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Procedures for document facsimile transmission in the general switched telephone network

ITU-T Recommendation T.30

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Procedures for document facsimile transmission in the general switched telephone network

Summary

This Recommendation defines the procedures used by Group 3 facsimile terminals as defined in ITU-T Rec. T.4. These procedures enable documents to be transmitted on the general switched telephone network, international leased circuits and the Integrated Services Digital Network (ISDN). Further, these procedures allow communication to be manual or automatic and for document transmission to be requested alternatively with telephone conversation.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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NOTE

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

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Introduction

i)   This Recommendation is intended to apply to document facsimile terminals covered by ITU-T Rec. T.4. It describes the procedures and signals to be used where facsimile terminals are operated over the general switched telephone network. When an existing terminal is operating in a non-ITU-T manner, it shall not interfere with a terminal 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)   For digital document facsimile terminals conforming to ITU-T Rec. T.4, the binary coded system defined in this Recommendation shall be the standard signalling arrangement.

v)   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.

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

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Procedures for document facsimile transmission in the general switched telephone network[1]

The ITU-T,

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 terminals 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 terminal 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 terminals 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 terminals as well as of automatic terminals.

The automatic facsimile terminal is understood to be a terminal 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 terminal must be regarded as a manually operated terminal.

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

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[1] Facsimile terminals referred to as Group 3 in this Recommendation are those conforming to ITU-T Rec. T.4.

Table 1/T.30

Method No.	Description of operating method	Direction of facsimile transmission	Overall designation
1	*Manual* operation at calling terminal and	Calling terminal *transmits to* called terminal	1-T
	Manual operation at called terminal	Calling terminal *receives from* called terminal	1-R
2	*Manual* operation at calling terminal and	Calling terminal *transmits to* called terminal	2-T
	Automatic operation at called terminal	Calling terminal *receives from* called terminal	2-R
3	*Automatic* operation at calling terminal and	Calling terminal *transmits to* called terminal	3-T
	Manual operation at called terminal	Calling terminal *receives from* called terminal	3-R
4	*Automatic* operation at calling terminal and	Calling terminal *transmits to* called terminal	4-T
	Automatic operation at called terminal	Calling terminal *receives from* called terminal	4-R
4 *bis*	*Automatic* operation using the procedures defined in ITU-T Rec. V.8 at calling terminal and	Calling terminal *transmits to* called terminal using the procedures defined in ITU-T Rec. V.8	4-T
	Automatic operation using the procedures defined in ITU-T Rec. V.8 at called terminal	Calling terminal *receives from* called terminal using the procedures defined in ITU-T Rec. V.8	4-R

NOTE – There may also be operating methods which will allow messages to be received by more than one terminal (multipoint connection).

1.3 Terminal identification

1.3.1 For the purpose of classifying an automatic facsimile terminal as a non-speech terminal, a tone must be transmitted to line. As both automatic calling and called facsimile terminals 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 terminal 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 destination is an automatic facsimile terminal 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 terminal may have the possibility of calling the other terminal at any time during the progress of the facsimile procedure (see 2.2).

1.5.2 The procedures in this Recommendation allow a facsimile terminal 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 terminal identification command if required to prevent unauthorized terminals from demanding a message.

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

1.6   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

–   ITU-T Recommendation G.726 (1990), *40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)*.

–   ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

–   ITU-T Recommendation T.6 (1988), *Facsimile coding schemes and coding control functions for Group 4 facsimile apparatus*.

–   ITU-T Recommendation T.36 (1997), *Security capabilities for use with Group 3 facsimile terminals*.

–   ITU-T Recommendation T.43 (1997), *Colour and gray-scale image representations using lossless coding scheme for facsimile*.

–   ITU-T Recommendation T.44 (1999), *Mixed Raster Content (MRC)*.

–   ITU-T Recommendation T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines*.

–   ITU-T Recommendation T.82 (1993) | ISO/IEC 11544:1993, *Information technology – Coded representation of picture and audio information – Progressive bi-level image compression*.

–   ITU-T Recommendation T.85 (1995), *Application profile for Recommendation T.82 – Progressive bi-level image compression (JBIG coding scheme) for facsimile apparatus*.

–   ITU-T Recommendation T.434 (1996), *Binary file transfer format for the telematic services*.

–   ITU-T Recommendation V.8 (2000), *Procedures for starting sessions of data transmission over the public switched telephone network*.

- ITU-T Recommendation V.17 (1991), *A 2-wire modem for facsimile applications with rates up to 14 400 bit/s*.

- ITU-T Recommendation V.27 *ter* (1988), *4800/2400 bits per second modem standardized for use in the general switched telephone network*.

- ITU-T Recommendation V.29 (1988), *9600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits*.

- ITU-T Recommendation V.33 (1988), *14 400 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits*.

- ITU-T Recommendation V.34 (1998), *A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits*.

The referenced RFC documents contain provisions that are themselves described in yet other documents and which through indirect reference constitute provisions of this Recommendation. A list of the status of Internet RFCs and updates to other RFCs is regularly published.

- IETF RFC 822, *Standard for the format of ARPA Internet text messages*.
- IETF RFC 1738, *Uniform Resource Locators (URL)*.

2 Terms and definitions

This Recommendation defines the following terms:

2.1 facsimile terminal main functions: One or more terminals 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.
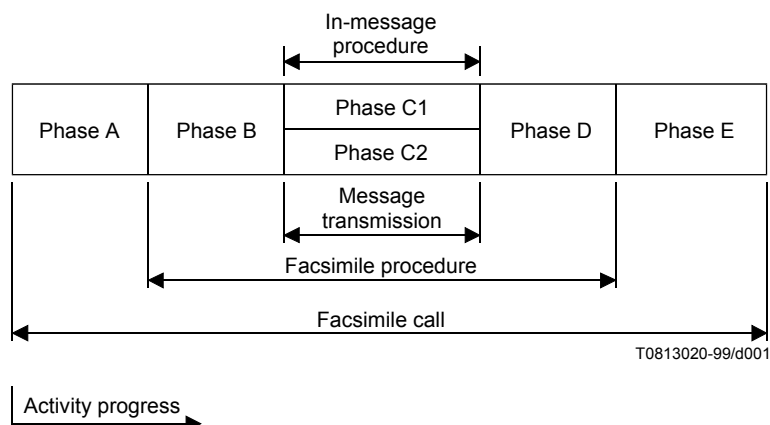
Figure 1/T.30

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 a terminal operating in accordance with this Recommendation and a terminal operating in a non-ITU-T manner, the terminals should disconnect before the in-message procedure unless both terminals include optional, compatible procedures.

2.3.2.1 Identification section

– capabilities identification;

– confirmation for reception;

– terminal identification (option);

– non-standard facilities identification (option).

2.3.2.2 Command section

– capabilities command;

– training;

– synchronization;

as well as the following optional commands:

– non-standard facilities command;

– terminal identification command;

– polling (send) command;

– 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

The message transmission procedure is covered by ITU-T Rec. T.4.

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.

For automatic operation at the calling side, the timer T0 is used for the terminals which conform to the 1997 and later versions of this Recommendation. Timer T0 is detailed in 5.4.3.1.

3.1.1 Operating method 1

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

3.1.2 Operating method 2

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

3.1.3 Operating method 3

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

3.1.4 Operating method 4

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

3.1.5 Operating method 4 *bis*

3.1.5.1 Operating method 4 *bis* a

Automatic operation at both the calling and called terminals when either or both the calling and called terminal are capable of V.8 and V.34 operation. Figure 6a indicates the actions required by the terminal to establish a call.

3.1.5.2 Operating method 4 *bis* b

Manual operation at the calling and automatic operation at the called terminal when either or both the calling and called terminals are capable of V.8 and V.34 operation. Figure 6b indicates the actions required by the terminal 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 receiving terminals and all auto-answering terminals must enter phase B by identifying their capabilities (i.e., Node R of the flow diagram in 5.2). All manual transmitting terminals and all auto-calling terminals 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 s ± 15% when sent from a manual receiving terminal.

The detailed information pertaining to the binary coded facsimile procedures is contained in clause 5.

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[2] See Appendix I for abbreviations used in this Recommendation.

3.2.1 Signal sequences

The recommended system utilizes the interchange of signals between the two terminals to verify compatibility and assure operation. To do this, the called terminal identifies its capabilities. The calling terminal responds to this accordingly with a command. 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 terminal is transmitting.

The condition where the calling terminal is to receive documents is shown in Figure 8.

3.3 Phase E – Call release

Call release occurs after the last post-message signal of the procedure or under certain conditions, for example:

3.3.1 Time-out

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

3.3.3 Command

The call may be immediately terminated by the appropriate commands, as specified in clause 5.

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

Figure 2/T.30 – Call establishment, operating method 1

Call event No.	Calling terminal	Called terminal
1	Operator hears dial tone and dials desired number	
2	Operator hears ringing tone	Terminal detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4	Operator hears CED or an optional recorded announcement and facsimile terminal is switched to line and transmits CNG	Transmit CED
5	Begin facsimile procedure (see clauses 4 and/or 5)	Begin facsimile procedure (see clauses 4 and/or 5)
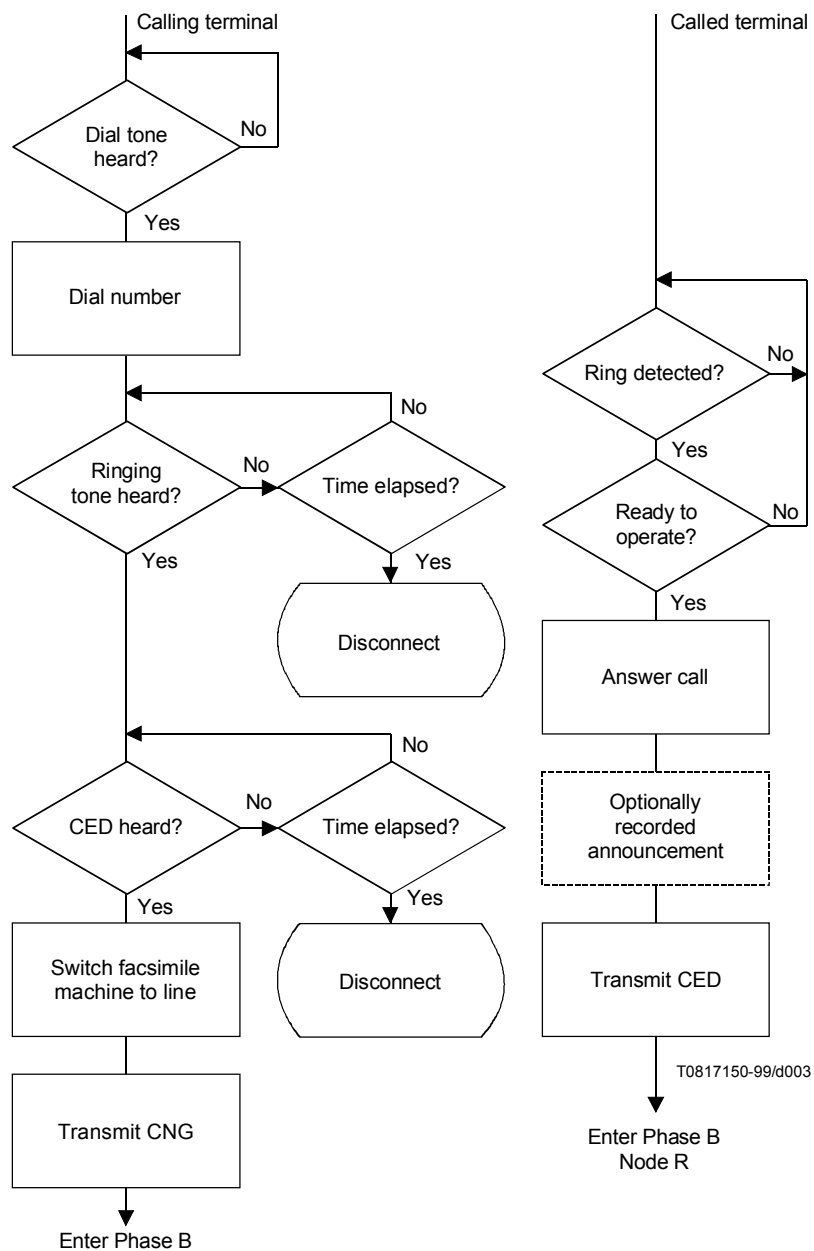
Figure 3/T.30 – Call establishment, operating method 2

Call event No.	Calling terminal	Called terminal
1	Terminal detects dial tone and dials desired number (Note). To clearly indicate to a called operator that he is connected to a facsimile terminal 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 terminal to line (optionally CED may be generated)
4	Begin facsimile procedure (see clauses 4 and/or 5)	Begin facsimile procedure (see clauses 4 and/or 5)
NOTE – An alternative procedure may be specified by Administrations.		

Figure 4/T.30 – Call establishment, operating method 3

Call event No.	Calling terminal	Called terminal
1	Terminal detects dial tone and dials desired number (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		Terminal detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4		Transmit CED
5	Begin facsimile procedure (see clauses 4 and/or 5)	Begin facsimile procedure (see clauses 4 and/or 5)
NOTE – An alternative procedure may be specified by Administrations.		

Figure 5/T.30 – Call establishment, operating method 4

Call event No.	Calling terminal	Called terminal
1	Terminal detects dial tone and dials desired number. To clearly indicate to a normal telephone user that he is inadvertently connected, CNG will be transmitted during the time that signals are attempted to be detected	
2		Terminal detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4		Transmit ANSam
5	Transmit CM	
6	Begin T.30 Annex F if half-duplex or Annex C if duplex procedures	Begin T.30 Annex F if half-duplex or Annex C if duplex procedures

Figure 6a/T.30 – Call establishment, operating method 4 *bis* a

Call event No.	Calling terminal	Called terminal
1	Operator detects dial tone and dials desired number	
2		Terminal detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4		Transmit ANSam
5	Operator switches the terminal to line CNG will be transmitted during the time that signals are attempted to be detected	
6		Transmit DIS
7	Terminal detects V.8 capability and transmits CI	
8	Begin T.30 Annex F if half-duplex or Annex C if duplex procedures	Begin T.30 Annex F if half-duplex or Annex C if duplex procedures
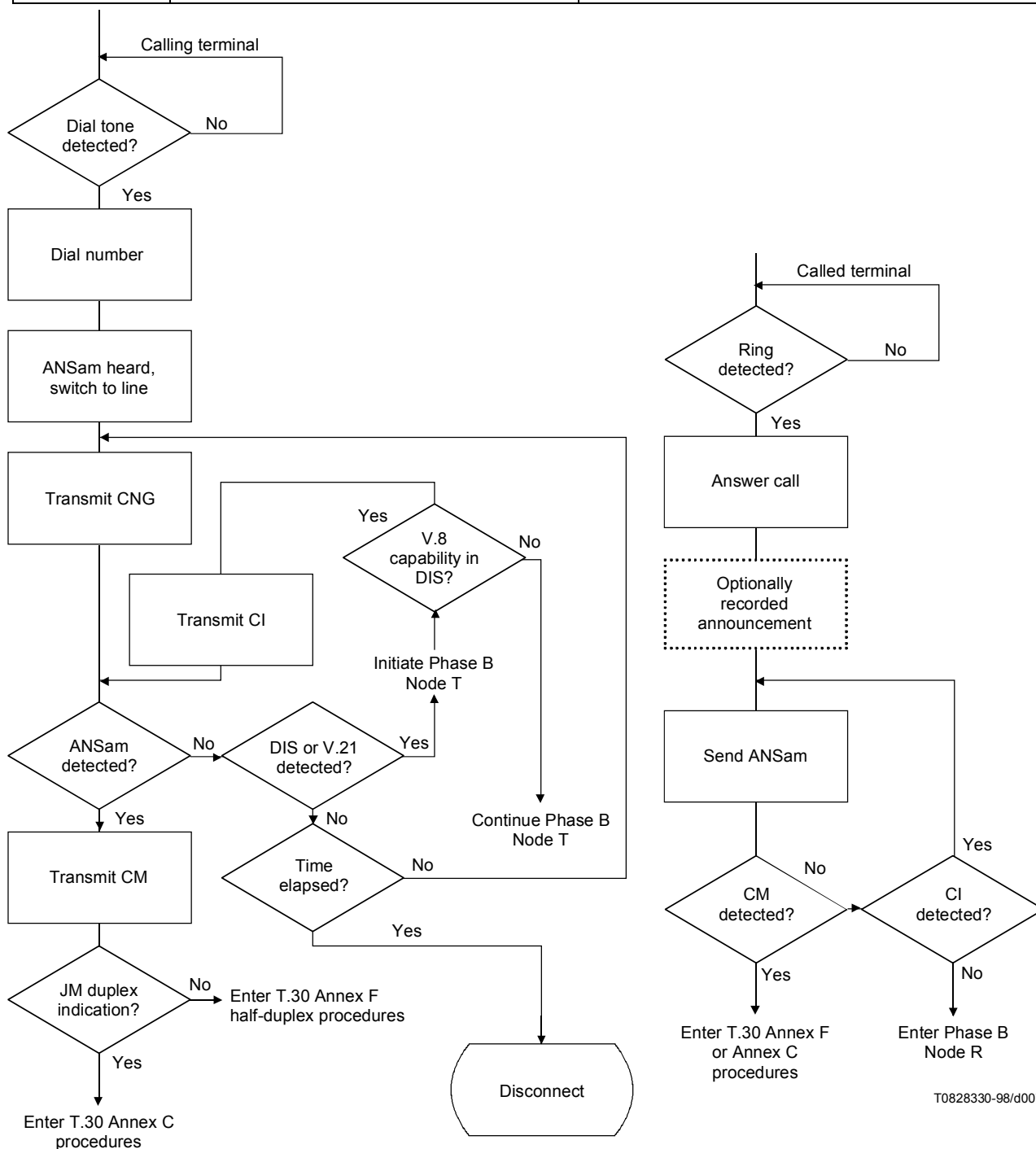
T0828330-98/d007

Figure 6b/T.30 – Call establishment, operating method 4 *bis* b
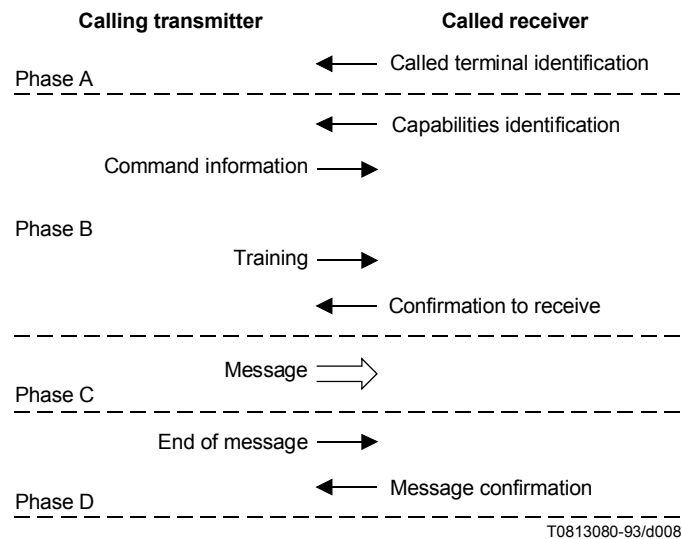
Figure 7/T.30 – Calling terminal is transmitting
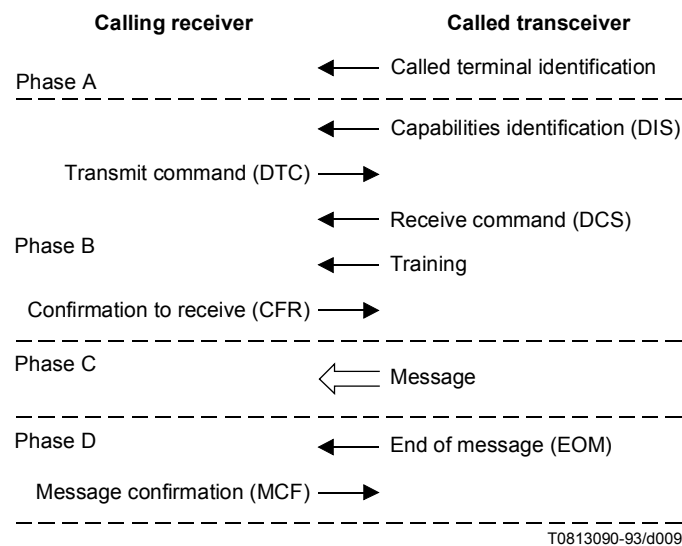
Figure 8/T.30 – Calling terminal is receiving

4 Tonal signal functions and formats

4.1 Automatic answer sequence

Group 3 facsimile terminals may automatically answer calls in accordance with either 4.1.1 or 4.1.2.

4.1.1 For a period of at least 0.2 s after it is connected to line, it shall transmit no signal. After this period, it shall transmit the Called terminal identification (CED) answer tone, a continuous 2100 Hz ± 15 Hz tone for a duration of not less than 2.6 s and not more than 4.0 s and then follow the procedures defined in clause 5. The terminal delays for a period of 75 ± 20 ms after transmitting the CED tone before transmitting further signals.

4.1.2 If the terminal incorporates the optional procedures defined in ITU-T Rec. V.8, it transmits the answer tone ANSam defined in ITU-T Rec. V.8 and then follows the procedures defined in clause 6.

NOTE – Some terminals which conform to the pre-1996 versions of this Recommendation may transmit a different automatic answer sequence to that described above. This alternative sequence is shown in Figure III.1.

4.2   Calling tone (CNG)

Format

See Figure 9.

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

NOTE – Tolerances: timing, ± 15%: frequency, 1100 Hz ± 38 Hz.
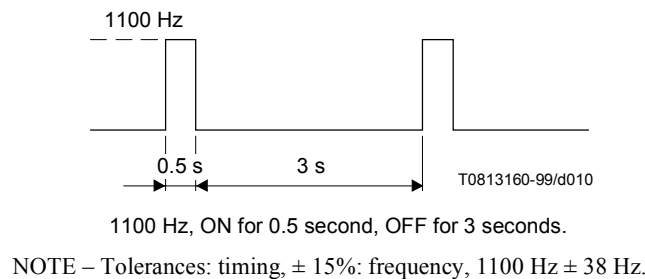
Figure 9/T.30

Function

1)   To indicate a calling non-speech terminal. This signal is mandatory for automatic calling terminals and for manual terminals. However, manual calling terminals conforming to the 1993 and previous versions of this Recommendation may not transmit this signal.

2)   To indicate that the terminal is in the transmit mode and is ready to transmit on receipt of the Digital Identification Signal (DIS).

3)   Where a terminal 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 Digital Identification Signal (DIS). It would indicate to an operator that the transmitter was still connected to line.

5   Binary coded signalling procedure

300 bits per second is the standard data signalling rate for the transmission of binary coded procedural data.

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 V.21 channel No. 2 modulation system. For the tolerances, see clause 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%.

An error correction capability is utilized as a recognized option. This procedure is defined in Annex A.

A capability to operate over public digital networks or on the GSTN using duplex modulation systems is provided as a standardized option. This procedure is defined in Annex C.

NOTE 1 – The transmission of training, TCF, and all in-message signals, shall be at the data rate of the high-speed message channel.

NOTE 2 – It is acknowledged that existing terminals 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.

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

NOTE 4 – The transmission of signalling utilizing the modulation systems of ITU-T Recs V.27 *ter*, V.29, or V.17 should be followed by a delay of 75 ± 20 ms before the signalling, utilizing a different modulation system, commences (e.g., the delay between RTC and MPS).

NOTE 5 – Terminals using the modulation system defined in ITU-T Rec. V.17 (as specified by bits 11, 12, 13 and 14 of Table 2/V.17) 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.

5.1 Description

Phases B, C and D

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

Calling terminal	Called terminal
	1. Transmit DIS
2. DIS detected	
3. Transmit DCS	
	4. DCS detected
	5. Select mode
6. Transmit training	
	7. 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 one 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 terminal wishes to receive (see Figure 8).

Calling terminal	Called terminal
	1. Transmit DIS
2. DIS detected	
3. Transmit DTC	
	4. DTC detected
	5. Transmit DCS
6. DCS detected	
7. Select mode	
	8. Transmit training
9. Training	
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 one of the confirmation signals of post-message responses (see 5.3.6.1.7)	

5.2   Flow diagrams – Figures 5-2a to 5-2x (see also Appendix IV)

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

Transmitting terminal

Figure 5-2a/T.30

T0824710-95/d011

Receiving terminal

R

Transmit
(NSF)(CSI)DIS
(NSC)(CIG)DTC

RESPONSE REC? — Yes / No

Maximum tries? (Note 7) — No / Yes

T1 elapsed? — No / Yes

Go to non-specified procedures (Note 1)

C

F

COMMAND REC? — No / Yes

T2 elapsed? — Yes / No

EOM? — No / Yes

Error correction? (Note 2) — Yes / No

Maximum tries? (Note 7) — No / Yes

F

MSG CARRIER REC? — Yes / No

R

LOCAL INT? — Yes / No

F

DTC? — Yes / No

D

A

DIS? — Yes / No

F

B

DCS? — Yes / No

Receive training TCF

Receive training

Error correction? (Note 2) — Yes / No

VII

III

TCF OK? — Yes / No

Receive facsimile message

EOM/RTC? — No / Yes

MSG CARRIER REC? — Yes / No

Respond CFR

Respond FTT

F

1

F

T0829310-99/d012

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

Figure 5-2b/T.30

Figure 5-2c/T.30

Timers
T1 = 35 ± 5 s
T2 = 6 ± 1 s
T3 = 10 ± 5 s

T0813190-93/d013

Figure 5-2d/T.30

Transmitting terminal

Figure 5-2e/T.30

Transmitting terminal

Va

Transmit PPS-NULL

RESPONSE REC?

3rd TRY?

PPR?

4th PPR?

CONTINUE TO CORRECT?

RNR?

RR RESPONSE REC?

MCF?

CTC RESPONSE REC?

Transmit training

Transmit error frames

Transmit RCP

C

IV

C

VI

C

T0813370-93/d016

Figure 5-2f/T.30

Transmitting terminal

T0813380-93/d017

Figure 5-2g/T.30

Transmitting terminal

Figure 5-2h/T.30

T0813390-93/d018

Transmitting terminal

Figure 5-2i/T.30

T0813400-93/d019

Transmitting terminal

Figure 5-2j/T.30

Figure 5-2k/T.30
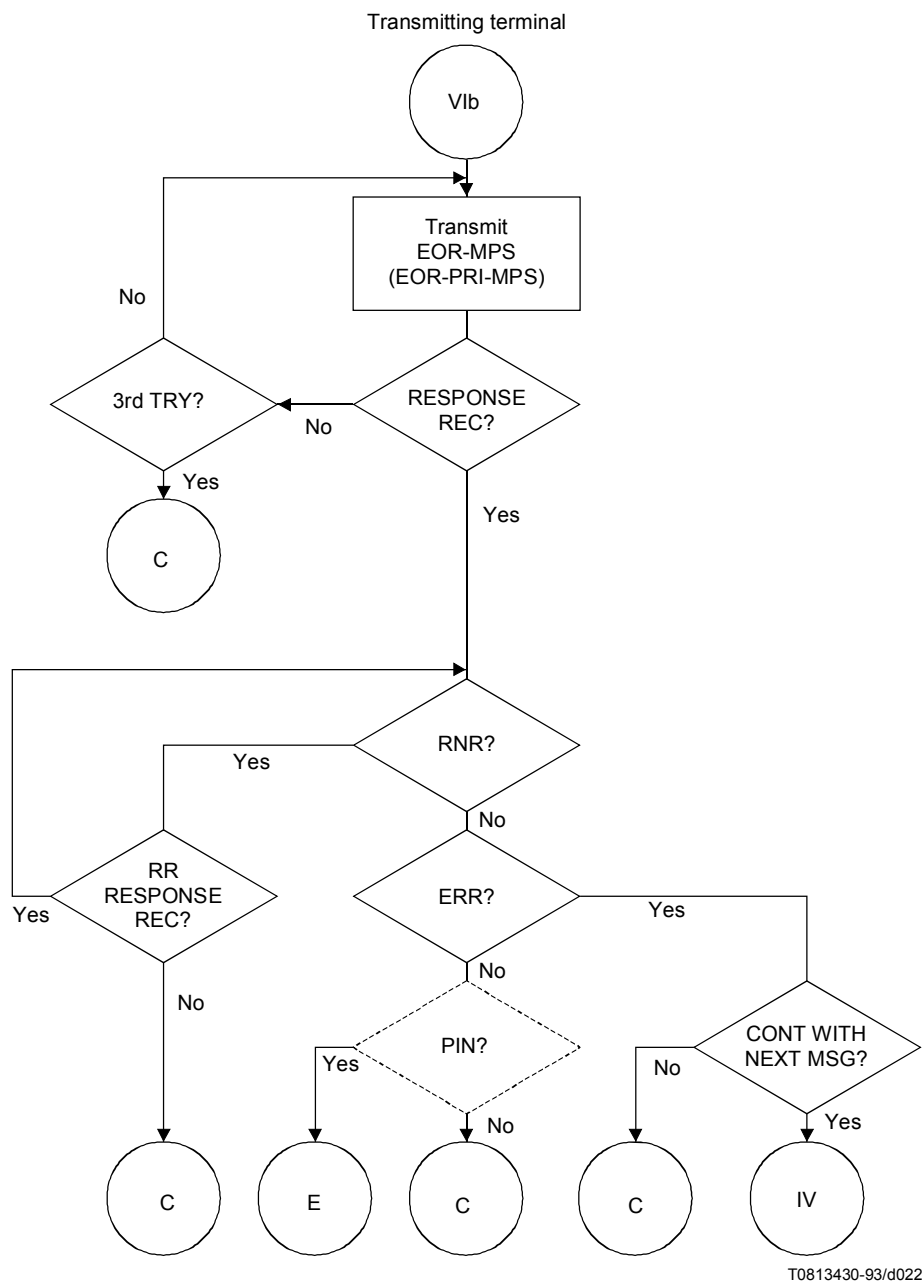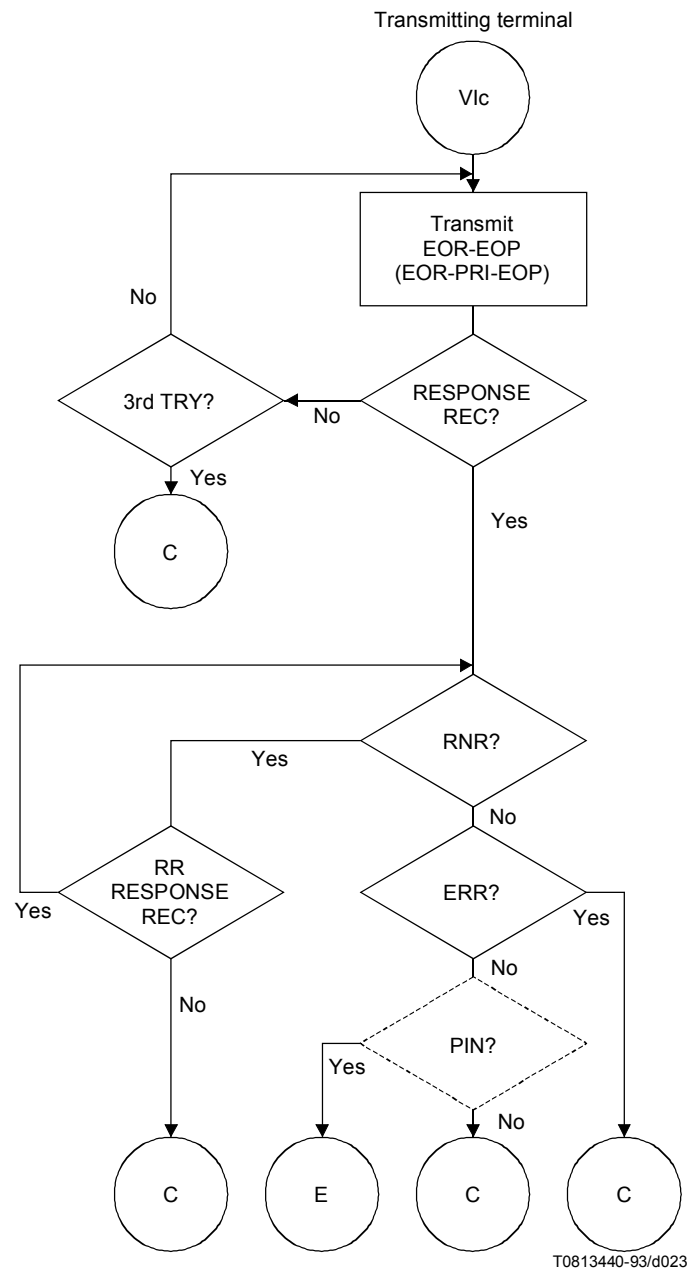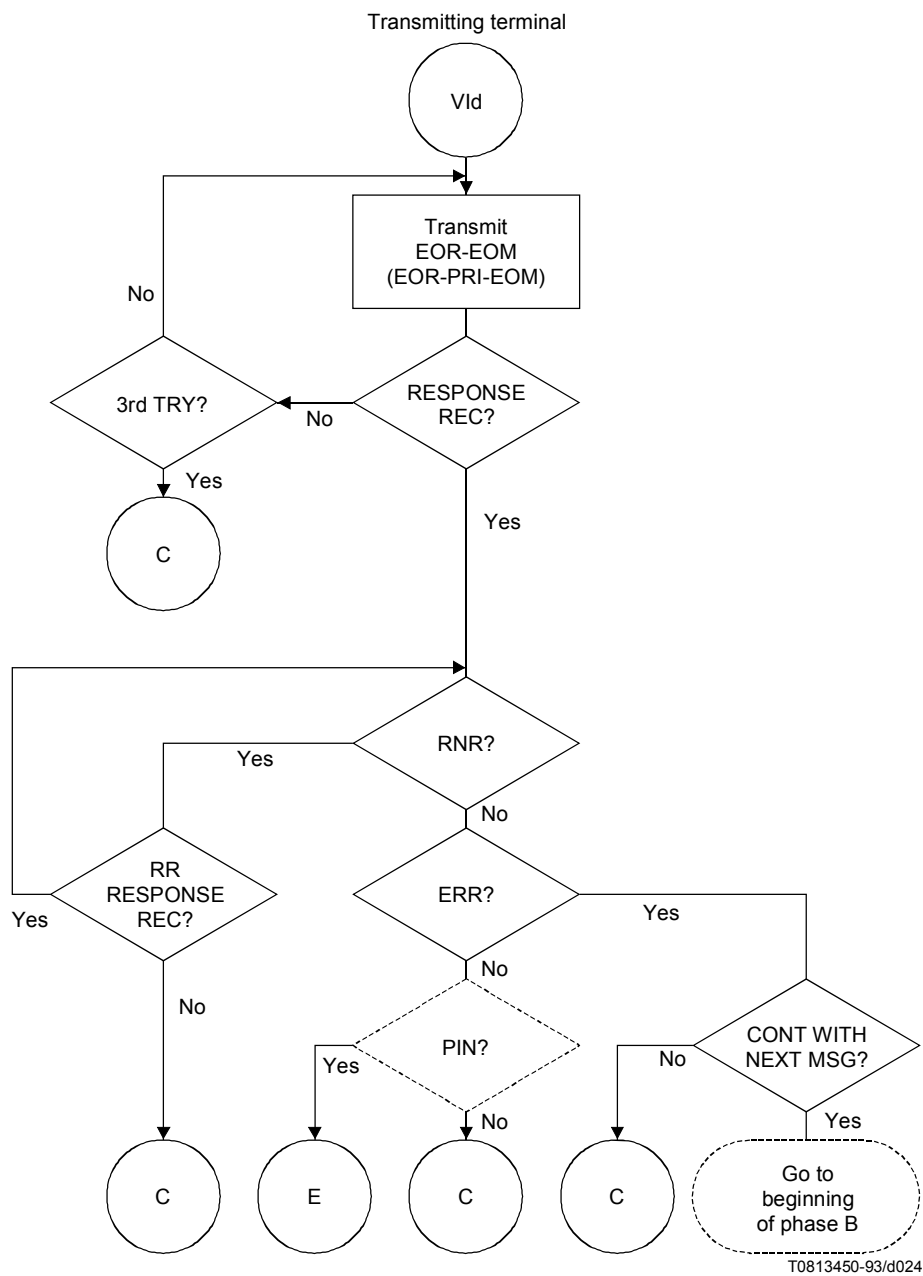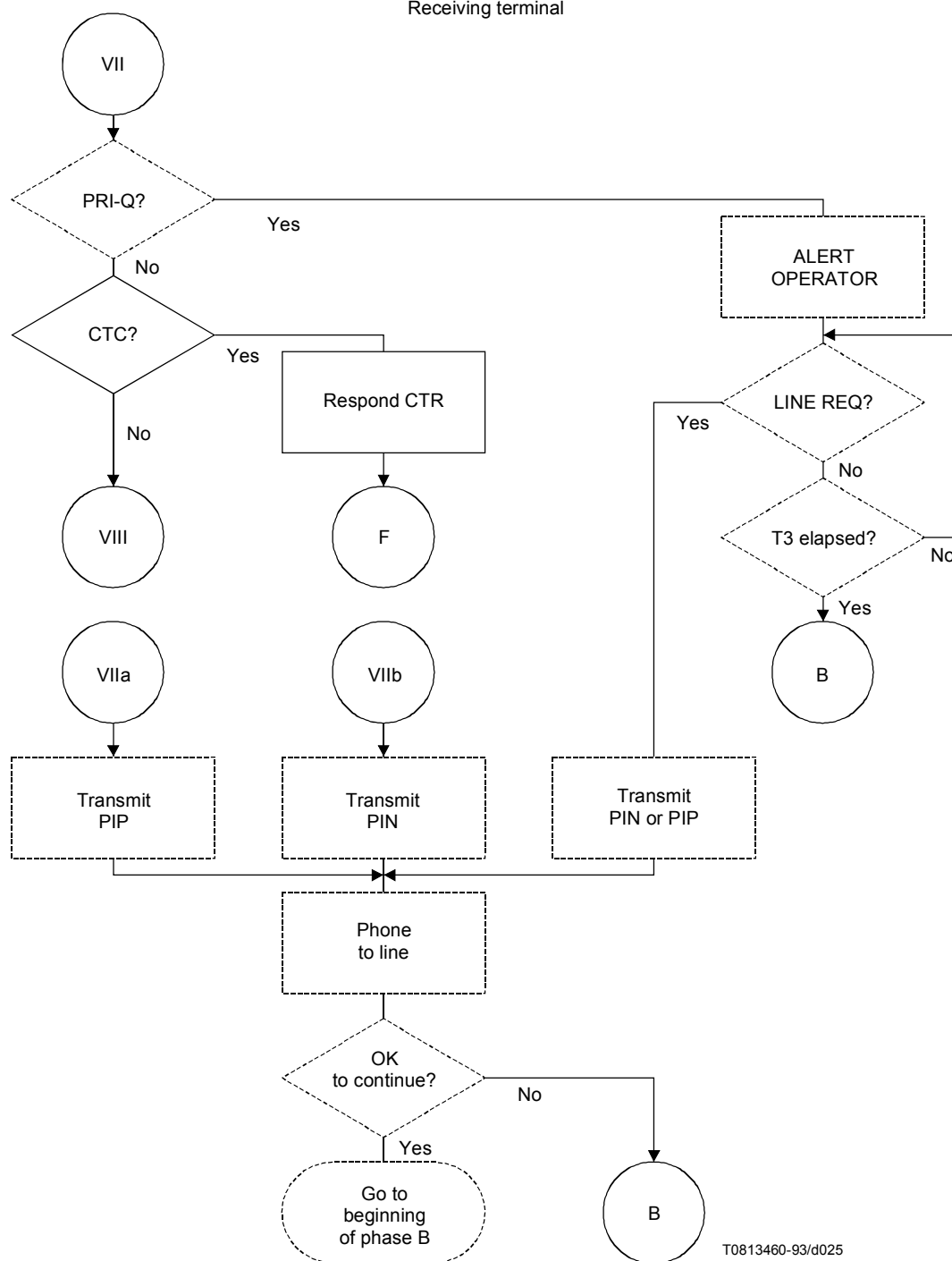
Transmitting terminal


```
                            ┌────────┐
                            │  VIb   │
                            └───┬────┘
                                │
        ┌───────────────────────┼
        │                 ┌──────────────┐
        │                 │  Transmit    │
        │                 │  EOR-MPS     │
        │                 │ (EOR-PRI-MPS)│
        │                 └──────┬───────┘
   No   │                        │
     ◇ 3rd TRY?  ◁── No ──  ◇ RESPONSE REC?
        │                        │
       Yes                      Yes
        │
      ( C )
```

RNR?

Yes

No

RR RESPONSE REC?

Yes

No

ERR?

Yes

No

PIN?

Yes   No

CONT WITH NEXT MSG?

No   Yes

(C)   (E)   (C)   (C)   (IV)

T0813430-93/d022

Figure 5-2l/T.30

Transmitting terminal

Figure 5-2m/T.30

T0813440-93/d023

Figure 5-2n/T.30

Receiving terminal

Figure 5-2o/T.30

T0813460-93/d025

Receiving terminal

Figure 5-2p/T.30

T0813470-93/d026

Receiving terminal

Figure 5-2q/T.30

T0813480-93/d027

Receiving terminal
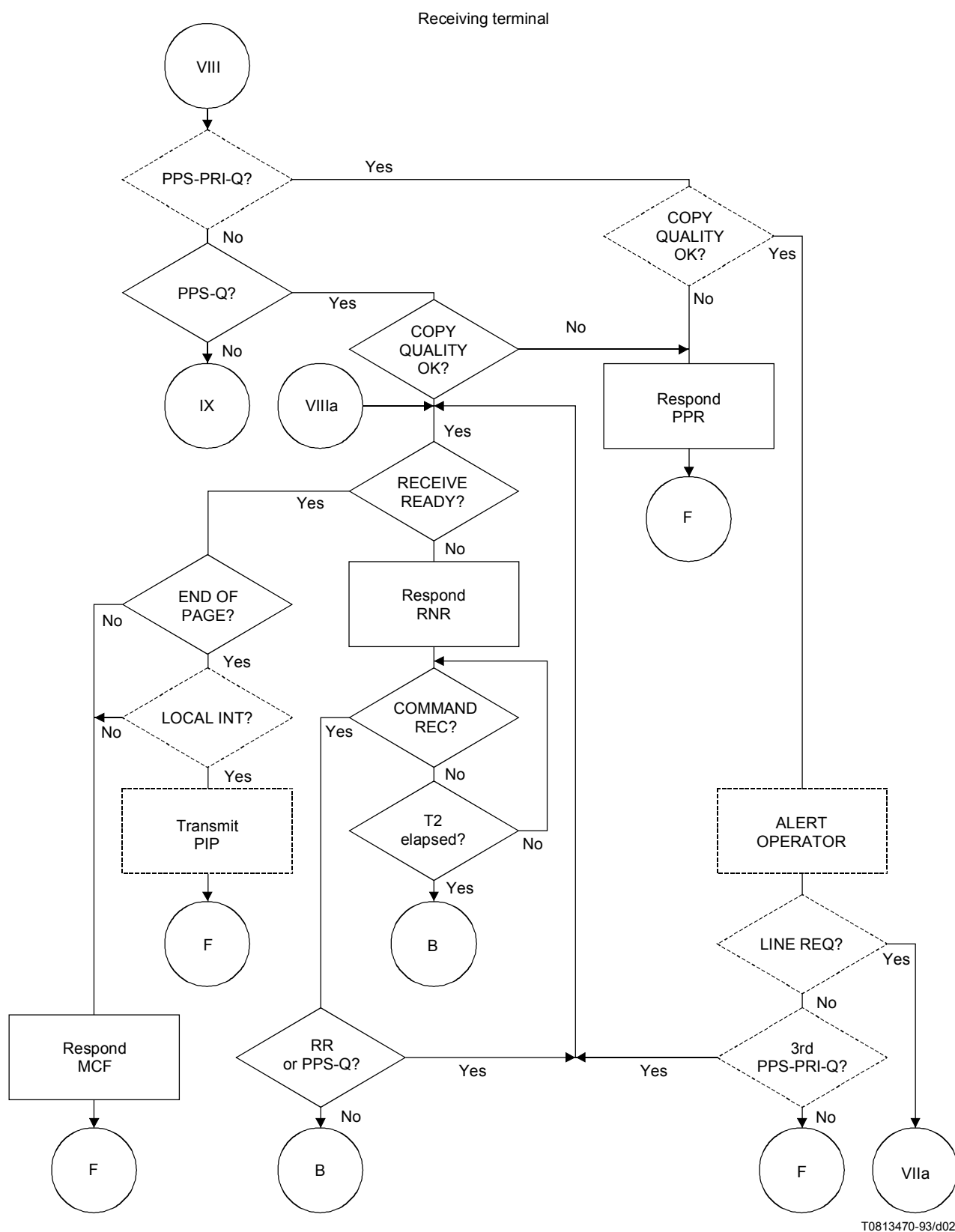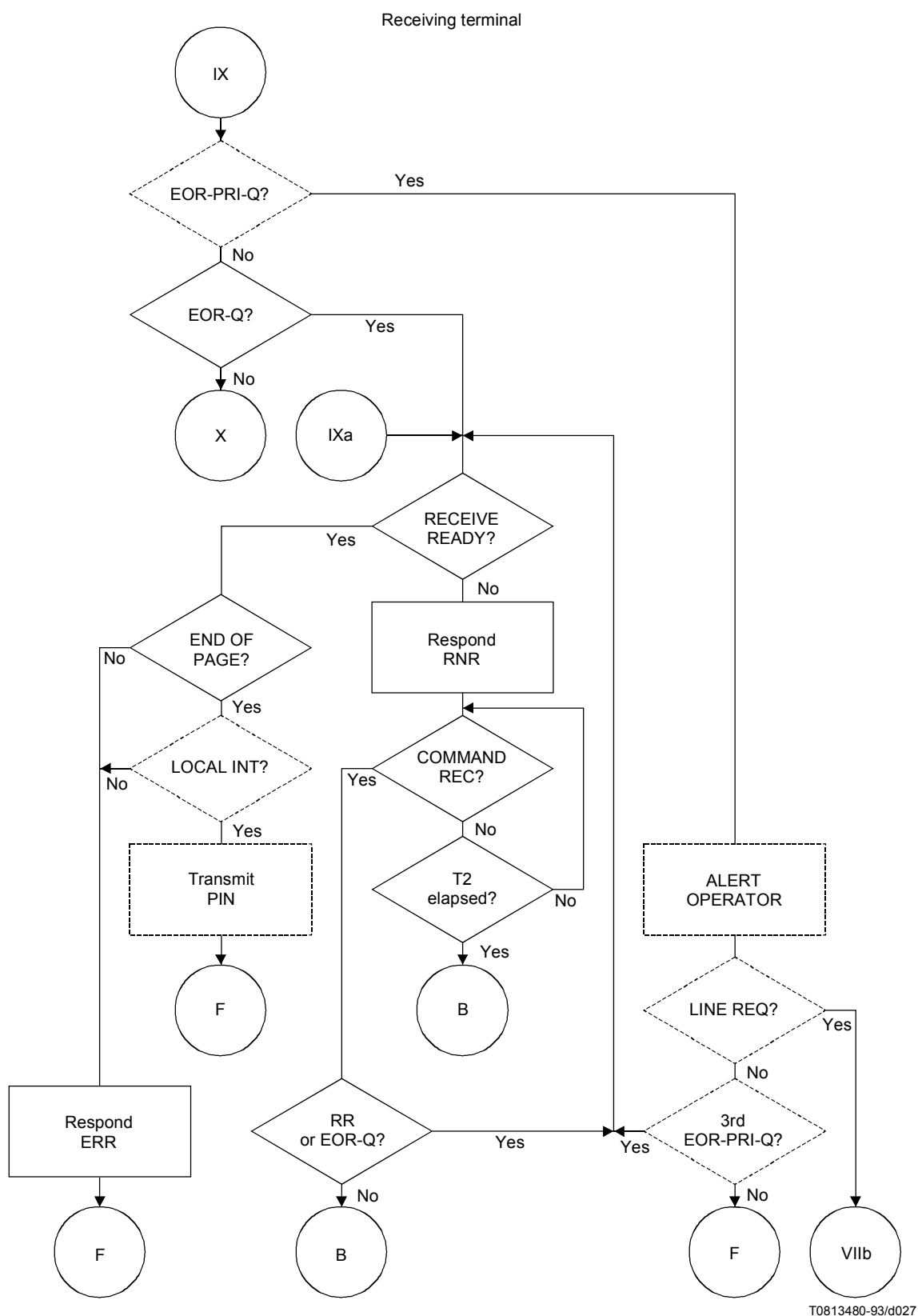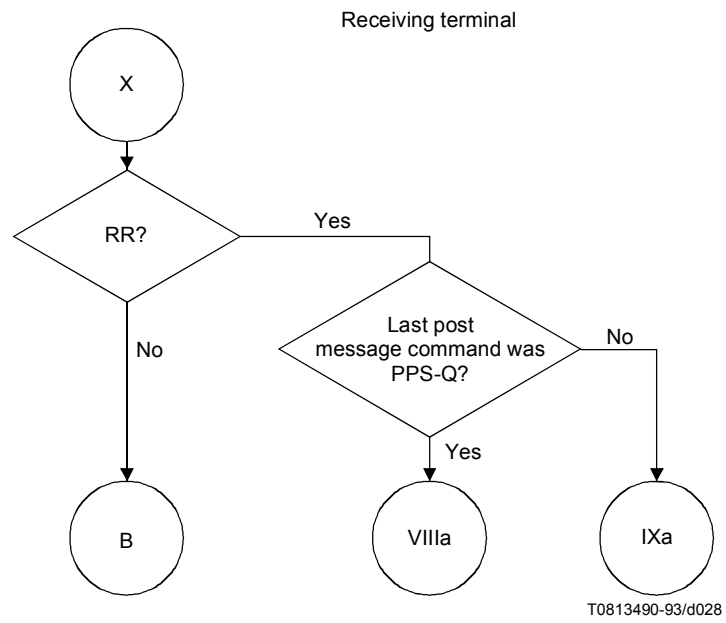
Figure 5-2r/T.30
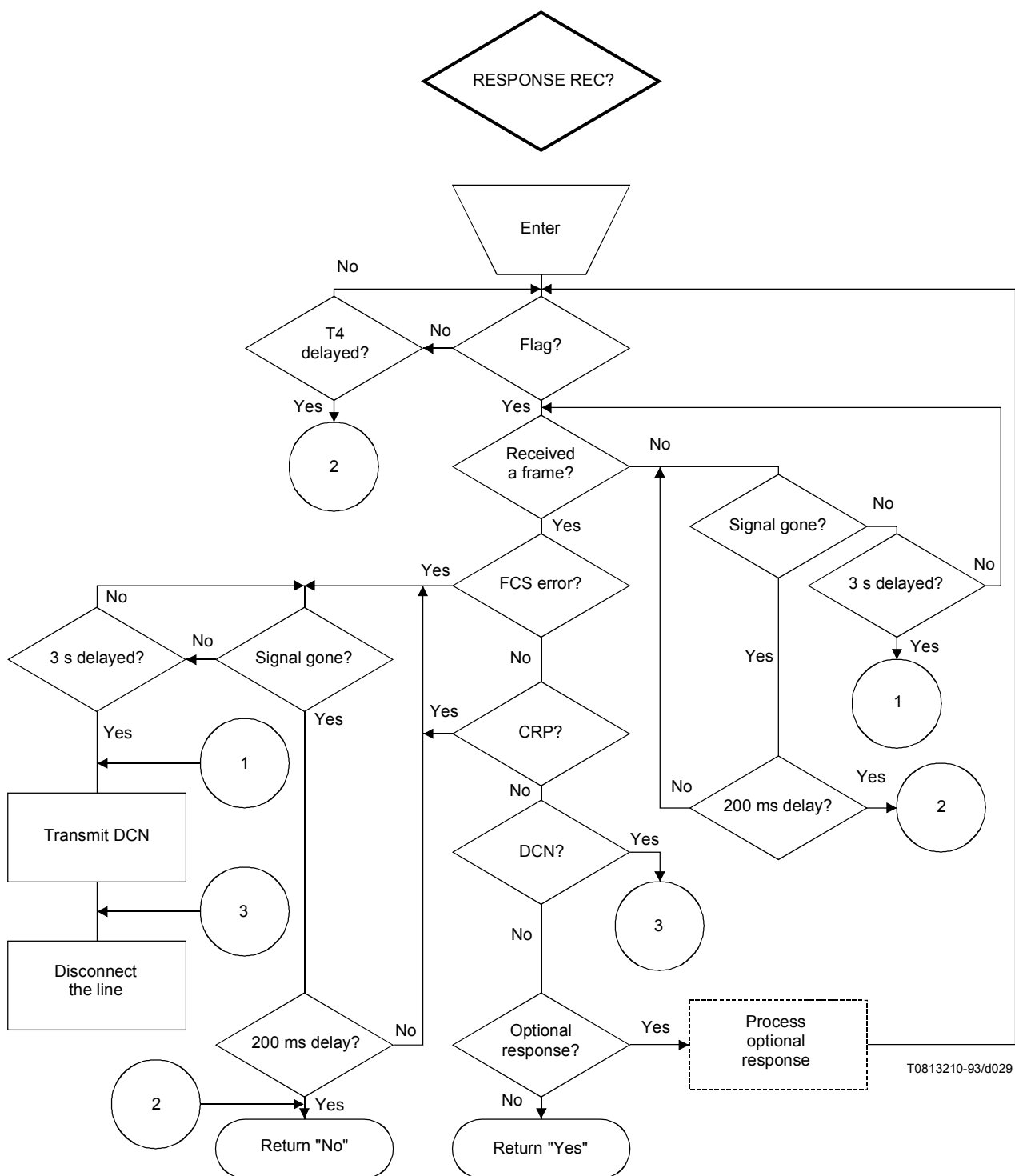
NOTE – For manual units, the value of timer T4 may be either 3.0 s ± 15% or 4.5 s ± 15%. If the value of 4.5 s is used, then after detection of a valid response to the first DIS, it may be reduced to 3.0 s ± 15%. T4 = 3.0 s ± 15% for automatic units.

Figure 5-2s/T.30

Figure 5-2t/T.30

Figure 5-2u/T.30

T5 = 60 s ± 5 s

CTC
RESPONSE
REC?

Enter

SET MODE

Transmit
CTC

RESPONSE
REC?

Yes

No

3rd TRY?

No

Yes

CTR?

No

Yes

Return "No"

Return "Yes"

T0813530-93/d032
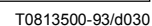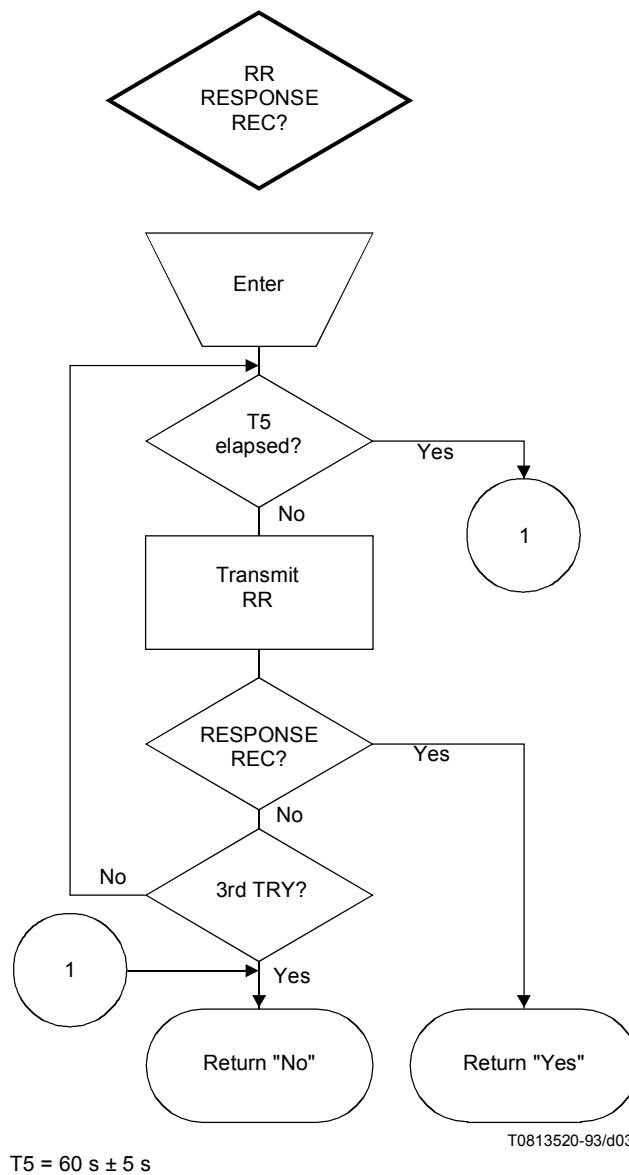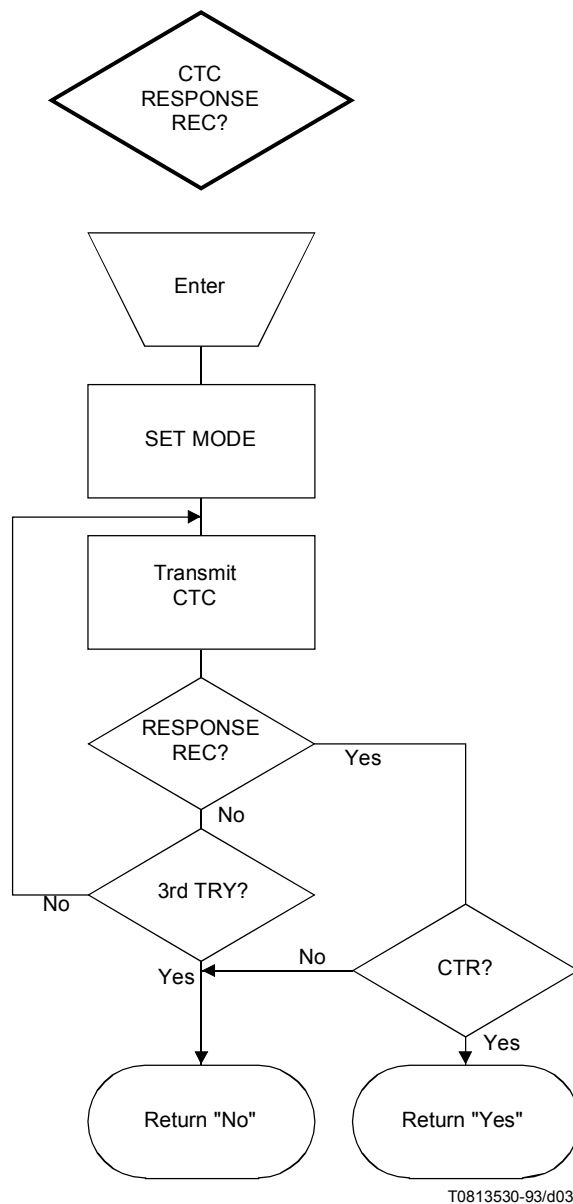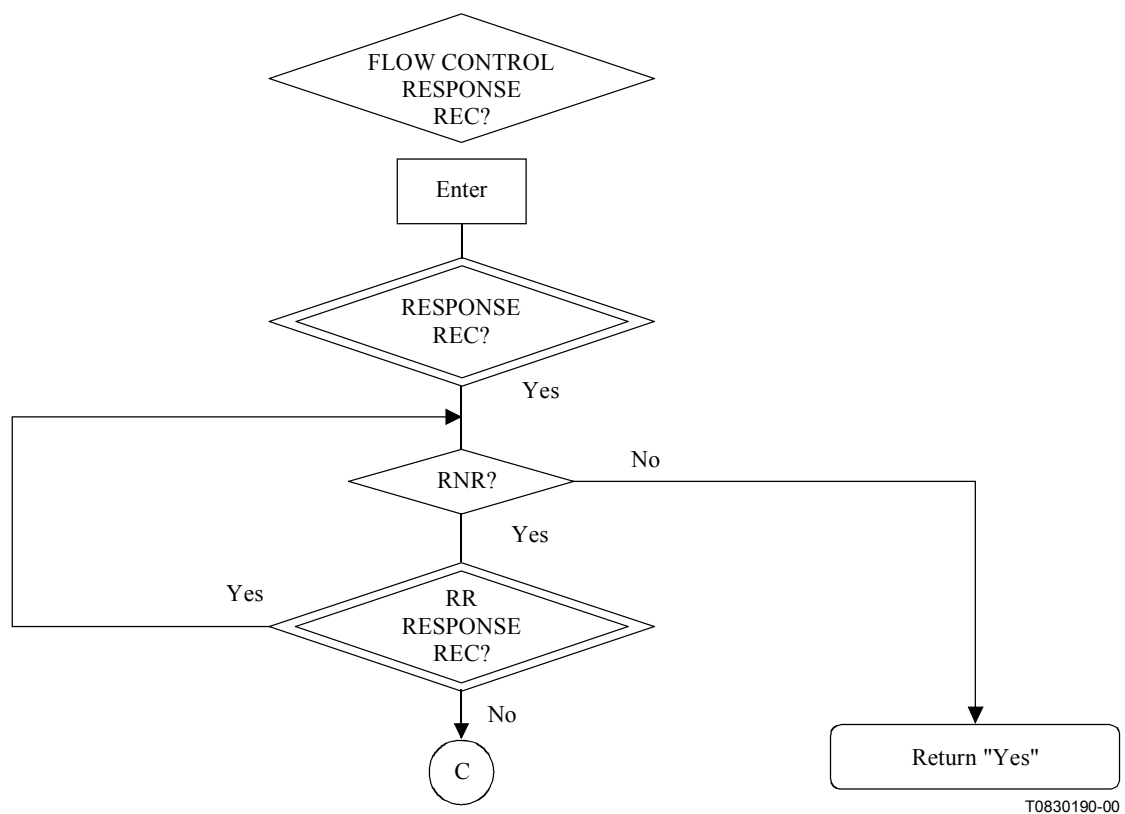
Figure 5-2v/T.30

Figure 5-2w/T.30 – Response received in the optional flow control mode

Figure 5-2x/T.30 – Command receive in optional flow control mode

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 REC "compatible remote receiver".
DOC TO XMIT	The terminal 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 terminal 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 basic Group 3 modulation scheme. For details of the optional modulation schemes, refer to the relevant V-series Recommendations.
TRAIN OK	The training TCF signal has been analyzed and the results of "training were OK".
CHANGE MODE	The transmitting terminal 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 terminal compatible with the terminal initiating that procedure.
COPY QUALITY OK	By some algorithm, the "copy quality was deemed OK".
RETRAIN	By some algorithm, it is deemed desirable to transmit a new training signal.
FLAG	There has been the detection of a "flag".
RECEIVE A FRAME	The terminal 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 terminal has the "CRP option" and can, therefore, request an immediate retransmission of the most recent command.

LOCAL INT	Either the "local" terminal 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 terminal 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.17 modulation system.
CONTINUE TO CORRECT?	The transmitting terminal by some algorithm decides to continue correcting the previous message.
CONTINUE WITH NEXT MESSAGE?	The transmitting terminal 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 terminal is ready to receive the next message.
RR RESPONSE REC?	The "RR response received" subroutine searches for an error-free response for the RR command.
CTC RESPONSE REC?	The "CTC response received" subroutine searches for an error free response for the CTC command.

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

NOTE 2 – The error correction mode is defined in Annex A.

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

NOTE 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 RTC/RCP signal will be transmitted prior to invoking the procedural interrupt.

NOTE 5 – Where the symbols { } are used, the signals within these symbols are a response to DIS from the calling terminal wishing to receive.

NOTE 6 – Where the symbols ( ) are used, the signals within these symbols are optional.

NOTE 7 – Maximum number of tries is between 1 and 3.

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 10 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 ITU-T Rec. V.1.

NOTE 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 10).

NOTE 2 – A terminal 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 shall be a series of flag sequences for 1 s ± 15%.

NOTE – Some terminals which conform to the pre-1996 versions of this Recommendation may transmit an optional binary coded preamble at 2400 bit/s – see Appendix III.

5.3.2 Message/signalling delineation
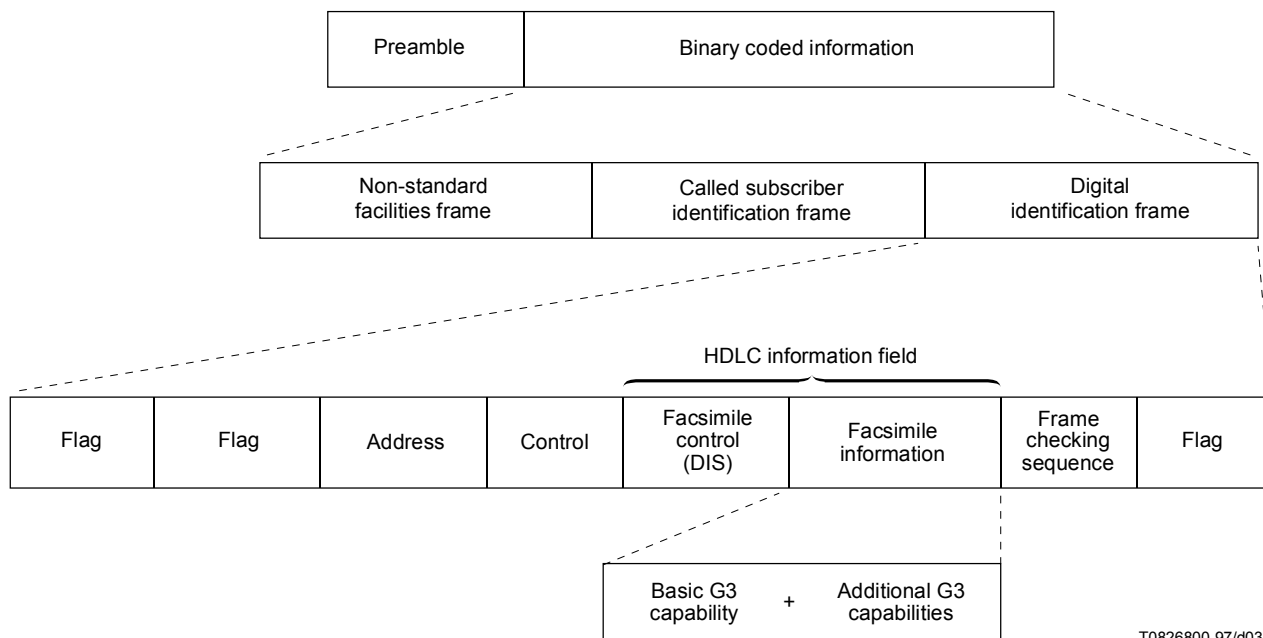
Figure 10/T.30

5.3.2.1 When the V.27 *ter*, V.29 or V.17 modulation scheme 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 binary coded modulation system. When the V.34 modulation scheme is employed, the delineation is obtained as defined in Annex F.

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

When operating in the duplex mode, the RCP frame is not used and delineation is obtained by use of the facsimile control field.

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

5.3.2.3 After receipt of a signal using the binary coded modulation system, the transmitting terminal must wait at least 75 ms before sending any signals using V.27 *ter*/V.29/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 synchronization. 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 terminal that the terminal 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 terminal(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 terminal.

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 terminals. 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 terminal which receives a valid DIS signal;

–   X is set to "0" by the terminal which receives a valid and appropriate response to a DIS signal;

–   X will remain unchanged until the terminal again enters the beginning of phase B.

5.3.6.1.1 Initial identification

From the called to the calling terminal.

Format: 0000 XXXX

1)   *Digital Identification Signal (DIS)* – Characterizes the standard ITU-T capabilities of the called terminal.

   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 T-series Recommendations.

   Format: 0000 0100

5.3.6.1.2 Command to send

From a calling terminal wishing to be a receiver to a called terminal 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 terminal. 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. This signal shall only be used once in each signal sequence i.e., concatenated signals are not permitted.

   Format: 1000 0011

5)   *Selective Polling (SEP)* – This optional signal indicates that the following FIF information is:

   a)   a subaddress for the polling mode; or

   b)   a specific document number.

(See 5.3.6.2.9, SEP coding format.) SEP is only sent if bit 47 in DIS is set. This signal shall only be used once in each signal sequence, i.e., concatenated signals are not permitted.

Format: 1000 0101

NOTE – When PSA and SEP are used together in the polling mode, option b) is applied.

6) *Polled Subaddress (PSA)* – This optional signal indicates that the following FIF information is a subaddress for polling (see 5.3.6.2.13, PSA coding format). PSA is only sent if bit 35 in the DIS is set. This signal shall only be used once in each signal sequence, i.e., concatenated signals are not permitted.

Format: 1000 0110

7) *Calling subscriber Internet Address (CIA)* – This optional signal indicates that the following FIF information is an address in the Internet of that calling station (see 5.3.6.2.12, CSA, TSA, CIA, IRA and ISP coding format). CIA is sent with DTC only when Internet capabilities (Bit 1 or 3) in DIS is set. Sending multiple Internet address is for further study.

Format: 1000 0111

8) *Internet Selective Polling Address (ISP)* – This optional signal indicates that the following FIF information is an address in the Internet for the polling mode. It may be used to indicate that a specific document shall be polled at the called gateway (see 5.3.6.2.12, CSA, TSA, CIA, IRA and ISP coding format). ISP is only sent if bit 101 in DIS is set. Sending multiple Internet address is for further study.

Format: 1000 1000

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 terminal. 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 subscriber's 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. This signal shall only be used once in each signal sequence, i.e., concatenated signals are not permitted.

Format: X100 0011

5) *Sender Identification (SID)* – This optional signal indicates that the following FIF information is the sender identity (see 5.3.6.2.11, SID coding format). SID is only sent if bit 50 in DIS is set. This signal shall only be used once in each signal sequence, i.e., concatenated signals are not permitted.

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 0 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.

8) *Transmitting Subscriber Internet address (TSA)* – This optional signal indicates that the following FIF information is an address in the Internet of that transmitting station (see 5.3.6.2.12, CSA, TSA, CIA, IRA and ISP coding format). TSA is sent with DCS only when Internet capabilities (Bit 1 or 3) in DIS is set to 1. Sending multiple Internet address is for further study.

Format: X100 0110

9) *Internet Routing Address (IRA)* – This optional signal indicates that the following FIF information is an address in the Internet. It may be used to provide additional routing information for gateways in the facsimile procedure (see 5.3.6.2.12, CSA, TSA, CIA, IRA and ISP coding format). IRA is only sent if bit 102 in DIS/DTC is set. Sending multiple Internet address is for further study.

Format: X100 0111

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 training signal and requesting a retrain.

Format: X010 0010

3) *Response for Continue To Correct (CTR)* – This digital response is only used in the optional T.4 error correction mode. For further details, refer to item 1) of A.4.2.

4) *Called Subscriber Internet Address (CSA)* – This optional signal indicates that the following FIF information is an address in the Internet of that called station (see 5.3.6.2.12, CSA, TSA, CIA, IRA and ISP coding format). CSA is sent with CFR only when Internet capabilities (Bit 1 or 3) in DCS is set to 1. Sending multiple Internet address is for further study.

Format: X010 0100

NOTE 1 – Transmitter will send message when CFR or CSA/CFR is detected.

NOTE 2 – Transmitter will send message, but will not request retransmission of CSA, when CFR is detected but CSA is not detected.

NOTE 3 – Transmitter will request retransmission of CFR when only CSA is detected.

5.3.6.1.5 In-message procedure

From the transmitter to the receiver. The in-message procedure formats and specific signals shall be consistent with ITU-T Rec. T.4.

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 Procedure (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

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

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

   Format: X111 1000

7) *End Of Selection (EOS)* – This optional command from the multiple-SEP-capable polling transmitter to the SEP-capable polling receiver shall be used to indicate that the end (last page or last block) of the currently selected document has been reached and that a return to phase B is expected for the purpose of eliciting any new SEP-selected document request. EOS may only be transmitted if bit 34 was set in the receiver's DTC.

8) *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.

9) *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.

10) *Receive ready (RR)* – This digital command is only used in the optional T.4 error correction mode or optional flow control mode. With respect to the optional T.4 error correction mode, see item 3) of A.4.3.

NOTE 3 – Post-message command coding format when applying double side mode is as follows:

| Flag | Address | Control | Facsimile control | Facsimile information | Frame checking sequence | Flag |

| PC | BC | FC | Length | Page number | Page information |

b0　　　b7　b0　　　b7　b0　　　b7　b0　　　b7　b0　　　b15　b0　　　　　　b7

T.30_F5.3.6.1.6

ECM only
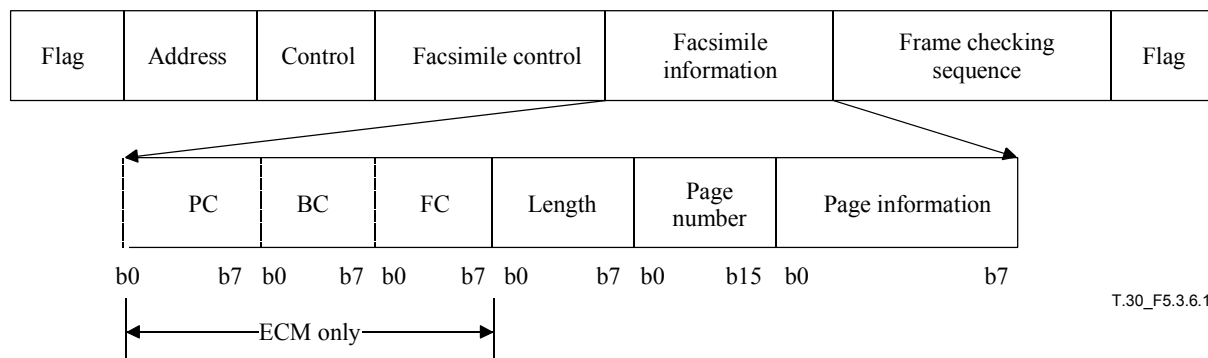
One octet for length, two octets for page number and one octet for page information are required for Facsimile information. A page number shall start from 1. The example of the length is "03h" and page number is "06h" is as follows:

Length	Page number
1 1 0 0 0 0 0 0	0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0

b0　　　b7　b0　　　　　　　　b15

The fourth octet is known as page information and the values which apply for this octet are shown in the table below. Bit 7 is an extended bit, which shall be set to "1" if there is additional page information octets

The receiving terminal shall receive unknown extended FIF data to keep the interoperability.

Bit No.	Page information
0	Page value 0: front side / 1: reverse side
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Extend bit – default "0"

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 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 is 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

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

NOTE 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 or optional flow control mode. With respect to 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 V for more information.

Format: X011 1111

NOTE 5 – 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

3) *Field Not Valid (FNV)* – This optional signal indicates that the last received PWD, SEP, SUB, SID, TSI, PSA or secure fax signal (or any combination of these) is invalid or not accepted. FNV is only sent if bit 33 in DIS/DTC and DCS is set.

NOTE – FNV shall be sent in place of CFR/FTT when the FIF of one or more optional signals associated with DCS is invalid or not accepted. FNV shall also be sent in response to the DTC when one or more of the related optional signals is invalid or not accepted. FNV may also be sent in response to the DEC, DES, DTR or DER signals (as defined in Annex H).

Format: X101 0011

4)   *Transmit not ready (TNR)* – This optional command is used to indicate that the transmitter is not ready to transmit.

Format: X101 0111

5)   *Transmit ready (TR)* – This optional response is used to ask for the status for transmitter.

Format: X101 0110

NOTE – TNR, TR are applicable only to the optional flow control mode. The transmitter can send TNR instead of any commands after exchanging DIS/DTC and DCS signals.

5.3.6.2   Facsimile Information Field (FIF)

In many cases the FIF 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 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, 13, 14 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.

Table 2/T.30

Bit No.	DIS/DTC	Note	DCS	Note
1	Store and forward Internet fax-Simple mode (ITU-T Rec. T.37)	60, 63	Store and forward Internet fax-Simple mode (ITU-T Rec. T.37)	60, 63
2	Reserved	1	Reserved	1
3	Real-time Internet fax (ITU-T Rec. T.38)	61, 63	Real-time Internet fax (ITU-T Rec. T.38)	61, 63
4	3rd Generation Mobile Network	71	3rd Generation Mobile Network	71
5	Reserved	1	Reserved	1
6	V.8 capabilities	23	Invalid	24
7	"0" = 256 octets preferred "1" = 64 octets preferred	23, 42	Invalid	24
8	Reserved	1	Reserved	1
9	Ready to transmit a facsimile document (polling)	18	Set to "0"	
10	Receiver fax operation	19	Receiver fax operation	20

Table 2/T.30

Bit No.	DIS/DTC	Note	DCS	Note
11, 12, 13, 14	Data signalling rate		Data signalling rate	
0, 0, 0, 0	ITU-T Rec. V.27 *ter* fall-back mode		2400 bit/s, ITU-T Rec. V.27 *ter*	33
0, 1, 0, 0	ITU-T Rec. V.27 *ter*	3	4800 bit/s, ITU-T Rec. V.27 *ter*	
1, 0, 0, 0	ITU-T Rec. V.29		9600 bit/s, ITU-T Rec. V.29	
1, 1, 0, 0	ITU-T Recs V.27 *ter* and V.29		7200 bit/s, ITU-T Rec. V.29	
0, 0, 1, 0	Not used		Invalid	31
0, 1, 1, 0	Reserved		Invalid	31
1, 0, 1, 0	Not used		Reserved	
1, 1, 1, 0	Invalid	32	Reserved	
0, 0, 0, 1	Not used		14 400 bit/s, ITU-T Rec. V.17	
0, 1, 0, 1	Reserved		12 000 bit/s, ITU-T Rec. V.17	
1, 0, 0, 1	Not used		9600 bit/s, ITU-T Rec. V.17	
1, 1, 0, 1	ITU-T Recs V.27 *ter*, V.29, and V.17	31	7200 bit/s, ITU-T Rec. V.17	
0, 0, 1, 1	Not used		Reserved	
0, 1, 1, 1	Reserved		Reserved	
1, 0, 1, 1	Not used		Reserved	
1, 1, 1, 1	Reserved		Reserved	
15	R8 × 7.7 lines/mm and/or 200 × 200 pels/25.4 mm	10, 11, 13, 25, 34	R8 × 7.7 lines/mm or 200 × 200 pels/25.4 mm	10, 11, 13, 25, 34
16	Two-dimensional coding capability		Two-dimensional coding	
17, 18	Recording width capabilities	27	Recording width	27
(0,0)	Scan line length 215 mm ± 1%		Scan line length 215 mm ± 1%	
(0,1)	Scan line length 215 mm ± 1% and Scan line length 255 mm ± 1% and Scan line length 303 mm ± 1%		Scan line length 303 mm ± 1%	
(1,0)	Scan line length 215 mm ± 1% and Scan line length 255 mm ± 1%		Scan line length 255 mm ± 1%	
(1,1)	Invalid	6	Invalid	
19, 20	Recording length capability		Recording length	
(0,0)	A4 (297 mm)	2	A4 (297 mm)	2
(0,1)	Unlimited		Unlimited	
(1,0)	A4 (297 mm) and B4 (364 mm)		B4 (364 mm)	
(1,1)	Invalid		Invalid	

Table 2/T.30

Bit No.	DIS/DTC	Note	DCS	Note
21, 22, 23	Minimum scan line time capability at the receiver	4, 8, 23	Minimum scan line time	8, 24
(0,0,0)	20 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$		20 ms	
(0,0,1)	40 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$		40 ms	
(0,1,0)	10 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$		10 ms	
(1,0,0)	5 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$		5 ms	
(0,1,1)	10 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$			
(1,1,0)	20 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$			
(1,0,1)	40 ms at 3.85 l/mm: $T_{7.7} = 1/2\ T_{3.85}$			
(1,1,1)	0 ms at 3.85 l/mm: $T_{7.7} = T_{3.85}$		0 ms	
24	Extend field	5	Extend field	5
25	Reserved	1, 41	Reserved	1, 41
26	Uncompressed mode		Uncompressed mode	
27	Error correction mode	17	Error correction mode	17
28	Set to "0"		Frame size 0 = 256 octets Frame size 1 = 64 octets	7 24
29	Reserved	1	Reserved	1
30	Reserved	1	Reserved	1
31	T.6 coding capability	9, 17	T.6 coding enabled	9, 17
32	Extend field	5	Extend field	5
33	Field not valid capability		Field not valid capability	
34	Multiple selective polling capability	52	Set to "0"	
35	Polled Subaddress	26, 44, 45	Set to "0"	
36	T.43 coding	17, 25, 34, 35, 37, 39, 40	T.43 coding	17, 25, 34, 35, 37, 39, 40
37	Plane interleave	25, 46	Plane interleave	25, 46
38	Voice coding with 32 k ADPCM (ITU-T Rec. G.726)	58, 59	Voice coding with 32 k ADPCM (ITU-T Rec. G.726)	17, 58, 59
39	Reserved for the use of extended voice coding	1	Reserved for the use of extended voice coding	1
40	Extend field	5	Extend field	5
41	R8 × 15.4 lines/mm	10, 62	R8 × 15.4 lines/mm	10, 62
42	300 × 300 pels/25.4 mm	34, 80	300 × 300 pels/25.4 mm	34
43	R16 × 15.4 lines/mm and/or 400 × 400 pels/25.4 mm	10, 12, 13, 34, 80	R16 × 15.4 lines/mm and/or 400 × 400 pels/25.4 mm	10, 12, 13, 34

Table 2/T.30

Bit No.	DIS/DTC	Note	DCS	Note
44	Inch-based resolution preferred	13, 14	Resolution-type selection "0": metric-based resolution "1": inch-based resolution	13, 14
45	Metric-based resolution preferred	13, 14	Don't care	
46	Minimum scan line time capability for higher resolutions "0": $T_{15.4} = T_{7.7}$ "1": $T_{15.4} = 1/2\ T_{7.7}$	15	Don't care	
47	Selective polling	26, 44	Set to "0"	
48	Extend field	5	Extend field	5
49	Subaddressing capability		Subaddressing transmission	26
50	Password	26	Sender Identification transmission	26
51	Ready to transmit a data file (polling)	17, 21	Set to "0"	
52	Reserved	1	Reserved	1
53	Binary File Transfer (BFT)	16, 17, 21	Binary File Transfer (BFT)	16, 17
54	Document Transfer Mode (DTM)	17, 21	Document Transfer Mode (DTM)	17
55	Electronic Data Interchange (EDI)	17, 21	Electronic Data Interchange (EDI)	17
56	Extend field	5	Extend field	5
57	Basic Transfer Mode (BTM)	17, 21	Basic Transfer Mode (BTM)	17, 59
58	Reserved	1	Reserved	1
59	Ready to transmit a character or mixed mode document (polling)	17, 22	Set to "0"	
60	Character mode	17, 22	Character mode	17
61	Reserved	1	Reserved	1
62	Mixed mode (Annex E/T.4)	17, 22	Mixed mode (Annex E/T.4)	17, 22
63	Reserved	1	Reserved	1
64	Extend field	5	Extend field	5
65	Processable mode 26 (ITU-T Rec. T.505)	17, 22	Processable mode 26 (ITU-T Rec. T.505)	17, 22
66	Digital network capability	43	Digital network capability	43
67 (0) (1)	Duplex and half-duplex capabilities Half-duplex operation only Duplex and half-duplex operation		Duplex and half-duplex capabilities Half-duplex operation only Duplex operation	
68	JPEG coding	17, 25, 34, 35, 39, 40	Full colour mode	17, 25, 34, 35, 39, 40
69	Full colour mode	25, 35	Full colour mode	25, 35
70	Set to "0"	36	Preferred Huffman tables	25, 36
71	12 bits/pel component	25, 37	12 bits/pel component	25, 37

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Bit No.	DIS/DTC	Note	DCS	Note
72	Extend field	5	Extend field	5
73	No subsampling (1:1:1)	25, 38	No subsampling (1:1:1)	25, 38
74	Custom illuminant	25, 39	Custom illuminant	25, 39
75	Custom gamut range	25, 40	Custom gamut range	25, 40
76	North American Letter (215.9 × 279.4 mm) capability	28	North American Letter (215.9 × 279.4 mm)	
77	North American Legal (215.9 × 355.6 mm) capability	28	North American Legal (215.9 × 355.6 mm)	
78	Single-progression sequential coding (ITU-T Rec. T.85) basic capability	17, 29, 30	Single-progression sequential coding (ITU-T Rec. T.85) basic	17, 29
79	Single-progression sequential coding (ITU-T Rec. T.85) optional L0 capability	17, 29, 30	Single-progression sequential coding (ITU-T Rec. T.85) optional L0	17, 29
80	Extend field	5	Extend field	5
81	HKM key management capability		HKM key management selected	
82	RSA key management capability		RSA key management selected	47
83	Override capability	53	Override mode selected	53
84	HFX40 cipher capability		HFX40 cipher selected	
85	Alternative cipher number 2 capability	56	Alternative cipher number 2 selected	56
86	Alternative cipher number 3 capability	56	Alternative cipher number 3 selected	56
87	HFX40-I hashing capability		HFX40-I hashing selected	
88	Extend field	5	Extend field	5
89	Alternative hashing system number 2 capability	57	Alternative hashing system number 2 selected	57
90	Alternative hashing system number 3 capability	57	Alternative hashing system number 3 selected	57
91	Reserved for future security features	1	Reserved for future security features	1
92	T.44 (Mixed Raster Content)	17, 50, 69	T.44 (Mixed Raster Content)	17, 50, 69
93	T.44 (Mixed Raster Content)	17, 50, 69	T.44 (Mixed Raster Content)	17, 50, 69
94	T.44 (Mixed Raster Content)	17, 50, 69	T.44 (Mixed Raster Content)	17, 50, 69
95	Page length maximum strip size for T.44 (Mixed Raster Content)	51	Page length maximum strip size for T.44 (Mixed Raster Content)	51
96	Extend field	5	Extend field	5

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Bit No.	DIS/DTC	Note	DCS	Note
97	Colour/gray-scale 300 pels/ 25.4 mm × 300 lines/ 25.4 mm or 400 pels/ 25.4 mm × 400 lines/ 25.4 mm resolution	49, 80	Colour/gray-scale 300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm resolution	49
98	100 pels/25.4 mm × 100 lines/25.4 mm for colour/gray scale	10, 48	100 pels/25.4 mm × 100 lines/25.4 mm for colour/gray scale	10, 48
99	Simple Phase C BFT Negotiations capability	54, 55	Simple Phase C BFT Negotiations capability	54, 55
100	Extended BFT Negotiations capability		Set to "0"	
101	Internet Selective Polling Address (ISP)	26	Set to "0"	
102	Internet Routing Address (IRA)	26	Internet Routing Address (IRA) transmission	26
103	Reserved	1	Reserved	1
104	Extend field	5	Extend field	5
105	600 pels/25.4 mm × 600 lines/25.4 mm	81	600 pels/25.4 mm × 600 lines/25.4 mm	
106	1200 pels/25.4 mm × 1200 lines/25.4 mm	81	1200 pels/25.4 mm × 1200 lines/25.4 mm	
107	300 pels/25.4 mm × 600 lines/25.4 mm	62	300 pels/25.4 mm × 600 pels/25.4 mm	62
108	400 pels/25.4 mm × 800 lines/25.4 mm	62	400 pels/25.4 mm × 800 lines/25.4 mm	62
109	600 pels/25.4 mm × 1200 lines/25.4 mm	62	600 pels/25.4 mm × 1200 lines/25.4 mm	62
110	Colour/gray scale 600 pels/25.4 mm × 600 lines/25.4 mm resolution	64, 81	Colour/gray scale 600 pels/25.4 mm × 600 lines/25.4 mm resolution	64
111	Colour/gray scale 1200 pels/25.4 mm × 1200 lines/25.4 mm resolution	65, 81	Colour/gray scale 1200 pels/25.4 mm × 1200 lines/25.4 mm resolution	65
112	Field Extend	5	Field Extend	5
113	Double-sided printing capability (alternate mode)	66, 67	Double-sided printing capability (alternate mode)	67
114	Double-sided printing capability (continuous mode)	66, 67, 68	Double-sided printing capability (continuous mode)	67
115	Black and white mixed raster content profile (MRCbw)	17, 50, 69	Not used set to "0"	17, 50, 69
116	T.45 (run length colour encoding)	17, 78	T.45 (run length colour encoding)	17, 78

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Bit No.	DIS/DTC	Note	DCS	Note
117, 118	SharedDataMemory capacity	70	SharedDataMemory required	70
(0,0)	Not available		Not Used	
(0,1)	Level 1 = 1.0 Mbytes		Level 1 = 1.0 Mbytes	
(1,0)	Level 2 = 2.0 Mbytes		Level 2 = 2.0 Mbytes	
(1,1)	Level 3 = unlimited (i.e., ≥32 Mbytes)		Level 3 = unlimited (i.e., ≥32 Mbytes)	
119	Reserved		Reserved	
120	Extend field		Extend field	
121	Flow Control Capability for T.38 communication	72, 73	Flow Control Capability for T.38 communication	72, 73
122	K>4	74	K>4	74
123	Internet aware T.38 mode fax device capability	75	Internet aware fax device operating in T.38 mode	76, 77
124,125, 126	T.89 (Application profiles for ITU-T Rec. T.88)	78, 79	T.89 (Application profiles for ITU-T Rec. T.88)	78, 79
(0,0,0)	Not used		Not used	
(0,0,1)	Profile 1		Profile 1	
(0,1,0)	Profile 2		Profile 2	
(0,1,1)	Profile 3		Profile 3	
(1,0,0)	Profiles 2 and 3		Invalid	
(1,0,1)	Reserved		Reserved	
(1,1,0)	Reserved		Reserved	
(1,1,1)	Reserved		Reserved	
127	sYCC-JPEG coding	17, 82	sYCC-JPEG coding	17, 82

NOTE 1 – Bits that are indicated as "Reserved" shall be set to "0".

NOTE 2 – Standard facsimile terminals conforming to ITU-T Rec. T.4 must have the following capability: Paper length = 297 mm.

NOTE 3 – Where the DIS or DTC frame defines V.27 *ter* capabilities, the terminal may be assumed to be operable at either 4800 or 2400 bit/s.

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

NOTE 4 – $T_{7.7}$ 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.

NOTE 5 – The standard FIF field for the DIS, DTC and DCS signals is 24 bits long. If the "extend field" bit(s) is a "1", the FIF field shall be extended by an additional 8 bits.

NOTE 6 – Existing terminals 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).

NOTE 7 – 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.

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NOTE 8 – The optional T.4 error correction mode of operation and IAFD mode require 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 and IAFD mode.

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

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

NOTE 9 – T.6 coding scheme capability specified by bit 31 is valid only when bit 27 (error correction mode) is set as a "1".

NOTE 10 – Resolutions of R4, R8 and R16 are defined as follows:

R4 = 864 pels/(215 mm ± 1%) for ISO A4, North American Letter and Legal.
R4 = 1024 pels/(255 mm ± 1%) for ISO B4.
R4 = 1216 pels/(303 mm ± 1%) for ISO A3.
R8 = 1728 pels/(215 mm ± 1%) for ISO A4, North American Legal and Letter.
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, North American Letter and Legal.
R16 = 4096 pels/(255 mm ± 1%) for ISO B4.
R16 = 4864 pels/(303 mm ± 1%) for ISO A3.

NOTE 11 – 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 pels/25.4 mm × 200 lines/25.4 mm
0	1	R8 × 7.7 lines/mm
1	1	R8 × 7.7 lines/mm and 200 pels/25.4 mm × 200 lines/25.4 mm

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

NOTE 12 – 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 pels/25.4 mm × 400 lines/25.4 mm
0	1	R16 × 15.4 lines/mm
1	1	R16 × 15.4 lines/mm and 400 pels/25.4 mm × 400 lines/25.4 mm.

