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TERMINALS FOR TELEMATIC SERVICES

**ASYNCHRONOUS FACSIMILE DCE
CONTROL – SERVICE CLASS 2**

ITU-T Recommendation T.32

(Previously “CCITT Recommendation”)

FOREWORD

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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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SUMMARY

A Group 3 Facsimile Terminal may include a DTE and a Facsimile DCE. This Recommendation describes a Facsimile DCE that includes physical, data link and session layer functions, including the Recommendation T.30 session protocol. The corresponding DTE must implement Recommendations T.4, T.6, T.434 or other higher layer functions.

KEYWORDS

Class 2; DCE; Group 3 Facsimile; Modem; Programmable Communications Interface.

ASYNCHRONOUS FACSIMILE DCE CONTROL – SERVICE CLASS 2

(Geneva, 1995)

1 Introduction and scope

1.1 Facsimile terminals

Group 3 Facsimile terminals were developed for sending digitized documents over the General Switched Telephone Network (GSTN). These facsimile terminals are now in widespread use around the world.

The operation of Group 3 Facsimile terminals has been standardized in Recommendations T.4, T.6 and T.30.

1.2 Facsimile DCE

There are two types of adapters which allow Data Terminal Equipment (DTE) to communicate as Group 3 facsimile terminals. Some of these adapters are installed inside the DTE, on the processor bus; these are called “fax boards”. Others are configured as an external “facsimile DCE”, connected to the DTE by a standard serial port (e.g. Recommendation V.24), using serial data interchange and start-stop framing as defined in Recommendation V.4.

1.3 Scope

This Recommendation contains protocols for use between a DTE and a facsimile DCE. It supports automatic calling and answering.

This Recommendation defines the commands that the DTE may issue to configure and control the DCE and the responses the facsimile DCE shall issue to those commands.

This Recommendation is useful for intelligent DTEs and DTE software, facsimile DCEs and facsimile terminals with digital connection to DTEs.

This Recommendation assumes that the DTE and DCE are connected via serial asynchronous connection using V.24 circuits; it requires the provision of the Packet Protocol (clause 9) when used on serial ports. However, the protocols defined may be implemented in any environment that provides a character serial bidirectional data stream, including processor-bus-attached “fax boards”, local area networks, Small Computer Systems Interface (SCSI, ISO 9316), IEEE 1284, etc. The adaptation of these protocols and procedures to these alternative communication schemes is beyond the scope of this Recommendation.

1.4 Overview

A system including a DTE and a facsimile DCE partitions Group 3 facsimile functions between the two devices. There are several levels in the communications path where a functional partition can be made. This Recommendation describes a protocol for use at one of those levels, Service Class 2. Each level is described as a “Service Class” based on the increasing number of functions performed by the DCE.

1.4.1 Service Class 1

Service Class 1 is defined in Recommendation T.31, Asynchronous Facsimile DCE Control Standard, Service Class 1, which describes a set of services at the physical and data link layers: waiting, signalling and HDLC data formatting. T.30 session management and T.4 or T.6 image data handling are done by the DTE.

1.4.2 Service Class 2

Service Class 2, as defined in this Recommendation, manages a set of services defined by Recommendation T.30. In Service Class 2 the facsimile DCE makes and terminates calls, manages the communication session, transports image data and may optionally convert between T.4 or T.6 image formats. The DTE prepares and interprets image data in compressed form, as described in Recommendation T.4 or T.6. The DTE transfers the image data as required by Recommendation T.30, prompted by the DCE.

2 Normative references

The following ITU-T Recommendations, International Standards and National Standards 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 Standards are subject to revision and parties to agreements based on this Recommendation are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The TSB maintains a list of the currently valid ITU-T Recommendations/CCITT Recommendations.

- ITU-T Recommendation T.4 (1993), *Standardization of Group 3 facsimile apparatus for document transmission*.
- CCITT Recommendation T.6 (1988), *Facsimile coding schemes and coding control functions for Group 4 facsimile apparatus*.
- ITU-T Recommendation T.30 (1993), *Procedures for document facsimile transmission in the general switched telephone network*.
- ITU-T Recommendation T.31 (1995), *Asynchronous facsimile DCE control – Service Class 1*.
- CCITT Recommendation T.50 (1992), *International Reference Alphabet (IRA) (formerly International Alphabet No. 5 or IA5), Information technology – 7-bit coded character set for information interchange*.
- CCITT Recommendation V.4 (1988), *General structure of signals of International Alphabet No. 5 code for character oriented data transmission over public telephone networks*.
- CCITT Recommendation T.434 (1992), *Binary file transfer format for the telematic services*.
- ITU-T Recommendation V.8 (1994), *Procedures for starting sessions of data transmission over the general switched telephone network*.
- ITU-T Recommendation V.24 (1993), *List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE)*.
- CCITT Recommendation V.25 (1988), *Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls*.
- ITU-T Recommendation V.25 ter (1995), *Serial asynchronous automatic dialling and control*.
- CCITT Recommendation T.81 (1992), *Information technology – Digital compression and coding of continuous – tones still images – Requirements and guidelines*.
- ISO 2111:1985, *Data communication – Basic mode control procedures – Code independent information transfer*.

3 Definitions

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

3.1 DTE (data terminal equipment): A DTE is any terminal or computer capable of providing commands and data to operate a DCE or facsimile DCE. In practice, these are computers of any size.

3.2 DCE (data circuit-terminating equipment): A DCE is any device which connects a DTE to a communications network. This Recommendation focuses on DCEs which connect to the GSTN. This class of DCEs includes DCEs compatible with the V-Series modem Recommendations and facsimile DCEs described below.

3.3 facsimile DCE: A facsimile DCE is a device which provides facsimile communication facilities between a DTE and a remote Group 3 Facsimile terminal across the GSTN. A Class 2 facsimile DCE includes the following functions:

- control functions;
- interchange circuits to the DTE;
- HDLC data link layer functions;
- V-Series signal converters;
- autodialler functions;
- GSTN interface.

3.4 facsimile DTE: A facsimile DTE must provide those Group 3 facsimile functions and services not provided by the facsimile DCE. The specific implementation of these functions is beyond the scope of this Recommendation.

4 Abbreviations

For the purposes of this Recommendation, the following abbreviations are used:

| | |
|-------|---|
| CCITT | International Telegraph and Telephone Consultative Committee |
| IRA | International Reference Alphabet (Recommendation T.50) |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISO | International Organization for Standardization |
| ITU-T | International Telecommunication Union Telecommunication Standardization |
| XON | IRA DC1 character, used to enable data flow on the opposite circuit |
| XOFF | IRA DC3 character, used to disable data flow on the opposite circuit |

5 Facsimile DTE-DCE interchange circuits

A facsimile DCE described by this Recommendation uses an asynchronous serial connection between the DTE and the DCE. Use of this protocol on other DTE-DCE interfaces is beyond the scope of this Recommendation.

5.1 Communication link data rates

The communications link between the DTE and facsimile DCE shall provide full duplex character data at rates fast enough to accommodate the transfer of synchronous T.30 Phase C data. The DTE-DCE data rate shall be at least 25% faster than the maximum expected connection rate to accommodate the start and stop bit overhead. For example, 12 000 bit/s is the minimum rate needed to support synchronous rate of 9600 bit/s Phase C data; 19 200 bit/s is sufficient to support facsimile signalling at up to 14 400 bit/s. Since format conversion facilities can compress the transmit data, even higher rates may be useful. It is preferred to use the highest data rate available.

Mechanisms to set the DTE-DCE serial rate are described in 6.10 and 6.2.10/V.25 *ter* (IPR parameter).

Because flow control is always used, changing the DTE-DCE communications link data rate during facsimile operation is not necessary, not recommended and DCEs are not required to support it (see 6.2.10/V.25 *ter*).

5.2 Asynchronous to synchronous conversion

Group 3 data communication is bit-synchronous. The DCE must delete start and stop elements from transmitted octets and add them to received octets. The bit order is by default unchanged between the DTE and the remote station, unless the DCE is directed otherwise by the +FBO parameter (8.5.3.4).

5.3 Flow control

Flow control is necessary to match the DTE-DCE data rate to the line signalling rate and to the requirements of Group 3 data transmission (for example, provision must be made for minimum scan line times). In-band unidirectional DC1/DC3 (XON/XOFF) flow control is mandatory; flow control using V.24 circuits 106 and 133 is optional (see 6.2.12/V.25 *ter*). Image data with the same ordinal values of DC1 (1/1) or DC3 (1/3) shall not be interpreted as flow control commands.

The DTE may turn off the above specified flow control methods, but some other method shall be used to avoid overrun of the DCE buffer. The credit method can be implemented using the <DLE><"?"> transparent data command character pair (see 8.3.3.9). In the receive direction, the DTE can use delayed Packet Protocol acknowledge characters for flow control.

The response time of the DCE to indication of a DTE-not-ready condition are for further study. These times shall not exceed 64 character times, as measured from the instant the DTE asserted the not-ready condition. The DCE shall further be prepared to accept at least 64 additional characters on circuit 103 at the instant it asserts a not-ready condition to the DTE.

The mechanism to identify and select the flow control mechanism is defined in 6.2.12/V.25 *ter* (+IFC).

NOTE – A facsimile DCE may provide additional data buffering beyond the needs of flow control. See the +FBS parameter in 8.5.3.2.

5.4 Serial data interchange circuits

5.4.1 Mandatory circuits

The required circuits are shown in Table 1.

TABLE 1/T.32

Mandatory serial data interchange circuits

| V.24 circuit | Description |
|--------------|------------------|
| 102 | Signal ground |
| 103 | Transmitted data |
| 104 | Received data |

5.4.2 Optional circuits

The optional circuits are shown in Table 2.

Provision of additional circuits is optional.

5.4.3 Optional circuit behaviour

The behaviour of circuits 105, 106 and 133 is described in 6.9 and 6.2.12/V.25 *ter*.

The behaviour of circuit 108/2 is described in 6.7.

The behaviour of circuit 125 is described in 6.5.

When the DCE switches to +FCLASS=0 operation (including upon issuing a +FDM response when a data modem is detected during adaptive answering), the behaviour of all control circuits shall be as specified by Recommendation V.25 *ter* and manufacturer-specific extensions and modifications.

TABLE 2/T.32

Optional serial data interchange circuits

| V.24 circuit | Description |
|--------------|--|
| 133 | Ready for receiving |
| 105 | Request to send |
| 106 | Ready for sending |
| 107 | Data set ready |
| 108/2 | Data terminal ready |
| 109 | Data channel received line signal detector |
| 125 | Calling indicator |

Circuit 107, if provided, shall normally be held in the ON condition at all times when the DCE is powered on and +FCLASS=2.0. Manufacturers may provide an option to cause circuit 107 to obey the V.24 definition, which is for circuit 107 to be ON only when the DCE is off-hook and OFF when the DCE is on-hook.

Circuit 109, if provided, shall normally be held in the ON condition at all times when the DCE is powered on and +FCLASS=2.0. Manufacturers may provide an option to cause circuit 109 to be ON when the DCE is off-hook and OFF when the DCE is on-hook. The "&Cn" command, defined in 6.2.8/V.25 *ter*, may be used for this purpose; the &C0 setting holds circuit 109 always in the ON condition and the &C1 setting may be used to indicate the optional behaviour (indicating the on-hook/off-hook condition).

6 Autodialler services

The protocol described in this Recommendation requires services common to those provided by serial asynchronous Automatic Calling Equipment (ACE).

6.1 Command syntax

6.1.1 Character set and format

The T.50 International Alphabet 5 is used for commands and responses. Only the low order 7 bits of each character are used; the high order bit is ignored. Upper case characters are equivalent to lower case characters.

For Phase C data transmission or reception, the data is binary (not Recommendation T.50), transferred using 8 data bits without parity (Recommendation V.4). It is therefore preferable to use character formatting with 8 data bits and no parity bit for all interactions to avoid the need to change formats when moving between command states and Phase C data transfer.

6.1.2 DTE command lines

A command line is a string of characters sent from a DTE to the facsimile DCE, while the DCE is in a command state. Command lines have a prefix, a body and a terminator. The prefix consists of the T.50 characters "AT" (4/1, 5/4) or "at" (6/1, 7/4). The body is a string of commands and associated values, restricted to printable T.50 characters (2/0 – 7/15). Space characters (T.50 2/0) and control characters other than <CR> (T.50 0/13) and <BS> (T.50 0/8) in the command string are ignored, except for space characters embedded within string constants. The default command line termination character is the T.50 <CR> character; DCE may implement the S3 register command defined in 6.2.1/V.25 *ter*. Characters that precede the AT prefix are ignored. The DCE shall support a command line of at least 40 characters, including embedded space characters.

6.1.3 Basic command syntax

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single T.50 characters, or single characters preceded by a prefix character (e.g. "&"), followed by a decimal parameter. Missing numeric parameters are evaluated as 0.

6.1.4 Extended command syntax

The facsimile commands described in this Recommendation use extended syntax. They are preceded by the "+F" characters and they are terminated by the semicolon ";" character (T.50 3/11) or by the <CR> that terminated the command line. The general formats of extended commands are as follows.

6.1.4.1 Execute command syntax

- +F<action_name>[=<value>] or
- +F<action_name>[=<compound value string>]

If +F<action_name> is supported, the DCE shall execute the command as described in the command reference. Otherwise, it shall report an ERROR result code.

Some action commands support use of a <value>, as an action parameter. For some of these action commands, the <value> may be omitted.

6.1.4.2 Test command syntax

- +F<action_name>=?

This syntax is used by the DTE to test if an action command is implemented by the DCE and if so to determine the range of <value>s supported for that command, if any.

If +F<action_name> is supported, the DCE shall report an OK result code; otherwise, it shall report an ERROR result code. If <action_name> supports <value>s the DCE shall report the <range of values> (6.1.5.4) or <compound range of values string> (6.1.5.6) to the DTE, followed by a final result code (6.8).

6.1.4.3 Set parameter syntax

- +F<parameter_name>=<value>or
- +F<parameter_name>=<compound value string>

If +F<parameter_name> is supported and if the <value> or <compound value string> is supported, the DCE shall set the parameter to the specified value. Otherwise, it shall report an ERROR result code and the previous value or values shall be unaffected.

6.1.4.4 Read parameter syntax

- +F<parameter_name>?

If +F<parameter_name> is supported, the DCE shall report the current <value> or <compound value string> to the DTE. Otherwise, it shall report an ERROR result code.

6.1.4.5 Test parameter syntax

- +F<parameter_name>=?

This syntax is used by the DTE to test if a parameter is implemented and if so list all valid values for the parameter, in a format specific to the individual parameter.

If +F<parameter_name> is supported, the DCE shall report the <range of values> (6.1.5.4) or <compound range of values string> (6.1.5.6) to the DTE. Otherwise, it shall report an ERROR result code.

6.1.5 Extended command parameter values

Each parameter, or action command that takes parameters, shall be defined as taking either numeric or string values. Parameters may be single or compound. Attempting to store a string value to a numeric parameter, or to store a numeric value to a string parameter or to use a compound value string where a single value is required, is an error; the DCE shall return an ERROR final result code.

6.1.5.1 Parameter values

A single parameter <value> shall consist of either a numeric constant or a string constant. Any <value> allowed but not specified is assumed to be 0 or the null string depending on type.

6.1.5.2 Numeric constants

Numeric constants shall be expressed in hexadecimal, made up of the characters "0" through "9" (T.50 3/0 – 3/9) and "A" through "F" (T.50 4/1 – 4/6) inclusive. Leading "0" characters shall be ignored by the DCE.

In this Recommendation, hexadecimal values are represented with an "h" suffix: "12h" is 18 decimal; "FFh" is 255 decimal. The trailing "h" shall NOT be sent to the DCE or the DTE.

The +FCLASS parameter (8.2) defines <value> that also include embedded "." (T.50 2/14) period characters, for delimiting revisions.

6.1.5.3 String constants

String constants shall consist of a string of characters bounded at the beginning and end by the double-quote character ("T.50 2/2). A null string (a string of zero length) is represented by two adjacent double-quote characters (""). String parameters defined in this Recommendation shall contain neither double-quote characters nor non-displayable characters, so no provisions are made for including them in string constants.

6.1.5.4 Ranges of numeric parameter values

In response to command testing, the DCE shall present a <range of values> to the DTE as an ordered list, preceded by a left parentheses character ("("T.50 2/8) and followed by a right parentheses character (")"T.50 2/9). The ordered list shall consist of a single <value>, a set of <value>s separated by commas (","T.50 2/12) (e.g. "0,2"), or as two <values> separated by a hyphen ("- "T.50 2/13) (e.g. 0-FFh) to represent a continuous range of values.

NOTE – The +FCLASS=? is an exception. Parentheses and hyphens are not permitted, for compatibility with Recommendation T.31 and existing DCE.

6.1.5.5 Compound parameter strings

A parameter may use multiple values; an action command may use multiple action parameters. A complete compound parameter string consists of a series of numeric (6.1.4.2) or string (6.1.4.3) constant values, separated by comma characters (T.50 2/12).

Incomplete compound parameter strings are allowed for some commands. The DCE shall retain the current value for any omitted <value> unless otherwise specified in the particular parameter description. Trailing comma characters may be omitted if the associated values are also omitted.

6.1.5.6 Compound parameter range strings

In response to the testing of compound commands, the DCE shall report a <compound range of values string>. This string is an ordered list of individual subparameter ranges of values, separated by commas. Individual subparameter ranges of values are presented as specified in 6.1.5.4 above, including parentheses characters, T.50 2/8 and 2/9. This format is illustrated here:

(1st range of values), ... (last range of values)

An example DCE test response for a compound parameter is illustrated for the Service Class 2 +FCC parameter (8.5.1.1). A DCE response to +FCC=? could report:

<CR><LF>(0,1),(0-3),(0-3),(0-2),(0-2),(0-1),(0),(0-7)<CR><LF>

6.1.6 Issuing commands

All characters in a command line shall be issued at the same data rate and with the same number of bits per character.

If the DCE detects a command line which is not properly terminated (6.1.2) it shall ignore the commands and generate an ERROR result code. In command mode, the DCE shall ignore any characters received from the DTE that are not part of a properly-formatted command line.

The DCE shall issue no unsolicited result codes to the DTE during reception and processing of a command line (i.e. between receipt of the first character of the prefix and issuance of the last character of any eventual response), unless enabled to do so by DTE command (e.g. +FBU command, 8.5.1.10).

If the DCE provides a facility for echo of command lines, it is recommended that this facility be disabled by the DTE during facsimile operation. If the Packet Protocol is in use, the DCE shall not echo command lines.

The DTE shall not issue a new command line until the DCE has finished delivering the complete final result code to the previous command line, including any following <CR> and <LF> characters (see 6.3.2).

6.2 Command execution

Upon receipt of the termination character, the DCE shall commence execution of the commands in the command line, if any. The DCE shall execute the commands in the body of the command line left-to-right. Each command is individually executed regardless of what follows on the line. If all commands execute properly, a final result code, for the final command, is issued after execution of the final command. If an invalid command is encountered, or if execution of any command results in an error, execution of the command line is terminated at that point and all subsequent commands on the line are ignored. Commands in the line prior to the error will have already been executed.

6.2.1 Command execution time

Parameter commands are assumed to execute instantaneously; these cannot be aborted. Action commands which require time to execute (e.g. 8.3) may be aborted while in progress, until the final result code is issued (6.8).

6.2.2 Aborting commands

Commands which may be aborted are explicitly Noted in the description of the command. Aborting of commands is accomplished by the transmission from the DTE to the DCE of any character, other than those explicitly required (e.g. <DC2>, IRA 1/2, for +FDR). A single character shall be sufficient to abort the command in progress; however, line feed (<LF>, T.50 0/10) characters following the command-line-terminating carriage return character (<CR>) shall be ignored. When such an aborting event is recognized by the DCE, it shall terminate the command in progress and return an OK result code to the DCE.

6.3 DCE response syntax

This Recommendation describes two types of responses: information text and result codes. The DCE shall format responses at the same serial port rate and parity as the preceding DTE command line; parity is detected from the "AT" or "at" command line prefix.

6.3.1 Information text responses

Information text responses shall always be preceded by the T.50 characters <CR><LF> and followed by <CR><LF>, unless set to some other characters by user option. If provided by the manufacturer, the S3 and S4 registers defined in 6.2.1/V.25 *ter* and 6.2.2/V.25 *ter* may be used to select the command line termination character (default <CR>) and the response formatting character (default <LF>).

The information text responses generated by a command are described in the command reference for each command.

6.3.2 Result code responses

A facsimile DCE described by this Recommendation shall provide verbose and non-verbose format for result code responses to the DTE. A user-selectable option shall be provided to select the format; the preferred mechanism is the ATV0 (non-verbose) and ATV1 (verbose) commands described in 6.2.6/V.25 *ter*.

In the verbose format, result code responses are preceded by the T.50 characters <CR><LF> and followed by <CR><LF>. In the non-verbose format, result code responses are preceded by no characters and followed by a single <CR>.

6.4 Capabilities identification and control

A facsimile DCE shall maintain a parameter for identification and control of facsimile services, "+FCLASS". This parameter can be read to determine the current setting, written to change the current setting and interrogated to determine the allowed values. This parameter is described in 8.2.1 to 8.2.3.

A facsimile DCE shall maintain a set of read-only parameters which allow the DTE to identify the manufacturer, model and revision. These are described in 6.1.4 to 6.1.6/V.25 *ter*.

6.5 Call answering

A facsimile DCE described by this Recommendation shall provide for manual (DTE controlled) answering of calls. Automatic answering is a system service, requiring DTE action. Answering DCE behaviour is specified in 8.3.2.

An answering facsimile DCE shall generate a 2100 Hz answer tone (CED), as required by Recommendation T.30.

NOTE – The use of other signalling conventions in place of CED (e.g. the ANSam signal from Recommendation V.8) is for future study.

The DCE may indicate incoming calls on V.24 Circuit 125, or using the RING result code (6.8), or both.

6.6 Call origination

A facsimile DCE described by this Recommendation shall provide for automatic and manual origination of calls. Originating DCE behaviour is specified in 8.3.1.

An originating facsimile DCE shall generate a 1100 Hz calling tone (CNG), as described by Recommendation T.30, for both manual and automatic operation.

NOTE – The use of other signalling conventions in place of or in addition to CNG (e.g. the CI signal from Recommendation V.8) is for future study.

6.7 Call termination

A facsimile DCE described by this Recommendation shall provide for automatic and manual termination of calls. If V.24 Circuit 108/2 is provided, an ON to OFF transition on 108/2 shall cause the DCE to disconnect the call and go on-hook, unless configured otherwise by the user. Other mechanisms may also be provided.

If the DCE provides data modem operation (+FCLASS=0), the DCE shall automatically reset the FCLASS parameter to 0 on OFF-HOOK to ON-HOOK transition. This is described in 8.2.

If the DCE provides the &D parameter (defined in 6.2.9/V.25 *ter*), this parameter shall also condition DCE behaviour while +FCLASS=2.0. The &D0 setting shall cause the DCE to ignore transitions on circuit 108/2. The &D1 and &D2 settings shall cause the DCE to disconnect the call and go on-hook on an ON-to-OFF transition of circuit 108/2 (the &D1 setting does not cause a transition to online command state as specified in Recommendation V.25 *ter*, because this Recommendation provides the <CAN> mechanism). Other values of the &D command are not defined in Recommendation V.25 *ter* or in this Recommendation.

