and SREJ-with-span-list recovery mechanism shall be supported but only one recovery mechanism shall be used at a time;

c. modulo 32 768 operation may optionally be supported — if supported, then SREJ-with-span-list recovery mechanism shall be supported with this operating mode; support of the REJ recovery mechanism is prohibited.

For those DTE/DCE connections that support basic (modulo 8) operation, extended (modulo 128) operation and/or modulo 32 768 operation, the choice of modulo and, when applicable, recovery mechanism is made at subscription-time only. For those DTE/remote DTE connections that support basic (modulo 8) operation, extended (modulo 128) operation and/or modulo 32 768 operation, the choice of modulo and, when applicable, recovery mechanism is made by bilateral agreement.

NOTE — The procedure herein described as basic (modulo 8) operation is the only one available in all public data networks.

Page 1

Clause 1

Replace paragraph 4 with the following:

Clause 4 describes the elements of procedures. Some aspects are only operable for the basic (modulo 8) operation, some for the extended (modulo 128) operation and some for modulo 32 768 operation.

Page 2

Clause 3

Replace paragraph 1 with the following:

All transmissions on a SLP are in frames conforming to one of the formats of table 1 for basic (modulo 8) operation, or one of the formats of table 2 for extended (modulo 128) operation or alternatively one of the formats of table 3 for modulo 32 768 operation. The flag preceding the address field is defined as the opening flag. The flag following the FCS field is defined as the closing flag.

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Clause 3

Add the following new Table 3, and renumber all the other tables that follow:

Table 3 — Frame formats — modulo 32 768 operation

Bit order of transmission

12345678	12345678	1 to *	16 to 1	12345678
Flag	**Address**	**Control**	**FCS**	**Flag**
F	**A**	**C**	**FCS**	**F**
01111110	8-bits	*-bits	16-bits	01111110

FCS = Frame Check Sequence

Bit order of transmission

12345678	12345678	1 to *		16 to 1	12345678
Flag	**Address**	**Control**	**Information**	**FCS**	**Flag**
F	**A**	**C**	**I**	**FCS**	**F**
01111110	8-bits	*-bits	N-bits	16-bits	01111110

FCS = Frame Check Sequence

* 32 for frame formats that contain sequence numbers; 8 for frame formats that do not contain sequence numl

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Subclause 3.3

Paragraph 1, Replace with the following:

For basic (modulo 8) operation, the control field shall consist of one octet. For extended (modulo 128) operation, the control field shall consist of two octets for frame formats that contain sequence numbers, and one octet for frame formats that do not contain sequence numbers. For modulo 32 768 operation, the control field shall consist of four octets for frame formats that contain sequence numbers, and one octet for frame formats that do not contain sequence numbers. The content of this field is described in 4.1.

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Subclause 3.4, Paragraph 1, Line 2:

Change 4.3.9 to 4.3.10

Page 3

Subclause 3.4, Paragraph 3:

Change 4.3.9 to 4.3.10 and 5.7.3 to 5.8.3.

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Subclause 3.7.1

Replace paragraph 3 with the following:

The FCS shall be transmitted to the line commencing with the coefficient of the highest term, which is found in bit position 16 of the FCS field (see tables 1, 2 and 3).

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Subclause 3.7.1, NOTE

Change "8" to "15".

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Subclause 3.11.2.2

Change 5.7.1.5 to 5.8.1.5.

Page 7

Subclause 3.11.2.2, Note

Change 5.7.1.3 to 5.8.1.3.

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Subclause 4.1.1

Replace the second paragraph with the following:

Three types of control field formats are used to perform numbered information transfer (I format), number supervisory functions (S format) and unnumbered control functions (U format). The control field formats for basic (modulo 8) operation are depicted in table 4, control field formats for extended (modulo 128) operation are depicted in table 5 and control field formats for modulo 32 768 operation are depicted in table 6.