NOTE 13 – 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.

NOTE 14 – Bits 44 and 45 do not require the provision of any additional features on the terminal 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.

NOTE 15 – $T_{15.4}$ refers to the scan line times to be utilized when the vertical resolution is 15.4 lines/mm, 400 lines/25.4 mm, 600 lines/25.4 mm and 1200 lines/25.4mm.

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$T_{15.4} = 1/2\ T_{7.7}$ 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" ($T_{15.4} = T_{7.7}$).

NOTE 16 – The binary file transfer protocol is described in ITU-T Rec. T.434.

NOTE 17 – When either bit of 31, 36, 38, 51, 53, 54, 55, 57, 59, 60, 62, 65, 68, 78, 79, 115, 116 and 127 is set to "1", bit 27 shall also be set to "1". If the value of bits 92 to 94 is non-zero, then bit 27 shall be set to "1".

NOTE 18 – Bit 9 indicates that there is a facsimile document ready to be polled from the answering terminal. It is not an indication of a capability.

NOTE 19 – Bit 10 indicates that the answering terminal has receiving capabilities.

NOTE 20 – Bit 10 in DCS is a command to the receiving terminal to set itself in the receive mode.

NOTE 21 – Bit 51 indicates that there is a data file ready to be polled from the answering terminal. It is not an indication of a capability. This bit is used in conjunction with bits 53, 54, 55 and 57.

NOTE 22 – Bit 59 indicates that there is a character-coded or mixed-mode document ready to be polled from the answering terminal. It is not an indication of a capability. This bit is used in conjunction with bits 60, 62 and 65.

NOTE 23 – When the optional procedure defined in Annex C is used, in DIS/DTC bits 6 and 7 shall be set to "0" and bits 21 to 23 and 27 shall be set to "1".

NOTE 24 – When the optional procedure defined in Annex C is used, in DCS bits 6, 7 and 28 shall be set to "0" and bits 21 to 23 and 27 shall be set to "1".

NOTE 25 – The optional continuous-tone colour mode and gray-scale mode (JPEG mode) protocols and the optional lossless encoded colour and gray-scale mode (T.43 mode) are described in Annexes E and I respectively. If bit 68 in the DIS/DTC frame is set to "1", this indicates JPEG mode capability. If bits 36 and 68 are set to "1", this indicates that the T.43 capability is also available. Bit 36 in the DIS/DTC frame shall only be set to "1" when bit 68 is also set to "1". Additionally, then bits 15 and 27 in the DIS/DTC frame shall also be set to "1", if bit 68 or bits 36 and 68 are set to "1". Bit 15 indicates 200 pels/25.4 mm × 200 lines/25.4 mm resolution capability, which is basic for colour facsimile. Bit 27 indicates error correction mode capability, which is mandatory for colour facsimile. Bits 69 to 71, 73 to 75 and 92 to 94 are relevant only if bit 68 is set to "1". Bit 73 is relevant only for JPEG mode. Bits 69, 71, 74 and 75 are relevant for JPEG mode and/or T.43 mode. Bit 37 is relevant only when bit 36 is set to "1" – see also Notes 39 and 40.

NOTE 26 – To provide an error recovery mechanism, when PWD/SEP/SUB/SID/PSA/IRA/ISP frames are sent with DCS or DTC, bits 49, 102 and 50 in DCS or bits 47, 101, 50 and 35 in DTC shall be set to "1" with the following meaning:

Bit set to "1"	DIS	DTC	DCS
35	Polled SubAddress capability	Polled SubAddress transmission	Not allowed – set to "0"
47	Selective polling capability	Selective polling transmission	Not allowed – set to "0"
49	Subaddressing capability	Not allowed (Set to "0")	Subaddressing transmission
50	Password	Password transmission	Sender Identification transmission
101	Internet Selective Polling Address capability	Internet Selective Polling Address transmission	Not allowed – set to "0"
102	Internet Routing Address capability	Not allowed (Set to "0")	Internet Routing Address transmission

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Terminals conforming to the 1993 version of this Recommendation may set the above bits to "0" even though PWD/SEP/SUB frames are transmitted.

NOTE 27 – The corresponding scan line lengths for inch-based resolutions can be found in clause 3/T.4.

NOTE 28 – While using bits 76 and 77 in DIS/DTC, the terminal is required to be able to receive ISO A4 documents in every combination of bits 76 and 77. A4, B4 and A3 transmitters may ignore the settings of bits 76 and 77.

NOTE 29 – The coding scheme indicated by bits 78 and 79 is defined in ITU-T Rec. T.85.

NOTE 30 – When bit 79 in DIS is set to "1", bit 78 shall also be set to "1".

NOTE 31 – In the case of setting (1,1,0,1) in DIS/DTC bits 11-14 in order to announce the capability to receive in ITU-T Rec. V.17, some terminals which conform to the 1994 version and earlier versions of this Recommendation recognize the capability to receive in ITU-T Rec. V.33 and may set (0,0,1,0) or (0,1,1,0) in DCS bits 11-14. Therefore, the terminal which has the capability to receive, using the modulation system defined in ITU-T Rec. V.17, may optionally support the capability to receive using the modulation system defined in ITU-T Rec. V.33.

NOTE 32 – Some terminals which conform to the 1994 and earlier versions of this Recommendation may have used this bit sequence to indicate use of the V.27*ter*, V.29 and V.33 modulation system.

NOTE 33 – When the modulation system defined in ITU-T Rec. V.34 is used or Internet-Aware Fax Device in DCS (Bit $X + 2$) is set to "1", bits 11-14 in DCS are invalid and should be set to "0".

NOTE 34 – Setting bit 68 to "0" indicates that the called terminal's JPEG mode and T.43 mode are not available and it cannot decode JPEG or T.43 encoded data. In a DCS frame, setting bit 68 to "1" indicates that the calling terminal's JPEG mode is used and JPEG encoded image data are sent. The horizontal image size parameter X of the JPEG data stream shall conform to the values defined in clause 2/T.4. Setting bit 68 to "0" and bit 36 to "1" indicates that the calling terminal's T.43 mode is used and T.43 encoded image data are sent. In the DCS frame, if bit 68 or 36 is set to "1" or the value of bits 92 to 94 is non-zero, then bits 15 or 42 or 43 or 98 or 105 or 106 and 27 in the DCS frame shall also be set to "1". Bits 98, 42, 43, 105 and 106 indicate 100×100, 300×300 and 400×400, 600×600 and 1200 pels/25.4 mm × 1200 lines/25.4 mm resolution respectively. Setting bit 68 and 36 to "0" indicates neither the JPEG mode nor the T.43 mode is used, image is not encoded using JPEG nor T.43.

NOTE 35 – In a DIS/DTC frame, setting bit 69 to "1" indicates that the called terminal has full colour capability. It can accept full colour image data in CIELAB space. If bit 36 is also set to "1", it can also accept colour image defined in ITU-T Rec. T.43. Setting bit 69 to "0" and bit 68 or bits 36 and 68 to "1" indicates that the called terminal has gray-scale mode only, it accepts only the lightness component (the L* component) in the CIELAB representation for JPEG mode and for T.43 mode respectively. In a DCS frame, setting bits 68 and 69 to "1" indicates that the calling terminal sends image in full colour representation in the CIELAB space in JPEG mode. In a DCS frame, setting bits 36 and 69 to "1" indicates that the calling terminal sends colour image in T.43 mode. Setting bit 36 or 68 to "1" and bit 69 to "0" indicates that the calling terminal sends only the lightness component (the L* component) in the CIELAB representation for JPEG or T.43 mode respectively. Note that colour image will be transmitted only when bits 68 and 69 or 36 and 69 are both set to "1".

NOTE 36 – Bit 70 is called "Indication of default Huffman tables". A means is provided to indicate to the called terminal that the Huffman tables are the default tables. Default tables are specified only for the default image intensity resolution (8 bits/pel/component). The default Huffman tables are to be determined (for example, Tables K.3 to K.6/T.81). In a DIS/DTC frame, bit 70 is not used and is set to zero. In a DCS frame, setting bit 70 to 0 indicates that the calling terminal does not identify the Huffman tables that it uses to encode the image data as the default tables. Setting bit 70 to "1" indicates that the calling terminal identifies the Huffman tables that it uses to encode the image data as the default tables.

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NOTE 37 – In a DIS/DTC frame, setting bit 71 to "0" indicates that the called terminal can only accept image data which has been digitized to 8 bits/pel/component for JPEG mode. This is also true for T.43 mode if bit 36 is also set to "1". Setting bit 71 to "1" indicates that the called terminal can also accept image data that are digitized to 12 bits/pel/component for JPEG mode. This is also true for T.43 mode if bit 36 is also set to "1". In a DCS frame, setting bit 71 to "0" indicates that the calling terminal's image data are digitized to 8 bits/pel/component for JPEG mode. This is also true for T.43 mode if bit 36 is also set to "1". Setting bit 71 to "1" indicates that the calling terminal transmits image data which has been digitized to 12 bits/pel/component for JPEG mode. This is also true for T.43 mode if bit 36 is also set to "1".

NOTE 38 – In a DIS/DTC frame, setting bit 73 to "0" indicates that the called terminal expects a 4:1:1 subsampling ratio of the chrominance components in the image data; the a* and b* components in the CIELAB colour space representation are subsampled four times to one against the L* (Lightness) component. The details are described in Annex E/T.4. Setting bit 73 to "1" indicates that the called terminal, as an option, accepts no subsampling in the chrominance components in the image data. In a DCS frame, setting bit 73 to "0" indicates that the called terminal uses a 4:1:1 subsampling ratio of the a* and b* components in the image data. Setting bit 73 to "1" indicates that the called terminal does no subsampling.

NOTE 39 – In a DIS/DTC frame, setting bit 74 to "0" indicates that the called terminal expects that the CIE Standard Illuminant D50 is used in the colour image data as specified in ITU-T Rec. T.42. Setting bit 74 to "1" indicates that the called terminal can also accept other illuminant types besides the D50 illuminant. Setting bit 68 to "1" indicates that the terminal has the JPEG coding capability as described in Annex E/T.4. Setting bit 36 to "1" indicates that the terminal has the colour coding capability as described in ITU-T Rec. T.43. In a DCS frame, setting bit 74 to "0" and bit 68 or bit 36 to "1", indicates the calling terminal uses the D50 illuminant in the colour image data representation a specified in ITU-T Rec. T.42. Setting bit 74 to "1" indicates that another type of illuminant is used. When bits 68 and 74 are set to "1" the specification is embedded into the JPEG syntax as described in Annex E/T.4. When bits 36 and 74 are set to "1", the specification is embedded into the T.43 syntax as described in ITU-T Rec. T.43.

NOTE 40 – In a DIS/DTC frame, setting bit 75 to "0" indicates that the called terminal expects that the colour image data are represented using the default gamut range as specified in ITU-T Rec. T.42. Setting bit 75 to "1" indicates that the called terminal can also accept other gamut ranges. Setting bit 68 to "1" indicates that the terminal has the JPEG coding capability, as described in Annex E/T.4. Setting bit 36 to "1" indicates that the terminal has the colour coding capability, as described in ITU-T Rec. T.43 . In a DCS frame, setting bit 75 to "0" and bit 68 or bit 36 to "1", indicates that the calling terminal uses the default gamut range as specified in ITU-T Rec. T.42. Setting bit 75 to "1" indicates that the calling terminal uses a different gamut range. When bits 68 and 75 are set to "1", the specification is embedded into the JPEG syntax as described in Annex E/T.4. When bits 36 and 75 are set to "1", the specification is embedded into the T.43 syntax as described in ITU-T Rec. T.43.

NOTE 41 – Some terminals which conform to the pre-1996 versions of this Recommendation may set this bit to "1". Such terminals will give an answering sequence as shown in Figure III.2.

NOTE 42 – It is understood that for backwards compatibility, a transmitting terminal may ignore the request for the 64-octet frame and therefore the receiving terminal must be prepared to handle 256-octet frames by some means.

NOTE 43 – See C.7.2.

NOTE 44 – Clarification on the use of selective polling based on the settings of bit 47 and bit 35 is given in 5.3.6.1.2, item 5).

NOTE 45 – Clarification on the use of subaddress for polling based on the setting of bit 35 is given in 5.3.6.1.2, item 6).

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NOTE 46 – In a DIS/DTC frame, setting bit 37 to "0" indicates that the called terminal can only accept image data that are interleaved by stripe interleave (128 line/stripe or less). Setting bit 37 to "1" indicates that the called terminal can also accept plane interleaved image data. In a DCS frame, setting bit 37 to "0" indicates that the calling terminal's image data are interleaved through stripe interleave. Setting bit 37 to "1" indicates that the calling terminal's image data are interleaved through plane interleave. The detail of both interleaving methods are described in ITU-T Rec. T.43.

NOTE 47 – The DCS is not emitted in the context of Annex H; FIF of DCS is included within the new signal "DEC" (see H.6.1) where the corresponding bit 82 must be set to "1".

NOTE 48 – In a DIS/DTC frame, setting bit 98 to "0" indicates that the called terminal does not have the capability to accept 100 pels/25.4 mm × 100 lines/25.4 mm spatial resolution for colour or gray-scale images. Setting bit 98 to "1" indicates that the called terminal does have the capability to accept 100 pels/25.4 mm × 100 lines/25.4 mm spatial resolution for colour or gray-scale images. Bit 98 is valid only when bit 68 is set to "1". In a DCS frame, setting bit 98 to "0" indicates that the calling terminal does not use 100 pels/25.4 mm × 100 lines/25.4 mm spatial resolution for colour or gray-scale images. Setting bit 98 to "1" indicates that the calling terminal uses 100 pels/25.4 mm × 100 lines/25.4 mm spatial resolution for colour or gray-scale images.

NOTE 49 – In a DIS/DTC frame, setting bit 97 to "0" indicates that the called terminal does not have the capability to accept 300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm resolutions for colour/gray-scale images or T.44 Mixed Raster Content (MRC) mask layer. Setting bit 97 to "1" indicates that the called terminal does have the capability to accept 300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. Bit 97 is valid only when bits 68 and 42 or 43 (300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm) are set to "1". In a DCS frame, setting bit 97 to "0" indicates that the calling terminal does not use 300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm resolutions for colour/gray-scale images and mask layer. Setting bit 97 to "1" indicates that the calling terminal uses 300 pels/25.4 mm × 300 lines/25.4 mm or 400 pels/25.4 mm × 400 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. Bit 97 is valid only when bits 68 and 42 or 43 (300 pels/25.4 mm × 300 lines/25.4 mm and 400 pels/25.4 mm × 400 lines/25.4 mm) are set to "1".

NOTE 50 – In a DIS/DTC frame, setting the value of bits 92 through 94 to "0" indicates that the called terminal does not have the capability to accept T.44 Mixed Raster Content (MRC) pages. Setting the value of bits 92 through 94 to non-zero (>0) indicates that the called terminal does have the capability to accept MRC pages. Bits 92 through 94 are valid only when bit 68 or 115 is set to "1". In a DCS frame, setting the value of bits 92 through 94 to "0" indicates that the calling terminal does not transmit MRC pages. Setting the value of bits 92 through 94 to non-zero (>0) indicates that the calling terminal transmits MRC colour or black-and-white only pages. The non-zero value of bits 92 through 94, ranging from X'01' to X'07', identifies the greatest functional mode (performance level) of MRC that is supported, as per ITU-T Rec. T.44. For hexadecimal value interpretation, bit 94 is defined as the MSB while bit 92 is the LSB (e.g., 100 for mode X'01'). Mode value X'01' identifies the base mode of T.44, each incremental mode shall support the capabilities defined in the previous mode. In the DIS/DTC, setting the mode value >0 together with bit 68 or 115 defines the capabilities, of the colour (as defined in T.44) or black-and-white only (MRCbw as defined in Annex H/T.4) profiles of MRC respectively, that are supported by the called terminal. In the DCS frame, the mode value may be set to any value less than or equal to that identified in the called terminals DIS/DTC frame. The mode value identified in the DCS frame defines the greatest MRC mode that will be applied to the transmitted data stream.

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NOTE 51 – In a DIS/DTC frame, setting bit 95 to "0" indicates that the called terminal does not have the capability to accept page length maximum stripe size when receiving T.44 Mixed Raster Content (MRC) pages. Setting bit 95 to 1 indicates that the called terminal does have the capability to accept page length maximum stripe size when receiving MRC pages. Bit 95 is valid only when the value of bits 92 through 94 is set non-zero (>0). In a DCS frame, setting bit 95 to 0 indicates that the calling terminal does not use page length maximum stripe size when transmitting MRC pages. Setting bit 95 to "1" indicates that the calling terminal uses page length maximum stripe size when transmitting MRC pages. Bit 95 is valid only when the value of bits 92 through 94 is non-zero (>0).

NOTE 52 – If bit 34 in a DIS frame is set to "1", this indicates the transmitter has multiple selective polling capability. If bit 34 in a DTC frame is set to "1", this indicates additional selection of document continues after current one. The transmitter can send EOS after the transmission of the final page of current document only if bit 34 in the received DTC is set to "1".

NOTE 53 – Bit 83 is used in the scope of Annex G (see G.2.3) and Annex D/T.36 (see D.2/T.36).

NOTE 54 – Bit 99 indicates the use of the simple Phase C BFT negotiation method defined in Annex B. Some appropriate examples are given in Appendix V.

NOTE 55 – The BFT negotiations capability specified by bit 99 is valid only when bit 53 (binary file transfer) is set to "1".

NOTE 56 – Bits 85 and 86 are reserved for future enhancement to Annex D/T.36.

NOTE 57 – Bits 89 and 90 are reserved for future enhancement to Annex E/T.36.

NOTE 58 – Bits 38 and 39 are used in the scope of Annex B/T.4 (see B.4.5/T.4)

NOTE 59 – When bit 38 and 39 are set to "1", bit 57 shall also be set to "1"

NOTE 60 – Bit 1 set to "1" indicates that the terminal has the Simple mode capability defined in ITU-T Rec. T.37

NOTE 61 – Bit 3 set to "1" indicates that the terminal has the capability to communicate using ITU-T Rec. T.38.

NOTE 62 – Non-square resolutions are applicable only to black and white images.

NOTE 63 – Internet address signals CIA, TSA or CSA can be sent and received when Internet capabilities, bit 1 or 3 of DIS, DCS and DTC, are indicated. When a terminal indicates Internet capabilities by DIS, DCS or DTC of bit 1 or 3, the recipient terminal may process or ignore these signals.

NOTE 64 – In a DIS/DTC frame, setting bit 110 to "0" indicates that the called terminal does not have the capability to accept 600 pels/25.4 mm × 600 lines/25.4 mm resolutions for colour/gray-scale images or T.44 Mixed Raster Content (MRC) mask layer. Setting bit 110 to "1" indicates that the called terminal does have the capability to accept up to 600 pels/25.4 mm × 600 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. The acceptable resolution values are determined by the DIS resolution bit settings. Bit 110 is valid only when bits 68 and 105 (600 pels/25.4 mm × 600 lines/25.4 mm) are set to "1". In a DCS frame, setting bit 110 to 0 indicates that the calling terminal does not use 600 pels/25.4 mm × 600 lines/25.4 mm resolutions for colour/gray-scale images and mask layer. Setting bit 110 to "1" indicates that the calling terminal uses 600 pels/25.4 mm × 600 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. Bit 110 is valid only when bits 36 or 68 and 105 (600 pels/25.4 mm × 600 lines/25.4 mm) are set to "1".

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NOTE 65 – In a DIS/DTC frame, setting bit 111 to "0" indicates that the called terminal does not have the capability to accept 1200 pels/25.4 mm × 1200 lines/25.4 mm resolutions for colour/gray-scale images or T.44 Mixed Raster Content (MRC) mask layer. Setting bit 111 to "1" indicates that the called terminal does have the capability to accept up to 1200 pels/25.4 mm × 1200 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. The acceptable resolution values are determined by the DIS resolution bit settings. Bit 111 is valid only when bits 68 and 106 (1200 pels/25.4 mm × 1200 lines/25.4 mm) are set to "1". In a DCS frame, setting bit 111 to "0" indicates that the calling terminal does not use 1200 pels/25.4 mm × 1200 lines/25.4 mm resolutions for colour/gray-scale images and mask layer. Setting bit 111 to "1" indicates that the calling terminal uses 1200 pels/25.4 mm × 1200 lines/25.4 mm resolutions for colour/gray-scale images and MRC mask layer. Bit 111 is valid only when bits 36 or 68 and 106 (1200 pels/25.4 mm × 1200 lines/25.4 mm) are set to "1".

NOTE 66 – The receiving terminal may print the image data only on to one side even if this bit is set to "1".

NOTE 67 – Alternate mode is defined as transmission of a front page and a reverse page alternately. Continuous mode is defined as transmission all front pages and then of all reverse pages.

NOTE 68 – When bit 114 in DIS is set to "1", bit 113 shall be set to "1".

NOTE 69 – In a DIS/DTC frame, setting the value of bit 115 to "0" indicates that the called terminal does not have the capability to accept Annex H/T.4 black-and-white mixed raster content profile (MRCbw) pages. Setting the value of bit 115 to "1" and the value of bits 92 through 94 to non-zero (>0) indicates that the called terminal does have the capability to accept MRCbw pages. The value of bits 92 through 94 determines the highest MRCbw mode supported. Interpretation of the values of bits 92 through 94 is defined in Note 50. In the DCS frame, bit 115 shall be set to "0" and the value of bits 92 through 94 shall determine the MRC modes as defined in Note 50.

NOTE 70 – SharedDataMemory is the memory used by a decoder to store data that is typically used more than once in the decoding of a data stream. In a DIS/DTC frame, setting the value of bits 117 through 118 to "0" indicates that the called terminal does not have SharedDataMemory capacity. Setting the value of bits 117 through 118 to non-zero (>0) indicates that the called terminal does have SharedDataMemory capacity. In a DCS frame, setting the value of bits 117 through 118 to "0" indicates that the data stream does not require use of SharedDataMemory. Setting the value of bits 117 through 118 to non-zero (>0) indicates that the data stream does require use of SharedDataMemory. Each value of the three non-zero values of bits 117 through 118 represents a different level of receiver SharedDataMemory capacity or SharedDataMemory required in decoding the data stream.

NOTE 71 – Bit 4 set to "1" indicates 3rd Generation Mobile Network Access to the GSTN Connection. Bit 4 set to "0" conveys no information about the type of connection.

NOTE 72 – Bit X can only be set in the communication through the T.38 gateway to cope with delay of network.

NOTE 73 – T.x timer (12 ± 1 s) should be used after emitting RNR or TNR, however, after receiving PPS signal in ECM mode, T.5 timer should be used.

NOTE 74 – For resolutions greater than 200 lines/25.4 mm, 4.2.1.1/T.4 specifies the use of specific K factors for each standardized vertical resolution. To ensure backward compatibility with earlier versions of ITU-T Rec. T.4, bit X+1 indicates when such K factors are being used.

NOTE 75 – This bit should be set to "1" if the fax device is an Internet-Aware Fax Device as defined in ITU-T Rec. T.38 and if it is not affected by the data signal rate indicated by the DIS and DTC signals when communicating with another Internet-Aware Fax Device operating in T.38 mode. This bit shall not be used in the GSTN mode.

NOTE 76 – This bit should be set to "1" if the fax device elects to operate in an Internet-Aware Fax mode as defined in ITU-T Rec. T.38 in response to a device which has set the related DIS bit to "1".

NOTE 77 – When this bit is set to "1", the data signal rate of the modem (bits 11-14) should be set to "0".

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NOTE 78 − In a DIS/DTC frame, bit 116 is valid only when:

1) bit 68 is set to "1" (i.e., JPEG);

2) the value of bits 92 through 94 is set to "4" or greater (i.e., unconstrained colour T.44 "Mixed Raster Content (MRC)" Mode 4 is available); and

3) the value of bits y through y + 2 is set to 2 or 4 (i.e., JBIG2 Profile 2 is available).

The value of bits 117 through 118 is typically non-zero (i.e., SharedDataMemory is available for symbol dictionaries). In a DCS frame, bit 116 is valid only when:

1) the value of bits 92 through 94 is set to "4" or greater (i.e., unconstrained colour MRC Mode 4 is being used);

2) the value of bits y through y + 2 is set to 2 (i.e., JBIG2 Profile 2 is being used); and

3) the value of bits 117 through 118 is typically non-zero (i.e., the data stream requires SharedDataMemory for storage of symbol dictionaries).

NOTE 79 − In a DIS/DTC frame, setting the value of bits y through y + 2 to "0" indicates that the called terminal does not have the capability to accept T.89 profiles of JBIG2 (ITU-T Rec. T.88). Setting the value of bits y through y + 2 to non-zero (>0) indicates that the called terminal does have the capability to accept JBIG2 encoded pages. Each of the non-zero values of bits y through y + 2 represents a different level of JBIG2 profile support. Support for Profile 1 is mandatory for all JBIG2 implementations. In other words, implementations of profile(s) greater than Profile 1 will also include support for Profile 1, although the Profile 1 bit is not activated. Interpretation of the profiles is defined in ITU-T Rec. T.89 (Application Profiles for ITU-T Rec. T.88). Bits y through y + 2 are valid only when bits 92 through 94 comprise a value equal or greater than "4" (i.e., ITU-T Rec. T.44 or ITU-T Annex H/T.4 "Black-and-White Mixed Raster Content Profile (MRCbw)" provision and Mode 4 or greater of each is available). The value of bits 117 through 118 is typically non-zero (i.e., >0). In a DCS frame, setting the value of bits y through y + 2 to "0" indicates that the calling terminal does not transmit JBIG2 encoded pages. Setting the value of bits y through y + 2 to non-zero (i.e., >0) indicates that the calling terminal transmits JBIG2 encoded pages. The non-zero value of bits y through y + 2 identifies the profile of T.89 that is used during the transmission. Bits y through y + 2 are valid only when bits 92 through 94 comprise a value equal or greater than "4". The value of bits 117 through 118 is typically non-zero (i.e., >0). The calling terminal shall not transmit a dictionary (e.g., symbol or halftone pattern dictionaries) or a collection of dictionaries that result in outstanding dictionary memory requirement (i.e., sum of all transmitted dictionaries for which a forget disposition has not been issued) greater than the capacity indicated by the value of DIS/DTC bits 117 through 118.

NOTE 80 − In a DIS/DTC frame, combinations of bit 42, bit 43 and bit 97 indicate that the called terminal has higher resolution capabilities as follows:

DIS/DTC			Resolution capabilities (pels/25.4 mm)			
			monochrome		colour/gray-scale	
42	43	97	300 × 300	400 × 400	300 × 300	400 × 400
0	0	0	no	no	no	no
1	0	0	yes	no	no	no
0	1	0	no	yes	no	no
1	1	0	yes	yes	no	no
0	0	1	(invalid)			
1	0	1	yes	no	yes	no
0	1	1	no	yes	no	yes
1	1	1	yes	yes	yes	yes

"yes" means that the called terminal has the corresponding capability.

"no" means that the called terminal does not have the corresponding capability.

NOTE 81 − In a DIS/DTC frame, combinations of bit 105, bit 106, bit 110 and bit 111 indicate that the called terminal has higher resolution capabilities as follows:

DIS/DTC				Resolution capabilities (pels/25.4 mm)			
				monochrome		colour/gray-scale	
105	106	110	111	600 × 600	1200 × 1200	600 × 600	1200 × 1200
0	0	0	0	no	no	no	no
1	0	0	0	yes	no	no	no
0	1	0	0	no	yes	no	no
1	1	0	0	yes	yes	no	no
0	0	1	0	(invalid)			
1	0	1	0	yes	no	yes	no
0	1	1	0	(invalid)			
1	1	1	0	yes	yes	yes	no
0	0	0	1	(invalid)			
1	0	0	1	(invalid)			
0	1	0	1	no	yes	no	yes
1	1	0	1	yes	yes	no	yes
0	0	1	1	(invalid)			
1	0	1	1	(invalid)			
0	1	1	1	(invalid)			
1	1	1	1	yes	yes	yes	yes

"yes" means that the called terminal has the corresponding capability.
"no" means that the called terminal does not have the corresponding capability.
NOTE 82 – Annex K describes the optional continuous-tone colour and gray scale images mode (sYCC-JPEG mode) protocol. When bit 127 in DIS/DTC frame is set to "1", the called terminal has the capability to accept sYCC-JPEG mode. This is defined with complete independent in the colour space CIELAB. In addition, when bit 127 in DCS frame is set to "1", bit 27 in DCS frame should be set to "1" and bits 15, 17, 18, 19, 20, 41, 42, 43, 45, 46, 68, 69, 71, 73, 74, 75, 76, 77, 97, 98, 105, 106, 107, 108, 109, 110 and 111 in DCS frame should be "Don't care", i.e., they should be set to "0". In the case of transmission of multiple images, a post message signal PPS-MPS between pages, PPS-NULL between partial pages and PPS-EOP following the last page should be sent from the calling terminal to the called terminal.

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 but excluding the "*" and "#" characters. 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 but excluding the "*" and "#" characters. 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 but excluding the "*" and "#" characters. The least significant bit of the least significant digit shall be the first bit transmitted.

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 an FIF. This information field will consist of at least two octets. The first octet will contain an ITU-T 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 ITU-T code is given in ITU-T Rec. T.35.

The country code shall be mapped to the FIF by mapping the most significant bit of the non-standard capabilities information to the most significant bit of the FIF. The order in which the bits are transmitted is from the most to the least significant bit (bit 8 to bit 1).

Note that some existing terminals may perform the bit mapping in the wrong order (bit 1 to bit 8). This may result in these terminals masquerading as a terminal with a different country code, possibly causing erroneous operation.

5.3.6.2.8   PWD coding format

The facsimile information field of the PWD signal shall consist of 20 numeric digits coded as shown in Table 3 but excluding the "+" character. The least significant bit of the least significant digit shall be the first bit transmitted. The unused octets in the information field shall be filled with the "space" character and the information should be right justified.

5.3.6.2.9 SEP coding format

The facsimile information field of the SEP signal shall consist of 20 numeric digits coded as shown in Table 3 but excluding the "+" character. The least significant bit of the least significant digit shall be the first bit transmitted. The unused octets in the information field shall be filled with the "space" character and the information should be right justified.

5.3.6.2.10 SUB coding format

The facsimile information field of the SUB signal shall consist of 20 numeric digits coded as shown in Table 3 but excluding the "+" character. The least significant bit of the least significant digit shall be the first bit transmitted. The unused octets in the information field shall be filled with the "space" character and the information should be right justified.

5.3.6.2.11 SID coding format

The facsimile information field of the SID signal shall consist of 20 numeric digits coded as shown in Table 3 but excluding the "+" character. The least significant bit of the least significant digit shall be the first bit transmitted. The unused octets in the information field shall be filled with the "space" character and the information should be right justified.

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
*	0	010101	0
#	0	010001	1

MSB   Most Significant Bit
LSB   Least Significant Bit
FB   Fill Bit

NOTE 1 – The "+" character shall not be used in the PWD/SEP/SUB signals.
NOTE 2 – The "*" and "#" characters shall not be used in the CSI/CIG/TSI signals.

5.3.6.2.12 CSA, TSA, CIA, IRA and ISP coding format

The facsimile information field of the CSA, TSA, CIA, IRA and ISP signal shall be the Internet address.

Internet address is e-mail address, URL, TCP/IP or international telephone number.

Sequence Number	Type	Length	Internet address

Multiple frames are transmitted for an Internet address, if the length of the Internet address is more than 77 octets.

Format of the facsimile information field:

1st octet	Sequence number of Internet address frame
2nd octet	Type of Internet address
3rd octet	Length of Internet address
4th octet	First character of Internet address
...	
xx octet	Last character of Internet address

1st octet of the FIF indicates the sequence number of frame for multiple transmission. The sequence number for the first frame is 00 to 7F(127). MSB of 1st octet of the FIF is the extend bit where "0" indicates the last frame and "1" indicates a non-last frame.

Format of the sequence number:

Bit No.	Meaning
1	LSB of sequence number
2	Sequence number
3	Sequence number
4	Sequence number
5	Sequence number
6	Sequence number
7	MSB of sequence number
8	Extend bit

2nd octet of the FIF indicates the type of Internet address. The attribute indicates the type of e-mail address, URL, TCP/IP V4 and International telephone number.

1)   E-mail address: *use of e-mail address in ITU-T Rec. T.38 is for further study*.

2)   URL: *for further study*.

3)   TCP/IP V4 and V6: *for further study*.

4)   International telephone number: including the "+" character, telephone country code, area code and subscriber number.

The format of the type of Internet address is shown below.

Bit No.	Meaning
1	Type of Internet address
2	Type of Internet address
3	Type of Internet address
4	Type of Internet address
5	Reserved – set to "0"
6	Reserved – set to "0"
7	Reserved – set to "0"
8	Reserved – set to "0"

The permitted setting of bits 1-4 is shown below.

Bit 1	Bit 2	Bit 3	Bit 4	Internet address type
0	0	0	0	Reserved – set to "0"
1	0	0	0	Reserved for e-mail address
0	1	0	0	Reserved for Uniform Resource Locator address
1	1	0	0	Reserved for TCP/IP Version 4 address
0	0	1	0	Reserved for TCP/IP Version 6 address
1	0	1	0	International telephone number
0	1	1	0	Reserved – set to "0"
1	1	1	0	Reserved
X	X	X	1	Reserved

3rd octet of the FIF indicates the length of Internet address in the frame. MSB of 3rd octet of the FIF is extended bit. Extended bit is used to indicate when the Internet address is divided into multiple frames. "0" indicates the last frame of the Internet address and "1" indicates a non-last frame of the Internet address.

The format of the length of Internet address is shown below.

Bit No.	Meaning
1	LSB of the length of Internet address
2	The length of Internet address
3	The length of Internet address
4	The length of Internet address
5	The length of Internet address
6	The length of Internet address
7	MSB of the length of Internet address
8	Extend bit

4th octet of the FIF is the first character of Internet address.

The bit transmission sequence is LSB of first byte of e-mail address. The least significant bit of the first character of Internet address shall be the first bit transmitted.

xx octet of the FIF is the last character of Internet address.

"xx" must be no more than 80.

5.3.6.2.13 FNV coding format

The structure of the FIF for the FNV signal is as follows:

Reason Octets	Frame Number Octet	Diagnostic Information Octets

At least one reason octet is required in the FIF of the FNV signal. The other octets are optional, but a frame number octet is required if any of the optional diagnostic information octets are presented. Use of the optional octets is application-dependent. Terminals which implement the FNV signal must be able to receive these octets but are not required to process or respond to them.

Format for reason octets

The first octet is known as a reason octet and is used to identify cases where the contents of the Facsimile Information Field (FIF) for the specified signals are not valid. The values which apply for this octet are shown in the table below. A bit setting of "0" indicates "OK" and a bit setting of "1" indicates "invalid". Bit 8 is an extend bit, which shall be set to "1" if there are additional reason octets in the FIF. If the extend bit is set to "0", there are no additional reason octets.

Bit No.	Meaning
1	Incorrect password (PWD)
2	Selective polling reference (SEP) not known
3	Subaddress (SUB) not known
4	Sender identity (SID) not known
5	Secure fax error
6	Transmitting Subscriber Identification (TSI) not accepted
7	Polled Subaddress (PSA) not known
8	Extend Bit – default "0"; set to "1" if extension used
9	BFT Negotiations Request not accepted
10	Internet Routing Address (IRA) not known
11	Internet Selective Polling address (ISP) not known
12	Reserved – set to "0"
13	Reserved – set to "0"
14	Reserved – set to "0"
15	Reserved – set to "0"
16	Extend Bit – default "0"
NOTE – As additional reason octets are defined, they shall have a bit structure which is consistent with the first reason octet. The first seven bits shall identify reasons (or be reserved) and the eighth bit is an extend bit for reason octets.	

Format for frame number of FNV

This is an eight-bit binary number. The frame number 0-255 (maximum number is 255) is used to identify the sequence number of an FNV frame. The frame 0 is the first frame to be transmitted in a series of FNV frames. The least significant bit is transmitted first.

Format for diagnostic information octets of FNV

The diagnostic information for one or more signals may optionally be presented. The diagnostic information for each signal is presented in a series of octets using a type, length, value encoding. The order of transmission for the diagnostic information octets shall be left to right as printed and the least significant bit (right-most) shall be the first one transmitted, except as noted (see rules for value octets below).

The format for the diagnostic information for each signal is as follows:

Type	Length	Value – Invalid FIF content or other diagnostic information (variable number of octets)

Type – Specified based on reversing the FCF (Facsimile Control Field) of the signal or another unique designation. One octet identifiers are normally used, but an extension method is available. The types are defined as follows:

Type	Description
1100 0001	Incorrect password (PWD)
1010 0001	Selective polling reference (SEP) not known
1100 001X	Subaddress (SUB) not known
1010 001X	Sender identify (SID) not known
0000 1000	Secure fax error
0100 001X	Transmitting subscriber identification (TSI) not accepted
0110 0001	Polled Subaddress not known
NOTE – X is as defined in 5.3.6.1.	

Length – Number of octets in the value to follow. One octet is normally used, but an extension method is available.

Value – Contains the portion of the FIF which was invalid for the signal type or other diagnostic information. For cases where all or a portion of an unaccepted FIF is being returned, the data shall be presented in the same bit and octet order as originally transmitted.

If diagnostic information is available for more than one signal, the "type" octet for the second signal will immediately follow the last "value" octet for the prior signal. In a similar manner, all of the diagnostic information for all signals shall be presented in the FIF of the FNV until all diagnostic information has been transmitted. In cases where the amount of diagnostic information to be transmitted exceeds the limits for a single T.30 frame, the remaining diagnostic information shall be placed in additional FNV frames and the frame number will be incremented by 1 for each new frame. For such additional frames, the contents of the reason octets shall be identical to the first FNV frame and the content of the diagnostic information octets shall continue from the previous frame.

Syntax of FNV facsimile information field

The detailed syntax of the FNV FIF is presented below in Backus-Naur Form (BNF). The symbols used in the BNF are defined in H.6.1.4.5.

<bit>	::= <0> | <1>
<octet>	::= <bit><bit><bit><bit><bit><bit><bit><bit>
<8_bit_tag>	::= <octet>
<extend_octet>	::= {<1><1><1><1><1><1><1><1>}
<FNV_type>	::= <8_bit_tag>|<extend octet><8_bit_tag><8_bit_tag>
<parameter_value>	::= <octet>{<octet>}
<count_extend_octet>	::= <0><0><0><0><0><0><0><0>
<parameter_length>	::= <octet>|<count_extend_octet><octet><octet>
<Diagnostic_Information>	::= {<FNV_type><parameter_length><parameter_value>}
<frame_number>	::= <octet>
<FNV_Reason_Octets>	::= <octet>{<octet>}
<FIF_of_FNV>	::= <FNV_Reason_Octets>[<frame_number><Diagnostic_Information>]

Coding examples for FNV facsimile information fields

Case A)

Password is invalid and no diagnostic information is sent.

Case B)

Password is invalid and diagnostic information is sent.

The example of the password is "123456789"

Case C)

New error bits are defined in the second reason octet.

An error occurs in bit 1 of the second reason octet and diagnostic information is not sent.

	Reason Octet 1	Reason Octet 2
Printed order	00000001	10000000
Transmit order	00000001	10000000
	b_1 b_8	b_9 b_{16}

Case D)

A new error bit is defined in the second reason octet.

An error occurs in bit 1 of the second reason octet and diagnostic information is sent for a case where the FIF of the invalid signal is being returned.

	Reason Octet 1	Reason Octet 2	Frame number		Type	Length	Value
Printed order	00000001	10000000	00000000		FCF (reverse order)	length	Return of FIF (reverse order)
			b_7 b_0				
Transmit order	00000001	10000000	00000000		FCF (normal order)	length	Return of FIF (normal order)
	b_1 b_8	b_9 b_{16}	b_0 b_7				

Case E)

New error bits are defined in the second reason octet. A portion of the Subaddress is invalid (see bit 3) and an error is indicated in bit 9 or the second reason octet. Diagnostic Information is included for both errors. The example of the subaddress is "SSSSSSSSSSS1002#2002" and only extension 1002 is being rejected. A portion of the value of the Diagnostic Information for the second error extends over the frame boundary, so a second frame is transmitted with the continuation of the value. The diagnostic information for the second error does not include the return of a previous FIF, so the general rule for transmission bit order (LSB or right-most bit first) applies.

First frame

	Reason Octet 1	Reason Octet 2	Frame number	Type 1 (SUB)	Length (4)	Value (Returned Portion of FIF)			
Printed order	00100001	10000000	00000000	11000011	00000100	31	30	30	32
			b_7 b_0		Length of 1st block				
Transmit order	00100001	10000000	00000000	11000011	00100000	32	30	30	31
	b_1 b_8	b_9 b_{16}	b_0 b_7						

10001100
Transmit bit order

First frame (continued)

	Type 2	Length (128)	value
Printed order	Type	10000000	value

Transmit order	Type (LSB order)	00000001	value (LSB order)

Second frame

	Reason Octet 1	Reason Octet 2	Frame number (2)	value (continuation)
Printed order	00100001	10000000	00000001	value (continued)
			$b_7 \quad b_0$	
Transmit order	00100001	10000000	10000000	value (LSB first)
	$b_1 \quad b_8$	$b_9 \quad b_{16}$	$b_0 \quad b_7$	

5.3.6.2.14 PSA coding format

The facsimile information field of the PSA signal shall consist of 20 numeric digits coded as shown in Table 3 but excluding the "+" character. The least significant bit of the least significant digit shall be the first bit transmitted. The unused octets in the information field shall be filled with the "space" character and the information should be right justified.

5.3.7 Frame Checking Sequences (FCSs)

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

1) remainder of $x^k (x^{15} + x^{14} + x^{13} + . . . + x^2 + x + 1)$ divided (modulo 2) by the generator polynomial $x^{16} + x^{12} + x^5 + 1$, 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 polynomial $x^{16} + x^{12} + x^5 + 1$, 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 polynomial (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 polynomial 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 terminal (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 s.

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 terminal or the receiving terminal. 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 terminals have been identified, all commands are initiated by the transmitting terminal and solicit an appropriate response from the receiving terminal (see Appendix II). Furthermore, the transmission of a response is permitted only when solicited by a valid command. If the transmitting terminal does not receive an appropriate valid response within 3 s ± 15%, it will repeat the command. After three unsuccessful attempts, the transmitting terminal 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 II).

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

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

After receipt of a signal using the T.30 binary coded modulation system or V.27 *ter*/V.29/V.17 modulation system, the terminal must respond within the time period of 1.5 s. However, alternative procedures used by some terminals which conform to the pre-2001 version of this Recommendation may exist.

NOTE 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.

NOTE 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-out T0 defines the amount of time an automatic calling terminal waits for the called terminal to answer the call.

T0 begins after the dialling of the number is completed and is reset:

a)   when T0 times out; or

b)   when timer T1 is started; or

c)   if the terminal is capable of detecting any condition which indicates that the call will not be successful, when such a condition is detected.

The recommended value of T0 is 60 ± 5 s; however, when it is anticipated that a long call set-up time may be encountered, an alternative value of up to 120 s may be used.

NOTE – National regulations may require the use of other values for T0.

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

For operating methods 3 and 4 (see 3.1), the calling terminal starts time-out T1 upon reception of the V.21 modulation scheme.

For operating method 4 *bis* a (see 3.1), the calling terminal starts time-out T1 upon starting transmission using the V.21 modulation scheme.

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 s 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 terminal will attempt to alert the local operator in response to a procedural interrupt. Failing to achieve operator intervention, the terminal will discontinue this attempt and shall issue other commands or responses. T3 is 10 ± 5 s, 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 terminal. T5 is 60 ± 5 s and 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.

6   Use of the modulation system defined in ITU-T Rec. V.34

6.1   Procedures

The use of Error Correction Mode (ECM) is mandatory for all facsimile messages using the V.34 half-duplex and duplex modulation system. The procedures in Annex A shall be followed except as indicated in Annexes C and F. A Group 3 facsimile terminal which supports the duplex mode is required also to support the half-duplex mode. The start-up procedures defined in ITU-T Rec. V.8 are common to both half-duplex and duplex modes of ITU-T Rec. V.34, the terminal shall follow the procedures defined in ITU-T Rec. V.8, except as noted here.

6.1.1 An answering V.34 capable facsimile terminal shall transmit ANSam until a valid CM response is received or until an ANSam time-out (2.6 to 4.0 s) has expired.

6.1.2 A calling V.34 capable terminal shall respond to the detection of ANSam by transmitting a call menu (CM). The direction of facsimile transmission shall be determined by the call terminal selecting one of the V.8 call function codes shown in Table 4.

Table 4/T.30 – The call function category

Start	b_0	b_1	b_2	b_3	b_4	b_5	b_6	b_7	Stop	Octet – "callf0"
0	1	0	0	0	0	0	0	1	1	Transmit facsimile from call terminal
0	1	0	0	0	0	1	0	1	1	Receive facsimile at call terminal
NOTE – The same codepoints are used for duplex and half-duplex modes.										

6.1.3 After receiving a valid CM, the terminal shall follow the procedures described in ITU-T Rec. V.8. However, if the ANSam time-out expires, the answer terminal shall proceed with the binary coded signalling procedures described in clause 5 using the basic 300 bit/s modulation. Bit 6 of the DIS frame shall be set to "1".

6.1.4 If a call terminal, while in the 300 bit/s mode receives a DIS frame with bit 6 set to "1", it may reinitiate the V.8 procedures by transmitting a CI signal. When an answer terminal, expecting a response to a DIS frame, detects a CI signal, it shall enter the V.8 mode by resending the answer tone ANSam.

6.1.5 If the CM/JM exchange indicates that the modulation system defined in ITU-T Rec. V.34 is available in both the calling and called terminals, then the procedures defined in Annex C shall be followed in the case of duplex operation and Annex F in the case of half-duplex operation.

6.1.6 If the CM/JM exchange indicates that the modulation system defined in ITU-T Rec. V.34 is not available in both the calling and called terminals, then the procedures defined in clause 5 shall be followed.

6.1.7 At any time during a GSTN call and while in telephony mode, the parties might verbally negotiate that they want to send a document via fax terminals. In this manual communication mode, the fax terminal which sends a document shall be defined as the call terminal and it uses the call modem procedure in ITU-T Recs V.8 and V.34. The fax terminal which receives a document shall be defined as the answer terminal and it uses the answer modem procedure in ITU-T Recs V.8 and V.34. The designation remains valid for the duration of the ensuing facsimile communication. The terminal which intends to send a document shall detect ANSam and send CM. The terminal which intends to receive a document shall enter the V.8 procedure by sending ANSam. Afterwards the call terminal and answer terminal procedures will be followed by the corresponding terminal regardless of which is the original caller.

6.2 The procedure for selecting the relevant mode is shown in Figure 11. The procedures for duplex and half-duplex operation are contained in Annexes C and F, respectively.

6.2.1 Optional codepoints are available during the V.8 procedure to select. Extended Negotiations. The procedures for selecting Extended Negotiations via V.8 are for further study.

T0829320-00/d034
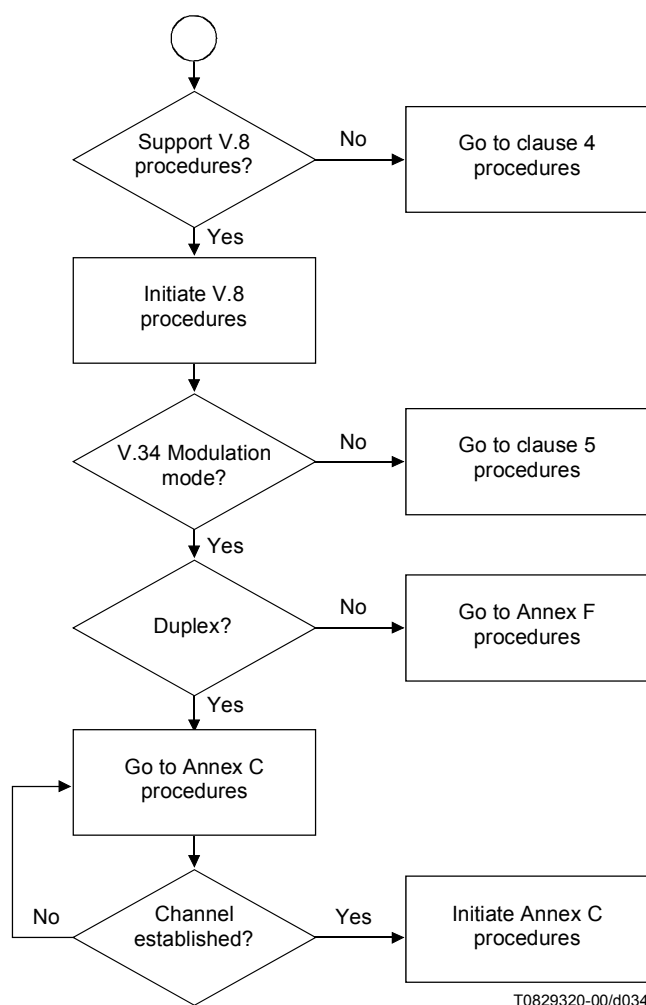
Figure 11/T.30

Annex A

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

A.1 Introduction

A.1.1 This annex is intended to apply to document facsimile terminals covered by Annex A/T.4. It describes the procedures and signals to be used where terminal incorporates error correction capabilities. When existing terminals are operating in a non ITU-T manner, they shall not interfere with terminals operating 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 receiving terminal can express a preference for the frame size by using the DIS/DTC command.

The transmitting terminal divides the coded data specified in clause 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 terminal 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 terminal 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 clause 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 are of variable length and contain the specific information for the control and message interchange between two facsimile terminals. 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 terminal which receives a valid DIS signal;

   – X is set to "0" by the terminal which receives a valid and appropriate response to a DIS signal;

   – X will remain unchanged until the terminal 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 terminal shall continue to correct the previous message. This is a response to the 4th PPR received, and indicates that the transmitting terminal 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 bits 1-16 of DCS standard command (see Table 2). The receiving terminal uses only bits 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 included in the 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.

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.

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

Format: X111 0110

NOTE 1 – This signal is defined for flow control.

NOTE 2 – For flow control, refer to A.5.

Figure A.1/T.30
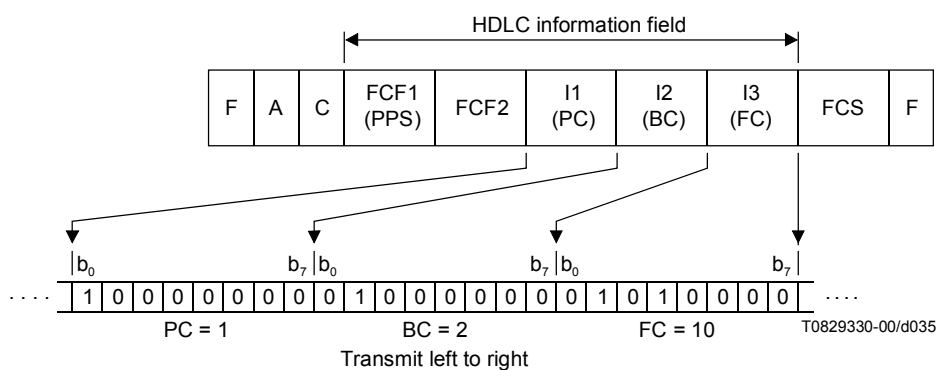
FCF1 Facsimile control field 1: Extension signal for error correction (PPS)
FCF2 Facsimile control field 2: Post-message command (NULL, MPS, EOM, EOP, EOS and PRI-Q)
I1(PC) Information field 1: Page counter (8 bits: modulo 256)
I2(BC) Information field 2: Block counter (8 bits: modulo 256)
I3(FC) Information field 3: (Number of frames) – 1 in each partial page (8 bits: maximum 255)

NOTE 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 0000	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 1000	EOS 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.

NOTE 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.

NOTE 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.

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

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

Figure A.1/T.30

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

HDLC
information
field

| F | A | C | FCF1 (EOR) | FCF2 | FCS | F |

T0830130-00/d036
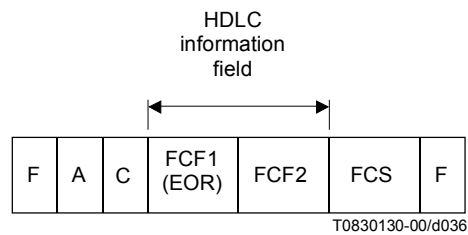
FCF1   Facsimile control field 1: Extension signal for error correction (EOR)
FCF2   Facsimile control field 2: Post-message command (NULL, MPS, EOM, EOP and PRI-Q)

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

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 of PPR response is shown in Figure A.3.

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

NOTE 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.)

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

HDLC
information field

| Flag | Address | Control | FCF (PPR) | FIF | FCS | Flag |

0 1 2 3   255 bits

FIF: | 0 | 0 | 1 | 0 | . . . . | . . . . | 0 | 0 |

T0813280-93/d037
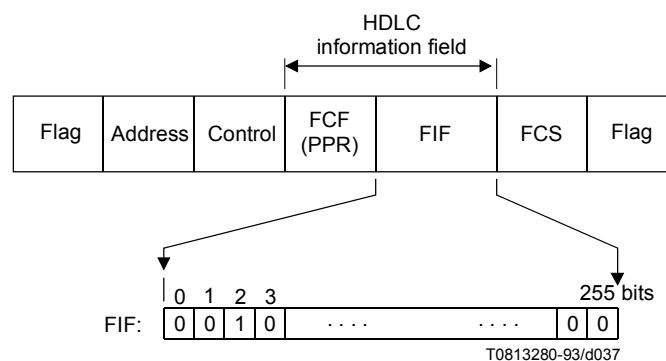
Figure A.3/T.30
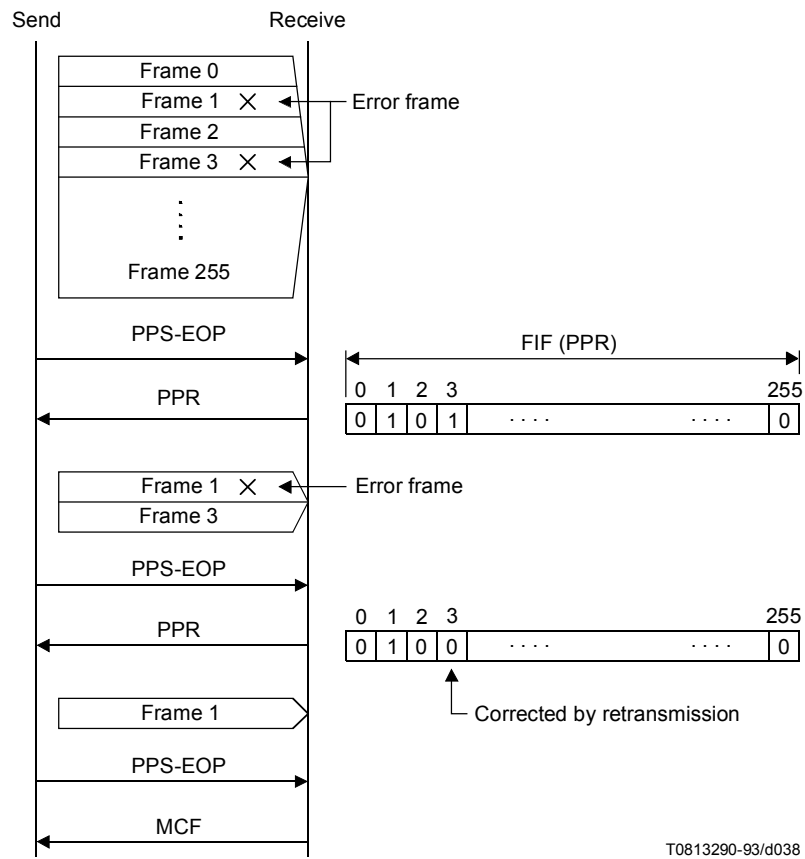
Figure A.4/T.30
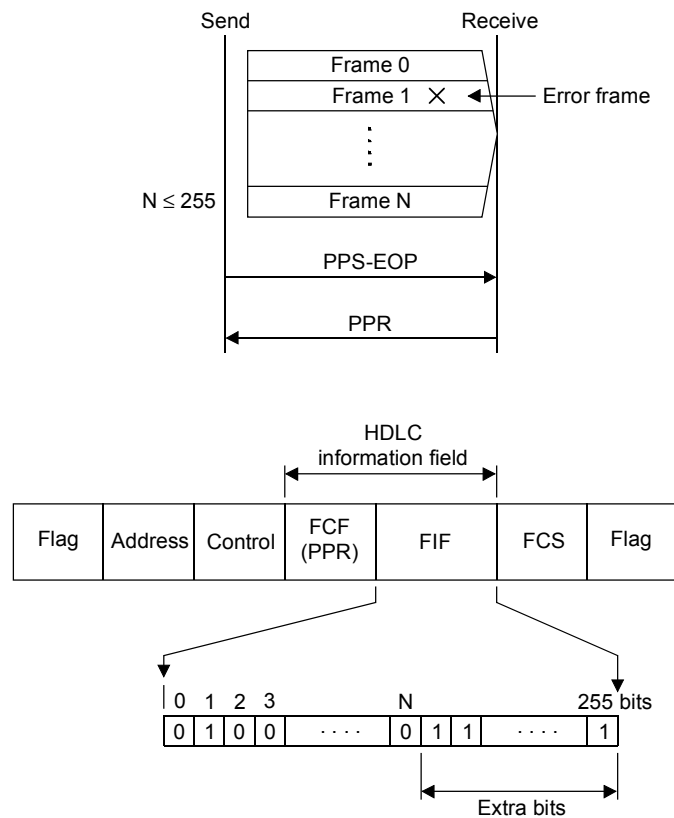
Figure A.5/T.30

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

   Format: X011 0111

   NOTE 3 – This signal is defined for flow control.

   NOTE 4 – For flow control, refer to A.5.

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

   Format: X011 1000

A.5 Flow control procedure

A.5.1 Flow control in the transmitting terminal 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 implement a control procedure to discard invalid frames which are obtained from erroneous flag sequences.

A.5.4 Flow control in the receiving terminal is made using RR/RNR signals as shown in Figure A.6.
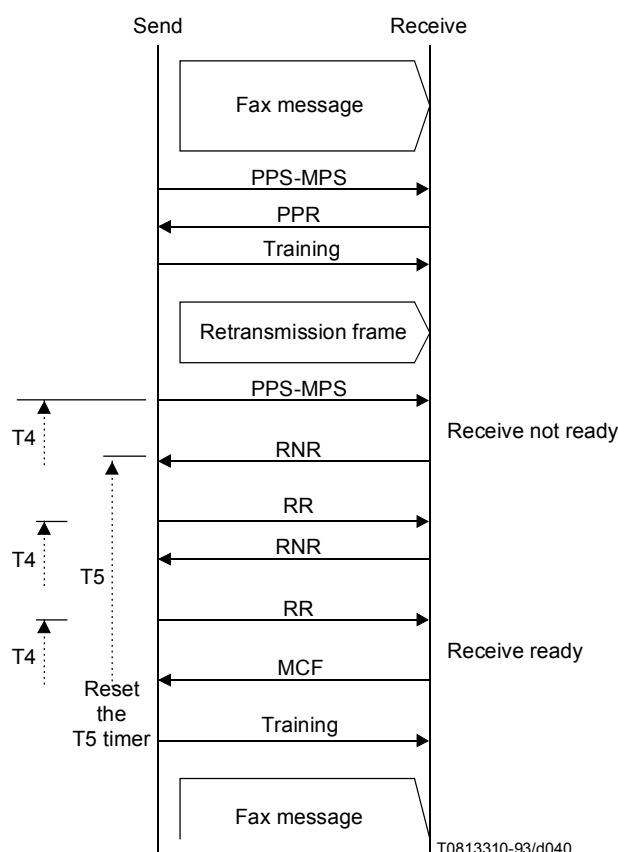
Figure A.6/T.30

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 in 5.2 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 terminals.

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

The examples in Figure A.7 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 (ITU-T Recs V.27 *ter*, V.29, V.17, V.34) and (X, Y) means (page modulo number, block modulo number).

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

Calling terminal   **Called terminal**

CNG

CED

(NSF) (CSI) DIS

(TSI) DCS

Training, TCF

CFR

Training, FAX MSG

PPS-NULL (0, 0)

MCF

Training, FAX MSG

PPS-MPS (0, 1)

MCF

Training, FAX MSG

PPS-NULL (1, 0)

MCF

Training, FAX MSG

PPS-EOP (1, 1)

MCF

DCN

T0829340-00/d041
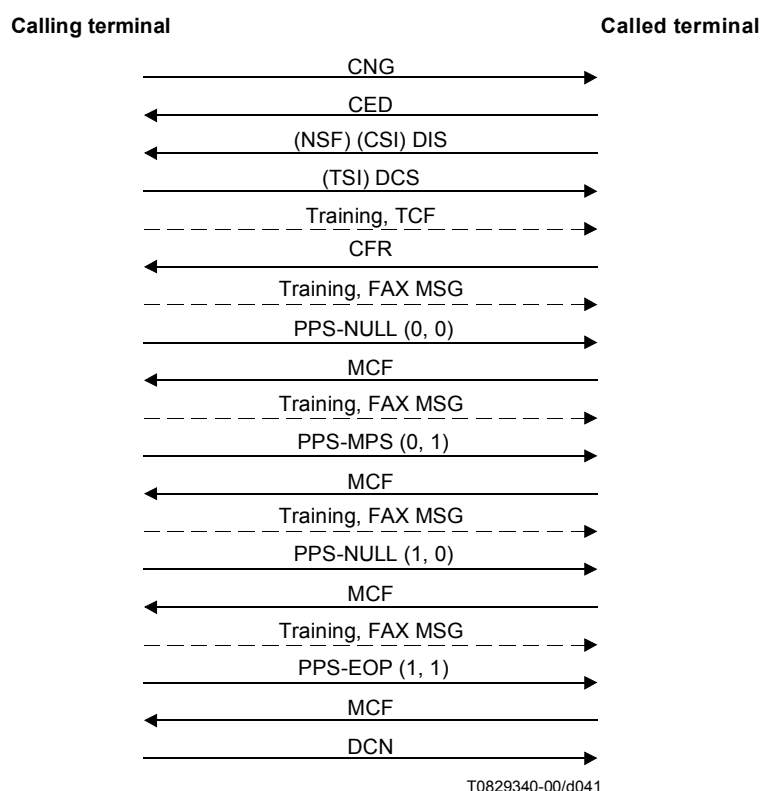
Figure A.7/T.30 (*sheet 1 of 13*)

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

Calling terminal   **Called terminal**

CNG

CED

(CSI) DIS

(TSI) DCS

Training, TCF

CFR

Training, FAX MSG   (error)

PPS-NULL (0, 0)

PPR

Training, FAX MSG (retransmit)

PPS-NULL (0, 0)

MCF

Training, FAX MSG

PPS-EOP (0, 1)

MCF

DCN

T0829350-00/d042
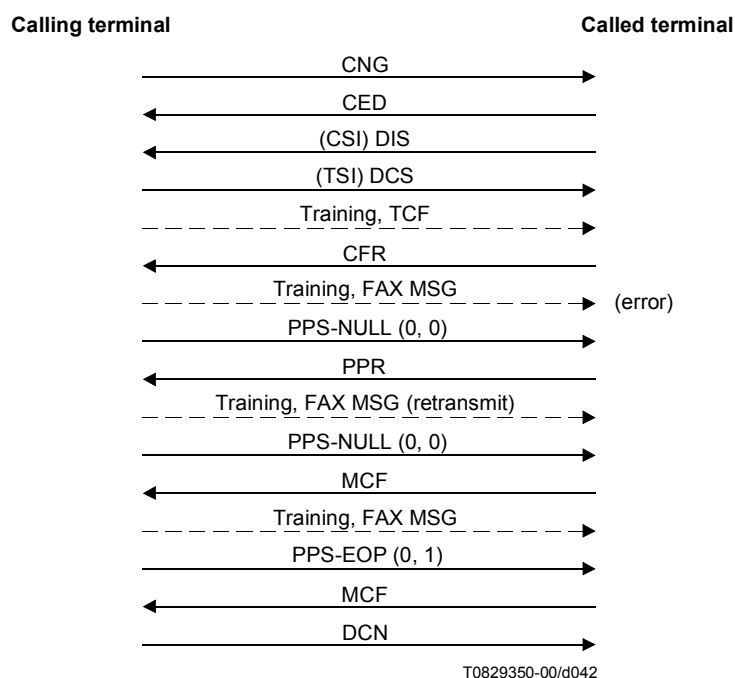
Figure A.7/T.30 (*sheet 2 of 13*)

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

Calling terminal   **Called terminal**

CNG

CED

(NSF) (CSI) DIS

(TSI) DCS

Training, TCF

CFR

Training, FAX MSG — (error)

PPS-MPS (0, 0)

PPR

Training, FAX MSG (retransmit) — (error)

PPS-MPS (0, 0)

PPR

Training, FAX MSG (retransmit)

PPS-MPS (0, 0)

MCF

Training, FAX MSG — (error)

PPS-EOP (1, 0)

PPR

Training, FAX MSG (retransmit)

PPS-EOP (1, 0)

MCF

DCN

T0829360-00/d043
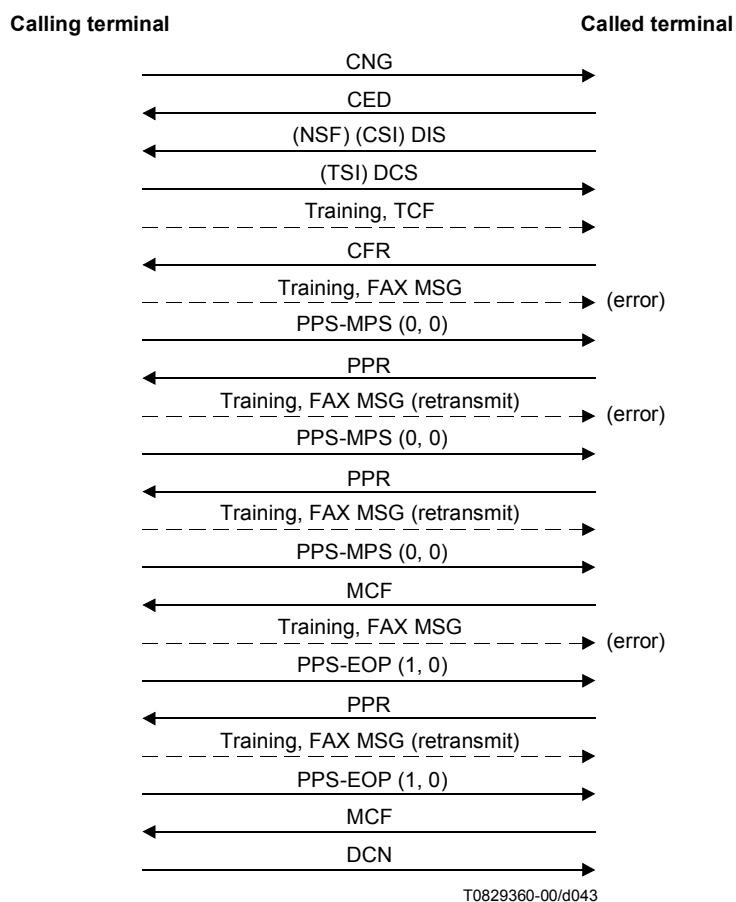
Figure A.7/T.30 (*sheet 3 of 13*)

Example 4   An auto calling terminal wishing to transmit to an auto answer terminal: example of first command failure with message errors.
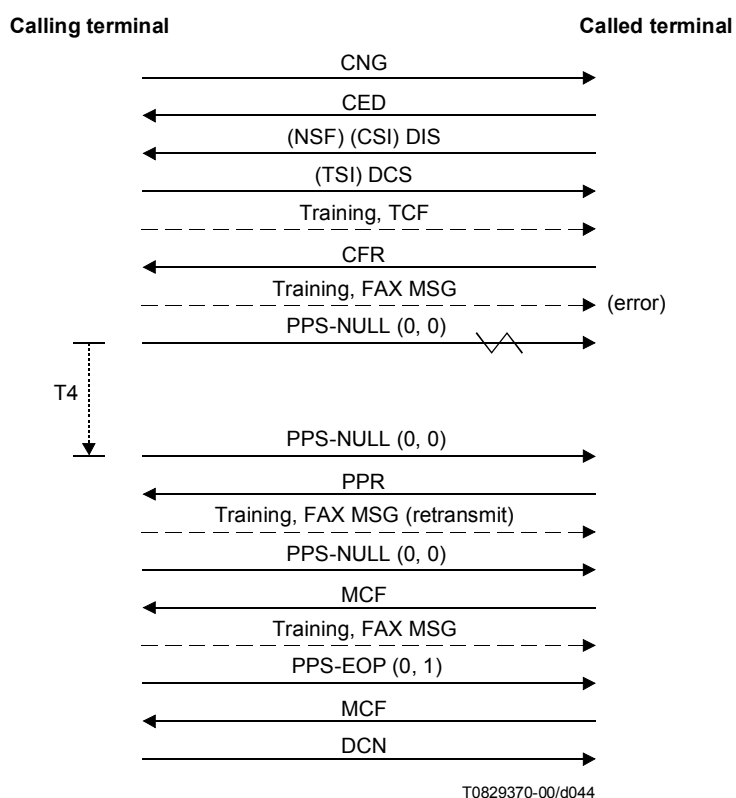
Figure A.7/T.30 (*sheet 4 of 13*)

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

Calling terminal   **Called terminal**

CNG	→
CED	←
(NSF) (CSI) DIS	←
(TSI) DCS	→
Training, TCF	→
CFR	←
Training, FAX MSG	→ (error)
PPS-NULL (0, 0)	→
PPR	←
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→
PPS-NULL (0, 0)	→
MCF	←
Training, FAX MSG	→
PPS-EOP (0, 1)	→
MCF	←
DCN	→

T4
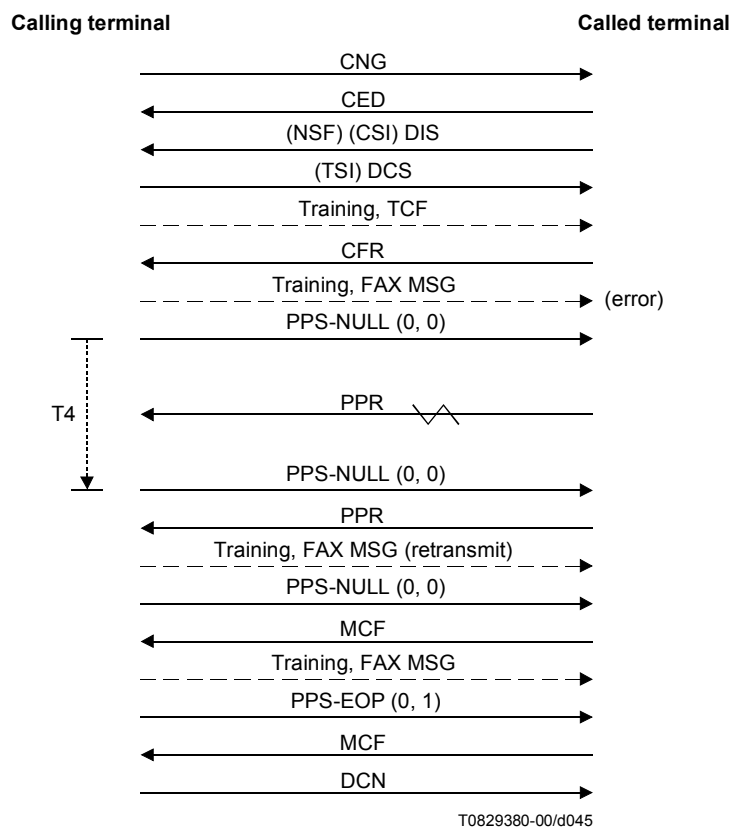
T0829380-00/d045

Figure A.7/T.30 (*sheet 5 of 13*)

Example 6   An auto calling terminal wishing to transmit to an auto answer terminal: example of fall-back (CTC).

Calling terminal   **Called terminal**

CNG	→
CED	←
(NSF) (CSI) DIS	←
(TSI) DCS	→
Training, TCF	→
CFR	←
Training, FAX MSG	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
CTC	→
CTR	←
Training, FAX MSG (retransmit)	→
PPS-NULL (0, 0)	→
MCF	←

T0829390-00/d046
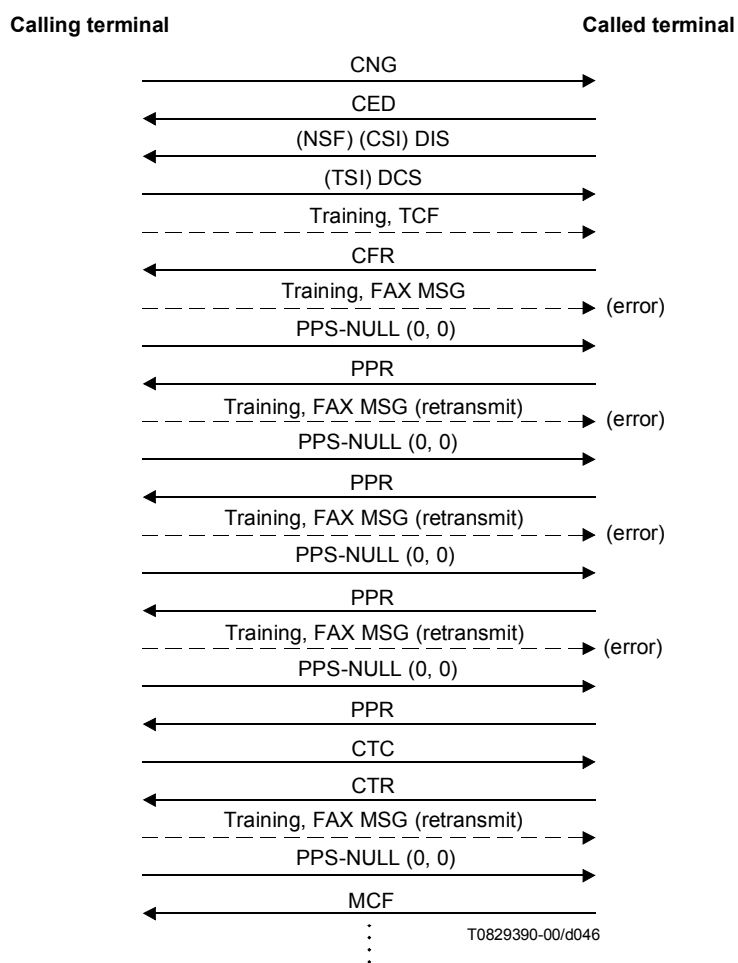
Figure A.7/T.30 (*sheet 6 of 13*)

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

Calling terminal   **Called terminal**

CNG →	
← CED	
← (NSF) (CSI) DIS	
(TSI) DCS →	
Training, TCF →	
← CFR	
Training, FAX MSG →	(error)
PPS-NULL (0, 0) →	
← PPR	
Training, FAX MSG (retransmit) →	
PPS-NULL (0, 0) →	MEMORY BUSY occurred
← RNR	
RR →	
← RNR	
RR →	
← MCF	
Training, FAX MSG →	
PPS-NULL (0, 1) →	
← MCF	

T5 ... Reset T5 timer

T0829400-00/d047
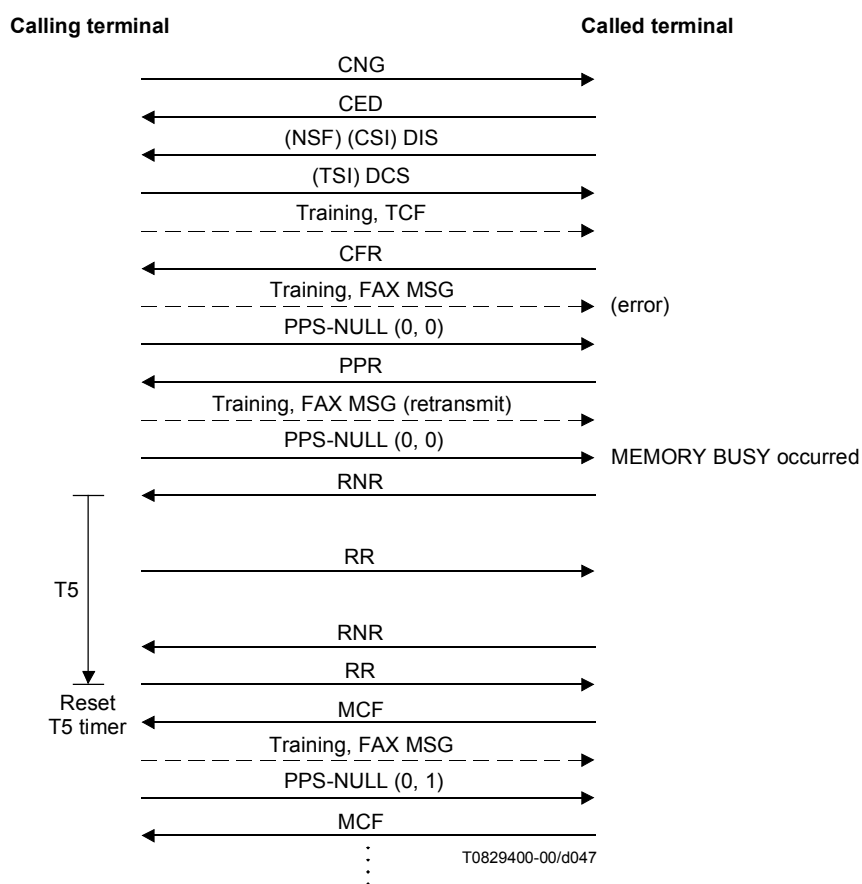
Figure A.7/T.30 (*sheet 7 of 13*)

Example 8   An auto calling terminal wishing to transmit to an auto answer terminal:
example of T5 time-out during flow control.
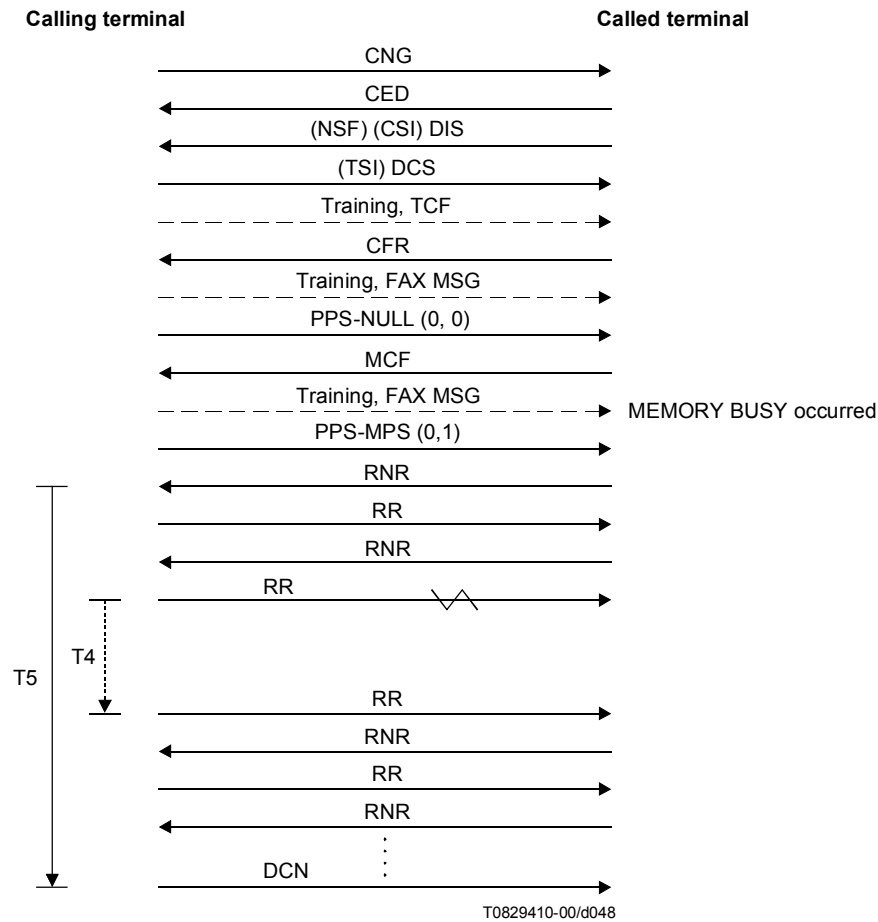
Figure A.7/T.30 (*sheet 8 of 13*)

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

Calling terminal   **Called terminal**

CNG
CED
(NSF) (CSI) DIS
(TSI) DCS
Training, TCF
(Request for operator intervention)   CFR
Training, FAX MSG   (error)
PPS-PRI-EOP (0, 0)

PPR
Training, FAX MSG (retransmit)
PPS-PRI-EOP (0, 0)   Alert operator
Alert operator   PIP
Operator on line   PRI-EOP   Operator on line

T0829420-00/d049
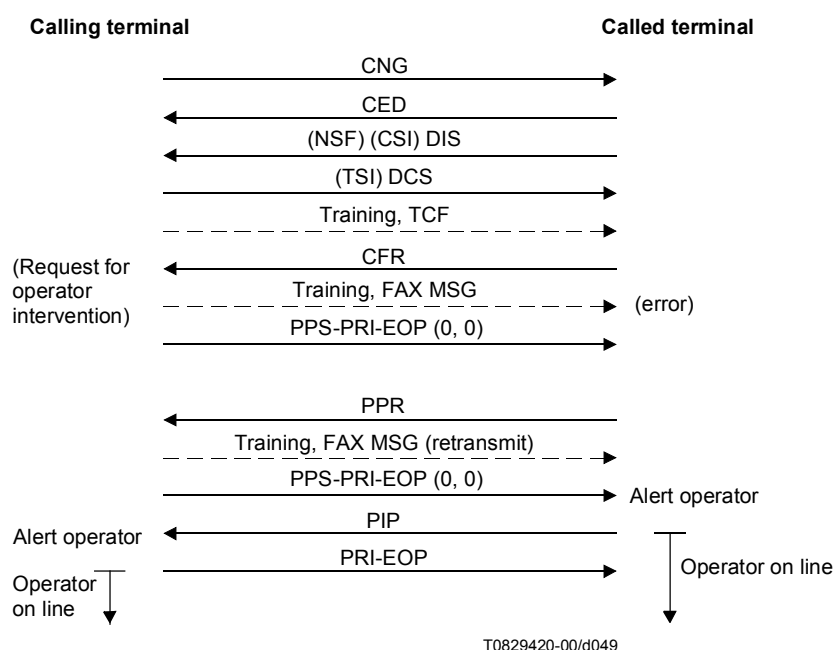
Figure A.7/T.30 (*sheet 9 of 13*)

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

Calling terminal   **Called terminal**

CNG
CED
(NSF) (CSI) DIS
(TSI) DCS
Training, TCF
CFR
Training, FAX MSG   (error) (Request for operator intervention)
PPS-MPS (0, 0)
PPR
Training, FAX MSG (retransmit)
PPS-MPS (0, 0)
Alert operator   PIP
PRI-Q   Alert operator
Operator on line (Operator will hear PIP response)   PIP
Operator on line

T0829430-00/d050
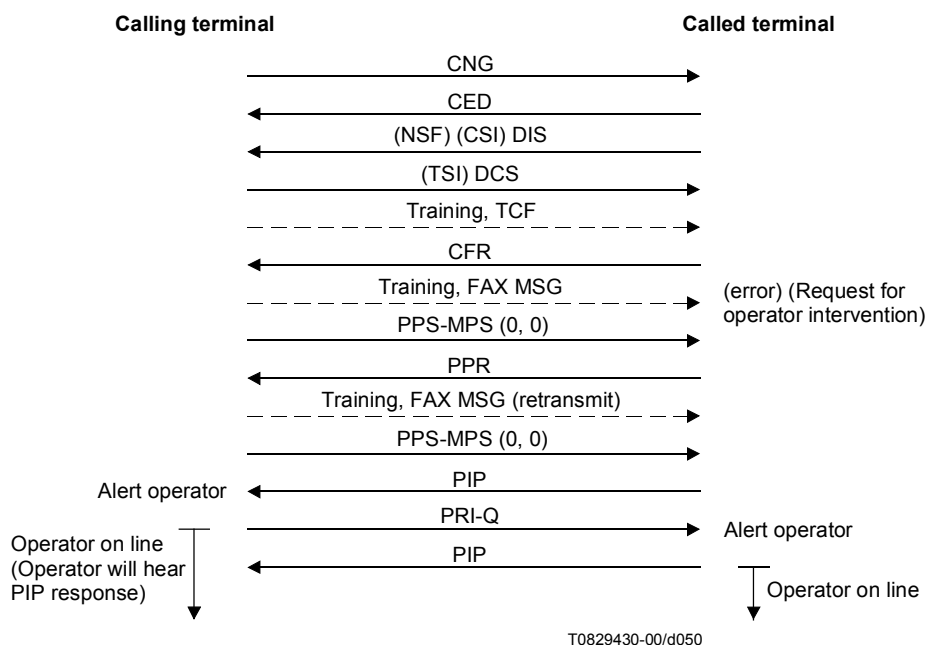
Figure A.7/T.30 (*sheet 10 of 13*)

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

Calling terminal   **Called terminal**
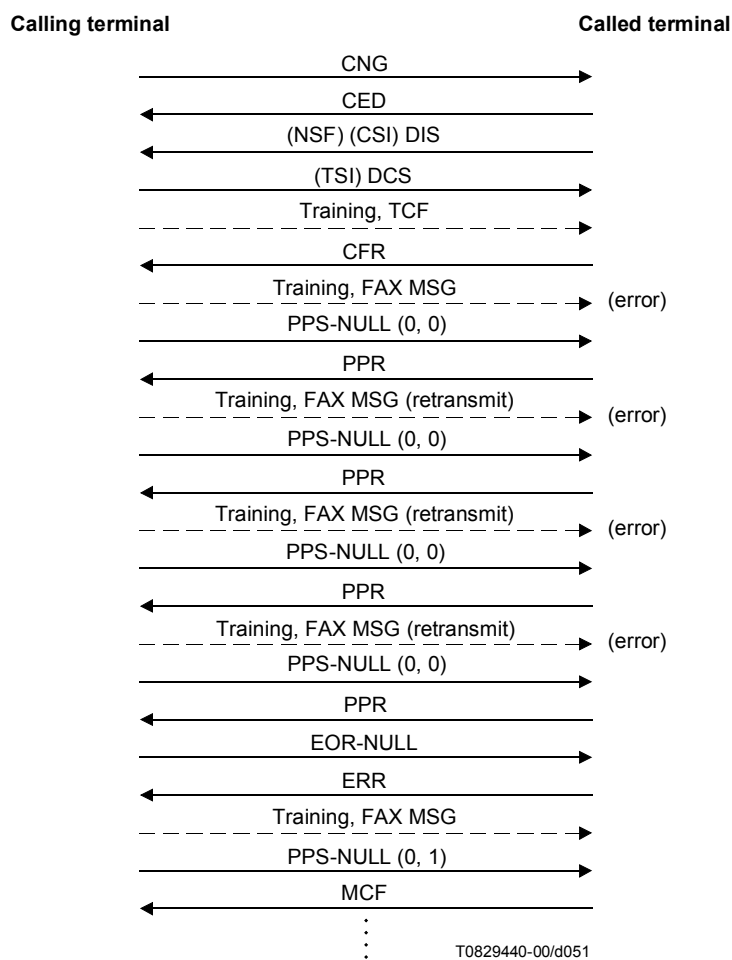
Figure A.7/T.30 (*sheet 11 of 13*)

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

Calling terminal   **Called terminal**

CNG	→
CED	←
(NSF) (CSI) DIS	←
(TSI) DCS	→
Training, TCF	→
CFR	←
Training, FAX MSG	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
Training, FAX MSG (retransmit)	→ (error)
PPS-NULL (0, 0)	→
PPR	←
EOR-MPS	→
ERR	←
Training, FAX MSG	→
PPS-NULL (1, 0)	→
MCF	←

T0829450-00/d052
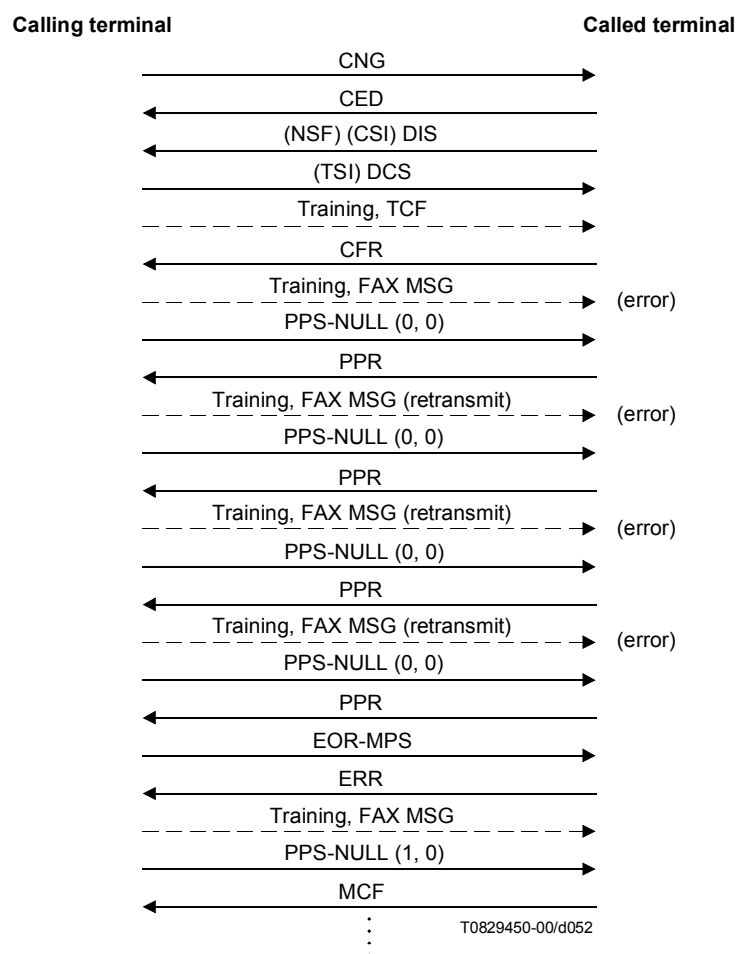
Figure A.7/T.30 (*sheet 12 of 13*)

Example 13   An auto calling terminal wishing to transmit to an auto answer terminal: example of all frames and flag sequences in FAX MSG failure to receive.
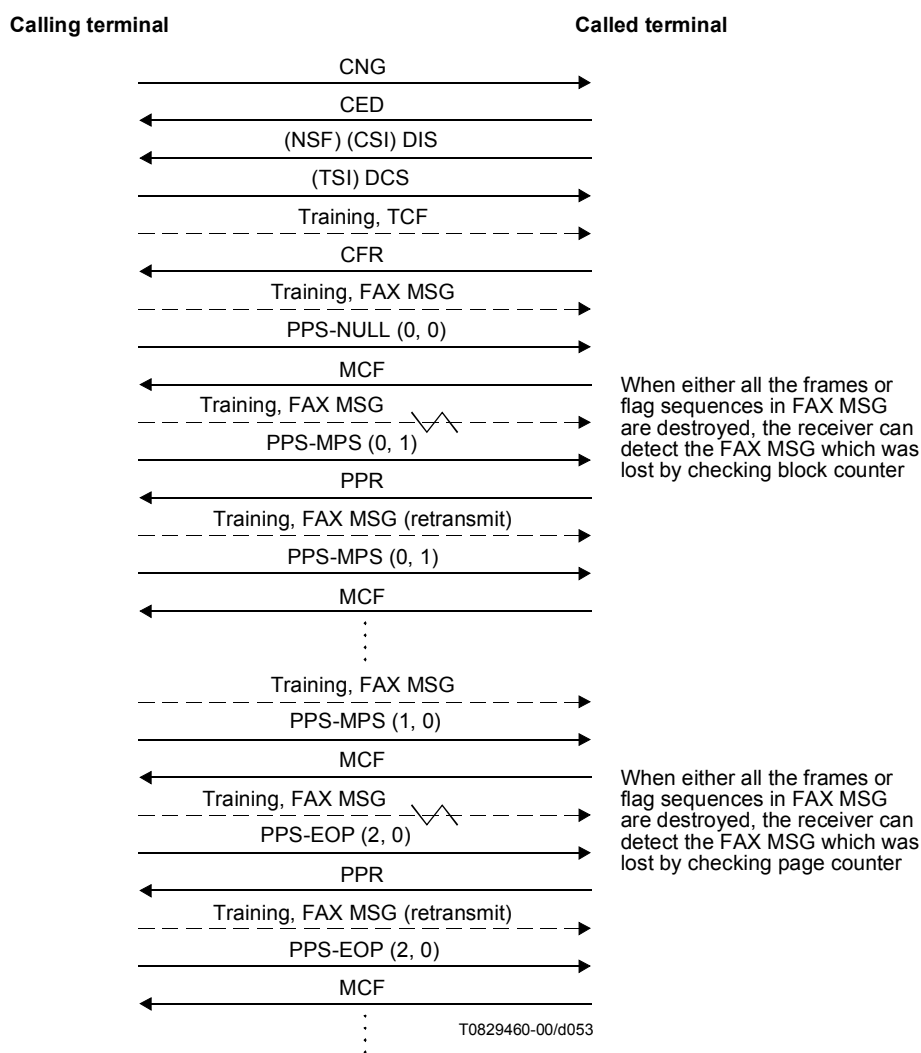
Figure A.7/T.30 (*sheet 13 of 13*)

Annex B

BFT diagnostic message

B.1   Introduction

This annex defines the signals and procedures which shall be used when conducting Binary File Transfer (BFT) or BFT negotiation operations within Group 3 facsimile. The syntax and use of the file diagnostic message (FDM) frame within Group 3 facsimile are defined. The methods which are described shall be applicable when using the Binary File Transfer format defined within ITU-T Rec. T.434. The purpose of BFT negotiations within Group 3 facsimile is to confirm that the attributes of a file transfer request will be acceptable to the receiver prior to the actual transfer of binary file data.

