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1995-11-15

Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures

AMENDMENT 6: Extension of HDLC sequence number modulus beyond 128

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Procédures de commande de liaison de données à haut niveau (HDLC) — Éléments de procédures

AMENDEMENT 6: Extension du module du numéro de séquence HDLC au-delà de 128

Reference number
ISO/IEC 4335:1993/Amd.6:1995(E)

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.

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Amendment 6 to International Standard ISO/IEC 4335:1993 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

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Introduction

This amendment increases the modulus number (i.e. the sequence number) in steps up to a maximum of 2 147 483 648 which can be represented in 31 bits. This is done by the introduction of a new "Set Mode" command that can be used to negotiate or indicate the modulus in absence of, or to override, a default value. This uses an optional information field in the mode-setting commands/responses.

This amendment also introduces the information field in mode-setting commands/responses.

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Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures

AMENDMENT 6: Extension of HDLC sequence number modulus beyond 128

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Subclause 5.2

Change item (a) of the fifth paragraph to read as follows:

a) accepting and responding to one of several appropriate mode-setting commands [set normal response mode (SNRM), set asynchronous response mode (SARM), set normal response mode extended (SNRME), set asynchronous response mode extended (SARME), set mode (SM) or set mode (SM) with the mode in the optional information field selected as normal response mode or asynchronous response mode, set initialization mode (SIM), and disconnect (DISC)];

In the first sentence of the sixth paragraph, insert the following after ".....extended (SABME)," and before "SIM .....":

set mode (SM) or SM with the mode in the optional information field selected as balanced mode,

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Subclause 5.2.2

In the first sentence of the third paragraph, change the phrase in the parentheses to read as follows:

(SABM, SABME, SM or SM with the mode in the information field selected as balanced mode, SIM).....

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Subclause 6.2.1

Replace the second sentence of the first paragraph to read as follows:

The modulus equals 8, 128, 32 768 or 2 147 483 648.

Add the following at the end of the first paragraph.

The control field formats for modulo 32 768 are shown in table 6 (see 7.5).

The control field formats for modulo 2 147 483 768 are shown in table 7 (see 7.6).

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Subclause 7.1

Add the following unnumbered command to table 3.

SM - Set Mode

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Subclause 7.2.4

Add the following after the third sentence in paragraph 2.

For modulo 32 768 sequence numbering the N(R) value for each designated I frame shall occupy bit positions 2-16 of the two-octet field, as per the encoding of the N(R) field in octets 3-4 of the control field for modulo 32 768, with bit position 1 in the first octet of the two-octet field set to "0", as illustrated in Figure 8. For modulo 2 147 483 648 sequence numbering the N(R) value for each designated I frame shall occupy bit positions 2-32 of the four-octet field, as per the encoding of the N(R) field in octets 5-8 of the control field for modulo 2 147 483 768, with bit position 1 in first octet of the four-octet field set to "0", as illustrated in figure 9.

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Subclause 7.2.4

Insert new figures 8 and 9, as shown below. Renumber present figures 8 to 13 as figures 18 to 23.

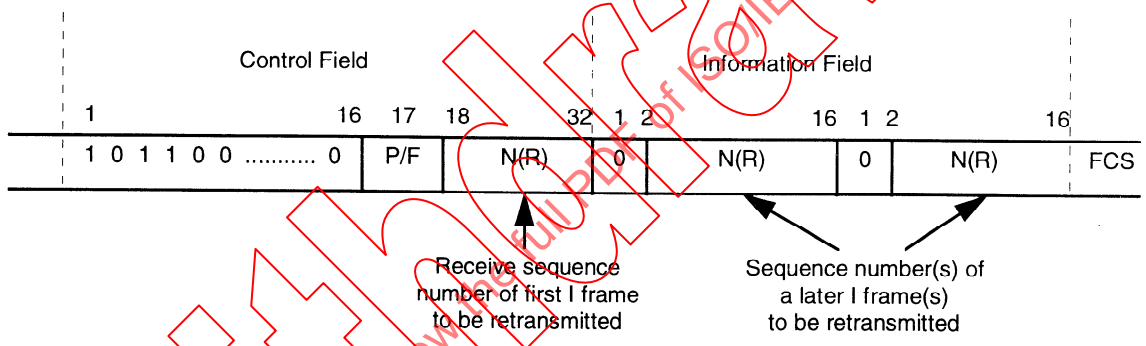

Figure 8 — Control field and information field encoding in SREJ frame for modulo 32 768 numbering

