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TERMINALS FOR TELEMATIC SERVICES

ASYNCHRONOUS FACSIMILE DCE CONTROL – SERVICE CLASS 1

ANNEX B – PROCEDURE FOR SERVICE CLASS 1 SUPPORT OF V.34 MODEMS

Amendment 1 to
ITU-T Recommendation T.31

(Previously "CCITT Recommendations")

FOREWORD

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

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

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

Amendment 1 to ITU-T Recommendation T.31, was prepared by ITU-T Study Group 8 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 3rd of July 1996.

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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.

CONTENTS

SUMMARY

This amendment contains a new Annex B: "Procedure for Service class 1 support of V.34 modems" which support the features in future Recommendation T.30

ASYNCHRONOUS FACSIMILE DCE
CONTROL – SERVICE CLASS 1

Annex B

Procedure for Service Class 1 support of V.34 modems

(This annex forms an integral part of the Recommendation)

(Geneva, 1996)

B.1   Introduction

B.1.1   V.34 Modems

References in this annex to user data rates greater than 28,800 bits/s are in anticipation of an amended version of Recommendation V.34 expected in 1996.

Recommendation V.34 is standardized for use on the GSTN at rates up to 33,600 bit/s. Recommendation V.34 defines two modes of operation:

- Duplex (clauses 5, 7, 8, 9, 10.1, 11).

- Half duplex (clauses 5, 7, 8, 9, 10.2, 12).

Half duplex mode has two channels:

- Half duplex high speed primary channel

- Duplex low speed control channel

B.1.2   T.30 procedures for use with V.34 modems

Procedures for V.34 facsimile are defined for both V.34 modes:

- Annex C/T.30, with revisions, defines Group 3 facsimile duplex V.34.

- Annex F/T.30 defines Group 3 facsimile procedures for half duplex V.34.

This annex defines procedures for a Service Class 1 facsimile DCE to implement Annex C/T.30 or Annex F /T.30 with V.34 modems.

B.1.3   V.8 call negotiation

For all uses of Recommendation V.34, procedures defined in Recommendation V.8 are required for negotiating the call type. For T.30 operation, this includes determination of the V.34 mode (duplex or half-duplex) and the direction of the message (send or receive) if half duplex is used.

Annex A/V.25 *ter* defines procedures for a DCE to implement V.8 call negotiation under control of a DTE; these procedures are used in implementing Service Class 1 support for V.34 facsimile.

B.2   References

- ITU-T Recommendation V.34 (1996), *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.*

- ITU-T Recommendation V.25 *ter*/Annex A (1996), *Procedure for DTE – controlled call negotiation.*

- ITU-T Recommendation T.30 (1996).

B.3 Functions

A DCE compliant with this annex shall provide the following functions to the DTE:

    a) Procedures to control V.8 call type negotiation (e.g. Annex A/V.25 *ter*).

    b) Optional procedures to constrain the primary channel rate.

    c) Optional procedures to constrain the control channel rate.

    d) Procedures to simultaneously send and receive data in Annex C/T.30 operation.

    e) Procedures to simultaneously send and receive data in Annex F/T.30 operation.

    f) Procedures for flow control of DTE-DCE data streams.

    g) Procedures to control the V.34 mode.

    h) Indications of the V.34 state.

B.4 Definitions and conventions

The following definitions apply, in addition to those defined in this Recommendation or in Recommendations T.30 or V.34:

B.4.1 **source DCE**: The DCE which transmits primary channel data in half duplex mode.

B.4.2 **recipient DCE**: The DCE which receives primary channel data in half duplex mode.

B.4.3 **HDLC frame octets:** The binary coded information contained in the HDLC frames defined in Recommendation T.30 and its Annexes, consisting of the control octet, the address octet, received FCS octets and any FIF octets. The DCE generates and consumes: flags, flag transparency 0-bits, transmitted FCS octets.

B.5 Transparent data commands

Table 4 defines three Transparent Data Commands used in Service Class 1 facsimile DCE. This annex defines additional transparent data commands in Table B.1, for the following functions:

    a) shielding of escape characters in data;

    b) shielding of DC1 and DC3 characters for duplex DC1/DC3 in band flow control;

    c) transmit HDLC frames;

    d) transmit HDLC aborts;

    e) receive HDLC frames and indicate error/no-error FCS;

    f) indicate received HDLC aborts;

    g) carrier termination command and indication;

    h) half duplex primary/control channel selection and indication;

    i) rate renegotiation initiation, selection and indication;

    j) retrain initiation and selection;

    k) rate selection and indication.