B.2 Normative references

The following ITU-T Recommendations contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations indicated below. A list of the currently valid ITU-T Recommendations is regularly published.

–   ITU-T Recommendation T.434 (1999), *Binary file transfer format for the telematic services*.

–   ITU-T Recommendation X.680 (2002) | ISO/IEC 8824-1:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

B.3 Definitions

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 semantics and the syntax of the FDM are described in ITU-T Rec. T.434 and extended for use in Group 3 facsimile within this annex (see B.8.2.1).

B.4 Signals and components for BFT file transfer operations

B.4.1 Diagnostic messages in Group 3 facsimile

The file diagnostic message may be used during BFT file transfer operations or as part of BFT negotiations within Phase C of the facsimile procedure. The syntax and procedures for use of diagnostic messages within Group 3 facsimile file transfer procedures are defined below. The use of diagnostic messages during BFT negotiations in Phase C is defined in B.6.3.1.

B.4.2 Use of diagnostic messages during file transfer operations

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 set-up for the current binary file being transmitted. Control will continue as though four PPRs were received (emission of CTC command).

B.4.3 Syntax of FDM Facsimile Information field

The syntax for the FDM Facsimile Information field is defined in B.8.2.

B.5 Service models for BFT negotiations

There are two service models for Binary File Transfer negotiations within Group 3 facsimile. The two models are:

1) File Transfer Request;

2) Identification of Capabilities.

Depending upon the application, elements of one or both service models may be used in order to successfully complete a BFT negotiation. The two service models are defined below.

B.5.1 File Transfer Request

When this service model is used, the facsimile transmitter makes a File Transfer Request and the receiver responds with either a positive or negative acknowledgement. If the initial request is not accepted, the transmitter may choose to make additional requests.

B.5.2 Identification of Capabilities

In this service model, the called facsimile terminal identifies its file transfer capabilities, optionally including a list of support file types, and then the sender makes a selection from the list of supported capabilities.

B.6 Signals and components for BFT negotiations

It is possible to conduct Binary File Transfer negotiations via either a simple Phase C mode, using the traditional DIS/DTC/DCS negotiations or in an extended, Phase B, mode, using extended signals. The signals and settings which are used for the simple mode and the extended mode are defined below.

B.6.1 Settings for DIS/DTC bits

A receiver shall indicate support for the simple Phase C method by setting bit 99 within the DIS or DTC to "1". A transmitter may indicate the intention to proceed with a file request using the simple Phase C method by setting bit 99 within the DCS.

A receiver shall indicate support for the extended Phase B method, by setting bit 100 in the DIS or DTC to "1", and by using the extended settings as shown in the next clause.

B.6.2 Settings for extended signals

Extended signals protocol may optionally be used to conduct Binary File Transfer negotiations that support extended features. The extended features may include:

1) identification of BFT capabilities;

2) conducting single or multi-pass BFT negotiations via the file request method within Phase B of the Group 3 facsimile procedure.

The use of the extended signals to select further BFT negotiations method via the Phase C method is for further study.

The following signals are used for Phase B negotiations:

– FNV, RNR and RR as defined in the main body of this Recommendation (see 5.3);

– DES, DER, DTR, DEC, TNR, TR, DNK as defined in Annex H (see H.6.1).

Supergroups

The following Supergroup 8 bit code should be used to introduce the groups which are applicable for extended Binary File Transfer Negotiations: "0000 0100".

Groups

The groups which may be used for extended Binary File Transfer negotiations are shown below.

Table B.1/T.30 – Groups for Binary File Transfer negotiations

Group code	Name	Data content	Description
0000 0001	Negotiations	Bit settings defined in Table B.2	Define bit settings for Phase B
0000 0010	Transfer Request	See guidelines in B.7.1.	Transmitter presents tags for a file transfer request.
0000 0011	File Types	See guidelines in B.7.2.	Receiver presents a list of supported binary file types.
0000 0101	Media types	See guidelines in B.7.2.	Receiver presents a list of supported media methods
0000 0100	Compression Types	See guidelines in B.7.2.	Receiver presents a list of supported compression methods.
0000 0101	Capabilities Request	Bit settings as defined in Table B.3	Request to see if receiver supports specific lists of capabilities
NOTE – The unused bits of this value octet are set to "0" by default.			

Table B.2/T.30 – Coding of the value octet for the negotiations group

Meaning of codes	Coding of the value octet of the negotiations group
Reserved for Simple Phase C BFT Negotiations Capability/Command	Bit No. 7 6 5 4 3 2 1 0 1 x x x x x x x
Extended BFT Negotiations Capability/Command	Bit No. 7 6 5 4 3 2 1 0 x 1 x x x x x x
Bits 0 to 5 are reserved for future use	Bit No. 7 6 5 4 3 2 1 0 x x x x x x x x
NOTE – The unused bits of this value octet are set to "0" by default.	

Table B.3/T.30 – Coding of the value octet for the Capabilities Request group

Meaning of codes	Coding of the value octet of the negotiations group
Request List of Supported File Types	Bit No. 7 6 5 4 3 2 1 0 1 x x x x x x x
Request list of Supported Compression Types	Bit No. 7 6 5 4 3 2 1 0 x 1 x x x x x x
Request List of Supported Media Types	Bit No. 7 6 5 4 3 2 1 0 x x 1 x x x x x
Bits 0 to 4 are reserved for future use	Bit No. 7 6 5 4 3 2 1 0 x x x x x x x x

B.6.3   Use of Group 3 Fax Signals for BFT negotiations

B.6.3.1   Simple Phase C method

The Simple Phase C method for BFT negotiations may be selected using the traditional DIS/DTC negotiations method. A file transfer request using the Simple Phase C method is submitted by

presenting BFT negotiations data within Facsimile Coded Data frames available within Group 3 error correction mode. The MCF (message confirmation) signal is used to accept the file request and the File Diagnostic Message (FDM) is used to reject the file request. The syntax of the FIF of the FDM signal for Group 3 facsimile is defined in B.8.2.1.

B.6.3.2   Extended Method – Phase B

A facsimile receiver may identify its BFT negotiations capabilities, optionally including lists of supported file types and values for other BFT attributes, using the DES signal. Where applicable, for polling operations, a terminal may identify its BFT negotiations capabilities using the DTR signal.

The following extended signals may be used when conducting file transfer negotiations within Phase B: DES, DEC, DER, DTR.

The FNV signal shall be used for the purpose of a negative acknowledgement, when it is necessary to reject all or part of a BFT file request via Phase B. Per Annex H, when all extended negotiations are complete, the CFR signal is issued by the receiver.

The following signals may be used for flow control during Phase B, per the procedures defined within H.6.3: TNR, TR, RNR, RR. The FNV and DNK signals provide error control features as defined within H.6.

B.7   Procedures for BFT negotiations

B.7.1   File Transfer Request

B.7.1.1   Phase C method

A receiver shall indicate support for the Phase C method by setting bit 99 within the DIS or DTC to "1". A transmitter may indicate the intention to proceed with a file request using the Phase C method by setting bit 99 within the DCS.

B.7.1.2   Phase B method

A transmitting terminal may issue a file transfer request within Phase B by using either the DER or DEC signal, where the FIF shall include the BFT Negotiations supergroup and the Transfer Request group. The data content of the Transfer Request group shall consist of all or a subset of the T.434 tags for the proposed file transfer (see B.7.2.1). The DER signal shall be used where additional information is needed from the receiver before completing the negotiation. The DEC signal shall be used when issuing a command where further information is not requested from the receiver.

B.7.2   Identification of Capabilities

A called or receiving terminal may identify its BFT capabilities using the DES signal (or the DTR signal when polled operations are to be requested). The capabilities are contained within the Facsimile Information Field of the DES/DTR and are encoded using the BFT supergroup and one or more related groups. The terminal indicates support for BFT negotiations using the Negotiations group. The terminal may indicate support for specific capabilities using the following groups:

1)   File Types – list of supported BFT file types.

2)   Compression Types – list of supported BFT compression types.

3)   Media Types – list of supported BFT media types.

NOTE – Identification of Capabilities is only available with the Phase B method.

B.7.3 BFT File Transfer Response

B.7.3.1 Simple Phase C method

The receiver indicates acceptance of a file transfer request by issuing an MCF signal. The receiver may reject a file transfer request by issuing an FDM signal containing a T.434 diagnostic message code indicating the reason for the rejection. The receiver may optionally return the T.434 tags and values which are not accepted as part of the FDM diagnostic information.

B.7.3.2 Enhanced Phase B method

The receiver indicates acceptance of a file transfer request by issuing a DES signal in response to a request made via the DER signal or a CFR in response to the DEC command. The receiver may reject a file transfer request by issuing an FNV signal with the BFT negotiations reason code set and is required to return a T.434 diagnostic message code indicating the reason for the rejection. The receiver may optionally return the T.434 tags and values which are not accepted as part of the FNV diagnostic information.

B.8 Presentation of BFT negotiations data

This clause offers rules on how BFT data should be presented during BFT negotiations and syntax for the related signals.

B.8.1 BFT File Transfer Request

For a binary file transfer request, the full ASN.1 coding for a BINARY-DATA-Message shall be used as defined in ITU-T Rec. T.434. All or a subset of the tags may be presented during the request. The data-contents tag, length and value may be omitted. Only definite length coding shall be used.

B.8.1.1 Phase C method File Transfer Request

Syntax for Phase C method Transfer Request:

Phase C Signal ::= <T.434 Binary Data Message>

B.8.1.2 Phase B method File Transfer Request

Syntax for Phase B method Transfer Request:

Phase B method signal: DER or DEC.

Group Structure:

Tag Encoded Data ::=

<BFT Negotiations SG><SG Length>< Transfer Request Group Tag><Group Length><Group Value>

<Group Value> ::= <T.434 Binary Data Message>

B.8.2 BFT File Transfer Response

For a response to a BFT File Transfer request, the following presentation rules apply:

1) Only definite length coding is permitted.

2) If multiple tags are to be returned, use the "IMPLICIT SEQUENCE OF SEQUENCE" coding.

3) If only a single tag is to be returned, only present the ASN.1 syntax for that tag (and data as applicable).

B.8.2.1   Phase C method File Transfer Response

Phase C method signals: FDM, MCF.

Syntax for FDM Response

FIF ::= <Diagnostic Code>[<Frame Number><Diagnostic Information>]

where the <Diagnostic Information> ::= <Length><Rejected T.434 data>

The structure of the octets of the FIF for the FDM frame shall be as follows:

Octet	Contents	Requirements	Additional comments
First	Diagnostic code	Mandatory	Values defined in Table B.3/T.434
Second	Frame number	Optional	To allow multi-frame responses.
Additional octets	Diagnostic information	Optional	Structure for rejected T.434 data

The format of the rejected T.434 data shall follow the rules defined in B.8.2.

B.8.2.2   Phase B Method File Transfer Response

Phase B method signals: FNV, DES, CFR.

Syntax for FNV Response.

FNV bit setting for BFT Negotiations Rejection: bit n

FIF ::= <first octet><extend octet><frame_number><FDM_diagnostic_code><length><rejected_T434_data>

The rejected T.434 data are coded based on the presentation rules for responses. The values for the FDM_diagnostic_code are contained in Table B.3/T.434.

B.8.3   Lists of Capabilities

For lists of capabilities of a single attribute, called terminals or receivers use the ASN.1 "OF" syntax, followed by the list of tags and values. The following rules apply:

–   Only definite length coding is permitted.

–   Fax transmitters may make a specific request for lists of capabilities using the "Capabilities Request" group, whose structure and syntax is defined in B.8.4.

B.8.3.1   Syntax for File Types Capability List

Phase B method signal: DES or DTR.

Group Structure:

Tag Encoded Data ::=

<BFT Negotiations SG><SG Length><File Types Group Tag><Group Length><Group Value>

<Group Value> ::= <SEQUENCE OF OBJECT IDENTIFIER >

B.8.3.2   Syntax for Compression Types Capability List

Phase B method signal: DES or DTR.

Group Structure:

Tag Encoded Data ::=

<BFT Negotiations SG><SG Length><Compression Types Group Tag><Group Length><Group Value>

<Group Value> ::= <SEQUENCE OF OBJECT IDENTIFIER >

B.8.3.3 Syntax for Media Types Capability List

B method signal: DES or DTR.

Group Structure:

Tag Encoded Data ::=

<BFT Negotiations SG><SG Length><Media Types Group Tag><Group Length><Group Value>

<Group Value> ::= <SEQUENCE OF Mime-Media-Type-Attribute >

NOTE – The syntax of the Mime-Media-Type-Attribute is defined in ITU-T Rec. T.434.

B.8.4 Capabilities Request

Transmitters may make a specific request for lists of capabilities using the "Capabilities Request" group. One or more requests may be made at a time, depending upon the bit settings for the group value octet.

B.8.4.1 Syntax for Capabilities Request

B Method signal: DER.

Group Structure:

Tag Encoded Data ::=

<BFT Negotiations SG><SG Length><Capabilities Request Group Tag><Group Length><Group Value>

The group value is a single octet as defined in Table B.3.

Annex C

Procedure for Group 3 document facsimile transmission on the Integrated Services Digital Network or on the GSTN using duplex modulation systems

C.1 Introduction

C.1.1 This annex describes the protocol used by Group 3 document facsimile terminals when operating over the Integrated Services Digital Network. Optionally, the protocols described in this annex may be used on digital networks other than the ISDN. The protocols described in this annex may also be used on the GSTN using modulation schemes. The procedures and signals used are based upon those defined in the main body as well as in Annex A. The protocol operates in either half-duplex only or duplex and half-duplex mode. In both cases, error correction is an integral part of the protocol. The Group 3 facsimile option described in this annex may be referred to as Group 3 Option C or Group 3C.

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 terminal 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 terminal uses a frame size of 256 octets as indicated in the DCS command and the receiving terminal must be able to receive a frame of that size. Optionally, when operating over analogue networks, a frame size of 64 octets may be indicated by the transmitting terminal.

In the duplex mode of operation, the transmitting terminal 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.

When the previous message has not been satisfactorily received, the receiving terminal 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 terminal 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.

The format of the initial identification is a repeated sequence of XID + DIS or XID + NSF + DIS or XID + NSF + CSI + DIS sent three times concatenated together followed by 256 flags. This sequence is transmitted until a valid response is received from the calling terminal subject to a maximum time of 5 seconds.

The flow diagrams in C.5 do not address the issue of resilience against the remainder of the sequence but rather consider that this is implicitly ensured.

C.2 Definitions

C.2.1 When operating in the Group 3C mode, 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 in Annex A.

CIG   Calling subscriber identification (see Note)

CRP   Command repeat

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)
PPR	Partial page request
PPS-EOM	Partial page signal-End of message
PPS-EOP	Partial page signal-End of procedure
PPS-MPS	Partial page signal-Multipage signal
PPS-NULL	Partial page signal-null
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 Call establishment procedures

The call establishment procedures for this option are defined in Annex F/T.90.

C.3.2 Initial identification

Exchange identification procedure (XID) – This signal indicates that the called terminal has Group 3C capabilities and also can be used to facilitate identification of the characteristics of the remote terminal when interworking with other facsimile groups. This signal is defined in ITU-T Rec. T.90.

The format of the XID frame is defined in Annex F/T.90.

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.1.

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.2.

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 s, it may transmit DCN and enter Phase E.

Format: X011 0111
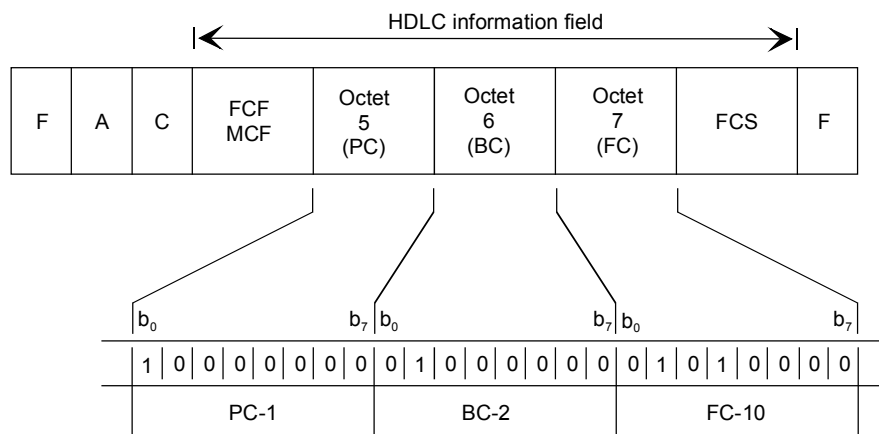
Octet 5(PC) Information field 1: Page counter (8 bits: modulo 256)
Octet 6(BC) Information field 2: Block counter (8 bits: modulo 256)
Octet 7(FC) Information field 3: (Number of frames) −1 in each partial
             page (8 bits: maximum 255)

NOTE 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.

NOTE 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.

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

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

Figure C.1/T.30

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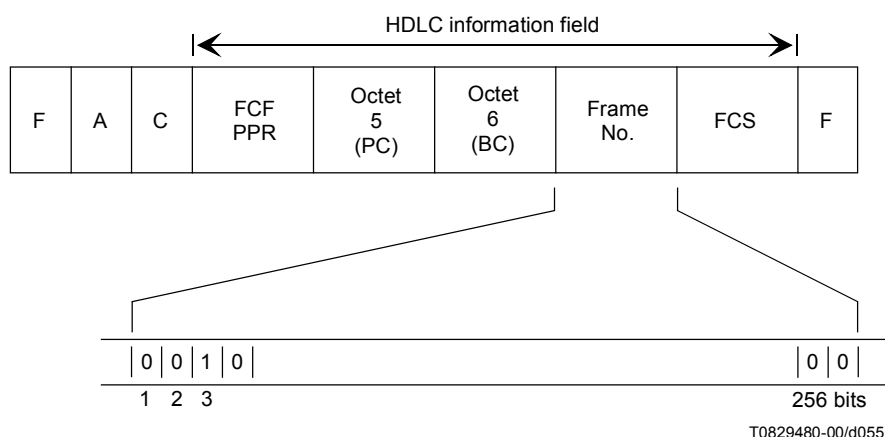
Octet 5(PC)   Page counter (8 bits: modulo 256)
Octet 6(BC)   Block counter (8 bits: modulo 256)

NOTE 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.

NOTE 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.

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

Figure C.2/T.30

C.3.6   Facsimile information field (FIF)

C.3.6.1   DIS standard capabilities

The bit assignment for this information is given in Table 2 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 2.

C.3.6.3   DTC standard command

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

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 terminal.

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.

C.3.7.2   Timing considerations

C.3.7.2.1   Time-outs

Time-out T6 defines the amount of time two terminals will continue to attempt to identify each other. T6 is 5 ± 0.5 s. 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 s. The time-out begins when initiating a command search (e.g., the first entrance into the "command received" subroutine – 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 terminal. T8 is 10 ± 1 s, 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 terminal 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 terminal is made using the RNR signal. An example is shown in Figure C.3.

C.5   Flow diagrams

The flow diagrams of Figures C.4 to C.23 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 terminals.

For the notes and an explanation of terms to the flow diagrams, see 5.2.1 and C.5.1.

C.5.1   Explanation of flow chart terms

Unless defined otherwise below, the definition of the flow chart terms is given in the main body and/or in Annex A.

COPY QUALITY OK	All message frames have been received correctly or have been corrected.
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.
RE-ISSUE COMMANDS	The "outstanding commands" are transmitted in their chronological order prior to transmission of the next page or partial page.

NOTE 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.

NOTE 2 – CRP is used only in the case of a pre-message command being received in error.

Send   Receive

Facsimile message	
PPS-EOP →	← Flags
PPS-EOP →	← PPR

Retransmission frames	
PPS-EOP →	← RNR Receive not ready
PPS-EOP →	← RNR
PPS-EOP →	← RNR
PPS-EOP →	← RNR
PPS-EOP →	← RNR
PPS-EOP →	← RNR Receive ready
PPS-EOP →	← MCF
DCN →	← Flags

T0807040-91/d056
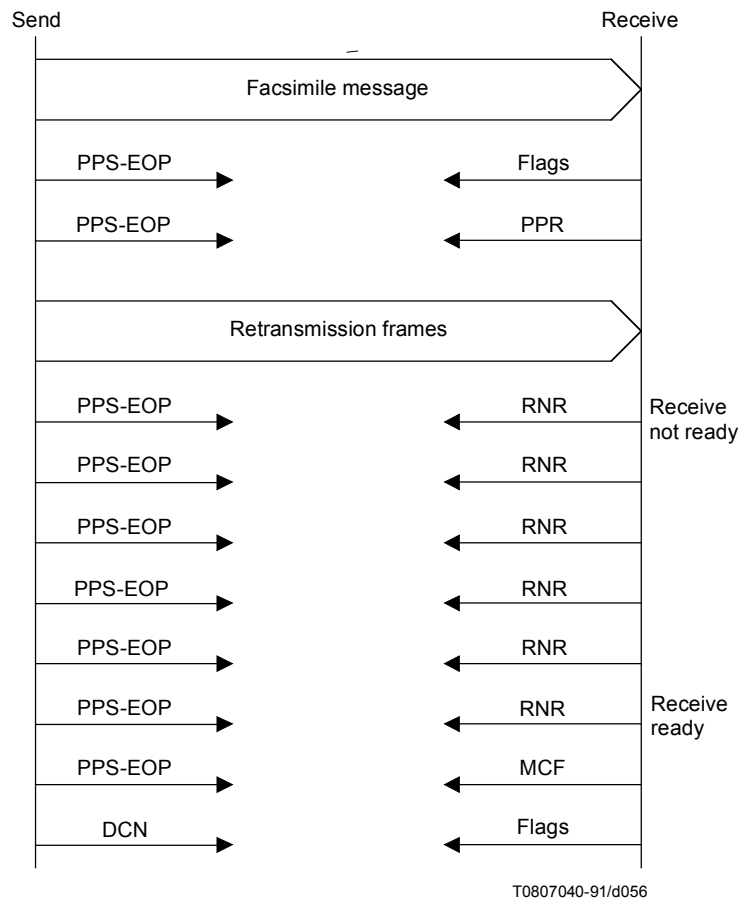
Figure C.3/T.30

Full duplex operation

Figure labels and text within the flowchart:

Transmitting terminal

T

Constitutes also the entry from Figure F.5/T.90 calling side

Put T6 = 0

No

T6 elapsed? — Yes → C

No — COMMAND REC? — Yes

DIS or DTC? — No → C

A → Yes

No — COMPT REMOTE REC? — Yes

No

COMPT REMOTE XMTR? — No → C

Doc to XMIT? — Yes ← D

Yes → R

C

SET MODE

Transmit DCN

Transmit (TSI) (NSS) or (TSI) DCS

K →

Disconnect the line

Transmit facsimile message

V

Timers
T6 = 5 ± 0.5 s
T7 = 6 ± 1 s
T8 = 10 ± 1 s
T9 = duration of 256 flags

T0829490-00/d057

Figure C.4/T.30

Transmitting terminal

```
                        ( V )
                          │
                          ▼
        No         ┌──────────────┐
◄────────────────  │   END OF     │
                   │   PAGE?      │
                   └──────────────┘
                          │ Yes              ┌──────────────┐
                          │◄─────────────────│  Interrupt   │
                          │                  │  (Note 1)    │
                          ▼                  └──────────────┘
        No         ┌──────────────┐
◄────────────────  │   LAST       │
                   │   DOC?       │
                   └──────────────┘
                          │ Yes
                          ▼
                   ┌──────────────┐    Yes
                   │   CHANGE     │───────────┐
                   │   MODE?      │           │
                   └──────────────┘           │
                          │ No                │
                          ▼                   ▼
   (Va)      (Vb)       (Vc)               (Vd)
```

T0807060-91/d058

Figure C.5/T.30

Transmitting terminal

Figure C.6/T.30

T0829500-00/d059

Transmitting terminal

Figure C.7/T.30

Transmitting terminal

Figure C.8/T.30

T0807090-91/d061

Transmitting terminal

T0807100-91/d062

Figure C.9/T.30

Figure C.10/T.30

Receiving terminal

R

Transmit
(NSF)(CSI)DIS
{(NSC)(CIG)DTC}

RESPONSE REC?

Yes

No

T6 elapsed?

No

Yes

C

F

COMMAND REC?

No

T7 elapsed?

Yes

PPS-EOM?

No

C

No

Yes

Yes

R

G

Yes

DTC?

Yes

D

No

DIS?

Yes

A

No

DCS?

No

VIII

Yes

S

Receive
Facsimile Message

F

T0817220-94/d064

Figure C.11/T.30

Receiving terminal

Figure C.12/T.30

T0807120-91/d065

Half-duplex operation

Transmitting terminal

Constitutes also the entry from
Figure F.5/T.90 calling side

T

Set
T6 = 0

No → COMMAND REC?

T6 elapsed? — Yes → C

No ← COMMAND REC? → Yes

DIS or DTC? — No → C

A → Yes

COMPT REMOTE REC? — No

COMPT REMOTE XMTR? — No → C

Yes → R

Doc to XMIT? — No

Yes → D

SET MODE

C

Transmit DCN

Transmit (TSI) (NSS) or (TSI) DCS

K →

Transmit Facsimile Message

Disconnect the line

V

Timers
T6 = 5 ± 0.5 s
T7 = 6 ± 1 s
T8 = 10 ± 1 s
T9 = duration of 256 flags

T0829510-00/d066

Figure C.13/T.30

Transmitting termimal
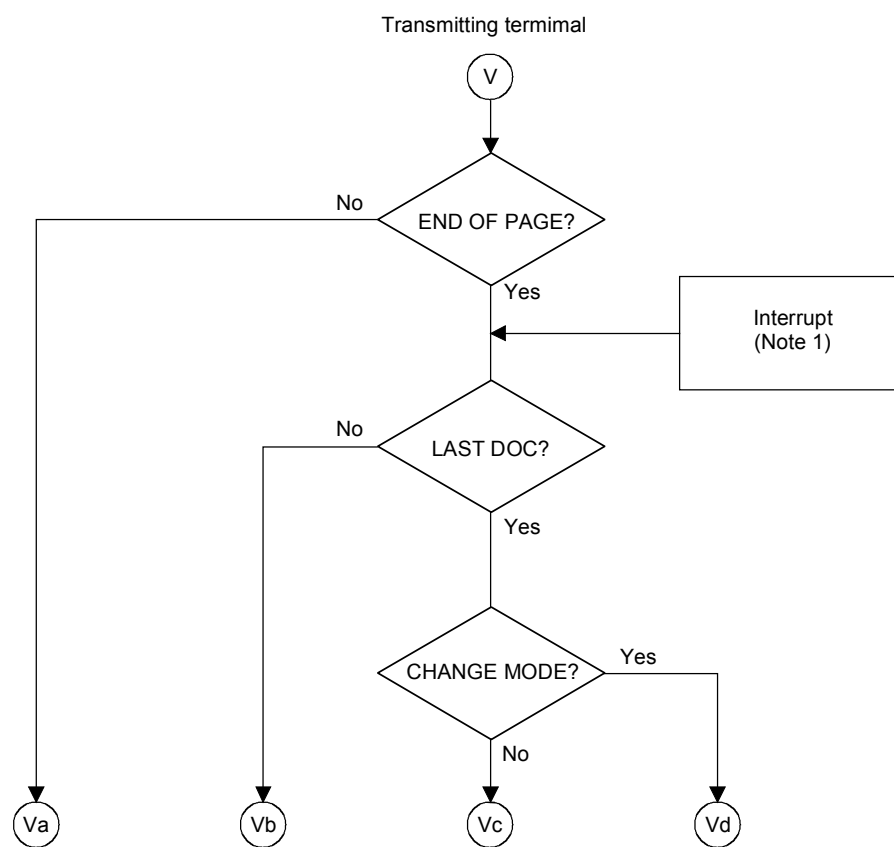
T0807140-91/d067

Figure C.14/T.30
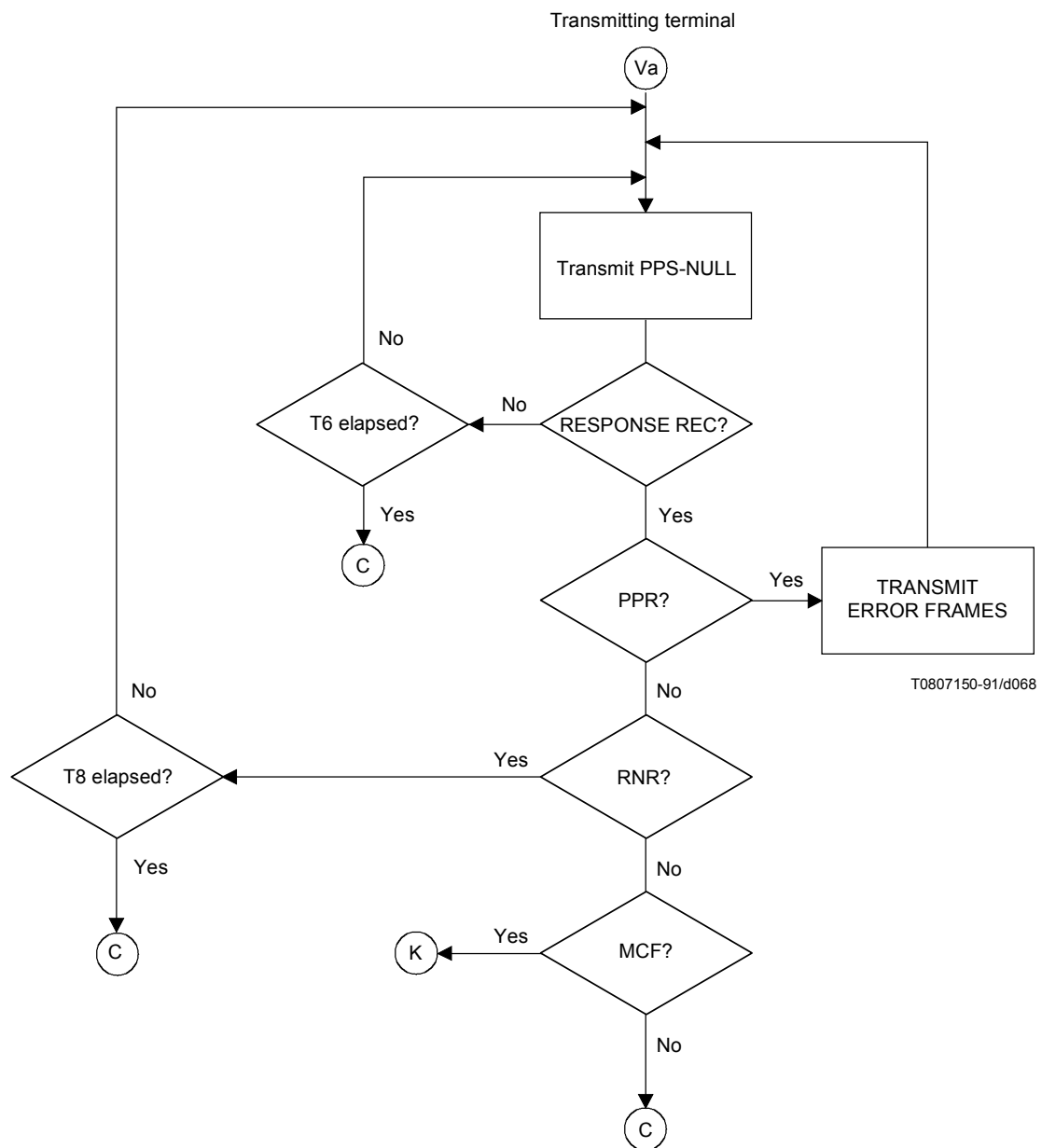
Transmitting terminal

Figure C.15/T.30

Transmitting terminal

Figure C.16/T.30

T0807160-91/d069

Transmitting terminal

Figure C.17/T.30

Transmitting terminal

Figure C.18/T.30

T0807180-91/d071

Figure C.19/T.30

Receiving terminal

T0817250-94/d073

Figure C.20/T.30

Receiving terminal
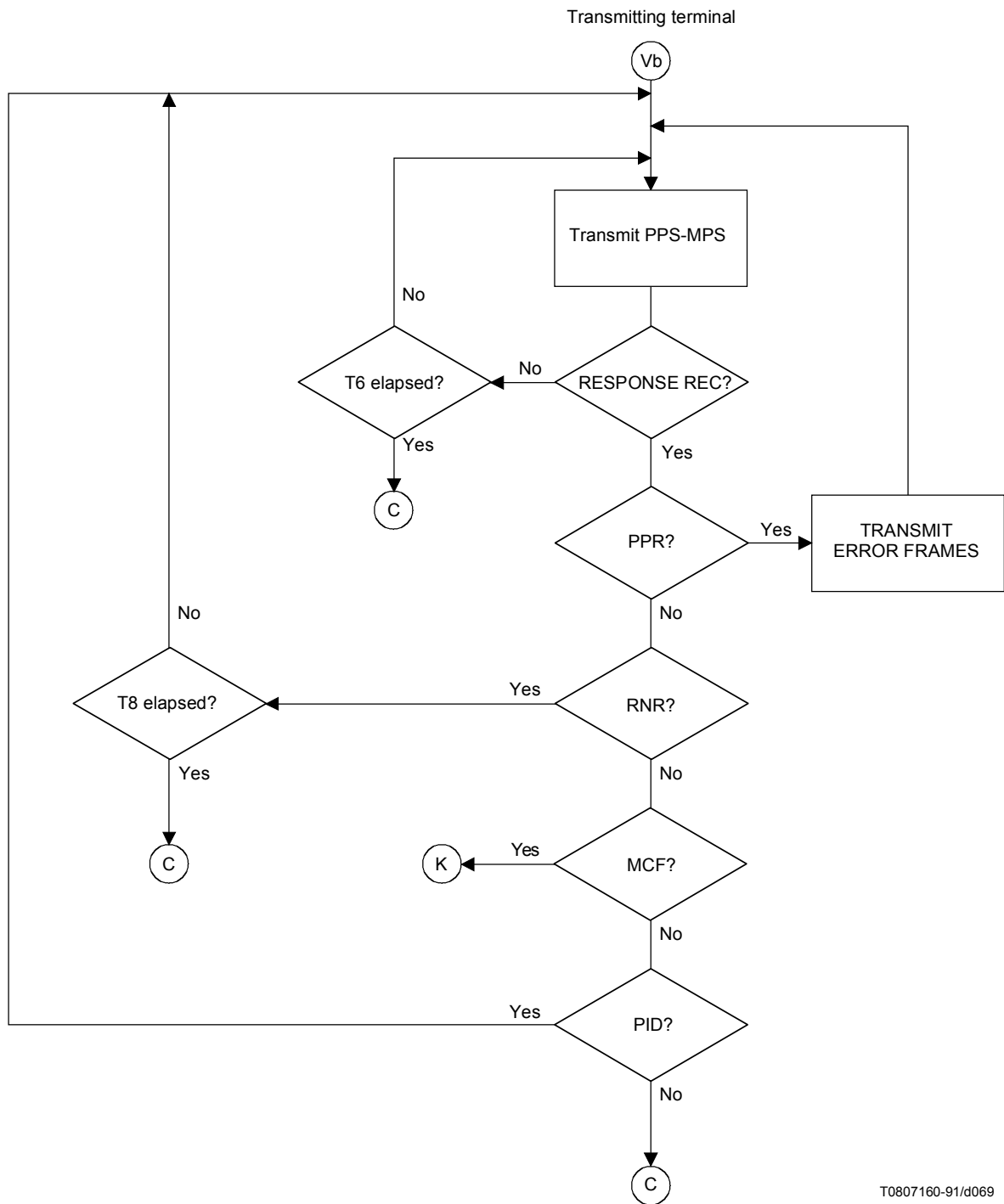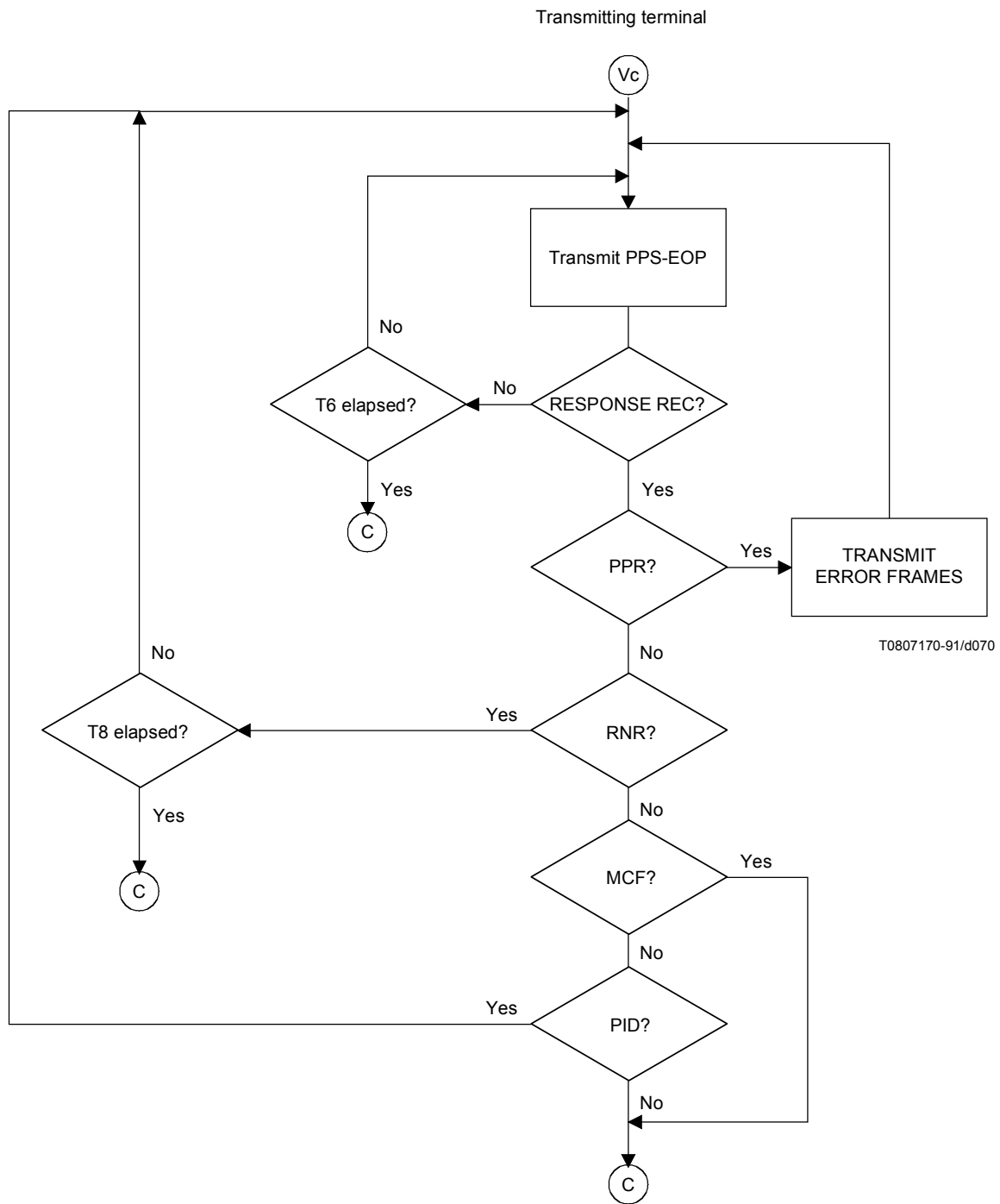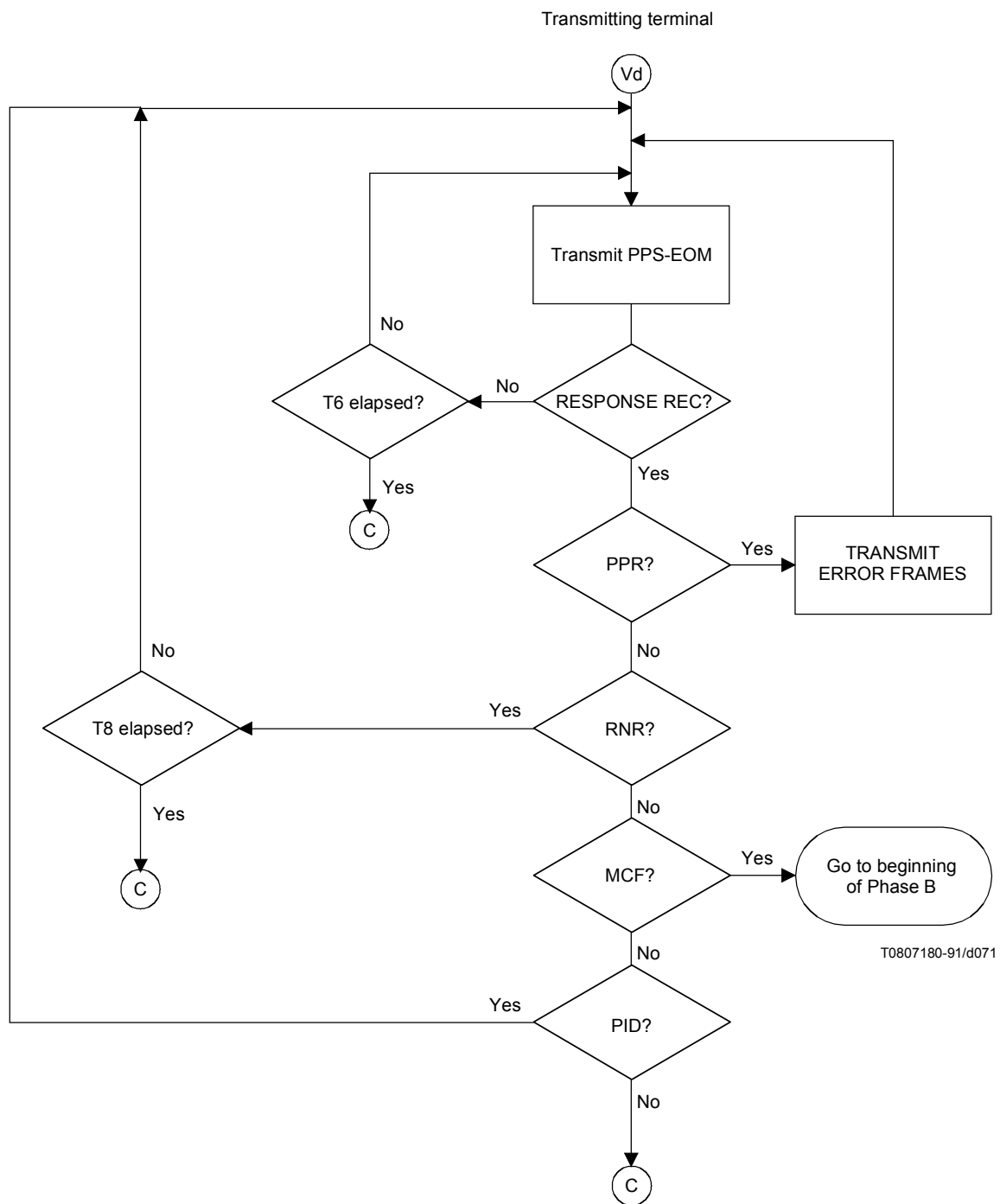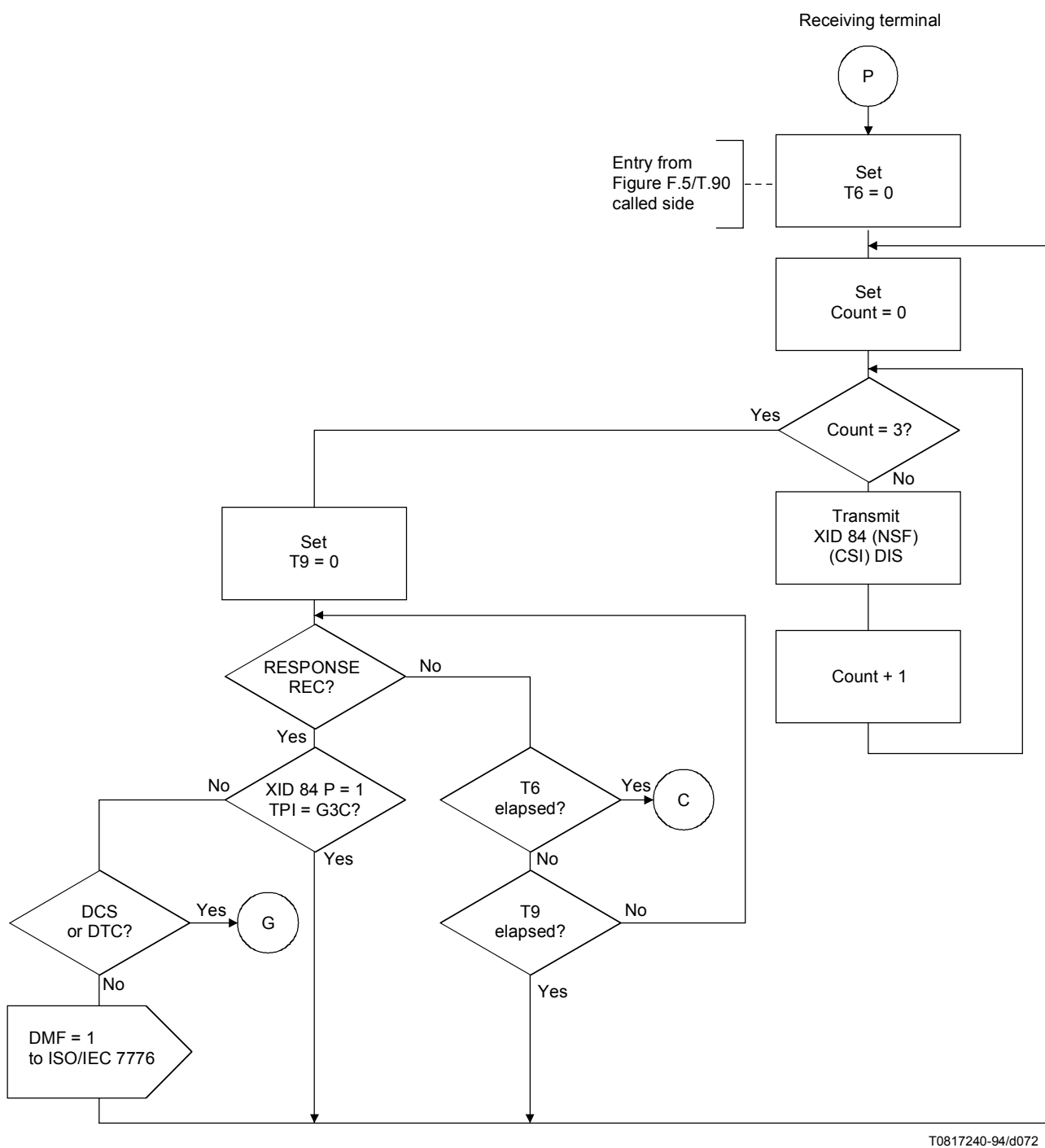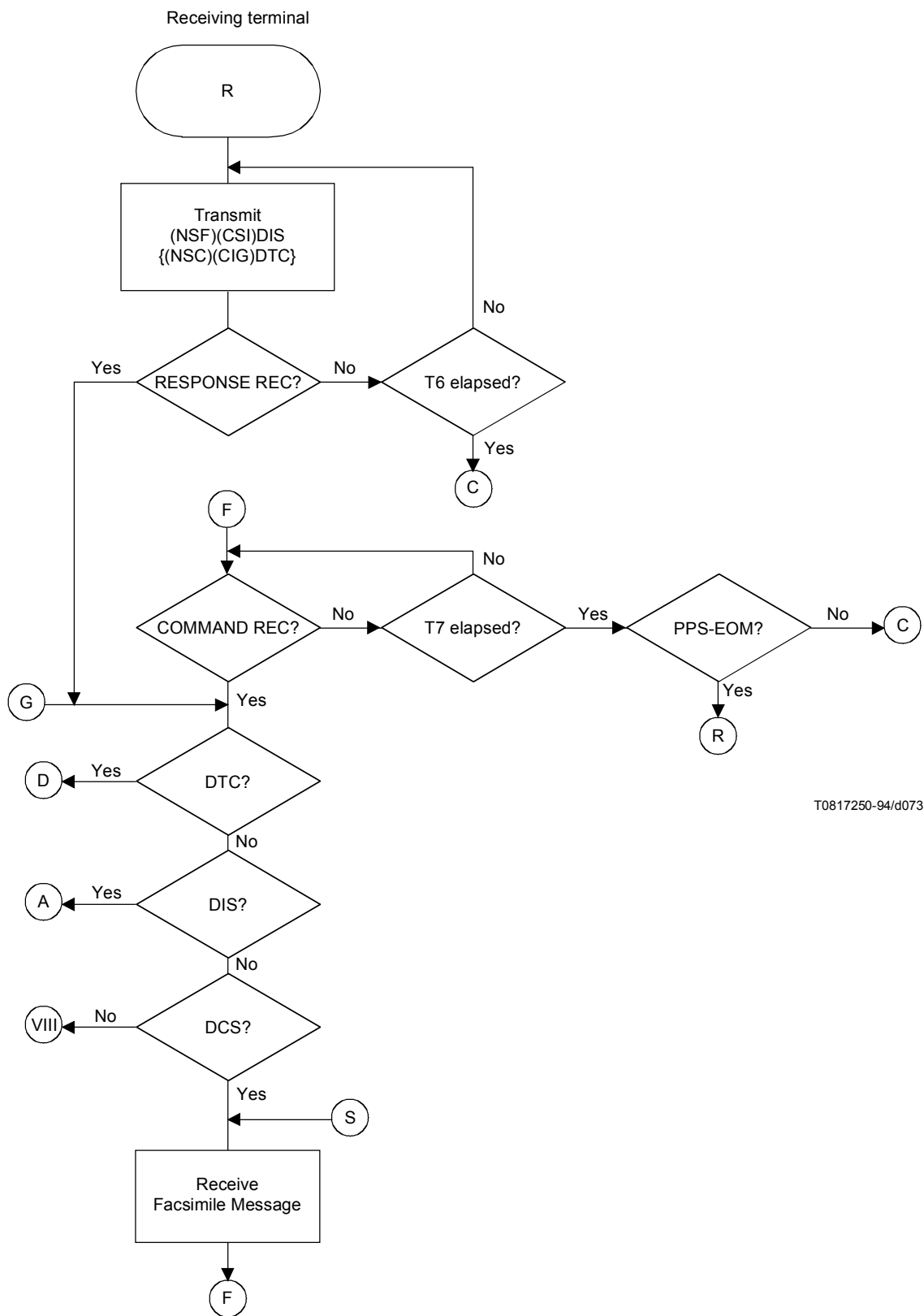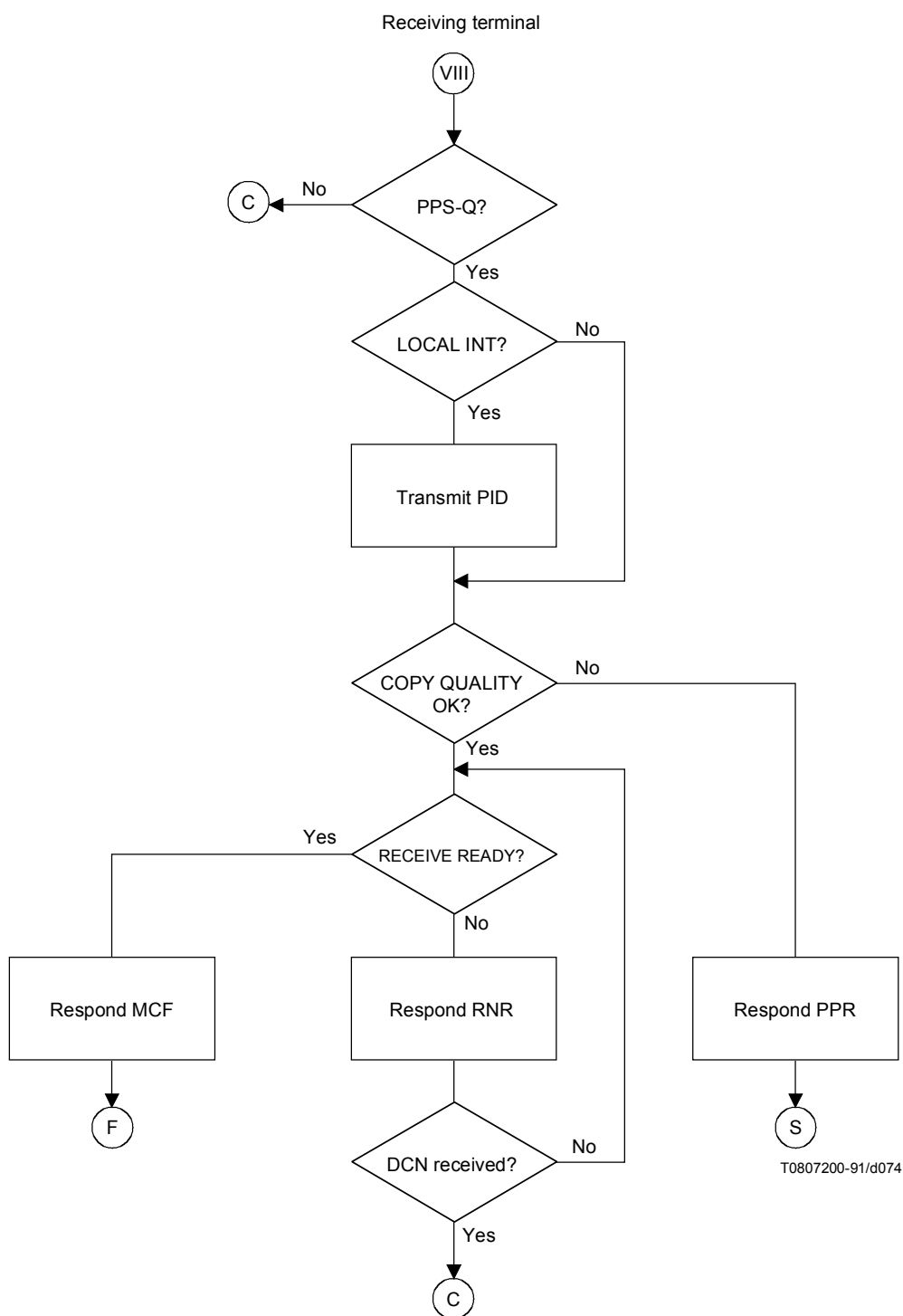
Figure C.21/T.30
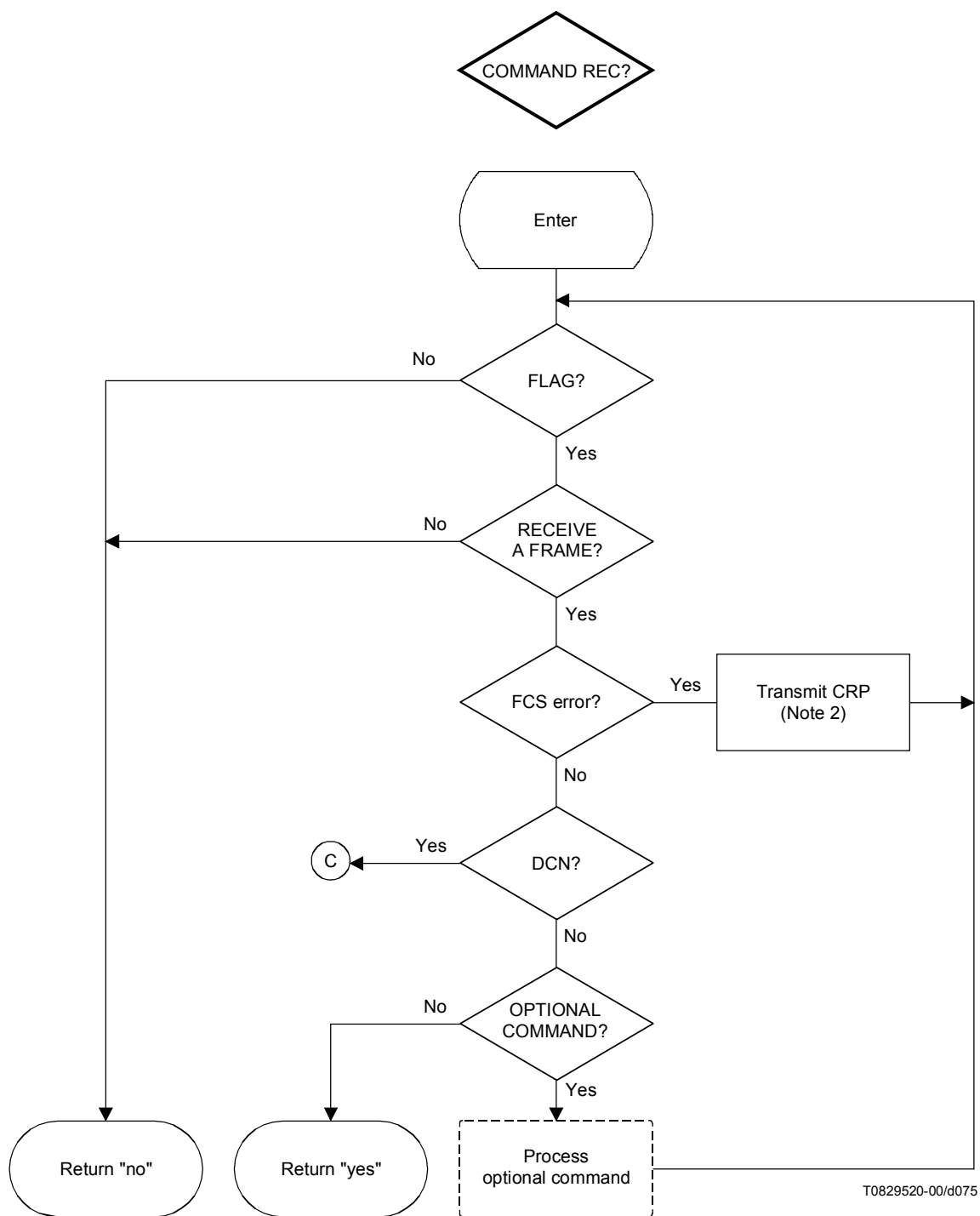
Figure C.22/T.30

Figure C.23/T.30

T0829530-00/d076
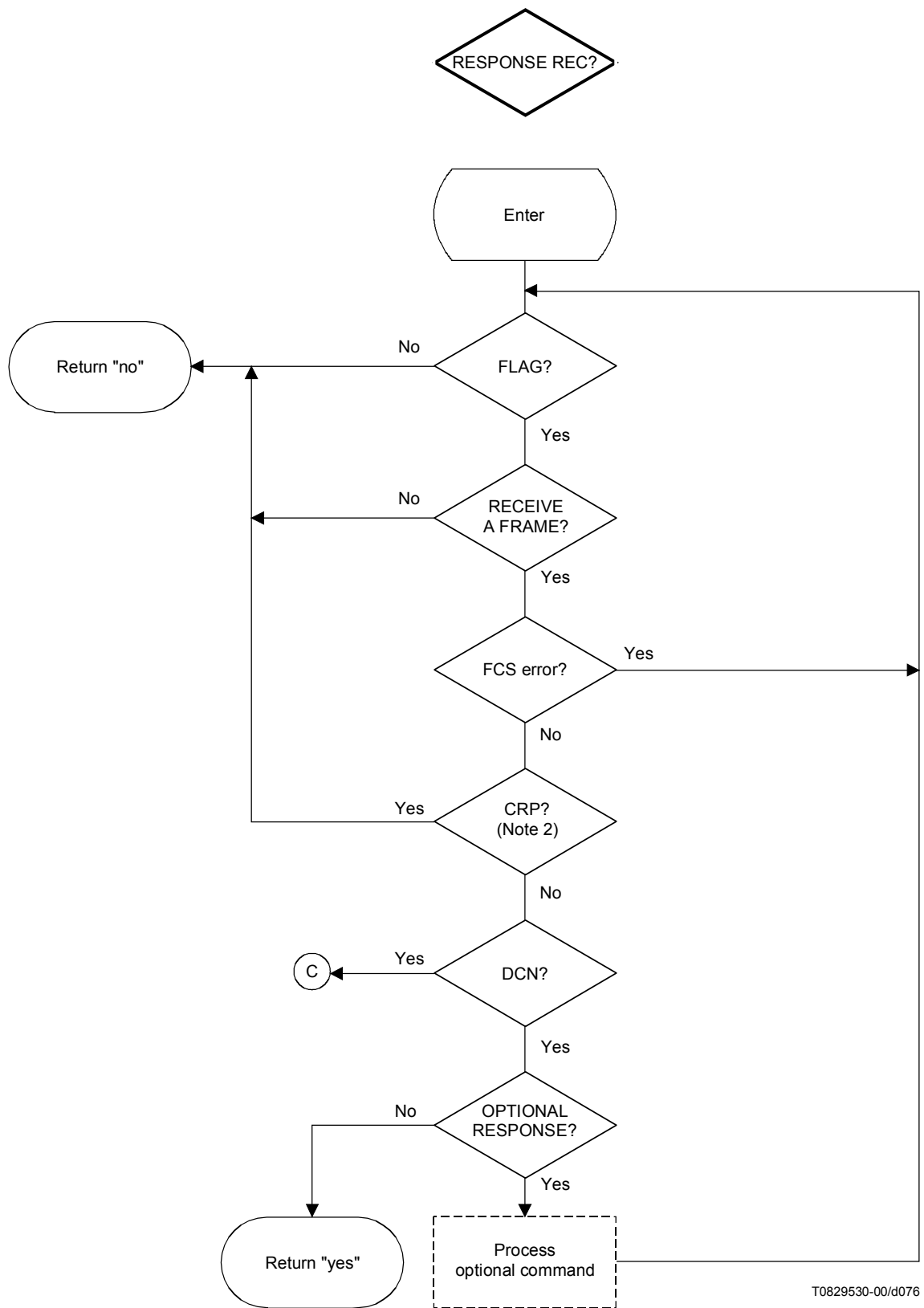
C.6   Signal sequence examples

C.6.1   Duplex operation

The examples below (Figures C.24 to C.37) 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.

C.6.2   Half-duplex operation

The examples below (Figures C.38 to C.51) 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.

Calling		Called
		Flags
Flags		Flags
Flags		3 X XID (NSF) (CSI) DIS
Flags		3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS		3 X XID (NSF) (CSI) DIS
FCD frames		Flags
		Flags
		Flags
FCD frames		Flags
3 X PPS-EOP (1, 1, x)		Flags
3 X PPS-EOP (1, 1, x)		3 X MCF (1, 1)
3 X DCN		3 X MCF (1, 1)

T0829540-00/d077

Figure C.24/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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (1, 2, x)	→ ←	Flags
3 X PPS-EOP (1, 2, x)	→ ←	3 X MCF (1, 2)
3 X PPS-EOP (1, 2, x)	→ ←	3 X MCF (1, 2)
3 X DCN	→ ←	3 X MCF (1, 2)

T0829550-00/d078

Figure C.25/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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ error ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
FCD frames	→ ←	Flags
	→ ←	3 X PPR (1, 1, z)
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (1, 2, y)	→ ←	Flags
FCD error frames	→ ←	3 X MCF (1, 2)
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, z)	→ ←	Flags
3 X PPS-NULL (1, 1, z)	→ ←	3 X MCF (1, 1)
3 X DCN	→ ←	3 X MCF (1, 1)

T0829560-00/d079
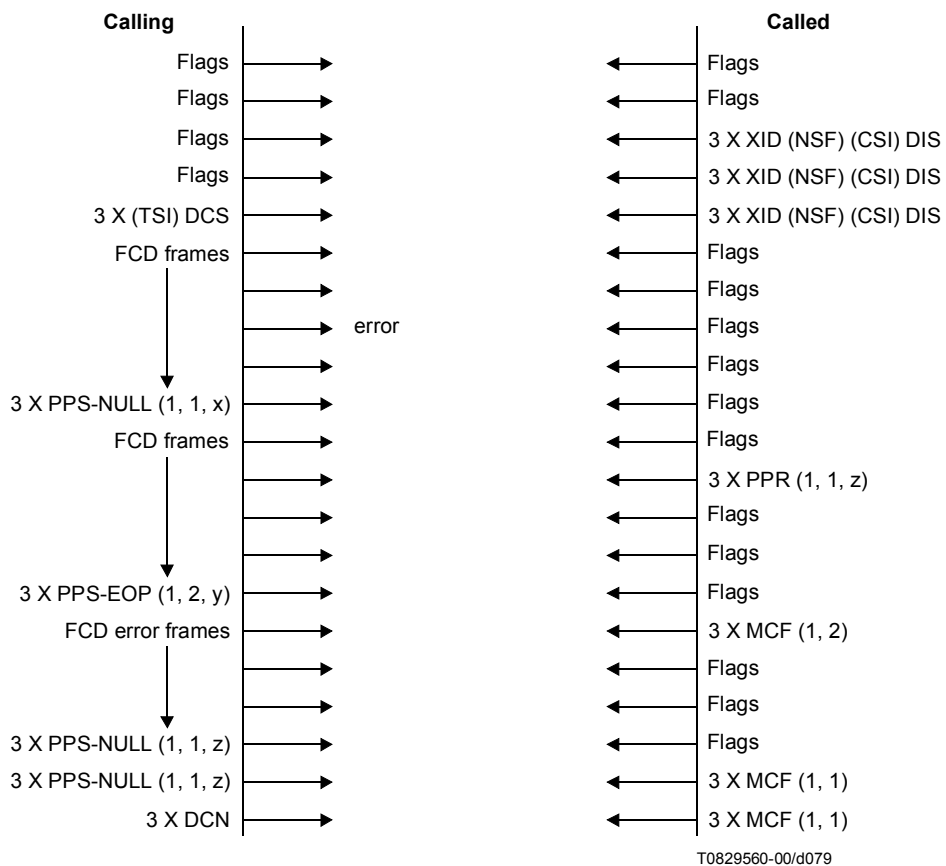
Figure C.26/T.30

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.

Calling				Called
Flags	→		←	Flags
Flags	→		←	Flags
Flags	→		←	3 X XID (NSF) (CSI) DIS
Flags	→		←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→		←	3 X XID (NSF) (CSI) DIS
FCD frames	→		←	Flags
	→		←	Flags
	→	error	←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, x)	→		←	Flags
FCD frames	→		←	3 X PPR (1, 1, z)
	→		←	Flags
	→		←	Flags
	→		←	Flags
3 X PPS-EOP (1, 2, y)	→		←	Flags
FCD error frames	→		←	3 X MCF (1, 2)
	→	error	←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, z)	→		←	Flags
3 X PPS-NULL (1, 1, z)	→		←	3 X PPR (1, 1, a)
FCD error frames	→		←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, a)	→		←	Flags
3 X PPS-NULL (1, 1, a)	→		←	3 X MCF (1, 1)
3 X DCN	→		←	3 X MCF (1, 1)

T0829570-00/d080

Figure C.27/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.

Calling		Called
Flags →		← Flags
Flags →		← Flags
Flags →		← 3 X XID (NSF) (CSI) DIS
Flags →		← 3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS →		← 3 X XID (NSF) (CSI) DIS
FCD frames →		← Flags
→		← Flags
→		← Flags
→		← Flags
3 X PPS-NULL (1, 1, x) →	error	← Flags
FCD frames →		← Flags
→		← Flags
→		← Flags
→		← Flags
3 X PPS-MPS (1, 2, y) →		← Flags
3 X PPS-NULL (1, 1, x) →		← 3 X PPR (1, 2, y)
FCD frames →		← 3 X PPR (1, 1, x)
→		← Flags
→		← Flags
→		← Flags
3 X PPS-EOP (2, 1, z) →		← Flags
FCD error frames →		← 3 X MCF (2, 1)
→		← Flags
→		← Flags
→		← Flags
3 X PPS-MPS (1, 2, y) →		← Flags
FCD error frames →		← Flags
→		← 3 X MCF (1, 2)
→		← Flags
→		← Flags
3 X PPS-NULL (1, 1, x) →		← Flags
3 X PPS-NULL (1, 1, x) →		← 3 X MCF (1, 1)
3 X PPS-NULL (1, 1, x) →		← 3 X MCF (1, 1)
3 X DCN →		← 3 X MCF (1, 1)

T0829580-00/d081

Figure C.28/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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 2)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ ←	Flags
3 X PPS-EOP (2, 1, z)	→ ←	3 X MCF (2, 1)
3 X PPS-EOP (2, 1, z)	→ ←	3 X MCF (2, 1)
3 X DCN	→ ←	3 X MCF (2, 1)

T0829590-00/d082

Figure C.29/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.
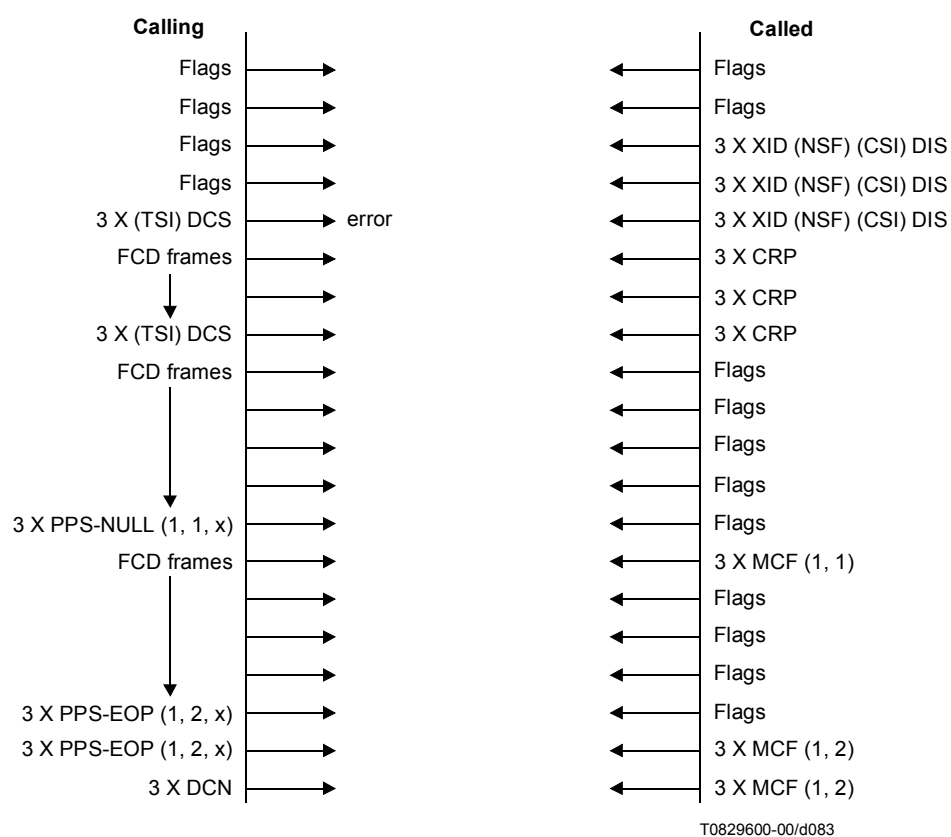
Figure C.30/T.30

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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 2)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
	→ error ←	Flags
Repeat for up to 5 seconds i.e. T6 expires	→ error ←	Flags
	→ error ←	Flags
	→ error ←	Flags
3 X DCN	→ ←	Flags

T0829610-00/d084
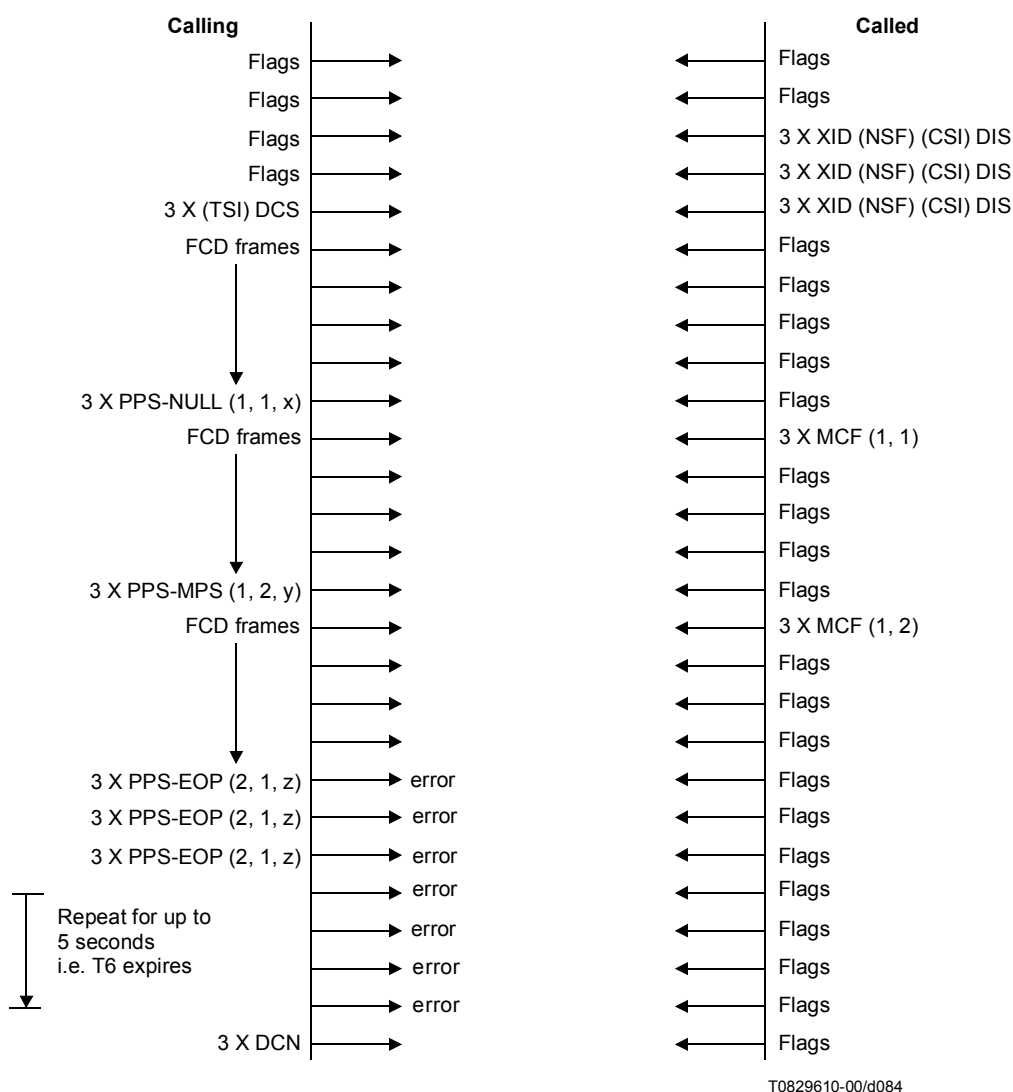
Figure C.31/T.30

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.

Calling			Called
Flags	→	←	Flags
Flags	→	←	Flags
Flags	→	←	3 X XID (NSF) (CSI) DIS
Flags	→	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→	←	3 X XID (NSF) (CSI) DIS
FCD frames	→	←	Flags
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	Flags
FCD frames	→	←	3 X MCF (1, 1)
	→	←	Flags
	→ error	←	Flags
	→	←	Flags
3 X PPS-MPS (1, 2, y)	→	←	Flags
FCD frames	→	←	3 X PPR (1, 2, a)
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (2, 1, z)	→	←	Flags
FCD error frames	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-MPS (1, 2, a)	→	←	Flags
FCD frames	→	←	Flags
	→	←	RNR
	→	←	RNR
3 X PPS-MPS (2, 2, p)	→	←	RNR
3 X PPS-MPS (1, 2, a)	→	←	RNR
3 X PPS-NULL (2, 1, z)	→	←	RNR
3 X PPS-MPS (2, 2, p)	→	←	3 X MCF (1, 2)
3 X PPS-NULL (2, 1, z)	→	←	RNR
3 X PPS-MPS (2, 2, p)	→	←	RNR
3 X PPS-NULL (2, 1, z)	→	←	RNR
3 X PPS-MPS (2, 2, p)	→	←	3 X MCF (2, 1)
3 X PPS-MPS (2, 2, p)	→	←	3 X MCF (2, 2)
FCD frames	→	←	Flags
	→	←	Flags
3 X PPS-EOP (3, 1, q)	→	←	Flags
3 X PPS-EOP (3, 1, q)	→	←	3 X MCF (3, 1)
3 X DCN	→	←	3 X MCF (3, 1)

T0829620-00/d085

Figure C.32/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.

Calling				Called
Flags	→		←	Flags
Flags	→		←	Flags
Flags	→		←	3 X XID (NSF) (CSI) DIS
Flags	→		←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→		←	3 X XID (NSF) (CSI) DIS
FCD frames	→		←	Flags
	→		←	Flags
	→		←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, x)	→		←	Flags
FCD frames	→		←	3 X MCF (1, 1)
	→		←	Flags
	→	error	←	Flags
			←	Flags
3 X PPS-MPS (1, 2, y)	→		←	Flags
FCD frames	→		←	3 X PPR (1, 2, a)
	→		←	Flags
	→		←	Flags
	→		←	Flags
3 X PPS-NULL (2, 1, z)	→		←	Flags
FCD error frames	→		←	3 X MCF (2, 1)
	→		←	Flags
	→		←	Flags
3 X PPS-MPS (1, 2, a)	→		←	Flags
FCD frames	→		←	RNR
	→		←	RNR
	→		←	RNR
3 X PPS-MPS (2, 2, b)	→		←	RNR
	→		←	3 X MCF (1, 2)
	→		←	RNR
Repeat for up to 10 seconds	→		←	RNR
	→		←	RNR
	→		←	RNR
	→		←	RNR
3 X DCN	→		←	RNR

T0829630-00/d086

Figure C.33/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.

Calling			Called
Flags	→	←	Flags
Flags	→	←	Flags
Flags	→	←	3 X XID (NSF) (CSI) DIS
Flags	→	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→	←	3 X XID (NSF) (CSI) DIS
FCD frames	→	←	Flags
	→	←	Flags
	→ error	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	Flags
FCD frames	→	←	3 X PPR (1, 1, a)
	→	←	Flags
	→	←	PID
3 X PPS-EOP (1, 2, y)	→	←	Flags
FCD error frames	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, a)	→	←	Flags
3 X PPS-NULL (1, 1, a)	→	←	Flags
3 X PPS-NULL (1, 1, a)	→	←	3 X MCF (1, 1)
3 X DCN	→	←	3 X MCF (1, 1)

T0829640-00/d087

Figure C.34/T.30

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

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

Calling			Called
		←	Flags
Flags	→	←	Flags
Flags	→	error ←	3 X XID (NSF) (CSI) DIS
Flags	→	error ←	3 X XID (NSF) (CSI) DIS
Flags	→	error ←	3 X XID (NSF) (CSI) DIS
Flags	→	error ←	3 X XID (NSF) (CSI) DIS
Timer T6 expires Flags	→	error ←	3 X XID (NSF) (CSI) DIS
Flags	→	error ←	3 X XID (NSF) (CSI) DIS
3 X DCN	→	error ←	3 X XID (NSF) (CSI) DIS

T0830140-00/d088
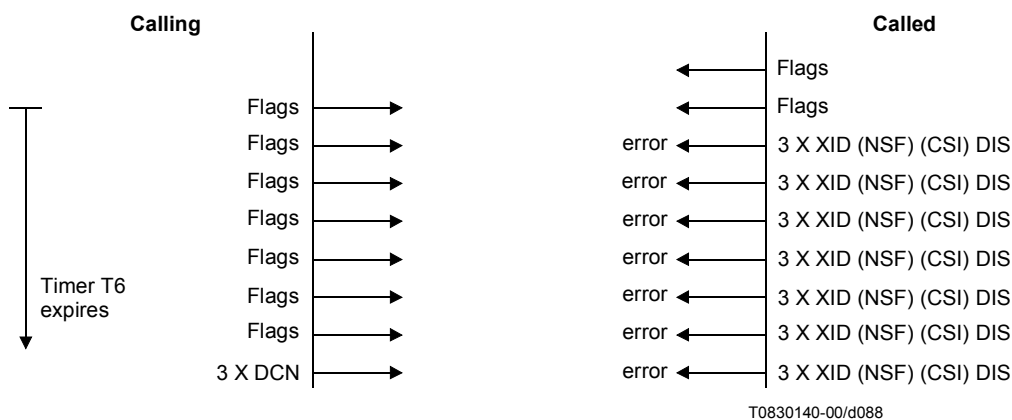
Figure C.35/T.30

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

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

Calling   **Called**

                                                    Flags

Flags →   Flags

Flags →   3 X XID (NSF) (CSI) DIS

Flags →

Flags →   Repeat until
                                                    timer T6
Flags →   expires

Flags →

Flags →

Flags →   3 X DCN

T0830150-00/d089

Figure C.36/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.

Calling   **Called**

                                                    Flags

Flags →   Flags

Flags →   3 X XID (NSF) (CSI) DIS

Flags →   3 X XID (NSF) (CSI) DIS

3 X (CIG) DTC →   3 X XID (NSF) (CSI) DIS

3 X (CIG) DTC →   3 X (TSI) DCS

Flags →   FCD frames

Flags →

Flags →

Flags →

Flags →   3 X PPS-EOP (1, 1, x)

3 X MCF (1, 1) →   3 X PPS-EOP (1, 1, x)

3 X MCF (1, 1) →   3 X DCN

T0829650-00/d090

Figure C.37/T.30

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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
FCD frames	→ ←	Flags
3 X PPS-EOP (1, 1, x)	→ ←	Flags
3 X PPS-EOP (1, 1, x)	→ ←	3 X MCF (1, 1)
3 X DCN	→ ←	3 X MCF (1, 1)

T0829660-00/d091

Figure C.38/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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	3 X MCF (1, 1)
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (1, 2, y)	→ ←	Flags
3 X PPS-EOP (1, 2, x)	→ ←	3 X MCF (1, 2)
3 X DCN	→ ←	3 X MCF (1, 2)

T0829670-00/d092

Figure C.39/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.

Calling				Called
Flags	→		←	Flags
Flags	→		←	Flags
Flags	→		←	3 X XID (NSF) (CSI) DIS
Flags	→		←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→		←	3 X XID (NSF) (CSI) DIS
FCD frames	→		←	Flags
	→		←	Flags
	→	error	←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, x)	→		←	Flags
3 X PPS-NULL (1, 1, x)	→		←	3 X PPR (1, 1, z)
FCD error frames	→		←	3 X PPR (1, 1, z)
	→		←	Flags
	→		←	Flags
3 X PPS-NULL (1, 1, z)	→		←	Flags
3 X PPS-NULL (1, 1, z)	→		←	3 X MCF (1, 1)
FCD frames	→		←	3 X MCF (1, 1)
	→		←	Flags
	→		←	Flags
	→		←	Flags
3 X PPS-EOP (1, 2, p)	→		←	Flags
3 X PPS-EOP (1, 2, p)	→		←	3 X MCF (1, 2)
3 X DCN	→		←	3 X MCF (1, 2)

T0829680-00/d093
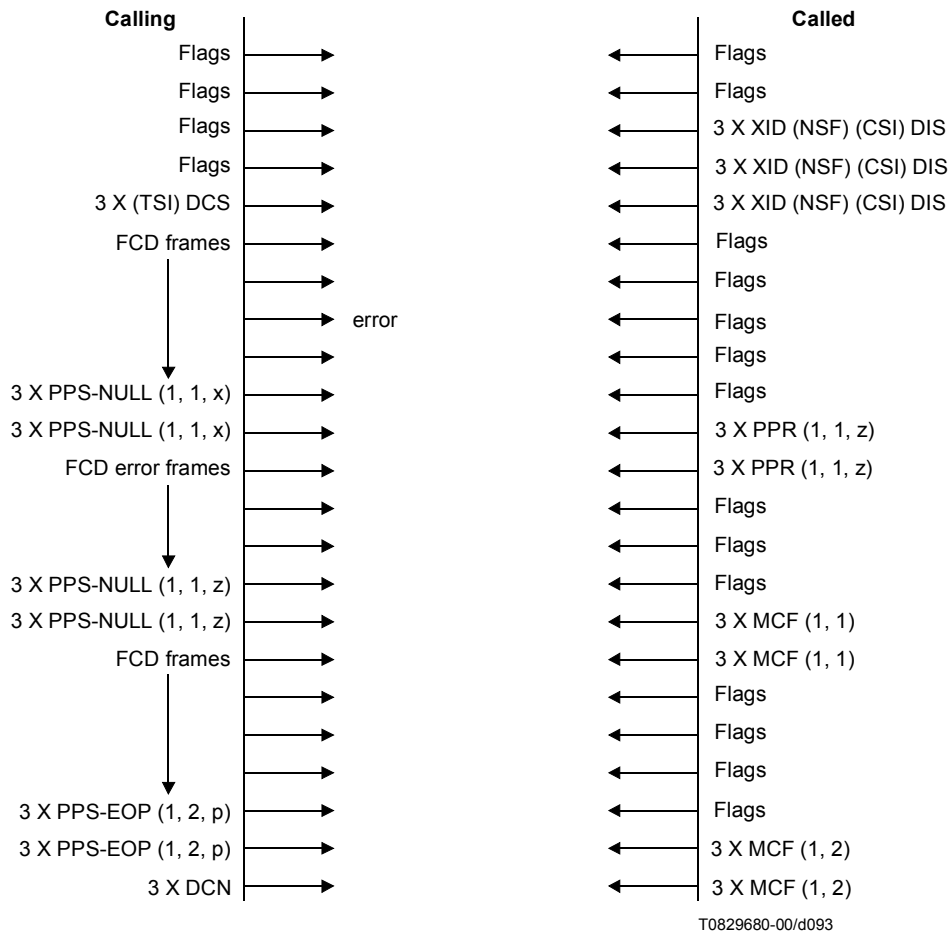
Figure C.40/T.30

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.