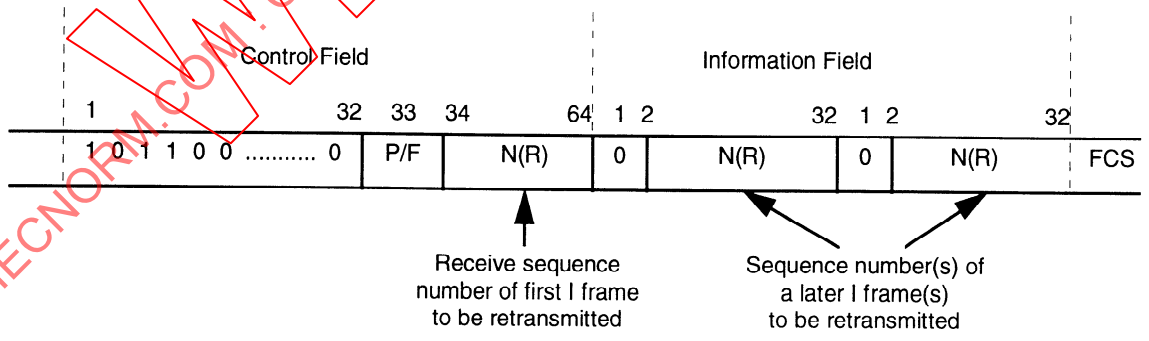

Figure 9 — Control field and information field encoding in SREJ frame for modulo 2 147 483 648 numbering

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Subclause 7.3

Replace the last sentence of the first paragraph by the following:

Fourteen command functions and eight response functions are defined below; all others are reserved.

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Subclause 7.3

Add the following at the end of 7.3 and renumber 7.3.1 as 7.3.4 and 7.3.2 as 7.3.5:

Several unnumbered commands and responses (e.g. SABM, SABME, SNRM, SNRME, SARM, SARME, SM, UA, DISC, DM) may have an optional information field.

7.3.1 Information field structure

The general structure of the information field is illustrated in figure 10. The first octet of the information field, when present, shall be a format identifier subfield. One or more data link layer subfields may follow the format identifier subfield. This may be followed by a user data subfield.

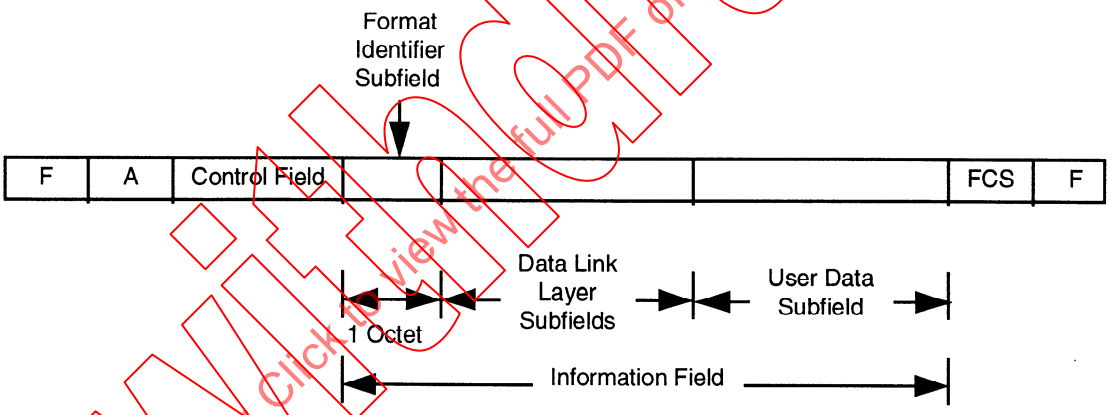


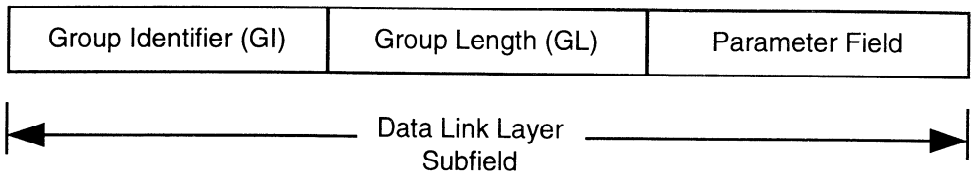
Figure 10 — Format of the optional information field in specified unnumbered command and responses

7.3.1.1 Format identifier subfield

The format identifier subfield is a fixed length of one octet and is illustrated in figure 10.

