
AT Command Guide

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Chapter 1

AT Command Set

AT Command Set

This section defines the basic AT commands used to control modem operations.

AT Command Format

A command line is a string of characters sent from Data Terminal Equipment (DTE) to Data Communications Equipment (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator. Each command line (with the exception of the A/ command) must begin with the character sequence AT and must be terminated by a carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case, i.e., "AT" = ASCII 065, 084 or "at" = ASCII 097, 116. The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command line are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

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

The modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. This editing is not applicable to the AT header of a command.

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line are ignored. The maximum number of characters on any command line is 39 (including "A" and "T"). If a syntax error is found anywhere in a command line command, the remainder of the line is ignored and the ERROR result code is returned.

Most commands entered with parameters out of range are not accepted and the ERROR response is returned to the DTE.

Commands are only accepted by the modem once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code. Execution of commands D and A, either as a result of a direct command or a re-execute command are aborted if another character is entered before completion of the handshake.

Time Independent Escape Sequence

ESS can support either TIES (default) or the Hayes escape sequence formats. However, since Hayes requires a valid license, ESS Technology, Inc., accepts no responsibility for, nor indemnifies against, nor in any way provides any type of protection against infringements of or violations of patents by its customers or any users of its products.

The Time Independent Escape Sequence (TIES) is an in-band escape sequence that allows the modem to escape from the data mode to the command mode. The escape command is identical to that used by Hayes. The escape character is normally a “+” (default); however, it can be changed using the S2 register.

Note: Only the following AT commands are supported in the TIES command mode:

En	Hn	Mn	On	Qn	Vn
Xn	&Dn	&Kn	&Wn	&V	

Basic AT Commands

The modem responds to the commands detailed in this section. Parameters applicable to each command are listed with the command description.

A/ **A/**

Repeat Command

The modem executes the last command line sent by the DTE. “A/” repeats all the commands in the command buffer.

The principal application of this command is to place another call (using the Dial command) that failed to connect due to a busy line, no answer, or a wrong number. This command must appear alone on a command line. This command should not be terminated by a carriage return.

AT= x **AT=x**

Write to Selected S-Register

This command writes the value x to the currently selected S-register. An S-register can be selected by using the ATSn command. All of the S-registers return the OK response if x is a number.

Result Codes:

OK For all arguments.

AT?**AT?****Read Selected S-Register**

This command reads and displays the contents of the selected S-register. An S-register can be selected by using the ATSn command.

Result Codes:

OK For all arguments.

A**A****Answer**

The modem goes off-hook and attempts to answer an incoming call if the correct conditions are met. Upon successful completion of answer handshake, the modem goes online in answer mode.

If +FCLASS=0 is selected, the modem enters the connect state after exchanging carrier with the remote modem. If no carrier is detected within a period specified in register S7, the modem hangs up. Any character entered during the connect sequence aborts the connection attempt.

If +FCLASS=1 or 2 is selected, the modem goes off-hook in V.21 answer mode. It generates the V.21 2100 Hz answer tone for 3 ± 0.5 seconds and, following a delay of 70ms, proceeds as if the +FTH=3 command were issued. At any stage up to (but excluding) the +FTH=3 command state, any character aborts the communication. See the description of command +FTH “Transmit Data with HDLC Framing” on page 50 and “Receive Data with HDLC Framing” on page 51 for details.

Bn**Bn****CCITT or Bell**

When the modem is configured to allow either option, the modem selects Bell or CCITT modulation for a line speed connection of 300 or 1200 bit/s according to the parameter supplied. Any other line speed uses a CCITT modulation standard.

B0 Selects CCITT operation at 300 or 1200 bit/s (default).

Result Codes:

OK n = 0

ERROR Otherwise

Cn**Cn****Carrier Control (dummy command)**

This command is included for compatibility only, and has no effect other than returning a result code. The only valid parameter is 1.

Result Codes:

OK n=1.

ERROR Otherwise.

Dn**Dn****Dial**

This command directs the modem to go online, dial according to the string entered and attempt to establish a connection. If no dial string is supplied, the modem goes online and attempts the handshake in originate mode. If the ATD command is issued before the S1 register has cleared, the modem responds with the NO CARRIER result code.

If +FCLASS=0 is selected, the modem behaves as a data modem and attempts to connect to another data modem. The modem has up to the period of time specified by register S6 or S7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem goes on-hook with the NO CARRIER response. This command is aborted in progress upon receipt of any DTE character before completion of the handshake.

If +FCLASS=1 or 2 is selected, the modem behaves as a facsimile modem and attempts to connect to a facsimile machine (or modem) by entering the HDLC V.21 channel 2 receive state (as if +FRH=3 had been issued). This command is aborted upon receipt of any DTE character if the modem has not finished dialing. In this case, the modem goes on-hook and returns to command mode after displaying the NO CARRIER message. If the modem has finished dialing, it proceeds as if the +FRH=3 command has been issued. (Refer to the +FRH command to determine how the modem behaves following this stage.)

Dial Modifiers

The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

- | | |
|-----|---|
| 0-9 | DTMF digits 0 to 9. |
| ! | Flash: the modem goes on-hook for a time defined by the value of S29 (not used) . |
| @ | Not supported. |
| # | The 'gate' digit (tone dialing only). |
| * | The 'star' digit (tone dialing only). |
| a-d | DTMF digits a, b, c, and d. Some countries may prohibit sending of these digits during dialing. |
| L | Redial last number: the modem redials the last valid telephone number. The L must be immediately after the D with all the following characters ignored. |

P	Select pulse dialing: pulse dial the numbers that follow until a “T” is encountered. Affects current and subsequent dialing.
Sn	Dials the stored phone number associated with the &Zn command.
T	Select tone dialing: tone dial the numbers that follow until a “P” is encountered. Affects current and subsequent dialing
W	Wait for dial tone: the modem waits for dial tone before dialing the digits following “W”. If dial tone is not detected within the time specified by S7, the modem aborts the rest of the sequence, returns on-hook, and generates an error message.
,	Dial pause: the modem pauses for a time specified by S8 before dialing the digits following “,”.
;	Return to command state. Added to the end of a dial string, this causes the modem to return to the command state after it processes the portion of the dial string preceding the “;”. This allows the user to issue additional AT commands while remaining off-hook. The additional AT commands may be placed in the original command line following the “;” and/or may be entered on subsequent command lines. The modem enters call progress only after an additional dial command is issued without the “;” terminator. Use “L” to abort the dial in progress, and go back on-hook.
()	Ignored may be used to format the dial string.
.	Ignored: may be used to format the dial string.
-	Ignored: may be used to format the dial string.
<space>	Ignored and may be used to format the dial string.
<i>	Invalid character: is ignored.

En**En**

Command Echo

The modem enables or disables the echo of characters to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 1.

- | | |
|----|---------------------------------|
| E0 | Disables command echo. |
| E1 | Enables command echo. (DEFAULT) |

Result Codes:

- | | |
|-------|------------|
| OK | n=0 or 1. |
| ERROR | Otherwise. |

Hn**Hn**

Disconnect (Hang-Up)

This command initiates a hang up sequence.

- H0 The modem releases the line if the modem is currently online, and terminates any test (AT&T) that is in progress. Country specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.
- H1 If on-hook, the modem goes off-hook and enter command mode.

Result Codes:

- OK n=0 or 1.
 - ERROR Otherwise.
-

In**In**

Identification

The modem reports to the DTE the requested result according to the command parameter.

- I0 Reports modem speed. For example, 56000/33600.
- I1 Reports chipset. For example, ES2898/2818.
- I2 Reports DSP code major revision. For example, RXF2-V90A.
- I3 Reports controller code major revision. For example, V3.43_V_PI.
- I4 Reports manufacture name. For example, ESS Technology, Inc.
- I5 Reports board name. For example, ES56V-PI
- I6 Reports OK.
- I7 Reports OK.
- I9 Data/fax/TAM/handset/speakerphone.
- I10 Reports detailed DSP code revision. For example, R903X152.E-x2a.exe 01/11/98 03:23pm.
- I11 Reports detailed controller code revision. For example, V3.43.005K-V-PI.
- I12 Reports driver time stamp. For example, 15:28:27-Jan 13 1999.

Result Codes:

- OK n = 0 to 12.
- ERROR Otherwise.

Ln**Ln****Speaker Volume**

The modem sets the speaker volume control according to the parameter supplied. The parameter value, if valid, is written to S22 bits 0 and 1.

- L0 Lowest volume.
- L1 Low volume (DEFAULT).
- L2 Medium volume.
- L3 High volume.

Result Codes:

- OK n = 0 to 3.
- ERROR Otherwise

Mn**Mn****Speaker Control**

This command selects when the speaker is on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

- M0 Speaker is always off.
- M1 Speaker is on during call establishment, but off when receiving carrier (default).
- M2 Speaker is always on.
- M3 Speaker is off when receiving carrier and during dialing, on with dial tone and during handshaking, and on during answering.

Result Codes:

- OK n = 0 to 3.
- ERROR Otherwise

Nn**Nn****Automode Enable**

This command enables or disables automode detection. The parameter value, if valid, is written to S31 bit 1.

- N0 Automode detection is disabled. A subsequent handshake is conducted according to the contents of S37 or, if S37 is zero, according to the most recently sensed DTE speed.
- N1 Automode detection is enabled. A subsequent handshake is conducted according to the automode algorithm supported by the modem (default).

Result Codes:

- OK n=0 or 1.
- ERROR Otherwise.

On**On**

Return to Online Data Mode

This command determines how the modem enters the online data mode. If the modem is in the online command mode, it enters the online data mode with or without a retrain. If the modem is in the off-line command mode (no connection), ERROR is reported.

Result Codes:

- O0 Enters online data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).
- O1 Enters online data mode with a long retrain before returning to online data mode.
- O2 Enters online data mode with a short retrain before returning to online data mode.

Result Codes:

- OK n = 0 to 2 and a connection exists.
- ERROR Otherwise or if not connected.

P**P**

Set Pulse Dial

This command forces pulse dialing until the next T dial modifier or T command is received. As soon as a dial command is executed which explicitly specifies the dialing mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialing is tone dialed. See command T “Set Tone Dial” on page 9.

Result Code:

- OK

Qn**Qn**

Results Codes Control

The command enables or disables the sending of result codes to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 2.

- Q0 Enables result codes to the DTE (default).
- Q1 Disables result codes to the DTE.

Result Codes:

- OK n =0 or 1.
- ERROR Otherwise.

Sn**Sn****Read/Write S-Register**

The modem selects an S-register, performs an S-register read or write function, or reports the value of an S-register.

- n Establishes S-register n as the last register accessed.
- n=v Sets S-register n to the value v.
- n? Reports the value of S-register n.

The parameter n can be omitted, in which case the last S-register accessed is assumed. The S can be omitted for AT= and AT? in which case the last S register accessed is assumed.

For example:

ATS7 establishes S7 as the last accessed register.

AT=40 sets the contents of the last register accessed to 40.

ATS=20 sets the contents of the last register accessed to 20.

If the number “n” is beyond the range of the S-registers available, the modem returns the ERROR message. The value “v” is “MOD”ed with 256. If the result is outside the range permitted for a given S-register the values are still stored, but functionally the lower and higher limits are observed. Input and output are always in decimal format. Note that some S-registers are read-only.

In some cases, writing to the S register appears to be accepted but the value is not actually written.

Due to country restrictions, some commands are accepted, but the value may be limited and replaced by a maximum or minimum value.

Result Codes:

- OK 0-99.
- ERROR Otherwise.

T**T****Set Tone Dial**

This command forces DTMF dialing until the next P dial modifier or DP command is received. DTMF or tone dialing is the default method of dialing. The modem sets an S register bit to indicate that all subsequent dialing should be conducted in tone mode. Clears S14 bit 5.

Result Code:

- OK

Vn**Vn****Result Code Form**

This command selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.

- | | |
|----|---|
| V0 | Enables short-form (terse) result codes. Line feed is not issued before a short-form result code. |
| V1 | Enables long-form (verbose) result codes (default). |

Wn**Wn****Connection Message Control**

This command controls the format of CONNECT messages.

- | | |
|----|---|
| W0 | Upon connection, the modem reports only the DTE speed (e.g., CONNECT 115200). Subsequent responses are disabled. |
| W1 | Upon connection, the modem reports the line (carrier) speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled. |
| W2 | Upon connection, the modem reports only the DCE speed (e.g., CONNECT 33600). Subsequent responses are disabled (default). |

Result Codes:

- | | |
|-------|--------------|
| OK | n=0, 1 or 2. |
| ERROR | Otherwise. |

Xn**Xn****Extended Result Codes**

This command selects which subset of the result messages are used by the modem to inform the DTE of the results of commands.

If the modem is in facsimile mode (+FCLASS=1 or 2), the only message sent to indicate a connection is CONNECT without a speed indication.

- X0** Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, and, ERROR result codes. If busy tone detection is enforced and busy tone is detected, NO CARRIER is reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER is reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.
- X1** Same as X0, plus CONNECT XXXX (XXXX = rate).
- X2** Same as X1, plus NO DIAL TONE response. NO DIAL TONE is reported instead of NO CARRIER, if dial tone is not detected.
- X3** Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Disables dial tone detection (blind dialing).
- X4** Enables monitoring of busy tones; send all messages (default).

Result Codes:

- OK** n=0 to 4.
- ERROR** Otherwise.

Yn**Yn****Long Space Disconnect (not implemented)**

This command is included for compatibility only and has no effect other than returning a result code.

Result Codes:

- OK** n=0 or 1.
- ERROR** Otherwise.

Zn**Zn****Soft Reset and Restore Profile**

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

Z0 Soft reset and restore stored profile 0.

Z1 Soft reset and restore stored profile 1.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

Extended AT Commands

&Cn**&Cn**

Data Carrier Detect (DCD) Option

The modem controls the RLSD output in accordance with the parameter supplied.

&C0 DCD remains ON at all times. (DEFAULT.)

&C1 DCD follows the state of the carrier being received.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

&Dn**&Dn**

DTR Option

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4.

&D0 DTR is always on. (DEFAULT)

&D1 DTR drop causes modem to enter command mode

&D2 DTR drop causes modem to hang up

Result Codes:

OK n=0-2.

ERROR Otherwise.

&Fn**&Fn**

Restore Factory Configuration (Profile)

The modem loads the factory default configuration (profile) The factory defaults are identified for each command and in the S register descriptions. A configuration (profile) consists of a subset of S-registers.

&F0 Restore factory configuration 0

&F1 Same as &F0.

Result Codes:

OK n=0 or 1.

ERROR If the modem is connected.

&Jn**&Jn****Telephone Jack Control**

This command is only included for compatibility and performs no function except to load the S-Register. The parameter value, if valid, is written to S21 bit 0.

&J0 &J0 command.

Result Codes:

OK n=0 .

ERROR Otherwise.

&Kn**&Kn****Flow Control**

This command defines the DTE/DCE (terminal/modem) flow control mechanism.

&K0 Disables flow control.

&K3 Enables RTS/CTS flow control. (Default for data modem modes.)

&K4 Enables XON/XOFF flow control.

&K5 Enables transparent XON/XOFF flow control.

&K6 Enables both RTS/CTS and XON/XOFF flow control.

Result Codes:

OK n=0,3,4,5,or 6.

ERROR Otherwise.

&Ln**&Ln****Lease Line Control**

This command is included for compatibility only and has no effect other than returning a result code.

Result Codes:

OK n=0 or 1.

ERROR Otherwise.

&Mn**&Mn****Asynchronous/Synchronous Mode Selection**

This command is included for compatibility only, and has no effect other than returning a result code.

Result Codes:

OK n = 0

ERROR Otherwise

&Pn**&Pn****Select Pulse Dial Make/Break Ratio**

This command determines the make/break ratio used during pulse dialing. The parameter value, if valid, is written to S28 bits 3 and 4.

&P0 39%-61% make/break ratio at 10 pulses per second. (DEFAULT)

&P1 Selects 33%-67% make/break ratio at 10 pulses per second.

Result Codes:

OK n= 0 to 3.

ERROR Otherwise.

&Qn**&Qn****Sync/Async Mode**

This command is included for compatibility only, and has no other effect than returning a result code. The parameter value, if valid, is written to S27, bits 0, 1 and 3.

Result Codes:

OK n = 0, 5, 6.

ERROR Otherwise.

&Sn**&Sn****DSR Control**

This command is included for compatibility only, and has no other effect than returning a result code. The parameter value, if valid, is written to S21, bit 6.

Result Codes:

OK n=0.

ERROR Otherwise.

&Tn**&Tn****Test and Diagnostics**

The modem performs selected test and diagnostic functions according to the parameter supplied. A test can be run only when in an asynchronous operation in non-error-correction mode (normal or direct mode). To terminate a test in progress, the escape sequence must be entered first. If S18 is non-zero, a test will terminate automatically after the time specified by S18 and display the OK message.