Calling			Called
Flags	→	←	Flags
Flags	→	←	Flags
Flags	→	←	3 X XID (NSF) (CSI) DIS
Flags	→	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→	←	3 X XID (NSF) (CSI) DIS
FCD frames	→	←	Flags
	→	←	Flags
	→ error	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	3 X PPR (1, 1, z)
FCD error frames	→	←	3 X PPR (1, 1, z)
	→ error	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, z)	→	←	Flags
3 X PPS-NULL (1, 1, z)	→	←	3 X PPR (1, 1, a)
FCD error frames	→	←	3 X PPR (1, 1, a)
	→	←	Flags
3 X PPS-NULL (1, 1, a)	→	←	Flags
3 X PPS-NULL (1, 1, a)	→	←	3 X MCF (1, 1)
FCD frames	→	←	3 X MCF (1, 1)
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-EOP (1, 2, p)	→	←	Flags
3 X PPS-EOP (1, 2, p)	→	←	3 X MCF (1, 2)
3 X DCN	→	←	3 X MCF (1, 2)

T0829690-00/d094
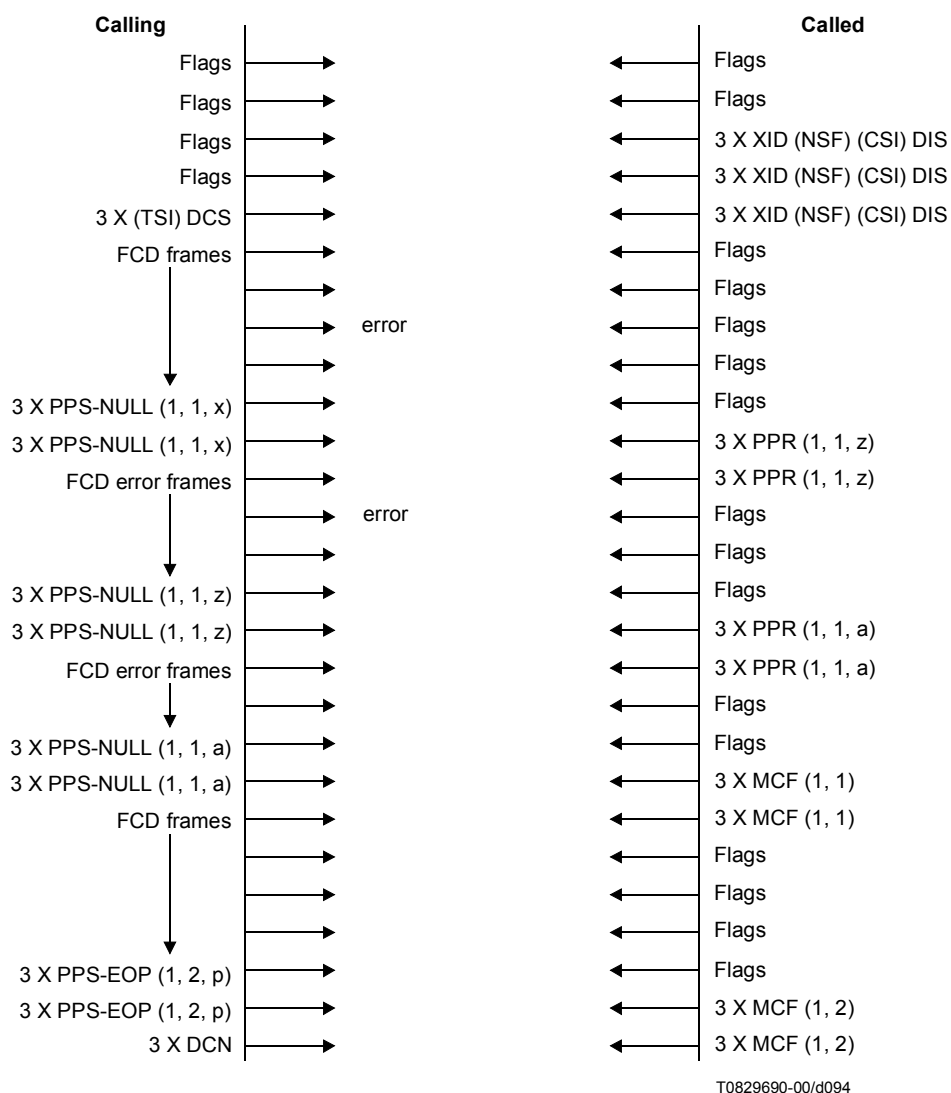
Figure C.41/T.30

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.
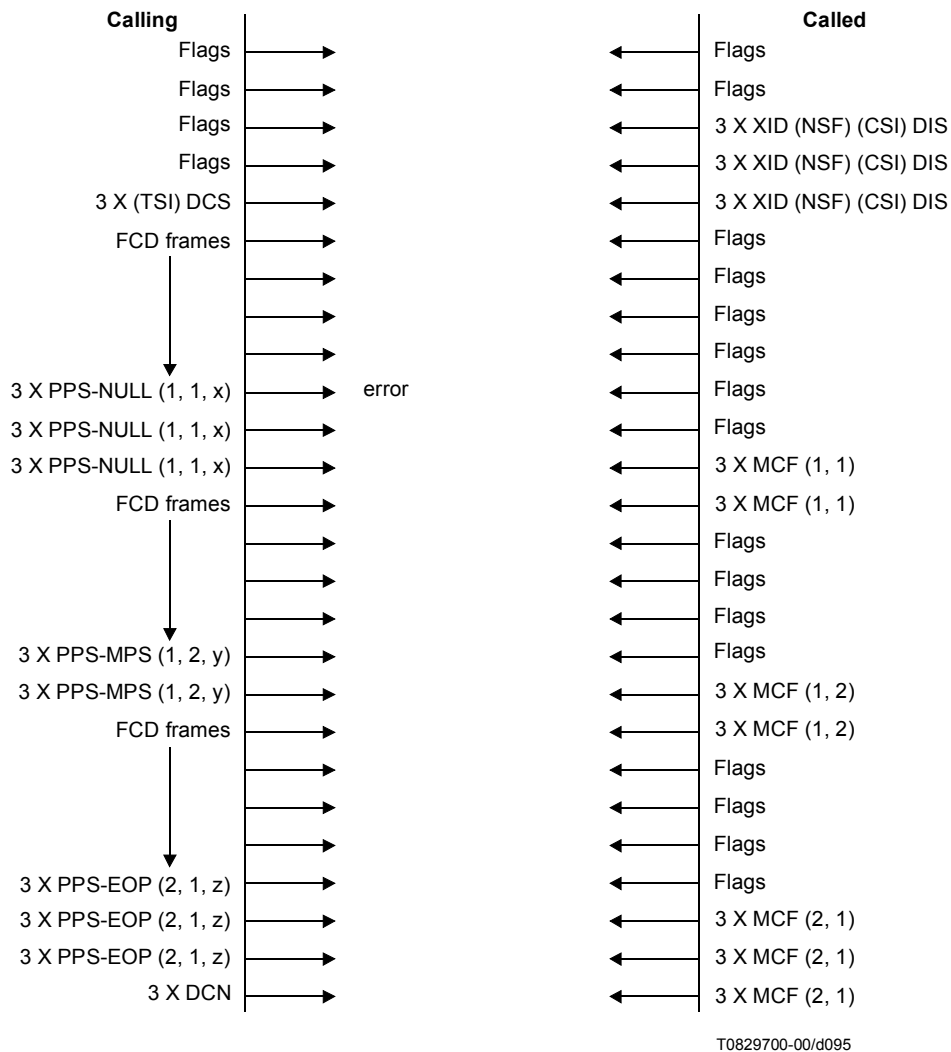
Figure C.42/T.30

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.

Calling		Called
Flags →	←	Flags
Flags →	←	Flags
Flags →	←	3 X XID (NSF) (CSI) DIS
Flags →	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS →	←	3 X XID (NSF) (CSI) DIS
FCD frames →	←	Flags
→	←	Flags
→	←	Flags
→	←	Flags
3 X PPS-NULL (1, 1, x) →	←	Flags
3 X PPS-NULL (1, 1, x) →	←	3 X MCF (1, 1)
FCD frames →	←	3 X MCF (1, 1)
→	←	Flags
→	←	Flags
→	←	Flags
3 X PPS-MPS (1, 2, y) →	←	Flags
3 X PPS-MPS (1, 2, y) →	←	3 X MCF (1, 2)
FCD frames →	←	3 X MCF (1, 2)
→	←	Flags
→	←	Flags
→	←	Flags
3 X PPS-EOP (2, 1, z) → error	←	Flags
3 X PPS-EOP (2, 1, z) → error	←	Flags
3 X PPS-EOP (2, 1, z) →	←	Flags
3 X PPS-EOP (2, 1, z) →	←	3 X MCF (2, 1)
3 X PPS-EOP (2, 1, z) →	←	3 X MCF (2, 1)
3 X DCN →	←	3 X MCF (2, 1)

T0829710-00/d096
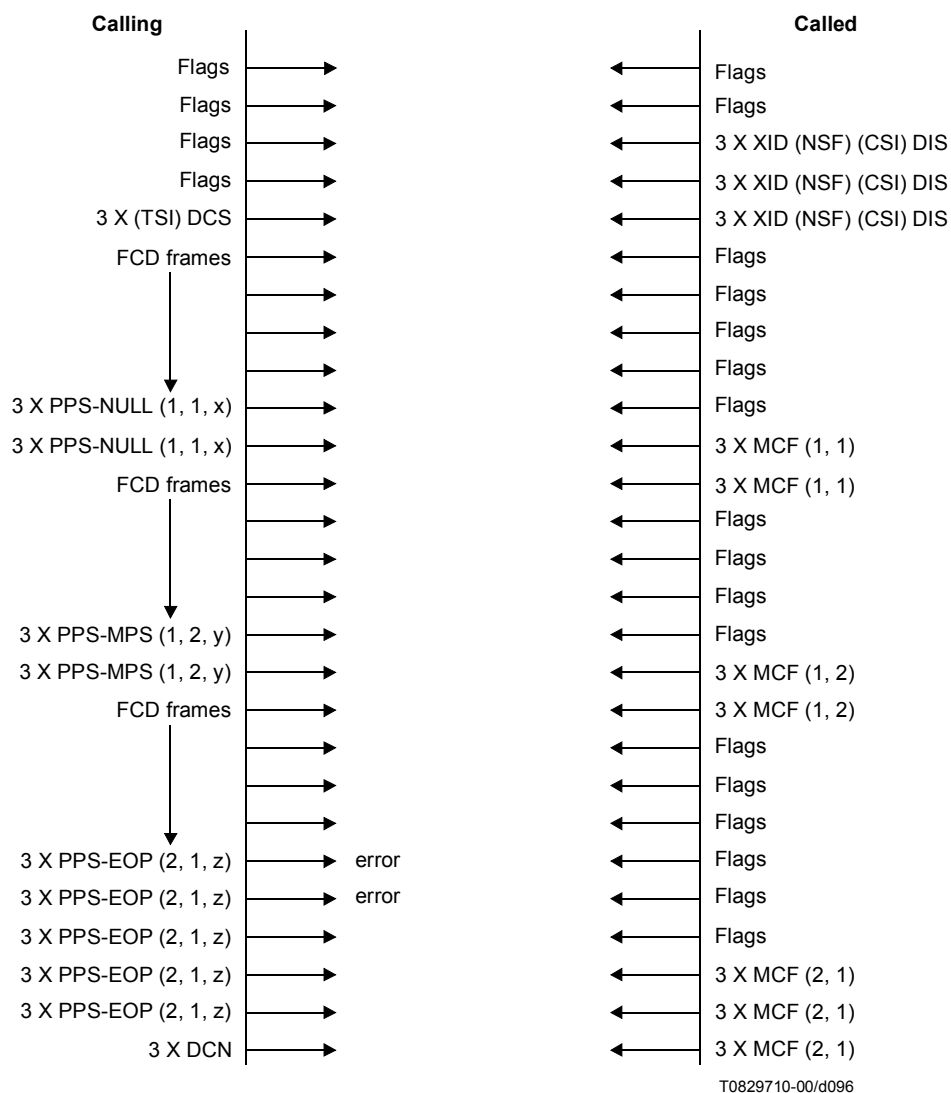
Figure C.43/T.30

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.

Calling			Called
Flags	→	←	Flags
Flags	→	←	Flags
Flags	→	←	3 X XID (NSF) (CSI) DIS
Flags	→	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ error	←	3 X XID (NSF) (CSI) DIS
FCD frames	→	←	3 X CRP
	→	←	Flags
3 X (TSI) DCS	→	←	Flags
FCD frames	→	←	Flags
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	3 X MCF (1, 1)
FCD frames	→	←	3 X MCF (1, 1)
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-EOP (1, 2, y)	→	←	Flags
3 X PPS-EOP (1, 2, y)	→	←	3 X MCF (1, 2)
3 X DCN	→	←	3 X MCF (1, 2)

T0829720-00/d097
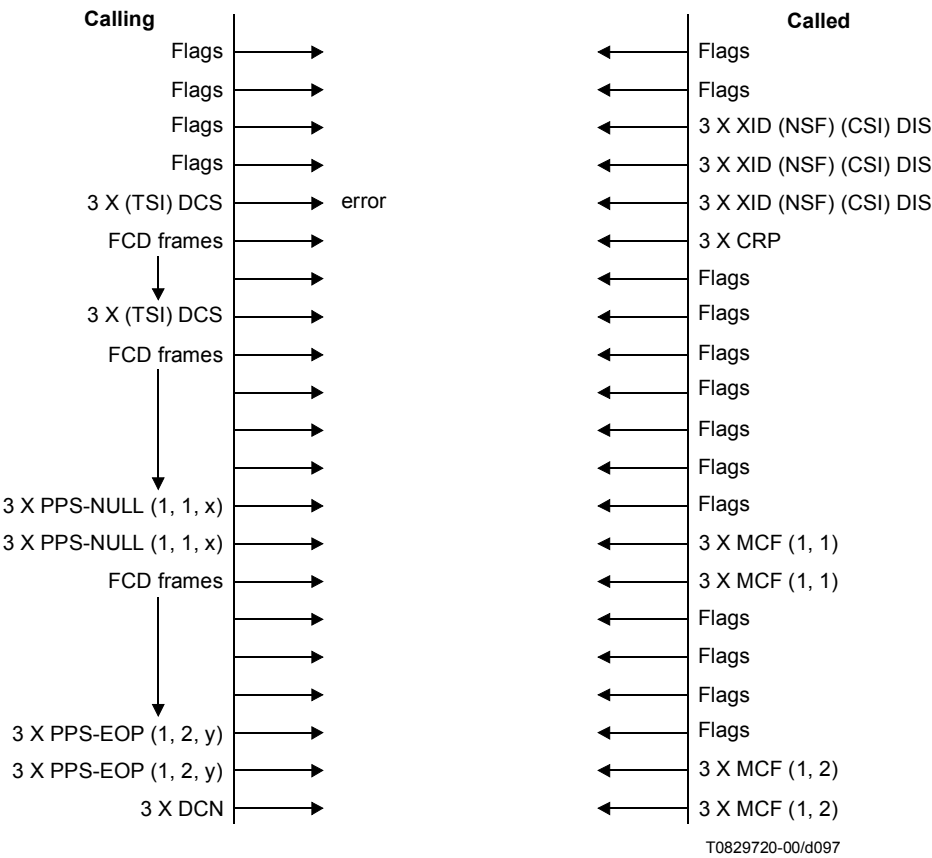
Figure C.44/T.30

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.

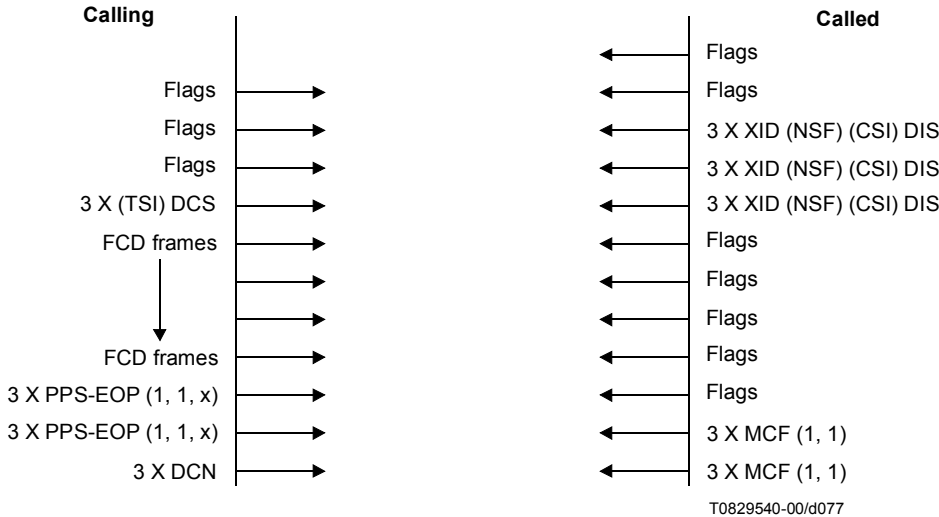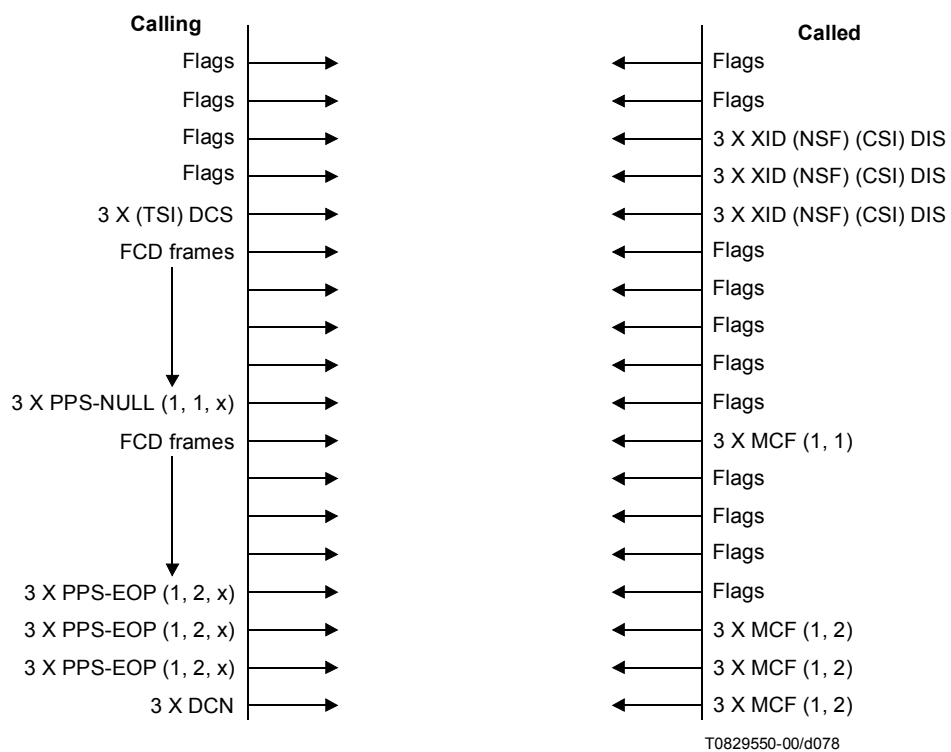| Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	3 X MCF (1, 1)
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	3 X MCF (1, 2)
FCD frames	→ ←	3 X MCF (1, 2)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
3 X PPS-EOP (2, 1, z)	→ error ←	Flags
	→ error ←	Flags
Repeat for up to 5 seconds i.e. T6 expires	→ error ←	Flags
	→ error ←	Flags
	→ error ←	Flags
3 X DCN	→ ←	Flags

T0829730-00/d098
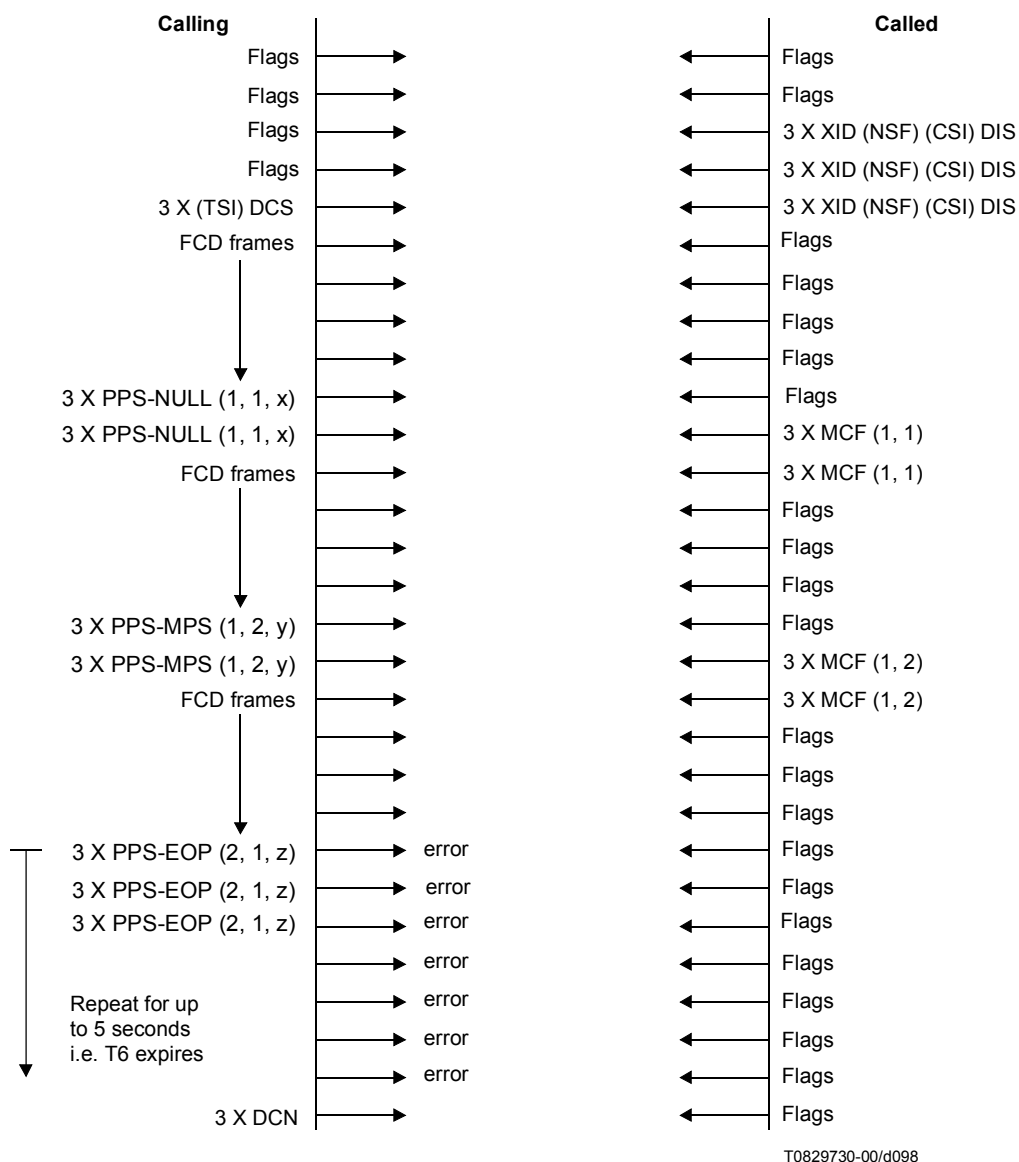
Figure C.45/T.30

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.

Calling		Called
Flags	→ ←	Flags
Flags	→ ←	Flags
Flags	→ ←	3 X XID (NSF) (CSI) DIS
Flags	→ ←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→ ←	3 X XID (NSF) (CSI) DIS
FCD frames	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (1, 1, x)	→ ←	Flags
FCD frames	→ ←	3 X MCF (1, 1)
	→ ←	Flags
	→ error ←	Flags
	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	Flags
3 X PPS-MPS (1, 2, y)	→ ←	3 X PPR (1, 2, a)
FCD error frames	→ ←	3 X PPR (1, 2, a)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-MPS (1, 2, a)	→ ←	Flags
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	RNR
3 X PPS-MPS (1, 2, a)	→ ←	3 X MCF (1, 2)
FCD frames	→ ←	3 X MCF (1, 2)
	→ ←	Flags
	→ ←	Flags
	→ ←	Flags
3 X PPS-NULL (2, 1, z)	→ ←	Flags
3 X PPS-NULL (2, 1, z)	→ ←	3 X MCF (2, 1)
FCD frames	→ ←	3 X MCF (2, 1)
	→ ←	Flags
	→ ←	Flags
3 X PPS-EOP (2, 2, q)	→ ←	Flags
3 X PPS-EOP (2, 2, q)	→ ←	3 X MCF (2, 2)
3 X DCN	→ ←	3 X MCF (2, 2)

T0829740-00/d099

Figure C.46/T.30
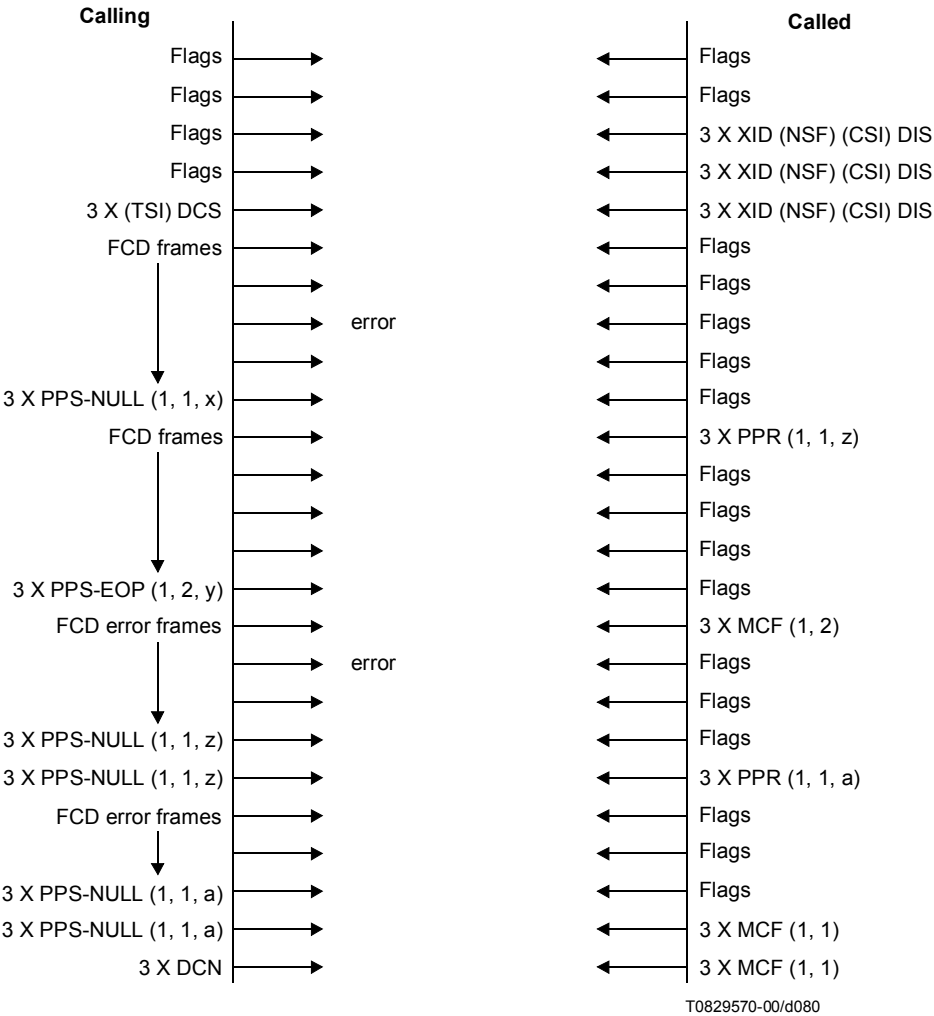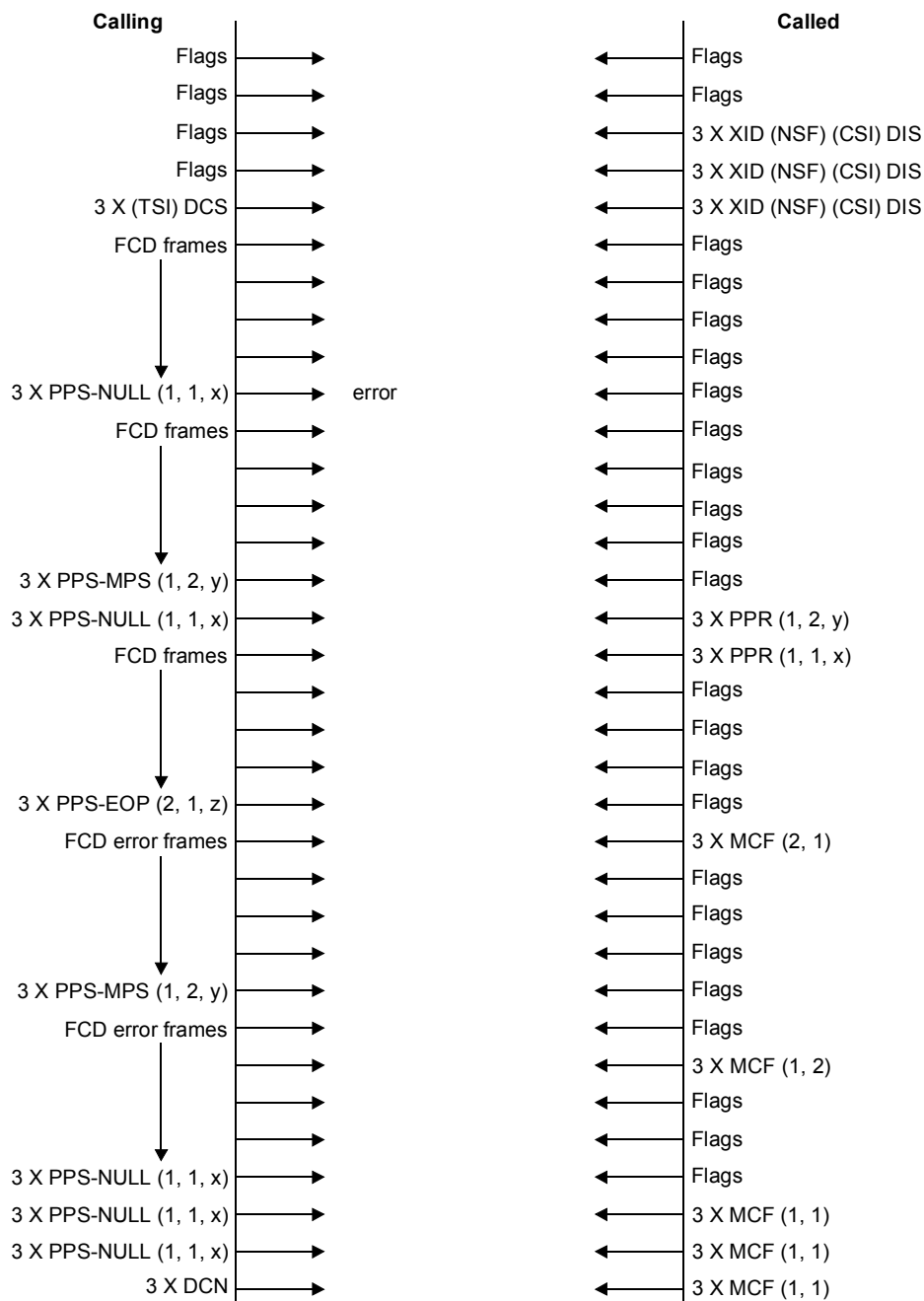
Example 10   A calling terminal wishing to transmit to an answering terminal.

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.

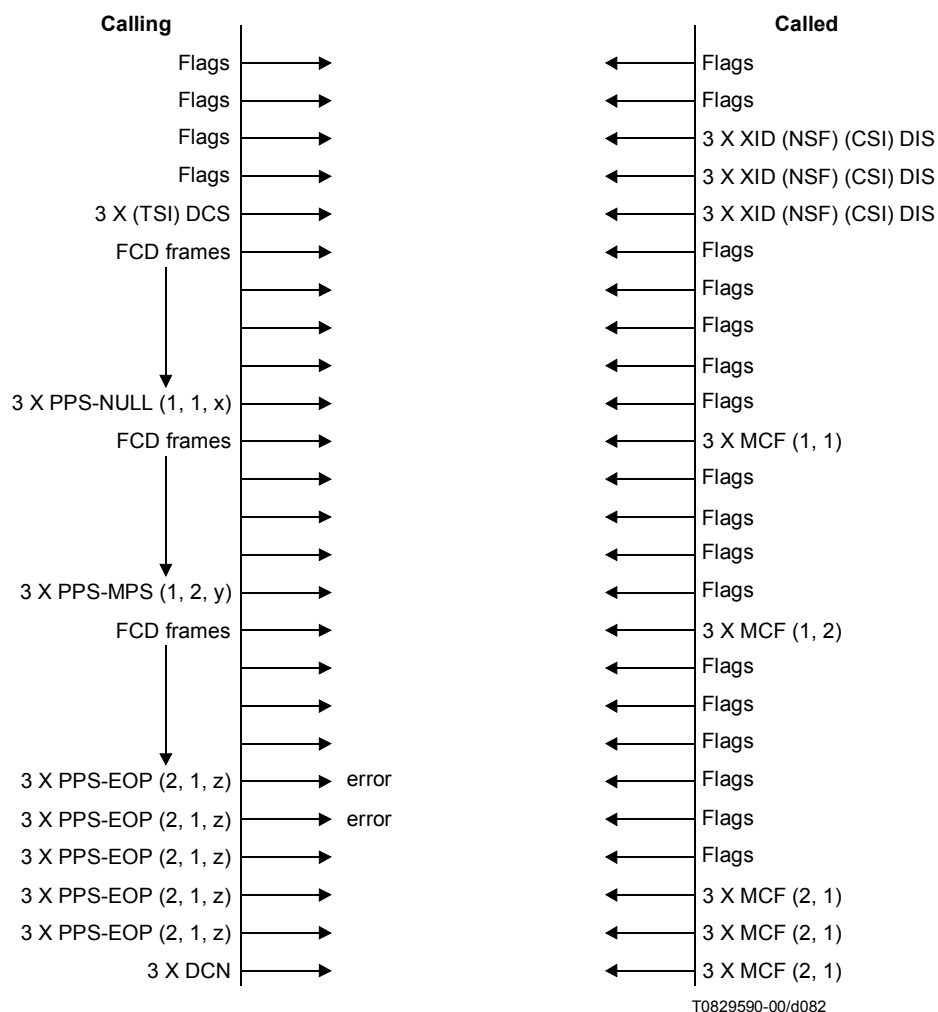| Calling			Called
Flags	→	←	Flags
Flags	→	←	Flags
Flags	→	←	3 X XID (NSF) (CSI) DIS
Flags	→	←	3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS	→	←	3 X XID (NSF) (CSI) DIS
FCD frames	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 1, x)	→	←	Flags
FCD frames	→	←	3 X MCF (1, 1)
	→	←	Flags
	→ error	←	Flags
		←	Flags
3 X PPS-MPS (1, 2, y)	→	←	Flags
3 X PPS-MPS (1, 2, y)	→	←	3 X PPR (1, 2, a)
FCD error frames	→	←	3 X PPR (1, 2, a)
	→	←	Flags
	→	←	Flags
3 X PPS-MPS (1, 2, a)	→	←	Flags
3 X PPS-MPS (1, 2, a)	→	←	3 X MCF (1, 2)
FCD frames	→	←	3 X MCF (1, 2)
	→	←	Flags
	→	←	Flags
	→	←	Flags
3 X PPS-NULL (1, 2, a)	→	←	Flags
3 X PPS-NULL (1, 2, a)	→	←	3 X MCF (1, 2)
FCD frames	→	←	3 X MCF (1, 2)
	→	←	RNR
	→	←	RNR
3 X PPS-MPS (2, 2, b)	→	←	RNR
	→	←	RNR
	→	←	RNR
Repeat for up to 10 seconds	→	←	RNR
	→	←	RNR
	→	←	RNR
	→	←	RNR
3 X DCN	→	←	RNR

T0829750-00/d100
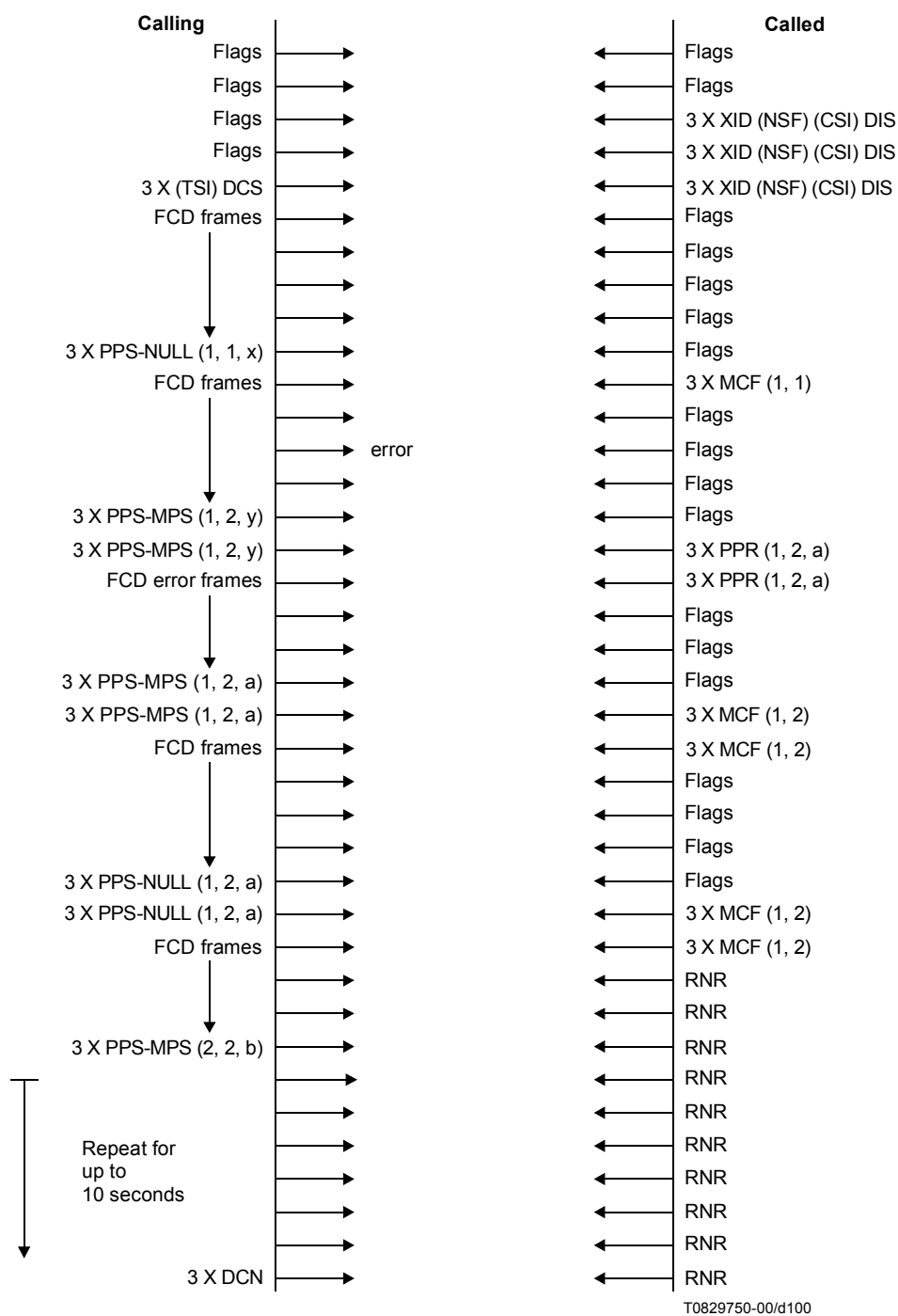
Figure C.47/T.30

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.

Calling		Called
Flags →		← Flags
Flags →		← Flags
Flags →		← 3 X XID (NSF) (CSI) DIS
Flags →		← 3 X XID (NSF) (CSI) DIS
3 X (TSI) DCS →		← 3 X XID (NSF) (CSI) DIS
FCD frames →		← Flags
→		← Flags
→ error		← Flags
→		← Flags
3 X PPS-NULL (1, 1, x) →		← Flags
3 X PPS-NULL (1, 1, x) →		← 3 X PPR (1, 1, a)
FCD error frames →		← 3 X PPR (1, 1, a)
→		← Flags
→		← Flags
3 X PPS-NULL (1, 1, a) →		← Flags
3 X PPS-NULL (1, 1, a) →		← 3 X MCF (1, 1)
FCD frames →		← 3 X MCF (1, 1)
→		← PID
→ error		← Flags
3 X PPS-MPS (1, 2, b) →		← Flags
3 X PPS-MPS (1, 2, b) →		← 3 X PPR (1, 2, p)
FCD error frames →		← 3 X PPR (1, 2, p)
→		← Flags
→		← Flags
3 X PPS-MPS (1, 2, p) →		← Flags
3 X PPS-MPS (1, 2, p) →		← 3 X MCF (1, 2)
3 X DCN →		← 3 X MCF (1, 2)

T0829760-00/d101
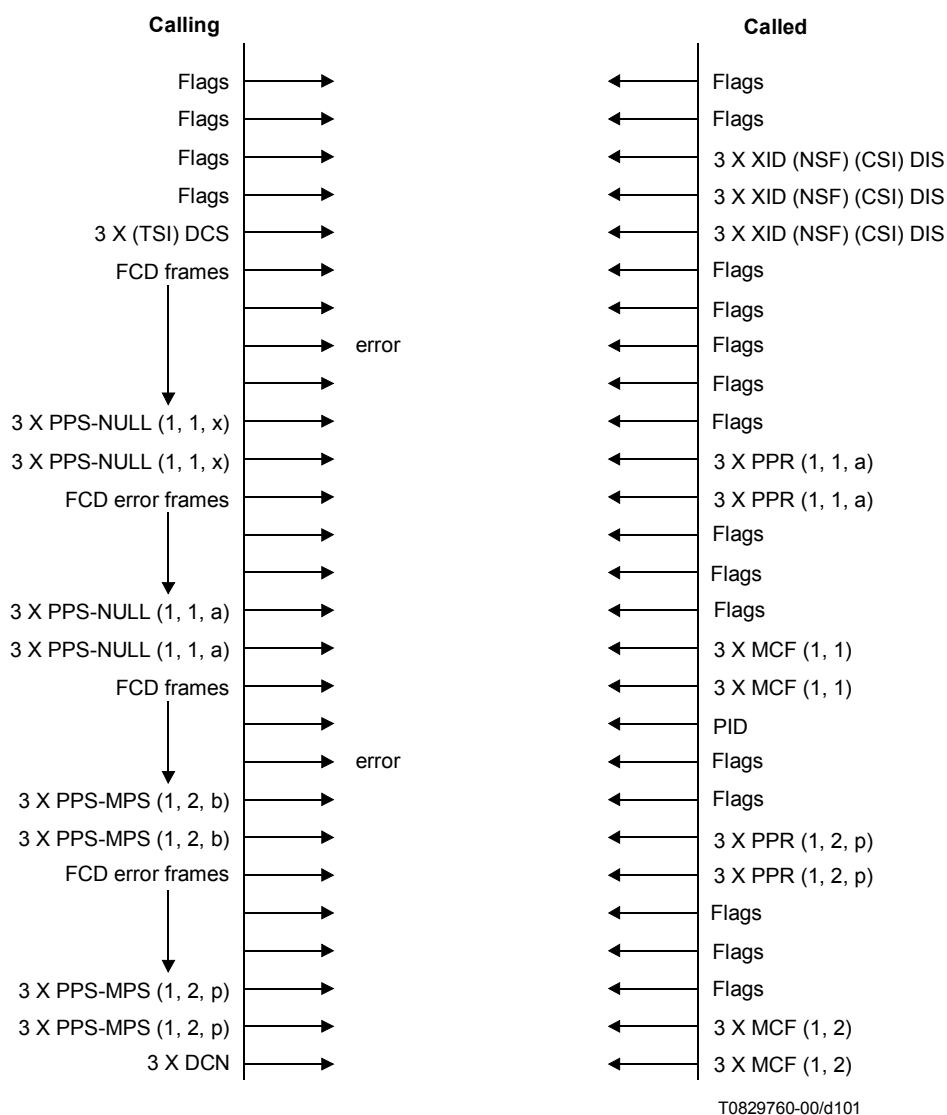
Figure C.48/T.30

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

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

T0830160-00/d102
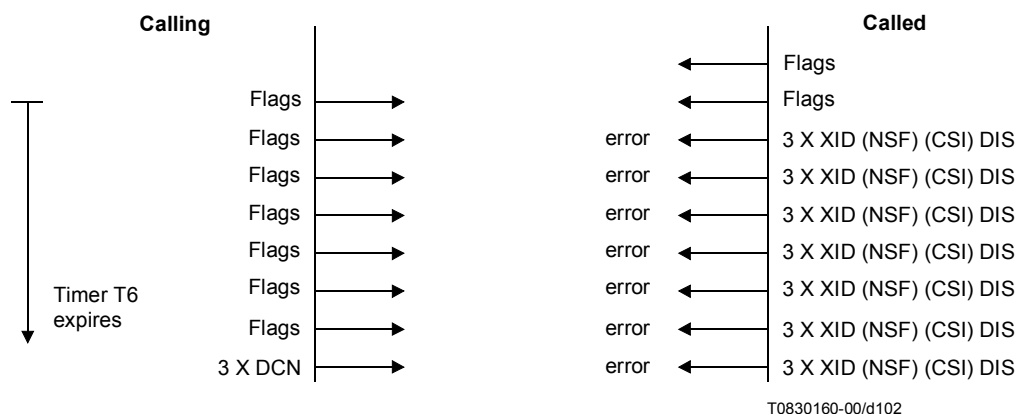
Figure C.49/T.30

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

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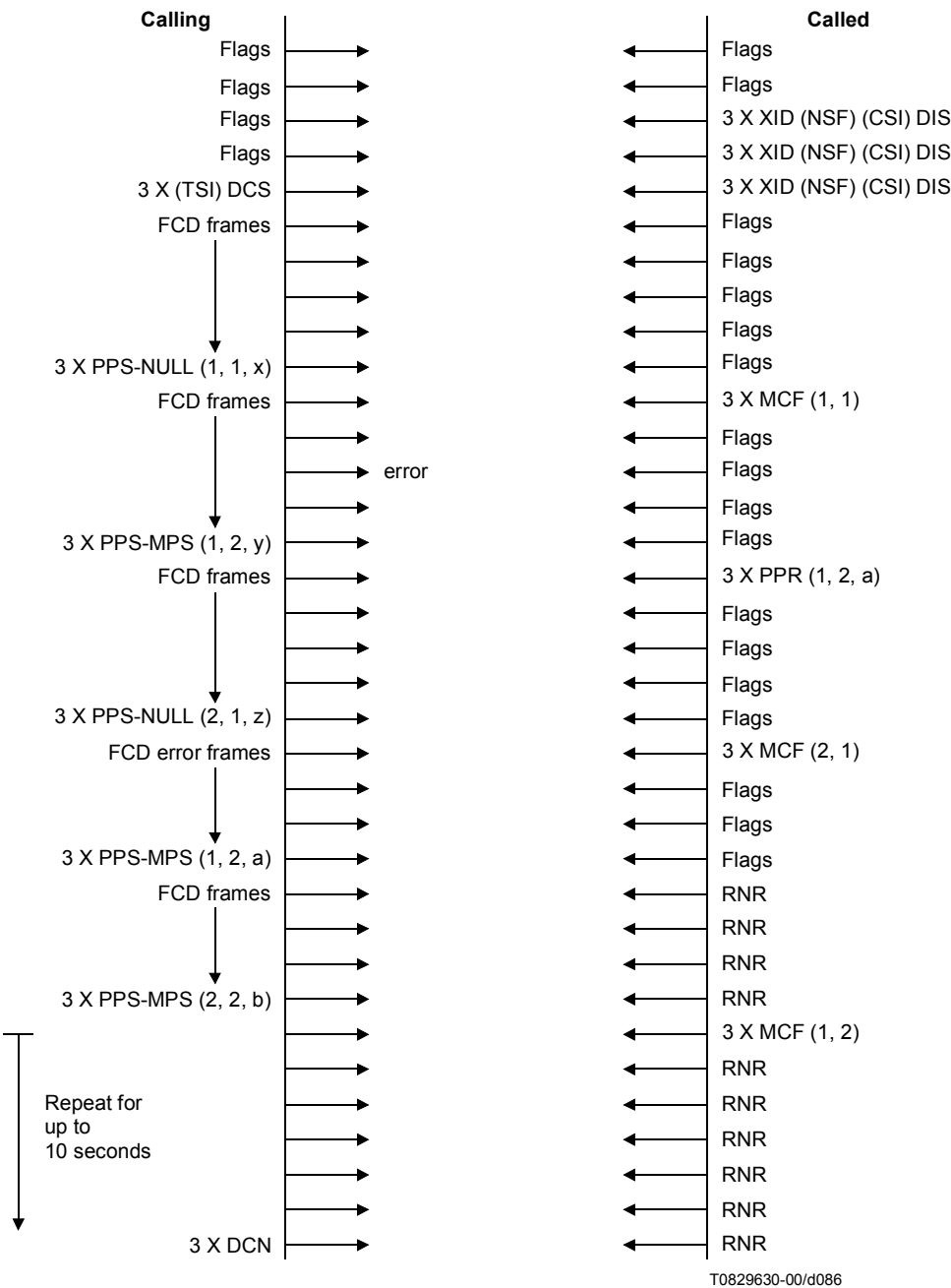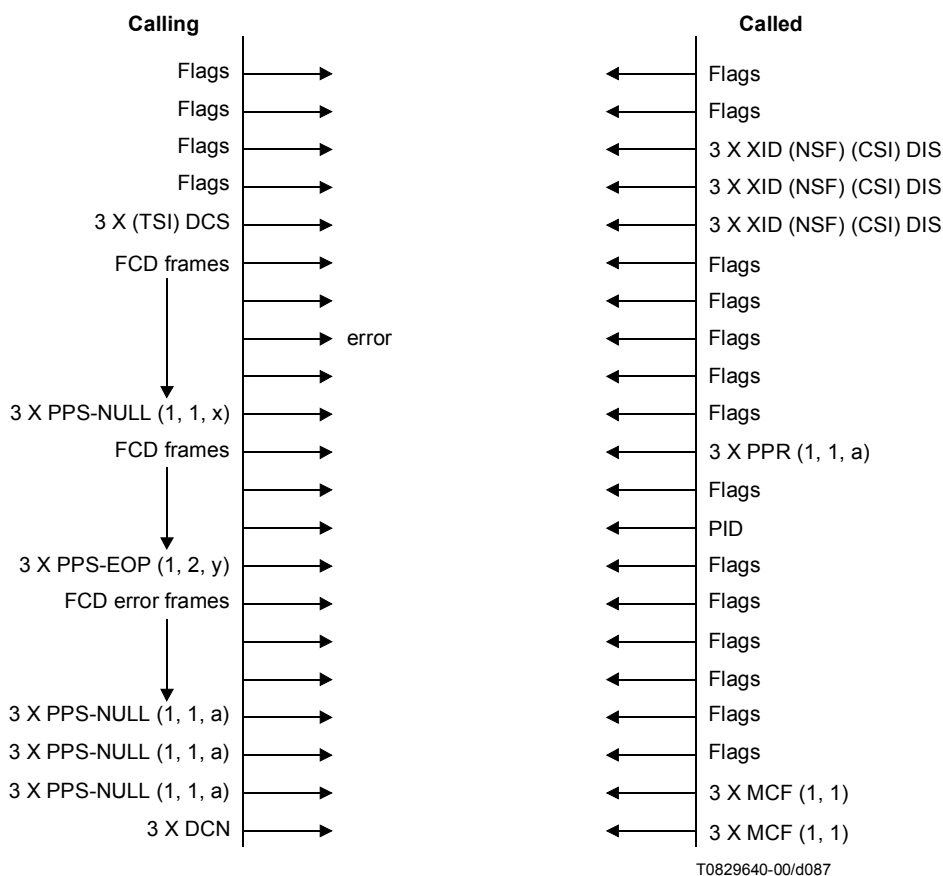

T0830170-00/d103
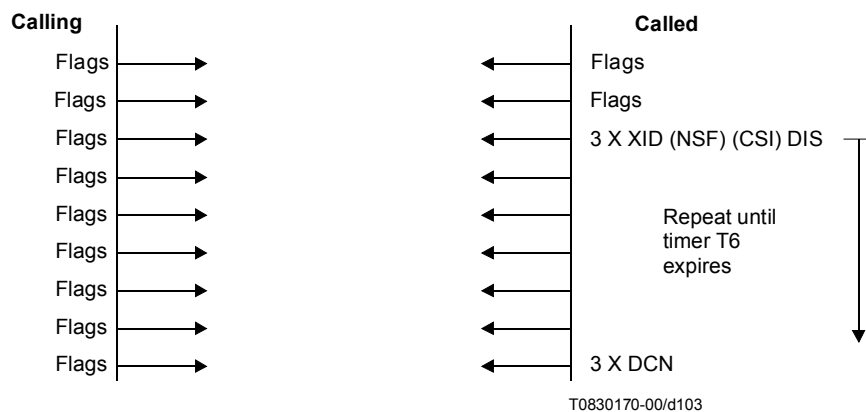
Figure C.50/T.30

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

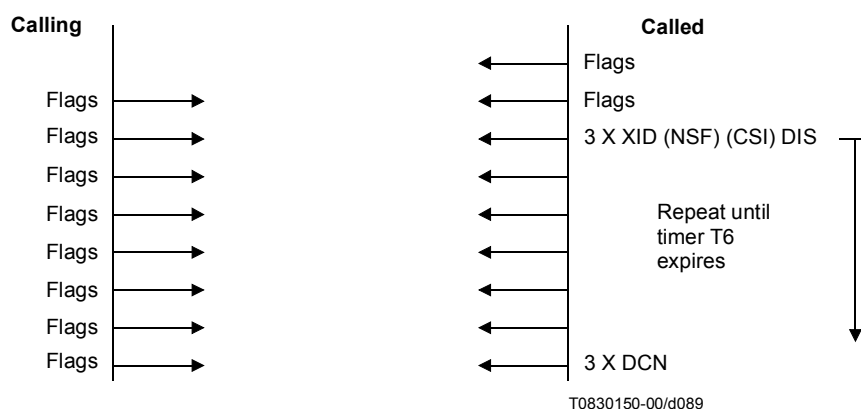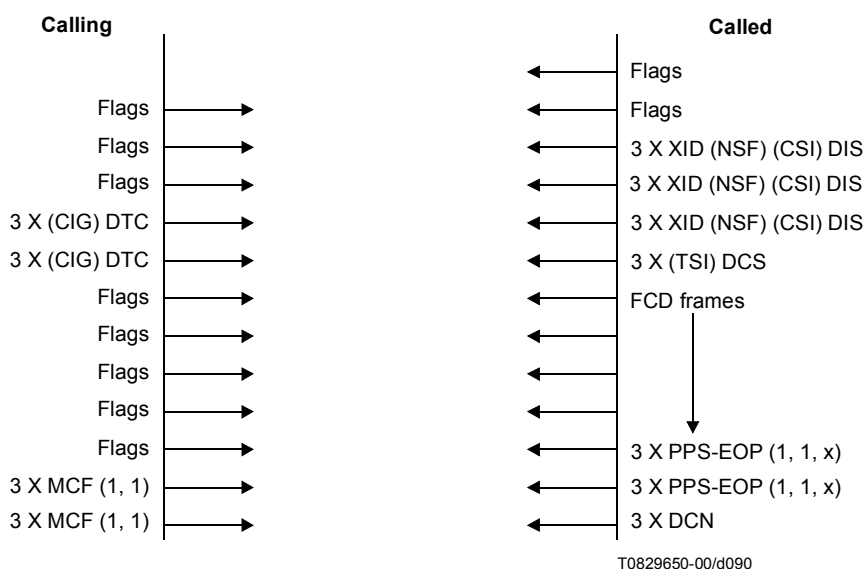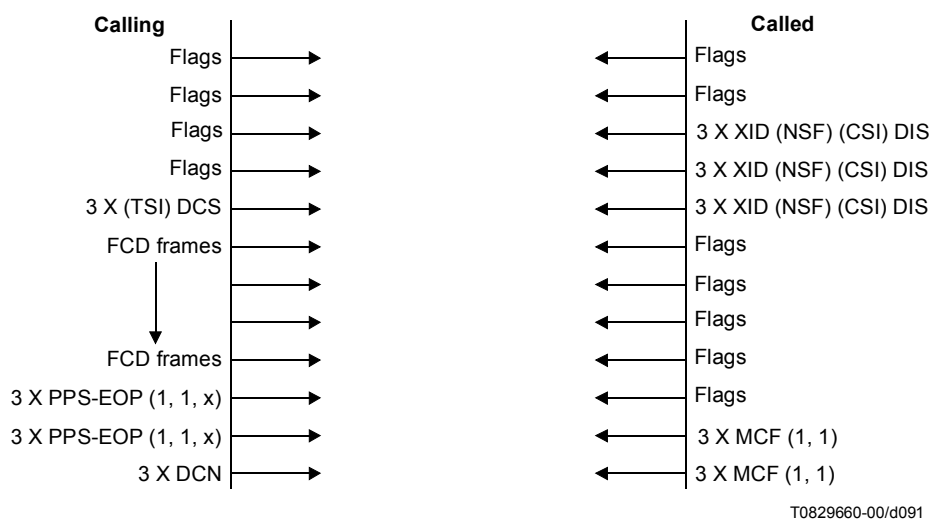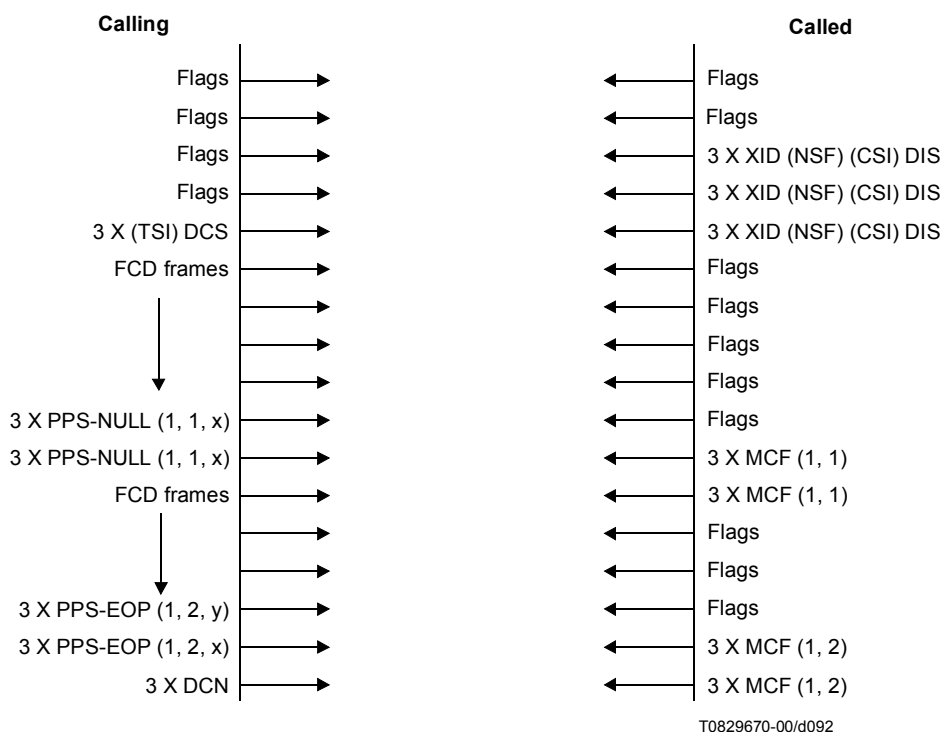The document being transmitted consists of a single partial page with no errors on the received document.

Calling		Called
	←	Flags
Flags →	←	Flags
Flags →	←	3 X XID (NSF) (CSI) DIS
Flags →	←	3 X XID (NSF) (CSI) DIS
3 X (CIG) DTC →	←	3 X XID (NSF) (CSI) DIS
3 X (CIG) DTC →	←	3 X (TSI) DCS
Flags →	←	FCD frames
Flags →	←	
Flags →	←	
Flags →	←	
Flags →	←	3 X PPS-EOP (1, 1, x)
3 X MCF (1, 1) →	←	3 X PPS-EOP (1, 1, x)
3 X MCF (1, 1) →	←	3 X DCN

T0829770-00/d104
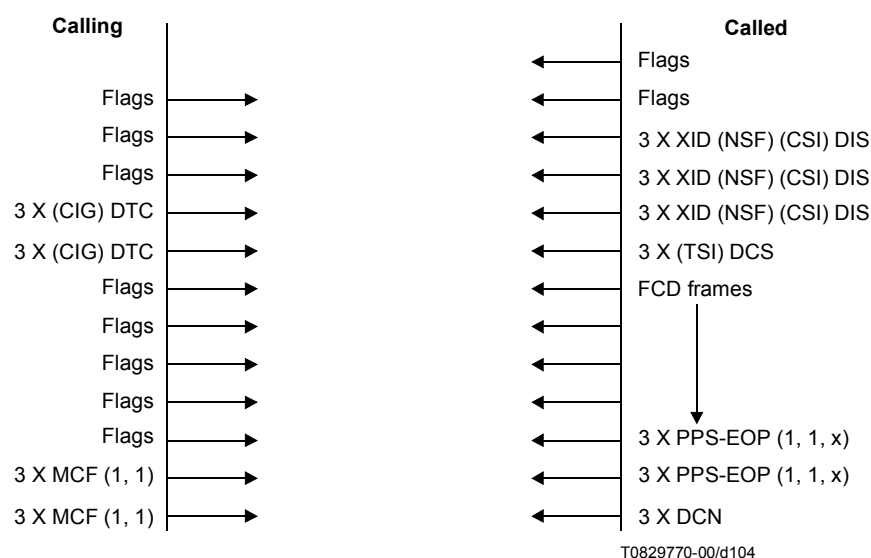
Figure C.51/T.30

C.7 Procedures for using Annex C within analog transmission environments

This clause describes the use of Annex C procedures when a prior data path has been established between two facsimile terminals by means other than those described in Phases A and B of this Recommendation.

C.7.1 Frame size

The called terminal should be able to support 64 octet frames in addition to 256 octet frames. This capability will be indicated by setting DIS/DTC bit 7 to "1". The calling terminal shall honour a called terminal's request for 64 octet frames and respond by setting bit 28 of the DCS to "1".

C.7.2 DIS/DTC/DCS indications

When the Annex C procedures are used in the analog transmission mode, bit 66 shall be set to "0".

C.7.3 Use of XID

The User Data Subfield (UDS) of the XID information field may be employed to indicate the data rates to be used in transmission over the channel.

C.7.4 Timers

When Annex C procedures are used with analog transmission rates less than 32 kbit/s, the values for T6 and T8 (see C.3.7.2.1) should be increased according to Table C.1.

Table C.1/T.30

Timer	Value and tolerance	Comment	Note
T6	35 ± 5 s	Annex C, terminal ID timer	1
T8	60 ± 5 s	Annex C, busy (no corrections and RNR) timer	2
NOTE 1 – In Annex C, timer T6 is functionally equivalent to timer T1 (see 5.4.3.1) and is given the same value.			
NOTE 2 – In Annex C, timer T8 is functionally equivalent to timer T5 (see 5.4.3.1) and is given the same value.			

Annex D

Optional automatic terminal selection procedures

This annex provides for optional automatic terminal selection procedures for two types of devices. Device 1 provides for selection between combined facsimile and telephone answering. Device 2 provides for selection between combined facsimile and telephone answering and recording device. Other terminal configurations 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 terminal shall attempt to detect CNG during the 1.8 to 2.5 seconds of quiet immediately after the called terminal is connected to the line.

2) Outgoing message (OGM1) shall be issued by the called terminal 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 seconds after the called terminal 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 terminal may continue to detect CNG in parallel during OGM1.

4) A local operator at the called terminal 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 terminal 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.
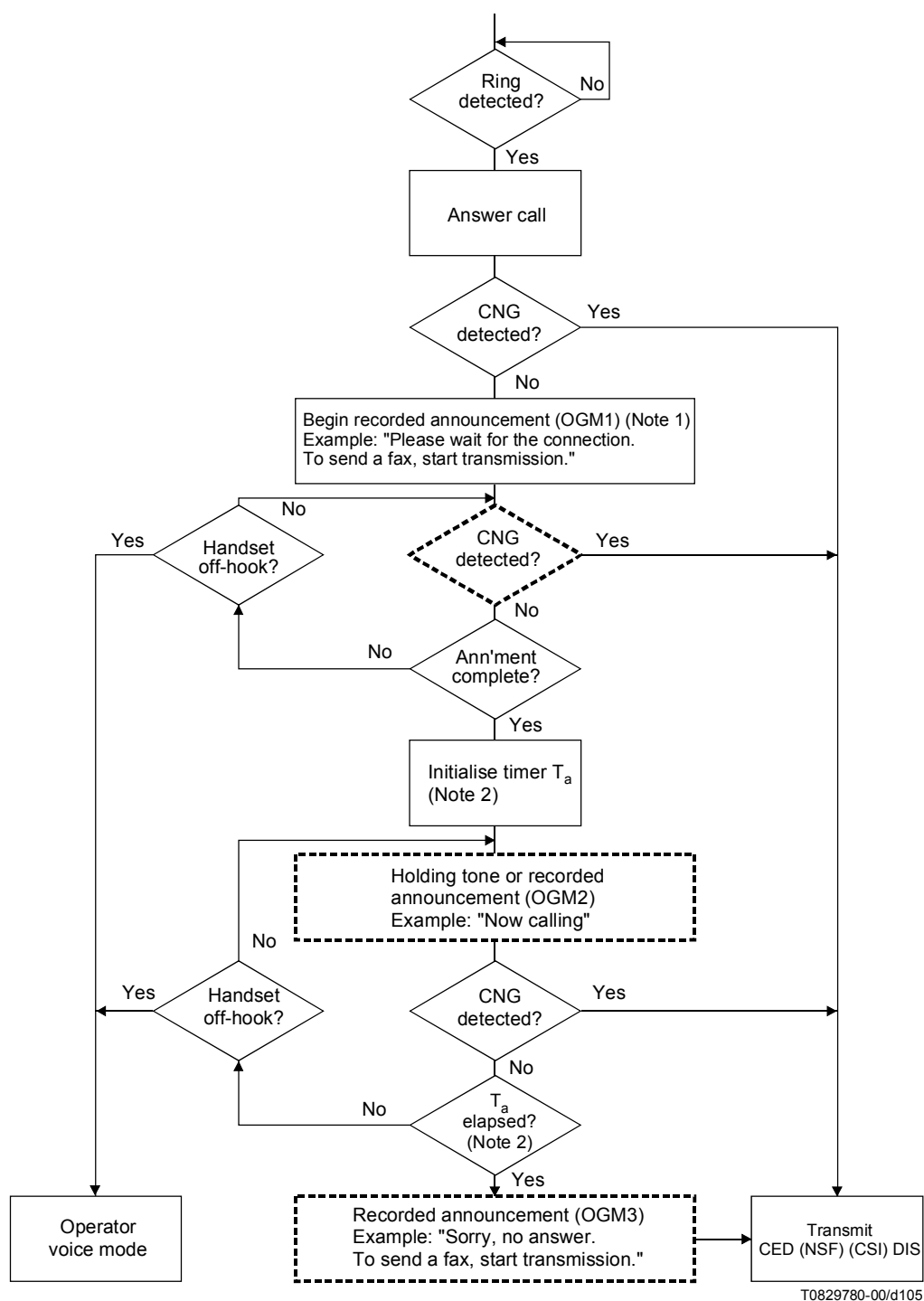
NOTE 1 – At 1.8 to 2.5 seconds after the called station is connected to line, it sends a recorded announcement. CNG detection during this silent period.

NOTE 2 – $3.5 \, (CNG) \times 1.15 \, (tolerance) \times 2 \leq T_a < T1 - (OGM1) - (OGM3)$. T1 = 35 ± 5 seconds.

Figure D.1/T.30 – Terminal selection method for combined facsimile and telephone answering
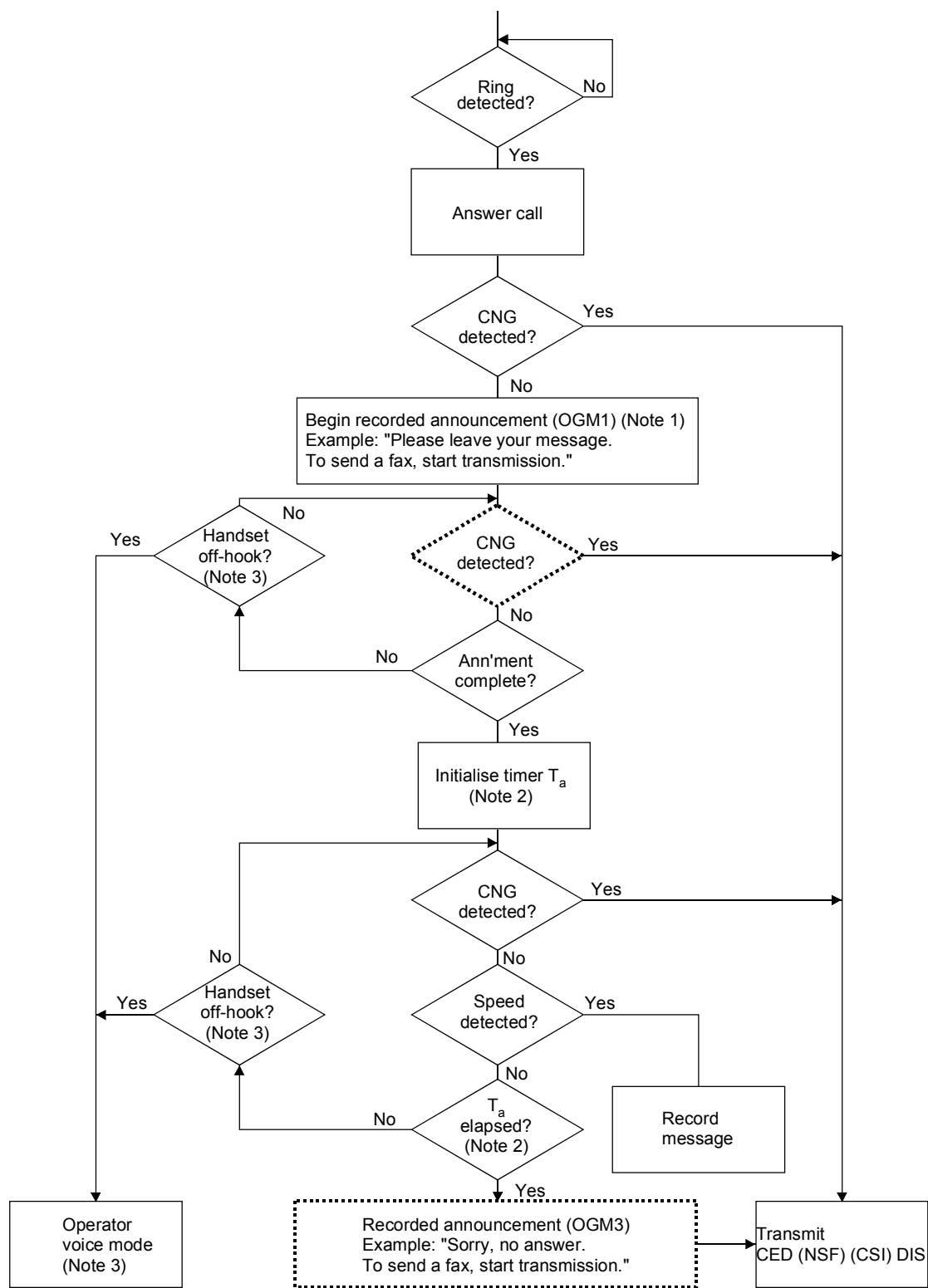
NOTE 1 – At 1.8 to 2.5 seconds after the called station is connected to line, it sends announcement. CNG detection during this silent period.

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

NOTE 3 – Procedure when operator is in attendance.

Figure D.2/T.30 – Terminal selection method for combined facsimile, telephone answering and recording device

Annex E

Procedure for the Group 3 document facsimile transmission of continuous-tone colour images

E.1   Introduction

This annex describes the additions to ITU-T Rec. T.30 to enable the transmission of continuous-tone (multilevel) colour and gray-scale images for Group 3 facsimile mode of operation.

The objective is to enable the efficient transmission of high quality, full colour and gray-scale images over the general switched telephone network and other networks. The images are normally obtained by scanning the original sources with scanners of 200 pels/25.4 mm or higher, and bit depths of eight bits per picture element per colour component or higher. The original sources are typically colour or gray-scale photographs or hard copies from high-quality printing systems.

The method specified here performs well on full-colour images, but for transmission of multi-colour images such as business graphics, other methods may be more efficient. Two such methods would be the transmission of images using ITU-T Recs T.434 (Binary File Transfer) and T.82 (JBIG encoding). This annex does not address the encoding of multi-colour images. This topic is left for further study.

The encoding methodology for continuous-tone (multilevel) images is based on the JPEG (ITU-T Rec. T.81 | ISO/IEC 10918-1) image encoding standard. The JPEG image coding method includes both a lossy mode and a lossless mode of encoding. This annex adopts the lossy mode of encoding which is based on the Discrete Cosine Transform.

The representation of colour image data is based on ITU-T Rec. T.42. It adopts a device-independent colour space representation, the CIELAB space, that allows unambiguous exchange of colour information.

This annex explains the procedure for negotiation of the capabilities for transmission of continuous-tone colour and gray-scale images. It specifies the definitions and the specifications of new entries to the Facsimile Information Field of the DIS/DTC and DCS frames of this Recommendation.

Information is specified pertaining to image digitization resolution (in bits/pel), spatial resolution, sampling ratio of colour components, JPEG capability, colour capability, and image data scaling that is subject to negotiation in the pre-message phase of the T.30 protocol.

This annex does not address the semantics and syntax of the actual encoding of the continuous-tone colour and gray-scale images. That information is included in Annex E/T.4.

The use of Error Correction Mode (ECM) for error-free transmission is mandatory in the procedure described by this annex. Under the error correction mode of transmission, the JPEG encoded image data are embedded in the Facsimile Coded Data (FCD) part of the HDLC (High-level Data Link Control) transmission frames specified by Annex A.

The technical features of encoding and decoding the continuous-tone colour and gray-scale image data are described in Annex E/T.4. It describes two modes of image encoding (lossy gray-scale and lossy colour) which are defined using ITU-T Rec. T.81.

E.2   Definitions

E.2.1   CIELAB: CIE 1976 (L* a* b*) space: A colour space defined by the CIE (*Commission internationale de l'éclairage*), having approximately equal visually perceptible difference between equally spaced points throughout the space. The three components are L*, or Lightness, and a* and b* in chrominance.

E.2.2   JPEG: Joint Photographic Experts Group, and also shorthand for the encoding method, described in ITU-T Rec. T.81, which was defined by this group.

E.2.3   baseline JPEG: A particular eight-bit sequential Discrete Cosine Transform (DCT) – based encoding and decoding process specified in ITU-T Rec. T.81.

E.2.4   quantization table: A set of 64 values used to quantize the DCT coefficients in baseline JPEG.

E.2.5   Huffman table: A set of variable length codes required in a Huffman encoder and a Huffman decoder.

E.3   Normative references

– ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

– ITU-T Recommendation T.42 (2003), *Continuous-tone colour representation method for facsimile*.

– ITU-T Recommendation T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines*. (Commonly referred to as JPEG standard.)

E.4   Negotiation procedure

The negotiation to transmit and receive JPEG encoded continuous-tone colour and gray-scale images under the Group 3 facsimile protocol is invoked through the setting of the bits in the DIS/DTC and DCS frames during the pre-message procedure (Phase B) of the T.30 protocol.

The first capability to be established between the calling terminal and the called terminal is to indicate whether JPEG Mode is available. Then the second capability to be established is whether full colour mode is available.

Thirdly, a means is provided to indicate to the called terminal that the Huffman tables are the default tables. The transmission of Huffman tables is mandatory.

In addition to these three characteristics, the following four capabilities (see Table E.1) that pertain to mandatory or optional capabilities are exchanged.

Table E.1/T.30 – Mandatory and optional capabilities

Mandatory	Optional
8 bits/pel/component	12 bits/pel/component
4:1:1 Chrominance subsampling	No subsampling (1:1:1)
CIE Standard Illuminant D50	Custom illuminant
Default gamut range	Custom gamut range
200 × 200 pels/25.4 mm	300 × 300 or 400 × 400 or 600 × 600 or 1200 × 1200 pels/25.4 mm
200 × 200 pels/25.4 mm	100 × 100 pels/25.4 mm

Annex F

Procedures for Group 3 facsimile transmission using the half-duplex modulation system defined in ITU-T Rec. V.34

F.1   Introduction

This annex describes the procedures to be used for the optional use of the half-duplex modulation system defined in ITU-T Rec. V.34 in Group 3 facsimile terminals covered by Annex A/T.4 and Annex A.

F.2   References

–   ITU-T Recommendation V.8 (2000), *Procedures for starting sessions of data transmission over the general switched telephone network.*

–   ITU-T Recommendation V.34 (1998), *A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.*

F.3   Procedures

The use of the Error Correction Mode (ECM) is mandatory for all facsimile messages using the V.34 modulation system. The procedure described in Annex A shall be followed except as indicated below.

F.3.1   General

F.3.1.1 The terminal shall follow the start-up procedures defined in ITU-T Rec. V.8 and clause 12/V.34 except as noted in clause 6 and in this annex.

F.3.1.2 After receiving the ANSam answer tone, in order to keep network echo suppressors disabled, the source terminal must transmit continuously except for the silent periods defined in ITU-T Recs V.8 and V.34 during the start-up procedure and between control channel and primary channel transmissions. After control channel start-up, the recipient terminal shall be silent only when receiving primary channel training or data.

F.3.1.3 The binary coded procedural data shall be transmitted using the control channel also described in ITU-T Rec. V.34. The message data and RCP command shall be transmitted using the half-duplex primary channel described in ITU-T Rec. V.34.

F.3.1.4 After executing the control channel start-up procedure defined in 12.4/V.34, each terminal shall condition its receiver to receive HDLC frames and shall transmit HDLC flags using the control channel data rate determined between terminals during the control channel start-up procedure. At least two flags shall be sent prior to the first control channel frame after any start-up, resynchronization or retraining procedure.

The data signalling rate for the control channel shall be determined by the MPh sequence described in 12.4/V.34.

NOTE – Use of the asymmetric data signalling rate as defined in bit 50 of MPh in Table 23/V.34 is left for further study.

F.3.1.5 If, during control channel operation, a terminal determines, by some means, that its modulation system receiver has lost control channel synchronization with the remote transmitter, then it shall initiate a control channel retrain as described in 12.8/V.34.

F.3.2 Pre-message procedures (Phase B)

F.3.2.1 The TCF signal is not used in V.34 facsimile operation. Therefore, after transmitting a DCS frame, the source terminal shall transmit control channel HDLC flags while waiting to receive a valid response. The recipient terminal shall respond to a DCS with a CFR indicating that the entire pre-message procedure has been completed and the message transmissions may commence. The FTT response shall not be used.

F.3.2.2 After sending a CFR frame, the recipient modulation system shall send flags until a string of at least 40 consecutive 1s is detected and then shall transmit silence. While silent, the recipient terminal shall be prepared to receive the primary channel resynchronization signal followed by message data at the data rate determined by the MPh exchange.

F.3.2.3 After receiving a CFR frame, the source terminal shall transmit consecutive 1s until silence (or absence of flags) is detected from the recipient terminal and at least 40 1s have been sent. The source terminal shall then transmit silence for 70 ± 5 ms followed by the primary channel resynchronization signal as defined in ITU-T Rec. V.34 followed by the synchronization signal defined in A.3.1/T.4 and then the message data at the data rate determined by the MPh exchange.

NOTE 1 – Optionally, machines may restart the T1 timer when the V.8 procedure is completed in order to conform with operation of Annex D.

NOTE 2 – T2 timer shall be reset at the start of each new frame instead of the detection of flags.

F.3.3 In-message procedure and message transmission (Phase C)

Use of primary channel retrain as described in 12.7/V.34 is for further study.

F.3.4 Post-message procedure (Phase D)

F.3.4.1 After sending the message data and the return to control for partial page (RCP) sequence, the source terminal shall follow the primary channel turn-off procedure defined in ITU-T Rec. V.34 and then initiate either the control channel resynchronization procedure or, if a data rate change is desired, the control channel start-up procedure defined in ITU-T Rec. V.34. Its receiver shall be conditioned to detect either a control channel resynchronization response or a control channel start-up response in the case of the resynchronization procedure and a control channel start-up response in the case of the start-up procedure from the recipient terminal. The control channel start-up procedure allows the renegotiation of data rate through an MPh exchange

F.3.4.2 After receiving the message and the RCP sequence, the recipient modulation system shall condition its receiver to detect the control channel resynchronization signal. After detecting the signal, the recipient terminal shall respond with either the control channel resynchronization response or, if a data rate change is desired, the control channel start-up response in case of the resynchronization signal and with the control channel start-up response in case of the start-up signal. The control channel start-up procedure allows for the renegotiation of data rate through an MPh exchange.

F.3.4.3 After the control channel has been re-established, the source modulation system shall send the post-message command. After receiving the post-message command, the recipient terminal shall send the post-message response.

F.3.4.4 After sending the last post-message response between messages, the recipient modem modulation system shall send flags until a string of at least 40 consecutive 1s is detected and then shall transmit silence. While silent, the recipient terminal shall be prepared to receive the primary channel resynchronization signal followed by message data at the rate determined by the MPh exchange.

F.3.4.5 After receiving the last post-message response between messages, the source terminal shall transmit consecutive 1s until silence (or absence of flags) is detected from the recipient terminal and at least forty 1s have been sent. The source terminal shall then transmit silence for 70 ± 5 ms

followed by the primary channel resynchronization signal as defined in ITU-T Rec. V.34, followed by the synchronization signal defined in A.3.1/T.4 and then message data at the data rate determined by the MPh exchange.

NOTE 1 – Data rate change is possible at every start of the control channel according to the procedures in F.3.4.1 and F.3.4.2. CTR/CTC frames shall not be used in V.34 ECM protocol and EOR/ERR or DCN signals are used to transit.

NOTE 2 – Optionally, terminals may disconnect the line immediately after sending DCN without sending consecutive 1s.

NOTE 3 – Use of PIP/PIN and PRI-Q commands is left for further study.

F.4   Half-duplex operating procedures of ITU-T Recs V.34 and V.8 for Group 3 facsimile

These procedures are defined by the corresponding parts of ITU-T Recs V.8 and V.34.

F.5   Examples of sequences

This clause contains examples of sequences used for the V.34 ECM protocol. See Figures F.5-1 to F.5-14.
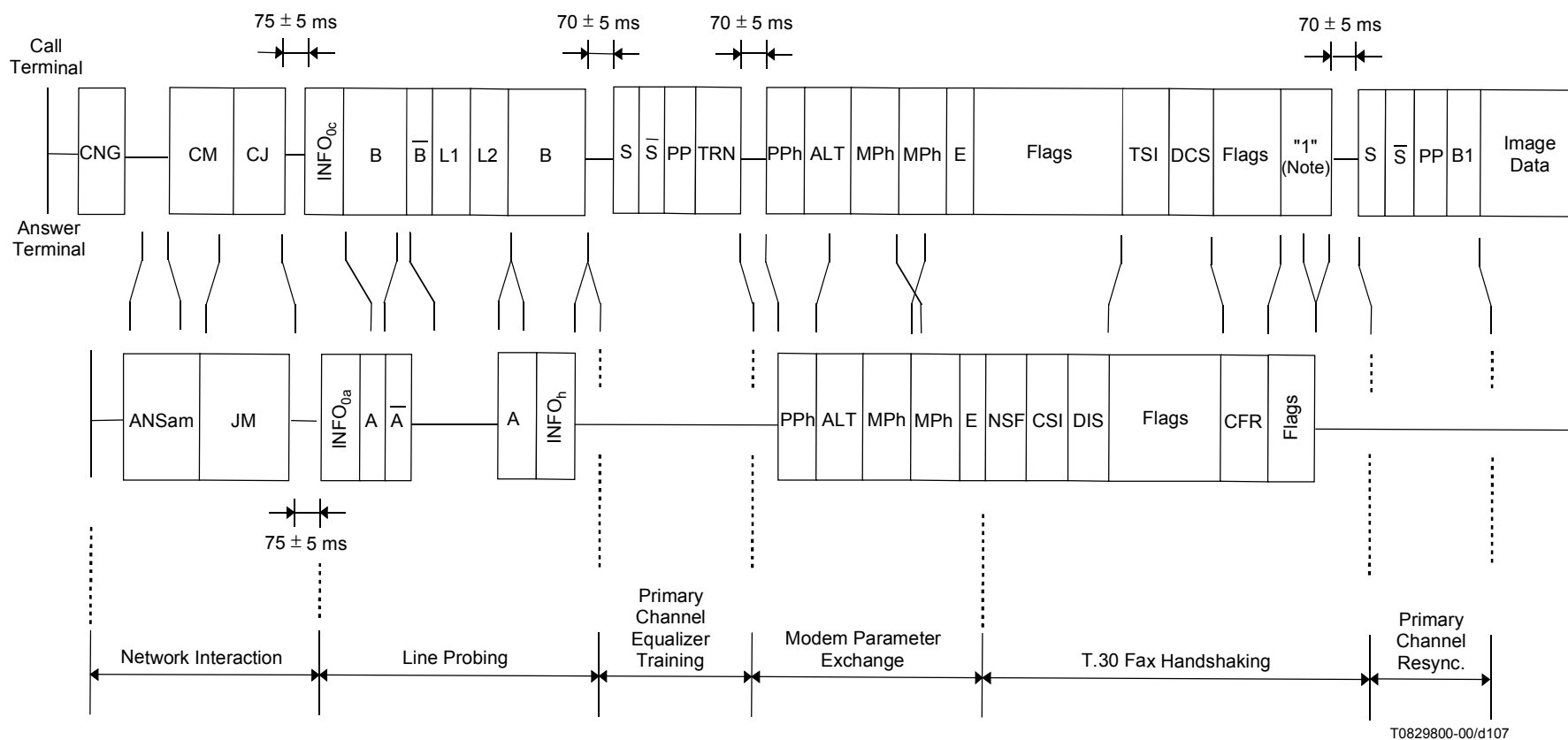
NOTE – The string of consecutive 1s shall be followed by the 4T of scrambled ones defined in 12.6.3/V.34.

Figure F.5-1/T.30 – Typical V.34 fax start-up sequence

Source Terminal

| Image Data | | Sh | S̄h | ALT | E | PPS-MPS | Flags | "1" | | S | S̄ | PP | B1 | Image Data |

Recipient Terminal

| Sh | S̄h | ALT | E | Flags | MCF | Flags |
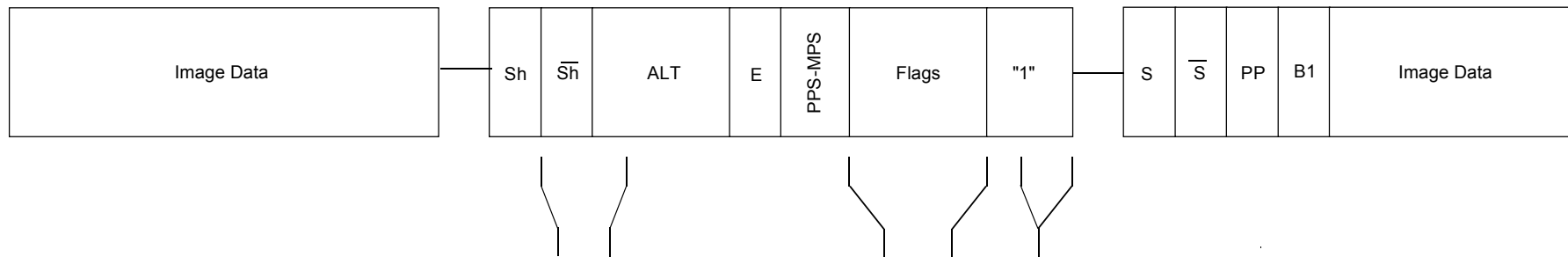
T0829810-00/d108

Figure F.5-2/T.30 – Between pages

Source Terminal

Recipient Terminal
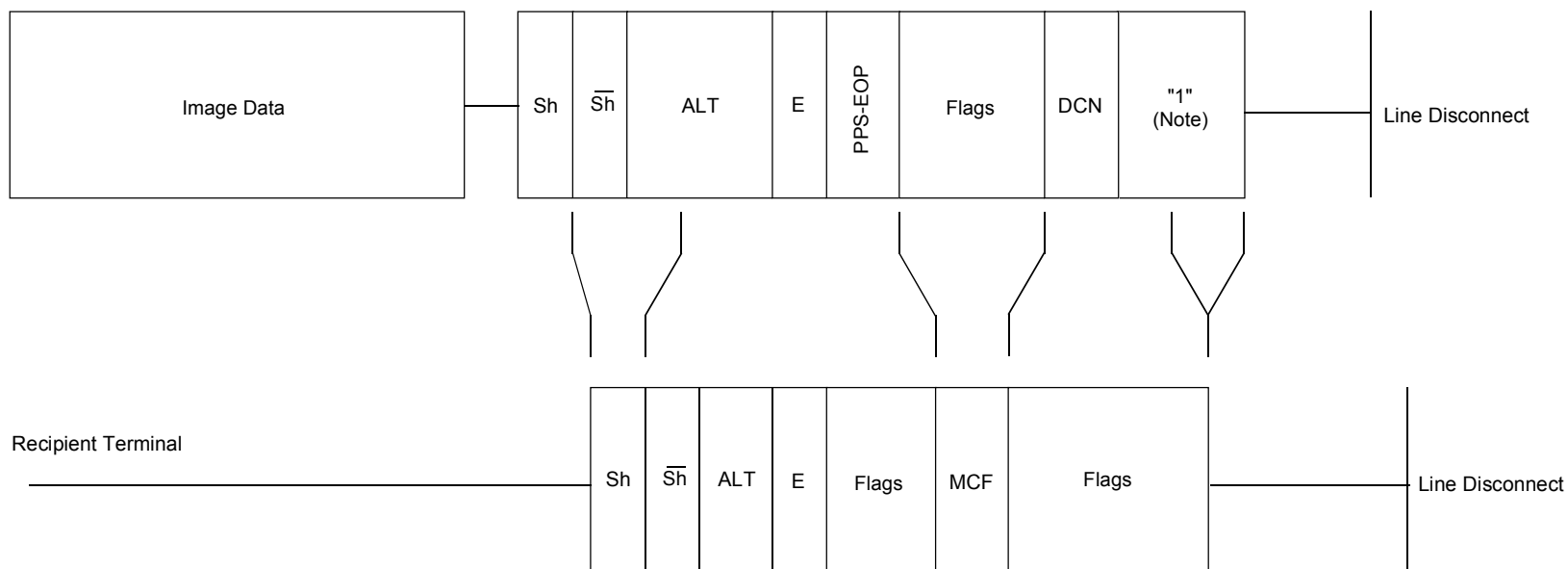
T0829820-00/d109

NOTE – Some terminals may disconnect the line immediately after sending DCN without sending consecutive 1s.

