INTERNATIONAL TELECOMMUNICATION UNION

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TERMINAL EQUIPMENTS AND PROTOCOLS FOR TELEMATIC SERVICES

PROCEDURES FOR DOCUMENT FACSIMILE TRANSMISSION IN THE GENERAL SWITCHED TELEPHONE NETWORK

ITU-T Recommendation T.30

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation T.30 was revised by the ITU-T Study Group VIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

CONTENTS

INTRODUCTION

i) This Recommendation is intended to apply to document facsimile apparatus covered by Recommendations T.2, T.3 and T.4. It describes the procedures and signals to be used where facsimile equipment is operated over the general switched telephone network. When existing equipment is operating in a non-CCITT manner, it shall not interfere with equipment operating in accordance with the T-Series Recommendations.

ii) Arrangements for automatic calling/answering on the general switched telephone network have been aligned as closely as possible with those described in the V-Series Recommendations for data terminal equipment.

The answering procedures for multifunction terminal configurations are contained in Annex D.

iii) While there are eight possible operating methods (see Table 1) each may be described by five separate and consecutive phases:

Phase A Call set up

Phase B Pre-message procedure for identifying and selecting the required facilities

Phase C Message transmission (includes phasing and synchronization where appropriate)

Phase D Post-message procedure including end-of-message and confirmation and multi-document procedures

Phase E Call release

iv) Two separate signalling systems are described: first a simple system using single frequency tones and second a binary coded system which offers a wide range of signals for more complex operational procedures. Thus tonal signalling is restricted to manual operation at both stations or where a manually operated station intends to transmit to a called station equipped as an automatic answering receiver. Facsimile machines conforming to Recommendations T.2 and T.3 will normally use the tonal signalling system although the binary coded system may be provided in addition where complex procedures are required, e.g. comprehensive automatic functions.

v) For digital document facsimile apparatus conforming to Recommendation T.4 it is intended that the binary coded system shall be the standard signalling arrangement, but additionally a tonal signalling capability may be provided when the digital facsimile apparatus has a fallback capability to apparatus conforming to Recommendations T.2 and T.3. The binary coded signalling has priority and should be tried first; if this fails to elicit a response, tonal signalling should be attempted.

vi) The binary coded signalling system is based on a high level data link control (HDLC) format developed for data transmission procedures. The basic HDLC structure consists of a number of frames each of which is subdivided into a number of fields. It provides for frame labelling, error checking and confirmation of correctly received information and the frames can be easily extended if this should be required in the future.

vii) The transmission of the facsimile message itself (phase C) will be according to the modulation system described in the appropriate Recommendation for the facsimile apparatus.

Recommendation T.30

PROCEDURES FOR DOCUMENT FACSIMILE TRANSMISSION IN THE GENERAL SWITCHED TELEPHONE NETWORK[1)]

(Former Recommendation T.4, Mar del Plata, 1968; amended and renumbered at Geneva, 1976 and 1980, Malaga-Torremolinos, 1984, Melbourne, 1988 and Helsinki, 1993)

The CCITT,

considering

(a) that facilities exist for facsimile transmission over the general switched telephone network;

(b) that such facsimile transmission may be requested either alternatively with telephone conversation or when either or both stations are not attended;

(c) that for this reason the operations involved in establishing and/or releasing a facsimile call should be capable of automatic operation;

unanimously declares the view

that the facsimile apparatus should be designed and operated according to the following standards:

1 Scope

1.1 General

1.1.1 This Recommendation is concerned with the procedures which are necessary for document transmission between two facsimile stations in the general switched telephone network.

These procedures essentially comprise the following:

- call establishment and call release;
- compatibility checking, status and control command;
- checking and supervision of line conditions;
- control functions and facsimile operator recall.

1.1.2 Only the procedures with their corresponding signals are specified in this Recommendation.

1.2 Classification of operating methods

1.2.1 This Recommendation regulates the operational sequence of manually operated facsimile stations as well as of automatic stations.

The automatic facsimile station is understood to be a station which is capable of performing all procedures (listed in 1.1) automatically. In this case, an operator is not necessary.

If, however, an operator is required for any of these procedures, the station must be regarded as a manually operated station.

1.2.2 Based upon all combinations which may result from the fact that there are manually operated stations and automatic facsimile stations, the operating methods shown in Table 1 are possible.

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1) Facsimile apparatus referred to as Groups 1, 2 or 3 in this Recommendation are those conforming to Recommendations T.2, T.3 or T.4, respectively.

TABLE 1/T.30

Method No.	Description of operating method	Direction of facsimile transmission	Overall designation
1	*Manual* operation at calling station and	Calling station *transmits to* called station	1-T
	Manual operation at calling station and	Calling station *receives from* called station	1-R
2	*Manual* operation at calling station and	Calling station *transmits to* called station	2-T
	Automatic operation at called station	Calling station *receives from* called station	2-R
3	*Automatic* operation at calling station and	Calling station *transmits to* called station	3-T
	Manual operation at called station	Calling station *receives from* called station	3-R
4	*Automatic* operation at calling station and	Calling station *transmits to* called station	4-T
	Automatic operation at called station and	Calling station *receives from* called station	4-R
NOTE – There may also be operating methods which will allow messages to be received by more than one station (multipoint connection).			

1.3 Station identification

1.3.1 For the purpose of classifying an automatic facsimile station as a non-speech terminal, a tone must be transmitted to line. As both automatic calling and called facsimile stations transmit tones to line during call establishment, a normal telephone user who becomes inadvertently connected to one will receive tone signals for a period of sufficient duration to indicate clearly to him that he is incorrectly connected.

1.3.2 Additionally an automatic verbal announcement may be used which can provide station identification.

1.4 General provisions

1.4.1 The control signals specified in this Recommendation have been chosen in such a way that the telephone service is not affected.

1.4.2 If any malfunction of the facsimile procedures described in this Recommendation is detected, the call should be released.

1.4.3 Where the called station has automatic facsimile apparatus which is not ready or not able to operate, the call should not be answered automatically.

1.4.4 This Recommendation includes procedures for switching from facsimile to speech. However, speech facilities may be omitted if this is permitted by the regulations of the Administrations.

1.5 Optional provisions

1.5.1 The operator at each station may have the possibility of calling the other station at any time during the progress of the facsimile procedure (see 2.2).

1.5.2 The procedures in this Recommendation allow a facsimile station to transmit and/or receive several documents successively without the aid of an operator.

1.5.3 This Recommendation includes procedures for incorporating a unique station identification command if required to prevent unauthorized stations from demanding a message.

If enhanced security is required, this may be provided by the use of the non-standard facilities frame.

2 Explanation of terms used

2.1 Facsimile station main functions

One or more equipment at the end of the line providing three main functions.

2.1.1 Call establishment and call release

The establishment and release of a connection according to the normal rules of using the general switched telephone network.

2.1.2 Procedure

To identify, to supervise and to control the facsimile transmission according to a protocol.

2.1.3 Message transmission

To transmit and/or receive the facsimile message.

2.2 Time sequence of a facsimile call

See Figure 1.

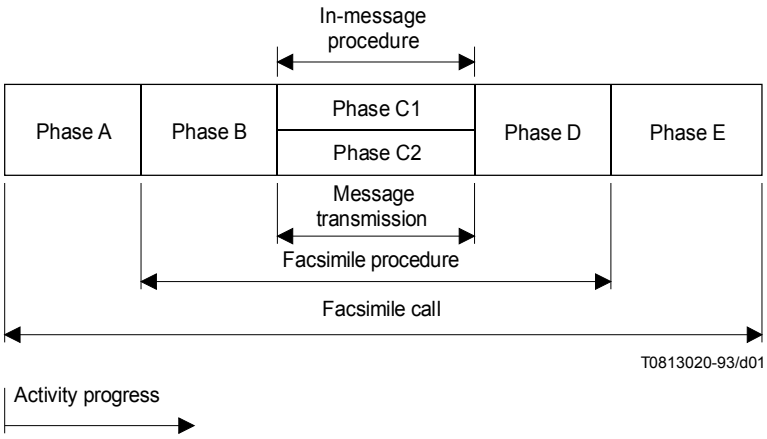

FIGURE 1/T.30

2.3 Description of phases

2.3.1 Phase A – Call establishment

Call establishment can be realized manually and/or automatically.

2.3.2 Phase B – Pre-message procedure

The pre-message procedure consists of the identification of capabilities and the commanding of the chosen conditions as well as the confirmation of acceptable conditions.

When connection is established between apparatus operating in accordance with this Recommendation and apparatus operating in a non-CCITT manner, the equipment should disconnect before the in-message procedure unless both equipment include optional, compatible procedures.

2.3.2.1 Identification section

- group identification;
- confirmation for reception;
- subscriber identification (option);
- non-standard facilities identification (option).

2.3.2.2 Command section

- group command;
- phasing/training;
- synchronization;

as well as the following optional commands;

- non-standard facilities command;
- subscriber identification command;
- polling (send) command;
- line conditioning;
- echo suppressor disabling;

2.3.3 Phase C1 – In-message procedure

The in-message procedure takes place at the same time as message transmission and controls the complete signalling for in-message procedure, e.g in-message synchronization, error detection and correction and line supervision.

2.3.4 Phase C2 – Message transmission

Message transmission procedure is covered by the appropriate Recommendation for the equipment.

2.3.5 Phase D – Post-message procedure

The post-message procedure includes information regarding:

- end-of-message signalling;
- confirmation signalling;
- multipage signalling;
- end-of-facsimile procedure signalling.

2.3.6 Phase E – Call release

Call release shall be realized manually and/or automatically.

3 Description of a facsimile call

3.1 Phase A – Call establishment[2)]

The establishment of a facsimile call may be realized either manually, if an operator is in attendance, or automatically. To accomplish this, four operating methods have been defined.

3.1.1 Operating method 1

Manual operation at both the calling and called station. Figure 2 indicates the operators' actions required to establish a call.

3.1.2 Operating method 2

Manual operation at the calling station and automatic operation at the called station. Figure 3 indicates the operator's and apparatus actions required to establish a call.

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2) See Appendix II for abbreviations used in this Recommendation.

Call event No.	Calling station	Called station
1	Operator hears dial tone and dials desired number	
2	Operator hears ringing tone	Calls rings and operator answers the call
3	Verbal identification	Verbal identification
4	Facsimile machine is switched to line	Facsimile machine is switched to line
5	Begin facsimile procedure (see clause 4 and/or 5)	Begin facsimile procedure (see clause 4 and/or 5)

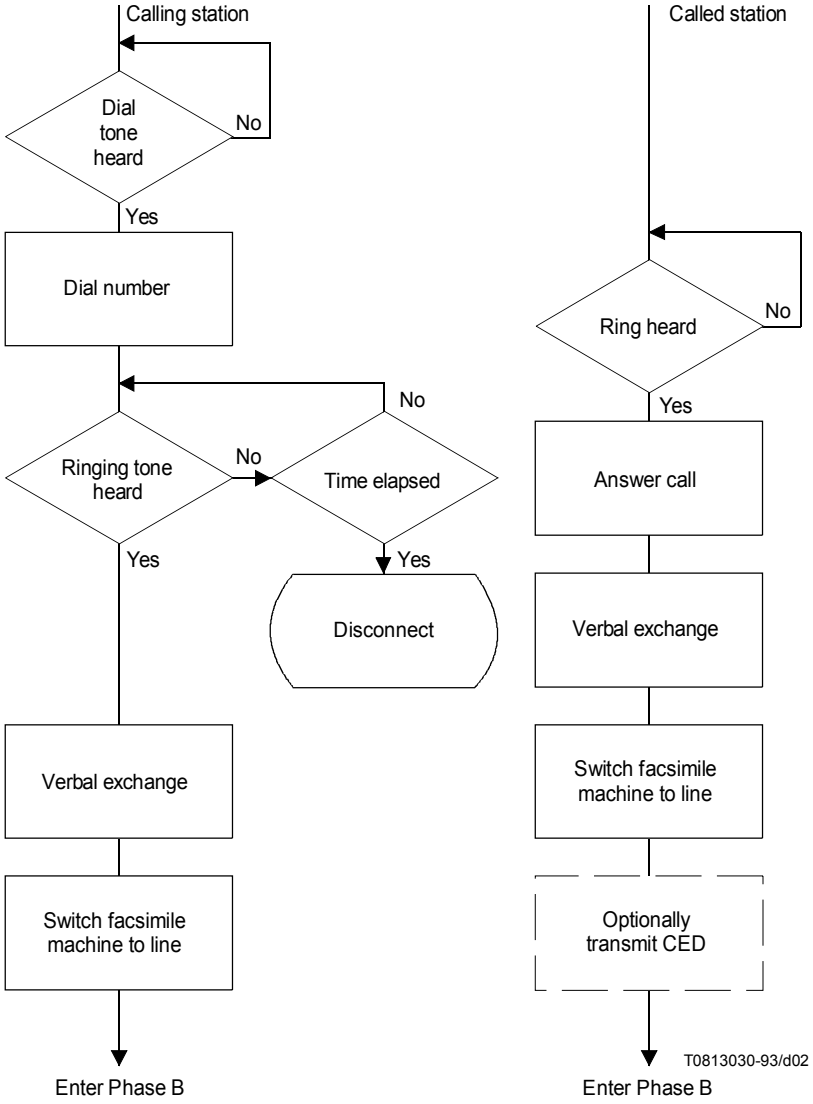


FIGURE 2/T.30

Call establishment, operating method 1

Call event No.	Calling station	Called station
1	Operator hears dial tone and dials desired number	
2	Operator hears ringing tone	Equipment detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4	Operator hears CED and facsimile machine is switched to line	Transmit CED
5	Begin facsimile procedure (see clause 4 and/or 5)	Begin facsimile procedure (see clause 4 and/or 5)

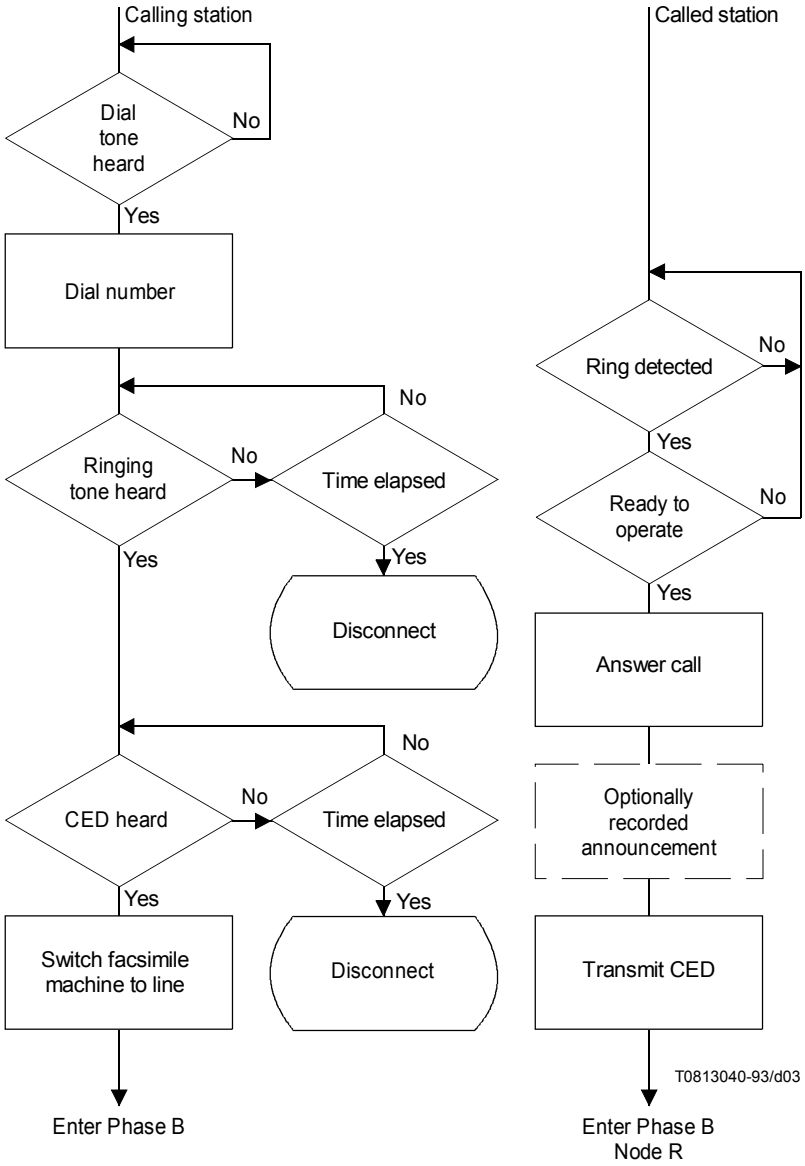


FIGURE 3/T.30

Call establishment, operating method 2

3.1.3 Operating method 3

Automatic operation at the calling station and manual operation at the called station. Figure 4 indicates the operator's and apparatus actions required to establish a call.

3.1.4 Operating method 4

Automatic operation at both the calling and called stations. Figure 5 indicates the actions required by the apparatus to establish a call.

3.2 Phases B, C and D – Facsimile procedure

When entering phase B, the following rules should be adhered to:

All manual receivers and all auto-answering units must enter phase B by identifying their capabilities (i.e Node R of the flow diagram in 4.2 or 5.2). All manual transmitters and all auto-calling units must enter phase B prepared to detect the capabilities and issue the appropriate mode setting command (i.e Node T of the flow diagram in 5.2). To allow for operating method 2-R, the delay between the transmission of the digital identification signals shall be 4.5 seconds ± 15% when sent from a manual facsimile receiver.

The detailed information pertaining to the tonal and binary coded facsimile procedures is contained in 4 and 5. The relationship between these two procedures and an overview regarding the total system operation is given in the following.

3.2.1 The interaction between tonal and binary coded procedures

Facsimile procedures, as described in this Recommendation, may be realized in two different ways:

- tonally, with a limited number of tones for simple procedures (see 4); and
- binary coded, for more comprehensive procedures (see 5).

Binary coded signalling is especially desirable for machines which use:

- comprehensive automatic functions;
- digital concepts internally (e.g redundancy reduction techniques);
- fast transmission rates (in order to keep pre- and post-message time short compared to total transmission time);
- special security features.

Recommendations concerning the interaction between tonal and binary coded signalling recognize the principle of the priority of coded procedures such that, when available, binary coded signalling shall be tried first. The interaction steps are as follows:

- The unattended called station shall answer a call with the CED signal.
- The unattended calling station shall indicate a call with the CNG signal.
- Whenever it is capable of binary coded signalling, the called station will start with binary coded signalling.
- Facsimile stations being capable of tonal signalling only will start tonally.
- Facsimile stations being capable of both binary coded and tonal signalling will send a sequence of signals, the first being a binary coded signal and the second and all following signals being a composite of tonal and binary coded information.
- If the calling station reacts tonally, then the tonal signalling goes on through all procedures.

An example of a station having both binary-coded and tonal capabilities is shown in Figure 6 for further clarification.

Call event No.	Calling station	Called station
1	Equipment detects dial tone and dials desired number (see Note). To clearly indicate to a called operator that he is connected to a facsimile machine or to a normal telephone user that he is inadvertently connected, CNG will be transmitted to line during the time that signals are attempted to be detected.	
2		Call rings and operator answers the call
3		Operator detects CNG and switches facsimile machine to line (optionally CED may be generated)
4	Begin facsimile procedure (see clause 5)	Begin facsimile procedure (see clause 5)
NOTE – An alternative procedure may be specified by Administrations.		

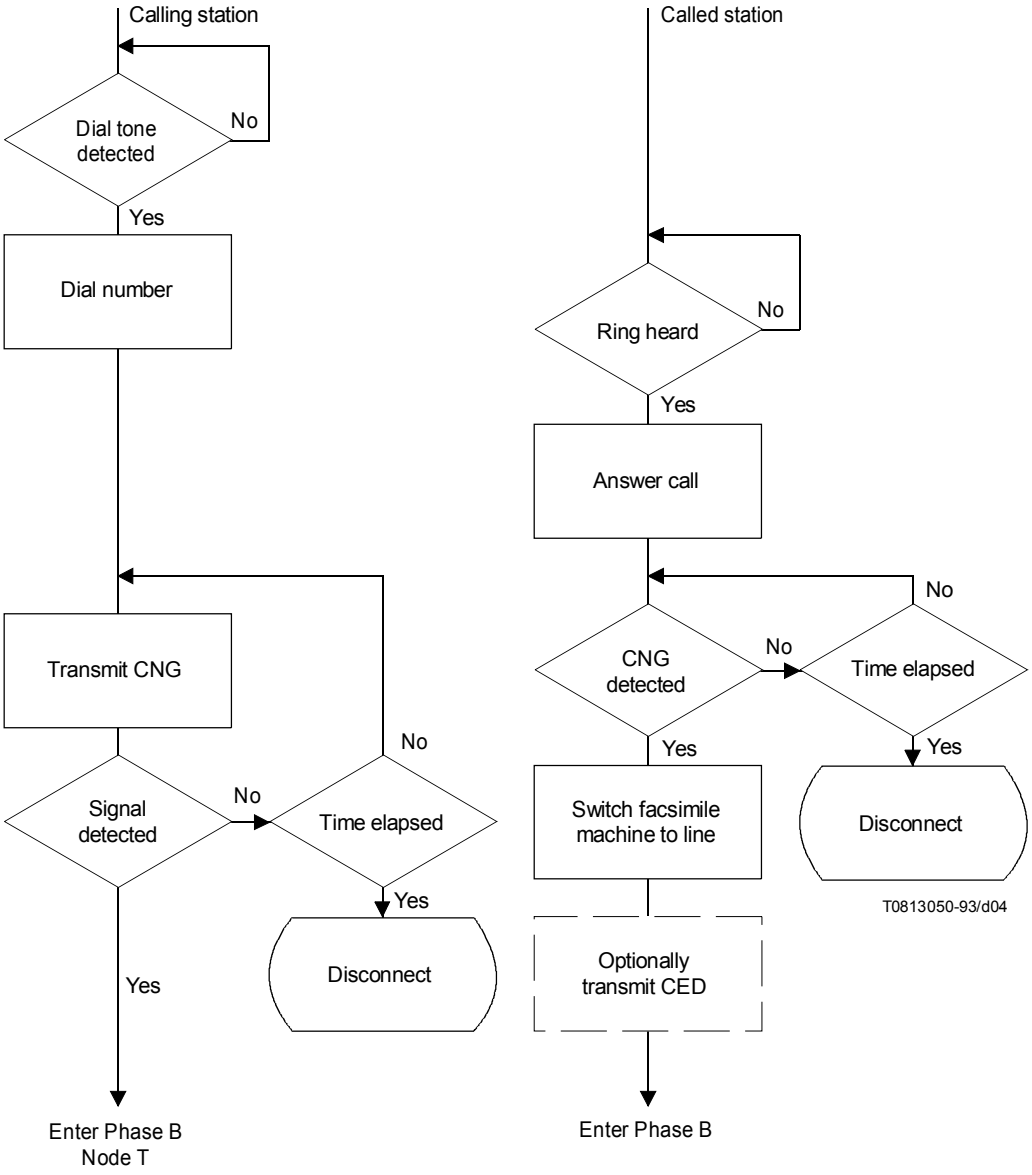


FIGURE 4/T.30

Call establishment, operating method 3

Call event No.	Calling station	Called station
1	Equipment detects dial tone ands dials desired number (see Note). To clearly indicate to a normal telephone user that he is inadvertently connected, CNG will be transmitted to line during the time that signals are attempted to be detected	
2		Equipment detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4		Transmit CED
5	Begin facsimile procedure (see clause 5)	Begin facsimile procedure (see clause 5)
NOTE – An alternative procedure may be specified by Administrations.		

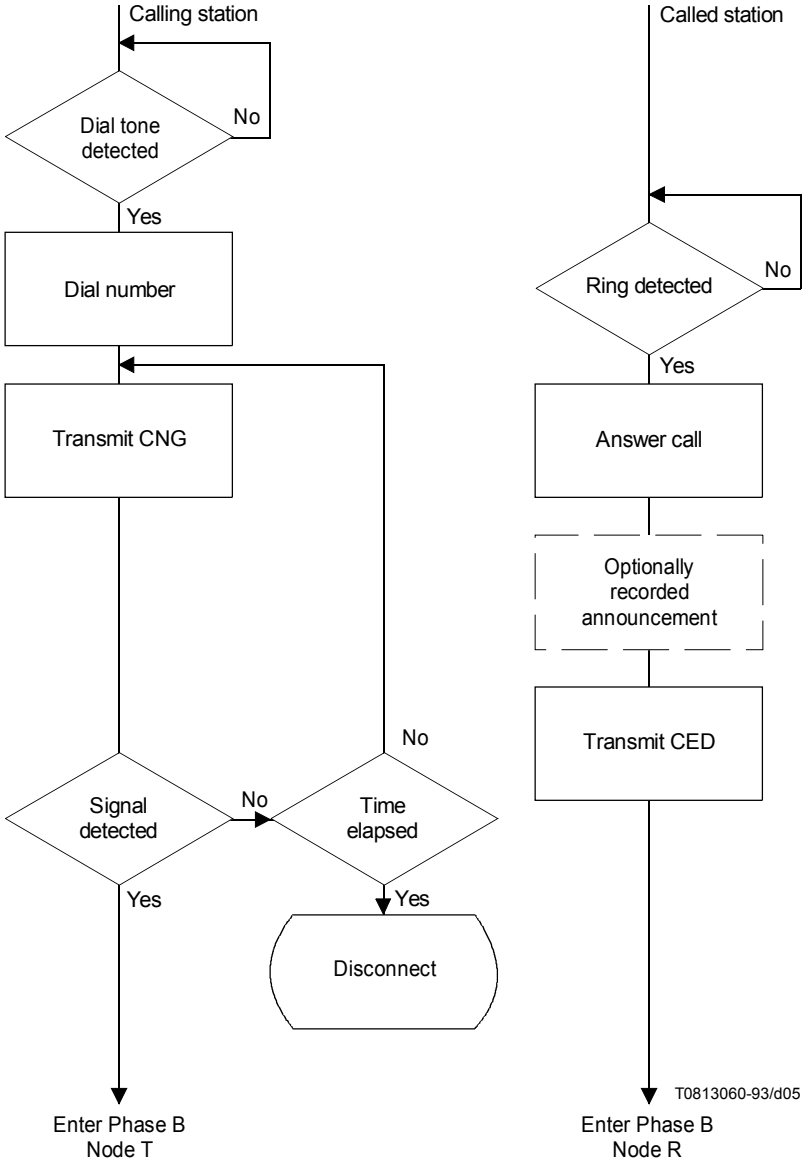
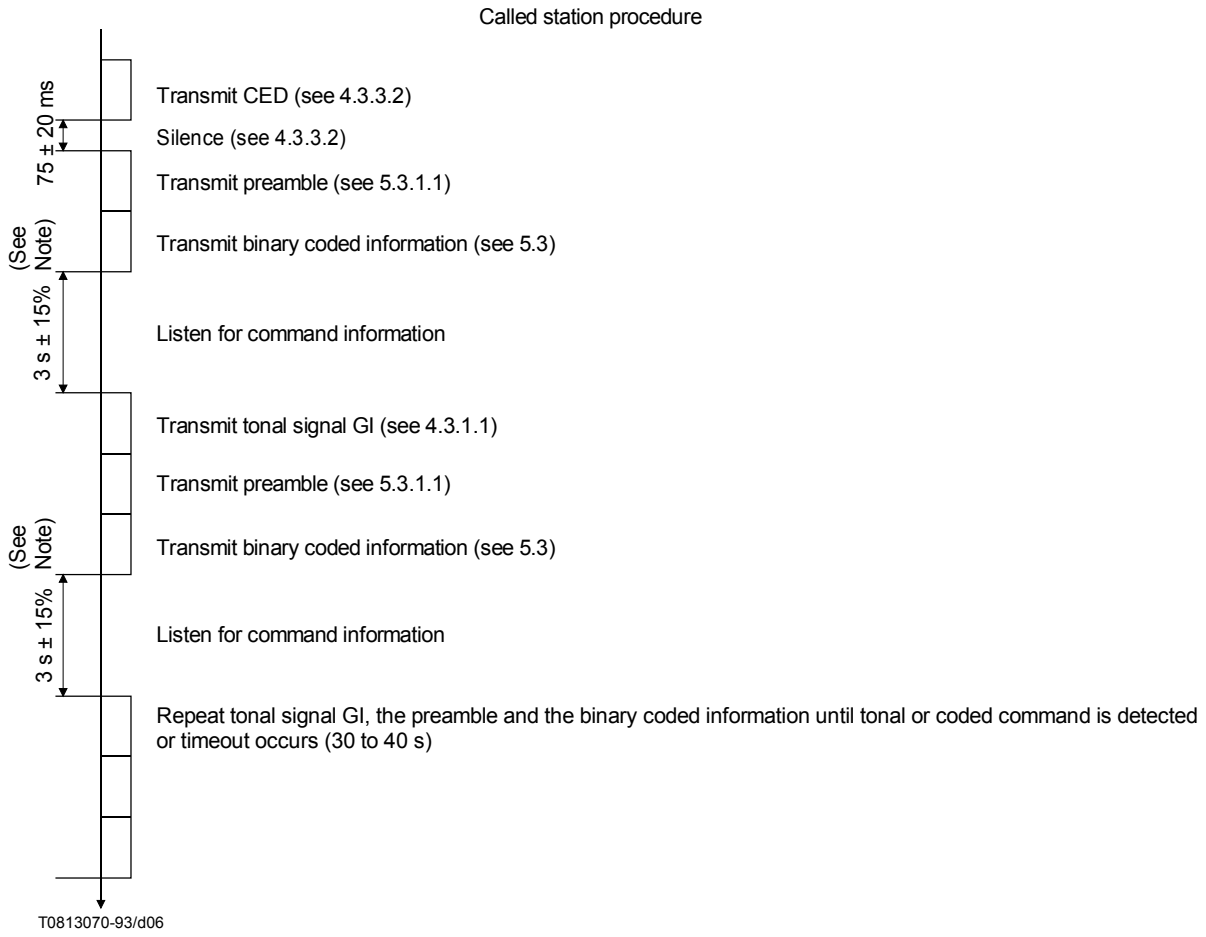


FIGURE 5/T.30

Call establishment, operating method 4



NOTE – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

FIGURE 6/T.30

Binary-tonal identification signal

3.2.2 Signal sequences

The recommended system utilizes the interchange of signals between the two equipment to verify compatibility and assure operation. To do this, the called station identifies its capabilities tonally (in the simplest configuration) and/or binary coded. The calling station responds to this accordingly with a command tonally or binary coded. Now the transmitter continues phase B.

Following the transmission of the message, the transmitter sends an end-of-message signal and the receiver confirms reception. Multiple documents can then be transmitted by the repetition of this procedure.

The flow of signals is shown in Figure 7 for the configuration where the calling station is transmitting. These signals may be tonal or binary coded, subject to the conditions of 3.2.1.

The condition where the calling station is to receive documents is shown in Figure 8. The simple tonal systems do not provide this capability.

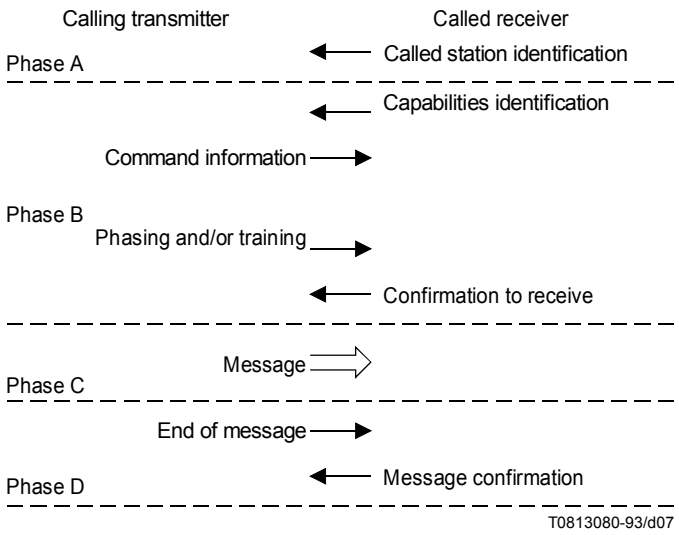


FIGURE 7/T.30

Calling station is transmitting

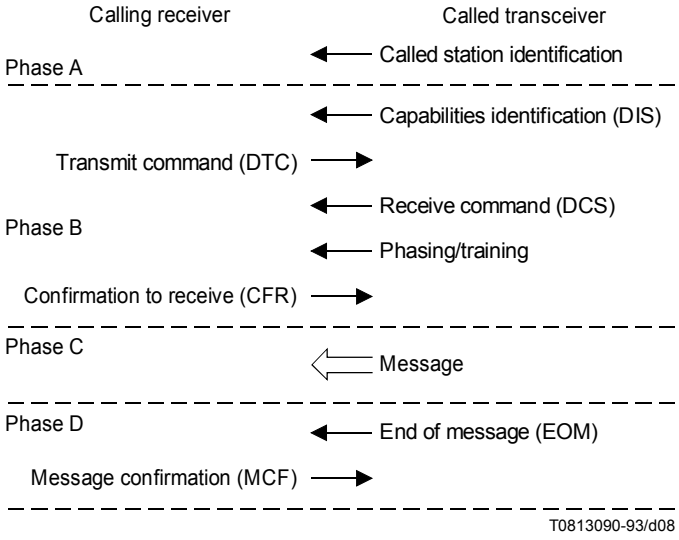


FIGURE 8/T.30

Calling station is receiving

3.3 Phase E – Call release

Call release occurs after the last post-message signal of the procedure or under certain conditions, e.g:

3.3.1 Time out

When a signal as specified by the facsimile procedure is not received within the specified time-out period, the apparatus may signal to the operator (if one is in attendance) or disconnect the telephone connection. The appropriate time-out periods are specified in clauses 4 and 5.

3.3.2 Procedural interrupt

The facsimile procedure may be interrupted by sending a procedural interrupt signal, by notifying the attending operator or by disconnecting the connection. The signal is defined in clauses 4 and 5.

3.3.3 Command

In the case where binary coded procedures are utilized, the call may be immediately terminated by the binary coded system commands, as specified in clause 5.

4 Tonal signalling for facsimile procedure

This signalling system covers operating methods 1-T and 2-T and has to be implemented for apparatus operating according to Recommendations T.2 and T.3.

4.1 Description

Phases B and C

Transmitter	Receiver
	1. Transmit GI
2. GI detected	
3. Select appropriate group	
4. Transmit GC	
5. Transmit phasing	
	6. Detect GC and phasing Select group and phase
	7. Transmit CFR
8. Detect CFR	
9. Transmit message	

Phase D

Single-document transmitter	Multi-document receiver
1. Transmit EOM	
	2. Detect EOM
	3. Transmit MCF
	4. Prepare for next document
5. Detect MCF Switch back to telephone Operator loads document	
	6. When ready to receive transmit GI
7. Operator hears GI and switches machine to line	
8. Detect GI	
9. Transmit GC Continue phases B and C	

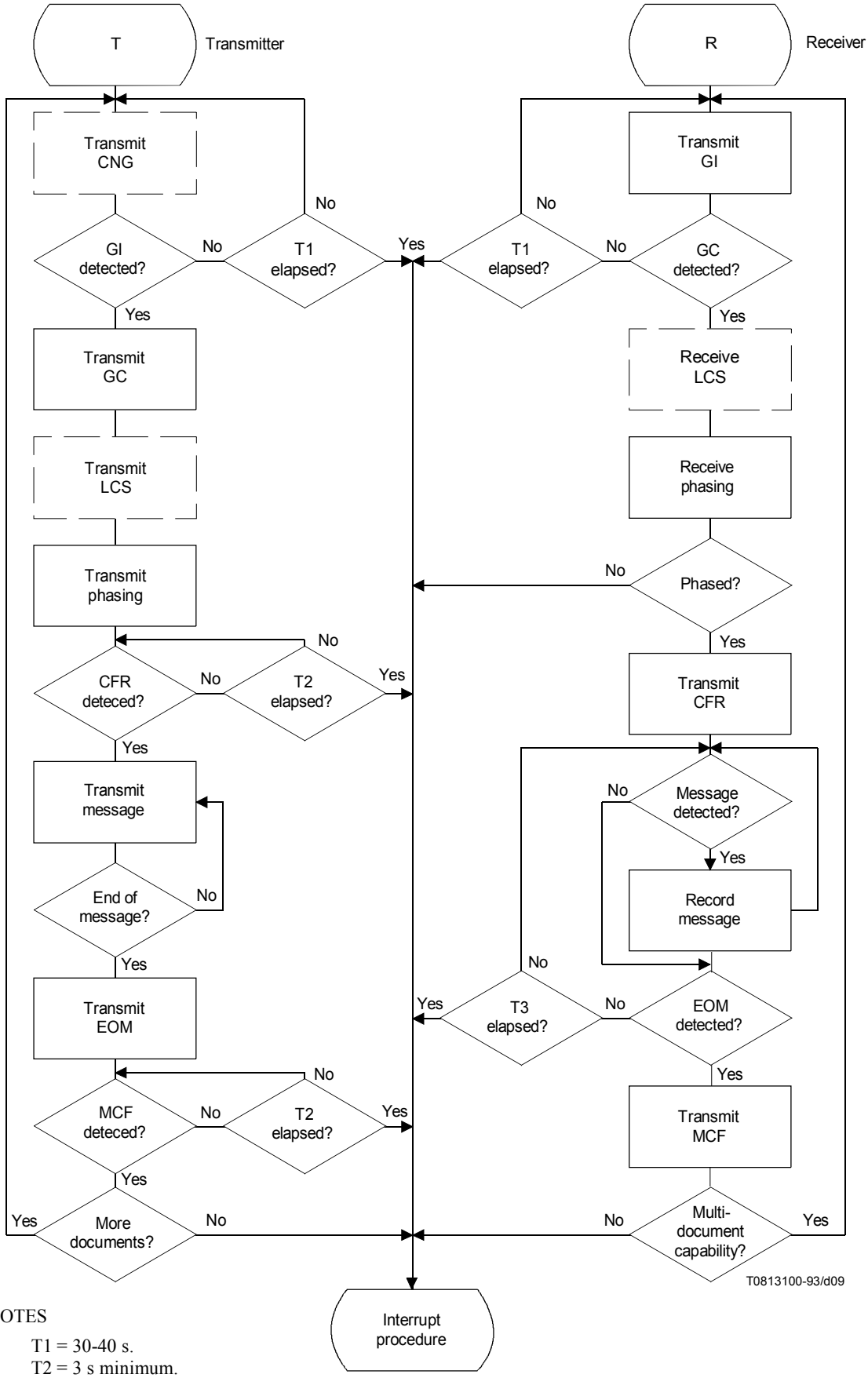
Multi-document transmitter	Single-document receiver
1. Transmit EOM	
	2. Detect EOM
	3. Transmit MCF
	4. Switch back to telephone Operator loads paper
5. Detect MCF and prepare for next document	
6. When ready to transmit, transmit CNG (optional)	
	7. Operator hears CNG and switches machine to line
	8. Transmit GI
9. Detect GI	
10 Transmit GC Continue phases B and C	

Multi-document transmitter to multi-document receiver and single document facsimile apparatus operate accordingly.

NOTE – It is acknowledged that there is existing equipment in the field that may not conform in all aspects to this Recommendation. Therefore, the decision may be made to go to a mode of operation other than specified herein. The diagram of Appendix I describes, as an example, one of these conditions. Other methods may be possible as long as they do not interfere with the recommended operation.

4.2 Flow diagram

See Figure 9.



NOTES

1 T1 = 30-40 s.
2 T2 = 3 s minimum.
3 T3 = 1 s minimum.
4 Broken boxes indicate signals not used in all methods.

FIGURE 9/T.30

4.3 Tonal signal functions and formats

The signals used are single frequencies to line. The equipment used to detect the signal should be capable of functioning correctly with the frequency tolerances quoted plus an additional tolerance of ± 6 Hz due to the line.

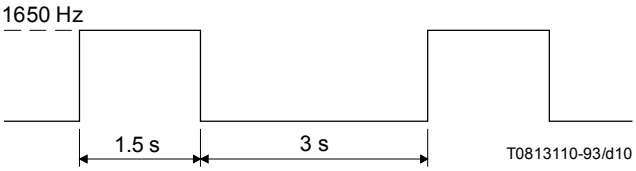
4.3.1 Facsimile receiver signals (signals transmitted by the receiver)

4.3.1.1 Group identification (GI) signals

4.3.1.1.1 GI 1 (Group 1)

Format

See Figure 10.



NOTE – Tolerances: timing ± 15%: frequency ± 6 Hz.

FIGURE 10/T.30

Function

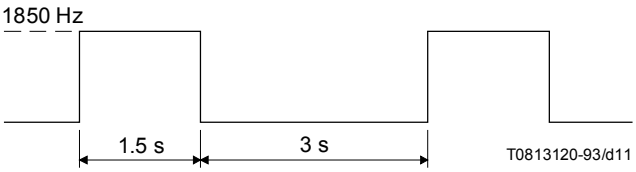
1) To indicate the apparatus is in the receive mode and capable of receiving at least one page in the Group 1 mode.

2) The signal is repeated until detection of GC or time T1 elapses.

4.3.1.1.2 GI 2 (Group 2)

Format

See Figure 11.



NOTE – Tolerances: timing ± 15%: frequency ± 6 Hz.

FIGURE 11/T.30

Function

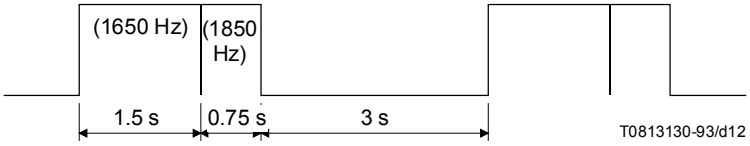
1) To indicate the apparatus is in the receive mode and is capable of receiving at least one page in the Group 2 mode.

2) The signal is repeated until detection of GC or time T1 elapses.

4.3.1.1.3 GI 1/2 (Group 1/2)

Format

See Figure 12.



NOTE – Tolerances: timing ± 15%: frequency ± 6 Hz.

FIGURE 12/T.30

Function

1) To indicate the apparatus is in the receive mode and is capable of receiving at least one page in the Group 1 or Group 2 mode. The apparatus is capable of adjusting automatically to the speed of the transmitting.

2) The signal is repeated until detection of GC or time T1 elapses.

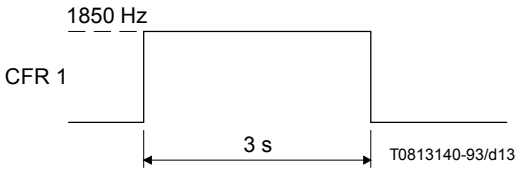
NOTE – To prevent confusing the repeating GI signal with the busy tone, it may be required by certain Administrations that a delay be incorporated prior to answering the call.

4.3.1.2 Confirmation to receive (CFR) signals

4.3.1.2.1 CFR 1 (Group 1)

Format

See Figure 13.



NOTE – Tolerances: timing ± 15%: frequency ± 6 Hz.

FIGURE 13/T.30

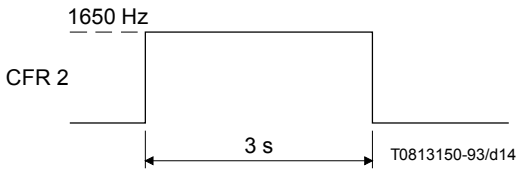
Function

To indicate that the receiver has phased and is ready to receive at least one page in the Group 1 mode. The signal must start after the completion of the phasing signal at the receiver with a maximum delay of one second.

4.3.1.2.2 CFR 2 (Group 2)

Format

See Figure 14.



NOTE – Tolerances: timing ± 15%: frequency ± 6 Hz.

FIGURE 14/T.30

Function

To indicate that the receiver has phased and is ready to receive at least one page in the Group 2 mode. The signal must start after the completion of the phasing signal at the receiver with a maximum delay of one second.

4.3.1.3 Message confirmation (MCF) signal

4.3.1.3.1 MCF 1 (Group 1)

Format

The same frequency and duration as for CFR 1.

Tolerances : timing ± 15% ; frequency ± 6 Hz.

Function

To indicate that the receiver has received one page in Group 1 mode.

4.3.1.3.2 MCF 2 (Group 2)

Format

The same frequency and duration as for CFR 2.

Tolerances : timing ± 15% ; frequency ± 6 Hz.

Function

To indicate that the receiver has received one page in the Group 2 mode.

NOTE – The MCF signal must start a maximum of 0.5 second after the completion of the EOM signal (see 4.3.2.4) at the receiver.

4.3.2 Facsimile transmitter signals (signals transmitted by the transmitter)

4.3.2.1 Group command (GC) signal

Format

GC1 = 1300 Hz ± 32 Hz for a duration of more than 1.5 seconds and less than 10 seconds

GC2 = 2100 Hz ± 10 Hz for a duration of more than 1.5 seconds and less than 10 seconds

Function

To indicate to the receiver the Group that the transmitter has chosen. The GC signal starts at the end of the capabilities identification signal with a maximum delay of 1 second as measured on the line at the transmitter.

NOTE – It should be noted that the capabilities identification of a combined Group 1 or 2 and Group 3 machine may consist of the tonal GI signal concatenated with the binary coded identification signal. Some equipment exists which sends the GC signal at the end of the GI signal and not at the end of the capabilities identification signal. This should be avoided in new designs. However, manufacturers of combined group equipment should take account of this anomaly.

4.3.2.2 Line conditioning signals (LCS)

Format

As in Recommendation T.3

Function

1) To enable a receiver to equalize the line.

2) This is an optional signal and non-transmission should not affect compatibility.

4.3.2.3 Phasing

Format and function

As defined by Recommendations T.2 and T.3

4.3.2.4 End-of-message (EOM) signal

Format

1100 Hz ± 38 Hz. Timing : 3 seconds ± 15% immediately following the message.

Function

To indicate phase C has been completed.

4.3.3 Common signals

4.3.3.1 Procedure interrupt signal (PIS) (applicable in both directions)

Format

462 Hz ± 1.5 Hz for 3 seconds minimum

Function

1) To stop a distant machine

2) May be used as operator recall

NOTES

1 This is an optional signal

2 Some Administrations have in use national telephone signalling systems which may interpret this signal as a clearing signal. This may cause clear down of the connection.

3 Some machines use this signal as a disconnect signal only when the receiver detects this signal immediately after transmitting MCF or transmitting MCF/GI and, in either case, before a subsequent GI.

4 The satisfactory operation of the PIS signal cannot be guaranteed in the presence of, for example, echo suppressors.

4.3.3.2 Called station identification (CED)

At 1.8 to 2.5 seconds after the called station is connected to the line, it sends a continuous 2100 Hz ± 15 Hz tone for a duration of not less than 2.6 seconds and not more than 4.0 seconds.

The called station delays for a period of 75 ± 20 milliseconds after terminating the CED tone before transmitting further signals.

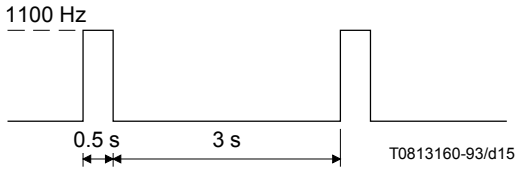
Function

To indicate a called non-speech terminal.

4.3.3.3 Calling tone (CNG)

Format

See Figure 15.



1100 Hz, ON for 0.5 second, OFF for 3 seconds.

NOTE – Tolerances: timing ± 15%: frequency 1100 Hz ± 38 Hz.

FIGURE 15/T.30

Function

1) To indicate a calling non-speech terminal. This signal is mandatory for automatic calling units and optional or manual units.

2) To indicate that the apparatus is in the transmit mode and is ready to transmit on receipt of the appropriate GI.

3) Where an apparatus is capable of sending more than one document without the necessity of operator assistance, this signal may be transmitted between documents whilst the transmitter is waiting for the appropriate GI. It would indicate to an operator that the transmitter was still connected to line.

NOTE – It should generally be assumed that for Group 1 and Group 2 transmissions, echo suppressors may be in the circuit.

5 Binary coded signalling for facsimile procedure

For Group 1 and Group 2 machines that require additional facilities to those provided by the procedures described in 4, the binary coded control procedures should be transmitted in a synchronous mode at 300 bits per second.

For Group 3 machines, 300 bits per second is the standard data signalling rate for the transmission of binary coded procedural data. Additionally, signalling of the binary coded procedural data at 2400 bits per second is allowed as a recognized option.

For Group 3 machines, an error correction capability is utilized as a recognized option. This procedure is defined in Annex A.

Except as otherwise noted, the binary coded control procedures should be transmitted in a synchronous mode on the general switched telephone network at 300 bits per second ± 0.01% utilizing the characteristics of the Recommendation V.21 channel No. 2 modulation system. For the tolerances, see 3/V.21. Signal generators should have a distortion not exceeding 1% and the control signal receivers should accept signals with a distortion not exceeding 40%.

NOTES

1 For Group 3 machines, the transmission of training, TCF, and all in-message signals, shall be at the data rate of the high-speed message channel.

2 It is acknowledged that existing equipment may not conform in all aspects to this Recommendation. Other methods may be possible as long as they do not interfere with the recommended operation.

3 Transmission of signals utilizing the modulation system of Recommendation V.21 channel No. 2 should be followed by a delay of 75 ± 20 milliseconds before the signalling, utilizing a different modulation system, commences (e.g. the delay between DCS and the Recommendation V.27 *ter* or V.29 training sequence).

4 The transmission of signalling utilizing the modulation systems of Recommendations V.27 *ter*, V.29, V.33 or V.17 should be followed by a delay of 75 ± 20 milliseconds before the signalling, utilizing a different modulation system, commences (e.g. the delay between RTC and MPS).

5 Group 3 machines using the modulation system defined in V.17 (as specified by bits 11, 12, 13 and 14 of Table 2) shall use the short resynchronization sequence defined in Table 3/V.17 for all trellis mode training except during a TCF message and the first high speed message after a CTC/CTR ECM message sequence. The long synchronization sequence shall be used in the TCF and the first high speed message after the CTC/CTR sequence.

For Group 3 machines, a capability to operate over public digital networks is provided as a standardised option. This procedure is defined in Annex C.

5.1 Description

Phases B, C and D

Case 1: Calling station wishes to transmit (see Figure 7).

Calling station	Called station
	1. Transmit DIS
2. DIS detected	
3. Transmit DCS	
	4. DCS detected
	5. Select mode
6. Transmit phasing/training	
	7. Phasing/training
	8. Transmit CFR
9. Detect CFR	
10. Transmit message	
	11. Receive message
12. At the end of message send either: a) EOM, or b) EOP, or c) MPS, or d) PRI-Q, or e) PPS-NULL, or f) PPS-MPS, or g) PPS-EOM, or h) PPS-EOP, or i) PPS-PRI-Q	
	13. Detect EOM, EOP, MPS, PRI-Q, PPS-NULL, PPS-MPS, PPS-EOM, PPS-EOP or PPS-PRI-Q
	14. Transmit of the confirmation signals of post-message responses (see 5.3.6.1.7)
NOTE – Binary coded signals must be preceded by a preamble (see 5.3.1).	

Case 2: Calling station wishes to receive (see Figure 8).

Calling station	Called station
	1. Transmit DIS
2. DIS detected	
3. Transmit DTC	
	4. DTC detected
	5. Transmit DCS
6. DCS detected	
7. Select mode	
	8. Transmit training/phasing
9. Training/phasing	
10. Transmit CFR	
	11. Detect CFR
	12. Transmit message
13. Receive message	
	14. At the end of message send either: a) EOM, or b) EOP, or c) MPS, or d) PRI-Q, or e) PPS-NULL, or f) PPS-MPS, or g) PPS-EOM, or h) PPS-EOP, or i) PPS-PRI-Q
15. Detect EOM, EOP, MPS, PRI-Q, PPS-NULL, PPS-MPS, PPS-EOM, PPS-EOP or PPS-PRI-Q	
16. Transmit of the confirmation signals of post-message responses (see 5.3.6.1.7)	

5.2 Flow diagrams – Figures 5.2A to 5.2H (see also Appendix IV)

For the Notes and an explanation of terms to the flow diagrams, see 5.2.1.