Unless specified in the text, all transparent data commands defined are valid as commands from the DTE and as indications from the DCE.

B.6 Initial V.34 rate controls and indications

B.6.1 Initial V.34 rate controls, +F34 parameter

Write Syntax: +F34=[<maxp>][,[<minp>][,<prefc>][,<maxp2>][,<minp2]]

Valid Values: see subparameters below.

Default values: 0,0,0,0,0 no preference specified; data rate limits determined by DCE.

Description

V.34 channel rate negotiation is done by the modem, not T.30 Phase B DIS/DCS/TCF/CFR exchange. The DTE may use this parameter to constrain the DCE in V.34 rate negotiation.

The DTE may set them anytime before the commencement of the V.34 training in which thay are to take effect, including in advance of call establishment and V.8 negotiation. They remain in effect until altered by a subsequent <DLE><rate> transparent command code.

Subparameters

In half duplex V.34 operation, <maxp> is the maximum rate that the DCE may use for the primary channel, in units of 2400 bit/s. Valid non-zero <maxp> values range from 1 (2400 bit/s) to 14 (33 600 bit/s). In duplex operation, <maxp> is the maximum rate that the DCE may use for transmit data. If not set by the DTE, the default value 0 selects the maximum rate supported by the DCE.

In half duplex V.34 operation, <minp> is the minimum rate that the DCE may use for the primary channel. Valid values are the same as those defined for <maxp>. In duplex V.34 operation, <minp> is the minimum rate the DCE may use for transmit data. If not set by the DTE, the default value 0 selects the minimum rate supported by the DCE (2400 bit/s in Recommendation V.34).

In half duplex V.34 operation, <prefc> is the preferred rate that the DCE may use for the control channel receive rate, in units of 1200 bit/s. Valid <prefc> values are 1 (1200 bit/s) and 2 (2400 bit/s) and 0 (no preference specified). The default value is 0. If set to 0, the DCE allows the V.34 modem to select the rate. If set to 1 or 2, and if that rate is supported by the remote terminal, that rate is selected. This subparamter is ignored in duplex V.34 operation.

<maxp2> is the maximum rate that the DCE may use for receive data in duplex V.34 operation. Valid values are the same as those defined for <maxp>. If not set by the DTE, the default value 0 selects the same value as <maxp>. This subparameter is ignored in half duplex V.34 operation.

<minp2> is the minimum rate that the DCE may use for receive data in duplex V.34 operation. Valid values are the same as those defined for <maxp>. If not set by the DTE, the default value 0 selects the same value as <minp>. This subparameter is ignored in half duplex V.34 operation.

B.6.2   Initial V.34 rate indication

Syntax: +F34:<prate>,<crate>[,<crate2>]   for half duplex

or: +F34:<prate>[,<prate2>]   for duplex

The DCE shall issue this indication before the CONNECT result code is issued.

The DCE shall include a <prate> indication for duplex or half-duplex operation. Valid values for <prate> are the same as those defined for <maxp> (B.6.1). For duplex operation, the <prate2> indicates the receive rate, if different from the transmit rate.

If V.34 half duplex mode is used, the DCE shall also include a <crate> indication. <crate2> indicates the control channel receive rate, if different from the control channel transmit rate. Valid values for <crate> and <crate2> are the same as those defined for <prefc> (B.6.1).

TABLE B.1/T.31

Transparent data commands

Command pair symbol	T.50 code, printed	Subclauses	Description
<DLE><DLE> <DLE><SUB>	1/0 1/10	6.11 6.11	Character Transparency: substitute one 10h pattern substitute two 10h patterns
<DLE><DC1> <DLE><DC3>	5/1 5/3	B.7.3 B.7.3	Shielded Control Words: substitute one 11h pattern to enable flow control substitute one 13h pattern to disable flow control
<DLE><ETX> <DLE><ferr>	0/3 0/7	B.7 B.7	HDLC frame Delimiters End of HDLC frame w/o detected FCS error End of HDLC frame with FCS error
<DLE><EOT> <DLE><pri> <DLE><ctrl> <DLE><pph> <DLE><rtn> <DLE><mark> <DLE><rtnc>	 0/4 6/11 6/13 6/12 6/10 6/8 6/9	 B.8.3 B.8.4 B.8.4 B.8.5-B.8.6 B.8.7 B.9.8	V.34 mode selection/indication End transmission Select primary channel (12.5/V.34) Select control channel (half duplex only) (12.6/V.34) Request primary rate renegotiation (12.5/V.34) Request duplex retrain (12.7/V.34) Initiate termination of send (Figure F.5.11/T.30) Request control channel retrain
<DLE><c12> <DLE><c24>	6/14 6/15	B.8.4	V.34 control channel rate request/indication 1200 bit/s 2400 bit/s
<DLE><p24> <DLE><p48> <DLE><p72> <DLE><p96> <DLE><p120> <DLE><p144> <DLE><p168> <DLE><p192> <DLE><p216> <DLE><p240> <DLE><p264> <DLE><p288> <DLE><p312> <DLE><p336>	7/0 7/1 7/2 7/3 7/4 7/5 7/6 7/7 7/8 7/9 7/10 7/11 7/12 7/13	B.8.4	V.34 primary channel rate request/indication 2 400 bit/s 4 800 bit/s 7 200 bit/s 9 600 bit/s 12 000 bit/s 14 400 bit/s 16 800 bit/s 19 200 bit/s 21 600 bit/s 24 000 bit/s 26 400 bit/s 28 800 bit/s 31 200 bit/s 33 600 bit/s

