
SocketModem™

MT5634SMI V.34 & V.92

**AT Commands
Fax Class 1 Commands
Fax Class 2 Commands
Voice Commands**

Reference Guide

SocketModem Reference Guide

Serial: MT5634SMI-34, MT5634SMI-92

Parallel: MT5634SMI-P-92

Medical Device: MT5634SMI-HV-92, MT5634SMI-P-HV-92

Industrial Temperature: MT5634SMI-ITP-92, MT5634SMI-P-ITP-92

PN S000263C, Version C

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Revisions

<i>Revision Level</i>	<i>Date</i>	<i>Description</i>
A	08/09/02	First release. Includes global configuration and V.92 protocol.
B	06/27/03	Add V.34 documentation. Updated the Serial Test/Demo Board graphic. Updated the parts list. Updated Flash Programming Protocol. Updated Telecom Approvals and Country Codes. Changed the product name from ModemModule to SocketModem.
C	06/04/04	Create a separate Universal Socket Hardware guide and a separate AT Command Reference Guide.

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Chapter 1 – AT Commands, S-Registers and Result Codes

Introduction

The AT commands are used to control the operation of your modem. They are called *AT* commands because the characters **AT** must precede each command to get the *AT*tention of the modem.

AT commands can be issued only when the modem is in command mode or online command mode.

- The modem is in *command mode* whenever it is not connected to another modem.
- The modem is in *data mode* whenever it is connected to another modem and ready to exchange data. *Online command mode* is a temporary state in which you can issue commands to the modem while connected to another modem.
- To put the modem into online command mode from data mode, you must issue an *escape sequence* (**+++**) followed immediately by the *AT* characters and the command, e.g., **+++ATH** to hang up the modem. To return to data mode from online command mode, you must issue the command **ATO**.

To send AT commands to the modem you must use a communications program, such as the HyperTerminal applet in Windows 98 and NT 4.0, or some other available terminal program. You can issue commands to the modem either directly, by typing them in the terminal window of the communications program, or indirectly, by configuring the operating system or communications program to send the commands automatically. Fortunately, communications programs make daily operation of modems effortless by hiding the commands from the user. Most users, therefore, need to use AT commands only when reconfiguring the modem, e.g., to turn auto answer on or off.

The format for entering an AT command is **ATXn**, where *X* is the command and *n* is the specific value for the command, sometimes called the command *parameter*. The value is always a number. If the value is zero, you can omit it from the command; thus, **AT&W** is equivalent to **AT&W0**. Most commands have a *default* value, which is the value that is set at the factory. The default values are shown in the “AT Command Summary” (See below).

You must press ENTER (it could be some other key depending on the terminal program) to send the command to the modem. Any time the modem receives a command, it sends a response known as a *result code*. The most common result codes are *OK*, *ERROR*, and the *CONNECT* messages that the modem sends to the computer when it is connecting to another modem. See a table of valid result codes at the end of this chapter.

You can issue several commands in one line, in what is called a command *string*. The command string begins with **AT** and ends when you press ENTER. Spaces to separate the commands are optional; the command interpreter ignores them. The most familiar command string is the *initialization string*, which is used to configure the modem when it is turned on or reset, or when your communications software calls another modem.

AT Command Summary

Organization of AT Commands on the following pages: 1st, by the initial command character (&, +, %) 2nd, alphabetized by the second command character (Except for listing of **AT**).

Command	Description
AT	Attention Code
A	Answer
A/	Repeat Last Command
Bn	Communication Standard Setting
Ds	Dial
DS=y	Dial Stored Telephone Number
En	Echo Command Mode Characters
Fn	Echo Online Data Characters
Hn	Hook Control
In	Information Request
Mn	Monitor Speaker Mode
Nn	Modulation Handshake
On	Return Online to Data Mode
P	Pulse Dialing
Qn	Result Codes Enable/Disable
Sr=n	Set Register Value
Sr?	Read Register Value
T	Tone Dialing
Vn	Result Code Format
Wn	Result Code Options
Xn	Result Code Selection
Zn	Modem Reset
&Cn	Data Carrier Detect (DCD) Control
&Dn	Data Terminal Ready (DTR) Control
&En	XON/XOFF Pass-Through
&Fn	Load Factory Settings
&Gn	V.22bis Guard Tone Control
&Kn	Flow Control Selection
&Ln	Leased Line Operation
&Pn	Pulse Dial Make-to-Break Ratio Selection
&Qn	Asynchronous Communications Mode
&Sn	Data Set Ready (DSR) Control
&Tn	Loopback Test (V.54 Test) Commands
&V	Display Current Settings
&Wn	Store Current Configuration
&Zy=x	Store Dialing Command
\An	Select Maximum MNP Block Size
\Bn	Transmit Break
\Kn	Break Control
\Nn	Error Correction Mode Selection
\Qn	Flow Control Selection
\Tn	Inactivity Timer
\Vn	Protocol Result Code
-Cn	Data Calling Tone
%A	Adaptive Answer Result Code Enable
%B	View Numbers in Blacklist
%Cn	Data Compression Control
%DCn	AT Command Control
%En	Fallback and Fall Forward Control
%Hn	Direct Connect Enable
%Rn	Cisco Configuration
%Sn	Command Speed Response
\$EBn	Asynchronous Word Length

Command	Description
\$Dn	DTR Dialing
\$MBn	Online BPS Speed
\$SBn	Serial Port Baud Rate
#CBAn	Callback Attempts
#CBDn	Callback Delay
# CBF?	Callback Failed Attempts Display
# CBFR	Callback Failed Attempts Reset
# CBI n	Local Callback Inactivity Timer
# CBNy=n	Store Callback Password
# CBPn	Callback Parity
# CBRy	Callback Security Reset
# CBSn	Callback Enable/Disable
#Pn	Set 11-bit Parity
#Sx	Enter Setup Password
#S=x	Store Setup Password
+VDR=x, y	Distinctive Ring Report
+++AT<CR>	Escape Sequence
%%%ATMTSMODEM<CR>	Remote Configuration Escape Sequence
V.92 Commands	

AT Commands

Command:	AT	Attention Code
Values:		N/A
Description:		The attention code precedes all command lines except A/ , A: and escape sequences.
Command:		ENTER Key
Values:		N/A
Description:		Press the ENTER (RETURN) key to execute most commands.
Command:	A	Answer
Values:		N/A
Description:		Answer call before final ring.
Command:	A/	Repeat Last Command
Values:		N/A
Description:		Repeat the last command string. Do not precede this command with AT. Do not press ENTER to execute.
Command:	Bn	Communication Standard Setting
Values:		$n = 0-3, 15, 16$
Default:		0 and 15
Description:		B0 Select ITU-T V.22 mode when modem is at 1200 bps. B1 Select Bell 212A when modem is at 1200 bps. B2 Deselect V.23 reverse channel (same as B3). B3 Deselect V.23 reverse channel (same as B2). B15 Select V.21 when the modem is at 300 bps. B16 Select Bell 103J when the modem is at 300 bps.

Command:	Ds	Dial
Values:		s = dial string (phone number and dial modifiers)
Default:		none
Description:		Dial telephone number s, where s may up to 40 characters long and include the 0–9, *, #, , B, C, and D characters, and the L, P, T, V, W, S, comma (,), semicolon (;), !, @, ^ and \$ dial string modifiers.
		Dial string modifiers:
		L Redial last number. (Must be placed immediately after ATD .)
		P Pulse-dial following numbers in command.
		T Tone-dial following numbers in command (default).
		V Switch to speakerphone mode and dial the following number. Use ATH command to hang up.
		W Wait for a new dial tone before continuing to dial. (X2 , X4 , X5 , X6 , or X7 must be selected.)
		, Pause during dialing for time set in register S8.
		; Return to command mode after dialing. (Place at end of dial string.)
		! Hook flash. Causes the modem to go on-hook for one-half second, then off-hook again.
		@ Wait for quiet answer. Causes modem to wait for a ringback, then 5 seconds of silence, before processing next part of command. If silence is not detected, the modem returns a NO ANSWER code.
		^ Disable data calling tone transmission.
		\$ Detect AT&T call card “bong” tone. The character should follow the phone number and precede the user’s call card number: ATDT1028806127853500\$123456789
Command:	DS=y	Dial Stored Telephone Number
Values:		n = 0–2 (0–1 for SMI-Parallel {internal})
Default:		none
Description:		Dial a number previously stored in directory number y by the &Zy=x command. Example: ATDS=2
Command:	En	Echo Command Mode Characters
Values:		n = 0 or 1
Default:		1
Description:		E0 Do not echo keyboard input to the terminal. E1 Do echo keyboard input to the terminal.
Command:	Fn	Echo Online Data Characters
Values:		n = 1
Default:		1
		F0 Enable online data character echo. (Not supported.)
		F1 Disable online data character echo (included for backward compatibility with some software).
Command:	Hn	Hook Control
Values:		n = 0 or 1
Default:		0
Description:		H0 Go on-hook (hang up). H1 Go off-hook (make the phone line busy).

Command: In Information Request

Values: $n = 0-5, 9, 11$
 Default: None
 Description: I0 Display default speed and controller firmware version.
 I1 Calculate and display ROM checksum (e.g., 12AB).
 I2 Check ROM and verify the checksum, displaying *OK* or *ERROR*.
 I3 Display default speed and controller firmware version.
 I4 Display firmware version for data pump (e.g., 94).
 I5 Display the board ID: software version, hardware version, and country ID
 I9 Display the country code (e.g., *NA Ver. 1*).
 I11 Display diagnostic information for the last modem connection, such as DSP and firmware version, link type, line speed, serial speed, type of error correction/data compression, number of past retrains, etc.

Command: Mn Monitor Speaker Mode

Values: $n = 0, 1, 2, \text{ or } 3$
 Default: 1
 Description: M0 Speaker always off.
 M1 Speaker on until carrier signal detected.
 M2 Speaker always on when modem is off-hook.
 M3 Speaker on until carrier is detected, except while dialing.

Command: Nn Modulation Handshake

Values: $n = 0 \text{ or } 1$
 Default: 1
 Description: N0 Modem performs handshake only at communication standard specified by S37 and the B command.
 N1 Modem begins handshake at communication standard specified by S37 and the B command. During handshake, fallback to a lower speed can occur.

Command: On Return Online to Data Mode

Values: 0, 1, 3
 Default: None
 Description: O0 Exit online command mode and return to data mode (see `+++AT<CR>` escape sequence).
 O1 Issue a retrain and return to online data mode.
 O3 Issue a rate renegotiations and return to data mode.

Command: P Pulse Dialing

Values: P, T
 Default: T
 Description: Configures the modem for pulse (non-touch-tone) dialing. Dialed digits are pulsed until a T command or dial modifier is received.

Command: Qn Result Codes Enable/Disable

Values: $n = 0 \text{ or } 1$
 Default: 0
 Description: Q0 Enable result codes.
 Q1 Disable result codes.
 Q2 Returns an *OK* for backward compatibility with some software.

Command: Sr=n Set Register Value

Values: r = S-register number; n varies
 Default: None
 Description: Set value of register Sr to value of n , where n is entered in decimal format (e.g., $S0=1$).

Command: Sr? Read Register Value

Values: r = S-register number
 Default: None
 Description: Read value of register Sr and display it in 3-digit decimal form (e.g., $S2?$ gives the response 043).

Command: T Tone Dialing

Values: P, T
 Default: T
 Description: Configures the modem for DTMF (touch-tone) dialing. Dialed digits are tone dialed until a **P** command or dial modifier is received.

Command: Vn Result Code Format

Values: $n = 0$ or 1
 Default: 1
 Description: $V0$ Displays result codes as digits (terse response).
 $V1$ Displays result codes as words (verbose response).

Command: Wn Result Code Options

Values: $n = 0, 1,$ or 2
 Default: 2
 Description: $W0$ CONNECT result code reports serial port speed, disables protocol result codes.
 $W1$ CONNECT result code reports serial port speed, enables protocol result codes.
 $W2$ CONNECT result code reports line speed, enables protocol result codes.

Command: Xn Result Code Selection

Values: $n = 0-7$
 Default: 4
 Description: $X0$ Basic result codes (*CONNECT*); does not look for dial tone or busy signal.
 $X1$ Extended result codes (*CONNECT 46000 V42bis*); does not look for dial tone or busy signal.
 $X2$ Extended result codes with *NO DIALTONE*; does not look for busy signal.
 $X3$ Extended result codes with *BUSY*; does not look for dial tone.
 $X4$ Extended result codes with *NO DIALTONE* and *BUSY*.
 $X5$ Extended result codes with *NO DIALTONE* and *BUSY*.
 $X6$ Extended result codes with *NO DIALTONE* and *BUSY*.
 $X7$ Basic result codes with *NO DIALTONE* and *BUSY*.

Command: Zn Modem Reset

Values: $n = 0$ or 1
 Default: None
 Description: $Z0$ Reset modem to profile saved by the last **&W** command.
 $Z1$ Same as **Z0**.

Command: &Cn Data Carrier Detect (DCD) ControlValues: $n = 0, 1, 2$

Default: 1

Description: &C0 Forces the DCD circuit to be always ON.
&C1 DCD goes ON when the remote modem's carrier signal is detected, and goes OFF when the carrier signal is not detected.
&C2 DCD turns OFF upon disconnect for time set by S18. It then goes high again (for some PBX phone systems).

Command: &Dn Data Terminal Ready (DTR) ControlValues: $n = 0, 1, 2, \text{ or } 3$

Default: 2

Description: &D0 Modem ignores true status of DTR signal and responds as if it is always on.
&D1 If DTR drops while in online data mode, the modem enters command mode, issues an *OK*, and remains connected.
&D2 If DTR drops while in online data mode, the modem hangs up. If the signal is not present, the modem will not answer or dial.
&D3 If DTR drops, modem hangs up and resets as if **ATZ** command were issued.

Command: &En XON/XOFF Pacing ControlValues: $n = 12 \text{ or } 13$

Default: 12

Description: &E12 Disables XON/XOFF pacing.
&E13 Enables XON/XOFF pacing.

Command: &Fn Load Factory SettingsValues: $n = 0$

Default: None

Description: &F0 Load factory settings as active configuration.

Note: See also the **Z** command.

Command: &Gn V.22bis Guard Tone ControlValues: $n = 0, 1, \text{ or } 2$

Default: 0

Description: &G0 Disable guard tone.
&G1 Set guard tone to 550 Hz.
&G2 Set guard tone to 1800 Hz.

Note: The **&G** command is not used in North America.

Command: &Kn Flow Control SelectionValues: $n = 0, 3, \text{ or } 4$

Defaults: 3

Description: &K0 Disable flow control.
&K3 Enable CTS/RTS hardware flow control.
&K4 Enable XON/XOFF software flow control.

Command: &Ln Leased Line OperationValues: $n = 0, 1, \text{ or } 2$

Defaults: 0

Description: &L0 The modem is set for standard dial-up operation.
 &L1 The modem is set for leased line operation in originate mode.
 &L2 The modem is set for leased line operation in answer mode.

Note: For **&L1** and **&L2**, there is a 30-second window between power up and the starting of the leased line handshake. During this time, you can turn off the command, if desired.

Command: &Pn Pulse Dial Make-to-Break Ratio SelectionValues: $n = 0, 1, \text{ or } 2$

Default: 0

Description: &P0 60/40 make-to-break ratio
 &P1 67/33 make-to-break ratio
 &P2 20 pulses per second

Note: The **&P2** command is available only if the country code is set to Japan.

Command: &Qn Asynchronous Communications ModeValues: $n = 0, 5, 6, 8, \text{ or } 9$

Default: 5

Description: &Q0 Asynchronous with data buffering. Same as **IN0**.
 &Q5 Error control with data buffering. Same as **IN3**.
 &Q6 Asynchronous with data buffering. Same as **IN0**.
 &Q8 MNP error control mode. If MNP error control is not established, the modem falls back according to the setting in **S36**.
 &Q9 V.42 or MNP error control mode. If neither error control is established, the modem falls back according to the setting in **S36**.

Command: &Sn Data Set Ready (DSR) ControlValues: $n = 0 \text{ or } 1$

Default: 0

Description: &S0 DSR is always ON.
 &S1 DSR goes ON only during a connection.

Command: &Tn Loopback Test (V.54 Test) Commands Values: $n = 0, 1, 3, 6$

Default: None

Description: The modem can perform selected test and diagnostic functions. A test can be run only when the modem is operating in non-error-correction mode (normal or direct mode). For tests 3 and 6, a connection between the two modems must be established. To terminate a test in progress, the escape sequence (**+++AT**) must be entered.

&T0 Stops any test in progress.
 &T1 Starts a local analog loopback, V.54 Loop 3, test. If a connection exists when this command is issued, the modem hangs up. When the test starts, a *CONNECT* message is displayed.
 &T3 Starts local digital loopback, V.54 Loop 2, test. If no connection exists, *ERROR* is returned.
 &T6 Initiates a remote digital loopback, V.54 Loop 2, test without self-test. If no connection exists, *ERROR* is returned.

Command: &V Display Current Settings

Values: N/A
 Description: Displays the active modem settings.

Command: &Wn Store Current Configuration

Values: $n = 0$ or 1
 Default: 1
 Description: &W0 Stores current modem settings in non-volatile memory and causes them to be loaded at power-on or following the **ATZ** command instead of the factory defaults. See **&F** command.
 &W1 Clears user default settings from non-volatile memory and causes the factory defaults to be loaded at power-on or following the **ATZ** command.

Command: &Zy=x Store Dialing Command

Values: $y = 0-2$ (0–1SMI-Parallel {internal})
 $x =$ Dialing command
 Default: None
 Description: Stores dialing command x in memory location y . Dial the stored number using the command **ATDS=y**. See Also the **#CBS** command, a callback security command.

Command: \An Select Maximum MNP Block Size

Values: $n = 0, 1, 2,$ or 3
 Default: 3
 Description: \A0 64-character maximum
 \A1 128-character maximum
 \A2 192-character maximum
 \A3 256-character maximum

Command: \Bn Transmit Break

Values: $n = 0-9$ in 100 ms units
 Default: 3
 Description: In non-error-correction mode only, sends a break signal of the specified length to a remote modem. Works in conjunction with the **\K** command.

Command: \Kn Break ControlValues: $n = 0-5$

Default: 5

Description: Controls the modem's response to a break received from: computer, remote modem, or **\B** command. Response is different for each of three different states.**Data mode. Modem receives the break from the computer:**

\K0 Enter online command mode, no break sent to the remote modem.

\K1 Clear data buffers and send break to the remote modem.

\K2 Same as **\K0**.

\K3 Send break immediately to the remote modem.

\K4 Same as **\K0**.

\K5 Send break to the remote modem in sequence with the transmitted data.

Data mode. Modem receives the break from the remote modem:

\K0 Clear data buffers and send break to the computer.

\K1 Same as **\K0**.

\K2 Send break immediately to the computer.

\K3 Same as **\K2**.

\K4 Send break to the computer in sequence with the received data.

\K5 Same as **\K4**.**Online command mode. Modem receives a \Bn command from the computer:**

\K0 Clear data buffers and send break to the remote modem.

\K1 Same as **\K0**.

\K2 Send break immediately to the remote modem.

\K3 Same as **\K2**.

\K4 Send break to the remote modem in sequence with the transmitted data.

\K5 Same as **\K4**.**Command: \Nn Error Correction Mode Selection**Values: $n = 0-5, \text{ or } 7$

Default: 3

Description: \N0 Non-error correction mode with data buffering (buffer mode; same as **&Q6**).

\N1 Direct mode.

\N2 MNP reliable mode. If the modem cannot make an MNP connection, it disconnects.

\N3 V.42/MNP auto-reliable mode. The modem attempts first to connect in V.42 error correction mode, then in MNP mode, and finally in non-error correction (buffer) mode with continued operation.

\N4 V.42 reliable mode. If the modem cannot make a V.42 connection, it disconnects.

\N5 V.42, MNP, or non-error correction (same as **\N3**).\N7 V.42, MNP, or non-error correction (same as **\N3**).**Command: \Qn Flow Control Selection**Values: $n = 0, 1, \text{ or } 3$

Default: 3

Description: \Q0 Disable flow control (same as **&K0**).\Q1 XON/XOFF software flow control (same as **&K4**).

\Q2 CTS-only flow control. Not supported.

\Q3 RTS/CTS hardware flow control (same as **&K3**).**Command: \Tn Inactivity Timer**Values: $n = 0, 1-255$

Default: 0

Description: Sets the time (in minutes) after the last character is sent or received that the modem waits before disconnecting. A value of zero disables the timer. Applies only in buffer mode.

Note: You can also set the inactivity timer by changing the value of **S30**.

- Command:** **\Vn** **Protocol Result Code**
 Values: n = 0, 1, or 2
 Default: 1
 Description: \V0 Disables the appending of the protocol result code to the DCE speed.
 \V1 Enables the appending of the protocol result code to the DCE speed.
 \V2 Same as **\V1**.
- Command:** **\Xn** **XON/XOFF Pass-Through**
 Values: n = 0 or 1
 Default: 0
 Description: \X0 Modem responds to and discards XON/XOFF characters.
 \X1 Modem responds to and passes XON/XOFF characters.
Note: This is also controlled via **&E6** and **&E7**.
- Command:** **-Cn** **Data Calling Tone**
 Values: n = 0 or 1
 Defaults: 1
 Description: -C0 Disable V.25 data calling tone to deny remote data/fax/voice discrimination.
 -C1 Enable V.25 data calling tone to allow remote data/fax/voice discrimination.
- Command:** **%A** **Adaptive Answer Result Code Enable**
 Values: n = 0 or 1
 Default: 0
 Description: The %A command controls whether the DATA or FAX result codes will be sent by the modem. The modem must be in fax mode for this command to work. Also, the modem must be set to **+FAA=1**, which enables the modem to distinguish between a fax and a data call. When these commands are enabled, the modem sends DATA to the computer when it detects data tones and FAX when it detects fax tones. These strings are used by some servers to select the appropriate communication program.
 %A0 Disables adaptive answer result codes.
 %A1 Enables adaptive answer result codes.
- Command:** **%B** **View Numbers in Blacklist**
 Values: N/A
 Description: If blacklisting is in effect, **AT%B** displays the numbers for which the last call attempted in the previous two hours failed. In countries that do not require blacklisting, the *ERROR* result code appears.
- Command:** **%Cn** **Data Compression Control**
 Values: n = 0 or 1
 Default: 1
 Description: %C0 Disable V.42bis/MNP 5 data compression.
 %C1 Enable V.42bis/MNP 5 data compression.
- Command:** **%DCn** **AT Command Control**
 Values: n = 0 or 1
 Default: 0
 Description: %DC0 The modem responds to AT commands.
 %DC1 The modem ignores AT commands.
Note: The modem will respond to **AT%DC** for 10 seconds after power-up.

Command: %En Fallback and Fall Forward ControlValues: $n = 0, 1, \text{ or } 2$

Default: 2

Description: %E0 Disable fallback and fall forward.
%E1 Enable fallback, disable fall forward.
%E2 Enable fallback and fall forward.**Command: %Hn Direct Connect Enable**Values: $n = 0, 1$

Default: 0

Description: %H0 Sets callback security to normal operation.
%H1 All callback security calls will be direct connect regardless of whether the password or phone number has the - character.**Command: %Rn Cisco Configuration**Values: $n = 0, 1$

Default: 0

Description: %R0 Disables Cisco configuration.
%R1 Sets **E0**, **Q1**, **&D0**, **IN0**, **\$SB9600**, and **%S1** for operation with a Cisco router.**Command: %Sn Command Speed Response**Values: $n = 0, 1$

Default: 0

Description: %S0 Sets modem to respond to AT commands at all normal speeds.
%S1 AT commands accepted at 115200 bps only. Commands at other speeds are ignored.**Command: \$Dn DTR Dialing**Values: $n = 0 \text{ or } 1$

Default: 0

Description: \$D0 Disables DTR dialing.
\$D1 Dials the number in memory location 0 when DTR goes high.**Command: \$EBn Asynchronous Word Length**Values: $n = 0 \text{ or } 1$

Default: 0

Description: \$EB0 Enables 10-bit mode.
\$EB1 Enables 11-bit mode.**Command: \$MBn Online BPS Speed**Values: $n = \text{speed in bits per second}$

Default: 28,800

Description: \$MB75 Selects CCITT V.23 mode
\$MB300 Selects 300 bps on-line
\$MB1200 Selects 1200 bps on-line
\$MB2400 Selects 2400 bps on-line
\$MB4800 Selects 4800 bps on-line
\$MB9600 Selects 9600 bps on-line
\$MB14400 Selects 14400 bps on-line
\$MB19200 Selects 19200 bps on-line
\$MB28800 Selects 28800 bps on-line
\$MB33600 Selects 33600 bps on-line

Command: \$RPn	Ring Priority vs. AT Command Priority
Values:	$n = 0$ or 1
Default:	1
Description:	<p>\$RP0 The AT command will have priority over the ring. S1 will be reset to 0 if an AT command is received. This command is storable to memory.</p> <p>\$RP1 The ring will have priority over the AT command. S1 will increment even if an AT command and ring are received together and the incoming call will be answered when S1 is equal to S0.</p> <p>Note: SocketModems do not detect ring cadence of TelTone telephone line simulators as a valid ring.</p>
Command: \$SBn	Serial Port Baud Rate
Values:	$n =$ speed in bits per second
Default:	57600
Description:	<p>\$SB300 Sets serial port to 300 bps</p> <p>\$SB1200 Sets serial port to 1200 bps</p> <p>\$SB2400 Sets serial port to 2400 bps</p> <p>\$SB4800 Sets serial port to 4800 bps</p> <p>\$SB9600 Sets serial port to 9600 bps</p> <p>\$SB19200 Sets serial port to 19200 bps</p> <p>\$SB38400 Sets serial port to 38400 bps</p> <p>\$SB57600 Sets serial port to 57600 bps</p> <p>\$SB115200 Sets serial port to 115200 bps</p> <p>\$SB230400 Sets serial port to 230400 bps</p>
Command: +VDR=x, y	Distinctive Ring Report
Values:	$x = 0, 1$ Distinctive Ring report control. See description. $y = 0-255$ Minimum ring interval in 100 ms units. See description.
Default:	0, 0
Description:	<p>Enables reporting of ring cadence information to the DTE and specifies the minimum ring cadence that will be reported.</p> <p>The report format is one line per silence period and one line per ring period. The length of the silence period is in the form DROF=number in units of 100 ms<CR><LF>, and the length of the ring is in the form DRON=number in units of 100 ms<CR> <LF>. The modem may produce a Ring event code after the DRON message if enabled by the y parameter. The y parameter must be set to a value equal to or smaller than the expected ring cadence in order to pass the report to the DTE.</p> <p>+VDR=0, N/A Disables Distinctive Ring cadence reporting.</p> <p>+VDR=1, 0 Enables Distinctive Ring cadence reporting. Other call progress result codes (including RING) are reported as normal.</p> <p>+VDR=1, >0 Enables Distinctive Ring cadence reporting. The RING result code is reported after the falling edge of the ring pulse (i.e., after the DRON report).</p> <p>+VDR=? Displays the allowed values.</p> <p>+VDR? Displays the current value.</p>

Command: #CBAn	Callback Attempts
Values:	n = 1–255
Default:	4
Description:	Sets the number of callback attempts that are allowed after passwords have been exchanged between modems.
Command: #CBDn	Callback Delay
Values:	n = 0–255
Default:	15
Description:	Sets the length of time (in seconds) that the modem waits before calling back the remote modem.
Command: #CBF?	Callback Failed Attempts Display
Values:	N/A
Default:	N/A
Description:	Requests the number of failed callback passwords since reset or power-up. This number can be stored to nonvolatile memory using the &W command.
Command: #CBFR	Callback Failed Attempts Reset
Values:	N/A
Default:	N/A
Description:	Resets the number of failed callback passwords to 0. This does not reset the number stored in nonvolatile memory.
Command: #CBIn	Local Callback Inactivity Timer
Values:	n = 1–255
Default:	20
Description:	Sets the time (in minutes) that the modem waits for a command before forcing the user to enter the setup password again.
Command: #CBNy=x	Store Callback Password
Values:	y = 0–29 x = password
Defaults:	None
Description:	Sets the callback security password for the y memory location. The password must have 6 to 10 characters, and cannot include the + or - characters.
Command: #CBPn	Callback Parity
Values:	n = 0, 1, or 2
Default:	0
Description:	Sets parity for the callback security messages. #CBP0 No parity. #CBP1 Odd parity. #CBP2 Even parity.