6.8 DCE autodialler result codes

The following set of autodialler result codes are defined. Result codes are reported either in Verbose form or in Numeric form (6.3.2). Result Codes OK, ERROR and CONNECT are mandatory. Other codes are implemented at the manufacturer's option. See Table 3.

6.9 Serial port flow control

A facsimile DCE shall provide for DC1/DC3 (XON/XOFF) flow control. A facsimile DCE may also implement other types of flow control, such as V.24 Circuits 106 and 133 and select them using the +IFC parameter described in 6.2.12/V.25 *ter*.

6.10 Serial port rate control

6.10.1 Autobaud operation, +IPR=0

If +FCLASS=2.0 and +FPR=0, the DCE shall automatically detect the data rate being used by the DTE for each command line issued (for example, by measuring the duration of the start bit of the "A" or "a" of the command line prefix). This method of operation is known as "autobauding". Once the data rate has been so established by the DTE, all

subsequent transmissions from the DCE to the DTE, including unsolicited messages such as RING (6.8), shall be at that rate, until the DTE changes the rate again.

The DCE shall not transmit to the DTE at any rate except that used in the immediately preceding command line; in particular, no automatic DCE-to-DTE data rate change shall occur upon entry into or exit from Service Class 2 operation (when a fixed data rate has not been established) or upon entry into or exit from T.30 Phase C data transfer. The data rate assumed by the DCE upon power up or reset, prior to the issuance of the first command line by the DTE, is not specified and shall be determined by the manufacturer; it is the responsibility of the DTE to issue a command line to establish the initial rate to be used.

TABLE 3/T.32

DCE autodialler result codes

| Numeric | Verbose | Description |
|--|-------------|--|
| 0 | OK | The previous command or operation was completed normally; the DCE is ready for another command |
| 1 | CONNECT | The DCE is entering the data transfer state |
| 2 | RING | Report receipt of a complete network alerting signal. This response may be issued after each ringing signal |
| 3 | NO CARRIER | This may be generated if the DCE switches into operation as a data modem (Recommendation V.25 <i>ter</i>) |
| 4 | ERROR | The previous command or operation was not recognized or was completed abnormally; the DCE is ready for another command |
| 6 | NO DIALTONE | Dial tone detection was attempted but not found within the timeout period (manufacturer option) |
| 7 | BUSY | A busy signal has been detected |
| 8 | NO ANSWER | The "@" dial modifier was used, but five seconds of silence was not detected before the DCE's connect timer expired |
| NOTE – The ATX command defined in 6.2.7/V.25 <i>ter</i> may be used by a Facsimile DCE; this command enables other messages. | | |

6.10.2 Fixed rate operation, +IPR>0

The DTE may establish a fixed rate of operation by using the +IPR command (6.2.10/V.25 *ter*). Such fixed rates may include additional rates that are not possible to establish by autobauding. The DCE shall accept commands and issue responses, including unsolicited responses, at the selected fixed rate. While a fixed rate is in effect, the DCE may ignore commands issued by the DTE at other rates.

6.11 Data stream transparent commands

A Service Class 2 Facsimile DCE transfers Phase C data in streams while executing data transfer commands (+FDT, 8.3.3; +FDR, 8.3.4). A Facsimile DCE shall recognize transparent data stream commands in transmitted data and it shall insert transparent data stream commands into received data. This method is based on ISO 2111.

The T.50 <DLE> character (1/0) is used as a special character, to precede command characters. Character pairs <DLE><command> are used to mark the end of data and to convey other commands or status information between DTE and DCE. These characters are octet-aligned. Character pairs used are summarized in Table 9. The following example patterns are used (see Table 4).

6.11.1 DTE to DCE streams

The DCE shall filter the data stream from the DTE and remove all character pairs beginning with <DLE>. The DCE shall recognize any command characters; see Table 4.

TABLE 4/T.32

Example Transparent Data Commands

| | |
|---|--|
| Any data...<DLE><DLE> | Single <1/0> in data |
| Any data...<DLE><"A"> | Single <0/1> in data |
| Any data...<DLE><"W"> | Single <1/7> in data |
| And data...<DLE><SUB> | <1/0><1/0> pair in data |
| Any data...<DLE><ETX> | End of stream |
| Any data...<DLE><command> | Remove <DLE><command> and interpret <command> if valid (Table 9) |
| NOTES | |
| 1 Above <CHAR> names are defined in Recommendation T.50. | |
| 2 The use of new valid transparent data commands, in addition to those defined in Tables 4 and 9, is for further study. | |

The DTE shall filter the stream data to the DCE and insert an extra <DLE> character ahead of each <1/0> data octet. If the DTE encounters two consecutive <DLE> characters in the data, it may replace that pair with the sequence <DLE><SUB> (1/0, 1/10).

6.11.2 DCE to DTE streams

The DCE shall insert transparent commands into the data stream to the DTE (see Table 4); the DCE shall filter stream data to the DTE and insert an extra <DLE> character ahead of each <1/0> data octet. If the DCE encounters two consecutive <DLE> characters in the data, it may replace that pair with the sequence <DLE><SUB>.

The DTE shall filter the received data stream to recognize and remove all character pairs beginning with <DLE>. The DTE shall recognize <DLE><ETX> as the stream terminator. The DTE shall recognize each <DLE><DLE> character pair and substitute a single <1/0> in its place. The DTE shall recognize <DLE><SUB> pairs and substitute <1/0><1/0>.

If the DTE has enabled the Packet Protocol (8.5.3.3), the DCE shall substitute <DLE><"A"> (1/0, 4/1) character pairs for each data octet with ordinal value of <0/1> (<SOH>) and substitute <DLE><"W"> (1/0, 5/7) character pairs for each data octet with ordinal value of 17h (<ETB>).

7 Facsimile Class 2 services

A Service Class 2 Facsimile DCE has responsibility for conducting the facsimile session protocols specified in Recommendation T.30. A Service Class 2 Facsimile DCE shall include the following services:

- a) Connection;
- b) Configuration:
 - 1) T.30 Procedure Options,
 - 2) T.30 Procedure Policy,
 - 3) Optional Service Gateways,
 - 4) Additional Parameters.
- c) Session Status Reporting;
- d) Transmit Phase C Data Transfer;
- e) Bit reverse Phase C data;
- f) Zero-Bit insertion for minimum transmit line time;
- g) Copy Quality Checking on Received Data (if reception supported);
- h) Other services mandatory in Recommendation T.30;
- i) Packet Protocol for DCE-DTE data delivery.

A Service Class 2 Facsimile DCE may include the following optional services:

- a) Receive Phase C Data Transfer;
- b) Adaptive Answering;
- c) Transmit Data Conversion among T.4 or T.6 formats;
- d) Error Correction Mode;
- e) Transition to Service Class 1 commands;
- f) Other services optional in Recommendation T.4 or T.30.

A DTE working with a Service Class 2 facsimile DCE needs to do the following:

- a) Preconfigure the DCE, if desired;
- b) Initiate sessions: answer or dial;
- c) Monitor session status;
- d) Transfer Phase C image data, with page separation.

A DTE may also implement:

- Packet Protocol for DCE-DTE data delivery.

7.1 Connection

Connection is made at the beginning of a call, from both sides. Connection is also made in manual call placement and in returning from procedure interrupts.

7.1.1 Answer connection

Facsimile Service Class 2 answer response must be selected by prior setting of parameter +FCLASS=2.0. Service Class 2 answer operation may be initiated by the A command, described in 8.3.2. The use of DCE automatic answering is beyond the scope of this Recommendation.

7.1.2 Originate connection

Facsimile Service Class 2 originate response must be selected by prior setting of parameter +FCLASS=2.0. Service Class 2 originate operation shall be initiated by the D command, described in 8.3.1.

7.2 Configuration

7.2.1 Configuration and identification of T.30 options

Group 3 facsimile devices negotiate session parameters in DIS, DCS and DTC frames. These parameters include:

- a) data transmission bit rate;
- b) minimum scan line time;
- c) document resolution, width and length;
- d) data compression algorithm;
- e) use of error correcting mode;
- f) use of Binary File Transfer;
- g) capability to receive;
- h) capability to poll or be polled.

These options may be limited by the capabilities of the facsimile DCE (8.5.1.1). A Facsimile DCE compliant with this Recommendation must implement all capabilities specified as mandatory in Recommendations T.4 and T.30.

7.2.2 Configuration and identification of T.30 procedure parameters

These parameters are used to make decisions in the T.30 procedure: the conditions for requesting a page retransmit, the conditions for retransmitting a page and timeouts.

7.2.3 Configuration of answer behaviour

A Service Class 2 Facsimile DCE may have the ability to answer as a data modem DCE or as a Facsimile DCE. It also may be able to adaptively change from Class 2 facsimile mode (+FCLASS=2.0) to data modem operation (+FCLASS=0) in response to the incoming call. The +FAA parameter controls this feature (8.5.2.5); the +FDM response (8.4.1.2) indicates detection of a calling data modem.

7.3 Session status reporting

A Service Class 2 facsimile DCE shall provide reports to the DTE on the status of a session. These reports include:

- a) connection and hangup status;
- b) requested DIS or DTC session parameters;
- c) negotiated DCS session parameters;
- d) remote station ID strings, if any;
- e) Non Standard negotiation frames, if any;
- f) Phase C prompts;
- g) Phase C page status reports;
- h) control frame data, if requested.

Some of these reports may be selectively suppressed by the +FNR command, 8.5.1.11.

7.4 Phase C data transfer

A Service Class 2 Facsimile DCE shall accept commands from the DTE to control the transfer of T.4 or T.6 facsimile image data, both for transmission and reception.

A Service Class 2 Facsimile DCE shall generate responses to the DTE to control the transfer of T.4 or T.6 facsimile image data, both for transmission and reception.

A Service Class 2 Facsimile DCE shall also generate responses to the DTE to report the status of image data transfers. The responses indicate both parameter status and procedure status.

The facsimile DCE shall be prepared in some manner to withstand the cessation of data flow from the DTE for a minimum of 5 seconds. This may be implemented in any manner the Manufacturer chooses; this method shall in no way damage the integrity of the image being transferred to the remote facsimile device.

7.5 Phase C error checking

Copy Quality checking is the responsibility of the DCE. A Service Class 2 Facsimile DCE shall offer services to check the integrity of the received Phase C data. This service is controlled by the +FCQ parameter (8.5.2.3).

7.6 Phase C data conversion

In Group 3 Facsimile, the originating station receives the remote station's capabilities via DIS or DTC frames, decides the session selections and reports that to the remote station via the DCS message. If the transmitter has documents that depend on T.30, T.4 or T.6 options, it has the responsibility of adjusting to the receiver's capabilities. In a station consisting of a facsimile DCE and a DTE, the facilities for adjustment may be in either device.

A Service Class 2 facsimile DCE may offer services to convert Phase C data between different Group 3 formats, transparently to the DTE and the remote Facsimile station. These include vertical resolution, page width, page length, data compression format and bit order within asynchronous octets. These optional services are controlled by the +FBO and +FFC parameters (8.5.3.4 and 8.5.3.6).

A Service Class 2 facsimile DCE that does format conversion shall do conversions between the choices it supports as reported in the DCE Capabilities compound parameter, +FCC, described in 8.5.1.1.

For page length conversion, the DCE shall partition pages into partial pages as necessary, with intermediate Phase D transitions hidden from the DTE.

7.7 T.30 error correction mode

Recommendation T.30 contains an optional Error Correcting Mode (ECM) for error free transfer of Phase C page data, using HDLC framing and selective retransmission. A facsimile DCE may support ECM operation, transparent to the DTE. This service is controlled by the +FCC=,,,EC subparameter, described in 8.5.1.4.

The DCE must partition pages into partial pages on transmission and reassemble them on reception, as necessary, with the intermediate Phase D transitions hidden from the DTE.

In the body of this Recommendation, T.30 symbols like EOP and MCF also represent their ECM equivalents.

7.8 Non-standard facilities

A Service Class 2 facsimile DCE may support Non-standard Facilities, but the description of that support is beyond the scope of this Recommendation.

A Service Class 2 facsimile DCE shall support non-standard message data; see +FND, 8.5.2.10.

A Service Class 2 facsimile DCE shall report received Non-standard Facilities messages, using the responses described in 8.4.2.4. A DTE may shift to Service Class 1 (Recommendation T.31) commands to implement NSF services as described in Annex B.

A Service Class 2 facsimile DCE may provide a parameter to store an octet string for use in generating Non-standard negotiation messages (NSF, NSS, NSC). This parameter is described in 8.5.1.6.

7.9 Transition to Service Class 1

A Service Class 2 facsimile DCE may also implement the Service Class 1 commands described in Recommendation T.31. DCE that support Service Class 1 commands can be identified using the +FCLASS=? command (8.2.2).

A DCE may accept a +FCLASS=1.0 command to shift from Service Class 2 to Service Class 1 operation. DCE behaviour under this condition is specified in B.1. If Service Class 1 commands are not supported, the DCE shall report an ERROR final result code in response to Service Class 1 commands.

A DCE may accept a +FCLASS=2.0 command to shift from Service Class 1 to Service Class 2 operation. DCE behaviour under this condition is specified in B.2.

7.10 Procedure interrupt negotiation

Recommendation T.30 allows a station to request a Procedure Interruption at the end of a page. This request is passed between stations by the PIP, PIN and PRI-Q messages.

A Service Class 2 facsimile DCE may provide a mechanism for the DCE to negotiate procedure interrupts, conditioned by the DTE. Means to request Procedure Interrupts are described in 8.3.3.8 and 8.3.4.8. The DCE can be preconditioned to accept or ignore Procedure Interrupts from the remote station using the +FIE parameter (8.5.2.1). The +FVO response (8.4.4.2) reports the Procedure Interrupt transition. The call origination and answering procedures may be used to return to a T.30 session.

The procedure that the facsimile DCE uses to switch to the local operator is left to the manufacturer.

7.11 2400 bit/s negotiation

A Service Class 2 Facsimile DCE may support 2400 bit/s negotiation, in compliance with Recommendation T.30. If present, this service is handled automatically by the DCE.

7.12 Packet protocol

A Service Class 2 Facsimile DCE shall provide the Packet Protocol, described in clause 9; this service is enabled by the +FPP parameter, described in 8.5.3.3. With DTE cooperation, the mechanism provides for detection of lost data and retransmission of that data. This allows reliable system operation in small or multi-tasking DTE, using insecure data links (e.g. Recommendation V.24).

8 Service Class 2 commands and responses

This Recommendation describes several sets of messages:

- Service Class 2 Action Commands;
- Service Class 2 Responses;
- Service Class 2 Parameters;
- Service Class 2 Transparent Data Commands;
- Service Class 2 Single Character Commands.

8.1 Summary of commands and responses

All Commands and Responses are mandatory. Mandatory values are specified for each command and parameter.

NOTE – In Tables 5 to 8, noted parameters, commands and responses depend on the capability to receive (+FCR, 8.5.1.9).

8.1.1 Service Class 2 action commands

See Table 5.

TABLE 5/T.32

Action commands

| Command | References | Description |
|----------------|------------|---|
| D<dial string> | 8.3.1 | Dial <dial string> and originate a call |
| A | 8.3.2 | Answer a call |
| +FDT | 8.3.3 | Send a page |
| +FDR | 8.3.4 | Receive a page |
| +FKS | 8.3.5 | Terminate a session, orderly fax abort |
| +FIP | 8.3.6 | Initialize Service Class 2 parameters |

8.1.2 Service Class 2 DCE responses

All responses except +FCO and +FHS: are enabled by parameters (see +FNR, 8.5.1.11). See Table 6.

8.1.3 Service Class 2 parameters

Appendix I lists all parameters, mandatory values, optional values and default values. See Table 7 for parameters for mandatory services.

8.1.4 Service Class 2 optional parameters

Implementation of these parameters is mandatory. Implementation of the associated services is optional. See Table 8.

TABLE 6/T.32

DCE responses

| Response | References | Description |
|----------|------------|--|
| +FCO | 8.4.1.1 | Indicates connection with a fax terminal |
| +FVO | 8.4.4.2 | Indicates transition to voice |
| +FDM | 8.4.1.2 | Indicates detection of data modem |
| +FHS: | 8.4.5 | Call terminated with status |
| +FCS: | 8.4.2.1 | Report the DCS frame information |
| +FIS: | 8.4.2.1 | Report the DIS frame information |
| +FTC: | 8.4.2.1 | Report the DTC frame information |
| +FPO | 8.4.2.2 | Indicates polling request |
| +FTI: | 8.4.2.3 | Report the remote ID, TSI |
| +FCI: | 8.4.2.3 | Report the remote ID, CSI |
| +FPI: | 8.4.2.3 | Report the remote ID, CIG |
| +FNF: | 8.4.2.4 | Report non-standard facilities frame |
| +FNS: | 8.4.2.4 | Report non-standard Set-up frame |
| +FNC: | 8.4.2.4 | Report non-standard command frame |
| +FET: | 8.4.4.1 | Report post page message |
| +FPS: | 8.4.3 | Report received page status |
| +FHT: | 8.6.1 | Report transmitted HDLC frames |
| +FHR: | 8.6.2 | Debug report received HDLC frames |

TABLE 7/T.32

Parameters for mandatory services

| Command | References | Description |
|---------|------------------------|--|
| +FCLASS | 8.2.1 to 8.2.3 | Service Class Identification and Control |
| +FCC= | 8.5.1.1 | Establish DCE capabilities |
| +FIS= | 8.5.1.2 | Current session negotiating position |
| +FCS= | 8.5.1.2 | Current session parameters (read only) |
| +FLI= | 8.5.1.5 | Local facsimile station ID String, TSI/CSI |
| +FPI= | 8.5.1.5 | Local facsimile station ID String, CIG |
| +FLP= | 8.5.1.7 | Indicate document available for polling |
| +FSP= | 8.5.1.8 | Enable polling |
| +FNR= | 8.5.1.11 | Negotiation reporting enable |
| +FIE= | 8.5.2.1 | Procedure interrupt enable |
| +FPS= | 8.5.2.2 | Page transfer status |
| +FCQ= | 8.5.2.3 | Copy quality |
| +FIT= | 8.5.3.1 | DTE inactivity timer |
| +FPP= | 8.5.3.3 | Packet protocol control |
| +FBO= | 8.5.3.4 | Phase C data bit order |
| +FEA= | 8.5.3.5 | Phase C received EOL alignment |
| +GMI? | 6.1.4/V.25 <i>ter</i> | Report manufacturer ID |
| +GMM? | 6.1.5/V.25 <i>ter</i> | Report model ID |
| +GMR? | 6.1.6/V.25 <i>ter</i> | Report revision ID |
| +IPR= | 6.2.10/V.25 <i>ter</i> | Local DTE-DCE serial port rate |
| +IFC= | 6.2.12/V.25 <i>ter</i> | Local DTE-DCE flow control |

TABLE 8/T.32

Parameters for optional services

| Command | References | Description |
|---------|------------|--|
| +FNS= | 8.5.1.6 | Pass-through non-standard negotiation octet string |
| +FCR= | 8.5.1.9 | Capability to receive |
| +FBU= | 8.5.1.10 | HDLC frame reporting enable |
| +FAP= | 8.5.1.12 | Address and polling capabilities |
| +FRQ= | 8.5.2.4 | Receive quality thresholds |
| +FAA= | 8.5.2.5 | Adaptive answer mode |
| +FCT= | 8.5.2.6 | Phase C timeout |
| +FHS= | 8.5.2.7 | Hangup status code |
| +FRY= | 8.5.2.8 | CTC retry value |
| +FMS= | 8.5.2.9 | Minimum Phase C speed |
| +FND | 8.5.2.10 | NSF message data indication |
| +FFC= | 8.5.3.6 | Image data format conversion |
| +FBS? | 8.5.3.7 | Buffer size, read only |

8.1.5 Service Class 2 transparent data commands

See Table 9.

8.1.6 Single character commands

See Table 10.

8.2 Service class identification and selection

A Service Class 2 facsimile DCE shall report its Service Class capabilities, both the current setting and the range of services available. This is provided by the +FCLASS parameter. Currently defined values for the +FCLASS parameter are:

- 0 data modem (e.g. V.25 *ter*);
- 1.0 Service Class 1 (see Recommendation T.31);
- 2.0 Service Class 2 (this Recommendation).
- All other values are reserved.

NOTE 1 – Some existing DCE accept and report values 1 (IRA 3/1) and 2 (IRA 3/2) for +FCLASS.

NOTE 2 – The +FCLASS parameter defines <value>s with embedded "." period characters.

NOTE 3 – Values of 2.n are reserved for future versions of this Recommendation. For example, the first subsequent version of this Recommendation could be designated +FCLASS=2.1. Such values shall be reported separately in response to a +FCLASS=? command.

NOTE 4 – Future standards may define new values for +FCLASS that are not in consecutive numeric order.

The +FCLASS parameter is changed by the following events:

- explicit DTE +FCLASS=<value> command (8.2.3);
- adaptive auto-answer (8.5.2.5 and 8.3.2.4).

If the DCE supports +FCLASS=0, the DCE shall set this parameter to +FCLASS=0 under the following conditions:

- DCE power-up;
- DCE reset (e.g. ON-to-OFF transition on Circuit 108/2, 6.7, or ATZ command, 6.1.1/V.25 *ter*);
- explicit DTE hangup command (e.g. +FKS, 8.3.5, or ATH, 6.3.6/V.25 *ter*);
- automatic hangup (e.g. T.30 timeout, +FCL or +FIT).

TABLE 9/T.32

Transparent data command summary

| Command pair | IRA code/printed | References | Description |
|--|---|--|--|
| <DLE><DLE> <DLE><SUB> | 1/0 ^P 1/10 ^Z | 6.11 6.11 | DLE transparency: substitute one 10h pattern substitute two 10h patterns |
| <DLE><mps> <DLE><eom> <DLE><eop> <DLE><pri> <DLE><bc?> <DLE><ETX> | 2/C , 3/11 ; 2/14 . 2/1 ! 3/15 ? 0/3 ^C | 8.3.3.7 8.3.3.7 8.3.3.7 8.3.3.8 8.3.3.9 8.3.3.6 | Transmitter commands: end of page, more to follow end of document end of document and session request Procedure Interrupt check Buffer Credit acknowledge <CAN> |
| <DLE><ETX> <DLE><"A"> <DLE><"W"> <DLE><ovr> | 0/3 ^C 4/1 A 5/7 W 4/15 O | 8.3.4.4 6.11.2 6.11.2 8.3.4.6 | Receiver commands: end of page <SOH> in packet data <ETB> in packet data overrun error marker |
| <DLE><vr0> <DLE><vr1> <DLE><ln0> <DLE><ln1> <DLE><ln2> <DLE><wd0> <DLE><wd1> <DLE><wd2> <DLE><wd3> <DLE><wd4> <DLE><df0> <DLE><df1> <DLE><df2> <DLE><df3> | 6/1 a 6/2 b 6/3 c 6/4 d 6/5 e 6/6 f 6/7 g 6/8 h 6/9 i 6/10 j 6/11 k 6/12 l 6/13 m 6/14 n | 8.3.3.5 | Transmit data format: vertical resolution normal vertical resolution fine A4 length B4 length unlimited length 1728 pels/215mm width 2048 pels/255mm width 2432 pels/313mm width 1216 pels/151mm width 864 pels/107mm width 1-D Modified Huffman 2-D Modified Read 2-D Uncompressed 2-D Modified Modified Read |
| <DLE><DC2> <DLE><rb0> <DLE><rb1> <DLE><rb2> <DLE><rb9> | 1/2 ^R 3/0 0 3/1 1 3/2 2 3/3-3/8 3-8 3/9 9 | 8.3.4.6 | Receive buffer status: buffer is empty buffer is 0-10% full buffer is 10-20% full buffer is 20-30% full buffer is 90-100% full |

If the DTE sets +FCLASS to a value other than 2.0 by an explicit command (e.g. +FCLASS=0, ATH, ATZ), the DCE shall change the +FCLASS value, which in turn disables use of the Packet Protocol, before the final result code is issued. If the DCE automatically sets +FCLASS=0, that change in +FCLASS shall occur after any result code is delivered (e.g. after hangup and the +FHS response delivered, after the +FDM response and transition to data operation, or after a failed call and associated modem result codes); such result codes would be delivered using the Packet Protocol if +FPP=1.