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Renumber Tables 3 and 4 as Tables 4 and 5 and insert the following new Table 6:

Table 6 — Control field formats — modulo 32 768 operation

Control field format	Control field bits																			
	First two octets																Next two octets			
	1	2						8								16	17	18		32
I format	0							N(S)									P/F		N(R)	
S format	1	0	S	S	x	x	x	x	x	. . .						x	P/F		N(R)	
U format	1	1	M	M	P/F	M	M	M												

N(S) = transmitter send sequence number (bit 2 = low-order bit)

N(R) = transmitter receive sequence number (bit 18 = low-order bit)

S = supervisory function bit

M = modifier function bit

P/F = poll bit when issued as a command; final bit when issued as a response (1 = Poll/Final)

P = poll bit (1 = Poll)

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Subclause 4.1.1.3

Replace the last sentence with the following:

The unnumbered frames shall have the same control field length (one octet) in the basic (modulo 8) operation, extended (modulo 128) operation and modulo 32 768 operation.

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Subclause 4.1.2.1

Replace the last sentence with the following:

The modulus equals 8, 128 or 32 768 and the sequence numbers cycle through the entire range.

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Subclause 4.1.2.2.1

Replace the last sentence with the following:

The value of *k* is defined in 5.8.4.

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Subclause 4.1.2.2.4

Replace with the following:

All I frames and supervisory frames, except SREJ frames with F bit set to "0", shall contain N(R), the expected sequence number of the next received I frames. Prior to transmission of a frame of the above types of the DTE, the value of N(R) shall be set equal to the current value of the DTE receive state variable. N(R) indicates that the transmitter of the N(R) has correctly received all I frames numbered up to N(R) – 1 inclusive.

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Subclause 4.3

Replace with the following:

The commands and responses supported by the DTE are represented in table 7 for basic (modulo 8) operation, table 8 for extended (modulo 128) operation and table 9 for modulo 32 768 operation. For purposes of this International Standard, those encodings of the modifier function bits in tables 4, 5 and 6 not identified in tables 7, 8 and 9 are identified as "undefined or not implemented" command and response control fields. The commands and responses in tables 7, 8 and 9 are defined as follows"

Page 9-10

Renumber Tables 5 and 6 as Tables 7 and 8. Replace Table 8 with the following. Insert the following new Table 9:

Table 8 — Commands and responses — Extended (modulo 128) operation

Format	Commands	Responses	Encoding									
			1	2	3	4	5	6	7	8	9	10 to 16
Information transfer	I (information)		0	N(S)							P	N(R)
Supervisory	RR (receive ready) RNR (receive not ready) REJ (reject)	RR (receive ready) RNR (receive not ready) REJ (reject) SREJ (selective reject)	1 0 1 0 1 0 1 0		0 0 1 0 0 1 1 1		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				P/F P/F P/F F	N(R) N(R) N(R) N(R)
Unnumbered	SABME (set asynchronous balanced mode extended)		1 1		1 1		P	1	1	0		
	DISC (disconnect)		1 1		0 0		P	0	1	0		
		UA (unnumbered acknowledgement)	1 1		0 0		F	1	1	0		
		DM (disconnected mode)	1 1		1 1		F	0	0	0		
		FRMR (frame reject)	1 1		1 0		F	0	0	1		

Table 9 — Commands and responses — modulo 32 768 operation

Format	Commands	Responses	Encoding									
			1	2	3	4	5	.8	.	16	17	18 to 32
Information transfer	I (information)		0	N(S)							P	N(R)
Supervisory	RR (receive ready) RNR (receive not ready)	RR (receive ready) RNR (receive not ready) SREJ (selective reject)	1 0 1 0 1 0		0 0 1 0 1 1		0 0 0 0 0 0 0 0 0 0 0 0				P/F P/F F	N(R) N(R) N(R)
Unnumbered	SM (set mode)		1 1		0 0		P	011				
	DISC (disconnect)		1 1		0 0		P	010				
		UA (unnumbered acknowledgement)	1 1		0 0		F	110				
		DM (disconnected mode)	1 1		1 1		F	000				
		FRMR (frame reject)	1 1		1 0		F	001				