- &T0** Terminates test in progress. Clears S16.
- &T1** Initiates local analog loopback, V.54 Loop 3. Sets S16 bit 0. If a connection exists when this command is issued, the modem hangs up. The CONNECT XXXX message is displayed upon the start of the test.
- &T2** Returns ERROR.
- &T3 – 8** These commands are included for compatibility only and have no effect other than returning a result code.

&V**&V****Display Current Configuration and Stored Profiles**

Reports the current (active) configuration, the two stored (user) profiles, and the first four stored telephone numbers.

Result Code:

OK

&Wn**&Wn****Store Current Configuration**

Saves the current (active) configuration (profile), including S registers, in one of the two user profiles in NVRAM as denoted by the parameter value. This command yields an ERROR message if the NVRAM is not installed or is not operational as detected by the NVRAM test.

The current configuration is comprised of a list of storable parameters illustrated in the &V command. These settings are restored to the active configuration upon receiving an Zn command or at power up. See command &Yn “Designate a Default Reset Profile” on page 17.

- &W0** Store the current configuration as profile 0.
- &W1** Store the current configuration as profile 1.

Result Codes:

- OK n = 0 or 1 .
- ERROR Otherwise.

&Yn**&Yn****Designate a Default Reset Profile**

This command is included for compatibility only, and has no other effect than returning a result code. The parameter value, if valid, is written to S96.

Result Codes:

OK n=0 to 1.

ERROR Otherwise

&Zn=x**&Zn=x****Store telephone number**

The modem can store up to four telephone numbers. Each telephone number dial string can contain up to 38 digits.

&Zn=x n = 0 to 3 and x = dial string.

Result Codes:

OK For n <= 3, and x <= 38 digits.

Error Control AT Commands

%Cn**%Cn**

Enable/Disable Data Compression

Enables or disables data compression negotiation. The modem can only perform data compression on an error corrected link. The parameter value, if valid, is written to S41 bits 0 and 1.

- %C0** Disables data compression. Resets S46 bit 1.
- %C1** Enables MNP 5 data compression negotiation. Resets S46 bit 1.
- %C2** Enables V.42 bis data compression. Sets S46 bit 1.
- %C3** Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1 (default).

Result Codes:

- OK** n=0 to 3.
- ERROR** Otherwise.

%En**%En**

Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback

Controls whether or not the modem requests a retrain (%E1) or fall back when line quality is insufficient. Applies to dial-up line only. The parameter value, if valid, is written to S41 bits 2 and 6.

If enabled, the modem attempts to retrain for a maximum of 30 seconds.

- %E0** Disable line quality monitor and auto-retrain.
- %E1** Enable line quality monitor and auto-retrain (default).

Result Codes:

- OK** n=0,1.
- ERROR** Otherwise.

Data Compression AT Commands

\An**\An**

Select Maximum MNP Block Size

The modem operates an MNP error corrected link using a maximum block size controlled by the parameter supplied. The parameter value, if valid, is written to S40 bits 6 and 7.

\A0 64 characters. (Default.)

\A1 128 characters.

\A2 192 characters.

\A3 256 characters.

Result Codes:

OK n = 0 to 3.

ERROR Otherwise.

\Gn**\Gn**

Modem to Modem Flow Control (XON/XOFF)

In non-error correction mode, the modem enables or disables the generation or recognition of modem-to-modem XON/XOFF flow control according to the parameter supplied. The parameter value, If valid, is written to S41 bit 3.

In error correction mode, the setting of modem-to-modem XON/XOFF flow control is ignored.

Due to the buffering system used in the modem, modem-to-modem flow control is normally disabled.

\G0 Disables modem-to-modem XON/XOFF flow control (default).

\G1 Enables modem-to-modem XON/XOFF flow control.

Result Codes:

OK n =0 or 1.

ERROR Otherwise.

Note: When the modem receives a break from the remote modem, break is passed to the DTE as follows: In non-error correction mode direct, the break length is passed; in non-error correction mode normal and in error correction mode, a 300 ms break is passed.

\Ln

\Ln

MNP Block/Stream Mode Select

At connection time, this command controls the selection between block and stream modes of operation in MNP. The parameter value, if valid, is written to S41 bit 4.

- \L0 Use stream mode for MNP connection (default).
- \L1 Use interactive block mode for MNP connection. This command accepts block mode but implement stream mode.

Result Codes:

- OK n=0 or 1.
- ERROR Otherwise.

\Nn

\Nn

Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection.

- \N0 Selects normal speed buffered mode (disables error-correction mode).
- \N1 Selects direct mode.
- \N2 Selects reliable (error-correction) mode. The modem first attempts a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up.
- \N3 Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (DEFAULT)
- \N4 Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up.
- \N5 Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up.

Result Codes:

- OK n=0 to 5.
- ERROR Otherwise.

AT+ Commands

+MS

+MS

Select Modulation

This extended format command selects the modulation, enables or disables automode, and specifies the lower and highest connection rate using up to four subparameters.

+MS= <mod>[,<automode>][,<min_rate>][,<max_rate>]]]

<mode>	Modulation	Possible Rate (bps)
0	V.21	300
1	V.22	1200
2	V.22bis	2400, 1200
9	V.32	9600, 4800
10	V.32bis	14400, 12000, 9600, 7200, 4800
11	V.34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400
17	V.90	57,333 – 33,333
64	Bell 103	300

<automode>	Option Selected
0	Automode Disabled
1	Automode Enabled

<min_rate>

300 to 57333 Set <min_rate> = <max_rate> to force a <max_rate>

<max_rate>

300 to 57333

AT+CID Commands

+CIDn

+CIDn

Caller ID

Enables or disables Caller ID.

+CID=0 Disables Caller ID (default).

+CID=1 Enables Caller ID with a formatted presentation to the DTE. The modem presents the data items in a <Tag><Value> pair format. The expected pairs are data, time, caller code (telephone number), and name.

+CID=2 Enables Caller ID with an unformatted presentation to the DTE. The modem presents the entire packet of information, excluding the U's, in ASCII printable hex numbers.

Result Codes:

OK n=0 or 2.

ERROR Otherwise.

Inquiries:

+CID? Retrieves the current Caller ID mode from the modem.

+CID=? Returns the mode capabilities of the modem in a list with each element separated by commas.

Formatted Form Reporting

The modem presents the data in the <tag> = <value> pair format as described in Table 1. Spaces are present on both sides of the equal sign.

Table 1 Tag Description

Tag	Description
DATE	DATE = MMDD where MM is the month number (01 to 12) and DD is the day number (01 to 31)
TIME	TIME = HHMM where HH is the hour number (00 to 23) and MM is the minute number (00 to 59).
NMBR	NMBR = <number> or P or O where <number> is the telephone number of the caller, where P indicates that the calling number information is not available since the originating caller has requested private service, and where O indicates that the calling number information is not available or out of service at the calling location.
NAME	NAME = <listing name> where <listing name> is the subscription name.
MESG	MESG = <data tag> <length of message> <data> <checksum> in printable ASCII hex numbers. This tag indicates a data item not listed above. The message is only possible for Multiple Message Format.

Note: The modem does not present any Caller ID information if the DCE detects a checksum error in the Caller ID packet. In the event of an unrecognized data tag, the modem presents the data in ASCII hex numbers following the MESG tag.

Example of Formatted Form Reporting

1. The following example illustrates the standard Caller ID message packet, which is received between the first and second rings.

First RING;

DATE = 0321
 TIME = 1405
 NMBR = 5045551234
 NAME = JOHN SMITH

Second RING

Third RING

2. The following example illustrates the case where the tag of the packet is not recognized by the modem.

First RING;

MESG = 060342424231

Second RING

Third RING

Unformatted Form Reporting

The modem presents all information and packet control information found in the message. The modem, however, excludes the leading U's (channel seizure information) from the presentation. The packet is presented in ASCII printable hex numbers. the modem does not insert spaces, or line feeds, for formatting between bytes or words of the packet.

AT Command Result Codes

The modem responds to commands from the DTE and to activity on the line by signaling to the DTE in the form of result codes. The result codes that the modem can send are described below.

Two forms for each result code are available: long-form, an English-like “verbose” response, and short-form, a data-like numeric response (included in parentheses following the long-form). The long-form code is preceded and terminated by the sequence <CR> <LF>. The short-form is terminated by <CR> only with no preceding sequence.

If result messages are suppressed, nothing is returned to the DTE.

Table 2 AT Command Result Codes

No.	Verbose Form	Description
0	OK	The modem returns the OK code to acknowledge the execution of a command line.
1	CONNECT	The modem sends this result code upon connecting when: <ol style="list-style-type: none"> 1. The line speed is 300 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or 2. The DTE speed is 300 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting, or 3. The range of result code responses is restricted by the X command such that no speed reporting is allowed.
2	RING	The modem sends this result code when incoming ringing is detected on the line.
3	NO CARRIER	The modem sends this result code when attempting to establish a call if: <ol style="list-style-type: none"> 1. No ringback is detected within the period of time determined by register S7, or 2. The modem detects ringback and later doesn't, but no carrier is detected within the period of time determined by register S7. This result code is also used with the modem automatically disconnects due to loss of carrier. If busy tone detection is enforced (see command Xn “Extended Result Codes” on page 11) NO CARRIER is also used to report busy or circuit busy. If dial tone detection is enforced (see command Xn “Extended Result Codes” on page 11) NO CARRIER is also used to report no dial tone.
4	ERROR	The modem sends this result code if the command line contains a syntax error or it is unable to execute a command contained in the command line. It is issued if a command does not exist or if the parameter supplied is outside the permitted range.
5	CONNECT 1200	For X1, X2, X3, and X4, the modem sends this result code when: <ol style="list-style-type: none"> 1. The line speed is 1200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or 2. The DTE speed is 1200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.
6	NO DIALTONE	For X2 and X4, the modem sends this result code if it has been instructed to wait for a dial tone before dialing, but no dialtone is detected.
7	BUSY	For X3 and X4, if busy tone detection is enabled, the modem sends this result code, if the busy (engaged) signal is detected on the line.
8	NO ANSWER	The modem sends this result code, if the modem detects a continuous ringback signal for the duration set by register S7 while attempting to make a call.

No.	Verbose Form	Description
9	CONNECT 0600	For X1, X2, X3, and X4, the modem sends this result code when: 1. The line speed is 600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or 2. The DTE speed is 600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.
10	CONNECT 2400	For X1, X2, X3, and X4, the modem sends this result code when: 1. The line speed is 2400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or 2. The DTE speed is 2400 BPs and the modem has been instructed to report the DTE speed to the DTE upon connecting.
11	CONNECT 4800	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 4800 bps and the modem has been instructed to report the DTE speed upon connecting.
12	CONNECT 9600	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 9600 bps and the modem has been instructed to report the DTE speed upon connecting.
13	CONNECT 7200	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 7200 bps and the modem has been instructed to report the DTE speed upon connecting.
14	CONNECT 12000	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 12000 bps and the modem has been instructed to report the DTE speed upon connecting.
15	CONNECT 14400	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 14400 bps and the modem has been instructed to report the DTE speed upon connecting.
16	CONNECT 19200	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 19200 bps and the modem has been instructed to report the DTE speed upon connecting.
17	CONNECT 38400	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 38400 bps and the modem has been instructed to report the DTE speed upon connecting.
18	CONNECT 57600	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 57600 bps and the modem has been instructed to report the DTE speed upon connecting.
19	CONNECT 115200	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 115200 bps and the modem has been instructed to report the DTE speed upon connecting.
33	FAX	The modem returns this result code when a fax modem connection is established in a facsimile mode.
34	+FCERROR	The modem returns this result code when high speed fax data (V.27, V.29, V.33, or V.17) is expected and a V.21 signal is received.
35	DATA	The modem returns this result code when a data modem connection is established in a facsimile mode.
40	CARRIER 300	The modem returns this result code when Bell 103 carrier has been detected on the line and carrier reporting is enabled.
44	CARRIER 1200/75	The modem returns this result code when V.23 backward channel carrier has been detected on the line and carrier reporting is enabled.
45	CARRIER 75/1200	The modem returns this result code when V.23 forward channel carrier has been detected on the line and carrier reporting is enabled.
47	CARRIER 2400	The modem sends this result code when either the high or low channel carrier in V.22bis mode has been detected on the line and carrier reporting is enabled.
48	CARRIER 4800	The modem sends this result code when the 4800 bps data rate in V.32bis or V.32 mode has been detected on the line and carrier reporting is enabled.
49	CARRIER 7200	The modem sends this result code when the 7200 bps data rate in V.32bis mode has been detected on the line and carrier reporting is enabled.
50	CARRIER 9600	The modem sends this result code when the 9600 bps data rate in V.32bis or V.32 mode has been detected on the line and carrier reporting is enabled.
51	CARRIER 12000	The modem sends this result code when the 12000 bps data rate in V.32bis or V.32 mode has been detected on the line and carrier reporting is enabled.
52	CARRIER 14400	The modem sends this result code when the 14400 bps data rate in V.32bis or V.32 mode has been detected on the line and carrier reporting is enabled.

No.	Verbose Form	Description
53	CARRIER 16800	The modem sends this result code when the 16800 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
54	CARRIER 19200	The modem sends this result code when the 19200 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
55	CARRIER 21600	The modem sends this result code when the 21600 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
56	CARRIER 24000	The modem sends this result code when the 24000 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
57	CARRIER 26400	The modem sends this result code when the 26400 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
58	CARRIER 28800	The modem sends this result code when the 28800 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
59	CONNECT 16800	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 16800 bps and the modem has been instructed to report the DTE speed upon connecting.
60	CONNECT 31200	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 31200 bps and the modem has been instructed to report the DTE speed upon connecting.
61	CONNECT 21600	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 21600 bps and the modem has been instructed to report the DTE speed upon connecting.
62	CONNECT 24000	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 24000 bps and the modem has been instructed to report the DTE speed upon connecting.
63	CONNECT 26400	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 26400 bps and the modem has been instructed to report the DTE speed upon connecting.
64	CONNECT 28800	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 28800 bps and the modem has been instructed to report the DTE speed upon connecting.
65	CONNECT 33600	For X1, X2, X3, and X4, the modem sends this result code when the DTE speed is 33600 bps and the modem has been instructed to report the DTE speed upon connecting.
66	COMPRESSION: CLASS 5	The modem returns this result code to the DTE when the modem has connected in MNP Class 5 and compression reporting is enabled.
67	COMPRESSION: V.42BIS	The modem returns this result code to the DTE when the modem has connected in V.42bis and compression reporting is enabled.
69	COMPRESSION: NONE	The modem returns this result code to the DTE when the modem has connected without data compression and compression reporting is enabled.
70	PROTOCOL: NONE	The modem returns this result code to the DTE when the modem has connected without any form of error correction and the protocol reporting is enabled.
77	PROTOCOL: LAPM	The modem returns this result code to the DTE when the modem has connected in the V.42 LAPM mode of error correction and protocol reporting is enabled.
80	PROTOCOL: ALT	The modem returns this result code to the DTE when the modem has connected in the MNP mode of error correction and protocol reporting is enabled.
82	CARRIER 31200	The modem sends this result code when the 31200 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
83	CARRIER 33600	The modem sends this result code when the 33600 bps data rate in V.34 mode has been detected on the line and carrier reporting is enabled.
84	CONNECT 230400	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 230400 bps and the modem has been instructed to report the DTE speed upon connecting.
85	CONNECT 460800	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 460800 bps and the modem has been instructed to report the DTE speed upon connecting.
86	CONNECT 28000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 28000 bps and the modem has been instructed to report the DTE speed upon connecting.

No.	Verbose Form	Description
87	CONNECT 29333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 29333 bps and the modem has been instructed to report the DTE speed upon connecting.
88	CONNECT 30666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 30666 bps and the modem has been instructed to report the DTE speed upon connecting.
89	CONNECT 32000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 32000 bps and the modem has been instructed to report the DTE speed upon connecting.
90	CONNECT 33333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 33333 bps and the modem has been instructed to report the DTE speed upon connecting.
91	CONNECT 34666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 34666 bps and the modem has been instructed to report the DTE speed upon connecting.
92	CONNECT 36000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 36000 bps and the modem has been instructed to report the DTE speed upon connecting.
93	CONNECT 37333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 37333 bps and the modem has been instructed to report the DTE speed upon connecting.
94	CONNECT 38666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 38666 bps and the modem has been instructed to report the DTE speed upon connecting.
95	CONNECT 40000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 40000 bps and the modem has been instructed to report the DTE speed upon connecting.
96	CONNECT 41333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 41333 bps and the modem has been instructed to report the DTE speed upon connecting.
97	CONNECT 42666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 42666 bps and the modem has been instructed to report the DTE speed upon connecting.
98	CONNECT 44000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 44000 bps and the modem has been instructed to report the DTE speed upon connecting.
99	CONNECT 45333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 45333 bps and the modem has been instructed to report the DTE speed upon connecting.
100	CONNECT 46666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 46666 bps and the modem has been instructed to report the DTE speed upon connecting.
101	CONNECT 48000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 48000 bps and the modem has been instructed to report the DTE speed upon connecting.
102	CONNECT 49333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 49333 bps and the modem has been instructed to report the DTE speed upon connecting.
103	CONNECT 50666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 50666 bps and the modem has been instructed to report the DTE speed upon connecting.
104	CONNECT 52000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 52000 bps and the modem has been instructed to report the DTE speed upon connecting.