B.7   DTE-DCE Data

For V.34 transfer between DTE and DCE, the following procedures apply:

B.7.1   DTE to DCE messages

After the CONNECT result code, the DCE shall accept three types of data from the DTE.

  a)   Transparent data commands, as defined in Table B.1.

  b)   HDLC frame octets, terminated by <DLE><ETX>.

  c)   <DLE><DC1> and <DLE><DC3> commands for flow control of data from the DCE.

B.7.2   DCE to DTE messages

After the CONNECT result code, the DCE shall send three types of data to the DTE.

  a)   Transparent data indications, as defined in Table B.1.

  b)   HDLC frame octets, terminated by <DLE><ETX> or <DLE><ferr>.

  c)   <DLE><DC1> and <DLE><DC3> commands for flow control of data from the DTE.

B.7.3 HDLC frame data

The DCE shall transmit FLAGs upon DTE data underrun.

HDLC frame octet data may not contain control character <DLE>. Therefore, the Transparent Data commands defined in Table B.1 shall be used to represent the characters.

Each HDLC frame sent from the DTE to the DCE shall be terminated by the <DLE><ETX> transparent data command.

Each HDLC frame sent from the DCE to the DTE shall be terminated by the <DLE><ETX> transparent data command if the received FCS sequence is valid, or by the <DLE><ferr> transparent data command if the received FCS sequence is invalid. This received HDLC frame shall include the FCS sequence, or a substitute sequence of the same length.

B.8 Source terminal procedures

This subclause defines procedures for the Source DCE and DTE.

B.8.1 Transition from V.8 negotiation

After V.8 negotiation is complete, the T.30 procedures must commence. These begin with V.34 carrier training, as preconfigured by the V.8 negotiation (direction, half duplex or duplex mode) and the +F34 command (rates).

The DCE shall decode V.8 negotiation to detect these selections, and prepare to conduct V.34 carrier training in the appropriate mode. If the source DCE is the originate terminal, it shall issue appropriate indication of the JM selections (e.g. A.6.5/V.25 *ter*) and prompt the DTE for the command to complete Recommendation V.8 (send CJ) and initiate V.34 training. If the source DCE is the answer terminal, the DTE should issue the ATO command on the same command line as the +A8M command (or the ATA command if configured for DCE-controlled V.8 negotiation). This is necessary as the DCE must stop JM transmission shortly after receiving CJ to avoid missing the beginning of the V.34 training sequence.

B.8.2 Initiate procedures

The DCE shall accept an ATO command to complete Recommendation V.8 and initiate V.34 procedures. The DCE shall acknowledge this command with the following consecutive messages:

     a) an +A8J:1 indication (A.6.4/V.25 *ter*).

     b) an +F34 indication (B.6.2).

     c) a CONNECT result code (Table 3).

     d) If in half duplex mode, a <DLE><ctrl><DLE><prate><DLE><crate>[<DLE><crate2>] transparent data commands.
        If in duplex mode, a <DLE><pri><DLE><prate>[<DLE><prate2>] transparent data commands.

Once the DCE has connected, it shall transmit HDLC flags until it receives data from the DTE, and shall hunt for HDLC flags in the received data.

This command is issued once for each T.30 message transfer. If the Source DTE sends an EOM signal to the remote terminal, the V.8 procedures will be repeated, so ATO command execution must be terminated.

B.8.3 Terminate procedures

B.8.3.1 Terminating events

ATO command execution is terminated by one of three events:

- Source DTE issues a <DLE><EOT> transparent data command to the DCE.

- Remote terminal disconnection by the DCE, using any standard or proprietary means.