7.3.1.2 Data link layer subfields

The general structure of a data link layer subfield is illustrated in figure 11.



Group Identifier (GI): 1 Octet
Group Length (GL): 1 Octet (to indicate the length of the associated parameter field in octets)
Parameter Field: n Octets

Figure 11 — Data link layer subfield

The data link layer subfields specify various data link layer characteristics and parameters. The contents of these subfields are generated and consumed by the data link layer logic. The length of these subfields is limited by the maximum length restrictions on the HDLC frame information field, taking into account the lengths of the FI subfield and the user data subfield.

In terms of figure 11, a data link layer subfield consists of

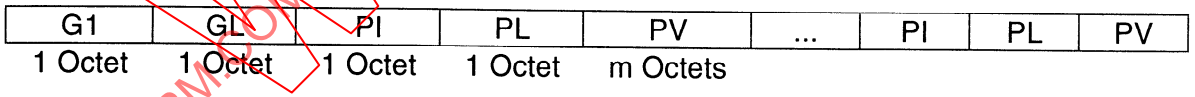
Group Identifier (1 octet);
Group Length (1 octet); and
Parameter field (n octets).

The Group Identifier (GI) identifies the function of that data link layer subfield. Three data link layer subfield identifiers are defined:

Mode and Modulus Group;
Parameter Negotiation Group; and
Private Parameter Group.

The Parameter field consists of a series of Parameter Identifier (PI) (1 octet), Parameter Length (PL) (1 octet), and Parameter Value (PV) (m octets) sets, one set for each defined data link layer subfield element. The structure of the defined PI/PL/PV sets is detailed in 7.3.3.

A data link layer subfield, therefore, has the general organization depicted in figure 12.



Where

PI: Parameter Identifier, expressed as a decimal value
PL: Parameter Length, expressed as a decimal value

Figure 12 — Data link layer subfield for the parameter negotiation group

7.3.1.3 User data subfield

The optional information field may contain a user data subfield that contains user information. This data link user information is transported transparently across the data link layer to the user of the data link. The amount of information (number of bits) that can be accommodated is limited only by the maximum length restrictions on the HDLC frame

information field, taking into account the lengths of the FI subfield and the data link layer subfields.

The user data subfield is composed of

User data identifier (1 octet), and
User data field (n bits).

The user data subfield, therefore, has the organization illustrated in figure 13.

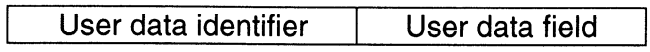


Figure 13 — User data subfield

7.3.2 Information field encoding

The format identifier subfield is always the first octet of the optional information field. The data link layer subfields, if present, follow in ascending order according to their GI values. Except where noted, specific data link layer subfields may appear only once. The absence of a particular data link layer subfield should be interpreted to mean default values. The user data subfield, if present, is always the last subfield.

7.3.2.1 Format identifier subfield encoding

The format identifier subfield can be encoded to have the capability of designating 256 different standardized formats. The format identifier shall be encoded as illustrated in figure 14.

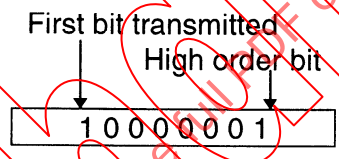


Figure 14 — Format identifier subfield encoding

All other values of the format identifier are reserved.

7.3.2.2 Data link layer subfield encoding

7.3.2.2.1 Group identifier encoding

Group identifiers identify various functions that pertain to the data link layer. Figure 15 indicates the GI encodings for the data link layer subfields covered in this International Standard.

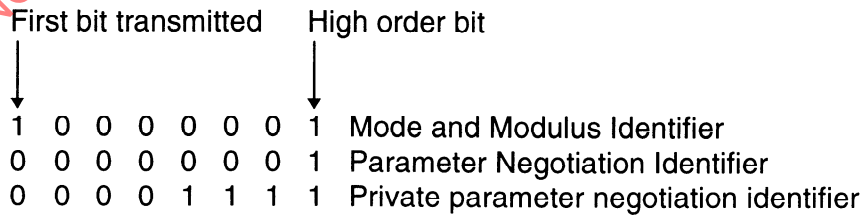


Figure 15 — Data link layer subfield encodings

NOTE — The parameter negotiation data link layer subfield and the private parameter negotiation data link layer subfield may each appear more than once in the information field. This allows the station to convey multiple menus in the information field.

7.3.2.2.2 Group length encodings

Group length indicates the length of the associated Parameter field. This length is expressed as a one-octet binary number representing the length of the associated Parameter field in octets.