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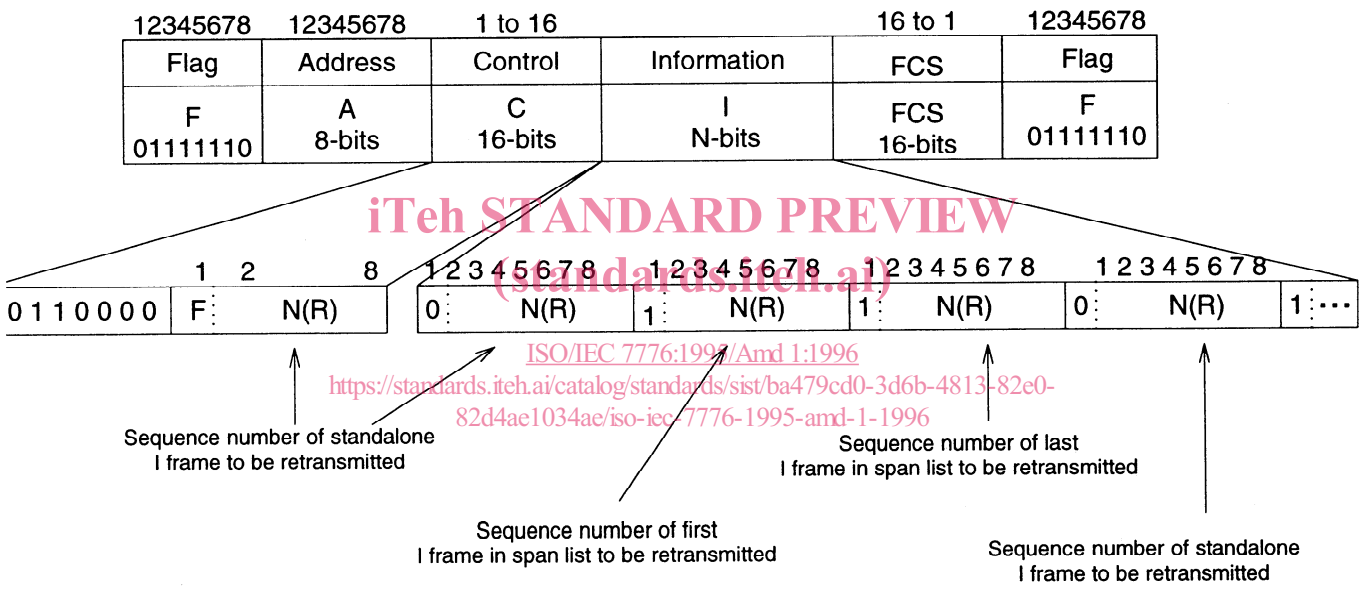
Insert a new subclause 4.3.5 as follows and renumber all subclauses that follow:

4.3.5 Selective reject (SREJ) response

The selective reject, SREJ, frame shall be used by a DTE to request retransmission of one or more (not necessarily contiguous) I frames. The N(R) field of the control field of the SREJ frame shall contain the sequence number of the earliest I frame to be retransmitted and the information field shall contain the sequence numbers of additional I frame(s), if any, in need of retransmission. (The DTE shall create a list of sequence numbers N(X), N(X+1), N(X+2), N(Y), N(Z+3), N(Z+4), ... , N(S)-1, where N(X) is greater than or equal to V(R) and none of the I frames N(X) to N(S-1) have been received. The N(R) field of the SREJ frame shall be set to N(X) and the information field set to the list N(X)+1, ..., N(S)-1.)