Command: #CBRy	Callback Security Reset
Values:	y = 0–29
Default:	None
Description:	Clears the password and phone number in the y memory location.
Command: #CBSn	Callback Enable/Disable
Values:	n = 0, 1, 2, or 3
Default:	0
Description:	#CBS0 Disables callback security. #CBS1 Enables local and remote callback security. #CBS2 Enables remote callback security only. #CBS3 Disables callback security until local hang-up or reset.
Command: #Pn	Set 11-bit Parity
Values:	n = 0 or 1
Default:	2
Description:	#P0No parity. #P1Odd parity. #P2Even parity.
Command: #Sx	Enter Setup Password
Values:	x= password (1–8 characters, case sensitive)
Default:	MTSMODEM
Description:	Enters the remote configuration setup password.
Command: #S=x	Store Setup Password
Values:	x= password (1–8 characters, case sensitive)
Default:	MTSMODEM
Description:	Stores a new remote configuration setup password.

Escape AT Commands

Command: **+++AT<CR>**

Values:

Description:

Escape Sequence

N/A

Puts the modem in command mode (and optionally issues a command) while remaining online. Type **+++AT** and up to six optional command characters; then press ENTER. Used mostly to issue the hang-up command: **+++ATH<CR>**.

Command: **%%%ATMTSMODEM<CR>** **Remote Configuration Escape Sequence**

Values:

Description:

N/A

Initiates remote configuration mode while online with remote modem. The remote configuration escape character (%) is defined in register **S13**.

V.92 Commands

Command: **+MS= Modulation Selection**

Values: See description.

Defaults: See description.

Description: This extended-format command selects modulation, enables or disables automode, and specifies the highest downstream and upstream connection rates using one to four subparameters.

The command syntax is

+MS=[mod],[automode],[0],[max_rate],[0],[max_rx_rate]]<CR>

Subparameters that are not entered retain their current value. Commas separate optional subparameters, and must be inserted to skip a subparameter. Example:

+MS=,0<CR> disables automode and keeps all other settings at their current values.

+MS=? Reports supported options in the format (list of supported mod values),(list of supported automode values),(0),(list of supported max_rate values),(0),(list of supported max_rx_rate values). Example: **+MS: (BELL103, V21, BELL212A, V22, V22B, V23C, V32, V32B, V34, V90, V92), (0, 1), (0), (0-33600), (0), (0-56000)**

+MS? Reports current options in the format mod, automode, 0, max_rate, 0, max_rx_rate. Example: **+MS: V92, 1, 0, 31200, 0, 56000.**

Subparameters

mod Specifies the preferred modulation (automode enabled) or the modulation to use in originating or answering a connection (automode disabled). The default is V92.

<i>mod</i>	Modulation	Possible rates (bps) ¹
V92 ²	V92	56000, 54666, 53333, 52000, 50666, 49333, 48000, 46666, 45333, 44000, 42666, 41333, 40000, 38666, 37333, 36000, 34666, 33333, 32000, 30666, 29333, or 28000
V903	V.90	56000, 54666, 53333, 52000, 50666, 49333, 48000, 46666, 45333, 44000, 42666, 41333, 40000, 38666, 37333, 36000, 34666, 33333, 32000, 30666, 29333, or 28000
V34	V.34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400
V32B	V.32bis	14400, 12000, 9600, 7200, or 4800
V32	V.32	9600 or 4800
V22B	V.22bis	2400 or 1200
V22	V.22	1200
V23C	V.23	1200
V21	V.21	300
Bell212A	Bell 212A	1200
Bell103	Bell 103	300

Notes:

1. See optional *<automode>*, *<max_rate>*, and *<max_RX_rate>* subparameters.
2. Selects V.92 modulation as first priority. If a V.92 connection cannot be established, the modem attempts V.90, V.34, V.32bis, etc.
3. Selects V.90 modulation as first priority. If a V.90 connection cannot be established, the modem attempts V.34, V.32bis, etc.

automode An optional numeric value that enables or disables automatic modulation negotiation using V.8 bis/V.8 or V.32 bis Annex A. Automode is disabled if values are specified for the max_rate and max_rx_rate parameters. The options are:

- 0 Disable automode
- 1 Enable automode (default)

- max_rate** An optional number that specifies the highest rate at which the modem may establish an upstream (transmit) connection. The value is decimal coded in units of bps, for example, 33600 specifies the highest rate to be 33600 bps.
- 0 Maximum rate determined by the modulation selected in *mod* (default).
 - 300–33600 Maximum rate value limited by the modulation selected in *mod*. For valid *max_rate* values for each *mod* value, see the following table.

mod value	Valid max_rate values (bps)
V92, V90, V34	31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400
V32B	19200, 16800, 14400, 12000, 9600, 7200, 4800
V32	14400, 12000, 9600, 7200, 4800
V22B	2400
V22, V23C, Bell212A	1200
V21, Bell103	300

- max_rx_rate** An optional number that specifies the highest rate at which the modem may establish a downstream (receive) connection. The value is decimal coded in units of bps, e.g., 28800 specifies the highest rate to be 28800 bps.
- 0 Maximum rate determined by the modulation selected in *mod* (default).
 - 300–56000 Maximum rate value limited by the modulation selected in *mod*. See “Possible rates” in the *mod* table.

Command: +PCW=n Call Waiting Enable

Values: n = 0, 1, or 2

Default: 2

Description: Controls the action to be taken upon detection of a call waiting tone in V.92 mode. Values specified by this command are not modified when an **AT&F** command is issued.

- +PCW=0 Toggles V.24 Circuit 125 and collects Caller ID if enabled by +VCID
- +PCW=1 Hangs up
- +PCW=2 Ignores V.92 call waiting
- +PCW=? Displays the allowed values
- +PCW? Displays the current value

Command: +PIG=n PCM Upstream Ignore

Values: n = 0 or 1

Default: 1

Description: Controls the use of PCM upstream during V.92 operation. PCM upstream allows faster upload speeds to a V.92 server.

- +PIG=0 Disables PCM upstream
- +PIG=1 Enables PCM upstream
- +PIG=? Displays the allowed values
- +PIG? Displays the current value

Command: +PMH=n Modem on Hold Enable

Values: n = 0 or 1

Default: 1

Description: Controls if modem on hold procedures are enabled during V.92 operation. Normally controlled by a modem on hold program. Values specified by this command are not modified when an **AT&F** command is issued.

- +PMH=0 Enables V.92 modem on hold
- +PMH=1 Disables V.92 modem on hold
- +PMH=? Displays the allowed values
- +PMH? Displays the current value

Command: +PMHF	V.92 Modem Hook Flash
Values:	N/A
Default:	N/A
Description:	Causes the DCE to go on-hook for a specified period of time, and then return off-hook for at least a specified period of time. The specified period of time is normally one-half second, but may be governed by national regulations. "ERROR" is returned if MOH is not enabled.
Command: +PMHR=n	Modem on Hold Initiate
Values:	n = 0–13
Default:	0
Description:	+PMHR is an action command that causes the modem to initiate MOH with the central site modem. It returns the following values to indicate what has been negotiated. Valid only if MOH is enabled and the modem is off-hook or in data mode. Otherwise, ERROR will be returned. +PMHR=0 Deny MOH request +PMHR=1 Grant MOH request with 10 second timeout +PMHR=2 Grant MOH request with 20 second timeout +PMHR=3 Grant MOH request with 30 second timeout +PMHR=4 Grant MOH request with 40 second timeout +PMHR=5 Grant MOH request with 1 minute timeout +PMHR=6 Grant MOH request with 2 minute timeout +PMHR=7 Grant MOH request with 3 minute timeout +PMHR=8 Grant MOH request with 4 minute timeout +PMHR=9 Grant MOH request with 6 minute timeout +PMHR=10 Grant MOH request with 8 minute timeout +PMHR=11 Grant MOH request with 12 minute timeout +PMHR=12 Grant MOH request with 16 minute timeout +PMHR=13 Grant MOH request with indefinite timeout +PMHR=? Displays the allowed values +PMHR? Displays the current value
Command: +PMHT=n	Modem on Hold Timer
Values:	n = 0–13
Default:	0
Description:	Determines if the modem will accept a V.92 Modem on Hold (MOH) request and will set the MoH timeout. +PMHT=0 Deny MOH request +PMHT=1 Grant MOH request with 10 second timeout +PMHT=2 Grant MOH request with 20 second timeout +PMHT=3 Grant MOH request with 30 second timeout +PMHT=4 Grant MOH request with 40 second timeout +PMHT=5 Grant MOH request with 1 minute timeout +PMHT=6 Grant MOH request with 2 minute timeout +PMHT=7 Grant MOH request with 3 minute timeout +PMHT=8 Grant MOH request with 4 minute timeout +PMHT=9 Grant MOH request with 6 minute timeout +PMHT=10 Grant MOH request with 8 minute timeout +PMHT=11 Grant MOH request with 12 minute timeout +PMHT=12 Grant MOH request with 16 minute timeout +PMHT=13 Grant MOH request with indefinite timeout +PMHT=? Displays the allowed values +PMHT? Displays the current value

Command: +PQC=n	Quick Connect Control
Values:	n = 0, 1, 2, or 3
Default:	3
Description:	Controls V.92 shortened Phase 1 and Phase 2 startup procedures (Quick Connect). When line conditions are stable, quick connect results in shortened connect times; however, significant fluctuation in line conditions from call to call can cause longer connect times; thus, it may be advisable to disable quick connect. +PQC=0 Enables Short Phase 1 and Short Phase 2 (Quick Connect) +PQC=1 Enables Short Phase 1 +PQC=2 Enables Short Phase 2 +PQC=3 Disables Short Phase 1 and Short Phase 2 +PQC=? Displays the allowed values +PQC? Displays the current value
Command: +VCID=n	Caller ID Selection
Values:	n = 0, 1, or 2
Default:	0
Description:	Enables Caller ID detection and configures the reporting and presentation of the Caller ID data that is detected after the first ring. The reported data includes the date and time of the call, the caller's name and number, and a message. Set S0=2. +VCID=0 Disables Caller ID +VCID=1 Enables Caller ID with formatted data +VCID=2 Enables Caller ID with unformatted data +VCID=? Displays the allowed values +VCID? Displays the current value
Command: +VDR=x, y	Distinctive Ring Report
Values:	x = 0, 1 Distinctive Ring report control. See description. y = 0–255 Minimum ring interval in 100 ms units. See description.
Default:	0, 0
Description:	Enables reporting of ring cadence information to the DTE and specifies the minimum ring cadence that will be reported. Report format is one line per silence period and one line per ring period. The length of the silence period is in the form DROF=number in units of 100 ms<CR><LF>, and the length of the ring is in the form DRON=number in units of 100 ms<CR> <LF>. The modem may produce a Ring event code after the DRON message if enabled by the y parameter. The y parameter must be set to a value equal to or smaller than the expected ring cadence in order to pass the report to the DTE. +VDR=0, N/A Disables Distinctive Ring cadence reporting. +VDR=1, 0 Enables Distinctive Ring cadence reporting. Other call progress result codes (including RING) are reported as normal. +VDR=1, >0 Enables Distinctive Ring cadence reporting. RING result code is reported after falling edge of the ring pulse (after the DRON report). +VDR=? Displays the allowed values. +VDR? Displays the current value.

Command: #CBAn	Callback Attempts
Values:	n = 1–255
Default:	4
Description:	Sets the number of callback attempts that are allowed after passwords have been exchanged between modems.
Command: #CBDn	Callback Delay
Values:	n = 0–255
Default:	15
Description:	Sets the length of time (in seconds) that the modem waits before calling back the remote modem.
Command: #CBF?	Callback Failed Attempts Display
Values:	N/A
Default:	N/A -
Description:	Requests the number of failed callback passwords since reset or power-up. This number can be stored to nonvolatile memory using the &W command.
Command: #CBFR	Callback Failed Attempts Reset
Values:	N/A
Default:	N/A
Description:	Resets the number of failed callback passwords to 0. This does not reset the number stored in nonvolatile memory.
Command: #CBIn	Local Callback Inactivity Timer
Values:	n = 1–255
Default:	20
Description:	Sets the time (in minutes) that the modem waits for a command before forcing the user to enter the setup password again.
Command: #CBNy=x	Store Callback Password
Values:	y = 0–29 x = password
Defaults:	None
Description:	Sets the callback security password for the y memory location. The password must have 6 to 10 characters, and cannot include the + or - characters.
Command: #CBPn	Callback Parity
Values:	n = 0, 1, or 2
Default:	0
Description:	Sets parity for the callback security messages. #CBP0 No parity. #CBP1 Odd parity. #CBP2 Even parity.
Command: #CBRy	Callback Security Reset
Values:	y = 0–29
Default:	None
Description:	Clears the password and phone number in the y memory location.

Command:	#CBSn	Callback Enable/Disable
Values:		n = 0, 1, 2, or 3
Default:		0
Description:		#CBS0 Disables callback security. #CBS1 Enables local and remote callback security. #CBS2 Enables remote callback security only. #CBS3 Disables callback security until local hang-up or reset.
Command:	#Pn	Set 11-bit Parity
Values:		n = 0 or 1
Default:		2
Description:		#P0No parity. #P1Odd parity. #P2Even parity.
Command:	#Sx	Enter Setup Password
Values:		x= password (1–8 characters, case sensitive)
Default:		MTSMODEM
Description:		Enters the callback security setup password.
Command:	#S=x	Store Setup Password
Values:		x= password (1–8 characters, case sensitive)
Default:		MTSMODEM
Description:		Stores a new callback security and remote configuration setup password.

S-Registers

Certain modem values, or parameters, are stored in memory locations called S-Registers. Use the **S** command to read or to alter the contents of S-Registers (see previous section).

Register	Unit	Range	Default	Description
S0	1 ring	0, 1–255	1	Sets the number of rings until the modem answers. ATS0=0 disables auto answer completely.
S1	1 ring	0–255	0	Counts the rings that have occurred.
S2	decimal	0–127 128–255	43 (+)	Sets ASCII code for the escape sequence character. Values greater than 127 disable escape.
S3	decimal	0–127	13 (^M)	Sets the ASCII code for the carriage return character.
S4	decimal	0–127	10 (^J)	Sets the ASCII code for the line feed character.
S5	decimal	0–32 33–127	8 (^H)	Sets the ASCII code for the backspace character. Values greater than 32 disable backspace.
S6	seconds	2–65*	2*	Sets the time the modem waits after it goes off-hook before it begins to dial the telephone number.
S7	seconds	35-65*	50*	Sets the time the modem waits for a carrier signal before aborting a call. Also sets the wait for silence time for the @ dial modifier.
S8	seconds	0–65	2	Sets the length of a pause caused by a comma character in a dialing command.
S9	decimal	0, 1–127	37 (%)	Sets ASCII code for remote configuration escape character. S9=0 disables remote configuration.
S10	100 ms	1–254	20	Sets how long a carrier signal must be lost before the modem disconnects.
S11	1 ms	50–150*	95*	Sets spacing and duration of dialing tones.
S28	decimal	0, 1–255	1	0 disables, 1–255 enables V.34 modulation.
S30	1 minute	0, 1–255	0	Sets the length of time that the modem waits before disconnecting when no data is sent or received. A value of zero disables the timer. See also the \T command
S35	decimal	0–1	1	0 disables, 1 enables the V.25 calling tone, which allows remote data/fax/voice discrimination.
S36	decimal	0–7	7	Specifies the action to take in the event of a negotiation failure when error control is selected. (See S48 .)

S37	decimal	0–19	0	<p>Sets the maximum V.34 “upstream” speed at which the modem attempts to connect.</p> <p>0 = maximum speed 1 = reserved 2 = 1200/75 bps 3 = 300 bps 4 = reserved 5 = 1200 bps 6 = 2400 bps 7 = 4800 bps 8 = 7200 bps 9 = 9600 bps 10 = 12000 bps 11 = 14400 bps 12 = 16800 bps 13 = 19200 bps 14 = 21600 bps 15 = 24000 bps 16 = 26400 bps 17 = 28800 bps 18 = 31200 bps 19 = 33600 bps</p>
S38	decimal	0–23	1	<p>Sets “downstream” data rate where V.90 provides rates of 28,000 to 56,000 bps in increments of 1,333 bps.</p> <p>0 = V.90 disabled 1 = V.90 auto rate 2 = 28,000 bps 3 = 29,333 bps 4 = 30,666 bps 5 = 32,000 bps 6 = 33,333 bps 7 = 34,666 bps 8 = 36,000 bps 9 = 37,333 bps 10 = 38,666 bps 11 = 40,000 bps 12 = 41,333 bps 13 = 42,666 bps 14 = 44,000 bps 15 = 45,333 bps 16 = 46,666 bps 17 = 48,000 bps 18 = 49,333 bps 19 = 50,666 bps 20 = 52,000 bps 21 = 53,333 bps 22 = 54,666 bps 23 = 56,000 bps</p> <p>Upstream data rates: Upstream V.90 data rates are 4800 to 33,600 bps in 2400 bps increments.</p>
S43	decimal	0–1	1	<p>For testing and debugging only. Enables/disables V.32bis start-up auto mode operation. 0 = disable; 1 = enable.</p>

S48 decimal 7 or 128 7 Enables (7) or disables (128) LAPM negotiation. The following table lists the **S36** and **S48** configuration settings for certain types of connections.

	S48=7	S48=128
S36=0, 2	LAPM or hang up	Do not use
S36=1, 3	LAPM or async	Async
S36=4, 6	LAPM, MNP, or hang up	MNP or hang up
S36=5, 7	LAPM, MNP, or async	MNP or async

S89 seconds 0, 5–255 10 Sets the length of time in the off-line command mode before the modem goes into standby mode or “sleep mode”. A value of zero prevents standby mode; a value of 1–4 sets the value to 5. Standby mode (sleep mode or low power mode) is controlled by **S89**. It programs the number of seconds of inactivity before the modem will go to sleep. The default value is 0. A value of 0 disables standby mode. The modem will wake on an incoming ring or an AT command.

S108 decimal 0–3, 6, 7 6 Selects the 56K digital loss if using the modem through a PBX line. The default value is -6 dB loss, the value used when calling from a typical POTS line long distance.

0 = -0 dB digital loss, no robbed-bit signaling
 1 = -3 dB PBX digital loss
 2 = -2 dB digital loss
 3 = -3 dB digital loss
 6 = -6 dB digital loss
 7 = -0 dB digital loss with robbed-bit signaling

Result Codes

In command mode your modem can send responses called **Result Codes** to your computer. Result codes are used by communications programs and can also appear on your monitor.

<u>Terse</u>	<u>Verbose</u>	<u>Description</u>
0	OK	Command executed
1	CONNECT	Modem connected to line
2	RING	Ring signal detected
3	NO CARRIER	Carrier signal lost or not detected
4	ERROR	Invalid command
5 *	CONNECT 1200	Connected at 1200 bps
6	NO DIALTONE	No dial tone detected
7	BUSY	Busy signal detected
8	NO ANSWER	No answer at remote end
9	CONNECT 75	Connected at 75 bps
10*	CONNECT 2400	Connected at 2400 bps
11*	CONNECT 4800	Connected at 4800 bps
12*	CONNECT 9600	Connected at 9600 bps
13*	CONNECT 14400	Connected at 14400 bps
14*	CONNECT 19200	Connected at 19200 bps
18	CONNECT 57600	Connected at 57600 bps
24*	CONNECT 7200	Connected at 7200 bps
25*	CONNECT 12000	Connected at 12000 bps
28	CONNECT 38400	Connected at 38400 bps
40*	CONNECT 300	Connected at 300 bps
55*	CONNECT 21600	Connected at 21600 bps
56*	CONNECT 24000	Connected at 24000 bps
57*	CONNECT 26400	Connected at 26400 bps
58*	CONNECT 28800	Connected at 28800 bps
59*	CONNECT 31200	Connected at 31200 bps
60*	CONNECT 33600	Connected at 33600 bps
70	CONNECT 32000	Connected at 32000 bps
71	CONNECT 34000	Connected at 34000 bps
72	CONNECT 36000	Connected at 36000 bps
73	CONNECT 38000	Connected at 38000 bps
74	CONNECT 40000	Connected at 40000 bps
75	CONNECT 42000	Connected at 42000 bps
76	CONNECT 44000	Connected at 44000 bps
77	CONNECT 46000	Connected at 46000 bps
78	CONNECT 48000	Connected at 48000 bps
79	CONNECT 50000	Connected at 50000 bps
80	CONNECT 52000	Connected at 52000 bps
81	CONNECT 54000	Connected at 54000 bps
82	CONNECT 56000	Connected at 56000 bps
83	CONNECT 58000	Connected at 58000 bps
84	CONNECT 60000	Connected at 60000 bps
86	CONNECT 16800	Connected at 16800 bps
87	CONNECT 115200	Connected at 115200 bps
88	DELAYED	Delay is in effect for the dialed number
89	BLACKLISTED	Dialed number is blacklisted
90	BLACKLIST FULL	Blacklist is full
91	CONNECT 230400	Connected at 230400 bps
100	CONNECT 28000	Connected at 28000 bps
101	CONNECT 29333	Connected at 29333 bps
102	CONNECT 30666	Connected at 30666 bps
103	CONNECT 33333	Connected at 33333 bps
104	CONNECT 34666	Connected at 34666 bps
105	CONNECT 37333	Connected at 37333 bps
106	CONNECT 38666	Connected at 38666 bps
107	CONNECT 41333	Connected at 41333 bps
108	CONNECT 42666	Connected at 42666 bps
109	CONNECT 45333	Connected at 45333 bps
110	CONNECT 46666	Connected at 46666 bps
111	CONNECT 49333	Connected at 49333 bps

112	CONNECT 50666	Connected at 50666 bps
113	CONNECT 53333	Connected at 53333 bps
114	CONNECT 54666	Connected at 54666 bps
115	CONNECT 25333	Connected at 25333 bps
116	CONNECT 26666	Connected at 26666 bps

*EC is added to these result codes when the extended result codes configuration option is enabled. EC is replaced by one of the following codes, depending on the type of error control connection:

V42bis – V.42 error control (LAP-M) and V.42bis data compression
V42 – V.42 error control (LAP-M) only
MNP5 – MNP 4 error control and MNP 5 data compression
MNP4 – MNP 4 error control only
NoEC – No error control protocol).

Chapter 2 – Fax Class 1 and Class 1.0 Commands

Fax I/O Processing

The fax I/O interface supports asynchronous serial and parallel interfaces. The character format is 8 bit 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 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.

DTE-to-Modem Transmit Data Stream

Characters Detected

<DLE><data>
<DLE><ETX>
<DLE><DLE>

Action Taken

Delete <DLE><data> characters.
Recognize as a string terminator and take appropriate action.
Replace with single <DLE> character.

Modem-to-DTE Receive Data Stream

Characters Detected

<DLE>

Action Taken

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 and Fax Class 1.0 commands are identified in Table 3-1.