- DCE reset.

B.8.3.2 DTE initiated termination

If the DTE terminates ATO execution by <DLE><EOT>, the DCE shall:

    a)   if sending an HDLC frame, complete sending the frame, including FCS and final flag;

    b)   send an HDLC abort;

    c)   send any V.34 specific carrier termination signals;

    d)   if in half duplex mode, wait for remote carrier to turn off;

    e)   stop carrier transmission;

    f)   issue <DLE><EOT> and an OK final result code to the DTE;

    g)   stay connected to the GSTN;

    h)   switch to command mode.

B.8.3.3 DCE initiated termination

If the DCE detects remote disconnection or if the half duplex mode receives at least 40 consecutive ones from the remote DCE, the DCE shall:

    a)   stop carrier transmission;

    b)   stay connected to the GSTN;

    c)   send <DLE><EOT> to the DTE;

    d)   issue an OK final result code to the DTE;

    e)   switch to command mode.

B.8.4 Half-duplex modem channel selection

In Annex F/T.30, the source terminal is responsible for selecting between the primary and control channels in half duplex mode. The recipient DCE is signalled to switch between primary and control channels by signals from the source DCE.

If the DTE issues a <DLE><pri> transparent command, the DCE shall:

    a)   If sending an HDLC frame, complete sending the frame, including FCS and final flag.

    b)   Follow procedures defined in Annex F/T.30 to switch to primary channel.

    c)   Indicate success to the DTE with the <DLE><pri> transparent data command.

    d)   Append a transparent data command to indicate the rates (Table B.1).

If the DTE issues a <DLE><ctrl> transparent command, the DCE shall:

    a)   If sending an HDLC frame, complete sending the frame, including FCS and final flag.

    b)   Follow procedures defined in Annex F/T.30 to switch to the control channel.

    c)   Indicate success to the DTE with the <DLE><ctrl> transparent data command.

    d)   Append a transparent data command to indicate the (possibly renegotiated) primary channel rate (Table B.1).

    e)   Append a transparent data command to indicate the control channel rate (Table B.1).

    f)   Append a transparent data command to indicate the receive control channel rate if different than the transmit rate (Table B.1).

If either attempted channel change results in a failure condition (e.g. disconnection), the DCE shall issue an appropriate transparent data command (e.g. <DLE><EOT> for disconnection) and, if necessary, terminate ATO command execution, stay connected to the GSTN, and switch to command mode.

B.8.5 Half-duplex mode rate renegotiation

Annex F/T.30 provides for rate renegotiation between message elements (e.g. partial pages), at the beginning of control channel operation (e.g. Phase D). If the DTE issues a <DLE><pph> command to the DCE, optionally preceded by a primary channel rate command and/or a control channel rate command, the DCE shall:

  a) Request a rate renegotiation after the next transition from primary to control channel begins.

  b) If a primary rate channel command is received, constrain the new maximum primary rate to the value specified in that command.

  c) If a control channel rate command is received, constrain the new maximum control channel receive rate to the value specified in that command.

  d) Indicate the resulting primary channel and control channel rates to the DTE after the next transition to control channel operation is indicated.

B.8.6 Duplex rate negotiation

Annex C/T.30 does not address rate renegotiation; this is within the scope of Recommendation V.34. If the DTE issues a <DLE><pph> command to the DCE, optionally preceded by a primary channel rate command, the DCE shall:

  a) Use V.34 procedures to request a rate renegotiation.

  b) If a primary rate channel command is received, constrain the new maximum rate to the value specified in that command.

  c) Indicate the resulting channel rates to the DTE after rate renegotiation is completed.

B.8.7 V.34 retrain

If the DTE issues a <DLE><rtn> command in duplex mode or <DLE><rtnc> command in half duplex mode to the DCE, optionally preceded by a primary rate channel rate command, the DCE shall:

  a) Use V.34 procedures to request a retrain. (For half-duplex mode, only control channel retrains during control channel mode are allowed in Annex F/T.30.)

  b) If a primary rate channel command is received, constrain the new maximum rate to the value specified in that command.

  c) If a control channel rate command is received in half duplex mode, constrain the new maximum control channel maximum rate to the value specified in that command.

  d) Indicate the resulting channel rates to the DTE after retrain is completed.

B.9 Recipient terminal procedures

This subclause defines procedures for the Receiving DCE and DTE.

B.9.1 Transition from V.8 negotiation

After V.8 negotiation is complete, T.30 procedures must commence. These begin with V.34 carrier training, as determined by the V.8 negotiation (half duplex source, half duplex recipient, or duplex mode) and +F34 command (rates).