NOTE 5 – Parameters defined in other standards (e.g. Recommendation V.25 *ter*) may be used while +FCLASS=2.0 (e.g. ATV, ATX, AT&D, ATS7, ATS8). However, this Recommendation does not specify the relationship between these parameter settings made while +FCLASS=2.0 or while +FCLASS=0. DTE should set these commands explicitly while +FCLASS=2.0.

8.2.1 Service class indication, +FCLASS?

The current Service Class setting of a Facsimile DCE is tested by the "+FCLASS?" command. The response shall be a single value.

TABLE 10/T.32

Single character command summary

| Command character | Hex value | Direction | References | Description |
|-------------------|-----------|-----------|--------------------------------|--|
| <DC1> (XON) | 1/1 | Either | 5.3, 6.2.12/V.25 <i>ter</i> | Indicates ready to receive data |
| <DC3> (XOFF) | 1/3 | Either | 5.3, 6.2.12/V.25 <i>ter</i> | Indicates not ready to receive data |
| <DC2> | 1/2 | DTE->DCE | 8.3.4 | Indicates ready to start receiving Phase C data |
| <"?"> | 3/15 | DTE->DCE | 8.3.3.9 | Requests DCE to report transmit buffer status |
| <CAN> | 1/8 | DTE->DCE | 8.3.4.7 | Requests DCE to stop delivering receive Phase C data |
| | | DCE->DTE | 8.3.3.6 | Requests DTE to stop delivering Phase C data |

8.2.2 Service class capabilities, +FCLASS=?

The Service Classes available from a Facsimile DCE are tested by the "+FCLASS=?" command. The response is a string of values, separated by commas, followed by a result code; neither bracketing parentheses nor hyphens are permitted. For example, a DCE that supported data communication and both Service Classes could respond:

<CR><LF>0,1.0,2.0<CR><LF>

8.2.3 Service class selection, +FCLASS=<value>

The Service Class may be set by the DTE from the choices available (see above), using the "+FCLASS=<value>" command. Once the result code is received from the DCE the serial port rate is set to the value specified by the +IPR parameter (6.2.10/V.25 *ter*).

The +FCLASS=2.0 command enables the DCE to accept any of the commands described in this Recommendation. The DCE may report ERROR if any CLASS 2 command other than +FCLASS is issued while +FCLASS is not 2.0, unless it is a valid command for the service class (e.g. ATA).

The DCE shall not modify the Service Class 2 parameters in response to the +FCLASS=<value> command. The AT+FIP[=n] command (8.3.6) may be used to initialize parameters.

If the +FPP parameter had previously been set to 1 (enabled), then the response to +FCLASS=2.0 command shall be issued using the Packet Protocol.

8.3 Facsimile Service Class 2 action commands

These commands transfer data and punctuate sessions. They also cause specific T.30 messages to be sent.

Some action commands (A, D without trailing semicolon, +FDT, +FDR) cause all subsequent commands on the same command line to be ignored. This is indicated by the terminating <CR> in the syntax specification.

All action commands initiate processes. The DCE shall not accept other commands from the DTE until the DCE issues a final result code (e.g. OK, ERROR). The DCE shall abort the process if it receives any character before the final result code is issued other than an immediate <LF> character, flow control characters (<DC1> or <DC3>), or other characters defined for that command (e.g. transmit data after a CONNECT result code).

8.3.1 Originate command, ATD

- Syntax: ATD[<dial string>]<CR>
- or: ATD[<dial string>];<valid commands><CR>

A Service Class 2 Facsimile DCE shall support the D command to initiate a call or to resume a session after procedure interruption. Dial strings are defined in 8.3.1.3 (or 6.3.1/V.25 *ter*).

If the <dial string> is terminated by a semicolon, the DCE returns to command state while remaining off-hook without generating CNG tone or entering T.30 Phase A. This allows long dial strings to be divided into multiple command lines and to permit tandem dialling under DTE control through intermediate systems.

If the D command is unsuccessful, the DCE shall report an appropriate result code, such as NO CARRIER or BUSY (Table 3), or +FHS:<hsc> (Table 20) and terminate the call (6.7). The D command is aborted by any character sent during call establishment.

8.3.1.1 Call placement

A Service Class 2 facsimile DCE dials, detects call progress and generates the CNG tone as described in 6.6 and then it waits for a DIS frame (as specified in Recommendation T.30). If the dial string is omitted, the DCE shall commence sending CNG without waiting for dial tone. The DCE manufacturer may provide a user settable parameter to cause the DCE to abandon the call if no CED or DIS is received within a specified time (see S7, 6.3.10/V.25 *ter*). On detection of the first Phase B Preamble (Recommendation T.30) it reports the "+FCO" message to the DTE.

Conditioned by the +FNR parameter (8.5.1.11) the DCE shall report the initial received T.30 negotiation messages, including the DIS frame, the optional CSI ID string and the optional NSF frame. The +FIS: report shall be last, followed by the OK final result code.

The facsimile DCE generates a DCS frame based on the received DIS frame and on the previously set +FIS parameter. A +FDT command from the DTE instructs the DCE to transmit that DCS frame; a +FDR command instructs the DCE to transmit a DTC frame. (The DCE may wait to avoid collisions with repeated HDLC frames from the remote station.) See Table 11.

TABLE 11/T.32

Dial command DCE responses

| Condition | DCE response | References |
|--|------------------------------|---|
| HDLC flags received | +FCO | 8.4.1.1 |
| Answering station can receive: | | |
| NSF received & +FNR=x,x,x,1 | +FNF:<NSF FIF data> | 8.4.2.4 and 8.5.1.11 |
| CSI received & +FNR=x,x,1,x | +FCI:<remote ID> | 8.4.2.3 and 8.5.1.11 |
| DIS received & +FNR=x,1,x,x & +FSP=1 & DIS.9=1 | +FIS:<parameters> +FPO OK | 8.4.2.1 8.5.1.8 and 8.5.1.11 |
| DIS received & +FNR=x,1,x,x & +FSP=0 | +FIS:<parameters> OK | 8.4.2.1 8.5.1.8 8.5.1.11 |
| Answering station is a data modem | | |
| Unsuccessful data modem handshake | +FHS:10 OK | Answer tone seen but no flags seen before timeout |
| NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study. | | |

8.3.1.2 Manual origination or restart Class 2 operation

The DTE commands the DCE to resume Service Class 2 facsimile operation, within a single phone call, by issuing a D command. A facsimile DCE may also operate as a data modem (+FCLASS=0); the DCE may operate as a facsimile DCE in a different Service Class (e.g. +FCLASS=1.0, T.31); the facsimile DCE may have suspended DCE operation for procedure interrupts. If the DTE issues a D command while the DCE is off-hook, with +FCLASS=2.0, after T.30 Phase A has been completed, the DCE shall restart in T.30 Phase B, waiting for flags and the DIS frame set.

8.3.1.3 Dial strings

The D command uses an optional string to determine dialling digits, to select dialling method and to introduce delays.

- Syntax: A string of 0 or more of the following characters:
 - mandatory digits: 0 1 2 3 4 5 6 7 8 9
 - optional digits (DTMF): * # A B C D
 - dial string modifiers: T P ; , ! W @

The details of dial string syntax are defined in 6.3.1/V.25 *ter*. The actions of the dial string modifiers are defined in 6.3.1.1/V.25 *ter* through 6.3.1.7/V.25 *ter*.

Manufacturers may implement other dial string modifiers.

8.3.2 Answer command, ATA

- Syntax: ATA<CR>

A Service Class 2 Facsimile DCE shall support the A command to answer an incoming call. The DTE may issue an A command in response to incoming Ringing (see 6.8) or to resume a session after procedure interruption.

If the A command is unsuccessful, the DCE shall report an appropriate error result code, such as +FHS:<hsc> (Table 20) or +FDM followed by NO CARRIER (if it enters data modem operation and fails to connect) and terminate the call (see 6.7). The A command is aborted by any character sent during call establishment other than a trailing <LF> character or DTE responses to DCE Packets.

8.3.2.1 Answer operation

On receipt of an Answer command from the DTE, a Service Class 2 Facsimile DCE answers and generates the CED tone as described in 6.5. Then it sends a DIS frame set (derived from the +FNS, +FLI and +FIS parameters) and listens for a response from the calling device. On detection of the first Phase B preamble (Recommendation T.30) it reports the "+FCO" (8.4.1.1) message to the DTE. The DCE manufacturer may provide a user settable parameter to cause the DCE to abandon the call if this detection does not occur within a specified time (see S7, 6.3.10/V.25 *ter*). See Table 12.

Conditioned by the +FNR parameter, (8.5.1.11) the DCE shall report the initial received T.30 negotiation messages. The +FCS: or +FTC: reports shall be last, followed by the CONNECT or OK result codes.

8.3.2.2 Automatic answer

A Service Class 2 Facsimile DCE may provide services for automatic answering of incoming calls; the specification of a DCE automatic answering mechanism is beyond the scope of this Recommendation. The use of such mechanisms is discouraged; to maintain coordinated system operation, the preferred method for providing automatic answering of facsimile calls is for the DTE to respond to DCE indication of incoming calls (see RING, 6.8) by explicitly issuing the A command.

If the DTE configures the DCE to auto-answer, the DTE shall be prepared to respond and answer calls within time limits specified by the user, or by national Administrations.

If configured for automatic answer, the DCE shall answer an incoming call in compliance with Recommendation T.30 and report the same messages as described for manual answer.

TABLE 12/T.32

Answer command DCE responses

| Condition | DCE response | References |
|--|--|---------------------|
| HDLC flags received | +FCO | 8.4.1.1 |
| Calling station wants to send: | | |
| NSC received & +FNR=x,x,x,1 | +FNS:<NSC FIF data> | 8.4.2.4 8.5.1.11 |
| PWD received & +FAP=x,x,1 | +FPW:<PWD frame data> | 8.4.2.5 8.5.1.12 |
| SUB received & +FAP=1,x,x | +FSA:<SUB frame data> | 8.4.2.5 8.5.1.12 |
| TSI received & +FNR=x,x,1,x | +FTI:<remote ID> | 8.4.2.3 8.5.1.11 |
| DCS received & +FNR=x,1,x,x | +FCS:<parameters> | 8.4.2.1 8.5.1.11 |
| Calling station wants to poll: | | |
| NSS received & +FNR=x,x,x,1 | +FNS:<NSS FIF data> | 8.4.2.4 8.5.1.11 |
| PWD received & +FAP=x,x,1 | +FPW:<PWD frame data> | 8.4.2.5 8.5.1.12 |
| SEP received & +FAP=x,1,x | +FPA:<SEP frame data> | 8.4.2.5 8.5.1.12 |
| CIG received & +FNR=x,x,1,x | +FPI:<remote ID> | 8.4.2.3 8.5.1.11 |
| DTC received & +FNR=x,1,x,x | +FTC:<parameters> OK | 8.4.2.1 8.5.1.11 |
| Calling station is a data modem, +FAA=1 | | |
| DCE detects data modem | +FDM | 8.4.1.2 |
| Successful data modem handshake | [optional information] CONNECT[more optional information]<data>... | 8.3.2.4 |
| NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study. | | |

8.3.2.3 Manual answer or restart Class 2 operation

The DTE commands the DCE to resume Service Class 2 facsimile operation, within a single phone call, by issuing an "A" command (e.g. ATA<CR>). A facsimile DCE may also operate as a data modem (+FCLASS=0); the DCE may operate as a facsimile DCE in a different Service Class (e.g. +FCLASS=1.0); the facsimile DCE may have suspended DCE operation for procedure interrupts. If the DTE issues an A command while the DCE is off-hook, with +FCLASS=2.0, the DCE shall restart in Phase B, sending flags and the DIS frame set and then waiting for flags and a DCS or DTC frame set.

8.3.2.4 Connection as a data modem

The DCE may be configured to adaptively answer as a facsimile DCE or as a data DCE, if +FCLASS=2.0 and if +FAA=1 (8.5.2.5). If so configured, if the DCE detects that the calling party is a compatible data modem, it shall report this using the +FDM response (8.4.1.2), reconfigure itself to answer as a data modem, reset the +FCLASS parameter to 0 and issue appropriate result codes (e.g. CONNECT, NO CARRIER, etc.) to the DTE (see Recommendation V.25 *ter*). The DCE shall not change any other facsimile parameters (see 8.5).

If the DCE reconfigures itself to data modem operation in adaptive answering, the DTE must reissue a new +FCLASS=2.0 command to enable subsequent Service Class 2 facsimile operation.

8.3.3 Data transmission, +FDT

- Syntax: +FDT<CR>

The FDT command requests the DCE to transmit a Phase C page. It is issued at the beginning of each page, either in Phase B or in Phase D. When the DCE is ready to accept Phase C data, it shall issue the negotiation responses and the CONNECT result code to the DTE. Negotiation responses are controlled by the +FNR subparameters (8.5.1.11).

In Phase B (after ATA, ATD or the end of a document), the +FDT command releases the DCE to proceed with negotiation and release the DCS message to the remote station. In Phase D (after sending a page), the +FDT command resumes transmission after the end of a previous page.

The +FDT command results in a CONNECT result code response if the DCE is ready for data, or another result code if not (e.g. +FHS:<hangup code>). Following the CONNECT message, the DTE shall deliver image data to the DCE as negotiated. After image data is delivered, the DTE shall deliver a <DLE><ppm> character pair (8.3.3.7) to mark the end of the data and to indicate subsequent actions.

The +FDT command results in an ERROR result code response if the DCE is on-hook.

8.3.3.1 Initiate page transmission

See Table 13.

TABLE 13/T.32

Phase B +FDT command DCE responses, beginning of a document

| Condition | DCE response | References |
|--|---------------------|---------------------|
| NSF received & +FNR=x,x,x,1 | +FNF:<NSF FIF data> | 8.4.2.4 8.5.1.11 |
| CSI received & +FNR=x,x,1,x | +FCI:<remote ID> | 8.4.2.3 8.5.1.11 |
| DIS received & +FNR=x | +FIS:<parameters> | 8.4.2.1 8.5.1.11 |
| DCS generated & +FNR=1,x,x,x | +FCS:<parameters> | 8.4.2.1 8.5.1.11 |
| NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study. | | |

8.3.3.2 Respond to polling

See Table 14.

8.3.3.3 Continue a document

- DCE response: CONNECT

The DTE shall issue a +FDT command for each new page, or to resend a page.

8.3.3.4 Phase C data framing

Phase C data is presented to the DCE in stream mode. The DCE will expect Phase C data to follow until it detects the <DLE><ppm> termination character pair (8.3.3.7); the DCE must filter the stream as described in 6.11.1.

The DCE shall acknowledge the end of the data by returning the OK or ERROR result code to the DTE, after Phase D is completed. The DCE shall return OK if the remote facsimile station accepted the page (local DCE received MCF, RTP or PIP frames); the DCE shall return ERROR if the remote facsimile station rejected the page (local DCE received RTN or PIN frames).

TABLE 14/T.32

Phase B +FDT command DCE responses, polling beginning of a document

| Condition | DCE response | References |
|--|-----------------------|---------------------|
| NSS received & +FNR=x,x,x,1 | +FNF:<NSS FIF data> | 8.4.2.4 8.5.1.11 |
| PWD received & +FAP=x,x,1 | +FPW:<PWD frame data> | 8.4.2.5 8.5.1.12 |
| SEP received & +FAP=x,1,x | +FPA:<SEP frame data> | 8.4.2.5 8.5.1.12 |
| DTC received & +FNR=x,1,x,x | +FTC:<parameters> | 8.4.2.1 8.5.1.11 |
| DCS generated +FNR=1,x,x,x | +FCS:<parameters> | 8.4.2.1 8.5.1.11 |
| NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study. | | |

8.3.3.5 Phase C data format

The Phase C data shall be of the format specified by the negotiated T.30 DCS frame, unless specified otherwise by embedded Data Format Code <DLE><data format code> character pairs or indicated by +FND=1 (8.5.2.10). The DCE shall implement data format changes at EOL boundaries. Data format codes range from hexadecimal values 61h to 6Eh. These are summarized in Table 9.

If the optional Data Format Code character pairs are to be included in the data, the DTE shall first enable the needed format conversion service, using the format conversion parameters in the +FFC command (8.5.3.6).

The DCE shall use the negotiated minimum Scan Time parameter from the DCS frame and insert sufficient fill bits to pad each line to the minimum scan time. This is reported in the +FCS:ST subparameter.

If the DCE finds more than one consecutive embedded EOL in Phase C data, it may insure that only one EOL is sent. Manufacturers may provide means to check and assure the integrity of transmit data, controlled by <tq> subparameter of the +FCQ parameter (8.5.2.3).

NOTES

- 1 For T.4 data, the DTE shall include a final RTC, since the DCE will not append an RTC in response to <DLE><ppm> commands.
- 2 Some facsimile terminals treat two consecutive EOLs as an RTC.
- 3 If the DCE must convert a long page into a short one, e.g. (B4 to A4), enabled by +FFC=1 (8.5.3.6), the DCE shall generate a page break and conduct intermediate Phase D exchanges without reports to the DTE.

8.3.3.6 Escape from transmission, <CAN>

The DCE may request the DTE to halt Phase C transmission, by sending a T.50 <CAN> cancel character (1/8) to the DTE. The DTE shall terminate Phase C transmission, issue a <DLE><ETX> data termination command and wait for the OK response code from the DCE.

This mechanism may be used if the DCE detects that the call is lost (e.g. receives a DCN), or if the DTE sends invalid data (e.g. a page that is too long, such as more than 2287 lines while A4 length and fine vertical resolution is negotiated), or if the DTE sends inappropriate data format codes (e.g. 2-D while 1-D is negotiated and while format conversion is not available or enabled).

The disposition of untransmitted data in the DCE buffer is manufacturer specific.

8.3.3.7 End page transmission

The DTE indicates the end of page by appending a Post Page Message <DLE><ppm> Transparent Data Command to the DCE. This will cause the DCE to enter Phase D by sending the selected T.30 Post Page message. The selected <ppm> code signals the DTE's intentions for subsequent actions:

- <DLE><2/12> Signals that another page of the same format will follow (MPS sent).
- <DLE><3/11> Signals that another document will follow, requiring re-negotiation in Phase B (EOM).
- <DLE><2/14> Signals that there are no more pages or documents (EOP sent).

See Table 15.

TABLE 15/T.32

DCE <DLE><ppm> command responses

| Condition | DCE response | Notes |
|--|---------------------|---|
| <DLE><ppm>, Receive Post Page Response | OK or ERROR | Normal page termination |
| <DLE><ppm>, Receive PIN/PIP and +FIE=1 | +FVO OK or ERROR | Normal termination, remote requested procedure interrupt |
| <DLE><pri> <DLE><ppm> Receive PIP or PIN from remote | +FVO OK or ERROR | Normal termination, local DTE requested procedure interrupt, remote granted |

The OK or ERROR result codes listed above depend on the reply received from the remote facsimile station (8.3.3.4).

8.3.3.8 Request procedure interrupt

The DTE may request procedure interrupt by issuing a <DLE><pri> Transparent Data Command (1/0, 2/1) at any time during Phase C data transmission prior to the <DLE><ppm> page termination command. If the remote station grants the request, it will return a PIN or PIP T.30 post page response to the DCE; the DCE shall negotiate the procedure interrupt, remain off-hook, report the +FVO response and report the OK result code to the DTE if successful; the +FCLASS parameter shall remain unchanged while the DCE is Off-hook. The DTE must take explicit action to hang-up or to resume the session.

8.3.3.9 Query transmit buffer credit status

The DTE may request the DCE to report on the transmit buffer status, by embedding a <DLE><bc?> Transparent Data Command (1/0, 3/15) in the Phase C data.

If the DCE receives the <DLE><bc?> command, it shall compute and report the remaining space in the transmit buffer, computed by subtracting the current buffer octet count from the "flow control off" (XOFF) threshold. The value reported is a hexadecimal quantity, terminated by a <CR>. For example, a credit value of 592 octets would be reported as "250<CR>".

The DTE shall stop transmission of Phase C data after the <DLE><bc?> pair is sent and not resume transmission until the credit message is received from the DCE.

If the Packet Protocol is enabled (+FPP=1) the DCE shall report the remaining buffer space in a packet and the DTE shall acknowledge that packet before it resumes data transmission. However, the packet that contains the buffer credit status shall not have a length of 11h or 13h, to avoid confusion with flow control characters.

8.3.4 Data reception, +FDR

- Syntax: +FDR<CR>

The +FDR command initiates transition to Phase C data reception. This can occur after answering, after dialling, after a document is received, or after a page is received.

The DCE may report the negotiated T.30 parameters, with the remote ID and NSS frame information if available. When the DCE is ready to commence data transfer, it shall issue a CONNECT response code. After the DTE receives the CONNECT response and the DTE is ready to accept data, it shall issue a <DC2> character (T.50 1/2) to the DCE.

From the +FDR command until the end of Phase C Data, the DCE is in a data transfer state and shall not respond to DTE command lines. The DCE shall respond to four T.50 control characters: <DC1> (1/1) and <DC3> (1/3) flow control characters, <CAN> (1/8) (8.3.4.6) and to <"?"> (3/15) (8.3.4.7); all other characters are discarded.

When the DCE delivers the last octet of a page, indicated by the <DLE><ETX> stream termination sequence, the DCE shall report the Page Status via the +FPS:<ppr> response, described in 8.4.3. The Page Status is also stored in the +FPS parameter (8.5.2.2). The <ppr> response codes are described in Table 18.

After a Page Status report, the DCE shall report the post page message from the remote facsimile station via the +FET:<ppm> response (8.4.4.1), which signals the intentions of the remote station. <ppm> response codes are described in Table 19.

The DCE shall use the <ppr> code stored in the +FPS parameter to determine the Post Page response to the remote facsimile station. The DTE may modify the +FPS parameter before issuing the +FDR command, which releases that message. The DTE must issue a +FDR command to release Post Page Messages.

The +FDR command shall result in an ERROR result code if the DCE is on-hook or if the capability to receive is missing or disabled (+FCR=0, 8.5.1.9).

8.3.4.1 Initiate page reception

The +FDR command may be issued in Phase B after an answer command, or in Phase B after a previous document, to initiate document reception. The DCE responses shall be as follows (see Table 16):

8.3.4.2 Initiate polling

The DTE may issue a +FDR command to initiate polling. The command indicates that the DTE can receive. +FSP parameter must be set first. This command instructs the DCE to send a DTC frame set (NSC/CIG/DTC) in response to the remote station's DIS signal, instead of a DCS frame set (NSS/TSI/DCS).