Table 3-1. Fax Class 1 and Fax Class 1.0 Commands

Command/Parameter	Function	Applicable in Fax Class 1	Applicable in Fax Class 1.0
+FCLASS=<class>	Select, read or test service class	X	X
+FAA=<value>	Auto answer enable	-	X
+FAE=<value>	Auto answer enable	X	X
+FTS=<time>	Stop transmission and pause	X	X
+FRS=<time>	Wait for silence	X	X
+FTM=<mod>	Transmit data with <mod> carrier	X	X
+FRM=<mod>	Receive data with <mod> carrier	X	X
+FTH=<mod>	Transmit HDLC data with <mod> carrier	X	X
+FRH=<mod>	Receive HDLC data with <mod> carrier	X	X
+FAR=<off/on>	Adaptive reception control	-	X
+FCL=<time>	Carrier loss timeout	-	X
+FDD=<value>	Double escape character replacement control	-	X
+FIT=<time>, <action>	DTE inactivity timeout	-	X
+FPR=<rate>	Fixed DTE Rate	-	X
+FMI?	Report manufacturer ID	-	X
+FMM?	Report model ID	-	X
+FMR?	Report revision ID	-	X
+FLO	Flow Control	-	X
&K	Local DTE-modem flow control (see Call Control Section)	X	X
A	Answer	X	X
D<string>	Dial	X	X
H	Hang-up (see Call Control Section)	X	X
X stands for Applicable. - stands for Not Applicable.			

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=<mod> 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=<mod> 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 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 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=<mod> 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 for a minimum of one second and continues to transmit 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=<mod> 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 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.

Commands and Parameters

Mode Entry Commands

+FCLASS=1 Select Facsimile Class 1 Mode

+FCLASS=1 selects the Fax Class 1 Mode. The Fax Class 1 Mode commands and responses described in this section are applicable when command +FCLASS=1 as shown in Table 3-1.

+FCLASS=1.0 - Select Facsimile Class 1.0 Mode

+FCLASS=1.0 selects the Fax Class 1.0. The Fax Class 1.0 Mode commands and responses described in this section are applicable when command +FCLASS=1.0 as shown in Table 3-1.

Mode Commands

Command: +FAA Auto Answer Enable - Class 1.0

Description:

This command enables or disables fax adaptive answer. This command operates identically to the +FAE command.

Defined Values:

<value> Decimal number corresponding to the selected option.

0 Disable data /fax auto answer mode. (Default.)

1 Enable data /fax auto answer mode. The modem determines the calling type and issues DATA result code (13) if the caller is a data modem or issues FAX result code (15) if the caller is a fax modem.

Command: +FAE Auto Answer Enable - Class 1 and 1.0

Description:

This command enables or disables fax adaptive answer. This command operates identically to the +FAA command.

Defined Values:

<value> Decimal number corresponding to the selected option.

0 Disable data /fax auto answer mode. (Default.)

1 Enable data /fax auto answer mode. The modem determines the calling type and issues DATA result code (13) if the caller is a data modem or issues FAX result code (15) if the caller is a fax 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.

Command: +FTS Transmit Silence

Description:

This command causes the modem to terminate a transmission and wait for <time> 10-ms intervals before responding with the OK result code.

Defined Values:

<time> Decimal number from 0 (default) to 255 that specifies the length of time in 10-ms intervals to delay before responding with the OK result code after terminating the session.

Result Codes:

OK Reported when transmission has been terminated for the specified amount of time.

ERROR <value> is invalid or this command is issued while the modem is on-hook.

Reporting Supported Range of Parameter Values:

Command: +FTS=?

Response: +FTS: <time> range

Example: +FTS: 0-255.

Command: +FRS Receive Silence

Description: This command causes the modem to listen and report an OK result code when silence has been detected on the line for the specified period of time. This command will terminate when the required period of silence is detected or when the DTE sends the modem another character other than XON or XOFF, which is discarded. In either event, the OK result code is returned. This command is aborted if any character is received from the DTE after receipt of the command but before the time delay elapses. In this case, the modem discards the aborting character and issues an OK result code.

Defined Values: <time> Decimal number from 0 (default) to 255 which specifies the length of time in 10-ms intervals to delay before responding with the OK result code after detecting silence on the line.

Result Codes: OK Reported when silence has been present on the line for the specified amount of time or when the DTE sends the modem a character other than XON or XOFF.
ERROR <value> is invalid or this command is issued while the modem is on-hook.

Reporting Supported Range of Parameter Values:
Command: +FRS=?
Response: +FRS: <time> range
Example: +FRS: 0-255

Command: +FTM Transmit Facsimile

Description: This command causes the modem to transmit data using the modulation defined below. When a valid <mod> value is entered, the modem transmits the proper training sequence in the selected mode, followed by constant 1 bits until data is received from the DTE. The modem also returns the CONNECT result code at the beginning of the training sequence.

Defined Values: <mod> Decimal number corresponding to the selected modulation mode and data rates shown in Table 3-2.

Table 3-2. Fax Class 1 and Fax Class 1.0 Modulation Modes and Rates

<mod>	Modulation	Training	Modulation Mode and Rate
3	V.21		300 bps
24	V.27 ter		2400 bps
48	V.27 ter		4800 bps
72	V.29		7200 bps
73	V.17	Long	7200 bps long
74	V.17	Short	7200 bps short
96	V.29		9600 bps
97	V.17	Long	9600 bps long
98	V.17	Short	9600 bps short
121	V.17	Long	12000 bps long
122	V.17	Short	12000 bps short
145	V.17	Long	14400 bps long
146	V.17	Short	14400 bps short

Result Codes: CONNECT – Reported when the modem begins the training sequence after receipt of a valid <mod> value.
 ERROR – If the modem transmit buffer becomes empty and the last transmitted character is NUL (00), the modem continues to transmit NULs until the DTE sends more data or five seconds elapses. After five seconds elapse with an empty transmit buffer, the modem will turn off the transmit carrier, return to the command state, and report the ERROR result code.
 OK – If the modem's transmit buffer becomes empty and the last transmitted character is not NUL, the modem will turn off the transmit carrier, return to the command state, and report the OK result code.

Reporting Current or Selected Values:
 Command: +FTM?
 Response: +FTM: <mod>
 Example: +FTM: 98 For V.17 9600 bps.

Reporting Supported Range of Parameter Values:
 Command: +FTM=?
 Response: +FTM: (<mod> range)
 Example: +FTM: 3,24,48,72,73,74,96,97,98,121,122,145,146

Command: +FRM Receive Facsimile

Description: This command causes the modem to enter the receiver mode using the modulation defined below.

Defined Values: <mod> Decimal number corresponding to the selected modulation mode and data rates shown in Table 3-2.

Reporting Current or Selected Values:
 Command: +FRM?
 Response: +FRM: <mod>
 Example: +FRM: 98 for V.17 9600 bps.

Reporting Supported Range of Parameter Values:
 Command: +FRM=?
 Response: +FRM: (<mod> range)
 Example: +FRM: 3,24,48,72,73,74,96,97,98,121,122,145,146

Result Codes: CONNECT – Reported when the selected carrier is detected.
 +FCERROR – Reported if another carrier is detected and FAR=0; the modem then returns to the command state.
 NO CARRIER – Reported if loss-of-carrier is detected.
 OK – Reported if the DTE sends any character to the modem other than XON or XOFF while operating in configured flow control from the DTE; the modem then returns to the command state.

Command:	FTH	Transmit Data with HDLC Framing
Description:		This command causes the modem to transmit data using HDLC protocol and the modulation defined below.
Defined Values:		<mod> Decimal number corresponding to the selected modulation mode and data rates shown in Table 3-2.
Result Codes:		CONNECT Reported for either of two conditions: <ol style="list-style-type: none"> 1. At the beginning of transmission of the training pattern for the selected modulation. 2. If the Final Frame bit is 0. OK Reported for either of two conditions: <ol style="list-style-type: none"> 1. If the Final Frame Bit is 1. 2. If the DTE sends only <DLE><ETX> (a null frame) while transmitting flags. ERROR – Reported if five seconds elapse from the time when the modem reported the CONNECT result code without any additional data transmitted from the DTE; the modem then turns off carrier and returns to the command mode.
Reporting Current or Selected Values:		Command: +FTH? Response: +FTH: <mod> Example: +FTH: 98 For V.17 9600 bps.
Reporting Supported Range of Parameter Values:		Command: +FTH? Response: +FTH? Example: +FTH: 98 For V.17 9600 bps.
 Command:	 +FRH	 Receive Data with HDLC Framing
Description:		This command 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.
Defined Values:		<mod> Decimal number corresponding to the selected modulation mode and data rates shown in Table 3-2.
Reporting Current or Selected Values:		Command: +FRH? Response: +FRH: <mod> Example: +FRH: 98 For V.17 9600 bps.
Reporting Supported Range of Parameter Values:		Command: +FRH? Response: +FRH? Example: +FRH: 98 For V.17 9600 bps.
Result Codes:		CONNECT Reported for either of two conditions: <ol style="list-style-type: none"> 1. When the selected carrier is detected with an HDLC flag. 2. If the DTE sends another +FTH=<MOD> command after sending the result code indicating frame reception is complete. +FCERROR – Reported if a different carrier is detected and FAR=0. NO CARRIER – Reported if loss of carrier is detected. OK – Reported for either of two conditions: <ol style="list-style-type: none"> 1. If a frame was received correctly. 2. If the DTE sends any character other than XON or XOFF while the modem is in the configured flow control. ERROR – Reported if a frame was received in error.

Service Class 1 Commands

Command: **+FAR** **Adaptive Reception Control**

Description: If Adaptive Reception is enabled, the modem adaptively detects the selected message carrier or V.21 control messages. If the expected carrier is detected, the modem operates as specified in the respective +FRM=<mod or +FRH=<mod commands. If V.21 flag preamble is detected instead, the modem issues a +FRH:3 intermediate result code, and then executes an implied +FRH=3 command.

Defined Values: <value> Decimal number corresponding to the selected option.
0 Disable Adaptive Reception. (Default.)
1 Enable Adaptive Reception.

Reporting Current or Selected Values:
Command: +FAR?
Response: +FAR: <value>
Example: +FAR: 0 For the default setting.

Reporting Supported Range of Parameter Values:
Command: +FAR=?
Response: +FAR: (<value> range)
Example: +FAR: (0,1)

Command: **+FCL** **Carrier Loss Timeout**

Description: This parameter allows the DTE to select the modem's loss-of-carrier delay between initial loss-of-carrier and qualified loss-of-carrier, when the modem will give up and exit a receive mode. Intermediate (less than FCL timeout) loss-of-carrier should be indicated by insertion of the SQ-BAD signal quality indicator in the received data stream.
In unframed receive modes, if the modem detects RTC as described in Recommendation T.30 prior to initial loss of the high speed carrier, or if the modem detects V.21 carrier after initial loss of high speed carrier, then the modem immediately accepts the loss-of-carrier as qualified, without waiting for the FCL timer to expire.
In HDLC receive modes, if the modem detects HDLC abort prior to initial loss of the high speed carrier, or if the modem detects V.21 carrier after initial loss of high speed carrier, then the modem immediately accepts the loss-of-carrier as qualified, without waiting for the FCL timer to expire.

Defined Values: <value> Decimal number representing the loss-of-carrier delay time in units of 100 ms. The range is 0 - 255.

Reporting Current or Selected Values:
Command: +FCL?
Response: +FCL: <time>
Example: +FCS: 0 For the default setting.

Reporting Supported Range of Parameter Values:
Command: +FCL=?
Response: +FCL: (time range)
Example: +FCL: (0-255)

Command: +FDD Double Escape Character Replacement

Description: This parameter conditions the use of the ~DLE~SUB~ pair to encode consecutive <1/0 <1/0 in data. This may be used to prevent unbound expansion of data that contains many <1/0 patterns.

Defined Values: <value> Decimal number corresponding to the selected option. For modem decode of <DLE><SUB>, the defined range are:
 0 <DLE> <DLE> or discard (default and only)
 1 <DLE> <DLE> (not supported)
 For modem encoding of <1/0> <1/0>the defined values are:
 0 <DLE> <DLE> <DLE> <DLE> (default and only)
 1 <DLE> <SUB> (not supported)

Reporting Current or Selected Values:
 Command: +FDD?
 Response: +FDD: <value>
 Example: +FDD: 0 For the default setting.

Reporting Supported Range of Parameter Values:
 Command: +FDD=?
 Response: +FDD: (<value> range)
 Example: +FDD: (0)

Command: +FIT DTE Inactivity Timeout

Description: This command specifies a DTE inactivity timeout value that allows the modem to break away from an unsuccessful connection attempt at any stage of a facsimile transfer. The DTE inactivity timer operates only while the modem is off-hook.

Defined Values: <time> The <time> parameter indicates the DTE inactivity timeout in seconds. The value of 0 indicates that timeout is disabled (default). The required timeout range is 1 to 255 seconds. The inactivity timer starts when the modem has taken some action that requires DTE response. If the DTE does respond, the modem resets the inactivity timer. Inactivity timer related events are listed in Table 3-3.
 <action> The <action> parameter has two meanings.
 0 Upon timeout, the modem will go on-hook, executing an implied ATH command; then reset to +FCLASS 0.
 1 Upon timeout, the DCE will only go on-hook.

Reporting Current or Selected Values:
 Command: +FIT?
 Response: +FIT: <time> ,<action>
 Example: +FIT: 0,0 For the default settings.

Reporting Supported Range of Parameter Values:
 Command: +FIT?
 Response: +FIT: (<time> range), (<action> range)
 Example: +FIT: (0-255),(0-1)

Table 3-3. Inactivity Timer Start and Stop Events

On-line state	Start timer event	Stop timer event
Waiting for a command	modem sends final result code	DTE sends AT or "at"
Waiting for transmit data	modem sends CONNECT after +FTM or +FTH command	DTE sends data
Waiting for transmit data	modem sends <XON or sets CTS ON	DTE sends data
Waiting to deliver received data	modem sends <XOFF after +FRM or +FRH command	DTE sends <XON
Waiting to deliver received data	DTE sets V.24 Ckt 133 OFF after +FRM or +FRH command	DTE sets V.24 Ckt 133 ON

Command:	+FPR	Fixed DTE Rate
Description:		This numeric extended-format parameter specifies the data rate at which the modem will accept commands during on-line operation. It may be used to select operation at rates at which the modem is not capable of automatically detecting the data rate being used by the DTE. Specifying a value of 0 disables the function and allows operation only at rates automatically detectable by the modem. The specified rate takes effect following the issuance of any result code(s) associated with the current command line. The <rate> specified does not apply in Online Data State if Normal Mode (Direct Mode) of operation is selected.
Syntax:		+FPR=<rate code>
Defined Values:		<rate code> Specifies the DTE-modem interface operation rate in bits/s with a rate code. The available rate codes are: 0 Automatic detection (default) 1 2400 bits/s (executes +IPR=2400) 2 4800 bits/s (executes +IPR=4800) 4 9600 bits/s (executes +IPR=9600) 8 19200 bits/s (executes +IPR=19200) 10 38400 bits/s (executes +IPR=38400) 18 57400 bits/s (executes +IPR=57400) If unspecified or set to 0, automatic detection is selected and the character format is also forced to autodetect, +ICF=0. If the rate specified is not supported by the modem, an ERROR result code will be returned.
Reporting Current or Selected Values:		Command: +FPR? Response: <rate code> Example 1: 0 For automatic rate detection. Example 2: 18 For 57600 bits/s.
Reporting Supported Range of Parameter Values:		Command: +FPR=? Response: (<rate code> range) Example: (0,1,2,4,8,10,18)
Command:	+FMI?	Request Manufacturer Identification
Description:		This command causes the modem to report the modem product manufacturer.
Syntax:		+FMI?
Typical Response:		Multi-Tech OK
Command:	+FMM?	Request Model Identification
Description:		This command causes the modem to report the modem product model.
Syntax:		+FMM?
Typical Response:		V90 OK
Command:	+FMR?	Request Revision Identification
Description:		This command causes the modem to transmit one or more lines of information text identifying the modem version, revision level, or date.
Syntax:		+FMR?
Typical Response:		V3.001-V90_2M_DLS OK

Command:	+FLO	Flow Control
Description:	This parameter allows the DTE to identify and select the type of flow control used.	
Syntax:	+FLO=<method>	
Defined Values:	<method> Decimal number corresponding to the selected option. 0 XON/XOFF and RTS/CTS flow control turned off. 1 Use XON/XOFF flow control in either direction. 2 Use RTS for flow control of the modem by the DTE; use CTS for flow control of the DTE by the modem.	
Reporting Current or Selected Values:	Command: +FLO? Response: +FLO: <method> Example: +FLO: 0 For the default setting.	
Reporting Supported Range of Parameter Values:	Command: +FLO=? Response: +FLO: (<method>range) Example: +FLO: (0-2)	
Result Codes:	OK <method> = 0-2. ERROR Otherwise.	

Examples

Examples of calling (transmitting) and answering (receiving) one page using Fax Class 1 commands are shown in Table 3-4 and Table 3-5, respectively. The examples show the interchange between the DTE and the modem for various cases. Comments are included to explain how to handle various situations. Commands and responses are in upper case and comments are in lower case. All streams of data denoted by <..frame> are terminated by the <DLE><ETX> characters.

Table 3-4. Fax Class 1 Calling Sequence (Transmitting a Single Page)

DTE Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FCLASS=1	OK	Set Class 1		
ATDT<string>	CONNECT <NSF frame> <DLE><ETX> OK	Dial and send CNG Look for V.21 Detect flags	Answer send CED, V.21 Send HDLC flags Send NSF frame	AT+FRH=3 implied by dialing with +FCLASS=1.0
AT+FRH=3	CONNECT <CFI frame data> <DLE><ETX> OK	Detect flags get CSI get FCS accept FCS	send CSI frame check FCS	Frame status OK
AT+FRH=3	CONNECT <DIS frame data> <DLE><ETX> OK	Detect flags get DIS get FCS accept FCS	send DIS frame check FCS	DTE must detect final frame bit to anticipate loss of carrier
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	
AT+FRH=3 <TSI frame data> <DLE><ETX> <DCS frame data> <DLE><ETX>	CONNECT CONNECT OK	send V.21 carrier send flags send TSI frame send FCS send DCS frame send FCS, flags drop carrier	detect carrier detect flags get TSI frame get DCS frame	Final frame bit clear tells the modem to expect another frame. Final frame bit set tells the modem not to expect another frame
AT+FTS=8; +FTM=96 <TCF data pattern> <DLE><ETX>	CONNECT OK	wait 80 ms send V.29 carrier send TCF data drop carrier	detect carrier get TCF data	
AT+FRH=3	CONNECT <CFR frame data> <DLE><ETX> OK	detect carrier detect flags get CFR frame check FCS accept FCS	send V.21 carrier send flags get CRF frame send FCS	Final frame bit set. frame OK
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	
AT+FTM=96 <page image data> <DLE><ETX>	CONNECT OK	send V.29 carrier send page data drop carrier	detect carrier receive page	
AT+FTS=8; +FRH=3 <EOP frame data> <DLE><ETX>	CONNECT OK	wait 80 ms send V.21 carrier send flags send EOP frame send FCS drop carrier	detect carrier detect flags receives EOP	final frame
AT+FRH=3	CONNECT <MCF frame data> <DLE><ETX> OK	detect carrier detect flags get MCF frame check FCS accept FCS	send V.21 carrier send flags get MCF frame send FCS	Final frame bit set. frame OK

DTE Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	
AT+FRH=3 <DNC frame> <DLE><ETX>	CONNECT OK	send V.21 carrier send flags send DNC frame send FCS drop carrier	detect carrier detect flags receive DC|NC	final frame
ATH0	OK	hang up	hang up	

Table 2-5. Fax Class 1 Answering Sequence (Receiving a Single Page)

DTE Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FCLASS=1	OK	Set Class 1		
	RING<-	detect ringing	dials [,send CNG]	
ATA <CSI frame data> <DLE><ETX> <DIS frame data> <DLE><ETX>	CONNECT CONNECT OK	off-hook, send CED, send V.21 carrier send flags send CSI frame send FCS send flags send DIS data send FCS and flags drop carrier	get CED, detect carrier detect flags receive CSI get FCS get flags get DIS get flags	AT+FRH=3 implied by answering with +FCLASS=1.0. not final frame final frame
AT+FRH=3	CONNECT <TSI frame data> <DLE><ETX> OK	detect carrier detect flags receive TSI receive FCS accept FCS	send V.21 carrier send flags send TSI frame send FCS	frame OK
AT+FRH=3	CONNECT <DCS frame data> <DLE><ETX> OK	receive DCS receive FCS accept FCS	send DCS frame send FCS	final frame bit set frame OK
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	DTE did not check final frame bit and issued +FRH=3
AT+FTM=96	CONNECT <TCF data> <DLE><ETX> OK	detect carrier receive TCF detect loss-of-carrier	wait 75 ms send V.29 carrier send TCF data drop carrier	
AT+FRH=3 <CFR frame data> <DLE><ETX>	CONNECT OK	send V.21 carrier send flags get CRF frame send FCS drop carrier	detect carrier detect flags receive CFR	final frame
AT+FTM=96	CONNECT <page image data> <DLE><ETX> NO CARRIER	detect carrier receive page detect loss-of-carrier	send V.29 carrier send page data drop carrier	
	CONNECT <EOP frame data> <DLE><ETX> NO CARRIER	detect carrier detect flags receive EOP receive FCS accept FCS	wait 75 ms send V.21 carrier send flags send EOP frame send FCS	frame OK

DTE Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	
AT+FRH=3 <MCFame data> <DLE><ETX>	CONNECT OK	send V.21 carrier send flags get MCF frame send FCS accept FCS	detect carrier detect flags receive MCF frame	final frame
AT+FRH=3	CONNECT <DCN frame data> <DLE><ETX> OK	detect carrier detect flags receive DCN receive FCS accept FCS	send V.21 carrier send flags send DCN frame send FCS	frame OK
AT+FRH=3	NO CARRIER	detect loss-of-carrier	drop carrier	end of session
ATH0	OK	hang up		

Chapter 3 – Fax Class 2 and 2.0/2.1 Commands

Introduction

This chapter summarizes the fax Service Class 2 and Service Class 2.0/2.1 command sets as implemented in Multi-Tech Systems, Inc. modems. The Service Class 2.0 command set applies to facsimile communications at speeds up to 14 400 bits per second (bps). The Service Class 2.1 command set is a modification of the Class 2.0 command set for facsimile communications at V.34 speeds up to 33 600 bits per second (bps), as documented in ITU-T T.32 Amendment 1. Because the two command sets differ only in subparameter values for a few Class 2.1 commands, they are treated here as a single Class 2.1 command set with differences noted as appropriate.

The Multi-Tech implementation of Class 2.1 follows ITU-T Recommendation T.32 as amended, except for a few subparameter values. Again, differences are noted as appropriate.

This Chapter also summarizes the Multi-Tech implementation of the Service Class 2 command set, which was based on EIA proposed standard TIA-592 (August 1990). The complete Multi-Tech Class 2 Developer's Kit can be downloaded from

<http://www.multitech.com/DOCUMENTS/manuals/82006502.pdf>. EIA/TIA documents can be purchased from Global Engineering Documents at <http://global.ihs.com/>.

Please note that the Class 2 and Class 2.0 commands though similar in outline are sometimes quite different in detail. Class 2 is a proposed early version of Class 2.0 that was never approved, but was widely implemented by modem manufacturers. As a result, all implementations of Class 2 are non-standard and manufacturer-specific. Class 2.0 is the version of Class 2 that was approved by the ITU after substantial changes to the original proposal. Major changes include a shortening of command names to three characters, a change from decimal values to hexadecimal values, the elimination of some commands, and the addition of others.

This chapter is organized so that Class 2 commands are described with and compared to the equivalent Class 2.1 commands.

AT Command Implementation

The best way to get an understanding of how Class 2.1 commands or responses are used is to present an example of the transmission and reception of a one-page fax using Class 2.1.

Below are the commands and responses given to and returned from the transmitting and receiving modems. Commands are shown in upper case, responses in lower case.

Transmitting Modem			Receiving Modem		
Line #	Command/response	Comments	Line #	Command/response	Comments
T1	AT+FCLASS=2.1	Set class to originate as a fax modem	R1	AT+FCLASS=2.1	Set class to answer as a fax modem. Tell the modem the host can receive documents and to auto-detect the calling modem. Required setting: +FCLASS=2.1
T2	ok		R2	ok	
	AT+FNR = 1,1,1,1	Enable all fax responses.		AT+FNR = 1,1,1,1	Enable all fax responses.
T3	AT+FLI="666 6676"	Set local fax ID	R3	AT+FLI="555 1212"	Set local fax ID
T4	ok		R4	ok	
T5	ATDT5551212	Dial the receiving fax modem	R5	ring	
T6	+FCO	Fax connection received			
T7	+fci:"555 1212"	Remote fax's identification string			
T8	+fis:0,5,0,2,0,0,0,0	Remote fax's capabilities			
T9	ok				
T10	AT+FDT	Begin negotiation and page transmission			
			R7	+FCO	Fax connection received
			R8	+fti:"666 6676"	Remote fax's identification string
			R9	+fcs:0,5,0,2,0,0,0,0	Negotiated fax parameters (speed may change)
			R10	ok	
			R11	AT+FDR	Begin page reception
T11	+fcs:0,5,0,2,0,0,0,0	Negotiated fax parameters	R13	+fcs:0,5,0,2,0,0,0,0	Final negotiated fax parameters
T12	connect	Ready for page data	R14	connect	Ready to receive page data
T13			R15	<DC2>	

Transmitting Modem			Receiving Modem		
Line #	Command/response	Comments	Line #	Command/response	Comments
T14	<page data>	Send T.4 formatted page data	R16	<page data>	Receive T.4 formatted page data
T15	<DLE><EOP>		R17	+fps:1000,0,0,0	1000 lines received
T16		This is the last page	R18	+fet:2	This is the last page
			R19	ok	
			R20	AT+FDR	Send page received OK message
T18	+fhs:0	Send one page done	R21	+fhs:0	Receive one page done
T19	ok		R22	ok	

We can now use the example to help explain the terminology for the fax command extensions.

Modes of Interaction

The modem has three modes of interaction: AT command mode, command execution mode, and data transfer mode.

In AT command mode, serial data sent to the modem is interpreted as commands when preceded by the characters *AT*.