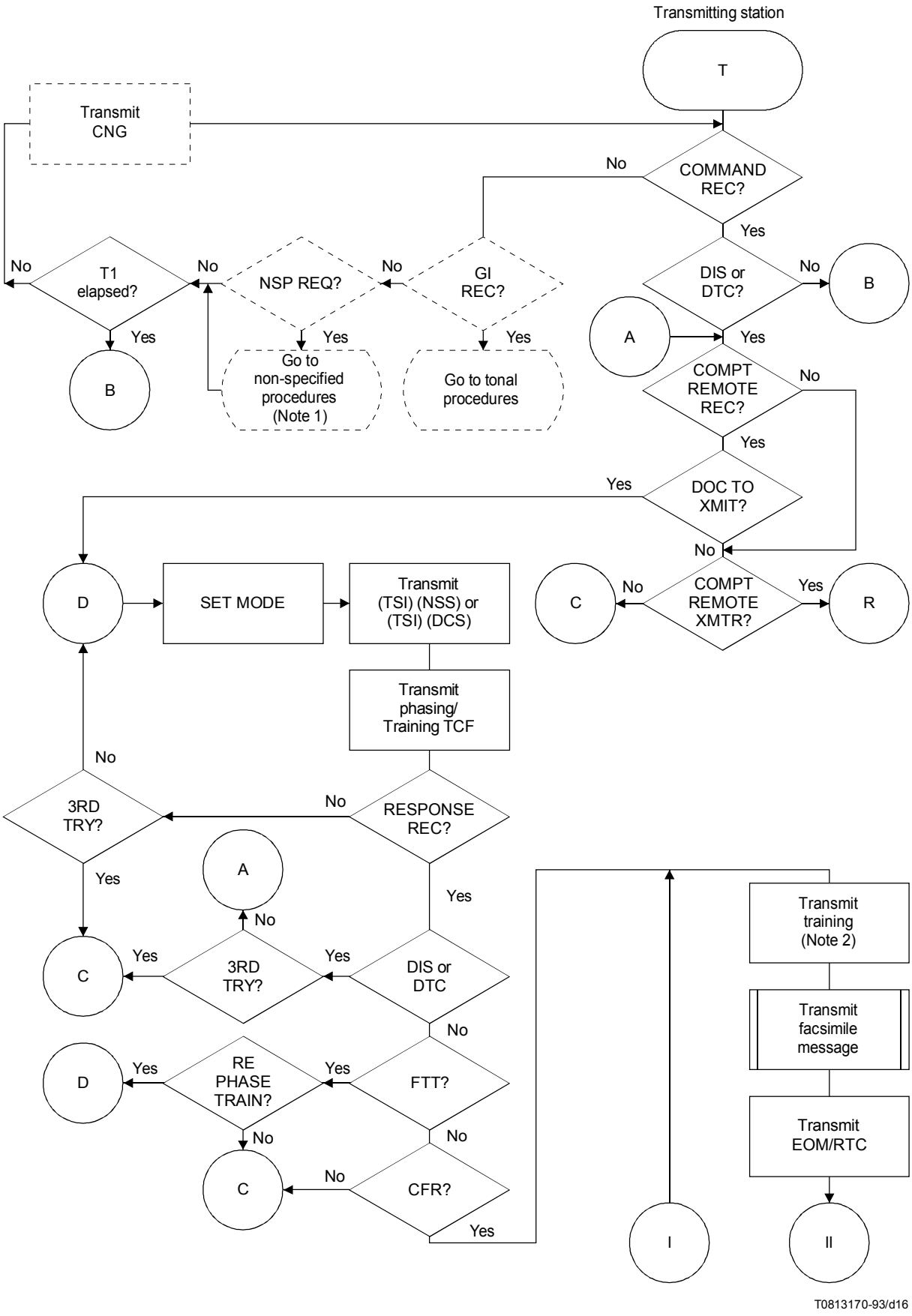


FIGURE 5.2A/T.30

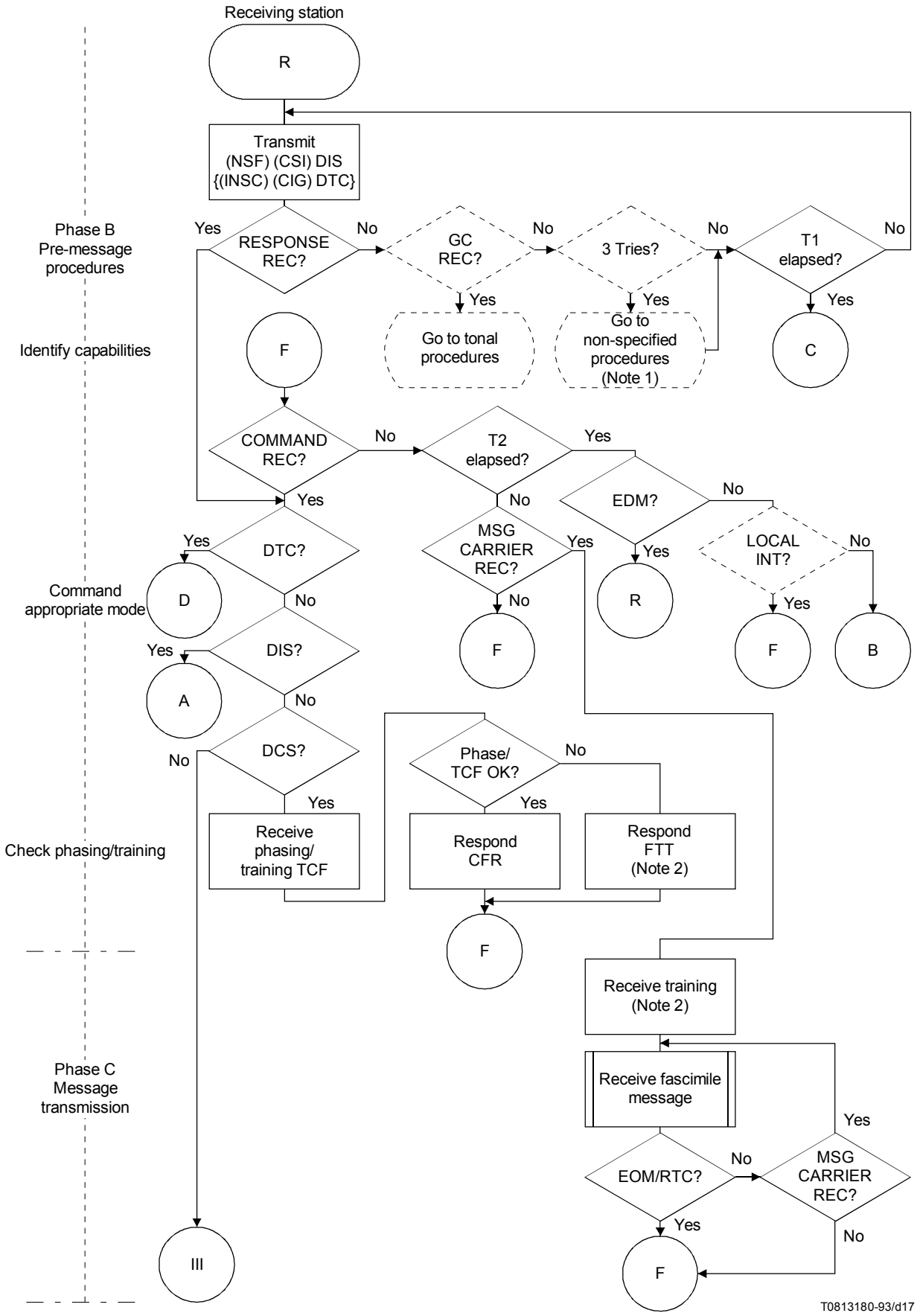


FIGURE 5.2B/T.30

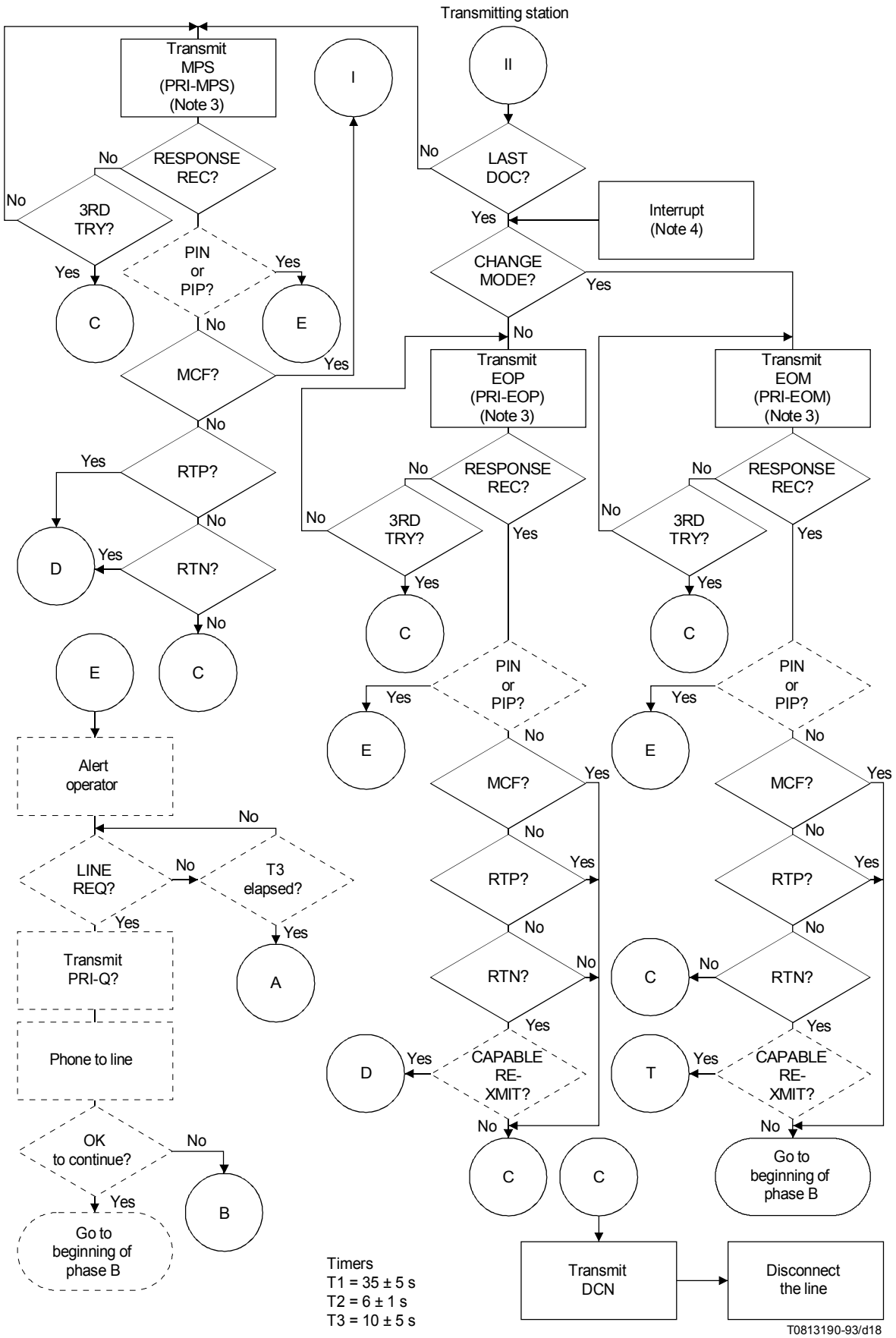


FIGURE 5.2C/T.30

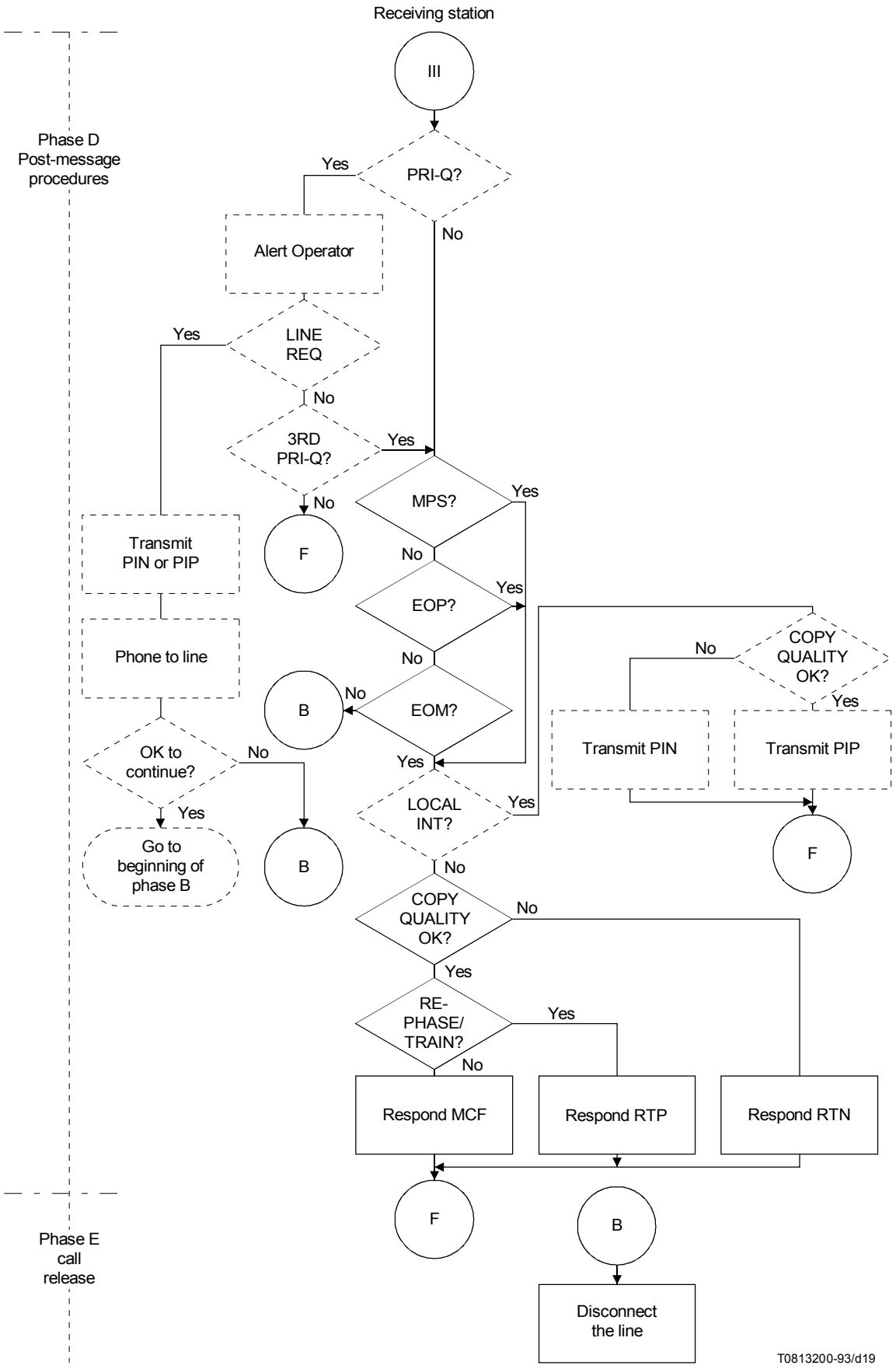
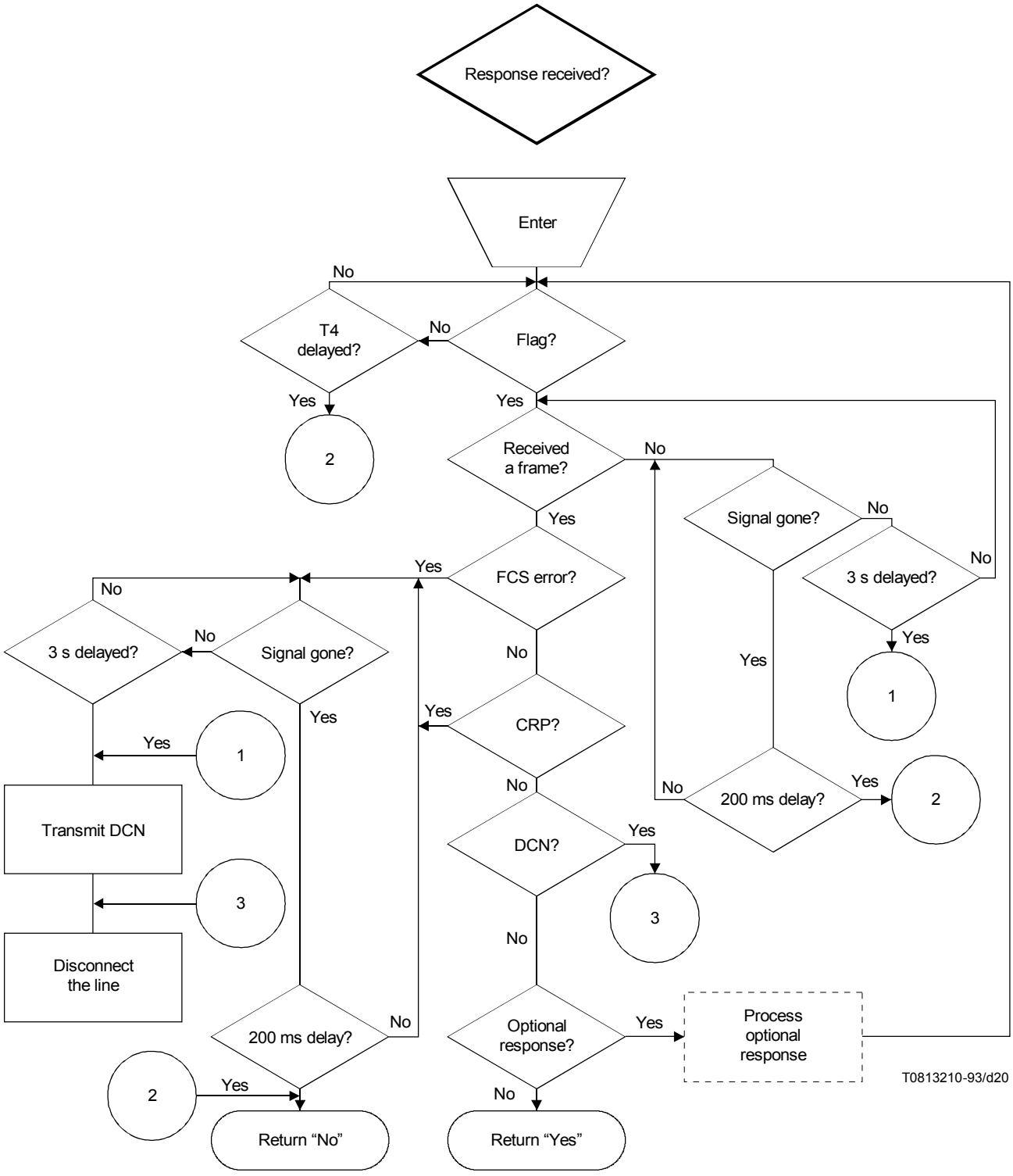


FIGURE 5.2D/T.30



T4 = 4.5 s ± 15% for manual units
T4 = 3.0 s ± 15% for automatic units

FIGURE 5.2E/T.30

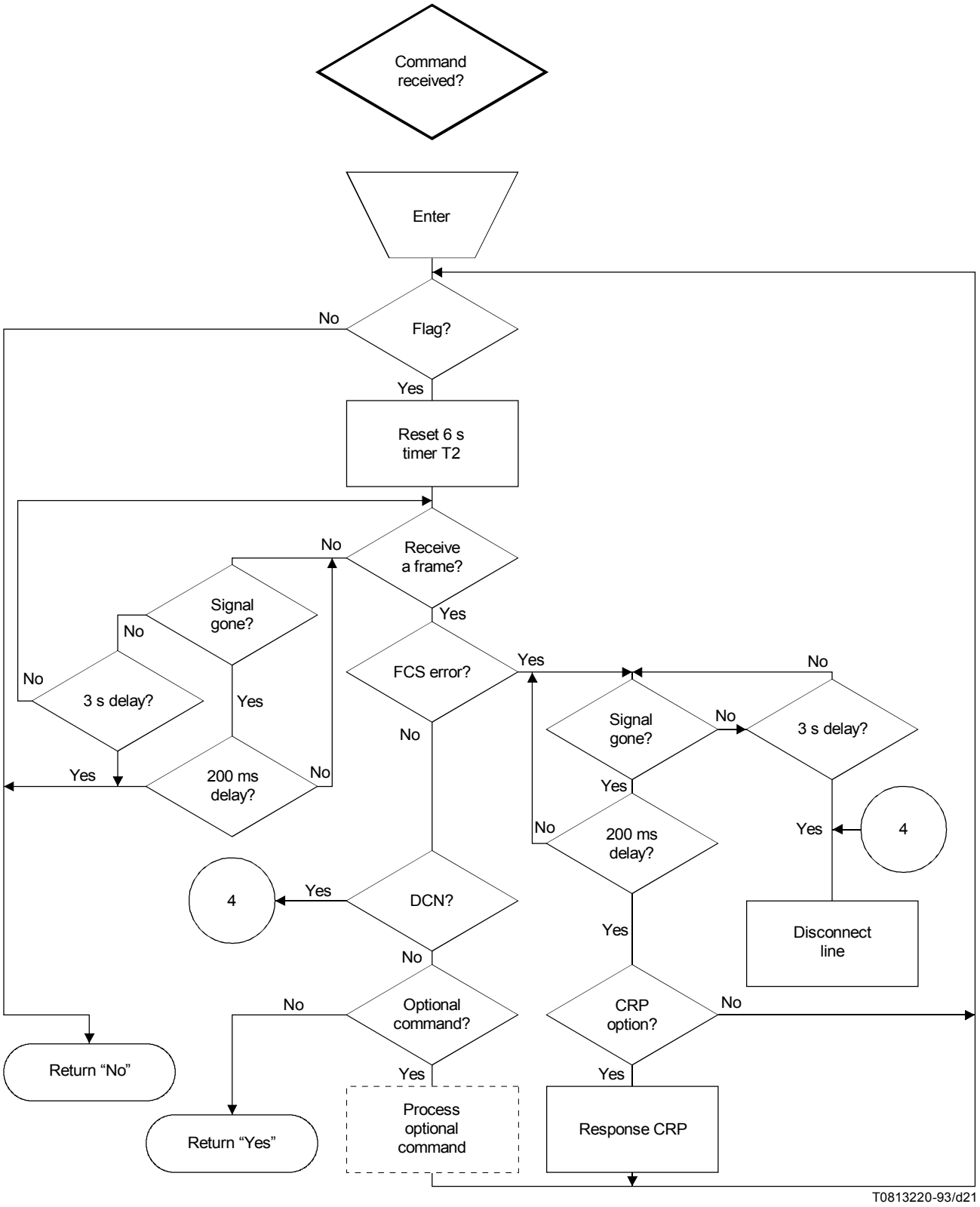
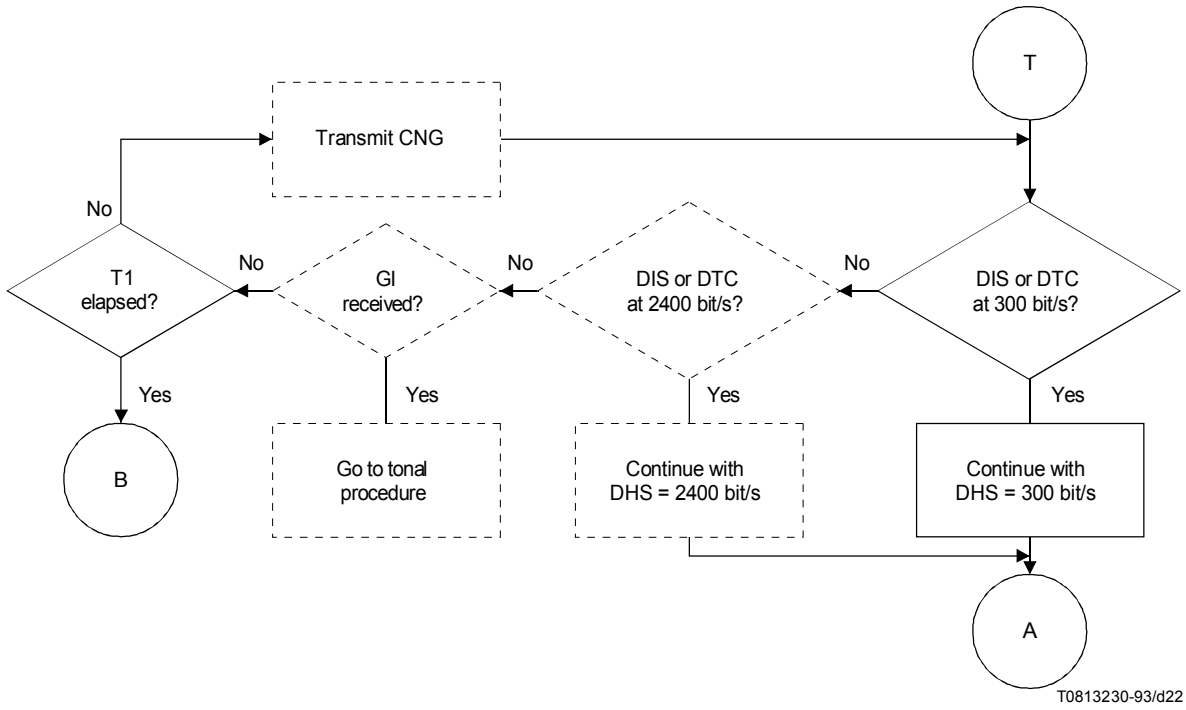


FIGURE 5.2F/T.30

Interworking between the standard mode (300 bit/s) and the recognized optional mode (2400 bit/s) for the binary coded handshaking procedure is provided by an alternating method.

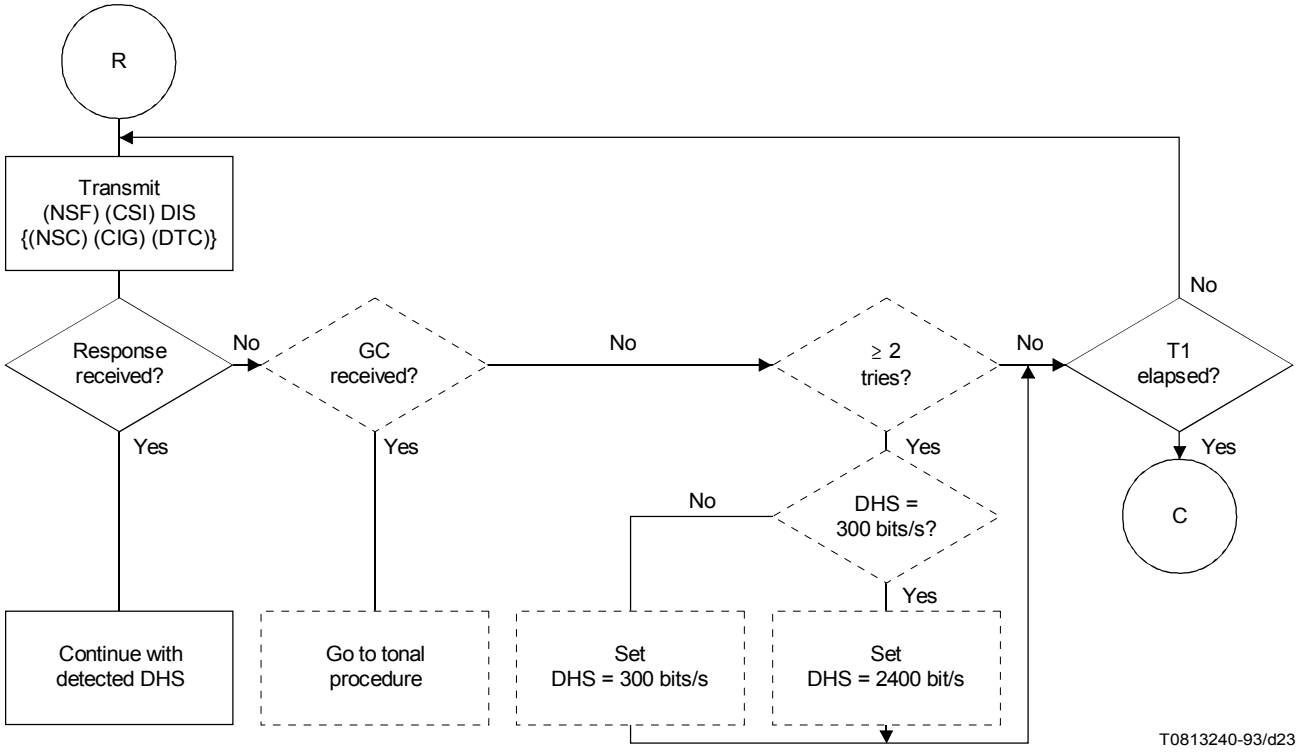
Left-hand side of beginning of phase B of the flow diagram



NOTE – DHS = Digital handshaking speed and dotted lines = optional.

FIGURE 5.2G/T.30

Right-hand side of beginning of phase B of the flow diagram



NOTE – The station listens to a response at 300 bit/s (2400 bit/s) after transmitting a command at 300 bit/s (2400 bit/s) and continues with the detected DHS.

FIGURE 5.2H/T.30

5.2.1 Flow diagram key

COMMAND REC	The "command received" subroutine searches for an error-free standard command. The decision diamonds in the flow diagram refer to the most recent standard command received (e.g. EOM, MPS, etc).
COMPT REMOTE REC	The FIF associated with the DIS has indicated a "compatible remote receiver".
DOC TO XMIT	The station has "at least one document to be transmitted".
COMPT REMOTE XMTR	The FIF associated with the DIS has indicated a "compatible remote transmitter" which has documents to send.
RESPONSE REC	The "response received" subroutine which searches for an error-free standard response.
LAST DOC	The "last document", for the given operating mode, has been transmitted.
SET MODE	The system controller will "set the appropriate mode" of operation.
3RD TRY	The command has been repeated three times without an appropriate response.
CAPABLE RE-XMIT	The transmitting station is "capable of retransmitting" a document which was not received with acceptable quality.
MSG CARRIER REC	The "message channel carrier has been received". This carrier is 1800 Hz for the Group 3 modulation scheme, and 1700 Hz for the Group 3 optional modulation scheme, 2100 Hz for the Group 2 modulations, and 1300-2100 Hz for the Group 1 modulation scheme.
PHASE/ TRAIN OK	The phasing/training-TCF signal has been analysed and the results of "phasing/training were OK".
CHANGE MODE	The transmitting unit desires to exit from the transmitting mode of operation and re-establish the capabilities.
NSP REQ	A "non-specified procedure" has been "recognized" by a unit compatible with the station initiating that procedure.
COPY QUALITY OK	By some algorithm, the "copy quality was deemed OK".
REPHASE/ TRAIN	By some algorithm, it is deemed desirable to transmit a new phasing/training signal.
FLAG	There has been the detection of a "flag".
RECEIVE A FRAME	The unit has "received one complete HDLC frame".
FCS ERROR	The HDLC frame received contained an "FCS error".
OPTIONAL RESPNS	The HDLC frame received contained one of the listed "optional responses".
OPTIONAL COMMAND	The HDLC frame received contained one of the listed "optional commands".
CRP OPTION	The facsimile unit has the "CRP option", and can therefore request an immediate retransmission of the most recent command.

LOCAL INT — Either the "local" machine or the "local" operator wishes to generate an interrupt of the standard facsimile procedures. An operator would use this as a means to request the establishment of voice contact.

LINE REQ — This means that the local operator has "requested" that the telephone line be connected to the handset for voice contact with the remote end.

PRI-Q — A general term referring to either PRI-EOM, a PRI-MPS, or a PRI-EOP post-message command, i.e the fifth bit of the standard post-message command is set to 1.

NOTES

1 The non-specified procedure, NSP, refers to a procedure which takes 6 seconds or less to complete. It may not necessarily be a definable signal sequence.

2 This signal pertains to Group 3 apparatus only.

3 The PRI-EOM, PRI-EOP, PRI-MPS post-message commands are sent when a local interrupt request is pending.

4 At any time during the operation an interrupt may be generated which would result in a procedural interrupt. It is understood that if this interrupt happens during the transmission of the document, the EOM/RTC signal will be transmitted prior to invoking the procedural interrupt.

5 Where the symbol / is used, the term to the left of the symbol refers to Groups 1 and 2 equipment, and the term to the right of the symbol refers to Group 3 equipment.

6 Where the symbols { } are used, the signals within these symbols are a response to DIS from the calling unit wishing to receive.

7 Where the symbols ( ) are used, the signals within these symbols are optional.

5.3 Binary coded signal functions and formats

An HDLC frame structure is utilized for all binary coded facsimile control procedures. The basic HDLC structure consists of a number of frames, each of which is subdivided into a number of fields. It provides for frame labelling, error checking and confirmation of correctly received information.

More specifically, the example in Figure 16 of a format is used for binary coded signalling. This example shows an initial identification sequence (see 5.3.6.1.1).

In the following descriptions of the fields, the order in which the bits are transmitted is from the most to the least significant bit, i.e. from left to right as printed. The exception to this is the CSI format (see 5.3.6.2.4).

The equivalent between binary notation symbols and the significant conditions of the signalling code should be in accordance with Recommendation V.1.

NOTES

1 Any initial (capabilities identification) non-standard frame which is transmitted shall be accompanied by a mandatory frame. The mandatory frame shall always be the last one transmitted (see Figure 16).

2 A machine which receives optional frame(s) which it does not recognize shall discard the frame(s) and use the mandatory frames in continuing the procedure.

5.3.1 Preamble

The preamble shall precede all binary coded signalling whenever a new transmission of information begins in any direction (i.e for each line turnaround). This preamble assures that all elements of the communication channel (e.g echo suppressors) are properly conditioned so that the subsequent data may be passed unimpaired. This preamble may take the following forms:

5.3.1.1 The preamble for binary coded signalling at 300 bit/s shall be a series of flag sequences for 1 s ± 15%.

5.3.1.2 For the optional binary coded procedure at 2400 bit/s, the preamble shall be the long training modem sequence defined in Recommendation T.4.

5.3.2 Message/signalling delineation

5.3.2.1 Where Group 1 or Group 2 modulation techniques are employed, the delineation is obtained by the transmission of the tonal EOM signal as defined in 4.3.2.4. This signals the T.2 or T.3 modulation system to drop off the line and be replaced by the T.30 binary coded modulation system.

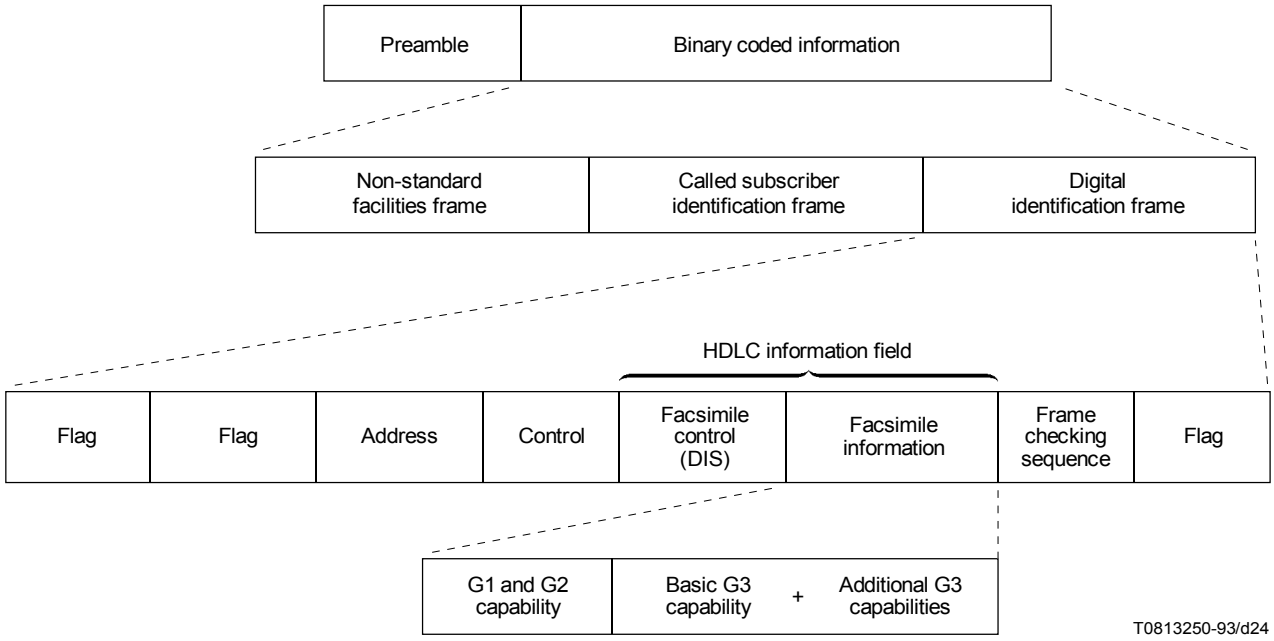


FIGURE 16/T.30

5.3.2.2 When Group 3 modulation technique is employed, the delineation is obtained by the transmission of the RTC signal (see 4.1.4/T.4) and an RCP frame (see Annex A/T.4). This signals the T.4 modulation system to drop off the line and be replaced by the T.30 binary coded modulation system.

NOTE – If the receiver detects at least one RCP frame correctly, it may initiate post-message command reception.

When operating over public digital networks, the RCP frame is not used and delineation is obtained by use of the facsimile control field.

5.3.2.3 The transmission of the delineation signal, either the tonal EOM signal or the RTC signal or the RCP frame, shall be followed by a delay of 75 ± 20 ms before the T.30 binary coded modulation system commences to transmit.

5.3.2.4 After receipt of a signal using the T.30 binary coded modulation system, the transmitting station must wait at least 75 ms before sending any signals using V.27 *ter*/V.29/V.33/V.17 modulation system.

5.3.3. Flag sequence

The eight bit HDLC flag sequence is used to denote the beginning and end of the frame. For the facsimile procedure, the flag sequence is used to establish bit and frame synchronisation. The trailing flag of one frame may be the leading flag of the following frame.

Continued transmission of the flag sequence may be used to signal to the distant station that the machine remains on line but is not presently prepared to proceed with the facsimile procedure.

Format: 0111 1110

5.3.4 Address field

The eight bit HDLC address field is intended to provide identification of specific station(s) in a multi-point arrangement. In the case of transmission on the general switched telephone network, this field is limited to a single format.

Format: 1111 1111

5.3.5 Control field

The eight bit HDLC control field provides the capability of encoding the commands and responses unique to the facsimile control procedures.

Format: 1100 X000

X = 0 for non-final frames within the procedure, X = 1 for final frames within the procedure. A final frame is defined as the last frame transmitted prior to an expected response from the distant station.

5.3.6 Information field

The HDLC information field is of variable length and contains specific information for the control and message interchange between two facsimile stations. In this Recommendation it is divided into two parts, the facsimile control field (FCF) and the facsimile information field (FIF).

5.3.6.1 Facsimile control field (FCF)

The facsimile control field is defined to be the first 8 or 16 bits of the HDLC information field. An FCF of 16 bits should be applied only for the optional T.4 error correction mode. This field contains the complete information regarding the type of information being exchanged and the position in the overall sequence. The bit assignments within the FCF are as follows:

Where X appears as the first bit of FCF, X will be defined as follows:

- X is set to 1 by the station which receives a valid DIS signal;
- X is set to 0 by the station which receives a valid and appropriate response to a DIS signal;
- X will remain unchanged until the station again enters the beginning of phase B.

5.3.6.1.1 Initial identification

From the called to the calling station.

Format : 0000 XXXX

1) *Digital identification signal (DIS)* – Characterizes the standard CCITT capabilities of the called apparatus.

Format : 0000 0001

2) *Called subscriber identification (CSI)* – This optional signal may be used to provide the specific identity of the called subscriber by its international telephone number (see 5.3.6.2.4, CSI coding format).

Format : 0000 0010

3) *Non-standard facilities (NSF)* – This optional signal may be used to identify specific user requirements which are not covered by the Recommendations.

Format : 0000 0100

5.3.6.1.2 Command to send

From a calling station wishing to be a receiver to a called station which is capable of transmitting.

Format : 1000 XXXX

1) *Digital transmit command (DTC)* – The digital command response to the standard capabilities identified by the DIS signal.

Format : 1000 0001

2) *Calling subscriber identification (CIG)* – This optional signal indicates that the following FIF information is an identification of that calling station. It may be used to provide additional security to the facsimile procedure (see 5.3.6.2.5, CIG coding format).

Format : 1000 0010

3) *Non-standard facilities command (NSC)* – This optional signal is the digital command response to the information contained in the NSF signal.

Format : 1000 0100

4) *Password (PWD)* – This optional signal indicates that the following FIF information is a password for the polling mode. It may be used to provide additional security to the facsimile procedure (see 5.3.6.2.8 PWD coding format). PWD is only sent if Bit 50 in DIS is set.

Format : 1000 0011

5) *Selective polling (SEP)* – This optional signal indicates that the following FIF information is a subaddress for the polling mode. It may be used to indicate that a specific document shall be polled at the called side (see 5.3.6.2.9 SEP coding format). SEP is only sent if Bit 47 in DIS is set.

Format : 1000 0101

5.3.6.1.3 Command to receive

From the transmitter to the receiver.

Format : X100 XXXX

1) *Digital command signal (DCS)* – The digital set-up command responding to the standard capabilities identified by the DIS signal.

Format : X100 0001

2) *Transmitting subscriber identification (TSI)* – This optional signal indicates that the following FIF information is the identification of the transmitting station. It may be used to provide additional security to the facsimile procedures. (See 5.3.6.2.6 TSI coding format.)

Format: X100 0010

3) *Non-standard facilities set-up (NSS)* – This optional signal is the digital command response to the information contained in the NSC or NSF signal.

Format: X100 0100

4) *Subaddress (SUB)* – This optional signal indicates that the following FIF information is a subaddress in the called subscribers domain. It may be used to provide additional routing information in the facsimile procedure (see 5.3.6.2.10 SUB coding format). SUB is only sent if Bit 49 in DIS/DTC is set.

Format : X100 0011

5) *Password (PWD)* – This optional signal indicates that the following FIF information is a password for transmission (see 5.3.6.2.8 PWD coding format). PWD is only sent if Bit 50 in DIS is set.

Format : X100 0101

6) *Training check (TCF)* – This digital command is sent through the T.4 modulation system to verify training and to give a first indication of the acceptability of the channel for this data rate.

Format: A series of 0s for 1.5 s ± 10%.

NOTE – No HDLC frame is required for this command.

7) *Continue to correct (CTC)* – This digital command is only used in the optional T.4 error correction mode. See item 1) of A.4.1.

5.3.6.1.4 Pre-message response signals

From the receiver to the transmitter.

Format: X010 XXXX

1) *Confirmation to receive (CFR)* – A digital response confirming that the entire pre-message procedure has been completed and the message transmissions may commence.

Format : X010 0001

2) *Failure to train (FTT)* – A digital response rejecting the Group 3 training signal and requesting a retraining.

Format : X010 0010

3) *Response for continue to correct (CTR)* – This digital response is only used in the optional T.4 error correction mode. In detail, make reference to item 1) of A.4.2.

5.3.6.1.5 In-message procedure

From the transmitter to the receiver. In case of Group 3 machines the in-message procedure formats and specific signals shall be consistent with Recommendation T.4. In-message procedures for Group 1 and Group 2 are defined in Recommendations T.2 and T.3, respectively.

5.3.6.1.6 Post-message commands

From the transmitter to the receiver.

Format: X111 XXXX

1) *End-of-message (EOM)* – To indicate the end of a complete page of facsimile information and to return to the beginning of phase B.

Format: X111 0001

2) *Multipage signal (MPS)* – To indicate the end of a complete page of facsimile information and to return to the beginning of phase C upon receipt of a confirmation.

Format: X111 0010

3) *End of procedures (EOP)* – To indicate the end of a complete page of facsimile information and to further indicate that no further documents are forthcoming and to proceed to phase E, upon receipt of a confirmation.

Format: X111 0100

4) *Procedure interrupt – End of message (PRI-EOM)* – To indicate the same as an EOM command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1001

5) *Procedure interrupt – Multipage signal (PRI-MPS)* – To indicate the same as an MPS command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1010

6) *Procedure interrupt – End of procedure (PRI-EOP)* – To indicate the same as an EOP command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1100

NOTES

1 Commands EOM, MPS, EOP, PRI-Q should not be used in the optional T.4 error correction mode.

2 In the duration between partial-pages, procedure interrupt signals should not be transmitted in the optional T.4 error correction mode.

7) *Partial page signal (PPS)* – This digital command is only used in the optional T.4 error correction mode. See item 1) of A.4.3.

8) *End of retransmission (EOR)* – This digital command is only used in the optional T.4 error correction mode. See item 2) of A.4.3.

9) *Receive ready (RR)* – This digital command is only used in the optional T.4 error correction mode. See item 3) of A.4.3.

5.3.6.1.7 Post message responses

From the receiver to the transmitter.

Format: X011 XXXX

1) *Message confirmation (MCF)* – To indicate that a complete message has been satisfactorily received and that additional messages may follow. (This is a positive response to MPS, EOM, EOP, RR and PPS.)

Format: X011 0001

2) *Retrain positive (RTP)* – To indicate that a complete message has been received and that additional messages may follow after retransmission of training and/or phasing and CFR.

Format: X011 0011

NOTE 1 – RTP is not applicable to the optional T.4 error correction mode.

3) *Retrain negative (RTN)* – To indicate that the previous message has not been satisfactorily received. However, further receptions may be possible, provided training and/or phasing are retransmitted.

Format: X011 0010

NOTE 2 – RTN is not applicable to the optional T.4 error correction mode.

4) *Procedure interrupt positive (PIP)* – To indicate that a message has been received but that further transmissions are not possible without operator intervention. Failing operator intervention and if further documents are to follow, the facsimile procedure shall begin at the beginning of phase B. This is a positive response only to MPS, EOM, EOP, PRI-Q, PPS-MPS, PPS-EOM, PPS-EOP, PPS-PRI-Q.

Format: X011 0101

5) *Procedure interrupt negative (PIN)* – To indicate that the previous (or in-process) message has not been satisfactorily received and that further transmissions are not possible without operator intervention. Failing operator intervention and if further documents are to follow, the facsimile procedure shall begin at the beginning of phase B. This is a negative response only to MPS, EOM, EOP, PRI-Q, PPS-MPS, PPS-EOM, PPS-EOP, PPS-PRI-Q, EOR-MPS, EOR-EOM, EOR-EOP and EOR-PRI-Q.

Format: X011 0100

NOTES

3 All machines shall be able to recognize the PIN and PIP signals. The ability to transmit these signals is optional.

4 In the duration between partial-pages, RTP, RTN, PIP and PIN signals should not be transmitted in the optional T.4 error correction mode.

6) *Partial page request (PPR)* – This digital response is only used in the optional T.4 error correction mode. See item 1) of A.4.4.

7) *Receive not ready (RNR)* – This digital response is only used in the optional T.4 error correction mode. See item 2) of A.4.4.

8) *Response for end of retransmission (ERR)* – This digital response is only used in the optional T.4 error correction mode. See item 3) of A.4.4.

9) *File diagnostics message (FDM)* – This digital response may be used in place of MCF. See Appendix VI for more information.

Format: X011 1111

NOTE – Applicable only to the optional BFT mode.

5.3.6.1.8 Other line control signals

For the purpose of handling errors and controlling the state of the line.

Format: X101 XXXX

1) *Disconnect (DCN)* – This command indicates the initiation of phase E (call release). This command requires no response.

Format: X101 1111

2) *Command repeat (CRP)* – This optional response indicates that the previous command was received in error and should be repeated in its entirety (i.e. optional frames included).

Format: X101 1000

5.3.6.2 Facsimile information field (FIF)

In many cases the FCF will be followed by the transmission of additional 8-bit octets to further clarify the facsimile procedure. This information for the basic binary coded system would consist of the definition of the information in the DIS, DCS, DTC, CSI, CIG, TSI, NSC, NSF, NSS, PWD, SEP, SUB, FDM, CTC, PPS and PPR signals.

5.3.6.2.1 DIS standard capabilities

Additional information fields will be transmitted immediately following the DIS facsimile control field. The first 8 bits of this information relate to Group 1 and Group 2 apparatus and subsequent bits relate to Group 3 apparatus. The bit assignment for this information is given in Table 2 where a 1 indicates the condition is valid, except where specifically noted otherwise (e.g. bits 11 ,12 and 21, 22, 23).

5.3.6.2.2 DCS standard commands

When issuing the command, bits 1, 4 and 9 shall be set to 0. The DCS standard commands are formatted as shown in Table 2.

5.3.6.2.3 DTC standard commands

The DTC standard capabilities are formatted as shown in Table 2.

5.3.6.2.4 CSI coding format

The facsimile information field of the CSI signal shall be the international telephone number including the "+" character, the telephone country code, area code and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.6.2.5 CIG coding format

The facsimile information field of the CIG signal shall be the international telephone number including the "+" character, telephone country code, area code and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.6.2.6 TSI coding format

The facsimile information field of the TSI signal shall be the international telephone number including the "+" character, telephone country code, area code and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3. The least significant bit of the least significant digit shall be the first bit transmitted.

TABLE 2/T.30

Bit No.	DIS/DTC	DCS
1	Transmitter T.2 operation	
2	Receiver – T.2 operation	Receiver – T.2 operation
3	T.2 IOC = 176	T.2 IOC = 176
4	Transmitter – T.3 operation	
5	Receiver – T.3 operation	Receiver – T.3 operation
6	Reserved for future T.3 operation features	
7	Reserved for future T.3 operation features	
8	Reserved for future T.3 operation features	
9	Transmitter – T.4 operation	
10	Receiver – T.4 operation	Receiver – T.4 operation
11, 12, 13, 14 0, 0, 0, 0 0, 1, 0, 0 1, 0, 0, 0 1, 1, 0, 0 0, 0, 1, 0 0, 1, 1, 0 1, 0, 1, 0 1, 1, 1, 0 0, 0, 0, 1 0, 1, 0, 1 1, 0, 0, 1 1, 1, 0, 1 0, 0, 1, 1 0, 1, 1, 1 1, 0, 1, 1 1, 1, 1, 1	Data signalling rate V.27 *ter* fall back mode V.27 *ter* V.29 V.27 *ter* and V.29 Not used Reserved Not used V.27 *ter*, V.29 and V.33 Not used Reserved Not used V.27 *ter*, V.29, V.33 and V.17 Not used Reserved Not used Reserved	Data signalling rate 2400 bit/s, V.27 *ter* 4800 bit/s, V.27 *ter* 9600 bit/s, V.29 7200 bit/s, V.29 14 400 bit/s, V.33 12 000 bit/s, V.33 Reserved Reserved 14 400 bit/s, V.17 12 000 bit/s, V.17 9600 bit/s, V.17 7200 bit/s, V.17 Reserved Reserved Reserved Reserved
15	R8 × 7.7 lines/mm and/or 200 × 200 pels/25.4 mm (See Notes 13, 14)	R8 × 7.7 lines/mm or 200 × 200 pels/25.4 mm (See Note 13)
16	Two dimensional coding capability	Two dimensional coding
17, 18 (0,0) (0,1) (1,0) (1,1)	Recording width capabilities 1728 picture elements along scan line length of 215 mm ± 1% 1728 picture elements along scan line length of 215 mm ± 1% 2048 picture elements along scan line length of 255 mm ± 1% 2432 picture elements along scan line length of 303 mm ± 1% 1728 picture elements along scan line length of 215 mm ± 1% and 2048 picture elements along scan line length of 255 mm ± 1% Invalid (see Note 7)	Recording width 1728 picture elements along scan line length of 215 mm ± 1% 2432 picture elements along scan line length of 303 mm ± 1% 2048 picture elements along scan line length of 255 mm ± 1% Invalid

TABLE 2/T.30 *(cont.)*

Bit No.	DIS/DTC	DCS
19, 20 (0,0) (0,1) (1,0) (1,1)	Maximum recording length capability A4 (297 mm) Unlimited A4 (297 mm) and B4 (364 mm) Invalid	Maximum recording length A4 (297 mm) Unlimited B4 (364 mm) Invalid
21, 22, 23 (0,0,0) (0,0,1) (0,1,0) (1,0,0) (0,1,1) (1,1,0) (1,0,1) (1,1,1)	Minimum scan line time capability at the receiver 20 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$ 40 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$ 10 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$ 5 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$ 10 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$ 20 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$ 40 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$ 0 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$	Minimum scan line time 20 ms 40 ms 10 ms 5 ms 0 ms
24	Extend field	Extend field
25	2400 bit/s handshaking	2400 bit/s handshaking
26	Uncompressed mode	Uncompressed mode
27	Error correction mode	Error correction mode
28	Set to “0”	Frame size 0 = 256 octets Frame size 1 = 64 octets
29	Error limiting mode	Error limiting mode
30	Reserved for G4 capability on PSTN	Reserved for G4 capability on PSTN
31	T.6 coding capability	T.6 coding enabled
32	Extend field	Extend field
33 (0) (1)	Validity of bit/s 17, 18 Bits 17, 18 are valid Bits 17, 18 are invalid	Recording width Recording width indicated by bits 17, 18 Recording width indicated by this field bit information
34	Recording width capability 1216 picture elements along scan line length of 151 mm ± 1%	Middle 1216 elements of 1728 picture elements
35	Recording width capability 864 picture elements along scan line length of 107 mm ± 1%	Middle 864 elements of 1728 picture elements
36	Recording width capability 1728 picture elements along scan line length of 151 mm ± 1%	Invalid
37	Recording width capability 1728 picture elements along scan line length of 107 mm ± 1%	Invalid
38	Reserved for future recording width capability	
39	Reserved for future recording width capability	
40	Extend field	Extend field
41	R8 × 15.4 lines/mm (See Note 13)	R8 × 15.4 lines/mm (See Note 13)

TABLE 2/T.30 *(cont.)*

Bit No.	DIS/DTC	DCS
42	300 × 300 pels/25.4 mm	300 × 300 pels/25.4 mm
43	R16 × 15.4 lines/mm and/or 400 × 400 pels/25.4 mm (See Notes 13, 15)	R16 × 15.4 lines/mm and/or 400 × 400 pels/25.4 mm (See Note 13)
44	Inch based resolution preferred (See Notes 16, 17)	Resolution type selection "0": metric based resolution "1": inch based resolution (See Notes 16, 17)
45	Metric based resolution preferred (See Notes 16, 17)	Don't care
46	Minimum scan line time capability for higher resolutions "0": $T_{15.4} = T_{7.7}$ "1": $T_{15.4} = 1/2\ T_{7.7}$ (See Note 18)	Don't care
47	Selective polling capability	Set to "0"
48	Extend field	Extend field
49	Subaddressing capability	Set to "0"
50	Password capability	Set to "0"
51	Capable to emit data file	Not used
52	Reserved for facsimile service info (FSI)	Reserved for facsimile service info (FSI)
53	Binary file transfer (BFT) (See Note 19)	Binary file transfer (BFT) (See Note 19)
54	Document transfer mode (DTM)	Document transfer mode (DTM)
55	Edifact transfer (EDI)	Edifact transfer (EDI)
56	Extend field	Extend field
57	Basic transfer mode (BTM)	Basic transfer mode (BTM)
58	Reserved for future negotiation mechanism for data file transmission	Reserved for future negotiation mechanism for data file transmission
59	Capable to emit character file	Not used
60	Character mode	Character mode
61	Reserved for control document	Reserved for control document
62	Mixed mode (Annex E/T.4)	Mixed mode (Annex E/T.4)
63	Reserved for future negotiation mechanism for character file transmission	Reserved for future negotiation mechanism for character file transmission
64	Extend field	Extend field
65	Processable mode 26 (T.505)	Processable mode 26 (T.505)
66	Digital network capability	Digital network capability

TABLE 2/T.30 *(cont.)*

Bit No.	DIS/DTC	DCS
67 (0) (1)	Full and half duplex capabilities Half duplex operation only Full and half duplex operation	Full and half duplex capabilities Half duplex operation Full duplex operation
68 69 70 71	Reserved for future use	Reserved for future use
72	Extend field	Extend field

NOTES

1 Standard facsimile units conforming to T.2 must have the following capability: Index of cooperation (IOC) = 264.

2 Standard facsimile units conforming to T.3 must have the following capability: Index of cooperation (IOC) = 264.

3 Standard facsimile units conforming to T.4 must have the following capability: Paper length = 297 mm.

4 Where the DIS or DTC frame defines V.27 *ter* capabilities, the equipment may be assumed to be operable at either 4800 or 2400 bit/s.

Where the DIS or DTC frame defines V.29 capabilities, the equipment may be assumed to be operable at either 9600 or 7200 bit/s per V.29; where it defines V.33 capabilities, the equipment may be assumed to be operable at either 14 400 bit/s or 12 000 bit/s per V.33 and where it defines V.17, the equipment may be assumed to be operable at 14 400 bit/s, 12 000 bit/s, 9600 bit/s or 7200 bit/s per V.17.

5 $T_{7.7}$ and $T_{3.85}$ refer to the scan line times to be utilized when the vertical resolution is 7.7 lines/mm (or 200 lines/25.4 mm or 300 lines/25.4 mm) or 3.85 lines/mm, respectively (see bit 15 above). $T_{7.7} = 1/2\ T_{3.85}$ indicates that when the vertical resolution is 7.7 lines/mm or 200 lines/25.4 mm or 300 lines/25.4 mm, the scan line time can be decreased by half.

6 The standard FIF field for the DIS, DTC and DCS signals is 24 bits long. If the "extended field" bit(s) is a "1", the FIF field shall be extended by an additional eight bits.

7 Existing equipment may send the invalid (1.1) condition for bits 17 and 18 of their DIS signal. If such signal is received, it should be interpreted as (0.1).

8 The values of bit No. 28 in the DCS command is valid only when the indication of the T.4 error correction mode is invoked by bit 27.

9 When bit 33 is set to 1 in DCS, the meaning of bit 15 originally defined to indicate 7.7 lines/mm vertical resolution is modified to mean a higher resolution.

10 When the recording width is A4 only, the field consisting of bits 33-40 need not be present.

11 The optional T.4 error correction mode of operatioon requires 0 ms of the minimum scan line time capability. Bits 21-23 in DIS/DTC signals indicate the minimum scan line time of a receiver regardless of the availability of the error correction mode.

In case of error correction mode, the sender sends DCS signal with bits 21-23 set to 1, 1, 1 indicating 0 ms capability.

In case of normal G3 transmission, the sender sends DCS signal with bits 21-23 set to the appropriateness according to the capabilities of the two machines.

12 T.6 coding scheme capability specified by bit 31 is valid only when bit 27 (error correction mode) is set as a "1".

13 Resolutions of R8 and R16 are defined as follows:

R8 = 1728 pels/(215 mm ± 1%) for ISO A4

R8 = 2048 pels/(255 mm ± 1%) for ISO B4

R8 = 2432 pels/(303 mm ± 1%) for ISO A3

R16 = 3456 pels/(215 mm ± 1%) for ISO A4

R16 = 4096 pels/(255 mm ± 1%) for ISO B4

R16 = 4864 pels/(303 mm ± 1%) for ISO A3

TABLE 2/T.30 *(end)*

14 Bit 15, when set to "1", is interpreted according to bit 44 and 45 as follows:

bit 44	bit 45	Interpretation
0	0	(invalid)
1	0	200 × 200 pels/25.4 mm
0	1	R8 × 7.7 lines/mm
1	1	R8 × 7.7 lines/mm and 200 × 200 pels/25.4 mm

"1" in bit 15 without bits 41, 42, 43, 44, 45 and 46 indicates R8 × 7.7 lines/mm.

15 Bit 43, when set to "1", is interpreted according to bit 44 and 45 as follows::

bit 44	bit 45	Interpretation
0	0	(invalid)
1	0	400 × 400 pels/25.4 mm
0	1	R16 × 15.4 lines/mm
1	1	R16 × 15.4 lines/mm and 400 × 400 pels/25.4 mm

16 Bits 44 and 45 are used only in conjunction with bits 15 and 43. Bit 44 in DCS, when used, shall correctly indicate the resolution of the transmitted document, which means that bit 44 in DCS may not always match the indication of bits 44 and 45 in DIS/DTC. Cross selection will cause the distortion and reduction of reproducible area.

If a receiver indicates in DIS that it prefers to receive metric based information but the transmitter has only the equivalent inch based information (or vice versa), then communication shall still take place.

17 Bits 44 and 45 do not require the provision of any additional features on the apparatus to indicate to the sending or receiving user whether the information was transmitted or received on a metric-metric, inch-inch, metric-inch, inch-metric basis.

18 $T_{15.4}$ refers to the scan line times to be utilized when the vertical resolution is 15.4 lines/mm or 400 lines/mm.

$T_{15.4}$ = 1/2 $T_{7.7}$ indicates that when $T_{7.7}$ is 10, 20 or 40 ms the scan line time can be decreased by half in higher resolution mode.

When $T_{7.7}$ is 5 ms [i.e (bit 21, bit 22, bit 23) = (1, 0, 0), (0, 1, 1)] or 0 ms [i.e (1, 1, 1)], bit 46 in DIS/DTC should be set to "0" ($T_{15.4} = T_{7.7}$).

19 The binary file transfer protocol is described in Recommendation T.434.

20 During file transfer, only the transmitter initiates the maximum frame size of 64 or 256 octets.

21 When either bit of 31, 51, 53, 54, 55, 57, 59, 60 and 62 is set to "1", bit 27 shall also be set to "1".

5.3.6.2.7 Non-standard capabilities (NSF, NSC, NSS)

When a non-standard capabilities FCF is utilized, it must be immediately followed by a FIF. This information field will consist of at least two octets. The first octet will contain a CCITT country code (see Note below). Additional information could then be transmitted within the FIF field. This information is not specified and can be used to describe non-standard features, etc.

NOTE – The procedure for obtaining a registered CCITT code is given in Recommendation T.35.

5.3.6.2.8 PWD coding format

The facsimile information field of the PWD signal shall consist of 20 numeric digits. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.6.2.9 SEP coding format

The facsimile information field of the SEP signal shall consist of 20 numeric digits. The least significant bit of the least significant digit shall be the first bit transmitted.

TABLE 3/T.30

Digit	MSB (FB)	Bits	LSB
+	0	010101	1
0	0	011000	0
1	0	011000	1
2	0	011001	0
3	0	011001	1
4	0	011010	0
5	0	011010	1
6	0	011011	0
7	0	011011	1
8	0	011100	0
9	0	011100	1
Space	0	010000	0

MSB Most significant bit.
LSB Least significant bit.
FB Fill bit.

5.3.6.2.10 SUB coding format

The facsimile information field of the SUB signal shall consist of 20 numeric digits. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.7 Frame checking sequences (FCS)

The FCS shall be a 16 bit sequence. It shall be the 1s complement of the sum (modulo 2) of:

1) remainder of x^k $(x^{15} + x^{14} + x^{13} + \ldots + x^2 + x + 1)$ divided (modulo 2) by the generator polynominal $x^{16} + x^{12} + x^5 + 1$, where k is the number of bits in the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency; and

2) the remainder after multiplication by x^{16} and then division (modulo 2) by the generator polynominal $x^{16} + x^{12} + x^5 + 1$, of the content of the frame, existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency.

As a typical implementation, at the transmitter, the initial remainder of the division is preset to all 1s and is then modified by division by the generator polynominal (as described above) on the address, control and information fields; the 1s complement of the resulting remainder is transmitted as the 16-bit FCS sequence.

At the receiver, the initial remainder is preset to all 1s and the serial incoming protected bits and the FCS when divided by the generator polynominal will result in a remainder of 0001110100001111 (x^{15} through x^0, respectively) in the absence of transmission errors.

The FCS shall be transmitted to the line commencing with the coefficient of the highest term.

5.4 Binary coded signalling implementation requirements

5.4.1 Commands and responses

Whereas 5.2 defines a flow diagram to give an accurate example of the typical use of the binary coded procedures, these procedures are defined specifically in terms of the actions that occur on receipt of commands by the receiving station (see 5.3).

A response must be sent, and only sent, upon detecting a valid command. Upon receiving a valid response, a new command must be issued within 3 seconds.

5.4.1.1 Optional command and response frames

If optional frames (e.g. NSF or NSF, CSI) are sent, they must directly precede any mandatory command/response frame which is sent. In this case, bit 5 of the control field is 0 for the optional frames and is 1 only for the final frame (refer to 5.3.5).

5.4.1.2 Options within standard frames

Certain optional portions of standard signals (e.g. the fifth bit of the PRI-Q signal) need not be utilized at either the transmitting unit or the receiving unit. However, the use of these optional portions of standard signals shall not cause erroneous operation.