The DCE response is the same as shown in Table 16.

8.3.4.3 Continue document reception

The DCE expects a +FDR command from the DTE after each page is reported, during Phase D, to release the T.30 Post Page Message (see +FPS parameter, 8.5.2.2). The DCE will then negotiate to one of several states, depending on the remote station and preset parameters (+FIE, 8.5.2.1). These conditions and associated DCE responses are shown in Table 17.

8.3.4.4 Phase C data framing

Phase C data shall be presented to the DTE as a stream of data to the DTE including the <DLE><ETX> stream termination characters. The DCE shall filter the stream as described in 6.11.2.

TABLE 16/T.32

Phase B +FDR command DCE responses

| Condition | DCE response | References/notes |
|--|------------------------------|---|
| NSC received & +FNR=x,x,x,1 | +FNC:<NSC FIF data> | 8.4.2.4 8.5.1.11 |
| TSI received & +FNR=x,x,1,x | +FTI:<remote ID> | 8.4.2.3 8.5.1.11 |
| DCS received & +FNR=x.1,x,x | +FCS:<parameters> CONNECT | 8.4.2.1 8.5.1.11 DTE must send <DC2> to receive data |
| Data received | <Phase C Data stream> | 8.3.4.5 to 8.3.4.6 |
| RTC received | <DLE><ETX> +FPS:<ppr>...etc. | 8.4.3 |
| Receive post page message | +FET:<ppm> OK or ERROR | 8.4.4.1 DTE must send FDR command to release post page response |
| NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study. | | |

TABLE 17/T.32

Phase D +FDR command DCE responses

| Condition | DCE action | DCE responses | Notes |
|---|--|---|--|
| MPS received | Finish Phase C Re- enter Phase C | CONNECT | Another page |
| EOM received DCS received | Finish Phase C Enter Phase B [NSF received] [TSI received] Enter Phase C | [+FNF:...] [+FTI:...] [+FCS:...] CONNECT | Another receive document |
| EOM received DTC received | Finish Phase C Enter Phase B [NSS received] [CIG received] | [+FNS:...] [+FPI:...] [+FTC:...] OK | Switch to polling request +FDT expected |
| EOP received DCN received | Finish Phase C Enter Phase E Hangup | +FHS:00 OK | End of session |
| PRI-Q received and +FIE=1 | Finish Phase C | +FVO OK | Remote system requests interrupt |
| PIN or PIP sent (DTE sets +FPS=4 or 5) | Finish Phase C | +FVO OK | Local DCE requests interrupt |

8.3.4.5 Phase C data format

The received data format is that negotiated under Recommendation T.30 and reported by the +FCS:VR,BR,WD,LN,DF,EC,BF,ST,JP response.

The DCE may strip zero fill bits from the data, to minimize storage needs. The DCE may insert zero fill bits to octet-align EOLs, controlled by the +FEA parameter, 8.5.3.5.

<DLE><DC2> character pairs may be embedded in the data stream to indicate that the DTE has caught up with the receive data and the buffer is empty (8.3.4.6).

If the DCE has lost data due to receive buffer overflow, the DCE shall insert <DLE><"O"> (T.50 1/0, 4/15) character pairs into the data stream to mark the location of the loss.

<DLE><rb0-rb9> Receive Buffer Status codes may be embedded in the data stream in response to DTE commands (8.3.4.6).

8.3.4.6 Receive buffer status query and indication

If the DTE issues a <DC3> to the DCE for flow control, followed by a <DC1>, the DCE shall signal the DTE when its buffers are empty, by sending a <DLE><DC2> (T.50 1/0, 1/2) character pair.

If the DTE issues a <DC3> to the DCE for flow control and if the DCE subsequently loses data due to buffer overrun, the DCE shall discard the most recent data (rather than older data) and insert a <DLE><"O"> character pair as an error marker into the Phase C data.

The DTE can query the contents of the DCE receive buffer during Phase C reception by sending a <"?"> character (T.50 3/15) to the DCE. If the DCE receives a <"?"> character from the DTE, it shall report the approximate buffer contents as a fraction of the full amount, rounded to intervals of 10%. The <DLE><buffer status> codes range from <DLE><"0"> (T.50 1/0, 3/0) to <DLE><"9"> (T.50 1/0, 3/9), representing 0-10% to 90-100% full respectively (see Table 9). The full buffer size is that reported in response to the +FBS? command (8.5.3.2).

8.3.4.7 Escape from reception, <CAN>

On receipt of <CAN> character the DCE shall terminate reporting of received data by sending trailing <DLE><ETX> characters to the DTE, discard all remaining data and the DCE shall execute an implied +FKS command, conducting an orderly disconnection. If the page is fixed length, the DCE should wait and send the DCN frame after the current page completes, so that the sending station can hear the DCN. If the page length is unlimited, the DCE may halt reception and terminate the session at any time. If the DTE sends any character after the <CAN> character other than <DC1> or <DC3>, before the DCE returns an "OK" response, the DCE shall immediately abort the session and hang up.

8.3.4.8 Request procedure interrupt

The receiving DTE may request procedure interrupt by setting the +FPS=<ppm> parameter to 4 (PIN) or 5 (PIP) before issuing a post page +FDR command. If the remote station accepts the request, it will return a PRI-Q T.30 post page response message; the DCE shall complete the negotiation, suspend the T.30 session and report the +FVO response and OK result code to the DTE; the +FCLASS parameter shall remain unchanged while the DCE is off-hook. If the remote station ignores the PRI-Q, the DCE shall report OK or ERROR as appropriate; if the remote station indicates rejection by sending a DCN, the DCE shall report +FHS:A3 (Table 20).

8.3.5 Session termination, +FKS

- Syntax: +FKS

The +FKS command causes the DCE to terminate the session in an orderly manner. In particular, it will send a DCN message at the next opportunity and hang up. At the end of the termination process, the DCE shall report the +FHS response with result code, defined in 8.4.5, go On-Hook and, if +FCLASS=0 is supported, set +FCLASS=0.

The DTE may also invoke this operation using the T.50 <CAN> (Cancel, T.50 1/8) character during Phase C data reception (see 8.3.4.7).

If the DTE issues this command while the DCE is On-Hook, the DCE shall report OK.

8.3.6 Initialize facsimile parameters, +FIP

- Syntax: +FIP[=<value>]

The +FIP command causes the DCE to initialize all Service Class 2 Facsimile Parameters to the manufacturer determined default settings. This command does not change the setting of +FCLASS. This command has the same effect as if the DTE had issued individual parameter setting commands.

Manufacturers may also provide a selection of default profiles, chosen by the optional <value>. If <value> is unspecified or 0, the parameters shall be set to those specified in this Recommendation (e.g. Appendix I). For other <value>s, the manufacturer determines the profile settings.

This command may be issued during a session. The DCE shall use the new settings at the next time they are sampled; for example, a new +FIS setting would be used the next time the DCE enters Phase B.

8.4 Facsimile service Class 2 DCE responses

The DCE shall send information responses to the DTE as a facsimile session proceeds. They indicate the state of the facsimile session and convey needed information. These messages are solicited messages, generated by execution of DTE action commands described in 8.3. Some of these messages can be inhibited by DTE command (8.5.1.11).

8.4.1 T.30 phase A responses

8.4.1.1 Facsimile connection, +FCO

The +FCO response indicates connection with a Group 3 facsimile station. The DCE shall deliver this message to the DTE upon detection of HDLC flags in the first received frame, in execution of Originate commands (8.3.1) or Answer commands (8.3.2) only.

8.4.1.2 Transition to data modem, +FDM

- Syntax: +FDM

+FDM response indicates that the DCE has identified that the calling device is a data modem. The DCE shall issue this response immediately upon recognition of a data modem. For example, the DCE might detect a V.32 AA pattern, or V.22 *bis* S1 signal, or V.25 1300 Hz calling tone. The +FDM response shall precede any data modem information text or result codes (e.g. CONNECT).

The DTE should respond to a +FDM message by preparing itself to handle a data call. The +FDM response is enabled by DTE command to set the +FAA parameter to 1 (8.5.2.5). The DTE should not set +FAA=1 unless it is able to handle this result.

8.4.2 T.30 phase B negotiation responses

The DCE may provide the on-line status of several session parameters, when available in T.30 handshaking and if enabled via the +FNR subparameters (8.5.1.11). These include the remote ID string and the DIS/DCS/DTC parameters.

NOTE – The use of additional optional negotiation responses in order to support future optional T.30 features is for future study.

8.4.2.1 Report DIS/DCS/DTC frame information

- Syntax: +FCS:VR,BR,WD,LN,DF,EC,BF,ST, JP current session;
- Syntax: +FIS:VR,BR,WD,LN,DF,EC,BF,ST, JP remote identification;
- Syntax: +FTC:VR,BR,WD,LN,DF,EC,BF,ST, JP request for polling.

These responses report the T.30 session parameter frames. The subparameters are described in Table 21.

+FCS:<subparameter string> reports negotiated parameters. Phase C data will be formatted as reported by these subparameters. +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses, before the CONNECT result code, if new DCS frames are generated or received.

+FIS:<subparameter string> or +FTC:<subparameter string> report remote facsimile station capabilities and intentions. Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses, if the corresponding frames are received, before the OK final result code.

NOTE – The use of additional parameters or subparameters for +FCC, +FIS or +FCS in order to support future optional T.30 features is for future study.

8.4.2.2 Remote polling indication, +FPO

- Syntax: +FPO

+FPO indicates that the remote station has a document to poll and invites the DTE to poll it (see Table 2/T.30, bit 9). The +FPO response is delivered between the +FIS:<string>, and the OK final result code, if enabled. Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate this response. +FSP=0 inhibits the +FPO response (8.5.1.8).

The DTE may respond to a +FPO message with either a +FDR command, to poll the remote station, or a +FDT command, if it does not wish to poll.

8.4.2.3 Report remote ID

- Syntax: +FTI:"<TSI ID string>" Transmit Station ID
- Syntax: +FCI:"<CSI ID string>" Called Station ID
- Syntax: +FPI:"<CIG ID string>" Polling Station ID

These responses report the received remote ID string, if any. Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses, if the corresponding frames are received.

The DCE shall report the characters in the ID string in reversed time order from the order received from the remote station. For example, if the following ID FIF character string is received (hexadecimal values):

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

The result would be:

<CR><LF>+FCI:"+1 234 567 8901 " <CR><LF>

8.4.2.4 Report non-standard negotiation frames

- Syntax: +FNF:<NSF FIF string> Non-Standard Facilities;
- Syntax: +FNS:<NSS FIF string> Non-Standard Setup;
- Syntax: +FNC:<NSC FIF string> Non-Standard Commands.

These responses report any received Non-Standard negotiation frames, one response per frame. Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses if the corresponding frames are received.

The NSF Facsimile Information Field (FIF) frame octets (beginning with the country code, but not including the FCS) are presented in hex notation, and separated by spaces. HDLC flags, and zero bits inserted for transparency are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received. For example, the two octet bit string 0001101101000101 would be reported D8 A2.

The facsimile DCE reports the frame; it need not act on it. Specification of any other Non Standard behaviour is beyond the scope of this Recommendation.

8.4.2.5 Report addressing or password strings

- Syntax: +FSA:"<SUB string>" destination SUBaddress;
- Syntax: +FPA:"<SEP string>" Polling Address;
- Syntax: +FPW:"<PWD string>" polling PassWord.

These responses report the received Addressing or Password string, if any. Originate (8.3.1), Answer (8.3.2), +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses, if the corresponding frames are received.

If the corresponding subparameter in the +FAP parameter is set, the DCE shall report the characters in these strings in reversed time order from the order received from the remote station. For example, if the following hexadecimal SUBaddress string is received:

<39><38><37><36><35><34><33><32><31><30><39><38><37><36><35><34><33><32><31> <30>

The result would be:

<CR><LF>+FCI:"01234567890123456789"<CR><LF>

8.4.2.6 Report file transfer diagnostic frame, +FFD:

- Syntax: +FFD:<FDM FIF string> File Diagnostic Message.

This response reports any received File Diagnostic Message frame, one response per frame. +FDT (8.3.3) or +FDR (8.3.4) command execution may generate these responses if the corresponding frames are received. This report is disabled if the BF subparameter is not set to 1.

The FDM Facsimile Information Field (FIF) frame octets are presented in hex notation, and separated by spaces. HDLC flags, and zero bits inserted for transparency are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received. For example, the two octet bit string 0001101101000101 would be reported D8 A2. The facsimile DCE reports the frame; it need not act on it.

8.4.3 T.30 phase C page reception response

- Syntax: +FPS:<ppr>,<lc>,<blc>,<cblc>,<lbc>

The +FPS:<ppr> is generated by the DCE at the end of Phase C data reception, in execution of a +FDR command (8.3.4).

The initial <ppr> is generated by the DCE; it depends on the DCE for T.4 or T.6 error checking capabilities, controlled by the +FCQ parameter (8.5.2.3). See Table 18 for <ppr> values. Note that the <ppr> value may be changed by the DCE in response to a remote request for procedure interrupt (8.5.2.2).

The receiving DCE may count lines, bad lines, maximum consecutive bad lines, and octets lost due to DCE buffer overflow, and report them:

- <lc> line count;
- <blc> bad line count;
- <cblc> maximum consecutive bad line count; this is the number of lines in the largest group of consecutive bad lines;
- <lbc> lost octet count.

The line counts are qualified by the DCE's copy quality checking capabilities, controlled by the +FCQ parameter (8.5.2.3). If the DCE is not configured to count lines, or if line counts are irrelevant (e.g. in Binary File Transfer mode, Recommendation T.434) the DCE shall set the line counts to 0.

A receiving DTE may inspect <ppr>, and write a modified value into the +FPS parameter. The DCE shall hold the corresponding Post Page Response message until released by a subsequent +FDR command from the DTE.

TABLE 18/T.32

T.30 post page response message codes

| Value | T.30 label | Result code | Description |
|-------|------------|-------------|--|
| 1 | MCF | OK | Page good |
| 2 | RTN | ERROR | Page bad; retrain requested |
| 3 | RTP | OK | Page good; retrain requested |
| 4 | PIP | OK | Page good; remote request for procedure interrupt accepted |
| 5 | PIN | ERROR | Page bad; retrain requested; remote request for procedure interrupt accepted |

8.4.4 T.30 phase D post page responses**8.4.4.1 Post page message response, +FET:**

- Syntax: +FET:<ppm>

The +FET:<post page message> response is generated by a receiving facsimile DCE on receipt of the post page message from the transmitting station, in execution of a +FDR command (8.3.4). The <ppm> codes correspond to the T.30 post page messages (see Table 19):

TABLE 19/T.32

Post page message codes

| PPM code | T.30 mnemonic | Description |
|----------|---------------|---|
| 0 | MPS | Another page next, same document |
| 1 | EOM | Another document next |
| 2 | EOP | No more pages or documents |
| 3 | PRI-MPS | Another page next, same document, procedure interrupt requested |
| 4 | PRI-EOM | Another document next, procedure interrupt requested |
| 5 | PRI-EOP | No more pages or documents, procedure interrupt requested |

If Procedure interrupts are disabled (+FIE=0, 8.5.2.1), the DCE shall report only non-PRI-Q codes, and convert PRI-Q post page messages to non-PRI-Q equivalents (e.g. PRI-MPS would be reported as +FET:0).

If procedure interrupts are enabled (+FIE=1), the DCE reports the PRI-Q post page message, and adjusts the value of the +FPS parameter (8.5.2.2) to reflect the provisional acceptance of the procedure interrupt. Prior to issuing the subsequent +FDR command releasing the post page response, the DTE may change the +FPS parameter value to refuse the interrupt. See 8.3.3.8, 8.3.4.8, and 8.5.2.1 for specification of procedure interrupt operation.

8.4.4.2 Transition to voice, +FVO

- Syntax: +FVO

+FVO indicates that a procedure interruption has been negotiated, and the session has been suspended; the DCE remains off-hook. (The +FCLASS parameter is unchanged.) This response is generated if either the local DTE initiated a procedure interrupt (8.3.3.8, 8.3.4.8), and the remote station agreed, or if the remote station requested a procedure interrupt, and the +FIE parameter was set (8.5.2.1). If the remote station requests a procedure interrupt during document reception, the DCE issues a +FVO response after the DTE issues the next +FDR command with the +FPS parameter set to accept the request.

The DTE should respond to a +FVO message by suspending the session, and waiting for the operator or application process to determine if the session should be resumed or terminated.

8.4.5 Call termination status, +FHS:

- Syntax: +FHS:<hsc>

+FHS indicates that the call has been terminated. The hangup cause is reported, and stored in the +FHS parameter for later inspection. These values are described in Table 20.

+FHS:<hsc> is a possible intermediate result code to any DTE action command described in 8.3. It is always followed by the OK final result code.

All <hsc> codes are two-digit hexadecimal values. The <hsc> values are organized according to the Phases of the facsimile transaction as defined by Recommendation T.30. In Annex A/T.30 flow charts, there are decision boxes labelled "Command Received?"; this is referred to as COMREC in the table. Similarly, decision boxes labelled "Response Received?" are referred to as RSPREC in the table. A COMREC error or RSPREC error indicates that one of two events occurred:

- 1) a DCN (disconnect) signal was received; or
- 2) an FCS error was detected, and the incoming signal was still present after 3 seconds. (See Annex A/T.30).

The table values are in hexadecimal notation.

TABLE 20/T.32

Hangup status codes

| Values | Hangup cause description |
|--------|--|
| 00-0F | Call placement and termination |
| 00 | Normal and proper end of connection |
| 01 | Ring detect without successful handshake |
| 02 | Call aborted, from +FKS or <CAN> |
| 03 | No loop current |
| 04 | Ringback detected, no answer (timeout) |
| 05 | Ringback detected, answer without CED |
| 10-1F | Transmit Phase A and miscellaneous errors |
| 10 | Unspecified Phase A error |
| 11 | No answer (T.30 T1 timeout) |
| 20-3F | Transmit Phase B hangup codes |
| 20 | Unspecified transmit Phase B error |
| 21 | Remote cannot receive or send |
| 22 | COMREC error in transmit Phase B |
| 23 | COMREC invalid command received |
| 24 | RSPREC error |
| 25 | DCS sent three times without response |
| 26 | DIS/DTC received 3 times; DCS not recognized |
| 27 | Failure to train at 2400 bit/s or +FMS value |
| 28 | RSPREC invalid response received |

TABLE 20/T.32 (end)

Hangup status codes

| Values | Hangup cause description |
|--|---|
| 40-4F | Transmit Phase C hangup codes |
| 40 41 42 43 44 45 46 47 | Unspecified transmit Phase C error Unspecified image format error Image conversion error DTE to DCE data underflow Unrecognized transparent data command Image error, line length wrong Image error, page length wrong Image error, wrong compression code |
| 50-6F | Transmit Phase D hangup codes |
| Values | Hangup cause description |
| 50 51 52 53 54 55 56 57 58 | Unspecified transmit Phase D error RSPREC error No response to MPS repeated 3 times Invalid response to MPS No response to EOP repeated 3 times Invalid response to EOP No response to EOM repeated 3 times Invalid response to EOM Unable to continue after PIN or PIP |
| 70-8F | Receive Phase B hangup codes |
| 70 71 72 73 74 | Unspecified receive Phase B error RSPREC error COMREC error T.30 T2 timeout, expected page not received T.30 T1 timeout after EOM received |
| 90-9F | Receive Phase C hangup codes |
| 90 91 92 93 | Unspecified receive Phase C error Missing EOL after 5 seconds (3.2/T.4) Bad CRC or frame (ECM mode) DCE to DTE buffer overflow |
| A0-BF | Receive Phase D hangup codes |
| A0 A1 A2 A3 | Unspecified receive Phase D errors RSPREC invalid response received COMREC invalid response received Unable to continue after PIN or PIP |
| C0-DF | Reserved for future standardization |
| E0-FF | Reserved for manufacturer-specific use |
| NOTE – Except for the set of codes specifically designated for manufacturer-specific use, all other unused codes are reserved for specification in future versions of this Recommendation. | |

8.5 Facsimile service Class 2 parameters

Unless otherwise specified, all service Class 2 parameters can be read, written, and tested for a range of legal values by the DCE. The general syntax is described in 6.1.4. These parameters are written only by explicit command, by issuing a +FIP[=<value>] command, or by other operations defined in this Recommendation. Commands not defined in this Recommendation shall not affect these parameters.

Appendix I shows the Class 2 parameters, and subparameters, with mandatory values, optional values, and default values summarized.

8.5.1 T.30 session parameters

Group 3 facsimile devices negotiate session parameters in DIS, DCS and DTC frames. The following parameters are provided to condition the facsimile DCE for the capabilities it will offer, and to report the session settings negotiated.

The three primary T.30 session parameters are +FCC, +FIS and +FCS, described in 8.5.1.1 through 8.5.1.3. They are compound parameters, using subparameter values listed in Table 21. Figure 1 illustrates their relationships:

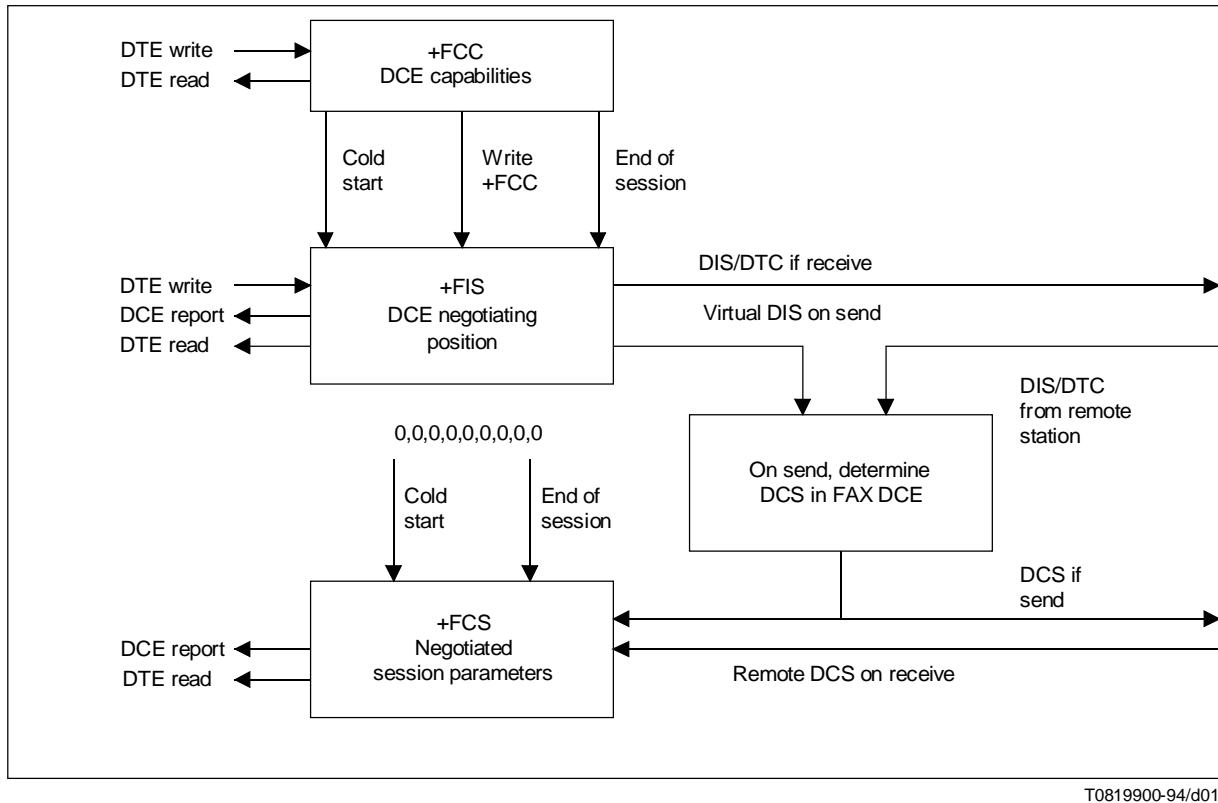


FIGURE 1/T.32
T.30 session parameters

FIGURE 1/T.32...[D01] = 12,5 CM

8.5.1.1 DCE capabilities parameters, +FCC

- Write syntax: +FCC=VR,BR,WD,LN,DF,EC,BF,ST,JP
- Valid values: see Table 21
- Default values: set by manufacturer
- Mandatory values: as required by Recommendation T.30

+FCC allows the DTE to sense and constrain the capabilities of the facsimile DCE, from the choices defined in Table 2/T.30. When +FCC is modified by the DTE, the DCE shall copy +FCC into +FIS.