No.	Verbose Form	Description
105	CONNECT 53333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 53333 bps and the modem has been instructed to report the DTE speed upon connecting.
106	CONNECT 54666	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 54666 bps and the modem has been instructed to report the DTE speed upon connecting.
107	CONNECT 56000	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 56000 bps and the modem has been instructed to report the DTE speed upon connecting.
108	CONNECT 57333	For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 57333 bps and the modem has been instructed to report the DTE speed upon connecting.
109	CARRIER 28000	The modem sends this result code when the 28000 bps data rate has been detected on the line and carrier reporting is enabled.
110	CARRIER 29333	The modem sends this result code when the 29333 bps data rate has been detected on the line and carrier reporting is enabled.
111	CARRIER 30666	The modem sends this result code when the 30666 bps data rate has been detected on the line and carrier reporting is enabled.
112	CARRIER 32000	The modem sends this result code when the 32000 bps data rate has been detected on the line and carrier reporting is enabled.
113	CARRIER 33333	The modem sends this result code when the 33333 bps data rate has been detected on the line and carrier reporting is enabled.
114	CARRIER 34666	The modem sends this result code when the 34666 bps data rate has been detected on the line and carrier reporting is enabled.
115	CARRIER 36000	The modem sends this result code when the 36000 bps data rate has been detected on the line and carrier reporting is enabled.
116	CARRIER 37333	The modem sends this result code when the 37333 bps data rate has been detected on the line and carrier reporting is enabled.
117	CARRIER 38666	The modem sends this result code when the 38666 bps data rate has been detected on the line and carrier reporting is enabled.
118	CARRIER 40000	The modem sends this result code when the 40000 bps data rate has been detected on the line and carrier reporting is enabled.
119	CARRIER 41333	The modem sends this result code when the 41333 bps data rate has been detected on the line and carrier reporting is enabled.
120	CARRIER 42666	The modem sends this result code when the 42666 bps data rate has been detected on the line and carrier reporting is enabled.
121	CARRIER 44000	The modem sends this result code when the 44000 bps data rate has been detected on the line and carrier reporting is enabled.
122	CARRIER 45333	The modem sends this result code when the 45333 bps data rate has been detected on the line and carrier reporting is enabled.
123	CARRIER 46666	The modem sends this result code when the 46666 bps data rate has been detected on the line and carrier reporting is enabled.
124	CARRIER 48000	The modem sends this result code when the 48000 bps data rate has been detected on the line and carrier reporting is enabled.
125	CARRIER 49333	The modem sends this result code when the 49333 bps data rate has been detected on the line and carrier reporting is enabled.
126	CARRIER 50666	The modem sends this result code when the 50666 bps data rate has been detected on the line and carrier reporting is enabled.
127	CARRIER 52000	The modem sends this result code when the 52000 bps data rate has been detected on the line and carrier reporting is enabled.
128	CARRIER 53333	The modem sends this result code when the 53333 bps data rate has been detected on the line and carrier reporting is enabled.

No.	Verbose Form	Description
129	CARRIER 54666	The modem sends this result code when the 54666 bps data rate has been detected on the line and carrier reporting is enabled.
130	CARRIER 56000	The modem sends this result code when the 56000 bps data rate has been detected on the line and carrier reporting is enabled.
131	CARRIER 57333	The modem sends this result code when the 57333 bps data rate has been detected on the line and carrier reporting is enabled.

Chapter 2

S-Registers

S-Registers

The S-registers are summarized along with their default values. Registers or register fields quoted as “reserved” are reserved for current or future use by the firmware.

All bit-mapped registers are read-only. The appropriate AT command which controls the relevant bits in the S-Register should be used to change the value. To change the value of an S-register, use the ATSn command.

The proper use of the ATSn command is

ATSn=v

where *n* is the number of the S-register and *v* is the desired value.

Factory Defaults

The factory default values are loaded into the active configuration when Windows is started or by the ATZn command after a warm reset. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values.

The factory default values may be loaded or restored at any time by entering the AT&F0 command.

S-Register Definitions

S0

S0

Number of Rings to Auto-Answer

Sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables auto-answer mode.

Range: 0-255 rings

Default: 0

S1

S1

Ring Counter

S1 is incremented each time the modem detects a ring signal on the telephone line. S1 is cleared if no rings occur over an eight second interval.

Range: 0-255 rings

Default: 0

S2 S2

Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII '+'. A value over 127 disables the escape process, i.e., no escape character will be recognized.

Range: 0-255, ASCII decimal

Default: 43 (+)

S3 S3

Carriage Return Character

Sets the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0-127, ASCII decimal

Default: 13 (Carriage Return)

S4 S4

Line Feed Character

Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used

Range: 0-127, ASCII decimal

Default: 10 (Line Feed)

S5 S5

Backspace Character

Sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.

Range: 0-32, ASCII decimal

Default: 8 (Backspace)

S6**S6****Wait Time for Dial Tone Before Blind Dialing**

Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. The “Wait for Dial Tone” call progress feature (W dial modifier in the dial string) will override the value in register S6.

The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.

Range: 2-255 seconds

Default: 2

S7**S7****Wait Time For Carrier After Dial, For Silence, or For Dial Tone After W Dial Modifier**

Sets the length of time, in seconds, that the modem will wait for carrier before hanging up. The timer is started when the modem finishes dialing (originate), or 2 seconds after going off-hook (answer). In originate mode, the timer is reset upon detection of answer tone if allowed by country restrictions.

Range: 1-255 seconds

Default: 60

S8**S8****Pause Time For Dial Delay**

Sets the time, in seconds, that the modem must pause when the “,” dial modifier is encountered in the dial string.

Range: 0-255 seconds

Default: 2

S9**S9****Carrier Detect Response Time (not used)**

Sets the time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on RLSD. As this time is increased, there is less chance to detect a false carrier due to noise from the telephone line.

Range: 1-255 tenths of a second

Default: 6 (0.6 second)

S10**S10****Lost Carrier To Hang Up Delay**

Sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnecting is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier (not implemented).

Range: 1-255 tenths of a second

Default: 100 (10seconds)

S11**S11****DTMF Tone Duration**

Sets the duration of tones in DTMF dialing. This value has no effect on pulse dialing.

Range: 50-255 milliseconds

Default: 70 milliseconds

S12**S12****Escape Prompt Delay (EPD)**

Defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Note that sending of the OK result code does not affect entry into command mode.

Range: 0-255 1/50 of a second

Default: 50 (1 second)

S13**S13****Reserved**

S14**S14****General Bit Mapped Options Status**

x		T/P	x	Vn	Qn	En	x
7	6	5	4	3	2	1	0

Indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit Definitions:

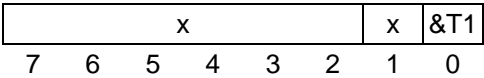
Bits	Name	Description
7:6	–	Reserved.
5	Tone/ Pulse	1 = Pulse. 0 = Tone (Default).
4	–	Reserved.
3	Result Codes	1 = Verbose, V1 (Default). 0 = Numeric, V0.
2	Quiet Mode	1 = Do not send result codes, Q1. 0 = Send result codes, Q0 (Default).
1	Command Echo	1 = Command Echo enabled, E1 (Default). 0 = Command Echo disabled, E0.
0	–	This bit is ignored.

S15**S15****Reserved**

S16

S16

General Bit Mapped Test Options Status



Indicates the test in progress status.
Default: 0

Bit Definitions:

Bits	Name	Description
7:2	–	Reserved.
1	–	Not used.
0	Local analog loopback	1 = Enabled (&T1) 0 = Disabled (Default).

S17 – S20

S17 – S20

Reserved

S21**S21****V.24/General Bit Mapped Options Status**

x	0	x	&Dn		x	&Jn	
7	6	5	4	3	2	1	0

Indicates the status of command options.

Default: 52 (34h) (00110100b)

Bit Definitions:

Bits	Name	Description															
7	–	Reserved.															
6	DSR behavior	Not implemented. 0 = &S0 selected (Default).															
5	–	Reserved.															
4:3	DTR behavior	DTR behavior. <table> <tr> <th>bit 3</th><th>bit 2</th><th>DTR behavior</th></tr> <tr> <td>0</td><td>0</td><td>&D0 selected (default).</td></tr> <tr> <td>0</td><td>1</td><td>&D1 selected.</td></tr> <tr> <td>1</td><td>0</td><td>&D2 selected.</td></tr> <tr> <td>1</td><td>1</td><td>Not used.</td></tr> </table>	bit 3	bit 2	DTR behavior	0	0	&D0 selected (default).	0	1	&D1 selected.	1	0	&D2 selected.	1	1	Not used.
bit 3	bit 2	DTR behavior															
0	0	&D0 selected (default).															
0	1	&D1 selected.															
1	0	&D2 selected.															
1	1	Not used.															
2:1	–	Reserved.															
0	Phonejack control	Set by &Jn, but otherwise ignored. 0 = &J0 (Default).															

Speaker/Results Bit Mapped Options Status

x	Xn				Mn		Ln
7	6	5	4	3	2	1	0

Indicates the status of command options.

Default: 117 (75h) (01110101b)

Bit Definitions:

Bits	Name	Description																								
7	–	Reserved.																								
6:4	Limit result codes	Limit result codes. <table><tr><th>bit 3</th><th>bit 1</th><th>bit 0</th><th>DTR behavior</th></tr><tr><td>0</td><td>0</td><td>0</td><td>X0.</td></tr><tr><td>1</td><td>0</td><td>0</td><td>X1.</td></tr><tr><td>1</td><td>0</td><td>1</td><td>X2.</td></tr><tr><td>1</td><td>1</td><td>0</td><td>X3.</td></tr><tr><td>1</td><td>1</td><td>1</td><td>X4 (default).</td></tr></table>	bit 3	bit 1	bit 0	DTR behavior	0	0	0	X0.	1	0	0	X1.	1	0	1	X2.	1	1	0	X3.	1	1	1	X4 (default).
bit 3	bit 1	bit 0	DTR behavior																							
0	0	0	X0.																							
1	0	0	X1.																							
1	0	1	X2.																							
1	1	0	X3.																							
1	1	1	X4 (default).																							
3:2	Speaker control	Sets the speaker control as defined by Mn. <table><tr><th>bit 3</th><th>bit 2</th><th>Speaker control</th></tr><tr><td>0</td><td>0</td><td>Disabled, M0.</td></tr><tr><td>0</td><td>1</td><td>Off on carrier, M1 (default).</td></tr><tr><td>1</td><td>0</td><td>Always on, M2.</td></tr><tr><td>1</td><td>1</td><td>On during handshake, M3.</td></tr></table>	bit 3	bit 2	Speaker control	0	0	Disabled, M0.	0	1	Off on carrier, M1 (default).	1	0	Always on, M2.	1	1	On during handshake, M3.									
bit 3	bit 2	Speaker control																								
0	0	Disabled, M0.																								
0	1	Off on carrier, M1 (default).																								
1	0	Always on, M2.																								
1	1	On during handshake, M3.																								
1:0	Speaker volume	Sets the speaker volume as defined by Ln. <table><tr><th>bit 1</th><th>bit 0</th><th>Speaker volume</th></tr><tr><td>0</td><td>0</td><td>&L0 selected.</td></tr><tr><td>0</td><td>1</td><td>&L1 selected (default).</td></tr><tr><td>1</td><td>0</td><td>&L2 selected.</td></tr><tr><td>1</td><td>1</td><td>&L3 selected.</td></tr></table>	bit 1	bit 0	Speaker volume	0	0	&L0 selected.	0	1	&L1 selected (default).	1	0	&L2 selected.	1	1	&L3 selected.									
bit 1	bit 0	Speaker volume																								
0	0	&L0 selected.																								
0	1	&L1 selected (default).																								
1	0	&L2 selected.																								
1	1	&L3 selected.																								

S23 – S28**S23 – S28****Reserved**

S29**S29****Flash Dial Modifier Time**

Sets the length of time in 10ms units that the modem takes to go on-hook when it receives the flash (!) dial modifier in the dial ring. The time can be limited as it is a country dependent parameter.

Range: 0-255 10ms intervals.

Default: 5

S30-S36**S30-S36****Reserved**

S37

S37

Desired Line Connection Speed

x				Line connection speed			
7	6	5	4	3	2	1	0

Default: 0

Bit Definitions:

Bits	Name	Description																																																																																																																																																
7:5	—	Reserved.																																																																																																																																																
4:0	Line connection speed	Desired connection speed. This is interlinked with the Nn command.																																																																																																																																																
		<table><tr><th>bit 4</th><th>bit 3</th><th>bit 2</th><th>bit 1</th><th>bit 0</th><th>Selection</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Automode connection (default).</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Connect at 300 bps.</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>Connect at 300 bps.</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>Connect at 300 bps.</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>Reserved.</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>Connect at V.22bis 1200 bps.</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>Connect at V.22bis 2400 bps.</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>Reserved.</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>Connect at V.32bis/V.32 4800 bps.</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>Connect at V.32bis/V.32 9600 bps.</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>Connect at V.32bis 12000 bps.</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>Connect at V.32bis 14400 bps.</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>Connect at V.32bis 7200 bps.</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>Reserved.</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>Reserved.</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Connect at V.34 14400 bps.</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Connect at V.34 16800 bps.</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>Connect at V.34 19200 bps.</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>Connect at V.34 21600 bps.</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>Connect at V.34 24000 bps.</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>Connect at V.34 26400 bps.</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>Connect at V.34 28800 bps.</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>Connect at V.34 33600 bps.</td></tr></table>	bit 4	bit 3	bit 2	bit 1	bit 0	Selection	0	0	0	0	0	Automode connection (default).	0	0	0	0	1	Connect at 300 bps.	0	0	0	1	0	Connect at 300 bps.	0	0	0	1	1	Connect at 300 bps.	0	0	1	0	0	Reserved.	0	0	1	0	1	Connect at V.22bis 1200 bps.	0	0	1	1	0	Connect at V.22bis 2400 bps.	0	0	1	1	1	Reserved.	0	1	0	0	0	Connect at V.32bis/V.32 4800 bps.	0	1	0	0	1	Connect at V.32bis/V.32 9600 bps.	0	1	0	1	0	Connect at V.32bis 12000 bps.	0	1	0	1	1	Connect at V.32bis 14400 bps.	0	1	1	0	0	Connect at V.32bis 7200 bps.	0	1	1	0	1	Reserved.	0	1	1	1	1	Reserved.	1	0	0	0	0	Connect at V.34 14400 bps.	1	0	0	0	1	Connect at V.34 16800 bps.	1	0	0	1	0	Connect at V.34 19200 bps.	1	0	0	1	1	Connect at V.34 21600 bps.	1	0	1	0	0	Connect at V.34 24000 bps.	1	0	1	0	1	Connect at V.34 26400 bps.	1	0	1	1	1	Connect at V.34 28800 bps.	1	1	0	0	0	Connect at V.34 33600 bps.
bit 4	bit 3	bit 2	bit 1	bit 0	Selection																																																																																																																																													
0	0	0	0	0	Automode connection (default).																																																																																																																																													
0	0	0	0	1	Connect at 300 bps.																																																																																																																																													
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0	0	1	0	0	Reserved.																																																																																																																																													
0	0	1	0	1	Connect at V.22bis 1200 bps.																																																																																																																																													
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0	0	1	1	1	Reserved.																																																																																																																																													
0	1	0	0	0	Connect at V.32bis/V.32 4800 bps.																																																																																																																																													
0	1	0	0	1	Connect at V.32bis/V.32 9600 bps.																																																																																																																																													
0	1	0	1	0	Connect at V.32bis 12000 bps.																																																																																																																																													
0	1	0	1	1	Connect at V.32bis 14400 bps.																																																																																																																																													
0	1	1	0	0	Connect at V.32bis 7200 bps.																																																																																																																																													
0	1	1	0	1	Reserved.																																																																																																																																													
0	1	1	1	1	Reserved.																																																																																																																																													
1	0	0	0	0	Connect at V.34 14400 bps.																																																																																																																																													
1	0	0	0	1	Connect at V.34 16800 bps.																																																																																																																																													
1	0	0	1	0	Connect at V.34 19200 bps.																																																																																																																																													
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1	0	1	0	0	Connect at V.34 24000 bps.																																																																																																																																													
1	0	1	0	1	Connect at V.34 26400 bps.																																																																																																																																													
1	0	1	1	1	Connect at V.34 28800 bps.																																																																																																																																													
1	1	0	0	0	Connect at V.34 33600 bps.																																																																																																																																													

S38-S40

S38-S40

Reserved

S41**S41****General Bit Mapped Options Status**

x			\Ln	\Gn	x	%Cn	
7	6	5	4	3	2	1	0

Indicates the status of command options.