Figure F.5-3/T.30 – Communication end procedure
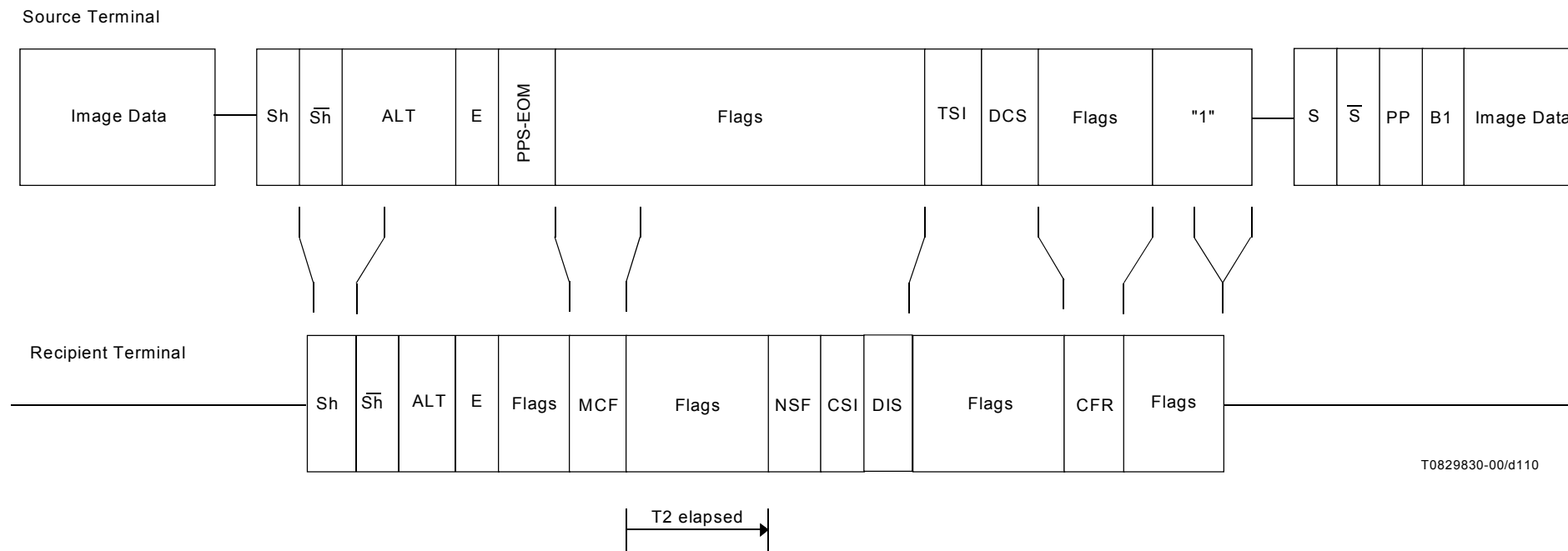
Figure F.5-4 – Mode change (without data rate change)

T0829830-00/d110
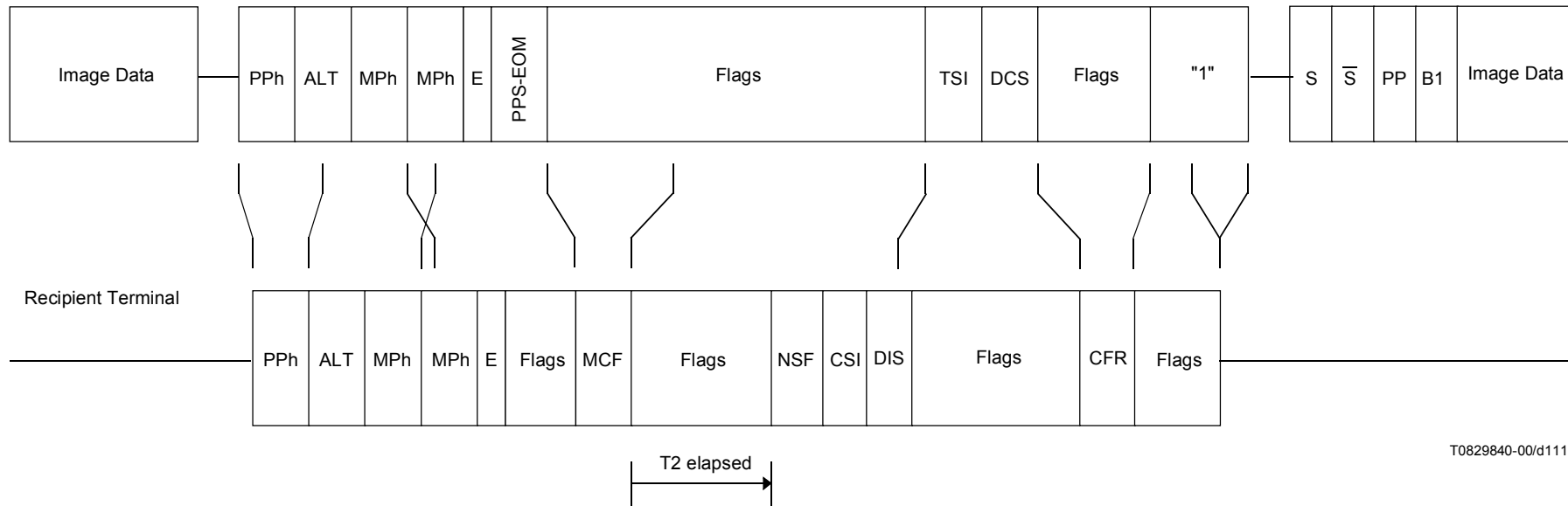
Figure F.5-5/T.30 – Mode change (with data rate change from source terminal)
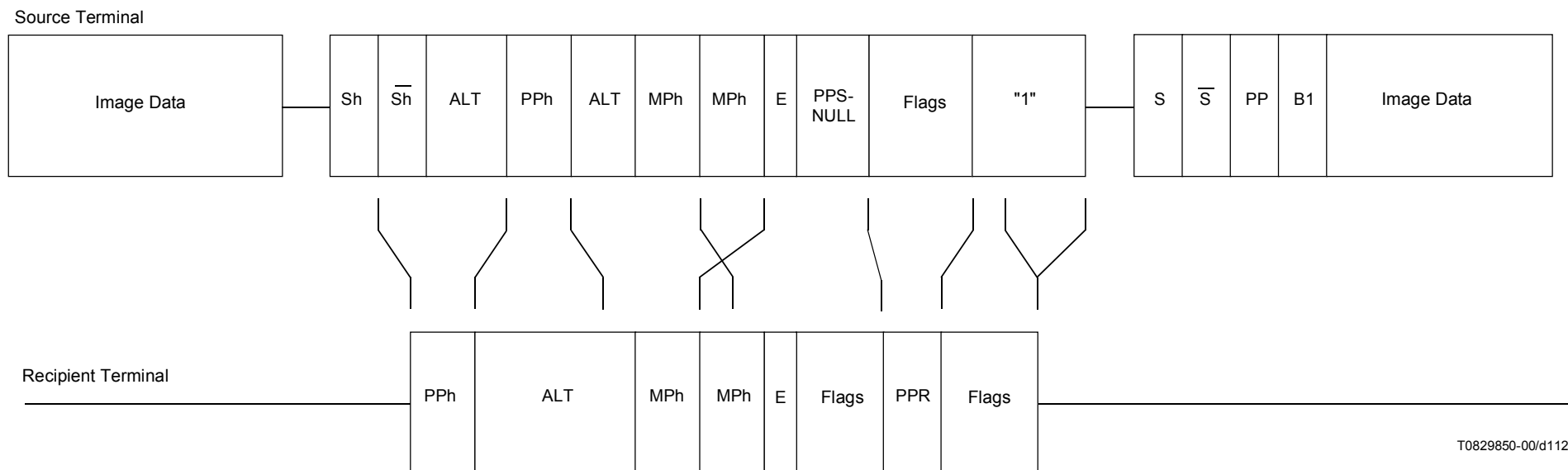
Figure F.5-6/T.30 – Data rate change between partial pages
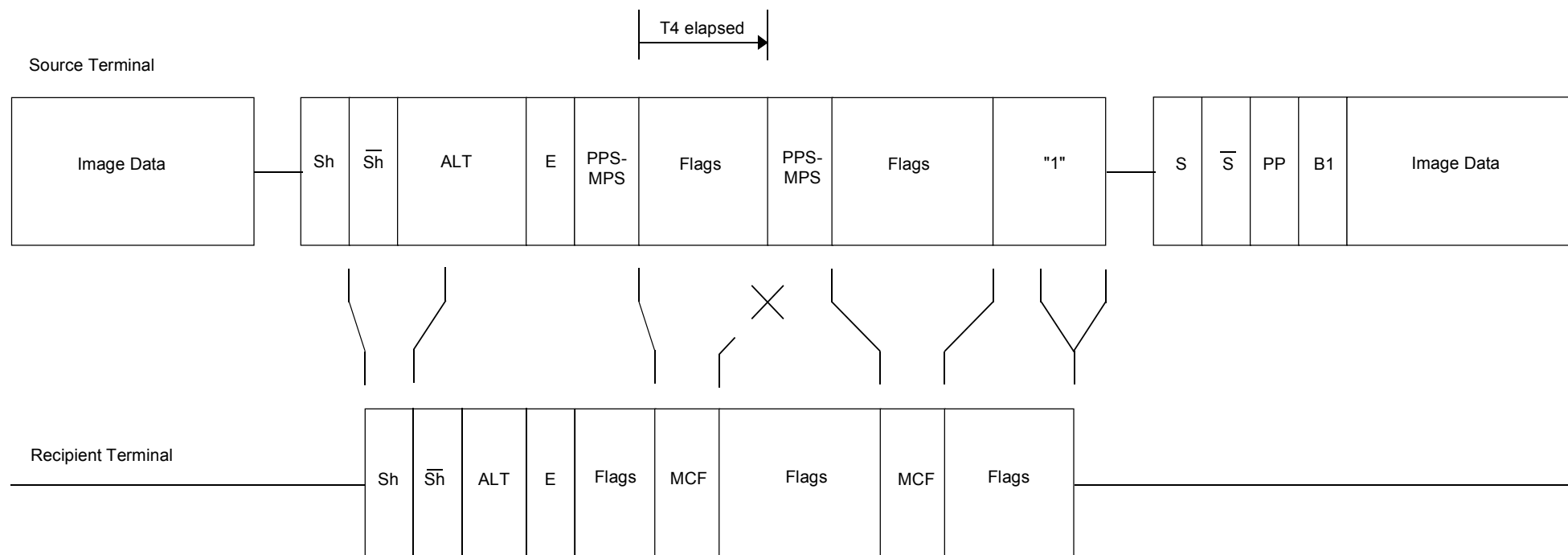
Figure F.5-7/T.30 – Command retransmission
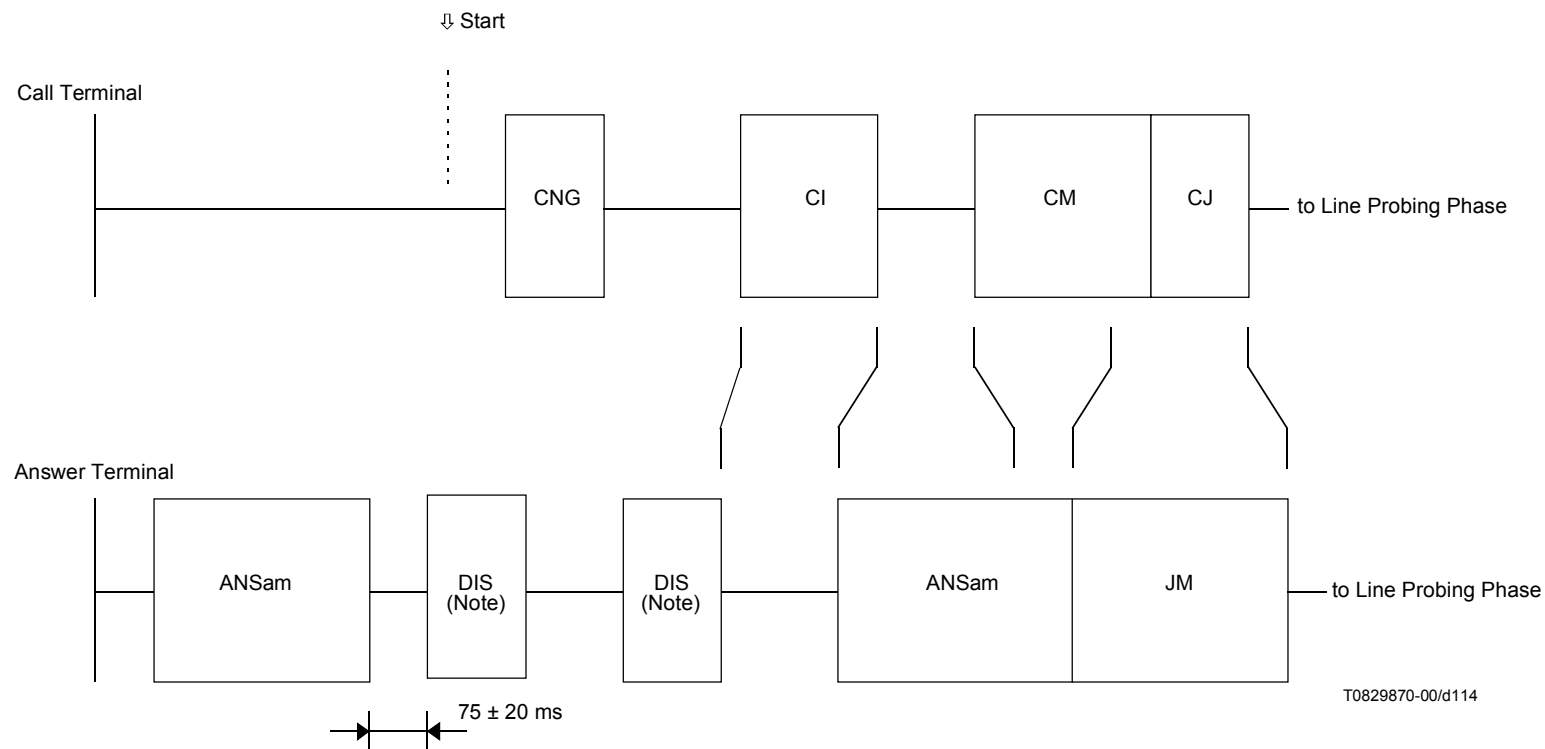
NOTE – Bit 6 is set to "1".

Figure F.5-8/T.30 – Manual sending

Call Terminal

CNG CNG CNG CI CM CJ to Line Probing Phase

⇩ Start

Answer Terminal

ANSam DIS (Note) ANSam JM to Line Probing Phase

75 ± 20 ms

T0829880-00/d115

NOTE – Bit 6 is set to "1".
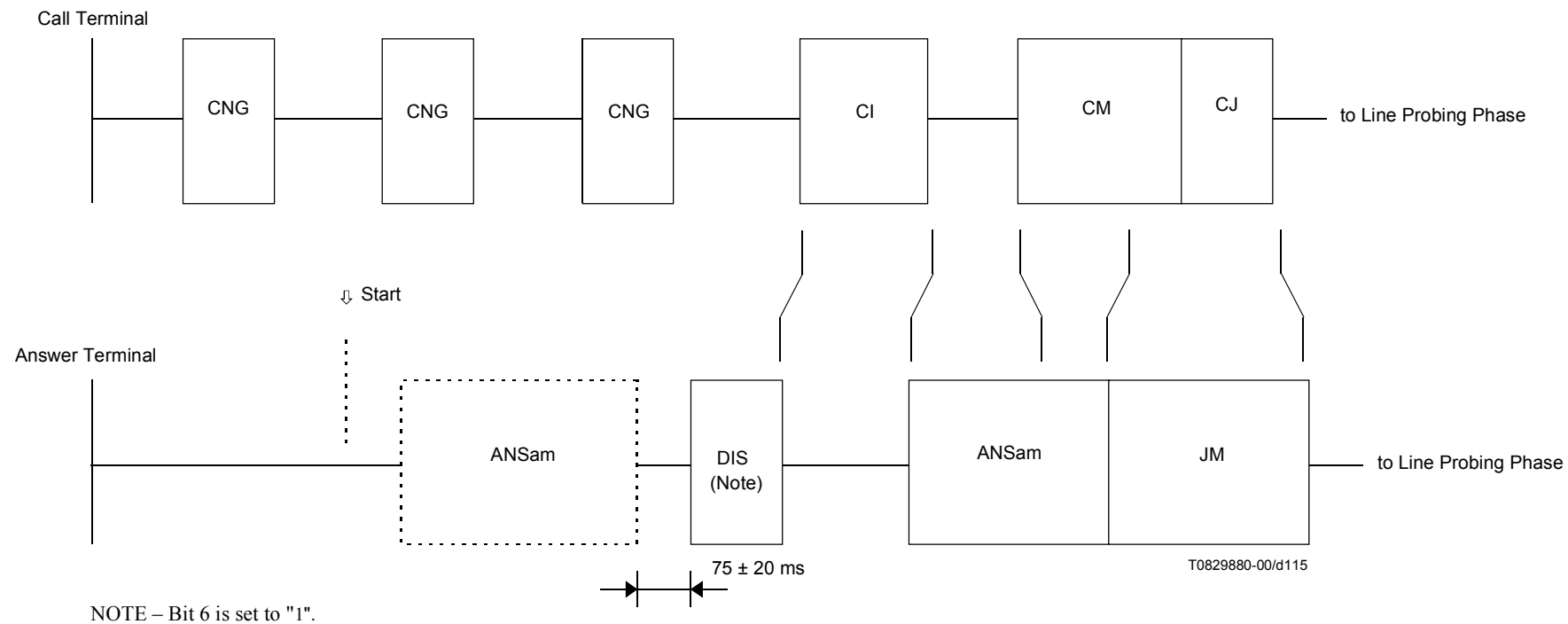
Figure F.5-9/T.30 – Manual receiving

Call Terminal

CNG CM CJ (TSI) DCS (Note) Training and TCF Image Data (e.g., Rec. V.17)

Answer Terminal

ANSam JM (NSF) (CSI) DIS (Note) CFR (Note)

75 ± 5ms

Rec. V.8

Normal T.30 Procedure
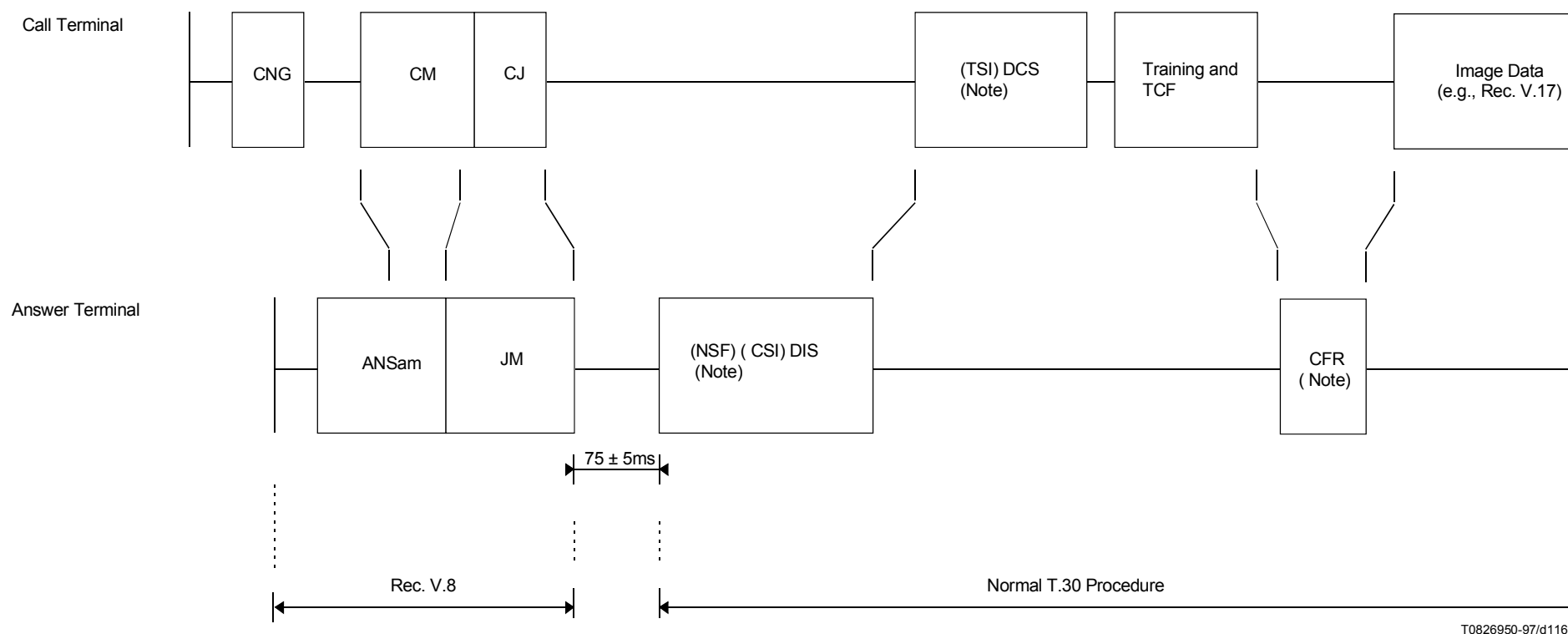
T0826950-97/d116

NOTE – V.21 modulation mode

Figure F.5-10/T.30 – Normal T.30 procedure from ITU-T Rec. V.8
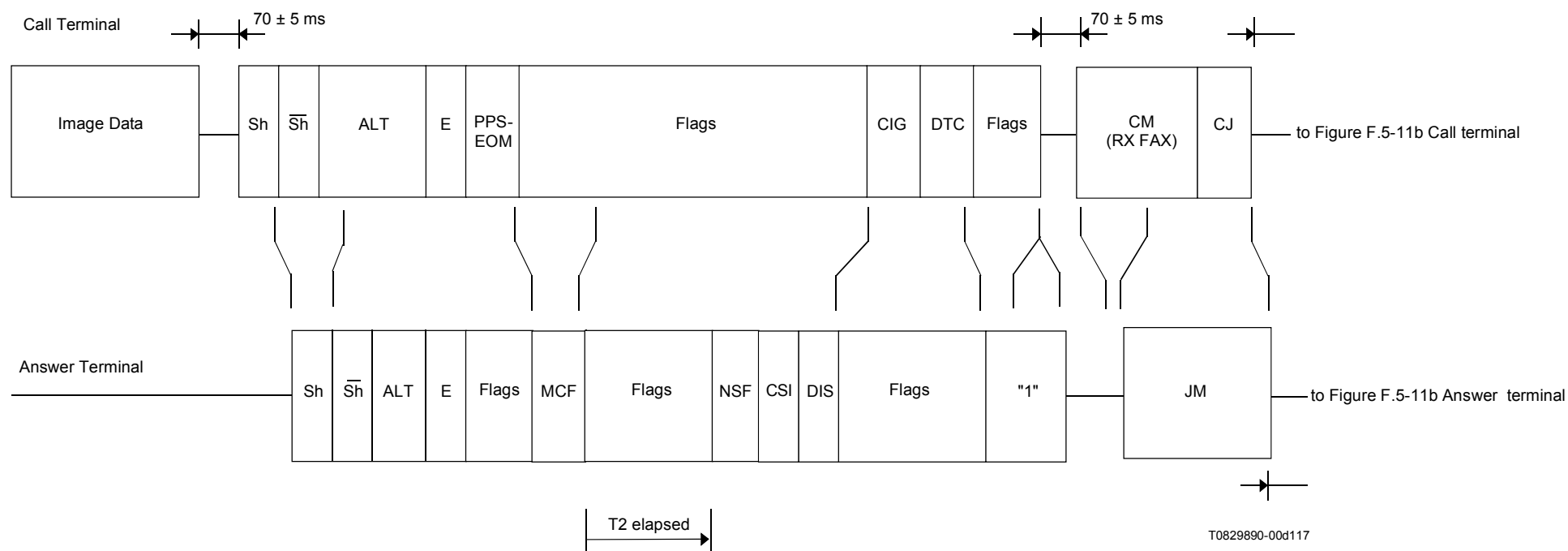
Figure F.5-11a/T.30 – Turnaround polling (send → receive in the call terminal [1/2])
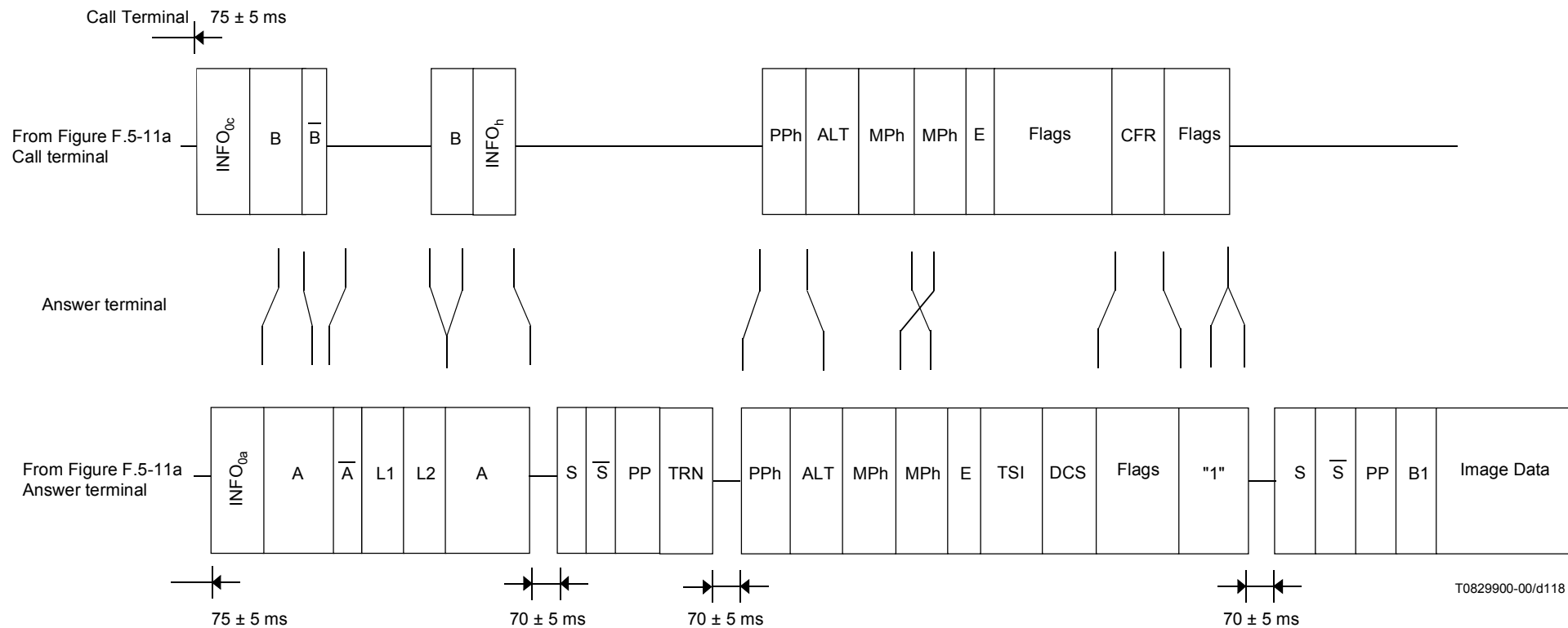
Figure F.5-11b/T.30 – Turnaround polling (send → receive in the call terminal [2/2])
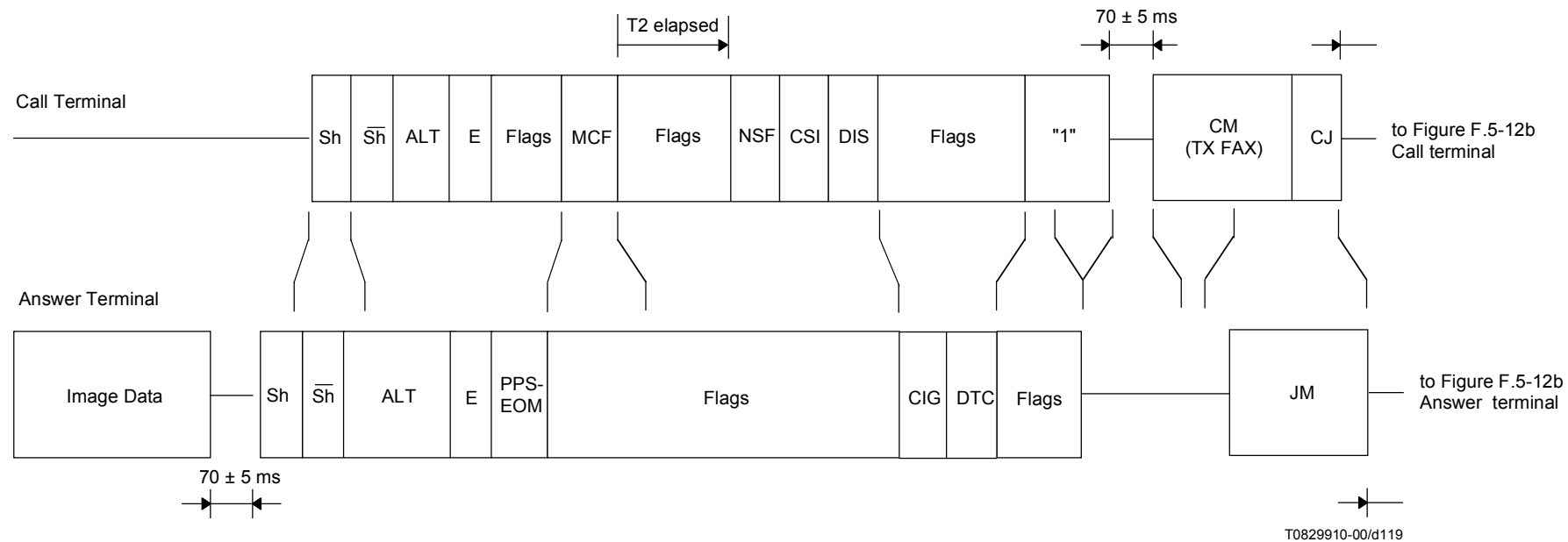
Figure F.5-12a/T.30 – Turnaround polling (receive → send in the call terminal [1/2])
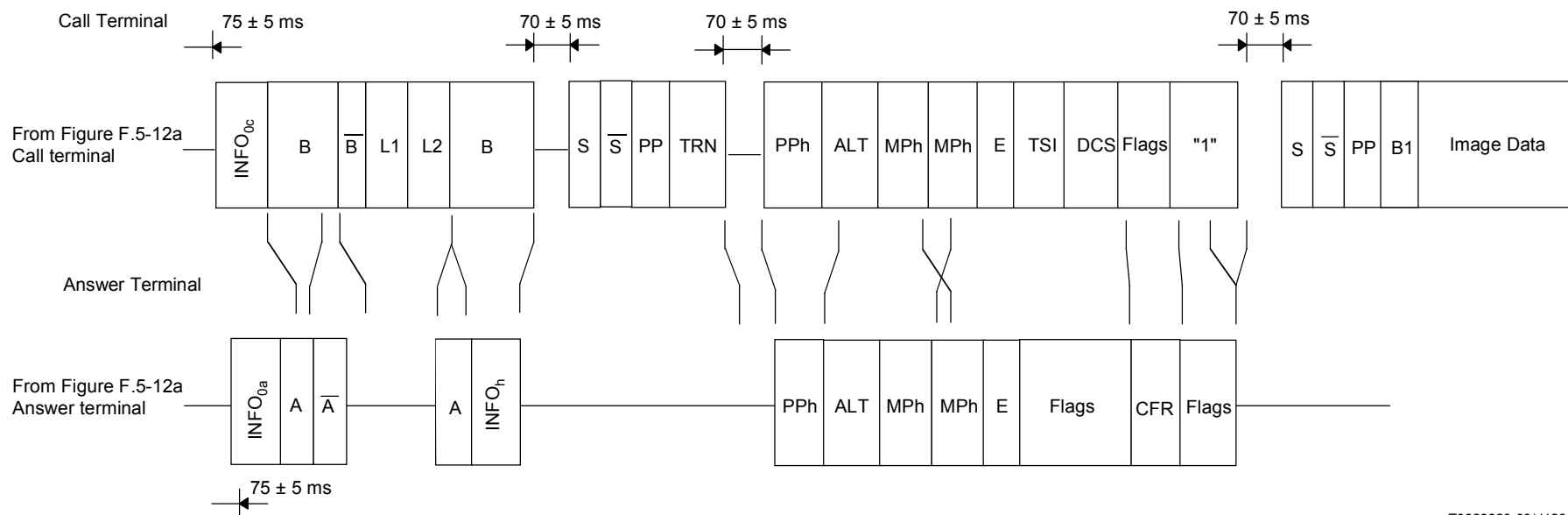
Figure F.5-12b/T.30 – Turnaround polling (receive → send in the call terminal [2/2])

Figure F.5-13/T.30 – Polling sequence
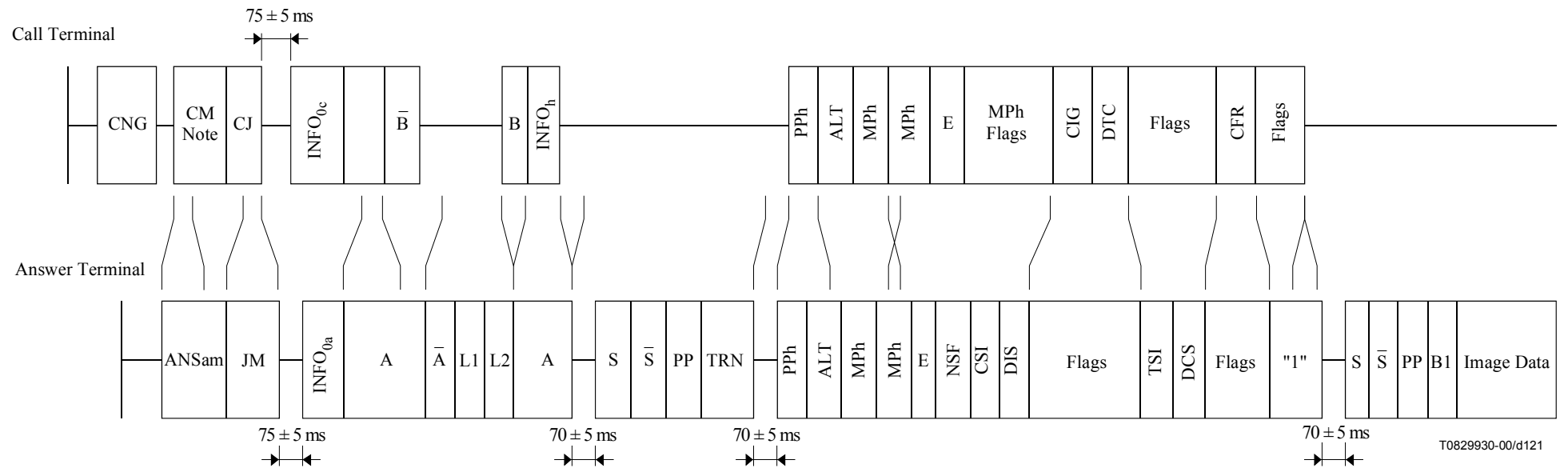
NOTE – RX FAX is set.
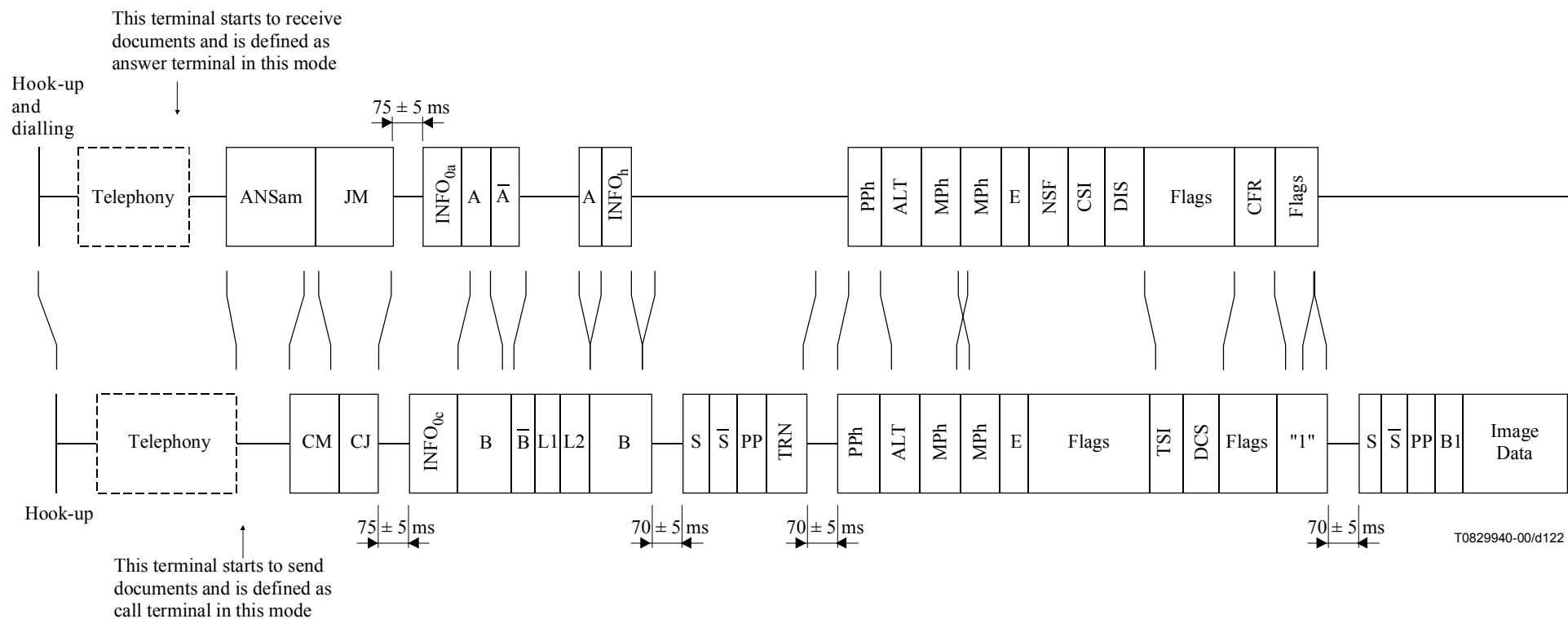
Figure F.5-14/T.30 – The manual communication after the telephony mode

Annex G

Procedures for secure Group 3 document facsimile transmission using the HKM and HFX system

G.1   Introduction

G.1.1   This annex describes the protocol used by Group 3 document facsimile terminals to provide secure communications using the HKM and HFX systems. The procedures used are based upon those defined in the main body as well as in Annexes A and C.

G.1.2   Use of this annex is optional.

G.1.3   The error correction defined in Annex A or Annex C (as appropriate) is mandatory.

G.2   Outline of the secure facsimile document procedure

G.2.1   The HKM and HFX systems provide the following capabilities for secure document communications between entities (terminals or terminal operators):

•   mutual entity authentication;

•   secret session key establishment;

•   document confidentiality;

•   confirmation of receipt;

•   confirmation or denial of document integrity.

G.2.2   Functions

Key management is provided using the HKM system defined in Annex B/T.36. Two procedures are defined: the first being registration and the second being the secure transmission of a secret key. Registration establishes mutual secrets and enables all subsequent transmissions to be provided securely. In subsequent transmissions, the HKM system provides mutual authentication, a secret session key for document confidentiality and integrity, confirmation of receipt and a confirmation or denial of document integrity.

Document confidentiality is provided using the carrier cipher defined in Annex D/T.36. The carrier cipher uses a 12-decimal digit key which is approximately equivalent to 40 bits.

Document integrity is provided using the system defined in Annex E/T.36. ITU-T Rec. T.36 defines the hashing algorithm including the associated calculations and information exchange.

G.2.3   Method

In the registration mode, the two terminals exchange information which enables entities to uniquely identify each other. This is based upon the agreement between the users of a secret one-time key. Each entity stores a 16-digit number which is uniquely associated with the entity with which it has carried out registration.

When it is required to send a document securely, the transmitting terminal transmits the 16-digit secret number associated with the receiving entity together with a random number and an encrypted session key as a challenge to the receiving entity. The receiving terminal responds by transmitting the 16-digit key associated with the transmitting entity along with a random number and a re-encrypted version of the challenge from the transmitting entity. At the same time it transmits a

random number and an encrypted session key as a challenge to the transmitting entity. The transmitting terminal responds with a random number and a re-encrypted version of the challenge from the receiving entity. This procedure enables the two entities to mutually authenticate each other. At the same time, the transmitting terminal transmits a random number and the encrypted session key to be used for encrypting and hashing.

After transmission of the document, the transmitting terminal transmits a random number and an encrypted session key as a challenge to the receiving entity. At the same time, it sends a random number and encrypted hash value which enables the receiving entity to ensure the integrity of the received document. The receiving terminal transmits a random number and the re-encrypted version of the challenge from the transmitting entity. At the same time, it sends a random number and encrypted Integrity Document to act as confirmation or denial of the integrity of the received document.

The hashing algorithm used for document integrity is carried out on the whole document.

An override mode is provided, it does not involve the exchange of any security signals between the two terminals. The users agree a one-time secret session key to be entered manually. This is used by the transmitting terminal to encrypt the document and by the receiving terminal to decrypt the document.

G.3 References

–   ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

–   ITU-T Recommendation T.36 (1997), *Security capabilities for use with Group 3 facsimile terminals*.

G.4 Definitions

G.4.1 Operation on the PSTN using the V.27 *ter*, V.29, V.17 and V.34 (half-duplex mode) modulation systems

The signals and definitions used with the secure facsimile document procedures are as defined in the main body and in Annex A together with those detailed in G.6.1.

G.4.2 Operation on the PSTN using the V.34 (full-duplex mode) modulation system and on the ISDN

The signals and definitions used with the secure facsimile document procedures are as defined in Annex C together with those in G.6.1.

G.5 Abbreviations

G.5.1   The abbreviations used for secure facsimile transmission are as defined in the main body of this Recommendation and in Annexes A and C together with those specified below.

ESHx   Encrypted Scrambled Hash Value from the transmitter

ESIMy   Encrypted Scrambled Integrity Message from the receiver

ESSC1x   Encrypted Scrambled Secret Challenge key from the transmitter

ESSC1y   Encrypted Scrambled Secret Challenge key from the receiver

ESSC2x   Encrypted Scrambled Secret Challenge key from the transmitter

ESSR1x   Encrypted Scrambled Secret Response key from the transmitter

ESSR1y   Encrypted Scrambled Secret Response key from the receiver

ESSR2y   Encrypted Scrambled Secret Response key from the receiver

ESSS1x   Encrypted Scrambled Secret session key from the transmitter

RCNx   Registered Crypt Number (16 decimal digits in 16 octets) associated with the transmitter

RCNy   Registered Crypt Number (16 decimal digits in 16 octets) associated with the receiver

RK   Receiver Keys – see G.6.1

RNC1x   Random number associated with a secret challenge from the transmitter

RNC1y   Random number associated with a secret challenge from the receiver

RNC2x   Random number associated with a secret challenge from the transmitter

RNIMy   Random number associated with an integrity message from the receiver

RNSR1x   Random number associated with a secret response from the transmitter

RNSR1y   Random number associated with a secret response from the receiver

RNSR2y   Random number associated with a secret response from the receiver

RNSS1x   Random number associated with a secret session key from the transmitter

RTC   Return to control – as defined in ITU-T Rec. T.4

TK   Transmitter Keys – see G.6.1

TKx   Transfer Key provided by the transmitter

TKy   Transfer Key provided by the receiver

TNR   Transmitter Not Ready – see G.6.1

TR   Transmitter Ready – see G.6.1

NOTE 1 – All Random Number values are 4 decimal digits in 4 octets.

NOTE 2 – All Encrypted Scrambled values are 12 decimal digits in 12 octets.

G.6 Facsimile procedures

G.6.1 Facsimile control field

The HKM Key Management system uses the T.30 Transmitter Keys (TK) and Receiver Keys (RK) frames. The FIF contents of these signals vary according to use and are listed G.6.2. Each TK and RK signal is suffixed by a digit for cross reference to the flow diagrams and signal sequence diagrams in this annex.

Each key transferred (other than during Registration) is in Encrypted Scrambled (ES) format and is accompanied by an associated Random Number (RN).

1)   *Transmitter Not Ready (TNR)* – This signal is used to indicate that the transmitter is not yet ready to transmit.

    Format: X101 0111

2)   *Transmitter Ready (TR)* – This signal is used to ask the status of the transmitter.

    Format: X101 0110

3)   *Transmitter Keys (TK)* – This signal is used to carry security keys, etc., from the document transmitter to the document receiver. The FIF contents of this signal are defined later in this annex and will vary according to the circumstances under which they are used.

    Format: 1101 0010

4) *Receiver Keys (RK)* – This signal is used to carry security keys, etc., from the document receiver to the document transmitter. The FIF contents of this signal are defined later in this annex and will vary according to the circumstances under which they are used.

Format: 0101 0010

G.6.2 Facsimile information fields

The coding of the keys shall be as shown in Table 3 and the least significant bit of the least significant digit shall be the first bit transmitted.

G.6.2.1 Mutual Registration and authentication

See Table G.1.

Table G.1/T.30

Signal	FIF octets	FIF contents
TK0	1	0000 0000
	2 length	0010 0000
	3-18	TKx
	19-22	RNC0x
	23-34	ESSC0x
RK1	1	0000 0001
	2 length	0100 0000
	3-18	RCNy
	19-34	TKy
	35-38	RNSR0y
	39-50	ESSR0y
	51-54	RNC0y
	55-66	ESSC0y
TK2	1	0000 0010
	2 length	0010 0000
	3-18	RCNx
	19-22	RNSR0x
	23-34	ESSR0x

G.6.2.2 Pre-message signals: mutual authentication and exchange of secret session key

See Table G.2.

Table G.2/T.30

Signal	FIF octets	FIF contents
TK8	1	0000 1100
	2 length	0010 0000
	3-18	RCNy
	19-22	RNC1x
	23-34	ESSC1x
RK9	1	0000 1001
	2 length	0011 0000
	3-18	RCNx
	19-22	RNSR1y
	23-34	ESSR1y
	35-38	RNC1y
	39-50	ESSC1y
TK10	1	0000 1010
	2 length	0010 0000
	3-6	RNSR1x
	7-18	ESSR1x
	19-21	RNSS1x
	23-34	ESSS1x
NOTE – If the document is not encrypted, RNC1x and ESSS1x are set to all zeros.		

G.6.2.3 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.

G.6.2.4   Post-message signals: document confirmation and integrity (normal transmission)

See Table G.3.

Table G.3/T.30

Signal	FIF octets	FIF contents
TK16	1	0001 0000
	2 length	0010 1000
	3-6	RNC2x
	7-18	ESSC2x
	19-42	ESHx
RK17	1	0001 0001
	2 length	0010 0000
	3-6	RNSR2y
	7-18	ESSR2y
	19-22	RNIMy
	23-34	ESIMy
NOTE 1 – If the document does not have an integrity check, ESHx, RNIMy and ESIMy are set to all zeros.		
NOTE 2 – Frame TK16 is not provided if DCS indicates no hashing.		
NOTE 3 – Frame RK17 is not provided if TK16 is not provided.		

G.6.2.5   General notes

1)   During registration, challenges and responses are mandatory. The challenge/response mechanism is defined in ITU-T Rec. T.36.

2)   During normal calls, all valid challenges and responses must have a non-zero random number. Random numbers set to zero in challenges or responses indicate that mutual authentication is not supported.

3)   TK16/RK17 are normally sent with/after PPS-EOP except in the case of turnaround polling when they may be sent with/after PPS-EOM.

4)   Hashing/encryption are determined by the first DIS/DCS exchange and apply to every document transmitted in that session.

G.7   Flow diagrams

G.7.1   Operation on the PSTN using the V.27 *ter*, V.29, V.17 and V.34 (half-duplex mode) modulation systems

The flow diagrams in Figure G.7 show the phase B, pre-message procedures, phase C, message procedure, phase D, post-message procedure and phase E, call release, for both the transmitting and receiving terminals.

Reference should also be made to the procedures defined in ITU-T Rec. T.36.

G.7.2 Flow diagram rules

The flow diagrams follow two simple rules:

1) All lines have an arrow at the destination only.
2) No lines cross.

G.7.3 Timers used in the flow diagrams

T1	35 s ± 5 s
T2	6 s ± 1 s
T3	10 s ± 5 s
T4	4.5 s ± 15% for manual units
	3.0 s ± 15% for automatic units
T5	60 s ± 5 s

G.7.4 Abbreviations and descriptions used in the flow diagrams

Unless defined otherwise below, the definition of the flow chart terms is as given in the main body and/or in Annex A.

Authen reqd?   Check to see if mutual authentication is required at the beginning of the transmission.

NOTE 1 – Once mutual authentication has been completed, then within the same session the "No" exit should always be followed.

Reg mode?   Check to see if security registration is required.

First page?   Check to see if mutual authentication is required at the beginning of the transmission.

NOTE 2 – Once mutual authentication has been completed, then within the same session the "No" exit should always be followed.

G.8 Flow diagrams

G.8.1 Operation on the PSTN using the V.34 (full-duplex mode) modulation system and on the ISDN

The operation of secure document facsimile on the PSTN using the V.34 (full-duplex) modulation system and on the ISDN is exactly as defined in Annex C with the exceptions shown on the flow diagrams below.

The flow diagrams in Figure G.8 show the phase B, pre-message procedures, phase D, post-message procedure and phase E, call release, for both the transmitting and receiving terminals.

Reference should also be made to the procedures defined in ITU-T Rec. T.36.

Transmitting Terminal

Transmit CNG

T1 elapsed? — No → Transmit CNG
T1 elapsed? — Yes → B

NSP req? — No
NSP req? — Yes → Non-specified procedures (Note)

Command rec? — No
Command rec? — Yes → DIS or DTC?

DIS or DTC? — No → B
DIS or DTC? — Yes

A

Compat remote rec? — No
Compat remote rec? — Yes → Doc to Xmit?

Doc to Xmit? — Yes
Doc to Xmit? — No

Compat remote XMTR? — No → C
Compat remote XMTR? — Yes → R

D → Set mode

Set mode

Security? — No → Procedures as in Figure 5-2/T.30
Security? — Yes → Reg mode?

Reg mode? — Yes → M
Reg mode? — No → Authen reqd?

Authen reqd? — Yes → P
Authen reqd? — No → Transmit (TSI) DCS

IV → Transmit training

Transmit (TSI) DCS → Transmit training + TCF

Transmit training → Transmit facsimile message

C → Transmit DCN

Transmit facsimile message → Transmit RCP

Transmit RCP → V

Transmit DCN → Disconnect line

Response rec? — No → 3rd try?
Response rec? — Yes → DIS or DCS?

3rd try? — No → D
3rd try? — Yes → C

DIS or DCS? — Yes → 3rd try?
DIS or DCS? — No → FTT?

3rd try? — No → A
3rd try? — Yes → C

FTT? — Yes → Retrain?
FTT? — No → CFR?

Retrain? — Yes → D
Retrain? — No → C

CFR? — Yes → IV
CFR? — No → C

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NOTE – 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.

Figure G.7/T.30 (*sheet 1 of 20*)
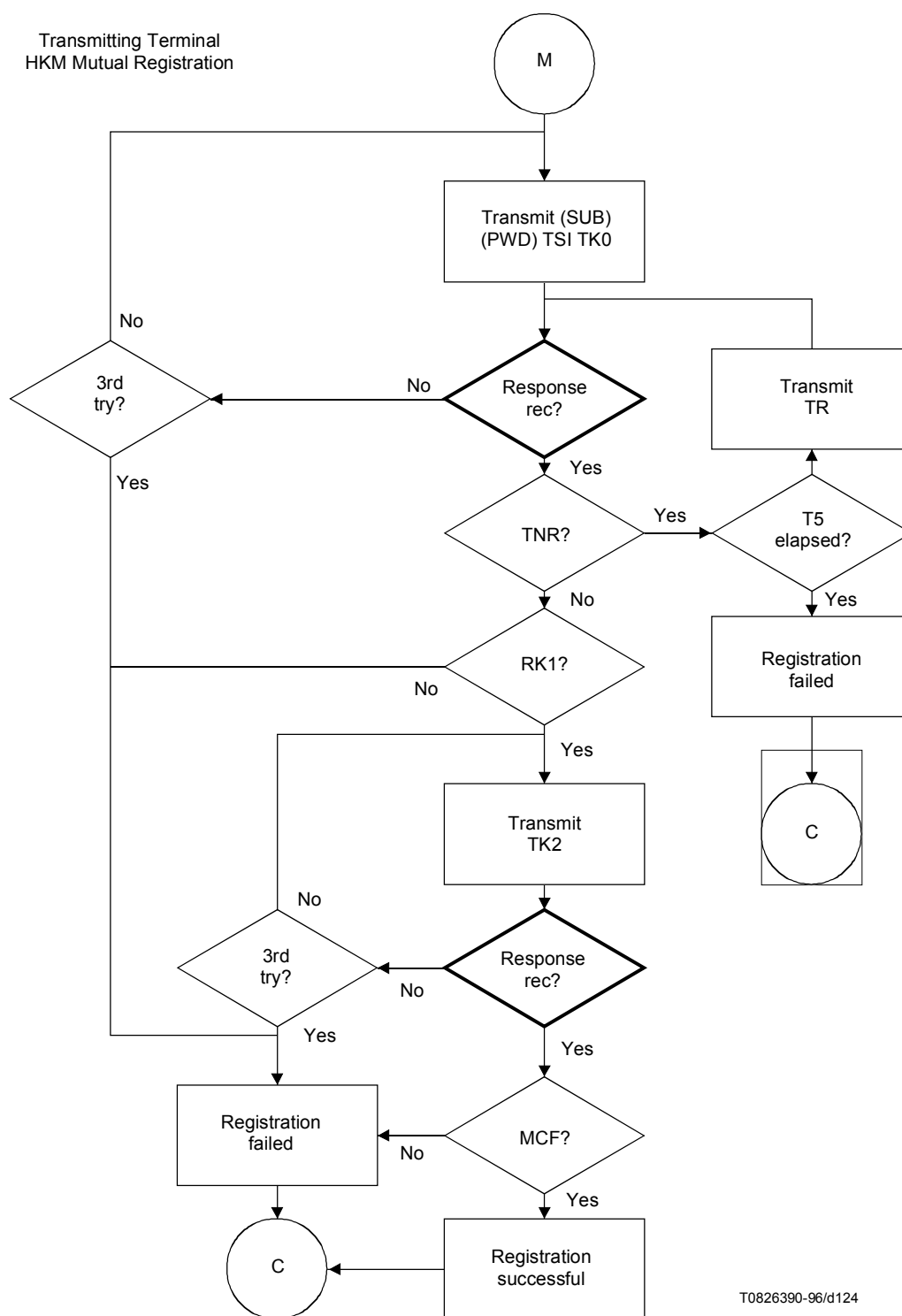
Figure G.7/T.30 (*sheet 2 of 20*)

Transmitting Terminal

Figure G.7/T.30 (*sheet 3 of 20*)
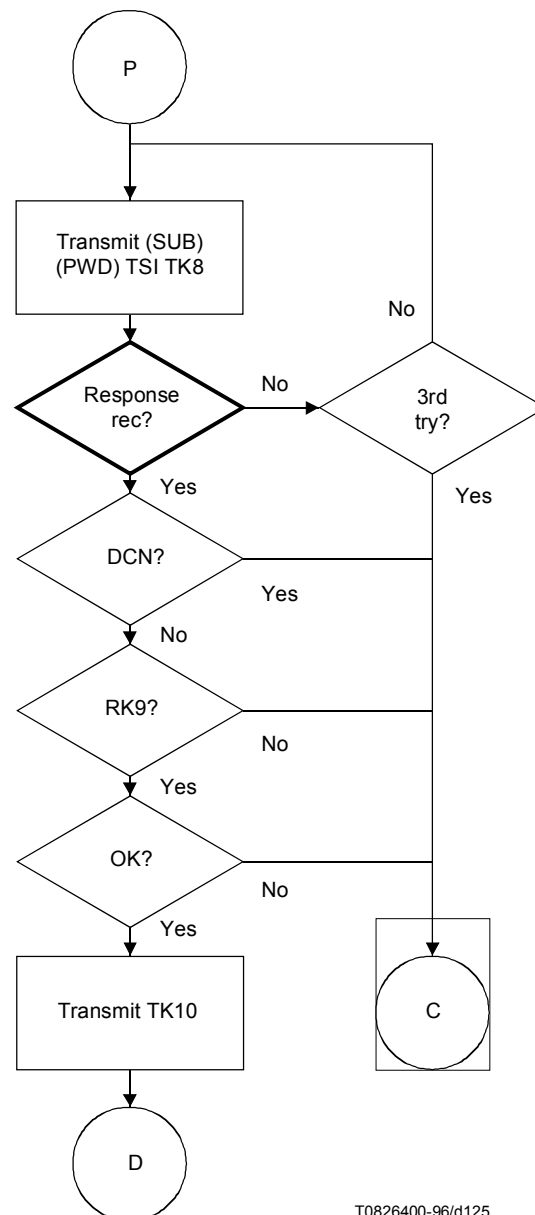
T0826400-96/d125
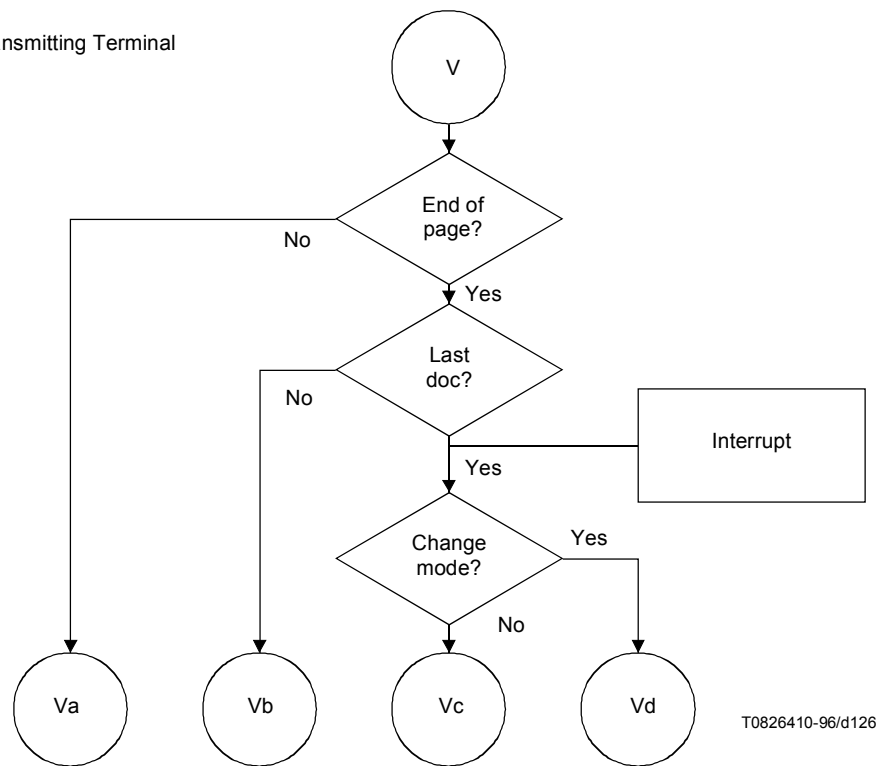
Figure G.7/T.30 (*sheet 4 of 20*)
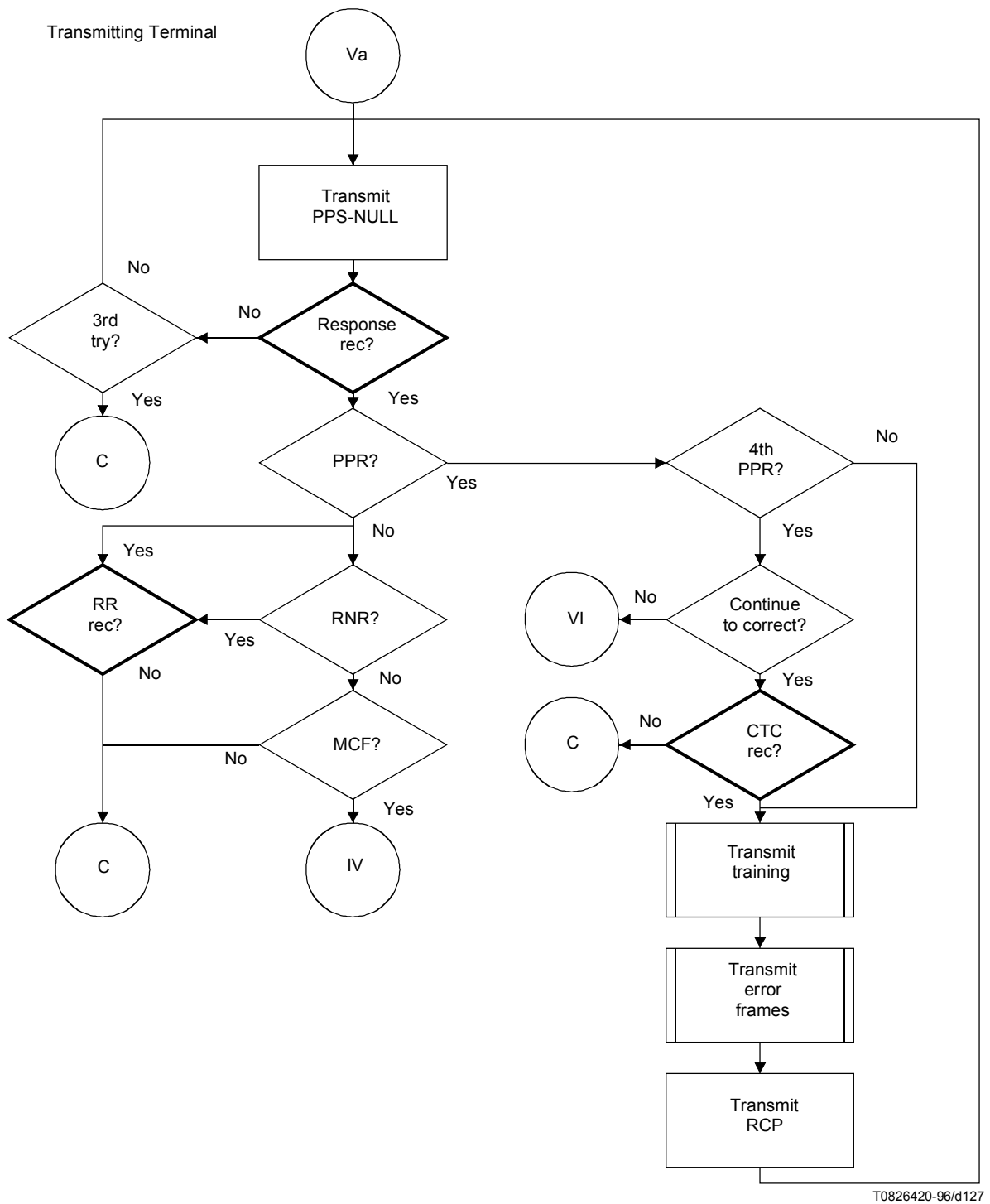
Figure G.7/T.30 (*sheet 5 of 20*)
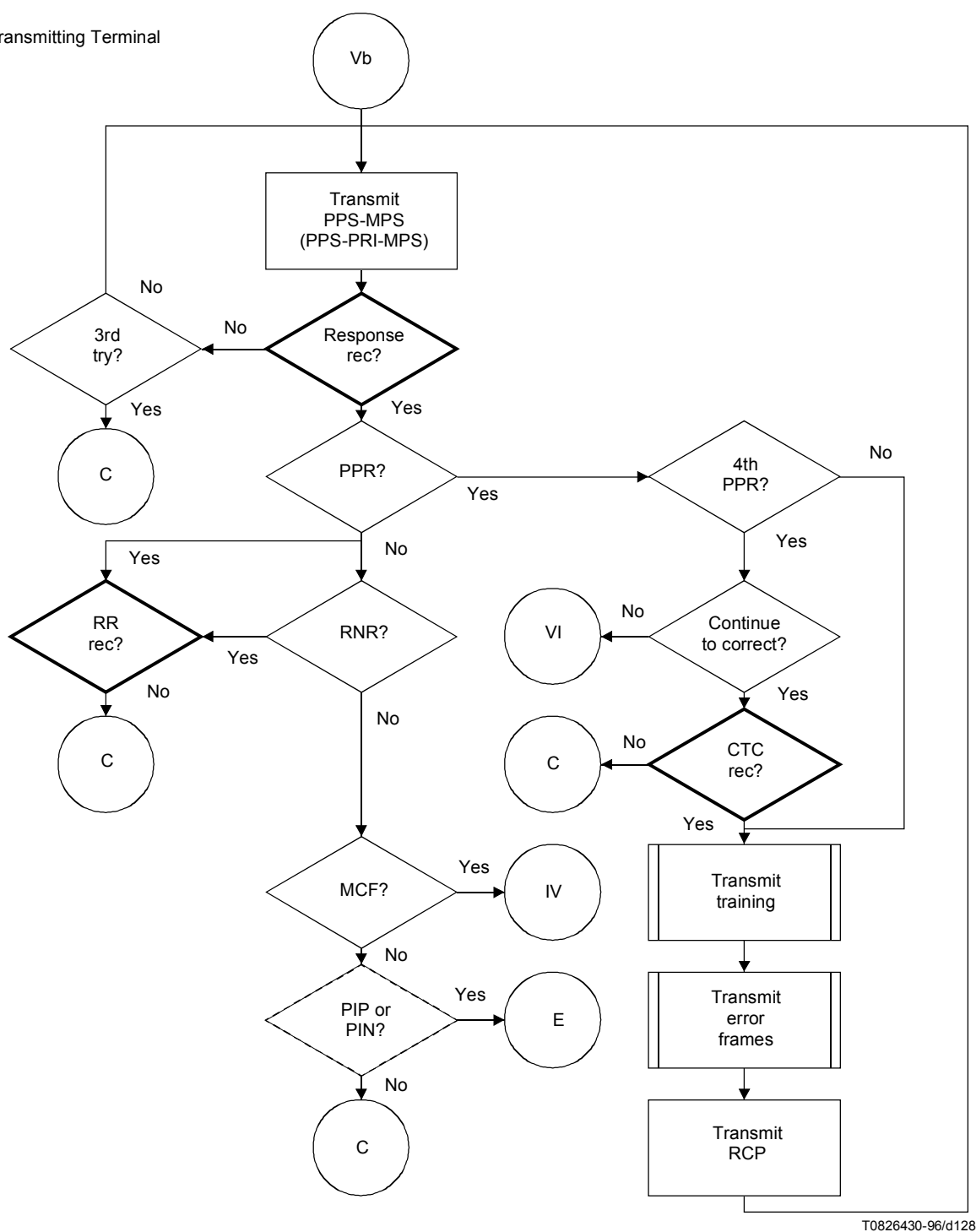
Figure G.7/T.30 (*sheet 6 of 20*)

Figure G.7/T.30 (*sheet 7 of 20*)

Transmitting Terminal

T0826450-96/d130
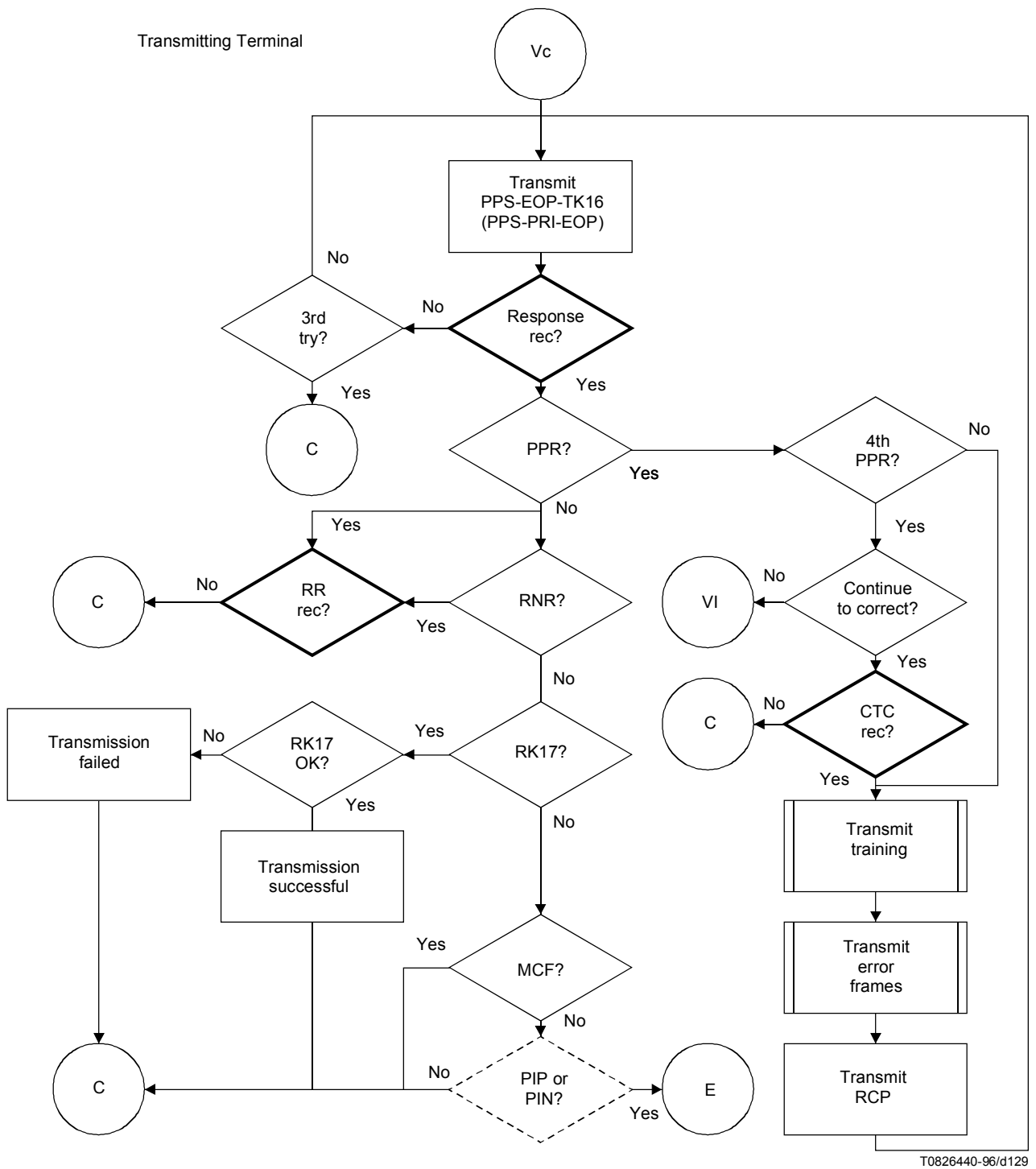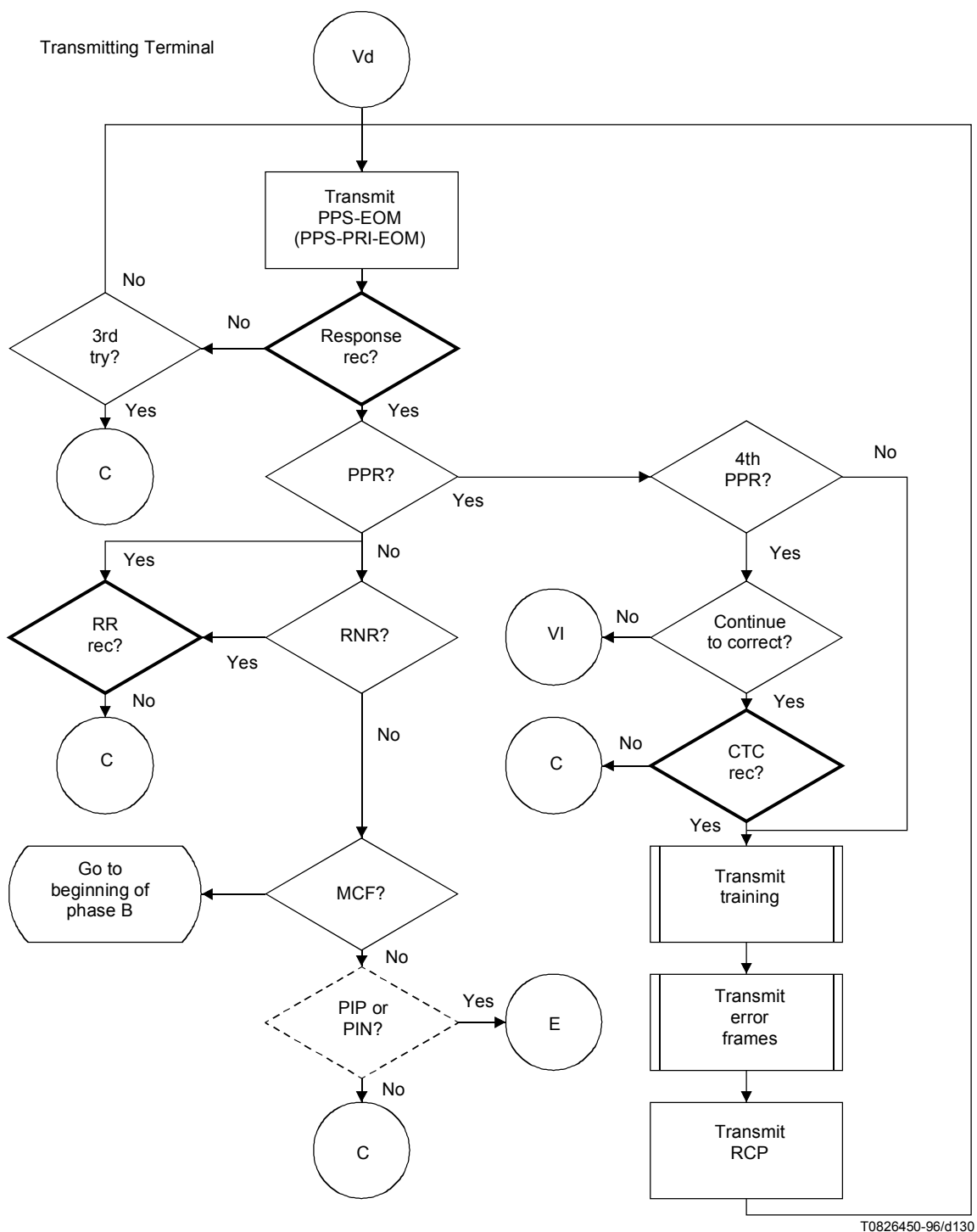
Figure G.7/T.30 (*sheet 8 of 20*)

Transmitting Terminal

T0826460-96/d131
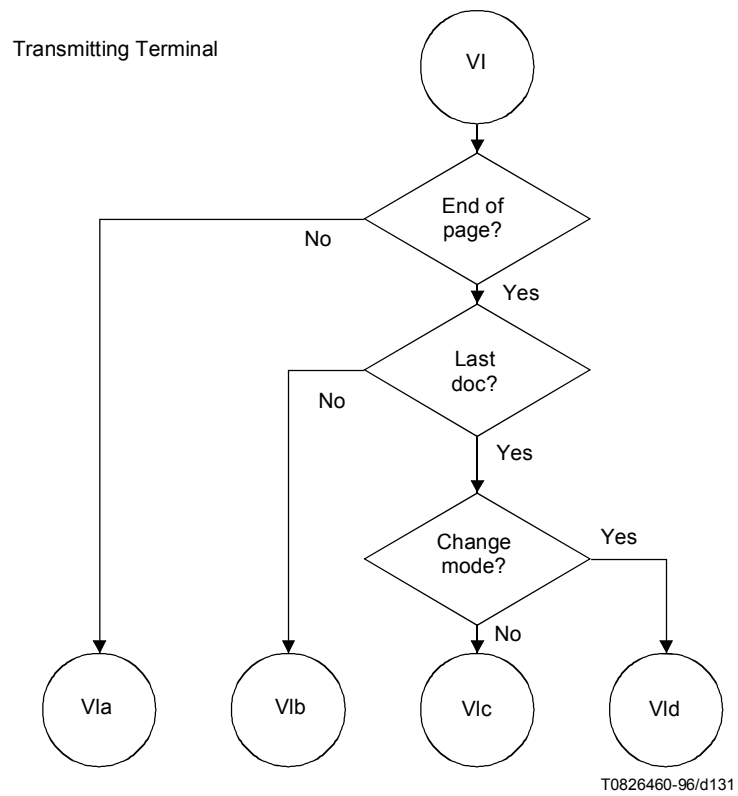
Figure G.7/T.30 (*sheet 9 of 20*)
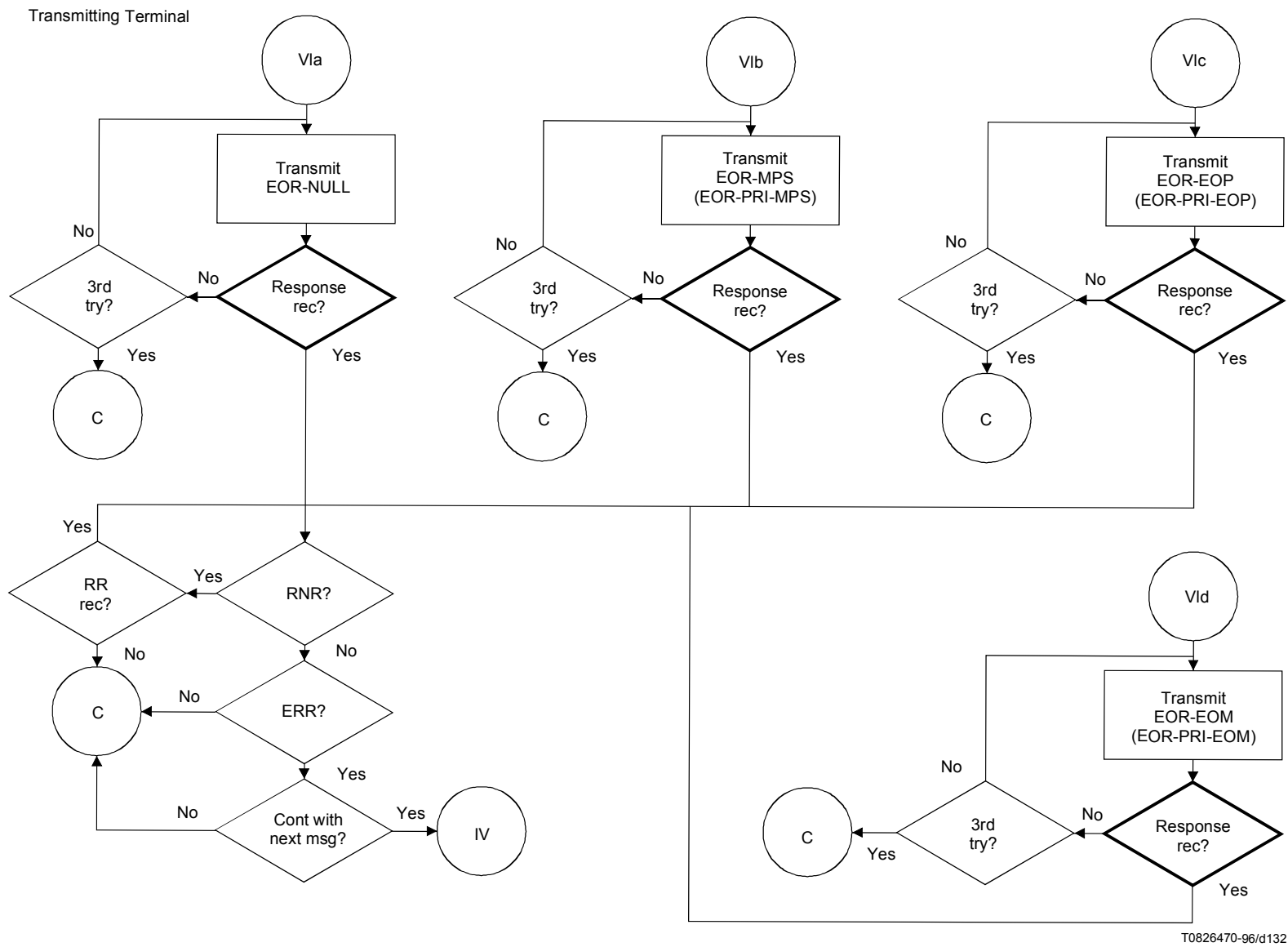
Figure G.7/ T.30 (*sheet 10 of 20*)
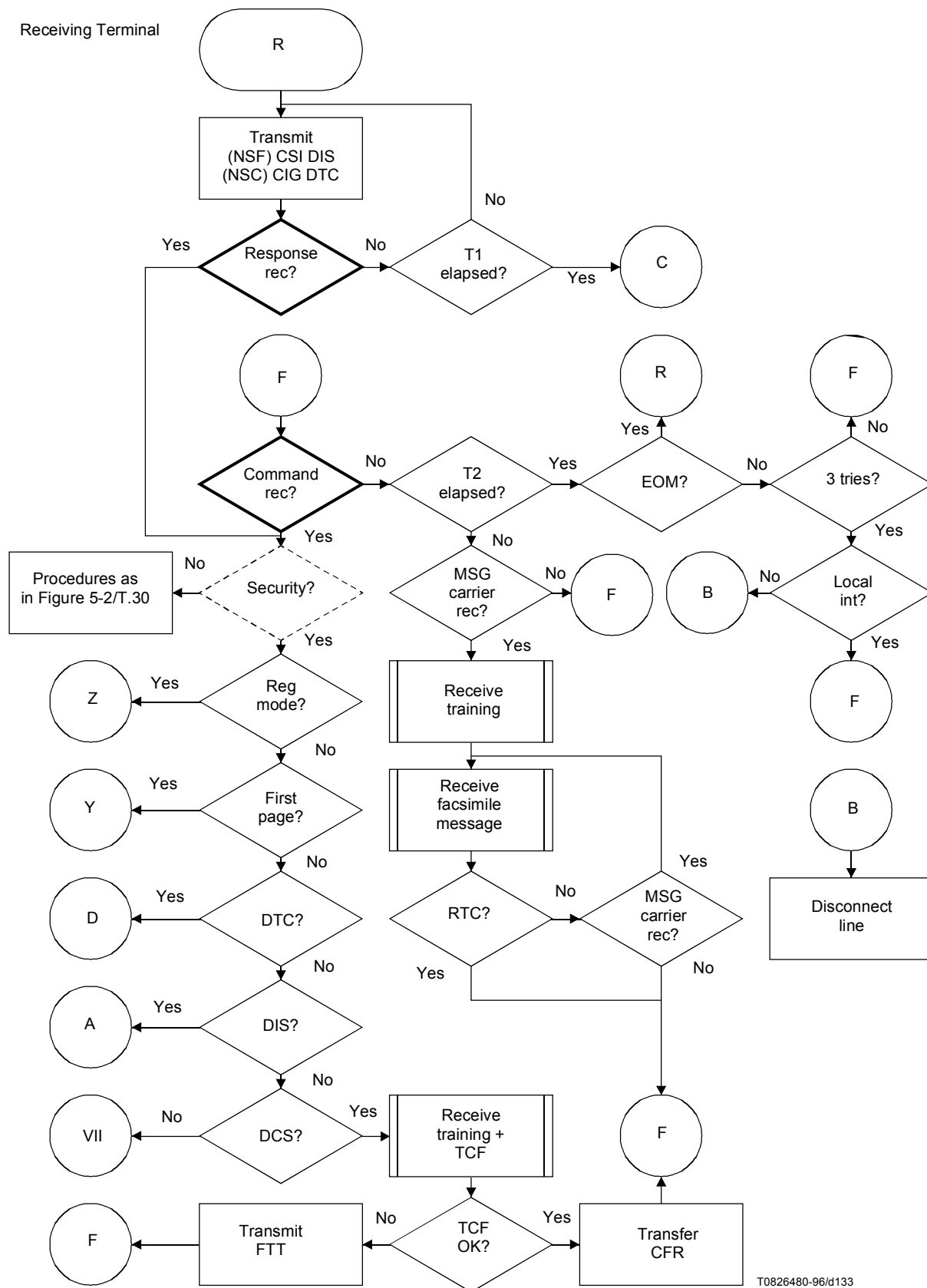
Figure G.7/T.30 (*sheet 11 of 20*)
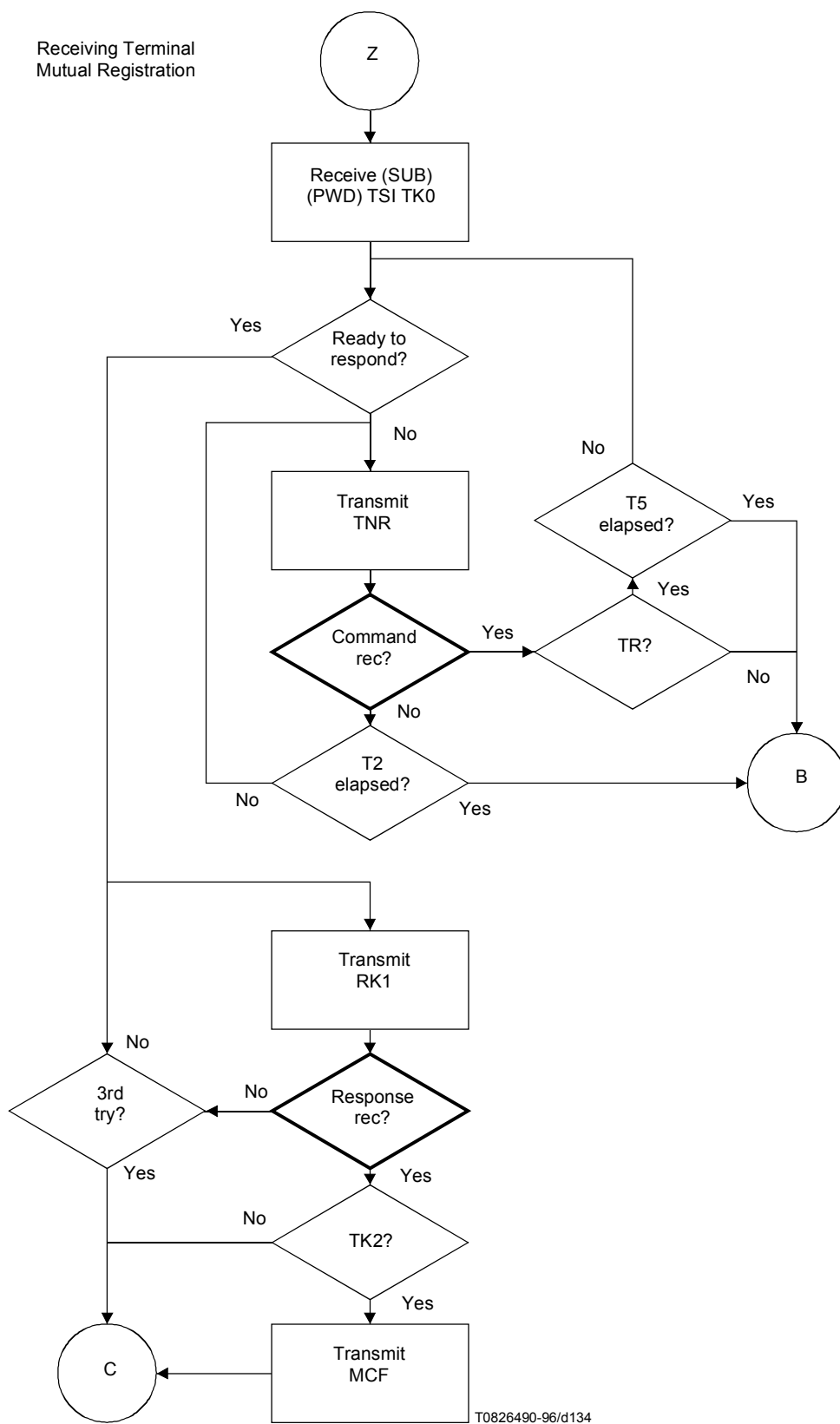
Figure G.7/T.30 (*sheet 12 of 20*)

Receiving Terminal

Y

Receive (SUB)
(PWD) TSI TK8

Transmit
RK9

Response rec?

3rd try?

TK10?

Security OK?