NOTE — The Group Length value does not does not include the lengths of either itself or its associated identifier.

A Group Length value of zero indicates that there is no associated Parameter field and that all parameters within the subfield specified by the associated Group Identifier should assume their default values.

7.3.2.2.3 Parameter field encoding

A parameter field contains a series of Parameter Identifier (PI), Parameter Length (PL) and Parameter Value (PV) set structures in that order. Each PI identifies a parameter and is one octet in length. Each PL indicates the length of the associated parameter value (PV) and is one octet in length. Each PV contains the parameter value and is m octets in length.

NOTE — The value of PL does not include the lengths of either itself or its associated PI.

The value of PL is expressed as a one-octet binary number representing the length of the PV in octets. A PL value of zero indicates that the associated PV is absent and that the parameter shall assume the default value.

A PI/PL/PV set may be omitted if it is not required for conveying information or if default values for the parameters are to be used. A Parameter field containing a PI that is not specified in this International Standard is defined as invalid and shall be ignored (except within the private negotiation subfield, in which PIs other than PI=0 may be defined by a prior agreement between the stations). Except where noted, duplicate PIs should not be sent within the same data link layer subfield. The behavior of the receiver upon receipt of duplicate PIs within the same data link layer subfield is not defined in this International Standard.

7.3.2.3 User Data subfield encoding

7.3.2.3.1 User data identifier encoding

The user data identifier identifies the subfield as the user data subfield. Figure 16 provides its encoding.

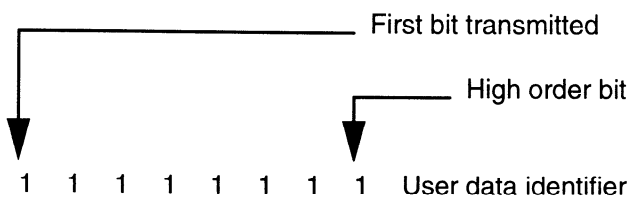


Figure 16 — User data subfield encoding

7.3.2.3.2 User data field encoding

The user data field is transported transparently by the data link and passed to the user of the data link. The encoding of the user data field is the responsibility of the data link user and may be any format that is mutually agreed upon by the data link users involved.

7.3.3 Definition and encoding of data link layer subfield fields

7.3.3.1 Data link layer subfield mode and modulus group

The data link layer subfield associated with the Mode and Modulus Group is illustrated in figure 17.

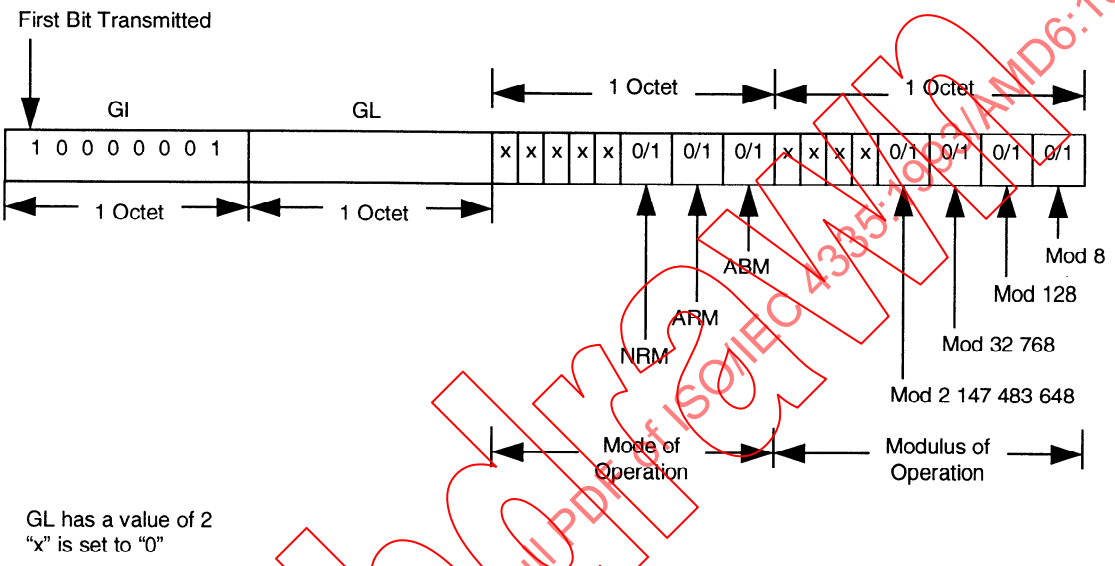


Figure 17 — Data link layer subfield mode and modulus group

The mode(s) of operation is indicated by setting the corresponding bit(s) to "1". The modulus for operation is indicated by setting the corresponding bit(s) to "1".