Command execution mode follows AT command mode when an action command, such as a dialing command, is sent to the modem. The modem responds to an action command by displaying responses that indicate the progress of the command and also information received from the remote fax modem. If serial data is received at that point, the fax is aborted and the phone call terminated.

Data transfer mode begins after a +FDT or +FDR command is entered from AT command mode, the command is executed, and a *CONNECT* response is given. When a +FDT command is used to enter data transfer mode, the serial data sent to the modem should be image data for the page being transmitted, as specified by the ITU-T T.4 standard. When a +FDR command is used to enter data transfer mode, the serial data received from the modem should be image data for the page currently being received.

AT Command Mode

In AT command mode, both regular AT commands and fax AT commands can be sent. Regular AT commands are used to control data modem functions and functions common to both modem and fax operation, such as dialing (ATD) and answering (ATA). Fax AT commands begin with the characters +F followed by a command name followed by either “?” if reading a parameter, “=” followed by a parameter value if setting a parameter, or “=?” if inquiring the valid values of a parameter. Any AT command that follows a fax AT command must be separated from it by a semicolon.

Fax AT command types. There are two types of fax AT commands: action commands and parameter commands. Action commands initiate a sequence of events that change command mode to command execution mode, and therefore do not execute instantaneously. Because of this mode change, an action command must be the last command in a command line. In contrast, parameter commands execute immediately; therefore more than one can appear in the same command line.

Parameter command types. There are three types of parameter commands: set a parameter, read a parameter, and read the valid values for a parameter.

Note: When receiving fax responses from the modem, the state of the regular AT parameter V is important. If verbose mode is enabled (set by issuing the ATV1 command), and then all responses will be preceded and followed by a <CR><LF> combination. If terse mode is enabled (set by issuing the ATV0 command), and then all responses will be followed by <CR> only. Also, regular AT responses are affected by the same V parameters (e.g., verbose response: OK, terse response: 1). All examples in this chapter assume verbose mode.

Responses. When a parameter is set, the response is OK if the parameter value is valid, and ERROR if the parameter value is invalid. When a parameter is read, the response has the following format: +F<parameter_name>=<value>. When the valid values for a parameter are requested, the response is given as a valid parameter string as described below. When action commands are given, responses may be given to report the progress of the action command. For example, the ATD command may give the responses +FCO, +FIS:0,2,2,2,0,0,0,0 before the OK response is given.

Responses to action commands have the following format:

```
+F<parameter_name>:<value>
```

Parameter types. There are three types of parameters: numeric, character string, and compound.

Numeric parameters are hexadecimal numbers in the range 0–FFh (0–255 decimal) or 0–FFFFh (0–65535 decimal), depending on the parameter being set or read. Any number of leading zeros is permissible. A valid values string for numeric parameters consists of a list of numbers and/or number ranges separated by commas. Number ranges consist of two values separated by a hyphen. For example, (A, 14-17, 1e) means the valid parameter values are Ah, 14h, 15h, 16h, 17h, and 1Eh (10, 20, 21, 22, 23, and 30 in decimal notation).

String parameters consist of a string of characters enclosed by double-quote characters. The string may not contain non-printable characters or double-quote characters. A valid values string for string parameters consists of a list of valid character values and character value ranges in hexadecimal format separated by commas and enclosed in parentheses. For example, (20, 2b, 30-39) means the string can consist of the space character (20h), the plus character (2Bh), and the characters 0–9 (30h–39h).

Compound parameters consist of a list of numeric and string parameters separated by commas. For example, the compound parameter DIS consists of eight numeric parameters set by the following command AT+FIS=*n,n,n,n,n,n,n,n*). It is possible to omit values from a compound parameter either by omitting values in the parameter string or by truncating the parameter string. For example, the command AT+FIS=,,2,0 sets only the third and fourth values of the DIS parameter and leaves the rest unchanged. Note that when you omit leading parameters, you must leave their separation commas as placeholders, but trailing parameters and their commas can simply be omitted. It is possible to receive a compound parameter response from the modem that will have missing values. For example, the +FPS response sometimes has only two values (+FPS:1,1134) and other times has five values (+FPS:1,1134,30,4,0), depending on the setting of the +FCQ parameter). A valid values string for a compound parameter consists of a valid values string for each parameter enclosed in parentheses and separated by commas. Example: +FIS (0-1), (0-3), (0-4), (0-2), (0), (0), (0), (0-7).

The following table illustrates how each of the parameter types is set or read, with typical responses.

Parameter type	Set	Read	Read valid values
Numeric	AT+FLP=1 ok	AT+FLP? 1 ok	AT+FLP=? 0,1 ok
String	AT+FLI="123" ok	AT+FLI? "123" ok	AT+FLI=? (20) (32 -127) ok
Compound	AT+FIS=,,2,0 ok	AT+FIS? 0,1,1,0,0,0,0,4 ok	AT+FIS=? (0-1), (0-3), (0-4), (0-2), (0), (0), (0-7) ok

Command Execution Mode

In command execution mode, responses indicate the progress of an action command. Response format is the same as the format of a parameter that is read except that "=" following the parameter name is replaced by ":". All action commands can be aborted by sending a single byte of serial data to the modem while it is in command execution mode. This not only aborts the command, but initiates the fax disconnect sequence.

Data Transfer Mode

Data transfer mode is entered after the *CONNECT* response is given (or a 1 response is given in terse mode). This is initiated by either a +FDT or +FDR action command.

When the connect response is initiated by a +FDT command, any data sent to the modem after the connect response is sent across the phone line to the receiving fax modem. This data is a compressed bit map for the page being transmitted. It must be formatted according to the ITU-T standard T.4 (or according to the T6 standard, in the case of MMR compression). When data is sent to the modem, single DLE characters (ASCII 10h) are replaced by two DLE characters, and, for Class 2 fax only, the end of the fax page is indicated by a DLE ETX sequence (ASCII 10h followed by ASCII 03h).

When data is sent to the modem, single DLE characters (ASCII 10h) are replaced by two DLE characters, and the end of the fax page is indicated differently in different fax standards:

- in Class 2, end-of-page is indicated by a DLE ETX sequence (ASCII 10h followed by ASCII 03h);
- in Class 2.0 and Class 2.1, end-of-page is indicated by
 - DLE-EOP (ASCII 10h ASCII 2Eh)
 - DLE-MPS (ASCII 10h ASCII 2Ch)
 - DLE-EOM (ASCII 10h ASCII 3Bh)

When the connect response is initiated by a +FDR command, any data received from the modem after the connect response is data received from the transmitting fax modem. This data is a compressed bit map for the page being received, formatted according to ITU-T standard T.4 (or according to the T6 standard, in the case of MMR compression). When data is received from the modem, DLE DLE character sequences are replaced by a single DLE character. The DLE ETX character sequence indicates that the end of the fax page has been received.

The baud rate between the host and the fax modem should be at least 20 percent faster than the negotiated baud rate at which the page is transmitted between fax modems. This is because the link between the fax modems is synchronous and the link between the host and the fax modem is asynchronous. Thus, when a fax page is transmitted, fewer bits are going out of the fax modem than are coming in (8 bits per character versus 10 bits per character). If the baud rates are the same or the host-to-fax modem baud rate is less, there will be errors in the fax page, because periodically the modem will run out of data to send. Therefore, the recommended baud rate between the host and the fax modem is *at least* 38400 bps, since the fastest fax modem to fax modem baud rate is between 14400 bps and 28800 bps, with the exact rate used depending on the modem model and configuration. The same logic applies when receiving fax page data.

The baud rate is set by the speed at which the dial command is given when originating a fax call, the speed at which the answer command is given when manually answering a fax call, or the speed at which the last command is received before automatically answering the call.

Since the baud rate should be set to a minimum of 38400 bps, flow control is required on transmitting so that no data is lost. Receive flow control may be required to accommodate delays in processing the received data.

When receiving a fax in a non-error-corrected fax connection, the host should not stop the data flow for long (using the selected flow control means) lest its internal buffers overflow. The local, receiving modem has no way to stop the data from the remote modem. Therefore, if its internal buffers overflow, data loss will occur. The host must send a DC2 character (ASCII 12h) after the connect response is received before the modem will transmit the received page data to the host.

The modem can cancel a page transmission by sending a CAN character (ASCII 18h) to the host. Upon receiving the CAN character the host should send the end of page sequence (DLE-ETX) to the modem.

There are two reasons why the modem might send a cancel to the host on page transmission: First, the +FCT timeout may have occurred, which would result in a +FHS: response as the modem hung up. Second, the modem might cancel the host because it has sent enough lines for the negotiated page length. The host can also cancel page reception by sending a CAN to the modem, to which the modem will respond by sending a DLE ETX to the host and then display a +FHS: response as the modem hangs up.

If you are sending data in Class 2.0/2.1 with format conversions enabled (see Format Conversion +FFC), then you must specify the format of the data for each image parameter that is different the negotiated parameters. You must specify the data in the form of DLE sequences before the image is sent or between each image segment. The table below indicates what sequences should be sent for different image parameters.

If you are using Class 2 format, this information is provided through the use of the AT+FDT command with its optional parameters.

Fax Parameter	DLE Character to Precede Image Data
fax page width, 2048 pixels	67h
fax page width, 2432 pixels	68h
fax page width, 1216 pixels	69h
fax page width, 864 pixels	6Ah
data compression, MH	6Bh
data compression, MR	6Ch
data compression, uncompressed	6Dh * not supported
vertical resolution, standard	61h
vertical resolution, fine	62h
fax page length, A4	63h
fax page length, B4	64h
fax page length, unlimited	65h
fax page with, 1728 pixels	66h
data compression, MMR	6Fh

Commands and Responses Overview

This chapter describes three kinds of commands and responses:

Action commands. Action commands initiate a sequence of events that do not execute instantaneously, and therefore change command mode to command execution mode. An action command must be the last command in a command string.

Responses. Responses are result code messages sent to the host by the modem.

Note: Older MultiModem II modems, those with model numbers MT2834xx and lower, respond with the parameter name as a prefix to the value of the parameter value when a parameter value or range of values is queried.

For example: AT+FCLASS=2
Response Returned: **+FCLASS=2**
OK

The command name as prefix can be omitted by setting the +FV option to zero (see Phase C Data Format Parameters). If the command name prefix is omitted, then the response returned would simply be **2**.

Parameters. Parameter commands set operating conditions. Multiple parameter commands can be sent in a command string; however, semicolons must separate them. All action commands and responses are mandatory. Some parameter commands are mandatory, but others are optional. Mandatory values are specified for each command and parameter.

Action Commands

Class 2.1	Class 2	Action description
+FDR	+FDR	Begin or continue Phase C data reception*
+FDT	+FDT	Begin or continue Phase C data transmission
	+FET	End page or document command
+FIP		Initialize Class 2.0/2.1 parameters command
+FKS	+FK	Terminate session command—orderly fax abort

* Depends on the capability to receive set by +FCR.

Modem Responses

Class 2.1	Class 2	Response description
	+FCFR	Confirmation to Receive prompt
+FCO	+FCON	Facsimile connection
+FDM		Transition to data modem operation
+FVO	+FVOICE	Transition to voice operation
+FCS:	+FDCS:	Report negotiated session parameters, DCS frame information
+FIS:	+FDIS:	Report remote capabilities, DIS frame information
+FTC:	+FDTC:	Report remote capabilities, DTC frame information
+FPO	+FPOLL	Remote polling request indication
+FTI:	+FTSI:	Report remote ID, TSI
+FCI:	+FCSI:	Report remote ID, CSI
+FPI:	+FCIG:	Report remote ID, CIG
+FNF:	+FNSF:	Report received NSF frame
+FNS:	+FNSS:	Report received NSS frame
+FNC:	+FNCS:	Report received NSC frame
+FSA:		Destination subaddress
+FPA:		Selective polling address
+FPW:		Password (sending or polling)
+FFD:		File diagnostic message
+FET:	+FET:	Post page message report
+FPS:	+FPTS:	T.30 Phase C page transfer status report (post page responses)
+FHS:	+FHNG:	Call termination status
+FHR:	+FHR:	Report received HDLC frame
+FHT:	+FHT:	Report transmitted HDLC frame
+FPS:	+FPTS:	T.30 Phase C page reception
	+FV=	Prefix output on query response

Parameters for Mandatory Services

Class 2.1	Class 2	Mandatory parameter description
+FCLASS=	+FCLASS=	Service class selection
+FBO=	+FBOR=	Phase C data bit order (optional parameter in Class 2)
+FCC=	+FDCC=	Set modem capabilities
+FCQ=	+FCQ=	Copy quality checking (optional parameter in Class 2)*
+FIS=	+FDIS=	Set current session capabilities
+FCS?	+FDCS?	Current session results (read only)
+FEA=	+FREL=	Phase C Received EOL alignment (optional parameter in Class 2)*
+FLI=	+FLID=	Local fax station ID string, TSI or CSI
+FPI=	+FCIG=	Local fax station polling ID string, CIG
+FSP=	+FSPL=	Request to poll*
+FLP=	+FLPL=	Indicate document to poll
+FPS=	+FPTS=	Page transfer status*
+FFD=		File diagnostic message
+FHS?		Call termination status
+FIE=		Procedure interrupt enable
+FIT=		host inactivity timer
+FNR=		Negotiation message reporting control
+FPA=		Selective polling address
+FSA=		Subaddress
+FPP=		Packet protocol control
+FPW=		Password (sending or polling)
+FLO=	+FLO=	Set local flow control
+FPR=		Set local port rate
+FMI?	+FMFR?	Request modem manufacturer
+FMM?	+FMDL?	Request modem model
+FMR?	+FREVEV?	Request modem revision

* Depends on the capability to receive set by +FCR.

Parameters for Optional Services

Class 2.1	Class 2	Optional parameter description
+FAA=	+FAA=	Adaptive answer mode
+FAP=		Addressing & polling capabilities
	+FBADLIN=	Number of consecutive bad lines for a bad page
	+FBADMUL=	Error threshold multiplier
+FBS?	+FBUF?	Buffer size, read only
+FBU=	+FBUG=	HDLC frame reporting enable
+FCR=	+FCR=	Capability to receive
+FCT=	+FPHCTO=	host Phase C timeout
+FFC=	+FDFFC=	Data compression format conversion
	+FLNFC=	Page length format conversion
	+FVRFC=	Vertical resolution format conversion
	+FWDFC=	Page width format conversion
+FMS=	+FMINSP=	Minimum Phase C speed
+FND=		Non-standard message data indication
+FNS=		Non-standard frame FIF
+FRQ=		Receive quality thresholds
+FRY=	+FCTCRTY	CTC/ECM retry value
	+FAXERR=	Fax error value
	+FRBOR	Set receive Bit Order to Rockwell/Lucent order. *
	+FV	Display prefix on parameter queries. *

Identification Commands

Service Class Indication

A MultiModem modem will report its Service Class capabilities, both the current setting and the range of services available. This is provided by the +FCLASS parameter. Currently-defined values for the +FCLASS parameter are:

Parameter	Service Class
0	Data modem
1	Fax Service Class 1 (TIA-578, ITU-T.31)
1.0	Fax Service Class 1.0 (ITU-T T.31, Amendment 1)
2	Fax Service Class 2 (EIA 29.2)
2.0	Fax Service Class 2.0 (ITU-T T.32)
2.1	Fax Service Class 2.1 (ITU-T T.32 Amendment 1)
3-7	Reserved (not supported)
8	Voice modem
9-255	Reserved (not supported)
[None]	Not supported

The +FCLASS factory default setting is +FCLASS=0. When +FCLASS is set to other than 0 and a call is made, but the call fails or the modem is disconnected, the +FCLASS value returns to the default setting (+FCLASS=0).

Class 2.1 +FCLASS?

A modem's current Service Class setting is tested by the +FCLASS? command. The response is a single value.

Class 2 +FCLASS?

Same as Class 2.1.

Service Class Capabilities

Class 2.1 +FCLASS=?

The Service Classes available from a modem are tested by the +FCLASS=? command. The response is a string of values separated by commas. A Class 2.1 MultiModem can respond:

Example: <CR><LF>0,1,2,1.0,2.0,2.1,8<CR><LF>OK<CR><LF>.

Class 2 +FCLASS=?

A Class 2 MultiModem responds similarly; however, older Multi-Tech modems that do not support Class 2.1 report fewer options.

Service Class Selection

Class 2.1 +FCLASS=<value>

The Service Class may be set by the host from the above choices using the +FCLASS=<value> command. Once the result code is received from the modem.

Class 2 +FCLASS=<value>

Same as Class 2, except for the +FPR command. In Class 2, the serial port rate is set by the speed at which the dial command is given when originating a fax call, the speed at which the answer command is given when manually answering a fax call, or the speed at which the last command is received before automatically answering the call.

Request Manufacturer Identification

Class 2.1 +FMI?

The +FMI? command executes the V.25ter +GMI? command to request the name of the modem's manufacturer.

Example: AT+FMI?
Multi-Tech Systems
OK

Class 2 +FMFR?

The +FMFR? command requests the name of the modem's manufacturer.

Request Model Identification

Class 2.1 +FMM?

The +FMM? command executes the V.25ter +GMM? command to request the modem's model number.

Example: AT+FMM?
MT5634ZBA-V92
OK

Class 2 +FMDL?

The +FMDL? command requests the modem's model number.

Request Revision Identification

Class 2.1 +FMR?

The +FMR? command executes the V.25ter +GMR? command to request the modem's firmware revision number.

Example: AT+FMI?

OK

Class 2 +FREVP?

The +FREVP? command requests the modem's model number.

Action Commands

Action commands transfer data and punctuate sessions. They also release specific T.30 messages.

An action command with a terminating carriage return character, <CR>, in the syntax specification must be the last command on a command line. Subsequent commands on the same line as one of these action commands will be ignored.

All action commands initiate processes. The modem does not accept other commands from the host 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 other than an immediate <LF> character, flow control characters (<DC1> or <DC3>), or other characters defined for that command.

Originate a Call

Class 2.1 ATD

Syntax: ATD[<dial string>]<CR> or
ATD[<dial string>;<valid commands><CR>
All Multi-Tech MultiModems support the D command to originate a call. This Originate command is documented in the MultiModem *User Guide*.

Class 2 ATD

Same as Class 2.1.

Answer a Call

Class 2.1 ATA

Syntax: ATA <CR>
The Answer command is documented in the MultiModem User Guide.
If the Answer command is unsuccessful, the MultiModem reports an appropriate failure or error type result code, such as *NO CARRIER*.
If configured to do so by the +FAA parameter, the modem may adaptively answer as a fax modem or as a data modem. If the modem answers as a data modem, it resets the +FCLASS parameter to 0, and issues appropriate final result codes (e.g. *CONNECT*, *NO CARRIER*) to the host.

Class 2 ATA

Same as Class 2.1.

Data Transmission

Class 2.1 +FDT

Syntax: +FDT<CR>

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

In Phase B, the +FDT command releases the modem to proceed with negotiation, and to release the DCS message to the remote station. In Phase D, the +FDT command resumes transmission after the end of a previous page.

Class 2 +FDT

Syntax: +FDT[=DF,VR,WD,LN]<CR>.

Post-Page Message Release

Class 2 +FET=n

This command releases the post-page message to the remote modem. The possible values for *n* are listed in the table below.

n =	Symbol	Description
0	MPS	Multi-Page Signal
1	EOM	End of Message
2	EOP	End of Page
4*	PRI-MPS	Multi-Page Signal, with procedure interrupt
5*	PRI-EOM	End of Message, with procedure interrupt
6*	PRI-EOP	End of Procedure, with procedure interrupt

Data Reception

Class 2.1 +FDR

Syntax: +FDR<CR>

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

The modem may report the negotiated T.30 parameters with the remote ID and NSS frame information, if available. When the modem is ready to commence data transfer, it will issue a *CONNECT* response code. After the host receives the *CONNECT* response and the host is ready to accept data, it will issue a <DC2> character (12h) to the modem.

Class 2 +FDR

Same as Class 2.1.

Session Termination

Class 2.1 +FKS

Syntax: +FKS

The +FKS command causes the modem to terminate the session in an orderly manner by sending a DCN message at the next opportunity and hanging up. At the end of the termination process, the modem will report the +FHS response with a result code, go on-hook, and set +FCLASS=0.

This operation can also be invoked by using the <CAN> (cancel) character during Phase C data reception.

Class 2 +FK

Syntax: +FK

Essentially the same as Class 2.1.

Initialize Facsimile Parameters

Class 2.1 +FIP

Syntax: +FIP

The +FIP command causes the modem to initialize all Service Class 2.0/2.1 facsimile parameters to the default settings. This command does not change the setting of +FCLASS. It has the same effect as if the host had issued individual parameter setting commands.

MultiModem modems do not support multiple profiles, and thus do not support the optional +FIP=<value> syntax documented in T.32.

Class 2 There is no equivalent command in Class 2.

Modem Responses

The modem sends information responses to the host as a facsimile session proceeds. Responses convey needed information and indicate the state of the facsimile session. These responses are solicited messages, generated in execution of host action commands described in Action Commands section.

The modem precedes all of the following information responses with <CR><LF>, and follow them with <CR><LF> if in verbose mode (ATV1) or follow them with just a <CR> if in terse mode (ATV0).

T.30 Phase A Negotiation Responses

Facsimile Connection Response

Class 2.1 +FCO

Syntax: +FCO

The +FCO response indicates connection with a Group 3 facsimile station. It is released by detection of HDLC flags in the first received frame. +FCO is generated in response to an Originate command (2.3.1) or an Answer command (2.3.2).

Class 2 +FCON

Syntax: +FCON

The Class 2 response is essentially the same as the Class 2.1 response.

Transition to Data Modem, +FDM

Class 2.1 +FDM

Syntax: +FDM

The +FDM response indicates that the modem has identified that the calling device is a data modem. The modem issues this response immediately upon recognition of a data modem. The +FDM response precedes any data modem information text or result codes.

Class 2 There is no equivalent response in Class 2.

T.30 Phase B Negotiation Responses

The modem will provide the on-line status of several session parameters when they are available in the T.30 handshaking and if enabled via the +FNR subparameters. These include the remote ID string and the DIS/DCS/DTC parameters.

Report DIS/DCS/DTC Frame Information

Class 2.1 +FCS:, +FIS:, +FTC:

Syntax: +FCS:VR,BR,WD,LN,DF,EC,BF,ST,JP Current Session

Syntax: +FIS:VR,BR,WD,LN,DF,EC,BF,ST,JP Remote Identification

Syntax: +FTC:VR,BR,WD,LN,DF,EC,BF,ST,JP Request for Polling

T.32 reference: 8.4.2.1

These responses report the T.30 session parameter frames. The subparameters are described in Table 3.5.

+FCS:<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.

+FIS:<string> and +FTC:<string> report remote facsimile station capabilities and intentions. If the remote has a document to poll, a +FPO response will trail +FIS:<string>; if the remote station wants to poll, the +FTC:<string> response is generated. These messages are generated in execution of Originate, Answer, +FDT and +FDR commands.

Class 2 +FDCS:, +FDIS: +FDTC:

Syntax: +FDCS:VR,BR,WD,LN,DF,EC,BF,ST Current Session

Syntax: +FDIS:VR,BR,WD,LN,DF,EC,BF,ST Remote Identification

Syntax: +FDTC:VR,BR,WD,LN,DF,EC,BF,ST Request for Polling

The Class 2 responses are essentially the same as the Class 2.1 responses, except that Class 2 lacks the JP subparameter, and the sets of values supported for each sub-parameter is a subset of class 2.1 values. See table 3.5 for more information.

Remote Polling Indication

Class 2.1 +FPO

Syntax: +FPO

T.32 reference: 8.4.2.2

The +FPO response indicates that the remote station has a document to poll and invites the host to poll it. This response is generated in execution of Originate) Answer), +FDT) and +FDR) commands. +FSP=0 inhibits the +FPO response (2.5.1.9). The host may respond to an +FPO message with either the begin transmit command, AT+FDT, if it does not wish to poll, or the +FDR command, to indicate willingness to poll the remote station.

Class 2 +FPOLL

Syntax: +FPOLL

The Class 2 response is essentially the same as the Class 2.1 response.

Report Remote ID**Class 2.1 +FTI:, +FCI:, +FPI:**

Syntax: +FTI:"<TSI ID string>" Transmit Station ID

Syntax: +FCI:"<CSI ID string>" Called Station ID

Syntax: +FPI:"<CIG ID string>" Polling Station ID

These responses report the received remote ID string, if any. They are generated in execution of the Originate, Answer, +FDT, and +FDR commands.

The modem reports the characters in the ID string in reversed time order from the order received from the remote station. For example, if the following ID FIF character string were received (hexadecimal values):

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

The result would be:

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

Class 2 +FTSI:, +FCSI:, +FCIG:

Syntax: +FTSI:"<TSI ID string>" Transmit Station ID

Syntax: +FCSI:"<CSI ID string>" Called Station ID

Syntax: +FCIG:"<CIG ID string>" Polling Station ID

The Class 2 responses are essentially the same as the Class 2.1 responses.

Report Non-Standard Negotiation Frames**Class 2.1 +FNF:, +FNS:, +FNC:**

Syntax: +FNF:<NSF FIF string> Non-Standard Facilities

Syntax: +FNS:<NSS FIF string> Non-Standard Setup

Syntax: +FNC:<NSC FIF string> Non-Standard Commands

These responses report received non-standard negotiation frames, one response per frame. These responses are generated in execution of the Originate, Answer, +FDT, and +FDR commands.

The NSF Facsimile Information Field (FIF) frame octets are presented in hex notation, and are separated by spaces. Flags and zero bits are removed. Frame octets are reported in the order received. For each frame octet the LSB is the first bit sent or received.

Class 2 +FNSF:, +FNSS:, +FNCS:

Syntax: +FNSF:<NSF FIF string> Non-Standard Facilities

Syntax: +FNSS:<NSS FIF string> Non-Standard Setup

Syntax: +FNCS:<NSC FIF string> Non-Standard Commands

The Class 2 responses are essentially the same as the Class 2.1 responses.