Default: 3 (00000011b)

Bit Definitions:

Bits	Name	Description
7:5	—	Reserved.
4	Block mode control	1 = Block mode (\L1). 0 = Stream mode (\L0 default).
3	Modem-to-Modem flow control	1 = Enabled (\G1). 0 = Disabled (\G0 default).
2	—	Reserved.
1:0	Compression selection	Selects the compression method.
	<u>bit 1</u>	<u>bit 0</u> <u>Compression method</u>
	0	0 Disabled (%C0).
	0	1 MNP 5 (%C1).
	1	0 V.42bis (%C2).
	1	1 MNP 5 and V.42bis (%C3 default).

S42 – S45**S42 – S45****Reserved****S46****S46****Data Compression Control**

Controls selection of compression. The following actions are executed for the given values:

Range: 136 or 138

Default: 138

S46 = 136 Execute error correction protocol with no compression.

S46 = 138 Execute error correction protocol with compression. (Default.)

S47-S90

S47-S90

Reserved

S91

S91

Data Mode Transmit Level

Sets the transmit attenuation level from -6 to -15 dBm. In some countries, the transmit level may not be changed.

- Range: 6 to 15 (corresponding to -6 to -15 dBm transmit level)
- Default: 10 (-10 dBm transmit level)

S92

S92

Fax Transmit Attenuation Level

Sets the transmit attenuation level from -6 to -15 dBm for the fax mode. In some countries, the transmit level may not be changed.

- Range: 6 to 15 (corresponding to -6 to -15 dBm transmit level)
- Default: 10 (-10 dBm transmit level)

S95

S95

Extended Result Code

x	Cmp	x	Prtcl	Car	ARQ	DCE	
7	6	5	4	3	2	1	0

The bits in this register can be set to override some of the Wn command options. A bit set to a 1 in this register will enable the corresponding result code regardless of the Wn setting.

Default: 0

Bit Definitions:

Bits	Name	Description
7:6	—	Reserved.
5	Compression	Enable COMPRESSION xxxx result code (xxxx = compression type).
4	—	Reserved.
3	Protocol	Enable PROTOCOL xxxx result code (xxxx = protocol identifier).
2	Carrier	Enable CARRIER xxxx result code (xxxx = rate).
1	ARQ to Connect	Append/ARQ to CONNECT xxxx result code in error correction mode (xxxx = rate).
0	DCE speed	CONNECT result code indicates DCE speed instead of DTE speed.

Chapter 3

Class 1 Fax Commands

Fax I/O Processing

The character format is 8 bits data, no parity, and 1 stop bit. Start and stop elements are removed from the transmit data and added to the receive data. Both transmit and receive data are buffered. Flow control using XON/XOFF (DC1/DC3) or RTS/CTS is provided.

Unique control character strings are identified, filtered, or reinserted into the I/O data stream. These control characters and their resultant action are described below.

Table 3 DTE-to-Modem Transmit Data Stream

Characters Detected	Action Taken
<DLE><Data>	Delete <DLE><Data> characters.
<DLE><ETX>	Recognize as a string terminator and take appropriate action.
<DLE><DLE>	Replace with single <DLE> character.

Table 4 Modem-to-DTE Receive Data Stream

Characters Detected	Action Taken
<DLE>	Insert extra <DLE> ahead of <DLE>.

The modem also identifies the end of a frame by inserting <DLE><ETX> into the data stream after the FCS bytes.

Fax Mode Selection

Fax class 1 commands are identified in Table 5. Fax modes and rates are determined by the AT+F commands.

Table 5 Fax Class 1 Commands

Command	Function
+FCLASS=	Service Class
+FAE=n	Data/Fax Auto Answer
+FTS=n	Stop Transmission and Wait
+FRS=n	Receive Silence
+FTM=n	Transmit Data
+FRM=n	Receive Data
+FTH=n	Transmit Data with HDLC Framing
+FRH=n	Receive Data with HDLC Framing

Fax Origination

Origination of fax calls is made using the ATD command. Upon completion of the dial function, a calling tone at 1100 Hz is transmitted, with a cadence of 0.5 seconds on and 3 seconds off. The modem automatically enters mode +FRH=3 and sends the CONNECT message to the DTE when FSK flags are detected from the remote.

Fax Answering

Answering of fax calls is identical to answering of data calls with the exception that the modem enters the fax handshaking mode instead of the data handshaking mode after going off-hook. If +FAE=0, the modem, after sending answer tone, automatically enters fax mode (+FTH=3), sends the CONNECT message to the DTE, and starts sending FSK flags. If +FAE=1, the modem determines whether the caller is a data modem or fax modem and sends the DATA or FAX result code, respectively, to the DTE.

Fax Control Transmission

Fax control transmission is initiated by the +FTH=n command. After this command is issued, the modem generates the CONNECT message and transmits carrier in the modulation scheme specified by the parameter n. The modem then transmits HDLC flags for a minimum of 1 second. The modem continues to transmit the HDLC flags until it receives a character from the DTE.

When characters are received from the DTE, the modem adds start and end flags, performs zero-bit insertion, generates FCS, and deletes <DLE><chr> character pairs before transmitting the characters to the remote fax machine. Each <DLE><DLE> sequence is transmitted as a single <DLE>. <DLE><ETX> is considered as the end of frame marker and is not transmitted. All data received from the DTE after <DLE><ETX> is ignored by the modem until the modem generates either the CONNECT, OK, or ERROR result code.

If no more data is in the transmit buffer and the final bit was a 1 (bit 4 of the second byte received from the DTE), the modem generates the OK result code and returns to the command mode. If the final bit was a 0, the modem generates the CONNECT message and waits for further data from the DTE while transmitting HDLC flags. If no more data is received before 5 seconds elapse, the modem drops carrier, goes on-hook, and generates the ERROR result code.

Fax Control Reception

Fax control reception is initiated using the AT+FRH=n command. After this command is issued, the modem looks for carrier in the modulation scheme specified by the parameter n. If no carrier is detected before the period of time specified by register S7 expires, the modem generates the NO CARRIER message and returns to command mode. If carrier is detected that is not the one specified by the parameter n, the modem generates the +FCERROR message and returns to the command mode. If the specified carrier is detected, the modem generates the CONNECT message and enters the HDLC receive mode.

In HDLC receive mode, the modem receives HDLC frames from the remote fax machine, strips the flags, performs zero-bit deletion, performs error checking, and handles <DLE><chr> character pairs before passing the data to the DTE. The modem prefixes each <DLE> character with another <DLE> character before sending it to the DTE. After the last byte in the frame, the modem sends <DLE><ETX> to the DTE marking the end of the frame. The modem then generates either the OK message if no errors were detected or the ERROR message if errors were detected (FCS is incorrect), and returns to command mode.

While in command mode, the modem continues to receive data in the selected modulation scheme, and sends the data after sending the CONNECT message to the DTE when the DTE reissues the +FRH command with the same parameter. If the DTE issues the +FRH command with a different parameter, the modem clears all buffers and proceeds as described previously.

If carrier is lost while in command mode and the DTE reissues the +FRH command with the same parameter, and there is no data in the buffer, the modem sends the ERROR result code to the DTE and returns to the command mode. If there is data in the buffer, the modem sends the next frame of buffered data to the DTE, followed by <DLE><ETX>, and either the ERROR result code if errors were detected or the OK result code if no errors were detected. The modem then returns to command mode.

The modem concludes an error is detected if carrier is lost for any period of time during or before the reception of a frame. If carrier is lost for a time period longer than the time specified by the register S10, the modem finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the ERROR message, and returns to command mode. All subsequent data received from the remote is discarded.

If the modem detects a frame abort sequence (seven consecutive ones with no zero insertion) while it is waiting for a frame beginning flag (it was receiving HDLC flags), it will wait for the HDLC flags again until either carrier is lost, or the DTE aborts the process by sending an abort character or by dropping DTR with &D2 in effect. If the frame abort sequence is detected while the modem is receiving a frame it finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the ERROR message, and returns to command mode. The modem keeps looking for HDLC flags followed by more data from the remote, with the selected modulation scheme.

If the modem detects a receive buffer overflow condition, it concludes that there was an FCS error in that frame. The modem will receive more frames only if a starting flag is detected and there is room in the receive buffer. If a starting flag is detected and there is no room in the buffer, the modem discards all data in that frame.

If the modem receives any character from the DTE after the +FRH command (except flow control characters if software flow control is in effect), or if the modem detects a high-to-low transition of the DTR signal while &D1 is in effect, it sends <DLE><ETX> to the DTE, generates OK result code, and returns to command mode. The receive buffer is cleared and all data received from the remote is discarded. If the modem detects a DTR drop while &D2 is in effect, it goes on-hook, sends <DLE><ETX> to the DTE, generates OK result code, and returns to command mode. If the modem detects a DTR drop while &D3 is in effect, the modem performs a warm reset.

Fax Data Transmission

Fax data transmission is initiated by the AT+FTM=n command. After this command is issued, the modem generates the CONNECT message and transmits carrier in the modulation scheme specified by the parameter n. The modem then transmits constant 1 bits until it receives a character from the DTE.

When data is received from the DTE, the modem deletes start and stop bits and deletes all <DLE><chr> character pairs before transmitting the data to the remote. Each <DLE><DLE> sequence is transmitted as a single <DLE>. <DLE><ETX> is considered as

the end of stream marker, and is not transmitted. All data received from the DTE after the <DLE><ETX> is ignored by the modem until the modem generates either the CONNECT, OK, or ERROR result code.

If no more data is in the transmit buffer, and the last transmitted character was not an ASCII NULL, the modem generates the OK result code and returns to the command mode. If the last character transmitted was an ASCII NULL, the modem generates the CONNECT message to the DTE and waits for further data from the DTE while transmitting NULLs to the remote. If more data is received before five seconds elapse, the modem continues to transmit the data as described in the previous paragraph. If five seconds elapse and no data is received from the DTE, the modem drops carrier, goes on-hook, and generates the ERROR result code.

Fax Data Reception

Fax data reception is initiated using the AT+FRM=n command. After this command is issued, the modem looks for carrier in the modulation scheme specified by the parameter n. If no carrier is detected before the period of time specified by register S7 expires, the modem generates the NO CARRIER message and returns to command mode. If a V.21 carrier is detected when a high speed carrier is expected, the modem generates the +FCERROR message and returns to the command mode. If the specified carrier is detected, the modem generates the CONNECT message and enters the data receive mode.

While in data receive mode, the modem receives data from the remote, adds start and stop bits, and handles <DLE><chr> character pairs before passing the data to the DTE. The modem prefixes each <DLE> character with another <DLE> character before sending it to the DTE.

If carrier is lost for a time period longer than the time specified by the register S10, the modem finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the NO CARRIER result code, and returns to the command mode. All subsequent data received from the remote is discarded.

If the modem detects a receive buffer overflow condition, it stops receiving from the remote until there is room in the receive buffer. The modem informs the DTE of the buffer overflow after it sends to the DTE the last character that was stored in the buffer before the overflow occurred.

If the modem receives any character from the DTE after the +FRM command (except flow control characters if software flow control is in effect), or if the modem detects a high-to-low transition of the DTR signal while &D1 is in effect, it sends <DLE><ETX> to the DTE, generates the OK result code, and returns to command mode. The receive buffer is cleared and all data received from the remote is discarded. If loss of DTR is detected while &D2 is in effect, the modem goes on-hook, sends <DLE><ETX> followed by OK result code to the DTE, and returns to command mode. If the modem detects a DTR drop while &D3 is in effect, the modem performs a warm reset.

Class 1 Fax Commands

+FCLASS=n

Select Service Class

+FCLASS=n command sets the active service class.

Parameters: 0-1

Command options:

- +FCLASS=0 Select Data Mode (Default.)
- +FCLASS=1 Select Facsimile Class 1
- +FCLASS=2 Select Facsimile Class 2 (not implemented)

+FCLASS=n

+F<command>?

Report Active Configuration

+F<command>? interrogates the modem to determine the active configuration.

Typical responses are:

- +FAE? 0 if auto answer is disabled; 1 if auto answer is enabled
- +FCLASS? 0 if in data mode; 1 if in fax class 1; 2 if in fax class 2

+F<command>?

+F<command>=?

Report Operating Capabilities

+F<command>=? can be used to determine the operating capabilities of the modem.

Typical responses are:

- +FAE=? 0 or 1
- +FCLASS=? 0, 1, or 2
- +FTM=? 24, 48, 72, 96 (9600 bps version)
- +FRM=? 24, 48, 72, 96 (9600 bps version)
- +FTM=? 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 (14400 bps version)
- +FRM=? 24, 48, 72, 73, 74, 96, 97, 98, 121,122, 145, 146 (14400 bps version)

+F<command>=?

+FAE = n

+FAE = n

Data/Fax Auto Answer

+FAE=n allows the DTE to either restrict answering to class 1, or to automatically detect whether the calling station is a fax class 1 modem or data modem, and answer accordingly.

Parameters: n = 0 or 1

Command options:

n = 0 Disable data/fax auto answer mode. The modem answers as a fax modem only (Default.).

n = 1 Enable data/fax auto answer mode. The modem answers as a fax or data modem.

After a data (not fax) connection is achieved (indicated by the DATA result code), the DTE must issue an ATO command to cause the modem to go on-line.

+FTS = n

+FTS = n

Stop Transmission and Wait

+FTS=n (n=0 to 255) causes the modem to terminate a transmission and wait for n 10-ms intervals before responding with the OK result code. An ERROR response code results if this command is issued while the modem is on-hook.

+FRS = n

+FRS = n

Receive Silence

+FRS=n (n=0 to 255) causes the modem to report back to the DTE with an OK result code after n 10 ms-intervals of silence have been detected on the line. This command is aborted if any character is received from the DTE. The modem discards the aborting character and issues an OK result code. An ERROR response code results if this command is issued while the modem is on-hook.

+FTM = n**+FTM = n****Transmit Data**

+FTM=n causes the modem to transmit data using the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options.

Command options:

- +FTM=24 V.27ter 2400 bps
- +FTM=48 V.27 ter 4800 bps
- +FTM=72 V.29 7200 bps
- +FTM=73 V.17 7200 bps long
- +FTM=74 V.17 7200 bps short
- +FTM=96 V.29 9600 bps
- +FTM=97 V.17 9600 bps long
- +FTM=98 V.17 9600 bps short
- +FTM=121 V.17 12000 bps long
- +FTM=122 V.17 12000 bps short
- +FTM=145 V.17 14400 bps long
- +FTM=146 V.17 14400 bps short

+FRM = n**+FRM = n****Receive Data**

+FRM=n causes the modem to enter the receiver mode using the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options.

Command options:

- +FRM=24 V.27 ter 2400 bps
- +FRM=48 V.27 ter 4800 bps
- +FRM=72 V.29 7200 bps
- +FRM=73 V.17 7200 bps long
- +FRM=74 V.17 7200 bps short
- +FRM=96 V.29 9600 bps
- +FRM=97 V.17 9600 bps long
- +FRM=98 V.17 9600 bps short
- +FRM=121 V.17 12000 bps long
- +FRM=122 V.17 12000 bps short
- +FRM=145 V.17 14400 bps long
- +FRM=146 V.17 14400 bps short

+FTH = n**+FTH = n****Transmit Data with HDLC Framing*****Transmit Data with HDLC Framing***

+FTH=n causes the modem to transmit data using HDLC protocol and the modulation defined below. An ERROR response code results if this command is issued while the modem is on hook.

Parameters: See Command options.

Command options:

+FTH=3	V.21 channel 2 300 bps
+FTH=24	V.27 ter 2400 bps
+FTH=48	V.27 ter 4800 bps
+FTH=72	V.29 7200 bps
+FTH=73	V.17 7200 bps long
+FTH=74	V.17 7200 bps short
+FTH=96	V.29 9600 bps
+FTH=97	V.17 9600 bps long
+FTH=98	V.17 9600 bps short
+FTH=121	V.17 12000 bps long
+FTH=122	V.17 12000 bps short
+FTH=145	V.17 14400 bps long
+FTH=146	V.17 14400 bps short

+FRH = n**+FRH = n****Receive Data with HDLC Framing*****Receive Data with HDLC Framing***

+FRH=n causes the modem to receive frames using HDLC protocol and the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options.

Command options:

+FRH=3	V.21 channel 2, 300 bps
+FRH=24	V.27 ter 2400 bps
+FRH=48	V.27 ter 4800 bps
+FRH=72	V.29 7200 bps
+FRH=73	V.17 7200 bps long
+FRH=74	V.17 7200 bps short
+FRH=96	V.29 9600 bps
+FRH=97	V.17 9600 bps long
+FRH=98	V.17 9600 bps short
+FRH=121	V.17 12000 bps long
+FRH=122	V.17 12000 bps short
+FRH=145	V.17 14400 bps long
+FRH=146	V.17 14400 bps short

Example Sessions

Table 6 and Table 7 show examples of one page calling and answering sequences, respectively.