F

B

T0826500-96/d135
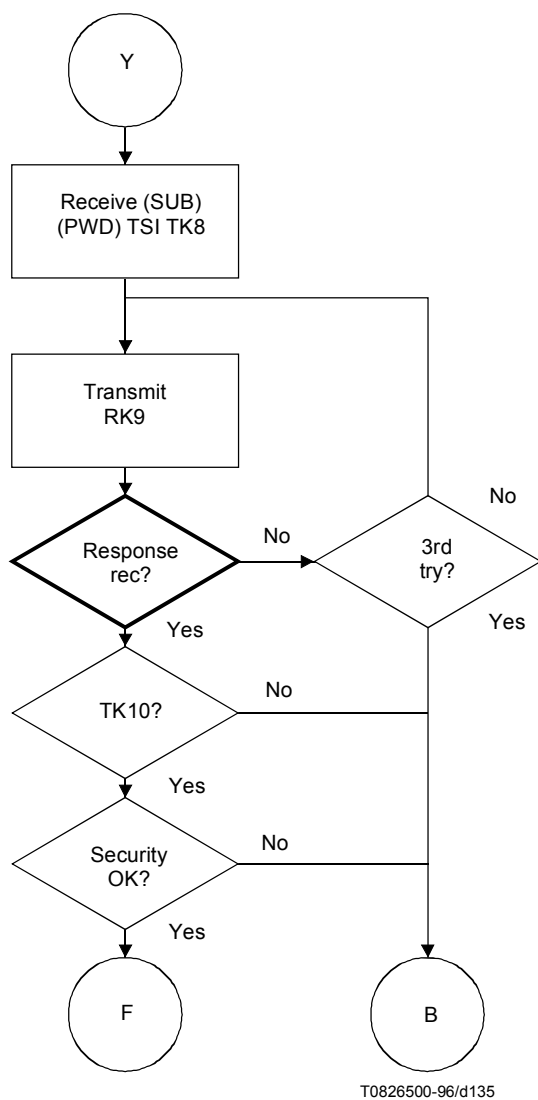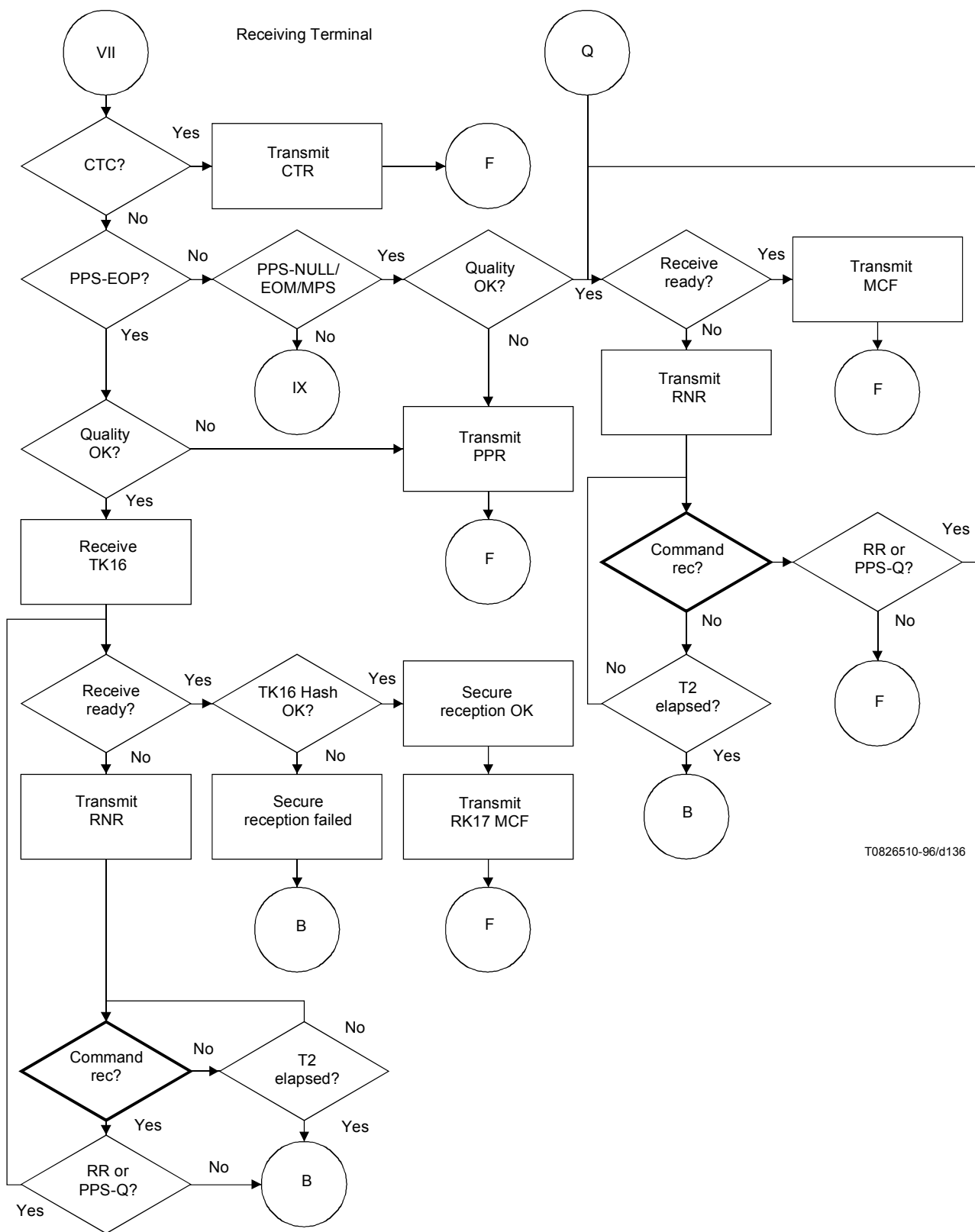
Figure G.7/T.30 (*sheet 13 of 20*)

Figure G.7/T.30 (*sheet 14 of 20*)
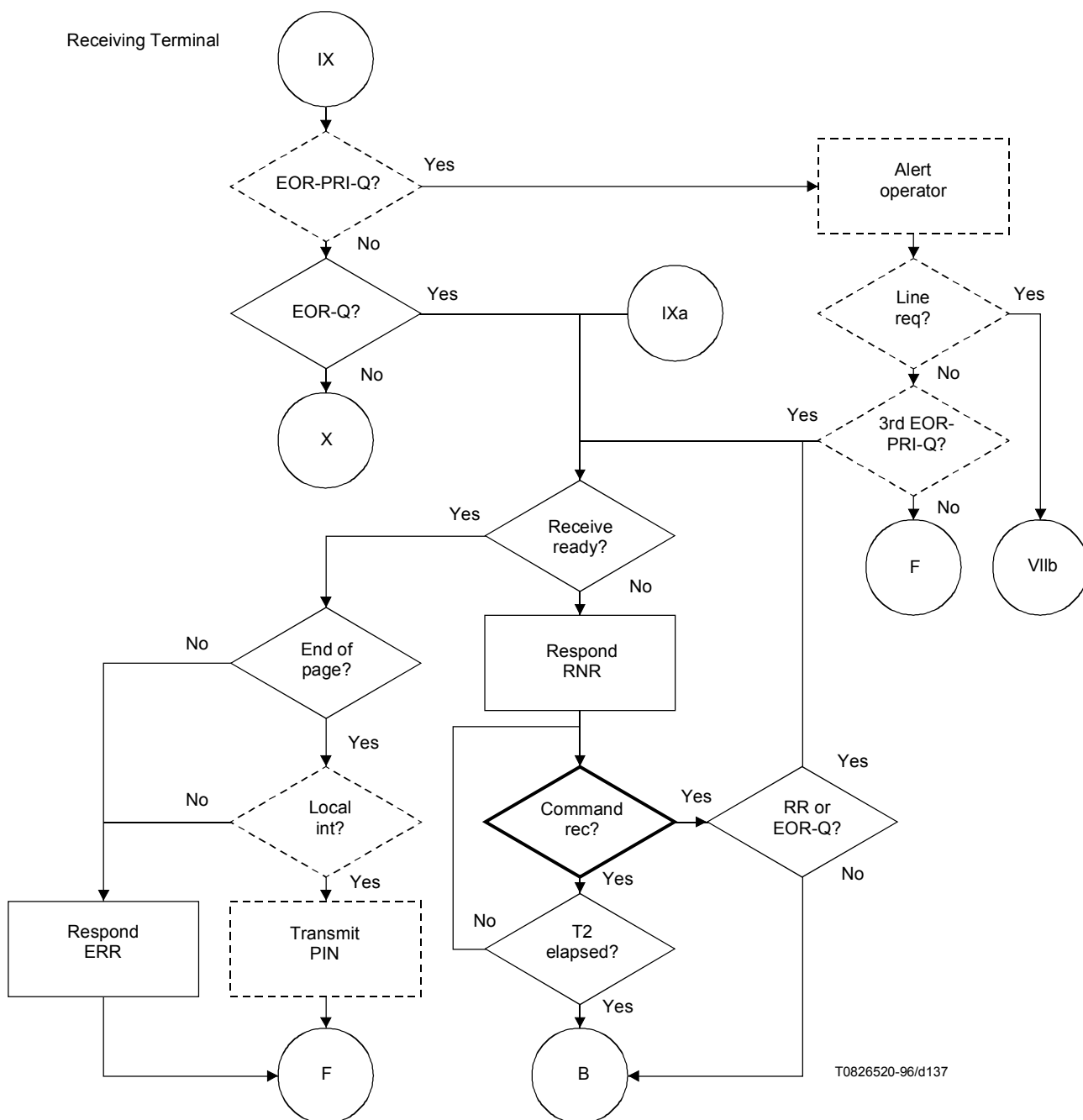
Figure G.7/T.30 (*sheet 15 of 20*)

Receiving Terminal
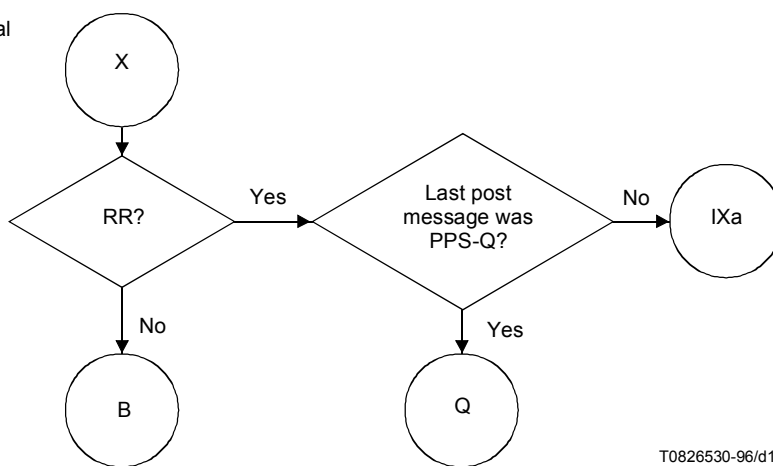
Figure G.7/T.30 (*sheet 16 of 20*)
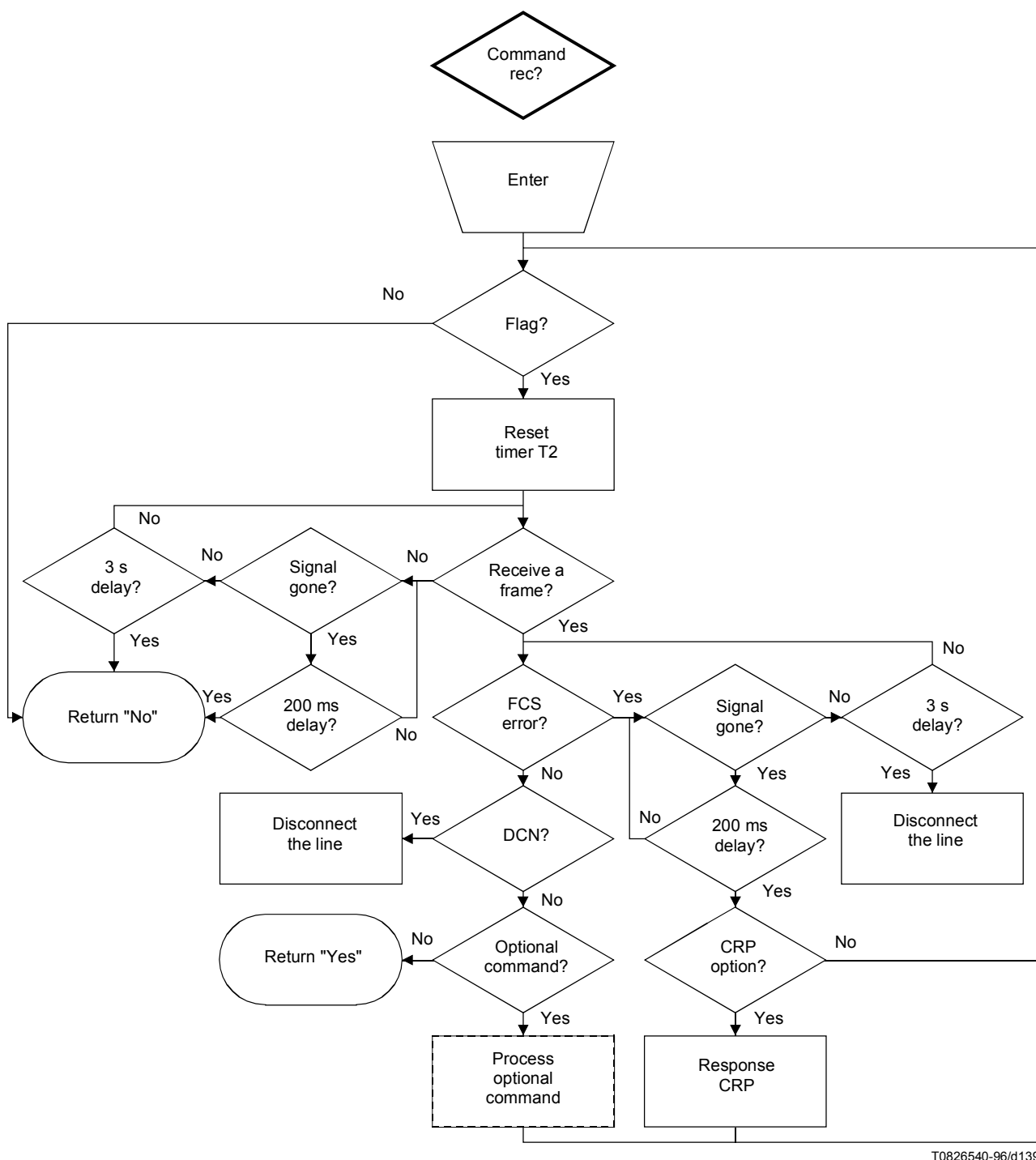
Figure G.7/T.30 (*sheet 17 of 20***)**
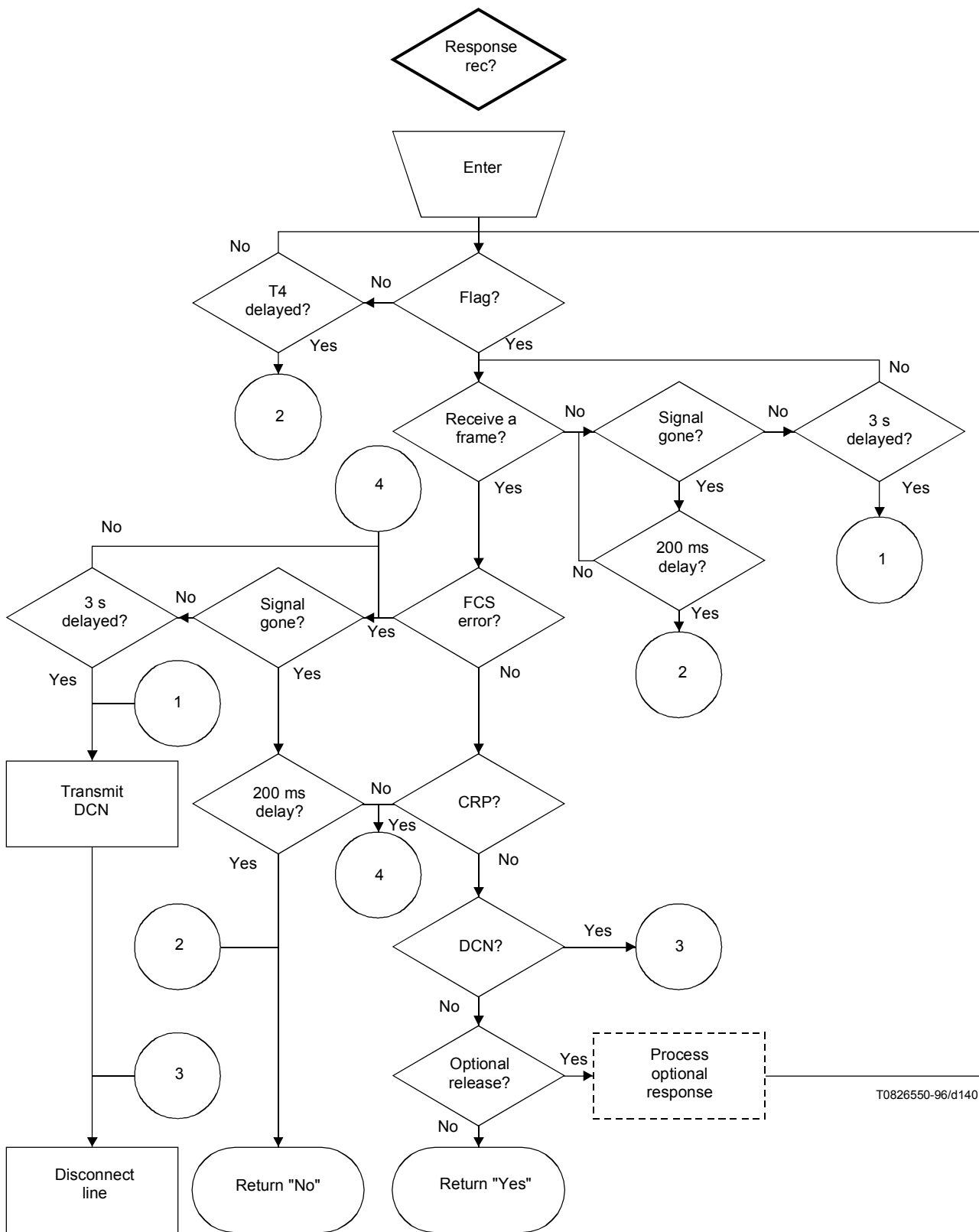
Figure G.7/T.30 (*sheet 18 of 20*)
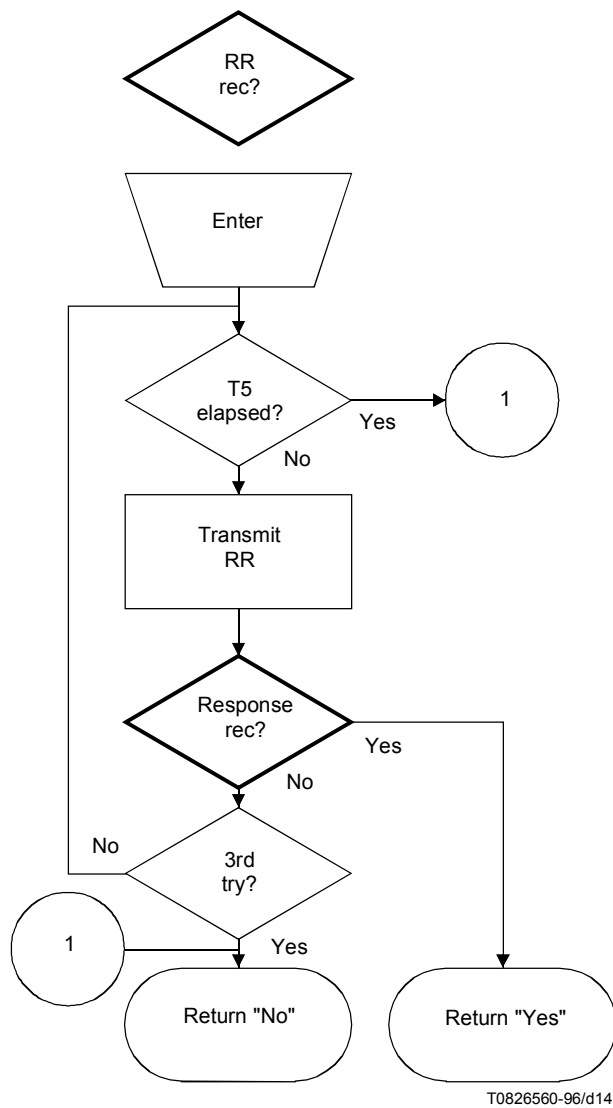
Figure G.7/T.30 (*sheet 19 of 20*)
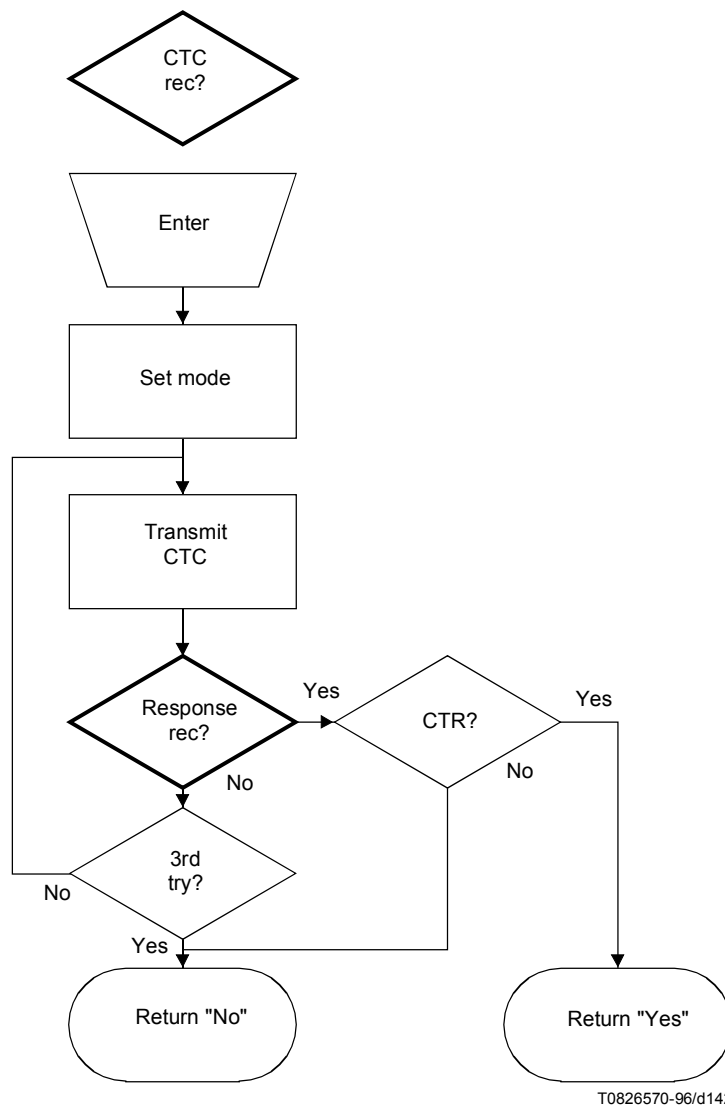
Figure G.7/T.30 (*sheet 20 of 20*)

Transmitting terminal

Constitutes also the entry from Figure F.5/T.90 calling side
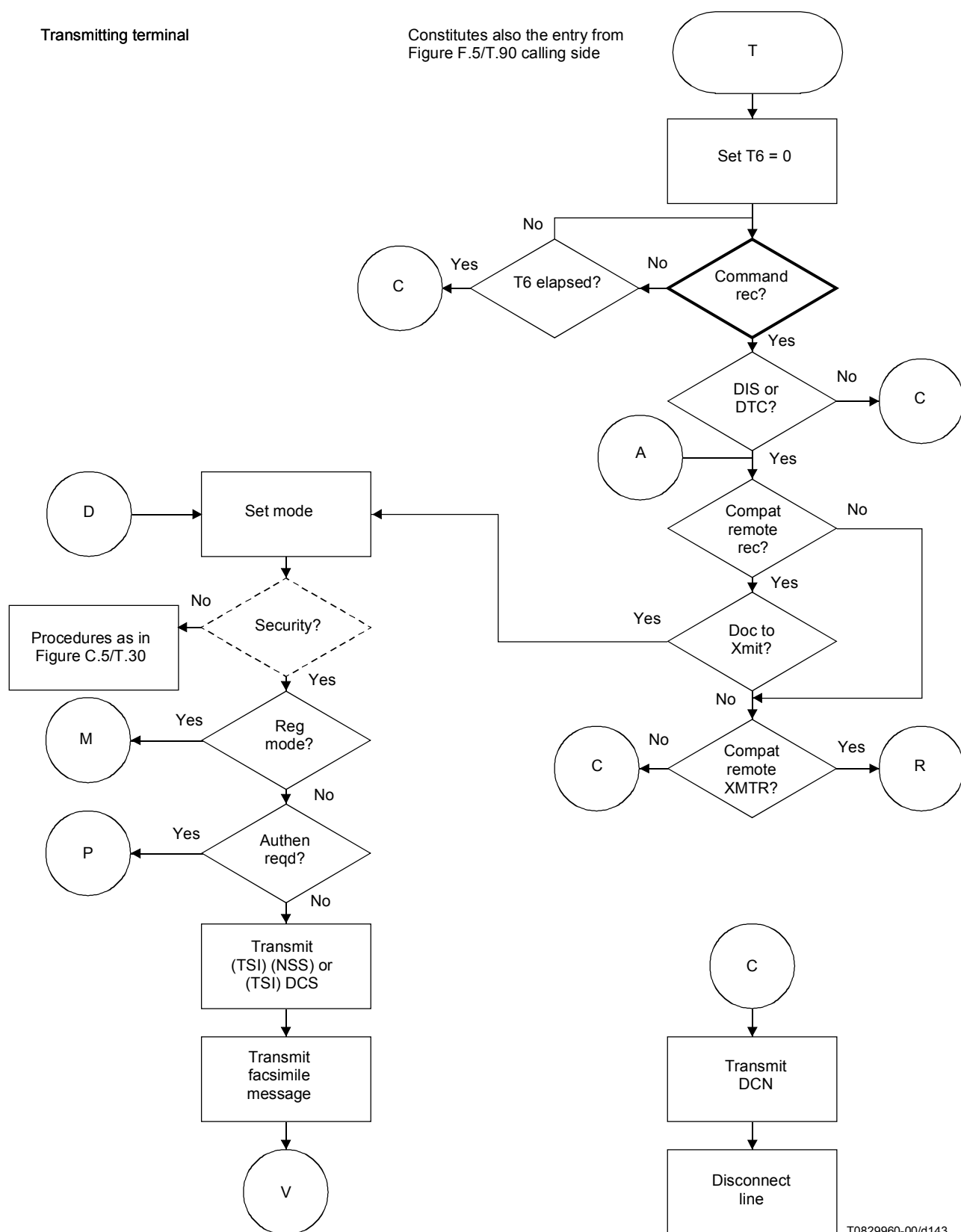
T0829960-00/d143

Figure G.8-1/T.30 – Duplex (*sheet 1 of 3*) (Used instead of Figure C.5)
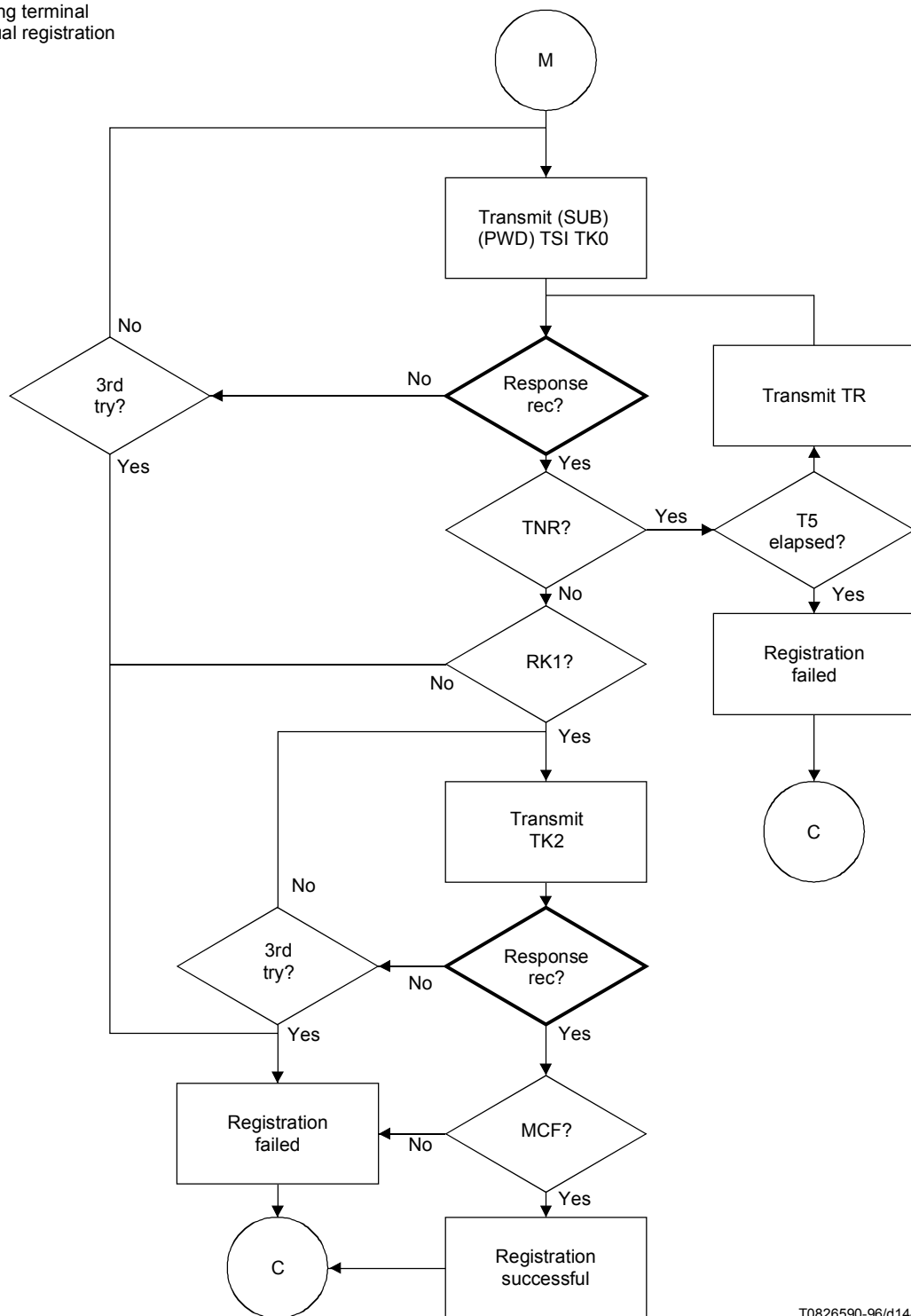
Figure G.8-1/T.30 – Duplex (*sheet 2 of 3*) (Used instead of Figure C.5)

Transmitting terminal


```
                              ( P )
                                |
                                |------------------------+
                                v                        |
                      +-------------------+              |
                      | Transmit (SUB)    |              |
                      | (PWD) TSI TK8     |         No   |
                      +-------------------+              |
                                |                        v
                           /---------\    No       /---------\
                          < Response  >----------->|   3rd   |
                           \  rec?   /              \  try?  /
                            \-------/                \------/
                                | Yes                    | Yes
                                v                        |
                           /---------\    Yes            |
                          <   DCN?   >------------------>|
                           \-------/                     |
                                | No                     |
                                v                        |
                           /---------\    No             |
                          <   RK9?   >------------------>|
                           \-------/                     |
                                | Yes                    |
                                v                        |
                           /---------\    No             |
                          <   OK?    >------------------>|
                           \-------/                     |
                                | Yes                    v
                      +-------------------+           (  C  )
                      |   Transmit TK10   |
                      +-------------------+
                                |
                                v
                             (  D  )
```
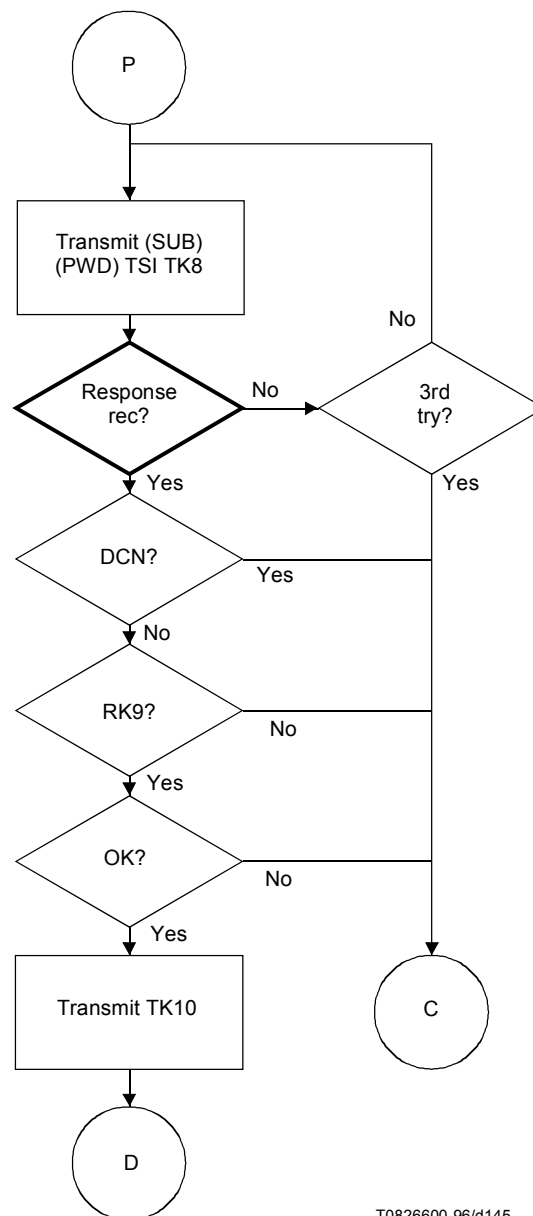
T0826600-96/d145

Figure G.8-1/T.30 – Duplex (*sheet 3 of 3*) (Used instead of Figure C.5)

Transmitting terminal

T0826610-96/d146
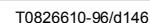
Figure G.8-2/T.30 – Duplex (Used instead of Figure C.9)

Receiving terminal
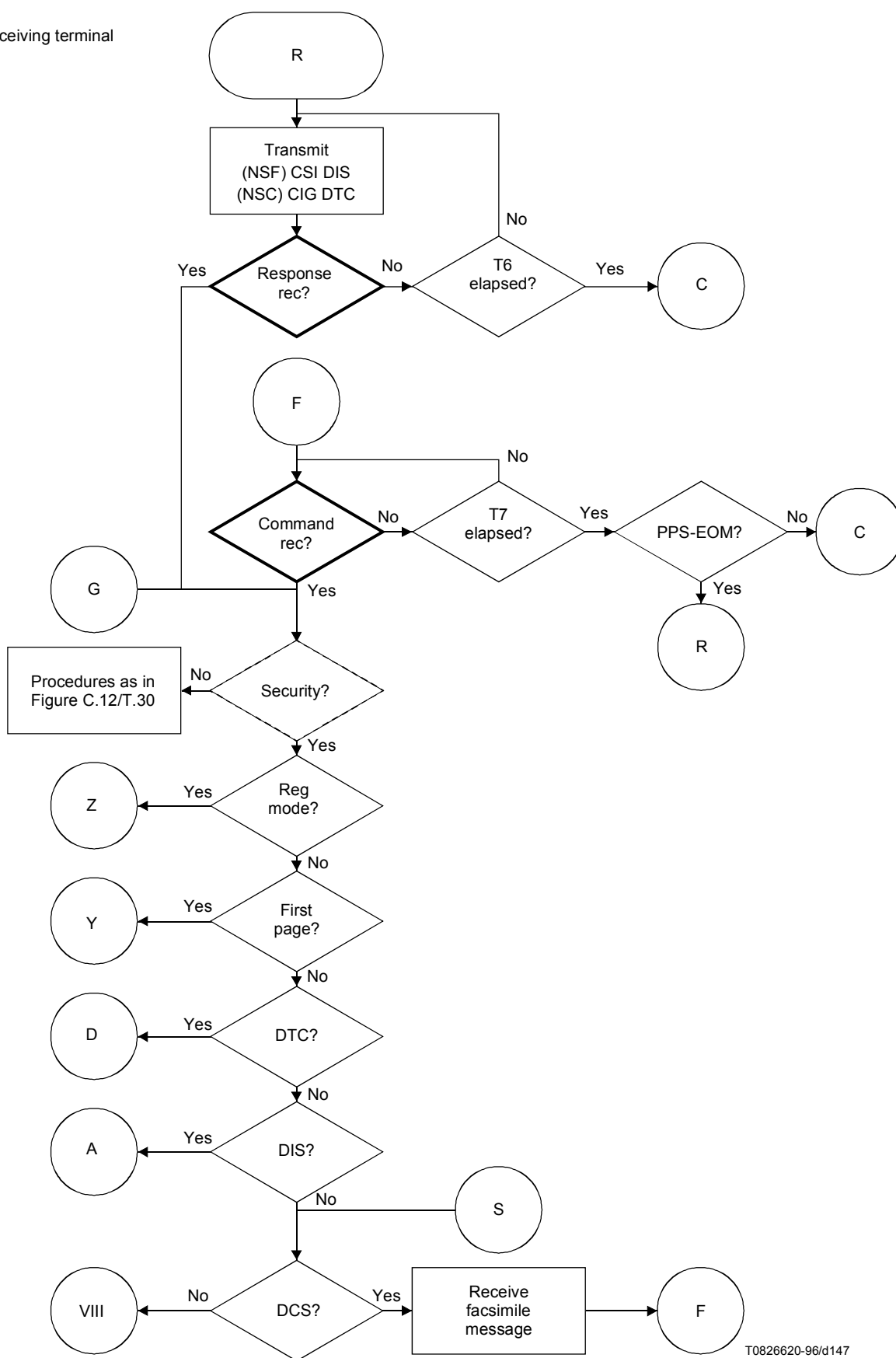
Figure G.8-3/T.30 – Duplex (*sheet 1 of 3*) (Used instead of Figure C.12)

Receiving terminal
mutual registration
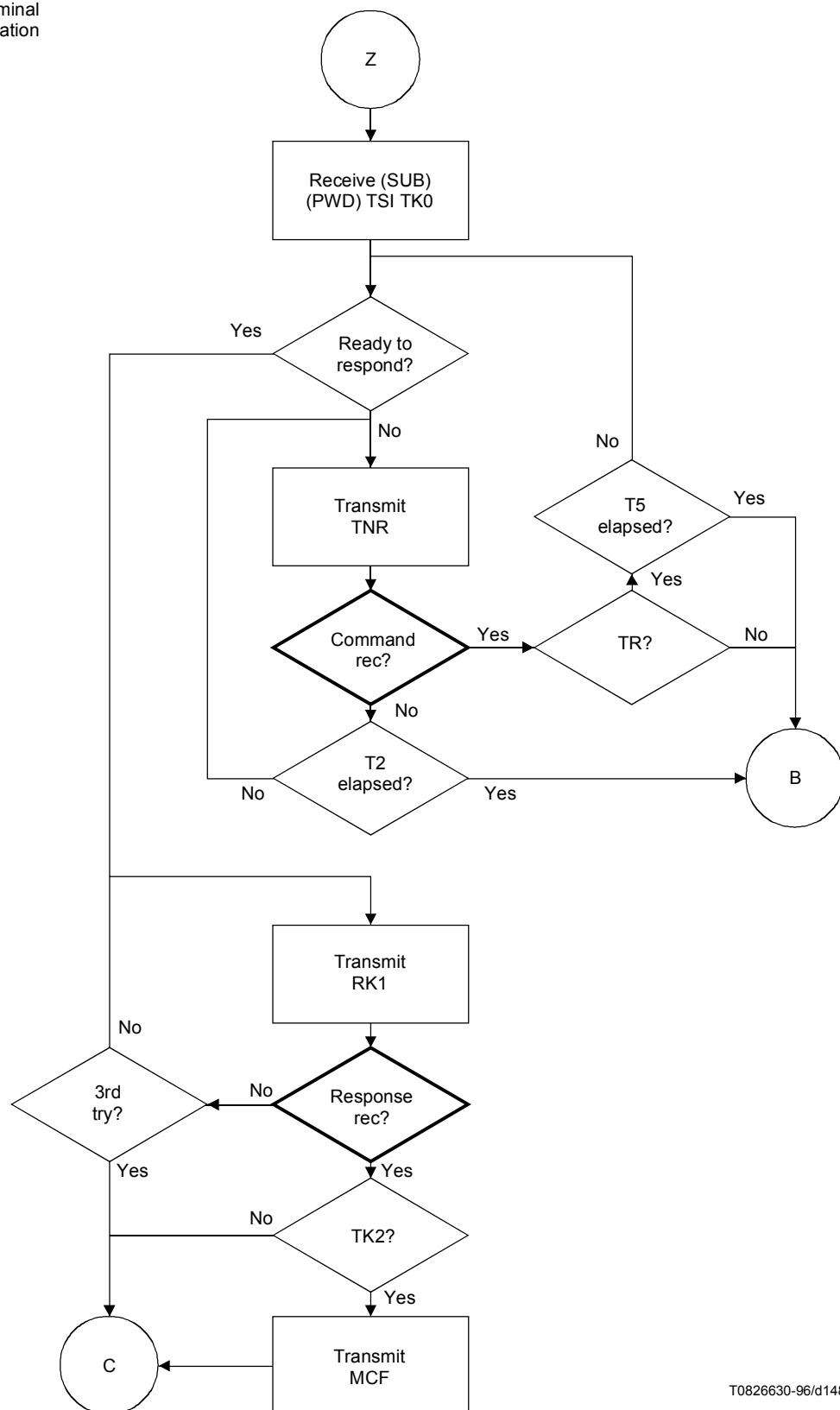
Figure G.8-3/T.30 – Duplex (*sheet 2 of 3*) (Used instead of Figure C.12)

Receiving terminal
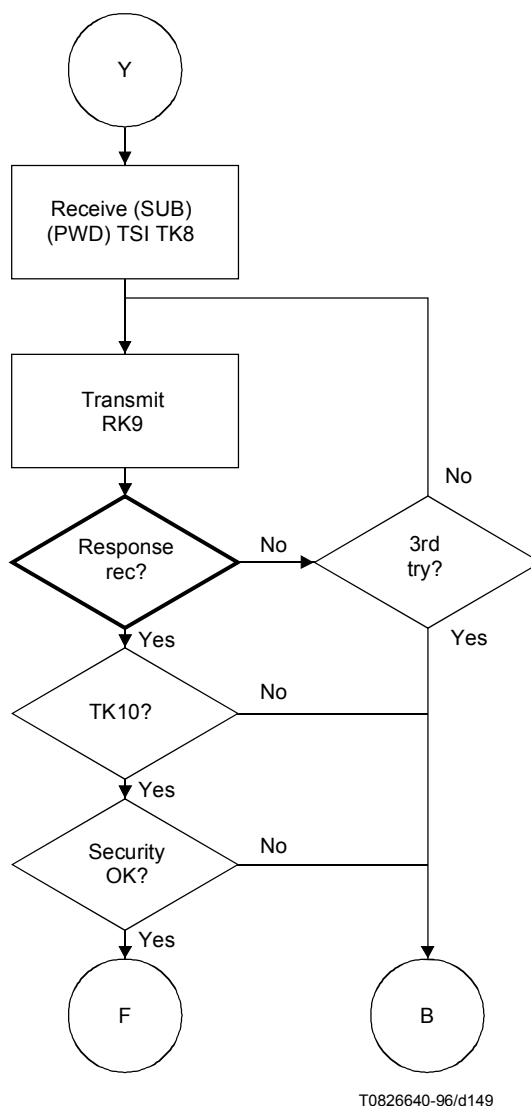
T0826640-96/d149

Figure G.8-3/T.30 – Duplex (*sheet 3 of 3*) (Used instead of Figure C.12)
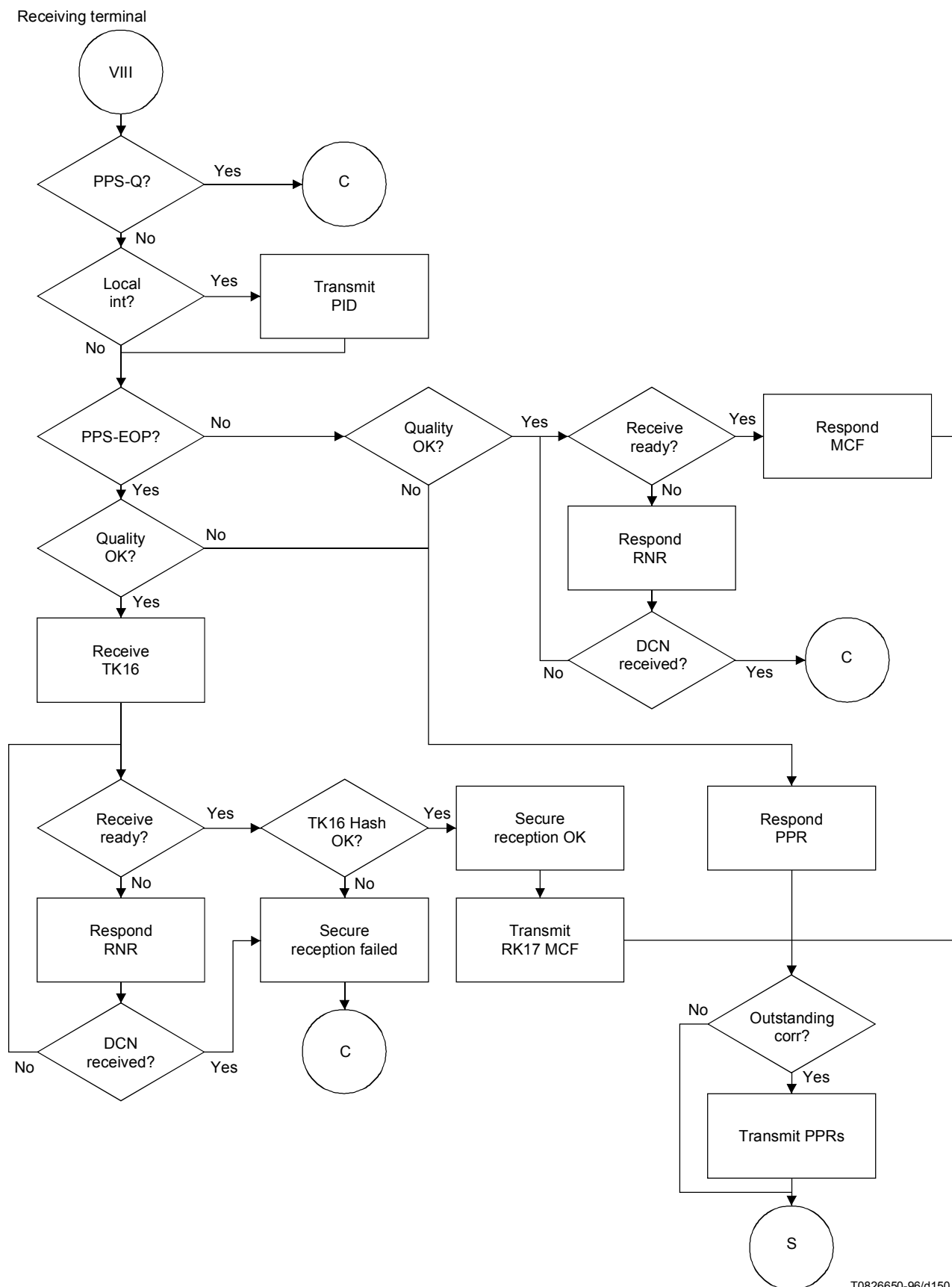
Figure G.8-4/T.30 – Duplex (Used instead of Figure C.13)

Transmitting terminal

Constitutes also the entry from
Figure F.5/T.90 calling side

Figure G.8-5/T.30 – Duplex (*sheet 1 of 3*) (Used instead of Figure C.14)

Transmitting terminal
HKM mutual registration
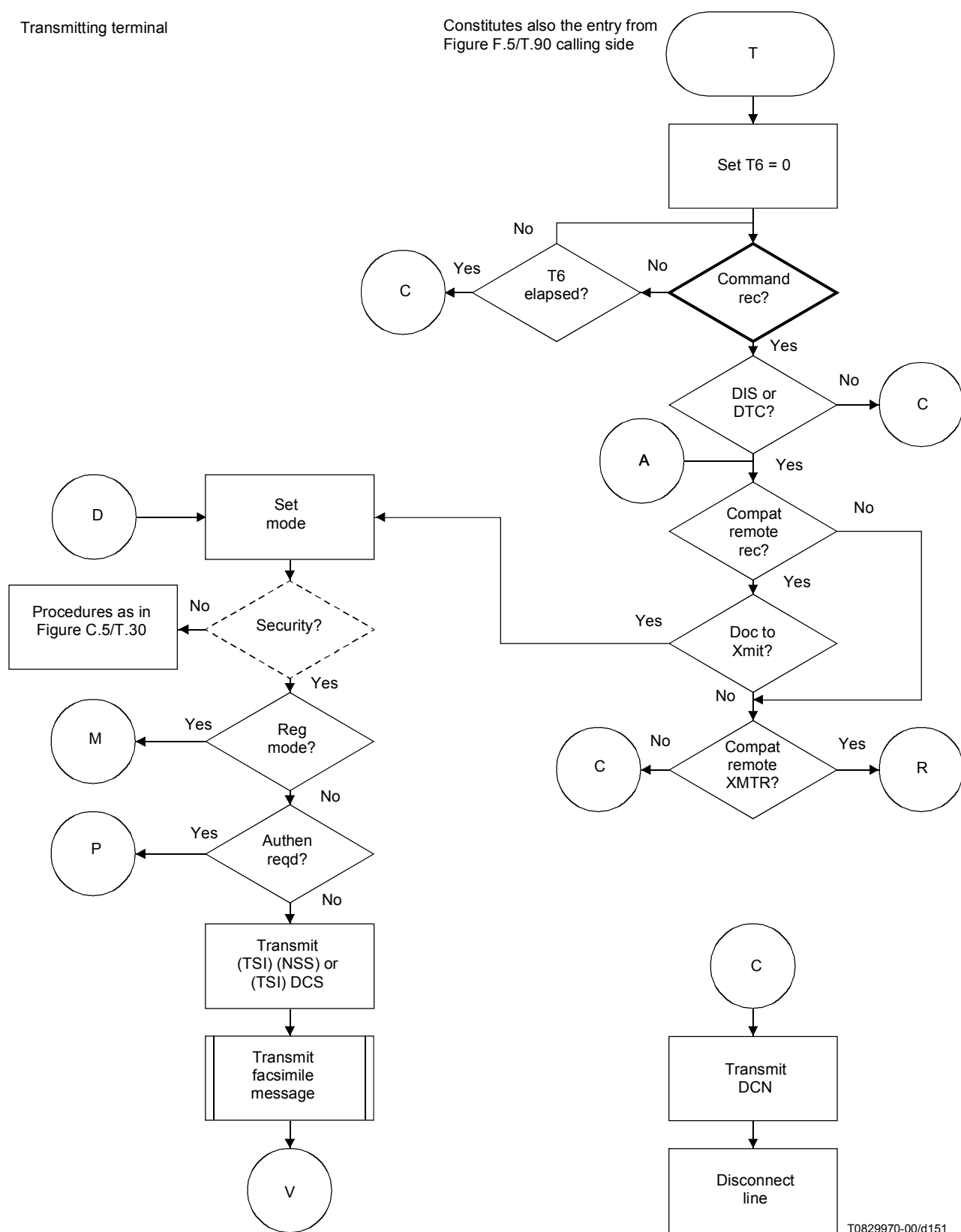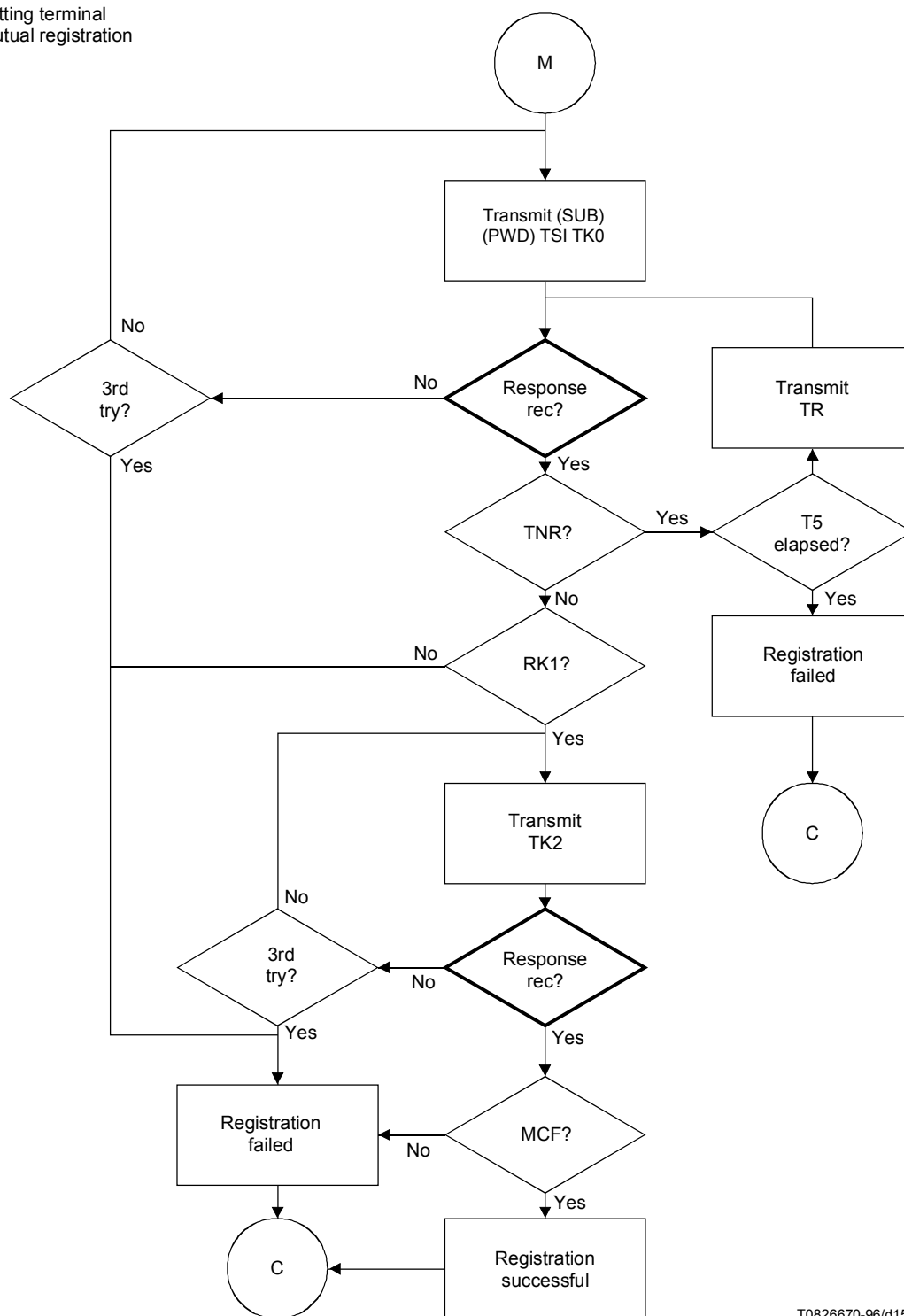
T0826670-96/d152

Figure G.8-5/T.30 – Duplex (*sheet 2 of 3*) (Used instead of Figure C.14)

Transmitting terminal
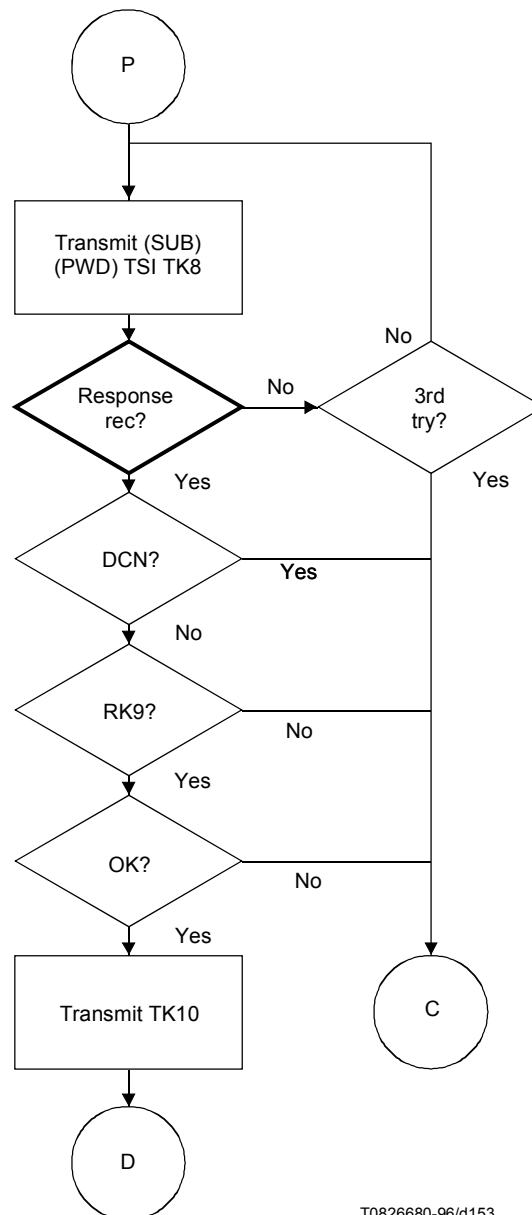
Figure G.8-5/T.30 – Duplex (*sheet 3 of 3*) (Used instead of Figure C.14)

Transmitting terminal
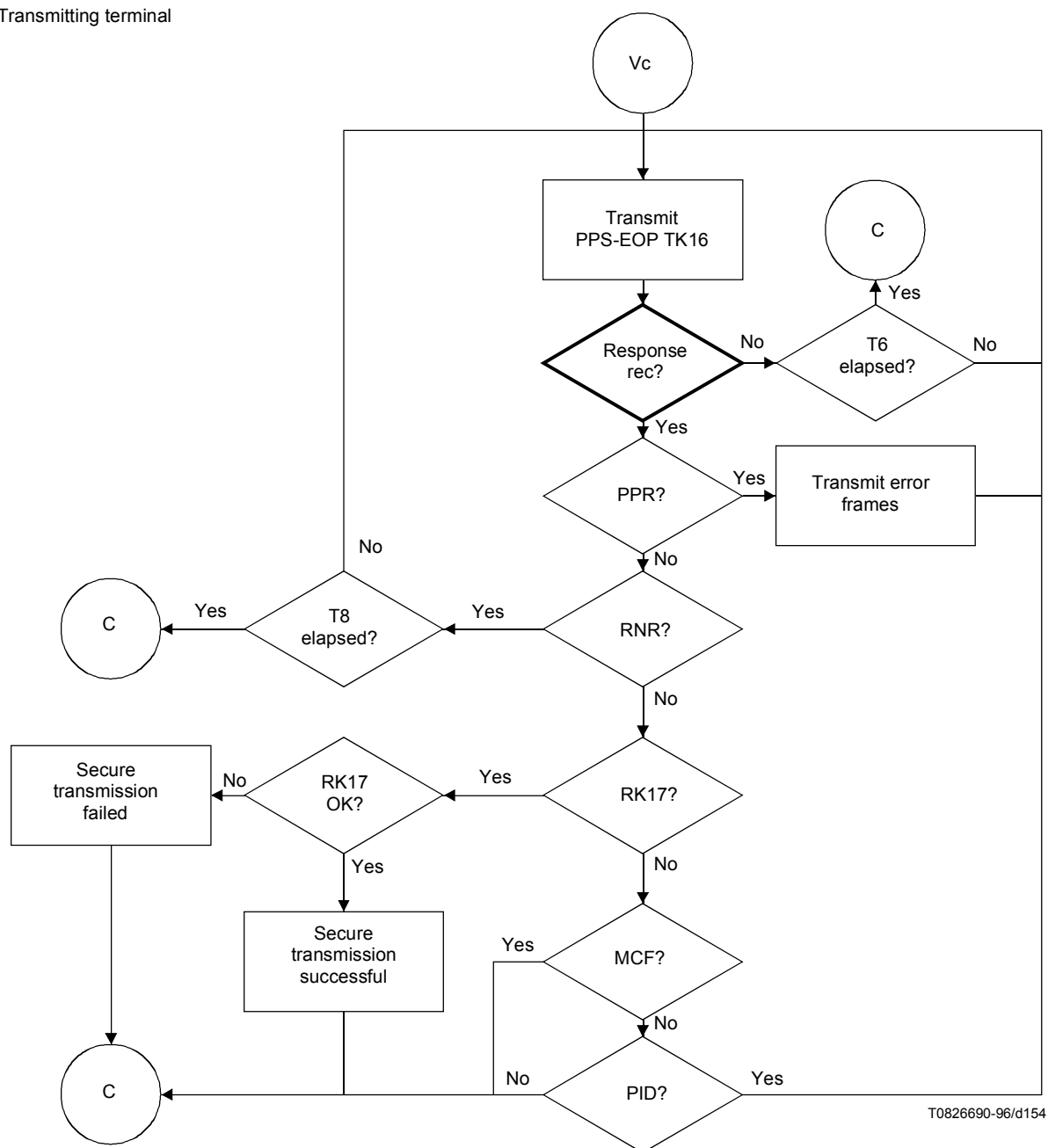
Figure G.8-6/T.30 – Duplex (Used instead of Figure C.18)

Receiving terminal

Figure G.8-7/T.30 – Duplex (Used instead of Figure C.21)
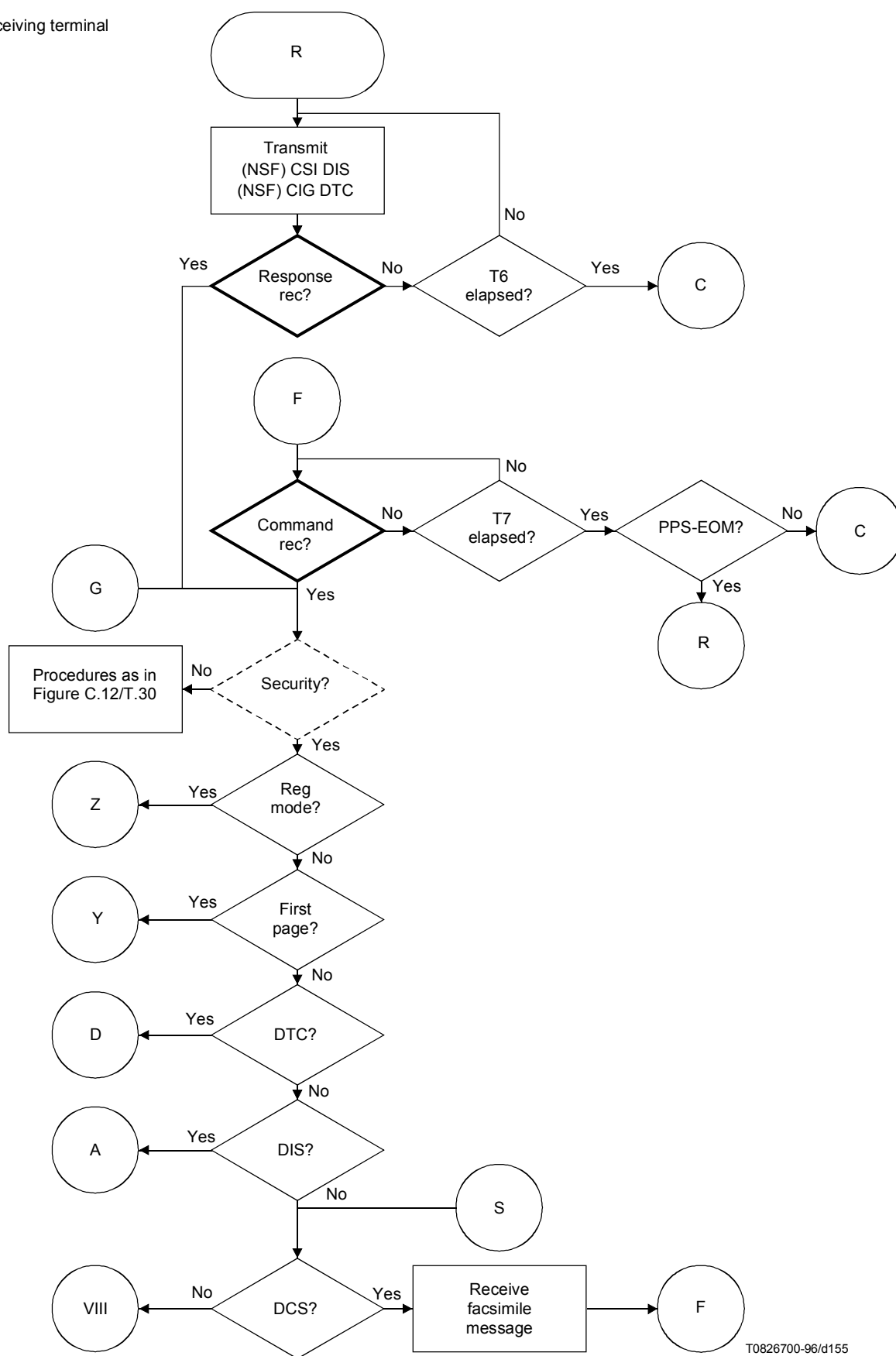
T0826700-96/d155
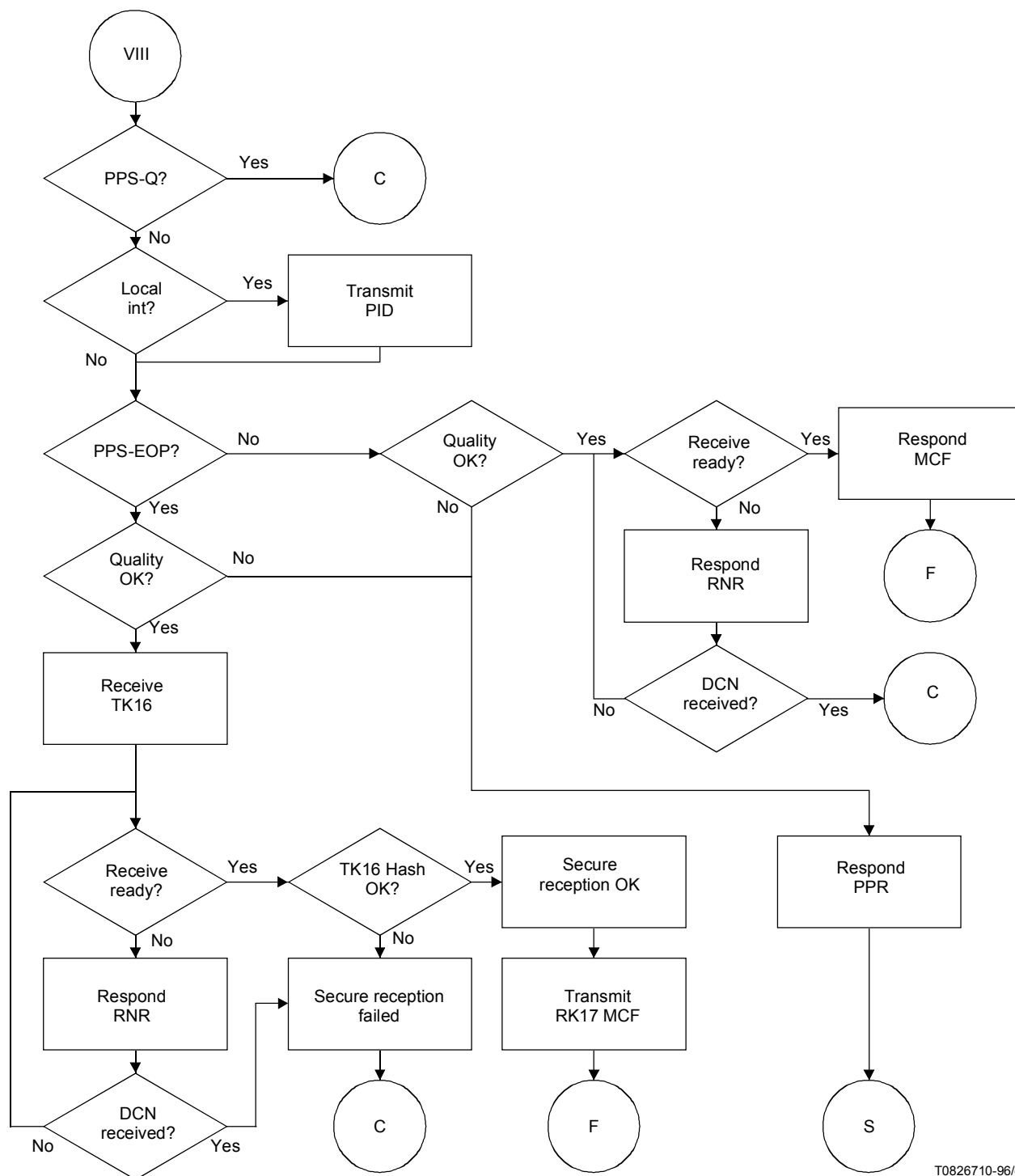
Figure G.8-8/T.30 – Duplex (Used instead of Figure C.22)

G.8.2 Flow diagram rules

The flow diagrams follow two simple rules:

1) All lines have an arrow at the destination only.

2) No lines cross.

G.8.3   Timers used in the flow diagrams

T1	35 s ± 5 s
T2	6 s ± 1 s
T3	10 s ± 5 s
T4	4.5 s ± 15% for manual units 3.0 s ± 15% for automatic units
T5	60 s ± 5 s
T6	5 s ± 0.5 s
T7	6 s ± 1 s
T8	10 s ± 1 s
T9	Duration of 256 flags

G.8.4   Abbreviations and descriptions used in the flow diagrams

Unless defined otherwise below, the definition of the flow chart terms is as given in the main body and/or in Annex A.

Authen reqd? Check to see if mutual authentication is required at the beginning of the transmission.

NOTE 1 – Once mutual authentication has been completed, then within the same session the "No" exit should always be followed.

Reg mode? Check to see if security registration is required.

First page? Check to see if mutual authentication is required at the beginning of the transmission.

NOTE 2 – Once mutual authentication has been completed, then within the same session the "No" exit should always be followed.

G.9   Signal sequence examples in case of secure facsimile procedure

The examples in Figures G.9-1 and G.9-2 are based on the flow diagrams and are for illustrative and instructional purposes only. They should not be interpreted as establishing or limiting the protocol. The exchanges of the various signals and responses are limited only by the rules specified in this Recommendation.

NOTE – The hold-off signals, RNR/RR and TNR/TR, may be used at any time during phase B and phase D to enable the receiver or transmitter time to carry out any processing involving in calculating security values or to obtain keys from storage or, in the case of registration, from the operator.

G.9.1   HKM mutual registration

Calling terminal ⟵ (NSF) CSI DIS ⟵ **Called terminal**

(SUB) (SID) TSI TK0 →

(RNR) ⟵

(RR) →

RK1 ⟵

(TNR) →

(TR) ⟵

TK2 →

(RNR) ⟵

(RR) →

MCF ⟵

DCN →

T0826720-96/d157

Figure G.9-1/T.30
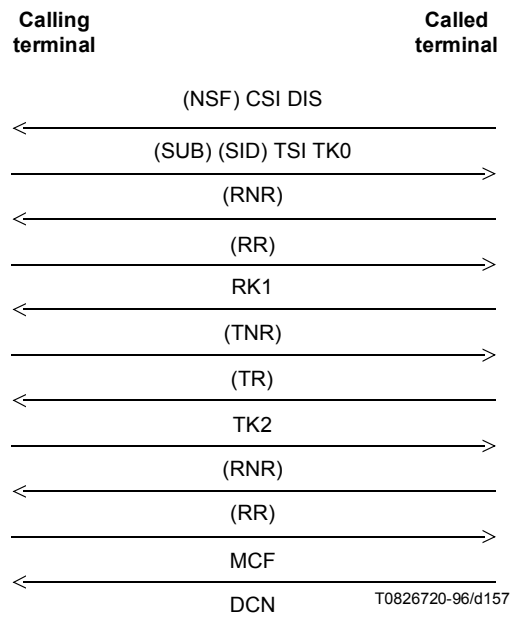
NOTE 1 – The operator of the called terminal may require time to enter the One Time key. If this is being entered manually in real time, RNR/RR is used to hold off the calling terminal. RNR/RR provides a delay of up to 65 seconds.

NOTE 2 – The SUB signal may be used to identify an individual within the domain of the called terminal with whom registration is requested.

NOTE 3 – The SID, Sender Identification, signal may be used to identify an individual within the domain of the calling terminal who is requesting the registration.

G.9.2   HKM secure transmission with optional encryption and hashing
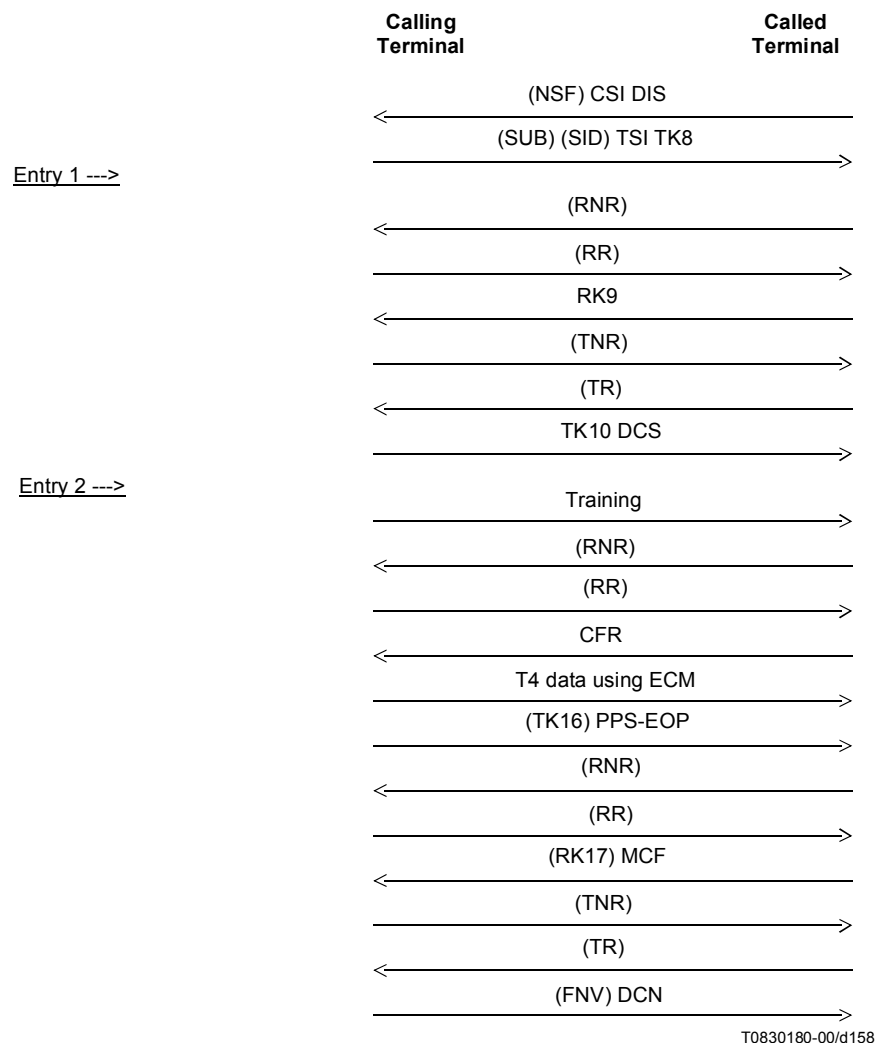

```
                    Calling                              Called
                    Terminal                             Terminal

                              (NSF) CSI DIS
                    <─────────────────────────────────────
                              (SUB) (SID) TSI TK8
                    ─────────────────────────────────────>
Entry 1 --->

                                  (RNR)
                    <─────────────────────────────────────
                                   (RR)
                    ─────────────────────────────────────>
                                   RK9
                    <─────────────────────────────────────
                                  (TNR)
                    ─────────────────────────────────────>
                                   (TR)
                    <─────────────────────────────────────
                               TK10 DCS
                    ─────────────────────────────────────>
Entry 2 --->
                                Training
                    ─────────────────────────────────────>
                                  (RNR)
                    <─────────────────────────────────────
                                   (RR)
                    ─────────────────────────────────────>
                                   CFR
                    <─────────────────────────────────────
                            T4 data using ECM
                    ─────────────────────────────────────>
                             (TK16) PPS-EOP
                    ─────────────────────────────────────>
                                  (RNR)
                    <─────────────────────────────────────
                                   (RR)
                    ─────────────────────────────────────>
                               (RK17) MCF
                    <─────────────────────────────────────
                                  (TNR)
                    ─────────────────────────────────────>
                                   (TR)
                    <─────────────────────────────────────
                               (FNV) DCN
                    ─────────────────────────────────────>
                                               T0830180-00/d158
```

NOTE 1 – The SUB signal may be used to identify an individual within the domain of the called terminal to receive the secure facsimile document.

NOTE 2 – The SID, Sender Identification, signal may be used to identify an individual within the domain of the calling terminal who is sending the secure facsimile document.

NOTE 3 – Data to be transmitted should be in exactly the same format as it would be if encryption was not being used, i.e., complete with any padding, etc. Encryption takes place immediately before these data are actually transmitted. When the receiving terminal decrypts the data, it should do so immediately before normal processing.

Figure G.9-2/T.30

G.9.3   HKM secure polling with optional encryption and hashing

See Figure G.9-3.
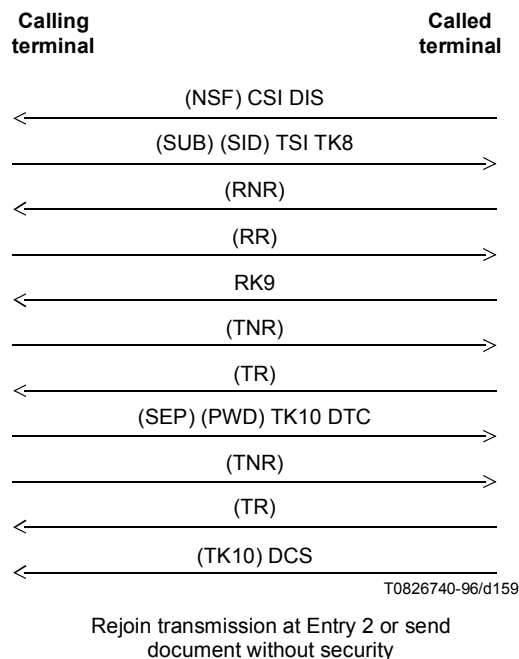
Figure shows signal flow between Calling terminal and Called terminal:

Calling terminal ← (NSF) CSI DIS
Calling terminal → (SUB) (SID) TSI TK8
Calling terminal ← (RNR)
Calling terminal → (RR)
Calling terminal ← RK9
Calling terminal → (TNR)
Calling terminal ← (TR)
Calling terminal → (SEP) (PWD) TK10 DTC
Calling terminal → (TNR)
Calling terminal ← (TR)
Calling terminal ← (TK10) DCS

T0826740-96/d159

Rejoin transmission at Entry 2 or send
document without security

NOTE 1 – The SUB signal may be used to identify an individual within the domain of the called terminal to receive the secure facsimile document.

NOTE 2 – The SID, Sender Identification, signal may be used to identify an individual within the domain of the calling terminal who is sending the secure facsimile document.

NOTE 3 – Data to be transmitted should be in exactly the same format as it would be if encryption was not being used, i.e., complete with any padding, etc. Encryption takes place immediately before these data are actually transmitted. When the receiving terminal decrypts the data, it should do so immediately before normal processing.

Figure G.9-3/T.30

G.9.4 HKM secure polling (initiated by polled system) with optional encryption and hashing

See Figure G.9-4.
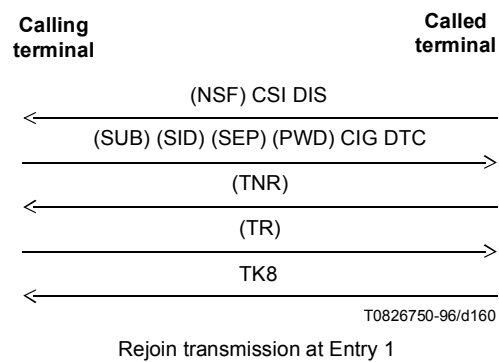
Figure G.9-4/T.30

NOTE 1 – The SUB signal may be used to identify an individual within the domain of the called terminal to provide the secure facsimile document.

NOTE 2 – The SID, Sender Identification, signal may be used to identify an individual within the domain of the calling terminal who is polling the secure facsimile document.

NOTE 3 – Data to be transmitted should be in exactly the same format as it would be if encryption was not being used, i.e., complete with any padding, etc. Encryption takes place immediately before these data are actually transmitted. When the receiving terminal decrypts the data, it should do so immediately before normal processing.

G.9.5 HKM secure turnaround poll with optional encryption and hashing

See Figure G.9-5.
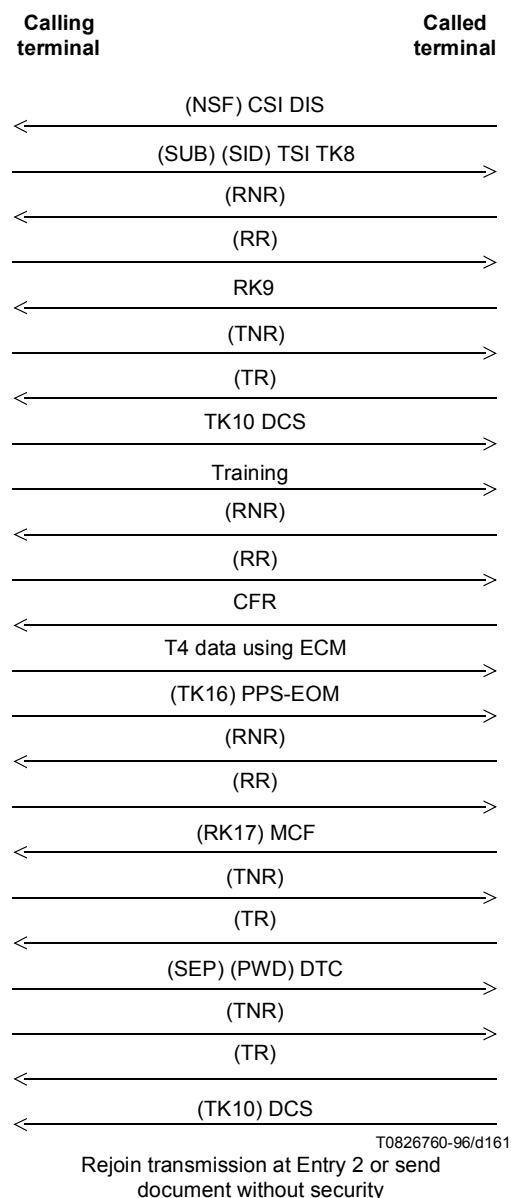
```
         Calling                           Called
         terminal                          terminal

                     (NSF) CSI DIS
         <───────────────────────────────────

                  (SUB) (SID) TSI TK8
         ───────────────────────────────────>

                        (RNR)
         <───────────────────────────────────

                        (RR)
         ───────────────────────────────────>

                        RK9
         <───────────────────────────────────

                        (TNR)
         ───────────────────────────────────>

                        (TR)
         <───────────────────────────────────

                      TK10 DCS
         ───────────────────────────────────>

                      Training
         ───────────────────────────────────>

                        (RNR)
         <───────────────────────────────────

                        (RR)
         ───────────────────────────────────>

                        CFR
         <───────────────────────────────────

                  T4 data using ECM
         ───────────────────────────────────>

                   (TK16) PPS-EOM
         ───────────────────────────────────>

                        (RNR)
         <───────────────────────────────────

                        (RR)
         ───────────────────────────────────>

                     (RK17) MCF
         <───────────────────────────────────

                        (TNR)
         ───────────────────────────────────>

                        (TR)
         <───────────────────────────────────

                  (SEP) (PWD) DTC
         ───────────────────────────────────>

                        (TNR)
         ───────────────────────────────────>

                        (TR)
         <───────────────────────────────────

                    (TK10) DCS
         <───────────────────────────────────
                                    T0826760-96/d161
          Rejoin transmission at Entry 2 or send
              document without security
```

NOTE 1 – The SUB signal may be used to identify an individual within the domain of the called terminal to receive the secure facsimile document.

NOTE 2 – The SID, Sender Identification, signal may be used to identify an individual within the domain of the calling terminal who is sending the secure facsimile document.

NOTE 3 – Data to be transmitted should be in exactly the same format as it would be if encryption was not being used, i.e., complete with any padding, etc. Encryption takes place immediately before these data are actually transmitted. When the receiving terminal decrypts the data, it should do so immediately before normal processing.

NOTE 4 – TK10 is optional and, if present, will contain a new session key with the response values set to zero.

Figure G.9-5/T.30

Annex H

Security in facsimile G3 based on the RSA algorithm

H.1   Preamble

(The preamble is left blank on purpose.)

H.2   Introduction

This annex specifies the mechanisms to offer security features based on the RSA cryptographic mechanism. The coding scheme of the document transmitted with security features may be of any kind defined in Recommendations T.4 and T.30 (Modified Huffman, MR, MMR, Character mode as defined in Annex D/T.4, BFT, other file transfer mode defined in Annex C/T.4).

H.3   References

–   ISO/IEC 9796-2:2002, *Information technology – Security techniques – Digital signature scheme giving message recovery – Part 2: Integer factorization based mechanisms*.

–   ISO/IEC 9796-3:2000, *Information technology – Security techniques – Digital signature schemes giving message recovery – Part 3: Discrete logarithm based mechanisms*.

   Annex A: RSA: RIVEST (R.L.), SHAMIR (A.), ADLEMAN (L.A.), A method for obtaining digital signatures and public-key cryptosystems, *CACM (Communications of the ACM),* Vol. 21, No. 2, pp. 120-126, 1978.

–   ISO/IEC 10118-3:2003, *Information technology – Security techniques – Hash-functions – Part 3: Dedicated hash-functions*.

   Ref. Number: ISO/IEC JTC 1/SC27 N1108:

   SHA-1 (Secure Hash Algorithm), described in *Secure Hash Standard*, FIPS (Federal Information Processing Standard) PUB 180-1, April 1995, an algorithm which comes from the NIST (National Institute of Standardization) in USA.

–   RFC 1321 (1992), *The MD5 message-digest algorithm*.

–   ISO/IEC 9979:1999, *Information technology – Security techniques – Procedures for the registration of cryptographic algorithms*.

H.4   Security mechanisms

H.4.1   Digital signature mechanism and keys management

The basic algorithm used for the digital signature (authentication and integrity type services) is the **RSA**.

The couple of keys used for this purpose is "public key"/"secret key".

When the optional confidentiality service is offered, the token containing the session key "Ks", used for enciphering the document, is encrypted also by the means of RSA algorithm. The couple of keys used for this purpose called ("encipherment public key"/"encipherment secret key") is not the same one as that used for authentication and integrity types services. This is for decoupling the two kinds of use.

The implementation of RSA which is used in this annex is described in ISO/IEC 9796 (Digital signature scheme giving message recovery).

For encipherment of the token containing the session key, the rules of redundancy when processing the algorithm RSA are the same ones as those specified in ISO/IEC 9796.

NOTE – Certain Administrations in addition to RSA (which is the basic mechanism in the context of this annex), may require that an optional mechanism be implemented: the DSA.

References

–   ISO/IEC 14888-3:1998, *Information technology – Security techniques – Digital signatures with appendix – Part 3: Certificate-based mechanisms*.

         Ref. Number: ISO/IEC JTC 1/SC27 N1113.

–   FIPS PUB 186-2: Digital Signature Standard, *U.S NIST*, 27 January 2000.

H.4.2   Length of the public keys, secret keys and digital signatures

As a basic feature, the length of the public keys, secret keys and digital signatures is **512 bits**. Longer lengths may be used as recognized options; they are negotiated through the protocol (see further).

H.4.3   Length of the public exponent of RSA

For digital signatures, the public exponent has a fixed value equal to 3.

For encipherment of the token which includes the session key "Ks", the public exponent has a fixed value equal to: $2^{16} + 1$. The session key is used in case of encipherment of the document, see further.

H.4.4   Certification authorities

By default, certification authorities are not used.

As an option, certification authorities may be used to certificate the validity of the public key of the sender of the facsimile message. In such a case, the public key may be certified as specified in the ITU-T Rec. X.509.

The means to transmit the certificate of the public key of the sender is described in this annex, but the precise format of the certificate is left for further study (in future versions of this annex).

The actual transmission of the certificate is negotiated in the protocol.

H.4.5   Registration mode

As a **mandatory** feature, a *registration mode* is provided. It permits the sender and the receiver to register and store the public keys of the other party in confident manner prior to any secure facsimile communication between the two parties.

Registration mode can avoid the need for the user to enter manually in the terminal the public keys of its correspondents (the public keys are fairly long, 64 octets or more).

Because the registration mode permits to exchange the public keys and store them in the terminals, it is not necessary to transmit them during the facsimile communications.

The scheme of the registration mode is detailed further in this annex.

H.4.6   Hash function

As described in this annex, some signatures are applied on the result of a "hash function".

The hash function which is used is either (SHA-1, *Secure Hash Algorithm 1*), an algorithm which comes from the "NIST" in USA or MD-5 (RFC 1321).

For SHA-1, the length of the result of the hashing process is on **160 bits**.

For MD-5, the length of the result of the hashing process is on **128 bits**.

A terminal may implement either SHA-1 or MD-5 or both.

The use of one algorithm or the other is negotiated in the protocol (see further).

In the future, other optional hash functions may be added in this annex.

H.4.7 Encipherment

H.4.7.1 General

The encipherment of the data for provision of the confidentiality service is optional. Five optional encipherment schemes are registered in the scope of this annex:

FEAL-32, SAFER K-64, RC5, IDEA and HFX40 (as described in ITU-T Rec. T.36). In some countries, their use may be subject to national regulation.

Other optional algorithms could be registered in the future.

Other optional algorithms may also be used. They are chosen conforming to the ISO/IEC 9979 (Procedure for registering cryptographic algorithms).

The capability of the terminal to handle one of these algorithms and the actual use of a particular one during the communication is negotiated in the protocol.

A session key is used for encipherment. The session key is called "**Ks**".

The basic length of "Ks" is 40 bits.

– For algorithms which use a 40-bit session key (e.g., HFX40), the session key "Ks" is the key actually used in the encipherment algorithm.

– For algorithms which require keys longer than 40 bits (e.g., FEAL-32, IDEA, SAFER K-64 requiring respectively: 64 bits, 128 bits and 64 bits), a redundancy mechanism is performed to get the necessary length. The resultant key is called the "redundant session key". The "redundant session key" is the key which is actually used in the encipherment algorithm.

The redundancy mechanism is described in the next clause.

The token "BE" which includes "Ks" (see further) is enciphered by the "encipherment public key" of the recipient and sent to it by the sender.

When a redundancy key is necessary, the receiving terminal regenerates it from the token "BE" received from the emitting terminal.

H.4.7.2 Redundancy mechanism to get the redundant session key when necessary

When a "redundant session key" is necessary (the encipherment algorithm needs a key longer than 40 bits), this entity is generated as follows:

The pattern of bits "Ks" is repeated as many times as necessary to get the necessary length required for the algorithm. If necessary, a portion of the pattern (beginning with the left-most bit) is appended at the end to fit the correct length.

This principle is illustrated on an example below where the algorithm requires 128 bits (e.g., IDEA).

Redundant session key = 128 bits long

8 bits

| x . . . . .40 bits . . . . | x . . . . .40 bits. . . . . | x . . . . .40 bits . . . . | xxxxxxxx |

Left-most bit of Ks   Left-most bit of Ks   Left-most bit of Ks   Left-most bit of Ks
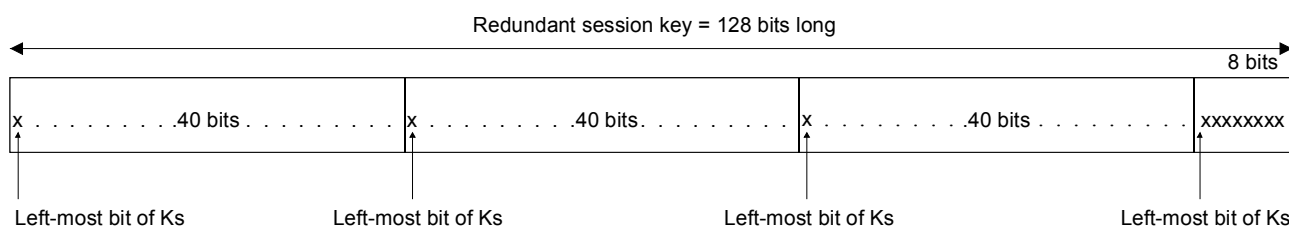
T0828020-98/d162

H.4.8 Use of hash function and RSA algorithm

H.4.8.1 General scheme

See Figure H.1.

Use of RSA for digital signature
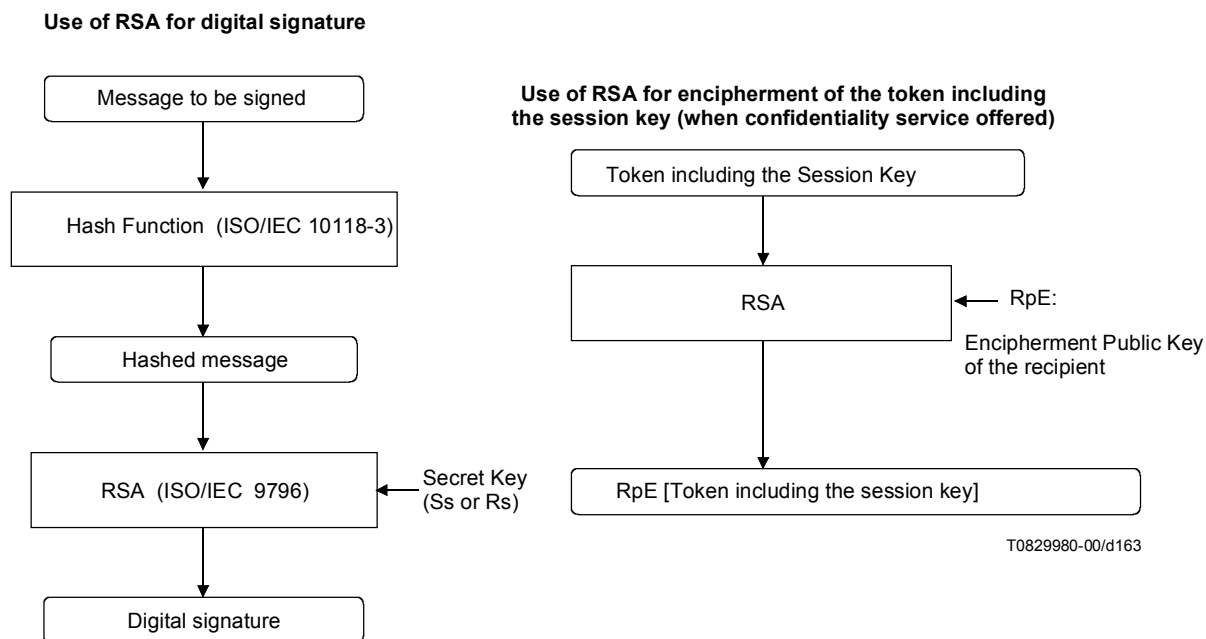
NOTE – ISO/IEC 9796 has been designed to RSA-sign a short data, which may be either the message to be signed (if it is short), or the hash code of the message to be signed (if the message is too long), see ISO/IEC 9796.

Figure H.1/T.30

H.4.8.2 Bit order for transmission

Throughout this annex:

1) All the sequence of octets are transmitted such as the left-most octet (as represented in this annex) is the first octet transmitted.

   The rule for bit transmission order within each octet is defined below.

2) Except for the content of the **FIF** of the DES, DEC, DER and DTR signals which are defined below, for each octet represented in this annex, the order in which the bits are transmitted is from left to right as printed, this is the case, for example, for the FCF codes.

3) For the content of the **FIF** of the signals DES, DEC, DER and DTR:

   a) There is a "General rule" which is the following:

      For each octet, the least significant bit is the first transmitted.

      When numbered in tables, the least significant bit is numbered "bit No. 0".

      For example: the octet "1 0 1 1 0 0 1 1"

      and numbered (if numbered):   bit No.7 6 5 4 3 2 1 0
                                          1 0 1 1 0 0 1 1

      will be transmitted as follows:

      Transmission order ==>

      1 1 0 0 1 1 0 1

b) For the cases where the content of the FIF of the existing T.30 signals is encapsulated within a tag encoded structure (see H.6.1.4.7, Encapsulated Frame Supergroup), consistency is maintained with the transmission order of the octets and bits for the FIF as previously defined for these signals (see 5.3 and 5.3.6.2).

c) Within the FIF of the DES, DEC, DER and DTR, an exception to the general rule is for parameters identified as "binary coded" within Table H.1. For these parameters, the following rule applies:

The first bit transmitted on the line is the left-most bit of the left-most octet:

```
left-most bit
 |
 |
 |
 ↓            left-most octet        |     left-most octet but one    |  ...
 0   1   2   3   4   5   6   7    0   1   2   3   4   5   6   7    0  ...
 |
 |
 0   1   2   3   4   5   6   7    8   9   10  11  12  13  14  15  16  ..
Transmission order ==>
```
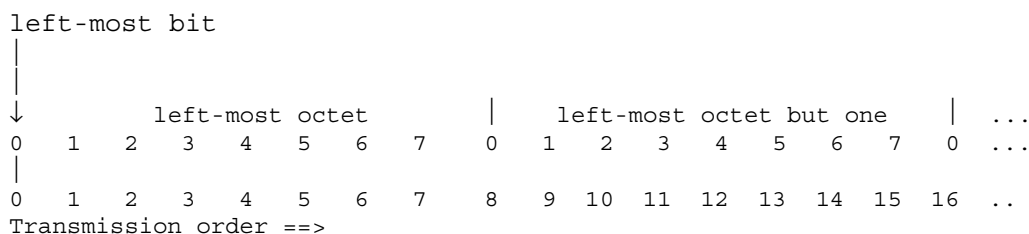
H.4.8.3   Bit order in the hash and RSA processes

The hash function standards (SHA-1 and MD-5) define a bit string upon which the hashing process is applied and a bit string which is the hash result.