5.4.2 Line control procedures and error recovery

Once the transmitting and receiving stations have been identified, all commands are initiated by the transmitting station and solicit an appropriate response from the receiving station (see Appendix III). Furthermore, the transmission of a response is permitted only when solicited by a valid command. If the transmitting station does not receive an appropriate valid response within 3 s ± 15%, it will repeat the command. After three unsuccessful attempts, the transmitting station will send the disconnect (DCN) command and terminate the call. A command or a response is not valid and should be discarded if

i) any of the frames, optional or mandatory, have an FCS error;

ii) any single frame exceeds 3 s ± 15% (see Note 1);

iii) the final frame does not have the control bit 5 set to a binary 1;

iv) the final frame is not a recognized standard command/response frame (see Appendix III).

The delay of 3 seconds before retransmission of the command can be shortened by the use of the optional command repeat (CRP) response. If the transmitting station receives a CRP response, it may immediately retransmit the most recent command.

During the initial pre-message procedure, neither station has a defined role (i.e. transmitter or receiver). Therefore, the station transmitting the DIS command will continue to retransmit it until, according to the procedures, each station has identified itself and the normal line control procedures may be followed.

NOTES

1 The implications of a maximum frame length of 3 s ± 15% are:

a) no transmitted frame should exceed 2.55 s (i.e. 3 s – 15%);

b) any frame which is received and is detected as greater than 3.45 s shall be discarded (i.e. 3 s + 15%);

c) a frame received which is between 2.55 and 3.45 s duration may be discarded.

2 A terminal may discard a received DIS signal with the identical bit allocation as that terminal has issued.

5.4.3 Timing considerations

5.4.3.1 Time-outs

Time-outs T1 defines the amount of time two stations will continue to attempt to identify each other. T1 is 35 ± 5 seconds, begins upon entering phase B, and is reset upon detecting a valid signal or when T1 times out.

Time-out T2 makes use of the tight control between commands and responses to detect the loss of command/response synchronization. T2 is 6 ± 1 seconds and begins when initiating a command search (e.g. the first entrance into the "command received" subroutine, reference flow diagram in 5.2). T2 is reset when an HDLC flag is received or when T2 times out.

Time-out T3 defines the amount of time a station will attempt to alert the local operator in response to a procedural interrupt. Failing to achieve operator intervention, the station will discontinue this attempt and shall issue other commands or responses. T3 is 10 ± 5 seconds, begins on the first detection of a procedural interrupt command/response signal (i.e. PIN/PIP or PRI-Q, and is reset when T3 times out or when the operator initiates a line request.

Time-out T5 is defined for the optional T.4 error correction mode. Time-out T5 defines the amount of time waiting for clearance of the busy condition of the receiving station. T5 is 60 ± 5 seconds, begins on the first detection of the RNR response. T5 is reset when T5 times out or the MCF or PIP response is received or when the ERR or PIN response is received in the flow control process after transmitting the EOR command. If the timer T5 has expired, the DCN command is transmitted for call release.

The time-outs for the optional mode of operation over public digital networks are given in Annex C.

Annex A

Procedure for G3 document facsimile transmission in the general switched telephone network incorporating error correction

(This annex forms an integral part of this Recommendation)

A.1 Introduction

A.1.1 This annex is intended to apply to document facsimile apparatus covered by Annex A/T.4. It describes the procedures and signals to be used where facsimile equipment incorporates error correction capabilities. When existing equipment is operating in a non-CCITT manner, they shall not interfere with equipment operation in accordance with the T-Series Recommendations.

A.1.2 Use of this annex is optional.

A.1.3 Outline of the error correction method

The error correction method described in this annex is based on half-duplex page selective repeat ARQ (automatic repeat request) technique.

An HDLC frame structure is utilized for all binary coded facsimile message procedures.

The transmitting terminal can decide to use either 256 or 64 octets for the frame size by using DCS command. The receiving terminal must be able to receive 256 and 64 octets of frame size.

The transmitting station divides the coded data specified in 4/T.4 into a number of frames and transmits them with each frame number.

When the previous message has not been satisfactorily received, the receiving station transmits PPR response to indicate that the frames specified in the associated facsimile information field are required to be retransmitted.

When PPR is received, the transmitting station retransmits the requested frames specified in PPR information field.

When PPR is received four times for the same block, either the EOR command is transmitted for end of retransmission or CTC (continue to correct) command is sent for continuous retransmission.

In the case of continuous retransmission, the modem speed may fall back or continue at the same speed in accordance with the decision of the transmitting terminal.

A.2 Definitions

A.2.1 The signals and definitions used in the error correction procedure are as defined in the main body of this Recommendation unless specified otherwise.

A.2.2 Frame formats of RCP frame and FCD frame for the in-message procedure are defined in Annex A/T.4.

A.2.3 Relations between a page, blocks, partial pages and frames

One page of coded data specified in 4/T.4 is divided into a number of blocks. The block contains a number of frames. A partial page is defined as one transmitted block or a number of retransmitted frames.

A.2.4 Block size

The block size is defined as the maximum number of frames that can be sent by the transmitter before receiving the response.

A.3 Block size and frame size

A.3.1 For T.4 error correction mode, a transmitting terminal indicates frame size by using DCS signal.

A.3.2 The following values of frame size are applicable: 256 or 64 octets. These values of frame size do not include either FCF or frame number octet. Therefore, the total length of the HDLC information field including both the FCF and the frame number octet is as follows: 258 or 66 octets.

A.3.3 The receiving terminal must have the following condition:

- frame size: 256 or 64 octets;
- block size: 256 frames.

A.3.4 The transmitting terminal may send the block whose size is less than 256 frames at the end of each page. This block is called a short block.

A.3.5 The frame size should not be changed during a transmission of one page. In order to change the frame size, indication of mode change should be made using PPS-EOM or EOR-EOM command at the page boundary.

A.4 Information field (see also 5.3.6)

The HDLC information fields is of variable length and contains the specific information for the control and message interchange between two facsimile stations. In this Recommendation it is divided into two parts, the facsimile control field (FCF) and the facsimile information field (FIF).

1) *Facsimile control field (FCF)* – The facsimile control field is defined to be the first 8 bits or 16 bits of the HDLC information field. FCF of 16 bits should be applied only for the optional T.4 error correction mode. This field contains the complete information regarding the type of information being exchanged and the position in the overall sequence. The bit assignments within the FCF are as follows:

   Where X appears as the first bit of FCF, X will be defined as follows:

   - X is set to 1 by the station which receives a valid DIS signal;
   - X is set to 0 by the station which receives a valid and appropriate response to a DIS signal;
   - X will remain unchanged until the station again enters the beginning of phase B.

2) *Facsimile information field (FIF)* – In many cases the FCF will be followed by the transmission of additional 8-bit octets to further clarify the facsimile procedure. This information for the basic binary coded system would consist of the definition of the information in DIS, DCS, DTC, CSI, CIG, TSI, NSC, NSF, NSS, CTC, PPS and PPR signals.

A.4.1 **Command to receive** (see also 5.3.6.1.3)

From the transmitter to the receiver.

Format: X100 XXXX

1) *Continue to correct (CTC)* – This command indicates that the transmitting station shall continue to correct the previous message. This is a response to the 4th PPR received, and indicates that the transmitting station shall immediately send the requested frames specified in PPR information field.

When the transmitter receives PPR four times, the modem speed may fall back or continue the previous transmission speed using CTC command.

This command should have the FIF of 2 octets, which corresponds to the bits No. 1-16 of DCS standard command (see Table 2). The receiving terminal uses only the bits No. 11-14 to determine the data signalling rate.

Format: X100 1000

A.4.2 **Pre-message response signals** (see also 5.3.6.1.4)

From the receiver to the transmitter.

Format: X010 XXXX

1) *Response for continue to correct (CTR)* – This signal is the digital response to CTC signal, so that the receiving terminal can accept the contents including in CTC signal.

Format: X010 0011

A.4.3 **Post message commands** (see also 5.3.6.1.6)

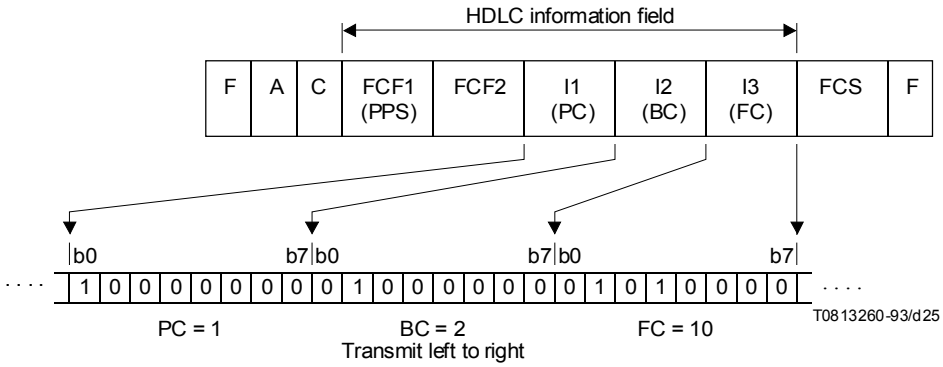
From the transmitter to the receiver.

Format: X111 XXXX

1) *Partial page signal (PPS)* – This command indicates the end of a partial page or a complete page of facsimile information and also indicates to return to the beginning of phase B or C upon receipt of MCF.

Format: X111 1101

The frame construction of PPS command and transmission order of bits included in I1-I3 are shown in Figure A.1.



FCF1 Facsimile control field 1: Extension signal for error correction (PPS)
FCF2 Facsimile control field 2: Post message command (NULL, MPS, EOM, EOP and PRI-Q)
I1(PC) Information field 1: Page counter 8 bits: modulo 256)
I2(BC) Information field 2: Block counter 8 bits: modulo 256)
I3(FC) Information field 3: (Number of frames) – 1 in each partial page 8 bits: maximum 255)

NOTES

1 FCF2 indicates the post message commands in case of the T.4 error correction mode and the format of FCF2 is shown hereafter.

FCF2	Meaning
0000 0000	NULL code which indicates the partial page boundary
1111 0001	EOM in optional T.4 error correction mode
1111 0010	MPS in optional T.4 error correction mode
1111 0100	EOP in optional T.4 error correction mode
1111 1001	PRI-EOM in optional T.4 error correction mode
1111 1010	PRI-MPS in optional T.4 error correction mode
1111 1100	PRI-EOP in optional T.4 error correction mode

The other bit combinations are not used.

2 I1: Page counter shows the page sequence modulo number in each call establishment for one direction of message transfer. Page counter is started from "0" and up to "255". The page counter is reset at the start of each call establishment.

3 I2: Block counter shows the block sequence modulo number in each page. Block counter is started from "0" and up to "255". The block counter is reset at the start of each page.

4 I3: Frame counter shows the total transmitted frame number minus 1 in each partial page. (Maximum 255).

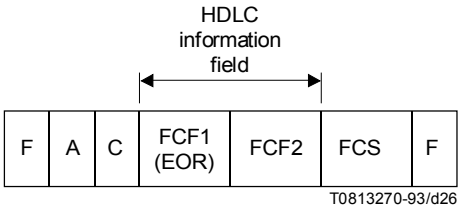
5 The least significant bit in I1-I3 should be transmitted first.

FIGURE A.1/T.30

2) *End of retransmission (EOR)* – This command indicates that the transmitter decides to terminate the retransmission of error frames in the previous partial page and to transmit the next block upon receipt of ERR response.

Format: X111 0011

The frame construction of EOR command is shown in Figure A.2.



FCF1 Facsimile control field 1: Extension signal for error correction (EOR)
FCF2 Facsimile control field 2: Post message command (NULL, MPS, EOM, EOP and PRI-Q)

NOTE – FCF2 indicates the post message commands in case of the T.4 error correction mode and the format of FCF2 is shown hereafter.

FCF2	Meaning
0000 0000	NULL code which indicates the partial page boundary
1111 0001	EOM in optional T.4 error correction mode
1111 0010	MPS in optional T.4 error correction mode
1111 0100	EOP in optional T.4 error correction mode
1111 1001	PRI-EOM in optional T.4 error correction mode
1111 1010	PRI-MPS in optional T.4 error correction mode
1111 1100	PRI-EOP in optional T.4 error correction mode

The other bit combinations are not used.
The signal EOR is excluded from use during file transfer, character mode and mixed mode.

FIGURE A.2/T.30

3) *Receive ready (RR)* – This command is used to ask for the status of the receiver.

Format: X011 0111

NOTES

3 This signal is defined for flow control.

4 For flow control, make reference to A.5.

A.4.4 **Post-message responses** (see also 5.3.6.1.7)

From the receiver to the transmitter.

Format: X011 XXXX

1) *Partial page request (PPR)* – This signal indicates that the previous message has not been satisfactorily received and that the frames specified in the associated facsimile information field are required to be retransmitted.

Format: X011 1101

The facsimile information field of the PPR signal is a fixed length of 256 bits, each bit corresponds to an FCD frame i.e. the first bit to the first frame etc. For FCD frames which are received correctly, the corresponding bit in the PPR information field will be set to "0"; those that are received incorrectly or not received will have their bit set to "1".

If more than one PPR signal is transmitted, the bit corresponding to an FCD frame which has been received correctly must always be set to "0".

The frame construction fo PPR response is shown in Figure A.3.

The process of an error correction is shown in Figure A.4.

NOTES

1 The number of frames in a partial page is less than or equal to 256 frames. Therefore in some circumstances there may be extra bits that do not correspond to any frames. These bits are set to "1" (see Figure A.5.)

2 The first bit in the FIF corresponds to the first frame (frame No. 0).

2) *Receive not ready (RNR)* – This signal is used to indicate that the receiver is not ready to receive more data.

Format: X011 0111

NOTES

3 This signal is defined for flow control.

4 For flow control, make reference to A.5.

3) *Response for end of retransmission (ERR)* – This signal is the digital response to EOR signal.

Format: X011 1000

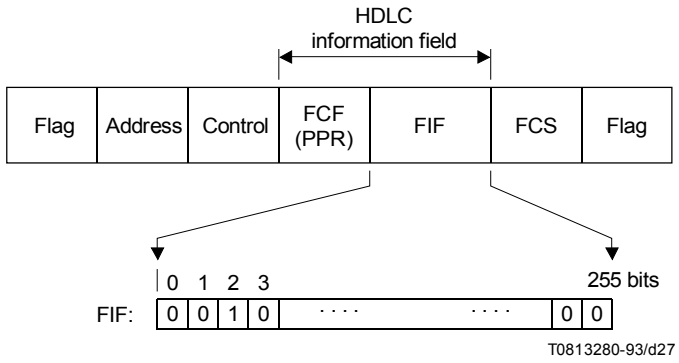


FIGURE A.3/T.30

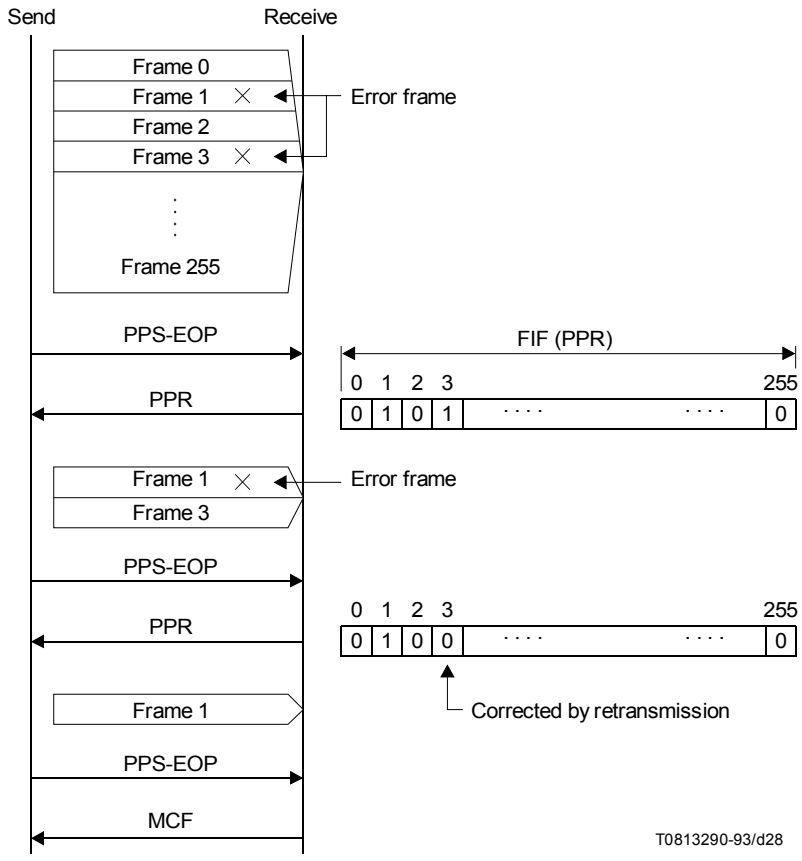


FIGURE A.4/T.30

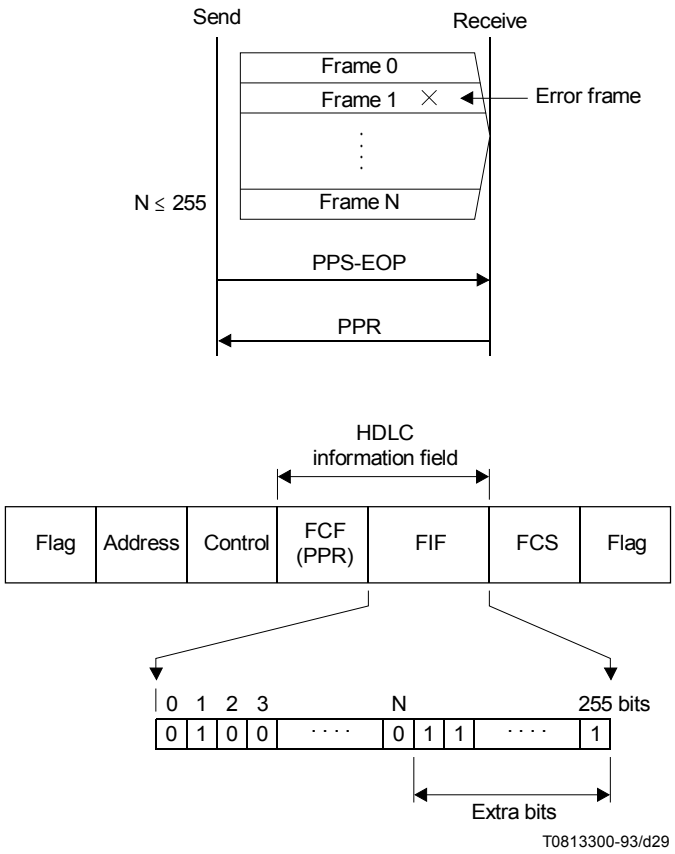


FIGURE A.5/T.30

A.5 Flow control procedure

A.5.1 Flow control in the transmitting station is made by continuous flag transmission between frames or before the first frame.

A.5.2 The maximum transmission time of flags should be less than the value of timer T1.

A.5.3 In case of transmission on a noisy channel, a long flag sequence may be destroyed by noise. Therefore, it is recommended that the receiver implements a control procedure to discard invalid frames which are obtained from erroneous flag sequences.

A.5.4 Flow control in the receiving station is made using RR/RNR signals as shown in Figure A.6.

A.5.4.1 Inactivity timer T5 is defined as follows:

T5 = 60 s ± 5 s.

NOTE – As the use of the T5 timer reduces transmission efficiency, implementation which minimizes its effect is desirable.

A.5.4.2 The timer T5 is started at the timing of the first RNR response recognition.

A.5.4.3 If the timer T5 has expired, the transmitter sends a DCN command for call release.

A.5.4.4 If RNR response is not received correctly, an RR command is retransmitted to the receiver. After three unsuccessful attempts, the transmitter sends a DCN command for call release.

A.5.4.5 After receiving RNR response, the transmitter immediately sends an RR command until an MCF/PIP response or an ERR/PIN response is received correctly.

A.5.4.6 An MCF or ERR response indicates that the busy condition is cleared and the receiver ready to receive the data which follows the interruption.

A.6 Procedure interrupt

A.6.1 Procedure interrupt signals are not allowed at the partial page boundaries.

A.6.2 Procedure interrupt after detection or transmission of PIP and PIN signals is accomplished by using the procedure defined in the main body of this Recommendation. This procedure is outside the scope of the error correction mode specified in this annex.

A.7 Flow diagrams

The flow diagrams of Figures A.7 to A.25 show the phase B, pre-message procedures, phase C, message procedure, phase D, post-message procedures and phase E, call release for both the transmitting and receiving stations.

For the notes and an explanation of terms to the flow diagrams see A.7.1.

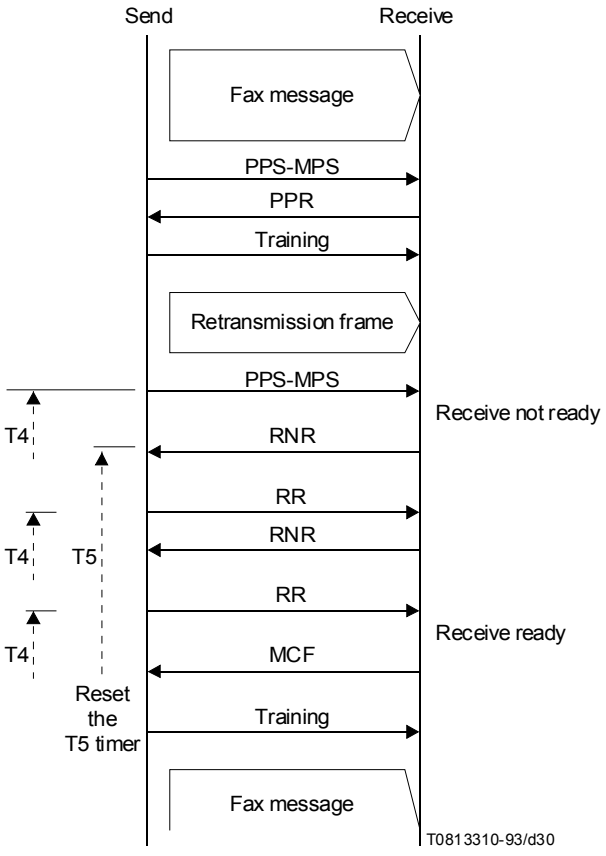


FIGURE A.6/T.30

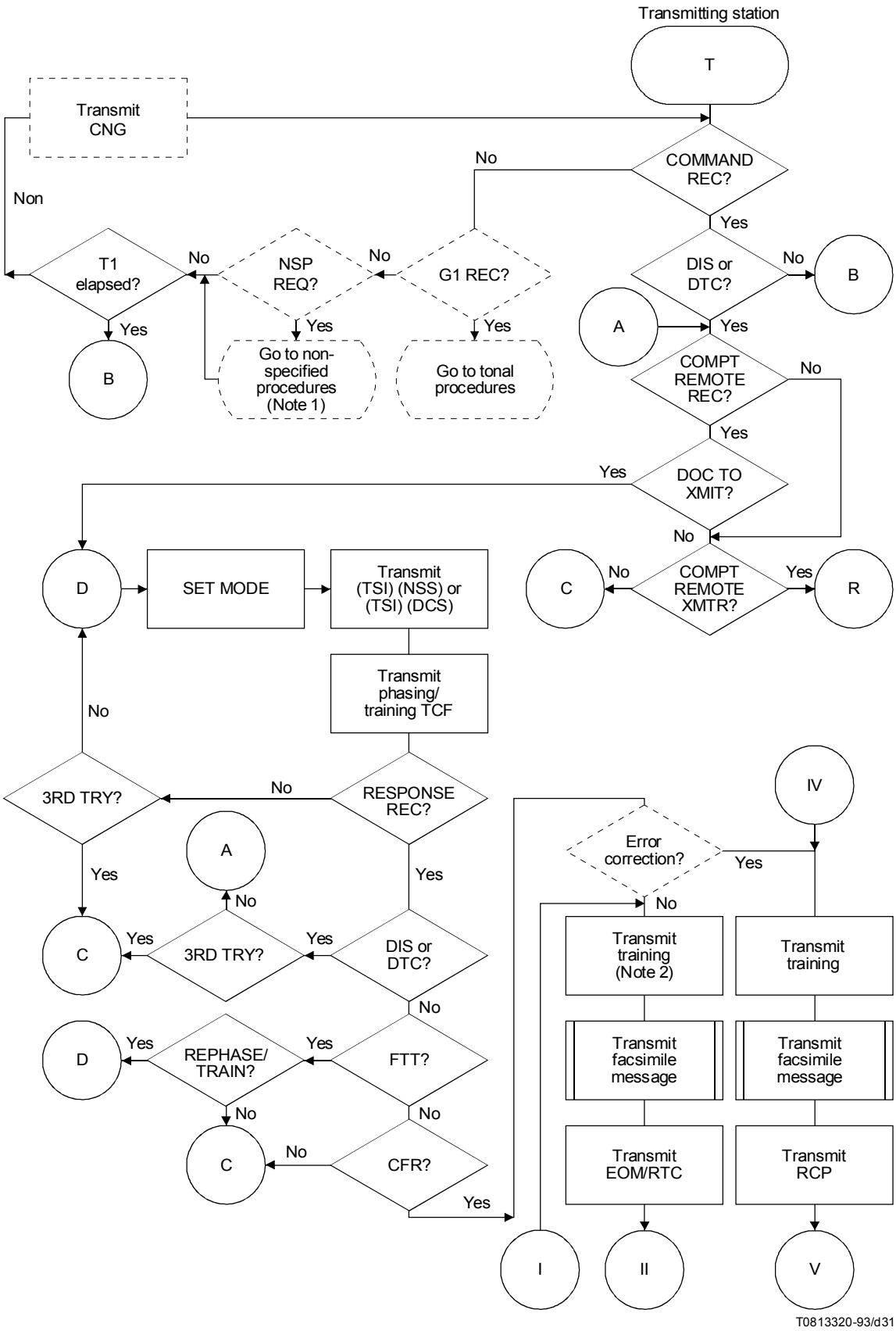
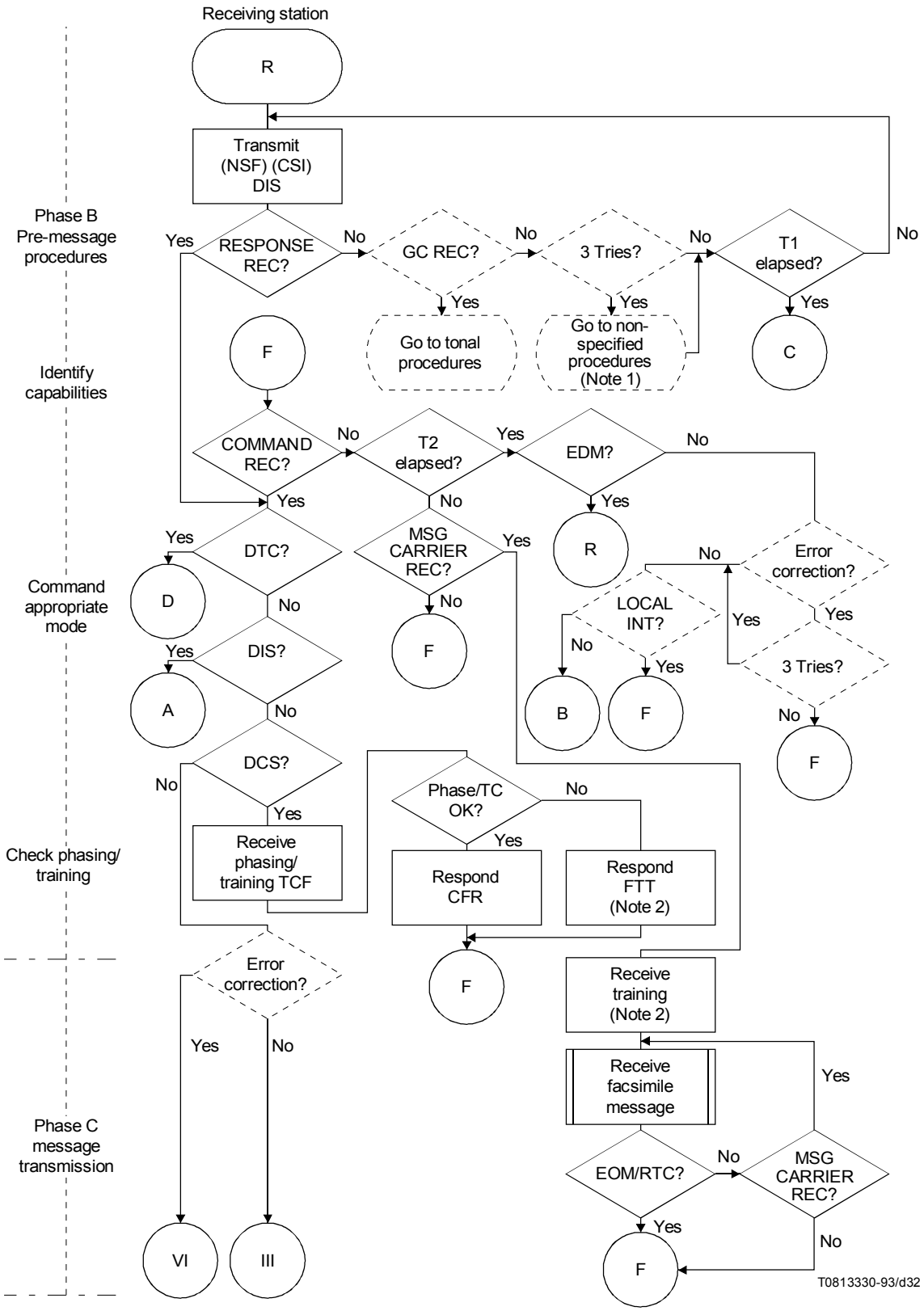


FIGURE A.7/T.30 (sheeet 1 of 4)



NOTE – The last command, except RR, was one of EOM, PPS-EOM or EOM-EOM?

FIGURE A.7/T.30 (sheet 2 of 4)

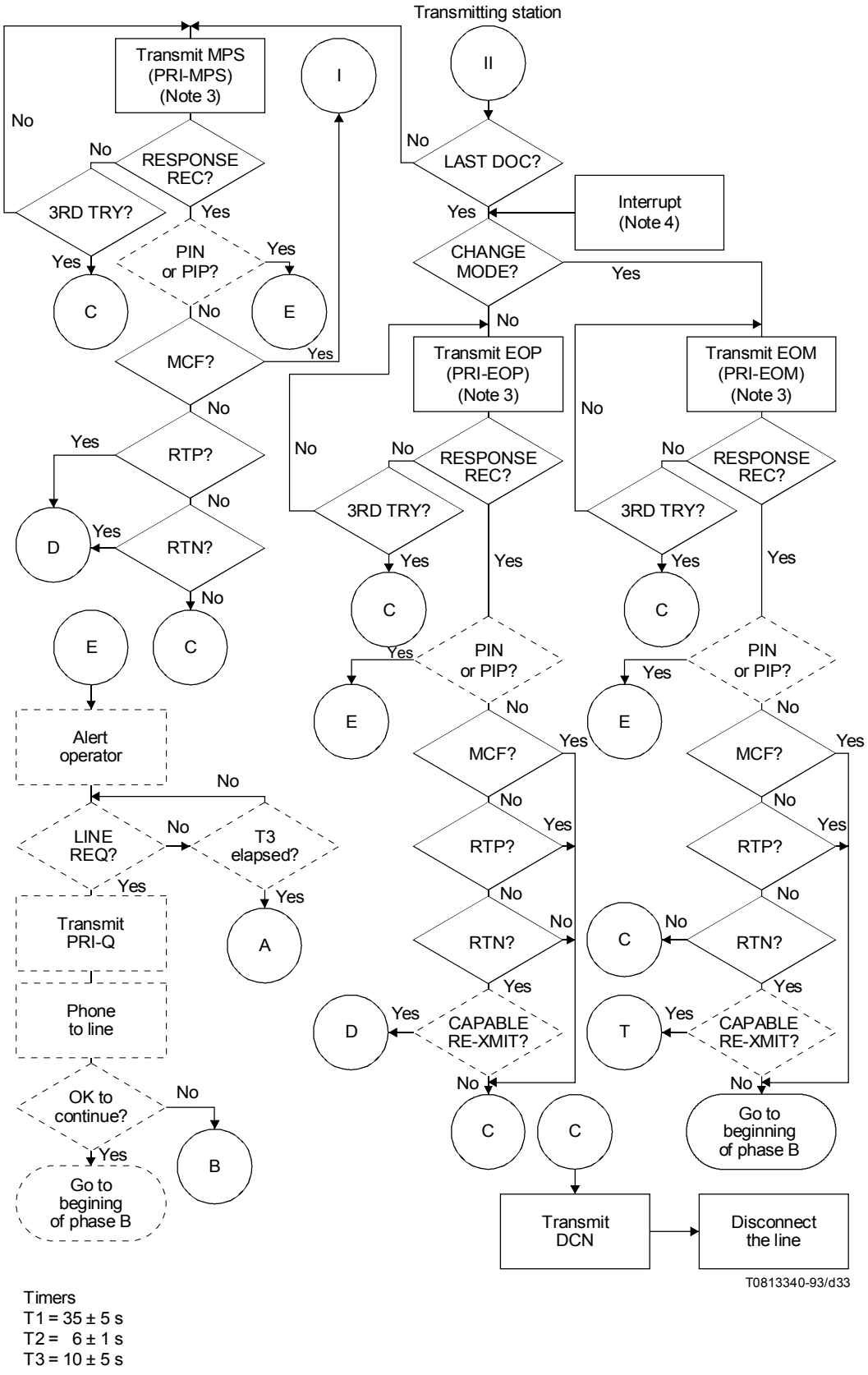


FIGURE A.7/T.30 (sheet 3 of 4)

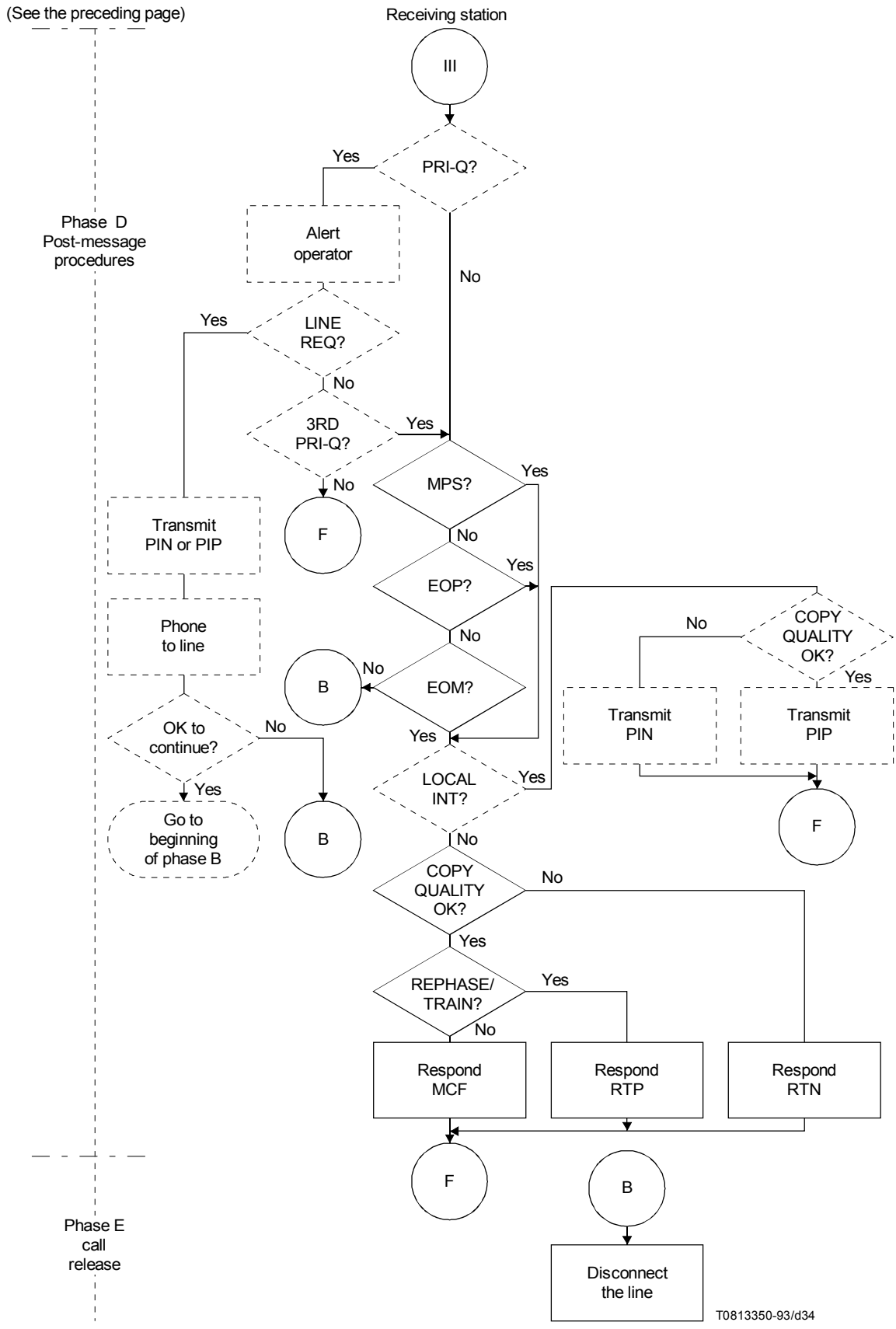


FIGURE A.7/T.30 (sheet 4 of 4)