The DCE shall decode V.8 negotiation to detect these selections, and prepare to conduct V.34 carrier training in the appropriate mode. If the recipient DCE is the answer terminal, the DTE should issue the ATO command on the same command line as the +A8M command (or the ATA command if configured for DCE-controlled V.8 negotiation). This is necessary as the DCE must stop JM transmission shortly after receiving CJ to avoid missing the beginning of the V.34 training sequence. If the recipient DCE is the originate terminal, it shall issue the appropriate indication of the JM selections and prompt the DTE for the command to initiate V.34 procedures.

B.9.2 Initiate procedures

The DCE shall accept an ATO command to complete Recommendation V.8 and initiate V.34 procedures. The DCE shall acknowledge this command with the following consecutive messages:

a) an +A8J:1 indication (A.6.4./V.25 *ter*).

b) an +F34 indication (B.6.2).

c) a CONNECT result code (Table 3).

d) If in half duplex mode, a <DLE><ctrl><DLE><prate><DLE><crate>[<DLE><crate2>] transparent data commands, if in half-duplex mode.
If in duplex mode, a <DLE><pri><DLE><prate>[<DLE><prate2>] transparent data commands.

Once the DCE has connected, it shall transmit HDLC flags until it receives data from the DTE, and shall hunt for HDLC flags in the received data.

This command is issued once for each T.30 message transfer. If the Source terminal sends an EOM signal to the Recipient DCE and DTE, the V.8 procedures will be repeated, so ATO command execution must be terminated.

B.9.3 Terminate procedures

B.9.3.1 Termination events

ATO command execution is terminated by one of three events:

a) Receiving DTE issues a <DLE><EOT> transparent data command to the DCE.

b) Remote terminal disconnection by the DCE, using any standard or proprietary means.

c) DCE reset.

B.9.3.2 DTE initiated termination

If the DTE terminates ATO execution by <DLE><EOT>, the DCE shall:

a) if sending an HDLC frame, complete sending the frame, including FCS and final flag;

b) send an HDLC abort, if there is primary or message carrier active;

c) send any V.34 specific carrier termination signals;

d) if in half duplex mode, wait for remote carrier to turn off;

e) stop carrier transmission, if active;

f) issue <DLE><EOT> and an OK final result code to the DTE;

g) stay connected to the GSTN;

h) switch to command mode.

B.9.3.3 DCE initiated termination

If the DCE detects remote disconnection, the DCE shall:

a) stop carrier transmission;

b) stay connected to the GSTN;

c) send <DLE><EOT> to the DTE;

d) issue a NO CARRIER final result code to the DTE;

e) switch to command mode.

B.9.4 Half-duplex modem channel indication

In Annex F/T.30, the source terminal is responsible for selecting between the primary and control channels in half-duplex mode. The recipient DCE is signalled to switch between primary and control channels by signals from the source DCE.

When the recepient DCE begins the procedure to switch to primary channel, it shall indicate this with the <DLE><pri> transparent command. When the channel switching procedure is complete, the DCE shall indicate this with the appropriate transparent rate commands (Table B.1).

When the recipient DCE begins the procedure to switch to control channel, it shall indicate this with the <DLE><ctrl> transparent command. When the channel switching procedure is complete, the DCE shall indicate this with the appropriate transparent primary channel and control channel rates in Table B.1.

If either attempted channel change results in a failure condition (e.g. disconnection), the DCE shall issue an appropriate transparent data command (e.g. <DLE><EOT> for disconnection) and, if necessary, terminate ATO command execution, stay connected to the GSTN, and switch to command mode.

If the recipient DTE issues any channel switching commands during ATO execution, the DCE shall ignore them.

B.9.5 Half-duplex mode rate renegotiation

Procedures for the receiving DTE to request rate renegotiation during half-duplex operation, and for DCE indications, are identical to those defined in B.8.5. The differences between sending and receiving terminal DCE-to-DCE procedures are described in Annex F/T.30.

B.9.6 Duplex rate negotiation

Procedures for the receiving DTE to request rate renegotiation during full-duplex operation, and for DCE indications, are identical to those defined in B.8.6. The differences between sending and receiving terminal DCE-to-DCE procedures are described in Recommendation V.34.

B.9.7 V.34 retrain

Procedures for the receiving DTE to request a retrain, and for DCE indications, are identical to those defined in B.8.7. The differences between sending and receiving terminal DCE-to-DCE procedures are described in Recommendation V.34.