Table 6 Calling Sequence, One Page

DTE Command	DCE Response	Remote Fax	Notes
(1) AT+FCLASS=1	(2) OK		Set to Class 1
PHASE A			
(3) ATDT6163	(4) Dials	(5) Answers	+FRH=3 (implied)
	(6) Connect	(7) Send HDLC flags	
PHASE B			
		(8)	Send NSF frame
	(9) <NSF>, OK		
(10) AT+FRH=3	(11) Connect	(12) Send CSI frame	
	(13) <CSI>, OK		
(14) AT+FRH=3	(15) Connect	(16) Send DIS frame	Last frame bit=1
	(17) <DIS>, OK	(18) Drop carrier	
(19) AT+FTH=3	(20) Send HDLC flags	(21) Receive flags	
	(21) Connect		
(22) <TSI>	(23) Send TSI frame	(24) Send TSI	Last frame bit=0
	(25) Connect		
(26) <DCS>	(27) Send DCS frame	(28) Send DCS	Last frame bit=1
	(29) Detect last frame bit		
	(30) OK, drop carrier		
(31) AT+FTS=8	(32) OK, wait 80ms		
(33) AT+FTM=96	(34) Send V.29		
	(35) Connect		
(36) <TCF>	(37) Send TCF data	(38) Receive & check	
	(39) OK		
(40) AT+FRH=3	(41) Connect		
	(42) Send CFR frame		Last frame bit=1
(43) <CFR>, OK	(44) Drop carrier		
	(45) OK		
PHASE C			
(46) AT+FTM=96	(47) Send V.29		
	(48) Connect		
(49) Age data	(50) Send page data	(51) Receive data	
	(52) OK		
(53) AT+FTH=3	(54) Send HDLC flags	(55) Receive flags	
	(56) Connect		
PHASE D			
(57) <EOP>	(58) Send EOP frame	(59) Receive EOP	Last frame bit=1

DTE Command	DCE Response	Remote Fax	Notes
	(60) OK, drop carrier		
(61) AT+FRH=3	(62) Connect	(63) Send MCF frame	Last frame bit=1
	(64) <MCF>, OK		
(65) AT+FTH=3	(66) Send HDLC flags	(67) Receive flags	
	(68) Connect		
(69) <DCN>	(70) Send DCN frame	(71) Receive DCN	Last frame bit=1
	(72) OK, drop carrier		
PHASE E			
(73) ATH0	(74) OK, hang up	(75) Hang up	

Table 7 Calling Sequence, One Page

DTE Command	DCE Response	Remote Fax	Notes
(1) AT+FCLASS=1	(2) OK		Set to Class 1
PHASE A			
		(3) Fax machine dials	
	(4) Ring		
(5) ATA	(6) Modem answers		
	(7) Send HDLC flags	(8) Receive flags	+FRH=3 (implied)
	(9) Connect		
PHASE B			
(10) <NSF>	(11) Send NSF frame	(12) Receive NSF	Last frame bit=0
	(13) Connect		
(14) <CSI>	(15) Send CSI frame	(16) Receive CSI	Last frame bit=0
	(17) Connect		
(18) <DIS>	(19) Send DIS frame	(20) Receive DSI	Last frame bit=1
	(21) OK, drop carrier		
(22) AT+FRH=3	(23) Connect	(24) Send TSI frame	Last frame bit=0
	(25) <TSI>, OK		
(26) AT+FRH=3	(27) Connect	(28) Send DSI frame	Last frame bit=1
	(29) <DCS>, OK	(30) Drop carrier	
(31) AT+FRM=96		(32) Send V.29	
	(33) Connect	(34) Send TCF frame	
	(35) <TCF>	(36) Drop carrier	
	(37) No Carrier		
(38) AT+FTH=3	(39) Connect		
(40) <CFR>	(41) Send CFR frame	(42) Receive CFR	Last frame bit=1
	(43) OK, drop carrier		
PHASE C			
(44) AT+FRM=96		(45) Send page data	
	(46) <page data>	(47) Drop carrier	

DTE Command	DCE Response	Remote Fax	Notes
	(48) No Carrier		
PHASE D			
(49) AT+FRH=3	(50) Connect	(51) Send EOP frame	Last frame bit=1
	(52) <EOP>, OK		
(53) AT+FTH=3	(54) Connect		
(55) <MCF>	(56) Send MCF frame	(57) Receive MCF	Last frame bit=1
	(58) OK, drop carrier		
(59) AT+FRH=3	(60) Connect	(61) Send DCN frame	Last frame bit=1
	(62) <DCN>, OK		
PHASE E			
(73) ATH0	(74) OK, hang up	(75) Hang up	

Chapter 4

Class 2 Fax Commands

Command Syntax and Guidelines

DTE Commands

The ISO 646 character set (CCITT T.50 International Alphabet 5, American Standard Code for Information Interchange) is used for the issuance of commands and responses. Only the low-order 7 bits of each character are used for commands or parameters; the high order bit is ignored. Upper case characters are equivalent to lower case characters. For Phase C data transmission or reception, all 8 bits are needed.

DTE Command Lines

A command line is a string of characters sent from a DTE to the modem (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator. Each command line (with the exception of the A/ command) must begin with the character sequence AT and must be terminated by a carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case, i.e., "AT" = ASCII 065, 084 or "at" = ASCII 097, 116.

The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

Facsimile Command Syntax

After the "AT" or "at" prefix, facsimile commands use extended syntax. Each command is preceded by the "+" character and consists of single characters and a decimal parameter (if applicable) terminated by the semicolon ";" character (ASCII 059) or by the <CR> that terminated the command line. A missing decimal parameter is evaluated as 0.

For example, the command to instruct the modem to automatically answer a data or fax call and also enable reception is:

```
AT+FAE=0; +FCR 1 <CR>
```

Basic data mode and fax service class mode select commands are:

```
AT+FCLASS=0 <CR> for Data Mode
```

```
AT+FCLASS=1 <CR> for Service Class 1 Fax
```

```
AT+FCLASS=2 <CR> for Service Class 2 Fax
```

In Class 2, the DCE makes and terminates calls, manages the communication session and negotiates (T.30 protocol) and transports the image data to DTE. The T.4 protocol management of image data, etc., is done by DTE. The response to

AT+FCLASS= 0<CR> in Data Mode; or

AT+FCLASS=2<CR> in Service Class 2 Fax

is OK

The service class may be set by the DTE from the choices available using the “+FCLASS=<VALUE>” command.

General Rules:

1. +Fnnn commands must be entered completely, otherwise an ERROR response is sent.
2. All response messages are preceded and followed by <CR><LF>. Multiple response commands (e.g., +FDIS: +FCSI: and +FDCS:) will, therefore, appear to have a blank line between them.
3. Class 2 Fax commands can be separated by the “:” character. The “;” character can be omitted if desired. Note that non-data commands cannot be separated by the “;” which is allowed as a dial modifier.
4. All Class 2 commands are assumed to be the final command on a command line. Additional characters will be ignored.
5. An ERROR message will be generated if any of the following conditions occur:
 - a. A Class 1 command is received while in Class 2.
 - b. A Class 2 command is received while in Class 1.
 - c. A Class 1 or Class 2 action command is received while in data modem mode.
 - d. A Class 2 read-only parameter is given the “=” form of a +F command (e.g., AT+FAXERR=5).

Table 8 Class 2 Fax Commands

Type of Command	Command	Function
Service Class ID	+FCLASS=	Service Class
Action	D	Originate a call
	A	Answer a call
	+FDT	Data transmission
	+FET=N	Transmit Page Punctuation
	+FDR	Begin or continue Phase C receive data
	+FK	Session termination
DCE Responses	+FCON	Facsimile connection response
	+FDCS:	Report current session
	+FDIS:	Report remote identification
	+FCFR	Indicate confirmation to receive
	+FTSI:	Report the transmit station ID
	+FCSI:	Report the called station ID
	+FPTS:	Page transfer status
	+FET:	Post page message response
	+FHNG	Call termination with status
Session Parameters	+FMFR?	Identify manufacturer
	+FMDL?	Identify model
	+FREV?	Identify revision
	+FDCC=	DCE capabilities parameters
	+FDIS=	Current sessions parameters
	+FDCS=	Current session results
	+FLID=	Local ID string
	+FCR	Capability to receive
	+FPTS=	Page transfer status
	+FCR=	Capability to receive
	+FPHCTO	Phase C time out
	+FAXERR	Fax error value
	+FBOR	Phase C data bit order

Serial Port Speed and Flow Control

During fax mode, the DTE-DCE port speed is 19200 bps.

Data Stream Termination

The DCE exchanges streams of data with the DTE while executing data transfer commands. These data streams use the termination described in Section 3.2/ISO 2111.

The ASCII <DLE> character (016) is used as a special character to shield special characters. The <DLE><ETX> character pair (<016><003>) is used to mark the end of a stream. The following patterns are used:

any data...<DLE><ETX>	end of stream
any data...<DLE><DLE>	single <DLE> in data
any data...<DLE><any byte>	delete <DLE><any byte>

DTE to DCE Streams

The DCE filters the data stream from the DTE, and removes all character pairs beginning with <DLE>. The DCE recognizes <DLE><ETX> as the stream terminator. The DCE recognizes <DLE><DLE> and reinserts a single <DLE> in its place.

The DTE must filter stream data to the DCE, and insert extra <DLE> characters ahead of data.

DCE to DTE Streams

The DTE must filter the data stream from the DCE, and remove all character pairs beginning with <DLE>. The DTE must recognize <DLE><ETX> as the stream terminator. The DTE must recognize <DLE><DLE> and reinsert a single <DLE> in its place.

The DCE filters stream data to the DTE, and inserts extra <DLE> characters ahead of data.

Identification of T.30 Options

Group 3 devices negotiate session parameters in DIS, DCS, and DTC frames. These parameters are defined in Table 9, "T.30 Session Subparameter Codes," on page 60.

Session Status Reporting

The DCE provides reports to the DTE on the status of a session. The DCE provides the following status reports:

1. Connection and hang up status:
+FCON
+FHNG:<0-255>
2. Requested DIS session parameters +FDIS: <string> reports remote facsimile capabilities.
Syntax: +FDIS: VR, BR, WD, LN, DF, EC, BF, ST
3. +FDCS: <string> reports the negotiated parameters
4. Phase C prompts:
XON, XOFF, DC2
5. Phase C base status reports: depending upon copy quality and related end-of page status:
+FPTS: <1-5>

Service Class 2 Identification and Selection

Three commands report identification and selection information. Each of these three commands cause the DCE to send a message to the DTE. The messages are programmable using ConfigurACE.

+FMFR?

+FMFR?

Request Manufacturer Identification

The +FMFR? command causes the DCE to send a message identifying the DCE product manufacturer. The default message is:

ESS Technology, Inc.
OK

+FMDL?

+FMDL?

Identify Product Model

The +FMDL? command causes the DCE to send a message identifying the DCE product model. The default message is similar to:

ES56V-PI
OK

+FREV?**+FREV?****Identify Product Revision**

The +FREV? command causes the DCE to send a message identifying the DCE product model revision number. The message format is the same as the ATI3 message, e.g:

Version 1.0

OK

Table 9 T.30 Session Subparameter Codes

Label	Function	Value	Description
VR	Vertical Resolution	0	Normal, 98 lpi
		1	Fine, 196 lpi
BR	Bit Rate	0	+FDCS (originate) +FDIS (answer) 2400 bps/V.27ter V.27ter (2400 only)
		1	4800 bps/V.27ter V.27ter
		2	7200 bps/V.29 V.29, V.27ter
		3	9600 bps/V.29 or V.17 V.29, V.27ter
		4	12000 bps/V.33 or V.17 V.17, V.33, V.29, V.27ter
		5	144000 bps/V.33 or V.17 V.17, V.33, V.29, V.27ter
			CCITT T.30 does not provide for the answering station to specify all speeds exactly using the DIS frame. Implementation of some BR codes by an answering DCE is manufacturer specific.
WD	Page Width	0	1728 pixels in 215 mm
		1	2048 pixels in 255 mm
		2	2432 pixels in 303 mm
		3	1216 pixels in 151 mm (not supported)
		4	864 pixels in 107 mm (not supported)
LN	Page Length	0	A4, 297 mm
		1	B4, 364 mm
		2	unlimited length
DF	Data Compression Format	0	1-D modified Huffman
		1	2-D modified Read (not supported)
		2	3-D uncompressed mode (not supported)
		3	2-D modified modified Read (not supported)
EC	Error Correction (Annex A/T.30)	0	Disable ECM
		1	Enable ECM, 64 bytes/frame (not supported)
		2	Enable ECM, 256 bytes/frame (not supported)
BF	Binary File Transfer	0	Disable BFT
		1	Enable BFT (not supported)
ST	Scan Time/Line		VR=normal VR=fine
		0	0 ms 0 ms
		1	5 ms 5 ms
		2	10 ms 5 ms
		3	10 ms 10 ms
		4	20 ms 10 ms
		5	20 ms 20 ms
		6	40 ms 20 ms
		7	40 ms 40 ms

Service Class 2 Action Commands

These commands transfer data, and punctuate sessions. They also release specific T.30 messages. All action commands must be the last command on a command line as indicated by the terminating <CR>.

All action commands initiate processes. The modem will not accept other commands from the DTE until the modem issues a final result code (e.g., OK, CONNECT). The modem will abort the process if it receives any character before the final result code is issued.

ATD

ATD

Originate a Call

The DCE can support a DTE command to originate a call using the ATD command (see “Class 1 Fax Commands” on page 47).

If this command is unsuccessful, the DCE reports an appropriate failure or error type result code such as NO CARRIER, NO DIALTONE, or BUSY (see “Example Sessions” on page 52).

If this call is successful, the typical DCE response is:

```
ATDnn..nn
(go off-hook, dial, get CED)
+FCON
(DCE detects flags)
[+FCSI:<remote ID string>]
+FDCS:<T.30 subparameter string>
OK
```

The DCE dials, detects call progress, and generates the CNG tone. It then waits for a DIS frame. On detection of the first Phase B preamble (V.21 ch. 2 modulated by 300 bps HDLC flags), it reports the “+FCON” message to the DTE. The DCE then switches to 19200 bps.

The DCE generates a DCS frame based on the received DIS frame and on the previously set +FDIS parameter. A +FDT command from the DTE releases the DCE to transmit that DCS frame.

The DCE reports the initial received T.30 negotiation messages, including the DIS frame and the optional CSI ID string. The +FDIS: report is followed by the OK final result code.

ATA**ATA****Answer a Call**

The DCE can support a DTE command to answer an incoming call using the ATA command (see “Class 1 Fax Commands” on page 47).

The DTE may issue an Answer command in response to an incoming ring.

If the Answer command is unsuccessful, the DCE will report an appropriate failure or error type result code, such as NO CARRIER (see “Example Sessions” on page 52).

Manual Call Answer

If this call is successful, the typical DCE response (answer and receive) is:

+FCON

[+FTSI:<remote ID string>]

+FDCS:<T.30 subparameter string>

OK

(DTE should issue +FDR command here)

Upon receipt of an Answer command from the DTE, the DCE answers and generates the CED tone. The DCE then generates a DIS frame (derived from the +FDIS parameter) and hunts for the first T.30 negotiation frames. Upon detection of the first Phase B preamble (V.21 ch 2 modulated by 300 bps HDLC flags), it reports the “+FCON” message to the DTE.

The DTE should report the initial received T.30 negotiation messages, including the DCS frame. The +FDCS: report will be followed by the OK final result code.

Automatic Answer

The modem provides for automatic answering of incoming calls. If configured for automatic answer, the modem answers an incoming call in compliance with T.30, and reports the same messages as described for manual answer.

Connection as a Data Modem

If configured to do so by the +FAA parameter, the DCE will adaptively answer as a facsimile DCE or as a data DCE. If the DCE answers as a data DCE, it resets the +FCLASS parameter to 0 and issues the appropriate final result code (e.g., CONNECT, or NO CARRIER) to the DTE.

+FDT**+FDT****Data Transmission**

The +FDT command prefixes Phase C data transmission. When the DCE is ready to accept Phase C data, it issues the negotiation responses and the CONNECT result code to the DTE. In Phase B, the +FDT command releases the DCE to proceed with negotiation, and releases the DCS message to the remote station. In Phase C, the +FDT command resumes transmission after the end of a prior transmit data stream.

Initiate Page Transmission

Phase B DCE polled response:

[+FCSI:<remote ID string>]- if new CSI received

[+FDIS:<subparameters from remote station>]- if new DIS received

+FDCS:<T.30 subparameter string>CONNECT

<XON> - when ready for data

After placing a call, or after finishing a document exchange, the DTE may command the DCE to re-enter T.30 Phase B to attempt to negotiate a document transmission.