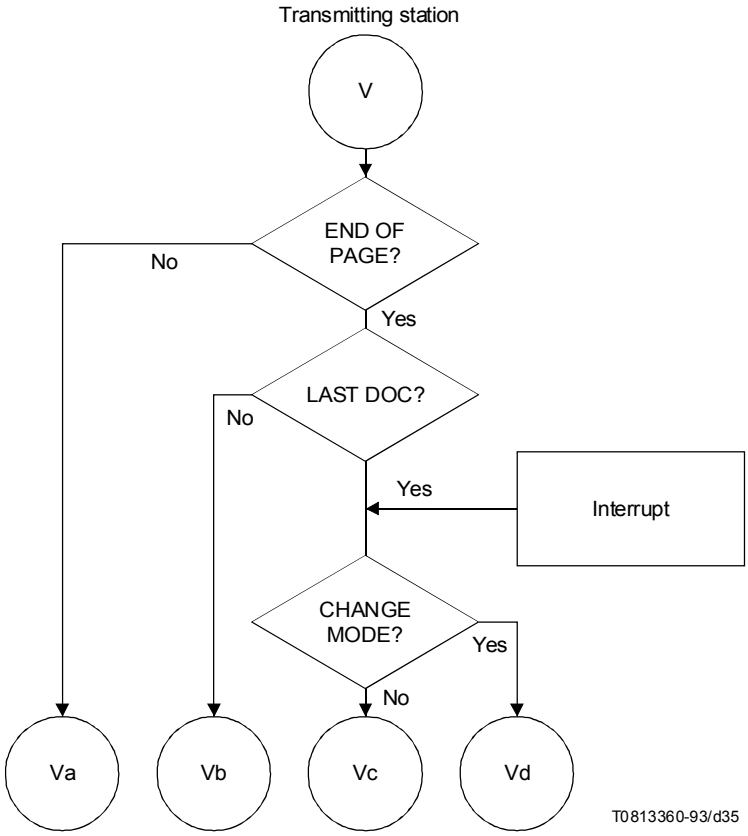


FIGURE A.8/T.30

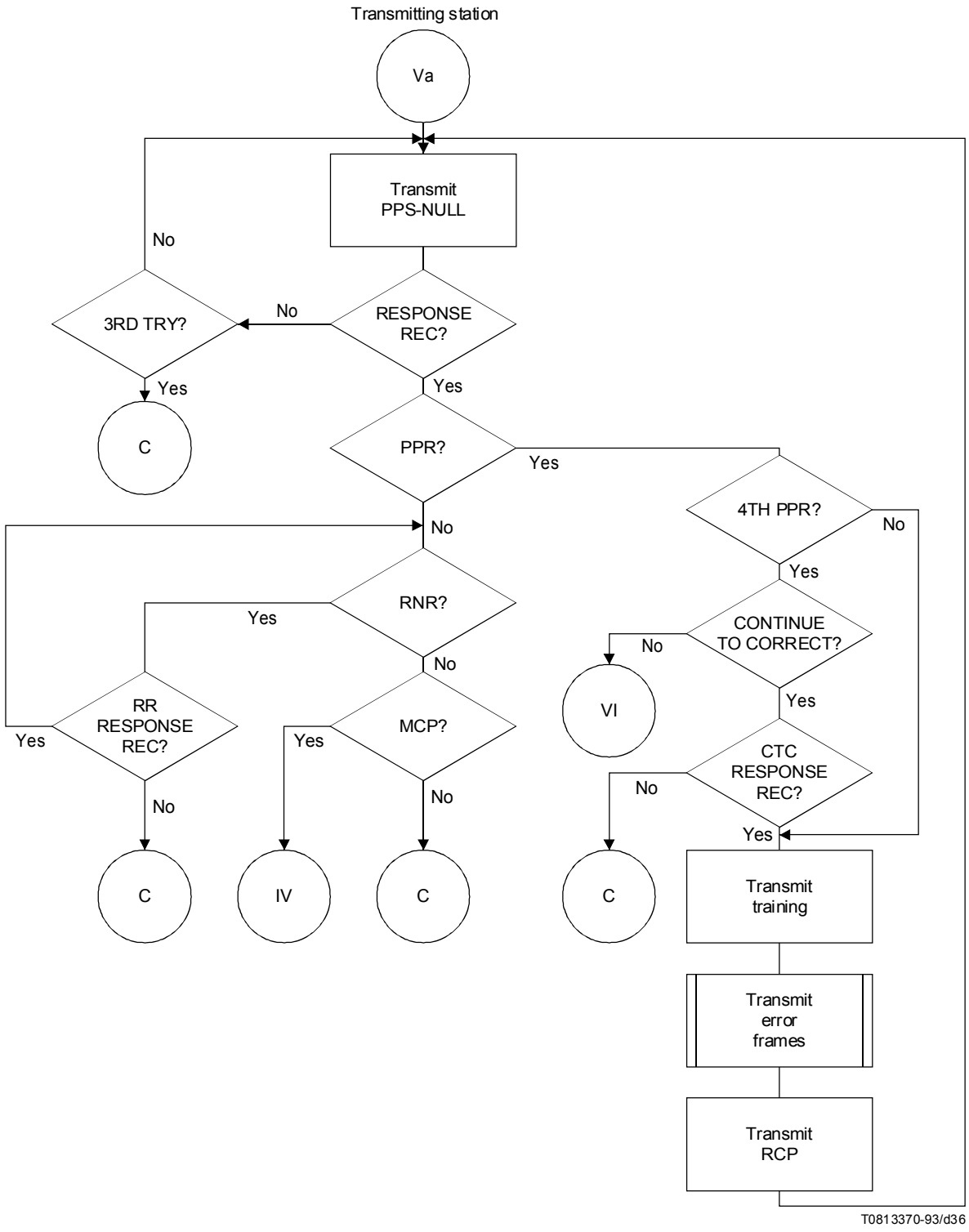


FIGURE A.9/T.30

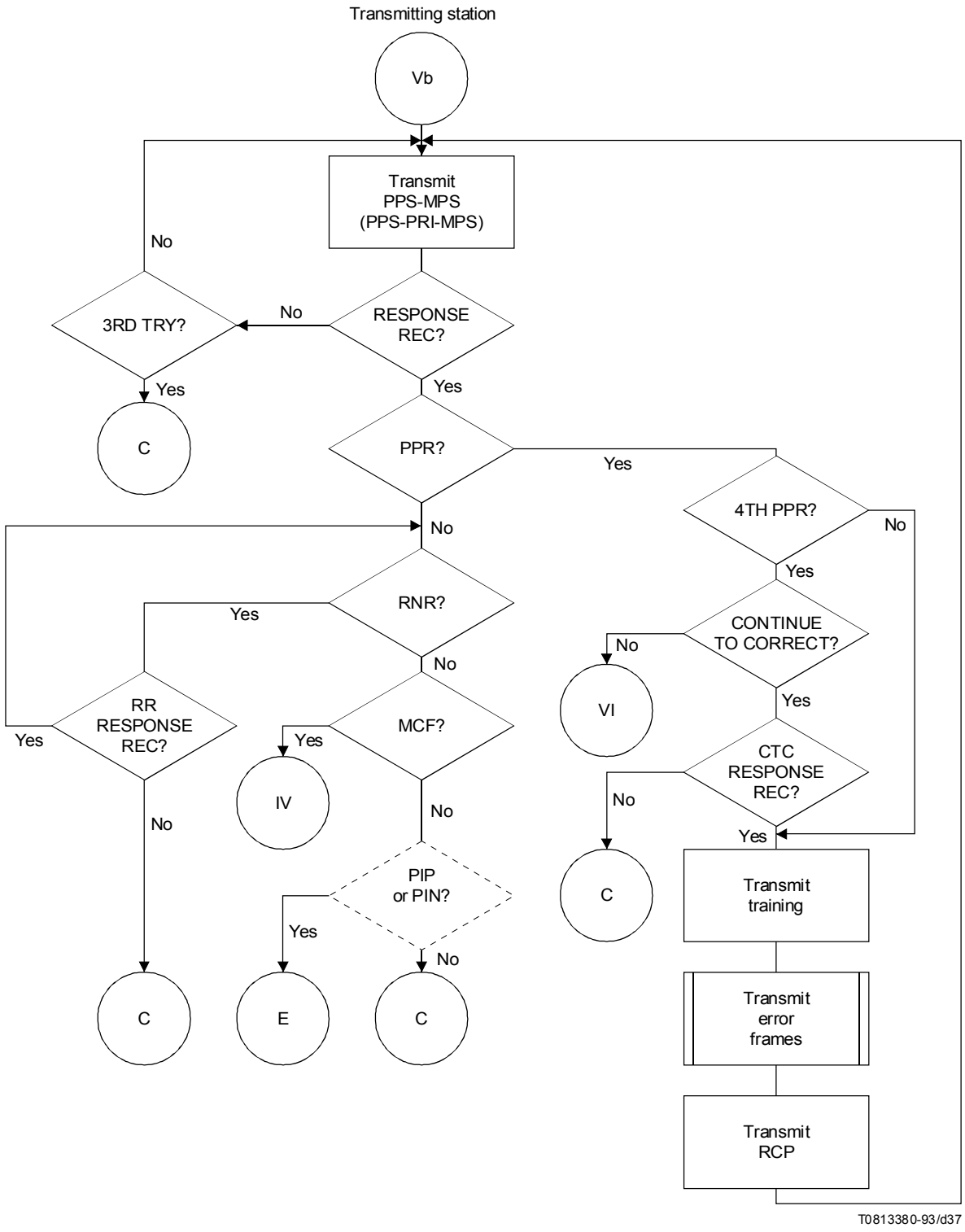


FIGURE A.10/T.30

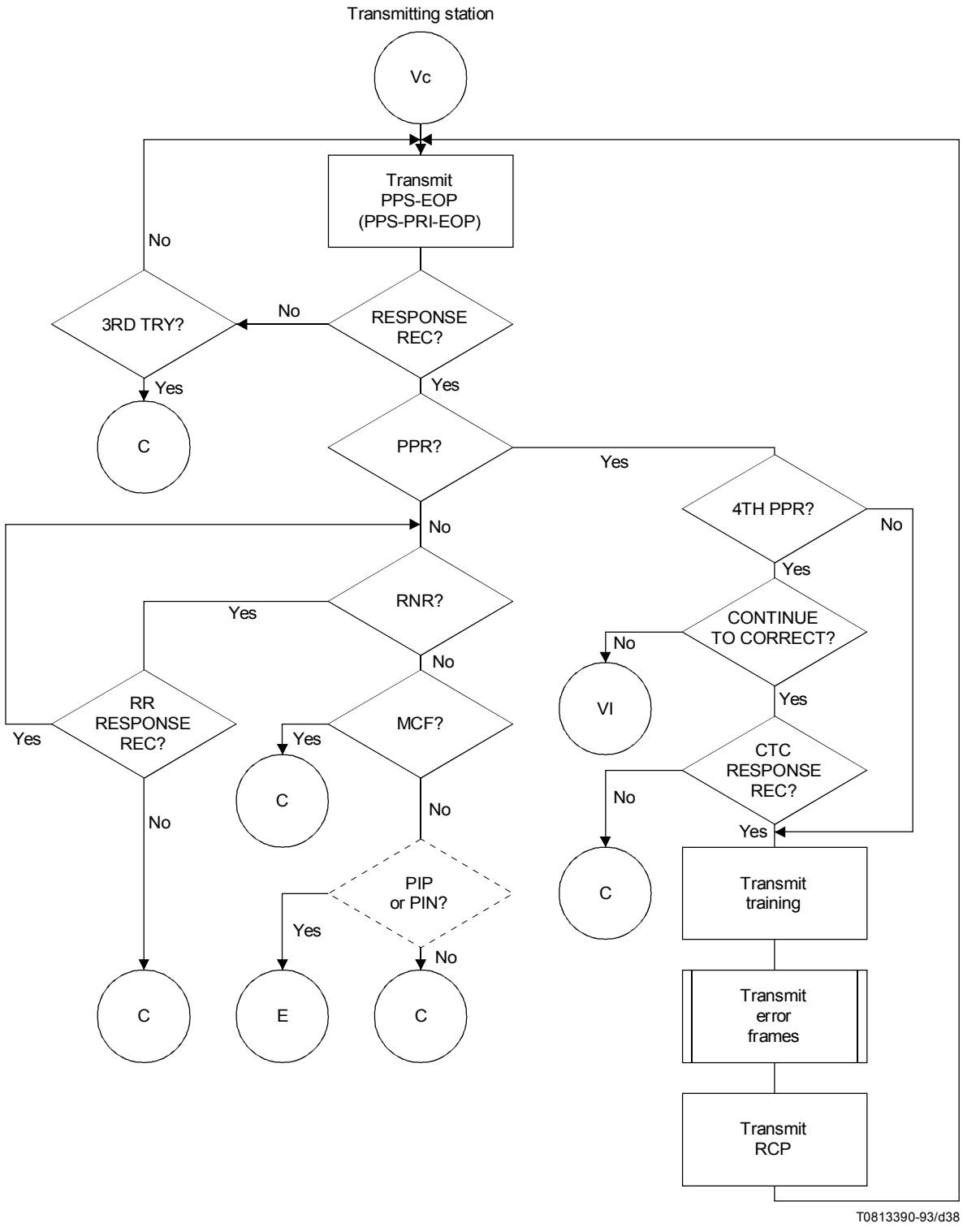


FIGURE A.11/T.30

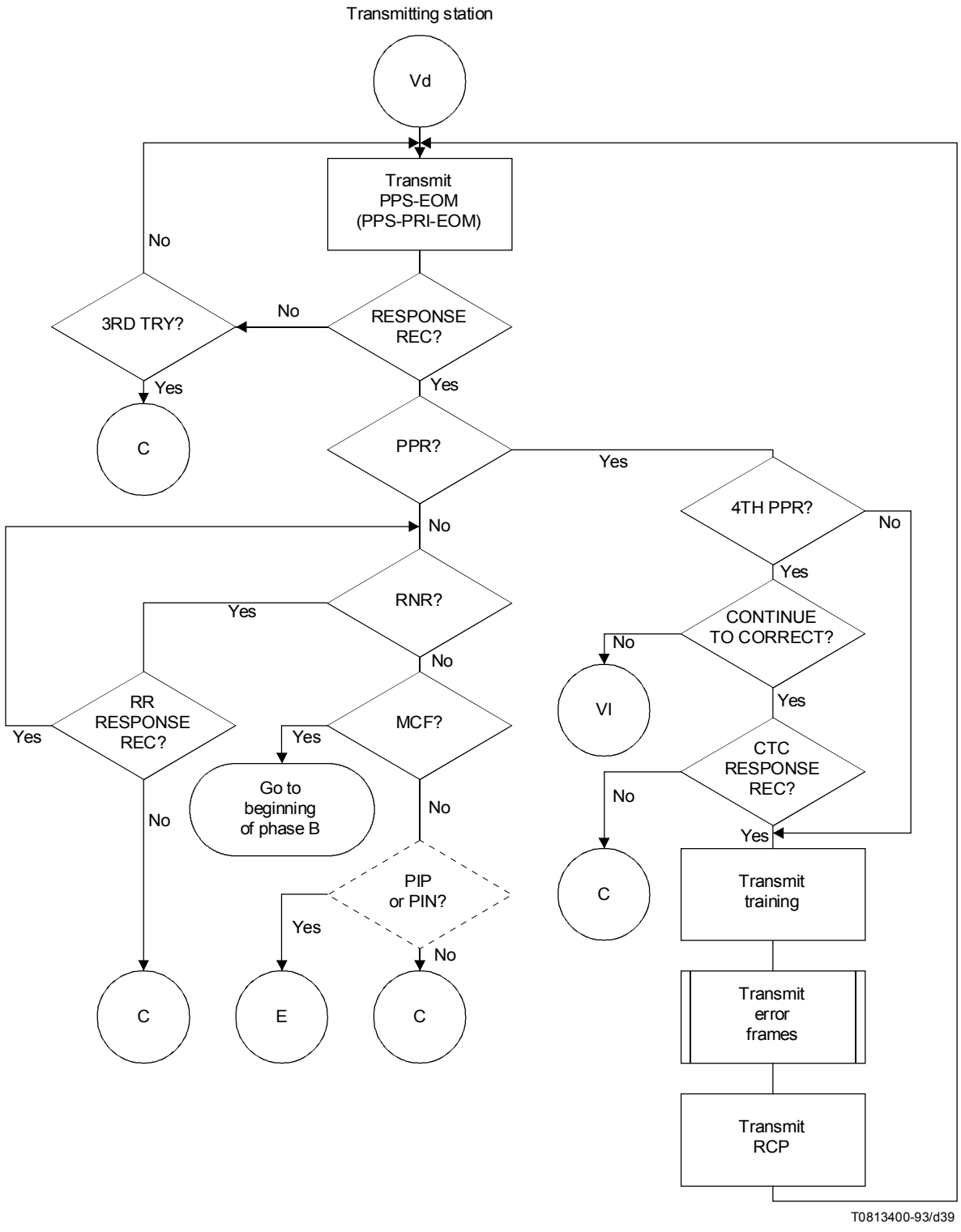


FIGURE A.12/T.30

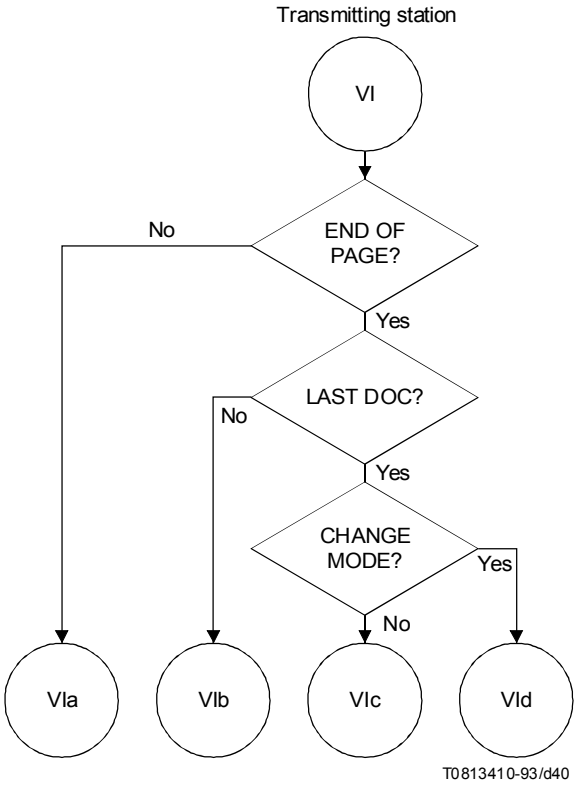


FIGURE A.13/T.30

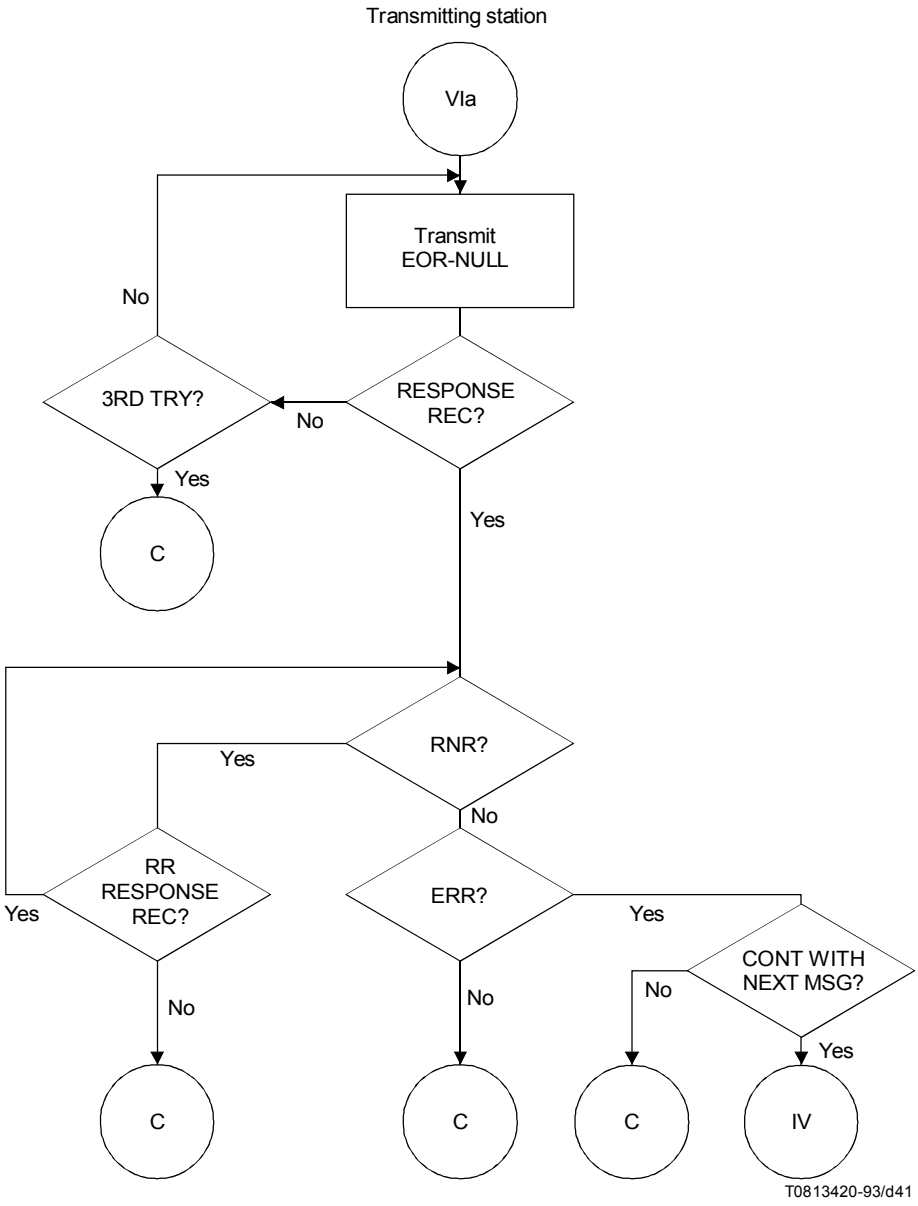


FIGURE A.14/T.30

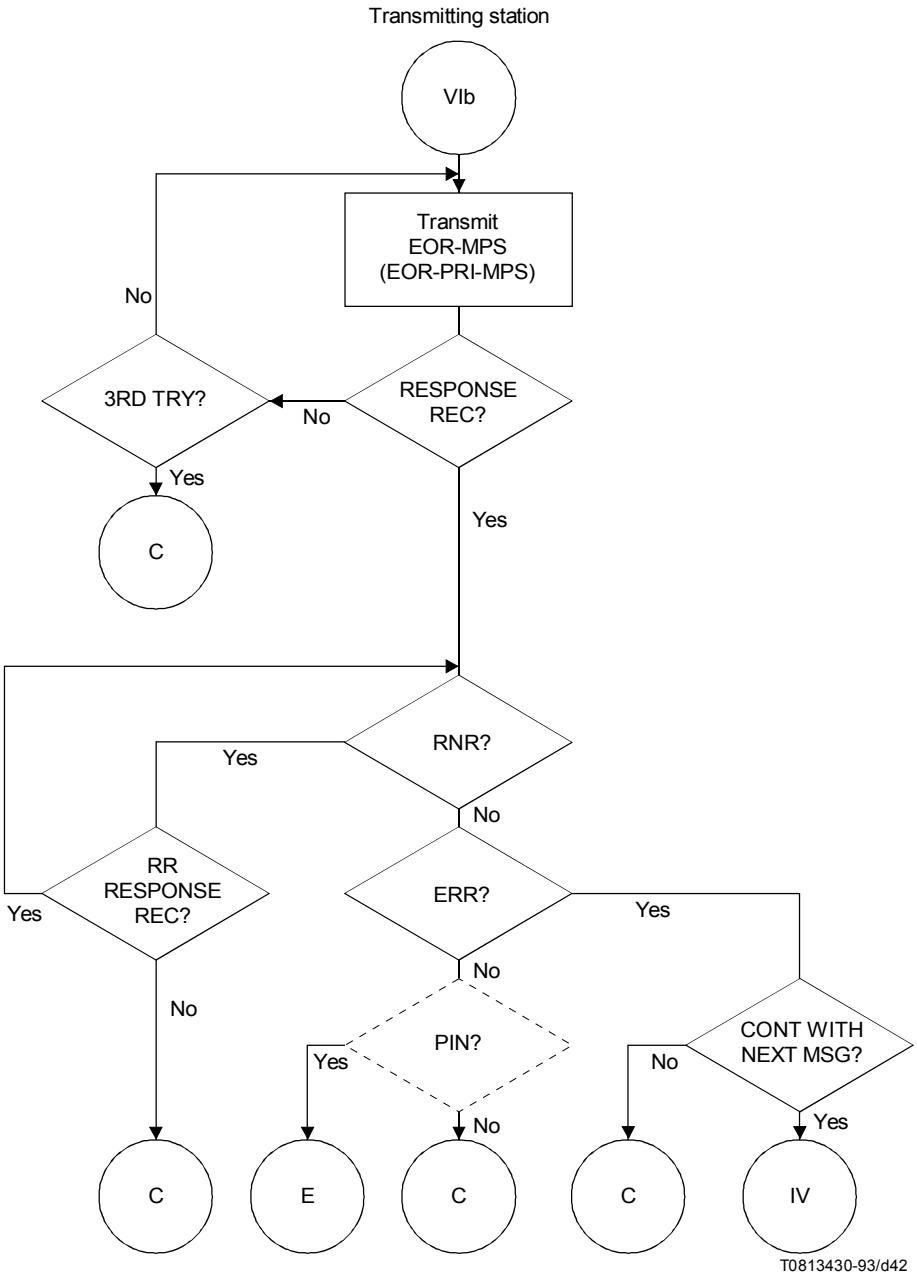


FIGURE A.15/T.30

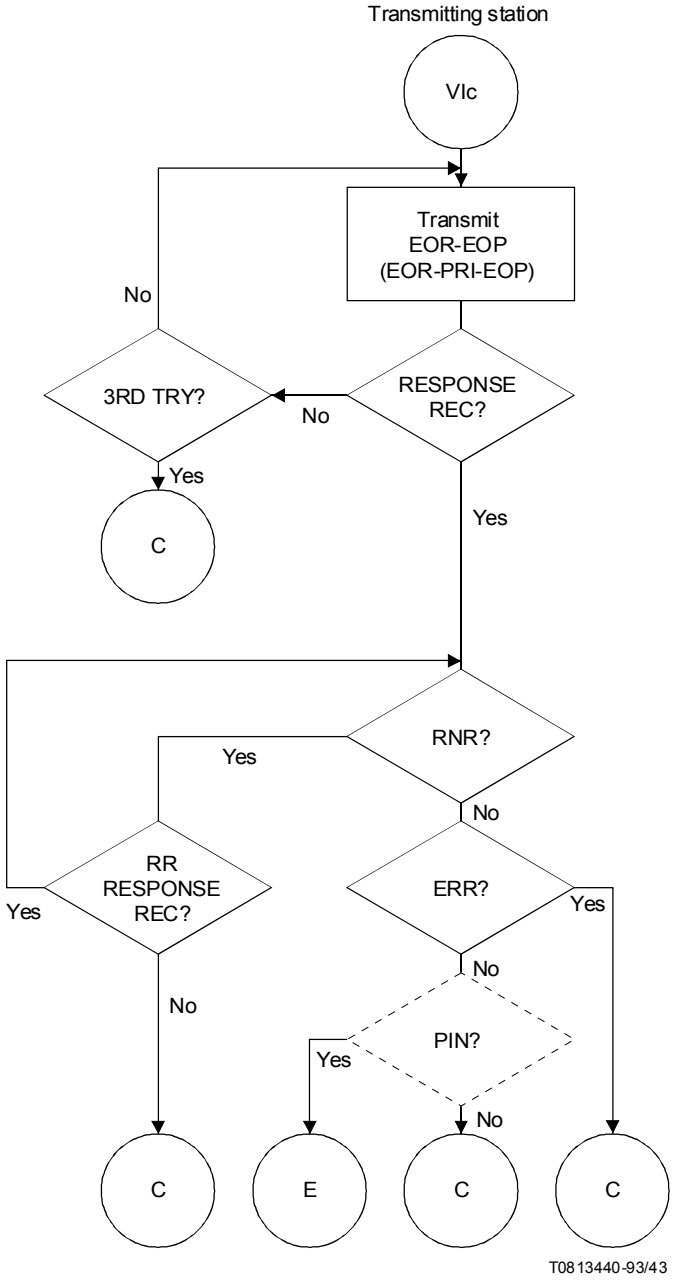


FIGURE A.16/T.30

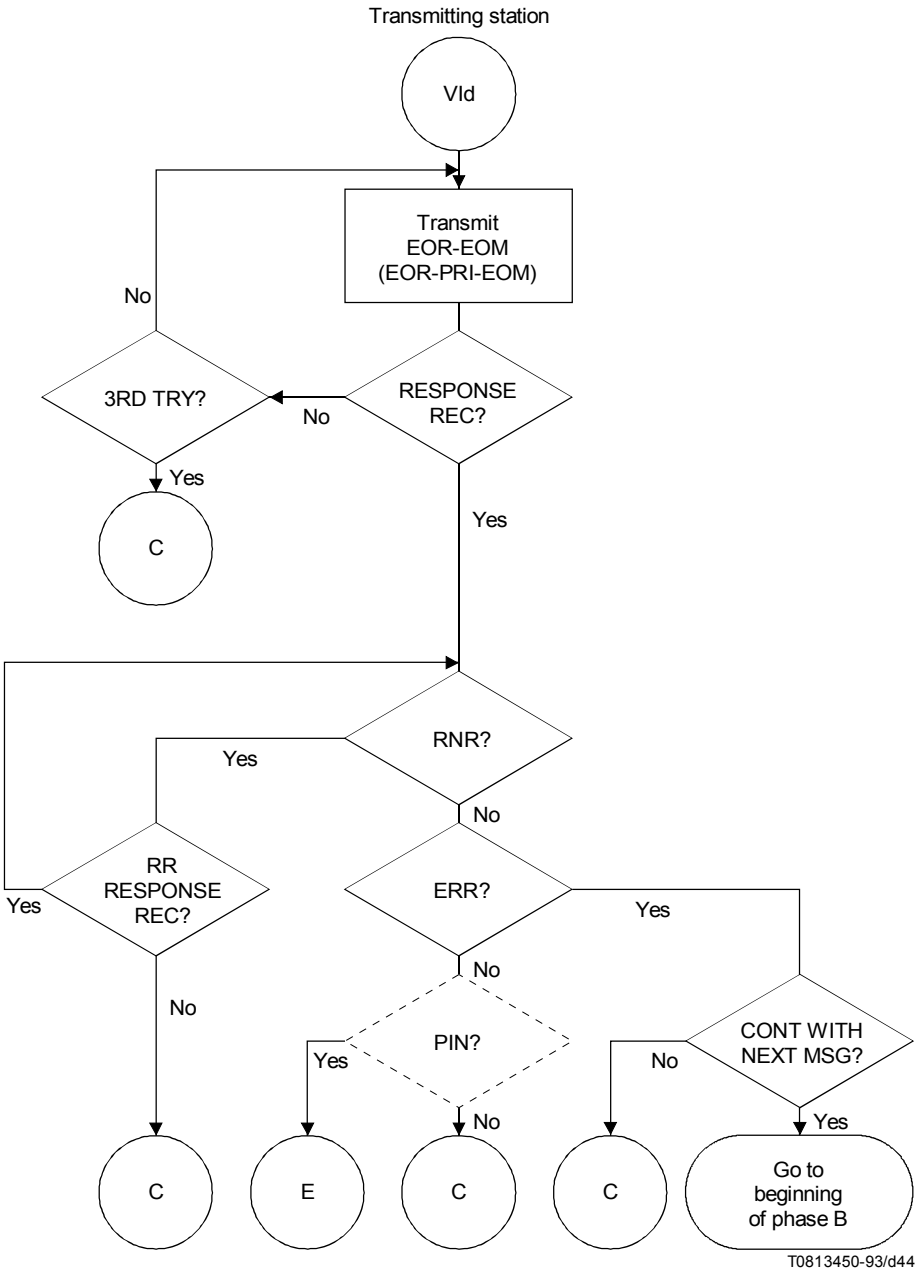


FIGURE A.17/T.30

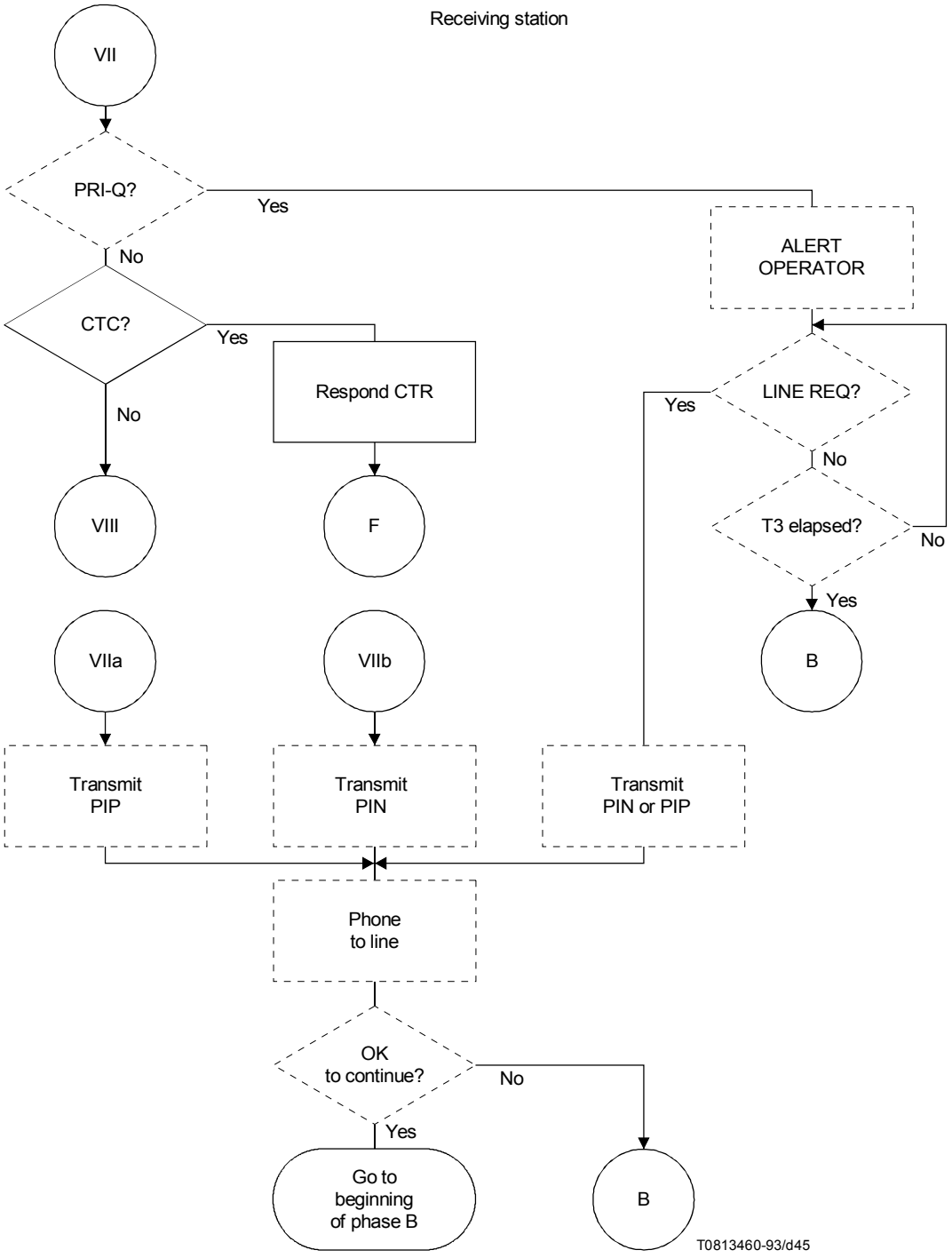


FIGURE A.18/T.30

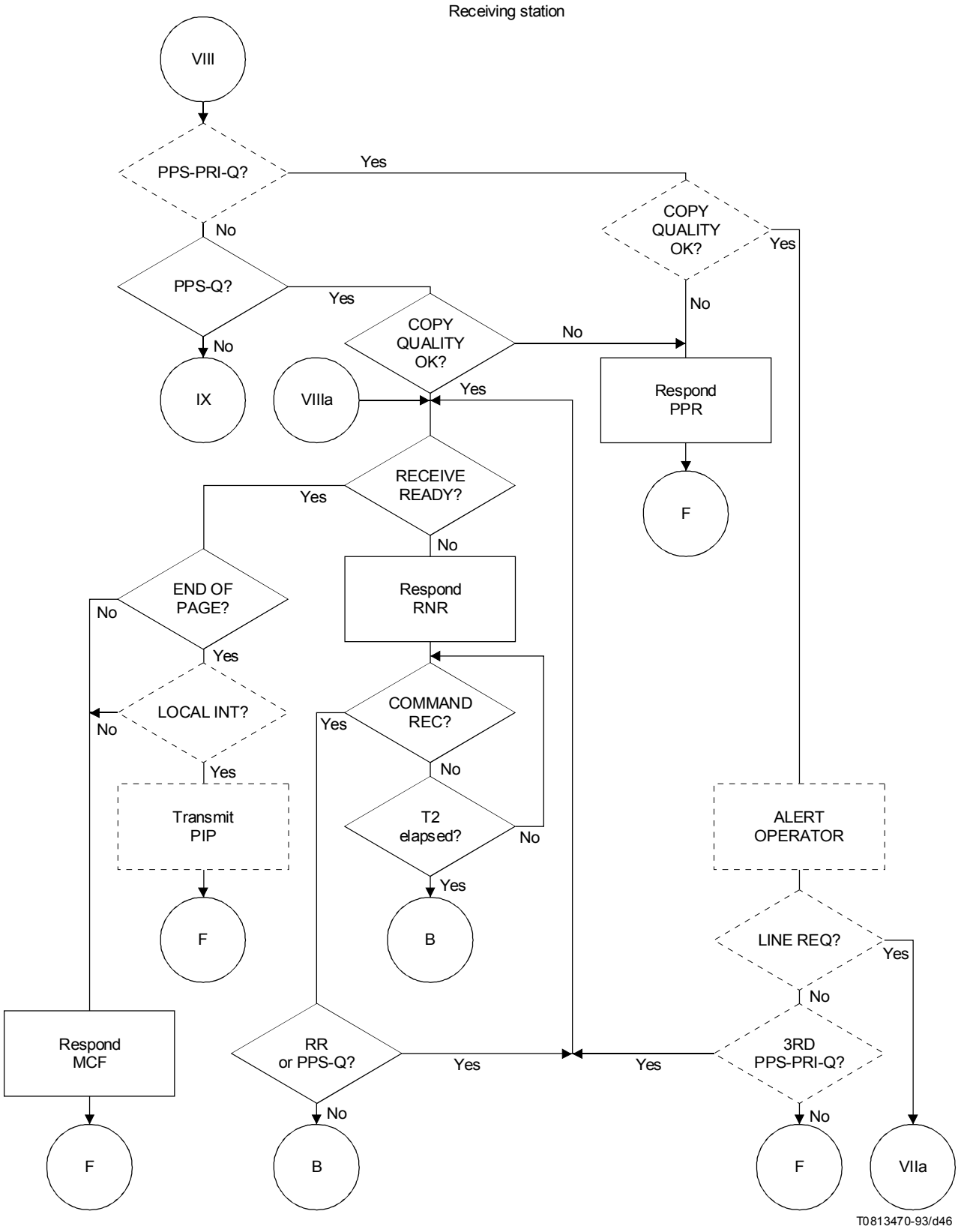


FIGURE A.19/T.30

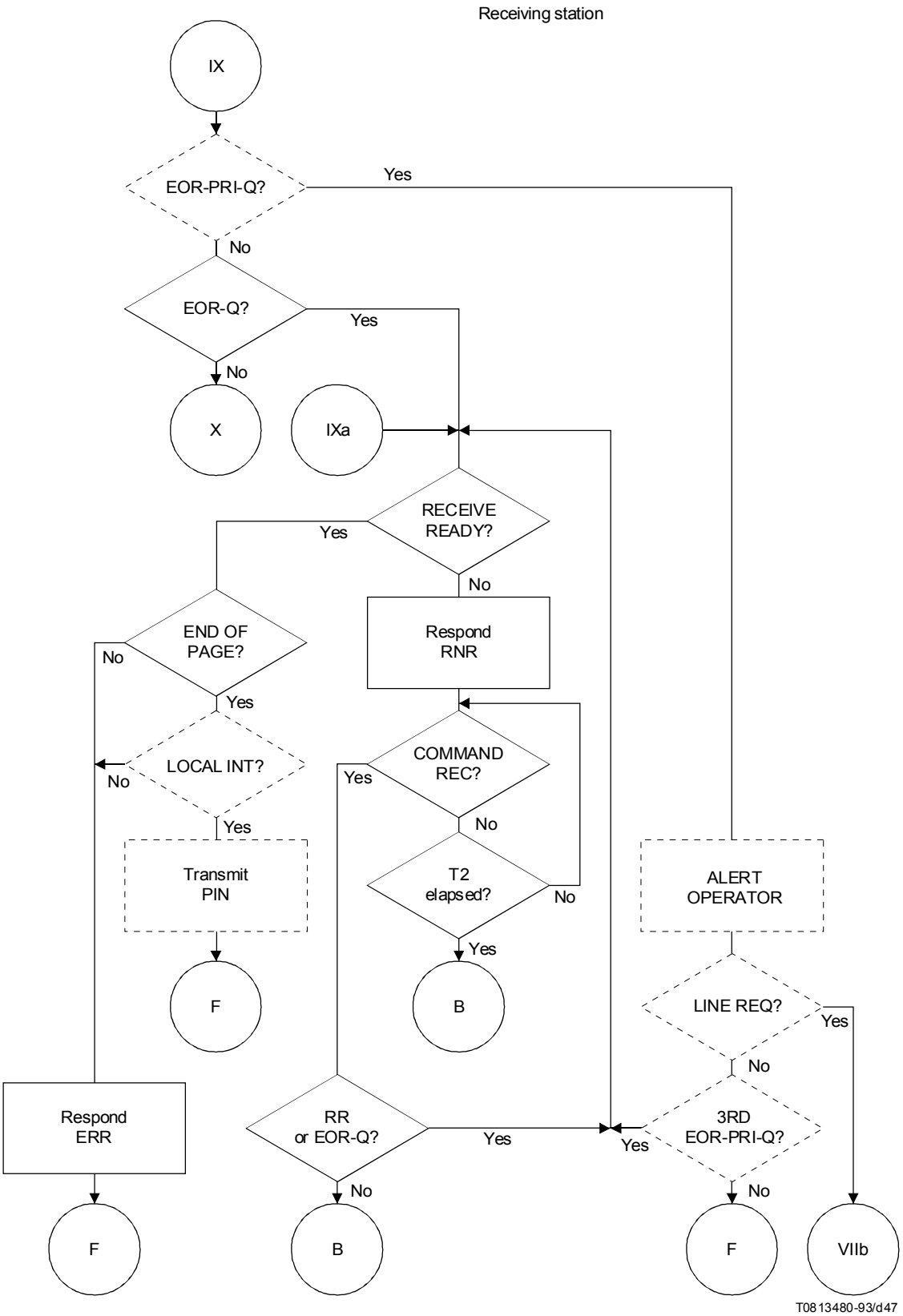


FIGURE A.20/T.30

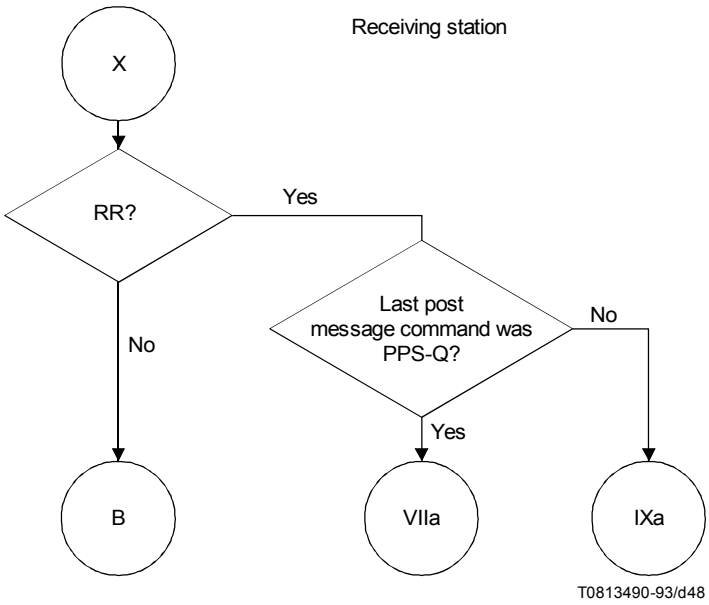


FIGURE A.21/T.30

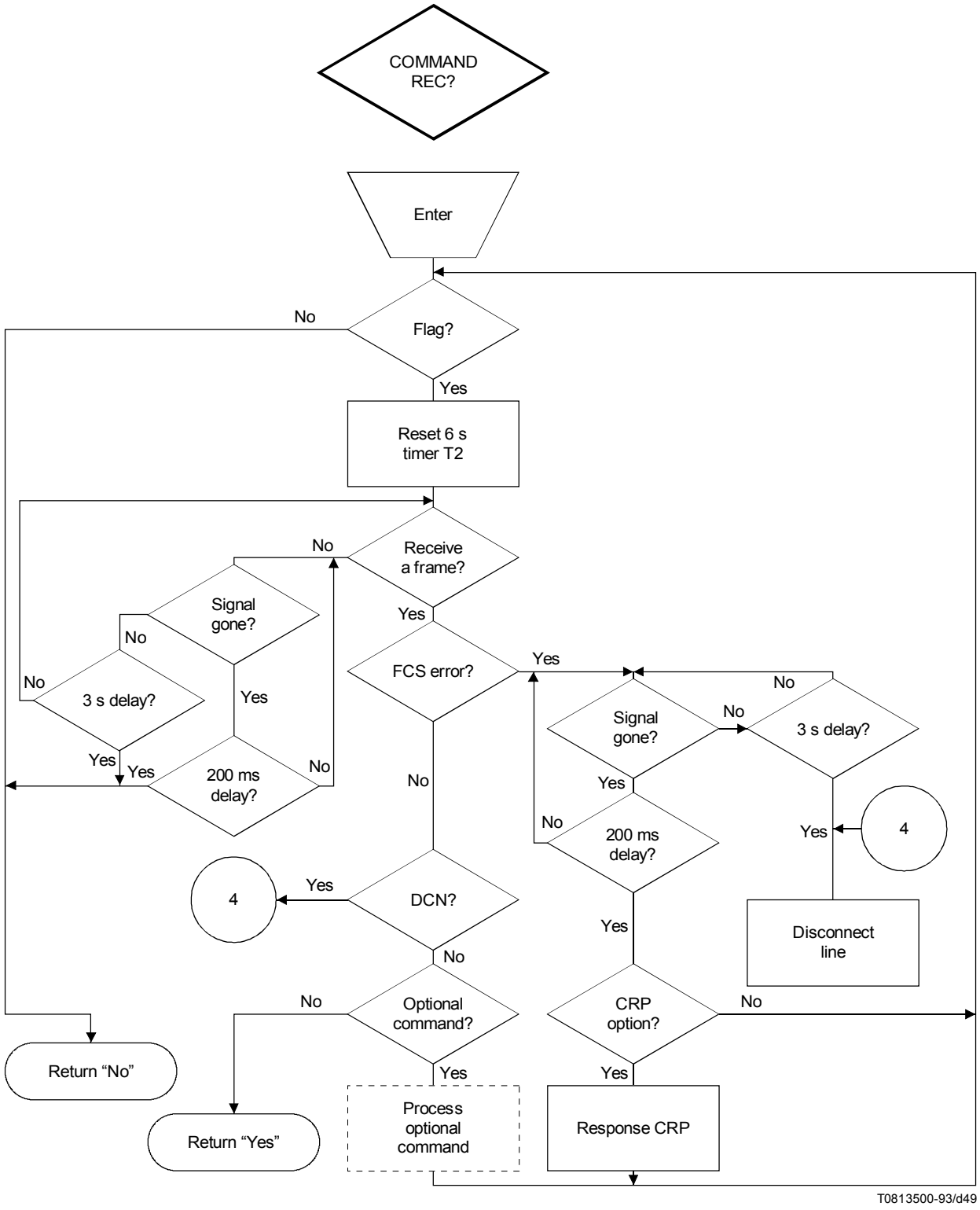
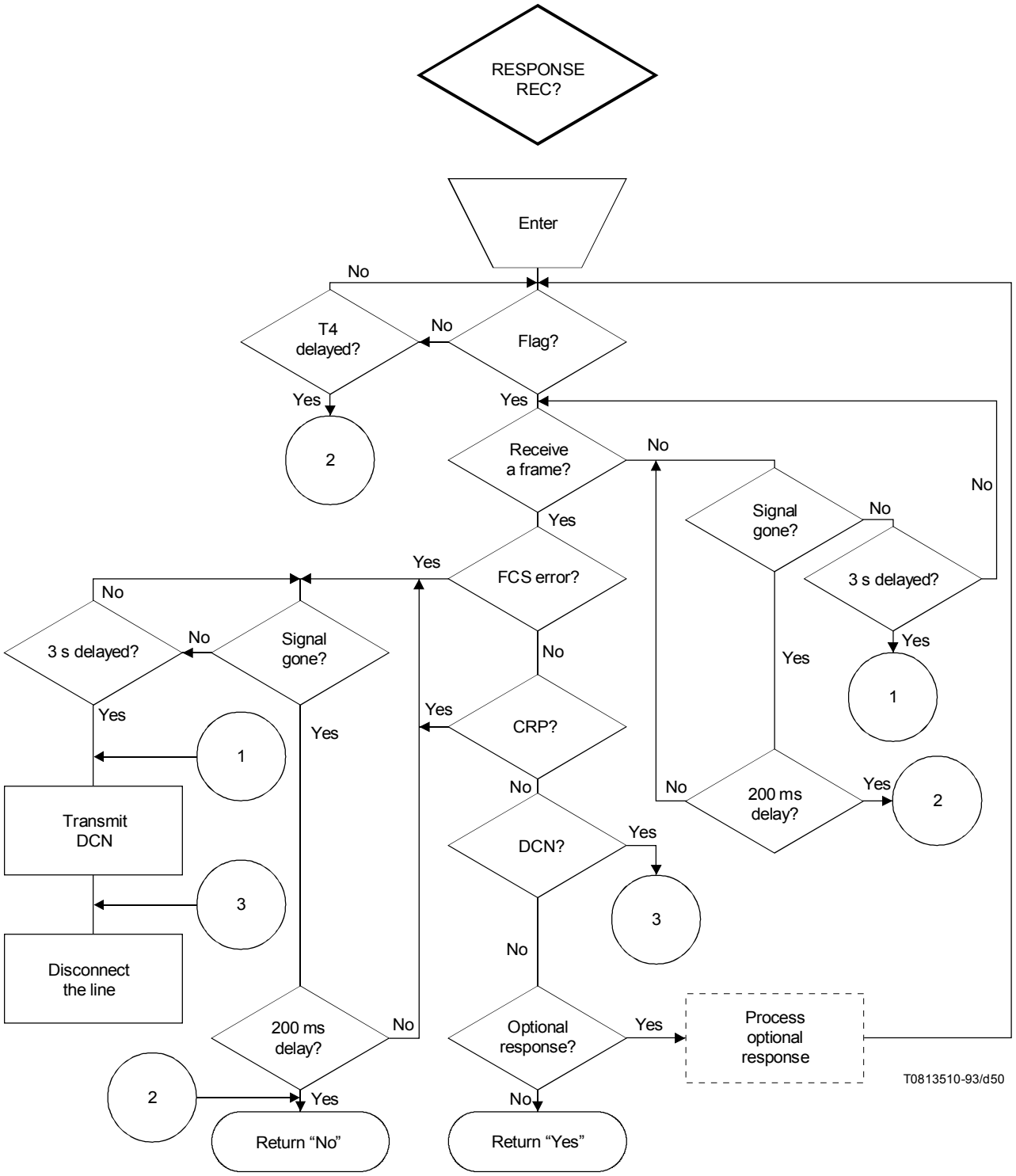


FIGURE A.22/T.30



T4 = 4.5 s ± 15% for manual units
T4 = 3.0 s ± 15% for automatic units

FIGURE A.23/T.30

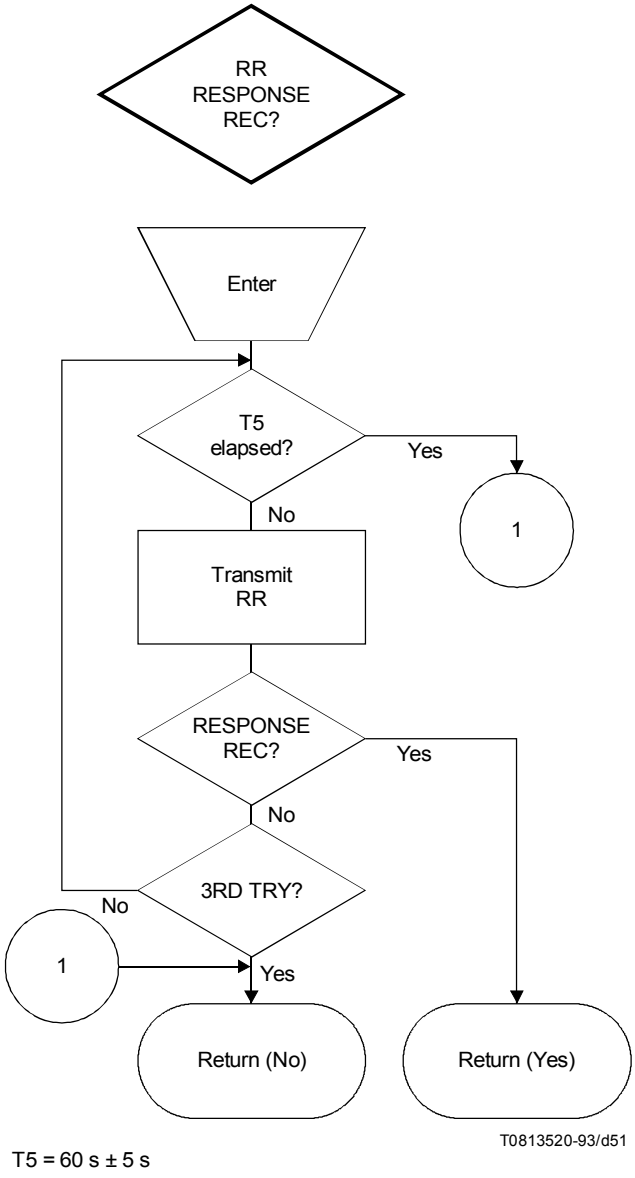


FIGURE A.24/T.30

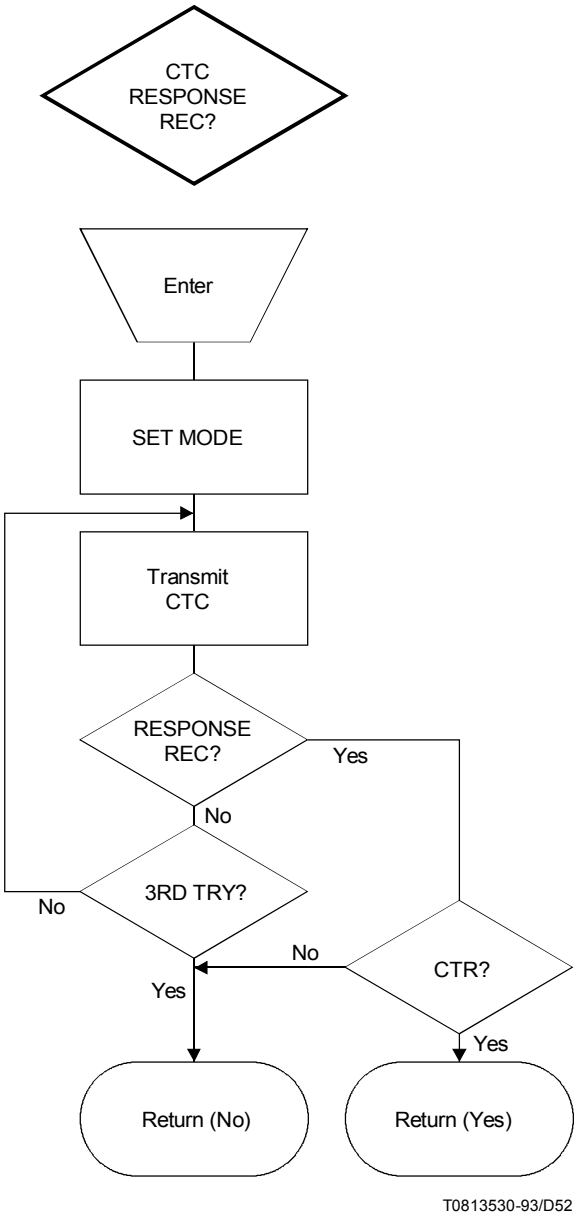


FIGURE A.25/T.30

A.7.1 Flow diagram key

COMMAND REC	The "command received" subroutine searches for an error-free standard command. The decision diamonds in the flow diagram refer to the most recent standard command received (e.g. EOM, MPS, etc).
COMPT REMOTE	The FIF associated with the DIS has indicated a REC "compatible remote receiver".
DOC TO XMIT	The station has "at least one document to be transmitted".
COMPT REMOTE XMTR	The FIF associated with the DIS has indicated a "compatible remote transmitter" which has documents to send.
REPONSE REC	The "response received" subroutine which searches for an error-free standard response.
LAST DOC	The "last document", for the given operating mode, has been transmitted.

SET MODE	The system controller will "set the appropriate mode" of operation.
3RD TRY	The command has been repeated three times without an appropriate response.
CAPABLE RE-XMIT	The transmitting station is "capable of retransmitting" a document which was not received with acceptable quality.
MSG CARRIER REC	The "message channel carrier has been received". This carrier is 1800 Hz for the Group 3 modulation scheme, and 1700 Hz for the Group 3 optional modulation scheme, 2100 Hz for the Group 2 modulations, and 1300-2100 Hz for the Group 1 modulation scheme.
PHASE/TRAIN OK	The phasing/training-TCF signal has been analysed and the results of "phasing/training were OK".
CHANGE MODE	The transmitting unit desires to exit from the transmitting mode of operation and re-establish the capabilities.
NSP REQ	A "non-specified procedure" has been "recognized" by a unit compatible with the station initiating that procedure.
COPY QUALITY OK	By some algorithm, the "copy quality was deemed OK".
REPHASE/TRAIN	By some algorithm, it is deemed desirable to transmit a new phasing/training signal.
FLAG	There has been the detection of a "flag".
RECEIVE A FRAME	The unit has "received one complete HDLC frame".
FCS ERROR	The HDLC frame received contained an "FCS error".
OPTIONAL RESPNS	The HDLC frame received contained one of the listed "optional responses".
OPTIONAL COMMAND	The HDLC frame received contained one of the listed "optional commands".
CRP OPTION	The facsimile unit has the "CRP option" and can, therefore, request an immediate retransmission of the most recent command.
LOCAL INT	Either the"local" machine or the "local" operator wishes to generate an interrupt of the standard facsimile procedures. An operator would use this as a means to request the establishment of voice contact.
LINE REQ	This means that the local operator has "requested" that the telephone line be connected to the handset for voice contact with the remote end.
PRI-Q	A general term referring to either PRI-EOM, a PRI-MPS, or a PRI-EOP post-message command i.e. the fifth bit of the standard post-message command is set to 1.
END OF PAGE?	The transmitting station may have further data to transmit to complete the page.
4th PPR?	PPR has been received 4 times.
TRANSMIT ERROR FRAMES	The frames defined in the information field associated with PPR are transmitted using the V.27 *ter*/V.29/V.33/V.17 modulation system.
CONTINUE TO CORRECT?	The transmitting station by some algorithm decides to continue correcting the previous message.
CONTINUE WITH NEXT MESSAGE?	The transmitting station by some algorithm decides to continue and transmit the next message. The previous message was not satisfactorily transmitted.
PPS-PRI-Q?	The terminal has "received either PPS-PRI-EOM, PPS-PRI-MPS or PPS, PRI-EOP post-message command".

PPS-Q?	The terminal has "received either PPS-EOM, PPS-MPS, PPS-EOP or PPS-NULL post-message command".
EOR-PRI-Q?	The terminal has "received either EOR-PRI-EOM, EOR, PRI-MPS or EOR, PRI-EOP post-message command".
EOR-Q?	The terminal has "received either EOR-EOM, EOR-MPS, EOR-EOP or EOR-NULL post-message command".
RECEIVE READY?	The receiving station is ready to receive the next message.
RR REPONSE REC?	The "RR response received" subroutine searches for an error-free response for the RR command.
CTC RESPONSE REC?	The "CTC reponse received" subroutine searches for an error free response for the CTC command.

NOTES

1 The non-specified procedure, NSP, refers to a procedure which takes 6 seconds or less to complete. It may not necessarily be a definable signal sequence.

2 This signal pertains to Group 3 apparatus only.

3 The PRI-EOM, PRI-EOP, PRI-MPS post-message commands are sent when a local interrupt request is pending.

4 At any time during the operation and interrupt may be generated which would result in a procedural interrupt. It is understood that if this interrupt happens during the transmission of the document, the EOM/RTC signal will be transmitted prior to invoking the procedural interrupt.

5 Where the symbol / is used, the term to the left of the symbol refers to Groups 1 and 2 equipment, and the term to the right of the symbol refers to Group 3 equipment.

6 Where the symbols { } are used, the signals within these symbols are a response to DIS from the calling unit wishing to receive.

7 Where the symbols ( ) are used, the signals within these symbols are optional.

A.8 Signal sequence examples in case of error correction procedure

The examples in Figure A.26 are based on the flow diagrams and for illustrative and instructional purposes only. They should not be interpreted as establishing or limiting the protocol. The exchange of the various commands and responses is limited only by the rules specified in this Recommendation.

In the following diagrams, the dashed lines indicate transmission at the message data rate (Recommendations V.27 *ter*, V.29, V.33, V.17 and (X,Y) means (page modulo number, block modulo number.

Example 1 An auto calling unit wishing to transmit to an auto answer unit: example of T.4 error correction.

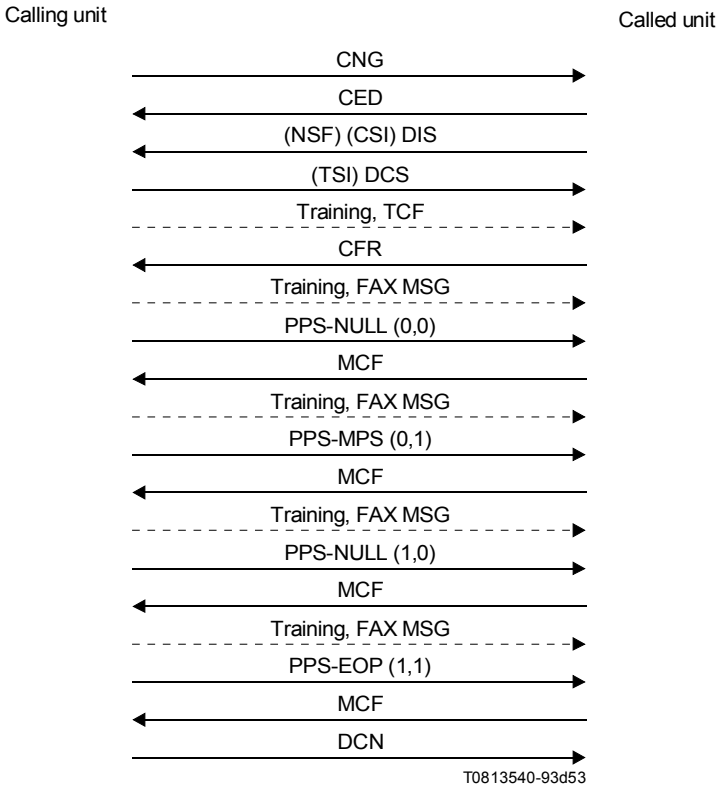


FIGURE A.26/T.30 (sheet 1 of 13)

Example 2 An auto calling unit wishing to transmit to an auto answer unit: example of PPR sequence with errors.

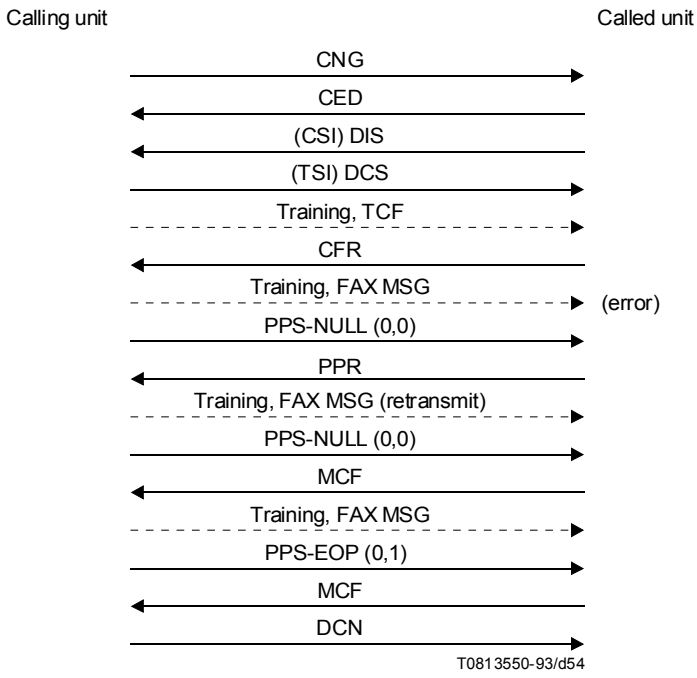


FIGURE A.26/T.30 (sheet 2 of 13)

Example 3 An auto calling unit wishing to transmit to an auto answer unit: example of post-message commands with errors.

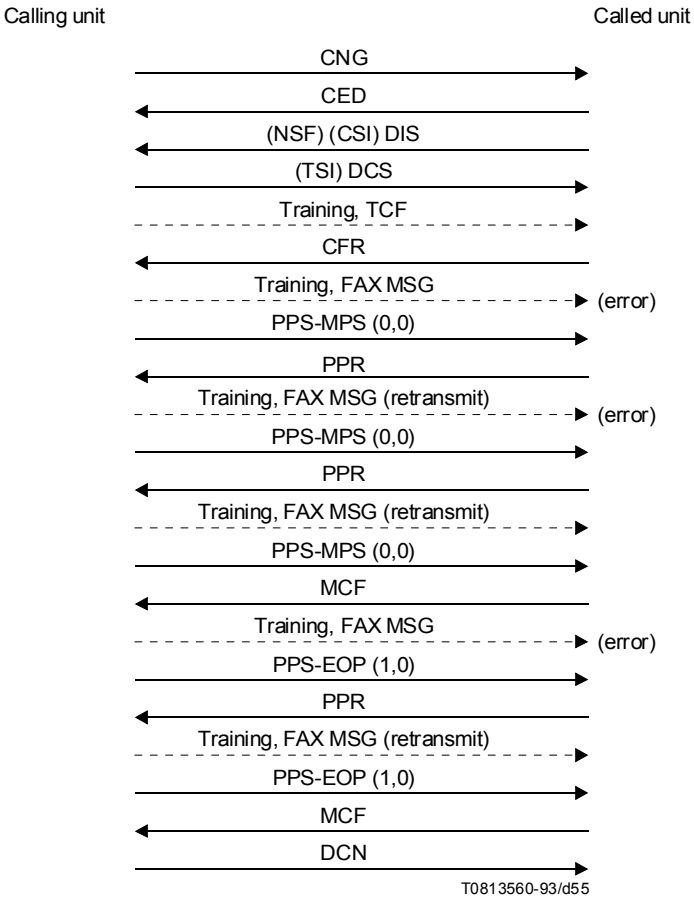


FIGURE A.26/T.30 (sheet 3 of 13)

Example 4 An auto calling unit wishing to transmit to an auto answer unit: example of first command failure with message errors.

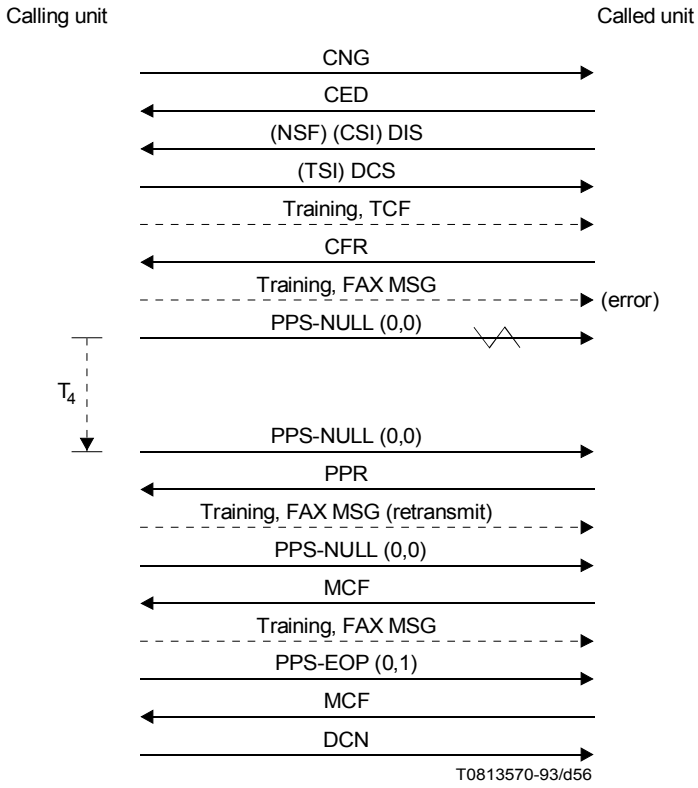


FIGURE A.26/T.30 (sheet 4 of 13)

Example 5 An auto calling unit wishing to transmit to an auto answer unit: example of response failure with message errors.

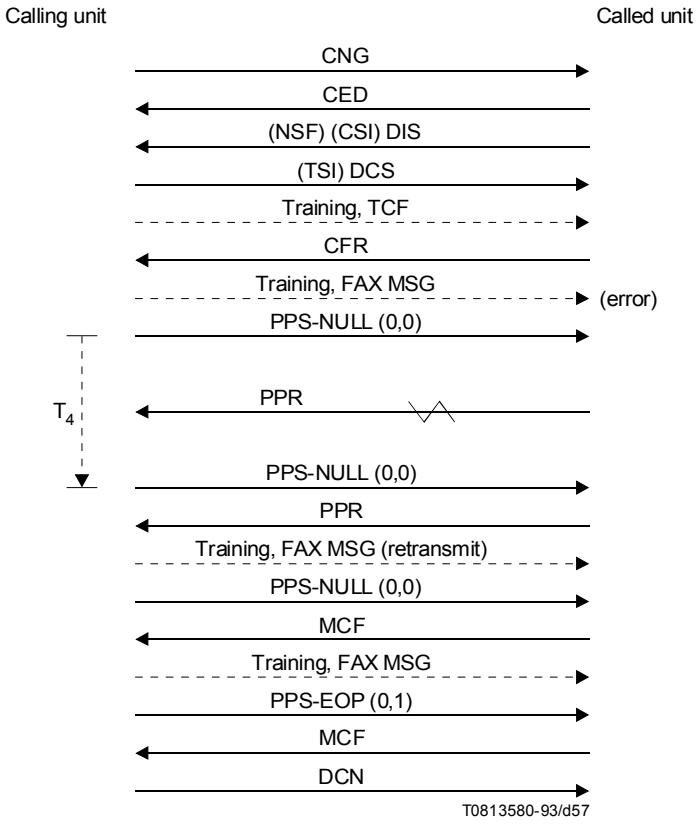


FIGURE A.26/T.30 (sheet 5 of 13)

Example 6 An auto calling unit wishing to transmit to an auto answer unit: example of fallback (CTC).

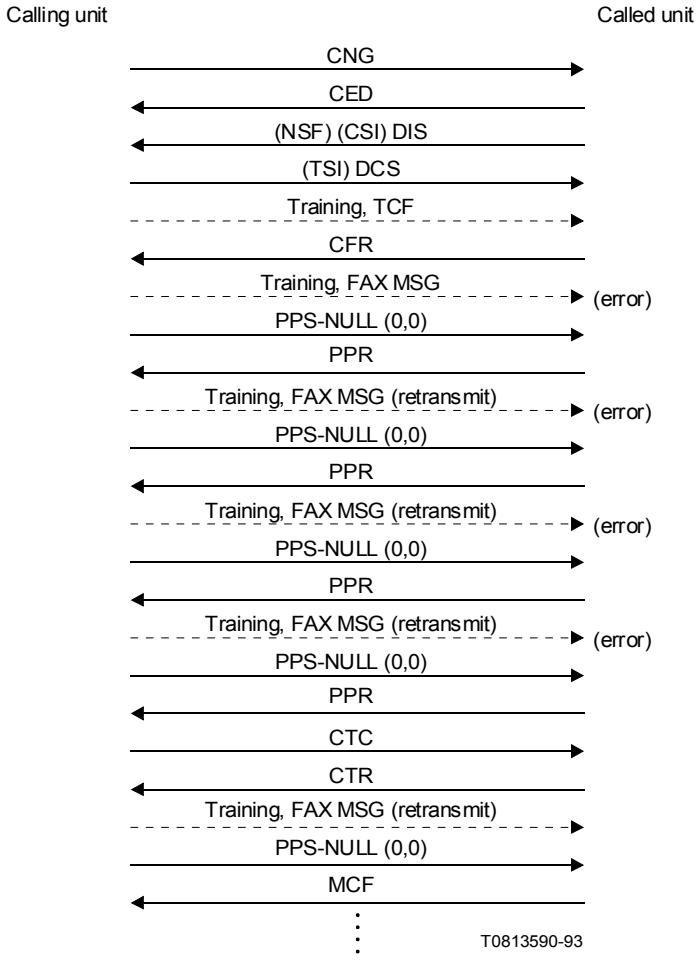


FIGURE A.26/T.30 (sheet 6 of 13)

Example 7 An auto calling unit wishing to transmit to an auto answer unit: example of flow control.

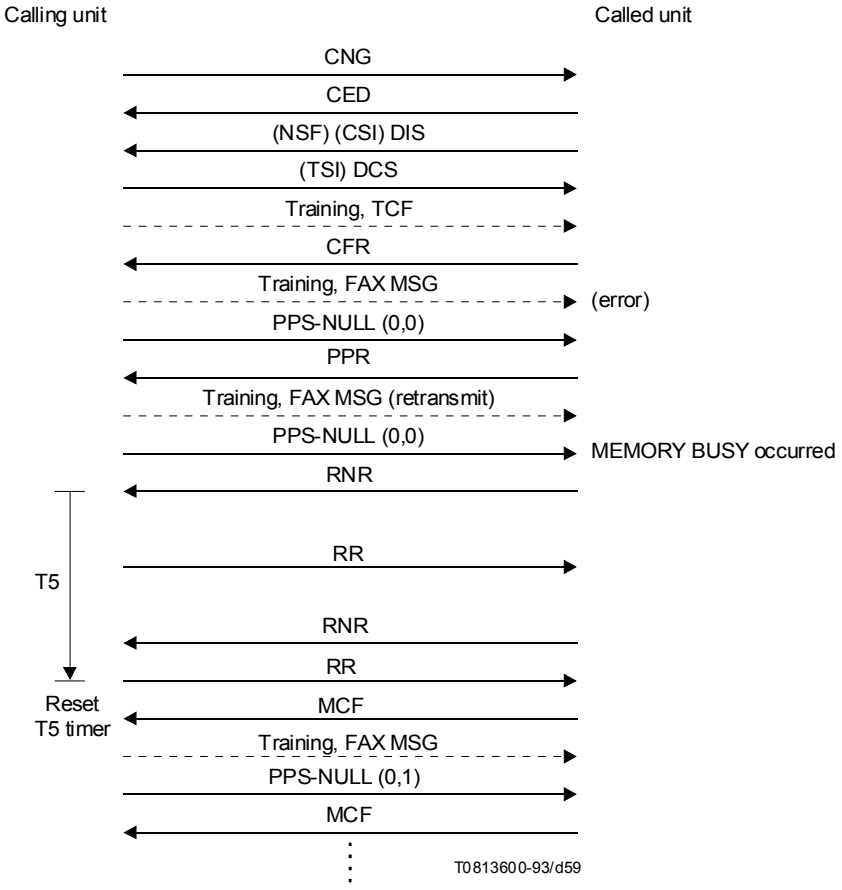


FIGURE A.26/T.30 (sheet 7 of 13)

Example 8 An auto calling unit wishing to transmit to an auto answer unit: example of T5 time out during flow control.

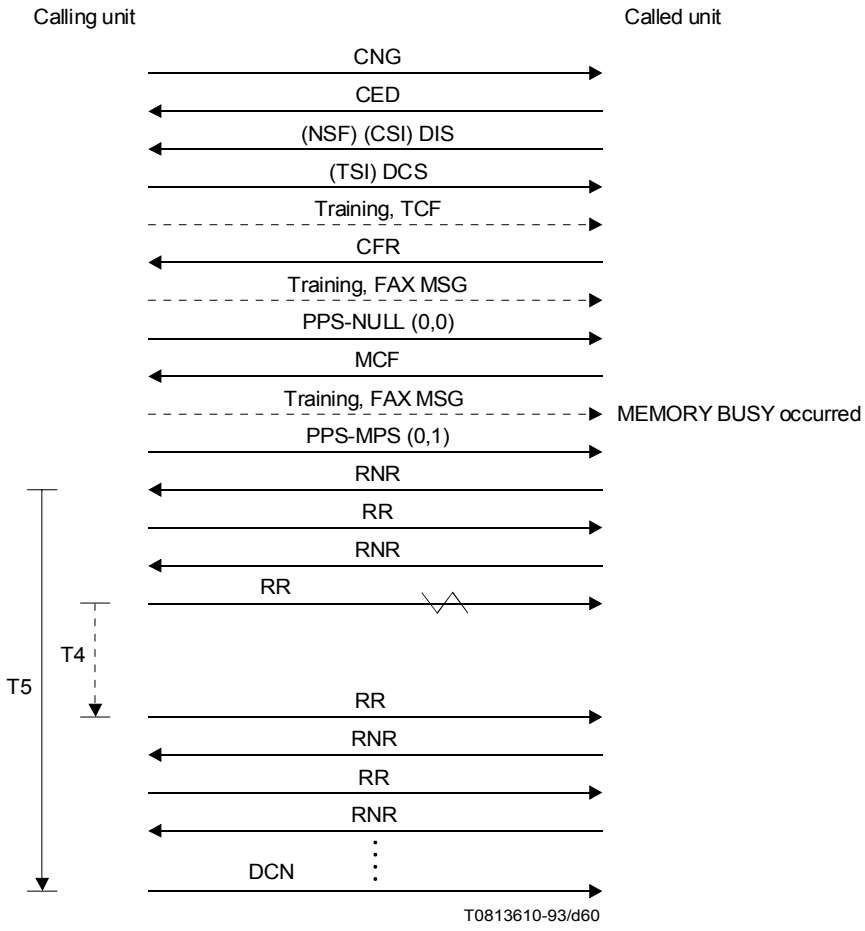


FIGURE A.26/T.30 (sheet 8 of 13)

Example 9 An auto calling unit wishing to transmit to an auto answer unit: example of procedural interrupt.