B.9.8 Turn around polling

When an answer DTE intends to initiate the termination of a recipient message in preparation to initiate a receive turn around polling, the recipient DTE issues a <DLE><mark> command. When the source terminal has terminated its carrier, the recipient DCE shall also terminate its carrier and issue a <DLE><EOT> indication and an OK final result.

B.10 Sample sessions (Informative)

In these informative examples, actions between the DTE and DCE on both the originating and answering side are illustrated.

The procedures defined for V.8 negotiation control in Annex A/V.25 *ter* are used in these examples.

For conciseness, in these examples, T.30 HDLC frames are represented by their T.30 three character frame abbreviation in [square brackets]. [DIS] represents the Control, Address, and FIF, terminated by <DLE><ETX>, or by <DLE><BEL> if an FCS error was detected on reception.

For clarity, the symbolic versions of transparent data commands are used.

Some examples of rate changes and renegotiations are included. This does not imply that these are common occurences in V.34 operation.

B.10.1 Originate and send a 2-page facsimile with V.34 half duplex

DTE controlled V.8

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
AT+A8E=3,,	OK	-		send CNG
AT+FCLASS=1.0	OK	select Class 1		
AT+F34=14,4,2	OK	PC preferred rate = 33.6~9.6 CC=2400		
ATD<string>		off hook, dial	detect ringing	
		send CNG	answer	
	+A8A:1	detectANSam	detect CNG	
	(1 sec delay) OK	stop CNG	send ANSam	
AT+A8M=8185D490		send CM	detect CM	try send w/any FAX carrier
	+A8M:8185D490 OK	detect JM	send JM	remote chooses V.34 HD
ATO	+A8J:1 +F34 =14,2	send CJ delay 75 ms	detect CJ	
	CONNECT	negotiate V.34 connection	negotiate V.34 connection	primary = 33 600 control = 2400 CC has begun
	<DLE><ctrl><DLE><p336><DLE><C24>			
	[DIS]<DLE><ETX>	get DIS	send DIS	
[DCS]<DLE><ETX>		send DCS	get DCS	in-band commands for character transparency may also be needed
	[CFR]<DLE><ETX>	get CFR	send CFR	
<DLE><pri>	<DLE><pri><DLE><p336>	change to primary channel	change to primary channel	
[FCD] frames		send FCD frames	receive FCD frames	assume some errors
<DLE><ctrl>	<DLE><ctrl><DLE><p240><DLE><C24>	change to control channel	change to control channel	remote asks for primary rate reduction
[PPS-MPS]<DLE><ETX>		send PPS-MPS	get PPS-MPS	

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
	[PPR]<DLE><ETX>	get PPR	send PPR	report errors
<DLE><pri>	<DLE><pri><DLE><p240>	change to primary at 24 000 bit/s	change to primary at 24 000 bit/s	
retry on some [FCD] frames		send FCD frames	receive FCD frames	no more errors
<DLE><ctrl>	<DLE><ctrl><DLE><p240><DLE><c12>	change to control channel	change to control channel	remote wants to reduced CC rate
[PPS-MPS]<DLE><ETX>		send PPS-MPS	get PPS-MPS	
	[MCF]<DLE><ETX>	get MCF	send MCF	
<DLE><pri>	<DLE><pri><DLE><p240>	change to primary w/o rate change	change to primary w/o rate change	leave primary rate, DCE does not step up
send new [FCD] for second page		send second page FCD	received second page	
<DLE><ctrl>	<DLE><p240><DLE><c12><DLE><ctrl>	change to control channel	change to control channel	
[PPS-EOP]<DLE><ETX>		send PPS-EOP	get PPS-EOP	
	[MCF]<DLE><ETX>	get MCF	send MCF	
[DCN]<DLE><ETX>		send DCN	get DCN	
<DLE><EOT>	OK	terminate V.34 channel	detect V.34 channel termination	
ATH	OK	hang up		

B.10.2   Answer scenerios

B.10.2.1 Answer and receive a 2-page facsimile with V.34 half duplex

Transmit ANSam immediately after answering, not trying to detect call signal.