The first bit of these bit strings is the left-most bit (as represented in the figures of this Recommendation).

In this annex, various parameters are specified on which hash function is applied. Some hash results are transmitted on the line. The rules for bit order on the line and bit order for processing in the hash function are the same ones:

–   The first bit passing through the hash function is the left-most bit of the left-most octet.

If the hash function is applied on several concatenated entities, for example h(a,b,c,...), the bit string to be hashed is the bit string [a] immediately followed by the bit string [b], etc.

For the RSA function, the same principle applies:

–   The first bit passing through RSA function is the left-most bit of the left-most octet.

The bit order through hash function and RSA is illustrated as follows (the bit strings represented are only for example):

```
|left-most bit in the entry of the hash function
|= first bit when transmitted on the line
|
↓
0010101010010101010001000100..........
|
↓HASH  FUNCTION

result of the hash function: 160 bits (or 128 bits if MD-5):
0101111001001010 ......      00010101
↑
|left-most bit at the result of the hash function
|= left-most bit in the entry of the RSA function
|
↓RSA

result of the RSA: 64 octets (or more if negotiated as such, see further)
10100101000000101010.........101010
↑
|
|left-most bit at the result of the RSA function
|= first bit when transmitted on the line
```

This principle is valid also for the parameters passing directly into the RSA function without hashing (e.g., Token which includes the Session Key "Ks").

If RSA is applied on several concatenated entities, for example (a,b,c, ...), the bit string to be processed by RSA is the bit string [a] immediately followed by the bit string [b], etc.

H.5   Security parameters

Table H.1 defines the various security parameters some of which are exchanged.

For all the security parameters, a basic length is defined. The support of this basic length is mandatory.

In addition, some parameters permit optional longer lengths which can be negotiated in the protocol.

Table H.1 indicates also the type of coding of the parameters (binary, ASCII, ...).

The means to transmit these parameters in the signals DES, DEC, DER and DTR is specified further in this annex.

Table H.1/T.30 – Security parameters

Abbreviation	Description	Basic length	Optional longer lengths	Coding of the field
S	Sender's identity	20 octets	For further study	IA5 coded (Note 1)
Sp	Sender's public key	64 octets	Possible	Binary coded (Note 2)
Ss	Sender's secret key	64 octets	Same as Sp	Binary coded (Note 2)
SpE	Encipherment Sender's public key (for encryption of token containing the session key)	64 octets	Possible	Binary coded (Note 2)
SsE	Encipherment Sender's secret key (for decryption of encrypted token containing the session key)	64 octets	Same as SpE	Binary coded (Note 2)
Sra	Random number created by the sender for authentication of the recipient	8 octets	Possible	Binary coded (Note 2)
Srd	Random number created by the sender for the digital signature	8 octets	Possible	Binary coded (Note 2)
R	Recipient's identity	20 octets	For further study	IA5 coded (Note 1)
Rp	Recipient's public key	64 octets	Possible	Binary coded (Note 2)
Rs	Recipient's secret key	64 octets	Same as Rp	Binary coded (Note 2)
RpE	Encipherment Recipient's public key (for encryption of token containing the session key)	64 octets	Possible	Binary coded (Note 2)

Table H.1/T.30 – Security parameters

Abbreviation	Description	Basic length	Optional longer lengths	Coding of the field
RsE	Encipherment Recipient's secret key (for decryption of encrypted token containing the session key)	64 octets	Same as RpE	Binary coded (Note 2)
Rra	Random number created by the recipient for authentication of the sender	8 octets	Possible	Binary coded (Note 2)
Ks	Session key	40 bits	For further study	Binary coded (Note 2)
BE	BE = RpE[S, Ks] = Sender identity and session key concatenated and encrypted by RpE	64 octets	Same as RpE	Binary coded (Note 2)
UTCd	Date/time chosen by the sender (date/time of the generation/signature of the document)	8 octets	For further study	YY MM DD HH MM SS offset GMT BCD coded (Note 3)
UTCr	Date/time chosen by the recipient (date/time of the confirmation of message receipt)	8 octets	For further study	YY MM DD HH MM SS offset GMT BCD coded (Note 3)
Lm	Length of the document	4 octets	For further study	Corresponds to the number of octets of the whole document transmitted (data octets + pad bits, see H.6.5). BCD coded (Note 4)
h(...)	Hashed result of the entity enclosed in brackets	160 bits or 128 bits depending on the hash-function	For further study	Binary coded (Note 2)
Rs[h(...)]	Hashed result of the entity enclosed in brackets signed by the recipient	64 octets	Same as Rp	Binary coded (Note 2)
Ss[h(...)]	Hashed result of the entity enclosed in brackets signed by the sender	64 octets	Same as Sp	Binary coded (Note 2)
Sia	Indicator in the token used for authentification of the sender	1 octet	No	Octet equal to: "00000000" (Note 5)
Ria	Indicator in the token used for authentification of the recipient	1 octet	No	Octet equal to: "00000001" (Note 5)

Table H.1/T.30 – Security parameters

Abbreviation	Description	Basic length	Optional longer lengths	Coding of the field
Sis	Indicator in the token used for digital signature	1 octet	No	Octet equal to: "00000010" (Note 5)
Ris	Indicator in the token used for confirmation of message receipt	1 octet	No	Octet equal to: "00000011" (Note 5)
document	The document sent during the secure facsimile transmission mode	Variable	Irrelevant	Irrelevant
enc. document	The encrypted document sent during the secure facsimile transmission mode when confidentiality service is invoked. The encryption of the document is made with session key Ks (or the redundant session key if the algorithm requires more bits than Ks to work).	Variable	Irrelevant	Irrelevant

NOTE 1 – The general rule for FIF of DES/DEC/DER/DTR applies: the least significant bit of each octet is the first one transmitted.

NOTE 2 – The rule for transmission of binary coded elements is defined in H.4.8.2.

NOTE 3 – Example: for the 24th March of 1995. 8H25 05s PM. Offset GMT: 3 H:

```
" 1    9       9       5       0       3       2       4       2       0       2       5       0       5       0       3 "
0001 1001   1001 0101   0000 0011   0010 0100   0010 0000   0010 0101   0000 0101   0000 0011
```

The general rule for FIF of DES/DEC/DER/DTR applies: the right-most bit of each octet is the first one transmitted.

NOTE 4 – Example: for a document length of 123456 octets:

```
" 0    0       1   2       3   4       5   6 "
0000 0000   0001 0010   0011 0100   0101 0110
```

The general rule for FIF of DES/DEC/DER/DTR applies: the right-most bit of each octet is the first one transmitted.

NOTE 5 – The general rule for FIF of DES/DEC/DER/DTR applies: the right-most bit of each octet is the first one transmitted.

H.6   Exchanges of security parameters

The Error Correction Mode (ECM) described in Annex A is required for offering the security services based on RSA.

Some specific security parameters must be transmitted during the facsimile communication at the protocol level (phases B and D of the T.30 protocol). As an option, see further "security page", some security parameters are transmitted at the message level (phase C of T.30 protocol).

H.6.1 Exchange of security parameters at the protocol level

The eight new signals which are used are the following:

– DER: Digital Extended Request

This command is sent by the sending terminal. It can set security parameters for the session and also requests further details on the security capabilities of the receiving machine.

– DES: Digital Extended Signal

Sent by the receiving device; contains security capabilities of the receiving machine.

– DEC: Digital Extended Command

Sent by the sending terminal in response to DES or DTR.

DEC contains all the settings for the current communication.

DEC replaces DCS which is not sent. The information which is normally contained in the FIF of the DCS is contained in the DEC. DEC contains also the various security parameters sent from the emitting terminal to the receiving terminal.

– DTR: Digital Turnaround Request

May be sent by the calling terminal in response to DIS or DES; used when polling or turnaround desired.

DTR replaces DTC which is not sent. The information which is normally contained in the FIF of the DTC is contained in the DTR. DTR contains also the various security parameters sent from the receiving terminal to the emitting terminal.

– DNK: Digital Not Acknowledge

DER, DES, DEC or DTR are structured in HDLC frames.

DNK indicates that the previous command (DER, DES, DEC or DTR) has not been satisfactorily received and that the frames specified in the FIF of DNK are required to be retransmitted. DNK may be issued either by the emitting terminal or by the receiving terminal (contrary to PPR in Annex A which can only be sent by the receiving terminal).

DNK is also used to reject TCF.

– TNR: Transmitter Not Ready

This signal is used to indicate that the transmitter is not yet ready to transmit.

Format:

FCF: X101 0111 (X is the bit defined in 5.3.6.1).

– TR: Transmitter Ready?

This signal is used to ask the status of the transmitter.

Format:

FCF: X101 0110 (X is the bit defined in 5.3.6.1).

– PPS-PSS: Partial Page Signal – Present Signature Signal

This signal is used to indicate the end of the document and that a digital signature signal follows.

Format:

FCF1: X111 1101 (X is the bit defined in 5.3.6.1)

FCF2: 1111 1000.

The particular coding of DER, DES, DEC, DTR and DNK is detailed further in this annex.

H.6.1.1 Structure of DER, DES, DEC and DTR

H.6.1.1.1 General

DER, DES, DEC and DTR signals are structured in HDLC frames.

The structure of the sequence of frames follows the same rules as that of the multiframe commands already specified in this Recommendation (e.g., NSF-CSI-DIS). These rules are described in 5.3.1, 5.3.3, 5.3.4 and 5.3.5.

H.6.1.1.2 FCF (Facsimile Control Field)

The FCF of the frames is the following:

–   DES frames: 0000 0101
–   DEC frames: 1100 1001
–   DER frames: 1100 1010
–   DTR frames: 1000 1000

H.6.1.1.3 FIF (Facsimile Information Field)

The specifications for the FIF of DES, DEC, DER and DTR in the scope of this annex are the following:

The maximum length of the FIF of a frame is 65 octets. If a frame is an intermediate frame (not the last one), its FIF must be 65 octets long, **except when the content of the frame is "FIF of DCS"** (see further). In this latter case, the frame is as long as necessary to contain the FIF octets of the DCS but no more (no pad octet is allowed).

If it is the last frame, the length of the FIF may be less than 65 octets depending on the number of data octets to carry. No pad octet is allowed.

The first octet of the FIF of each frame contains the frame number, then follows the data field. The frame number is an eight bits binary number. The general rules for FIF of DES/DEC/DER/DTR applies: the least significant bit of the frame number (right-most bit) is transmitted the first.

The frame numbered "0" is transmitted first.

Figure H.2 illustrates these principles.

NOTE – The use of frames with FIF longer than 65 octets is for further study.

Preamble	HDLC Address	Control field	Facsimile control field	FIF		FCS	Flag(s)	HDLC address	Control field	Facsimile control field	FIF		FCS	Flag(s)
Flags	1111 1111	1100 X000 X = 0 (non-final frame)	DEC = 1100 1001	Frame number 0000 0000	Data field 64 octets	FCS	At least one flag	1111 1111	1100 X000 X = 1 (final frame)	DEC = 1100 1001	Frame number 0000 0001	Data field ≤ 64 octets	FCS	At least one flag
NOTE 1 – The FCF is transmitted with the left-most bit (as printed in the figure) being the first one transmitted.														
NOTE 2 – The Frame number is transmitted with the right-most bit (as printed in the figure) being the first one transmitted.														
In the example, for the frame number of the second frame:														
1000 0000														
transmission order ===>														
NOTE 3 – The data field of frame "0" may be less than 64 octets if containing the "FIF of DCS".														

Figure H.2/T.30 – Example for a DEC consisting in 2 frames

H.6.1.2　Use and structure of DNK

H.6.1.2.1　Structure of the DNK

Definition

In the rest of this annex, the terms "signal X" or "X" designate either the signal DER, DES, DEC or DTR.

When some frames of "signal X" are improperly received, DNK permits to request the retransmission of those specific frames.

DNK is also used to reject TCF; see further.

NOTE – When all the frames of an X signal have been received correctly, the normal answer (as specified in this annex) is used as an implicit acknowledgement, except if TCF is to be rejected (DNK is used for this rejection).

DNK consists in one HDLC frame whose structure follows the same rules as for the other T.30 signals (rules are described in 5.3.1, 5.3.3, 5.3.4, 5.3.5).

H.6.1.2.2　FCF of the DNK

The FCF is the following: X101 1001

The definition of the X bit is in 5.3.6.1.

H.6.1.2.3　FIF of the DNK

H.6.1.2.3.1　General

The FIF consists in an integer number of octets.

For each octet of the FIF of DNK, the left-most bit (as printed) is the first one transmitted. It is numbered bit "0".

The transmission order corresponding to the bit numbering is the following:

Bit No.　01234567 01234567 01234567 …

　　　　transmission order ========>

The first octet of DNK is used to reject TCF when needed (TCF received corrupted).

The further octets are used to request frames received in error.

H.6.1.2.3.2　Request of frames received in error

Beginning with the second octet of the FIF, each bit corresponds to a frame in the previously sent command or response, i.e., the first transmitted bit to the first frame, etc. For frames which are received correctly, the corresponding bit shall be set to "0"; those that are received incorrectly shall have their bit set to "1". Pad bits of value "1" shall be added as required to align on the last octet boundary.

Likewise in ECM mode described in Annex A (but here at the protocol modulation speed), if more than one DNK is transmitted (consecutive to several faulty attempts of transmission of X frames), the bit corresponding to an X frame which has been already correctly received must always be set to "0".

NOTE 1 – It may happen that DNK is resent with a FIF of a different size.

For example: the X signal is received quite improperly and is found to be only 7 frames long whereas it is in fact 9 frames long. In such case, the FIF of the DNK will contain only two octets (the first one which is used for the TCF rejection – see further – and the second one which is sufficient to indicate the frames detected in error). Once the frames of the X signal are re-emitted, the receiving machine finds that the X signal is

9 frames length. If it happens again that some frames are corrupted, a new DNK is sent with 3 octets in its FIF. This example is illustrated below.

NOTE 2 – It must be noticed that the terminal receiving the X signal can locate the last frame with the bit "x" of the HDLC control field (set to "1").

Example with a DEC received improperly (the same principles apply for a corrupted DES, DER or DTR signal)

-------------------->
DEC

9 frames   <--------------------

DNK with FIF 2 octets long:

```
Bit No.   0123   4567   01234567

          xxxx   xxx0   10101111
```

first octet for TCF rejection (see explanation further)
frames 0, 2, 4, 5 and 6 improperly received
frames 7 and 8 not received
(the last bit "1" is only for octet alignment)

-------------------->
DEC

frames 0, 2, 4, 5, 6, 7 and 8   <--------------------

DNK with FIF 3 octets long:

```
Bit No.   0123   4567   01234567   01234567

          xxxx   xxx0   10000000   01111111
```

only frame 0 improperly received

-------------------->
DEC

frame 0   <--------------------

frame correctly received
normal response = implicit acknowledgement
(depends on the context)

H.6.1.2.3.3   Maximum time for retransmissions of signal X upon DNK occurrences

Concerning the retransmission of the signal X upon DNK occurrences, the "fail-safe" timer called Tx is defined.

– The fail-safe timer Tx is defined as follows:

Tx = 60 s ± 5 s.

– At the transmitter of the signal X, the timer Tx is started at the time of the first DNK recognition and is stopped at the time of the normal response recognition or FNV.

– If the timer Tx has expired, the transmitter of the signal X sends a DCN command for call release.

H.6.1.2.3.4 Specific rejection by DNK

The left-most bit of the first octet of the FIF of DNK (numbered "No. 0" in Table H.2) is used for rejection of TCF (TCF corrupted); this is the equivalent role of FTT in normal T.30.

The TCF rejection defined in Table H.2 cannot be combined with the indication of frames X received in error as defined in H.6.1.2.3.2.

The process of rejection is sequential as follows:

1)   First all the corrupted frames of the DEC (or DES, or DER or DTR) are requested by the DNK. The bit No. 7 and bit No. 0 of the first DNK octet are set to "0" (bit No. 0 meaningless at this stage).

2)   Once all the frames have been corrected, the content of the DEC (or DES, or DER or DTR) may be rejected by FNV if necessary (see further);

or if the content of DEC is correct and in case of the TCF following the DEC is corrupted, the TCF is rejected by the first octet of DNK.

Table H.2/T.30 – "Specific rejection by first octet of FIF of DNK"

Specific rejection	Coding of the first octet of FIF of DNK								
TCF corrupted (equivalent of FTT in normal mode)	Bit No.	0	1	2	3	4	5	6	7
		1	x	x	x	x	x	x	x
Bits 1 to 6 are reserved for future use.	Bit No.	0	1	2	3	4	5	6	7
		x	x	x	x	x	x	x	x
The bit No. 7 must be set to "1" if all the frames have been correctly received and DNK is sent only for TCF rejection. If bit No. 7 is set to "1", the octets after the first one are not sent.	Bit No.	0	1	2	3	4	5	6	7
		x	x	x	x	x	x	x	1

Precisions:

−   As specified in this annex, the bits of the FIF of DCS are placed in the first HDLC frame of the DEC.

−   As for the other frames, frame No. 0 of a DEC containing the FIF of DCS is re-emitted only when requested by the DNK (if this frame has been improperly received). There is an exception to this rule when TCF is rejected: in such a case, frame No. 0 must always be sent along with the TCF, see example further.

Example with a DEC followed by TCF

```
-------------------->
DEC 3 frames
————————————>
TCF                                    <-------------------
                                       DNK with FIF 2 octets long:
                           Bit No.     01234567   01234567
                                       00000000   01011111

                                       frame 1 improperly received
                                       frames 0 and 2 correctly received
-------------------->
DEC 1 frame:
frame 1
————————————>
TCF                                    <-------------------
                                       DNK with FIF 1 octet long:
                           Bit No.     01234567
                                       10000001

                                       frame 1 correctly received
                                       TCF rejection
-------------------->
DEC 1 frame:

frame 0 (contains FIF of
DCS)
————————————>
TCF                                    <-------------------
                                       frame 0 correctly received and TCF correct
                                       normal response = implicit acknowledgement
                                       (depends on the context)
```

H.6.1.3   Precisions for the use of FNV in Annex H

FNV defined in 5.3.6.2.13 is used only after the following condition is satisfied:

−   There is no pending frame of a signal X to be corrected.

Example

```
-------------------->
DEC 3 frames
───────────────>
```

TCF   `<--------------------`

                                                DNK with FIF 2 octets long:

                          Bit No.   01234567   01234567

                                     00000000   01011111

                                     frame 1 improperly received
                                     frames 0 and 2 correctly received

```
-------------------->
DEC 1 frame:
frame 1
───────────────>
```

TCF   `<--------------------`

                                     frame 1 correctly received
                                     FNV (because error in the parameter content)

H.6.1.4   Data encoding within the FIFs of the DER, DES, DEC and DTR

H.6.1.4.1 Supergroups and Groups

The sequence of the Facsimile Information Fields of DER, DES, DEC and DTR signals is structured in Groups and Supergroups.

Groups are collections of similar or related terminal or session attributes that will often need to be negotiated at the same time.

Supergroups provide an additional hierarchy so that Groups of related attributes may be kept together.

The general sequence of Supergroups and Groups which can be presented in the sequence of Facsimile Information Fields of DER, DES, DEC and DTR signals is as follows:

SG1[G1..G2..G3...]SG2[G1..G2..G3...]...SGn[G1..G2..G3...]

where SG indicates Supergroups and G indicates Groups.

Supergroups are identified by Supergroup Tags, called also in this annex "super-tags".

Supergoups contain Groups identified by Group Tags, called also in this annex simply as "tags".

A super-tag is followed by the length of the Supergroup it identifies and then by the sequence of the Groups of the Supergroup.

For each Group, the tag which identifies the Group is followed by the length of the Group and then by the content of the Group.

Notations

–   Within this annex, the content of the Group is called "parameter".

–   The length of the Group is called "length of the parameter value".

–   The content of the Group is called "value of the parameter".

H.6.1.4.2 Tag Assignment

1)   The super-tags are eight bits long.

An initial tag value of Hex FF indicates an extension of 8 additional bits (may be used in future versions of this annex).

2)   The tags are eight bits long. The extension principle applied is the same as used for super-tags.

H.6.1.4.3 Length of Supergroups – Length of Groups

The count is in units of octets. The first octet after the super-tag or tag contains the number of octets that follow. If the initial count octet is 0, then the two octets following the count octet indicate the number of octets to follow.

Examples: for a 20-octet long parameter value, the length octet will be: "00010100".

Examples: for a 257-octet long parameter value, the length octets will be:
            "0000 0000   0000 0001   0000 0001".

The general rule for FIF of DES/DEC/DER/DTR applies: the right-most bit of each octet as printed (least significant bit) is the first one transmitted.

H.6.1.4.4 Encoding rules

A formal description of the encoding rules for encoding the Facsimile Information Fields of DER, DES, DEC and DTR signals follows in Backus-Naur Form (BNF):

Encoding rules for facsimile tag encoding syntax

<bit>	::=	<0> | <1>
<octet>	::=	<bit><bit><bit><bit><bit><bit><bit><bit>
<8_bit_tag>	::=	<octet>
<extend_octet>	::=	{<1><1><1><1><1><1><1><1>}
<tag>	::=	<8_bit_tag> | <extend_octet> | <8_bit_tag><8_bit_tag>
<parameter_value>	::=	<octet>{<octet>}
<count_extend_octet>	::=	<0><0><0><0><0><0><0><0>
<parameter_length>	::=	<octet> | <count_extend_octet><octet><octet>
<Group>	::=	<tag><parameter_length><parameter_value>
<frame_number>	::=	<octet>
<Supergroup_tag>	::=	<tag>
<Supergroup_length>	::=	<parameter_length>
<Supergroup>	::=	<Supergroup_tag><Supergroup_length><Group>{<Group>}
<Tag_Encoded_Data>	::=	<Supergroup>{<Supergroup>}
<FIF>	::=	<frame_number><Tag_Encoded_Data>

NOTE – The Tag_Encoded_Data may extend over multiple frames; see H.6.1.4.6.

H.6.1.4.5 Description of Backus-Naur Form

The following provides a description of the Backus-Naur style syntax which is used in H.6.1.4.4.

Symbol Description of use

literal   A token (or component) is noted by a literal.

::=   This is the production assignment operator.

| This symbol is used to separate alternative tokens or groups of tokens.

< >   A non-terminal token is noted by a literal enclosed by the "<" and ">" characters.

[ ]   An optional token or group of tokens is enclosed by the "[" and "]" characters.

{ }   A group of tokens enclosed in "{" and "}" may be repeated 0, 1 or more times.

H.6.1.4.6 Relationship between FIFs encoding and the structure in HDLC frames

The formatting in super-tags, tags and parameters as described above is independent of the structure in HDLC frames described in H.6.1.1. The series of octets which constitutes the sequence of super-tags, tags and corresponding parameters is orderly inserted in the FIF of the HDLC frames: filling firstly the FIF of the first frame (frame "0"), then filling the FIF of the second frame (frame "1"), etc.

H.6.1.4.7 Encapsulated Frame Supergroup

A Supergroup is created which gathers all the Groups which contain the FIF of the following usual T.30 frames: DCS, TSI, SUB, SID, DTC, CIG, SEP, PWD, PSA.

This Supergroup is called "Encapsulated Frame Supergroup".

The super-tag which identifies this Supergroup is: "0000 0001".

H.6.1.4.8 The two Supergroups for security

Two Supergroups are created for security:

–   one for the registration mode;

–   another for the secure transmission mode.

H.6.1.4.9 List of the super-tags

See Table H.3.

Table H.3/T.30 – List of the super-tags

Code of the super-tag	Name of the super-tag	Description
0000 0001	Encapsulated Frame (Abbreviation "E-F")	This super-tag is that of the Encapsulated Frame Supergroup which gathers all the Groups which contain the FIF of usual T.30 frames.
0000 0010	Registration mode	This super-tag is that of the Supergroup which gathers all the Groups transmitted in the registration mode.
0000 0011	Secure transmission mode	This super-tag is that of the Supergroup which gathers all the Groups transmitted in the secure facsimile communication.

H.6.1.4.10 List of the tags within the Encapsulated Frame Supergroup

See Table H.4.

Table H.4/T.30 – List of the tags within the Encapsulated Frame Supergroup

Code of the tag	Name of the tag	Description
1000 0011	FIF of DCS	This tag delimits the zone where the bits corresponding to the FIF of the DCS are placed (bits of Table 2).
0100 0011	FIF of TSI	This tag delimits the zone where the bits corresponding to the FIF of the TSI are placed (when used).
1100 0011	FIF of SUB	This tag delimits the zone where the bits corresponding to the FIF of the SUB are placed (when used).

Table H.4/T.30 – List of the tags within the Encapsulated Frame Supergroup

Code of the tag	Name of the tag	Description
1010 0011	FIF of SID	This tag delimits the zone where the bits corresponding to the FIF of the SID are placed (when used).
1000 0001	FIF of DTC	This tag delimits the zone where the bits corresponding to the FIF of the DTC are placed (when used).
0100 0001	FIF of CIG	This tag delimits the zone where the bits corresponding to the FIF of the CIG are placed (when used).
1100 0001	FIF of PWD	This tag delimits the zone where the bits corresponding to the FIF of the PWD are placed (when used).
1010 0001	FIF of SEP	This tag delimits the zone where the bits corresponding to the FIF of the SEP are placed (when used).
0110 0001	FIF of PSA	This tag delimits the zone where the bits corresponding to the FIF of the PSA are placed (when used).

H.6.1.4.11 List of tags for security features

The following tags can be introduced by:

• the security super-tags "Registration mode"; or

• "Secure transmission mode".

Some of the parameters are only used at the message level ("security page", see further); they are marked by a star character "*" in Table H.5.

Table H.5/T.30 – List of tags for security features

Code of tag		Name of the tag	Description
0001 0001		S	Sender's identity
0001 0010		Sp	Sender's public key
0001 0011		Ss	Sender's secret key
0001 0100		SpE	Encipherment Sender's public key
0001 0101		SsE	Encipherment Sender's secret key
0001 0110		R	Recipient's identity
0001 0111		Rp	Recipient's public key
0001 1000		Rs	Recipient's secret key
0001 1001		RpE	Encipherment Recipient's public key
0001 1010		RsE	Encipherment Recipient's secret key
0001 1011		Sra Srd Rra	Random number created respectively – created by the sender authentication of the recipient – created by the sender for the digital signature – created by the recipient for the authentication of the sender
0001 1100		BE = RpE[S, Ks]	Sender identity and Session key encrypted by RpE
0001 1101		UTCd	Date/time chosen by the sender (date/time of the generation/signature of the document)

Table H.5/T.30 – List of tags for security features

Code of tag		Name of the tag	Description
`0001 1110`		UTCr	Date/time chosen by the recipient (date/time of the confirmation of message receipt)
`0001 1111`		Lm	Length of the document
`0010 0000`		Token 2 = Ss[h(Sra, Rra, R), Sia]	Token used for authentication of the sender when the [Message confidentiality + Session Key establishment] service has not been invoked
`0010 0001`		Token 2-enc. = Ss[h(Sra, Rra, R, BE), Sia]	Token used for authentication of the sender when the [Message confidentiality + Session Key establishment] service has been invoked
`0010 0010`		Token 3 = Rs[h(Rra, Sra, S), Ria]	Token used for authentication of the recipient
`0010 0011`		Token 4 = Ss[h(Srd, UTCd, Lm, R, h(document)), Sis]	Token used for providing the message integrity when the [Message confidentiality + Session Key establishment] has not been invoked
`0010 0100`		Token 4-enc. = Ss[h(Srd, UTCd, Lm, R, BE, h(enc.document)), Sis]	Token used for providing the message integrity when the [Message confidentiality + Session Key establishment] has been invoked
`0010 0101`		Token 5 = Rs[h(Srd, UTCr, Lm, S, h(document)), Ris]	Token used for confirmation of message receipt when the [Message confidentiality + Session Key establishment] service has not been invoked
`0010 0110`		Token 5-enc. = Rs[h(Srd, UTCr, Lm, S, BE, h(enc.document)), Ris]	Token used for confirmation of message receipt when the [Message confidentiality + Session Key establishment] service has been invoked
`0010 0111`		Security services	Security services
`0010 1000`		Security mechanisms	Key management mechanisms, hash functions, encipherment algorithms
`0010 1001`		Optional lengths capability	Optional lengths capability
`0010 1010`		Request of security capabilities	By use of this tag (and the relevant parameter), the terminal requests the remote terminal for the indication of its security capabilities
`0010 1011`		Acknowledgement	Acknowledgement used in registration mode
`0010 1100`	*	Security-page-indicator	Indicates the page where the security page is
`0010 1101`	*	Security-Page-Type-Identification	Indicates the version number of the security page. In future versions of this annex, other types of security pages may be allowed, there will be given other version numbers
`0010 1110`	*	Certification path	Certification path
`0010 1111`		Unstandardized features	Unstandardized features
NOTE – The optional tag "Unstandardized features" may be used on the basis of recognition of identification codes in the NSF. The information contained in the initial octets of the "Unstandardized features" parameter value shall be consistent with the identification rules defined in 5.3.6.2.7 (Non-standard capabilities NSF, NSC, NSS).			

H.6.1.4.12 Order of super-tags and tags

In the sequence of super-tags, tags and parameters values, the order is the following:

– encapsulated Frame Supergroup is transmitted before the security Supergroups;

– within each Supergroup, the order of tags is unfixed, except that:

• within the Encapsulated Frame Supergroup, the Tag "**FIF of DCS**" **must be the first transmitted** (if present); that is for easiness in case of re-emission after TCF rejected [the data field of the first DEC frame which contains (and only contains) "FIF of DCS" **is shorter than 64 octets**];

– within each sequence of tags (and parameters values) introduced by security super-tags, the order of tags is unfixed.

H.6.1.4.13 Coding of the "Security services" parameter

Table H.6 gives the coding of the parameter value which follows the tag "Security services" and the relevant length octet.

The length octet is "0000 0001" (the parameter is only one octet long). In future versions of this annex, the parameter may be longer.

Table H.6/T.30 – "Security services" parameter

Security services	Status	Coding of the field
Mutual authentication	Mandatory	Bit No. 7 6 5 4 3 2 1 0 x x x x x x x x No necessity of bit assignment because mandatory
Security service which includes: • Mutual authentication • Message integrity • Confirmation of message receipt	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x x x 1
Security service which includes: • Mutual authentication • Message confidentiality (encryption) • Session Key establishment	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x x 1 x
Security service which includes: • Mutual authentication • Message integrity • Confirmation of message receipt • Message confidentiality (encryption) • Session Key establishment	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x x 1 1
NOTE 1 – Registration service does not need bit allocation because it is mandatory. NOTE 2 – If no optional service, the bit allocation is "0000 0000". NOTE 3 – If the security service "Mutual authentication" is only selected by the sender (for Secure facsimile transmission mode), the "Security services" parameter is not sent (because "Mutual authentication" is the basic service).		

The four sets of services as described in Table H.6 can be depicted in Table H.7 where 4 profiles of services can be identified:

Table H.7/T.30 – Security profiles in Annex H

Security services	Service profiles			
	1	**2**	**3**	**4**
Mutual authentication	X	X	X	X
• Message integrity • Confirmation of message receipt		X		X
• Message confidentiality (encryption) • Session Key establishment			X	X

H.6.1.4.14 Coding of the "Security mechanisms" parameter

Table H.8 gives the coding of the parameter value which follows the tag "Security mechanisms" and the relevant length octet.

Table H.8/T.30 – "Security mechanisms" parameter

Mechanisms	Status	Coding of the field

Version of the security system	Mandatory	```Bit No. 7 6 5 4 3 2 1 0```
		``` x x x x x x 0 0```
		(Note)

SHA-1 (hash function)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x 1 x x```
MD-5 (hash function)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x 1 x x x```
Security page	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x 1 x x x x```
SAFER K-64 (encipherment algorithm)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x 1 x x x x x```
FEAL-32 (encipherment algorithm)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x 1 x x x x x x```
RC5 (encipherment algorithm)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` 1 x x x x x x x```
Second octet	Optional	
IDEA (encipherment algorithm)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x x x 1```
HFX40	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x x 1 x```
DSA (key management)	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x 1 x x```
Bits 3 to 7 reserved for future use (set to "0")		```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x x x x```
...	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x x x x```
Last octet	Optional	```Bit No. 7 6 5 4 3 2 1 0``` ``` x x x x x x x x```

Table H.8/T.30 – "Security mechanisms" parameter

NOTE – As new versions of Annex H security system are introduced, backward compatibility should be maintained.

The second octet is optional.

The octets from the third one to the last one are also optional octets. They may be absent.

Each of these octets codes an optional encipherment algorithm available in the receiving terminal. The octet is the number of one encipherment algorithm registered in the entry index of Attachment 2 of ISO/IEC 9979 (Procedure for registering cryptographic algorithms); this number is binary coded (e.g., "0000 0000" for the entry No. 00).

When the emitting terminal selects the mechanisms, the "Security mechanisms" parameter is usually only one or two octets long. The third octet is only necessary in case of selection of an encipherment algorithm registered in ISO/IEC 9979 and which is not SAFER K-64, nor FEAL-32, nor RC5, nor IDEA, nor HFX40 (the third octet indicates the algorithm selected).

The length octet depends on the number of optional encipherment algorithms which are indicated (see Table H.8).

For the negotiation:

– if requested by the emitting terminal, the receiving terminal indicates the security mechanisms it supports in sending the "Security mechanisms" parameter;

– the emitting terminal selects the security mechanisms for the session: one hash function, one (or none) encipherment algorithm.

In the "security page" (see further), the "Security mechanisms" parameter indicates also the security mechanisms which have been selected for the session.

H.6.1.4.15 Coding of the "Optional lengths capability" parameter

H.6.1.4.15.1 Principle

For indication of the optional lengths capabilities, the "Optional lengths capability" tag, length octet and corresponding parameter value are sent.

H.6.1.4.15.2 Coding of the parameter "Optional lengths capability"

For coding the parameter, the following principles are defined:

– Offsets permit to indicate the maximal lengths which can be processed by the terminal.

These offsets are binary coded on 4 bits or 8 bits depending on the parameter which is concerned.

– These offsets are used on a specific order:

7	6	5	4	3	2	1	0	Octets
offset a				offset b				0
offset c				reserved				1

First, the octet No. 0 which contains:

– firstly the offset "a" (4 bits) for indication of the maximum length of Public and Secret keys accepted;

– then the offset "b" (4 bits) for indication of the length of the Random numbers accepted (Sra, Srd, Rra).

Then, the octet No. 1 (optional) which contains:

– the offset "c" (4 bits) for indication of the maximum length of Encipherment Public and Encipherment Secret keys accepted.

Therefore, the length octet of the "Optional lengths capability" parameter is either "0000 0001" (one octet long if the [Message confidentiality + Session Key establishment] service is not offered) or "0000 0010" (two octets if the [Message confidentiality + Session Key establishment] service is offered). In future versions of this annex, the parameter may be longer.

H.6.1.4.15.3   Rules for using the offsets

Maximum length (in octets) of the Public and Secret keys =

$$64 \text{ (basic length)} + ([\text{offset a}] \times 16) \text{ octets}$$

$$\text{with } 0 \le \text{offset a} \le 4 \qquad \text{octets}$$

The terminal must be capable to handle all the lengths between the basic length and the maximum length, by 16-octet increments.

Maximum length (in octets) of Random numbers =

$$8 \text{ (basic length)} + [\text{offset b}] \qquad \text{octets}$$

$$\text{with } 0 \le \text{offset b} \le 8 \qquad \text{octets}$$

The terminal must be capable to handle all the lengths between the basic length and the maximum length.

Maximum length (in octets) of the Encipherment Public and Encipherment Secret keys =

$$64 \text{ (basic length)} + ([\text{offset c}] \times 16) \text{ octets}$$

$$\text{with } 0 \le \text{offset c} \le 4 \qquad \text{octets}$$

The terminal must be capable to handle all the lengths between the basic length and the maximum length, by 16-octet increments.

H.6.1.4.15.4   Examples

Example 1

7	6	5	4	3	2	1	0	Octets
0	0	0	1	0	0	0	0	0
0	0	0	1	0	0	0	0	1

In this example:

– Maximum length of Public and Secret key $= 64 + 16 \times 1$ $= 80$ octets

– Maximum length of Random numbers $= 8 + 0$ $= 8$ octets (no optional lengths supported)

– Maximum length of Encipherment Public and Encipherment Secret key $= 64 + 16 \times 1$ $= 80$ octets

Example 2

7	6	5	4	3	2	1	0	Octet
0	0	0	0	0	0	0	0	0

In this example, the terminal indicates the only basic capabilities.

H.6.1.4.16 Coding of the "Request of security capabilities" parameter

By use of this tag (and the relevant parameter), the terminal requests the remote terminal for the indication of its security capabilities. See Table H.9.

The length octet is "0000 0001" (the parameter is only one octet long). In future versions of this annex, the parameter may be longer.

Table H.9/T.30 – "Request of security capabilities" parameter

Capabilities indication requested	Status	Coding of the field
Request of the "Security services"	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x x x 1
Request of the "Security mechanisms"	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x x 1 x
Request of "Optional lengths capability"	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x x 1 x x
Request of "Unstandardized features"	Optional	Bit No. 7 6 5 4 3 2 1 0 x x x x 1 x x x
NOTE – If the "Request of security capabilities" parameter is used, at least one bit must be set to "1" (otherwise, there is no purpose of using this parameter for the session).		

H.6.2 Registration mode

H.6.2.1 Scheme

The scheme is described in Figure H.3. It comprises of two steps:

– *Step one*

[The identity of the sender and its public key are hashed by the sending terminal.

The identity of the recipient and its public key are hashed by the receiving terminal].

OR/AND

[(The identity of the sender and its encipherment public key are hashed by the sending terminal).

OR/AND

(The identity of the recipient and its encipherment public key is hashed by the receiving terminal)].

These hash results are exchanged out-of-band (direct hand-to-hand, by mail, by phone, etc.) and stored in the terminals.

– *Step two*

Exchange, by T.30 protocol means, of the identities and the public keys between the two parties. Storage in the terminals.

The order of the two steps is not fixed.

The validity of the identity and the public key(s) of the other party is assessed in comparing the hash result exchanged out-of-band with the hash result of the identity and public key(s) received through the protocol.

Once validated, these values [identity and public key(s) of the remote party] are stored in the terminals and are used for the further secure facsimile communications with this party.

The registration of either the public keys or the encipherment public keys or both is fixed by agreement between the users of the two terminals. For the encipherment public keys, the registration may concern only one user or both.

Settings of the terminals for the relevant registrations is a local matter.

Exchange of the hash results out-of-band and storage in the terminals.

```
      SENDER  (S)                                                           RECEIVER  (R)
S           Sp       Ss                                          R              Rp       Rs
 ┌──────────────┐                                                 ┌──────────────┐
 │    Hash      │                                                 │    Hash      │
 └──────────────┘                                                 └──────────────┘
       ↓                          h(S, Sp) and h(R, Rp)                  ↓
                       are exchanged out-of-band and stored in the memory of the
                                          terminals
   <--------------------- | ----------------------------------------------------------- | ------->
```
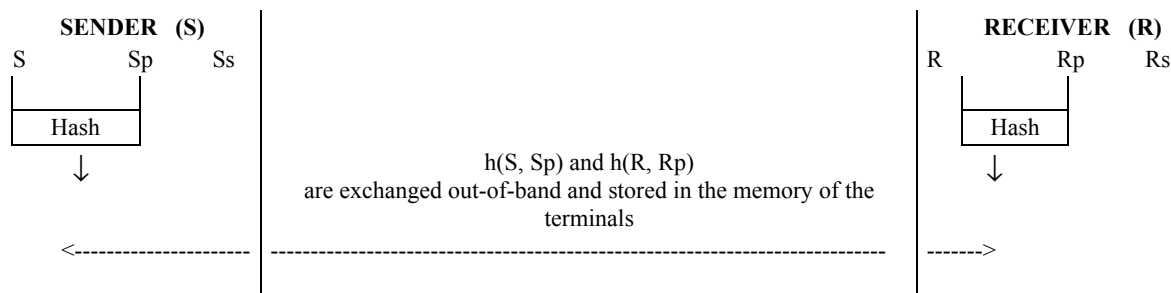
Instead of or in addition to [S, Sp, h(S, Sp)] and [R, Rp, h(R, Rp)], the above operation may concern [S, SpE, h(S, SpE)] and/or [R, RpE, h(R, RpE)]:

```
      SENDER  (S)                         and/or                            RECEIVER  (R)
S           SpE      SsE                                         R              RpE      RsE
 ┌──────────────┐                                                 ┌──────────────┐
 │    Hash      │                                                 │    Hash      │
 └──────────────┘                                                 └──────────────┘
       ↓                          h(S, SpE) and/or h(R, RpE)            ↓
                       are exchanged out-of-band and stored in the memory
                                       of the terminals
   <--------------------- | ----------------------------------------------------------- | ------->
```
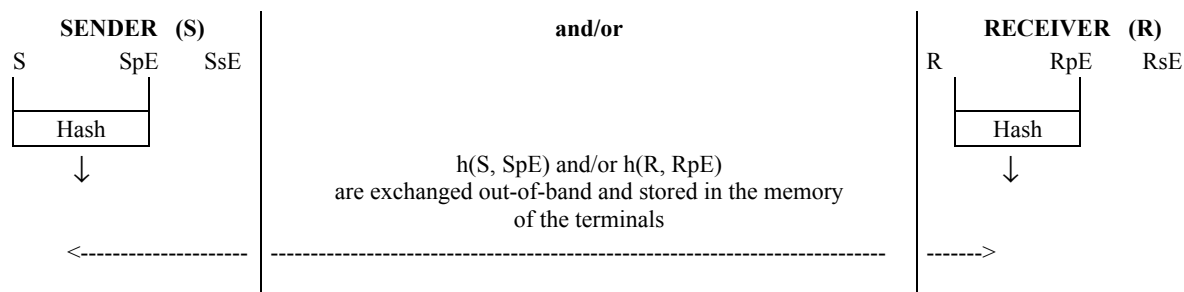
T.30 call establishment, exchange of identities and public keys through T.30 protocol.

```
      SENDER  (S)                                                           RECEIVER  (R)
                                        T.30 protocol
   (S        Sp) -------- | ----------------------------------------------------------- | -------->
                                                                        stored in the memory of the
                                                                        terminal
   <----------------------- | --------------------------------------------------------- | ------- (R          Rp)
stored in the memory of
the terminal
```
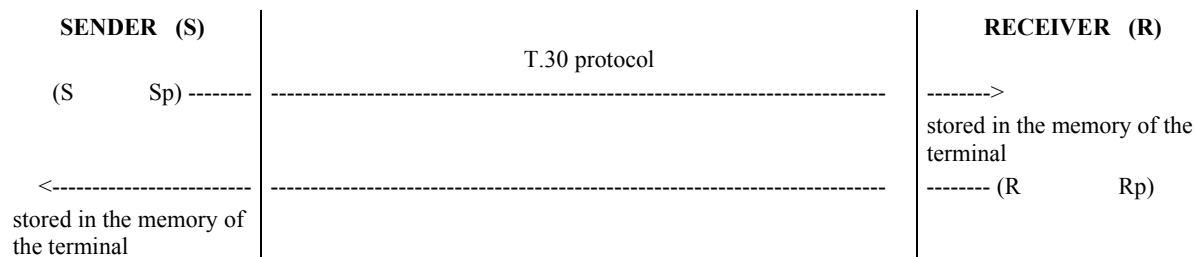
Instead of or in addition to [S, Sp] and [R, Rp], the above operation may concern [S, SpE] and/or [R, RpE]:

```
      SENDER  (S)                         and/or                            RECEIVER  (R)
                                        T.30 protocol
   (S        SpE) -------- | ---------------------------------------------------------- | -------->
                                                                        stored in the memory of the
                                                                        terminal
   <----------------------- | -------------------------------------------------------- | ------- (R          RpE)
stored in the memory of
the terminal
```
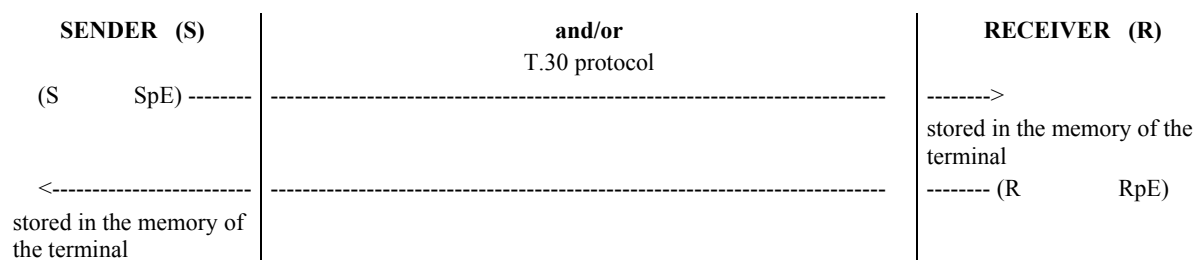
Figure H.3/T.30 – Scheme of registration mode

H.6.2.2   Use of DER, DES and DEC for registration mode

In the second step of the registration mode, the signals DER, DES, DEC are used as in Figure H.4.

```
            Calling side                              Called side
                     ------------------CNG------------------------>    │ (Note)
                     <------------------CED------------------------    │

                     <-----------(NSF)-(CSI)-DIS-----------------
                     -----------DER-----(phase 0)------------------>   │ Optional

                     <-----------DER-----(phase 1)-----------------    │
                     -----DER contains [S and Sp] (phase 2)---->
                     <---DES contains [R and Rp] (phase 3)------
                     -----DEC (acknowledgement) (phase 4)---->
                     <---DES (acknowledgement) (phase 5)------
                     -------------------DCN------------------------>
```

NOTE – The call establishment CNG/CED which is depicted in the figure is given for example.

The other operating methods defined in 3.1 may take place as well.

Instead of or in addition to respectively Sp and Rp, the above operation may concern SpE and/or RpE.

The timers used for the signals exchange above are the same ones as those for the standard T.30 protocol (T1, T2, T4, ...). Upon no response after timer T4, the command from the emitting side (DER, DEC or DNK) is resent (for DER and DEC, only the frames not yet acknowledged).

Figure H.4/T.30 – Signals exchange for registration mode

H.6.2.3   Bits allocation in the DIS

The bits allocation in the FIF of the DIS to indicate the security capabilities based on the RSA algorithm is given in Table 2. Bit No. 82 is used.

H.6.2.4   Format of the Facsimile Information Fields of DER, DES and DEC for registration mode

Convention

In the figures of this annex, when the tag (and the relevant length octet and parameter value) is represented in grey boxes, its use is optional.

When represented in white boxes, its use is mandatory.

H.6.2.4.1 Phase 0 OPTIONAL

If the calling side does not wish to use optional capabilities, phase 0 is optional; registration mode is carried on with the basic features (Sp, Rp are 64 octets long, no exchange of Encipherment public keys).

The sequence contained in the FIF(s) of the DER is:

Super-tag "E-F"	Length of Supergroup	Tag "FIF of SUB"	Length + Content of "FIF of SUB"	Tag "FIF of SID"	Length + Content of "FIF of SID"	Tag "FIF of TSI"	Length + Content of "FIF of TSI"

Super-tag "Registration mode"	Length of Supergroup	Tag "Request of security capabilities"	Length + Content of "Request of security capabilities"

Tag "Unstandardized features"	Length + Content of" Unstandardized features"

Conventions

For simplicity, the representations of sequences [super-tags, tags, length octets and parameters values] do not describe the internal HDLC structure of the signal (preamble, flags, address, control, ..., FCS, flags).

A sequence may be represented by boxes on several rows. This is only for commodity; the sequence is continuous.

These remarks apply for the rest of this annex where such representations are given.

H.6.2.4.2 Phase 1 OPTIONAL

Phase 1 takes place only if phase 0 exists.

The sequence contained in the FIF(s) of the DES is:

Super-tag "Registration mode"	Length of Supergroup	Tag "Security services"	Length + Content of "Security services"

Tag "Security mechanisms"	Length + Content of "Security mechanisms"	Tag "Optional lengths capability"	Length + Content of "Optional lengths capability"	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

The optional [tag, length octet and parameter value] groups are present depending on the requests in phase 0 (bits in the "Request of security capabilities" parameter).

H.6.2.4.3 Phase 2

The sequence contained in the FIF(s) of the DER is:

Super-tag "E-F"	Length of Supergroup	Tag "FIF of SUB"	Length + Content of "FIF of SUB"	Tag "FIF of SID"	Length + Content of "FIF of SID"	Tag "FIF of TSI"	Length + Content of "FIF of TSI"

Super-tag "Registration mode"	Length of Supergroup	Tag "S"	Length + Content of "S"	Tag "Sp"	Length + Content of "Sp"

Tag "SpE"	Length octet + Content of "SpE"	Tag "Security mechanisms"	Length octet + Content of "Security mechanisms"	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

Above is an example of registration of Sp and SpE at the same time.

It is also possible that only Sp or SpE is registered. S is present in all cases.

Settings of the terminals for the relevant registrations is a local matter.

The "Security mechanisms" parameter is mandatory because it indicates the selected hash function and/or the selected encipherment algorithm (in case of SpE and/or RpE exchanged).

H.6.2.4.4 Phase 3

The sequence contained in the FIF(s) of the DES is:

Super-tag "Registration mode"	Length of Supergroup	Tag "R"	Length + Content of "R"	Tag "Rp"	Length + Content of "Rp"

Tag "RpE"	Length + Content of "RpE"

Above is an example of registration of Rp and RpE at the same time.

It is also possible that only Rp or RpE is registered. R is present in all cases.

Settings of the terminals for the relevant registrations is local matter.

If the called terminal can find that the S and Sp parameters (and/or [S, SpE]) do not conform with the hash value stored (in case of exchange of hash values out-of-band already made, see H.6.2.1), it can reject them by the signal FNV.

The reason of the error in FNV is "Registration error for public key" or "Registration error for encipherment public key"; see Table H.10.

The use of FNV for such an error indication is explained in H.6.7.

H.6.2.4.5 Phase 4

The sequence contained in the FIF of the DEC is:

Super-tag "Registration mode"	Length of Supergroup	Tag "Acknowledgement"	Length octet "0000 0000"

If the calling terminal can find that the R and Rp parameters (and/or [R, RpE]) do not conform with the hash value stored (in case of exchange of hash values out-of-band already made, see H.6.2.1), it can reject them by the signal FNV.

The reason of the error in FNV is "Registration error for public key" or "Registration error for encipherment public key", see Table H.10.

The use of FNV for such an error indication is explained in H.6.7.

H.6.2.4.6 Phase 5

The sequence contained in the FIF of the DES is:

Super-tag "Registration mode"	Length of Supergroup	Tag "Acknowledgement"	Length octet "0000 0000"

H.6.3 Secure facsimile transmission mode

This mode consists in the transmission of the facsimile document with security features.

Security parameters are transmitted within protocol elements (phases B and D of the T.30 protocol).

As an option, some security parameters are transmitted at the message level (at the message speed, phase C of T.30 protocol): within a special page called "**the security page**".

H.6.3.1   Scheme

See Figure H.5.

```
SENDER  (S)              T.30 call establishment                              RECEIVER  (R)
                         ---------------------------------------phase 0------------------------------------ ------->
                                                                 Request of security capabilities
                                                                 Optional lengths capability
                                                                                of the sender
<-------------------     ----------------------------------------phase 1------------------------------------
                                                                       Receiver capabilities:
                                                                          Security services
                                                                       Security mechanisms
                                                                Optional lengths capability
                                                                                         Rra
(S, Sra, R, BE           ---------------------------------------phase 2-------------------------------------  ------->
Ss[h(Sra, Rra, R,        + choice of security features:
BE),                     Security services
Sia])                    Security mechanisms

(Note 1)
<-------------------     -----------------------------------------phase 3----------------------------------   (R, Rra,
                                                                                                              Rs[h(Rra, Sra, S), Ria])
                         --------------------------------Facsimile document-----------------------------      ------->
                         -----------------------------------optional phase 4-------------------------------   ------->
                                                                                                              (Note 2)
                         Signal containing the digital signature:
                         Srd, UTCd, Lm,                                                                       (Note 3)
(Note 1)                 Ss[h(Srd, UTCd, Lm, R, BE, h(enc.document)), Sis]
<-------------------     ------------------------------------optional phase 5--------------------------------  (Note 2)
                         Confirmation of message receipt
                         containing:
                         UTCr, Rs[h(Srd, UTCr, Lm, S, BE, h(enc.document)), Ris]                              (Note 1)
```
Italicized characters indicate optional features.

NOTE 1 – BE (= RpE[S, Ks]) exists in the various tokens only if the service [Message confidentiality + Session Key establishment] has been negotiated between the two parties (with the "Security services" parameter).

NOTE 2 – Phases 4 and 5 exist only if the service [Message integrity + Confirmation of message receipt] has been negotiated between the two parties (with the "Security services" parameter).

NOTE 3 – Additional parameters are present if the security page is used at phase 4.

Figure H.5/T.30 – Scheme of secure facsimile transmission mode

H.6.3.2 Use of DER, DES and DEC for secure facsimile transmission mode

H.6.3.2.1 General scheme for secure facsimile transmission mode

For the secure facsimile transmission mode, the signals DER, DES and DEC are used as in Figure H.6.
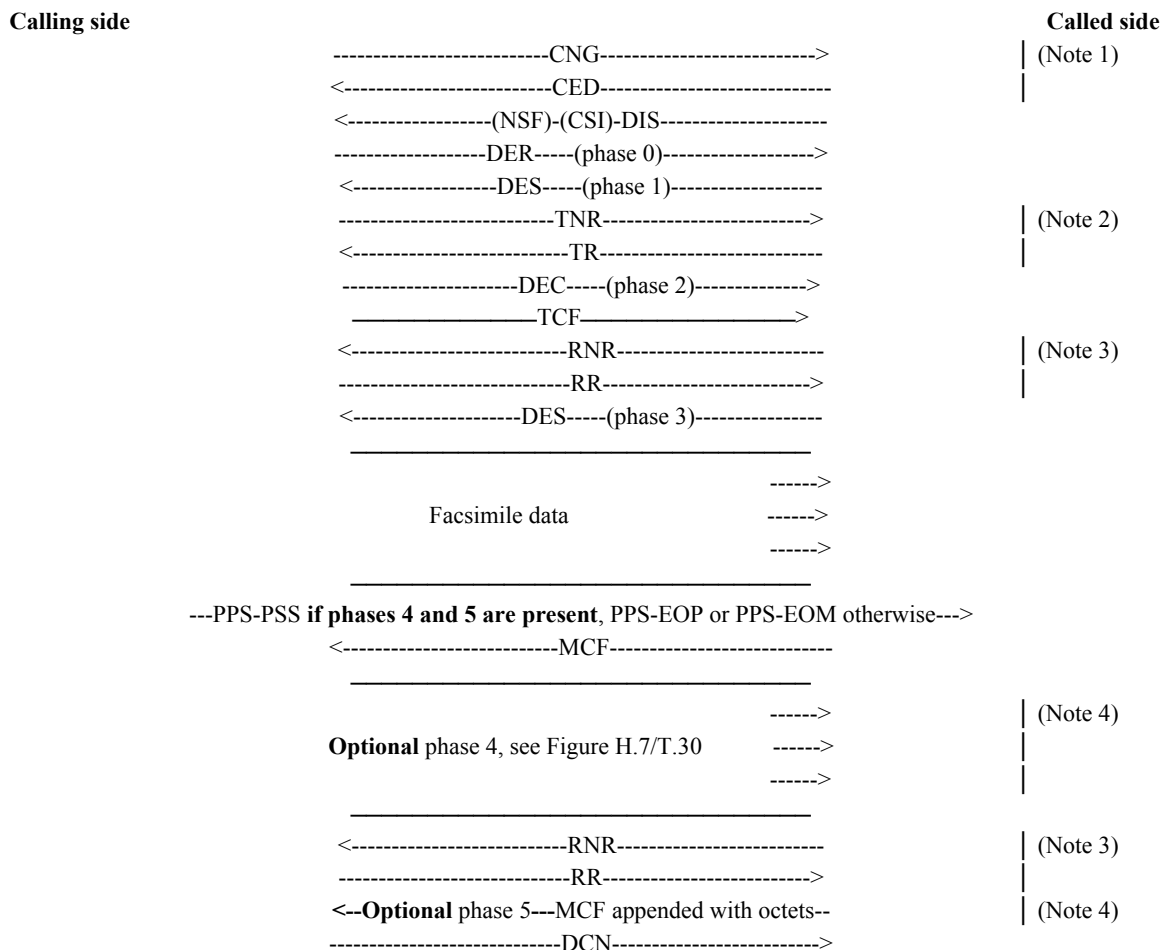
```
Calling side                                                                      Called side
                -------------------------CNG------------------------->       │ (Note 1)
                <-------------------------CED-------------------------        │
                <----------------(NSF)-(CSI)-DIS--------------------
                -------------------DER-----(phase 0)------------------>
                <------------------DES-----(phase 1)------------------
                -------------------------TNR------------------------->       │ (Note 2)
                <-------------------------TR-------------------------         │
                ---------------------DEC-----(phase 2)-------------->
                ───────────────TCF────────────────>
                <-------------------------RNR------------------------        │ (Note 3)
                -------------------------RR------------------------->        │
                <--------------------DES-----(phase 3)---------------
                ─────────────────────────────────────────
                                                    ------>
                          Facsimile data            ------>
                                                    ------>
                ─────────────────────────────────────────
      ---PPS-PSS if phases 4 and 5 are present, PPS-EOP or PPS-EOM otherwise--->
                <-------------------------MCF------------------------
                ─────────────────────────────────────────
                                                    ------>           │ (Note 4)
                Optional phase 4, see Figure H.7/T.30    ------>      │
                                                    ------>           │
                ─────────────────────────────────────────
                <-------------------------RNR------------------------        │ (Note 3)
                -----------------------------RR------------------------->    │
                <--Optional phase 5---MCF appended with octets--            │ (Note 4)
                ----------------------------DCN------------------------->
```

The timers used for the signals exchange above are the same ones as those for the standard T.30 protocol and Annex A (T1, T2, T4, T5, ...). Upon no response after timer T4, the command from the emitting side (DER, DEC or DNK) is resent (for DER and DEC, only the frames not yet acknowledged).

NOTE 1 – The call establishment CNG/CED which is depicted in the figure is given for example. The other operating methods defined in 3.1 may take place as well.

NOTE 2 – The use of TNR and TR is exactly the same one as the use of RNR/RR but concerns the emitting terminal instead of the receiving terminal. Some optional occurrences of the TNR-TR exchange can permit to the emitting terminal to hold off the receiving terminal during a maximum time of T5 (see Annex A).

NOTE 3 – Some optional occurrences of the RNR-RR exchange (already defined in Annex A) can permit to the receiving terminal to hold off the emitting terminal during a maximum time of T5 (see Annex A).

NOTE 4 – Phases 4 and 5 exist only if the service [Message integrity + Confirmation of message receipt] has been negotiated between the two parties (with the "Security services" parameter).

**Figure H.6/T.30 – Signals exchange for secure facsimile transmission mode
Example for a one facsimile page document**

H.6.3.2.2 Phase 4

When phase 4 (and then phase 5) is present, two cases exist depending on whether the security page capability has been negotiated between the two parties or not:

Case 1 – When both machines (emitting and receiving) provide the security page capability and the [Message integrity + Confirmation of message receipt] service is invoked, the security page solution (case 1) must be used.

Case 2 – When one of the two machines does not provide the security page capability and the [Message integrity + Confirmation of message receipt] service is invoked, the solution of PPS-EOP or PPS-EOM appended (case 2) must be used.

PPS-EOM (not appended in case 1, appended in case 2) is used if the communication is to be continued by another document.

PPS-EOP (not appended in case 1, appended in case 2) is used in the common case, with only one facsimile document during the communication.

Case 1:	**the [Message integrity + Confirmation of message receipt] service has been invoked and the security page is used**	

```
                   ───────────────────────────────────────
                          Security page              ------>
                                                     ------>
                   ───────────────────────────────────────
                ----------------PPS-EOP or PPS-EOM-------------------->
```

Case 2:	**the [Message integrity + Confirmation of message receipt] service has been invoked and the security page is not used**	

```
                -----PPS-EOP or PPS-EOM appended with octets----->
```

Figure H.7/T.30 – Signals exchange in phase 4

H.6.3.3   Bits allocation in the DIS

The bits allocation in the FIF of the DIS to indicate the security capabilities based on the RSA algorithm is given in Table 2. Bit No. 82 is used.

The DCS is not emitted in the context of Annex H; FIF of DCS is included within the new signal "DEC" where the corresponding bit No. 82 must be set to "1".

H.6.3.4   Format of Facsimile Information Field of DER, DES and DEC for secure facsimile transmission mode

H.6.3.4.1 Phase 0

The sequence contained in the FIF(s) of the DER is:

Super-tag "E-F"	Length of Supergroup	Tag "FIF of SUB"	Length + Content of "FIF of SUB"	Tag "FIF of SID"	Length + Content of "FIF of SID"	Tag "FIF of TSI"	Length + Content of "FIF of TSI"

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "Optional lengths capability"	Length + Content of "Optional lengths capability"	Tag "Request of security capabilities"	Length + Content of "Request of security capabilities"

Tag "Unstandardized features"	Length + Content of "Unstandardized features"

If the calling side does not wish to use optional services and optional capabilities, the "Request of security capabilities" parameter is not sent. Secure facsimile transmission mode is carried on with the basic features (Sp, Rp 64 octets long, etc.) with the Mutual authentication service only invoked.

Also, if the calling side cannot handle random numbers of optional lengths (longer than the basic one), it does not have to send the "Optional lengths capability" parameter.

H.6.3.4.2 Phase 1

The sequence contained in the FIF(s) of the DES is:

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "Rra"	Length + Content of "Rra"	Tag "Security services"	Length + Content of "Security services"

Tag "Security mechanisms"	Length + Content of "Security mechanisms"	Tag "Optional lengths capability"	Length + Content of "Optional lengths capability"	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

The optional [tag, length and parameter value] groups are present depending on the requests in phase 0 (bits in the "Request of security capabilities" parameter).

H.6.3.4.3 Phase 2

The sequence contained in the FIF(s) of the DEC is:

Super-tag "E-F"	Length of Supergroup	Tag "FIF of DCS"	Length + Content of "FIF of DCS"	Tag "FIF of SUB"	Length + Content of "FIF of SUB"	Tag "FIF of SID"	Length + Content of "FIF of SID"	Tag "FIF of TSI"	Length + Content of "FIF of TSI"

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "S"	Length + Content of "S"	Tag "Sra"	Length + Content of "Sra"	Tag "R"	Length + Content of "R"

Tag "BE"	Length + Content of "BE"	Tag "Token 2" or "Token 2-enc."	Length + Content of "Token 2" or "Token 2-enc."

Tag "Security services"	Length + Content of "Security services"	Tag "Security mechanisms"	Length + Content of "Security mechanisms"	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

– Tag BE is present only if the service [Message confidentiality + Session Key establishment] is invoked. In such case, this is Token 2-enc. which is sent.

– Tags "Security services" is not present if the transmission is to take place with the Mutual Authentication service only.

– The "Security mechanisms" parameter is mandatory because it indicates the selected hash function.

H.6.3.4.4 Phase 3

The sequence contained in the FIF(s) of the DES is:

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "R"	Length + Content of "R"	Tag "Rra"	Length + Content of "Rra"	Tag "Token 3"	Length + Content of "Token 3"

H.6.3.4.5 Phase 4

Phases 4 and 5 exist only if the service [Message integrity + Confirmation of message receipt] has been negotiated between the two parties.

The signal sent in phase 4 is either the PPS-EOP (or PPS-EOM) signal appended with octets (case 2 depicted in Figure H.7) or the security page (case 1 depicted in Figure H.7).

When both machines (emitting and receiving) provide the security page capability and the [Message integrity + Confirmation of message receipt] service is invoked, the security page solution must be used.

The content of the security page is defined in H.6.4.

In case 2, the structure of the PPS-EOP (or PPS-EOM) appended with octets is the same as that of DER, DES, DEC and DTR (as defined in H.6.1.1): multiframes, bit X = 1 for final frame, FIF of 65 octets, frame numbers, ...

The FCF is that already defined in Annex A (see A.4.3).

The sequence contained in the FIF(s) of the PPS-EOP (or PPS-EOM) appended is:

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "Srd"	Length + Content of "Srd"	Tag "UTCd"	Length + Content of "UTCd"	Tag "Lm"	Length + Content of "Lm"

Tag "Token 4" or "Token 4-enc."	Length + Content of "Token 4" or "Token 4-enc."	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

"Token 4" or "Token 4-enc." is sent depending on whether the service [Message confidentiality + Session Key establishment] has been invoked or not at phase 2.

H.6.3.4.6 Phase 5

Phases 4 and 5 exist only if the service [Message integrity + Confirmation of message receipt] has been negotiated between the two parties.

The signal sent at phase 5 is the MCF signal appended with octets.

The structure of the MCF appended with octets is the same as that of DER, DES, DEC and DTR (as defined in H.6.1.1): multiframes, bit X = 1 for final frame, FIF of 65 octets, frame numbers, etc.

The FCF is as already defined for the normal T.30 protocol (in 5.3.6.1).

The sequence contained in the FIF(s) of the MCF appended is:

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "UTCr"	Length + Content of "UTCr"	Tag "Token 5" or "Token 5-enc."	Length + Content of "Token 5" or "Token 5-enc."

"Token 5" or "Token 5-enc." is sent depending on whether the service [Message confidentiality + Session Key establishment] has been invoked or not at phase 2.

H.6.3.4.7 Error-messages

In case of errors detected in phase 1, 2, 3, 4 or 5, the sender or the recipient (depending on the phase) indicates the error with the signal FNV.

The reason of the error is coded in FNV.

Table H.10 gives the coding of the error value.

The use of FNV for error indication is explained in H.6.7.

H.6.3.5 Precisions for use of PPS-EOM within a secure document

Within the sequence of partial pages which constitute one secure document, the use of PPS-EOM is allowed (e.g., for changing the image resolution). The procedure after PPS-EOM is quite close as in Annex A:

```
-----------------------PPS-EOM---------------------->
<-------------------------MCF---------------------------
                                          T2 elapsed
<-------------------(NSF)-(CSI)-DIS------------------
--------------DEC (with FIF DCS)------------------->
————————TCF————————————>
```
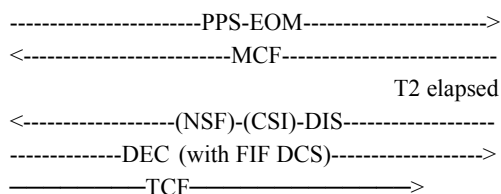
In such a case, for setting the transmission of the remaining pages of the document, the DEC must contain the FIF of DCS [with the relevant bit(s) for security set to "1", as in phase 2]. The security parameters sent in phase 2 are not included in the DEC at this stage; they are valid throughout the transmission of the document.

H.6.4 At the message level: Security page

The use of the security page is defined in case 1 of Figure H.7.

When both machines (emitting and receiving) provide the security page capability and the [Message integrity + Confirmation of message receipt] service is invoked, the security page solution must be used.

H.6.4.1 Content of the security page

The "security page" contains the following security parameters defined in Tables H.1 and H.5:

Security-page-indicator	:	Indicates that the block contains the security page.
S	:	Identity of the sender.
Sp	:	Public Key of the sender.
R	:	Identity of the recipient.
Srd	:	Random number created by the sender for the digital signature.

UTCd	:	Date/time chosen by the sender (date/time of the generation/signature of the document).
Lm	:	Length of the document.
"Security services" parameter	:	See definition in Table H.6.
"Security mechanisms" parameter	:	See definition in Table H.8.
BE	:	RpE[S, Ks].
Token 4 or Token 4-enc.	:	See definition in Table H.5.
Security-Page-Type-Identification	:	Indicates the version number of the security page. In future versions of this annex, other types of security pages may be allowed, they will be given other version numbers.
Certification path	:	Certificate of the public key of the sender. The precise definition of the certification path is for further study.
Unstandardized features	:	Unstandardized features.

The bit order transmission within the security page follows the same rules as defined for FIF of DES/DEC/DER/DTR in H.4.8.2 and specified in Table H.1.

H.6.4.1.1 Coding of the "Security-page-indicator" parameter

This tag (and the relevant parameter) indicates that the block contains the security page.

The length octet is "0000 1000" (8 octets).

The content is (in hexadecimal):

$$0x01 \ 0x23 \ 0x45 \ 0x67 \ 0x89 \ 0xAB \ 0xCD \ 0xEF$$

H.6.4.1.2 Coding of the "Security-Page-Type-Identification" parameter

This parameter is optional in the security page.

The length octet is "0000 0001" (1 octet).

The content is the version number of the security page. In this version of this annex, only one version of the security page exists, the version number is: 0x00.

H.6.4.2   Format of the security page

The security page has exactly the same kind of format as the sequences within the DER, DES, DEC and DTR signals (super-tags, tags and parameters values), except that in this case, the sequence is not placed in the series of FIF of DER, DES, DEC or DTR, but in the ECM frames.

Within the sequence of tags introduced by the super-tag, **the order is unfixed**, except the Security-page-indicator which is the first one.

The sequence is the following:

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "Security-page-indicator"	Length + Content of "Security-page-indicator"	Tag "S"	Length + Content of "S"	Tag "Sp"	Length + Content of "Sp"

Tag "R"	Length + Content of "R"	Tag "Srd"	Length + Content of "Srd"	Tag "UTCd"	Length + Content of "UTCd"	Tag "Lm"	Length + Content of "Lm"

Tag "Security services"	Length + Content of "Security services"	Tag "Security mechanisms"	Length + Content of "Security mechanisms"

Tag "BE"	Length octet + Content of "BE"

Tag "Token 4" or "Token 4-enc."	Length + Content of "Token 4" or "Token 4-enc."	Tag "Security-Page-Type-Identification"	Length + Content of "Security-Page-Type-Identification"

Tag "Certification path"	Length + Content of "Certification path"	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

NOTE 1 – The bits in the Security services and Security mechanisms parameters are set in conformance with respectively Tables H.6 and H.8 [version of the security system, bit indicating the hash function used, bit indicating the encipherment algorithm used (if document enciphered)].

NOTE 2 – Parameter BE is present only if the service [Message confidentiality + Session Key establishment] has been invoked.

NOTE 3 – The format of the certification path is for further study.

H.6.5 Rules for hashing the document – Rules for enciphering the document

H.6.5.1 Rules for hashing the document

The data of the document which are part of the bit string which is hashed are all the octets contained in the FIF of all the ECM data frames except the first octet of each frame (which is the frame number). Therefore, any fill bits and pad bits (as described in A.3.6.2/T.4 and in 2.4.1.2/T.6) are part of the data which pass through the hash function.

The bit stream entering in the hashing process for producing h(document) or h(enc.document) (in case of encipherment) can be represented as the bit string contained in the rectangle depicted in Figure H.8.

For each octet, this bit string has the same bit order in the hashing process as the data bits of each octet when transmitted over the line.

```
┌─────────────────────────────────────────────────────────────────────────────┐
│ First page                                                                    │
│ First block:                          ─────────────────────────────────────   │
│ First frame FIF    : frame number  │  first data octet . . . . last octet of FIF     │ │
│ Second frame FIF   : frame number  │  first data octet . . . . last octet of FIF     │ │
│ . . .                              │                                           │ │
│ Last frame FIF     : frame number  │  first data octet . . . . last octet of FIF     │ │
│ Second block:                      │                                           │ │
│ First frame FIF    : frame number  │  first data octet . . . . last octet of FIF     │ │
│ Second frame FIF   : frame number  │  first data octet . . . . last octet of FIF     │ │
│ . . .                              │                                           │ │
│ Last frame FIF     : frame number  │  first data octet . . . . last octet of  FIF    │ │
│ . . .                              │                                           │ │
│ . . .                              │                                           │ │
│ . . .                              │                                           │ │
│ Last block:                        │                                           │ │
│ First frame FIF    : frame number  │  first data octet . . . . last octet of  FIF    │ │
│ Second frame FIF   : frame number  │  first data octet . . . . last octet of FIF     │ │
│ . . .                              │                                           │ │
│ Last frame FIF     : frame number  │  first data octet . . . . last octet of FIF     │ │
│ Second page                        │                                           │ │
│ . . .                              │                                           │ │
│ . . .                              │                                           │ │
│ . . .                              │                                           │ │
│ Last  page                         │                                           │ │
│ . . .                              │                                           │ │
│ . . .                              │                                           │ │
│ Last  block:                       │                                           │ │
│ First frame FIF    : frame number  │  first data octet . . . . last octet of FIF     │ │
│ Second frame FIF   : frame number  │  first data octet . . . . last octet of FIF     │ │
│ . . .                              │                                           │ │
│ Last frame FIF     : frame number  │  first data octet . . . . last octet of FIF     │ │
│                                       ─────────────────────────────────────   │
└─────────────────────────────────────────────────────────────────────────────┘
```

Figure H.8/T.30 – Rules for hashing the document

H.6.5.2   Rules for enciphering the document

The data of the document which will be encrypted are the octets contained in the FIF of the ECM data frames except the first octet of each frame (which is the frame number).

The input bit order to the encryption function is the same order as the one when the facsimile data are transmitted over the line without encryption.

NOTE – For FEAL-32, these data are aligned every 64 bits in order from the left to the right and are input to FEAL-32 function.

Every 64 bits of the encrypted data from FEAL-32 function are aligned in order from the left to the right, and the left-most bit is transmitted first.

H.6.6   Secure polling mode

H.6.6.1   Simple polling

The use and the coding of the signals in the secure polling mode follows the same rules as for the secure facsimile transmission mode.

The signals exchange is depicted in Figure H.9.

Calling side   **Called side**
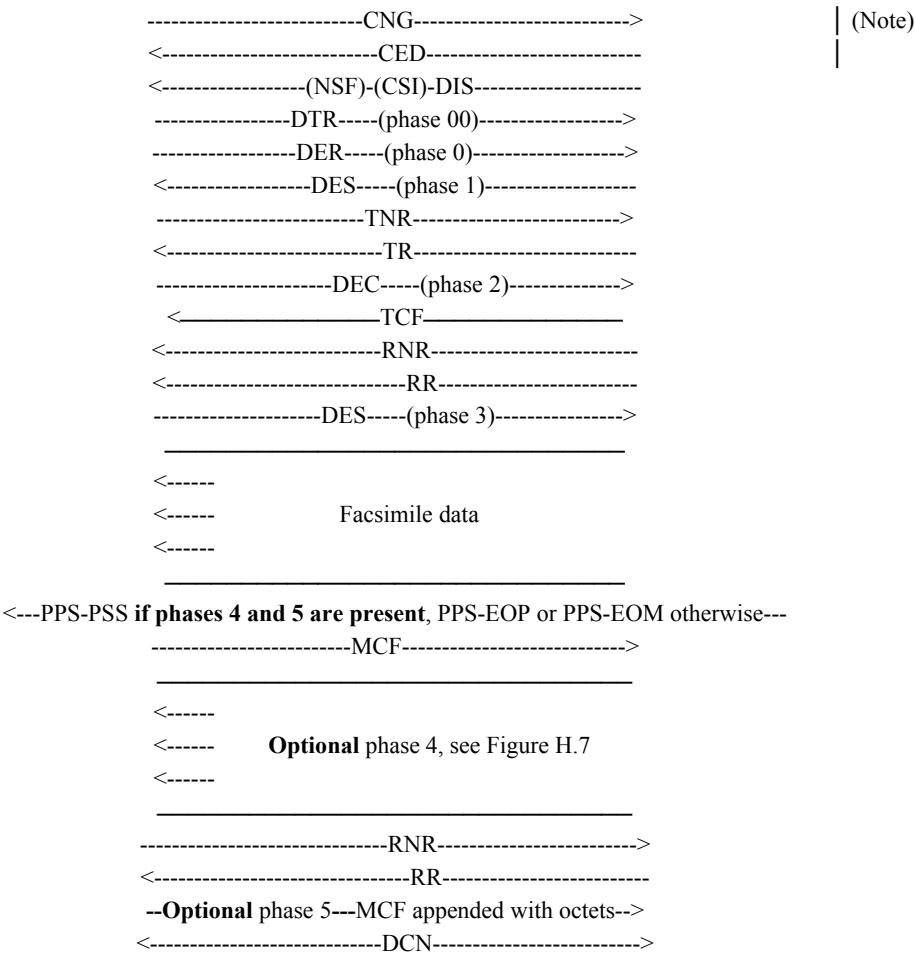
```
                          ------------------------CNG------------------------>         │ (Note)
                          <------------------------CED------------------------          │
                          <------------------(NSF)-(CSI)-DIS--------------------
                          -----------------DTR-----(phase 00)------------------>
                          ------------------DER-----(phase 0)------------------->
                          <------------------DES-----(phase 1)------------------
                          -------------------------TNR------------------------>
                          <-------------------------TR-------------------------
                          ---------------------DEC-----(phase 2)-------------->
                           <──────────────TCF──────────────
                          <------------------------RNR------------------------
                          <-------------------------RR-----------------------
                          --------------------DES-----(phase 3)---------------->
                             ───────────────────────────────────
                          <------
                          <------                Facsimile data
                          <------
                             ───────────────────────────────────
         <---PPS-PSS if phases 4 and 5 are present, PPS-EOP or PPS-EOM otherwise---
                          -------------------------MCF-------------------------->
                             ───────────────────────────────────
                          <------
                          <------        Optional phase 4, see Figure H.7
                          <------
                             ───────────────────────────────────
                          -----------------------------RNR------------------------>
                          <--------------------------------RR------------------------
           --Optional phase 5---MCF appended with octets-->
                          <----------------------------DCN------------------------>
```

NOTE – The call establishment CNG/CED which is depicted in the figure is given for example. The other operating methods defined in 3.1 may take place as well.

**Figure H.9/T.30 – Signals exchange for secure polling mode
Example for a one facsimile page document**

Phases 0, 1, 2, 3 and 4 are the same ones as those for the secure facsimile transmission mode.

For phase 00, the sequence contained in the FIF(s) of the DTR is:

Super-tag "E-F"	Length of Supergroup	Tag "FIF of PWD"	Length + Content of "FIF of PWD"	Tag "FIF of PSA"	Length + Content of "FIF of PSA"	Tag "FIF of SEP"	Length + Content of "FIF of SEP"

Tag "FIF of CIG"	Length + Content of "FIF of CIG"	Tag "FIF of DTC"	Length + Content of "FIF of DTC"

Super-tag "Secure transmission mode"	Length of Supergroup	Tag "Unstandardized features"	Length + Content of "Unstandardized features"

H.6.6.2 Turnaround polling

In case of turnaround polling, after DIS received, the sequence of phases (00, 0, 1, 2, 3 and 4) takes place exactly as for simple polling.

```
               document emission =====>              |
          -----------------------PPS-EOM---------------------->     | (Note)
          <--------------------------MCF-------------------------
                                                     T2 time-out
          <-------------------(NSF)-(CSI)-DIS-------------------
          --------------------DTR-----(phase 00)--------------->
                    the rest is the same as for simple polling
```
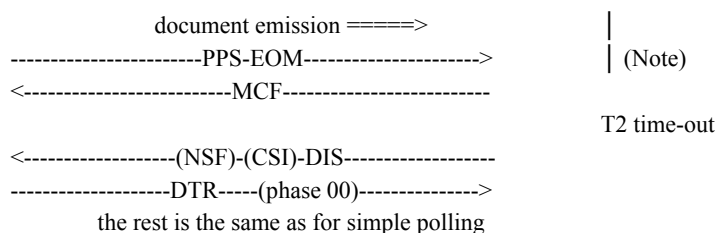
NOTE – If the document sent before the turnaround polling is sent with secure facsimile transmission mode, the rules in H.6.3.2 apply: if phases 4 and 5 are present, the security page is sent or the PPS-EOM appended with octets is sent and the response MCF is appended with octets.

H.6.7 Error messages

H.6.7.1 Error messages

When an error message is to be indicated, the bit No. 5 of the Reason octet of FNV (bit indicating "Secure Fax Error") must be set to "1".

FNV is defined in 5.3.6.2.13.

The error reason is contained in the Diagnostic Information Octets of FNV.

The Type octet for error messages is "Secure Fax Error" as defined in 5.3.6.2.13.

Table H.10 specifies the octets contained in the Value field of "Secure Fax Error".

Table H.10/T.30 – Error reasons coded in the value field of Secure Fax Error in FNV

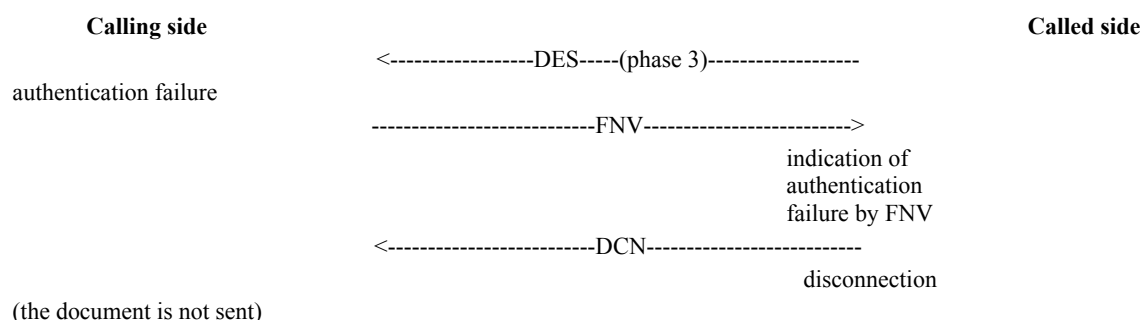| Coding of the value octets in FNV	Error reasons
	First octet
`Bit No.  7 6 5 4 3 2 1 0` `         x x x x x x x 1`	Registration error for public key
`Bit No.  7 6 5 4 3 2 1 0` `         x x x x x x 1 x`	Registration error for encipherment public key
`Bit No.  7 6 5 4 3 2 1 0` `         x x x x x 1 x x`	Service not supported
`Bit No.  7 6 5 4 3 2 1 0` `         x x x x 1 x x x`	Party not registered
`Bit No.  7 6 5 4 3 2 1 0` `         x x x 1 x x x x`	Authentication failure
`Bit No.  7 6 5 4 3 2 1 0` `         x x 1 x x x x x`	Receipt not confirmed (Srd non valid) The Random number received is rejected by the recipient (e.g., in case of replay detected)
`Bit No.  7 6 5 4 3 2 1 0` `         x 1 x x x x x x`	Receipt not confirmed (UTCd non valid) The recipient does not accept the UTCd received from the sender (the criteria are implementation matter)

Table H.10/T.30 – Error reasons coded in the value field of Secure Fax Error in FNV

Coding of the value octets in FNV	Error reasons
	First octet
Bit No. 7 6 5 4 3 2 1 0 1 x x x x x x x	Receipt not confirmed (Lm non valid) The length indicated by the sender does not correspond to the actual length of the document received
	Second octet
Bit No. 7 6 5 4 3 2 1 0 x x x x x x x 1	Receipt not confirmed (Token 4 or Token 4-enc. non valid) The recipient finds the digital signature by the sender not correct
Bit No. 7 6 5 4 3 2 1 0 x x x x x x 1 x	Receipt not valid (Token 5 or Token 5-enc. non valid)
NOTE 1 – Several reasons may be indicated together (several bits set to "1"). NOTE 2 – In future versions of this annex, more additional octets may be defined to code other error reasons. NOTE 3 – For each octet, the least significant bit (right-most bit) is the first one transmitted.	

H.6.7.2 Use of FNV for error indication

Once the FNV indicating the Secure Fax error has been sent, the terminal which has received it "acknowledges" it in sending DCN and disconnects the line.

An example is given below where authentication of the recipient at phase 3 of the secure facsimile transmission fails.