Report Addressing or Password Strings**Class 2.1 +FSA:, +FPA:, +FPW:**

Syntax: +FSA:"<SUB string>" Destination Subaddress

Syntax: +FPA:"<SEP string>" Polling Address

Syntax: +FPW:"<PWD string>" Polling Password

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

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

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

```
<33><32><31><30>
```

The result would be:

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

Class 2 There are no equivalent responses in Class 2.

T.30 Phase C Page Reception Responses

Receive Page Transfer Status

Class 2.1 +FPS:

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

The +FPS:<ppr> response is generated by the modem at the end of Phase C data reception in execution of a +FDR command.

The <ppr> response is generated by the modem; it depends on the modem for T.4 or T.6 error checking capabilities, controlled by the +FCQ parameter. See Table 3.0 for <ppr> values.

The receiving modem may count lines and bad lines and report them. Values are:

- <lc> line count
- <blc> bad line count
- <cblc> consecutive bad line count
- <lbc> lost byte count due to modem buffer overflow

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

A receiving host may inspect <ppr> and write a modified value into the +FPS parameter. The modem will hold the corresponding post page response message until released by a +FDR command from the host.

Table 3.0 Class 2.1 T.30 Post Page Response Message Codes

Value	Mnemonic	Description
1	MCF	Page good.
2	RTN	Page bad; retrain requested.
3	RTP	Page good; retrain requested.
4	PIN	Page bad; retrain requested; interrupt request accepted.
5	PIP	Page good; interrupt request accepted.

Class 2 +FPTS:

Syntax: +FPTS:<ppr>,<lc>[,<blc>,<cblc>][,<lbc>]

The Class 2 response is similar to the Class 2.1 response, except that it may also use <ppr> codes 0, 6, and 7, which are not used in the Class 2.1 response.

Table 3.1 Class 2 T.30 Post Page Response Message Codes

Value	Mnemonic	Description
0	PPR	Partial page errors.
1	MCF	Page good.
2	RTN	Page bad; retrain requested.
3	RTP	Page good; retrain requested.

T.30 Phase D Post Page Responses

Post Page Message

Class 2.1 +FET:

Syntax: +FET:<ppm>

The +FET:<post page message> response is generated by a receiving facsimile modem at 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 correspond to the T.30 post page messages as described in Table 3.1.

Table 3.2 Class 2.1 Post Page Message Codes

PPM code	T.30 mnemonic	Description
0	MPS	Another page next, same document
1	EOM	Another document next
2	EOP	No more pages or documents

Class 2

+FET:

Syntax: +FET:<ppm>

The Class 2 response is similar to the Class 2.1 response, except for the different <ppm> codes described in Table 3.1.

Table 3.3. Class 2 Post Page Message Codes

PPM code	T.30 mnemonic	Description
0	MPS	Another page next, same document
1	EOM	Another document next
2	EOP	No more pages or documents
3	PPS-NULL	Another partial page next
4	PRI-MPS	Another page, procedure interrupt
5	PRI-EOM	Another document, procedure interrupt
6	PRI-EOP	All done, procedure interrupt

Call Termination with Status

Class 2.1 +FHS:

Syntax: +FHS:<hangup status code>

+FHS: indicates that the call has been terminated. The hang-up cause is reported, and stored in the +FHS parameter for later inspection. The <hsc> values are hexadecimal codes as described in Table 3.4.

+FHS:<hsc> is a possible intermediate result code to any host action command described in Action Commands section. It is always followed by the OK result code.

Class 2 +FHNG:

Syntax: +FHNG:<hangup status code>

The Class 2 response is the same as the Class 2.1 response except that the hang-up cause is stored in the +FAXERR parameter and the <hsc> values are decimal codes as described in Table 3.4.

Table 3.4. Hang-up Status Codes

Class 2.1	Class 2	Cause
00–0F	0–9	Call placement and termination:
00	0	Normal and proper end of connection
01	1	Ring detect without successful handshake
02	2	Call aborted from +FKS [FK] or <CAN>
03	3	No Loop Current
04	-	Ringback detected, no answer (timeout)
05	-	Ringback detected, answer without CED
10–1F	10–19	Transmit Phase A & miscellaneous errors
10	10	Unspecified Phase A error
11	11	No Answer (T.30 T1 timeout)
20–3F	20–39	Transmit Phase B hang-up codes
20	20	Unspecified transmit Phase B error
21	21	Remote cannot receive or send
22	22	COMREC error in transmit Phase B
23	23	COMREC invalid command received
24	24	RSPEC error
25	25	DCS sent three times without response
26	26	DIS/DTC received 3 times; DCS not recognized
27	27	Failure to train at 2400 bps or +FMS [+FMINS] value
28	28	RSPREC invalid response received
40–4F	40–49	Transmit Phase C hang-up codes
40	40	Unspecified transmit Phase C error
41	-	Unspecified image format error
42	-	Image conversion error
43	43	host to modem data underflow
44	-	Unrecognized transparent data command
45	-	Image error, line length wrong
46	-	Image error, page length wrong
47	-	Image error, wrong compression code
50–6F	50–69	Transmit Phase D hang-up codes
50	50	Unspecified transmit Phase D error
51	51	RSPREC error
52	52	No response to MPS repeated 3 times
53	53	Invalid response to MPS
54	54	No response to EOP repeated 3 times
55	55	Invalid response to EOP
56	56	No response to EOM repeated 3 times
57	57	Invalid response to EOM
58	58	Unable to continue after PIN or PIP
70–8F	70–89	Receive Phase B hang-up codes
70	70	Unspecified receive Phase B error

Class 2.1	Class 2	Cause
71	71	RSPREC error
72	72	COMREC error
73	73	T.30 T2 timeout, expected page not received
74	74	T.30 T1 timeout after EOM received
90–9F	90–99	Receive Phase C hang-up codes
90	90	Unspecified receive Phase C error
91	91	Missing EOL after 5 seconds
92	-	Bad CRC or frame (ECM mode)
93	93	modem to host buffer overflow
-	94	Bad CRC or frame (ECM or BFT mode)
A0–BF	100–119	Receive Phase D hang-up codes
A0	100	Unspecified receive Phase D errors
A1	101	RSPREC invalid response received
A2	102	COMREC invalid response received
A3	103	Unable to continue after PIN or PIP
C0–DF	120–255	Reserved for future standardization
E0–FF	-	Reserved for manufacturer-specific use

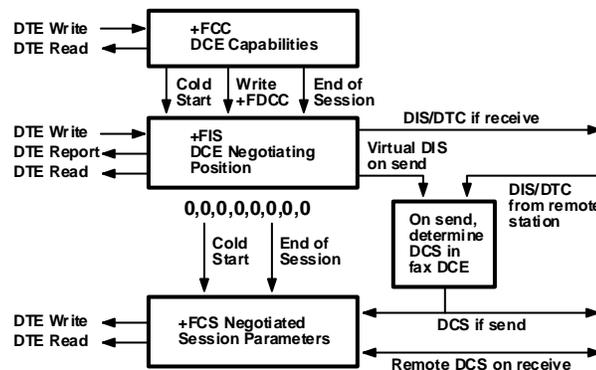
Parameter Commands

All Class 2 parameters can be read, written, and tested for the range of legal values by the modem. The general syntax is described in the AT Command section of this Chapter.

T.30 Session Parameters

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

The three primary T.30 session parameters are +FCC [FDCC], +FIS [FDIS] and +FCS [FDCS], described in 2.5.1.1–2.5.1.3. These are compound parameters using values listed in Table 3.5. The Figure below illustrates their relationships:



T.30 session parameters

Modem Capabilities Parameters

Class 2.1 +FCC=

Write Syntax: +FCC=VR,BR,WD,LN,DF,EC,BF,ST,JP

Values: See Table 3.5

Default: 1,5,0,2,0,0,0,0

+FCC allows the host to sense and constrain the capabilities of the facsimile modem, from the choices defined in ITU-T T.30. When +FCC is modified by the host, the modem will copy +FCC into +FIS.

Note: The Multi-Tech implementation does not include the T.32 subparameter WD 3 and 4 values or the EC 2 and 3 values; also, for subparameter BF only the 00 value is implemented.

Class 2 +FDCC=

Write Syntax: +FCC=VR,BR,WD,LN,DF,EC,BF,ST

Values: See Table 3.5.

Default: 1,5,0,2,0,0,0,0

The Class 2 parameter is essentially the same as the Class 2.1 parameter except that it lacks the JP subparameter, and the modem copies +FDCC into +FIS.

Current Sessions Parameters**Class 2.1 +FIS=**

Write Syntax: *+FIS=VR,BR,WD,LN,DF,EC,BF,ST,JP*
 Values: See Table 3.5
 Default: 1,3,2,2,0,0,0,0,0

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

The modem sets the +FIS parameter from the +FCC parameter on initialization, when +FCC is written, and at the end of a session.

Class 2 +FDIS=

Write Syntax: *+FCC=VR,BR,WD,LN,DF,EC,BF,ST*
 Values: See Table 3.5
 Default: 1,3,2,2,0,0,0,0

The Class 2 parameter is essentially the same as the Class 2.1 parameter except that it lacks the JP subparameter, and the +FDIS parameter is set from the +FDCC parameter.

Current Session Results**Class 2.1 +FCS?**

Read syntax: *+FCS?*
 Response: *VR,BR,WD,LN,DF,EC,BF,ST,JP*
 Values: See Table 3.5
 Default: 0,0,0,0,0,0,0,0,0

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

The +FCS parameter is set to 0,0,0,0,0,0,0,0 on initialization, on +FIP command execution, and at the beginning of a session. If the host issues a +FCS? command in the initial state, the modem will report: **<CR><LF>0,0,0,0,0,0,0,0<CR><LF>**

The contents of +FCS are spontaneously reported during execution of +FDR (2.3.5) or +FDT (2.3.3) commands by the *+FCS:VR,BR,WD,LN,DF,EC,BF,ST,JP* response, using the same compound parameter format. See T.30 Phase B Negotiation

Responses section.

Class 2 +FDCS?

Read syntax: *+FDCS?*
 Response: *+FDCS=VR,BR,WD,LN,DF,EC,BF,ST* or: *+FDCS=*
 Values: See Table 3.5
 Default: 0,0,0,0,0,0,0,0,0

The Class 2 parameter is essentially the same as the Class 2.1 parameter except that the response lacks the JP subparameter.

T.30 Session Subparameters

Several commands and responses reference T.30 session negotiated parameters. These are described by a set of common subparameters, which are described in Table 3.5. Optional parameter values are marked with an asterisk (*). Unspecified parameter values are reserved for future use.

The +FCC [+FDCC], +FIS [+FDIS], and +FCS [+FDCS] compound parameters, described in Parameter Commands sections, use these session subparameters. On writes, unspecified subparameters are unchanged.

The +FIS: [+FDIS:], +FCS: [+FDCS:], and +FTC: [+FDTC:] session report responses, described in T.30 Phase B Negotiation Responses section, also use these subparameters.

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

<CRLF>(0-1),(0-3),(0-4),(0-2),(0),(0),(0),(0-7),(0)<CRLF>

Example: +FIS=0,3,0,2,0,0,0,1,0 is interpreted as follows:

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

Table 3.5. T.30 Session Subparameter Codes

Note: Class 2.0/2.1 is shown in hexadecimal values. Class 2 is shown in decimal values.

Label	Function	Class 2.0/2.1	Class 2	Description				
VR	Vertical resolution (Note 1)	00h 01h *02h *04h *08h *10h *20h *40h *Class 2.1 only	0 1	R8 × 3.85 l/mm, (98 dpi) Normal R8 × 7.7 l/mm, (196 dpi) Fine R8 × 15.4 l/mm R16 × 15.4 l/mm 200 dpi × 100 l/25.4 mm 200 dpi × 200 l/25.4 mm 400 dpi × 400 l/25.4 mm 300 dpi × 300 l/25.4 mm				
BR	Bit rate (Note 2)	0h 1h 2h 3h 4h 5h	0 1 2 3	+FCC/+FIS description			+FCS description	
					2 400 bit/s preferred 4 800 bit/s preferred 7 200 bit/s preferred 9 600 bit/s preferred 12 000 bit/s preferred 14 400 bit/s preferred all with V.8 optional	2 400 bit/s selected 4 800 bit/s selected 7 200 bit/s selected 9 600 bit/s selected 12 000 bit/s selected 14 400 bit/s selected		
	V.34 bit rate (Class 2.1 only)	6h 7h 8h 9h Ah Bh Ch Dh Class 2.1 only Eh		16 800 bit/s preferred 19 200 bit/s preferred 21 600 bit/s preferred 24 000 bit/s preferred 26 400 bit/s preferred 28 800 bit/s preferred 31 200 bit/s preferred 33 600 bit/s preferred all with V.8 implied			16 800 bit/s selected 19 200 bit/s selected 21 600 bit/s selected 24 000 bit/s selected 26 400 bit/s selected 28 800 bit/s selected 31 200 bit/s selected 33 600 bit/s selected	
WD	Page width in pixels	0h 1h 2h	0 1 2	R8 d/mm	R16 d/mm	200 dpi	300 dpi	400 dpi
				1728	3456	1728	2592	3456
				2048	4096	2048		
				2432	4864	2432		
LN	Page length	0h 1h 2h	0 1 2	A4, 297 mm B4, 364 mm Unlimited length				
DF	Data compression format	0h 1h 3h	0 1	1-D modified Huffman (T.4) 2-D modified read (T.4) 2-D modified read (T.6)				
EC	Error correction, T.30	0h 1h	0 1 2	Disable ECM 64-byte frames, Annex A/T.30 256-byte frames, Annex A/T.30				
BF	Binary file transfer	00h	0	Disable file transfer modes				
ST	Scan time/line	0h 1h 2h 3h 4h 5h 6h 7h	0 1 2 3 4 5 6 7	VR = 0			VR > 0	
				0 ms 5 ms 10 ms 10 ms 20 ms 20 ms 40 ms 40 ms			0 ms 5 ms 5 ms 10 ms 10 ms 20 ms 20 ms 40 ms	

Label	Function	Class 2.0/2.1	Class 2	Description
JP	JPEG for color and B&W (Note 2)	00 01 02 04 08 10 20 40		Disable JPEG coding Enable JPEG coding (T.81) Full color mode Enable preferred Huffman tables (Note 3) 12 bits/pel/component No subsampling (1:1:1) Custom illuminant Custom gamut range

Notes:

- 1 For subparameter VR, values 00, 01, 02, 04, 08, 10, 20 and 40 (hexadecimal) indicate a single choice; they are the only values allowed in the +FCS parameter and +FCS: report. All values that are sums of these values shall only be used to indicate multiple capabilities; these are allowed in +FIS and +FCC parameters. For example, value 07 (01 + 02 + 04) would indicate capability for all metric-based resolutions.
- 2 For subparameter JP, values 00, 01, 02, 04 08, 10, 20 and 40 (hexadecimal) indicate a single choice. All values that are sums of these values shall only be used to indicate multiple capabilities in +FIS and +FCC subparameters and to indicate the choice in the +FCS subparameter. For example, to indicate support for JPEG, full color mode ,and no subsampling, the host should set the JP subparameter to 01 + 02 + 10 = 13h. If one or several of the values 02h to 40h are not used, that means that the default value for the subparameter (e.g. respectively: gray-scale, custom Huffman tables, 8 bit/pel/component, 4:1:1 subsampling ratio, D50 illuminant, default gamut range) is used, as defined in Annex E/T.30 and Annex G/T.4.
- 3 The modem ignores this value in •FCC and in •FIS when generating DIS or DTC frames.

Local ID String**Class 2.1 +FLI**

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

Values: 20-character printable ASCII string

Mandatory values: 20-character string, Table 3/T.30

Default: Null String

The modem generates a TSI or CSI frame if FLI is not a Null String. Table 3/T.30 includes digits 0–9, the + character, and the space character.

The modem transmits ID string characters to the remote station in reversed time order from the order in the command line. For example, if the command line

AT+FLI="+1 234 567 8901"<CR> is issued, the modem would send a CSI or TSI frame with FIF (hexadecimal) consisting of

<20><20><20><20><20><31><30><39><38><20><37><36><35><20><34>

<33><32><20><31><2B>

If less than 20 characters are specified in a non-Null String, the modem appends space characters (<20>). If the specified string is more than 20 characters in length, an ERROR result code is generated.

Class 2 +FLID

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

Valid values: 20-character printable ASCII string

Mandatory values: 20-character string, Table 3/T.30

Default value: Null String

The Class 2 parameter is essentially the same as the Class 2.1 parameter.

Local Polling ID String**Class 2.1 +FPI**

Write syntax: +FPI="<local polling ID string>"

Values: 20-character printable ASCII string

Mandatory Values: 20-character string, Table 3/T.30

Default: Null String

The modem generates a CIG frame if FPI is not a Null String. CIG is used in polling sessions. Table 3/T.30 includes digits 0–9, the + character, and the space character.

Like the +FLID command, the modem transmits ID string characters to the remote station in reversed order from the order in the command line.

Class 2 +FCIG

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

Values: 20-character printable ASCII string

Mandatory Values: 20-character string, Table 3/T.30

Default: Null String

The Class 2 parameter is essentially the same as the Class 2.1 parameter.

Non-standard Frame FIF Octet String**Class 2.1 +FNS**

Write syntax: +FNS="*hexadecimal-coded octet string*"

Values: up to 90 octets

Default: Null String

If +FNS is not a Null String, the modem sends the corresponding non-standard facilities frame. The type of frame is determined by the type of negotiation frame to be sent: NSF sent with DIS; NSS sent with DCS; NSC sent with DTC.

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

Class 2 There is no equivalent parameter in Class 2.

Indicate Document to Poll**Class 2.1 +FLP**

Write syntax: +FLP=<*value*>

Values: 0, 1

Default: 0

+FLP=0 The host has no document to poll.

+FLP=1 The host has a document ready for polling. The modem reports this to the remote station in the DIS frame. The modem resets this parameter to 0 after a polled document is sent.

Class 2 +FLPL

Write syntax: +FLPL=<*value*>

Values: 0, 1

Default: 0

The Class 2 parameter is the same as the Class 2.1 parameter except for the name.

Request to Poll**Class 2.1 +FSP**

Write syntax: +FSP=<*value*>

Values: 0, 1

Default: 0

+FSP=0 The host does not want to poll.

+FSP=1 The host can receive a polled document. The modem resets this parameter to 0 after a polled document is received.

Class 2 +FSPL

Write syntax: +FSPL=<*value*>

Values: 0, 1

Default: 0

The Class 2 parameter is the same as the Class 2.1 parameter except for the name.

Capability to Receive**Class 2.1 +FCR**

Write syntax: +FCR=<value>

Values: 0, 1

Default: 0

+FCR=0 The modem will not receive message data; also, the modem will not be able to poll a remote device. This can be used when the host has insufficient storage, or if the modem does not have a Phase C (V.27ter, V.29) demodulator. The modem can send and can be polled for a file.

+FCR=1 The modem can receive message data.

+FCR is sampled in ITU T.30 Phase B and Phase D.

Class 2 +FCR

Write syntax: +FCR=<value>

Values: 0, 1

Default: 0

The Class 2 parameter is identical to the Class 2.1 parameter.

Session Message Reporting**Class 2.1 +FBU**

Write syntax: +FBU=<value>

Valid values: 0, 1

Default value: 0

+FBU=0 Disables HDLC frame reporting.

+FBU=1 Enables the modem to report the contents of Phase B and Phase D HDLC frames to the host, as they are sent and received, in addition to other responses. Reports use the +FHT: and +FHR: responses, described in the Session Message Report Responses section of this chapter.

Class 2 +FBUG

Write syntax: +FBUG=<value>

Values: 0, 1

Default: 0

The Class 2 parameter is identical to the Class 2.1 parameter except for the name.

Negotiation Reporting**Class 2.1 +FNR**

Write syntax: +FNR=<rpr>,<tpr>,<idr>,<nsr>

Values: 0, 1 for each subparameter

Default: 0,0,0,0

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

Setting	Reference	Description
rpr=0 rpr=1	2.4.2.1	Receiver parameters are not reported; +FIS: and +FTC: reports are suppressed. Receiver parameters are reported; +FIS: and +FTC: reports are generated.
tpr=0 tpr=1	2.4.2.1	Transmitter parameters are not reported; +FCS: reports are suppressed. <i>(Note)</i> +FCS parameter is still loaded. Transmitter parameters are reported; +FCS: reports are generated.
idr=0 idr=1	2.4.2.3	ID strings are not reported; +FTI:, +FCI: and +FPI: reports are suppressed. ID strings are reported; +FTI:, +FCI: and +FPI: reports are generated.
nsr=0 nsr=1	2.4.2.4	Non-standard frames not reported; +FNF:, +FNS: and +FNC: reports suppressed. Non-standard frames reported; +FNF:, +FNS: and +FNC: reports generated.
<p>Note</p> <p>If tpr=0, the negotiated image data format will not be reported. Without that report, the host must send image data that is mandated by Recommendation T.30 (normal resolution, A4 length, 1728 width, 1-D coding) or it must enable the corresponding format conversion (+FFC). Otherwise, the data format negotiated and the data format sent might not match, causing the facsimile session to fail.</p>		

Class 2 There is no equivalent parameter in Class 2.

Address & Polling Capabilities**Class 2.1 +FAP**

Write syntax: +FAP=<sub>,<sep>,<pwd>

Values: 0 (disabled) or 1 (enabled) for each subparameter

Default: 0,0,0

The +FAP subparameters allow the host to indicate the inbound subaddressing, selective polling, and passwords capabilities to the remote station via the corresponding bits in the DIS or DTC frames: bit 47 for SEP, bit 49 for SUB, bit 50 for PWD.

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

Class 2 There is no equivalent parameter in Class 2.

Addressing & Polling Frames**Class 2.1 +FSA, +FPA, +FPW**

Write syntax: +FSA="<destination Subaddress string>"
 + FPA="<selective Polling Address string>"
 +FPW="<Password string>"

Values: 20 digit numeric ASCII string: digits 0-9, *, # and space only

Default: Null String

The modem sends the numeric string contained in +FSA, +FPA or +FPW at the times specified in Recommendation T.30, if the corresponding parameter is not a Null String. The +FPW parameter is used for the PWD frame sent with either DTC or with DCS.

The +FSA=?, +FPA=?, and +FPW=? test commands report the corresponding ranges of character values supported.

The modem transmits digit string characters to the remote station in reversed time order from the order in the command line. If less than 20 characters are specified in a non-Null String, the modem appends space characters. If the specified string is more than 20 characters in length, an ERROR result code is generated.

Class 2 There are no equivalent parameters in Class 2.

T.30 Procedure Control Parameters

The fax modem makes decisions at several nodes in the T.30 procedure. These parameters allow a host to sense or determine fax modem policy for these procedure decisions.

Page Transfer Status

Class 2.1 +FPS

Write syntax: +FPS=<ppr>

Values: 1, 2, 3

Default: 1

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

The set of <ppr> values is defined in Table 3.6. These values are also reported by the +FPS:<ppr> response to the +FDR command. The Multi-Tech implementation does not support <ppr> values 4 and 5.

Table 3.6 Class 2.1 T.30 Post Page Response Message Codes

Value	Mnemonic	Description
1	MCF	Page good.
2	RTN	Page bad; retrain requested.
3	RTP	Page good; retrain requested.
4*	PIN	Page bad; retrain requested; interrupt request accepted.
5*	PIP	Page good; interrupt request accepted.

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

A receiving host may do its own copy quality checking or decide to request a procedure interrupt from the remote station. The host will receive a report of the copy quality <ppr> as part of the +FPS:<ppr>,<lc>,<blc>,<cbic> response. The host may modify this result before it issues the next action command (e.g., +FDR), which releases the corresponding post page response to the remote facsimile station.

Class 2 +FPTS

Write syntax: +FPTS=<ppr>

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

Default value: 1

Except for the name and the range of values, the Class 2 parameter is identical to the Class 2.1 parameter.

Copy Quality Checking**Class 2.1 +FCQ**

Write syntax: +FCQ=<rq>,<tq>

Values: 0, 1 for <rq>
0 for <tq>Default: 1 for <rq>
0 for <tq>

Other values for <rq> and <tq> are not supported in the Multi-Tech implementation. The +FCQ parameter controls copy quality checking and correction by a facsimile modem. The <rq> subparameter controls copy quality checking and correction of data received from the remote station and delivered to the local host; the <tq> subparameter controls copy quality checking and correction of image data received from the local host and sent to the remote station.

The modem reports on Received Copy Quality to the host in the page status report, +FPS:<ppr>,<lc>,<b1c>,<cb1c>,<lbc>, and records it in the +FPS parameter.

+FCQ=0,0 modem receive copy quality checking is disabled; the modem will generate copy quality OK (MCF) responses to complete pages, and set +FPS=1. modem transmit copy quality checking is disabled; the host is responsible for T.4 or T.6 compliance.

+FCQ=1,0 modem receive copy quality checking is enabled; the modem will determine the recommended Post Page Message, and store it into the +FPS parameter. modem transmit copy quality checking is disabled; the host is responsible for T.4 or T.6 compliance.

Class 2 +FCQ

Write syntax: +FCQ=<value> Valid values: 0, 1

Default value: 0

This parameter controls copy quality checking by the receiving facsimile modem.

The modem will generate a page transfer report, indicated with the +FPTS=<ppr>,<lc>,<b1c>,<cb1c> response and posted in the +FPTS parameter. The +FCQ parameter setting also conditions the generation of bad line count <b1c> and consecutive bad line count <cb1c> subparameters.

+FCQ=0 The modem does no copy quality checking. The modem will generate copy quality OK (MCF) responses to complete pages, and set +FPS=1.

+FCQ=1 The modem can check 1-D Phase C data. The host must check copy quality for 2-D Phase C data. On new -V92 modems, +FCQ=1 means it will also check 2-D Phase C data.