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
AT+A8E=,2,	OK	-		send ANSam
AT+FCLASS=1.0	OK	select Class 1		
AT+F34=10	OK	max V.34 rate preferred		DTE sets max rate to 24 000 bit/s
	RING	detect ringing	dial	

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
ATA		off hook (delay 200ms) send ANSam ignore CNG detect CM	send CNG detect ANSam end CM	either V.34 OK
	+A8M:8185D490 OK			
AT+A8M=8185D490;0		send JM	detect JM	DTE chooses V.34 HD
	+A8J:1 +F34:10,1 CONNECT <DLE><ctrl><DLE> <P224><DLE><C12>	detect CJ negotiate Rec. V.34	send CJ negotiate Rec. V.34	negotiated to 24 000 bit/s, and 1200 bit/s for control channel
[DIS]<DLE><ETX>		send DIS	get DIS	
	[DCS]<DLE><ETX>	get DCS	send DCS	
[CFR]<DLE><ETX>		send CFR	get CFR	
	<DLE><pri><DLE> <p240>	change to primary rate	change to primary rate	
	good received FCD frames	get FCD frames	send FCD frames	
	[FCD] <DLE><ferr>	get FCD frame w/bad FCS	send FCD frame	bad frame(s) received
	more good FCD frames	get FCD frames	send FCD frames	
	more [FCD] <DLE><ferr>	get FCD frame w/bad FCS	send FCD frame	bad frame(s) received
<DLE><p216><DLE> <pph>				DTE requests rate reduction
	more good FCD frames	get FCD frames	send FCD frames	
	<DLE><ctrl><DLE> <p216><DLE><C12>	change to control channel	change to control channel	
	[PPS-NULL] <DLE><ETX>	get PPS-NULL	send PPS-NULL	
[PPR]<DLE><ETX>		send PPR	get PPR	
	<DLE><pri><DLE> <p216>	change to primary channel w/rate change	change to primary channel w/rate change	rate reduction accepted
	second page [FCD] frames	get good FCD frames	send FCD frames	no errors
	<DLE><ctrl><DLE> <P216><DLE><c12>	change to control channel	change to control channel	
	[PPS-EOP] <DLE><ETX>	get PPS-EOP	send PPS-EOP	
[MCF]<DLE><ETX>		send MCF	get MCF	
	[DCN]<DLE><ETX>	get DCN	send DCN	
	<DLE><EOT> OK	detect V.34 carrier termination	terminate V.34 carrier	
ATH		hangup		

B.10.2.2 Answer and receive a facsimile with V.34 half duplex

Transmit ANSam after receiving 2 CNG [or any CI (+A8I) or time out (+A8C:0)]

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
AT+A8E=,3,	OK	-		send no signal
AT+FCLASS=1.0	OK	select Class 1		
AT+F34=10	OK	max V.34 rate preferred		DTE sets max rate to 24 000 bits/s
	RING	detect ringing	dial	
ATA	+A8C:1	off hook detect 1st CNG	send CNG	
	+A8C:1 (no final result code)	(some delay) detect 2nd CNG		
any-key-abort	OK			
AT+A8E=,2,	+A8M:8185D490 OK	immediately transmit ANSam detect CM	send CM	
...				

B.10.2.3 Answer and receive a facsimile with V.34 half duplex

Transmit ANSam after receiving CI (+A8I).

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
AT+A8E=,3,	OK	-		send no signal
AT+FCLASS=1.0	OK	select Class 1		
AT+F34=10	OK	max V.34 rate preferred		DTE sets max rate to 24 000 bit/s
	RING	detect ringing	dial	
ATA		off hook	send CI	
	+A8I:81	detect 1st CI (some delay)		
	+A8I:81 (no final result code)	detect 2nd CI		
any-key-abort	OK			
AT+A8E=,2,	+A8M:8185D490 OK	immediately transmit ANSam detect CM	send CM	
...				

B.10.3   Control channel retrain

B.10.3.1 Control channel retrain – Initiator

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
...				
[DIS]<DLE><ETX>		send DIS	get DIS	
		DCS not received	send DCS	
[DIS}<DLE><ETX>		send DIS	get DIS	
		DCS not received	send DCS	
[DIS}<DLE><ETX>		send DIS	get DIS	
		DCS not received	send DCS	
<DLE><rtnc>	<DLE><rtnc>			CC retrain started
	<DLE><ctrl><DLE><P240><DLE><C12>			CC retrain completed
[DIS}<DLE><ETX>		send DIS	get DIS	
	[DCS]<DLE><ETX>	get DCS	send DCS	
...				

B.10.3.2 Control channel retrain – Responder

DTE commands and data	DCE indications and data	DCE actions	Remote terminal actions	Notes
...				
	[DCS]<DLE><ETX>	get DCS	send DCS	
[CFR]<DLE><ETX>		send CFR	CFR not received	
	<DLE><rtnc>			CC retrain commenced
	<DLE><ctrl><DLE><P240><DLE><C12>			CC retrain completed
	[DCS]<DLE><ETX>	get DCS	send DCS	
[CFR]<DLE><ETX>		send CFR	CFR received	
...				