```
         Calling side                                                              Called side
                            <-----------------DES-----(phase 3)------------------
    authentication failure
                            ----------------------------FNV------------------------>
                                                                   indication of
                                                                   authentication
                                                                   failure by FNV
                            <-------------------------DCN--------------------------
                                                                   disconnection

    (the document is not sent)
```

Annex I

Procedure for the Group 3 document facsimile transmission of colour and gray-scale images using T.43

I.1 Introduction

This annex describes the additions to this Recommendation to enable the transmission of colour and gray-scale images using lossless coding method defined by ITU-T Rec. T.43 for Group 3 facsimile mode of operation.

This Recommendation is an optional colour and gray-scale mode which shall only be implemented if the associated base colour and gray-scale mode defined in Annex E/T.4 is also implemented.

Implementation of the gray-scale mode of ITU-T Rec. T.43 requires implementation of the associated gray-scale mode of Annex E/T.4. Similarly, implementation of the colour mode of ITU-T Rec. T.43 requires implementation of the associated colour mode of Annex E/T.4.

The objective is to enable the efficient transmission of a wide variety of images, from a simple document such as containing red or blue characters to high-quality full-colour/gray-scale images over the general switched telephone network and other networks. The images are normally obtained by scanning the original sources with scanners of 200 pels/25.4 mm or higher. The original sources are typically business documents underlined with assorted colour, computer-generated business graph, palettized colour images and high definition continuous-tone colour and gray-scale images.

In this annex, three types of images are supported. They are one-bit per colour CMY(K)/RGB image, palettized colour image and continuous-tone colour and gray-scale image. One-bit per colour CMY(K)/RGB image is also represented using colour palette table, and is a special case of palettized colour image in which every colour is represented by one bit information of original printable colour. The representation of colour image data is based on ITU-T Recs T.42 and T.43. The basic way is a device-independent colour space representation, the CIELAB space, which enables unambiguous exchange of colour information. The bit-plane decomposition and coding using ITU-T Rec. T.82 is also described in ITU-T Rec. T.43.

This annex describes the procedure for negotiation of the capabilities for transmission of colour and gray-scale images. It specifies the definitions and the specifications of new entries to the Facsimile Information field of the DIS/DTC and DCS frames of this Recommendation.

Information pertaining to receiver capability, colour mode capability, image amplitude precision in digitization (bits/component), interleave method, custom illumination, and custom gamut are subject to negotiation in the pre-message phase of the T.30 protocol.

This annex does not address the semantics and syntax of the actual encoding of the colour and gray-scale images by lossless coding. Such information is included in ITU-T Rec. T.43.

The use of Error Correction Mode (ECM) for error-free transmission is mandatory in the procedure described by this annex. Under the error-correction mode of transmission, the encoded image data sequence is embedded in the Facsimile Coded Data (FCD) part of the HDLC (High-level Data Link Control) transmission frames specified by Annex A.

I.2 Definitions

I.2.1 CIE (L* a* b*) space (CIELAB): A colour space defined by the CIE (*Commission internationale de l'éclairage*), having approximately equal visually perceptible difference between equally spaced points throughout the space. The three components are L* (in Lightness), a* and b* (both in chrominance).

I.2.2 Joint Bi-level Image experts Group (JBIG), and also shorthand for the encoding method, described in ITU-T Rec. T.82, which was defined by this group.

I.3 Normative references

– ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

– ITU-T Recommendation T.42 (2003), *Continuous-tone colour representation method for facsimile*.

– ITU-T Recommendation T.43 (1997), *Colour and gray-scale image representations using lossless coding scheme for facsimile*.

– ITU-T Recommendation T.82 (1993) | ISO/IEC 11544:1993, *Information technology – Coded representation of picture and audio information – Progressive bi-level image compression*. (Commonly referred to as JBIG standard.)

I.4 Negotiation procedure

The negotiation to transmit and receive encoded colour and gray-scale images by lossless bit-plane coding under the Group 3 facsimile protocol is invoked through the setting of the bits in the DIS/DTC and DCS frames during the pre-message procedure (Phase B) of the T.30 protocol.

The above three image types are further divided into 7 coding submode classes as specified in Table G.1/T.4. The relation of 4 coding mode classes and 7 coding submode classes to be supported are shown in Table G.2/T.4.

The relation of 7 coding submode classes and 4 coding mode classes, which are given by the combination of bits X through X + 2, are given in Table I.1.

In Table I.1, the capability of lossless gray-scale/colour coding, number of palette indices, and the number of bit precision are explicitly described. Parameters to be negotiated can be found in Table I.2.

Table I.1/T.30 – The correspondence of coding submode classes and DIS/DTC/DCS bits

Coding submode class		Colour space	Bit 36 T.43 coding	Bit 69 Colour mode	Bit 71 12-bit mode	
Image type	# of bit plane					
One-bit per colour image	(3, 4)		1	1	0	(Note)
Palettized colour image	Basic (1-12) × 1 8 bits precision	Lab	1	1	0	
	Extended (1-12) × 1 12 bits precision or (13-16) × 1 8 or 12 bits precision	Lab	1	1	1	
Continuous-tone image	Gray-scale 2-8	L	1	0	0	
	9-12	L	1	0	1	
	Colour (2-8) × 3	Lab	1	1	0	
	(9-12) × 3	Lab	1	1	1	

NOTE – This coding submode is a special case of palettized colour submode, in which each bit plane corresponds to CMY(K) or RGB primaries. The number of planes (3 or 4) will be distinguished by G3FAX0 Entry.

Table I.2/T.30 – Mandatory and optional capabilities

Mandatory	Optional
T.43 gray-scale	T.43 colour
8-bit mode	12-bit mode
Stripe interleave	Plane interleave
CIE standard illuminant D50	Custom illuminant
Default gamut range	Custom gamut range

Annex J

Procedure for Group 3 document facsimile transmission of
Mixed Raster Content (MRC) images

J.1   Scope

The method for Mixed Raster Content (MRC) image representation is defined in ITU-T Rec. T.44. Together with Annex H/T.4, this annex provides specification for the application of MRC in Group 3 facsimile. Unconstrained MRC, as defined in ITU-T Rec. T.44, shall be applied as a colour option of Annex E/T.4 (i.e., Annex E/T.4 shall be implemented in unconstrained MRC applications). Black-and-white constrained MRC, as defined in Annex H/T.4, shall be implemented in non-colour applications (i.e., applications that do not implement Annex E/T.4). MRC defines a means to efficiently represent raster-oriented pages that contain a mixture of multilevel (e.g., continuous-tone and palettized colour) and bi-level (e.g., text and line-art) images by combining different encodings, spatial and colour resolutions on a single page. More than one of the multilevel encodings (e.g., T.81 and T.82 as per ITU-T Rec. T.43) and/or bi-level encodings (e.g., T.6 and T.4, one and two-dimensional) which are negotiated (as defined within this annex) may be combined within a page, however, only bi-level encodings may be used in the MRC mask layer. Similarly, more than one of the square spatial resolutions (same resolution in both horizontal and vertical direction) and colour resolutions (i.e., bits/pels/component and chrominance subsampling) which are negotiated (as defined within this annex) may be combined within a page. This annex does not introduce new encodings or resolutions. The method of image segmentation is beyond the scope of this annex; segmentation is left to the manufacturer's implementations.

J.2   References

The references of ITU-T Rec. T.44 apply to this annex, along with the following additional references:

–   ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

–   ITU-T Recommendation T.44 (1999), *Mixed Raster Content (MRC)*.

J.3   Definitions

The definitions in ITU-T Rec. T.44 apply to this annex.

J.4   Image representation

This annex makes provision for encapsulating two or more ITU-T encodings, spatial and colour resolutions as defined in ITU-T Rec. T.44 "Mixed Raster Content (MRC)". This provision marks a significant departure from normal T.30 procedures that typically permits only a single encoding, spatial and colour resolution within a page.

A page is composed from a set of page-wide stripes of image data, which are coded independently. The stripes are transmitted sequentially from the top to the bottom of the page. Data is transmitted in a bit stream of least to most significant bit order.

The different segments of the raster data are processed according to their individual attributes; text and line-art data (bi-level data), pictures and colour gradients (multilevel data). These different data types (bi-level and multilevel) are placed in separate layers/planes within the page and processed appropriately. The spatial details associate with text and line-art data is in the mask layer(s) (odd-numbered layers) while the colour details of the text and line-art data is in the image layers (odd-numbered layers such as the "foreground" layer). The continuous-tone colours associated with pictures and colour sweeps are in the lower "background" layer. The process of image regeneration

is controlled by the bi-level mask layer(s) selecting whether pixels from the image layer below, such as background (e.g., contone) or image layer above, such as foreground (e.g., text/line-art colour) will be reproduced.

The stripes are composed of one or more layers. No more than 3 types of stripes shall be used when applying the base mode (Mode 1) or Mode 2 of ITU-T Rec. T.44. Mode 3 defines provisions for more than three, up to N (where N is an integer), types of stripes. Stripe types are classified according to their layer (image type) content:

• N-layer stripe (NLS) where N is an integer, so referenced since it contains more than three layers.

• 3-layer stripe (3LS), so referenced since it contains all three of the foreground, mask and background layers.

• 2-layer stripe (2LS), so referenced since it contains coded data for two of the three layers (the third is set to a fixed value). The two layers may be mask and foreground or mask and background layers.

• 1-layer stripe (1LS), so referenced since it contains coded data for only one of the three layers (the other two are set to fixed values). The one layer may be mask, foreground or background. The 1LS is appropriate when addressing an image that contains one of monochrome text/line-art, contone image or possibly richly coloured graphics.

Each layer is coded using a recommended ITU-T encoding, spatial and colour resolution. A different encoding and colour resolution may be applied within each layer. The square spatial resolutions (same resolution in both horizontal and vertical direction) of Table 2 are available for use in this annex. The resolution of the main mask layer is fixed for the entire page. In general, it is possible to define lower spatial resolution for other layers. Within a stripe, varying spatial resolutions may be combined only when the resolutions of the other layers are integral factors of the main mask resolution. For example, if the main mask resolution is 400 pels/25.4 mm, the background and foreground layers may each be either 100, 200 or 400 pels/25.4 mm. The main mask resolution is specified in the page header. The resolutions of the other layers are specified in the layer data.

These encodings, spatial and colour resolutions are selected from a set that is negotiated at the start of the session.

Information required to decode the page, such as coding types available for use within the layers, is specified within the page header (start of page marker segment). Maximum Stripe height shall be negotiated at the start of the session. Mode 1 requires the actual applied stripe height to be specified within the stripe header (start of stripe marker segment) while other modes require its specification within the layer data structure. Information required to decode a layer is included in the stripe header and the layer data.

The main mask (layer 2) shall be transmitted first, followed by the background (layer 1) the foreground (layer 3), layer 4, layer 5 ..., layer N. Details of the syntax are described in ITU-T Rec. T.44.

The use of error correction mode (ECM) for error-free transmission, as defined in Annex A/T.4 and this Recommendation, is mandatory for the procedure specified in ITU-T Rec. T.44. Under the ECM mode of transmission the encoded image data sequence, associated headers and the layer data are embedded in the Facsimile Coded Data (FCD) part of the HDLC (High Level Data Link Control) transmission frames that are specified in Annex A. In alignment with Annex A/T.4, to complete the last frame, pad characters (X'00', the null character) may be added after ending marker within the last ECM frame of the page.

J.4.1 Black-and-white only or colour representation

The unconstrained MRC provisions accommodating use of multilevel and/or bi-level coders within a page shall only be implemented when the facsimile base colour mode, as defined in Annex E/T.4, is also implemented (i.e., Baseline JPEG is implemented). In other words, unconstrained MRC is a colour option of Annex E/T.4. When Annex E/T.4 is not implemented, then only the bi-level coder constrained provisions of MRC, as defined in the " Black-and-White Mixed Raster Content Profile (MRCbw)" clause 4 of Annex H/T.4, shall be implemented. The MH (T.4 one-dimensional) coder is the only required coder when implementing MRCbw.

All modes of MRC are available for use with Black-and-White Mixed Raster Content Profile; however, use of Modes 2 or higher modes is strongly recommended.

J.4.2 Shared data representation

MRC Mode 4 requires implementation of the SDMx (Share Data) marker segment provision to share coding information between pages, stripes or layers. The SDMx marker segment provision may be used with any encoder that benefits from sharing information between pages, stripes or layers. The JBIG2 encoder, however, shall only be used in combination with the SDMx marker segment provision.

J.4.3 Colour tag representation

The MRC Mode 4 optional colour tag provisions may be implemented in the representation of foreground colour. The T.45 "Run-length Encoder" shall be used to code the colour values of the foreground colour tags. Colour tags shall only be used with foreground layers that are associated with JBIG2 encoded mask layers.

J.5 Layer transmission order

In multi-layer stripes, the bi-level main mask data is transmitted first, followed by the background layer, the foreground layer, layer 4, layer 5, ..., layer N. In a multi-layer stripe without a background layer, the bi-level main mask image data is transmitted first, followed by the foreground, layer 4, layer 5, ..., layer N.

J.6 Negotiation

Negotiations to use the MRC (T.44) procedure, accommodating the transmission and reception of pages with mixed coding (i.e., encoding method, spatial and colour resolution, and other encoding parameters) and/or JBIG2 coding, shall be invoked through the setting of a sequence of bits in the DIS/DTC and DCS frames during the T.30 pre-message procedure (Phase B). This optional MRC procedure is only available when the base colour encoding mode, as defined in ITU-T Rec. T.42, Annex E/T.4 and Annex E, or the Black-and-White MRC Profile is available, as indicated by the setting of Table 2 bit 68 to "1" or bit 115 to "1" respectively. Provision is made, via the value of Table 2 bits 92-94, to negotiate one of the many modes (performance level) of ITU-T Rec. T.44 to be implemented during a transmission session. Table 2, Note 50, specifies the T.44 modes that are currently available for negotiations. Modes 1 and 2 make provision to apply one encoding scheme, one spatial and one colour resolution within each of the three layers of a stripe. Mode 3 and higher modes make provision to apply one encoding scheme, one spatial and one colour resolution within each of N layers per stripe, where N is an integer. Consult ITU-T Rec. T.44 to determine all the provisions made available by each mode.

Under the MRC procedure any of the different multilevel and bi-level coding methods, negotiated in Phase B, may be used in each of the layers. A bi-level coder must be used for the mask layer(s). Multilevel and bi-level encodings such as defined in: ITU-T Rec. T.42, Annex E/T.4 and Annex E; ITU-T Rec. T.43, Annex G/T.4 and Annex I; ITU-T Recs T.6 and T.4 are available. Multiple coding methods may be negotiated for use during Phase B by activating more than one coding

related bits in the DCS. The coding bits activated in the DCS must be a subset of those activated in the DIS. Different colour resolutions and/or subsamplings may be used between layers in the event that the DIS indicates 12 bits/pel component and/or no subsampling (1:1:1) is available. If the DCS indicates 12 bits/pel component then 8 bits/pel component may also be sent (e.g., 12 applied to the background while 8 is applied to the foreground, 12 applied to one page while 8 is applied to another). In the same manner, if the DCS indicates no subsampling, then subsampling may be applied. These combinations are possible since the receiver is required to support both base modes. Additionally the applied coder, bit resolution and subsampling are identified in the layer data stream.

Multiple spatial resolutions may be negotiated for use during Phase B by activating more than one resolution related bits in the DCS. The resolution bits activated in the DCS must be a subset of those activated in the DIS. All layer resolutions must be an integral factor of the main mask layer resolution. Resolution may vary between mask layers, as long as the mask layer resolution is one of the set identified in the DCS. The main mask layer resolution is identified in the start of page marker segment.

Maximum stripe size may be negotiated between the default size of 256 lines maximum and the full height of the page. This negotiated stripe size maximum may only be changed following EOM and DIS/DCS negotiations.

J.7 Application requirements summary

1) Only bi-level ITU-T coders shall be used in mask layers (i.e., even-numbered layers).

2) The Black-and-White MRC Profile, defined in Annex H/T.4, shall contain only mask layer data. The colours of the background layer (i.e., layer 1) and the foreground layers (i.e., odd-numbered layers greater than one) shall be fixed to black and white respectively.

3) Coders may vary between layers and between stripes within a layer; however, the main mask coder shall be fixed for the entire page.

4) All implementations shall include the MH (T.4 one-dimensional) bi-level coder, other ITU-T bi-level coders may be used.

5) Implementations other than Black-and-White MRC Profile shall include the Baseline JPEG (T.81, as defined in Annex E/T.4) multilevel coder, other multilevel coders may be used within the image layers (i.e., odd-numbered layers).

6) Only square (i.e., same resolution value in vertical and horizontal directions) ITU-T spatial resolutions shall be used.

7) Spatial and colour resolution may vary between layers and between stripes within a layer; however, the spatial resolution of all layers shall be integral factors of the main mask layer resolution and the main mask resolution shall be fixed for the entire page.

8) Dimensions of the main mask layer shall be such that the main mask layer(s) cover the entire page (i.e., each stripe has a mask layer that has a zero horizontal offset, the mask layer is always the page width, the stripe size is defined by the mask layer, and there are stripes that traverse the entire page height).

9) Pages may be subdivided into one or more contiguous horizontal stripes.

10) Maximum stripe heights of 256 lines or full page shall be accommodated.

11) Stripe width shall span the width of the page.

12) Dimensions of the main mask layer within a stripe shall be the same as the stripe dimensions.

13) Dimensions of other layers within a stripe may be the same as or less than the stripe dimensions.

14) A maximum of three (3) layers may be used in Mode 1 and Mode 2, while the number of layers are unrestricted in Mode 3 and higher level modes.

15) Error Correction Mode (ECM) shall be used during all transmissions.

16) Stripe transmission order within a page shall be in order of increasing stripe numbers.

17) Layer transmission order within a stripe shall be main mask layer (i.e., layer 2) first, followed by the background layer (i.e., layer 1), then the foreground layer (i.e., layer 3) and any other layers in order of increasing layer numbers (i.e., layers 4, 5, 6, 7, …, N). In the event that there is no background layer then the foreground layer shall immediately follow the main mask layer and any other layers in order of increasing layer numbers.

18) Layers shall be recombined and rendered in ascending order of layer numbers (i.e., layer 1 is rendered first, next layer 3 on top of layer 1, then layer 5 on top of the 1 and 3 combination, and so on until all layers have been rendered).

19) Mode 2 and higher mode implementations shall use the Start of Layer Coded Data (SLC) marker segment to specify information required to decode the coded layer data, such as layer coder, resolution, width, height, base colour and offset. Mode 1 implementations shall specify this information in the Start of Stripe (SOSt) marker segment.

20) Mode 4 and higher mode implementations may use the Shared Data (SDMx) marker segment to accommodate sharing of coding information between pages.

21) A JBIG2 encoded stream shall only be used in combination with the Mode 4 SDMx marker segment provision.

22) Shared data create (SDMc) marker segments must appear before the data stream (JBIG2) that uses the shared resources.

23) Shared data disposition (SDMd) marker segments identifying "use" of previously declared shared data resource(s) must appear before the layer in which the resource(s) is(are) used, and not before other layers. In other words, SDMd marker segments appear between layers and prior only to the layer that it will be used for. This could be between the SLC and EOH (unambiguously) or before or after the SOSt, if the use is for the first layer. Implementations must accommodate any of these placements.

24) The Black-and-White Mixed Raster Content Profile (MRCbw) (per Annex H/T.4) shall be used for black-and-white only applications of JBIG2.

25) Mode 4 and higher mode implementations may use T.45 "Run-length Colour Encoder" and colour tags provisions to code foreground layers, as defined in Annex B/T.44 and Annex H/T.4, only when JBIG2 is used to code the corresponding mask layers.

26) Unknown marker segments should be skipped (i.e., unknown APP1, APP3, and APP13 identifiers).

Annex K

Procedure for the Group 3 document facsimile transmission of continuous-tone colour and gray scale images (sYCC)

K.1 Introduction

This annex describes the additions to this Recommendation to enable the transmission of continuous-tone colour and gray scale images (sYCC) for Group 3 facsimile mode of operation.

The objective is to enable the efficient transmission of high-quality, multilevel images over the general switched telephone network and other networks. The images are normally obtained by

capturing the original sources with, for example, digital still-image cameras, and bit depths of eight bits per picture element per colour component or higher.

The encoding methodology for continuous-tone colour and gray scale images (sYCC) is based on the JPEG (ITU-T Rec. T.81 | ISO/IEC 10918-1) image encoding standard. The JPEG image coding method includes both a lossy mode and a lossless mode of encoding. This annex adopts the lossy mode of encoding which is based on the Discrete Cosine Transform.

The representation of colour image data is based on Annex F of IEC 61966-2-1 (8-bits sYCC values). It adopts colour space representation, the sYCC colour space.

This annex explains the procedure for negotiation of the capabilities for transmission of continuous-tone colour and gray scale images (sYCC). It specifies the definitions and the specifications of new entries to the Facsimile Information Field of the DIS/DTC and DCS frames of this Recommendation.

The two types of information specified – that pertaining to JPEG capability and the sYCC colour space – are subject to negotiation in the pre-message phase of the T.30 protocol.

This annex does not address the semantics and syntax of the actual encoding of the continuous-tone colour and gray scale images (sYCC). That information is included in Annex I/T.4.

The use of Error Correction Mode (ECM) for error-free transmission is mandatory in the procedure described by this annex. Under the error correction mode of transmission, the JPEG encoded image data are embedded in the Facsimile Coded Data (FCD) part of the HDLC (High-level Data Link Control) transmission frames specified by Annex A.

The technical features of encoding and decoding the continuous-tone colour and gray scale images (sYCC) data are described in Annex I/T.4. It describes two modes of image encoding (lossy gray-scale and lossy colour) which are defined using ITU-T Rec. T.81.

K.2   Definitions

K.2.1   sYCC: A colour space defined by the IEC (International Electrotechnical Commission) in Annex F of IEC 61966-2-1.

K.2.2   Joint Photographic Experts Group (JPEG): Shorthand for the encoding method, described in ITU-T Rec. T.81, which was defined by this group.

K.2.3   baseline JPEG: A particular eight-bit sequential Discrete Cosine Transform (DCT)-based encoding and decoding process specified in ITU-T Rec. T.81.

K.2.4   quantization table: A set of 64 values used to quantize the DCT coefficients in baseline JPEG.

K.2.5   Huffman table: A set of variable length codes required in a Huffman encoder and a Huffman decoder.

K.3   References

–   IEC 61966-2-1-am1 (2003-01), *Multimedia systems and equipment – Colour measurement and management – Part 2-1: Colour management – Default RGB colour space – sRGB.*

–   ITU-T Recommendation T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images – Requirements and guidelines*. (Commonly referred to as JPEG standard.)

–   ITU-T Recommendation T.4 (2003), *Standardization of Group 3 facsimile terminals for document transmission*.

K.4   Negotiation procedure

The negotiation to transmit and receive JPEG encoded continuous-tone colour and gray scale images (sYCC) under the Group 3 facsimile protocol is invoked through the setting of the bits in the DIS/DTC and DCS frames during the pre-message procedure (Phase B) of the T.30 protocol.

Table K.1/T.30 – Mandatory capabilities

Mandatory
8 bits/pel/component
Subsampling less than MCU 10
CIE Standard Illuminant D65
Default gamut range (Annex F of IEC 61966-2-1 Default range)

Appendix I

Index of abbreviations used in this Recommendation

Abbreviation	Function	Signal format	Reference
ANSam	Modulated answer tone	See ITU-T Rec. V.8.	4.1.2
CED	Called terminal identification	2100 Hz	4.1.1
CFR	Confirmation to receive	X010 0001	5.3.6.1.4, 1)
CI	Call indicator	See ITU-T Rec. V.8.	F.5
CIG	Calling subscriber identification	1000 0010	5.3.6.1.2, 2)
CJ	CM terminator	See ITU-T Rec. V.8.	F.5
CM	Call menu	See ITU-T Rec. V.8.	F.5
CNG	Calling tone	1100 Hz for 500 ms	4.2
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 for 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	5.3.6.1.6, 1)
EOP	End of procedure	X111 0100	5.3.6.1.6, 3)
EOR	End of retransmission	X111 0011	A.4.3, 2)
ERR	Response for end of retransmission	X011 1000	A.4.4, 3)
FCD	Facsimile coded data	0110 0000	A.2.2
FCF	Facsimile control field	–	5.3.6.1
FDM	File diagnostic message	X011 1111	5.3.6.1.7, 9)
FIF	Facsimile information field	–	5.3.6.2

Abbreviation	Function	Signal format	Reference
FTT	Failure to train	X010 0010	5.3.6.1.4, 2)
HDLC	High-level data link control	–	5.3
JM	Joint menu	See ITU-T Rec. V.8.	F.5
MCF	Message confirmation	X011 0001	5.3.6.1.7, 1)
MPh	Modulation parameter	See ITU-T Rec. V.34.	F.3.1.4
MPS	Multipage signal	X111 0010	5.3.6.1.6, 2)
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	Procedure interrupt negative	X011 0100	5.3.6.1.7, 5)
PIP	Procedure interrupt positive	X011 0101	5.3.6.1.7, 4)
PPS	Partial page signal	X111 1101	A.4.3, 1)
PPR	Partial page request	X011 1101	A.4.4, 1)
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)
PWD	Password (for polling)	1000 0011	5.3.6.1.2, 4)
PWD	Password (for transmission)	X100 0101	5.3.6.1.3, 5)
RCP	Return to control for partial page	0110 0001	A.2.2
RNR	Receive not ready	X011 0111	A.4.4, 2)
RR	Receive ready	X111 0110	A.4.3, 3)
RTN	Retrain negative	X011 0010	5.3.6.1.7, 3)
RTP	Retrain positive	X011 0011	5.3.6.1.7, 2)
SEP	Selective polling	1000 0101	5.3.6.1.2, 5)
SUB	Subaddress	X100 0011	5.3.6.1.3, 4)
TCF	Training check	Zeros for 1.5 s	5.3.6.1.3, 6)
TSI	Transmitting subscriber identification	X100 0010	5.3.6.1.3, 2)

Appendix II

List of commands and appropriate responses

Commands	Comments	Appropriate responses
(NSF) (CSI) DIS	Identifying capabilities: from a manual receiver or an auto answer terminal	(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 terminal 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 manual transmitter or automatic receiver This command is always followed by training	CFR FTT (NSC) (CIG) DTC (NSF) (CSI) DIS (CRP)
CTC	Mode setting command: from the transmitter to the receiver	(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)

Commands	Comments	Appropriate responses
(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 III

Alternative procedures used by some terminals which conform to the pre-1996 versions of this Recommendation

III.1   Alternative automatic answering sequence

See Figure III.1.
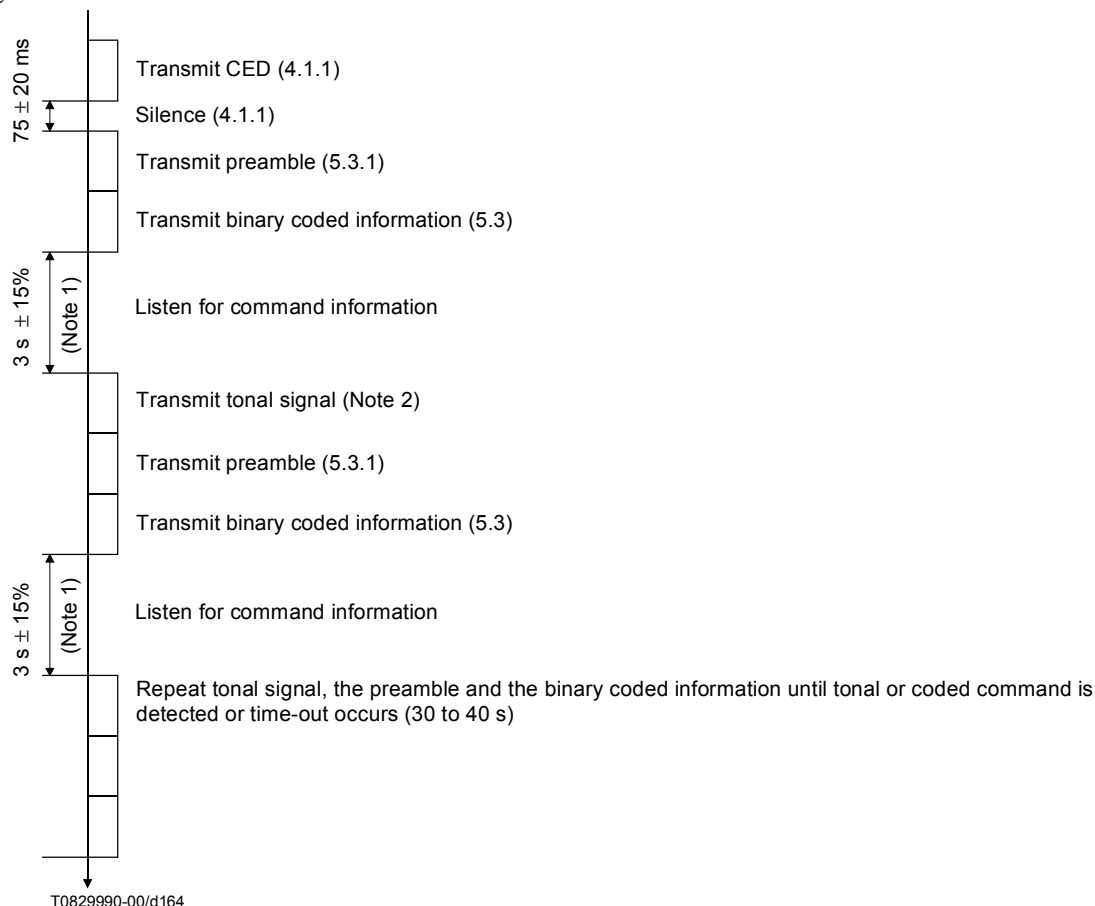
T0829990-00/d164

NOTE 1 – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

NOTE 2 – The tonal signal will have one of the following formats:

a) 1650 Hz (±6 Hz) ON for 1.5 s and OFF for 3 s (timing tolerance ±15%); or

b) 1850 Hz (±6 Hz) ON for 1.5 s and OFF for 3 s (timing tolerance ±15%); or

c) 1650 Hz (±6 Hz) ON for 1.5 s immediately followed by 1850 Hz ON for 0.75 s followed by silence for 3 s (timing tolerance ±15%).

Figure III.1/T.30 – Called terminal procedures

III.2 Optional binary coded preamble

An example of a terminal having the standard binary coded, recognized optional binary coded and tonal capabilities is given in Figure III.2.
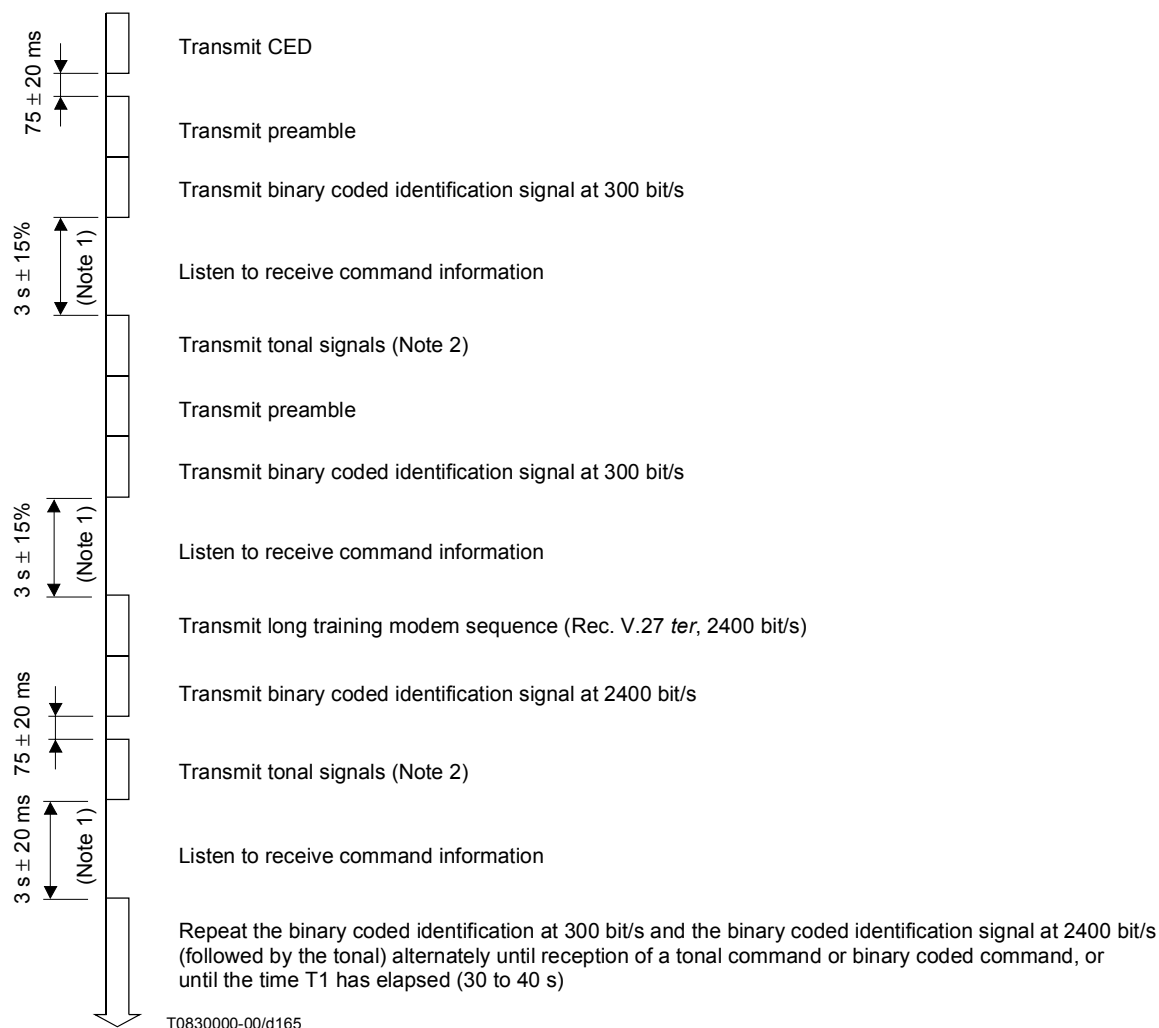
T0830000-00/d165

NOTE 1 – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

NOTE 2 – The tonal signal will have one of the following formats:

a) 1650 Hz (±6 Hz) ON for 1.5 s and OFF for 3 s (timing tolerance ±15%); or

b) 1850 Hz (±6 Hz) ON for 1.5 s and OFF for 3 s (timing tolerance ±15%); or

c) 1650 Hz (±6 Hz) ON for 1.5 s immediately followed by 1850 Hz ON for 0.75 s followed
   by silence for 3 s (timing tolerance ±15%).

Figure II.2/T.30 – Called terminal procedures

Appendix IV

Signal sequence examples

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 (ITU-T Recs V.27 *ter*, V.29 and V.17).

–   A lightning bolt (⚡) indicates an invalid frame.

–   A bold solid line indicates the transmission of tonal signals.

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

Example 1   An auto calling terminal wishing to transmit to an auto
answer terminal: example of post-message commands.
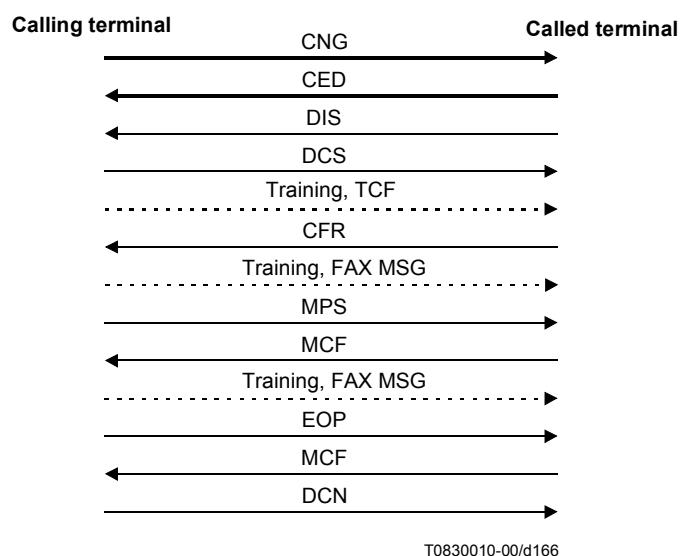
Figure IV.1/T.30

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

**Transmitting
terminal**   **Called
terminal**

CED

DIS

DCS

Training, TCF

CFR

Training, FAX MSG

EOM

MCF

T2 elapsed

DIS

DCS

Training, TCF

CFR

Training, FAX MSG

EOM

MCF

EOM

MCF

T2 elapsed

DIS

DCS

Training, TCF

CFR

Operator
disconnects
the line

Training, FAX MSG

EOM

MCF

DIS

T2 elapsed

DIS

T1 elapsed

DIS

T0830020-00/d167

Terminal
disconnects
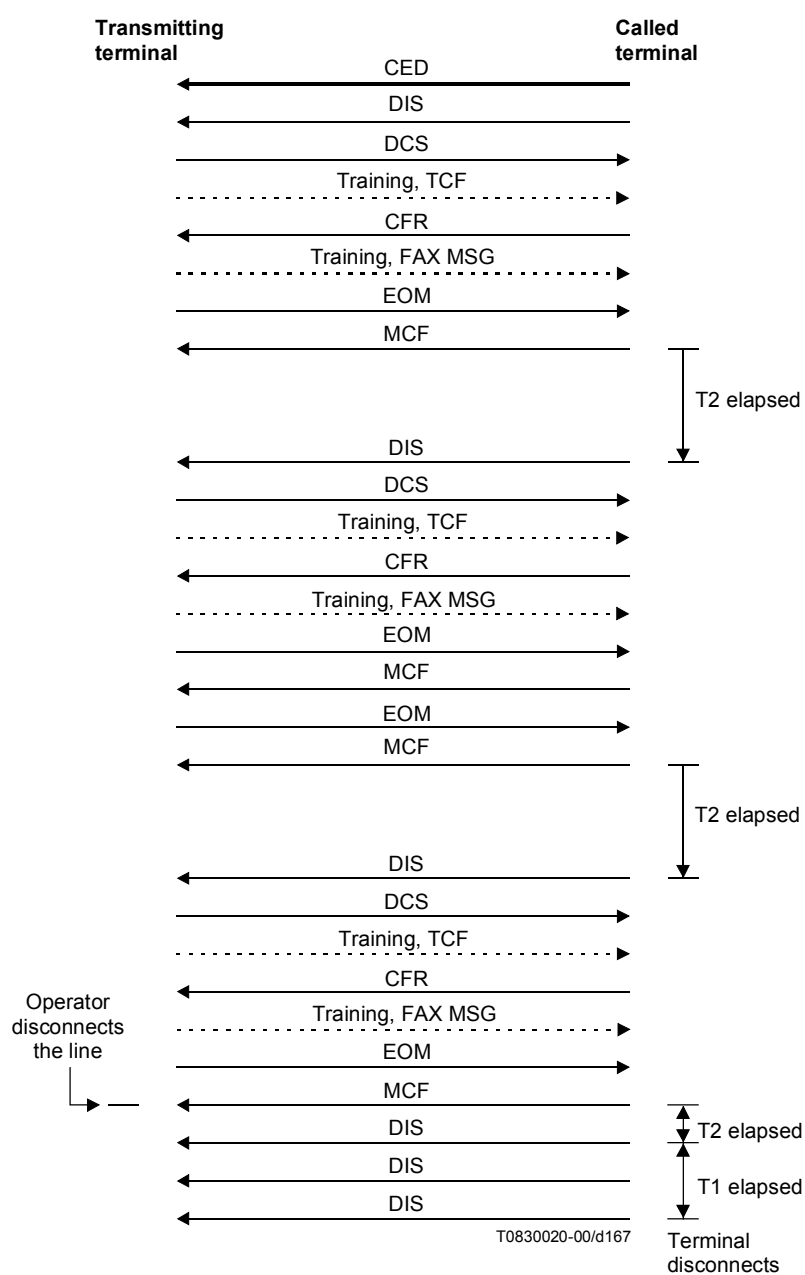
Figure IV.2/T.30

Example 3 An auto calling terminal wishing to transmit to an auto answer terminal: example of post-message responses.
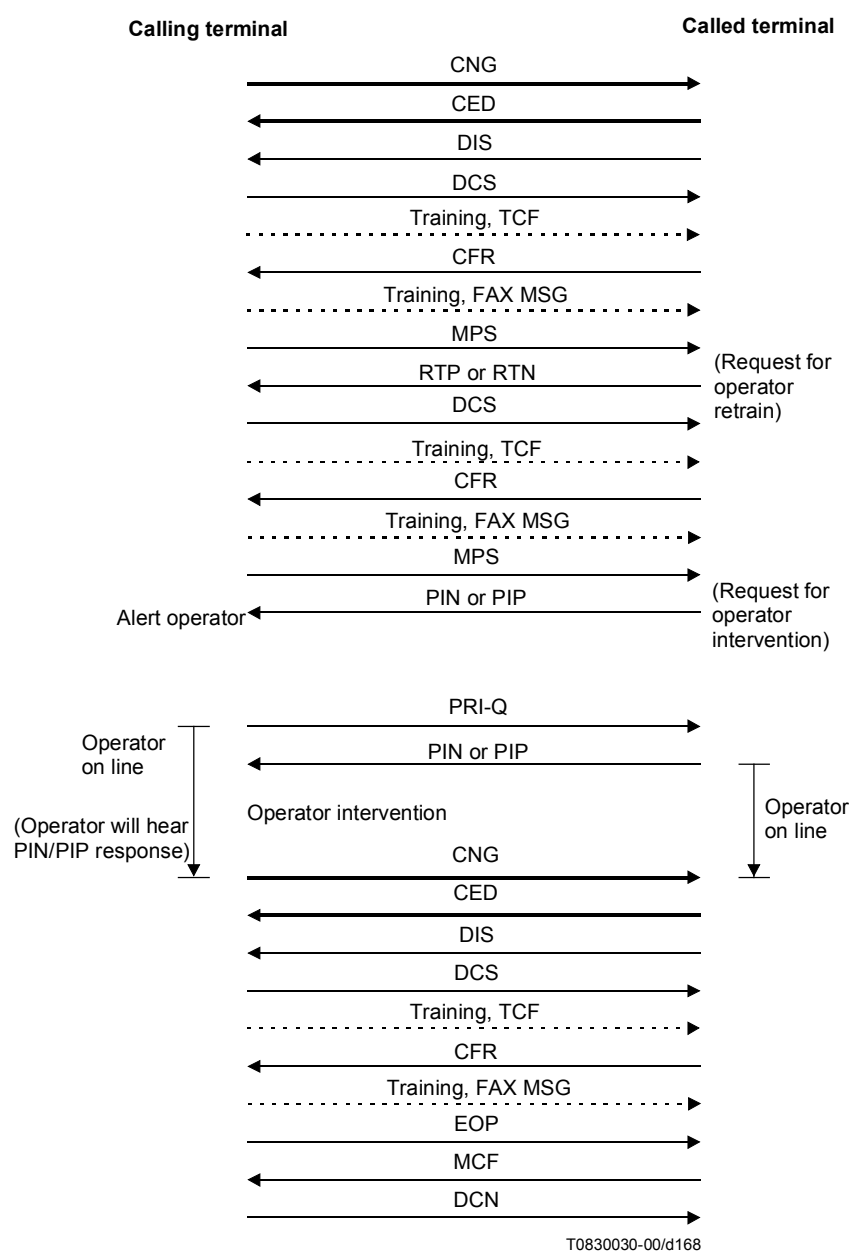
Figure IV.3/T.30

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

Transmitting terminal   **Called terminal**

CED

DIS

DCS

Training, TCF

FTT

DCS

Training, TCF

CFR

(Request for operator intervention)   Training, FAX MSG

PRI-Q   Alert operator

PIN or PIP

PRI-Q   Operator on line

                               (Operator will hear PRI-Q command)

Operator on line   Operator intervention

CED

DIS

DCS

Training, TCF

CFR

Training, FAX MSG

PRI-Q

PIN or PIP

PRI-Q   Operator on line

Operator on line   Operator intervention

                        Both operators mutually
                        decide to terminate the call

T0830040-00/d169

Figure IV.4/T.30

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

Calling terminal   **Called terminal**

CNG →
← CED
← DIS
DTC →
← DCS
← Training, TCF
CFR →
← Training, FAX MSG
← EOM
MCF →
T2 elapsed ↓   DIS →
← DTC
DCS →
Training, TCF →
← CFR
Training, FAX MSG →
EOP →
← MCF
DCN →

T0830050-00/d170
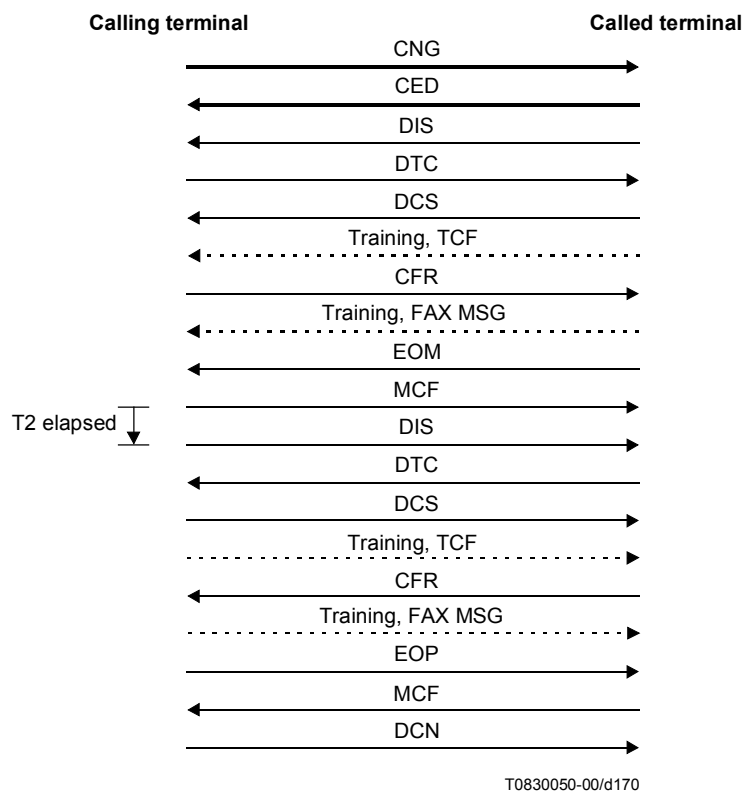
Figure IV.5/T.30

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

Calling terminal   **Called terminal**

CNG →
← CED
← (NSF) (CSI) DIS
(NSC) (CIG) DTC →
Compatible non-standard facilities?

No   Yes

← (TSI) DCS
← Training, TCF
CFR →
← Training, FAX MSG
EOP →
← MCF
DCN →

(NSS)
←

T0830060-00/d171
Proceed with non-standard operation
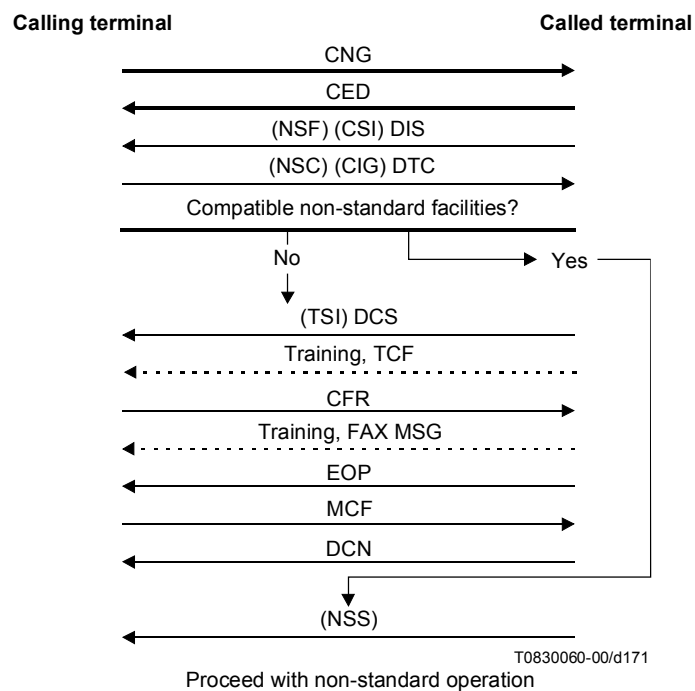
Figure IV.6/T.30

Example 7 An auto calling terminal wishing to transmit to an
auto answer terminal: example of standard error
recovery techniques.
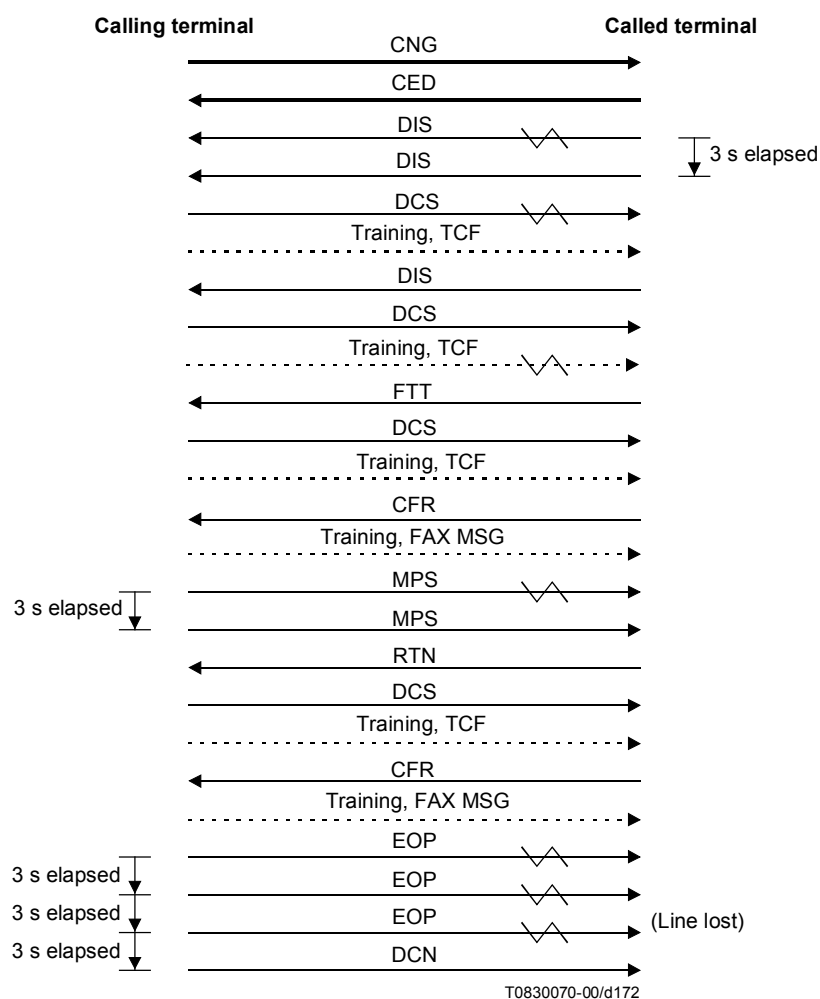
Figure IV.7/T.30

Example 8 Manual transmitter wishing to transmit to a manual receiver:
example of error recovery technique using the optional
CRP response.
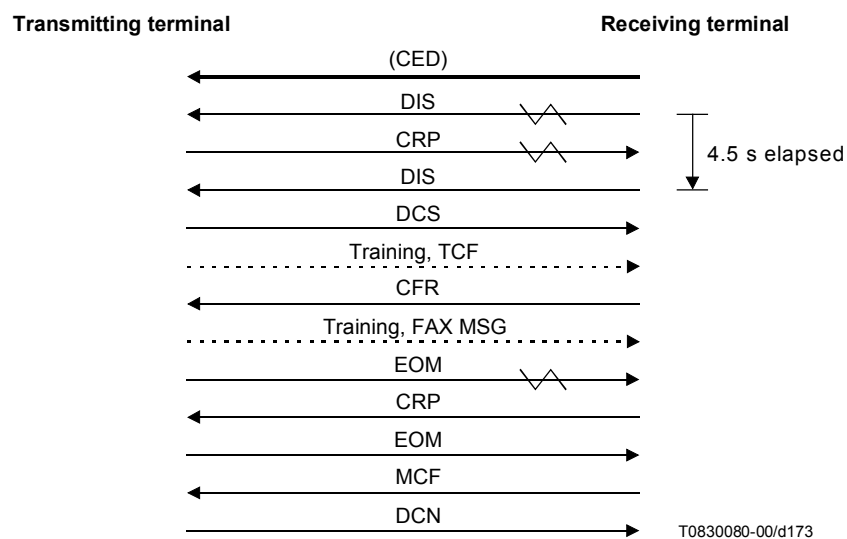
Figure IV.8/T.30

Example 9 An auto calling terminal wishing to receive from an auto
answer terminal using password/selective polling capabilities.

Calling terminal   **Called terminal**

CED

(NSF) (CSI) DIS

(PWD) (SEP) (CIG) DTC

(Password OK?)

Yes

No

(TSI) DCS

DCN

T0830090-00/d174
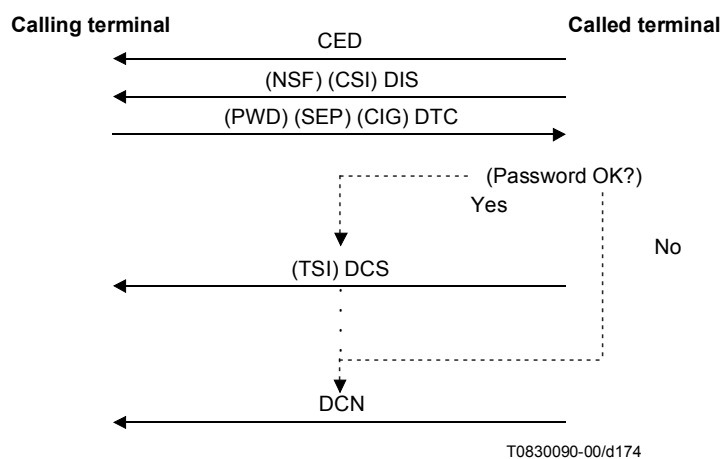
Figure IV.9/T.30

Example 10 An auto calling terminal wishing to transmit to an auto
answer terminal using password/subaddress capabilities.

Calling terminal   **Called terminal**

CED

(NSF) (CSI) DIS

(PWD) (SUB) (TSI) DCS

T0830100-00/d175
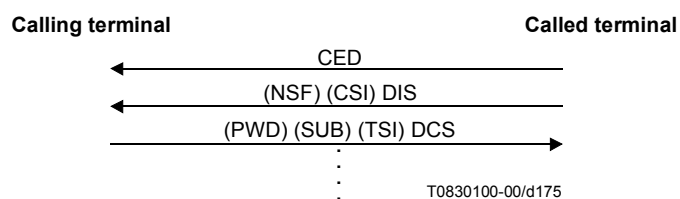
Figure IV.10/T.30

Example 11 Auto calling terminal wishing to first transmit to, then receive from
an auto answer terminal.

Calling terminal   **Called terminal**

CNG →

CED ←

(NSF) (CSI) DIS ←

(PWD) (SUB) (TSI) DCS →

Training, TCF →

CFR ←

Training, FAX MSG →

EOM →

MCF ←

T2 elapsed

(NSF) (CSI) DIS ←

(PWD) (SEP) (CIG) DTC →

(SUB) (TSI) DCS ←

Training, TCF ←

CFR →

Training, FAX MSG ←

EOP ←

MCF →

DCN ←

T0830110-00/d176
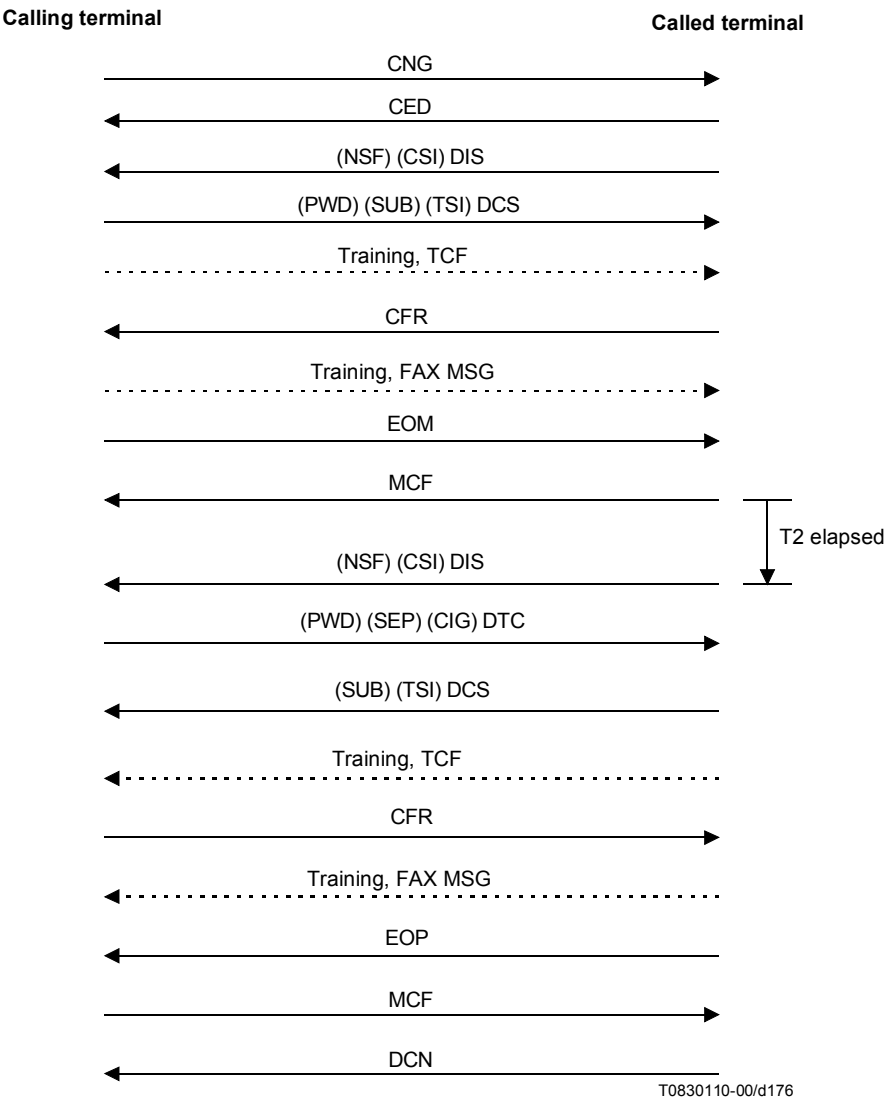
Figure IV.11/T.30

Example 12 Calling terminal wishing to receive multiple documents in one call.

Calling terminal (Receiver)   **Called terminal (Transmitter)**

| CNG → |
| ← CED |
| ← (CSI) DIS | Bits 9, 47, 34 in DIS = "1" |
| (PWD) SEP (CIG) DTC → |
| ← (TSI) DCS | Bit 34 in DTC = "1" (Notes 1 and 5) |
| ← Training, TCF |
| CFR → |
| ← Training, FAX MSG 1 (page 1) |
| ← EOM | (Note 6) |
| MCF → |
| T2 elapsed |
| ← (CSI) DIS |
| ← (TSI) DCS |
| ← Training, TCF |
| CFR → |
| ← Training, FAX MSG 1 (page 2) |
| ← EOS | (Note 2) |
| MCF → |
| T2 elapsed |
| (PWD) SEP (CIG) DTC → | Bit 34 in DTC = "0" (Notes 3 and 5) |
| ← (TSI) DCS |
| ← Training, TCF |
| CFR → |
| ← Training, FAX MSG 2 (page 1) |
| ← EOP | (Note 4) |
| MCF → |
| ← DCN | T0830120-00/d177 |

NOTE 1 – Receiver sets bit 34 in DTC = "1" to indicate additional selection of document continues after current one.

NOTE 2 – Transmitter sends EOS to indicate the end of document to Receiver.

NOTE 3 – Receiver sets bit 34 in DTC = "0" to indicate no additional selection of documents continues after current one.

NOTE 4 – Transmitter sends EOP to indicate the end of current document and communication to Receiver.

NOTE 5 – Each FIF of PWD and SEP may be different.

NOTE 6 – Transmitter can send EOM to indicate the end of complete page of facsimile information and return to the beginning of Phase B.

Figure IV.12/T.30

Receiving GW (T.38)   **Called terminal**

CED

CFR

DIS

Training, TCF

CFR

TNR

Set the
TX timer

TR

TNR

TR

TNR

TR

Message

Reset the
TX timer

T0830210-00

Figure IV.13/T.30

Calling terminal   **Sending GW (T.38)**

Message

MPS

Set the
TX timer

RNR

RR

RNR

RR

RNR

RR

MCF

Reset the
TX timer

Message
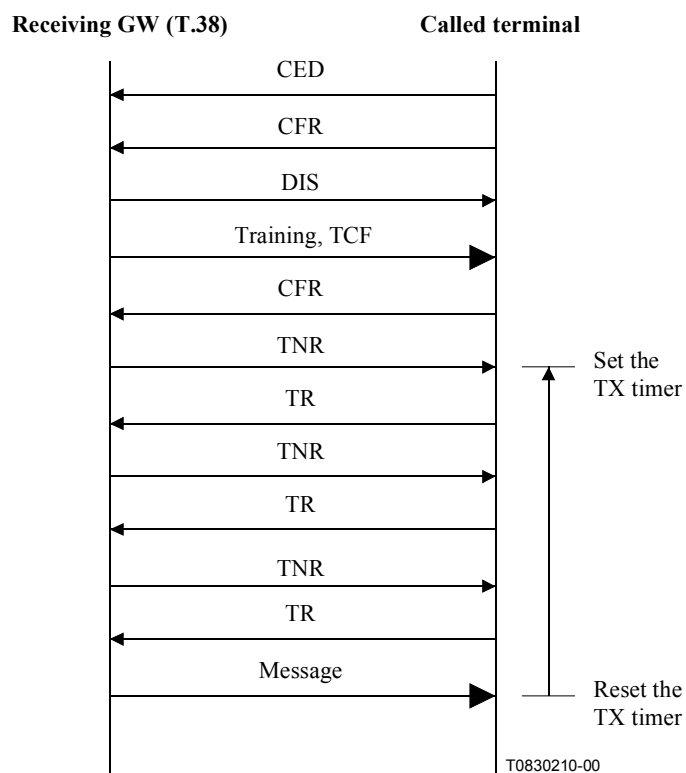
T0830220-00
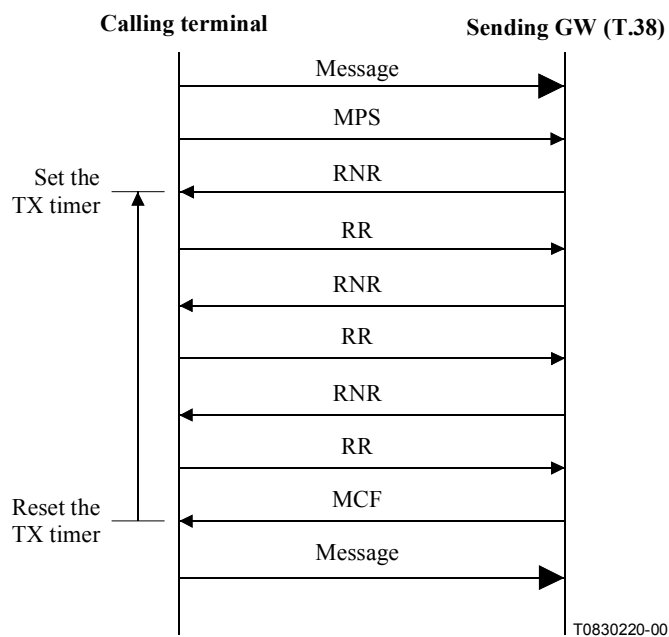
Figure IV.14/T.30

a) *Alternate mode with non-ECM*

Calling		Called
	CNG →	
	← CED	
	← DIS(X,X+1=1, bit27(ECM)=0)	
	DCS(X=1, bit27(ECM)=0) →	
	Training, TCF →	
	← CFR	
	Training, FAXMSG1 →	
	MPS(PN=1,0(front side)) →	
	← MCF	
	Training, FAXMSG2 →	
	MPS(PN=2,1(reverse side)) →	
	← MCF	
	Training, FAXMSG3 →	
	MPS(PN=3,0(front side)) →	
	← MCF	
	Training, FAXMSG4 →	
	MPS(PN=4,1(reverse side)) →	
	← MCF	
	Training, FAXMSG5 →	
	MPS(PN=5,0(front side)) →	
	← MCF	
	Training, FAXMSG6 →	
	EOP(PN=6,1(reverse side)) →	
	← MCF	
	DCN →	

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b)   *Alternate mode with ECM*

Calling		Called
	CNG →	
	← CED	
	← DIS(X,X+1, bit27(ECM)=1)	
	DCS(X, bit27(ECM)=1) →	
	Training,TCF →	
	← CFR	
	Training, FAXMSG1 →	
	PPS-MPS(PN=1,0(front side)) →	
	← MCF	
	Training, FAXMSG2 →	
	PPS-MPS(PN=2,1(reverse side)) →	
	← MCF	
	Training, FAXMSG3 →	
	PPS-MPS(PN=3,0(front side)) →	
	← MCF	
	Training, FAXMSG4 →	
	PPS-MPS(PN=4,1(reverse side)) →	
	← MCF	
	Training, FAXMSG5 →	
	PPS-MPS(PN=5,0(front side)) →	
	← MCF	
	Training, FAXMSG6 →	
	PPS-EOP(PN=6,1(reverse side)) →	
	← MCF	
	DCN →	

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c) *Continuous mode with non-ECM*

Calling		Called
	CNG →	
	← CED	
	← DIS(X,X+1=1, bit27(ECM)=0)	
	DCS(X+1=1, bit27(ECM)=0) →	
	Training, TCF →	
	← CFR	
	Training, FAXMSG1 →	
	MPS(PN=1,0(front side)) →	
	← MCF	
	Training, FAXMSG2 →	
	MPS(PN=3,0(front side)) →	
	← MCF	
	Training, FAXMSG3 →	
	MPS(PN=5,0(front side)) →	
	← MCF	
	Training, FAXMSG4 →	
	MPS(PN=2,1(reverse side)) →	
	← MCF	
	Training, FAXMSG5 →	
	MPS(PN=4,1(reverse side)) →	
	← MCF	
	Training, FAXMSG6 →	
	EOP(PN=6,1(reverse side)) →	
	← MCF	
	DCN →	

T0831500-01

d) *Continuous mode with ECM*

Calling   **Called**

CNG →

← CED

← DIS(X,X+1, bit27(ECM)=1)

DCS(X, bit27(ECM)=1) →

Training, TCF →

← CFR

Training, FAXMSG1 →

PPS-MPS(PN=1,0(front side)) →

← MCF

Training, FAXMSG2 →

PPS-MPS(PN=3,0(front side)) →

← MCF

Training, FAXMSG3 →

PPS-MPS(PN=5,0(front side)) →

← MCF

Training, FAXMSG4 →

PPS-MPS(PN=2,1(reverse side)) →

← MCF

Training, FAXMSG5 →

PPS-MPS(PN=4,1(reverse side)) →

← MCF

Training, FAXMSG6 →

PPS-EOP(PN=6,1(reverse side)) →

← MCF

DCN →

T0831510-01

Appendix V

Procedure for binary file transmission with protocol examples

V.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 protocol allows Group 3 facsimile terminal to interchange binary data files. Refer to ITU-T Rec. T.434 for information regarding the semantics and syntax of a binary encoded data file.

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

V.2 Definitions

V.2.1 attribute: A piece of information stating a property of something, taking one of a set of defined values, each value having a defined meaning.

V.2.2 binary file (data): A sequence of octets, representing a binary file and optional attributes, formed, using the coding rules in Appendix I/T.434.

V.2.3 file attributes: The name and other identifiable properties of a file.

V.2.4 real filestore: An organized collection of files, including their attributes and names, which reside on a real system.

V.2.5 virtual filestore: An abstract model for describing files and filestores, and the possible actions performed on them.

V.3 BFT file transfer-protocol overview

Group 3 terminals 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 indicated by the setting of a capability bit in the DIS/DTC frame. Bit 53 specifies the additional capability required by BFT.

The high-speed binary file data are formed using the coding rules in ITU-T Rec. T.434. These rules specify how to code the set of attributes as a sequence of octets. This binary data are 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 of 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.

V.4 ECM-BFT data format

The high-speed ECM-BFT binary data are a set of contiguous octets defined in ITU-T Rec. T.434. Using Group 3 facsimile terminal, this set of octets is transmitted as an ECM message. Within an ECM page, these octets are segmented into blocks and into the 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. Cases 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.

V.5 Simple BFT negotiation via Phase C method

Session examples for the Simple Phase C BFT method are provided. The examples below are based on flow diagrams and are for illustrative and instruction purposes only. They should not be interpreted as establishing or limiting the protocol.

V.5.1 Clause V.4 case a) examples

V.5.1.1 A transmitted file is acceptable on a receiver. See Figure V.1.
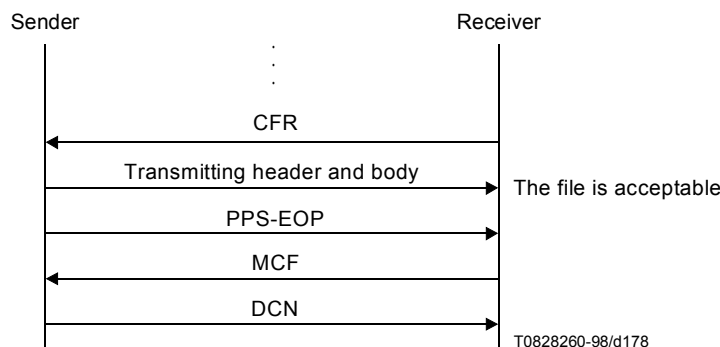
Figure V.1/T.30 – Transmitted file acceptable on a receiver

A sender transmits header and body as the first ECM page. (PPS-NULL is transmitted in case of more than one ECM page data.) As a receiver recognizes that the file is acceptable from the header, it transmits MCF.

V.5.1.2 A transmitted file is processed on a sender. See Figure V.2.
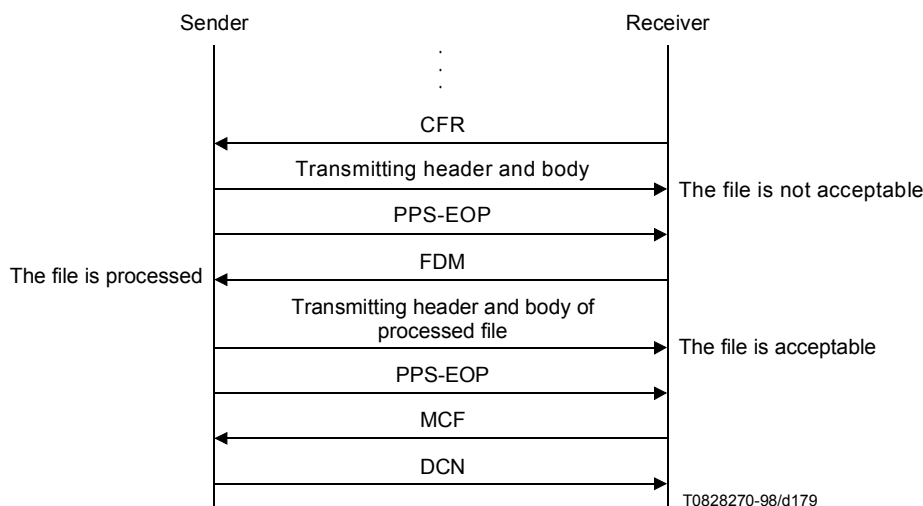
Figure V.2/T.30 – Transmitted file processed on a sender

A sender transmits header and body as the first ECM page. As a receiver recognizes that the file is not acceptable from the header, it transmits FDM and notifies the sender with the diagnostic message. The sender processes the file from the content of FDM and transmits header and body of the processed file as the next ECM page.

V.5.1.3 A transmitted file is not processed on a sender. See Figure V.3.

Figure V.3/T.30 – Transmitted file not processed on a sender

A sender transmits header and body as the first ECM page. As a receiver recognizes that the file is not acceptable from the header, it transmits FDM and notifies the sender of the diagnostic message. When the sender does not process the file from the content of FDM, it transmits DCN.

### V.5.2 Clause V.4 case b) examples

V.5.2.1 A transmitted file is acceptable on a receiver. See Figure V.4.

Figure V.4/T.30 – Transmitted file acceptable on a receiver

A sender transmits header as the first ECM page. As a receiver recognizes that the file is acceptable from the header, it transmits MCF. The sender transmits body as the next ECM page.
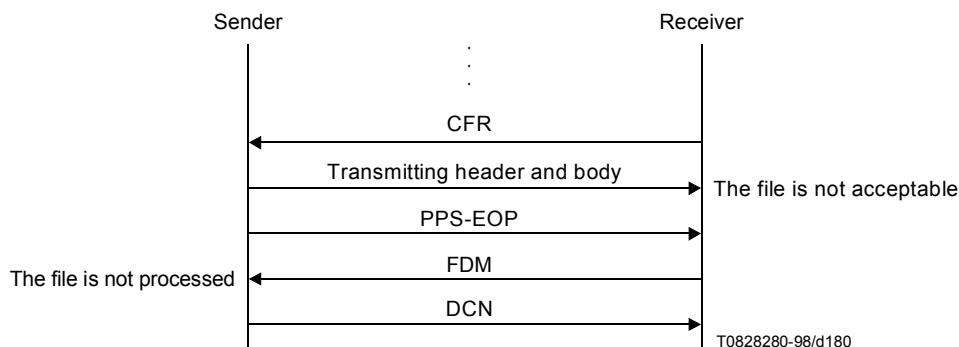
V.5.2.2 A transmitted file is processed on a sender. See Figure V.5.
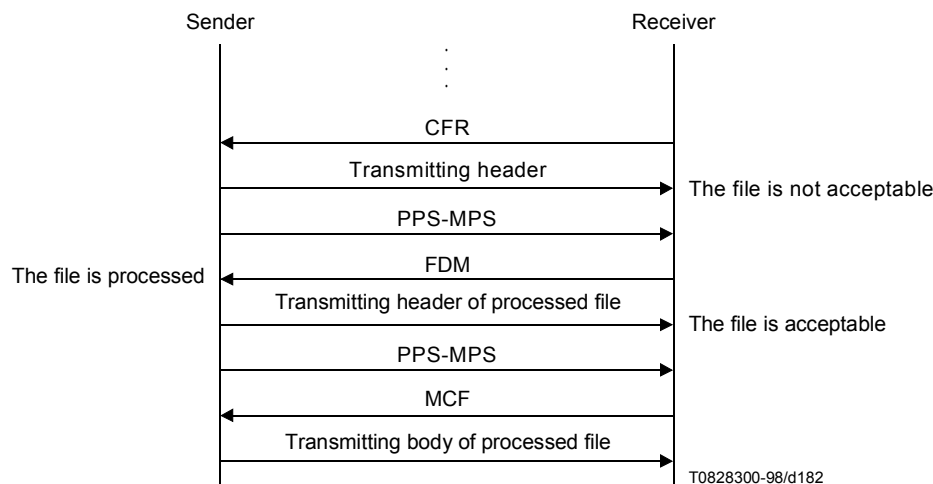
Figure V.5/T.30 – Transmitted file processed on a sender

A sender transmits header as the first ECM page. As a receiver recognizes that the file is not acceptable from the header, it transmits FDM and notifies the sender of the diagnostic message. The sender processes the file from the content of FDM and transmits header of the processed file as the next ECM page. The receiver transmits MCF and the sender transmits body of the processed file as the next ECM page.

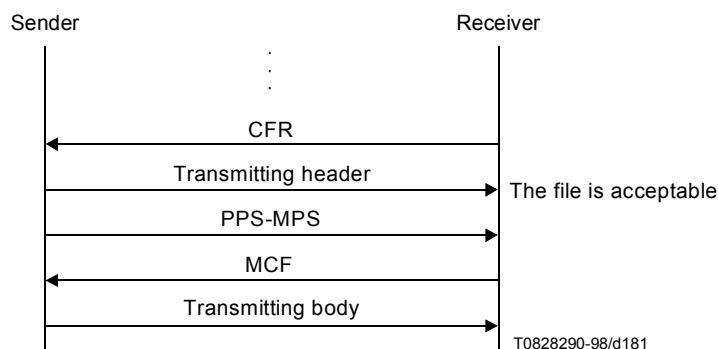**V.5.2.3** A transmitted file is not processed on a sender. See Figure V.6.
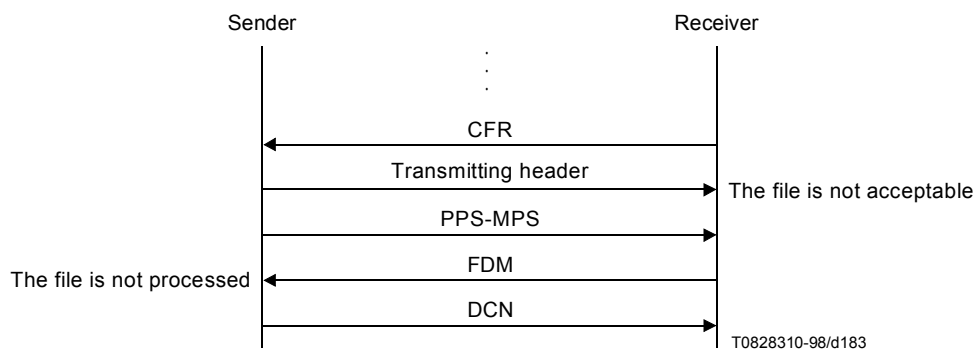
Figure V.6/T.30 – Transmitted file not processed on a sender

A sender transmits header as the first ECM page. As a receiver recognizes that the file is not acceptable from the header, it transmits FDM and notifies the sender of the diagnostic message. When the sender does not process the file from the content of FDM, it transmits DCN.

V.6 Extended BFT Negotiation via Phase B Method

Session examples for the Extended Phase B BFT method are provided. The examples below are based on flow diagrams and are for illustrative and instruction purposes only. They should not be interpreted as establishing or limiting the protocol.

V.6.1 Identification of BFT Capabilities followed by BFT File Transfer Negotiations (Selection of extended negotiations via V.8)

```
        Originator                                              Called Terminal
                                  <-------------------------------  DES   Identify BFT Capabilities
   BFT Transfer Request    DEC    ------------------------------->
                                  <-------------------------------  CFR   Accept BFT
                                                                          Transfer Request

   BFT Message                    ------------------------------->
   PPS-EOP                        ------------------------------->

                                  <-------------------------------  MCF
                                  ------------------------------->  DCN
```
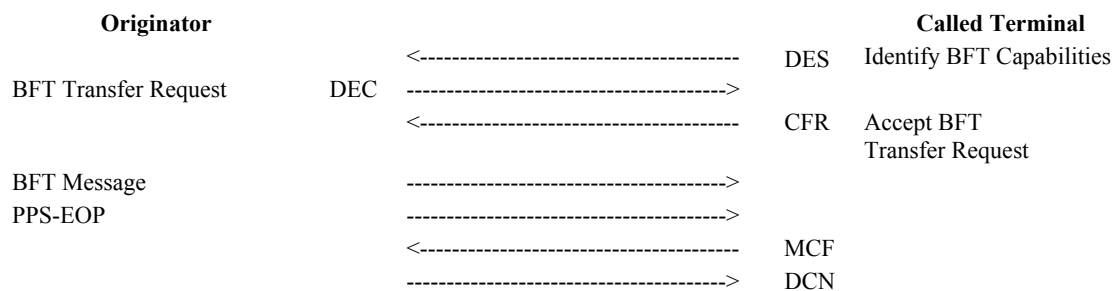
V.6.2 BFT File Transfer Negotiations in Phase B – Request rejected (Selection of extended negotiations via V.8)

```
        Originator                                              Called Terminal
                                  <-------------------------------  DES   Identify BFT Capabilities
   BFT Transfer Request       DEC ------------------------------->
                                  <-------------------------------  FNV   Reject File Transfer Request
   Revise BFT Transfer Request DEC ------------------------------->
                                  <-------------------------------  CFR
   BFT Message                    ------------------------------->
   PPS-EOP                        ------------------------------->

                                  <-------------------------------  MCF
                                  ------------------------------->  DCN
```

V.6.3 BFT File Transfer Request via Phase B (Single Step Indirect Entry)
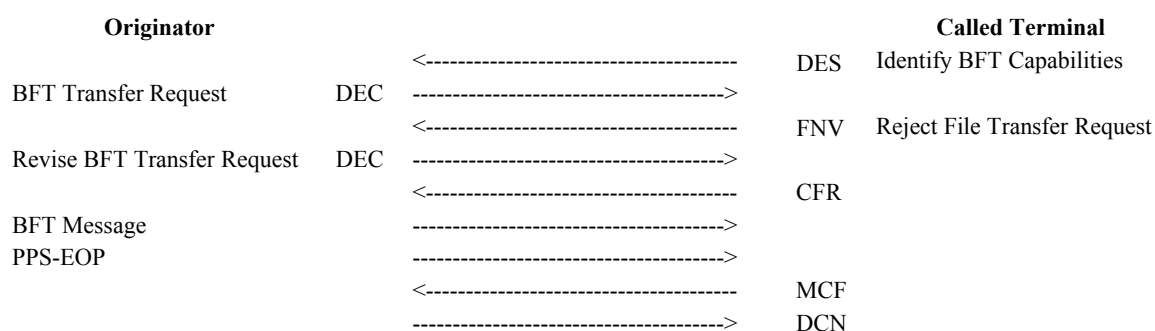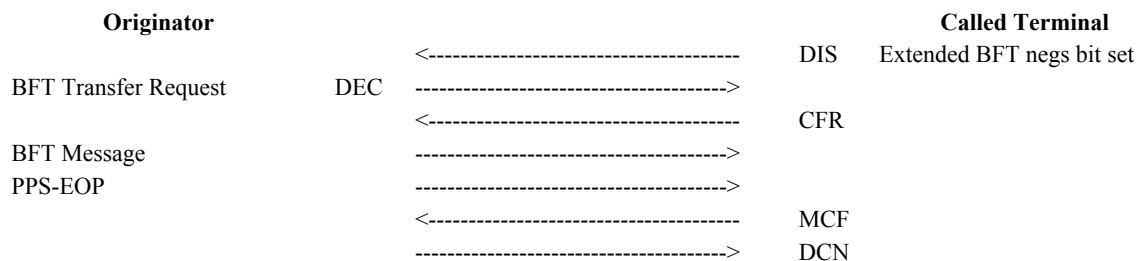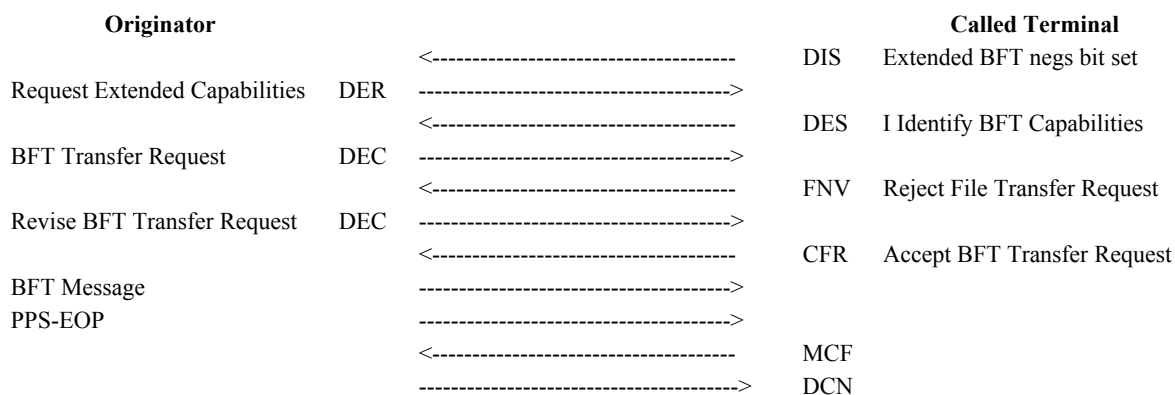
```
        Originator                                              Called Terminal
                                  <-------------------------------  DIS   Extended BFT negs bit set
   BFT Transfer Request    DEC    ------------------------------->
                                  <-------------------------------  CFR
   BFT Message                    ------------------------------->
   PPS-EOP                        ------------------------------->

                                  <-------------------------------  MCF
                                  ------------------------------->  DCN
```

V.6.4 BFT Capability Identification and File Transfer Request via Phase B (Indirect Entry)

```
        Originator                                              Called Terminal
                                  <-------------------------------  DIS   Extended BFT negs bit set
   Request Extended Capabilities DER ----------------------------->
                                  <-------------------------------  DES   I Identify BFT Capabilities
   BFT Transfer Request       DEC ------------------------------->
                                  <-------------------------------  FNV   Reject File Transfer Request
   Revise BFT Transfer Request DEC ------------------------------->
                                  <-------------------------------  CFR   Accept BFT Transfer Request
   BFT Message                    ------------------------------->
   PPS-EOP                        ------------------------------->

                                  <-------------------------------  MCF
                                  ------------------------------->  DCN
```

Sample Coding Example for this case:

Syntax of tag encoded data of first DER::=<Encapsulated Frame SG><SG Length><FIF of TSI Group><Group Length><TSI value>

Syntax of tag encoded data of DES response::=<BFT Negotiations SG><SG Length><File Types Group><Group Length><Sequence of Filetypes><Compression Types Group><Group Length><Sequence of Compression Types>

Syntax of tag encoded data of DEC used for BFT Transfer Request::=<BFT Negotiations SG><SG Length><Transfer Request Group><Group Length><BFT tags for T.434 Binary Data Message>

Appendix VI

Mixed Raster Content examples

The following examples illustrate how the various image parameters may be combined and changed between strips and pages as a function of the DIS/DTC and DCS negotiations as defined in ITU-T Rec. J.6. The relevant DIS/DTC and DCS bit definitions, per Table 2, are provided below:

Bit	Definition	Bit	Definition
15	200 × 200 pels/25.4 mm	16	Two-dimensional coding
31	T.6 coding	36	T.43 coding
98	100 × 100 pels/25.4 mm	42	300 × 300 pels/25.4 mm
43	400 × 400 pels/25.4 mm	68	JPEG coding
71	12 bits/pel component	73	No subsampling (1:1:1)
74	Custom illuminant	75	Custom gamut range
78	Single-progression sequential coding (ITU-T Rec. T.85)		

Bits 92, 93, 94	T.44 (MRC) Mode Definition
(1,0,0)	Base mode (Mode 1)
(0,1,0)	Extended Mode beyond three layers (Mode 2)

a)   In the example below, MMR (ITU-T Rec. T.6) and MH (ITU-T Rec. T.4, 1-D base mode) are the available bi-level coders. Switching between these two mask coders occurs on page boundary, the specific coder being used is identified in the Start of Page Marker Segment (SOP MS). JPEG and ITU-T Rec. T.43 are the available multilevel coders. JPEG or ITU-T Rec. T.43 may be used in either the background or foreground, switching between these two coders occurs on stripe boundary. Identification occurs in the data stream. The coders are made available for both layers by their identification in the SOP MS. Resolutions of 400 × 400 and 200 × 200 pels/25.4 mm are available for the mask layer. Switching between these two mask resolutions occurs on page boundary, the specific resolution being used is identified in the Start of Page Marker Segment (SOP MS). Resolutions of 400 × 400, 200 × 200 and 100 × 100 pels/25.4 mm or 200 × 200 and 100 × 100 pels/25.4 mm are available for the background and foreground layers when the mask resolution is 400 × 400 or 200 × 200 pels/25.4 mm respectively. Switching between these background and foreground resolutions occurs on stripe boundary. Identification occurs in the data stream. Only default colour resolution, subsampling, illuminant and gamut are available for the background and foreground layers.

Bits	15	16	31	36	98	42	43	68	71	73	74	75	78
DIS	1	1	1	1	1	1	1	1	1	1	1	1	1
DCS	1	0	1	1	1	0	1	1	0	0	0	0	0

	Coder	Spatial resolution	Colour resolution	Subsampling	Illuminant	Gamut
Page 1 stripe 1						
Mask	MMR	400	na	na	na	na
Background	ITU-T Rec. T.42	200	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.43	100	≤ 8 bpc	(4:1:1)	D50	Default
Page 1 stripe 2						
Mask	MMR	400	na	na	na	na
Background	ITU-T Rec. T.43	200	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.43	200	≤ 8 bpc	(4:1:1)	D50	Default
Page 1 stripe 3						
Mask	MMR	400	na	na	na	na
Background	ITU-T Rec. T.43	400	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	100	≤ 8 bpc	(4:1:1)	D50	Default
Page 2 stripe 1						
Mask	MH	200	na	na	na	na
Background	ITU-T Rec. T.43	100	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	200	≤ 8 bpc	(4:1:1)	D50	Default

b)   In the example below, JBIG (ITU-T Rec. T.85), MMR (ITU-T Rec. T.6) and MH (ITU-T Rec. T.4, 1-D base mode) are the available bi-level coders. Switching between these three mask coders occurs on page boundary; the specific coder being used is identified in the Start of Page Marker Segment (SOP MS). JPEG is the available multilevel coder. JPEG is used in both the background or foreground. The coder is made available for both layers by its identification in the SOP MS. Resolution of 300 × 300 pels/25.4 mm is available for the mask layer, it is identified in the Start of Page Marker Segment (SOP MS). Resolutions of 300 × 300 and 100 × 100 pels/25.4 mm are available for the background and foreground layers. Switching between these two background and foreground resolutions occurs on stripe boundary. Identification occurs in the data stream. Switching between the two available colour resolutions (8 or 12 bits/component) and the two subsamplings (4:1:1 or 1:1:1) in the background and foreground occurs on stripe boundary. Identification occurs in the data stream. Only default illuminant and gamut are available for the background and foreground layers.

Bits	15	16	31	36	98	42	43	68	71	73	74	75	78
DIS	1	1	1	1	1	1	1	1	1	1	1	1	1
DCS	0	0	1	0	1	1	0	1	1	1	0	0	1

	Coder	Spatial resolution	Colour resolution	Subsampling	Illuminant	Gamut
Page 1 stripe 1						
Mask	MMR	300	na	na	na	na
Background	ITU-T Rec. T.42	300 100	≤ 12 bpc	(1:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	100 100	≤ 8 bpc	(4:1:1)	D50	Default
Page 1 stripe 2						
Mask	MMR	300	na	na	na	na
Background	ITU-T Rec. T.42	300 100	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	300 100	≤ 8 bpc	(4:1:1)	D50	Default
Page 2 stripe 1						
Mask	JBIG	300	na	na	na	na
Background	ITU-T Rec. T.42	100 100	≤ 12 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	100 100	≤ 12 bpc	(1:1:1)	D50	Default
Page 3 stripe 1						
Mask	MH	300	na	na	na	na
Background	ITU-T Rec. T.42	100 100	≤ 8 bpc	(4:1:1)	D50	Default
Foreground	ITU-T Rec. T.42	100 100	≤ 8 bpc	(4:1:1)	D50	Default

c)   In the example below, MR (ITU-T Rec. T.4, 2-D) and MH (ITU-T Rec. T.4, 1-D base mode) are the available bi-level coders. Switching between these two mask coders occurs on page boundary, the specific coder being used is identified in the Start of Page Marker Segment (SOP MS). JPEG and ITU-T Rec. T.43 are the available multilevel coders. JPEG or ITU-T Rec. T.43 may be used in either the background or foreground; switching between these two coders occurs on stripe boundary. Identification occurs in the data stream. The coders are made available for both layers by their identification in the SOP MS. Resolution of 200 × 200 pels/25.4 mm is available for the mask layer, it is identified in the Start of Page Marker Segment (SOP MS). Resolutions of 200 × 200 and 100 × 100 pels/25.4 mm are available for the background and foreground layers. Switching between these background and foreground resolutions occurs on stripe boundary. Identification occurs in the data stream. Switching between the two available colour resolutions (8 or 12 bits/component) and the two subsamplings (4:1:1 or 1:1:1) in the background and foreground occurs on stripe boundary. Identification occurs in the data stream. Custom and default illuminant and gamut are available for the background and foreground layers. Switching between custom and default illuminant and gamut in the background and foreground occurs on stripe boundary. Identification occurs in the data stream.

Bits	15	16	31	36	98	42	43	68	71	73	74	75	78
DIS	1	1	1	1	1	1	1	1	1	1	1	1	1
DCS	1	1	0	1	1	0	0	1	0	1	1	1	1

	Coder	Spatial Resolution	Colour Resolution	Subsampling	Illuminant	Gamut
Page 1 stripe 1						
Mask	MH	200	na	na	na	na
Background	ITU-T Rec. 42	200	≤ 8 bpc	(1:1:1)	Custom	Custom
Foreground	ITU-T Rec. 43	100	≤ 8 bpc	(4:1:1)	D50	Default
Page 1 stripe 2						
Mask	MH	200	na	na	na	na
Background	ITU-T Rec. 43	200	≤ 8 bpc	(1:1:1)	D50	Custom
Foreground	ITU-T Rec. 43	100	≤ 8 bpc	(4:1:1)	Custom	Default
Page 2 stripe 1						
Mask	MR	200	na	na	na	na
Background	ITU-T Rec. 42	100	≤ 8 bpc	(1:1:1)	D50	Default
Foreground	ITU-T Rec. 43	100	≤ 8 bpc	(4:1:1)	D50	Default

Appendix VII

Application rules for use of V.8 with Group 3 facsimile

VII.1 Introduction

ITU-T Rec. V.8 is used to identify the capabilities and select the modes of operation of modems whose application and requirements vary. Confusion may occur if two facsimile terminals try to connect using V.8. If V.34 is not a mutual mode, then applying the rules of modulation selection as specified in V.8 may result in V.17, V.29 or V.27 *ter* being selected as the highest common modulation for Sig C and Sig A. This is not what is desired for Group 3 Facsimile, since the correct Sig A is V.21 channel 2. This appendix provides guidance on how to use and interpret V.8 to avoid the incorrect selection of modulation.

VII.2 Application rules

The basis of these procedures is to use the V.8 Call Function octets to determine the proper interpretation of the Modulation codepoints. The following procedures are recommended.

VII.2.1 Calling procedure

When transmitting CM the calling terminal sets the required facsimile Call Function, and its supported modulation codepoints should be identified.

VII.2.2 Answering procedure

The answering terminal responds in the JM sequence by indicating in the Call Function octet that it is also a facsimile terminal and identifies its common modulations by setting the appropriate codepoints.

VII.2.3 Decision procedure

If the agreed Call Function is a facsimile transaction, and the highest common modulation selected by the terminals is either V.17, V.29 or V.27 *ter*, then upon completion of the V.8 negotiation the answering modem conditions its transmitter and the calling modem its receiver for V.21 Channel 2. The terminals continue with the procedures as defined in clause 5.

NOTE – While the interpretation of the modulation bits for non-facsimile terminal applications is beyond the scope of this appendix, it is suggested the modulation bits be interpreted literally.

Appendix VIII

Examples for Internet routing/polling

NOTE – Signals indicated in parenthesis are optional.

VIII.1   Internet routing using e-mail fax through onramp and offramp gateways

Table VIII.1/T.30 – Phase 1: Calling facsimile terminal to the onramp gateway communication via T.30

Calling terminal	Onramp gateway
1) Traditional facsimile user sets document in standard facsimile terminal with IRA option. 2) Facsimile user introduces the international telephone number of the designated terminal to IRA. e.g., IRA: +41 1234 5678 Alternatively an E-mail address of the designated terminal (PC e-mail client, Internet aware facsimile terminal or standard facsimile terminal with optional Internet Address Exchange Protocol), e.g., ifax@ties.itu.int can be used, which is not applicable to this example. 3) Facsimile user introduces optional additional information for the called destination: (SUB) e.g., SUB:130 (SID) 4) Facsimile user selects Internet Provider or accepts the pre-set one (local function). 5) Facsimile user starts terminal. Terminal detects dial tone and dials telephone number of the gateway.	
	6) Gateway detects ring and answers the call Transmit CED/Begin facsimile procedure 7) (Transmit CSI) Transmit DIS with IRA-bit set; optional SUB- and SID-bits set.

**Table VIII.1/T.30 – Phase 1: Calling facsimile terminal to the onramp
gateway communication via T.30**

Calling terminal	Onramp gateway
8) DIS detected	
9) (Transmit TSI) (Transmit SUB:130) (Transmit SID) Transmit IRA: +41 1234 5678 Transmit DCS with IRA(/SUB/SID)-bit(s) set	
10) Continue with normal facsimile procedure (transmit fax message)	11) Continue with normal facsimile procedure (receive fax message)
	12) Send Phase D confirmation to the calling facsimile terminal.
13) Receive in Phase D confirmation from the onramp gateway	
14) Switch back to telephone.	15) Switch back to telephone.

Table VIII.2/T.30 – Phase 2: Onramp gateway to offramp gateway communication via T.37

Onramp gateway	Offramp gateway/Internet aware facsimile terminal
1) Communicate in T.37 mode of operation; map relevant information where applicable: IRA/(SUB) $\rightarrow$ E-mail address conforms to RFC 2304 e.g., IRA: +41 1234 5678, SUB:130 are designated by facsimile user, then e-mail address is FAX=+4112345678/T33S=130@faxworld.org where the domain name "faxworld.org" is generated in the onramp gateway by the appropriate method, and the method is outside the scope of this appendix. Information from the following signals may be used for access or authentication purposes locally at the onramp gateway: (TSI) (SID)	2) Communicate in T.37 mode of operation; receive left hand side of e-mail address.: Left hand side of e-mail address $\rightarrow$ Phone number to be dialled: +41 1234 5678 // (SUB:130)

**Table VIII.3/T.30 – Phase 3: Offramp gateway communication
to the called facsimile terminal via T.30**

Offramp gateway	Called facsimile terminal
1) Gateway switches to line. Gateway detects dial tone, takes telephone number: +41 1234 5678 from left hand side of e-mail address and dials this number.	
	2) Facsimile terminal detects ring and answers the call Transmit CED/Begin facsimile procedure
	3) (Transmit CSI) Transmit DIS; optional SUB- and SID-bits set.
4) DIS detected	
5) (Transmit TSI of the offramp gateway) (Transmit SUB:130 extracted from left hand side of e-mail address) (Transmit SID of the offramp gateway) Transmit DCS (with SUB/SID)-bit(s) set	
6) Continue with normal facsimile procedure (transmit fax message)	7) Continue with normal facsimile procedure (receive fax message)
	8) Send Phase D confirmation to the calling offramp gateway
9) Receive in Phase D confirmation from the called facsimile terminal.	
10) Switch back to telephone.	11) Switch back to telephone.

VIII.2 Internet routing using real-time fax

For further study.

VIII.3 Internet polling

For further study.

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