Receive Quality Thresholds**Class 2.1 +FRQ**

Write syntax: +FRQ=<pgl>,<cbt>
 Values: 0 to 64h for <pgl>
 0 to FFh for <cbt>
 Default: 0,0

This compound parameter replaces the +BADMUL and +FBADLIN parameters used in Class 2. The modem may use it to make the "Copy Quality OK" decision in the T.30 flow chart (Figure A.7/T.30). If it is used, the modem shall judge copy quality unacceptable if either the percentage of good lines is too low or too many consecutive lines contain errors. Bad line counts are reported in the +FPS:<blc> response. A value of 0 disables either subparameter for use in copy quality checking.

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

$$100 \times (<l> - <blc>) / <l>$$

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

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

If the page is found unacceptable by either criteria, the modem shall report the value 2 for the +FPS <ppr> subparameter, and store that value into the +FPS parameter.

Class 2 +FBADMUL

Write syntax: +FBADMUL=<value>
 Values: 0–255
 Default: 20

This is one of two Class 2 parameters used to determine "Copy Quality OK" on the T.30 flow chart. The number of lines received with a bad pixel count is multiplied by this number. If the result exceeds the number of lines in the page, then the error rate is too high. A value of 20 corresponds to a 5% error rate.

A value of 0 implies that error checking is not present or is disabled.

Class 2 +FBADLIN

Write syntax: +FBADLIN=<value>
 Valid values: 0–255
 Default value: 10

This is the other Class 2 parameter used to determine "Copy Quality OK." If the number of consecutive lines in normal resolution (98 dpi) mode that have pixel count errors is equal to or greater than <value>, then the copy quality is unacceptable. If the number of consecutive lines in fine resolution (196 dpi) mode that have pixel count errors is equal to or greater than <value> × 2, then the copy quality is unacceptable. "Copy Quality Not OK" occurs if either the error percentage is too high or if too many consecutive lines contain errors. Bad line counts are reported in the +FPTS: response.

A value of 0 implies that error checking is not present or disabled.

Adaptive Answer**Class 2.1 +FAA**

Write syntax: +FAA=<value>

Valid values: 0, 1

Default value: 0

+FAA=0 The modem shall answer only as a Class 2.1 facsimile device. No automatic switching of service class shall occur based on the calling device type.

+FAA=1 The modem can answer and automatically determine whether to answer as a facsimile modem or as a data modem. If the modem automatically switches, it resets the +FCLASS parameter to 0. +FCLASS does not affect switching to Class 2.1 from other classes or switching to classes other than Class 0.

Note: If the modem reconfigures itself to data modem operation in adaptive answering, the host must reissue a new +FCLASS=2.1 command to enable subsequent Service Class 2.1 facsimile operation.

Class 2 +FAA

Write syntax: +FAA=<value>

Valid values: 0, 1

Default value: 0

+FAA=0 Constrains the modem to answer as set by +FCLASS.

+FAA=1 The modem can answer and automatically determine whether to answer as a facsimile modem or as a data modem. If the modem automatically switches, it modifies FCLASS as appropriate.

Host Phase C Response Timeout, +FCT

Write syntax: +FCT=<value>

Valid values: 0–255 in 100-millisecond units.

Default value: 30

This determines how long the modem waits for a command after reaching the end of data when transmitting in Phase C. When this time-out is reached a cancellation signal and then a +FHS:43 is issued to the host and the remote side is sent a disconnect frame.

+FPHCTO, Host Phase C Response Time-out**Class 2.1/2.0** Not Applicable.**Class 2**

Syntax: +FPHCTO=<value>

Value Values: 0 – 255

Default Value: 30

+FPHCTO=? 0-255 +FPHCTO? 30 Default value. Range: 0 - 255

This command specifies the waiting period during a fax transmission beyond which the transmission is automatically terminated with an end-of-page command.

T.30 Session Error Report, +FAXERR**Class 2.0/2.1** not supported**Class 2 +FAXERR**Read syntax: > +FAXERR= *<table value>*, read only

Valid values: 0–255; see Table 3.5 for meaning

This read only parameter indicates the cause of a hang-up. Table 3.5 shows the valid values for this parameter as well as the meaning of each value. +FAXERR is set by the modem at the conclusion of a fax session. The modem will reset this to 0 at the beginning of Phase A off-hook time.

Minimum Phase C Speed, +FMS**Class 2.0/2.1 +FMS**Write syntax: +FMS=*BR*

Valid values: 0–5, in BR subparameter codes

Default value: 0 (V.27ter @ 2400 bit/s)

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

The units are the same as those defined for the BR Bit Rate subparameter as defined in Table 3.6 in this manual.

Class 2 +FMINSWrite syntax: +FMINS=*BR*

Valid values: 0–5, in BR subparameter codes

Default value: 0 (V.27ter @ 2400 bit/s)

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

The units are the same as those defined for the BR Bit Rate subparameter, as defined in Table 3.6 in this manual.

Phase C Data Format Parameters

Data Bit Order: +FBO and +FBOR

Class 2.0/2.1 +FBO

Write syntax: +FBO=<value>

Valid values: 0, 1

Default value: 0

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

+FBO=0 Direct bit order for both Phase C data. The first bit transferred of each byte on the host-modem link is the first bit transferred on the PSTN data carrier.

+FBO=1 Reversed bit order for Phase C data. The last bit transferred of each byte is the first bit transferred on the PSTN data carrier.

The effect of this parameter is illustrated for the EOL pattern in the Phase C Data Format Parameters section in this chapter.

Class 2 +FBOR

Write syntax: +FBOR =<value>

Valid values: 0, 1

Default value: 0

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

+FBOR=0 Direct bit order for both Phase C data. The first bit transferred of each byte on the host-modem link is the first bit transferred on the PSTN data carrier. Applies to FAX sending for all Multi-Tech modems.

+FBOR=1 Reversed bit order for Phase C data. The last bit transferred of each byte is the first bit transferred on the PSTN data carrier. Applies to FAX sending for all Multi-Tech modems.

The effect of this parameter is illustrated for the EOL pattern in the Phase C Data Format Parameters section in this chapter.

Phase C Received EOL Alignment: +FEA and +FREL

Class 2.0/2.1 +FEA

Write syntax: +FEA=<value>

Valid values: 0, 1

Default value: 0

+FEA=0 EOL patterns are bit-aligned as received.

+FEA=1 The last received bits of EOL patterns are byte-aligned by the modem, with necessary zero fill bits inserted. There are two 2-byte binary EOL patterns, in which xxxx represents previous data bits, zero bits, or other leading data:

+FBO=0: 0000xxxx 10000000

+FBO=1: xxxx0000 00000001

Class 2 +FREL

Write syntax: +FREL=<value>

Valid values: 0, 1

Default value: 0

+FREL=0 EOL patterns are bit-aligned as received.

+FREL=1 The last received bits of EOL patterns are byte-aligned by the modem, with necessary zero fill bits inserted. There are two 2-byte binary EOL patterns, in which xxxx represents previous data bits, zero bits, or other leading data:

+FBOR=1: 0000xxxx 10000000

+FBOR=1: xxxx0000 00000001

Format conversion, +FFC**Class 2.0/2.1**

Write syntax: +FFC=<vrc>,<dfc>,<inc>,<wdc>

Valid values: see table below

Default values: manufacturer's option

Mandatory values: 0,0,0,0

This compound parameter determines the modem response to mismatches between the Phase C data delivered after the +FDT command and the data format parameters negotiated for the facsimile session. For mismatch checking, the modem depends on the host to indicate the data format with embedded <DLE><format> character pairs. If these format indicators are not provided, the modem shall assume that the format is as negotiated for that session.

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

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

Class 2

Not Applicable

Note that the four arguments of the Class 2.0/2.1 command +FFC cover the same technical content as these four separate Class 2 commands (which are described in detail below):

- +FVRFC (for vertical resolution),
- +FDFFC (for data compression format version),
- +FLNFC (for page length format conversion), and
- +FWDFC (for page width format conversion).

Vertical Resolution Format Conversion +FVRFC**Class 2.0/2.1** Not Applicable**Class 2***Write syntax:* +FVRFC=<value>

Valid values: 0, 1, 2

Default value: 0

This parameter determines the modem response to a mismatch between the vertical resolution negotiated for the facsimile session, reported by the +FCS:VR subparameter, and the Phase C data desired by the host, indicated by the optional +FDT:VR subparameter, or the +FIS=VR subparameter for +FDR operation.

- FVRFC=0 Disables mismatch checking. The host must check the +FCS:VR subparameter, and transfer matching data.
- FVRFC=1 Enables mismatch checking. An implied +FKS command is executed on mismatch detection.
- FVRFC=2 Enables mismatch checking, with resolution conversion of 1-D data in the modem. An implied +FKS command is executed on 2-D mismatch detection.

Data Compression Format Conversion, +FDFFC**Class 2.0/2.1** Not Applicable**Class 2***Write syntax:* +FDFFC=<value>

Valid values: 0

Default value: 0

This parameter determines the modem response to a mismatch between the data format negotiated for the facsimile session, reported by the +FCS:DF subparameter, and the Phase C data desired by the host, indicated by the optional +FDT:DF subparameter, or the +FIS=DF subparameter for +FDR operation.

- FDFFC=0 Disables mismatch checking. The host must check the +FCS:DF subparameter, and transfer matching data.

Page Length Format Conversion, +FLNFC**Class 2.0/2.1** Not Applicable**Class 2***Write syntax:* +FLNFC=<value>

Valid values: 0, 1, 2

Default value: 0

This parameter determines the modem response to a mismatch between the page length negotiated for the facsimile session, reported by the +FCS:LN subparameter, and the Phase C data desired by the host, indicated by the optional +FDT:LN subparameter, or the +FIS=LN subparameter for +FDR operation. A mismatch would require clipping or scaling a longer format to a shorter one.

- FLNFC=0 Disables mismatch checking. The host must check the +FCS:LN subparameter and transfer matching data.
- FLNFC=1 Enables mismatch checking. An implied +FKS command is executed on mismatch detection.
- FLNFC=2 Enables mismatch checking, with page length conversion of 1-D data in the modem. An implied +FKS command is executed on 2-D mismatch detection.

Page Width Format Conversion, +FWDFC**Class 2.0/2.1** Not Applicable**Class 2**

Write syntax: +FWDFC=<value>

Valid values: 0, 1, 2

Default value: 0

This parameter determines the modem's response to a mismatch between the page width negotiated for the facsimile session, reported by the +FCS:WD subparameter, and the Phase C data desired by the host, indicated by the optional +FDT:WD subparameter, or the +FIS=WD subparameter for +FDR operation. A mismatch would require clipping or scaling a wider format to a narrower one.

FWDFC=0 Disables mismatch checking. The host must check the +FCS:WD subparameter and transfer matching data.

FWDFC=1 Enables mismatch checking. An implied +FKS command is executed on mismatch detection.

FWDFC=2 Enables mismatch checking with page width conversion in the modem.

Fax Flow Control, +FLO

Syntax: +FLO=<value>

Valid values: 0, 1, 2

Default value: 1

The +FLO command allows the host to select and identify the types of flow control provided and used. A TR29-standard modem can support XON/XOFF flow control. XON is the ASCII <DC1> character (11h); XOFF is the ASCII <DC3> character (13h). The modem may provide ITU-T V.24 circuits 106 (CTS) and 133 (RTS) for flow control.

+FLO=0 No fax flow control.

+FLO=1 Software fax flow control (XON/XOFF flow control in either direction).

+FLO=2 Hardware fax flow control. ITU-T circuit 133 (RTS) is used for flow control of the modem by the host. Circuit 106 (CTS) is used for flow control of the host by the modem.

If circuits 106 and 133 are not being used for flow control (+FLO=2), then circuit 106 drops when an XOFF is sent, and goes high when an XON is sent. The conductor used for circuit 133 normally reverts to use as circuit 105 (RTS) when not being used for flow control.

Set Current Time and Date, AT+FTD

The AT+FTD command is used to set the current date and time. The current time and date will be tracked automatically by the modem once the time and date are set. However, these boards do not have a real time clock. So, the accuracy of the time and date is not guaranteed. It is recommended that the current time and date be set before each FAX transmit session.

The syntax of the command is:

AT+FTD=<year>, <month>, <hour>, <minute>, <second>, <zone>, <dtsdelta>

The arguments to this command are:

<year>	The current year (UTC zone). Range: 1970 to 65535
<month>	The current month number (UTC zone). Range: 1 to 12. January is 1.
<day>	The current day of the month. Range: 1 to 31.
<hour>	The current hour in military time (UTC zone). Range: 0 to 23.
<minute>	The current minute (UTC zone). Range 0 to 59.
<second>	The current second (UTC zone). Range 0 to 59.
<zone>	The number of seconds east (positive) or west (negative) that the local time zone is from Greenwich. Range: -43200 to 43200.
<dtsdelta>	Zero if daylight savings time is not in effect at the current time. Otherwise, the number of minutes to add to the time. Range 0 to 255.

The current local time is calculated from the UTC (Universal Coordinated Time, i.e., GMT) time specified in this command, plus the <zone> offset, plus the <dtsdelta> offset, plus the number of seconds accumulated by the board since the command was executed.

Page Header Generation, AT+FPH

The AT+FPH command is used to enable automatic generation of a FAX page header.

There are four legal formats for the syntax of this command:

AT+FPH=*mode*, "*left*"(*string* is left justified)

AT+FPH=*mode*, "*left*'*middle*' *right*"

AT+FPH=*mode*, "*left* '*right*"

The arguments to this command are:

mode

The *mode* argument controls generation of the page header. A *mode* of 0 disables page header generation. A *mode* of 1 enables page header generation and the page header is prepended to the FAX page data. A *mode* of 2 enables page header generation and the page header is overlaid on the first few lines of the FAX page data.

string

The *string* defines the page header itself. Only ASCII printable characters are allowed in the string (0x20 through 0x7e). Escape sequences that are introduced with the percent (%) character are allowed. The string can be partitioned into one, two, or three parts by using single-quote characters (') in the command expression.

An escape sequence is a “%” followed by an optional width, which may include a leading left-justification signifier, and then by the escape character itself. It is of the form **%[*numbers*][*-*]*character***. The dash (“-”) denotes left justification. When the dash is absent, right justification is used. If the width specification starts with a zero, then, when the escape sequence is expanded, the value will be left-padded with zeroes. Otherwise, it will be left-padded with spaces.

The following escapes are recognized:

%d (or %D)	The day of the month as a decimal number (range 01 to 31).
%h (or %H)	The hour as a decimal number using a 24-hour clock (range 00 to 23).
%i (or %I)	The hour as a decimal number using a 12-hour clock (range 01 to 12).
%j (or %J)	The day of the year as a decimal number (range 001 to 366).
%m	The month as a decimal number (range 01 to 12).
%M	The minute as a decimal number (two digits).
%p	Either ‘am’ or ‘pm’ according to the given time value, or the corresponding strings.
%P	The current page number of the FAX being sent, as computed by the padding.
%r (or %R)	The ID of the remote FAX machine. Leading and trailing blanks are stripped. A print-style field width specifier such as %20r or %-20r can be used to print this always in a fixed width field.
%s (or %S)	The second as a decimal number (two digits).
%t (or %T)	The ID of the transmitting FAX machine. Leading and trailing blanks are stripped. A print-style field width specifier such as %20t or %-20t can be used to print this always in a fixed width field.
%y	The year as a decimal number without a century.
%Y	The year as a decimal number including the century.
%%	A literal ‘%’ character.

If the string contains single quotes, it will be partitioned into left, and also possibly, middle and right parts.

<i>left</i>	This portion of the header will be left justified.
<i>middle</i>	This portion of the header will be centered.
<i>right</i>	This portion of the header will be right justified.

Percent-introduced escapes are processed as above.

Miscellaneous Parameters

Buffer Size, +FBS (Class 2.1 only)

Read syntax: +FBS?
 modem response syntax: <bs>,<xoft>,<xont>,<bc>, where
 <bs> = total buffer size,)
 <xoft> = XOFF threshold,
 <xont> = XON threshold,
 <bc> = current buffer byte count

This parameter allows the host to determine the characteristics of the modem's data buffer. Flow control is mandatory; buffers are needed for flow control. Use of the reported values would allow a host to transfer data without provoking XOFF.

Session Message Report Responses

The modem may be commanded to report the T.30 Phase B and Phase D HDLC control frames as they are sent and received. This service supports session diagnostics and the debugging of host software. It is enabled by the +FBU parameter described in the Parameter Commands section of this chapter.

These messages are not generated in direct execution of host action commands; they are generated for each frame whenever the reported frame is sent or received. The host should not attempt to change serial port speed or parity with +FBU set. It is desirable to suppress echo of host commands, if the modem provides that facility.

The data will be reported with each T.30 command separated by <CR><LF>. The fill bits will be removed. The frame octets will be represented in hex notation, and separated by spaces. Flags and zero bits are removed. Frame octets are reported in the order sent or received. FCS bytes are deleted. Frame octets are presented with the LSB as the first bit sent or received.

The following is an example of a received DIS string report:

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

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

Report Transmit HDLC Frames, +FHT:

Syntax: +FHT:<*transmitted HDLC frame octets*>
Reports the HDLC data that was sent by the modem.

Report Received HDLC Frames, +FHR:

Syntax: +FHR:<*received HDLC frame octets*>
Reports the HDLC data that was received by the modem.

Sample Modem Control Sessions

Send two pages, 1-D data, no errors (Class 2)

Host Commands	Modem Responses	Local Modem Action	Remote Station Action
AT+FCLASS=2	OK	Set Class 2	
AT+FLID="<local ID>"	OK	Set local ID	
ATD<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>		send page data	receive page data
<DLE><ETX>	OK		
AT+FET=0	+FPTS:1 OK	send RTC send MPS get MCF	get RTC get MPS send MCF
AT+FDT	CONNECT <XON>	send carrier	receive carrier
<2nd page data>		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

Receive two pages, 1-D data, no errors (Class 2)

Host Commands	Modem Responses	Local Modem 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 [+FCSI"<tsi>"] +FDIS:<dis codes. OK	off hook, send CED, send CSI, send DIS, detect flags, [get TSI] get DIS begin TCF recv	get CED, get CSI, get DIS, send V.21 flags, [send TSI], send DIS, start TCF
AT+FDR	+FCFR +FDCS:<dcs codes> CONNECT	accept TCF send CFR get page carrier	finish FCT get CFR send page carrier
<DC2>	<page data stream> <DLE><ETX><- +FPTS:1,<lc> +FET:0 <- OK	get page data detect RTC <- get MPS	send page data send RTC drop carrier, send MPS
AT+FDR	+FHNG:0 <- OK	send MCF get DCN <-	get MCF send DCN

Send two pages, 1-D data, no errors (Class 2.0)

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

Square bracketed [] commas are optional for the host.

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

Receive two pages, 1-D data, no errors (Class 2.0)

In this example, the remote station sends NSS, SUB, PWD and TSI. The local modem has +FNR=1,1,1,1 and +FAP=1,1,1.

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

Originate and send a two page facsimile with V.34 half-duplex (Class 2.1)

Optional T.30 frames are omitted. +FNR=1,1,, +FIS and +FCS subparameters other than BR and EC are not shown.

Host Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FCLASS=2.1	OK	Set class 2		
AT+FIS=B,,,,3,,	OK	Set for Rec. V.34, Annex A/T.30, Annex C/T.30 or Annex F/T.30		
ATD<dial string>	+FCO +FIS:B,,,,1,,, OK	off-hook, dial, send CNG detect ANSam send CM get JM send CJ negotiate Rec. V.34 begin control chan get DIS	detect ringing answer detect CNG send ANSam get CM send JM get CJ negotiate Rec. V.34 begin control chan send DIS	("Chan" = channel) Rec. T.30 selected with JM signal from remote terminal the remote indicated 28 800 bit/s ability
AT+FDT <1st page data> <DLE><mps>	+FCS:9,,,,1,,, CONNECT OK	send DCS get CFR switch to primary chan send page FCD switch to control chan send MPS get MCF	get DCS send CFR switch to primary chan get page data switch to control chan get MPS send MCF	in this example, 24 400 bit/s is selected
AT+FDT <2nd page data> <DLE><eop>	CONNECT +FHS:00 OK	switch to primary chan send page 2 FCD switch to control chan send EOP get MCF send DCN hang-up	switch to primary chan get page 2 FCD switch to control chan get EOP send MCF get DCN hang-up	

Answer and receive a two-page facsimile with V.34 half-duplex (Class 2.1)

Host Commands	Modem Responses	Local Modem Action	Remote Station Action	Notes
AT+FCLASS=2.1	OK	Set class 2		
AT+FIS=D,,,,,3, ”	OK	Set for Rec. V.34, Annex A/T.30, Annex C/T.30 or Annex F/T.30		select max rate of 33 600 bit/s
	RING	detect ringing	off-hook, dial	
ATA	+FCO OK	answer detect CNG send ANSam get CM send JM get CJ negotiate Rec. V.34 begin control channel send DIS	send CNG detect ANSam send CM get JM send CJ negotiate Rec. V.34 begin control channel get DIS	Rec. T.30 selected with JM signal from remote terminal the remote indicated 28 800 bit/s ability
AT+FDT	+FCS:,B,,,,,1,,,, CONNECT <1st page data> <DLE><ETX> +FPS:1,<lc>,0,0 ,0 +FET:0 OK	get DCS send CFR switch to primary channel get page 1 FCD switch to control channel get MPS	send DCS get CFR switch to primary channel send page 1 FCD switch to control channel send MPS	in this example, 28 800 bit/s is selected
AT+FDR	CONNECT <2nd page data> <DLE><ETX> +FPS:1,<lc>,0,0 ,0 +FET:2	send MCF switch to primary channel get page 2 FCD switch to control channel get EOP	get MCF switch to primary channel send page 2 FCD switch to control channel send EOP	
AT+FDR	+FHS:00 OK	send MCF get DCN hang-up	get MCF send DCN hang-up	

Alphabetic List of Commands and Responses

Name	Description
A	Answer command
D<string>	Originate command
+FAA=	Auto Answer Mode parameter
+FAXERR=	Fax Error Value parameter
+FBADLIN=	Number of Consecutive Bad Lines for a Bad Page parameter
+FBADMUL=	Error Threshold Multiplier
+FBO=	Phase C Data Bit Order parameter
+FBS?	Buffer Size, read-only parameter
+FBU=	Session Message Reporting parameter
+FPI:	Report Remote ID response, CIG
+FCFR	Confirmation to Receive prompt
+FCLASS=	Service Class ID
+FCO	Facsimile Connection response
+FCQ=	Copy Quality Capabilities parameter
+FCR=	Capability to Receive parameter
+FCI:	Report remote ID response, CSI
+FPI=	Local Polling ID String parameter
+FCS:	Report Session Parameters response
+FCS=	Current Session results
+DFFC=	Data Compression Format Conversion parameter
+FCC=	modem Capabilities parameters
+FIS:	Report Remote Capabilities response
+FIS=	Current Session Negotiation parameters
+FDR	Receive Phase C Data command
+FDT[=]	Transmit Phase C Data command
+FRY=	CTC Retry Value
+FTC:	Report Remote capabilities response
+FET:	Post Page Message response
+FET=	End the Page or Document command
+FHS:	Call Termination Status response
+FHR:	Report Received HDLC Frame response
+FHT:	Report Transmitted HDLC Frame response
+FKS	Orderly Fax Abort command
+FLI=	Local ID String parameter, TSI/CSI
+FLNFC=	Page Length Format Conversion parameter
+FLO	Fax Flow Control
+FLP=	Document for Polling parameter
+FMM?	Request modem Model

Name	Description
+FMI?	Request modem Manufacturer
+FMS=	Minimum Phase C Speed parameter
+FNC:	Report NSC Frame response
+FNF:	Report NSF Frame response
+FNS:	Report NSS Frame response
+FCT=	Phase C Timeout parameter
+FPO	Remote Polling Indication
+FPS:	TX Page Transfer Status response
+FPS=	Page Transfer Status parameter
+FMR?	Request modem Revision
+FEA=	Phase C EOL Alignment parameter
+FSP=	Enable Polling parameter
+FTI:	Report Remote ID response, TSI
+FVO	Transition to Voice response
+FV	Prefix Output On Query response
+FVRFC=	Vertical Resolution Format Conversion parameter
+FWDFC=	Page Width Format Conversion parameter
+FTBC	Phase C Transmit Byte Count
+FRBC	Phase C Receive Byte Count

ASCII Conversion Chart

CTRL	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	DEC	CODE	HEX	DEC
@	NUL	00	0	SP	20	32	@	40	64	`	60	96
A	SOH	01	1	!	21	33	A	41	65	a	61	97
B	STX	02	2	"	22	34	B	42	66	b	62	98
C	ETX	03	3	#	23	35	C	43	67	c	63	99
D	EOT	04	4	\$	24	36	D	44	68	d	64	100
E	ENQ	05	5	%	25	37	E	45	69	e	65	101
F	ACK	06	6	&	26	38	F	46	70	f	66	102
G	BEL	07	7	'	27	39	G	47	71	g	67	103
H	BS	08	8	(	28	40	H	48	72	h	68	104
I	HT	09	9	)	29	41	I	49	73	i	69	105
J	LF	0A	10	*	2A	42	J	4A	74	j	6A	106
K	VT	0B	11	+	2B	43	K	4B	75	k	6B	107
L	FF	0C	12	,	2C	44	L	4C	76	l	6C	108
M	CR	0D	13	-	2D	45	M	4D	77	m	6D	109
N	SO	0E	14	.	2E	46	N	4E	78	n	6E	110
O	SI	0F	15	/	2F	47	O	4F	79	o	6F	111
P	DLE	10	16	0	30	48	P	50	80	p	70	112
Q	DC1	11	17	1	31	49	Q	51	81	q	71	113
R	DC2	12	18	2	32	50	R	52	82	r	72	114
S	DC3	13	19	3	33	51	S	53	83	s	73	115
T	DC4	14	20	4	34	52	T	54	84	t	74	116
U	NAK	15	21	5	35	53	U	55	85	u	75	117
V	SYN	16	22	6	36	54	V	56	86	v	76	118
W	ETB	17	23	7	37	55	W	57	87	w	77	119
X	CAN	18	24	8	38	56	X	58	88	x	78	120
Y	EM	19	25	9	39	57	Y	59	89	y	79	121
Z	SUB	1A	26	:	3A	58	Z	5A	90	z	7A	122
[	ESC	1B	27	;	3B	59	[	5B	91	{	7B	123
\	FS	1C	28	<	3C	60	\	5C	92	|	7C	124
]	GS	1D	29	=	3D	61	]	5D	93	}	7D	125
^	RS	1E	30	>	3E	62	^	5E	94	~	7E	126
_	US	1F	31	?	3F	63	_	5F	95	DEL	7F	127

NUL	Null, or all zeros	VT	Vertical Tab	SYN	Sync.
SOH	Start of Header	FF	Form Feed	ETB	End Transmission Block
STX	Start of Text	CR	Carriage Return	CAN	Cancel
ETX	End of Text	SO	Shift Out	EM	End of Medium
EOT	End of Transmission	SI	Shift In	SUB	Substitute
ENQ	Enquiry	DLE	Data Link Escape	ESC	Escape
ACK	Acknowledge	DC1	Device Control 1	FS	File Separator
BEL	Bell or Alarm	DC2	Device Control 2	GS	Group Separator
BS	Backspace	DC3	Device Control 3	RS	Record Separator
HT	Horizontal Tab	DC4	Device Control 4	US	Unit Separator
LF	Line Feed	NAK	Negative Acknowledge	DEL	Delete

Chapter 4 – Voice Commands

Introduction

This chapter describes **+V** command support. The **+V** Command standard IS-101 Voice Control Interim Standard for Asynchronous DCE (prepared by the TIA Technical Subcommittee TR29.2 on Facsimile Digital Interface) defines the commands that a PC user may issue to configure and control a voice/fax/data modem and the responses (result codes) that the voice/fax/data modem may issue in response to those commands.