NOTE – The use of additional subparameters for the +FCC, in order to support future T.30 features, is for further study.

8.5.1.2 Current session parameters, +FIS

- Write syntax: +FIS=VR,BR,WD,LN,DF,EC,BF,ST,JP
- Valid values: see Table 21
- Default values: set by manufacturer
- Mandatory values: as required by Recommendation T.30

The +FIS parameter allows the DTE to sense and constrain the capabilities used for the current session. The DCE uses +FIS to generate DIS or DTC messages directly, and uses +FIS and received DIS messages to generate DCS messages.

The DCE shall set the +FIS parameter from the +FCC parameter on DCE initialization, upon +FIP command execution, when +FCC is written, and at the end of a session.

NOTE – The use of additional subparameters for the +FIS, in order to support future T.30 features, is for further study.

8.5.1.3 Current session results, +FCS

- Read syntax: +FCS?
- DCE response: VR,BR,WD,LN,DF,EC,BF,ST,JP
- Valid values: see Table 21
- Default values: 0,0,0,0,0,0,0,0
- Mandatory values: as required by Recommendation T.30

The +FCS parameter is loaded with the negotiated T.30 parameters for the current session. A transmitting DCE generates DCS; a receiving DCE gets DCS from the remote station. The DTE may only read this parameter.

The DCE shall set the +FCS parameter to the default values on DCE initialization, on +FIP command execution, and at the end of a session.

The contents of +FCS are spontaneously reported during execution of +FDR (8.3.4) or +FDT (8.3.3) commands, by the +FCS:VR,BR,WD,LN,DF,EC,BF,ST, JP response, using the same compound parameter format. See 8.4.2.1.

NOTE – The use of additional subparameters for the +FCS, in order to support future T.30 features, is for further study.

8.5.1.4 T.30 session subparameters

Several commands and responses reference T.30 session negotiated parameters. These are described by a set of common subparameters. These subparameters are described in Table 21, with Notes. Optional parameter values are marked with an asterisk (*). Unspecified parameter values are reserved for future use.

The +FCC, +FIS and +FCS compound parameters, described in 8.5.1.1 through 8.5.1.3, use these session subparameters. On writes, unspecified subparameters are unchanged.

The +FIS:, +FCS: and +FTC: session report responses, described in 8.4.2.1, use these subparameters.

For test response, ranges of values are reported for each subparameter, enclosed in parentheses characters. For example, a DCE response to +FCC=? could report:

<CR><LF>(0,1),(0-3),(0-3),(0-2),(0-2),(0-1),(0),(0-7),(0)<CR><LF>

Use example: AT+FIS=0,3,0,2,0,0,0,1,0<CR> results in:

- VR = 0 98 dpi vertical resolution;
- BR = 3 9600 bit/s;
- WD = 0 1728 pixels;
- LN = 2 unlimited length;
- DF = 0 1-D modified Huffman coding;
- EC = 0 no ECM;
- BF = 0 no BFT;
- ST = 1 5 ms scan time;
- JP = 0 no JPEG.

NOTE 1 – The use of additional subparameters in Table 21, in order to support future T.30 features, is for further study.

For each subparameter, the DCE shall negotiate to a mutually available setting, as specified by Recommendation T.30, unless specified otherwise by the DTE; see the +FMS parameter in 8.5.2.9.

NOTE 2 – If some possible subparameter values represent unacceptable conditions to the DTE, the DTE must enable session reporting (+FNR, 8.5.1.11), inspect the session reports, and terminate the session if necessary. Otherwise, the data format negotiated and the data format transferred between the DTE and DCE might not match, and the facsimile session would fail.

TABLE 21/T.32

T.30 session subparameter codes

| Label | Function | Values | Description |
|-------|---------------------------|---|--|
| VR | Resolution (Note 1) | 00 01 *02 *04 *08 *10 *20 *40 | R8 × 3.85 l/mm, Normal R8 × 7.7 l/mm, Fine R8 × 15.4 l/mm R16 × 15.4 l/mm 200 dpi × 100 l/25.4 mm 200 dpi × 200 l/25.4 mm 200 dpi × 400 l/25.4 mm 300 dpi × 300 l/25.4 mm |
| BR | Bit Rate (Note 2) | 0 1 *2 *3 *4 *5 | 2 400 bit/s 4 800 bit/s 7 200 bit/s 9 600 bit/s 12 000 bit/s 14 400 bit/s |
| WD | Page Width in pixels | 0 *1 *2 *3 *4 | R8 R16 200 300 400 d/mm d/mm dpi dpi dpi 1728 3456 1728 2592 3456 2048 4096 2048 2432 4864 2432 1216 2432 864 1728 |
| LN | Page Length | 0 *1 *2 | A4, 297 mm B4, 364 mm Unlimited length |
| DF | Data Compression Format | 0 *1 *2 *3 | 1-D Modified Huffman (Rec. T.4) 2-D Modified read (Rec. T.4) 2-D Uncompressed mode (Rec. T.4) 2-D Modified modified read (Rec. T.6) |
| EC | Error Correction | 0 *1 *2 *3 | Disable ECM Enable Annex A/T.30, ECM Enable Annex C/T.30, half duplex Enable Annex C/T.30, full duplex |
| BF | File Transfer (Note 3) | 00 *01 *02 *04 *08 *10 *20 *40 | Disable file transfer modes Select enable BFT, Rec. T.434 Select document transfer mode Select edifact mode Select basic transfer mode Select character mode Annex D/T.4 Select mixed mode, Annex E/T.4 Select processable mode, Rec. T.505 |
| ST | Scan Time/Line | 0 1 2 3 4 5 6 7 | VR = 0 VR > 0 0 ms 0 ms 5 ms 5 ms 10 ms 5 ms 10 ms 10 ms 20 ms 10 ms 20 ms 20 ms 40 ms 20 ms 40 ms 40 ms |

TABLE 21/T.32 (end)

T.30 session subparameter codes

| Label | Function | Values | Description |
|-------|---|---|---|
| JP | JPEG for colour and B&W (Note 4) | 00 *01 *02 *04 *08 *10 *20 *40 | Disable JPEG coding Enable JPEG coding (Rec. T.81) Full colour mode Enable preferred Huffman tables (Note 5) 12 bits/pel/component No subsampling (1:1:1) Custom illuminant Custom gamut range |

NOTES

1 For subparameter VR, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice; they are the only values allowed in the +FCS parameter and +FCS: report. All other values which are sums of these values shall only be used to indicate multiple capabilities; these are allowed in +FIS and +FCC parameters. For example, value 07 (01 + 02 + 04) would indicate capability for all metric-based resolutions. Values higher than 7Fh are reserved for future study.

2 Recommendation T.30 does not provide for the answering station to specify all speeds exactly using the DIS frame. Implementation of some BR codes (e.g. code 2) by an answering DCE is manufacturer specific. Values higher than 5 are reserved for future modulations.

3 For subparameter BF, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice; they are the only values allowed in the +FCS parameter and +FCS: report. All other values which are sums of these values shall only be used to indicate multiple capabilities; these are allowed in +FIS and +FCC parameters. For example, to indicate support for BFT, character mode and mixed modes, the DTE should set the BF subparameter to 01 + 10 + 20 = 31. Values higher than 7F are reserved for future study.

4 For each subparameter JP, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice. All other values which are sums of these values shall be used to indicate multiple capabilities in +FIS and +FCC subparameters and to indicate the choice in +FCS subparameters. For example, to indicate support for JPEG, full colour mode and no subsampling, the DTE should set the JP subparameter to 01 + 02 + 10 = 13. If one or several of the values 02 up to 40 are not used, that means that the default value for the subparameter (e.g. respectively: gray-scale, custom Huffman tables, 8 bit/pel/component, 4:1:1 subsampling ratio, D50 illuminant, default gamut range) is used, as defined in Annex E/T.30 and Annex G/T.4.

5 The DCE shall ignore this value in +FCC and in +FIS when generating DIS or DTC frames.

8.5.1.5 Local ID strings, +FLI and +FPI

- Write syntax: +FLI="<local ID string>"
 +FPI="<local polling ID string>"
- Valid values: 20 character printable T.50 string
- Mandatory values: 20 character string, Table 3/T.30
- Default value: null string

The DCE shall send the corresponding ID frame if either +FLI or +FPI is not a null string. +FLI is used for CSI or TSI; +FPI is used for CIG. Table 3/T.30 includes digits 0-9, "+" and space.

The DCE shall transmit ID string characters to the remote station in reversed time order from the order in the command line. For example, if the command line:

AT+FLI="+1 234 567 8901"<CR>

is issued, the DCE would send a CSI or TSI frame with FIF (hexadecimal) consisting of:

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34><33><32><20><31><2B>

The +FLI=? or +FPI=? test commands reports the range of character values supported. For example, if the DCE supports use of Table 3/T.30 only, the response to a +FLI=? command is "(20,2B,30-39)" (hexadecimal values); if the DCE supports printable T.50, the response is: "(20-7E)".

If less than 20 characters are specified in a non-null string, the DCE shall append space characters (2/0). If the specified string is more than 20 characters in length, an ERROR result code is generated.

8.5.1.6 Non-standard frame FIF octet string

- Write syntax: +FNS="<string of hexadecimal coded octets>"
- Valid values: up to 90 octets
- Mandatory values: none, this parameter is optional
- Default value: null string

The DCE shall send the corresponding non-standard facilities frame if +FNS is not a null string. The type of frame is determined by the type of negotiation frame to be sent: NSF sent with DIS; NSS sent with DCS; NSC sent with DTC.

The DCE only delivers the data; the DTE must determine the content. The first octet must be the country code (see Recommendation T.35).

The DCE response format for the +FNS=? command is the number of octets that the parameter can hold. The maximum value is constrained by Recommendation T.30.

This parameter may require 180 hexadecimal characters to specify. The +FNS="<hex string>" may be repeated with new data; each use appends data to the data entered previously. The +FNS="" command resets this parameter to a null string.

The <hexadecimal coded octet string> shall consist of pairs of hexadecimal numbers (T.50 3/0-3/9, 4/1-4/6). Spaces between octets shall be ignored by the DCE. The DCE shall send octets in the order loaded. Each octet shall be sent LSB first; the string "D8A2" would result in the following bit pattern: 0001101101000101. (Note – This is the same format used in Non-Standard frame reports, see 8.4.2.4.)

8.5.1.7 Indicate document to poll, +FLP

- Write syntax: +FLP=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory values: 0, 1

+FLP=0 Indicates that the DTE has no document to poll. The DIS bit 9 will be cleared. Any received DTC frames will be result in an orderly disconnection, with hangup status code +FHS:23.

+FLP=1 Indicates that the DTE has a document ready for polling. The DIS bit 9 will be set, to report this to the remote station. Any received DTC frames will be accepted. The DCE shall reset this parameter to 0 after a polled document is sent.

8.5.1.8 Request to poll, +FSP

- Write syntax: +FSP=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory value: 0

+FSP=0 Indicates that the DTE does not want to poll. Bit 9 in a received DIS frame will be ignored.

+FSP=1 Indicates that the DTE can receive a polled document. Bit 9 in received DIS frames will be reported by the +FPO response (8.4.2.2). The DCE shall reset this parameter to 0 after a polled document is received.

NOTE – If receive capability is off or disabled (+FCR=0), the DCE cannot poll, and shall act as if the +FSP parameter is set to 0.

8.5.1.9 Capability to receive, +FCR

- Write syntax: +FCR=<value>
- Valid values: 0, 1
- Default value: manufacturer's option
- Mandatory value: 0

- +FCR=0 Indicates the DCE will not receive message data; also, the DCE will not be able to poll a remote device. This clears bit 10 in the DIS or DTC frame. This can be used when the DTE has insufficient storage, or if the DCE does not have a Phase C demodulator. The DCE can send and can be polled for a document.
- +FCR=1 Indicates the DCE can receive message data. Bit 10 in the DIS or DTC frame will be set.
- +FCR Is sampled in Recommendation T.30 Phase B and Phase D.

8.5.1.10 HDLC frame reporting, +FBU

- Write syntax: +FBU=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory value: 0

- +FBU=0 Disables HDLC frame reporting.
- +FBU=1 Enables the DCE to report the contents of Phase B and Phase D HDLC frames to the DTE, as they are sent and received, in addition to other responses. These will be reported using the +FHT: and +FHR: responses, described in 8.6.

8.5.1.11 Negotiation reporting, +FNR

- Write syntax: +FNR=<rpr>,<tpr>,<idr>,<nsr>
- Valid values: 0, 1 for each subparameter (Table 22)
- Default values: 0,0,0,0
- Mandatory values: 0, 1 for each subparameter

+FNR is a compound parameter, used to control the reporting of messages generated during T.30 Phase B negotiations. There are four switches, for four types of reports. These switches are described in Table 22:

TABLE 22/T.32

+FNR switch subparameters

| Switch setting | Message reference | Description |
|----------------|-------------------|---|
| rpr=0 rpr=1 | 8.4.2.1 | Receiver parameters are not reported +FIS: and +FTC: reports are suppressed Receiver parameters are reported +FIS: and +FTC: reports are generated |
| tpr=0 tpr=1 | 8.4.2.1 | Transmitter parameters are not reported +FCS: reports are suppressed (+FCS parameter is still loaded) Transmitter parameters are reported +FCS: reports are generated |
| idr=0 idr=1 | 8.4.2.3 | ID strings are not reported. +FTI:, +FCI: and +FPI: reports are suppressed ID strings are reported. +FTI:, +FCI: and +FPI: reports are generated |
| nsr=0 nsr=1 | 8.4.2.4 | Non-standard frames are not reported. +FNF:, +FNS: and +FNC: reports are suppressed Non-standard frames are reported. +FNF:, +FNS: and +FNC: reports are generated |

NOTES

- 1 If tpr=0, the negotiated image data format will not be reported. Without that report, the DTE must send image data that is mandated by Recommendation T.30 (normal resolution, A4 length, 1728 width, 1-D coding) or it must enable the corresponding format conversion (+FFC). Otherwise, the data format negotiated and the data format sent might not match, causing the facsimile session to fail.
- 2 The use of additional subparameters for +FNR, in order to control reporting of future optional T.30 negotiation reports, is for future study.

8.5.1.12 Address & polling capabilities, +FAP

- Write syntax: +FAP=<sub>,<sep>,<pwd>
- Valid values: 0 (disabled) or 1 (enabled) for each
- Mandatory values: 0 or 1 if +FAP supported
- Default values: 0,0,0

Recommendation T.30 defines three 20-digit numeric strings, used for inbound subaddressing, selective polling and passwords. Recommendation T.30 also allows the station to indicate its willingness to accept these strings.

Each of these binary subparameters allow the DTE to indicate these capabilities to the remote station, via the corresponding bits in the DIS or DTC frames: bit 47 for SEP, bit 49 for SUB, bit 50 for PWD.

These subparameters also control the reporting of those frames, if received. For example, if the <sep> subparameter value is set to 0 (disabled), then the DCE shall ignore a received SEP frame; if the <sep> subparameter is set to 1 (enabled), the DCE shall report the received frame using the +FPA: report (8.4.2.5).

8.5.1.13 Addressing & polling frames, +FSA, +FPA, +FPW

- Write syntax: +FSA="<destination SubAddress string>"
+FPA="<selective Polling Address string>"
+FPW="<PassWord string>"
- Valid values: 20 digit T.50 string
- Mandatory values: 20 digit string: digits 0-9, *, # and space
- Default value: null string

The DCE shall send the numeric string contained in +FSA, +FPA or +FPW at the times specified in Recommendation T.30, if the corresponding parameter is not a null string. The +FPW parameter is used for the PWD frame sent with either DTC or with DCS. Recommendation T.30 defines these frames for values of digits 0-9, space, * and # characters only.

The DCE shall transmit digit string characters to the remote station in reversed time order from the order in the command line. For example, if the command line AT+FSA="1 012 3456789**01#" is issued, the DCE would add two space characters, and send a SUB frame with FIF consisting of the following octets (expressed as hexadecimal digits):

<23><31><30><2A><2A><39><38><37><36><35><34><33><20><32><31><30><20><31><20><20>

The +FSA=?, +FPA=? or +FPW=? test commands report the corresponding ranges of character values supported. For example, if the DCE supports use of numeric digits only, the response to a +FSA=? command is "(30-39)" in hexadecimal values; if the DCE supports printable T.50, the response is: "(20-7E)".

If less than 20 characters are specified in a non-null string, the DCE shall append space characters (2/0). If the specified string is more than 20 characters in length, an ERROR result code is generated.

8.5.1.14 File transfer diagnostic message, +FFD

- Write syntax: +FFD="<string of hexadecimal coded octets>"
- Valid values: up to 90 octets
- Mandatory value: none, this parameter is optional
- Default value: null string

The DCE shall send a File transfer Diagnostic Message specified in the +FFD parameter as when specified in Recommendations T.30 and T.434, if the +FFD is not a null string. The DCE only delivers the data; the DTE must determine the content.

The DCE response format for the +FFD=? command is the number of octets that the parameter can hold. The maximum value is constrained by Recommendations T.30 and T.434.

This parameter may require 180 hexadecimal characters to specify, but it can be stored as 90 octets. The +FFD="<hex string>" may be repeated with new data; each use appends data to the data entered previously. The +FFD="" command resets this parameter to a null string.

The <hexadecimal coded octet string> shall consist of pairs of hexadecimal numbers (T.50 3/0-3/9, 4/1-4/6). Spaces between octets shall be ignored by the DCE. The DCE shall send octets in the order loaded. Each octet shall be sent LSB first; the string "D8A2" would result in the following bit pattern: 0001101101000101. (Note – This is the same format used in Non-Standard frame reports, see 8.4.2.4.)

8.5.2 T.30 procedure control parameters

The facsimile DCE makes decisions at several nodes in the T.30 procedure. These parameters allow a DTE to sense or determine facsimile DCE policy for these procedure decisions.

The facsimile DCE is required by this Recommendation to implement these parameters. However, it may report and accept the value that corresponds to a disabled feature. In some Administrations, national regulatory agencies may mandate some values.

8.5.2.1 Procedure interrupt enable, +FIE

- Write syntax: +FIE=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory value: 0

Recommendation T.30 provides for either station to initiate Procedure Interrupts. The other station may choose to accept or ignore these requests. A service Class 2 facsimile DCE may negotiate or ignore Procedure Interrupts, conditioned by this parameter.

+FIE=0 Procedure Interrupt Requests from the remote station are ignored, and not reported to the DTE. For the +FET: response (8.4.4.1), PRI-Q reports will be replaced by non-PRI equivalents.

+FIE=1 Procedure Interrupt Requests from the remote station are accepted, negotiated and reported using the +FVO response (8.4.4.2).

For transmission (+FDT), Procedure Interrupt Requests from the remote station are not reported directly; only the +FVO response is reported.

For reception (+FDR), Procedure Interrupt Requests from the remote station are reported in the +FET: response. The value stored in the +FPS parameter will be adjusted to values 4 or 5. If the DTE issues a subsequent +FDR command with the +FPS value intact, the DCE will complete the negotiation and issue a +FVO response.

8.5.2.2 Page status, +FPS

- Write syntax: +FPS=<ppr>
- Valid values: 1, 2, 3, 4, 5 (Table 23)
- Default value: 1
- Mandatory values: 1, 2, 3, 4, 5

The +FPS parameter contains a value representing the post page response, including copy quality and related end-of-page status. These values correspond to post page response messages defined in Recommendation T.30. The receiving DCE sets this parameter after it receives a page of Phase C data. The transmitting DCE sets this parameter with the status reported by the receiving station. The DTE may inspect or modify this parameter.

Valid <ppr> values are defined in Table 23 below. These values are also reported by the +FPS:<ppr> response to the +FDR command (8.4.3).

The DCE may set this parameter to values 1, 2 or 3 based on its own copy quality checking or access to received signal quality. The DCE shall set this parameter to a value of 1 if copy quality checking is disabled (+FCQ=0, see 8.5.2.3).

Copy quality checking is the responsibility of the DCE. However, a receiving DTE may do its own Copy Quality checking.

The DTE may request a Procedure Interrupt from the remote station using this parameter. To do so, the DTE shall modify the value reported by the DCE before it issues the next +FDR command, which in turn instructs the DCE to send the resulting post page response to the remote facsimile station.

TABLE 23/T.32

T.30 post page response message codes

| Value | T.30 mnemonic | Description |
|-------|---------------|--------------------------------|
| 1 | MCF | Page good |
| 2 | RTN | Page bad; retrain requested |
| 3 | RTP | Page good; retrain requested |
| 4 | PIN | Page bad; interrupt requested |
| 5 | PIP | Page good; interrupt requested |

8.5.2.3 Copy quality checking, +FCQ

- Write syntax: +FCQ=<rq>,<tq>
- Valid values: 0, 1, 2 for each subparameter
- Default values: 1 for <rq>
0 for <tq>
- Mandatory values: 0 and 1 for <rq>
0 for <tq>

The +FCQ compound parameter controls copy quality checking and correction by a facsimile DCE. The <rq> subparameter controls copy quality checking and correction of data received from the remote station and delivered to the local DTE; the <tq> subparameter controls copy quality checking and correction of image data received from the local DTE and sent to the remote facsimile station.

Receive copy quality checking is the responsibility of the DCE, for any data type supported. However, the DTE may turn off copy quality checking by setting +FCQ=0,0, or by setting +FND=1 (8.5.2.10).

Copy quality checking consists of determining if the incoming image data conforms to the negotiated standard format, e.g. Recommendation T.4 or T.6. Copy quality correction consists of detecting errors and altering the data in some way to guarantee that only valid data (according to negotiated parameters) is delivered. See Table 24.

The methods used for copy quality checking or for correction are not a subject of this Recommendation. The DCE may use the associated T.30 control parameters to condition its Copy Quality Checking behaviour (8.5.2.4). Common procedures for Copy Quality correction include deletion of bad lines or replacement of bad lines by previous good lines.

The DCE shall report on Received Copy Quality to the DTE in the page status report, +FPS:<ppr>,<lc>,<blc>,<cblc>,<lbc> (8.4.3), and record it in the +FPS parameter (8.5.2.2).