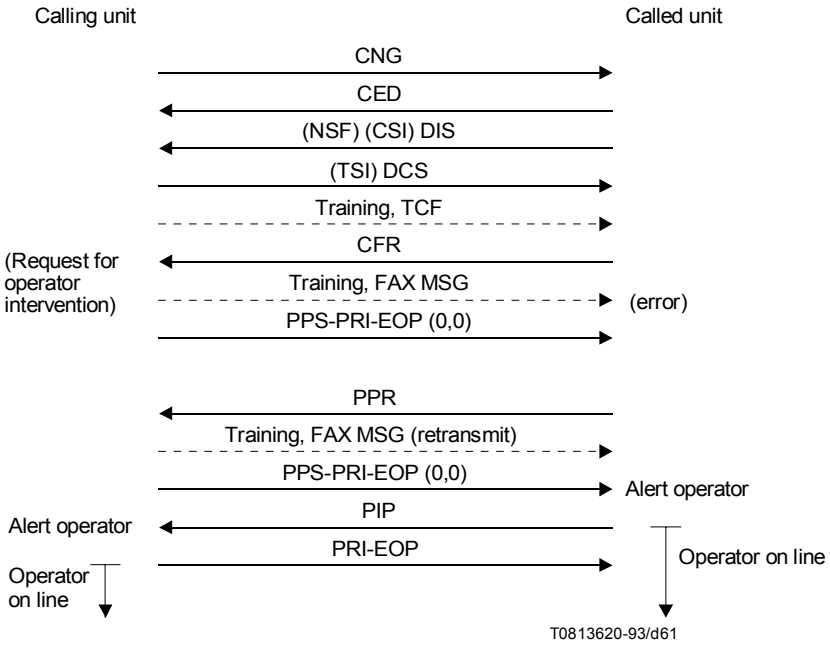


FIGURE A.26/T.30 (sheet 9 of 13)

Example 10 An auto calling unit wishing to transmit to an auto answer unit: example of post-message response.

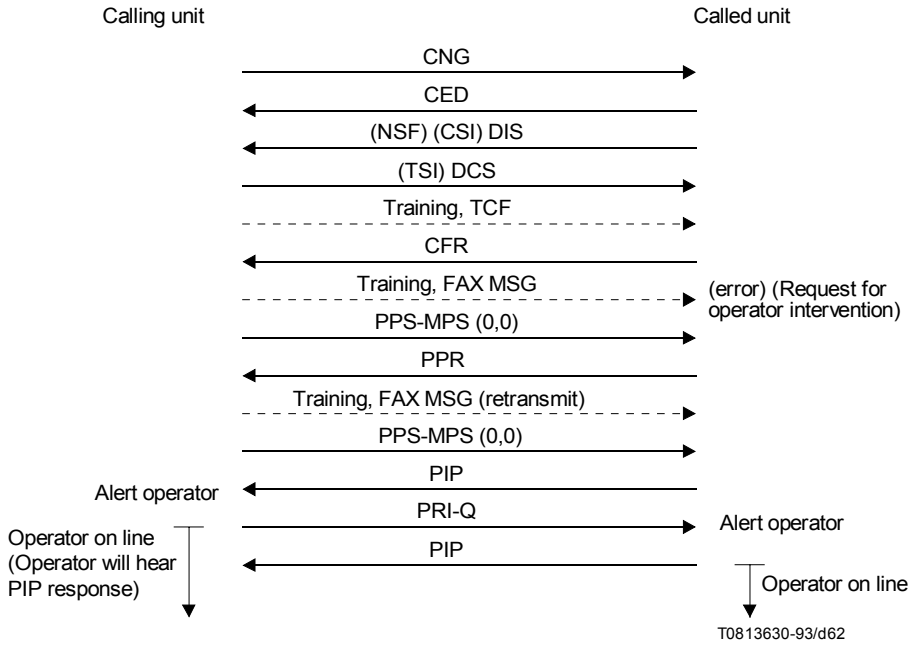


FIGURE A.26/T.30 (sheet 10 of 13)

Example 11 An auto calling unit wishing to transmit to an auto answer unit: example of EOR (first block message was not satisfactorily received).

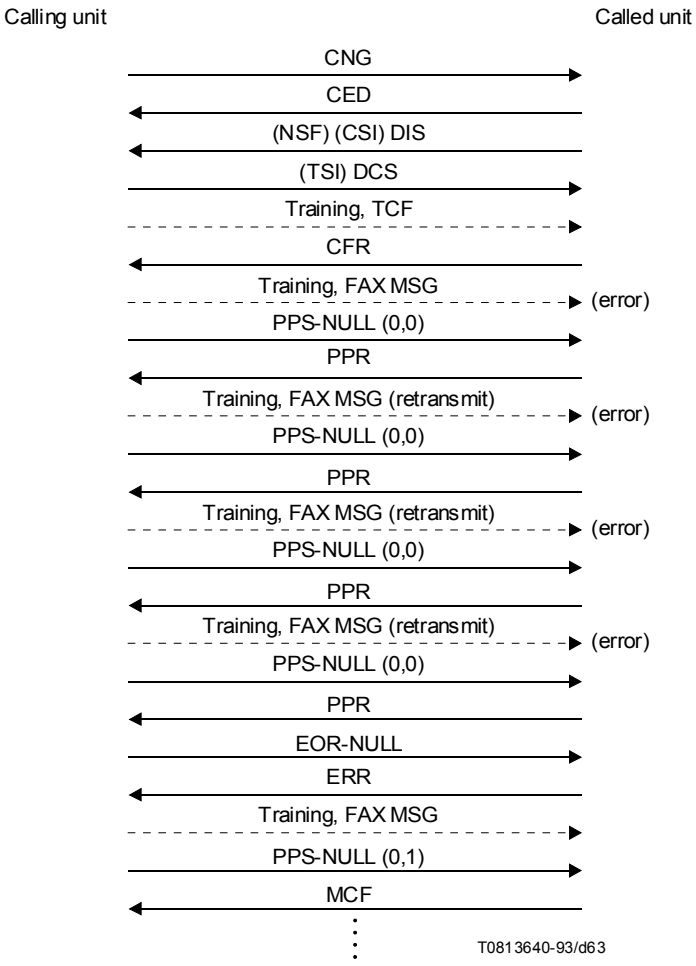


FIGURE A.26/T.30 (sheet 11 of 13)

Example 12 An auto calling unit wishing to transmit to an auto answer unit: example of EOR (first page was not satisfactorily received).

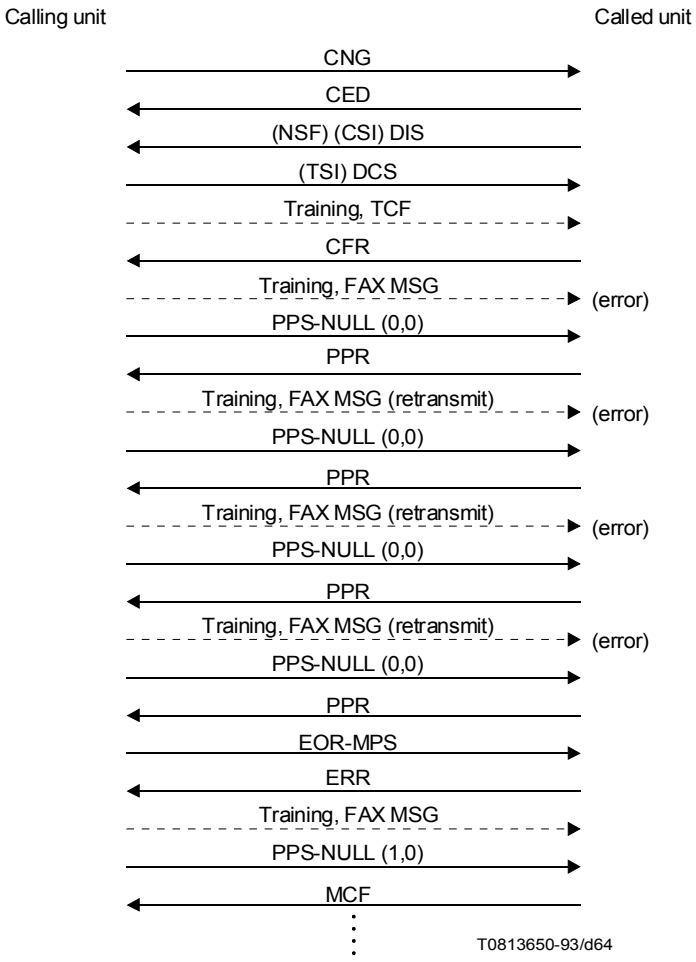


FIGURE A.26/T.30 (sheet 12 of 13)

Example 13 An auto calling unit wishing to transmit to an auto answer unit: example of all frames and flag sequences in FAX MSG failure to receive.

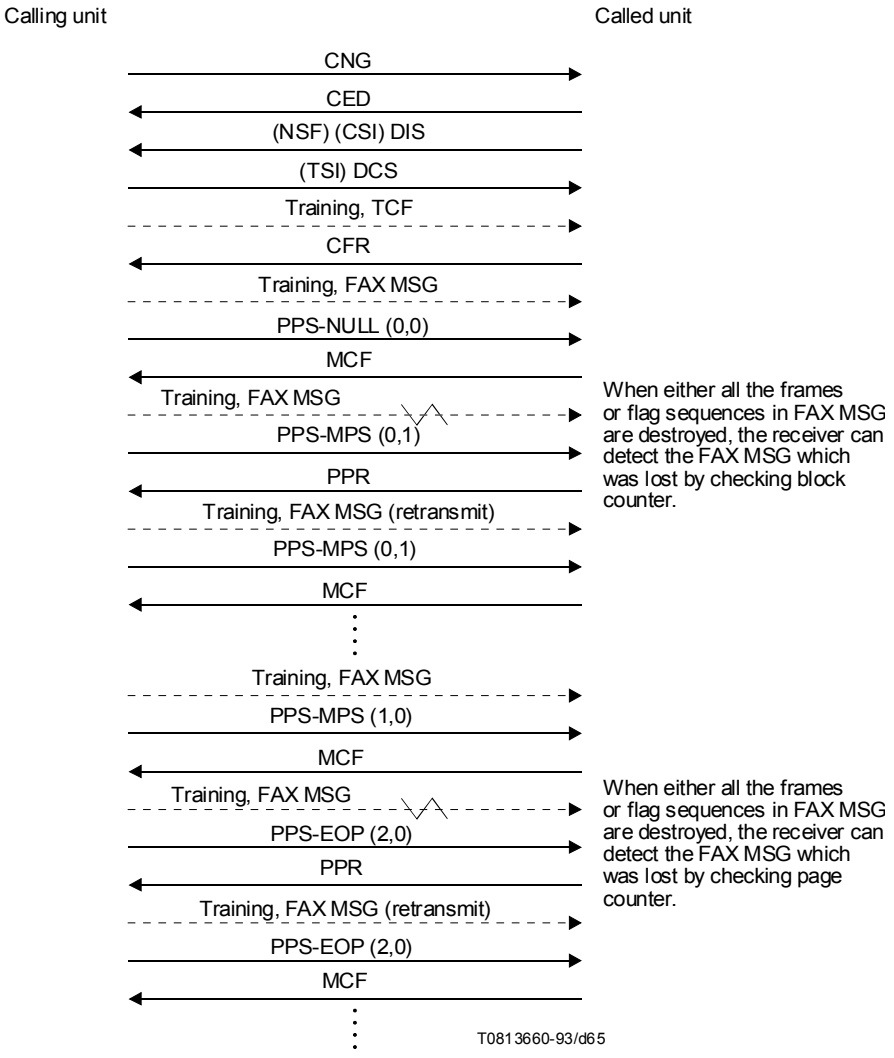


FIGURE A.26/T.30 (sheet 13 of 13)

Annex B

(This annex forms an integral Part of this Recommendation)

B.1 BFT diagnostic message

The file diagnostic message (FDM) frame is an optional post-message response which may be sent by the receiver. It provides the transmitter with diagnostic information concerning the current transfer taking place. The sematics and the syntax of the FDM are described in Recommendation T.434.

The diagnostic information may be composed of one or more messages. Each message is informative, transient or permanent. An informative message does not require recovery and does not affect the current state of the BFT. A transient message may not re-occur if the sequence of events is repeated but does imply the failure of the present BFT being performed. A permanent message is sent every time the sequence of events is repeated, and implies the failure of at least the present BFT being performed.

A diagnostic message may be sent in place of an MCF frame. The message may be sent using one or more HDLC frames. If more than one HDLC frame is used, only the last one will have the control field set for a final frame. The encapsulation of the diagnostic information within a frame is completely independent of attribute boundaries. However, each frame must meet the transmission requirements of this Recommendation.

If the transmitter receives a transient or permanent message, it should review the setup for the current binary file being transmitted. Control will continue as though four PPRs were received (emission of CTC command).

Annex C

Procedure for Group 3 document facsimile transmission on the Integrated Services Digital Network[4)]

(This annex forms an integral Part of this Recommendation)

C.1 Introduction

C.1.1 This annex describes the protocol used by Group 3 document facsimile apparatus when operating over the Integrated Services Digital Network. The procedures and signals used are based upon those defined in the main body as well as Annex A of this Recommendation. The protocol operates in either half duplex only or full and half duplex mode. In both cases, error correction is an integral part of the protocol.

C.1.2 Outline of the error correction method

The error correction method described in this Recommendation is based on page selective repeat ARQ (automatic repeat request) technique. An HDLC frame structure is utilized for all facsimile message procedures.

The transmitting apparatus divides the message into a number of concatenated frames as described in Annex A/T.4 and transmits it as a number of pages and/or partial pages.

The transmitting apparatus uses a frame size of 256 octets as indicated in the DCS command and the receiving apparatus must be able to receive a frame of that size.

In the full duplex mode of operation, the transmitting apparatus transmits subsequent partial pages without waiting for a response to the preceding partial page. If corrections are required, they are sent at the end of the next partial page transmission. If there are any unacknowledged commands from previous pages or partial pages, these are retransmitted prior to any corrections. In the half duplex case, all corrections are sent and acknowledged before a subsequent partial page is sent.

---

4) The use of these protocols on other digital networks or with full duplex modems is for further study.

When the previous message has not been satisfactorily received, the receiving apparatus transmits a PPR response to indicate that the frames specified in the associated facsimile information field are required to be retransmitted. The PPR signal contains the page and block numbers as well as the required frame numbers.

When a PPR signal is received, the transmitting apparatus retransmits the requested frames specified in the PPR information field.

There is no predefined number of attempts to correct a page, the decision is left up to the transmitter. If it is considered that too many attempts have been made then the transmitter will send the DCN signal.

If the receiver is unable to continue to receive new information it sends RNR continuously until it is ready to receive new information. During this time the transmitter will send any outstanding correction frames and any unacknowledged commands. If there are no outstanding corrections, then it will continuously transmit any unacknowledged commands until it receives a response other than RNR.

The transmitter will send no new information until all previously transmitted pages are acknowledged as having been received correctly.

In order to minimise the possibility of signals being received in error due to noise on the connection, all commands and responses are sent three times concatenated together. The exception to this is the initial identification sequence, i.e. XID + DIS or XID + NSF + DIS or XID + CSI + DIS or XID + NSF + CSI + DIS which is sent for a maximum of 5 seconds.

C.2 Definitions

C.2.1 When operating over the ISDN, only the signals listed below are used. When used over the ISDN, the procedures and signals specified in this annex are carried on the B-channel. Unless stated otherwise, the signal functions and formats are as defined in the main body and/or Annex A of this Recommendation.

CRP	Command repeat
CIG	Calling subscriber identification (see Note)
CSI	Called subscriber identification (see Note)
DCN	Disconnect
DCS	Digital command signal
DIS	Digital identification signal
DTC	Digital transmit command
FCD	Facsimile coded data
FCF	Facsimile control field
FIF	Facsimile information field
MCF	Message confirmation (see C.3)
NSC	Non-standard facilities Command (see Note)
NSF	Non-standard facilities (see Note)
NSS	Non-standard set-up (see Note)
PID	Procedure interrupt disconnect (see C.3)
PPS-EOM	Partial page signal – End of message
PPS-EOP	Partial page signal – End of procedure
PPS-MPS	Partial page signal – Multi-page signal
PPS-NULL	Partial page signal – null
PPR	Partial page request
RCP	Return to control for partial page

RNR Receiver not ready

TSI Transmitting subscriber identification (see Note)

XID Exchange identification procedure (see C.3)

NOTE – This signal is optional.

C.3 Facsimile procedure

C.3.1 Address field

The eight bit HDLC address field is intended to provide identification of specific station(s) in a multi-point arrangement. In the case of point to point transmission, this field is limited to a single format.

Format: 1111 1111

C.3.2 Initial identification

Exchange identification procedure (XID) – This signal indicates that the called terminal has Group 3 digital capabilities and also can be used to facilitate identification of the characteristics of the remote terminal.

The XID frame format as standardised in ISO 8885 is shown in Figure C.1. The XID frame is identified by the coding of the control field.

F	A	C	XID information field	FCS	F

F Flag

A Address

C Control – format 1111 0101

FCS Frame check sequence

The XID information field format consists of 7 octets:

		Bit No:	1	2	3	4	5	6	7	8
Octet 1:	Format identifier		0	1	0	0	0	0	0	1
Octet 2:	Group identifier		0	0	0	0	1	1	1	1
Octet 3:	Group length 1		0	1	0	0	0	0	0	0
Octet 4:	Group length 2		0	0	0	0	0	0	0	0
Octet 5:	Parameter identifier		0	0	0	0	0	0	0	0
Octet 6:	Parameter length		1	0	0	0	0	0	0	0
Octet 7:	Parameter value		X	X	X	X	X	X	X	X

NOTE – In the bit assignment for Octet 7, a "1" indicates that the condition is valid; the assignments are as follows:

Bit 1 = Group 3 digital capability

Bit 2 = Group 4 Class 1

Bit 3 = Group 4 Class 2

Bit 4 = Group 4 Class 3

Bit 5 = 64 kbit/s, unrestricted mode

Bit 6 = 32 kbit/s

Bit 7 = 16 kbit/s

Bit 8 = 9600 bit/s

FIGURE C.1/T.30

C.3.3 In-message procedure

From the transmitter to the receiver. The in-message procedure formats and specific signals shall be as defined in Annex A/T.4.

C.3.4 Post message responses

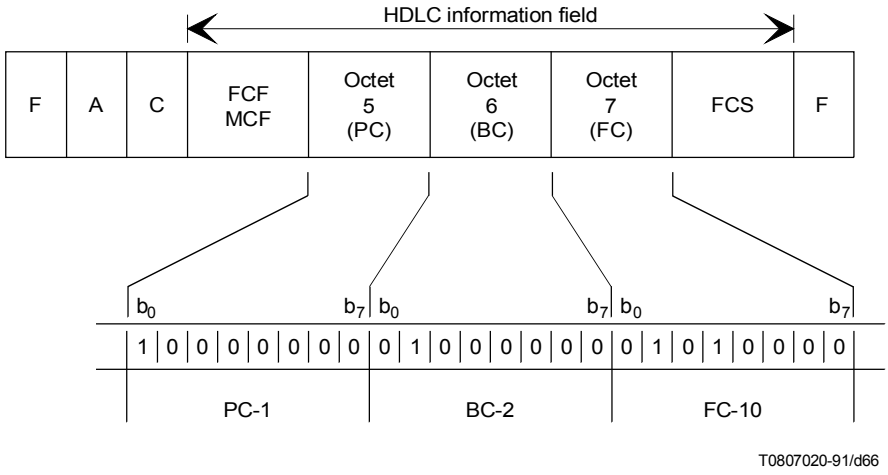
From the receiver to the transmitter.

Format: X011 XXXX

1) *Message confirmation* (MCF) – This digital response indicates that a complete message has been satisfactorily received and that additional messages may follow. This is a positive response to PPS-MPS, PPS-EOM, PPS-EOP and PPS-NULL.

Format: X011 0001

The frame construction of MCF command and transmission order of bits included in octets 5 – 7 are shown in Figure C.2.



Octet 5(PC)	Information field 1:	Page counter (8 bits: modulo 256)
Octet 6(BC)	Information field 2:	Block counter (8 bits: modulo 256)
Octet 7(FC)	Information field 3:	(Number of frames) –1 in each partial page (8 bits: maximum 255)

NOTES

1 Octet 5: The page counter shows the page sequence modulo number for each call establishment in one direction of message transfer. The page counter is started from "0" and goes up to "255"; it is reset at the start of each call establishment.

2 Octet 6: The block counter shows the block sequence modulo number for each page. The block counter is started from "0" and goes up to "255"; it is reset at the start of each page.

3 Octet 7: The frame counter shows the total number of transmitted frames minus 1 in each partial page (maximum 255).

4 The least significant bit in octets 5-7 is transmitted first.

FIGURE C.2/T.30

2) *Procedure interrupt disconnect (PID)* – This digital response indicates that a message has been received but that further transmissions are not possible and that after correction of all outstanding pages or partial pages, the transmitter shall enter Phase E. If a transmitter receives PID whilst it is transmitting a partial page, it shall stop sending that partial page immediately and send only the outstanding corrections (if any) to previous partial pages. The interrupted page shall be assumed as having been discarded at the receiver.

In the half-duplex case, PID is sent at the end of a partial page and precedes any post-message response, i.e. MCF or PPR. The transmitter will continue to transmit the post-message command until it receives a valid response.

Format: X011 0110

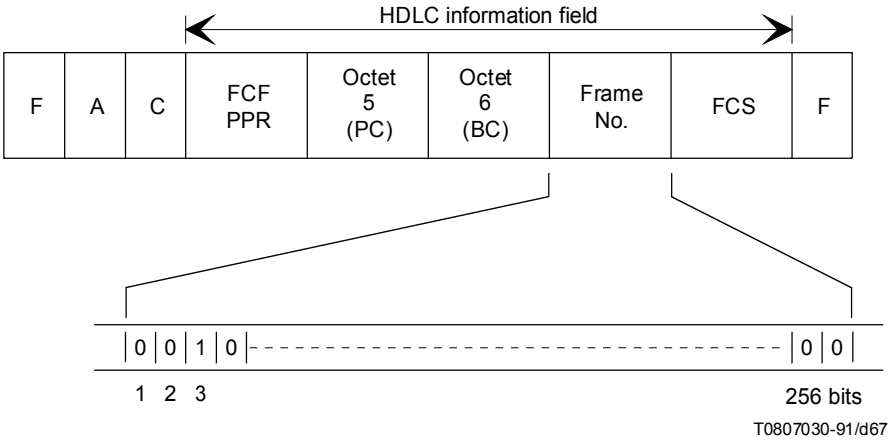
3) *Partial page request (PPR)* – This digital response indicates that the previous message has not been satisfactorily received and that the frames specified in the associated facsimile information field are required to be retransmitted.

Format: X011 1101

The facsimile information field of the PPR signal is a fixed length of 272 bits. The first 8 bits define the page number and the second 8 bits define the block number. Each of the remaining 256 bits corresponds to an FCD frame within the relevant page and block i.e: the first bit to the first frame etc. For FCD frames which are received correctly, the corresponding bit in the PPR information field will be set to "0"; those that are received incorrectly or not received will have their bit set to "1".

If more than one PPR signal is transmitted, the bit corresponding to an FCD frame which has been received correctly must always be set to "0".

The frame construction of PPR response is shown in Figure C.3.



Octet 5(PC) Page counter (8 bits: modulo 256)
Octet 6(BC) Block counter (8 bits: modulo 256)

NOTES

1 Octet 5: The page counter shows the page sequence modulo number for each call establishment in one direction of message transfer. The page counter is started from "0" and goes up to "255"; it is reset at the start of each call establishment.

2 Octet 6: The block counter shows the block sequence modulo number for each page. The block counter is started from "0" and goes up to "255"; it is reset at the start of each page.

3 The frame counter shows the total number of transmitted frames minus 1 in each partial page (maximum 255).

FIGURE C.3/T.30

4) *Receive not ready (RNR)* – This digital response is used to indicate that the receiver is not ready to receive more data. If a transmitter receives RNR it shall stop sending new information at the end of the current partial page and transmit any requested corrections and/or any unacknowledged commands. Any unacknowledged commands shall be continuously transmitted until a response other than RNR is received. It shall not send any new information until all previously transmitted pages or partial pages have been acknowledged as being correctly received. If a transmitter receives RNR continuously for a period of 10 ± 1 seconds, it may transmit DCN and enter Phase E.

Format: X011 0111

C.3.5 Other line control signals

For the purpose of handling errors and controlling the state of the line.

Format: X101 XXXX

1) *Command repeat (CRP)* – This response indicates that the previous pre-message command(s) was/were received in error and should be repeated (including any optional frames). Upon receiving CRP, a transmitter shall repeat all commands which have not yet been acknowledged. The CRP signal is sent continuously until an error free command(s) is/are received.

Format: X101 1000

C.3.6 Facsimile information field (FIF)

C.3.6.1 DIS standard capabilities

The bit assignment for this information is given in Table C.1 where a "1" indicates the condition is valid.

C.3.6.2 DCS standard commands

The DCS standard commands are formatted as shown in Table C.1.

C.3.6.3 DTC standard command

The DTC standard capabilities are formatted as shown in Table C.1.

NOTES

1 Facsimile equipment conforming to this Recommendation must have the following capability – paper length = 297 mm. unless bit 33 is set to "1".

2 The standard FIF field for the DIS, DTC and DCS signals is 48 bits long. If the "extend field" bit is a "1", the FIF field shall be extended by an additional eight bits.

3 When bit 33 is set to "1" in DCS, the meaning of bit 15 originally defined to indicate 7.7/mm vertical resolution is modified to mean higher resolution.

4 When the minimum recording width is A4 only, the octet containing bits 33-40 is set to "0".

C.3.7 Implementation requirements

C.3.7.1 Commands and responses

Whereas C.5 defines a flow diagram to give an accurate example of the typical use of the binary coded procedures, these procedures are defined specifically in terms of the actions that occur on receipt of commands by the receiving station.

A response must be sent, and only sent, upon detecting a valid command. Upon receiving a valid response, a new command must be issued within 3 seconds.

TABLE C.1/T.30

Bit No.	DIS/DTC	DCS
1 2 3 4 5 6 7 8	Set to “0”	Set to “0”
9 10	Transmitter – T.4 operation Receiver – T.4 operation	Receiver – T.4 operation
11 12 13 14	Bit assignments as per Table 2	Invalid
15	Vertical Resolution = 7.7 lines/mm and/or 200 × 200 pels/25.4 mm	Vertical Resolution = 7.7 lines/mm and/or 200 × 200 pels/25.4 mm
16	Two dimensional coding capability	Two dimensional coding capability
17,18	Recording width capabilities	Recording width
(0,0)	1728 picture elements along scan line length of 215 mm ± 1%	1728 picture elements along scan line length 215 mm ± 1%
(0,1)	1728 picture elements along scan line length of 215 mm ± 1% and 2048 picture elements along scan line length of 255 mm ± 1% and 2432 picture elements along scan line length of 303 mm ± 1%	2432 picture elements along scan line length of 303 mm ± 1%
(1,0)	1728 picture elements along scan line length of 215 mm ± 1% and 2048 picture elements along scan line length of 255 ± 1%	2048 picture elements along scan line length of 255 ± 1%
(1,1)	Invalid	Invalid
19,20 (0,0) (0,1) (1,0) (1,1)	Maximum recording length capability A4 (297 mm) unlimited A4 (297 mm) and B4 (364 mm) Invalid	Maximum recording length A4 (297 mm) Unlimited B4 (364 mm) Invalid
21 22 23	Set to “1” Set to “1” Set to “1”	Set to “1” Set to “1” Set to “1”
24	Extended field	Extended field
25	Set to “0”	Set to “0”
26	Uncompressed mode	Uncompressed mode
27 28 29	Set to “1” Set to “0” Set to “0”	Set to “1” Set to “0” Set to “0”

TABLE C.1/T.30 *(continued)*

Bit No.	DIS/DTC	DCS
30	Reserved for G4 capability on PSTN	Reserved for G4 capability on PSTN
31	Coding as per Recommendation T.6	Coding as per Recommendation T.6 enabled
32	Extend field	Extend field
33 (0) (1)	Validity of bit/s 17, 18 Bits 17, 18 are valid Bits 17, 18 are invalid	Recording width Recording width indicated by bits 17, 18 Recording width indicated by this field bit information
34	Recording width capability 1216 picture elements along scan line length of 151 mm ± 1%	Middle 1216 elements of 1728 picture elements
35	Recording width capability 864 picture elements along scan line length of 107 mm ± 1%	Middle 864 elements of 1728 picture elements
36	Recording width capability 1728 picture elements along scan line length of 151 mm ± 1%	Invalid
37	Recording width capability 1728 picture elements along scan line length of 107 mm ± 1%	Invalid
38	Reserved for future recording width capability	
39	Reserved for future recording width capability	
40	Extend field	Extend field
41	Resolution 8 pels /mm × 15.4 lines/in	Resolution 8 pels/mm × 15.4 lines/in
42	Resolution 300 × 300 pels/in	Resolution 300 × 300 pels/in
43	Resolution 16 pels/mm × 15.4 lines/in or 400 × 400 pels/in	Resolution 16 pels/mm × 15.4 lines/in or 400 × 400 pels/in
44	Inch based resolution preferred	"0" = metric, "1" = inch
45	Metric based resolution preferred	Don't care
46	MSLT scan line time – higher res. "0": $T_{15.4} = T_{7.7}$ "1": $T_{15.4} = 1/2\ T_{7.7}$	Don't care
47	Selective polling capability	Set to "0"
48	Extend field	Extend field
49	Subaddressing capability	Set to "0"
50	Password capability	Set to "0"
51	Capable of emitting a data file	Set to "0"
52	Reserved for Facsimile Service Info	Reserved for Facsimile Service Info
53	Binary file transfer (BFT)	Binary file transfer (BFT)

TABLE C.1/T.30 *(end)*

Bit No.	DIS/DTC	DCS
54	Document transfer mode (DTM)	Document transfer mode (DTM)
55	Electronic document interchange (EDI)	Electronic document interchange (EDI)
56	Extend field	Extend field
57	Basic transfer mode(BTM)	Basic transfer mode(BTM)
58	Reserved for future negotiation mechanism for data file transmission	Reserved for future negotiation mechanism for data file transmission
59	Capable of emitting a character file	Not used
60	Character mode	Character mode
61	Reserved for control document	Reserved for control document
62	Reserved for mixed mode (Annex E/T.4)	Reserved for mixed mode
63	Reserved for future negotiation mechanism for character file trans.	Reserved for future negotiation mechanism for character file trans.
64	Extend field	Extend field
65	Processable mode 26 (T.505)	Processable mode 26 (T.505)
66	Digital network capability	Digital network capability
67 (0) (1)	Full and half duplex capabilities Half duplex operation only Full and half duplex operation	Full and half duplex capabilities Half duplex operation Full and half duplex operation
68 69 70 71	Reserved for future use	Reserved for future use
72	Extend field	Extend field

C.3.7.2 Timing considerations

C.3.7.2.1 Time-Outs

Time-out T6 defines the amount of time two stations will continue to attempt to identify each other. T6 is 5 ± 0.5 seconds. The time-out begins upon entering Phase B and is reset upon detecting a valid signal or when T6 times out.

Time-out T7 is used to detect loss of command/response synchronization. T7 is 6 ± 1 seconds. The time-out begins when initiating a command search (e.g. the first entrance into the "command received" sub-routine – see flow diagram in C.5) and is reset upon detecting a valid signal or when T7 times out.

Time-out T8 defines the amount of time waiting for clearance of the busy condition of the receiving station. T8 is 10 ± 1 seconds, begins on the first detection of the combination of no outstanding corrections and the RNR response. T8 is reset when T8 times out or MCF response is received. If the timer T8 has expired, DCN command is transmitted for call release.

C.4 Flow control procedure

C.4.1 Flow control in the transmitting station is made by continuous flag transmission between frames or before the first frame.

C.4.2 The maximum transmission time of flags should be less than the value of timer T6.

C.4.3 In the case of transmission on noisy channel, a long flag sequence may be destroyed by noise. Therefore, it is recommended that the receiver implements a control procedure to discard invalid frames which are obtained from erroneous flag sequences.

C.4.4 Flow control in the receiving station is made using the RNR signal. An example is shown in Figure C.4.

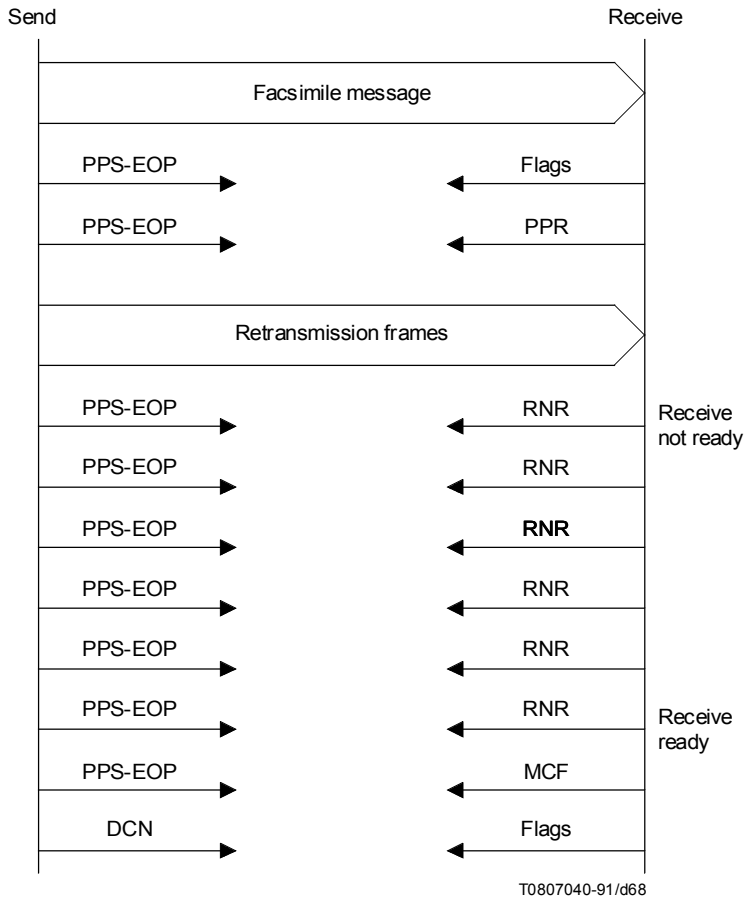


FIGURE C.4/T.30

C.5 Flow diagrams

The flow diagrams of Figures C.5 to C.22 show the phase B pre-message procedures, phase C message procedure, phase D post-message procedures and phase E call release for both the transmitting and receiving stations.

For the notes and an explanation of terms to the flow diagrams, see C.5.1.