Continue a Page

CONNECT

<XON>

The DTE may issue more than one +FDT command for a given page, so that different files may be concatenated together. These files must have the same format.

Phase C Data Framing

Phase C data must be presented to the DCE in stream mode. The DCE expects Phase C data to follow until it detects <DLE><ETX> termination characters. The DCE will filter the stream as described under “Serial Port Speed and Flow Control” on page 58.

The DCE will acknowledge the end of the data by returning the OK result code to the DTE.

If there is data underrun before the next +FDT or +FET= command, the DCE will zero-fill the pad as per T.4 until the Phase C timeout (+FPHCTO) is reached, or until more data is received. The DCE appends an RTC pattern to the transmit data after an +FET= command is received from the DTE.

Phase C Data Format

The Phase C data will be of the format specified by the negotiated T.30 DCS frame. The +FDCS:<string> response is defined in Table 13, “Service Class 2 DCE Responses,” on page 68 and the subparameter values are described in Table 9, “T.30 Session Subparameter Codes,” on page 60.

The DCE will 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 +FDCS:ST subparameter.

If the DCE finds more than one consecutive EOL in Phase C data (e.g., RTC), it will send only one EOL.

1. Phase C data must conform to T.4 specifications.
2. The DTE need not include a final RTC, since the DCE will append an RTC in response to an FET= command.
3. Some facsimile machines may treat two EOLs as an RTC.

+FET**+FET**

Transmit Page Punctuation

Syntax: +FET=<ppm>[,<pc>,<bc>,<fc>]

DCE response:

+FPTS:<ppr>- when receive from remote OK

This command is used to punctuate page and document transmission after one or more +FDT commands. This command generates T.30 Post Page Messages selected by the <ppm> code (Table 10). The +FET=<ppm> command indicates that the current page is complete; no more data will be appended to it. The value indicates whether there are any additional pages are to be sent and, if so, whether there is a change in any of the document parameters. The DTE can command the DCE to generate PRI-Q messages with the +FET=<ppm> command using ppm codes 4-6 (see Table 10).

This command must be sent within the time out specified by +FPHCTO after sending Phase C data, or else the DCE will end the page and document transmission. If the Phase C timeout is reached, the DCE sends an EOP post page message and terminates the session.

The remote facsimile station should respond to the post page message with a post page response. The DCE will report this using the +FPTS:<ppr> response (Table 11, "T.30 Post Page Response Messages," on page 65).

End a Page

The +FET= command causes the DCE to append an RTC (6 EOL) pattern as needed and enter Phase D by sending the selected T.30 Post Page message.

The +FET=1 (EOM) command signals the remote station that the next document will have a new DCS negotiated; this causes the session to re-enter Phase B.

Table 10 T.30 Post Page Message Codes

ppm Code	Mnemonic	Description
0	[PPS-]MPS	Another page nex, same document
1	[PPS-]EOM	Another document next
2	[PPS-]EOP	No more pages or documents
3	PPS-NULL	Another partial page next
4	[ps-]pri-mps	Another page, procedure interrupt
5	[PPS-]PRI-EOM	Another document, procedure interrupt
6	[PPS-]PRI-EOP	All done, procedure interrupt
=8+ppm		Post page message (ppm code)

Table 11 T.30 Post Page Response Messages

ppm Code	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

+FDR**+FDR****Begin or Continue Phase C Receive Data**

Syntax: +FDR <CR>

Default value: 3 seconds in some places

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

The DCE reports the negotiated T.30 parameters, with the remote ID information if available. When the DCE is ready to commence data transfer, it issues a CONNECT response code.

When the DCE delivers the last byte of a page, the DCE reports the Page Transfer Status via the +FPTS:<ppr> response (Table 11).

After a Page Transfer Status Report, the DCE reports the post page message from the remote facsimile station via the +FET:<ppm> response (Table 10, "T.30 Post Page Message Codes," on page 64) which signals the intentions of the remote station.

The DCE holds the post page response message to the remote facsimile station (MCF, etc.), represented in the +FPTS parameter until the next +FDR command. The DTE may modify the +FPTS parameter before issuing the +FDR command which releases that message. The DTE must issue a +FDR command to release Post Page Messages.

Initiate Document Reception

The +FDR command may be issued in Phase B after an answer command, or in Phase B after a previous document.

The DCE response in stream mode is:

```
+FCFR    when CFR sent
          [+FTSI:<remote ID string>] if new TSI received
          +FDCS:<T.30 subparameter string>] if new DCS
```

```
CONNECT
```

```
  <Phase C data stream>
```

```
  <DLE><ETX>
```

```
  +FPTS:<ppr>, <lc> [,<blc>, <cbic>]
```

```
  +FET:<ppm>
```

```
  OK
```

```
  (DTE must issue +FDR command to release post page response)
```

Continue Document Reception

The DTE may issue a +FDR command in Phase D, which releases the post page message, and indicates readiness to receive another page after receipt of a Multipage (+FET:0) or PPS-NULL (+FET:3) message. The DCE response will be:

```
CONNECT
  (<DC2> needed from DTE here)
  <Phase C data stream>
  <DLE><ETX>
  +FPTS:<ppr>, <lc> [,<blc>, <cbic>]
  +FET:<ppm>
  OK
  (DTE must issue +FDR command to release post page response)
```

If done receiving:

```
+FHNG: <hangup cause code>
  OK
  Continue page reception
```

Phase C Data Framing

Phase C data may be presented to the DTE in stream mode. The DCE will transfer a stream of data to the DTE, followed by the <DLE><ETX> stream termination characters. The DCE will filter the stream as described in 4.1.2.

Phase C Data Format

The received data format is negotiated under T.30 reported by the +FDCS: (VR, BR, WD, LN, DF, EC, BF, ST) response. The DCE will delete the terminating RTC (6 EOL's) patterns.

+FK**+FK****Session Termination**

Syntax: +FK

The +FK command causes the DCE to terminate the session in an orderly manner. In particular, the DCE will send a DCN message at the next opportunity and hang up. At the end of the termination process, the DCE will report the +FHNG response with result code (Table 12).

The DCE will wait until the current page completes, unless the reception is of unlimited length; in that case, the DCE may halt reception and terminate the session at any time.

Table 12 Hang Up Status Codes

Code Type	Code	Cause Description
Call Placement and Termination	0	Normal and proper end of connection
	1	Ring detect without successful handshake
	2	Call aborted, from +FK or AN
	3	No loop current
Transmit Phase A and Miscellaneous Errors	10	Unspecified transmit Phase B error
	11	No answer (T.30 T1 timeout)
Transmit Phase B	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	RSPEC error
	25	DCS sent three times without response
	26	DIS/DTC received 3 times; DCS not recognized
	27	Failure to train at 2400 bps or +FMINSP value
Transmit Phase C	28	RSPREC invalid response received
	40	Unspecified transmit Phase C error
Transmit Phase D	43	DTE to DCE data undeflow
	50	Unspecified transmit Phase D error
	51	RSPREC error
	52	No response to MPS repeated 3 times
	53	Invalid response to MPS
	54	No response to EOP repeated 3 times
	55	Invalid response to EOP
	56	No response to EOM repeated 3 times
	57	Invalid response to EOM
	58	Unable to continue after PIN or PIP
Receive Phase B (some codes not implemented)	70	Unspecified receive Phase B error
	71	RSPREC error
	72	COMREC error
	73	T.30 T2 timeout, expected page not received
	74	T.30 T1 timeout after EOM received
Receive Phase C	90	Unspecified receive Phase C error
	91	Missing EOL after 5 seconds
	92	Unused code
	93	DCE to DTE buffer overflow
	94	Bad CRC or frame (ECM or BFT modes)

Code Type	Code	Cause Description
Receive Phase D	100	Unspecified receive Phase D error
	101	RSPREC invalid response received
	102	COMREC invalid response received
	103	Unable to continue after PIN or PIP
Reserved Codes	120-255	Some codes are not implemented

Service Class 2 DCE Responses

The DCE sends 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 in execution of DTE action commands described under “Service Class 2 Action Commands” on page 61. The DCE precedes and follows the information responses with <CR><LF>.

The DCE provides the on-line status of several session parameters when they are available during T.30 handshaking. These include the remote ID string and the DIS/DCS parameters. These responses report the T.30 session parameter frames. The subparameters are described in Table 9, “T.30 Session Subparameter Codes,” on page 60.

Table 13 Service Class 2 DCE Responses

Response	Name	Description
+FCON	Facsimile Connection Response	+FCON indicates connection with a fax machine. It is released by detection of HDLC flags in the first received frame. +FCON is generated in response to an Originate or Answer command.
+FDCS	Report Current Session Capabilities	Syntax: +FDCS:VR,BR,WD,LN,DF,EC,BF,ST +FDCS:<string> reports the negotiated parameters. Phase C data will be formatted as described by the subparameters. This message may be generated in execution of +FDT or +FDR commands before the CONNECT result code if new DCS frames are generated or received. See Table 9, “T.30 Session Subparameter Codes,” on page 60.
+FDIS	Report Remote Station Capabilities	Syntax: +FDIS:VR,BR,WD,LN,DF,EC,BF,ST +FDIS:<string> reports remote facsimile station capabilities and intentions. The parameters are provided in ASCII notation. See Table 9, “T.30 Session Subparameter Codes,” on page 60. This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.
+FCFR	Indicate Confirmation to Receive	Syntax: +FCFR The DCE sends a +FCFR response to the DTE upon reception of an acceptable TCF training burst and a valid DCS signal from the remote machine. This indicates that the DCE will receive Phase C data after the remote station receives the local DCE's CFR message. The +FCFR message is generated in execution of a +FDR command.
+FTSI	Report the Transmit Station ID	Syntax: +FTSI: “<TSI ID string>” Transmit Station ID This response reports the received transmit station ID string, if any. This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.
+FCSI	Report the Called Station ID	Syntax: +FCSI: “<CSI ID string>” Called Station ID This response reports the received called station ID string, if any. This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.

Response	Name	Description
+FPTS	Receive Page Transfer Status	<p>Syntax: +FPTS:<ppr>, <lc> [, <blc>, <cbcl>]</p> <p>The +FPTS:<ppr> is generated by the DCE at the end of Phase C data reception in execution of a +FDR command. The <ppr> is generated by the DCE; it depends on the DCE capabilities at T.4 error checking. See Table 11, "T.30 Post Page Response Messages," on page 65 for <ppr> values. The receiving DCE will count the lines. These values are;</p> <p><lc> = line count <blc> = bad line count <cbcl> = <consecutive bad line count></p> <p>A receiving DTE may inspect <ppr> and write a modified value into the +FPTS parameter. The DCE will hold the corresponding Post Page Response message until released by a +FDR command from the DTE.</p>
+FET	Post Page Message Response	<p>Syntax: +FET:<ppm></p> <p>The +FET:<post page message> response is generated by a receiving DCE after the end of Phase C reception on receipt of the post-page message from the transmitting station. The +FET:<ppm> response is generated in execution of a +FDR command. The <ppm> codes respond to the T.30 post page messages See Table 10, "T.30 Post Page Message Codes," on page 64.</p>
+FPTS	Transmit Page Transfer Status	<p>Syntax: +FPTS:<ppr></p> <p>The +FPTS: response reports a <ppr> number representing the copy quality and related post-page message responses received from the remote DCE. The valid <ppr> values are defined in Table 11, "T.30 Post Page Response Messages," on page 65.</p> <p>The +FPTS:<ppr> response is generated in execution of a +FET=<ppm> command.</p>
+FHNG	Call Termination with Status	<p>Syntax: +FHNG:<hangup status code></p> <p>+FHNG indicates that the call has been terminated. The hangup cause is reported and stored in the +FAXERR parameter for later inspection. The <hangup status code> values are described in Table 12, "Hang Up Status Codes," on page 67.</p> <p>+FHNG:<hsc> is a possible intermediate result code to any DTE action command described under "Service Class 2 Action Commands" on page 61. It is always followed by the OK final result code.</p> <p>Upon termination of a call, the DCE determines the cause of termination and reports it as part of the FHNG:<hsc> response. It also stores this <hsc> code in the +FAXERR parameter for later inspection.</p> <p>The hangup values are organized according to the phases of the facsimile transaction as defined by T.30. In the Figure 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 Figure 1 on page 70).</p> <p>The table values are in decimal notation. Leading zero characters are optional.</p>

Service Class 2 Parameters

All Service Class 2 parameters can be read, written, and tested for range of legal values by the DCE. The general syntax is described in “Command Syntax and Guidelines” on page 55.

Group 3 FAX 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 +FDCC, +FDIS and +FDCCS. They are compound parameters, using values listed in Table 9, “T.30 Session Subparameter Codes,” on page 60.

Figure 1 illustrates their relationships.

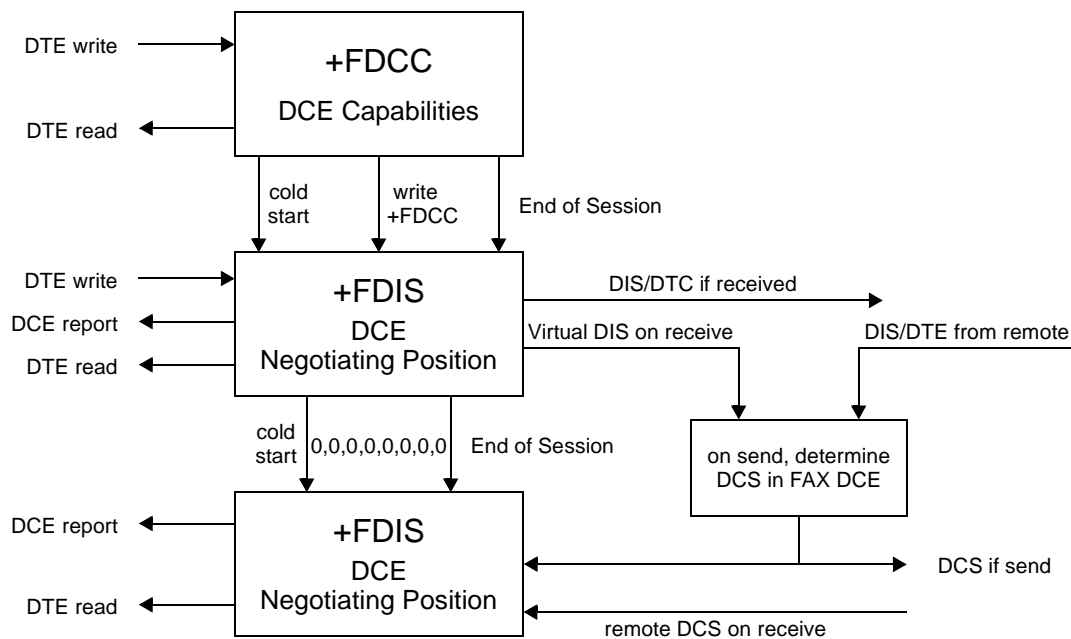


Figure 1 T.30 Session Parameter Relationships

+FDCC**+FDCC****DCE Capabilities Parameters**

Write syntax: +FDCC=VR,BR,WD,LN,DF,ED,BF,ST

Valid values: See Table 9, "T.30 Session Subparameter Codes," on page 60.

Default values: 0,5,0,2,0,0,0,0

+FDCC allows the DTE to sense and constrain the capabilities of the facsimile DCE from the choices defined in CCITT T.30 Table 2. When +FDCC is modified by the DTE, the DCE copies +FDCC into +FDIS.

+FDIS**+FDIS****Current Sessions Capabilities Parameters**

Write syntax: +FDIS=VR,BR,WD,LN,DF,EC,BF,ST

Valid values: See Table 9, "T.30 Session Subparameter Codes," on page 60.

Default values: 0,5,0,2,0,0,0,0

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

The DCE initializes the +FDIS parameter from the +FDCC parameter on initialization, when +FDCC is written, and at the end of a session.

+FDCS**+FDCS****Current Session Results Parameters**

Read syntax: +FDCS?

DCE response: +FDCS=VR,BR,WD,LN,DF,EC,BF,ST

or +FDCS=

Valid values: See Table 9, "T.30 Session Subparameter Codes," on page 60.

Default values: 0,0,0,0,0,0,0,0

The +FDCS 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 read this parameter.

The +FDCS parameter is initialized 0,0,0,0,0,0,0,0 upon initialization and at the beginning of a session. If the DTE issues a +FDCS? command in the initial state, the DCE reports:

<CR><LF>0,0,0,0,0,0,0,0<CR><LF>

The contents of +FDCS are spontaneously reported during execution of +FDR or +FDT commands by the +FDCS:VR,BR,WD,LN,BF,EC,BF,ST response using the same compound parameter format.