8.5.2.4 Receive quality thresholds, +FRQ

- Write syntax: +FRQ=<pgl>,<cbl>
- Valid values: 0 to 64h for <pgl>
0 to FFh for <cbl>
- Default values: manufacturer's option
- Mandatory values: 0,0 (unsupported)

The DCE may use this compound parameter to make the "Copy Quality OK" decision in the T.30 flow chart (Figure A.7/T.30). If used, the DCE shall judge Copy Quality unacceptable if either the percentage of good lines is too low or too many consecutive lines contain errors. Bad line counts are reported in the +FPS:<blc> response, described in 8.4.3. A value of 0 disables either subparameter for use in copy quality checking.

TABLE 24/T.32

Copy quality checking subparameters

| Setting | Description |
|---------|---|
| rq=0 | DCE receive copy quality checking is disabled. The DCE will generate copy quality OK (MCF) responses to complete pages, and set +FPS=1 |
| rq=1 | DCE receive copy quality checking is enabled. The DCE will determine the recommended Post Page Message, and store it into the +FPS parameter |
| rq=2 | DCE receive copy quality correction is enabled. The DCE will determine the recommended Post Page Message, and store it into the +FPS parameter. The DCE will detect and correct errors in data received from the remote station, by manufacturer-specific means |
| tq=0 | DCE transmit copy quality checking is disabled. The DTE is responsible for T.4 or T.6 compliance |
| tq=1 | DCE transmit copy quality checking is enabled. The DTE is responsible for T.4 or T.6 compliance. The DCE shall return a <CAN> to the DTE if errors are detected |
| tq=2 | DCE transmit copy quality correction is enabled. The DCE will detect and correct errors in data received from the local DTE, by manufacturer-specific means |

The first subparameter, <pgl>, specifies the percentage of good lines (e.g. with negotiated number of pixels) required for a page to be considered acceptable. For example, the DCE could count bad lines (as reported in the +FPS <blc> subparameter) and total line count (as reported in the +FPS<lc> subparameter); the percentage of good lines would be computed by the following equation:

$$100 \times (\text{<blc>} - \text{<bl>}) / \text{<lc>}$$

If the resulting value is less than the value in <pgl>, the page is unacceptable.

The second subparameter, <cbl>, specifies the maximum tolerable number of consecutive bad lines. If this value is exceeded for a given page, the DCE shall consider the page unacceptable.

If the page is found unacceptable by either criteria, the DCE shall report the value 2 (see Table 17) for the +FPS <ppr> subparameter (8.4.3), and store that value into the +FPS parameter (8.5.2.2).

8.5.2.5 Adaptive answer, +FAA

- Write syntax: +FAA=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory value: 0

+FAA=0 The DCE shall answer only as a Class 2 facsimile device. No automatic switching of service class shall occur based on the calling device type.

+FAA=1 The DCE can answer and automatically determine whether to answer as a facsimile DCE or as a data modem. If a data modem is detected, the DCE shall operate as described in 8.3.2.4.

NOTE – The +FAA parameter controls automatic switching only from Class 2 to Class 0, for call answering only. It does not affect call origination, switching to Class 2 from other classes, or switching to classes other than Class 0.

8.5.2.6 DTE phase C response timeout, +FCT

- Write syntax: +FCT=<value>
- Valid values: 0 to FFh, 1 second units
- Default value: 1Eh (30 seconds)
- Mandatory value: 1Eh (from Recommendation T.30)

This determines how long the DCE will wait for a command after having transmitted all available Phase C data.

For transmission (+FDT), when this timeout is reached, the DCE shall properly terminate any Phase C data transfer in progress, then execute an implied +FKS orderly abort command.

For reception (+FDR), when this timeout is reached, the DCE shall send the T.30 DCN response to the remote station and execute an implied orderly abort command.

8.5.2.7 Call termination status, +FHS

- Read syntax: +FHS?
- Valid values: 00 to FFh (Table 20)
- Default value: 00
- Mandatory values: 00, 10h, 20h, 40h, 50h, 70h, 90h, A0h (hexadecimal)

This read only parameter indicates the cause of a hangup. Table 19 shows the valid values for this parameter as well as the meaning of each value. +FHS is set by the DCE at the conclusion of a fax session. The DCE shall reset this parameter to 0 at the beginning of Phase A.

8.5.2.8 ECM retry count, +FRY

- Write syntax: +FRY=<value>
- Valid values: 0 to FFh, units of 4 retries
- Default value: 0
- Mandatory value: 0

In Error Correcting Mode the transmitting DCE will try to send a partial page four times. These four attempts are called an “attempt block”. If the transmitting DCE is not successful sending an attempt block at a particular signalling rate, it must decide if it should: i) retry the attempt block at the current signalling rate; ii) retry the attempt block at a lower signalling rate, or iii) discontinue trying to send the partial page.

- i) The transmitting DCE may continue to retry the attempt block at a particular signalling rate up to +FRY times. If the +FRY parameter is zero, the partial page cannot be resent at the current signalling rate.
- ii) The transmitting DCE may select a lower signalling rate subject to the +FMS parameter, and send the partial page at the new lower signalling rate.
- iii) The transmitting DCE can only discontinue sending the partial page once +FRY attempt block retries have been made at the lowest permissible signalling rate, as defined by the +FMS command. If the DCE fails to deliver the partial page, it shall send a DCN to the remote device, issue +FHS to the DTE, and disconnect in accordance with Recommendation T.30. If ECM is not required for a particular facsimile transfer, the DCE may alternatively send an EOR to the receiving station and return an ERROR result code for the +FDT command.

This allows the DCE to retry up to +FRY attempt blocks at each signalling rate and ensures +FRY attempt block retries at the lowest signalling rate specified in the +FMS parameter.

NOTES

1 Retries can take substantial time to execute. For example, to resend 16384 octets of image once with handshake at 9600 bit/s would take about 20 seconds. With a bad line and a setting of FFh, the DCE could spend more than an hour retrying to send a partial page if the remote station was patient enough. DTE application software should allow for these additional delays after issuing the +FDT or +FDR commands.

2 ECM is required operation for Recommendation T.6, Binary File Transfer, Character, Mixed and T.81 colourmodes.

8.5.2.9 Minimum phase C speed, +FMS

- Write syntax: +FMS=<value>
- Valid values: 0 to 5, in BR subparameter codes
- Default value: 0 (2400 bit/s)
- Mandatory value: 0

This optional parameter limits the lowest negotiable speed for a session. This parameter is useful for limiting the cost of a transmission, by requiring a minimum transmission speed. If the facsimile DCE cannot negotiate to a minimum speed, it shall perform an orderly disconnect.

The units are the same as those defined for the BR Bit Rate subparameter, defined in 8.5.1.4.

8.5.2.10 NSF message data indication, +FND

- Write syntax: +FND=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory values: 0, 1

If the DTE has negotiated to exchange a non-standard message type with the remote station, the DTE shall indicate this to the DCE before issuing the +FDT or +FDR command for that message data. Otherwise, the DCE may presume that the data is as specified in the DCS, including the default type (T.4 Modified Huffman); in this case, corruption of the message by the DCE is possible.

+FND=0 The message type is specified in DCS.

+FND=1 The message type is non-standard. The DCE shall not modify data on transmission or reception. The DCE copy quality checking (for assumed T.4 data type) shall be disabled.

This parameter shall be automatically reset to 0 on session termination. For transmission, the +FND command shall be issued before the +FDT command. For example, after issuing a dial command, the DCE might receive and report an NSF frame. In response, the DTE could issue:

- AT+FNS=<NSS frame contents>
- AT+FND=1;+FDT

For reception, the +FND command shall be issued before the +FDT command. For example, in response to a RING message, if the DTE issues these commands:

- AT+FNS=<NSF frame contents>
- ATA

the DCE might receive and report a corresponding NSS frame in addition to the TSI and DCS reports. If the negotiated message type is non-standard, the DTE should issues these commands:

- AT+FND=1;+FDR

8.5.3 DTE-DCE interface parameters

8.5.3.1 Inactivity timeout, +FIT

- Write syntax: +FIT=<time>,<action>
- Valid values: time = unlimited, action = 0, 1
- Default value: time = 0, action = 0
- Mandatory value: time = 0-255 (in seconds), action = 0

A service Class 2 facsimile DCE shall provide an inactivity timer that allows the DCE to break away from an unsuccessful connection attempt at any stage of a facsimile transfer. The inactivity timer only works while the DCE is off-hook.

The <time> parameter indicates the inactivity timeout in seconds. The required timeout is 1 to 255 seconds. The value of 0 indicates that timeout is disabled. Any values greater than 255 are optional values for the DCE manufacturer. The <action> parameter has two meanings.

The inactivity timer starts when the DCE has taken some action that requires DTE response. If the DTE does respond, the DCE shall reset the inactivity timer. Tables 25 and 26 define these sets of events.

TABLE 25/T.32

Inactivity timer start and stop events

| On-line state | Start timer event | Stop timer event |
|----------------------------------|--|--------------------------|
| Waiting for a command | DCE sends final result code | DTE sends AT or "at" |
| Waiting for transmit data | DCE sends CONNECT after +FDT command | DTE sends data |
| Waiting for transmit data | DCE sends <DC1> or sets V.24 Ckt 106 ON | DTE sends data |
| Waiting to deliver received data | DTE sends <DC3> after +FDR command | DTE sends <DC1> |
| Waiting to deliver received data | DTE sets V.24 Ckt 133 OFF after +FDR command | DTE sets V.24 Ckt 133 ON |

TABLE 26/T.32

DCE responses to DTE inactivity

| <action> | Description |
|----------|--|
| 0 | Upon timeout, the DCE shall go on-hook, executing an implied ATH command; then reset to +FCLASS=0 if +FCLASS=0 is supported by the DCE |
| 1 | Upon timeout, the DCE shall only go on-hook. This feature is used to detect possible system failure, when either no line or DTE activity has occurred for a minimum amount of time |

8.5.3.2 Buffer size, +FBS

- Read syntax: +FBS?
- DCE response syntax: <tbs>,<rbs> where:
 <tbs> = transmit buffer size
 <rbs> = receive buffer size

This parameter allows the DCE to report the size of the DCE's data buffers. The values shall be in hexadecimal and represent the buffer size in octets.

The DCE shall provide sufficient receive buffer to accommodate 3 seconds of flow-control-off at the maximum receive speed; at 9600 bit/s, this is E10h octets (3600 decimal).

This Recommendation does not mandate a minimum transmit buffer size.

8.5.3.3 Packet protocol control, +FPP

- Write syntax: +FPP=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory values: 0, 1

+FPP=0 Disables the DCE-to-DTE Packet Protocol.

+FPP=1 Enables the DCE-to-DTE Packet Protocol (clause 9). All multi-character messages from the DCE are sent to the DTE using a simple Packet Protocol data link, to assure reliable delivery of data.

This command takes effect after the +FPP command is executed, before the final result code is issued by the DCE. If this command is embedded in a command line containing multiple commands, it applies to information text and result codes of subsequent commands.

8.5.3.4 Data bit order, +FBO

- Write syntax: +FBO=<value>
- Valid values: 0, 1, 2, 3
- Default value: 0
- Mandatory values: 0, 1

This parameter controls the mapping between PSTN facsimile data and the DTE-DCE link. There are two choices:

- Direct – The first bit transferred of each octet on the DTE-DCE link is the first bit transferred on the GSTN data carrier.
- Reversed – The last bit transferred of each octet on the DTE-DCE link is the first bit transferred on the GSTN data carrier.

There are two data types to control:

- Phase C data – T.4 or T.6 encoded data, or any other type of data (e.g. T.434 BFT), transferred during execution of +FDT or +FDR commands.
- Phase B/D data – T.30 Phase B and Phase D control messages, reported to the DTE in +FHT: and +FHR: reports only (8.6), enabled by the +FBU parameter (8.5.1.10).

The following four values are defined (see Table 27):

TABLE 27/T.32

Bit order selections

| | |
|--------|---|
| +FBO=0 | Selects direct bit order for both Phase C data and for Phase B/D data |
| +FBO=1 | Selects reversed bit order for Phase C data and selects direct bit order for Phase B/D data |
| +FBO=2 | Selects direct bit order for Phase C data and selects reversed bit order for Phase B/D data |
| +FBO=3 | Selects reversed bit order for both Phase C data and for Phase B/D data |

The effect of this parameter is illustrated for the T.4 EOL pattern in 8.5.3.5 below.

NOTES

- 1 This parameter does not affect the bit order of control characters generated by the DCE.
- 2 When reversed bit order is being used on Phase C data, transparency mechanisms (e.g. for <DLE> characters, and for <SOH> and <ETB> characters when the packet protocol is in use) shall be applied to the data AFTER REVERSAL, i.e. as the data will be transmitted on the DTE-DCE link.
- 3 This does not affect the bit order for the +FNS parameter or for the +FNC, +FNF or +FNS responses.

8.5.3.5 Phase C received EOL alignment, +FEA

- Write syntax: +FEA=<value>
- Valid values: 0, 1
- Default value: 0
- Mandatory value: 0

This parameter enables optional octet-alignment of EOL markers in received T.4 data streams. It does not apply to T.6 data, or to any other form of data (e.g. T.434 BFT).

+FEA=0 Determines that T.4 EOL patterns are bit aligned (as received).

+FEA=1 Determines that the last received bits of T.4 EOL patterns are octet aligned by the DCE, with necessary zero fill bits inserted. There are two 2-octet patterns:

+FBO= binary EOL pattern
 0 or 2 0000xxxx 10000000
 1 or 3 xxxx0000 00000001

xxxx represent previous data bits, zero bits, or other leading data.

As per 4.2.2/T.4, the tag bit for two dimensional coding, which indicates the coding used for the following line, shall be included in that line in the octet following the previous EOL.

8.5.3.6 Format conversion, +FFC

- Write syntax: +FFC=<vrc>,<dfc>,<lnc>,<wdc>
- Valid values: see Table 28
- Default values: manufacturer's option
- Mandatory values: 0,0,0,0

This compound parameter determines the DCE response to mismatches between the Phase C data delivered after the +FDT command and the data format parameters negotiated for the facsimile session. [See +FCS: response (8.4.2.1) and +FCS parameter (8.5.1.3).]

For mismatch checking, the DCE depends on the DTE to indicate the data format with embedded <DLE><format> character pairs (see Table 9). If these format indicators are not provided, the DCE shall assume that the format is as negotiated for that session.

For each subparameter, value 0 determines that mismatch checking is disabled, and all format codes of this type are ignored. Value 1 determines that mismatch checking is enabled, with session termination if the format codes do not match the negotiated format reported in +FCS: responses. Other values enable degrees of format conversion. Unspecified values are reserved.

TABLE 28/T.32

Format conversion control subparameters

| Setting | Description |
|----------------------------------|--|
| vrc=0 vrc=1 vrc=2 vrc=3 | Vertical resolution format codes ignored Vertical resolution checking enabled Vertical resolution conversion enabled for 1-D data Vertical resolution conversion enabled for 2-D data |
| dfc=0 dfc=1 dfc=2 | Data format format codes ignored Data format checking enabled Data format conversion enabled |
| lnc=0 lnc=1 lnc=2 lnc=3 | Page length format codes ignored Page length checking enabled Page length conversion enabled for 1-D data Page length conversion enabled for 2-D data |
| wdc=0 wdc=1 wdc=2 | Page width format codes ignored Page width checking enabled Page width conversion enabled |

8.6 Session message report responses

The DCE may be commanded to report the T.30 Phase B and Phase D HDLC control frames as they are sent and received. This service supports session diagnostics and debugging DTE software. This service is enabled by the +FBU parameter, described in 8.5.1.10. This facility does not apply to ECM Phase C data frames.

These messages are not generated in direct execution of DTE action commands; they are generated whenever the reported frame is sent or received, for each frame. Therefore, the DTE should not attempt to change serial port rate or parity with +FBU set, and DTE commands shall not be echoed.

The data shall be reported with each T.30 command separated by <CR><LF>. The frame octets will be represented in hex notation and separated by spaces. The DCE shall delete HDLC Flags and FCS octets. Frame octets are reported in the order sent or received. An example received DIS string report is shown:

```
+FHR: FF 13 80 00 4E 78 FE AD<CR><LF>
```

Unless specified otherwise, the DCE shall report these frames before the corresponding responses are generated. For example, the above examples would occur before the standard +FIS: report was made.

8.6.1 Report transmit HDLC frames, +FHT:

- Syntax: +FHT:<transmitted HDLC frame octets>

This reports the HDLC data that was sent by the DCE.

8.6.2 Report received HDLC frames, +FHR:

- Syntax: +FHR:<received HDLC frame octets>

This reports the HDLC data that was received by the DCE.

9 DCE-DTE packet protocol

This clause describes a facsimile DCE-to-DTE Packet Protocol. With DTE implementation of the necessary procedures, this mechanism may be used to detect lost octets on the facsimile DCE-to-DTE serial link, and to recover the lost octets by requesting retransmission. This facility is controlled by the +FPP parameter in 8.5.3.3.

This protocol makes two assumptions: that data corruption is not a problem on the communications link, and that the last octet sent will never be lost due to data overrun (i.e. that newer octets always overwrite previous octets in the communications input buffer, this is the design of common UARTs).

Facsimile DCE must handle the transfer of received Phase C data. In common Group 3 facsimile, this is 9600 bit/s; options include up to 14 400 bit/s (bits per second). To accommodate this, the protocol recommends operating the asynchronous serial port at 19 200 bit/s, with flow control and buffering mandatory.

For 19 200 bit/s, the time between asynchronous characters is $1/1920 = 521 \mu\text{s}$ ($\mu\text{s} = \text{microseconds}$). There are many processes in common DTE (e.g. personal computers) that cause serial input channels to be neglected for longer than 500 μs ; data loss is a constant hazard. If a character is lost in the received data, the image will be impaired; if a character is lost in a DCE final result code, the connection may fail. This protocol permits recovery from such data loss so that images remain intact and the facsimile transfer will succeed.

This Packet Protocol uses control characters defined in Recommendation T.50. Control characters are represented in this Recommendation by the defined mnemonic designation enclosed in angle brackets (e.g. <ACK>).

9.1 Message types

There are five kinds of messages exchanged between a DTE and a facsimile DCE described by this Recommendation:

- a) DTE command lines;
- b) Facsimile DCE response lines;
- c) Transmitted Phase C data;
- d) Received Phase C data;
- e) Single control characters.

The Packet Protocol described here is used for facsimile DCE response lines and for received Phase C Data. The DCE is required to handle DTE command lines and transmitted Phase C data without loss. The DTE is expected to handle single characters without data loss.

Under this protocol, DCE response lines and received Phase C data shall be assembled into simple packets. Each packet shall contain only one type of message. Packets shall not exceed 254 octets, excluding the trailing <ETB> (T.50 1/7) or <SOH> (T.50 0/1) characters. The following subclauses describe how these messages are partitioned into packets.

9.1.1 Facsimile DCE response lines

The facsimile DCE generates line-oriented responses to DTE commands, including information text and result codes. A packet may include one or more complete DCE response lines resulting from a single command line. DCE response lines may be partitioned into more than one packet.

NOTE – Long responses are defined in 8.4.2.4 and 8.6.

9.1.2 Received Phase C data

The facsimile DCE shall break Phase C data into packets. The DCE shall process the data as specified in 9.6, prior to assembling packets.

9.1.3 Single control characters

<DC1>, <DC3> and <CAN> characters are used as single character DCE-to-DTE messages in facsimile DCE. These characters are not made into packets during Phase C data transmission.

9.2 DCE packet sender procedure

The base state for the DCE is IDLE, with no packet to send. When a new packet is ready to send, the DCE may commence transferring the packet.

Transferring the packet consists of: transmitting the length of the packet to the DTE; waiting for the DTE to acknowledge receipt of this single character; then transferring the body of the packet, terminated by either the <ETB> character or the <SOH> character. Note that the DCE must know the size of the packet before the packet can be transferred.

Packets are normally terminated with the <ETB> character. If the DCE can be certain that the next packet body will be the same length as the current packet body, it may terminate a packet with <SOH> to indicate that the next packet has the same length. If the DTE acknowledges a packet terminated by <SOH>, the DCE shall proceed directly to transferring the body of the next packet. This mechanism bypasses the exchange of the length octets and subsequent acknowledgement to improve efficiency.

The DCE may check for an <ENQ> (T.50 0/5) from the DTE (9.8) while transmitting the packet body to the DTE. If an <ENQ> is received before the complete packet is sent, the DCE should terminate the packet in progress by sending <SOH> or <ETB>, wait for a <NAK> (T.50 1/5), and restart sending the packet.

After the packet is sent, the DCE shall wait until a packet response is received, or until a manufacture specified timeout occurs. If an <ACK> character is received, the DCE should return to IDLE state. If the DCE receives a <NAK> character, the DCE shall restart sending the packet.

Table 29 shows a state table for the DCE. This table defines all possible states for the DCE.

TABLE 29/T.32

Example DCE state table

| Event | (State 1) IDLE Waiting to send LENgh | (State 2) LENgh sent | (State 3) Sending data | (State 4) <ETB> sent | (State 5) <SOH> sent |
|--|--|--|--|--|--|
| Data ready to be sent to DTE | Send LEN octet; Start TIMER; Go to State 2 | (Defer processing until State 3 entered) | Send octet; INC COUNT; If COUNT=LEN, then if next block likely to be different LEN, send ETB, start TIMER, and go to State 4; else, send <SOH>, start TIMER, and Go to State 5 | (Defer processing until State 1 entered) | (Defer processing until State 3 entered) |
| Request to forward data to DTE (end rcvd data) | (Ignore; no partial data sent) | (Ignore; no partial data sent) | Repeat Send 00h; INC COUNT until COUNT=LEN; start TIMER; send <ETB>; Go to State 4 | (Ignore; no partial data sent) | (Ignore; no partial data sent) |
| Timeout awaiting response from DTE | (Not possible; TIMER not running) | Resend LEN octet; Restart TIMER; | (Not possible; TIMER not running) | Resend <ETB>; Restart TIMER; Stay in State 4 | Resend <SOH>; Restart TIMER; Stay in State 5 |
| <ACK> received from DTE | (Procedural error) (Note 2) | Stop TIMER; Go to State 3 (Note 2) | (Procedural error) (Note 2) | Release buffer; COUNT=0; Stop TIMER; Go to State 1 | Release buffer; COUNT=0; Stop TIMER; Go to State 3 |
| <NAK> received from DTE | (Procedural error) (Note 2) | (Procedural error) (Note 2) | (Procedural error) (Note 2) | Setup buffer for retransmission; COUNT=0; Stop TIMER; Go to State 3 | Setup buffer for retransmission; COUNT=0; Stop TIMER; Go to State 3 |
| <ENQ> received from DTE | (Procedural error) (Note 2) | (Procedural error) (Note 2) | Send <SOH>; Start TIMER; Go to State 5 | (Ignore) | (Ignore) |
| Other character received from DTE | (Procedural error) (Note 3) | (Procedural error) (Note 3) | (Procedural error) (Note 3) | (Procedural error) (Note 3) | Procedural error (Note 3) |
| NOTES | | | | | |
| 1 The TIMER described above may be provided to allow the system to recover from catastrophic failure of system or the serial port. | | | | | |
| 2 If the receipt of <ACK>, <NAK> or <ENQ> results in a procedure Error, that character should be discarded. | | | | | |
| 3 Future Standards may define uses for other characters. These characters should be forwarded to the higher layer function. | | | | | |

9.3 DTE packet receiver procedure

The base state for the packet receiver is IDLE, with no packet expected. The procedures described in this Recommendation determine when a packet is expected.