The **+V** commands and responses provide control of the following services:

- Recording and playback of digitized voice.
- Generation and detection of DTMF and other tones.
- Switching between voice, fax, and data modes.
- Control-related functions.

The Voice mode has three states, which correspond to the direction of voice data flow:

Voice command state (event reports only; no data transfers).

Voice transmit state (digitized, half-duplex voice data transfers from PC to modem).

Voice receive state, (digitized, half-duplex voice data transfers from modem to PC).

The modem supports three levels of voice service: Service Levels A, B, and C. Service Level A provides the lowest level of services. Service level A performs operations and detects events as follows: Voice transmit, Voice receive, and DTMF generation and Single tone generation. The following events (Result Codes) are reported: 3, 4, 5, 6, 9, 10, 18, 19, 23, 25.

Service Level B provides an optionally greater amount of services, providing DTMF and facsimile calling tone detection during voice transmits in addition to Service Level A. Service Level B provides event-reporting similar to Service Level A, but with added event reporting states (e.g., fax calling in transmit state in addition to reporting in command state).

Service Level C provides the highest service level with the addition of facsimile calling tone and Busy detection during receives, Dial Tone detection, and double-tone detection. An example of event detection in a Service Level C modem is shown below:

```
AT+VEM=?  
"C"  
0A000100  
0E601800  
1A803840  
OK
```

Voice S-Register Summary

Voice mode S-Register changes are outlined below.

<u>S-Register</u>	<u>Description</u>
S0	Automatic answer is disallowed in Voice mode.
S7	Wait for Carrier After Dial. Default is 60 seconds. In Voice mode, S7 contains the maximum amount of time that the modem will wait during Call Origination, all the time detecting for ring backs, before assuming that the remote station will not go off hook.
S10	Automatic disconnect is disallowed in Voice mode.

Voice Commands

The **+V** Voice enhancements are implemented with **AT+V** (for Voice) commands, as well as changes to several existing commands.

In general, the modem does not accept Data mode (+FCLASS=0) commands or Fax mode (+FCLASS=1, 2, 2.0) commands when in Voice mode (+FCLASS=8).

Commands That Change for Voice Mode Support

<u>Command:</u>	<u>Description</u>
A	Disallowed in Voice mode.
D	Causes the modem to Dial assuming +VLS=2 if +VLS=0 when the ATD command was entered.
H	Values greater than 0 disallowed in Voice mode.
I	Disallowed in Voice mode.
L	Disallowed in Voice mode.
M	Disallowed in Voice mode.
O	Disallowed in Voice mode.
Q	Disallowed in Voice mode.
X	Disallowed in Voice mode.
Z	Reset modem.
&D	&D1 is disallowed in Voice mode.
+FCLASS=8	Places the modem in Voice mode.
+FCLASS=	New values are added for Voice mode.
+FCLASS=?	New values are added for Voice mode.

Voice +V Commands Summary

These commands support Voice mode.

Command:	Description
+VNH=	Automatic Hang Up Control
+FMI?	Report Manufacturer's ID
+FMM?	Report Product ID
+FMR?	Report Version Level
+FLO=	Select Flow Control Method
+VIP	Initialize Voice Parameters
+VRX	Enter Voice Receive State
+VTS	Produce DTMF and Tone Generation in Voice Mode
+VTS=?	Report Frequency Support
+VTX	Start Voice Transmission Process
+VGR=	Set the Gain for Received Voice Samples
+VGT=	Set the Volume for Transmitted Voice Samples
+VIT	Set DTE/DCE Inactivity Timer
+VLS=	Select Analog Source/Destination
+VLS=?	Identify Analog Source/Destination Configuration and Event Reporting Capabilities
+VRA=	Set Ring back Goes Away Timer
+VRN=	Set Ring back Never Appeared Timer
+VSD=	Set Silence Detection Sensitivity
+VSM=	Select Voice Compression Method
+VSM=?	Report Voice Compression Method
+VTD=	Select Default Beep Tone Duration Timer (DTMF/Tone Generation Duration)
+VDR=	Enable/Disable Distinctive Ring (Ring Cadence Reporting)
+VDT=	Control Tone Cadence Reporting
+VEM=	Event Reporting and Masking
+VEM=?	Report Event Reporting and Masking Capabilities
+VBT=	Set Modem Flow Control Assert and De-Assert Points
+VBT=?	Report Modem Flow Control Assert and De-Assert Points
+VPP=	Enable or Disable Voice Mode Packet Protocol
+VPR=	Select DTE/DCE Interface Rate (Turn Off Autobaud)

Voice +V Commands Detail

Command: **+FCLASS= <mode> <Enter> Select Modem Operating Mode**

Values: 0, 1, 2.0, 2, 3-7, 8, 9-15, 16-255

Default: 0

Result Codes: OK if the command is accepted; ERROR if the parameter value is out of range.

Description: The +FCLASS= command selects the mode of operation (data, facsimile, or voice), as shown below.

+FCLASS= Modem Operating Mode	
0	selects data modem mode
1	selects Service Class 1 (fax/data) modem mode
2.0	selects Class 2.0 fax/data modem mode
2	selects non-standard Class 2 modem
3-7	reserved for other Fax modes
8	selects IS-101 Voice mode
9-15	reserved for other Voice modes
16-255	reserved for future standards

Command: +FCLASS=8 DTMF Detect Detect and Control DTMF

Values: 8 characters, case sensitive

Description: The +FCLASS=8 is used to detect and control DTMF using the procedure below:

1. Enter the command AT+FCLASS=8 <cr> to the modem.
2. Call into modem with phone. A >r (incoming ring indication) is displayed, followed by OK. The modem is now in Online Voice Command mode, allowing DTMF characters to be passed through from the remote phone. The characters are displayed as shown below:

AT+FCLASS=8

OK

>R is Ring

>/>1>1>~

The Data link escape character (>), and the 'start of DTMF tone shielding' character (⌘) are both output once a button is pressed. The DTMF digit will continue to be output along with a > until the button is released. Then another > is output along with a 'DTMF transitions to off' (~) character. Silence on the line is indicated with a (>s) displayed.

DTMF (dual tone multi frequency) is the signal to the phone company that you generate when you press an ordinary telephone's touch keys. DTMF has generally replaced loop disconnect ("pulse" or "rotary") dialing. With DTMF, each key you press on your phone generates two tones of specific frequencies. So that a voice can't imitate the tones, one tone is generated from a high-frequency group of tones and the other from a low frequency group.

Touch Tone Signals

Digit	Low frequency	High frequency
1	697 Hz	1209 Hz
2	697	1336
3	697	1477
4	770	1209
5	770	1336
6	770	1477
7	852	1209
8	852	1336
9	852	1477
0	941	1336
*	941	1209
#	941	1477

When any key is pressed, both the high and low tones of the row are generated, hence the name "dual tone". For example, pressing the '5' button generates the tones 770Hz and 1336Hz. The frequencies were chosen to avoid harmonics (no frequency is a multiple of another, the difference between any two frequencies does not equal any of the frequencies, and the sum of any two frequencies does not equal any of the frequencies). For additional information on DTMF, see the Telecommunications Industry Association's Web site at http://www.tiaonline.org/resources/other_links.cfm.

Command: AT+FCLASS=? <Enter> Display Service Class Capabilities

Values: 0, 1 (other values are reserved)

Default: 0

Result Codes: OK if the command is accepted; ERROR if the parameter value is out of range.

Description: The +FCLASS=? command displays the set of Service Classes supported by the modem from the list of values (e.g., 0,1 for a modem that supports data comm plus fax Service Class 1). This command returns the service class or classes available with the modem. The modem returns a list of all supported values, separated by commas if more than one class is supported. For example, a modem that supports data communications, Class 1 Fax, Class 2 Fax, and Voice mode functions would respond with "0,1, 2.0, 8".

- Command:** **+VNH=<hook><Enter>** **Automatic Hang-Up Control**
Values: 0, 1, 2, 3 through 255
Result Codes: OK if command accepted; ERROR if parameter out of range.
Description: The +VNH command causes the modem to enable or disable automatic hang ups to a varying degree when in Data mode or Fax mode, as shown below:
+VNH=0 Enable automatic hang-ups as is normal in other non-Voice modes (such as hanging up the phone when the modem does not detect a data carrier within a given time interval).
+VNH=1 Disable automatic hang-ups in other non-Voice modes
+VNH=2 Disable automatic hang-ups in other non-Voice modes. The modem performs only a "logical" hang up (i.e., returns the OK result code).
+VNH=3-255 Reserved for future standards
- Command:** **+FMI?<Enter>** **Report Manufacturer's ID**
Values: N/A
Default: N/A
Result Codes: Only unsolicited result codes (not the standard AT -type OK result code)
Description: The + FMI? command causes the modem to report text consisting of a single line with the modem manufacturer's name (e.g., Lucent Data/Fax/Voice), and our address, phone, and fax numbers.
- Command:** **+FMM?<Enter>** **Report Product ID**
Result Codes: Only unsolicited result codes (not the standard AT-type OK result code)
Description: The +FMM command causes the modem to report text consisting of a single line with the modem's name (e.g., SocketModem).
- Command:** **+FMR?<Enter>** **Report Version Level**
Result Codes: OK or ERROR
Description: The +FMR command causes the modem to report the firmware version number and/or a date code (e.g., Vs. 2.07 – 2/4/95).
- Command:** **+FLO=<method><Enter>** **Select Flow Control Method**
Values: 0, 1, 2, 3–255
Result Codes: OK, or ERROR
Description: The +FLO? command lets you select the method of flow control provided and used by the modem. If +FLO=0, some other method (such as credit flow control) is used. The Xon-Xoff method is required. Xon is the ASCII character <DC1> (11 hex). Xoff is the ASCII character >DC3> (13 hex). CCITT V.24 circuits 106 and 133 are optional flow control methods. If circuits 106 and 133 are not used (+FLO<>2), then circuit 106 is held On whenever +FCLASS=8. In Voice mode, circuit 105 has no effect on the state of transmitted data. (Circuit 133 normally reverts to use as circuit 105 (RTS) when not used for Flow Control.)
+FLO=0 Disable Xon-Xoff and 133/105 flow control
+FLO=1 Enable Xon-Xoff flow control in either direction
+FLO=2 Enable CCITT Circuit 133 for flow control of the modem by the PC; use CCITT Circuit 106 for flow control of the PC by the modem.
+FLO=3-255 Reserved for future standards
- Command:** **VIP** **Initialize Voice Parameters**
Values: 0 (optional)
Description: The +VIP command causes the modem to initialize all Voice parameters to the factory default settings. This command has the same effect as if the PC had issued commands for the individual parameter settings. The +VIP command has no effect on the +FCLASS setting. The optional command +VIP=0 <Enter> provides a selection of default profiles.

Command: +VRX Enter Voice Receive State

Values: 0, 1, 2–127, 128–255

Result Codes: Values (above) if the modem accepts the command; ERROR if the modem is not connected to an off-hook Telco line, or one non-Telco input device.

Description: +VRX causes the modem to start the voice reception process. The modem starts the process by returning the CONNECT result code to the PC. The modem then sends shielded voice data to the PC, in the format previously selected by the +VSM command. The modem exits the voice/receive state by one of two means: a <DLE><I>, and an Inactivity Timer timeout. During the voice receive, the modem informs the PC of pertinent events, such as Presumed End of Message (Quiet), and Presumed Hang Up (Silence) detected, Busy detected, and Dial Tone detected, so that at the discretion of the PC, the PC may terminate the voice receive state. On termination of the voice receive state, the modem returns the OK result code, and then returns to the Voice Command state.

The Inactivity Timer is in effect during the receive operation. If the PC uses this timer and stops the modem from performing unwanted restarts, the PC must assure that there is data sent from the PC to the modem often enough to refresh the timer.

+VRX=0 Voice receive operation. This selection does not provide for modem periodical tone production during a voice receive operation. The PC must issue the proper notifications of a record operation in progress by message playbacks to satisfy possible legal requirements.

+VRX=1 Voice receive operation. This selection does not provide for modem periodical tone production during a voice-receive operation. The tone frequency and cadence is manufacturer specific.

+VRX=2–127 Reserved for future specification.

+VRX=128–255 Manufacturer specific.

The result code values (0, 1, 2–127, 128–255) are returned if the modem accepts the command. The ERROR result code is returned if the modem is not connected to an off-hook Telco line, or one non-Telco input device.

Command: +VTS=<string> Produce DTMF and Tone Generation in Voice Mode

Values: Refer to the IS-101 Spec.

Default: Refer to the IS-101 Spec.

Result Codes: Refer to the IS-101 Spec.

Description: The +VTS command causes the modem to produce DTMF tones, single-frequency tones, and optionally, double-frequency tones. This command allows the PC to generate a dial tone, busy, etc. for those modems capable of generating two arbitrary tones. The modem may perform tone detection during the playing of tones. When the modem receives the signal <DLE><!> to abort playing of the tones, the result code OK is displayed, and the modem returns to the voice command state.

The Inactivity Timer is in effect during the receive operation. If the PC uses this timer and stops the modem from performing unwanted restarts, the PC must assure that there is data sent from the PC to the modem often enough to refresh the timer.

Modem support for the second tone generation is optional. The modem produces compliant DTMF tones when processing DTMF tone production codes.

The tone generation string consists of elements in a list where each element is separated by commas. Each element can be:

1. A single ASCII character in the set of 0–9, #, *, and A–D
2. A string enclosed in square brackets [], or
3. A string enclosed in curly braces { }

The modem interprets item 1 as a DTMF digit with duration set by the +VTD command. The modem interprets item 2 as a general dual tone and duration selection. The modem interprets item 3 as a DTMF tone with a different duration than that given by the +VTD command.

Missing parameters are assumed to be the default value. Unspecified values always default to 0 for frequencies, DTMF * for DTMF tones, and +VTD for duration. The omission of commas (and associated subparameters) is valid.

The quantity in the square brackets consists of a three-element list. The first element is the first frequency, the second element is the second frequency, and the third element is the duration, in 0.01second intervals. A list may contain null elements. For example, [3000] means that the modem generates a single tone at 3000 Hz for the default duration. [3000,3300] means that the modem generates a dual tone at 3000 and 3300 Hz for the default duration. [,3300] means that the modem generates a single tone at 3300 Hz for the default duration.

The quantity in the curly braces consists of a two-element list. The first element is the DTMF tone character, and the second element is the tone duration in 0.01 seconds. The DTMF tone characters are listed above. A list may contain null elements. For example, {@} means DTMF tone "2" for the default duration. {} means silence for the default duration.

The modem will stop the tone generation at the point in the string where the modem detects a parsing error, encounters an invalid frequency range, encounters a <CR>, or encounters a semi-colon.

The modem returns the OK result code if the PC accepts the command. The ERROR result code is displayed if the modem encountered an error in parsing the subparameter, or if the selected frequency is out of range.

Example: Using the +VTS command for tone generation without using any null elements:

```
AT=VTS=1,2,[1000,1300,50],{*6},{800,1300,50},9
```

The above string will perform as follows:

1. Play DTMF 1 with a duration given by the +VTD command.
2. Play DTMF 2 with a duration given by the +VTD command.
3. Play tone pair at 1000 Hz and 1300 Hz with a duration of 500 ms.
4. Play DTMF * with a duration of 60 ms.
5. Play tone pair at 800 Hz and 1300 Hz with a duration of 500 ms.
6. Play DTMF 9 with a duration given by the +VTD command.

Refer to the IS-101 Spec for additional information.

Command: **+VTS=?** **Report Frequency Support**

Result Codes: OK follows the string

Description: The +VTS=? command reports the current frequency range in the form <freq1>,<freq2>,<dur> , where <freq1> is the first frequency range,<freq2> is the second frequency range, and<dur> is the duration range for the square brackets and curly braces constructs. The units are in 0.01 seconds. The range of valid <dur> values is that of the +VTD command.

Example: In the lines below, the modem responds to the +VTS=? command by reporting that it supports two frequencies, both in the range of 200-3300 Hz, and supports a duration range from 0 to 5 seconds.

```
AT+VTS=?
(200-3300), (200-3300), (0-500)
OK
```

Command: +VTX Start Voice Transmission Process

Result Codes: OK on completion of transmission; CONNECT if the modem accepts the command; ERROR if the modem is not connected to at least one off-hook Telco line, or one non-Telco device.

Description: The +VTX command causes the modem to start the voice transmission process. The PC sends the data in the format of the previously entered +VSM command, using the flow control method selected by the +FLO command. The voice data is buffered to withstand gaps of missing data from the PC. If the modem does not have any current voice data, the modem sends silence over to the analog destination until the PC provides more voice data. The modem returns the OK result code and returns to Command mode after the modem has completely transmitted its buffer contents. The Inactivity Timer can be used to terminate the transmit data state, after which the modem returns to Command mode.

Command: +VGR=<gain> Set the Gain for Received Voice Samples

Values: 0–255

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VGR= command causes the modem to set the gain for the received voice samples. Receive gain values larger than 128 indicate a larger gain than nominal, and values smaller than 128 indicate a gain smaller than nominal. The modem may limit the receive gain to a narrower range, such as from 120 to 136, or from 120 to 128. The value 0 is reserved for modem automatic gain control (AGC).

Command: +VGT=<level> Set the Volume for Transmitted Voice Samples

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VGT= command causes the modem to set the volume control, either by attenuating or amplifying the signal, for the transmitted voice samples. Values larger than 128 indicate a larger gain than nominal, and values smaller than 128 indicate a gain smaller than nominal. The modem may limit the receive gain to a narrower range, such as from 120 to 136, or from 120 to 128. The value 0 is reserved for modem automatic volume control (AVC).

Note: The modem will 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.

Command: +VIT=<timer> Set DTE/DCE Inactivity Timer

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VIT command sets the modem's initial value for the PC/Modem Inactivity Timer. The permitted range is displayed by the +VIT=? command. The units are in 1.0 seconds. The PC can disable the Inactivity Timer by using a value of 0 (+VIT=0). The Inactivity Timer serves to ensure that the PC does not leave the modem in a state where it is not accessible by voice-unaware software. The Inactivity Timer is activated when the PC selects the voice fixed-rate. The timer expires if the flow of data from the PC to the modem stops (in both Voice Command mode and Data mode) for a specified amount of time.

When this timer expires, the modem switches to Data mode with autobauding. By switching to autobauding (and Data mode), the PC is allowed voice-unaware software to recover control of the modem in the event of catastrophic failure that does not result in a modem power down. It is recommended that the PC software leave the modem in autobauding (and Data mode), and use the Inactivity Timer only as needed. Leaving the modem in autobauding is an extra measure to prevent confusion from voice-unaware software accessing the modem in Voice mode at a fixed PC/modem interface rate. You can use the H command to switch to autobauding and Data mode automatically. In Voice mode, the modem does not allow the auto answer feature, since this feature does not allow the PC to set the modem in Voice mode before answering the phone.

Command: +VLS=<label> Select Analog Source/Destination

Result Codes: OK if command accepted; ERROR if the <label> parameter is out of range or if the modem cannot service the <label> parameter requested.

Description: +VLS= causes the modem to select one or more source and destination devices for the analog data to be transmitted. The parameter <label> identifies each of the supported analog source/destination hardware devices. Codes, called "primitives", are provided to describe which voice I/O device(s) are components in a possible hardware configuration. The codes are grouped to help define and label 16 common hardware configurations. Each code, except "L" and "T" is followed by an ASCII 0 code (20 hex). Two codes can be concatenated to define a possible analog source/destination hardware configuration.

Code	Description
L	Local phone (no number code)
T	Telco line (no number code)
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)

The list below contains 16 commonly used hardware configurations, label, and codes used to select each configuration.

<label>	Code(s)	Description
0	none	Modem on-hook. Local phone connected to Telco.
1	T	Modem off-hook, and connected to Telco. Local phone provided with power to detect hook condition.
2	L	Modem off-hook. Local phone connected to modem.
3	LT	Modem off-hook. Local phone connected to Telco. Modem connected to Telco.
4	S	Internal speaker connected to the modem. Modem is on-hook. Local phone connected to Telco.
5	ST	Internal speaker connected to Telco. Modem off-hook. Modem connected to Telco. Local phone provided with power to detect hook condition.
6	M	Internal microphone connected to modem. Modem is on-hook. Local phone connected to Telco.
7	MST	Internal microphone and internal speaker connected to Telco. Squelching active. Modem is off-hook, and connected to Telco. Local phone provided with power to detect hook condition.
8	S1	External speaker connected to modem. Modem is on-hook. Local phone connected to Telco.
9	S1T	External speaker connected to Telco. Modem is off-hook and connected to Telco. Local phone provided with power to detect hook condition.
10	MS1T	Internal microphone and external speaker connected to Telco. Squelching active. Modem is off-hook, and connected to Telco. Local phone provided with power to detect hook condition.
11	M1	External microphone connected to modem. Modem is off-hook. Local phone connected to Telco.
12	M1ST	External microphone and internal speaker connected to Telco. Squelching active. Modem is off-hook, and connected to Telco. Local phone provided with power to detect hook condition.
13	M1S1T	External microphone and external speaker connected to Telco. Squelching active. Modem is off-hook, and connected to Telco. Local phone provided with power to detect hook condition.
14	H	External microphone and speaker combination (handset or headset) connected to modem. Modem is off-hook. Local phone connected to Telco.

15 HT External microphone and speaker combination (headset or handset) connected to modem. Modem is off hook, and connected to Telco. Local phone provided with power to detect hook condition.

Command: +VLS=? Identify Analog Source/Destination Configuration and Event Reporting Capabilities

Result Codes: <label>,<devices>,transmit event>,<receive event>,<idle event>

Description: The +VLS=? command displays the modem's current source and destination device information for the analog data to be transmitted. Refer to the +VLS= <label> command for label code and description information. Note that the +VEM command contains more information about event reporting.

Example: In the lines below, the modem reports that it supports only a Telco line at Service Level C.

```
AT+VLS=?
0, "", 0A0001000,0E601800,1A803840
1, "T", 0A0001000,0E601800,1A803840
OK
```

Command: +VRA=<interval> Set Ring Back Goes Away Timer

Values: 0–50 (in 0.10 second increments)

Default: 50

Result Codes: OK if the modem accepts the command; ERROR if the <interval> parameter entered is out of range.

Description: The +VRA= command sets the amount of time the modem will wait between ring backs before the modem can assume that the remote device has gone off-hook. This command does not effect the Quiet Answer @ dial modifier; the +VRA command functions the same as the @ entered at the end of a dial string. Entering +VRA=0 forces the modem to return the OK result code immediately after the first Ring Back. The parameter <interval> refers to the silence interval length between the end of one ring interval and the start of the next ring interval.

Command: +VRN=<interval> Set Ring Back Never Appeared Timer

Values: 0–10 (in 1.0 second increments)

Default: 10

Result Codes: OK if modem accepts the command; ERROR if the <interval> parameter entered is out of range.

Description: The +VRN= command sets the amount of time that the modem will wait for Ring Back. If the modem does not detect a Ring Back within the time period <interval>, the modem assumes that the remote device has gone off hook, and returns the OK result code. The modem only uses this command in call origination transactions. A +VRN= setting greater than the S-Register S7 setting means that only the S7 timer is in effect. Entering +VRA=0 forces the modem to return the OK result code immediately after dialing

Command: +VSD=<sds>,<sdi> Set Silence Detection Sensitivity

Values: 0–256 (in 0.1 second intervals)

Result Codes: OK if modem accepts the command; ERROR if one or more of the following apply: 1) the <sds> or <sdi> parameter entered is out of range, or 2) either of the two parameters is missing from the command string. If an error occurs, modem retains the previous <sds> and <sdi> parameter values.

Description: The +VSD= command sets the silence detection sensitivity and the required period of silence before the modem reports silence detected at the end of a voice receive, either with the Presumed End of Message (Quiet) or Presumed Hang Up (Silence) event reports. The table below outlines the possible combinations of the +VSD and +VSM commands using the <sds> parameter. An <sdi> parameter value of 0 means that long-term silence detection is disabled. (Note that long-term silence detection refers to the use of this function to detect the end of a voice receive (i.e., the user stops talking).