7.3.3.2 Data link layer subfield parameter field elements

The following is a list of parameter field elements that are defined here.

The following legend explains the symbols used in table 5.

PI: Parameter Identifier, expressed as a decimal value.

PL: Parameter Length in octets, expressed as a decimal value.

B: Indicates this field is binary encoded.

N: Number of octets.

NA: Not applicable.

Table 5 — Parameter Negotiation data link layer subfield parameter field elements

Name	PI	PL	Parameter field element	Code Type	Bit No.	Value
Information field length (transmit)	5	N	Maximum information field length-transmit (bits)	B	NA	B
Information field length (receive)	6	N	Maximum information field length-receive(bits)	B	NA	B
Window size (transmit)	7	4	Window size k-transmit (frames) Reserved	B	1 to 31 32	1 to 2^{31}-1 0
Window size (receive)	8	4	Window size k-receive (frames) Reserved	B	1 to 31 32	1 to 2^{31}-1 0

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New subclause 7.3.4

Change "figure 9" to "figure 19" in the first sentence of the first paragraph. Add the following unnumbered command encoding to figure 19.

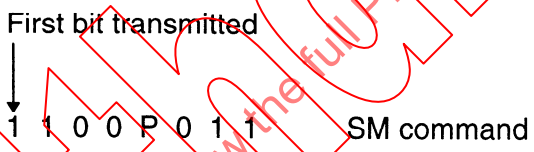

Figure 19 — Unnumbered command control field bit assignments

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New subclause 7.3.4.1

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SNRM command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

New subclause 7.3.4.2

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SARM command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

New subclause 7.3.4.3

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SABM command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

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New subclause 7.3.4.5

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SNRME command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

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New subclause 7.3.4.6

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SARME command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

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New subclause 7.3.4.7

Paragraph 1, Delete the second sentence from the text.

Insert the following as a separate paragraph at the end of this subclause.

An information field may be present in the SABME command. The structure of the information field when present is as indicated in 7.3.1 without the Mode and Modulus Group.

Renumber new subclauses 7.3.4.13 as 7.3.4.14, 7.3.4.12 as 7.3.4.13, 7.3.4.11 as 7.3.4.12, 7.3.4.10 as 7.3.4.11, 7.3.4.9 as 7.3.4.10, 7.3.4.8 as 7.3.4.9, 7.3.4.7 as 7.3.4.8, 7.3.4.6 as 7.3.4.7, 7.3.4.5 as 7.3.4.6, and 7.3.4.4 as 7.3.4.5.

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Insert a new subclause 7.3.4.4 as follows:

7.3.4.4 Set mode (SM) command

The SM command may be used to place the addressed station (combined/secondary) in one of the operational modes, which may be determined by other means. Furthermore, use of the SM frame may require other means to set the number of octets to be used in unnumbered command/response control fields.

NOTE — Various ways in which the mode and the modulus for operation can be selected are:

(a) with *a priori* knowledge;
(b) through XID exchange; or
(c) through the use of an information field in the SM command.

An information field is optional in the SM command. It may contain the following:

Mode and Modulus Group;
Parameter Negotiation Group;
Private Parameter Group; and
User Data Subfield.

If the Mode and Modulus Group is present, the Mode of operation and the Modulus for operation may be negotiated by setting the corresponding bits in the Mode and the Modulus field; if not, then the Mode of operation and Modulus for operation shall be specified as in the note above. The combined/secondary station shall confirm the acceptance of the SM command by transmission of a UA response at the first respond opportunity. Upon acceptance of this command, the combined/secondary station's send and receive state variables shall be set to zero.

When this command is actioned, the responsibility for all unacknowledged I frames assigned to data link control reverts to a higher level. Whether the content of the information field of such unacknowledged I frames is reassigned to data link control for transmission or not is decided at a higher level.

New subclause 7.3.4.5:

Change the fourth sentence of the first paragraph to read as follows:

An information field may be present with the DISC command and may contain the User Data Subfield.