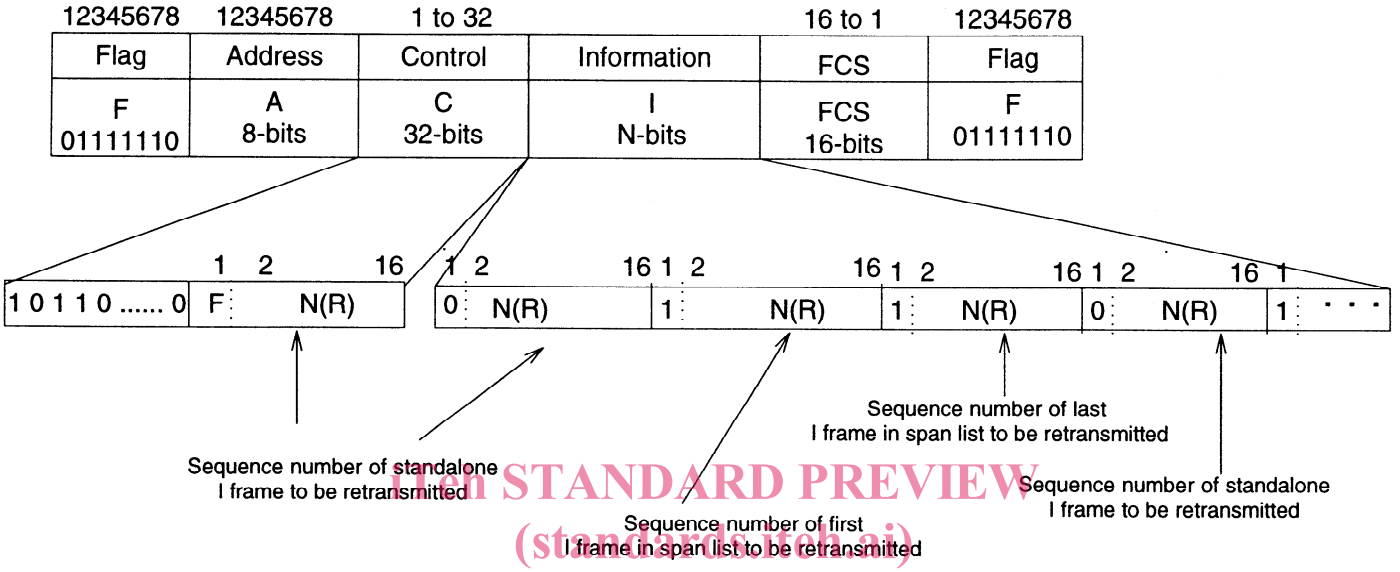
For extended (modulo 128) operation, the information field shall be encoded such that there is an octet for each standalone I frame in need of retransmission, and a two-octet span list for each sequence of two or more contiguously numbered I frames in need of retransmission, as depicted in table 10. In the case of standalone I frames, the sequence number of each designated I frame shall occupy bit positions 2-8 of an octet, with bit position 1 set to zero, as depicted in table 10. In the case of span lists, the sequence number of the first designated I frame in need of retransmission is encoded in the first octet (of the two octet field for span lists) and the second octet contains the sequence number of the last designated I frame in the sequence in need of retransmission. Sequence numbers in both octets are encoded in bits 2-8 with the bit position 1 in both octets set to 1 as depicted in table 10.

Table 10 – Control and Information field encoding of SREJ frame - Extended (modulo 128) operation



For modulo 32 768 operation, the information field shall be encoded such that there are two octets for each standalone I frame in need of retransmission, and a four-octet span list for each sequence of two or more contiguously numbered I frames in need of retransmission, as depicted in table 11. In the case of standalone I frames, the sequence number of each designated I frame shall occupy bit positions 2-16 of the two octet field, with bit position 1 set to zero, as depicted in table 11. In the case of span lists, the sequence number of the first designated I frame in need of retransmission is encoded in the first two octets (of the four octet field for span lists) and the second two octet field contains the sequence number of the last designated I frame in the sequence in need of retransmission. Sequence numbers in both two octet fields are encoded in bits 2-16 with the bit position 1 in both two-octet fields set to 1 as depicted in table 11.

Table 11 – Control and Information field encoding of SREJ frame - modulo 32 768 operation



If the list of sequence numbers is too large to fit in the information field of the SREJ frame, then the list shall be truncated to fit in one SREJ frame, by including only the earliest sequence numbers. The truncated sequence numbers may be transmitted in another SREJ frame. The number of bits in an SREJ frame shall not exceed the value of parameter N1, the maximum number of bits in an I frame.

If the F bit in an SREJ frame is set to "1", then I frames numbered up to N(R) – 1 inclusive (N(R) being the value in the control field) are considered as acknowledged. If the F bit in an SREJ frame is set to "0", then the N(R) in the control field of the SREJ frame does not indicate acknowledgement of I frames.

The procedures to be followed on receipt of an SREJ frame are specified in 5.5.6.

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Old Subclause 4.3.5

Replace with the following:

4.3.6 Set asynchronous balanced mode (SABM) command/Set asynchronous balanced mode extended (SABME) command/Set mode (SM) command

The SABM unnumbered command shall be used to place the addressed DCE or DTE in an asynchronous balanced mode (ABM) information transfer phase where all command/response control fields shall be one octet in length.

The SABME unnumbered command shall be used to place the addressed DCE or DTE in an asynchronous balanced mode (ABM) information transfer phase where numbered command/response control fields shall be two octets in length, and unnumbered command/response control fields shall be one octet in length.