The DTE shall treat the first octet received as the length octet. If the length is valid, the DTE shall acknowledge that length octet by sending an <ACK> character; invalid length octets are ignored.

The DTE shall receive that number of characters, while checking for either packet terminating character. Then, the DTE shall determine if the body of the packet, excluding the one terminating character (<ETB> or <SOH>), contains the number of octets stated in the header (which the DTE acknowledged).

DTE may use any means at its disposal to help make the determination that data has been lost or corrupted (e.g. serial port overrun or other indicators). If the body does not contain the correct number of octets, or if the DTE determines that data has been lost or corrupted, the DTE shall discard the contents of the body and respond to the DCE with <NAK>, and then wait for the body to be retransmitted by the DCE.

If the DTE has received the correct number of packet body octets from the DCE, and has not chosen to respond with <NAK> for any other reason, the DTE shall respond to the DCE with <ACK>, and return to the IDLE state.

A table of the packet receiver states is shown in Table 30.

TABLE 30/T.32

Example DTE state table

| Event | (State 1) Waiting for LEN | (State 2) Receiving data | (State 3) <ENQ> sent |
|--|--|---|--|
| <ETB> received (ordinal value of 1/7) | LEN = 23 send <ACK> Go to State 2 | If COUNT=LEN, Forward buffer; COUNT=0; Send <ACK>; Go to State 1 else Discard buffer; COUNT=0; Send <NAK>; Stay in State 2 | Send <NAK>; Go to State 2 |
| <SOH> received (ordinal value of 1) | LEN = 1 send <ACK> Go to State 2 | If COUNT=LEN, Forward buffer; COUNT=0; Send <ACK>; Stay in State 2 else Discard buffer; COUNT=0; Send <NAK>; Stay in State 2 | Send <NAK>; Go to State 2 |
| <FFh> received | Discard | If COUNT=LEN, (Note 1) Send <ENQ>; Discard buffer; COUNT=0; Go to State 3 else Increment COUNT; Buffer data octet | |
| Data octet received | LEN = ordinal value of data octet; send <ACK> Go to State 2 | If COUNT=LEN, (Note 1) Send <ENQ>; Discard buffer; COUNT=0; Go to State 3 else Increment COUNT; Buffer data octet | Discard data octet; Stay in State 3 |
| UART overrun Error detected | (Ignore; last octet should be length octet) | Discard buffer; COUNT=0; Send <ENQ>; Go to State 3 (Note 2) | (Ignore) |

NOTES

1 The logic included in the IF clause is for recovery from the unlikely event that an additional character is inserted into the serial link.

2 DTE may choose to ignore this event, or may choose to ignore it if most of the characters of the body have already been received.

9.4 Packet protocol example transfers

See Tables 31 to 33.

TABLE 31/T.32

Packet transfer without errors

| DCE | | DTE | Description |
|------------|---|-------|---|
| <COUNT> | ➔ | | Length of next block of data |
| | ← | <ACK> | DTE acknowledges the length octet |
| <Packet 1> | ➔ | | The DTE receives the negotiated amount of data |
| <ETB> | ➔ | | End of packet marker |
| | ← | <ACK> | If the proper amount of data was received, then the DTE shall acknowledge the reception with an ACK character |

TABLE 32/T.32

Packet transfer with errors and recovery

| DCE | | DTE | Description |
|------------|---|-------|---|
| <COUNT> | ➔ | | Length of next block of data |
| | ← | <ACK> | DTE acknowledges the length octet |
| <Packet 1> | ➔ | | Error: the DTE receives 3 octets fewer than indicated by <count> |
| <ETB> | ➔ | | End of packet marker |
| | ← | <NAK> | If the proper amount of data was not received, then the DTE shall explicitly reject the packet with a NAK character |
| <Packet 1> | ➔ | | The DCE repeats the packet, this time the octet count matches the <count> |
| <ETB> | ➔ | | End of packet marker |
| | ← | <ACK> | If the proper amount of data was received, then the DTE shall acknowledge the reception with an ACK character |

9.5 DC1 and DC3 characters

These procedures defined in this Recommendation mandate the use of flow control. This protocol allows use of flow control in command state and in Phase C data states.

For packets sent using this Packet Protocol, flow control can be implemented using the <ACK> (T.50 06h) characters.

With the Packet Protocol enabled, the DCE shall not send <DC1> (T.50 1/1) or <DC3> (T.50 1/3) characters to the DTE during receipt of a command from the DTE, to avoid confusion with <count> octets. The DCE may send flow control characters during Phase C data transmission; credit flow control may be implemented if available (8.3.3.9).

TABLE 33/T.32

Data sent as several consecutive packets

| DCE | | DTE | Description |
|------------|---|-------|---|
| <FEh> | → | | Packet size is 254 octets |
| | ← | <ACK> | DTE acknowledges the length octet |
| <Packet 1> | → | | The DTE receives 254 octets |
| <SOH> | → | | End of packet, same size to follow |
| | ← | <ACK> | Packet 1 acknowledged |
| <Packet 2> | → | | The DTE receives the 2nd packet |
| <SOH> | → | | End of packet, same size to follow |
| | ← | <ACK> | Packet 2 acknowledged too |
| <Packet 3> | → | | The DTE receives the 3rd packet |
| <ETB> | → | | End of packet marker |
| | ← | <ACK> | Packet 3 acknowledged too |
| <COUNT> | → | | Length of last packet of data |
| | ← | <ACK> | DTE acknowledges a new length octet |
| <Packet 4> | → | | The DTE receives <COUNT> octets of data |
| <ETB> | → | | End of packet marker |
| | ← | <ACK> | Packet 4 acknowledged too |

9.6 SOH and ETB characters

The DCE shall shield packet end marker characters <SOH> (T.50 0/1) and <ETB> (T.50 1/7) characters to prevent them from occurring in the packet data. The shielding mechanism is defined in 6.11.

It will also be necessary to do all packetizing after any and all DLE shielding has been performed on the data. Once all of the DLE shielding has been inserted then the data should be packetized and sent. Note that <DLE><character> pairs may be split into two consecutive packets if they fall on a boundary.

9.7 Octet count

Packet size octet counts can range from 0 to 254. The octet <count> value is the binary count, ranging from 00h to FEh. The DTE shall ignore an octet count of <FFh>.

The DCE chooses the packet size. The DCE may adjust the packet size to smaller values when data loss is common.

NOTE – When sending DCE response lines, the DCE should normally set the packet size to the exact length of the response(s) to be delivered, and use <ETB> to end each packet so that the exact size of the next packet can be specified.

During Phase C data reception, the DCE can maximize throughput by sending 254-octet packets, terminated by <SOH>. However, the received page data stream is unlikely to end on a 254-octet boundary, which means that the last packet will be partially filled. The DCE may either pad the last packet with 00h octets (after the end-of-page marker) to fill it to the required length, or may double-buffer packets and delay delivery so as to be able to use an <ETB> on the next-to-last packet and specify the exact length of the last packet. It is preferred that the DCE terminate the last packet with an <ETB> character.

9.8 Early detection of data loss

If the DTE detects a loss of data by the serial UART before receiving the end of block marker, then it may expedite data transfer by sending an <ENQ> (T.50 05h) character to the DCE. If the DTE sends an <ENQ>, it must wait for, receive and discard the remaining characters, and detect the terminating <ETB> or <SOH> sent by the DCE to close the packet, and then send a <NAK>.

Annex A

Interworking with existing facsimile DTE

(This annex forms an integral part of this Recommendation)

The DCE shall implement additional syntax for the V.25 *ter* commands referred to in Table A.1, in order to interwork with existing facsimile DTE which use the +F syntax commands.

See also A.2.

TABLE A.1/T.32

Common functions in Recommendations V.25 *ter* and T.32

| Function | V.25 <i>ter</i> command | V.25 <i>ter</i> reference | +F syntax command | Recommended implementation |
|--------------|-------------------------|---------------------------|-------------------|----------------------------------|
| Modem ID | +GMI | 6.1.1 | +FMI | +FMI has same definition as +GMI |
| Model ID | +GMM | 6.1.5 | +FMM | +FMM has same definition as +GMM |
| Revision ID | +GMR | 6.1.6 | +FMR | +FMR has same definition as +GMR |
| Port Rate | +IPR | 6.2.10 | +FPR | See Table A.2 |
| Flow Control | +IFC | 6.2.12 | +FLO | See Table A.2 |

TABLE A.2/T.32

+F Syntax command implementation

| DTE command | DCE action | Description or Notes |
|---|--------------------------|--|
| +FMI? | Execute +GMI? | Report DCE Manufacturer ID |
| +FMM? | Execute +GMM? | Report DCE model ID |
| +FMR? | Execute +GMR? | Report DCE revision ID |
| +FLO=0 | Execute +IFC=0,0 | Turn off flow control |
| +FLO=1 | Execute +IFC=1,1 | Select DC1/DC3 flow control |
| +FLO=2 | Execute +IFC=2,2 | Select Ckt 106/133 flow control |
| +FPR=0 | Execute +IPR=0 | Select automatic rate detection |
| +FPR=1 | Execute +IPR=2400 | Set DTE-DCE rate to 2400 bit/s |
| +FPR=2 | Execute +IPR=4800 | Set DTE-DCE rate to 4800 bit/s |
| +FPR=4 | Execute +IPR=9600 | Set DTE-DCE rate to 9600 bit/s |
| +FPR=8 | Execute +IPR=19200 | Set DTE-DCE rate to 19 200 bit/s |
| +FPR=10 | Execute +IPR=38400 | Set DTE-DCE rate to 38 400 bit/s |
| +FPR=18 | Execute +IPR=57600 | Set DTE-DCE rate to 57 600 bit/s |
| +FLO=? (if all values listed above are supported) | Report (0,1,2) | DCE supports DC1/DC3 and Ckt 106/133 flow control |
| +FPR=? (if all values listed above are supported) | Report (0,1,2,4,8,10,18) | DCE supports 2400, 4800, 9600, 19 200, 38 400 and 57 600 bit/s |
| +FLO? (if +IFC=0,0) | Report 0 | DTE-DCE flow control is disabled |

TABLE A.2/T.32 (end)

+F Syntax command implementation

| DTE command | DCE action | Description or Notes |
|---------------------------------|------------|--|
| +FLO? (if +IFC=1,1) | Report 1 | DTE-DCE flow control is DC1/DC3 |
| +FLO? (if +IFC=2,2) | Report 2 | DTE-DCE flow control is V.24 Ckt 106/133 |
| +FLO? (all other +IFC settings) | Report 255 | 255 indicates invalid setting |
| +FPR? (if +IPR=0) | Report 0 | DTE-DCE rate is automatically detected |
| +FPR? (if +IFC=2400) | Report 1 | DTE-DCE rate is 2400 bit/s |
| +FPR? (if +IFC=4800) | Report 2 | DTE-DCE rate is 4800 bit/s |
| +FPR? (if +IFC=9600) | Report 4 | DTE-DCE rate is 9600 bit/s |
| +FPR? (if +IFC=19200) | Report 8 | DTE-DCE rate is 19 200 bit/s |
| +FPR? (if +IFC=38400) | Report 10 | DTE-DCE rate is 38 400 bit/s |
| +FPR? (if +IFC=57600) | Report 18 | DTE-DCE rate is 57 600 bit/s |
| +FPR? (all other +IPR settings) | Report 255 | 255 indicates invalid setting |

Annex B**Service Class 1 and Service Class 2 interworking**

(This annex forms an integral part of this Recommendation)

A facsimile DCE may contain services and commands described in this Recommendation, service Class 2, and those services and commands described in Recommendation T.31, service Class 1. This annex describes optional procedures for interworking between these services and commands during a single session.

B.1 Transitions from Class 2 to Class 1

The DCE may accept a +FCLASS=1.0 command at any point where it has issued a final result code. This releases the DCE from the requirement to maintain the T.30 session state.

If the DCE was awaiting an appropriate command from the DTE (e.g. +FDR) before releasing a message to the remote station (e.g. CFR), the switch to +FCLASS=1.0 causes this message to be discarded. It becomes the responsibility of the DTE, using Class 1 procedures, to transmit the appropriate message (if necessary) in order to continue the facsimile session.

If the DCE was in the process of sending or receiving Phase C data or training, the DCE will shift to the state described by the corresponding Class 1 data transfer command. [For example, if +FCLASS=1.0 is issued while receiving training after an ATA command, the DCE should switch to the +FRM=<MOD> state (8.3.4/T.31), issue a CONNECT message, and deliver the remaining octets of data.]

B.2 Transitions from Class 1 to Class 2

The DCE may accept a +FCLASS=2.0 command at any point where the DCE is in a position to start at a known state in a session. Within a session, this is restricted to the top of Phase B where a command to start a new document negotiation is appropriate, or at the reentry to Phase B after a Procedure Interrupt. This is described in 8.3.1.2 and 8.3.2.3.

Appendix I

Service Class 2 parameter and subparameter values

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

TABLE I.1/T.32

| Parameter label | Reference | Mandatory value(s) | Optional value(s) | Default value(s) |
|-------------------------------|-----------|---|--------------------|------------------|
| +FCLASS | 8.2.3 | 2.0 | 0,1.0 | mfr |
| +FCC=VR,,,,,, | 8.5.1.1 | 0 | 1 | mfr |
| +FCC=,BR,,,,,, | 8.5.1.2 | 0,1 | 2-5 | mfr |
| +FCC=,,WD,,,,,, | 8.5.1.3 | 0 | 1-4 | mfr |
| +FCC=,,,LN,,,,, | 8.5.1.4 | 0 | 1-2 | mfr |
| +FCC=,,,,DF,,,, | | 0 | 1-3 | mfr |
| +FCC=,,,,EC,,,, | | 0 | 1 | mfr |
| +FCC=,,,,BF,,, | | 0 | 1 | mfr |
| +FCC=,,,,,ST, | | 0-7 | | mfr |
| +FCC=,,,,,,JP | | 0 | 01-7Fh | mfr |
| +FLI | 8.5.1.5 | 0-9, +, space | Printable T.50 | null string |
| +FPI | 8.5.1.5 | " | | null string |
| +FNS | 8.5.1.6 | -none- | Up to 90 octets | null string |
| +FLP | 8.5.1.7 | 0,1 | | 0 |
| +FSP | 8.5.1.8 | 0 | 1 | 0 |
| +FCR | 8.5.1.9 | 0 | 1 | mfr |
| +FBU | 8.5.1.10 | 0 | 1 | 0 |
| +FNR=rpr,,, | 8.5.1.11 | 0,1 | | 0 |
| +FNR=,tpr,, | | 0,1 | | 0 |
| +FNR=,,idr, | | 0,1 | | 0 |
| +FNR=,,,nsr | | 0,1 | | 0 |
| +FAP=sub,, | 8.5.1.12 | 0,1 | | 0 |
| +FAP=,sep, | | 0,1 | | 0 |
| +FAP=,,pwd | | 0,1 | | 0 |
| +FSA | 8.5.1.13 | digits 0-9, +, #, sp | Printable T.50 | null string |
| +FPA | | " | | |
| +FPW | | " | | |
| +FDM | 8.5.1.14 | -none- | Up to 90 octets | null string |
| +FIE | 8.5.2.1 | 0 | 1 | 0 |
| +FPS | 8.5.2.2 | 1-5 | | 1 |
| +FCQ=rq, | 8.5.2.3 | 0-1 | 2 | 1 |
| +FCQ=tq | | 0 | 1-2 | 0 |
| +FRQ=pgl, | 8.5.2.4 | 0 | 1-64h | mfr |
| +FRQ=cbl | | 0 | 1-FFh | mfr |
| +FND= | 8.5.2.10 | 0,1 | | 0 |
| +FAA | 8.5.2.5 | 0 | 1 | 0 |
| +FCT | 8.5.2.6 | 1Eh | 00-FFh | 1Eh |
| +FHS | 8.5.2.7 | 0, 10h, 20h, 40h, 50h, 70h, 90h, A0h | 00-BFh Table 19 | 00 |
| +FRY | 8.5.2.8 | 0 | 0-FFh | 0 |
| +FMS | 8.5.2.9 | 0 | 1-5 | 0 |
| +FND | 8.5.2.10 | 0,1 | - | 0 |
| +FIT=<time, +FIT=,<action> | 8.5.3.1 | 0-255 0,1 | - | 0 0 |
| +FBS:tbs, +FBS:,rbs | 8.5.3.2 | -none- 3 seconds | >3 seconds | mfr mfr |

TABLE I.1/T.32 (end)

| Parameter Label | Reference | Mandatory value(s) | Optional value(s) | Default value(s) |
|------------------|------------------------|--------------------|-------------------|------------------|
| +FPP | 8.5.3.3 | 0,1 | | 0 |
| +FBO | 8.5.3.4 | 0,1 | 2,3 | 0 |
| +FEA | 8.5.3.5 | 0 | 1 | 0 |
| +FFC=vrc,, | 8.5.3.6 | 0 | 1-3 | mfr |
| +FFC=,dfc,, | | 0 | 1-2 | mfr |
| +FFC=,,lnc, | | 0 | 1-3 | mfr |
| +FFC=,,wdc | | 0 | 1-2 | mfr |
| +IPR=<rate> | 6.2.10/V.25 <i>ter</i> | 9600, 19200 | 0-115200 | mfr |
| +IFC=dce-by dte, | 6.2.12/V.25 <i>ter</i> | 0-1 | 2 | 1 |
| +IFC=,dte_by_dce | | 0-1 | 2 | 1 |

Appendix II

Service Class 2 example sessions

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

In this subclause, examples of the interchange between the DTE and the DCE are given for various cases.

Refer to Recommendation T.30 for descriptions and flow charts of Group 3 Facsimile Procedures, and for timing requirements. Refer to Appendix II/T.30 for Abbreviations. Refer to Appendix V/T.30 for illustrations of sample sessions, including error recovery.

The +FCLASS=2.0 command is illustrated in the first example; it is assumed in subsequent examples.

NOTES

1 All streams of data denoted by angle brackets <...>, and terminated by the <DLE><ETX> characters (1/0, 0/3), are encoded as described in 6.11, with <1/0> data octets replaced by <DLE><DLE>.

2 All DCE information responses are preceded by <CR><LF>, and followed by <CR><LF>. Unless otherwise noted, all DCE result codes (CONNECT, OK) are shown in verbose form, and are followed by <CR><LF> characters.

There are four cases for polling. One is Dial and Receive, the complement is Answer and Send. Sample sessions II.5 and II.6 illustrate the composite cases of turn-around polling.

The arbitration of polling response may be preconditioned by the DTE, or determined during the session by the DTE. For example, the DTE may allow polling to be restricted on the basis of the received Fax ID, or a password sent in an NSF frame, or other means.

Examples II.7 and II.8 illustrate a pair of difficult sessions, simple sending and receiving, with every T.30 session message experiencing errors.

Examples II.9 and II.10 illustrate ECM operation, with data buffered by the DCE transparent to the DTE.

Examples II.11 and II.12 illustrate procedure interrupt negotiation, pre-enabled by the DTE and negotiated by the DCE. There are four cases: II.11 illustrates procedure interrupt negotiations during sending, initiated by the local or remote stations; II.12 illustrates procedure interrupt negotiations during reception, initiated by the local or remote stations.

Examples II.13 and II.14 illustrate use of the facsimile DCE-DTE Packet Protocol.

II.1 Send two pages, 1-D data, no errors

Square bracketed [] responses are conditional on the remote station actions; curly bracketed { } responses are conditional on switches set by the DTE. For this example, all reports are enabled: +FNR=1,1,1,1.

Square bracketed [] commas are optional for the DTE.

TABLE II.1/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|--|--|--|---|--|
| AT+FCLASS=2.0 | OK | Set Class 2 | | |
| [AT+FPW="<sending password string>"] | OK | Set local PWD | | DTE may load a Password |
| [AT+FSA="<SUB string>"] | OK | Set SUB | | DTE may load a destination SUBaddress |
| [AT+FLI="<local ID>"] | OK | Set local ID | | DTE may load a local ID |
| ATD<dial string> | +FCO [+FNF:<nsf>] [+FCI:"<csi>"] {+FIS:<dis codes>} OK | off hook, dial, send CNG detect flags [get NSF] [get CSI] get DIS | answer, send [CED], preamble, [NSF,] [CSI,] DIS | |
| [AT+FNS="<hex NSS FIF string>"] | OK | | | DTE may respond to NSF frame |
| AT+FDT <1st page data> <RTC pattern> <DLE><mps> | {+FCS:<codes>} CONNECT OK | [send NSS,] [send PWD,] [send SUB,] [send TSI,] send DCS send TCF get CFR send carrier send page data send RTC send MPS get MCF | [get NSS,] [get PWD,] [get SUB,] [get TSI,] get DCS get TCF send CFR get carrier get data get RTC get MPS send MCF | if +FNS loaded if +FPW loaded if +FSA loaded if +FLI loaded |
| AT+FDT <2nd page data> <RTC pattern> <DLE><eop> | CONNECT +FHS:00 OK | send carrier send 2nd page send RTC send EOP get MCF send DCN hangup | receive carrier get 2nd page get RTC get EOP send MCF get DCN hangup | |

II.2 Receive two pages, 1-D data, no errors

In this example, the remote station sends NSS, SUB, PWD and TSI. The local DCE has +FNR=1,1,1,1 and +FAP=1,1,1. See Table II.2.

TABLE II.2/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|---------------------------------|---|---|--|---|
| AT+FCR=1 | OK | Enable Reception | | |
| [AT+FLI="<local ID>"] | OK | Set local ID | | DTE may load the local ID |
| [AT+FNS="<hex NSF FIF string>"] | OK | | | DTE may set up NSF string |
| | RING <- | Detect ring <- | Dials[,send CNG] | |
| ATA | +FCO +FNS:<nss string> +FPW:<pwd string> +FSA:<sub string> +FTI:"<tsi ID>" {+FCS:<dcs codes>} OK | off hook, send CED, [send NSF,] [send CSI,] send DIS, detect flags, get NSS, get PWD, get SUB, get TSI, get DCS begin TCF recv | get CED, [get NSF,] [get CSI,] get DIS, send Preamble, send NSS, send PWD, send SUB, send TSI, send DCS, start TCF | if +FNS loaded if +FLI loaded |
| AT+FDR | [+FCS:<dcs codes>] CONNECT <page data> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:0 <- OK | accept TCF send CFR get page carrier get page data detect RTC <- get MPS <- | finish TCF get CFR send carrier send page data send RTC, send MPS | Another +FCS would be reported if the parameters changed after retraining |
| AT+FDR <DC2> | CONNECT <page data> <RTC pattern> <DLE><ETX> <- +FPS:1,<lc>,0,0,0 +FET:2 OK | send MCF get carrier get page data detect RTC <- get EOP <- | get MCF send carrier send page data send RTC, send EOP | |
| AT+FDR | +FHS:00 <- OK | send MCF get DCN <- hangup <- | get MCF, send DCN hangup | |

II.3 Send two complex documents

Credit flow control is illustrated, using <DLE><bc?>.

Negotiation messages are suppressed; +FNR=0,0,0,0.

Non-verbose mode is selected: 0 = OK; 1 = CONNECT.

Letterhead is added to page 1 and the signature to page 2, to illustrate concatenating image files within a page.

+FFC=2,,, to allow vertical resolution conversion.