New Subclause 7.3.5.1

Change the paragraph to read as follows:

The UA response shall be used by the secondary/combined station to acknowledge the receipt and acceptance of SABM, SNRM, SARM, SNRME, SABME, SARME, SM, RSET, SIM and DISC commands. An information field is optional in the UA response and may be present when the response acknowledges the receipt of the SM command. The format of the information field is as defined in 7.3.1. It may contain the following:

Mode and Modulus Group;
Parameter Negotiation Group;
Private Parameter Group; and
User Data Subfield.

However, when the UA response has an information field containing the Mode and Modulus Group, at most one mode bit and one modulus bit can be set to "1".

New subclause 7.3.5.2

Change the fourth paragraph to read as follows:

The primary/combined station receiving the FRMR response shall be responsible for initiating the appropriate mode setting or resetting corrective action by initializing one or both directions of transmission using the RSET, SNRM, SARM, SABM, SNRME, SARME, SABME, SM, or DISC command as applicable.

New subclause 7.3.5.2

Change the eighth paragraph to read as follows:

When the control field extension (see 7.4) is used for modulo 128, the format for the information field returned with the FRMR response shall be as shown in figure 23.

New subclause 7.3.5.2

Add the following at the end of this subclause.

When the control field extension (see 7.5) is used for modulo 32 768, the format for the information field returned with the FRMR response shall be as shown in figure 24.

1 32	33	34 48	49	50 64	65	66	67	68	69	70	71	72
Rejected extended frame control field	0	N(S)	C/R	N(R)	*w*	*x*	*y*	*z*	0	0	0	0

Figure 24 — Information field format for FRMR extended response in modulo 32 768 format

Bit 34 and bit 50 are the low-order bits of the state variable values.

In the extended FRMR response format, the rejected frame control field is the control field of the received frame which caused the frame reject exception condition. When the rejected frame is an unnumbered frame, the control field of the rejected is positioned in bit positions 1 to 8, with bits 9 to 32 set to zero.

When the control field extension (see 7.6) for modulo 2 147 483 648 is used, the format for the information field returned with the FRMR response shall be as shown in figure 25.

1 64	65	66 96	97	98 128	129	130	131	132	133	134	135	136
Rejected extended frame control field	0	N(S)	C/R	N(R)	*w*	*x*	*y*	*z*	0	0	0	0

Figure 25 — Information field format for FRMR extended response in modulo 2 147 483 648 format

Bit 66 and bit 98 are the low-order bits of the state variable values.

In the extended FRMR response format, the rejected frame control field is the control field of the received frame which caused the frame reject exception condition. When the rejected frame is an unnumbered frame, the control field of the rejected is positioned in bit positions 1 to 8, with bits 9 to 64 set to zero.

New subclause 7.3.5.3:

Change the last sentence of the second paragraph to read as follows:

An optional information field may be present with the DM response. The format of the information field is identical to the information field in the SM command. It may contain the following groups:

Mode and Modulus Group;
Parameter Negotiation Group;
Private Parameter Group; and
User Data Subfield.

New subclause 7.3.5.3

Insert the following in the last sentence of the third paragraph after "...SABME," and before "or SIM,.....":

SM

Add a new subclause 7.5 as follows:

7.5 Control field formats for modulo 32 768

The control field may be extended by the addition of three contiguous octets immediately following the basic control field of I frames and the supervisory frames. This capability shall provide for an N(S) and N(R) of modulo 32 768.

Control field extension for the information transfer command/response format (I format), the supervisory command/response format (S format), and the unnumbered command/response (U format) shall be as shown in table 5.

In table 5, the x bits are reserved and set to "0". Bit 2 and bit 18 shall be the low-order bits of the sequence numbers.

Table 6 — Control field formats for modulo 32 768

Control field format for	Control field bits											
	First two octets									Next two octets		
	1	2	3	4	5	6	7	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				

Add a new subclause 7.6 as follows:

7.6 Control field formats for modulo 2 147 483 648

The control field may be extended by the addition of seven contiguous octets immediately following the basic control field of I frames and supervisory frames. This capability shall provide for an N(S) and N(R) of modulo 2 147 483 648.

Control field extension for the information transfer command/response format (I format), the supervisory command/response format (S format), and the unnumbered command/response (U format) shall be as shown in table 6.

In table 6, the x bits are reserved and set to "0". Bit 2 and bit 34 shall be the low-order bits of the sequence numbers.

Table 7 — Control field formats for modulo 2 147 483 648

Control field format for	Control field bits											
	First four octets									Next four octets		
	1	2	3	4	5	6	7	8	32	33	34	64
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				

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Subclause 8.1

Insert the following in the first sentence of the third paragraph after "...SABME," and before "or SIM,.....":

SM