B.10.4 Originate and do initial polling

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
AT+A8E=3,,	OK	-		send CNG
AT+FCLASS=1.0	OK	select Class 1		
AT+F34=14,4	OK	max V.34 rate preferred = 33.6 ~ 9.6k		
ATD<string>		off hook, dial	detect ringing	
			answer	
		send CNG	detect CNG	
	+A8A:1	detect ANS stop CNG	send ANSam	
	(1 sec delay) OK	detect ANSam		
AT+A8M=A185D490		send CM	detect CM	try send w/any FAX carrier
	+A8M:A185D490 OK	detect JM	send JM	remote chooses V.34 HD
ATO	+A8J:1 +F34 =14,2 CONNECT	send CJ delay 75ms negotiate V.34 connection	detect CJ negotiate V.34 connection	
	<DLE<ctrl><DLE> <p336><DLE><C24>			primary = 33 600 control = 2400
	[DIS]<DLE><ETX>	get DIS	send DIS	
[DTC]<DLE><ETX>		send DTC	get DTC	
	[DCS]<DLE><ETX>	get DCS	send DCS	
[CFR]<DLE><ETX>		send CFR	get CFR	
	<DLE><pri><DLE> <p240>	change to primary rate	change to primary rate	
...				

B.10.5   Turnaround polling

B.10.5.1 Turnaround polling – Call terminal procedures – Tx to RX on call side

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
...				
send [FCD]		send page FCD	received page	
<DLE><ctrl>	<DLE><ctrl><DLE><p240><DLE><c12>	change to control channel	change to control channel	
[EOM]<DLE><ETX>		send EOM	get EOM	
	[MCF]<DLE><ETX>	get MCF	send MCF	
				wait
	[DIS]<DLE><ETX>	get DIS	send DIS	
[DTC]<DLE><ETX>		send DTC	get DTC	
	<DLE><EOT>	got 40 1's	send 1's	
	OK			
AT+F34=14,4; +A8E=5,,; +A8M=A185D490	+A8M:A185D490 OK	send CM detect JM	detect CM send JM	start Rec. V.8, send no tones send within 70 ± 5ms of CC turnoff
ATO	+A8J:1 +F34:14,2 CONNECT <DLE><ctrl><DLE><p336><DLE><C24>	send CJ negotiate V.34 connection	detect CJ negotiate V.34 connection	primary = 33 600 control = 2400
	[DCS]<DLE><ETX>	get DCS	send DCS	
[MCF]<DLE><ETX>		send MCF	get MCF	
...				

B.10.5.2 Turnaround polling – Answer terminal procedures – TX to RX on call

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
...				
	[DTC]<DLE><ETX>	get DTC	send DTC	
<DLE><EOT>		start sending 1's		
	<DLE><EOT> OK		turn off carrier	
AT+A8E=,3,		wait for CM		start Rec. V.8, send no signal
AT+A8M=A185D490	+A8M:A185D490 +A8J:1 OK	get CM send JM get CJ	send CM get JM end CJ	
ATO				RX in call modem
...				

B.10.5.3 Turnaround polling – Call terminal procedures – RX to TX on Call

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
...				
[DIS]<DLE><ETX>		send DIS	get DIS	
	[DTC]<DLE><ETX>	get DTC	send DTC	
<DLE><EOT>		send 1's	get 40 1's	
	<DLE><EOT> OK		turn off carrier	
AT+F34=14,4; +A8E=5,,; +A8M=8185D490	 +A8M:8185D490 OK	 send CM detect JM	 detect CM send JM	start Rec. V.8, send no signal send within 70 ± 5m of CC turnoff
ATO	+A8J:1 +F34:14,2 CONNECT <DLE><ctl><DLE> <p336><DLE><C24>	send CJ negotiate V.34 connection	detect CJ negotiate V.34 connection	primary = 33 600 control = 2400
[DCS]<DLE><ETX>		send DCS	get DCS	
...				

B.10.5.4 Turnaround Polling – Answer Terminal procedures – RX to TX from Call

DTE commands and data (103)	DCE indications and data (104)	DCE actions	Remote terminal actions	Notes
...				
[DTC]<DLE><ETX>		end DTC	get DTC	
	<DLE><EOT> OK		received 40 1's turn off carrier	
AT+A8E=,3,		wait for CM		start Rec. V.8, send no tones
 AT+A8M=8185D490	+A8M:8185D490 OK	get CM send JM	send CM get JM	
ATO	+A8J:1 (etc.)	get CJ	send CJ	
...				