Full duplex operation

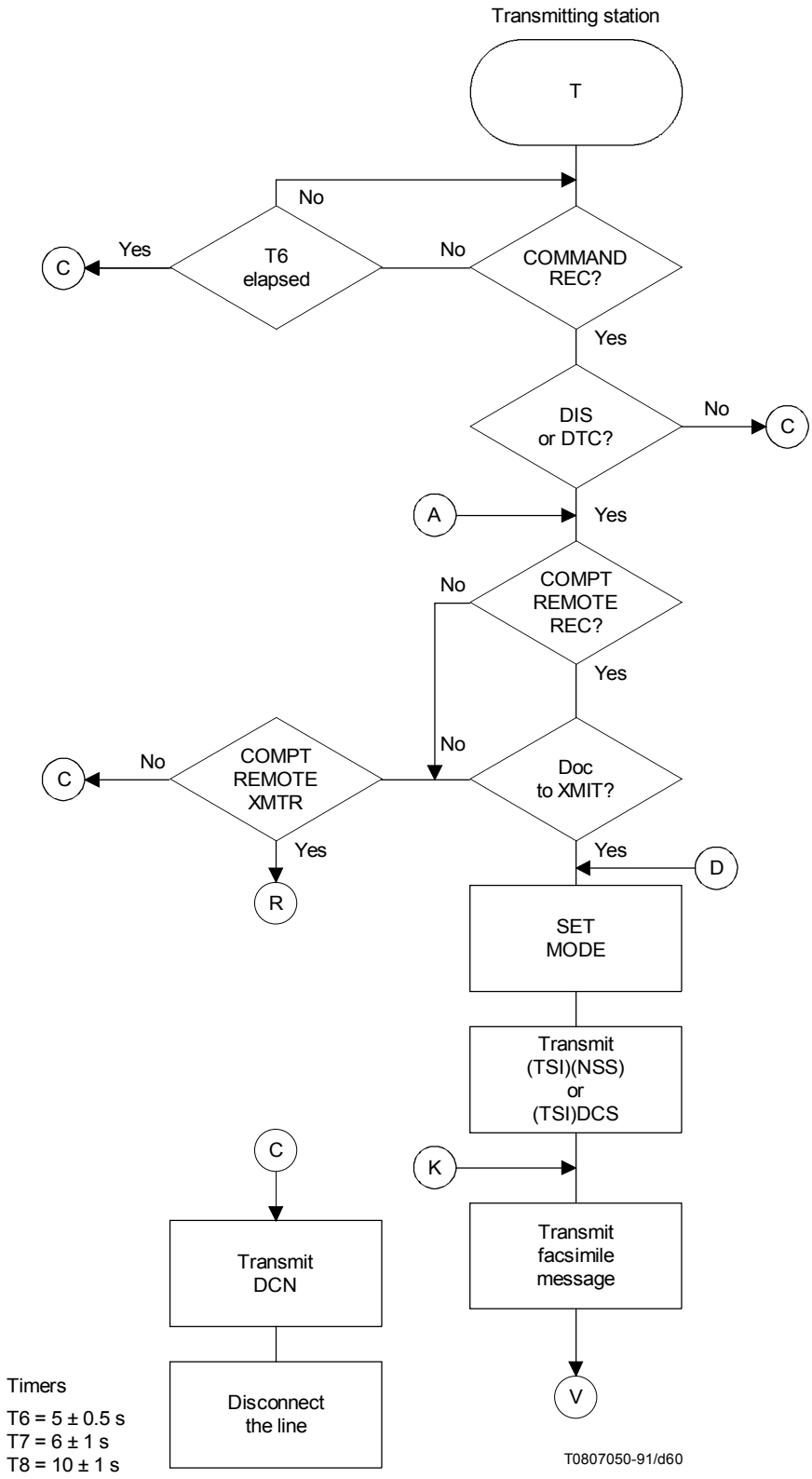


FIGURE C.5/T.30

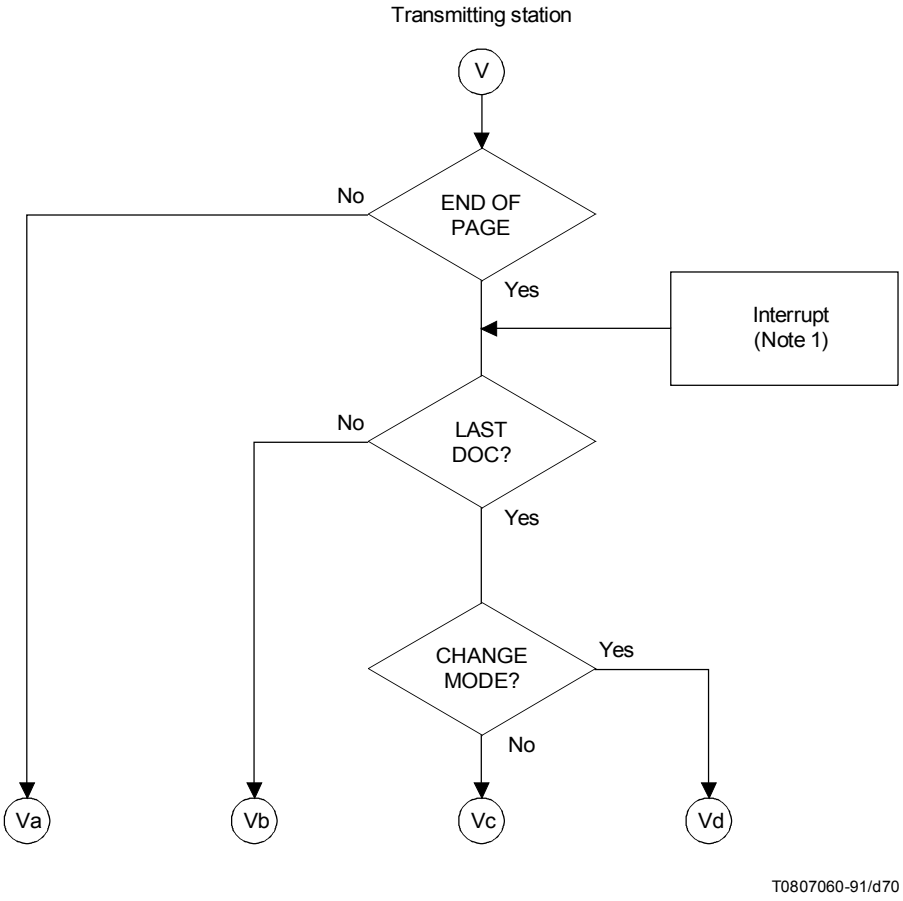


FIGURE C.6/T.30

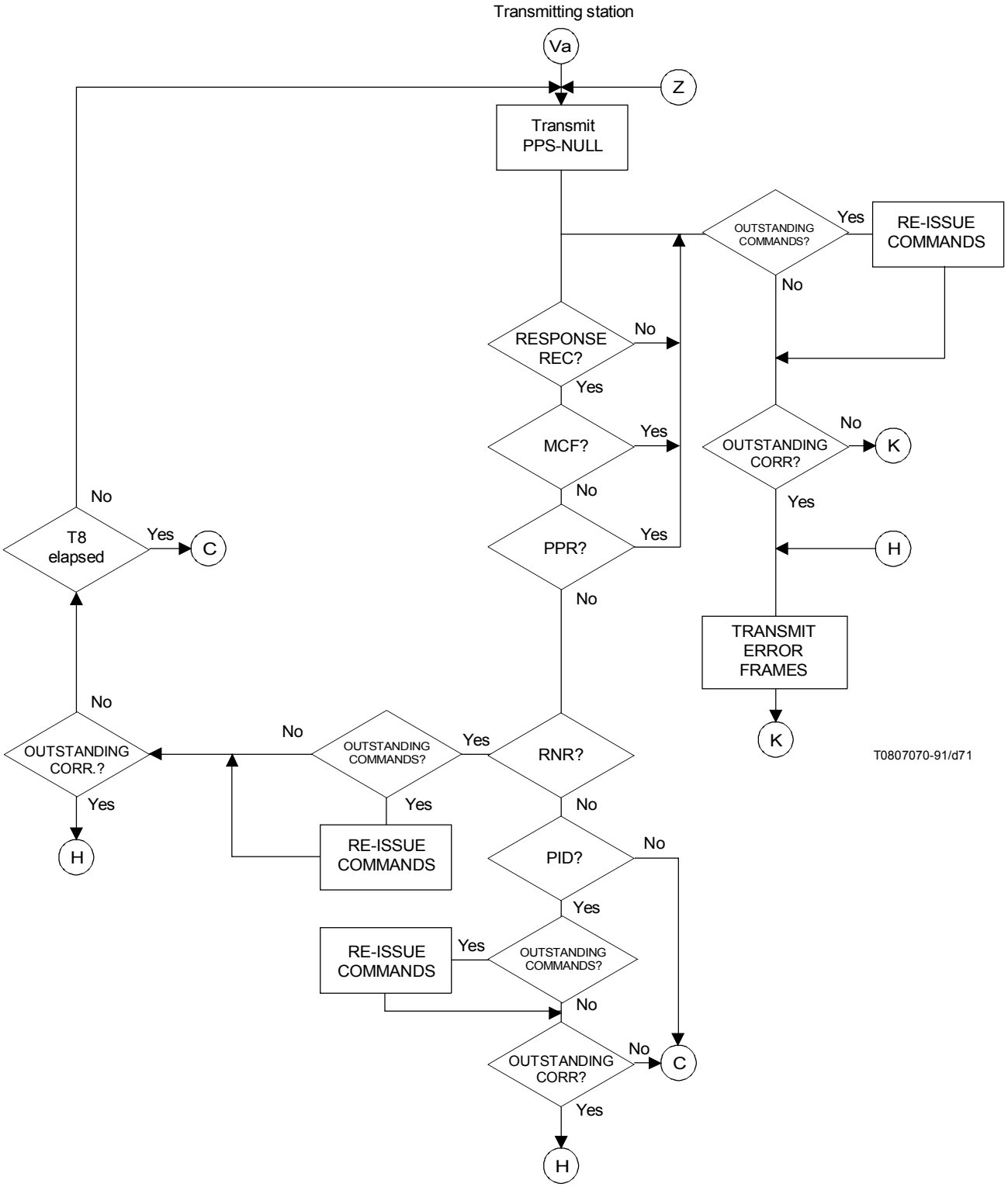


FIGURE C.7/T.30

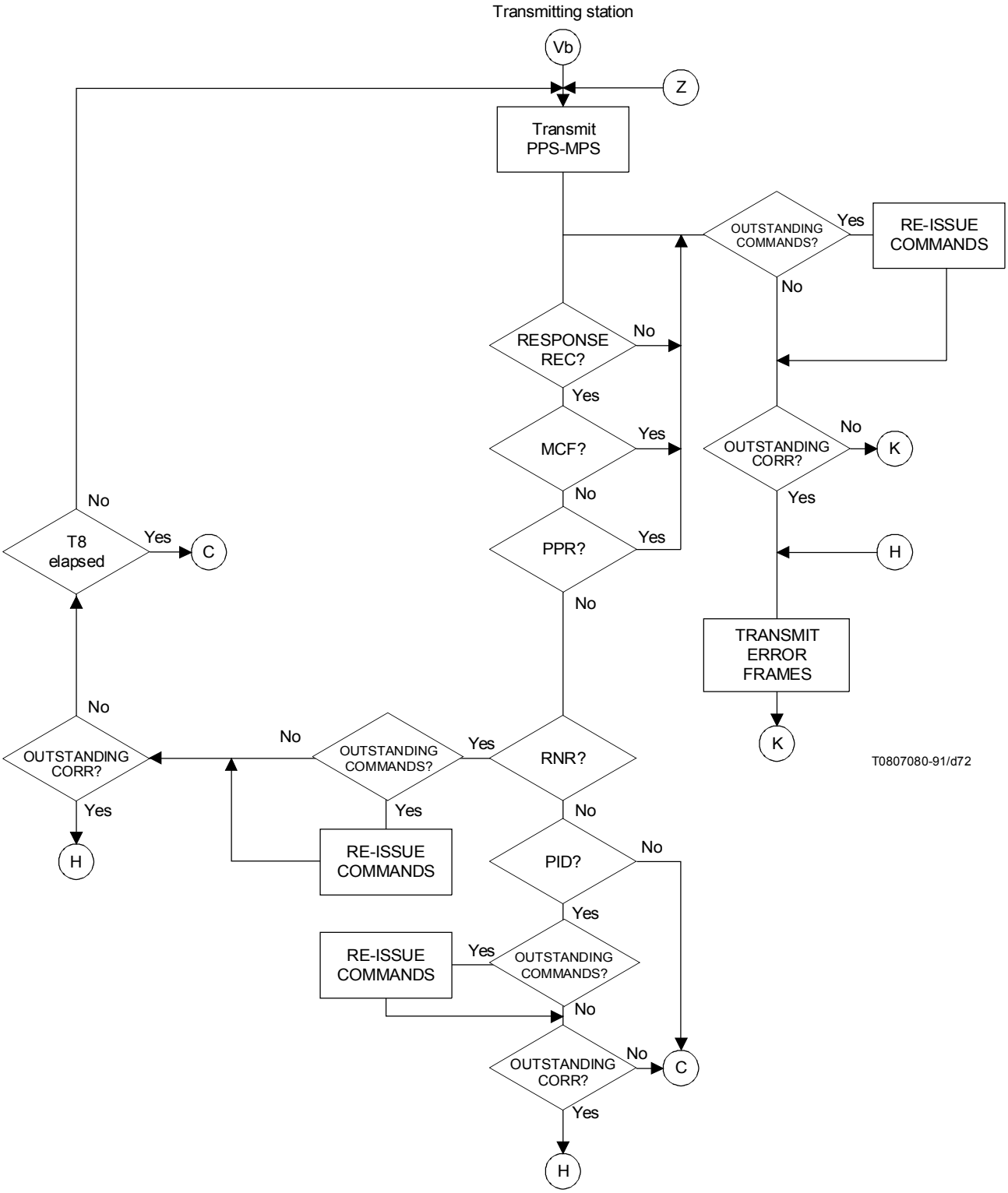


FIGURE C.8/T.30

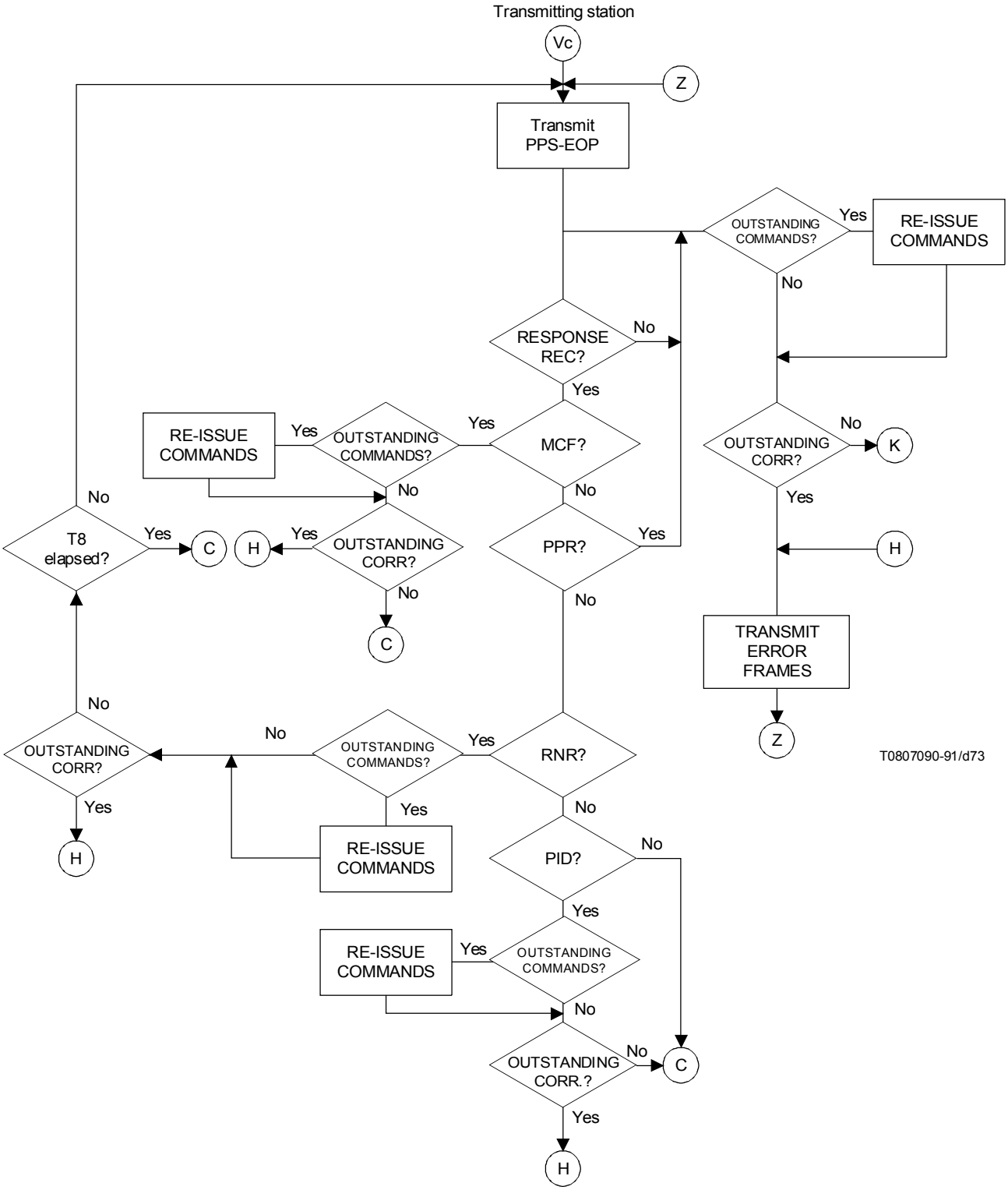


FIGURE C.9/T.30

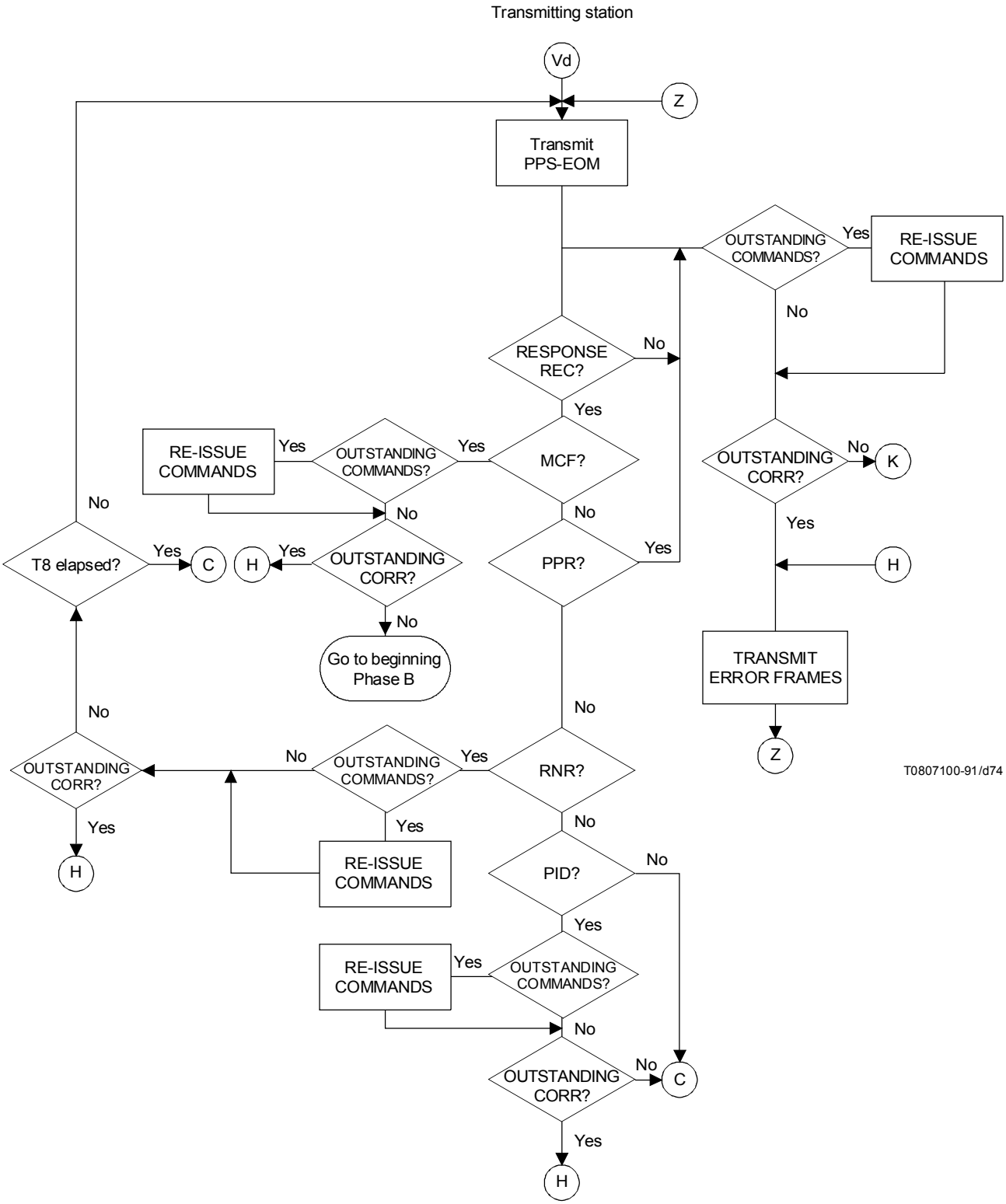


FIGURE C.10/T.30

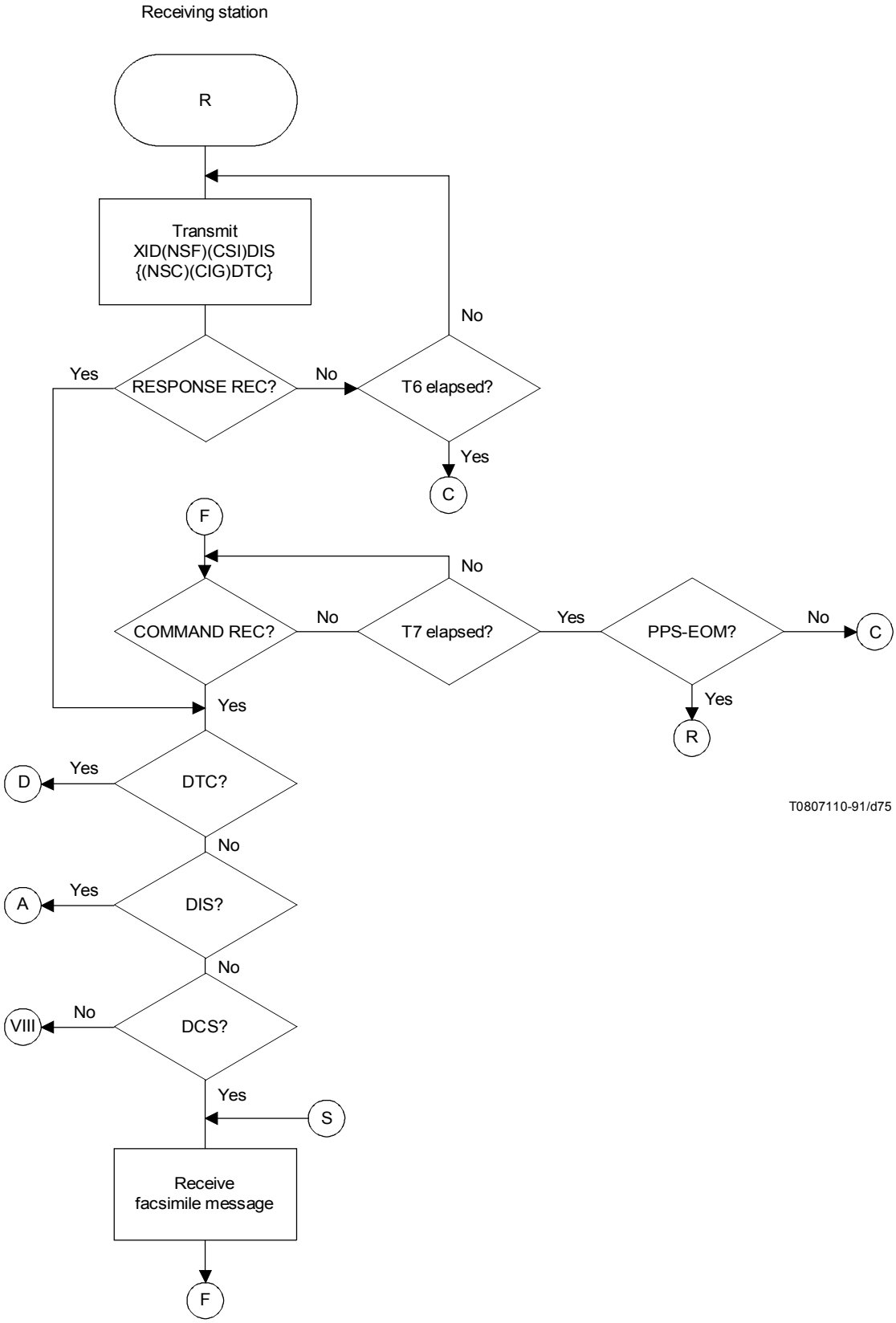


FIGURE C.11/T.30

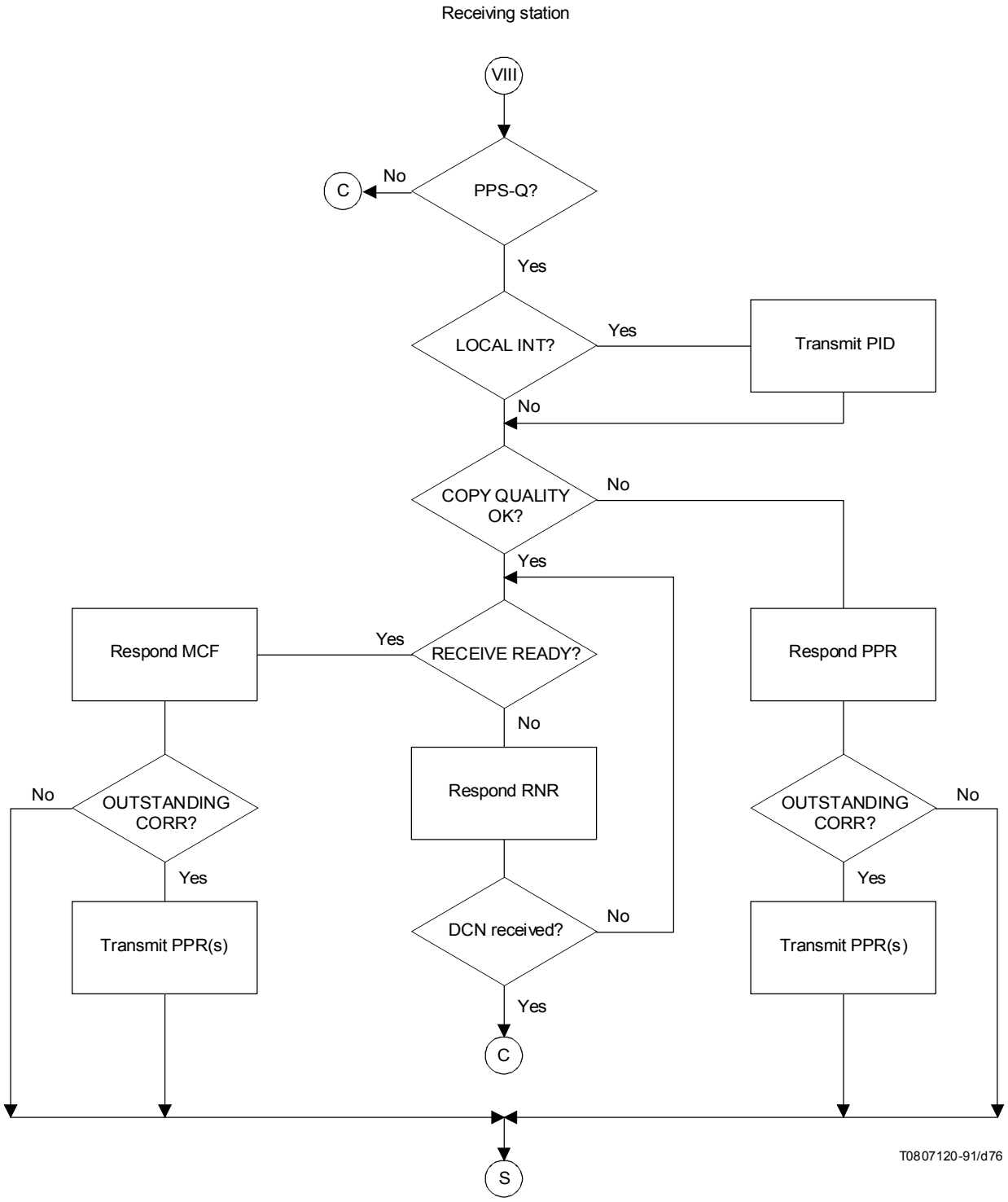
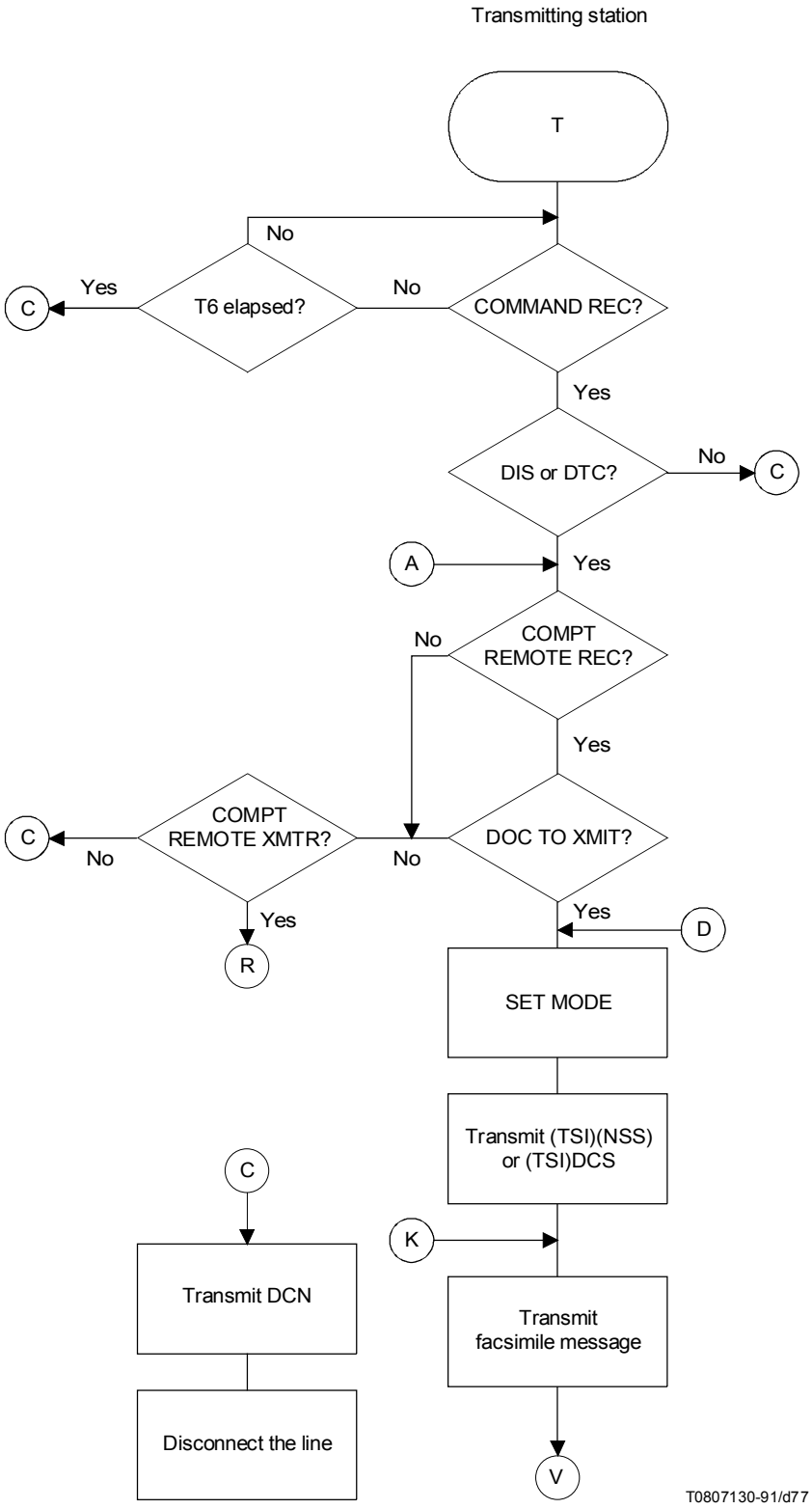


FIGURE C.12/T.30

Half duplex operation



Timers
T6 = 5 ± 0,5 s
T7 = 6 ± 1 s
T8 = 10 ± 1 s

FIGURE C.13/T.30

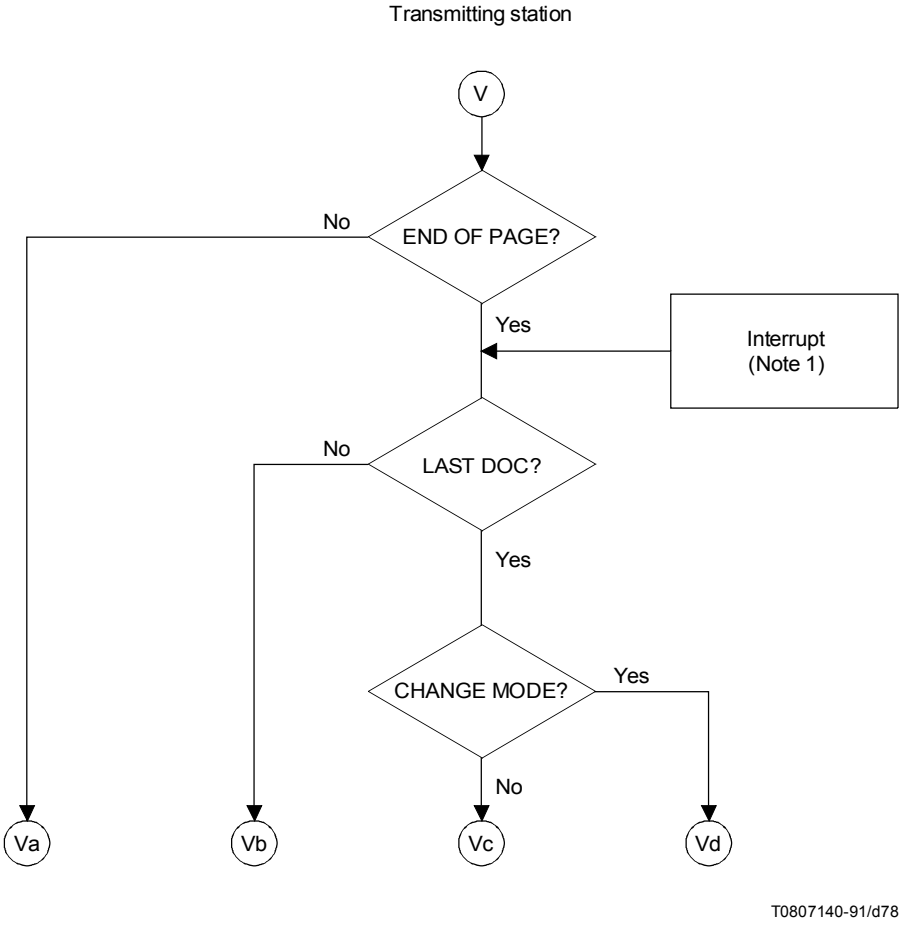


FIGURE C.14/T.30

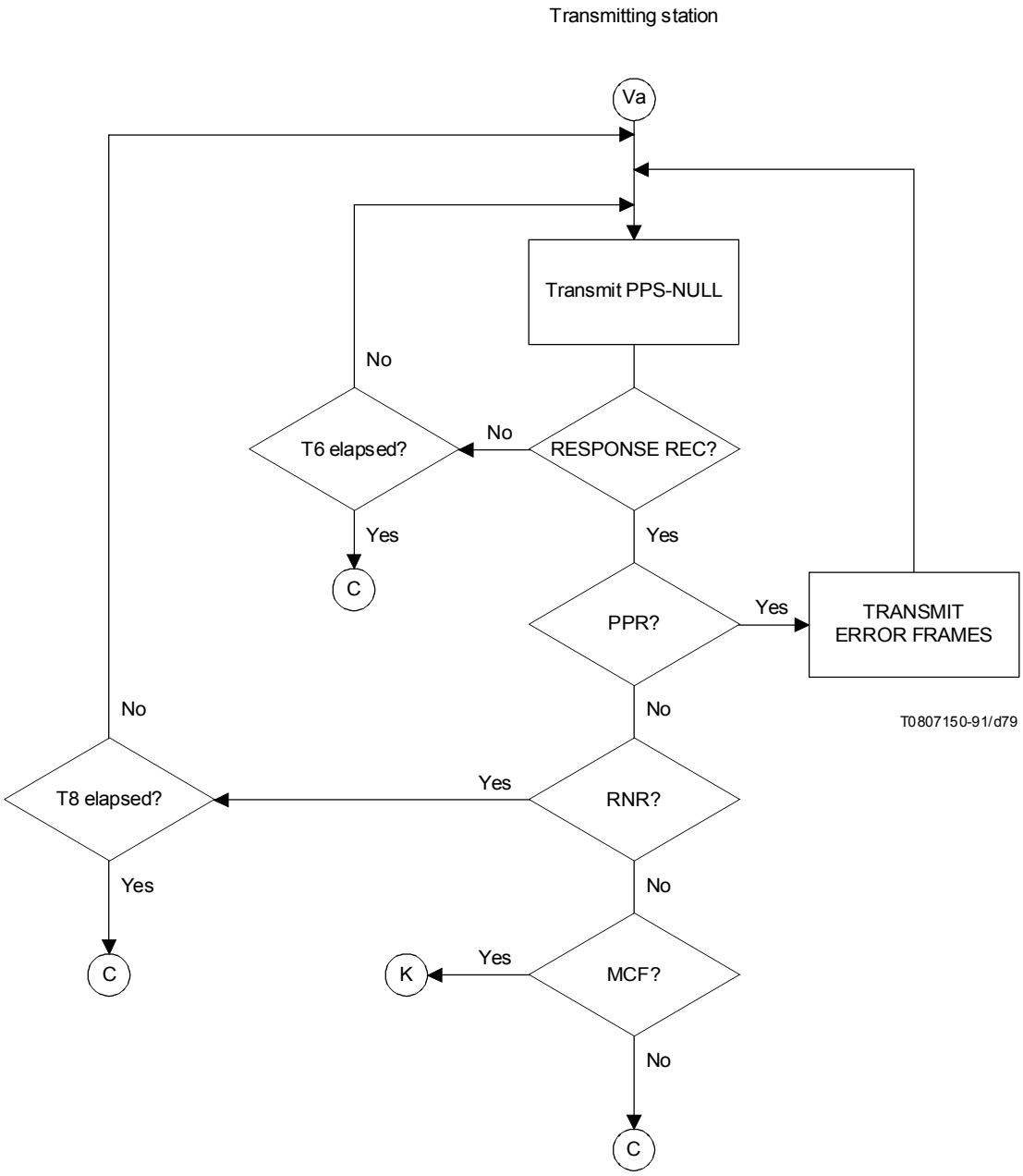


FIGURE C.15/T.30

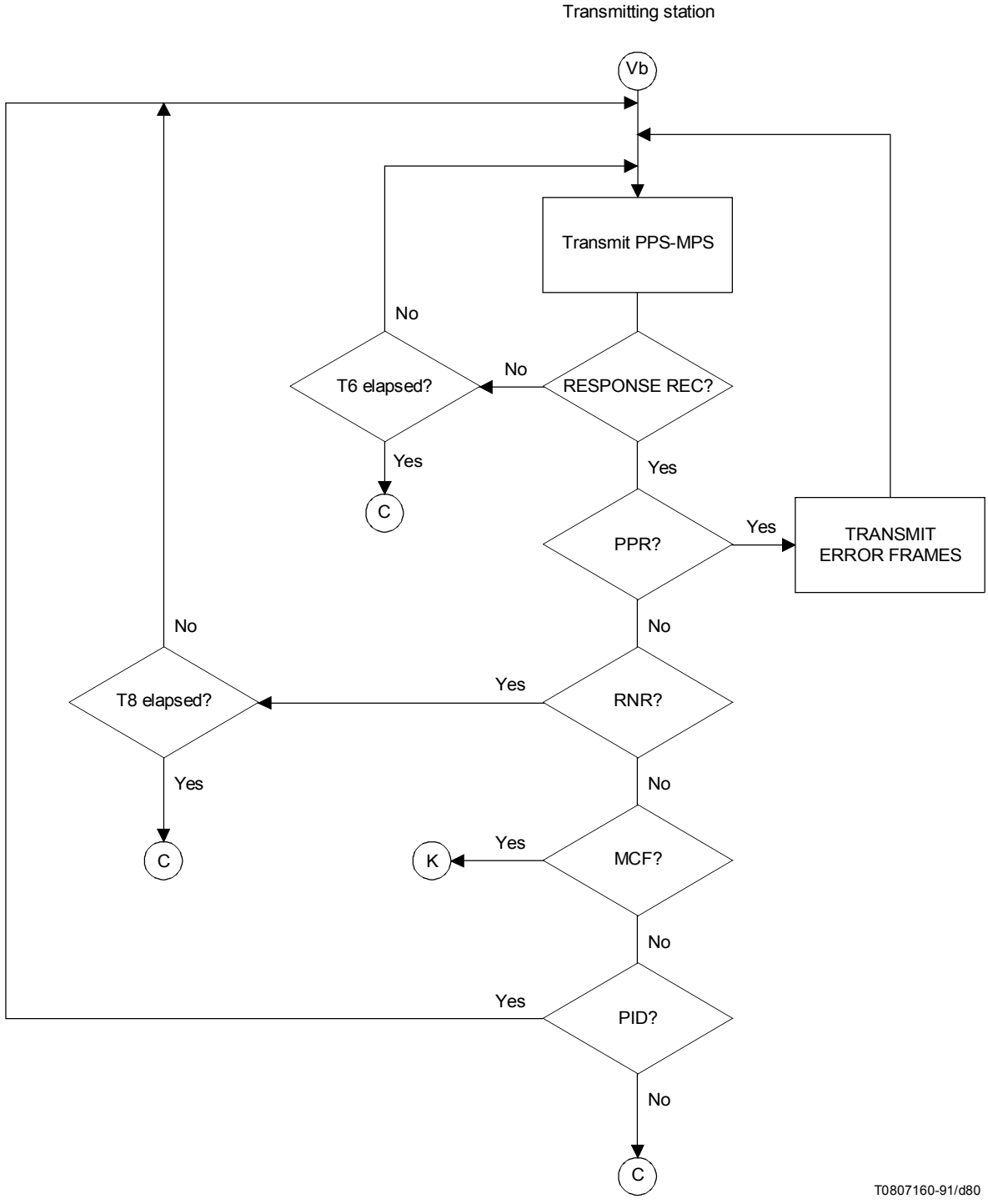


FIGURE C.16/T.30

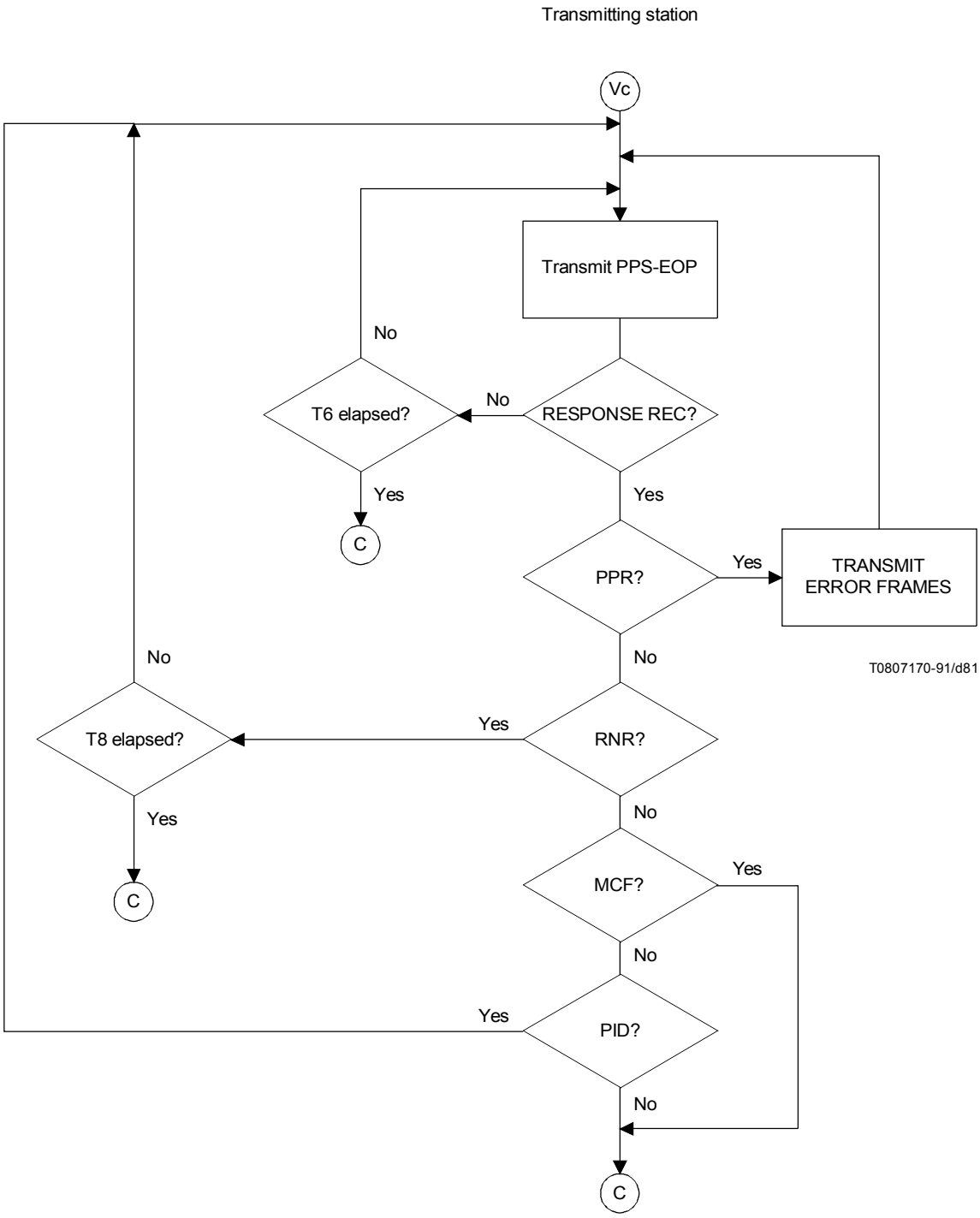


FIGURE C.17/T.30

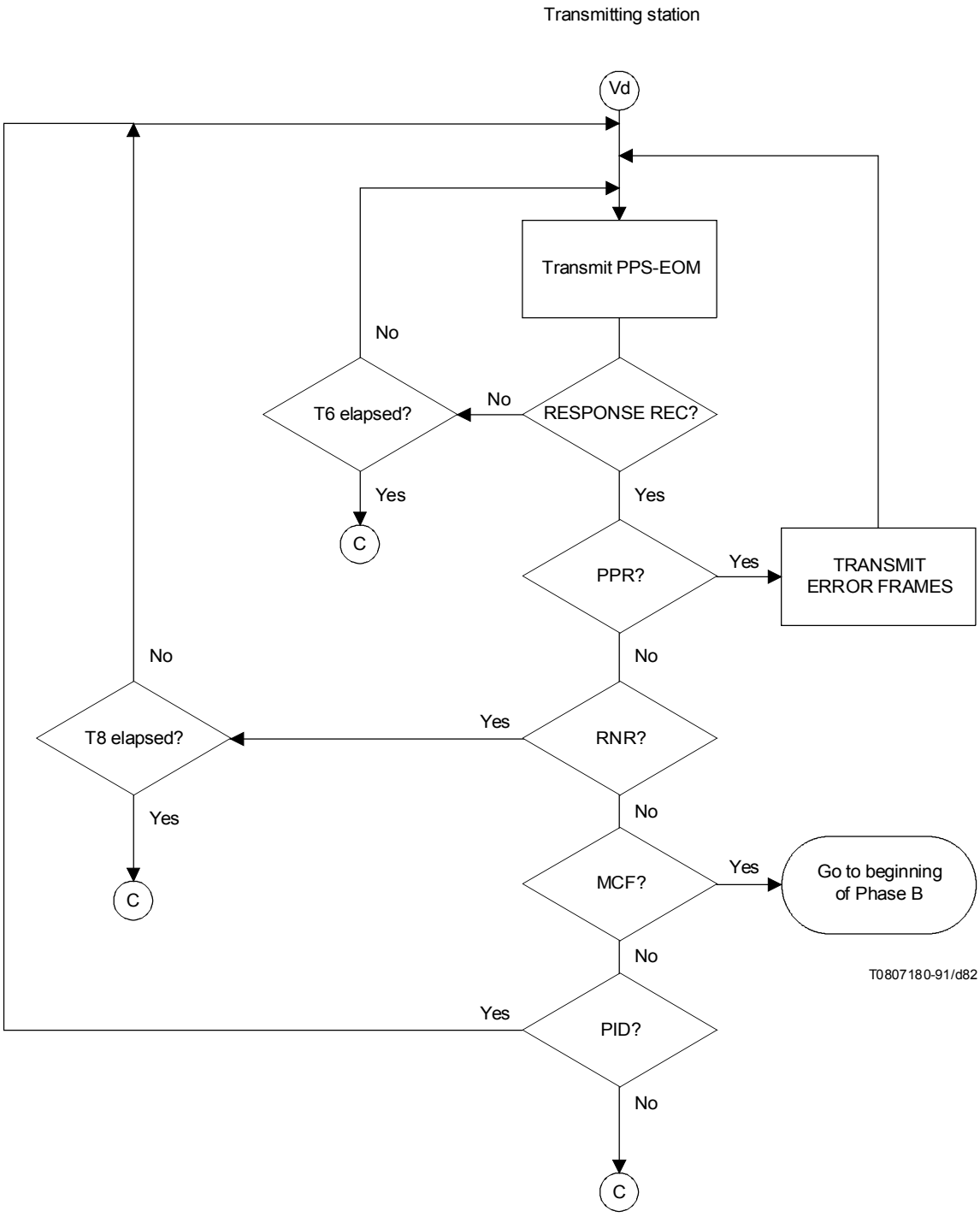


FIGURE C.18/T.30

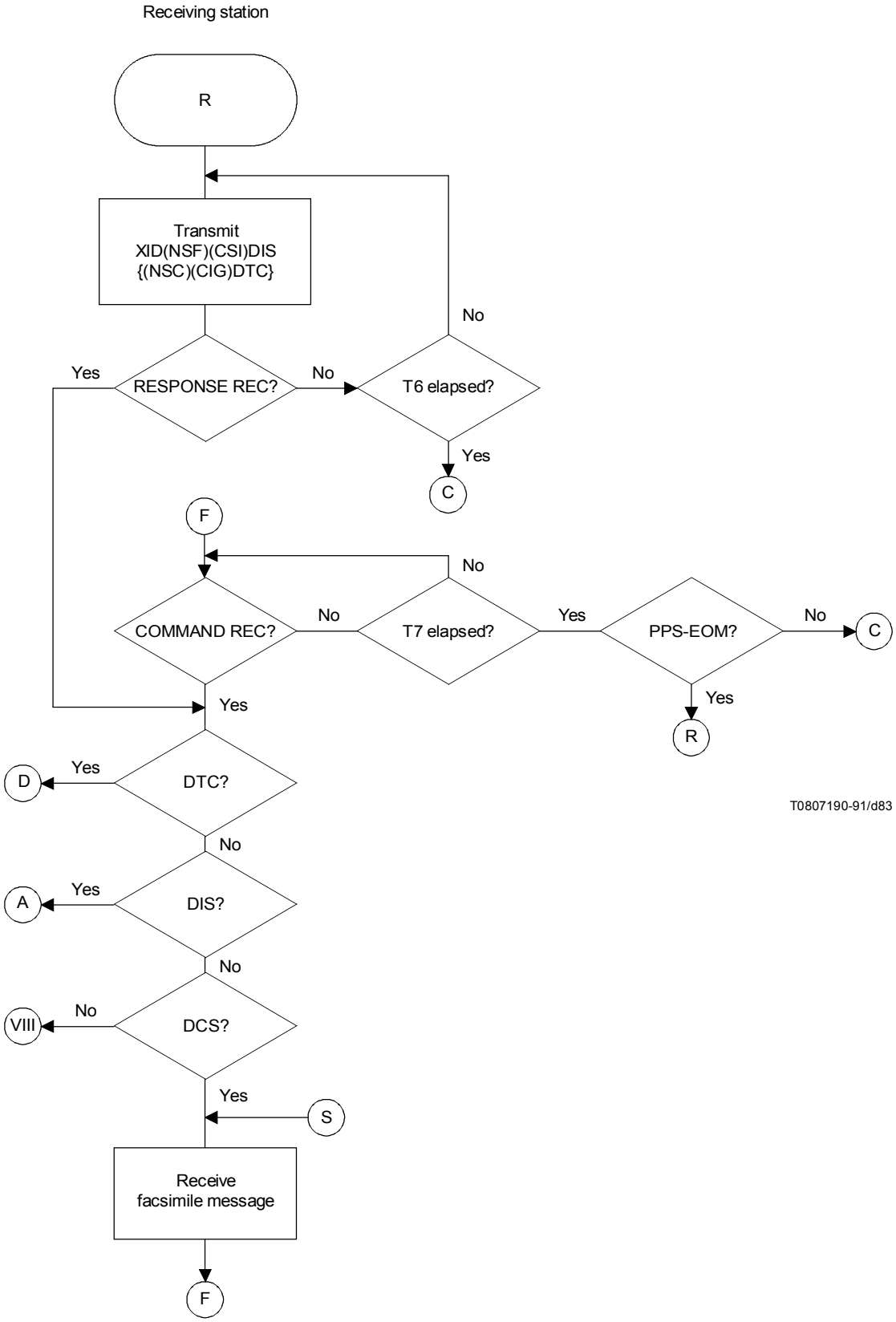


FIGURE C.19/T.30

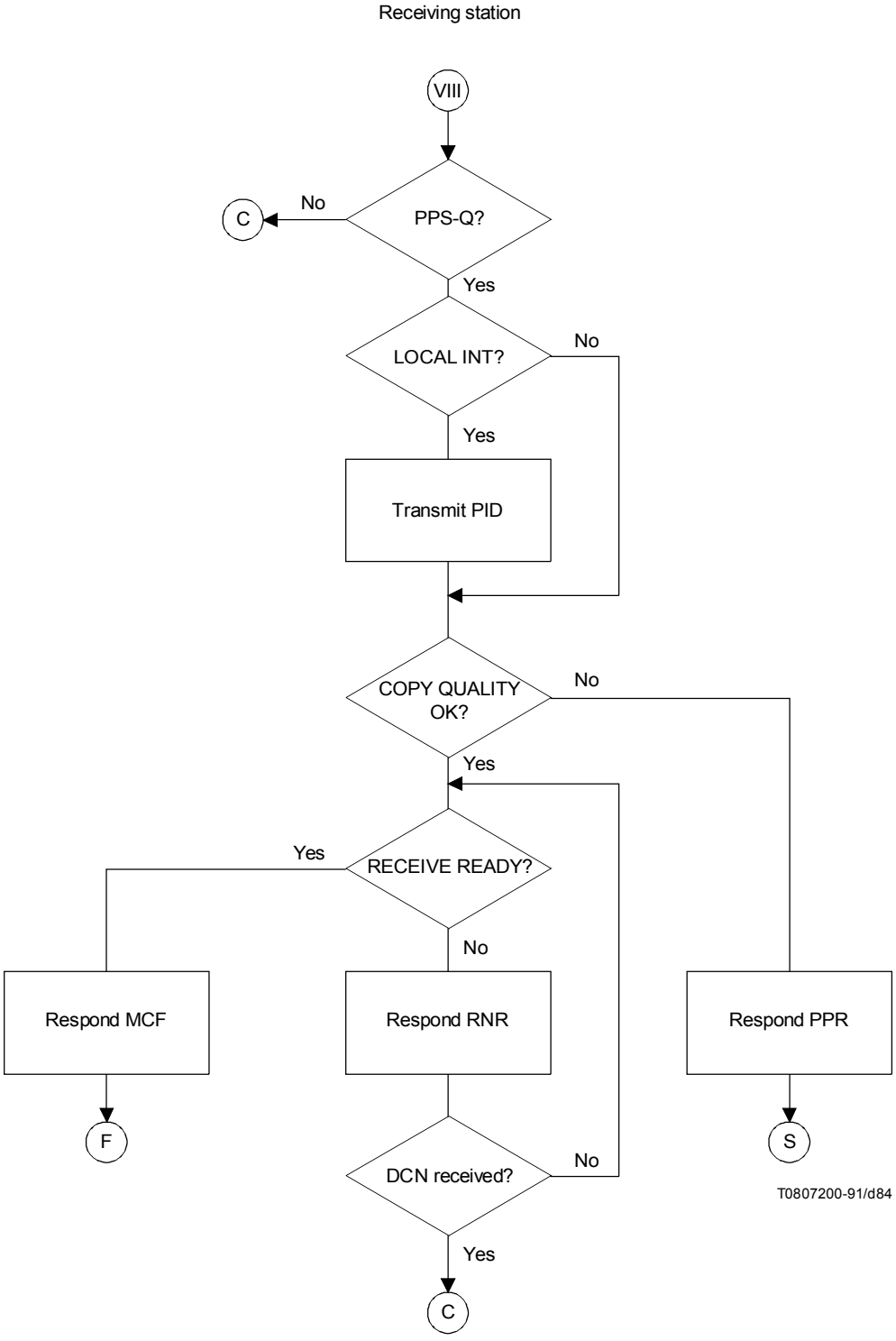


FIGURE C.20/T.30

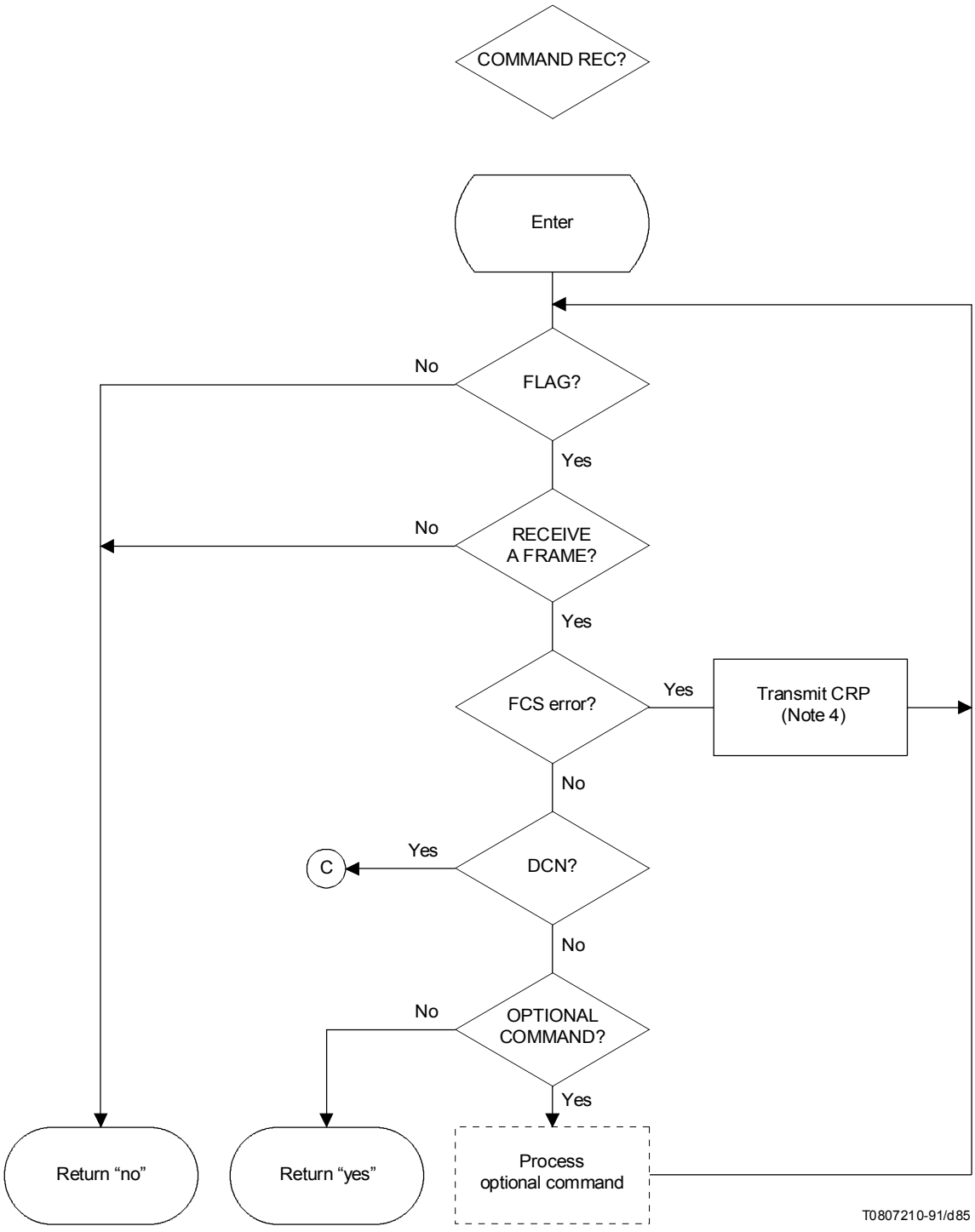


FIGURE C.21/T.30

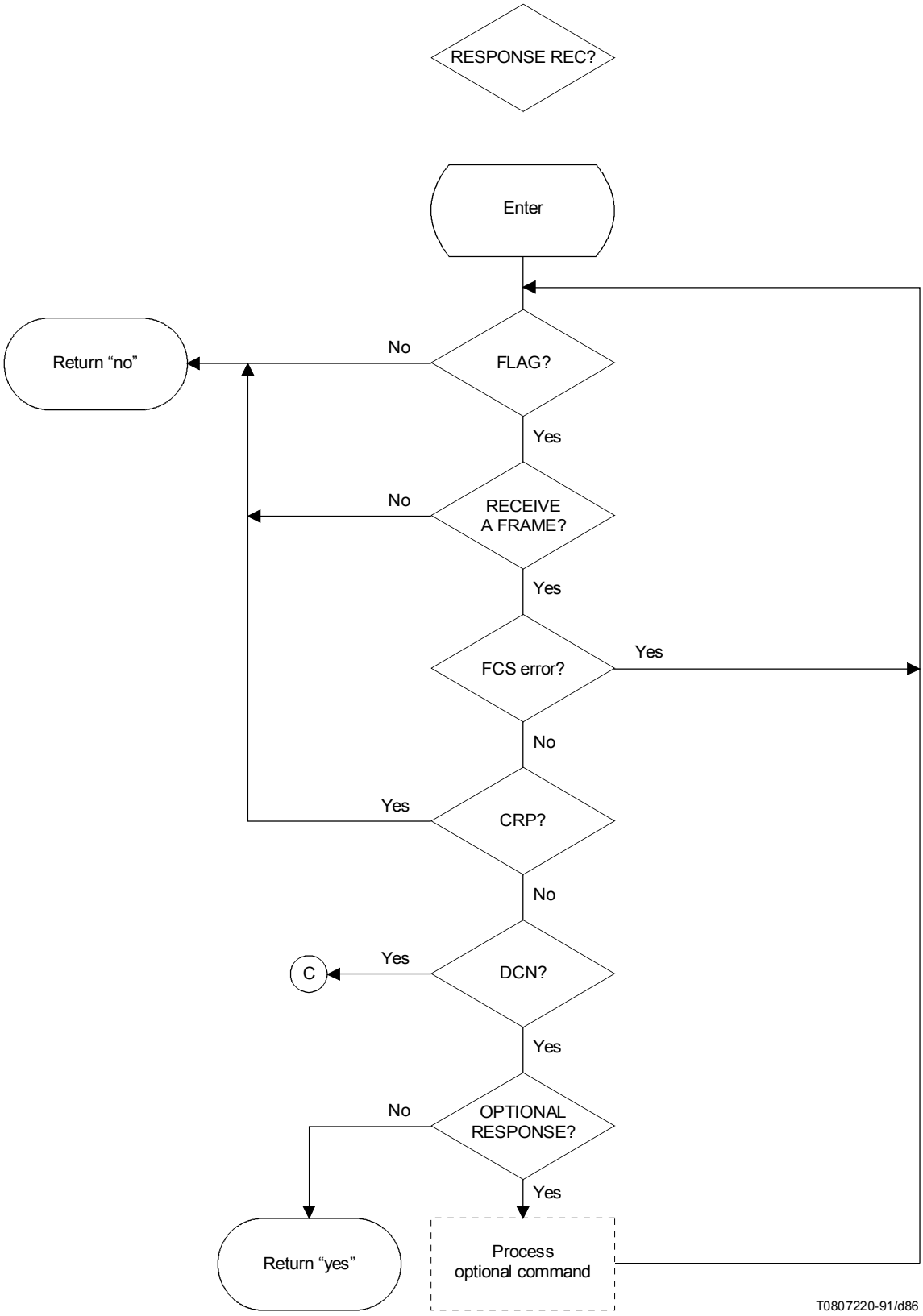


FIGURE C.22/T.30

C.5.1 Explanation of flow chart terms.

CHANGE MODE	The transmitting unit desires to exit from the transmitting mode of operation and re-establish the capabilities.
COMMAND REC	The "command received" subroutine searches for an error-free standard command. The decision diamonds in the flow diagram refer to the most recent standard command received (e.g. EOM, MPS, etc).
COMPT REMOTE REC	The FIF associated with the DIS has indicated a "compatible remote receiver."
COMPT REMOTE XMTR	The FIF associated with the DIS has indicated a "compatible remote transmitter" which has documents to send
COPY QUALITY OK	All message frames have been received correctly or have been corrected.
DOC TO XMIT	The station has "at least one document to be transmitted."
END OF PAGE?	The transmitting station may have further data to transmit to complete the page.
FCS ERROR	The HDLC frame received contained an "FCS" error.
FLAG	There has been the detection of a "flag".
LAST DOC	The "last document", for the given operating mode, has been transmitted.
OPTIONAL COMMAND	The HDLC frame received contained one of the listed "optional commands."
OPTIONAL RESPNS	The HDLC frame received contained one of the listed "optional responses."
OUTSTANDING COMMANDS	There are still some commands to which a response has not yet been received.
OUTSTANDING CORR?	There are still some pages or partial pages to which a positive acknowledgement has not yet been received.
PPS-Q?	The terminal has received either PPS-EOM, PPS-MPS, PPS-EOP or PPS-NULL post-message command.
RECEIVE A FRAME	The unit has "received one complete HDLC frame."
RECEIVE READY?	The receiving station is ready to receive the next message.
RE-ISSUE COMMANDS	The "outstanding commands" are transmitted in their chronological order prior to transmission of the next page or partial page.
RESPONSE REC	The "response received" subroutine which searches for an error-free standard response.
SET MODE	The system controller will "set the appropriate mode" of operation.
TRANSMIT ERROR FRAMES	The frames defined in the information field associated with PPR are transmitted.

NOTES

1 At any time during the operation an interrupt may be generated which would result in a procedural interrupt. It is understood that if this interrupt happens during the transmission of the document, all the outstanding partial pages will be corrected if necessary prior to invoking the procedural interrupt.

2 Where the symbols { } are used, the signals within these symbols are a response to DIS from the calling unit wishing to receive.

3 Where the symbols ( ) are used, the signals within these symbols are optional.

4 CRP is used only in the case of a pre-message command being received in error.

C.6 Signal sequence examples

C.6.1 Full duplex operation

The examples below are based on the flow diagrams and are for illustrative and instructional purpose only. They should not be interpreted as establishing or limiting the protocol. The exchange of the various commands and responses is limited only by the rules specified in this Recommendation.

Example 1 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of a single partial page with no errors on the received document.

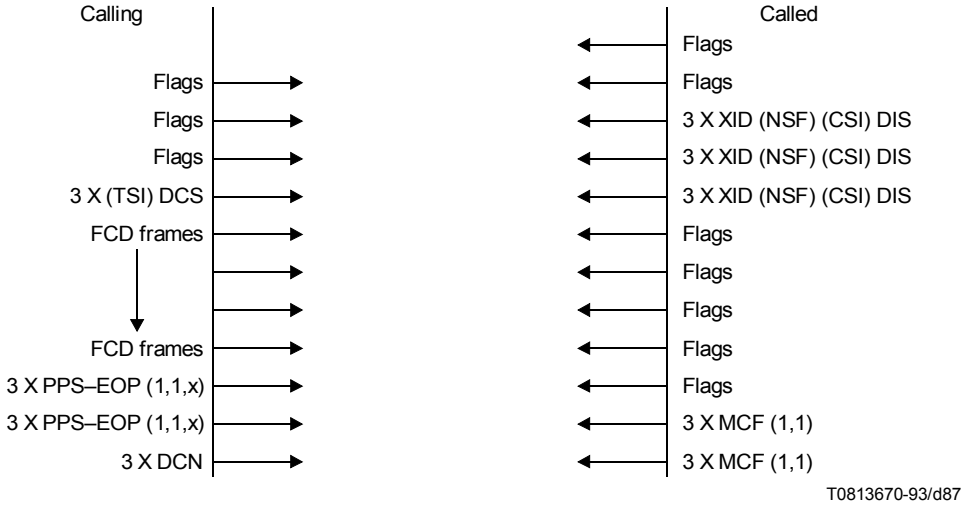


FIGURE C.23/T.30

Example 2 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with no errors on the received document.

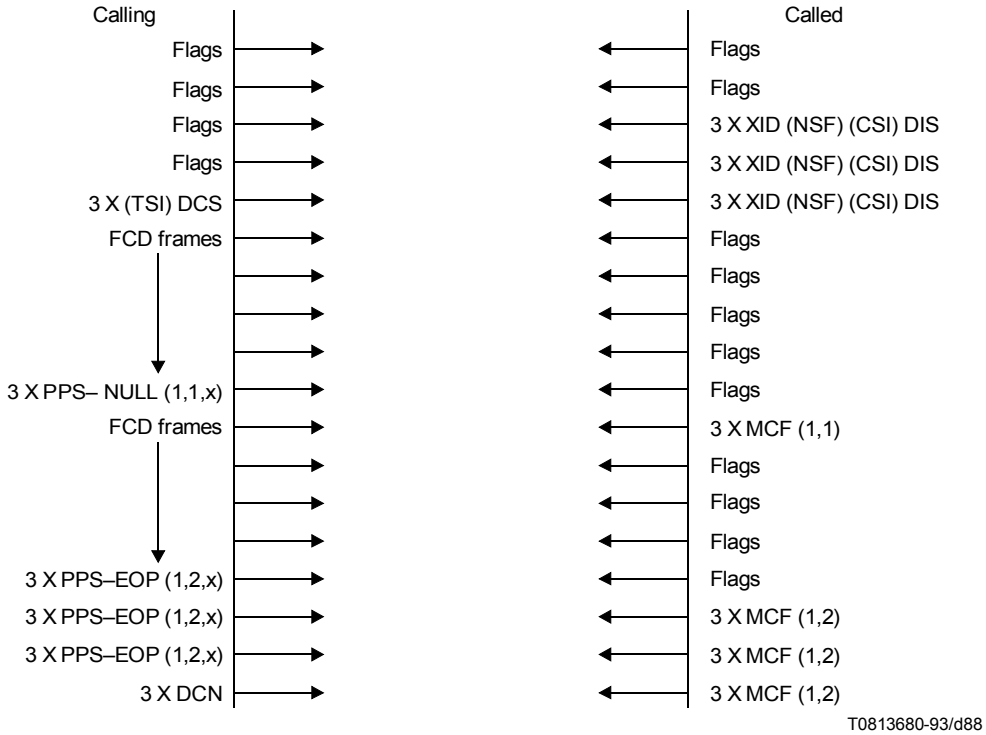


FIGURE C.24/T.30

Example 3 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document.

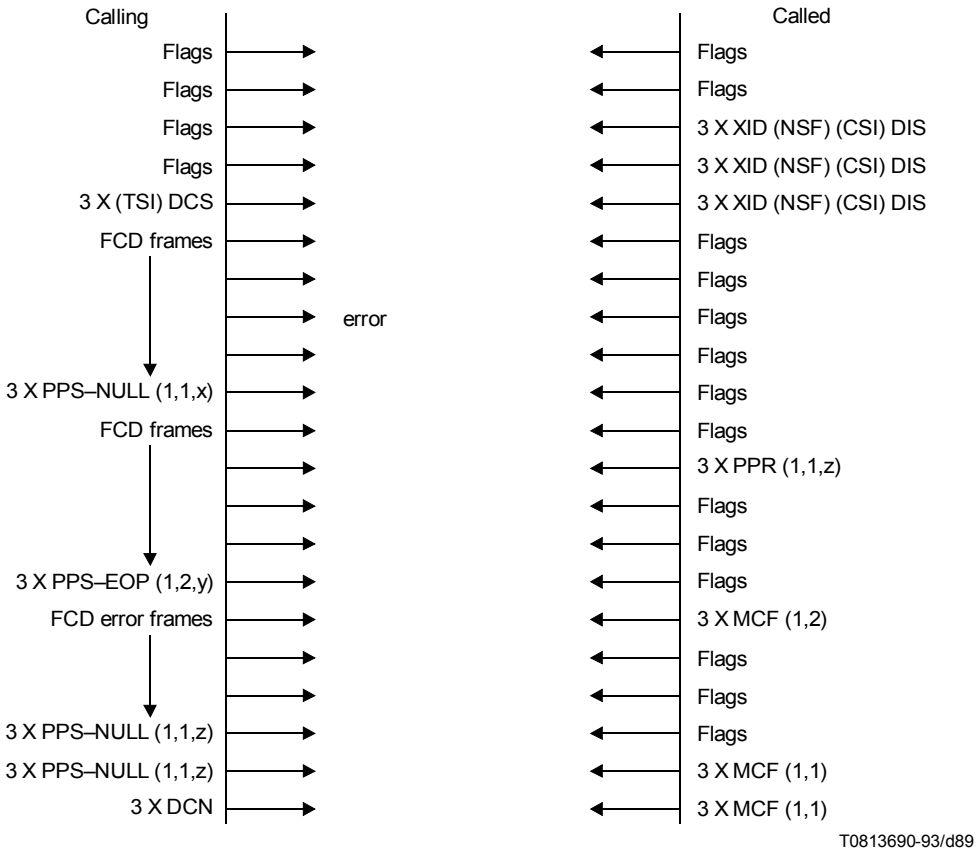


FIGURE C.25/T.30

Example 4 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document and errors on the corrections.

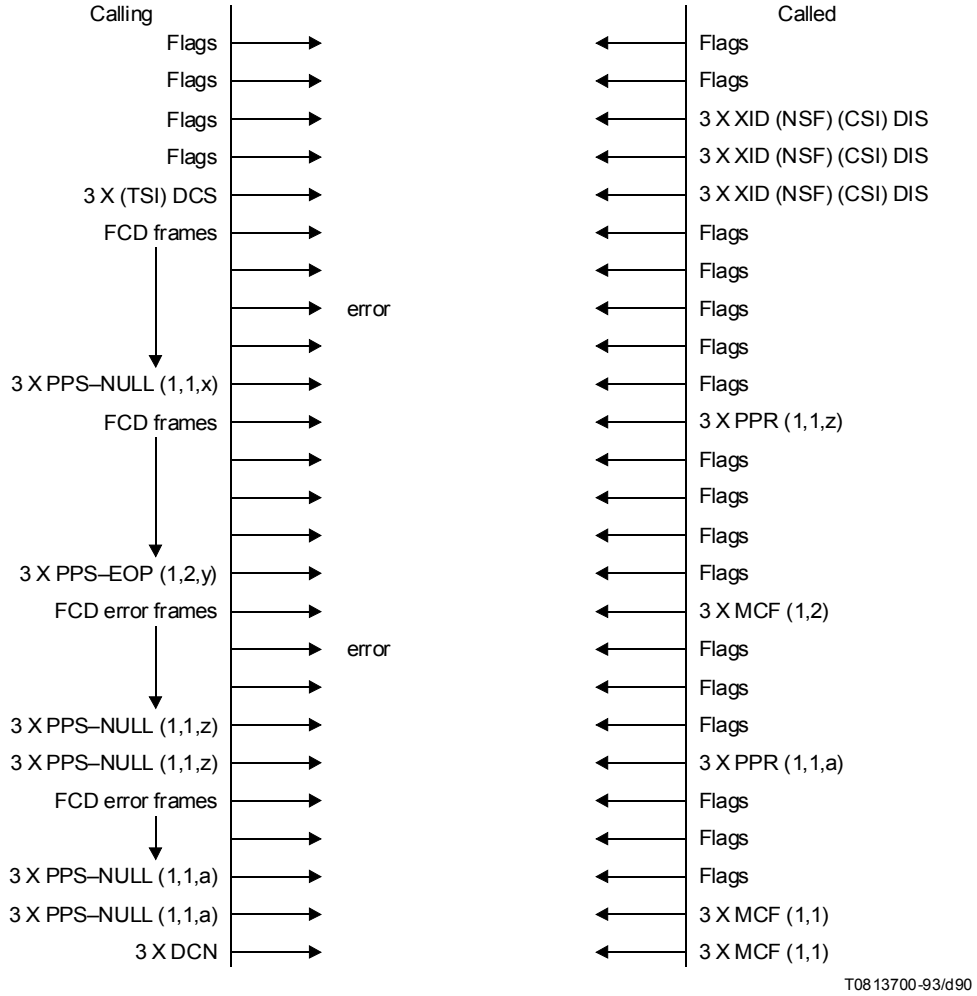


FIGURE C.26/T.30

Example 5 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on a post-message command.

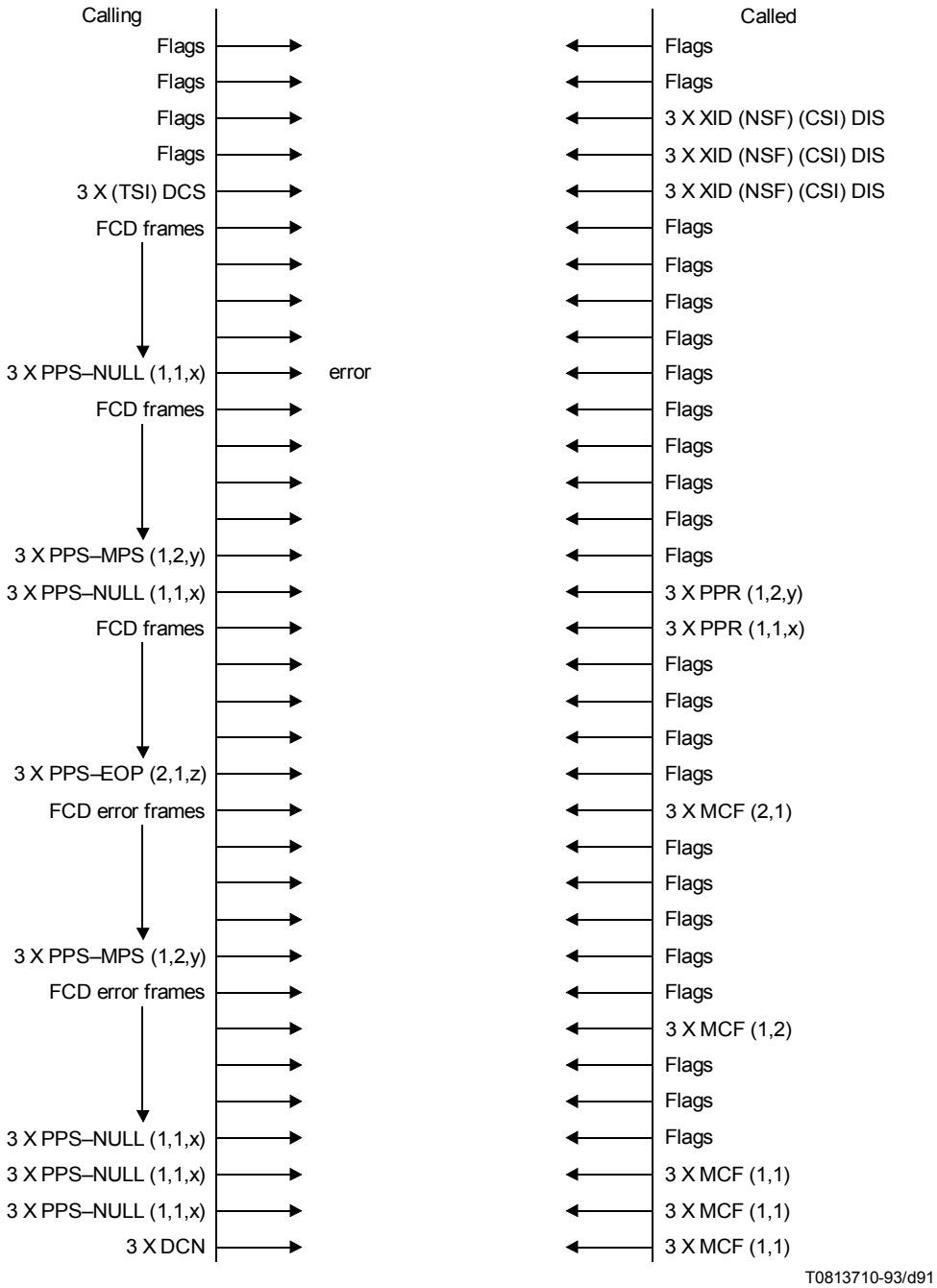


FIGURE C.27/T.30

Example 6 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the last post-message command.