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 9, "T.30 Session Subparameter Codes," on page 60. Optional parameter values are marked with an *. Unspecified parameter values are reserved for future use.

The +FDCC, +FDIS, and +FDCS compound parameters use these session parameters (On writes, unspecified subparameters are unchanged.)

The +FDIS:, +FDCS:, and +FDTC: session report responses use these subparameters.

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

<CRLF> (0,1), (0-5), (0-3), (0-2), (0-2), (0), (0-7) <CRLF>

Example:

+FDIS=0,3,0,2,0,0,1 =

VR = 0 98 dpi vertical resolution,

BR = 5 14400 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 = 0 5 ms scan time.

+FLID=**+FLID=****Local ID String**

Write syntax: +FLID="<local ID string>"

Valid value: 20-character ASCII string

Default value: Empty

If FLID is not a null string, it generates a TSI or CSI frame. Table 3/T.30, which outlines the basic bit values for CIG, CSI and TSI framing within the fax information field (FIF) during a fax session, includes digits 0-9, "+" and space.

If the DCE supports use of Table 3/T.30 only, the response to a +FLID=? command is "(20) (32, 43, 48-57)." If the DCE supports printable ASCII <, the response is: "(20) (32-127)<CRLF>." The first "(20)" represents string length: the second (character values) field reports supported string values.

1. The string is saved in RAM.
2. Non-numeric characters are not filtered out.
3. The string is right justified.

+FCR**+FCR****Capability to Receive**

Write syntax: +FCR=<value>

Valid values: 0 or 1

Default value: 0

+FCR=0 indicates that the DCE will not receive message data. This can be used when the DTE has insufficient storage. The DCE can send and can be polled for a file.

+FCR is sampled in CCITT T.30 Phase A and Phase D.

+FPTS=**+FPTS=****Page Transfer Status**

Write Syntax: +FPTS=<ppr>

Valid values: 1, 2, 3, 4, 5

Default value: 0

The +FPTS 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 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.

The set of <ppr> values is defined in Table 11, "T.30 Post Page Response Messages," on page 65. These values are also reported in the +FPTS response to the +FDR command.

+FCQ**+FCQ****Copy Quality Checking**

Write syntax: +FCQ=<value>

Valid values: 0

Default value: 0

This parameter controls Copy Quality checking by a receiving facsimile DCE.

The DCE returns +FCQ=0 which indicates the DCE does no quality checking. The DCE will generate Copy Quality OK (MCF) responses to complete pages, and set +FPTS=1.

+FPHCTO**+FPHCTO****DTE Phase C Response Time-out**

Write syntax: +FPHCTO=<value>

Valid values: 0 - 255, 100 millisecond units.

Default value: 30

The +FPHCTO command determines how long the DCE will wait for a command after reaching the end of data when transmitting in Phase C. When this time-out is reached, the DCE assumes there are no more pages and no documents to send. It then sends the T.30 EOP response to the remote device.

+FAXERR**+FAXERR****T.30 Session Error Report**

Read syntax: +FAXERR= <table value>, read only

Valid values: 0 - 255, see Table 12, "Hang Up Status Codes," on page 67 for meaning.

This read-only parameter indicates the cause of the hangup. Table 12, "Hang Up Status Codes," on page 67 shows the valid values for this parameter as well as the meaning of the each value. +FAXERR is set by the DCE at the conclusion of a fax session. The DCE resets +FAXERR to 0 at the beginning of Phase A off-hook time.

+FBOR**+FBOR****Data Bit Order**

Write syntax: +FBOR=<value>

Valid values: 0, 1, 2, or 3

Default value: 0

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

Direct: The first bit transferred to each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

Reversed: The last bit transferred of each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

There are two data types to control:

This command controls Phase C data (T.4 encoded data) transferred during execution of +FDT or +FDR commands.

The following two codes are supported:

+FBOR=0 or 2 Selects direct bit order for Phase C data.

+FBOR=1 or 3 Selects reversed bit order for Phase C data.

Note: This parameter does not affect the bit order of control characters generated by the DCE.

Example Sessions

Table 14 and Table 15 show the typical command and responses for sending and receiving two pages, respectively.

Table 14 Send Two Pages, 1-D Data, No Errors

DTE Command	DCE Response	Local DTE Action	Remote Station Action
AT+CLASS=2	OK	Set Class 2	x
AT+FLID="<local ID>"	OK	Set local ID	
AT<dial string>	+FCON [+FCSI:"<csi>"] +FDIS: <dis codes> OK	Off hook, dial Send CNG Detect flags [Get CSI] Get DIS	Answer, Send [CED] V.21 flags [CSI] DIS
AT+FDT	+FDCS:<DCS codes> CONNECT <XON>	[Send TSI] Send DCS Send TCF Get CFR Send carrier	[Get TSI] Get DCS Get TCF Send CFR Receive carrier
<1st page data> <DLE><ETX>	OK	Send page data	Receive page data
AT+FET=0	+FPTS:1 OK	Send RTC Get MPS Get MCF	Get RTC Get MPS Send MCF
AT+FDT	CONNECT <XON>	Send carrier	Receive carrier
<2nd page data> <DLE><ETX>	OK	Send page data	Receive page data
AT+FET=2	+FPTS:1 +FHNG:0 OK	Send RTC Send EOP Get MCF Send DCN Hang up	Get RTC Get EOP Send MCF Get DCN Hang up

Table 15 Receive Two Pages, 1-D Data, No Errors

DTE Command	DCE Response	Local DTE Action	Remote Station Action
AT+FCR=1	OK	Enable reception	
AT+FLID="<local ID>"	OK	Set local ID	
	RING	Detect ring	Dials[, Send CNG]
ATA	+FCON [+FTSI:"<tsi>"] +FDCS:<dc codes> OK	Off hook Send CED Send CSI Send DIS Detect flags [Get TSI] Get DCS Begin TCF receive	Get CED Get CSI Get DIS Send V.21 flags [Send TSI] Send DCS Start TCF
AT+FDR <DC2>	+FCFR [+FDCS:"<dc codes>"] CONNECT <page data stream> <DLE><ETX> +FPTS:1, <lc> +FET:0 OK	Accept TCF Send CFR Get page carrier Get page data Detect RTC Get MPS	Finish TCF Get CFR Send pager carrier Send page data Send RTC Drop carrier Send MPS
AT+FDR <DC2>	CONNECT <page data stream> <DLE><ETX> +FPTS:1, <lc> +FET:2 OK	Send MCF Get page carrier Get page data Detect RTC Get EOP	Get MCF Send page carrier Send page data Send RTC Drop carrier Send EOP
AT+FDR	+FHNG:0 OK	Send MCF Get DCN	Get MCF Send DCN

Chapter 5

Voice/Audio Commands

Voice/Audio AT Commands

#MDL? or +FMDL?

#MDL? or +FMDL?

Identify Model

This command requests the model number or name of the modem.

Example:

#MDL? ES56V-PI

#MFR? or +FMFR?

#MFR? or +FMFR

Identify Manufacturer

This command requests the modem manufacturer.

Example:

#MFR? ESS Technology, Inc.

#REV? or +FREV?

#REV? or +FREV?

Identify Revision Level

This command requests the revision level of the modem.

Example:

#REV? Version x.x

+VLS or #VLS

+VLS or #VLS

Voice Line Select

This command is equivalent to +VLS. See “+VLS=” on page 90.

+VRX or #VRX

+VRX or #VRX

Voice Receive

This command is equivalent to +VRX. See command +VRX “Receive Data State” on page 82.

+VTS or #VTS

+VTS or #VTS

Generate Tone Signals (Online Voice Command)

This command is equivalent to +VTS. See +VTS command “DTMF and Tone Generation in Voice” on page 85.

+VTX or #VTX

+VTX or #VTX

Voice Transmit

This command is equivalent to +VTX. See +VTX command.

+VIP**+VIP****Initialize Voice Parameters**

The +VIP command is used to reset all voice parameters back to their factory default settings and, optionally, select a voice parameter profile.

Syntax: +VIP[=<value>]

Parameter	Default	Acceptable Values
<value>	0	0 — Reset all voice parameters to factory default settings. See Table 16.

Results:

OK if all parameters are acceptable

ERROR otherwise

If <value> is not specified, a default value of 0 will be assumed.

Table 16 Voice Parameter Defaults

Parameter	Set By	Default Value
Caller ID Service Reporting	AT+VCID	0 (Disabled)
Automatic Hangup Control	AT+VNH	0 (Disabled)
Analog Source/Destination Selection	AT+VLS	0 (None)
Ringback Goes Away Timer	AT+VRA	50 (5 seconds)
Ringback Never Appeared Timer	AT+VRN	10 (10 seconds)
Silence Detection	AT+VSD	<sensitivity> = 128 (Nominal) <timeout> = 50 (5 seconds)
Beep Tone Duration Timer	AT+VTD	100 (1 second)
Distinctive Ring	AT+VDR	<enable> = 0 (Disabled) <report> = 0 (Disabled)
Event Reporting and Masking	AT+VEM	FFFFFFFF8
DTE/DCE Interface Rate	AT+VPR	<rate> = 0 (Autobauding)

+VIP?

This command is unacceptable and will generate an **ERROR** response from the DCE.

+VIP=?

Upon receiving the +VIP=? query, the DCE will display the acceptable range of parameter profiles.

AT+VIP=?

(0)

OK

+VRX**+VRX****Receive Data State**

Parameter	Default	Mandatory
<n>	0	0

Optionally +VRX=<n>.

This command causes the DCE to start the voice reception process.

The DCE begins the voice receive mode by returning the CONNECT result code to the DTE. After this report, the DCE sends <DLE> shielded voice data to the DTE. See Table 12, "Hang Up Status Codes," on page 67 for the list of possible action commands during a voice receive. The DCE shall send the voice data in the format previously selected by the +VSM command.

This Interim Standard provides for two ways to leave the Voice Receive State: (1) a <DLE><!>, and (2) a DTE/DCE Inactivity Timer time-out. The DCE shall inform the DTE, via <DLE> codes, about pertinent events during the voice receive, such as "Presumed End of Message" (QUIET) and "Presumed Hangup" (SILENCE) detected, so that, at the discretion of the DTE, the DTE may terminate the Voice Receive State. See Table 11, "T.30 Post Page Response Messages," on page 65 for a list of possible event determinations and associated ~DLE~ shielded event reports. On termination of the Voice Receive State, the DCE shall append a <DLE><ETX> character pair (padding out to a octet boundary may be necessary), followed by the OK result code. The DCE shall return to Voice Command State.

The DTE/DCE Inactivity Timer is in effect while the receive operation is in progress. If the DTE wishes to use this timer and stop the DCE from performing unwanted restarts, the DTE must assure that there is data sent from the DTE to the DCE often enough to refresh the timer: the DTE may use the <DLE><NUL> shielded code as a no-operation command to refresh the timer.

Subparameter Description:

<n>	Rx Operation
0	Voice receive operation described above. This selection does not provide for DCE periodical tone production during a voice receive operation. WARNING: this Interim Standard presumes that the DTE shall issue the proper notifications of a record operation in progress by message playbacks to satisfy possible legal requirements.
1	Voice receive operation described above. This selection does provide for DCE periodical tone production during a voice receive operation. The tone frequency and cadence is manufacturer specific.
2-127	Reserved for future standardization.
128-255	Manufacturer specific.

Result Code:

The DCE shall return this result code if the DCE accepts the command. The DCE shall return the ERROR result code if the DCE is not connected to the off-hook Telco line, or one non-Telco input device.

+VSD**+VSD****Silence Detection**

The +VSD command determines the level of silence detection and reporting that the DCE shall perform. This command allows the DTE to adjust the sensitivity of the <DLE><q> (Presumed end-of-message; QUIET) and <DLE><s> (Presumed hang-up; SILENCE) reports.

Syntax: +VSD=<sensitivity>,<timeout>

Parameter	Default	Acceptable Values
<sensitivity>	128	(0-127) Lower sensitivity level 128 - Nominal sensitivity level (129-255) Higher sensitivity level
<timeout>	50	0 - disable "Presumed quiet" and "Presumed hangup" time-out messages (1 - 600) - time-out in 0.1 second increments

Results:

OK is returned to the DTE for all acceptable values

ERROR otherwise

<timeout> specifies the amount of time to wait before reporting a Quite or Silence message. PN-3131 does not distinguish these two reports (other than the name). A value of 0 will completely disable reporting of these messages.

+VSD?

Upon receiving the +VSD? query, the DCE will display the current values for the sensitivity and time-out value of the Silence Detection parameter.

AT+VSD?

128, 050

OK

+VSD=? Upon receiving the +VSD=? query, the DCE will display the acceptable ranges for both the sensitivity and time-out values.

AT+VSD=?

(0-255),(0-600)

OK

+VTD

+VTD

Beep Tone Duration Timer

The +VTD command determines the length of the DTMF tones in conjunction with the +VTS command.

Syntax: +VTD=<duration>

Parameter	Default	Acceptable Values
<sensitivity>	100	0 - Default of 100ms (1 - 500) - Time in 0.01 second increments

Results:

OK issued to the DTE if the parameter is acceptable

ERROR otherwise

This command has no effect on the ATD command, only the +VTS command. A <duration> of 0 will default to the manufacturer specific value of 100ms.

+VTD?

Upon receiving the +VTD? query, the DCE will display the current value of the beep tone duration timer.

AT+VTD?

100

OK

+VTD=?

Upon receiving the +VTD=? query, the DCE will display the range of acceptable values for the beep tone duration timer.

AT+VTD=?

(0-500)

OK

+VTS

+VTS

DTMF and Tone Generation in Voice

The +VTS command is used to play DTMF tones or other tones while in voice mode.

Syntax: +VTS=<string>

Parameter	Default	Acceptable Values
<string>	n/a	See string definition below.

Results:

OK issued to the DTE if the parameter is acceptable
 ERROR otherwise

The format of the string is a list of elements separated by commas. The elements can be:

- a single ASCII character in the set {0 - 9, #, *, A - D} which will be interpreted as a DTMF tone with a length specified by the +VTD command.
- a string enclosed in square brackets (“[]”) which will be interpreted as dual tone values and a duration in 0.01 second increments. The list will consist of up to three values. The first and second elements are tone frequencies. The final parameter is the duration. Elements may be Null. If a duration is not specified, the default duration (+VTD) will be used. For example, [1000,2000,50] will play a 1000Hz tone and a 2000Hz tone at the same time for 500ms. [3000] or [,3000] will play a 3000 Hz tone for the default duration. [,50] will be interpreted as 500ms of silence.
- a string enclosed in curly braces (“{ }”) which will be interpreted as a DTMF tone with a duration in 0.01 second increments. {} will be interpreted as silence. If the duration is not specified, the default duration will be used (+VTD). For example, {2,50} will play DTMF 2 for 500ms. {2} will play DTMF 2 for the default duration. {,50} will be interpreted as 500ms of silence.

Frequencies for both ranges is 0 - 3400 Hz. The duration specified in the second two formats ranges from 0-6000 (0 - 60 seconds). This range matches the range of the +VTD command.

Even though frequencies down to 0 are supported, not all lower frequencies will be audible on all equipment.

+VTS?

This command is unacceptable and will generate an **ERROR** response from the DCE.

+VTS=?

Upon receiving the +VTS query, the DCE will display a list of acceptable ranges for the first frequency, the second frequency, and the duration, respectively.

AT+VTS=?

(200-3300),(200-3300),(0-500)
 OK

+VGR=<gain>

+VGR=<gain>

Receive Gain Selection

	Default	Mandatory
<gain>	0 or 128	0 or 128

This command causes the DCE to set the gain for the received voice samples.

Subparameter Description:

The receive gain is an unsigned octet where values larger than 128 indicate a larger gain than nominal, and values smaller than 128 indicate a gain smaller than nominal. The nominal value is 128. The largest range of numbers is 0 to 255. The DCE may limit the receive gain to a more narrow range, such as 120 to 136 or 120 to 128. The value of zero is reserved for DCE Automatic Gain Control (AGC).

Result Code:

The DCE shall return the OK result code if the DCE accepts the command. The DCE shall return the ERROR result code if the <gain> subparameter is out of range.

+VGT=<level>**+VGT=<level>****Volume Selection**

	Default	Mandatory
<level>	0 or 128	0 or 128

This command causes the DCE to set the volume level, either by amplifying or attenuating the signal, for the transmitted voice samples.

Subparameter Description:

The transmit gain (or attenuation) is an unsigned octet where values larger than 128 indicate a larger gain than nominal, and values smaller than 128 indicate a smaller gain (or larger attenuation) than nominal. The nominal value is 128. The largest range of numbers is 0 to 255. The DCE may use a more narrow range, such as 120 to 136 or 120 to 128. The value of zero is reserved for DCE Automatic Volume Control (AVC).

CAUTION! The DCE shall limit the transmit level over the Telco lines, regardless of the current +VGT setting, to that permitted by CFR FCC Rules Part 68, Subpart D.