See Table II.3.

TABLE II.3/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|--|---|---|--|--|
| ATD<dial string> | +FCO 0 | off hook, dial send CNG detect flags get DIS | answer, send [CED], Preamble, DIS | |
| AT+FDT <DLE><bc?> <DLE><letterhead> <DLE><"?"> <DLE><a><page data> <DLE><bc?> <more page data> <RTC pattern> <DLE><mps> | 1 <buffer credit> <buffer credit> <buffer credit> 0 | send DCS, TCF get CFR send carrier send page data send page data send page data send RTC send MPS get MCF | get DCS, TCF send CFR get carrier get page data get page data get page data get RTC get MPS send MCF | Fine data letterhead file. Normal data page text, converted to fine by the DCE |
| AT+FDT <DLE><bc?> <2nd page text> <DLE><bc?> <more 2nd page> <DLE><bc?> <DLE><signature> <RTC pattern> <DLE><eom> | 1 <buffer credit> <buffer credit> <buffer credit> 0 | send carrier send page data send page data send page data send RTC send EOM get MCF | get carrier get page data get RTC get EOM send MCF | continue normal test signature is fine EOM will start a new document |
| AT+FIS=0,,,1[,,,,] | 0 | | | new settings |
| AT+FDT <DLE><bc?> <DLE><letterhead> <DLE><bc?> <DLE><a><2nd doc p1> <RTC pattern> <DLE><mps> | 1 <buffer credit> <buffer credit> 0 | get DIS send DCS, TCF get CFR send carrier send letterhead send page 1 send RTC send MPS get MCF | resend DIS get DCS, TCF send CFR get carrier get page data get RTC get MPS send MCF | This is another document to send. The DCE converts the fine letterhead to normal resolution |
| AT+FDT <DLE><bc?> <2nd doc p2 body> <DLE><bc?> <DLE><signature> <RTC pattern> <DLE><eop> | 1 <buffer credit> <buffer credit> +FHS:00 0 | send page carrier send page data send signature send RTC send EOP get MCF send DCN hangup | get page carrier get page data get RTC get EOP send MCF get DCN hangup | |

II.4 Receive two documents

For this example, negotiation messages are suppressed: +FNR=0,0,0,0. Non-verbose mode selected. See Table II.4.

TABLE II.4/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|-----------------|--|--|--|-----------------------|
| | 2 | Detect ring | Dials[, send CNG] | |
| ATA | +FCO 0 | off hook, send CED, send DIS, detect flags, get DCS begin TCF rcv | get CED, get DIS, send Preamble, send DCS, start TCF | |
| AT+FDR <DC2> | 1 <1st page data> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:1 0 | accept TCF send CFR get carrier get page data get RTC get EOM | finish TCF get CFR send carrier send page data send RTC send EOM | Receive 1 page doc |
| AT+FDR <DC2> | 1 <page data stream> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:2 0 | send MCF send DIS get DCS & TCF send CFR get page carrier get page data get RTC get EOP | get MCF get DIS send DCS & TCF get CFR send page carrier send page data send RTC send EOP | restart Phase B |
| AT+FDR | +FHS:00 <- 0 | send MCF get DCN <- hangup | get MCF, send DCN hangup | |

II.5 Polling: dial, send and poll receive

TABLE II.5/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|--|--|---|--|---|
| AT+FSP=1 | OK | Enable polling | | |
| AT+FLI="<local ID>" | OK | save local ID | | |
| AT+FPA="<polling address>" | OK | save SEP frame | | |
| AT+FPW="<polling password>" | OK | save PWD frame | | |
| AT+FPI="<poll ID>" | OK | save polling ID | | |
| ATD<dial string> | +FCO [+FCI:"<csi>"] +FIS:<dis codes> +FPO OK | off hook, dial send CNG detect flags [get CSI] get DIS with bit 9 set | answer, send [CED], Preamble, [CSI], DIS | remote has doc to poll |
| AT+FDT <1st page data> <RTC pattern> <DLE><eom> | +FCS:<dcs codes> CONNECT OK | send TSI, DCS send TCF get CFR send carrier send page data send RTC send EOM get MCF ignore CSI & DIS | get TSI, DCS get TCF send CFR get carrier get page data get RTC get EOM send MCF send CIS & DIS | AT+FDT starts send session; AT+FDR starts polling EOM means time to start a new document. Remote will start Phase B again |
| AT+FDR <DC2> | [+FTI:"<tsi>"] +FCS:<dcs codes> CONNECT <page data> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:2 OK | [send PWD & SEP] send CIG & DTC get TSI/DCS/TCF send CFR get page carrier get page data get RTC, get EOP | [get PWD & SEP] get CIG & DTC send TSI/DCS/TCF get CFR send carrier send page data send RTC, send EOP | AT+FDR starts polling new TSI and DCS reported |
| AT+FDR | +FHS:00 <- OK | send MCF get DCN <- hangup | get MCF, send DCN hangup | |

II.6 Polling: answer, receive and poll send

TABLE II.6/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|--|---|--|---|---|
| AT+FLP=1 | OK | Set DIS bit 9 | | doc to poll |
| | RING | Detect ring | Dials[, send CNG] | |
| ATA | +FCO [+FTI:"<tsi>"] {+FCS:<dcs codes>} OK | off hook, send CED, send CSI & DIS detect flags, [get TSI] get DCS begin TCF recv | get CED, get CSI & DIS, send Preamble, [send TSI], send DCS, start TCF | |
| AT+FDR <DC2> | CONNECT <page data> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:1 OK | accept TCF send CFR get page carrier get page data detect RTC get EOM | finish TCF get CFR send carrier send page data send RTC, send EOM | |
| AT+FDR | [+FPW:<"pwd string">] [+FPA:<"sep string">] [+FPI:<"cig string">] {+FTC:<dtc codes>} OK | send MCF send CSI & DIS [get PWD,] [get SEP,] get [CIG &] DTC | get MCF ignore CSI & DIS [send PWD,] [send SEP,] send [CIG &] DTC | DCE restarts Phase B; calling station starts polling |
| AT+FDT <page data> <RTC pattern> <DLE><eop> | {+FCS:<dcs codes>} CONNECT +FHS:00 OK | send [TSI &] DCS send TCF get CFR send carrier send page data send RTC send EOP get MCF send DCN hangup | get [TSI &] DCS get TCF send CFR get carrier get page data get RTC get EOP send MCF get DCN hangup | |

II.7 Send one page with line errors and retransmission

TABLE II.7/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|---|--|--|--|---|
| ATD<dial string> | +FCO {+FIS:<dis codes>} OK | off hook, dial, detect flags get bad DIS <-/ ...wait... get good DIS <- | answer, CED, Preamble, send DIS wait for DCS resend DIS | |
| AT+FDT <page data stream> <RTC pattern> <DLE><eop> | {+FCS:<dcs codes>} CONNECT ERROR | send DCS -/> send TCF -?> get DIS <- repeat DCS -> repeat TCF -/> get FTT <- send new DCS -> send slower TCF-> get bad CFR <-/ repeat new DCS -> repeat new TCF -> get good CFR <- send carrier send page data-> send RTC send EOP get RTN | get bad DCS ignore TCF resend DIS get good DCS get bad TCF send FTT get new DCS get slower TCF send CFR get DCS again get good TCF repeat CFR receive carrier get page data get RTC get EOP send RTN | DCE responds to FTT by stepping down to 7200. errors in page ERROR indicates that the remote station rejected the page (RTN) |
| [AT+FPS?] | [2 OK] | | | DTE may inquire about ERROR |
| AT+FDT <repeat page data> <RTC pattern> <DLE><eop> | CONNECT +FHS:00 OK | send [new] DCS -> repeat TCF -> get CFR <- send carrier -> send page data -> send RTC send EOP-> wait for PPR repeat EOP -> get bad MCF repeat EOP get good MCF send DCN hangup | get good DCS get good TCF send CFR receive carrier get page data get RTC get bad EOP get good EOP send MCF get EOP again repeat MCF get DCN (?) hangup | RTN forces back to Phase B This time the remote gets the page without error |

II.8 Receive one page with line errors and retransmission

TABLE II.8/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|---------------------|---|---|--|---|
| | RING <- | Detect ring <- | Dials | |
| ATA | +FCO {+FCS:<dcs codes>} OK | off hook, CED -> send DIS -/> ...wait for DCS.. repeat DIS -> get bad DCS <-/ ignore TCF <-?<- repeat DIS -> get good DCS <- begin TCF RX<-/ | get CED, get bad DIS ...wait... get good DIS send DCS, start TCF get DIS again repeat DCS, send TCF | |
| AT+FDR <DC2> | {+FCS:<dcs codes>} CONNECT <page data> <RTC pattern> <DLE><ETX> <- +FPS:2,<lc>, <blc>,<cbic>,<lbc> +FET:2 ERROR | reject TCF send FTT -> get new DCS <- get slower TCF<- send CFR -/> get DCS again <- get good TCF <- send CFR -> get page carrier get page data detect RTC <- get EOP <- | finish TCF get FTT send new DCS send slower TCF get bad CFR repeat new DCS repeat new TCF get good CFR send carrier send page data send RTC, send EOP | DCE and remote repeat until TCF is good DCE re-reports +FCS:<dcs> when Phase B done, because of changes There are <blc> line errors in this page The ERROR result code indicates that the received data was unacceptable |
| AT+FDR <DC2> | {+FCS:<dcs codes>} CONNECT <page data> <RTC pattern> <DLE><ETX> <- +FPS:1,<lc>,0,0,0 +FET:2 OK | send RTN -> get DCS & TCF <- send CFR -> get page carrier get page data detect RTC <- get bad EOP <-/ ...wait... get good EOP <- | get RTN send DCS & TCF get CFR send carrier send page data send RTC send EOP repeat EOP | The remote could stepdown to 4800 This time the page is OK |
| AT+FDR | +FHS:A0 <- OK | send MCF -/> get EOP again <- repeat MCF -> get DCN <-/ timeout waiting for new frame | get bad MCF, repeat EOP again get good MCF send DCN hangup | |

II.10 Error correction mode, single page receive

TABLE II.10/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|---------------------|--|--|---|--|
| AT+FIS=,,,,,1[,,,] | OK | Enable ECM | | |
| | RING <- | Detect ring <- | Dials | |
| ATA | +FCO [+FTI:"<tsi>"] +FCS:<dis codes> OK | off hook, CED, send CSI & DIS detect flags, get [TSI &] DCS begin TCF recv | get CED, get CSI & DIS, send V.21 flags, send [TSI &] DCS, start TCF | |
| AT+FDR <DC2> | CONNECT <partial page data for 1st consecutive good frames> <remaining data for 1st partial page> <2nd partial page data> <RTC pattern> <DLE><ETX> +FPS:1,<lc>,0,0,0 +FET:2 OK | accept TCF send CFR get page carrier get frame 1 get frames 2-255... get frame 256 get PPS-NULL send PPR get carrier get resent frames get PPS-NULL send MCF get carrier get next partial page frames get PPS-EOP | finish TCF get CFR send page carrier send frame 1 send frames 2-255... send frame 256 drop carrier, send PPS-NULL get PPR send carrier resend frames that had errors send PPS-NULL get MCF send carrier send 2nd partial page data send PPS-EOP | Remote sends full sized partial page Assume some frame errors No errors on the 2nd try No errors in 2nd partial page |
| AT+FDR | +FHS:00 <- OK | send MCF get DCN <- hangup | get MCF, send DCN hangup | |

II.11 Send two documents with procedure interrupts

TABLE II.11/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|---|---|---|--|---|
| AT+FIE=1 | OK | | | Enable PRI negotiation |
| ATD<dial string> | +FCO [+FCI:"<csi>"] {+FIS:<dis codes>} OK | off hook, dial, detect flags [get CSI] get DIS | answer, CED send flags [send CSI] send DIS | |
| AT+FDT <1st document> <RTC pattern> <DLE><pri><DLE><eom> | {+FCS:<dcs codes>} CONNECT +FVO OK | send [TSI &] DCS send TCF get CFR send carrier send page data send RTC send PRI-EOM get PIP resend PRI-EOM -release line to user- | get [TSI &] DCS get TCF send CFR receive carrier get page data get RTC get PRI-EOM send PIP get 2nd PRI-EOM -release line to user- | Local DTE requests interrupt. 2nd PRI-Q confirms interrupt |
| ATD | +FCO <- [+FCI:"<csi>"] {+FIS:<dis codes>} OK | detect flags [get CSI] get DIS | send flags [send CSI] send DIS | DTE restarts session |
| AT+FDT <2nd document> <RTC pattern> <DLE><eop> | CONNECT +FVO OK | send carrier send page send RTC send EOP get PIP send PRI-EOP get 2nd PIP -release line to user- | get carrier get page get RTC get EOP send PIP get PRI-EOP resend PIP -release line to user- | Remote wants another procedure interrupt |
| [AT+FKS] | [+FHS:00 OK] | [go on-hook] | | If DTE wants to finish facsimile session |

II.12 Receive two documents with procedure interrupts

TABLE II.12/T.32

| DTE commands | DCE responses | Local DCE action | Remote station action | Notes |
|-----------------|---|---|--|---|
| AT+FIE=1 | OK | | | Enable PRI negotiation |
| | RING <- | Detect ring <- | Dials | |
| ATA | +FCO [+FTI:"<tsi>"] {+FCS:<dis codes>} OK | off hook, CED, send [CSI &] DIS detect flags, get [TSI &] DCS begin TCF RX | get CED, get [CSI &] DIS, send Preamble, send [TSI &] DCS start TCF | |
| AT+FDR <DC2> | CONNECT <page data> <RTC pattern> <DLE><ETX> <- FPS:1,<lc>,0,0,0 +FET:0 OK | accept TCF send CFR get carrier get page data detect RTC <- get MPS <- | finish TCF get CFR send carrier send page data send RTC send MPS | |
| AT+FPS=5;+FDR | +FVO OK | send PIP get PRI-MPS resend PIP -release line to local user- | get PIP send PRI-MPS get 2nd PIP -release line to remote user- | DTE wants PRI remote accepts PRI. 2nd PIP confirms PRI |
| ATA | +FCO [+FTI:"<tsi>"] {+FCS:<dcs codes>} OK | send [CSI &] DIS get [TSI &] DCS begin TCF RX | get [CSI &] DIS send [TSI &] DCS send TCF | Restart session, repeat Phase B |
| AT+FDR <DC2> | CONNECT <page data> <RTC pattern> <DLE><ETX> <- +FPS:1,<lc>,0,0,0 +FET:5 OK | accept TCF send CFR get page carrier get page data get RTC get PRI-EOP | finish TCF get CFR send page carrier send page data send RTC send PRI-EOP | Remote station wants procedure interrupt. DCE detects PRI-EOP, reports it (+FET:5) and replaces +FPS value 1 (MCF) by 5 (PIP) |
| AT+FDR | +FVO OK | send PIP get 2nd PRI-EOM -release line to local user- | get PIP send 2nd PRI-EOM -release line to remote user- | DTE negotiates procedure interrupt |
| [AT+FKS] | [+FHS:00 OK] | [go on-hook] | | If the DTE wants to end the FAX session |

II.13 Send two pages with packet protocol

Non-verbose mode, negotiation messages suppressed. See Table II.13

TABLE II.13/T.32

| DTE commands or responses | DCE responses or packet | Local DCE action | Remote station action | Notes |
|---|--|--|--|---|
| AT+FPP=1<CR> <ACK> <ACK> | <02h> 0<CR><ETB> | enable Packet Link Protocol | | |
| ATD<dial string> <ACK> <ACK> <ACK> <ACK> | <05h> +FCO<CR><ETB> <02h> 0<CR><ETB> | off hook, dial, send CNG detect flags get DIS | answer, send [CED], Preamble, DIS | |
| AT+FDT <ACK> <ACK> <1st page data> -pause- <more page data> <RTC pattern> <DLE><mps> <ACK> <ACK> | <02h> 1<CR><ETB> <DC3> <DC1> <02h> 0<CR><ETB> | [send TSI] send DCS send TCF get CFR send carrier send page data send RTC send MPS get MCF | [get TSI] get DCS get TCF send CFR get carrier get data get RTC get MPS send MCF | <DC1> and <DC3> may be used for flow control, but they are not packetized |
| AT+FDT <ACK> <ACK> <2nd page data> <RTC pattern> <DLE><eop> <ACK> <ACK> | <02h> 1<CR><ETB> <0Ah> +FHS:00<CR> 0<CR><ETB> | send carrier send 2nd page send RTC send EOP get MCF send DCN hangup | receive carrier get 2nd page get RTC get EOP send MCF get DCN hangup | 0AH = 10 octets: 8 octets +2 octets |

II.14 Receive one page with packet protocol

Retransmission required for lost page data or responses.

Non-verbose mode, negotiation messages suppressed.

See Table II.14

TABLE II.14/T.32

| DTE commands or protocol responses | DCE responses or packet | Local DCE action | Remote station action | Notes |
|---|---|---|--|---|
| <ACK> <ACK> | <02h> 2<CR><ETB> <- | Detect ring <- | Dials[, send CNG] | |
| ATA <ACK> <ACK> <ACK> <ACK> | <05h> +FCO<CR><ETB> <02h> 0<CR><ETB> | off hook, send CED, send CSI, send DIS, detect flags, get DCS begin TCF recv | get CED, get CSI, get DIS, send Preamble, send DCS, start TCF | |
| AT+FDR <ACK> <ACK> <DC2> <ACK> <ACK> <NAK> <ACK> <ACK> <ACK> ..N more <ACK>s <ACK> <ACK> <ACK> <ACK> <ACK> <ACK> <ACK> | <02h> 1<CR><ETB> <FEh> <254B><SOH> <254B><SOH> <254B><SOH> <repeat <254B><SOH>) <254B><SOH> ..N more blocks.. <254B><ETB> <19h> <23B><DLE><ETX><ETB> <0Bh> +FPS:1,LCH<CR><ETB> <09h> +FET:2<CR> <- 0<CR><ETB> | accept TCF send CFR get carrier get page data detect RTC <- get EOP <- | finish TCF get CFR send carrier send page data send RTC, send EOP | This document is (5+N)×254+23 octets of data including any transparent <DLE><DLE> or <DLE><SUB> pairs. RTC is in the last packet. <DLE><ETX> is part of the packet "LCH" is a 3 hex digit line count |
| AT+FDR <ACK> <ACK> | <0Ah> +FHS:00<CR> <- 0<CR><ETB> | send MCF get DCN <- hangup | get MCF, send DCN hangup | |

Appendix III

Alphabetic index of commands, parameters and responses

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

III.1 Action commands

TABLE III.1/T.32

| Command | References | Description |
|---------|------------|---------------------------------|
| A | 8.3.2 | Answer command |
| D<ds> | 8.3.1 | Originate command |
| +FDR | 8.3.4 | Data reception command |
| +FDT | 8.3.3 | Data transmission command |
| +FIP | 8.3.6 | Initialize facsimile parameters |
| +FKS | 8.3.5 | Session termination command |

III.2 Responses

TABLE III.2/T.32

| Response | References | Description |
|----------|------------|---|
| +FCI: | 8.4.2.3 | Report remote ID, CSI |
| +FCO | 8.4.1.1 | Facsimile connection |
| +FCS: | 8.4.2.1 | Report negotiated session parameters, DCS |
| +FDM | 8.4.1.2 | Transition to data modem operation |
| +FET: | 8.4.4.1 | Post page message |
| +FFD | 8.4.2.6 | File diagnostic message |
| +FHS: | 8.4.5 | Call termination status |
| +FHR: | 8.6.2 | Report received HDLC frame |
| +FHT: | 8.6.1 | Report transmitted HDLC frame |
| +FIS: | 8.4.2.1 | Report remote capabilities, DIS |
| +FNC: | 8.4.2.4 | Report NSC frame |
| +FNF: | 8.4.2.4 | Report NSF frame |
| +FNS: | 8.4.2.4 | Report NSS frame |
| +FPA: | 8.4.2.5 | Selective polling address |
| +FPI: | 8.4.2.3 | Report remote ID, CIG |
| +FPO | 8.4.2.2 | Remote polling indication |
| +FPS: | 8.4.3 | T.30 Phase C page reception |
| +FPW: | 8.4.2.5 | PassWord (sending or polling) |
| +FSA | 8.4.2.5 | Destination SubAddress |
| +FTC: | 8.4.2.1 | Report remote capabilities, DTC |
| +FTI: | 8.4.2.3 | Report remote ID, TSI |
| +FVO | 8.4.4.2 | Transition to voice |

III.3 Parameters

TABLE III.3/T.32

| Parameter | References | Description |
|-------------|------------------------|--|
| +FAA= | 8.5.2.5 | Adaptive answer parameter |
| +FAP= | 8.5.1.12 | Addressing & polling capabilities parameter |
| +FBS? | 8.5.3.2 | Buffer size, read only parameter |
| +FBO= | 8.5.3.4 | Phase C data bit order |
| +FBU= | 8.5.1.10 | HDLC frame reporting parameter |
| +FCC= | 8.5.1.1 | DCE capabilities parameters |
| +FCLASS | 8.2.3 | Service class selection parameter |
| +FCQ= | 8.5.2.3 | Copy quality checking parameter |
| +FCR= | 8.5.1.9 | Capability to receive parameter |
| +FCS? | 8.5.1.3 | Current session results parameters |
| +FCT= | 8.5.2.6 | DTE Phase C timeout parameter |
| +FEA= | 8.5.3.5 | Phase C Received EOL alignment parameter |
| +FFC= | 8.5.3.6 | Format conversion parameter |
| +FFD= | 8.5.1.14 | File diagnostic message parameter |
| +FHS? | 8.5.2.7 | Call termination status parameter |
| +FIE= | 8.5.2.1 | Procedure interrupt enable parameter |
| +FIS= | 8.5.1.2 | Current session parameters |
| +FIT= | 8.5.3.1 | DTE inactivity timer |
| +FLI= | 8.5.1.5 | Local ID string parameter, TSI or CSI |
| +FLP= | 8.5.1.7 | Indicate document to poll parameter |
| +FMS= | 8.5.2.9 | Minimum Phase C speed parameter |
| +FNR= | 8.5.1.11 | Negotiation message reporting control parameters |
| +FND | 8.5.2.10 | Non-standard message data indication |
| +FNS= | 8.5.1.6 | Non-standard frame FIF parameter |
| +FPA= | 8.5.1.13 | Selective polling address parameter |
| +FPI= | 8.5.1.5 | Local polling ID string parameter |
| +FPP= | 8.5.3.3 | Packet protocol control parameter |
| +FPS= | 8.5.2.2 | Page status parameter |
| +FPW= | 8.5.1.13 | PassWord parameter (sending or polling) |
| +FRQ= | 8.5.2.4 | Receive quality thresholds parameters |
| +FRY= | 8.5.2.8 | ECM Retry value parameter |
| +FSA= | 8.5.1.13 | SubAddress parameter |
| +FSP= | 8.5.1.8 | Request to poll parameter |
| +GMI? | 6.1.4/V.25 <i>ter</i> | Request DCE Manufacturer |
| +GMM? | 6.1.5/V.25 <i>ter</i> | Request DCE Model |
| +GMR? | 6.1.6/V.25 <i>ter</i> | Request DCE revision |
| +IFC= | 6.2.12/V.25 <i>ter</i> | Local flow control |
| +IPR=<rate> | 6.2.10/V.25 <i>ter</i> | Set local port rate |