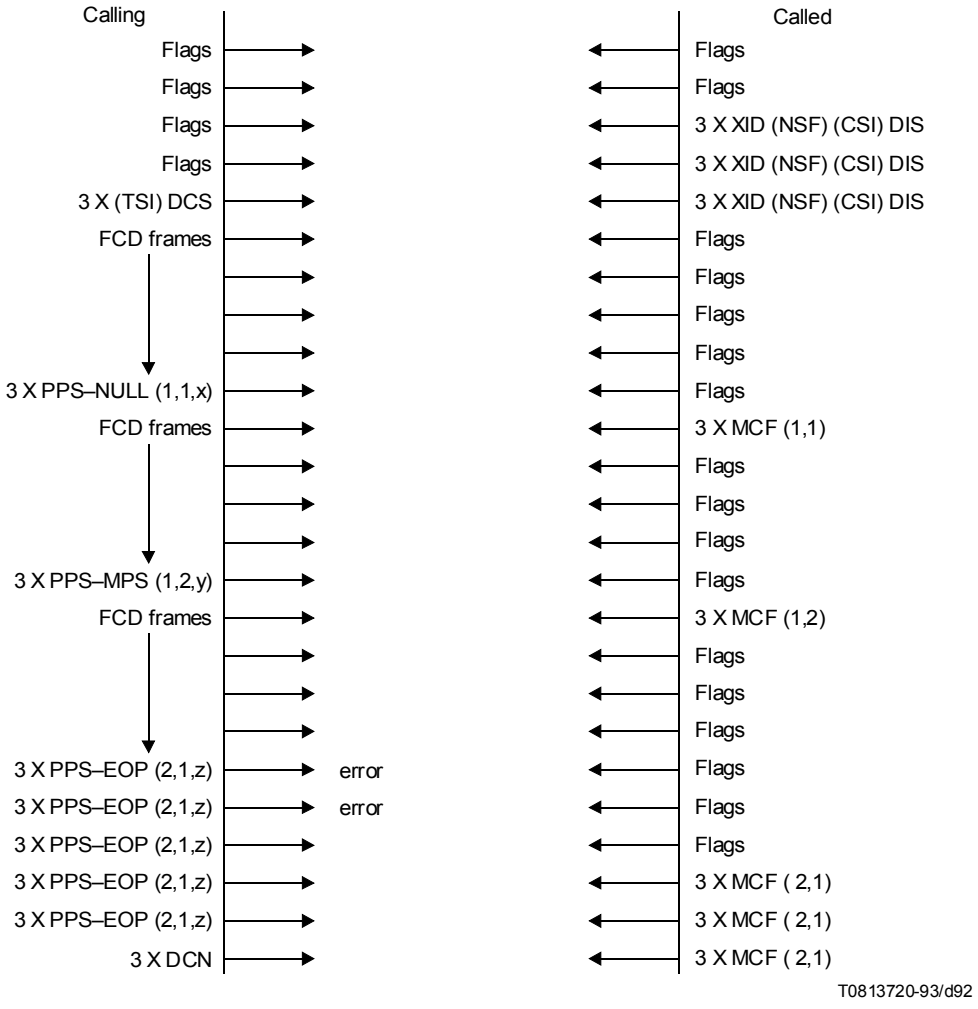


FIGURE C.28/T.30

Example 7 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with an error on the pre-message command.

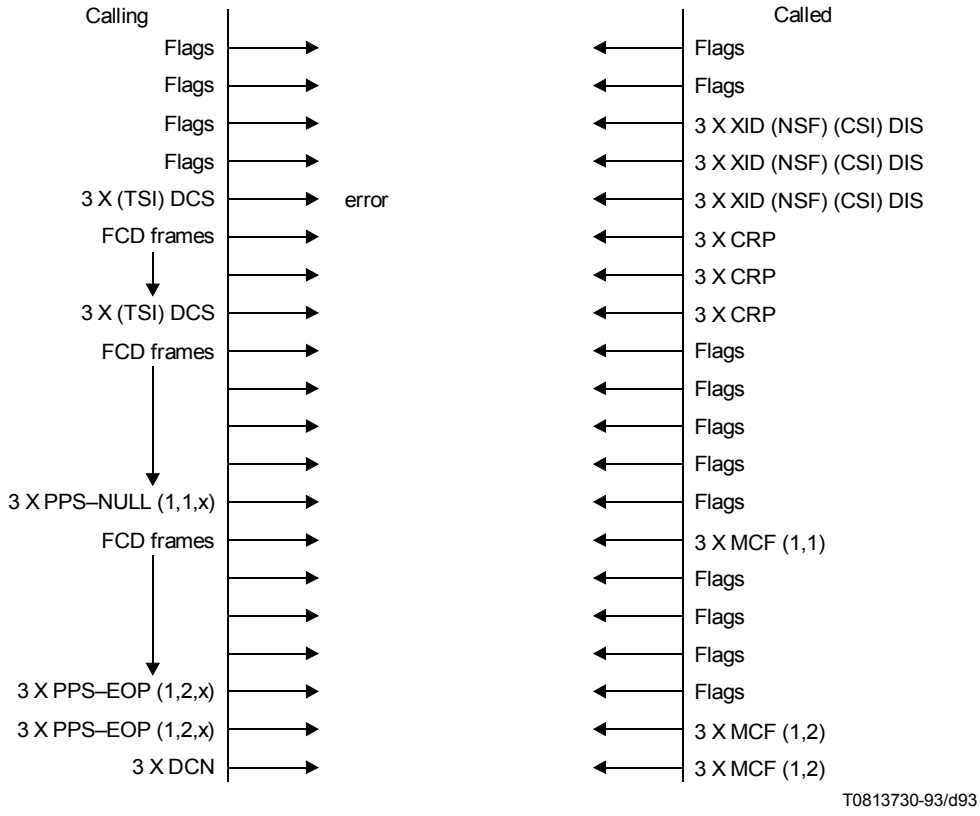


FIGURE C.29/T.30

Example 8 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with no response to the last post-message command.

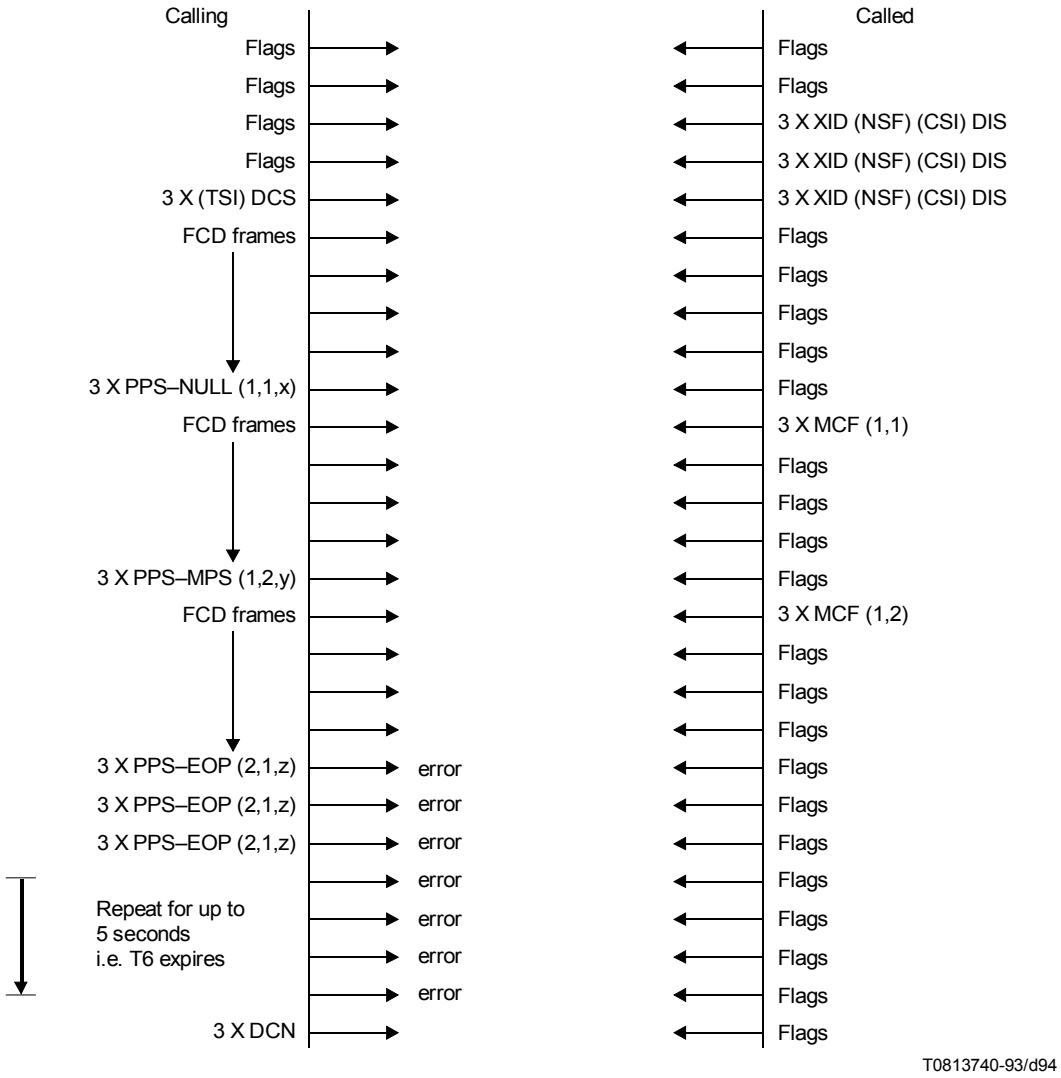


FIGURE C.30/T.30

Example 9 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document and receiver indicating it is not ready to receive new information.

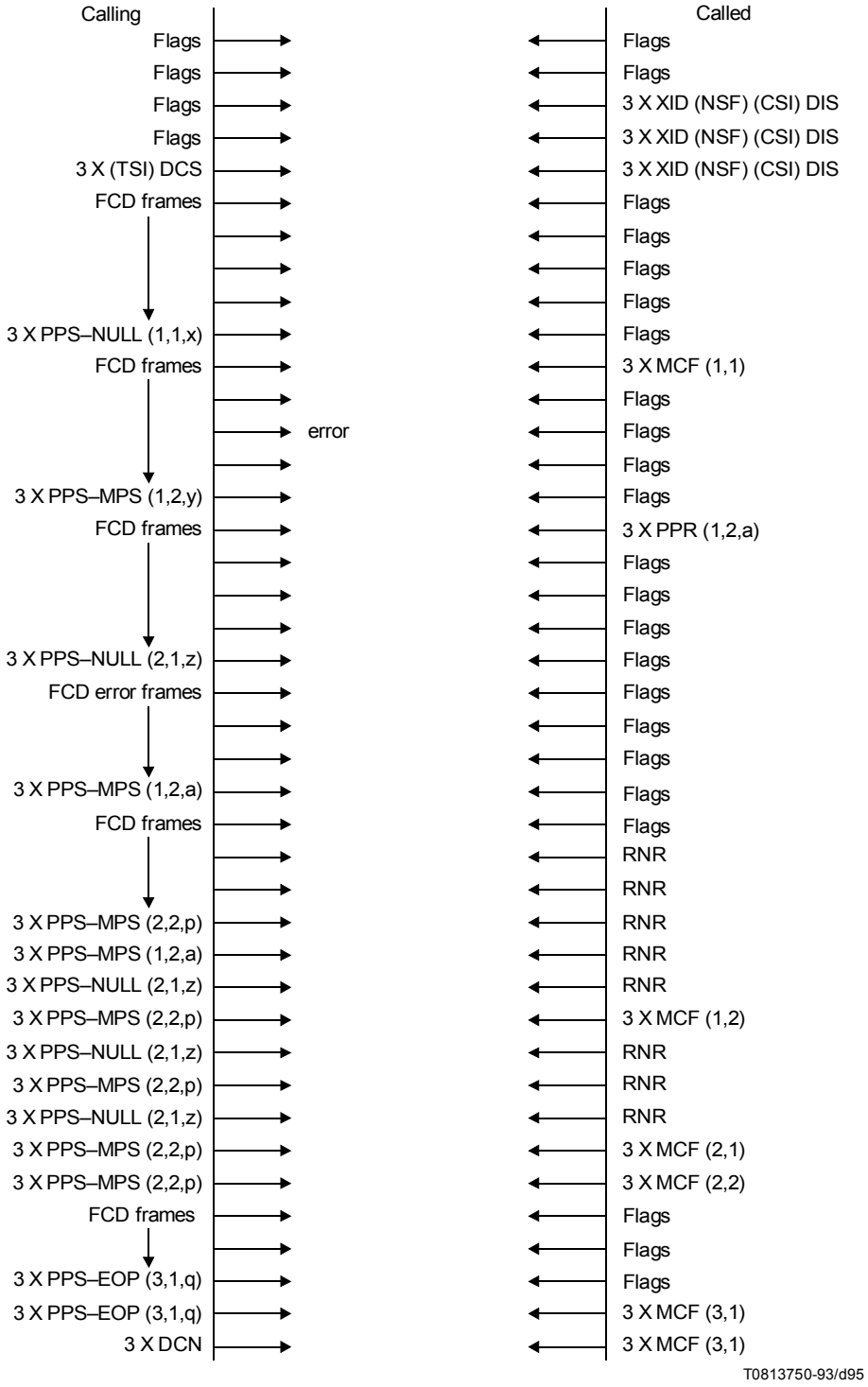


FIGURE C.31/T.30

Example 10 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document, receiver indicating it is not ready to receive new information and transmitter timing out.

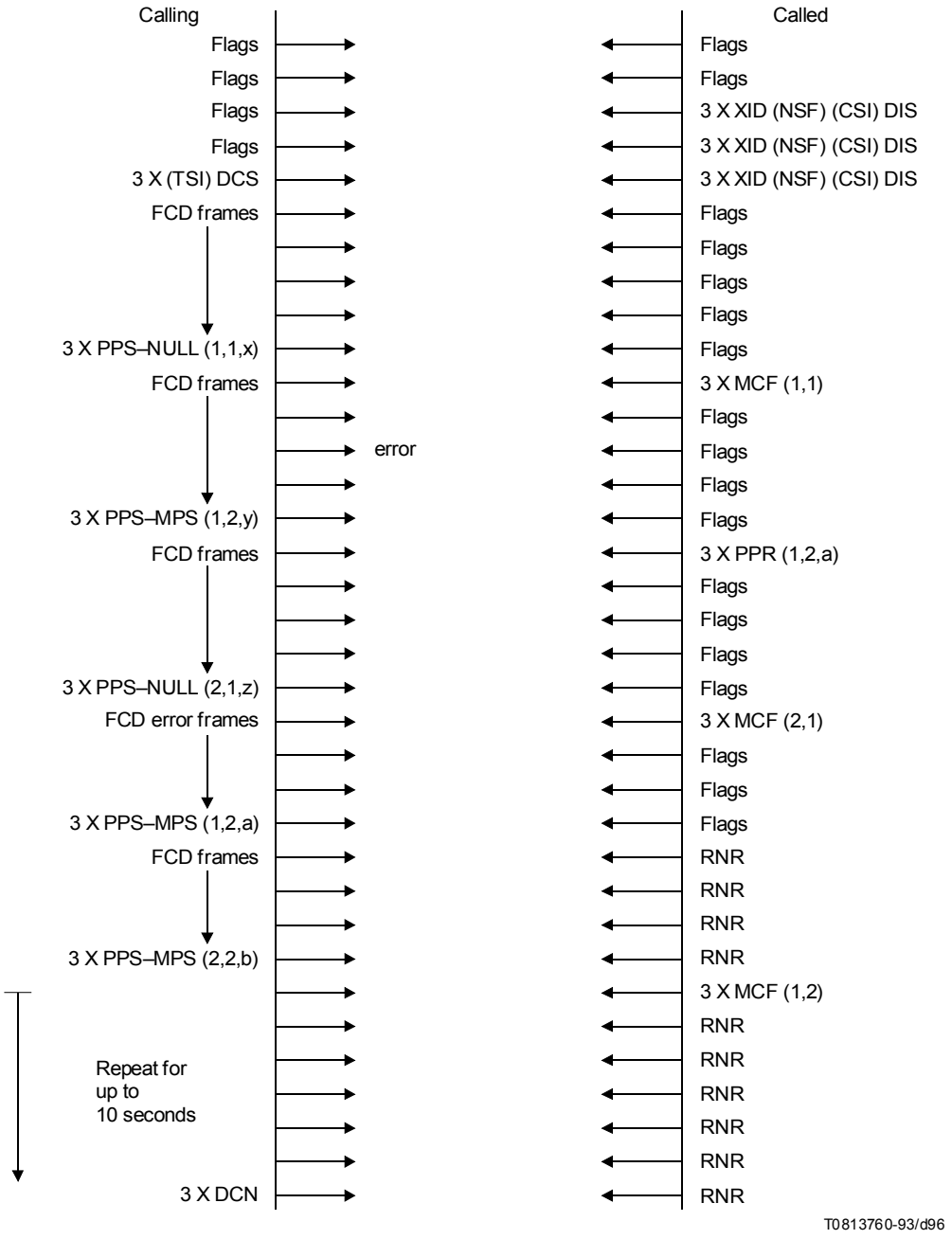


FIGURE C.32/T.30

Example 11 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document, receiver indicating it cannot receive any new information.

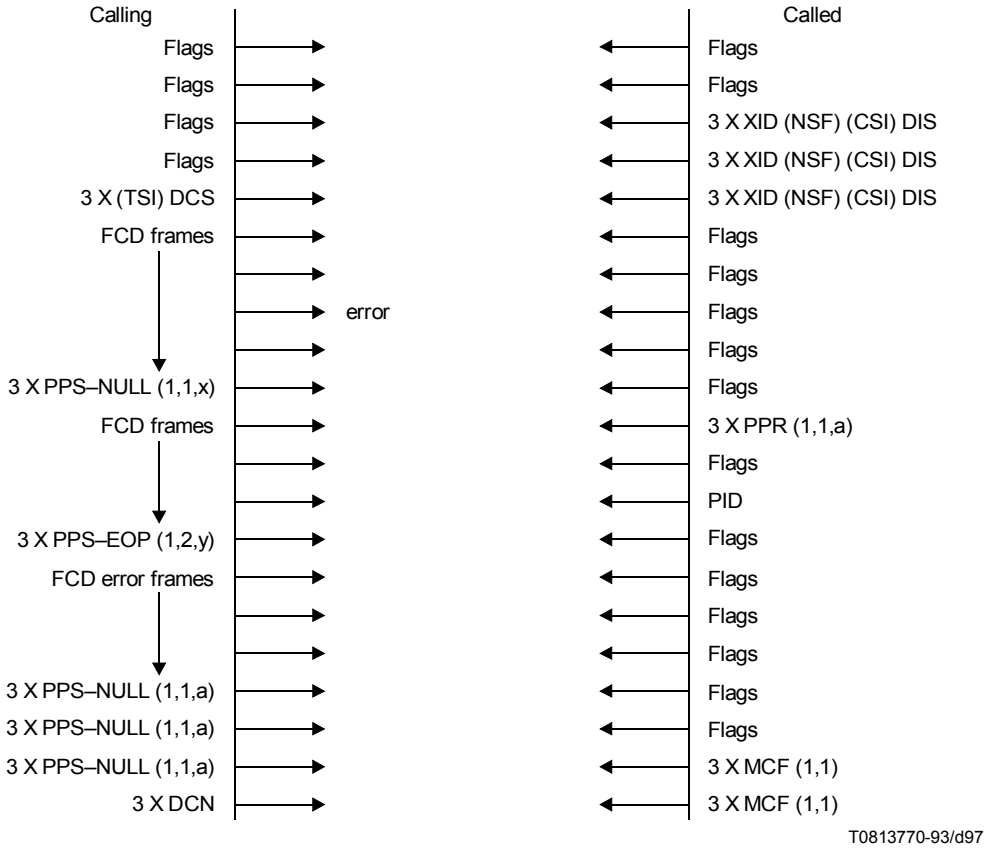


FIGURE C.33/T.30

Example 12 A calling terminal wishing to transmit to an answering terminal.

The calling terminal receives no recognisable signals from the called terminal and times out.

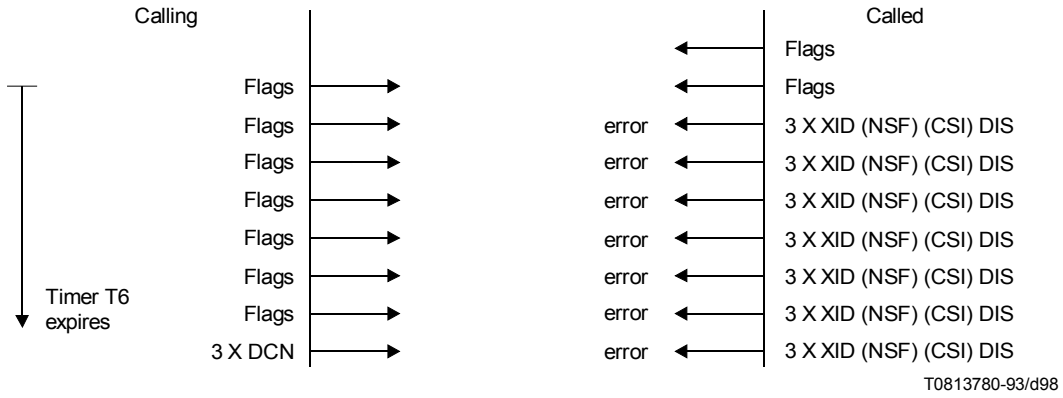


FIGURE C.34/T.30

Example 13 A calling terminal wishing to receive from an answering terminal.

The called terminal receives no recognisable signals from the calling terminal and times out.

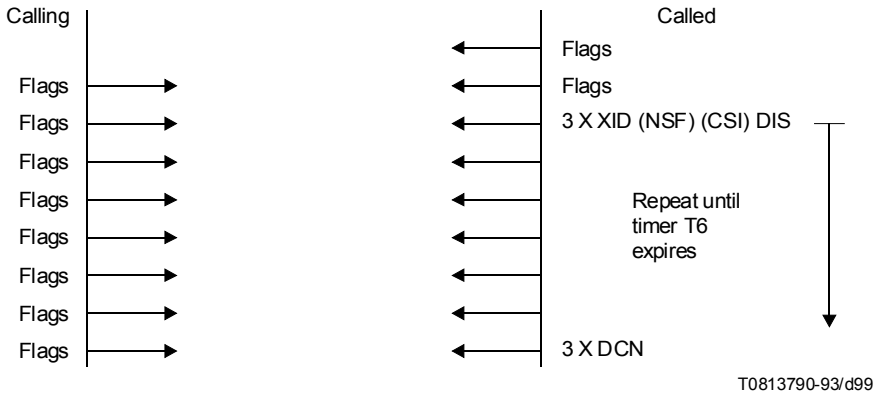


FIGURE C.35/T.30

Example 14 A calling terminal wishing to receive from an answering terminal.

The document being transmitted consists of a single partial page with no errors on the received document.

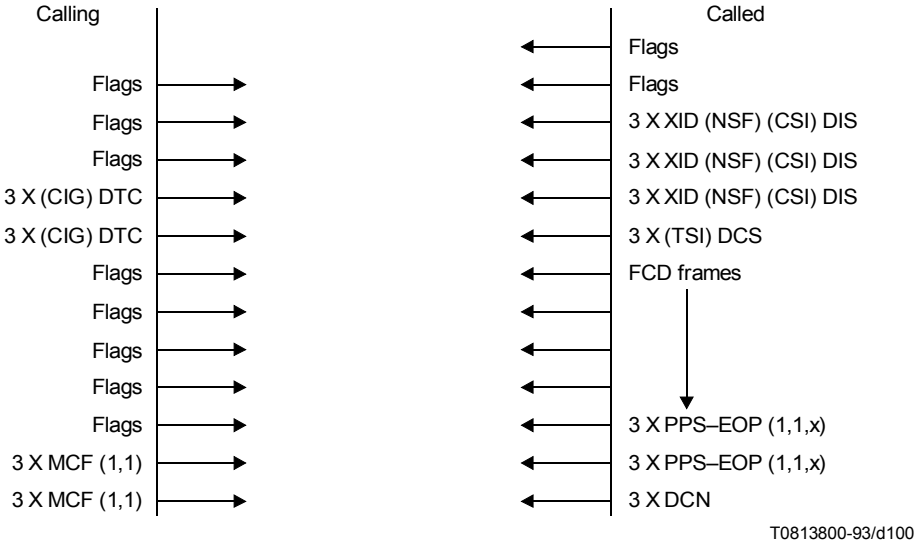


FIGURE C.36/T.30

C.6.2 Half duplex operation

The examples below are based on the flow diagrams and are for illustrative and instructional purpose only. They should not be interpreted as establishing or limiting the protocol. The exchange of the various commands and responses is limited only by the rules specified in this Recommendation.

Example 1 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of a single partial page with no errors on the received document.

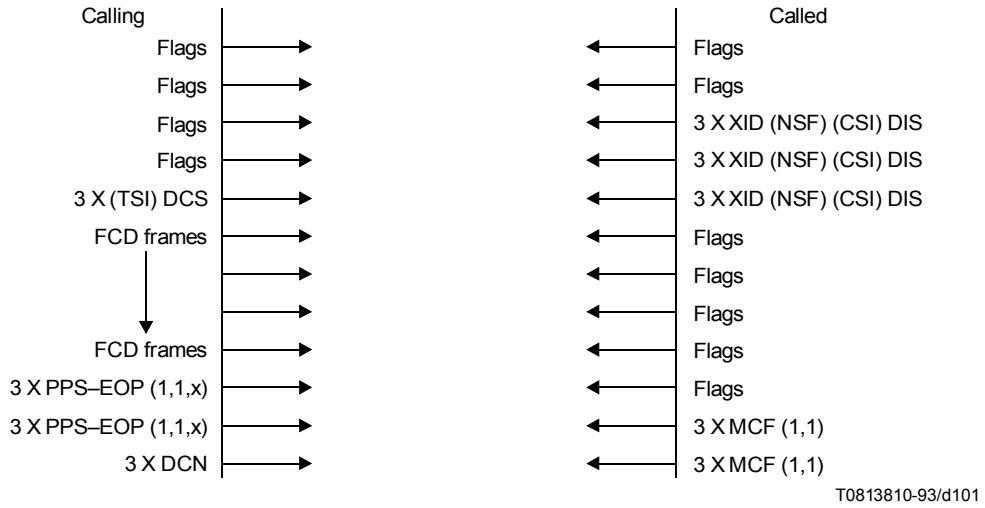


FIGURE C.37/T.30

Example 2 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with no errors on the received document.

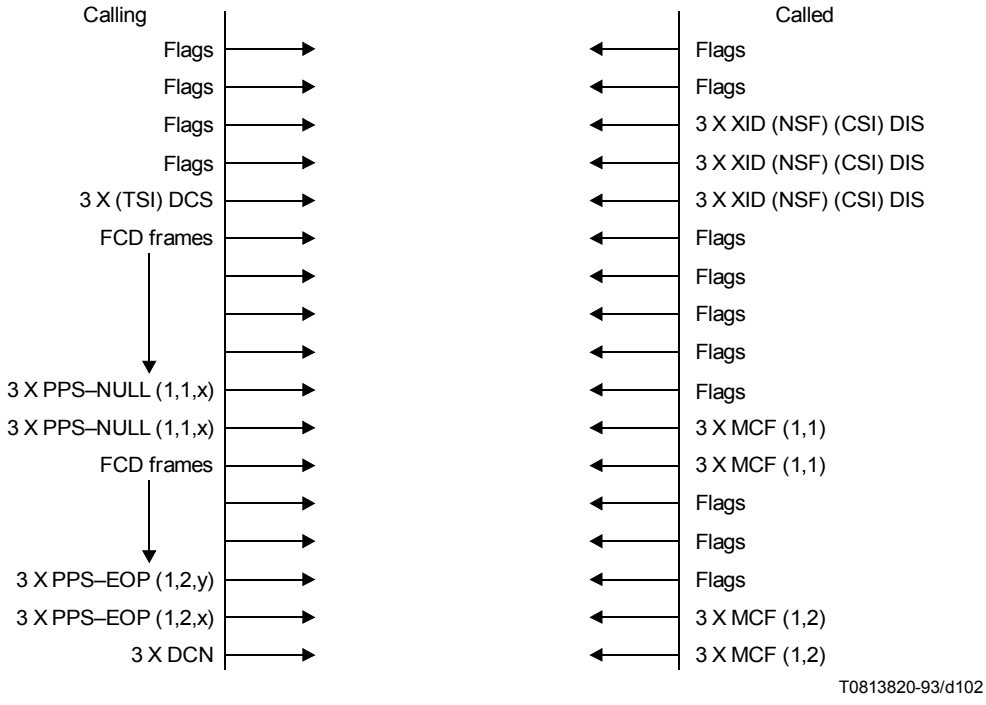


FIGURE C.38/T.30

Example 3 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document.

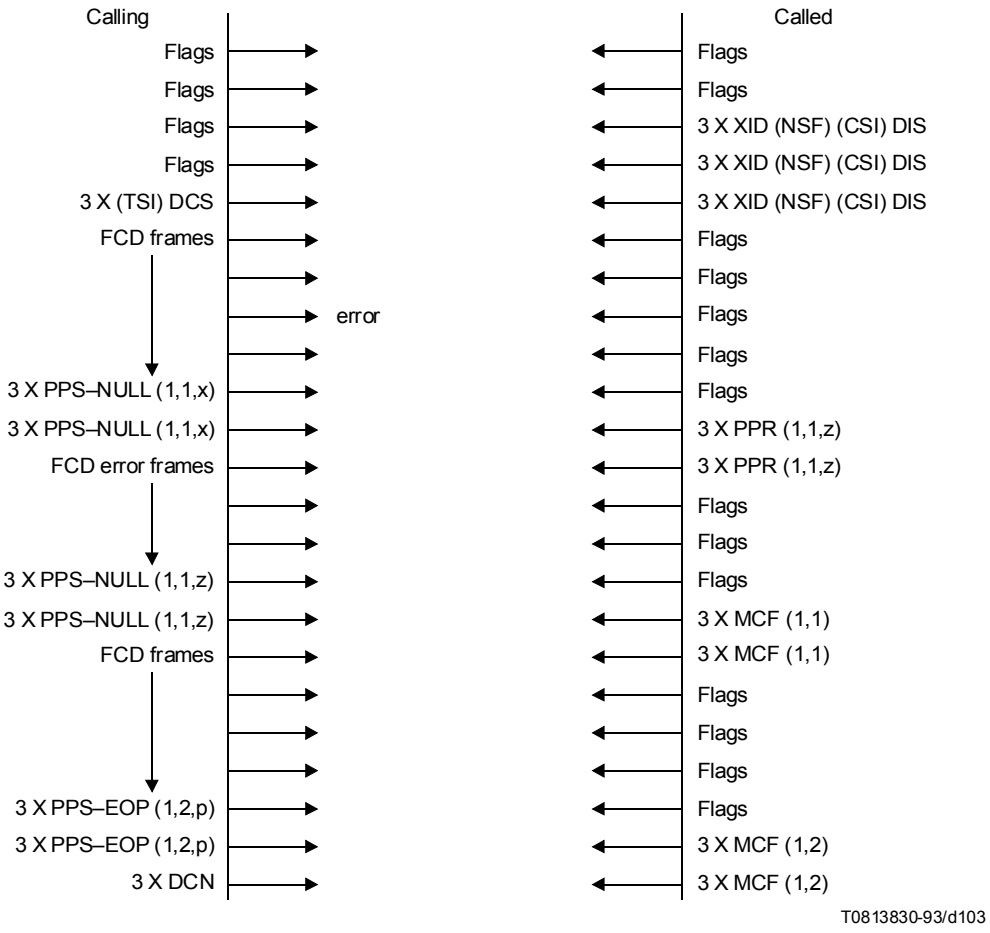


FIGURE C.39/T.30

Example 4 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document and errors on the corrections.

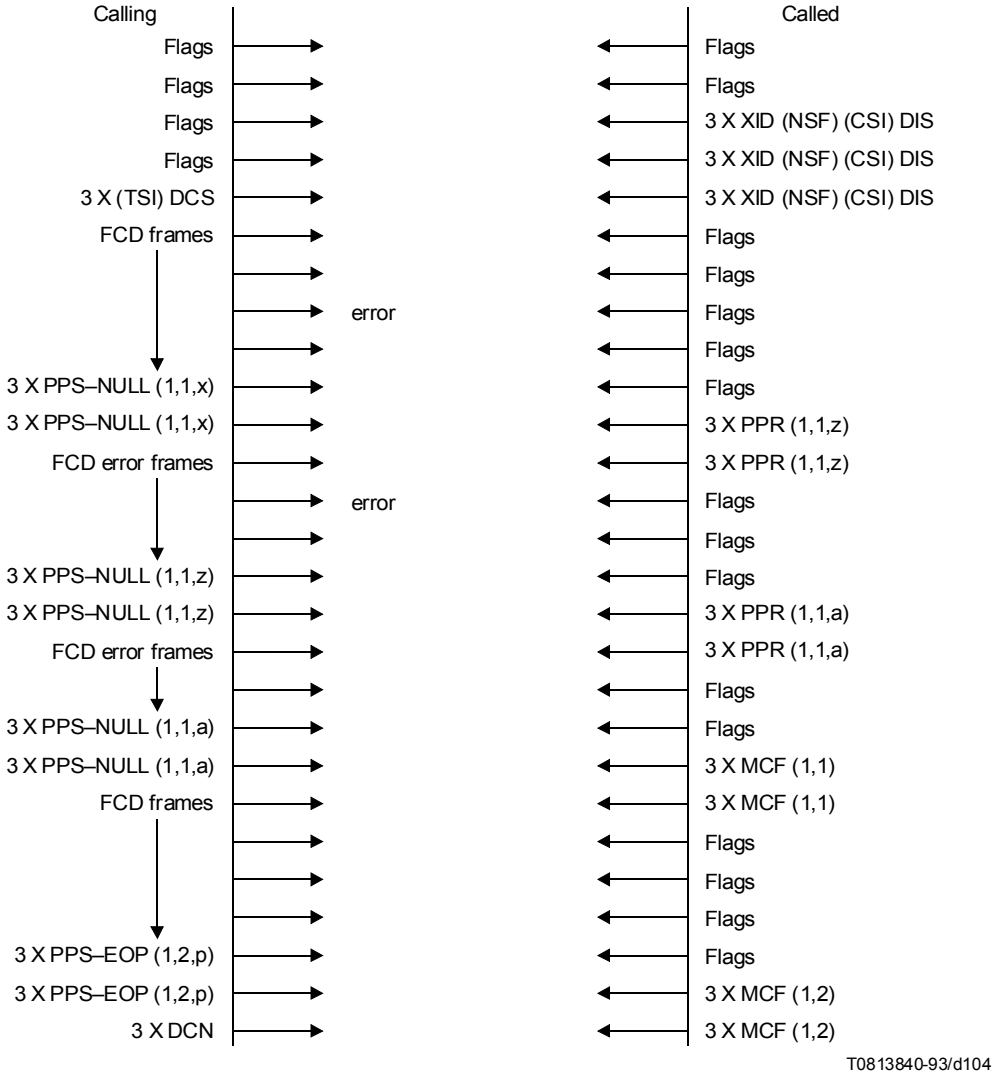


FIGURE C.40/T.30

Example 5 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on a post-message command.

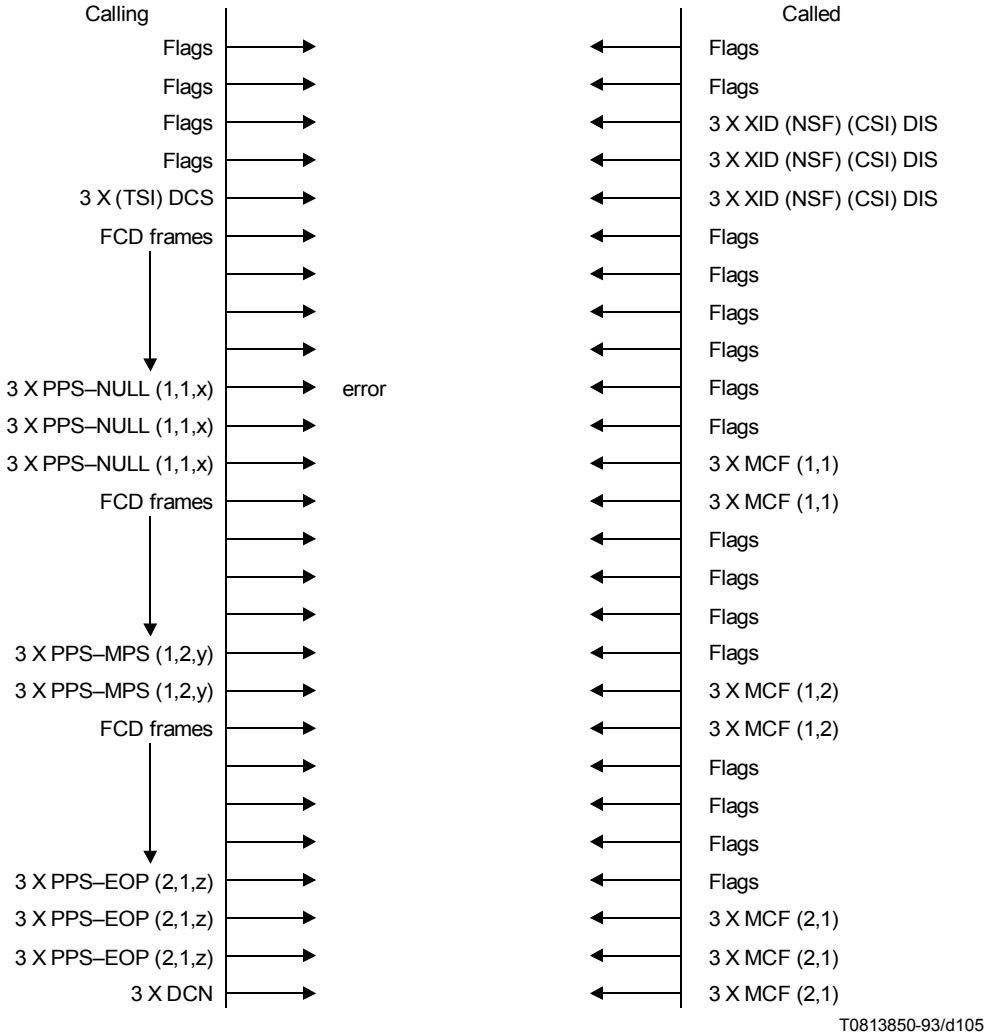


FIGURE C.41/T.30

Example 6 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the last post-message command.

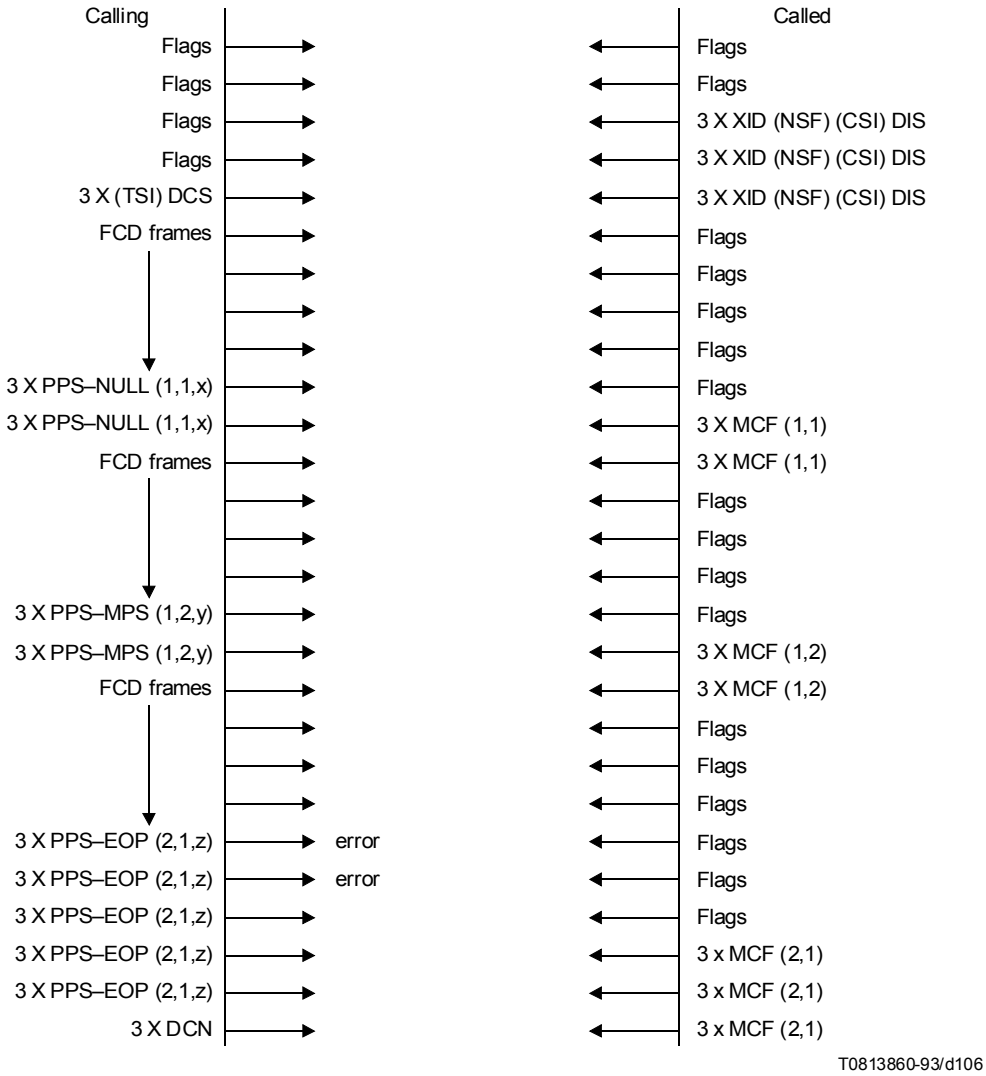


FIGURE C.42/T.30

Example 7 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with an error on the pre-message command.

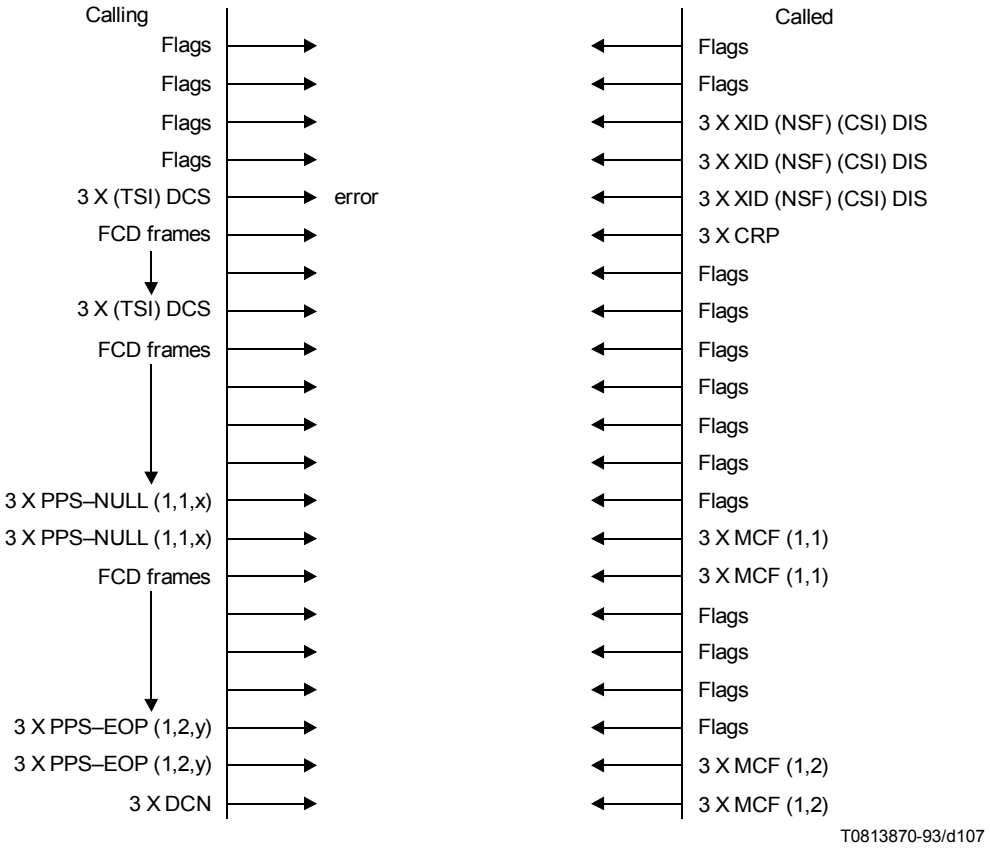


FIGURE C.43/T.30

Example 8 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with no response to the last post-message command.

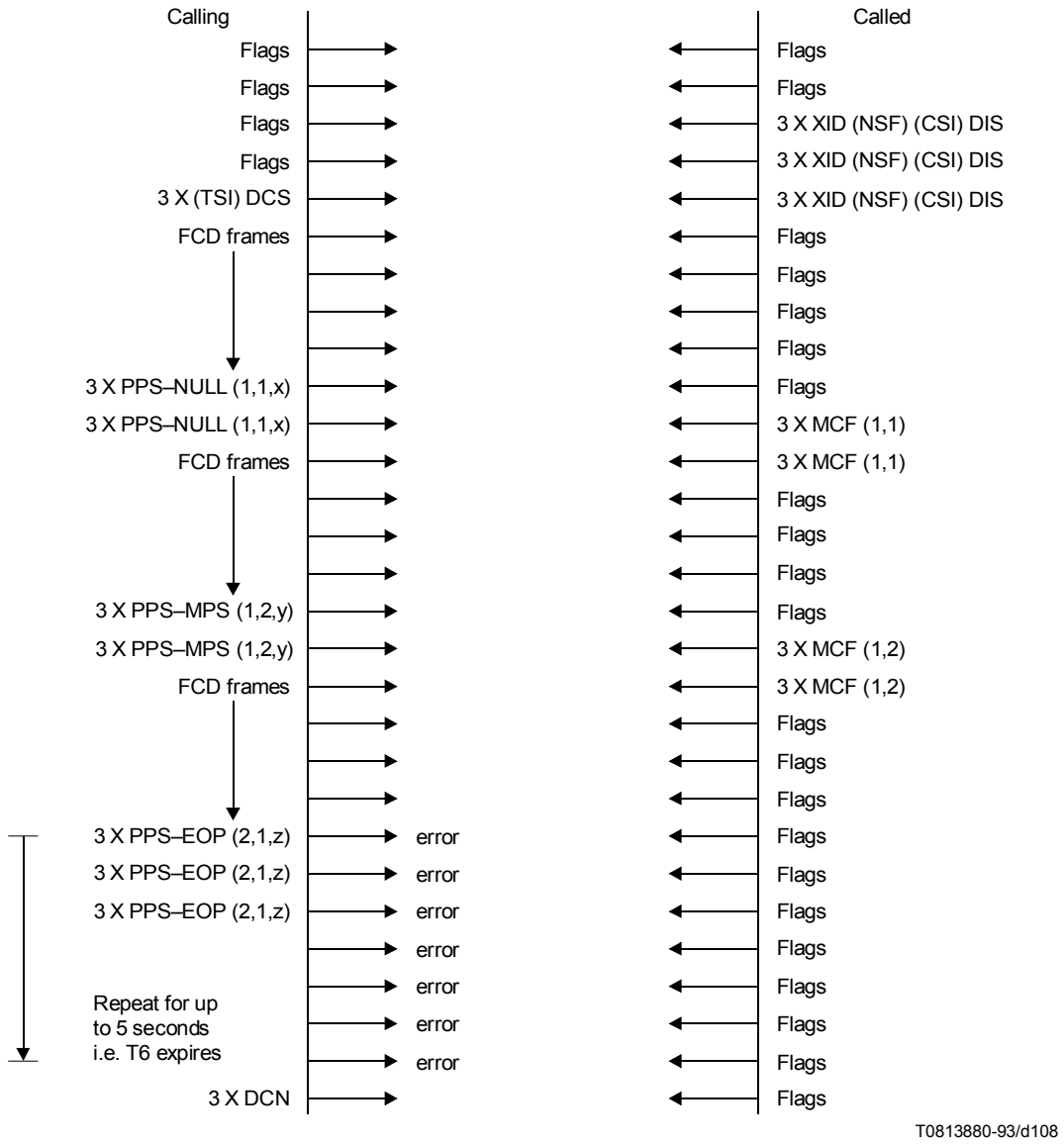


FIGURE C.44/T.30

Example 9 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document and receiver indicating it is not ready to receive new information.

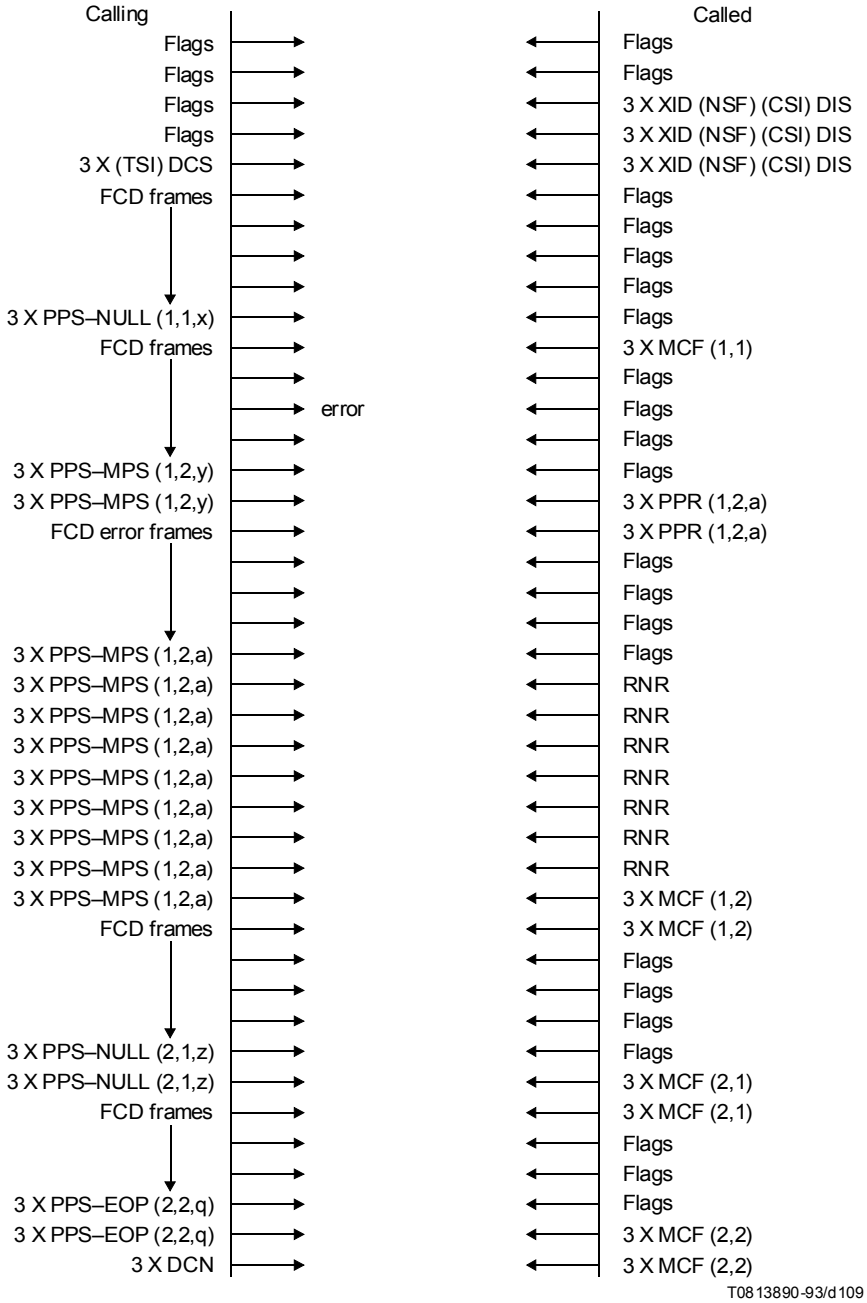


FIGURE C.45/T.30

Example 10 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document, receiver indicating it is not ready to receive new information and transmitter timing out.

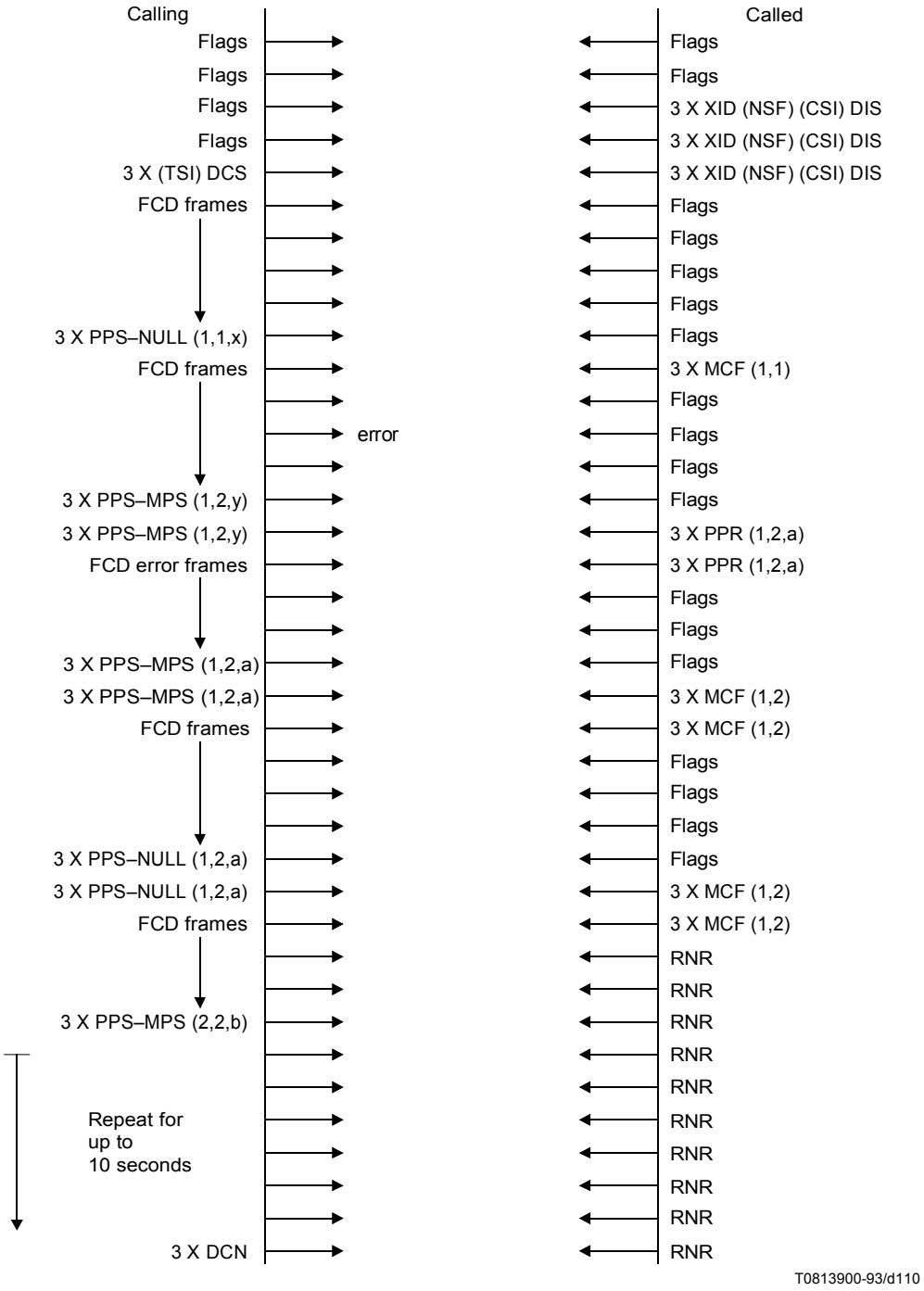


FIGURE C.46/T.30

Example 11 A calling terminal wishing to transmit to an answering terminal.

The document being transmitted consists of several partial pages with errors on the received document, receiver indicating it cannot receive any new information.

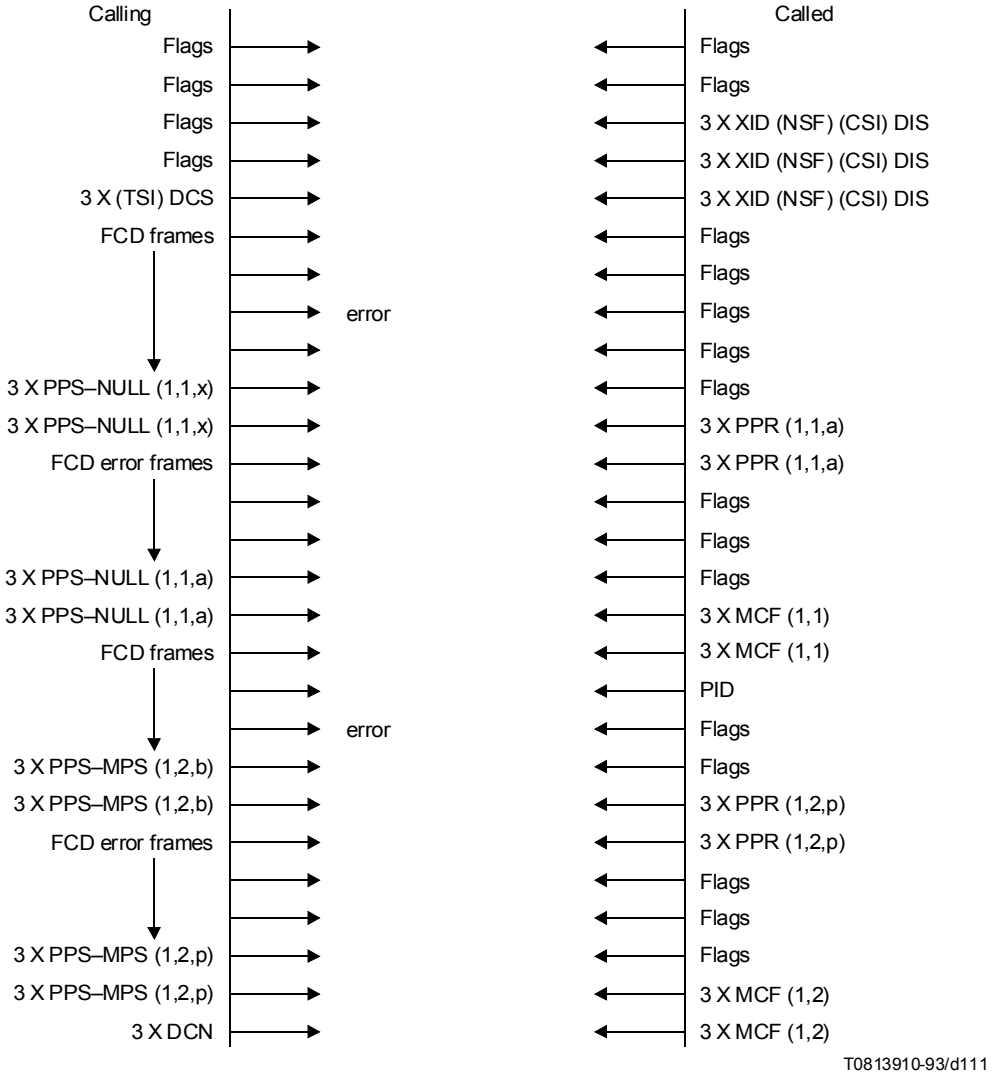


FIGURE C.47/T.30

Example 12 A calling terminal wishing to transmit to an answering terminal.