Result Code:

The DCE shall return the **OK** result code if the DCE accepts the command. The DCE shall return the **ERROR** result code if the <level> subparameter is out of range.

+VLS=<label>	Analog Source/Destination Selection
Default	Mandatory
<label>	Manufacturer specific

This command causes the DCE to select one or more source/destinations of the analog data.

Subparameter Description:

The DTE uses an integer, the <label> subparameter, as a label to identify each of the DCE supported analog source/destination hardware configurations. This Interim Standard uses Primitives to describe which voice I/O device (e.g., speaker) are components in a possible hardware configuration, and has group these Primitives in order to defined and label sixteen common configurations.

Primitives are <string constant>s with one ASCII character code optionally followed by an ASCII number code. The Primitives, "L" and "T", cannot have number codes. This Standard equates a Primitive with a single ASCII character code, and a Primitive with a ASCII character code followed by the ASCII "O" code (20 hex). The defined Primitives are listed as follows:

Table 17 Codes for Voice I/O Primitives

Primitive Code	Description
L	Local Phone.
T	Telco Line.
M0	Internal Microphone.
M1	External Microphone.
S0	Internal Speaker (requires squelch on any microphone activity).
S1	External Speaker (requires squelch on any microphone activity).
H0	External Microphone and Speaker combination (handset or headset).
Zn	Manufacturer specific device (n>=0).
Mn	Manufacturer specific extension (n>1).
Sn	Manufacturer specific extension (n>1).
Hn	Manufacturer specific extension (n>0).

A concatenation of the Primitives describes a possible analog source/destination hardware configuration. Table 18 lists sixteen commonly used hardware configurations by <label> subparameter values and the Primitive associated with each value. These parameters are used to select specific configurations.

Values after the first sixteen values are available for manufacturer specific hardware configurations.

Table 18 Pre-assigned Voice I/O Labels

<label>	Primitive Code	Description
0	None	DCE on-hook. Local phone connected to Telco.
1	T	DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
2	L	DCE on-hook Local phone connected to DCE.
3	LT	DCE off-hook. Local phone connected to Telco. DCE connected to Telco.
4	S	Internal Speaker connected to DCE. DCE on-hook. Local phone connected to Telco.
5	ST	Internal Speaker connected to Telco. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
6	M	Internal Microphone connected to DCE. DCE on-hook. Local phone connected to Telco.
7	MST	Internal Microphone and Internal Speaker connected to Telco. Squelching active. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
8	S1	External Speaker connected to DCE. DCE on-hook. Local phone connected to Telco.
9	S1T	External Speaker connected to Telco. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
10	MS1T	Internal Microphone and External Speaker connected to Telco. Squelching active. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
11	M1	External Microphone connected to DCE. DCE on-hook. Local one connected to Telco.
12	M1ST	External Microphone and Internal Speaker connected to Telco. Squelching active. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
13	M1S1T	External Microphone and External Speaker connected to Telco. Squelching active. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.
14	H	External Microphone and Speaker combination (handset or headset) connected to DCE. DCE on-hook. Local connected to Telco.
15	HT	External Microphone and Speaker combination (handset or headset) connected to DCE. DCE off-hook. DCE connected to Telco. Local phone provided with power to detect hook condition.

Result Codes:

The DCE shall return the OK result code if the DCE accepts the command. The DCE shall return the ERROR result code if the <label> subparameter is out of range, or if the DCE cannot service the request in the <label> subparameter.

+VLS=?

The response form for this command is as follows:

<label>,<devices>,<transmit event>,<receive event>,<idle event>;

where the <label> subparameter is a label that identifies the DCE analog source/destination hardware configuration, the <devices> subparameter is a <string constant> (6.3.3.3.2.) made up of Primitives, and the <transmit event>, the <receive event>, and the <idle event> subparameters are the DCE event reporting capabilities for the Voice Transmit Data State, Receive Data State, and the Voice Command State, respectively. Each of the event reporting subparameters is a hex number that represents an event bit field. A one in the bit field indicates that the DCE can report the associated event. The +VEM command contains additional information about event reporting.

Each of the possible hardware configurations has its own <label>,...,<idle event> description line (the above form description shows just one). A <CR><LF> separates each description line from another. Note that the event reporting capability is closely tied to the description of the hardware configuration.

The DCE detectable events depend on the compression method selected by the +VSM.

Example:

The following example illustrates inquiring about the DCE supported analog source/destination hardware configurations and event detection capabilities for the selected compression method. The DCE reports that it supports only a Telco line at Service Level C. DTE originated commands and data are in bold face.

AT+VLS=?

0,"",088A0800,08EA0800,988A1800

1,"T",088A0800,08EA0800,988A1800

2,"L",088A0800,08EA0800,988A1800

3,"LT",088A0800,08EA0800,988A1800

OK

+VNH**+VNH****Automatic Hangup Control**

The +VNH handles how hang-ups are handled in non-voice modes.

Syntax: +VNH=<value>

Parameter	Default	Acceptable Values
<value>	0	0 — Hang-ups work as normal in their respective Service Class. 1 — DCE initiated hang-ups are disabled for all non-voice modes. 2 — Logical hang-up: automatic hang-up is disabled but an OK result will be issued to a hang-up command in all non-voice modes.

Results:

OK issued to the DTE if the parameter is acceptable

ERROR otherwise

When <value> is 0, hanging up the phone works as it would normally in a respective service class, for both DTE initiated requests, and DCE initiated hang-ups.

When <value> is 1, DCE initiated hang-ups are suppressed. For example, in Data mode (+FCLASS=0), if a carrier is lost during a connection, the DCE normally will go back on-hook. However, when +VNH=1, this behavior is modified by not placing the DCE back on-hook. This command applies only to DCE initiated hang-ups in all non-Voice Service Classes and is reset by the rules described below.

A logical hang-up, performed when VNH=2, means that the respective Service Class that requested the hang-up will get the normal OK response, signifying the DCE is on-hook. However, the DCE will not really go on-hook, only simulate the behavior. This command applies to both DTE initiated and DCE initiated hang-ups in all non-Voice Service Classes and is reset by the rules described below.

The setting is effective immediately and is applicable across an FCLASS switch. The value will be reset when (1) +VNH=0 is received from the DTE, (2) a +FCLASS mode change is received from the DTE without issuing another +VNH command, (3) a reset event occurs (such as ATZ), and (4) a +VIP command is issued.

Issuing +FCLASS=8 while in FCLASS 8 will NOT result in a class switch and does not effect the +VNH value. This also applies to all other services: switch to the same service class that you are in has no effect.

Note: AT+VNH can be issued in any Service Class.

The value of the VNH command is reset after the second FCLASS switch. For example, for responses to commands received from the DTE+DCE:

Command	AT+VNH=2	The DTE requests that all hang-ups be suppressed.
Response	OK	The DCE acknowledges the VNH value.
Command	AT+FCLASS=0	The DCE switches to Data mode. The value of VNH is 2 at this point.
Response	OK	The DCE acknowledge the switch to Data mode and signifies Data mode is ready for commands.
	<Operations>	The DTE performs data operations such as a file transfer.
Command	ATH	The DTE wishes to hang up the phone. Since VNH=2, the DCE performs only a logical hang-up.
Response	OK	The DCE issues the OK to the DTE, however, the DCE does not go on-hook.
Command	AT+FCLASS=1	The DTE requests a switch to Fax Class 1 mode. The value of VNH will be reset to 0 at this point.
Response	OK	The DCE acknowledges the Service Class switch and signifies that Fax Class 1 mode is ready for commands.
	<Operations>	The DTE performs a fax transfer.
Command	ATH	The DTE wishes to hang-up the phone. Since the VNH value was reset upon entering this mode, the phone will go on-hook.

+VNH?

Upon receiving the +VNH? query, the DCE will display the current value of the +VNH parameter.

AT+VNH?

0

OK

+VNH=?

Upon receiving the +VNH=? query, the DCE will display the acceptable range for the +VNH parameter.

AT+VNH=?

0,1,2

OK

+VSP

+VSP

AEC/Speakerphone Control

Syntax: +VSP=<value>

Parameter	Default	Acceptable Values	Description
<value>	0	0	Disable AEC
		1	Enable AEC
		2	Mute speakerphone

Results:

OK issued to the DTE for acceptable values

ERROR otherwise

This command should be issued under FClass=8.

+VSP?

Upon receiving the +VSP? query, the DCE will display the current value of the +VSP parameter.

AT+VSP?

0

OK

+VSP=?

Upon receiving the +VSP=? query, the DCE will display the acceptable range for the +VSP parameter.

AT+VSP=?

0,1

OK

+VEM

+VEM

Event Reporting and Masking

The +VEM command controls which events will be reported to the DTE.

Syntax: +VEM=<mask>

Parameter	Default	Acceptable Values
<mask>	FFFFFFFF8	See the table below for bit position descriptions.

Results:

OK returned to the DTE for all acceptable parameters

ERROR otherwise

<mask> represents a bitfield of which events the DTE wishes to receive. A “1” in a position means to enable that report. NOTE: bit 0 is the most significant bit (big endian)

+VEM?

Upon receiving the +VEM? query, the DCE will display the current value of the event mask. Note that trailing zeros will be displayed.

AT+VEM?

FFFFFFFF8

OK

+VEM=?

Upon receiving the AT+VEM=? query, the DCE will return four lines of information:

1. The service level in quotes (“A”, “B”, or “C”).
2. The capability for the Voice Transmit State.
3. The capability for the Voice Receive State.
4. The capability for the Voice Command State

The capability will be the Hex mask of the events (in the table above) that are supported in the respective mode. This Hex digit will be the logical OR of the respective bit positions.

AT+VEM=?

“C”

“088A0800”

08EA0800

988A1800

In Table 19, “Event Reporting,” on page 96:

“Context” refers to when the command may be generated. Entries may be as follows:

- **Data** The DCE is in a Voice Receive State, Voice Transmit State, or Voice Translate State
- **Command** The DCE is in Voice Command State
- **Originate** The DCE is originating a call
- **Answer** The DCE is answering a call
- **Online** The DCE is off-hook, but is not in a data mode
- **Anytime** This event can be generated in any of the above modes

The “Hardware” column specifies whether or not a report is supported by the hardware. An “N/A” in the column signifies this report is a software (controller) event and requires nothing from the hardware. An entry in *italics* signifies that the event is not currently supported.

Table 19 Event Reporting

Bit Position	Event Description	Context	Hardware
0	Caller ID Report	Command	Yes
1	DID Report	N/A	No
2	Distinctive Ring	N/A	Yes
3	RING Detected	Command	Yes
4	DTMF Received	Anytime	Yes
5	Receive Buffer Overrun	Data	N/A
6	Facsimile Calling (1100 Hz)	Anytime	Yes
7	Data Calling (1300 Hz)	N/A	Yes
8	Local Phone On/Off Hook (Hook switch event)	Anytime	Yes
9	Presumed Hangup (SILENCE) Time-out	Receive	N/A
10	Presumed End of Message (QUIET) Time-out	Receive	N/A
11	SIT Tone Detected	N/A	No
12	Bong Tone Detected	N/A	Yes
13	Loop Current Interruption	Anytime	Yes
14	Loop Current Polarity Reversal	Anytime	Yes
15	Call Waiting Beep/Interrupt	N/A	No
16	Distinctive Call Waiting	N/A	No
17	TDD Detected (1400/1800 Hz)	N/A	No
18	Ringback/Remote Ring	Anytime	Yes
19	BUSY	Anytime	Yes
20	DIALTONE	Anytime	Yes
21	Reorder/Fast Busy	N/A	Yes
22	V.21 Channel 2 7E flags	N/A	N/A
23	Transmit Buffer Underrun	Data	N/A
24	Extension Phone On/Off Hook	N/A	N/A
25	Facsimile or Data Answer (2100 Hz)	Anytime	Yes
26	Data Answer (2225 Hz)	Anytime	Yes
27	Voice Detect	Anytime	Yes
28	Call Waiting plus Caller Id	N/A	No
29	Stuttered Dialtone	N/A	N/A
30	Invalid Voice Data Format	Data	N/A
31	Lost Data Detected Event	Data	N/A
32	Facsimile Answer	Anytime	Yes
33 – 63	Reserved		

Chapter 6

W-Class Commands

AT* Commands

***B**

***B**

Display Blacklisted Number

These commands request the modem to return a list of blacklisted phone numbers to DTE. The format of the response is shown by the example below. Delayed numbers as defined by country requirements will not appear on this list. If no numbers are blacklisted, only the OK result is issued.

Example:

NO.	PHONE NUMBER
1:	5553423
OK	

***Cn**

***Cn**

Data Calling tone (1300hz) selection

*C0	Disable 1300 hz calling tone, so that the modem will not generate Calling tone to the line during data mode calling.
*C1	Enable 1300 hz calling tone, so that the modem will generate Calling tone to the line during data mode calling.

***D**

***Dn**

Display Delayed Numbers

This command causes the modem to send a list of the delayed numbers together with the delay associated with each. The modem will return a list of delayed telephone. The format of the response is shown by the example below (delay times are shown as hours:minutes:seconds). If no numbers are delayed, only the OK result code is issued.

Example:

NO.	PHONE NUMBER	DELAY
1:	5557890	000:00:03
OK		

NC**NC**

Country Select

Up to seven sets of country parameters may be selected. This command checks if the entered number matches the country code of one of the countries. If found, the modem stores the location of that country in driver code. Upon power up or a soft reset (Z command), the modem uses this location to load the parameters for the corresponding country.

***NCn**

Select country parameter corresponding to entered country code (n).

Table 20 Country Codes

Country	Code (n)	Country	Code (n)	Country	Code (n)
United States	0	Australia	7	Malaysia	14
Japan	1	Sweden	8	South Africa	15
Germany	2	Denmark	9	Poland	16
United Kingdom	3	New Zealand	10	Czechoslovakia	17
France	4	Korea	11	Hungary	18
Netherlands	5	China	12		
Italy	6	Singapore	13		

Sn**Sn**

Select Single/Dual Tone

This command causes the modem to produce either single or dual tone with using an %TTn, command, where n can be 0 to 9 or A to F.

- *S0 Regular dual tone transmitted to the line.
- *S1 The low band tone transmitted to the line.
- *S2 The high band tone transmitted to the line.

Result:

OK n = 0, 1, 2

PTT Testing Utilities

%Tn

%Tn

PTT Testing of Signal Level

Facilitates PTT testing of signal levels by providing continuous signals regardless of whether the modem is connected or not. The signal transmitted is in accordance with the parameter provided.

This is a range of commands that allow the user to initiate a series of signals that are necessary for PTT approval. The signals emitted include answer tone, modulation, carriers, and other pertinent signals. A test is initiated upon receipt of a %TTn (the second “T” is a password and the “n” is a test number); the test is aborted when any keyboard character is entered. The mode, will continuously transmit the tone or carrier according to the parameter supplied.

%TT00–%TT09 Dual Tone Multifrequency (DTMF) tone dial digits 0 to 9

%TT0A DTMF digit *

%TT0B DTMF digit #

%TT0C DTMF digit A

%TT0D DTMF digit B

%TT0E DTMF digit C

%TT0F DTMF digit D

%TT10 V.21 Channel 1 mark (originate) symbol.

%TT11 V.21 Channel 2 mark symbol.

%TT15 V.22 originate signaling at 1200 bps.

%TT16 V.22 bis originate signaling at 2400 bps.

%TT17 V.22 answer signaling (guard tone if PTT required).

%TT18 V.22 bis answer signaling (guard tone if required).

%TT19 V.21 Channel 1 space symbol.

%TT1A V.21 Channel 2 space symbol.

%TT20 V.32 9600 bps.

%TT21 V.32 bis 14400 bps.

%TT30 Silence, i.e. Go off-hook.

%TT31 V.25 answer tone

%TT32 1800 Hz guard tone

%TT33 V.25 calling tone (1300 Hz)

%TT34 Fax calling tone (1100 Hz)

%TT40 V.21 channel 2

%TT41 V.27 ter 2400 bps

%TT42 V.27 ter 2400 bps
%TT43 V.29 7200 bps
%TT44 V.29 9600 bps
%TT45 V.17 7200 bps long train
%TT46 V.17 7200 bps short train
%TT47 V.17 9600 bps long train
%TT48 V.17 9600 bps short train
%TT49 V.17 12000 bps long train
%TT4A V.17 12000 bps short train
%TT4B V.17 14400 bps long train
%TT4C V.17 14400 bps short train
%TT60 2400 bps (V.34 only)
%TT61 4800 bps (V.34 only)
%TT62 7200 bps (V.34 only)
%TT63 9600 bps (V.34 only)
%TT64 12000 bps (V.34 only)
%TT65 14400 bps
%TT66 16800 bps
%TT67 19200 bps
%TT68 21600 bps
%TT69 24000 bps
%TT6A 26400 bps
%TT6B 28800 bps
%TT6C 31200 bps
%TT6D 33600 bps