The calling terminal receives no recognisable signals from the called terminal and times out.

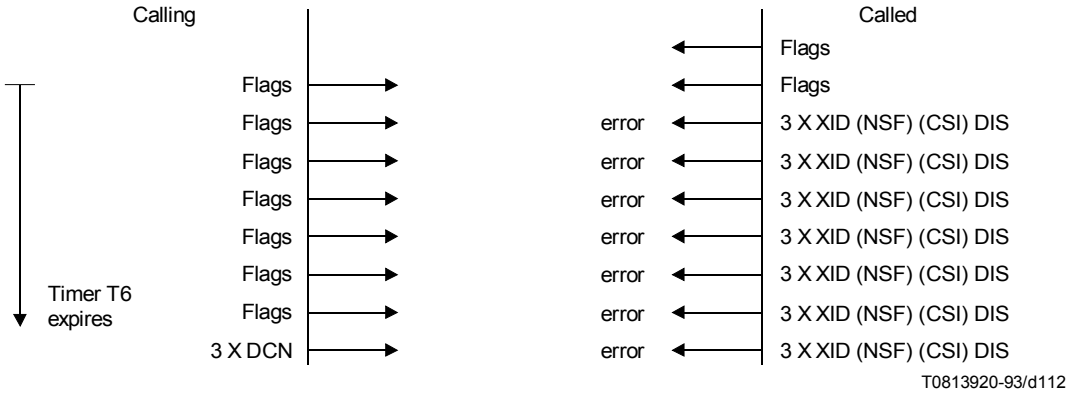


FIGURE C.48/T.30

Example 13 A calling terminal wishing to transmit to an answering terminal.

The called terminal receives no recognisable signals from the calling terminal and times out.

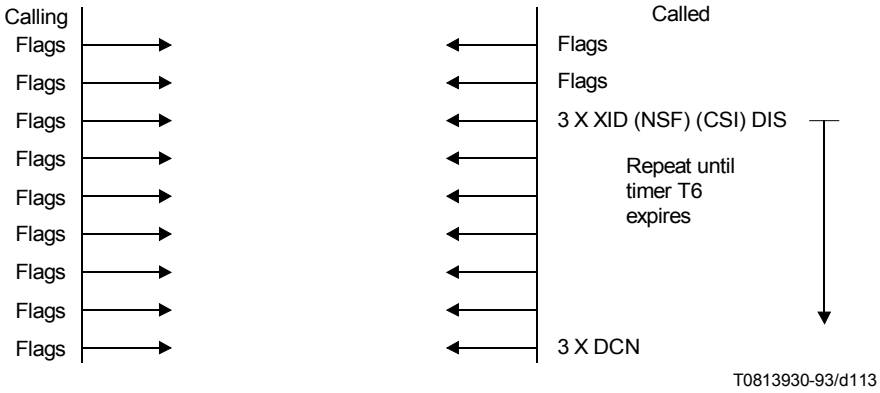


FIGURE C.49/T.30

Example 14 A calling terminal wishing to receive from an answering terminal.

The document being transmitted consists of a single partial page with no errors on the received document.

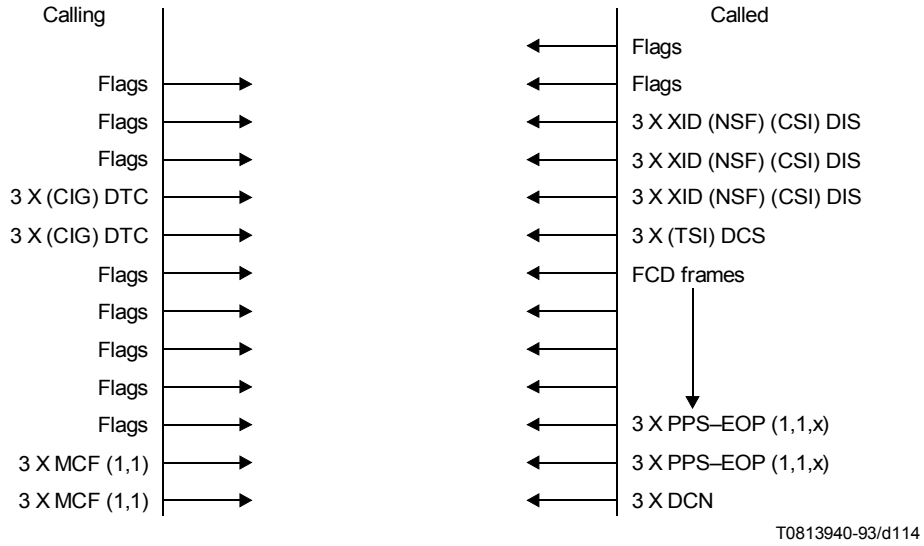


FIGURE C.50/T.30

Annex D

Optional automatic terminal selection procedures

(This annex forms an integral part of this Recommendation)

This annex provides for optional automatic terminal selection procedures for two types of devices. Device 1 provides for selection betwween combined facsimile and telephone answering. Device 2 provides for selection between combined facsimile and telephone answering and recording device. Other terminal configuration are for further study.

Device 1: Combined facsimile and telephone answering

Full details of this procedure are defined in Figure D.1.

1) The called station shall attempt to detect CNG during the 1.8 to 2.5 secs of quiet immediately after the called station is connected to the line.

2) Outgoing message (OGM1) shall be issued by the called station to inform the caller that the call has been answered and is being processed. An example of OGM1 follows: "Please wait, to start Fax begin transmission now".

   At 1.8 to 2.5 secs after the called station is connected to the line, it shall send OGM1 for a duration of not more than T_{OGM1}. The value of T_{OGM1} is for further study.

3) The called station may continue to detect CNG in parallel during OGM1.

4) A local operator at the called station may lift the handset off-hook at any point during this procedure, prior to detection of CNG.

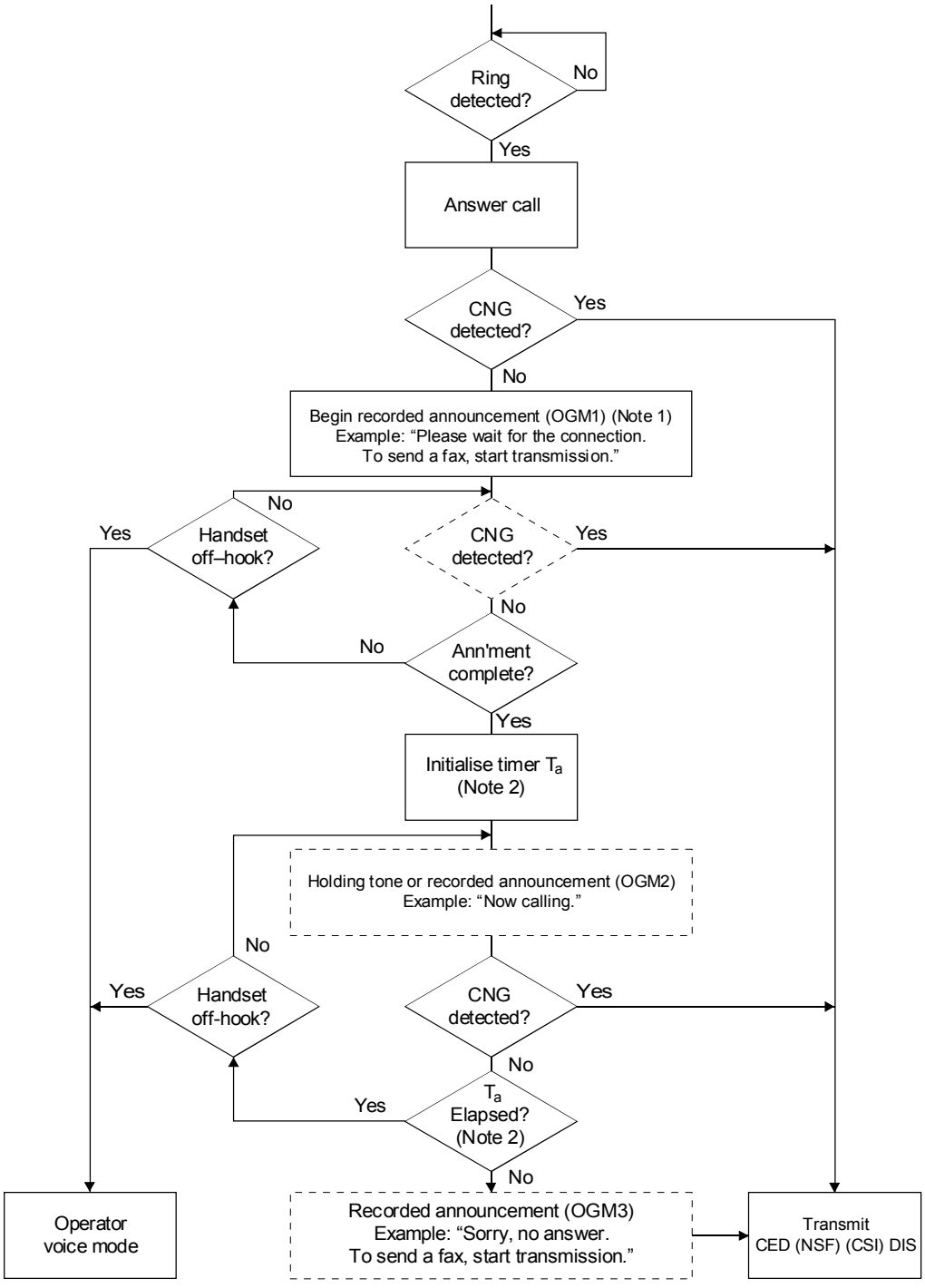
5) CNG detection shall continue at the end of OGM1 if CNG was not detected earlier or local operator has not taken control of the call. The duration of this CNG detection is defined by T_a timer. Another OGM (OGM2) may be issued during this CNG detection period.

6) Fax signals shall be issued by the called station some time after T_a timer has elapsed if CNG was not detected or local operator has not taken control of the call.

Device 2: Combined facsimile and telephone answering and recording device

Full details of this procedure are defined in Figure D.2.

This procedure is similar to that described for device 1. The procedure differs in that it shall provide for speech detection during the CNG detection period to permit switching to the recording device.



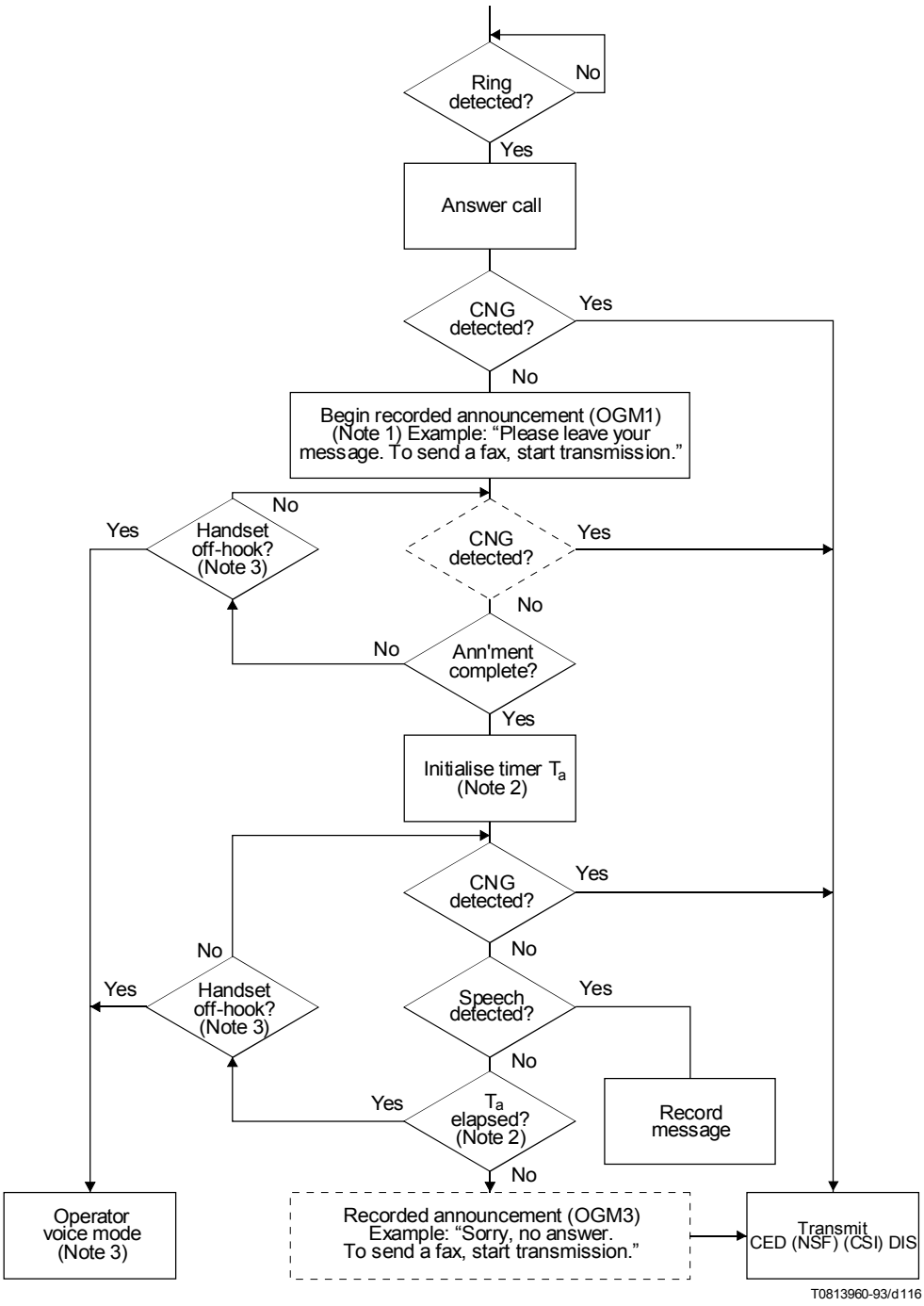
NOTES

1 At 1.8 to 2.5 seconds after the called station is connected to line, it sends a recorded announcement CNG detection during this silent period.

2 3.5 (CNG) x 1.15 (tolerance) x $2 \leq T_a < T1 - OGM1 - (OGM3)$, $T1 = 35 \pm 5$ seconds.

FIGURE D.1/T.30

Terminal selection method for combined facsimile and telephone answering



NOTES

1 At 1.8 to 2.5 seconds after the called station is connected to line, it sends announcement. CNG detection during this silent period.

2 3.5 (CNG) × 1.15 (tolerance) × 2 ≤ T_a (OGM1) – (OGM3). T1 = 35 ± 5 seconds.

3 Procedure when operator is in attendance.

FIGURE D.2/T.30

Terminal selection method for combined facsimile, telephone answering and recording device

Appendix I

Example of non-standard manual to manual basic facsimile operation

(This appendix does not form an integral part of this Recommendation)

It is acknowledged that there are existing equipment in the field that may not conform in all aspects to this Recommendation. Therefore the decision may be made to got to a mode of operation other than specified herein. Figure I.1 describes, as an example, one of these conditions. Other methods may be possible as long as they do not interfere with the recommended operation.

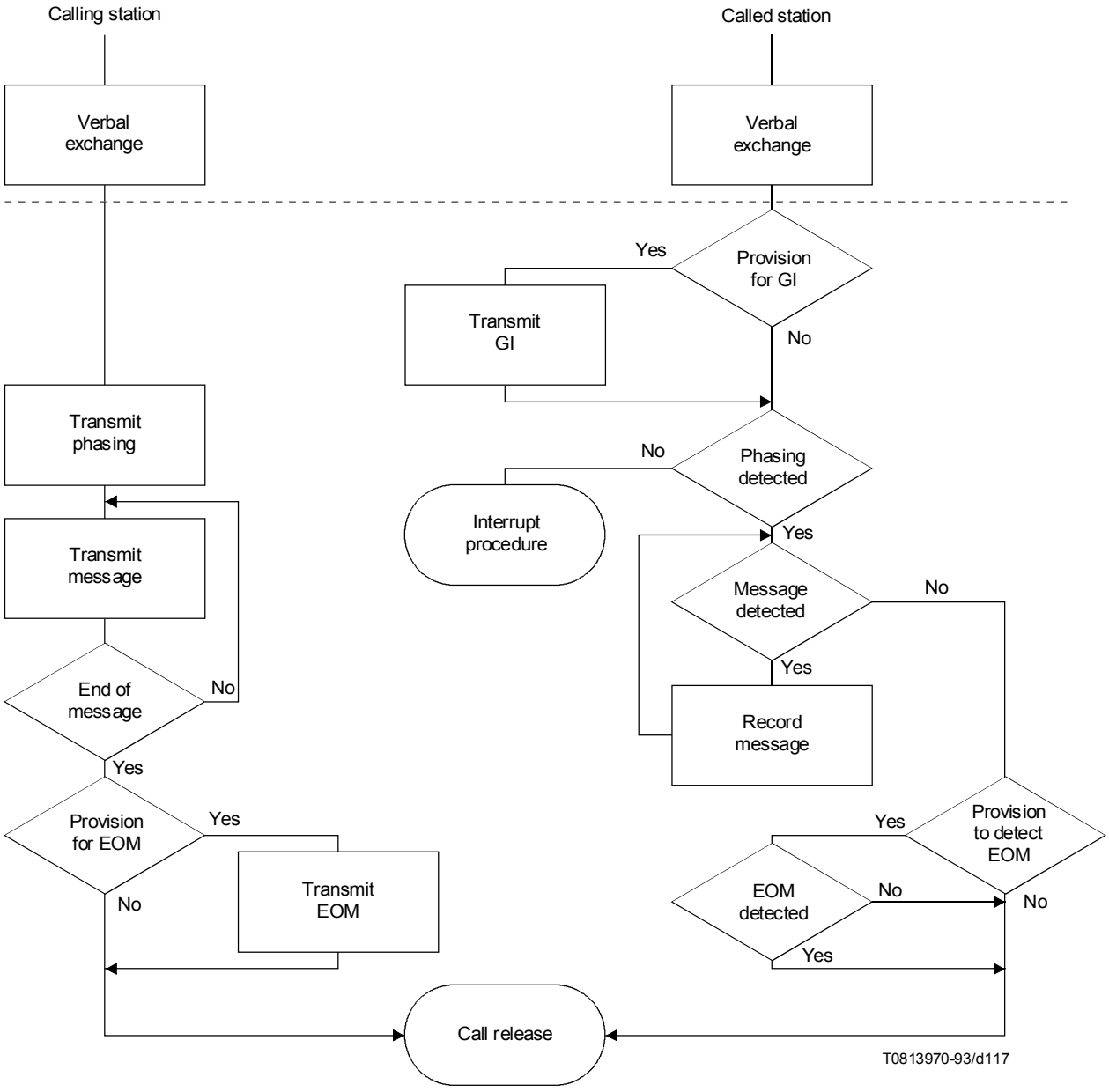


FIGURE I.1/T.30

Appendix II

Index of abbreviations used in this Recommendation

(This appendix does not form an integral part of this Recommendation)

Abbreviation	Function	Signal format	Reference
CED	Called station identification	2100 Hz	4.3.3.2
CFR	Confirmation to receive	X010 0001 1850 or 1650 Hz for 3 s	5.3.6.1.4, 1) 4.3.1.2
CIG	Calling subscriber identification	1000 0010	5.3.6.1.2, 2)
CNG	Calling tone	1100 Hz for 500 ms	4.3.3.3
CRP	Command repeat	X101 1000	5.3.6.1.8, 2)
CSI	Called subscriber identification	0000 0010	5.3.6.1.1, 2)
CTC	Continue to correct	X100 1000	A.4.1
CTR	Response to continue to correct	X010 0011	A.4.2
DCN	Disconnect	X101 1111	5.3.6.1.8, 1)
DCS	Digital command signal	X100 0001	5.3.6.1.3, 1)
DIS	Digital identification signal	0000 0001	5.3.6.1.1, 1)
DTC	Digital transmit command	1000 0001	5.3.6.1.2, 1)
EOM	End of message	X111 0001 1100 Hz	5.3.6.1.6, 1) 4.3.2.4
EOP	End of procedure	X111 0100	5.3.6.1.6, 3)
EOR	End of retransmission	X111 0011	A.4.3
ERR	Response for end of retransmission	X011 1000	A.4.4
FCD	Facsimile coded date	0110 0000	A.2.2
FCF	Facsimile control field	–	5.3.6.1
FDM	File diagnostics message	X011 1111	5.3.6.1.7, 9)
FIF	Facsimile information field	–	5.3.6.2
FTT	Failure to train	X010 0010	5.3.6.1.4, 2)
GC	Group command	1300 Hz for 1.5-10.0 s 2100 Hz for 1.5-10.0 s	4.3.2.1
GI	Group identification	1650 or 1850 Hz	4.3.1.1
HDLC	High level data link control	–	5.3
LCS	Line conditioning signals	1100 Hz	4.3.2.2
MCF	Message confirmation	X011 0001 1650 or 1850 Hz	4.3.1.3
MPS	Multi-page signal	X111 0010	5.3.6.1.6, 2)

Abbreviation	Function	Signal format	Reference
NSC	Non-standard facilities command	1000 0100	5.3.6.1.2, 3)
NSF	Non-standard facilities	0000 0100	5.3.6.1.1, 3)
NSS	Non-standard set-up	X100 0100	5.3.6.1.3, 3)
PID	Procedure interrupt disconnect	X011 0110	C.3.4.2
PIN	Procedural interrupt negative	X011 0100	5.3.6.1.7, 5)
PIP	Procedural interrupt positive	X011 0101	5.3.6.1.7, 4)
PIS	Procedural interrupt signal	462 Hz for 3 s	4.3.3.1
PPS	Partial page signal	X111 1101	A.4.3
PPR	Partial page request	X011 1101	A.4.4
PRI-EOM	Procedure interrupt-EOM	X111 1001	5.3.6.1.6, 4)
PRI-EOP	Procedure interrupt-EOP	X111 1100	5.3.6.1.6, 6)
PRI-MPS	Procedure interrupt-MPS	X111 1010	5.3.6.1.6, 5)
RCP	Return to control for partial page	0110 0001	A.2.2
RNR	Receive not ready	X011 0111	A.4.4
RR	Receive ready	X111 0110	A.4.3
RTN	Retrain negative	X011 0010	5.3.6.1.7, 3)
RTP	Retrain positive	X011 0011	5.3.6.1.7, 2)
TCF	Training check	Zeros for 1.5 s	5.3.6.1.3, 5)
TSI	Transmitting subscriber identification	X100 0010	5.3.6.1.3, 2)
PWD	Password (for polling)	1000 0011	5.3.6.1.2, 4)
PWD	Password (for transmission)	X100 0101	5.3.6.1.3, 5)
SEP	Selective polling	1000 0101	5.3.6.1.2, 5)
SUB	Subaddress	X100 0011	5.3.6.1.3, 4)

Appendix III

List of commands and appropriate responses

(This appendix does not form an integral part of this Recommendation)

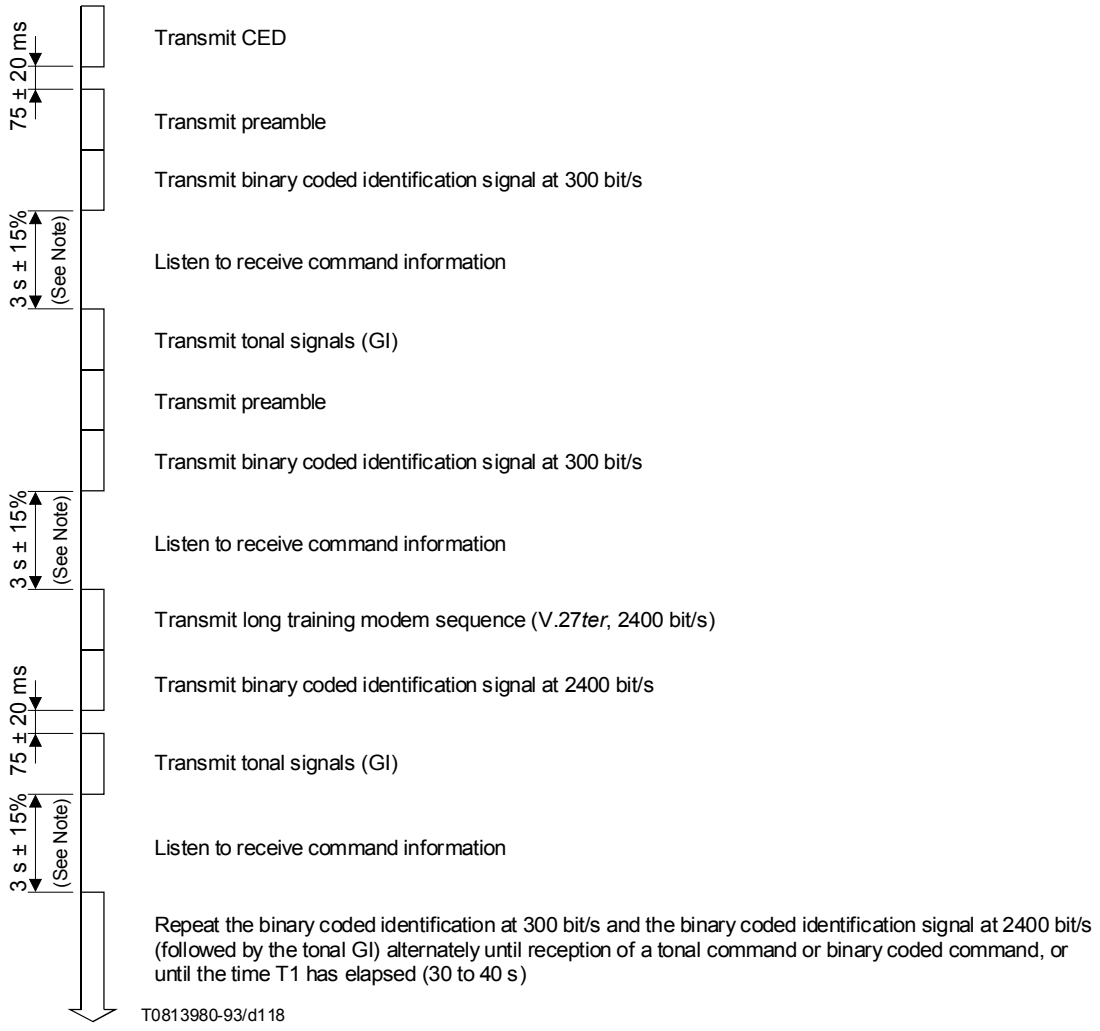
Commands	Comments	Appropriate responses
(NSF) (CSI) DIS	Identifying capabilites: from a manual receiver or an auto answer unit	(NSC) (CIG) DTC (TSI) DCS (NSF) (CSI) DIS (CRP) (TSI) (NSS) (PWD) (SEP) (CIG) DTC (PWD) (SUB) (TSI) DCS
(NSC) (CIG) DTC (PWD) (SEP) (CIG) DTC	Mode setting command: from calling unit This is a poll operation	(TSI) DCS (NSF) (CSI) DIS (CRP) (TSI) (NSS)
(TSI) DCS (TSI) (NSS) (PWD) (SUB) (TSI) DCS	Mode setting command: from from manual transmitter or automatic receiver This command is always followed by phasing/training	CFR FTT (NSC) (CIG) DTC (NSF) (CSI) DIS (CRP)
CTC	Mode setting command: from the transmitter to the reciver	(CTR) (CRP)
(EOR-NULL)	Indicate the next block transmission from the transmitter to the receiver	(ERR) (RNR) (CRP)
(EOR-MPS) or (EOR-EOP) or (EOR-EOM) or (EOR-PRI-MPS) or (EOR-PRI-EOP) or (EOR-PRI-EOM)	Indicate the next message transmission from the transmitter to the receiver	(ERR) (RNR) PIN (CRP)
MPS or EOP or EOM or (PRI-MPS) or (PRI-EOP) or (PRI-EOM)	Post message commands	MCF RTP RTN PIP PIN (CRP)
(PPS-NULL)	Post-message command for a partial page: from the transmitter to the receiver	(PPR) MCF (RNR) (CRP)
(PPS-MPS) or (PPS-EOP) or (PPS-EOM) or (PPS-PRI-MPS) or (PPS-PRI-EOP) or (PPS-PRI-EOM)	Post-message commands for a complete page: from the transmitter to the receiver	(PPR) MCF (RNR) PIP PIN (CRP)
(RR)	Ask for the status of the receiver: from the transmitter to the receiver	(RNR) (ERR) MCF PIP PIN (CRP)
DCN	Phase E command	None
NOTE – Where the symbols ( ) are used, the signals within these symbols are optional.		

Appendix IV

Interworking between the standard mode and the recognised optional mode for the binary coded handshaking procedure

(This appendix does not form an integral part of this Recommendation)

An example of a station having the standard binary coded, recognized optional binary coded and tonal capabilitites is given in Figure IV.1.



NOTE – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

FIGURE IV.1/T.30

Called station procedures (alternating method)

Appendix V

Signal sequence examples

(This appendix does not form an integral part of this Recommendation)

The examples below are based on the flow diagrams and are for illustrative and instructional purpose only. They should not be interpreted as establishing or limiting the protocol. The exchange of the various commands and responses is limited only by the rules specified in this Recommendation (see 5.3 and 5.4).

The notations used in these diagrams are as follows:

- an arrowhead signifies the receiver of the signal;
- a solid line indicates transmission of the signal at the data rate of 300 bit/s;
- the dashed lines indicate transmission at the message data rate (Recommendations V.27 *ter*, V.29, V.33 and V.17);
- a lightning bolt (↯) indicates an invalid frame;
- a bold solid line indicates the transmission of tonal signals.

In Figures V.1 to V.14 the examples given assume the DIS will be repeated for T1 seconds unless responded by a valid signal.

Example 1 An auto calling unit wishing to transmit to an auto answer unit: example of post-message commands.

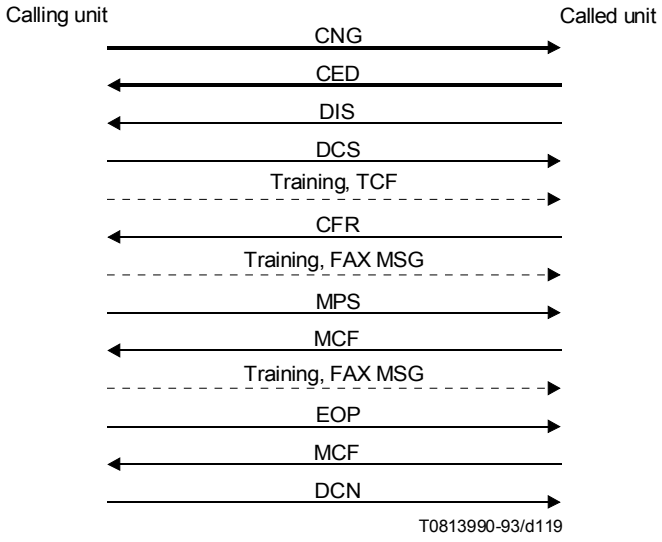


FIGURE V.1/T.30

Example 2 A single page transmitter wishing to transmit to an auto answer unit: example of EOM.

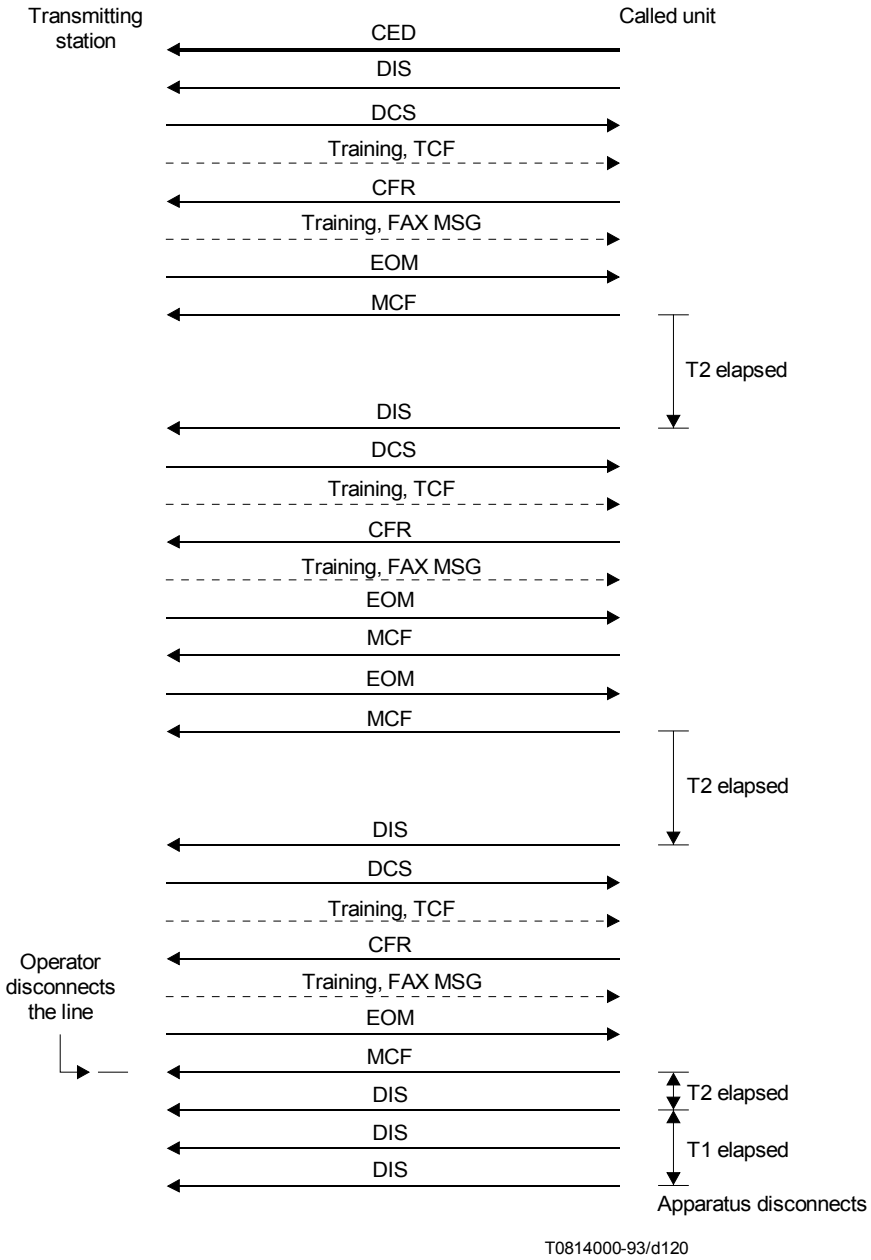


FIGURE V.2/T.30

Example 3 An auto calling unit wishing to transmit to an auto answer unit: example of post-message responses.

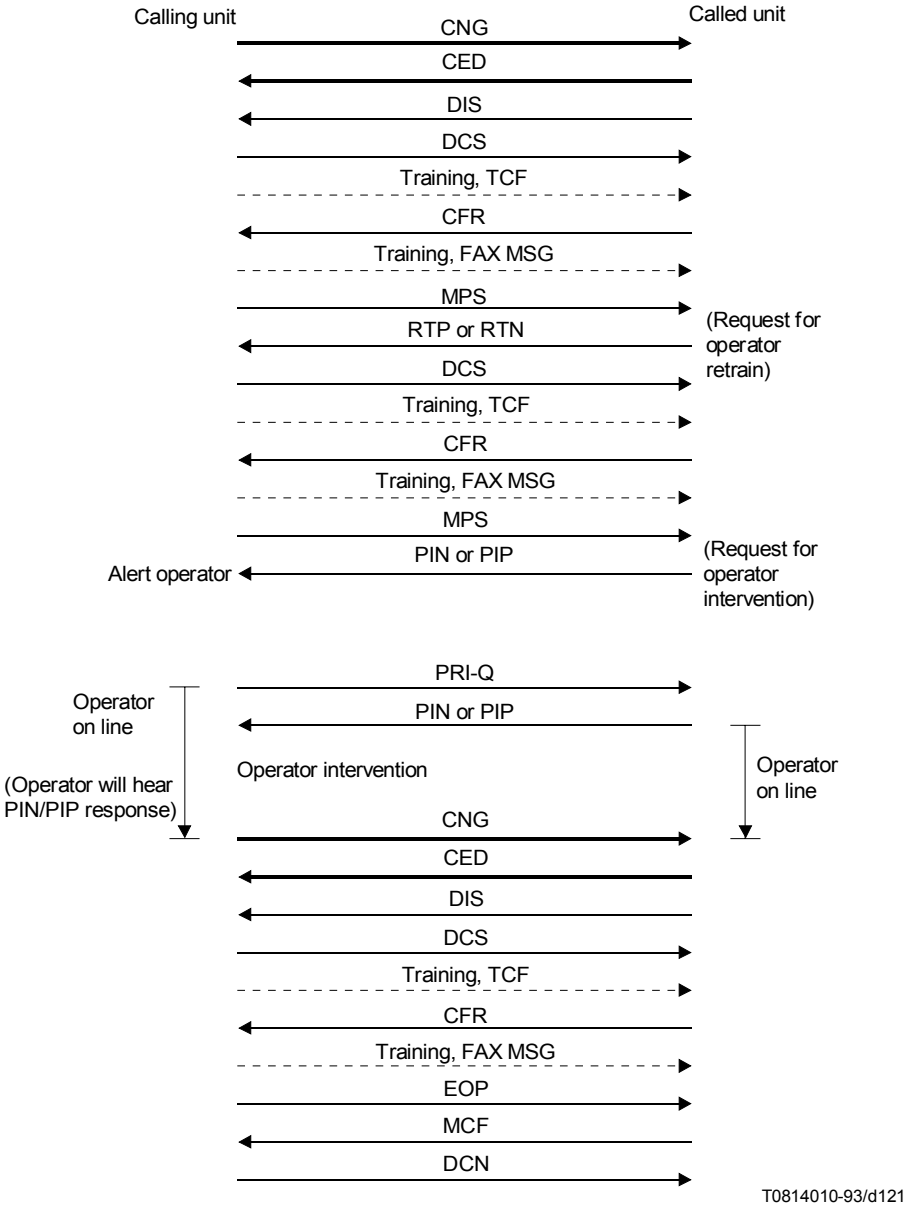


FIGURE V.3/T.30

Example 4 Manual transmitter wishing to transmit to an auto answer unit: example of initial training failure and procedural interrupts.

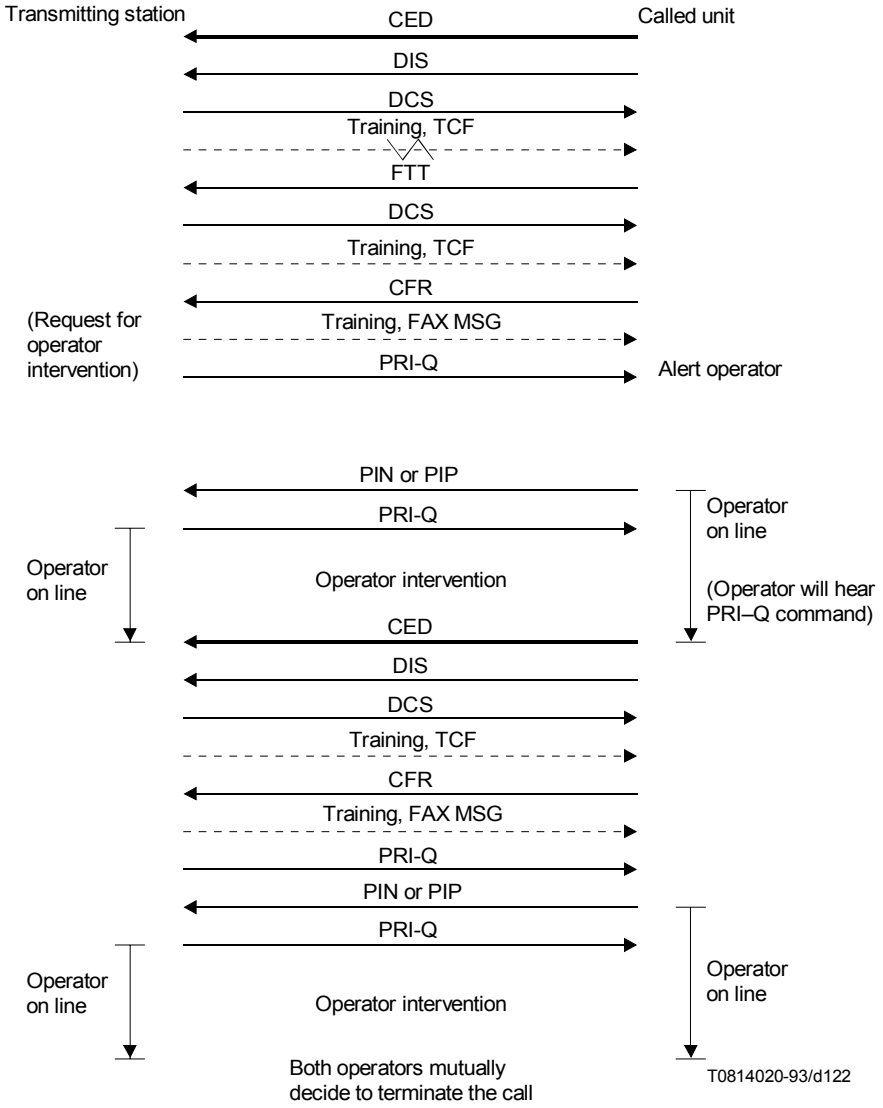


FIGURE V.4/T.30

Example 5 Auto calling unit wishing to first receive from, then transmit to, an auto answer unit.

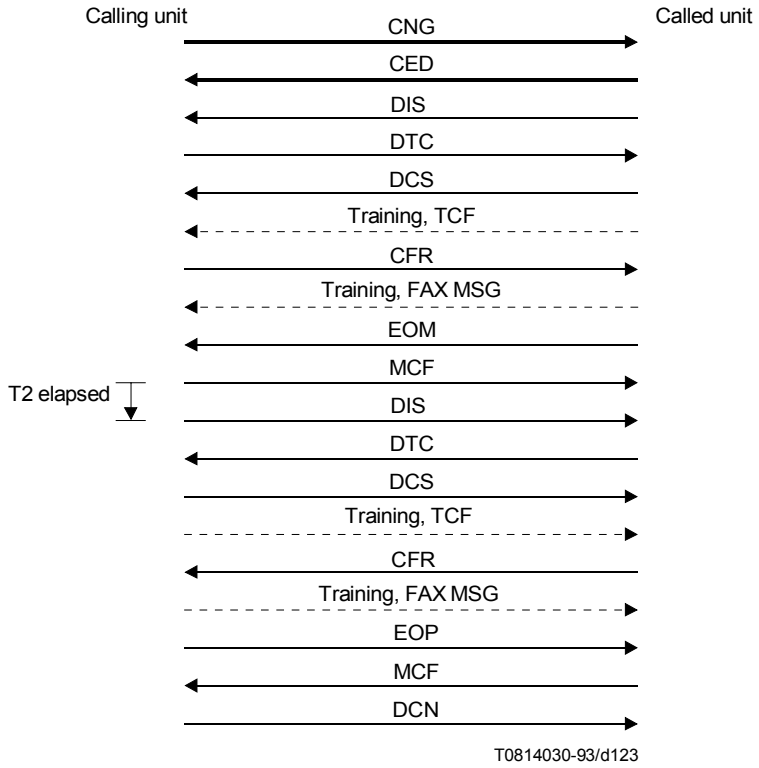


FIGURE V.5/T.30

Example 6 Auto calling unit wishing to receive from an auto answer unit: example of polling and of optional as well as non-standard signals.

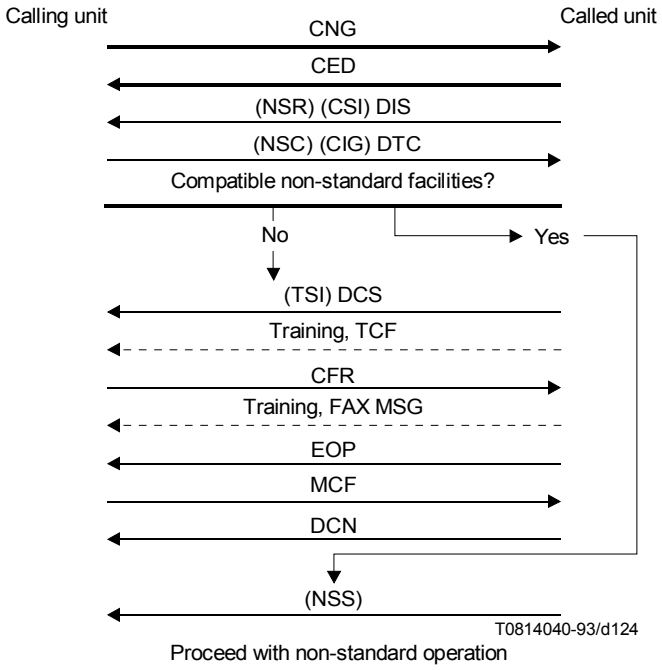


FIGURE V.6/T.30

Example 7 An auto calling unit wishing to transmit to an auto answer unit: example of standard error recovery techniques.

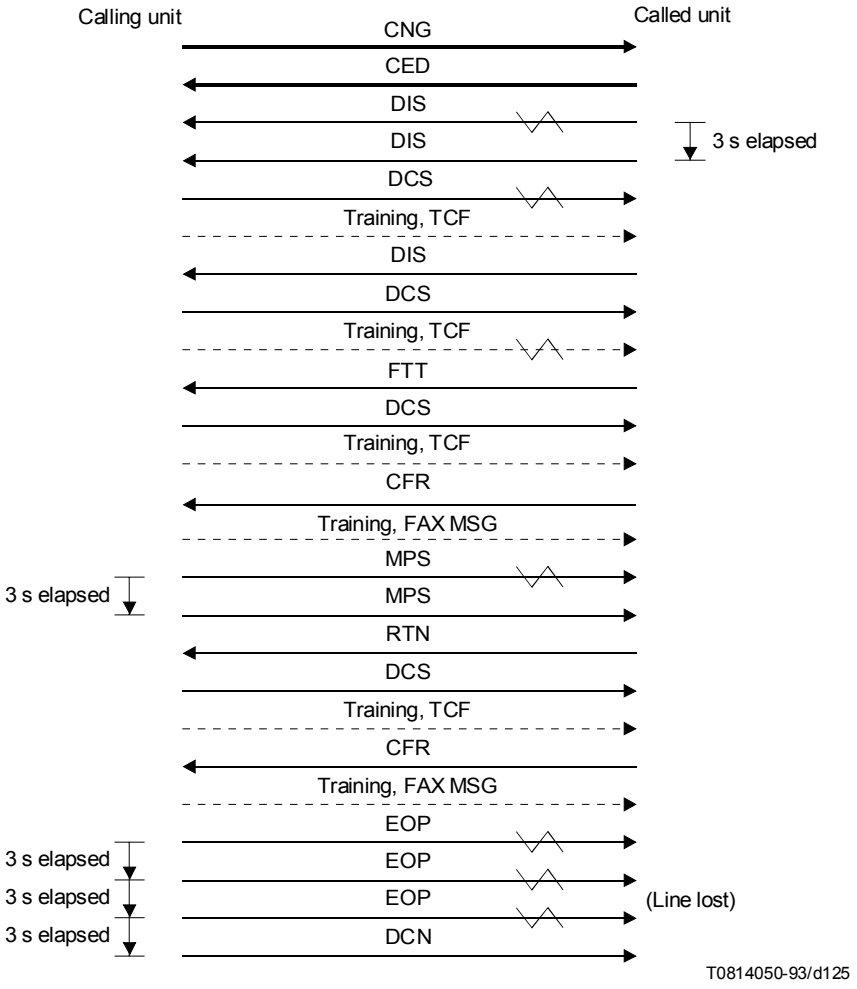


FIGURE V.7/T.30

Example 8 Manual transmitter wishing to transmit to a manual receiver: example of error recovery technique using the optional CRP response.

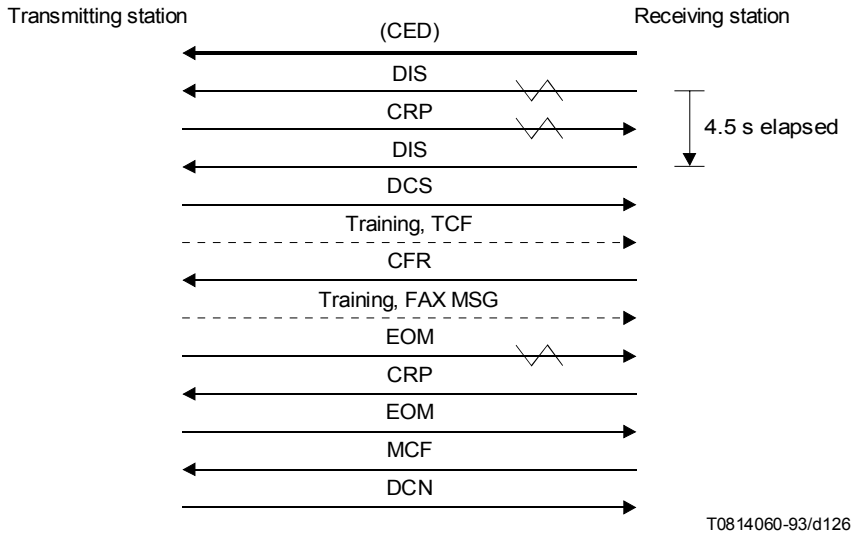


FIGURE V.8/T.30

Example 9 A 2400 bit/s only machine wishing to transmit to a standard machine including the recognized option for binary coded handshaking procedure.

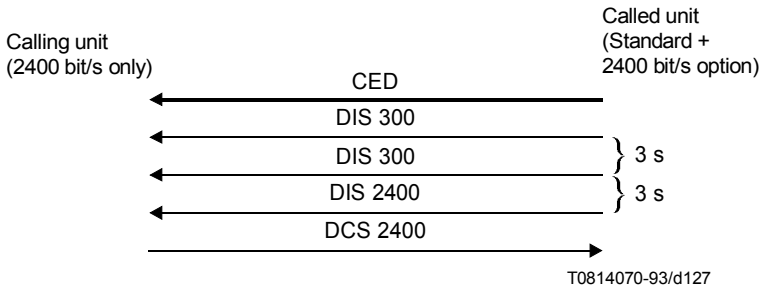


FIGURE V.9/T.30

Example 10 A standard machine including the recognized option for binary coded handshaking procedure wishing to transmit to a 2400 bit/s only machine.

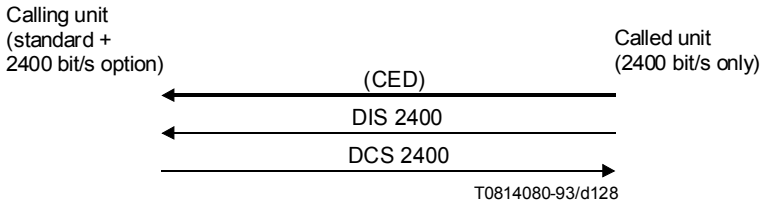


FIGURE V.10/T.30

Example 11 A standard machine including the recognized option for binary coded handshaking procedure wishing to transmit to a standard machine (not including the optional mode).

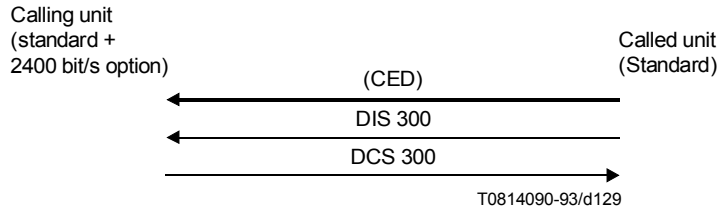


FIGURE V.11/T.30

Example 12 A standard machine (not including the optional mode) wishing to transmit to a standard machine including the recognized option for binary coded handshaking procedure.

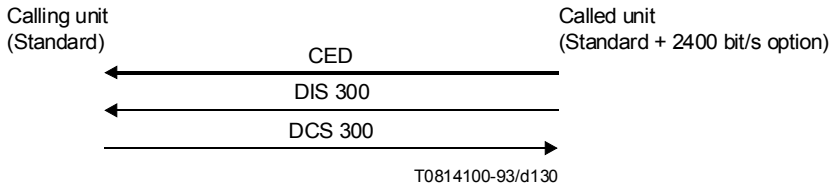


FIGURE V.12/T.30

Example 13 An auto calling unit wishing to receive from an auto answer unit using password/selective polling capabilities.

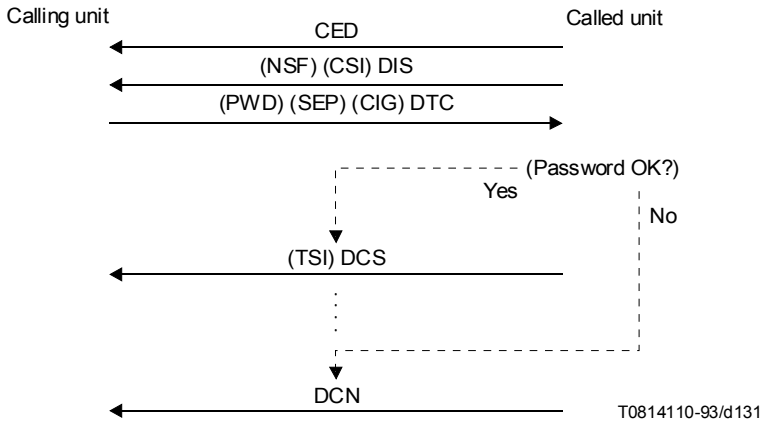


FIGURE V.13/T.30

Example 14 An auto calling unit wishing to transmit to an auto answer unit using password/subaddress capabilities.

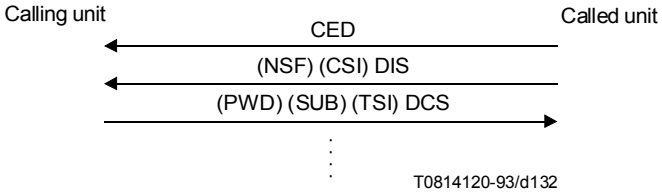


FIGURE V.14/T.30

Appendix VI

Procedure for binary file transmission with protocol examples

(This appendix does not form an integral part of this Recommendation)

VI.1 Introduction

This appendix describes the operation of the binary file transfer (BFT) protocol in the Group 3 facsimile mode of operation. Use of this procol allows Group 3 facsimile apparatus to interchange binary data files. Refer to Recommendation T.434 for information regarding the semantics and syntax of a binary encoded data file.

Facsimile apparatus that wish to support this facility must support optional error correction mode of this Recommendation.

VI.2 Definitions

For the purpose of this Recommendation, the following definitions apply:

attribute: A piece of information stating a property of something, taking one of a set of defined values, each value having a defined meaning.

binary file (data): A sequence of octets, representting a binay file and optional attributes, formed, using the coding rules in Appendix I/T.434.

file attributes: The name and other identifiable properties of a file.

real filestore: An organized collection of files, including their attributes and names, which reside on a real system.

virtual filestore: An abstract model for describing files and filestores, and the possible actions performed on them.

VI.3 BFT file transfer-protocol overview

Group 3 apparatus supporting BFT are capable of sending and receiving facsimile messages and binary data files in the same call establishment. This is accomplished by using error correction mode (ECM) and sending the binary data as the logical equivalent of an error-corrected facsimile message.

The BFT option is invoked through the setting of two additional capability bits located in the DIS and DCS frames. Bits 51 and 53 specify the additional capabilities required by BFT.

Bit 51 is called "capability to emit data file". Setting it to 1 in a DIS farme indicates that the called unit can send and receive data files.

Bit 53 is called "binary file transfer". Setting it to 1 in a DCS farme indicates that the calling unit wishes to send a data file using BFT.

The high-speed binary file data is formed using the coding rules in Recommendation T.434. These rules specify how to code the set of attributes as a sequence of octets. This binary data is then transmitted on the high-speed data channel using ECM.

Transmitting a binary file is logically equivalent to transmitting an error-corrected facsimile message (with one or more pages). In fact, multiple binary files may be contained within the logical equivalent of an error-corrected facsimile message. At any point during the transmission, the transmitter may request a diagnostic message from the receiver by suspending the current transfer with a PPS post-message command. At this point the receiver may optionally respond with a diagnostic message. Transfer of the current binary file(s) will continue on the next page. The first octet fo this new page will be the next unsent octet of the binary file data.

Other protocol considerations for BFT can be found in Annex C/T.4.

VI.4 ECM-BFT data format

The high-speed ECM-BFT binary data is a set of contiguous octets defined in Recommendation T.434. Using Group 3 facsimile apparatus, this set of octets is transmitted as an ECM message. Within an ECM page, these octets are segmented into blocks and the into HDLC frames. This segmentation is completely independent of attribute boundaries. A sequence of octets is transmitted beginning with the least significant bit in the first octet.

The ECM-BFT binary data format allows the following combinations of binary data and ECM pages. Case a) and d) where each binary file corresponds to a single ECM page are the preferred formats.

a) A single binary file in a single ECM page.

b) A single binary file in a multiple of ECM pages.

c) Multiple binary files in a single ECM page.

d) Multiple binary files in a multiple of ECM pages.

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