+VS<sds>	+VSM Silence Compression in Use	+VSM Silence Compression Not Used
0	Use +VSM silence compression setting and algorithm for long-term silence detection.	Use default long-term setting silence detection level and algorithm,
not 0	Sets long-term silence detection setting independent of presence or use of silence detection, where: <sds> = 128; nominal level of silence detection sensitivity <sds> > 128; more aggressive level of silence detection sensitivity (less sensitive, higher noise levels considered to be silence). <sds> < 128; less aggressive level of silence detection sensitivity (more sensitive, lower noise levels considered to be silence).	

The parameter <sds> is used by the PC to select greater amounts of modem silence detection activity; larger values imply that the PC wants the modem to treat noisier conditions as silence. The value entered for <sds> has no actual unit of measure. The modem may limit silence detection sensitivity to a more narrow range (e.g., from 120 to 136). A setting of 0 has no meaning.

The parameter <sdi> sets the required period of silence before the modem can report silence detected either with the Presumed End of Message (Quiet) or Presumed Hang Up (Silence) event reports. A value of 0 disables modem silence detection, in which case the modem will not report the Presumed End of Message (Quiet) or Presumed Hang Up (Silence) event reports.

Command	+VSM=<cml>,<vsr>,<scs>,<sel> Select Voice Compression Method
Values:	(see individual parameter descriptions)
Default:	(see individual parameter descriptions)
Result Codes:	OK if the modem accepts the command; ERROR if one or more of the following apply: 1) the any parameter entered is out of range, or 2) any of the four parameters are missing from the command string. If an error occurs, the modem retains the previous <sds> and <sdi> parameter values.
Description:	<p>The +VSM= command sets the modem to a specified voice compression method, silence compression sensitivity, and voice sampling rate. The modem can maintain a different event detection capability for each compression method. This command allows the PC to set the amount of silence compression appropriate to a particular situation or application. For example, you may want to record your welcome message with the lowest amount of silence removal, with the goal of reducing distortion, meanwhile recording other messages with a more assertive silence removal, to limit disk space used for recording purposes.</p> <p>The parameter meanings are described below.</p> <p><cml> is used by the PC to select a compression method. The valid range of values is from 128–256. The range of values from 0–127 is reserved for future standards.</p> <p><vsr> is used to select the modem voice sampling rate from the set of those supported. The unit of measure is samples per second. See the +VSM=? command for the list of sampling rates supported by the modem.</p> <p><scs> has different meanings in voice transmit and voice receive modes. In receive, the PC uses <scs> to select greater amounts of compression activity; larger <scs> values mean that the PC wants the modem to treat noisier conditions as silence. There is no unit of measure for this parameter; it merely represents a number in a range. 0 disables modem silence compression.</p> <p>In voice transmit mode, the PC signals the modem that the data stream was recorded with silence compression by selecting a non-zero value from within the valid range (the same value as receive). Unpredictable results can occur if you 1) enable silence compression for transmitting a voice data stream that was not recorded with silence compression enabled, or 2) you disable silence compression for transmitting a voice data stream that was recorded with silence compression enabled. You can modify the silence expansion with the <sel> parameter. The range of valid values is 0–255. The modem may limit silence compression sensitivity to a narrower range (e.g., 120–128). A setting of <scs>=0 disables silence compression.</p> <p><sel> is used to modify the amount of silence expansion. This parameter represents the minimum amount of silence that the modem will expand a period of silence that was previously deleted with a non-zero <sel> parameter. A setting of <sel>=0 means the modem will not modify the silence expansion. The valid range of values is ____ - ____ in 0.1second increments. The modem ignores the <sel> parameter if the <scs> parameter is 0 (silence compression disabled).</p>

Command: +VSM=? Report Voice Compression Method

Result Codes: OK

Description: The +VSM=? command reports several compression method identifiers in one of two ways: either 1) a compression method (for PCM coding) from the table below, or 2) a cooperative identifier (non-PCM coding) used with other manufacturer's equipment.

Example: The following shows an inquiry about the modem support of compression and other data. In this example, the modem reports that it supports two compression methods.

```
AT+VSM=?
```

```
128,"SIGNED PCM",12,0,(7200-8000,11025),(127-129),(0-50)
```

```
132,"ADPCM/AQ",2,40,(7200),(128),(0-50)
```

The compression method identifiers for PCM coding display the general classification of the compression method in the form <cmid>.

Non-PCM coding reports the compression method identifiers in the form <cmid>/<author>, where <cmid> is the general classification of the compression method and <author> is the source of the method. The source <author> may be a proprietary method or it may reference a published standard. Each field limit is 20 characters. The +VXT command starts a translation to or from a particular manufacturer's proprietary voice data stream format to an unsigned (non-PCM) format.

Identifier	Description
Signed PCM	Linear PCM sampling using twos complement signed numbers
Unsigned PCM	Linear PCM sampling using unsigned numbers
A-Log/Author	Compression using a-law
U-Log/Author	Compression using u-law
DPCM/Author	Differential Pulse Coded Modulation
DPCMAQ/Author	Differential Pulse Coded Modulation with Adaptive Quantizer
ADPCM/Author	Adaptive Differential Pulse Coded Modulation
VSELP/Author	Vector Sum Exited Linear Predictor
RELP/Author	Residual Exited Linear Predictor
CELP/Author	Code Book Exited Linear Predictor
CVSD/Author	Continuously Variable Slope Delta Modulation
TDHS/Author	Time Domain Harmonic Distortion
ADM/Author	Adaptive Delta Modulation
DM/Author	Delta Modulation
APC/Author	Adaptive Predictive Coding
ATC/Author	Adaptive Transform Coding
SBC/Author	Sub-Band Coding
GSM/Author	Regular Pulse Excitation Long-term Predictor (RPELTP)
LPC/Author	Linear Predictive Coding
EAPDPCM/Author	Embedded Bit ADPCM
MP-LPC/Author	Multi-pulse LPC
LSLTCQ	Least Squares Lattice Trellis Coded Quantization

IS-101 does not make any provisions for standard compression modifiers.

Command: +VTD=<dur> Select Default Beep Tone Duration Timer (DTMF/Tone Generation Duration)

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VTD= command causes the modem to set the default DTMF/tone generation duration used with the +VTS command. This command does not affect the ATD command settings. The <dur> parameter range is given by the +VTD=? command, in units of 0.01 seconds. A setting of +VTD=0 specifies a manufacturer-specific time interval.

Command: **+VDR=<enable>,<report>** **Enable/Disable Distinctive Ring (Ring Cadence Reporting)**

Values: See the Description

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VDR command causes the modem to enable or disable reporting of the ring cadence information, and to control the timing of the Ring event code report if ring cadence reporting is enabled.

This report format is one line per silence period, and one line per ring period. The length of the silence period is in the form DROF=<number in units of 0.1 seconds><CR><LF>, and the length of the ring in the form DRON=<number in units of 0.1 seconds>. The <LR> character is optional. The modem may produce a Ring event code after the DRON message if enabled by the <report> parameter. The <report> parameter should be set to a value larger than the expected off-times within a single pattern so that the Ring event reports are issued only during the off-times between the complex patterns.

<u><enable></u>	<u><report></u>	<u>Description</u>
0	N/A	The modem will not generate ring cadence reports. Other call progress event codes (including Ring) are reported as normal.
1	0	The modem only produces DROF and DRON messages. Other call progress result codes (including RING) are reported as normal.
1	non-zero	The modem only produces DROF and DRON messages. The RING result code is displayed after the falling edge of the ring pulse (i.e., after the DRON report).
2–255	non-zero	Reserved for future standards.

Example: The lines below shows a cadence with an off time of 4.0 seconds, an on time of 0.8 seconds, an off time of 0.4 seconds, and an on time of 0.8 seconds. The RING result code is displayed 0.5 seconds after the last DRON message. The command to enable this sample sequence is +VDR-1,5 , as shown below:

```
<DLE><X>
DROF=40
DRON=8
DROF=4
DRON=8
RING
<DLE><.>
<DLE><X>
DROF=40
DRON=8
DROF=4
DRON=8
RING
<DLE><.>
```

Command: +VDT=<enable>,<report> Control Tone Cadence Reporting

Result Codes: OK if the modem accepts the command; ERROR if the parameter is out of range.

Description: The +VDT command causes the modem to enable or disable reporting of the control tone cadence information in the frequency band used by the Ring Back/Remote Ring, Busy, and Reorder/Fast Busy tones (usually in the 300 - 600 Hz range). This reporting is subject to the tone detection restrictions reported by the +VLS=? command.

The report format is one line per silence period, and one line per ring period. The length of the silence period is in the form CPOF=<number in units of 0.1 seconds><CR><LF>, and the length of the ring period is in the form CPON=<number in units of 0.1 seconds>. The <LR> character is optional.

Note: The +VEM command can disable the reporting of this command regardless of the current setting of the +VDT= command.

<u><enable></u>	<u><report></u>	<u>Description</u>
0	N/A	The modem will not generate control tone cadence reports. Control tone event codes are reported as normal.
1	0	The modem only produces DROF and DRON messages. The modem will not report any Ring Back/Remote Ring, Busy, and Reorder/Fast Busy tones event codes. Other control tone event codes are reported as normal.
1	non-zero	(for future implementation)
2-255	non-zero	Reserved for future standards.

Example: The lines below shows control tone cadence reporting enabled, with an on tone of 2.0 seconds and an off time of 4.0 seconds. The command used to enable the sample sequence is +VDT=1. Note the absence of the Ring Back/Remote Ring, Busy, and Reorder/Fast Tone event reports.

```
CPOF=40
CPON=20
CPOF=40
CPON=20
CPOF=40
CPON=20
```

Command: +VEM=<mask> Event Reporting and Masking

Values: bits 0–32 on (i.e., FFFFFFFF8)

Result Codes: OK if the modem accepts this command; ERROR if the bit field contains illegal characters.

Description: The +VEM= command can be used to disable an event report, regardless of the modem's state, or of the modem's analog signal source or destination's configuration. The <mask> parameter is a bit field where bit 0 is the most significant bit of an eight-digit hex number. The PC setting of a bit enable event reporting for that event. Bit 0 in the bit field corresponds to Event number 0 (Caller ID) (see Features Matrix for models that support Caller ID). This mask effects the reporting of the specified event in all modes (Fax, On-line data, AT Command and Voice modes). Events cannot be masked by modes; however, the PC can change the mask each time it changes modes. The modem-detectable events depend on the compression method selected by the +VSM command. The +VEM command may effect the reporting capabilities of other +V commands. The detection of an event may not be possible at all times and for all compression methods. Use the +VLS=? command to ask which times and for which compression methods (as well as for which analog source/destination selections) events can be detected and reported when not disabled by the +VEM command.

Example: In the lines below, only the RING and the DTMF event detection reporting:

```
AT+VEM=18000000
OK
```

Command: **+VEM=?** **Report Event Reporting and Masking Capabilities**

Description: The +VEM=? command returns four lines of modem event reporting/masking capability information, followed by the OK result code. The first line indicates the Service Level supported by the modem (though the modem may support more than the capabilities displayed). The next three lines report the capability of the Voice Transmit mode, Voice Receive mode, and the Voice Command mode, respectively. Each line is a hex value that is the bit-wise OR function across all of the supported compression methods and across all analog source/destination hardware configurations (i.e., all +VLS settings) for the specified mode. Note that the displayed hex values are not connected to the <mask> parameter in the +VEM and +VEM? commands.

Interface Configuration Commands

The commands in this section are used to define the interface between the PC and the modem.

Command: **+VBT=<deassert>,<assert>** **Set Modem Flow Control Assert and Deassert Points**

Values: <assert> and <deassert> are buffer offsets from the start of the buffer. The buffer's first position is 0. The offset units are octets.

Result Codes: OK if the modem accepts the command; ERROR if either the <assert> or <deassert> parameter is greater than the buffer size, or if the <de-assert> parameter is greater than or equal to the <assert> value.

Description: The +VBT= command is used to set the flow control assert and deassert points inside the modem's internal transmit buffer. As data is sent from the PC to the modem and is stored in the modem's buffer, when the number of octets in the buffer equals the <assert> value, the modem asserts flow control to the PC (e.g., turns off CTS circuits, or sends an XOFF character). As the modem removes data from the buffer and processes the data, when the number of octets in the buffer equals the <deassert> value, the modem de-asserts flow control (e.g., turns on CTS circuits, or sends an XON character). The modem may inform the PC (using the +VBT=? command) that the PC does not permit the modifying of the flow control assert and deassert points by returning a single value, not in the range of values, for each control point.

The +VBT= command controls the amount of "skid" in the modem's voice buffer, where "skid" is the amount of octets that the modem could accept before losing data after the modem asserts an off flow control signal to the PC.

You can use the +VBT= command to balance performance versus robustness. For example, if the PC knows there are only 16450 UARTs present, a small "skid" is probably sufficient. If there are 16550 UARTs present, a larger "skid" is probably required.

Command: **+VBT=?** **Report Modem Flow Control Assert and Deassert Points**

Description: The +VBT=? command displays the possible <assert> and <deassert> values set by the +VBT= command, followed by the OK result code.

Example: In the lines below, the +VBT=? command is used to ask about the modem's flow control and buffer size ranges. The modem reports the deassert point is adjustable between 20 and 100 octets, the assert point is adjustable between 150 and 180 octets, and the transmit buffer size is 200 octets.

```
AT+VBT=?
(20-100) , (150-180) , (200
OK
```

Command: **+VPP=<enable>** **Enable or Disable Voice Mode Packet Protocol**

Values: 0, 1; (2–255 reserved for future standards)

Result Codes: OK if the modem accepts the command; ERROR if the <enable> value is out of range.

Description: The +VPP= command enables and disables the Packet protocol for Voice mode operation, and handles the new unsolicited Voice mode result codes. The Packet protocol is used to detect lost octets on the modem-to-PC serial link, and to recover the lost octets by requesting retransmission. The Packet protocol assumes that the data corruption is not a problem on the communications link, the last octet sent will never be lost due to data overrun (i.e., that the newer octets always overwrite previous octets in the communications input buffer, a common UART design feature).

Several PC processes can cause serial input channel neglect for longer than the Protocol time between asynchronous characters (typically less than 521 microseconds), and data loss can occur. If a character is lost in the received data, the playback of the voice data may be impaired or lost. If a character is lost in the final result code, the connection may fail. The Packet protocol permits recovery from such data loss.

Command: **+VPR=<rate>** **Select DTE/DCE Interface Rate (Turn Off Autobaud)**

Values: 0, 1, 2, 3, 4, 5, 6, 7, 8

Result Codes: OK if the modem accepts the command; ERROR if the <rate> value is out of range.

Description: The +VPR= command causes the modem to select between various fixed modem-to-PC interface rates and autobauding. The selected fixed interface rate stays in effect until the modem selects another interface rate or autobauding, or until the modem returns to autobauding on the expiration of the Inactivity Timer. The newly selected rate takes effect after the modem returns the OK result code.

+VPR=0 select autobauding
+VPR=1 select 2400 bps
+VPR=2 select 4800 bps
+VPR=3 select 7200 bps
+VPR=4 select 9600 bps
+VPR=5 select 12000 bps
+VPR=6 select 14400 bps
+VPR=7 select 16800 bps
+VPR=8 select 19200 bps

If the modem claims support for autobauding (+VPR=0), it means that the modem can accept AT commands at 2400 bps at all times while in Voice command mode and with +VPR=0.

Flow Control

XON/XOFF flow control is used by the SocketModem to match the PC-to-modem data rate to the line-signaling rate, as well as to the requirements of analog conversion of the voice signals and voice data.

In-band, uni-directional XON/XOFF flow control is mandatory. RTS/CTS (V.24 circuits 106 and 133) flow control is optional per the IS-101 standard.

Voice Mode Result Codes

In Voice mode, the modem can detect and report DTMF, detect call progress tone and cadence events, evaluate voice quality, and can monitor telco-related activities. Events can be reported as a single character (Simple or "Terse" reporting), a full-text message (Message or "Verbose" reporting), or as a repeating pattern (Pattern reporting).

Terse Verbose

0	Caller ID Report
1	DID Report
2	Distinctive Ringing
3	RING
4	DTMF Received
5	Receive Buffer Overrun
6	Facsimile Calling (e.g., 1100 Hz)
7	Data Calling (e.g., 1300 Hz)
8	Local Phone On/Off Hook
9	Presumed Hang Up (SILENCE) Time-out
10	Presumed End of Message (QUIET) Time-out
11	SIT Tone (CO Standard Information Tones, sent to pay phones)
12	Bong Tone (Calling Card Tone)
13	Loop Current Interruption
14	Loop Current Polarity Reversal
15*	Call Waiting Beep/Interrupt*
16*	Distinctive Call Waiting*
17*	TDD Detected (e.g., 1400/1800 Hz)*
18	Ring Back/Remote Ring
19	BUSY
20	DIALTONE
21	Reorder/Fast Busy
22	V.21 Channel 2 7E Flags
23	Transmit Buffer Under Run
24	Extension Phone On/Off Hook
25	Facsimile or Data Answer (e.g., 2100 Hz)
26	Data Answer (e.g., 2225 Hz)
27	Voice Detect
28	Call Waiting Plus Caller ID
29	Stuttered Dial Tone
30	Invalid Voice Data Format
31	Lost Data Detected Event
32	Facsimile Answer
33-63	Reserved for future standard
above 63	Manufacturer specific

* Further study required for final specification.

The TIA/EIA-602 CONNECT result code is disallowed in voice mode.

Unsolicited Voice Mode Result Codes

The form of the unsolicited result codes for voice mode is different from standard modem Command mode result codes. The **+V** specification refers to these voice mode result codes as "event detection reports". Event detection reports are provided in simple report format when one character is enough to report an event, such as *RING*. A complex report format is used when one character is not enough to report an event; generally, all multi-character responses. Complex event reports are in the format `<tag> <=> <data> <cr>`, where `<tag>` is the data type, `=` is the ASCII = sign, `<data>` is a specific data instance, and `<cr>` is ASCII 13 decimal.

Valid Complex Event Report Tags

Tag	Description
TIME	Caller ID Tag in the form TIME=HHMM, where HH is the hour (00-23) and MM is the minute (00–59). All numbers are in ASCII and numbers less than 10 have a leading 0.
DATE	The current date in the format MMDD (where MM is the month 0–12 and DD is the day 01–31). All numbers are in ASCII and numbers less than 10 have a leading 0.
NMBR	The telephone number of the caller, in the format NMBR=<Number> or P or O (ASCII 4F hex). The P indicates that the calling number information is not available since the originating caller has requested Private service. The O indicates that the calling number information is not available since the caller is outside of the area code.
NAME	The caller's name in the format NAME=<Listing Name>.
MESG	Indicates a data item not listed above in Multiple Message Format: MESG=<Data Tag><Length of Message><Data><Checksum> in printable ASCII (to avoid confusion with binary output).
ERRM	Error Tag (used for Caller ID and other uses). Refer to the +VCID command.
DRON	Distinctive Ring Cadence On time
DROF	Distinctive Ring Cadence Off time
CPON	Control Tone Cadence On time
CPOF	Control Tone Cadence Off time
CWON	Call Waiting Cadence On time
CWOF	Call Waiting Cadence Off time
ASTB	See Voice Mode Shielded Codes
SITT	The data value for the SITT tag, in the format <code><SITT><=><data><cr></code> , where <code><data></code> can mean: <ul style="list-style-type: none"> ICNT Intercept Tone VCCT Vacant Code Tone REOT Reorder Tone NCDT No Circuit Detected Tone TON4 Fourth SIT Tone Number TON5 Fifth SIT Tone Number TON6 Sixth SIT Tone Number TON7 Seventh SIT Tone Number

In the event of an unrecognized data tag, the SocketModem presents the data item information as printable hex ASCII numbers following the MESG tag. For example:

```
RING
DATE=0321
TIME=1405
NMBR=5045551234
NAME=DOE JOE
MESG=060342424231
RING
RING
```

Voice Mode Shielded Codes

These codes can be sent in either Command mode or Data mode. The DCE may return the event detection reports after the OK result code from the +FCLASS command. One or more simple event detection reports may be embedded within the data portion of a complex event detection report. Table 3 describes voice mode shielded codes. The number in the first column is the ASCII equivalent (in hex). Voice Mode Shielded Codes Detail

Shielded Code	Hex	Event Report Description
<DLE>	(10)	Two contiguous <DLE><DLE> codes indicate a single <DLE> in the data stream.
<SUB>	(1A)	<DLE><DLE> in the data stream.
<ETX>	(3)	End Data State; signifies the end of voice data. Can end with Event 9 (Presumed Hang Up Timeout), Event 10 (Presumed End of Message), Event 13 (Loop Current Interruption), Event 14 (Loop Current Polarity Reversal), Event 19 (BUSY), or Event 20 (DIALTONE).
Q	(51)	Data stream shielded Xon character. Used in the +VXT command to shield XON characters in the full-duplex data stream and in the Packet Protocol. (The +VXT command is not supported by the MT5634SMI-ITP.)
S	(53)	Data stream shielded Xoff character. Used in the +VXT command to shield XOFF characters in the full-duplex data stream and in the Packet Protocol.
M	(4D)	Data stream shielded SOH code used for the Packet Protocol.
W	(57)	Data stream shielded ETB code used for the Packet Protocol.
F	(46)	Data stream shielded ACK code used for the Packet Protocol.
U	(55)	Data stream shielded NAK code used for the Packet Protocol.
G	(47)	Data stream shielded ENQ code used for the Packet Protocol.
T	(54)	Timing Mark.
X	(58)	Packet Header for the "Complex Event Detection Report" (additional event data transfers to the DTE).
.	(2E)	Packet Terminator for the "Complex Event Detection Report" (additional event data transfers to the DTE).
/	(2F)	Start of DTMF tone shielding.
~	(7F)	DTMF transitions to off.
R	(52)	Event Number 3 (RING). The <DLE> shielded version of the RING result code.
1	(31)	Event Number 4 (DTMF 1).
2	(32)	Event Number 4 (DTMF 2).
3	(33)	Event Number 4 (DTMF 3).
4	(34)	Event Number 4 (DTMF 4).
5	(35)	Event Number 4 (DTMF 5).
6	(36)	Event Number 4 (DTMF 6).
7	(37)	Event Number 4 (DTMF 7).
8	(38)	Event Number 4 (DTMF 8).
9	(39)	Event Number 4 (DTMF 9).
0	(30)	Event Number 4 (DTMF 0).
A	(41)	Event Number 4 (Extended Keypad DTMF A).
B	(42)	Event Number 4 (Extended Keypad DTMF B).
C	(43)	Event Number 4 (Extended Keypad DTMF C).
D	(44)	Event Number 4 (Extended Keypad DTMF D).
*	(2A)	Event Number 4 (Extended Keypad DTMF E).
#	(23)	Event Number 4 (Extended Keypad DTMF E).
o	(6F)	Event Number 5 (Receive Buffer Overrun).
c	(63)	Event Number 6 (Facsimile Calling).
e	(65)	Event Number 7 (Data Calling).
h	(68)	Event Number 8 (line current break). Local phone goes on hook.
H	(48)	Event Number 8 (line current detected). Local phone goes off hook.
s	(73)	Event Number 9 (Presumed Hang Up "SILENCE" Timeout).
q	(71)	Event Number 10 (Presumed End of Message "QUIET" Timeout).

J	(4A) Event Number 11 (SIT Tone).
\$	(24) Event Number 12 (Bong Tone).
I	(6C) Event Number 13 (Loop Current Interruption). Usually indicates a remote hang up.
L	(4C) Event Number 14 (Loop Current Polarity Reversal). May indicate a hang up or a receive, depending on CO implementation.
w	(77) Event Number 15 (Call Waiting/Beep Interrupt).
t	(74) Event Number 17 (TDD Detected - 1400/1800).
r	(72) Event Number 18 (Ring Back).
b	(62) Event Number 19 (BUSY). May be repeatedly sent.
d	(64) Event Number 20 (DIALTONE). May be repeatedly sent.
K	(4B) Event Number 21 (Reorder/Fast Busy).
F	(46) Event Number 22 (V.21 Channel 2 7E flags).
u	(75) Event Number 23 (Transmit Buffer Under run).
p	(70) Event Number 24 (Line voltage increase - extension phone goes on hook).
P	(50) Event Number 24 (Line voltage increase - extension phone goes off hook).
a	(61) Event Number 25 (Facsimile or Data Answer).
f	(66) Event Number 26 (Data Answer).
V	(56) Event Number 27 (Voice Detection). A high confidence of voice.
v	(76) Event Number 27 (Voice Detection). A low confidence of voice.
i	(69) Event Number 29 (Stuttered Dial tone).
E	(45) Event Number 30 (Invalid Voice Data Format. Voice data is incompatible with selected Voice Compression Methods).
Y	(59) Event Number 31 (Lost Data Detected Event).
m	(6d) Event Number 32 (Facsimile Answer).
%	(25) Event Number 63 (manufacturer specific).
&	(26) Event Number 48 (manufacturer specific).
'	(27) Event Number 49 (manufacturer specific).
(	(28) Event Number 50 (manufacturer specific).
)	(29) Event Number 51 (manufacturer specific).
all other 7-bit ASCII	Reserved for future use.

Sample Sessions

This section provides voice mode Send/Receive handshaking examples.

Sample Rate Selection and Suggested Compression Method

Command	Response
AT+VSM=?	The PC inquires about the compression methods and bits-per-sample options. The modem reports two compression methods: 1) PCM, twelve bits per sample, timing marks, sampling rates of 7200-8000 and 11025, three levels of silence compression sensitivity, and silence clip to 0.5 seconds; 2) The same as 1 above, but without silence compression; 3) ADPCM, two bits per sample, timing marks, sampling rate of 7200, no silence compression, and no silence clip. 128, "SIGNED PCM", 12, 40, (7200-8000, 11025), (127-129), (0-50) 129, "SIGNED PCM", 12, 0, (7200-8000, 11025), (0), (0) 132, "ADPCM/AQ", 2, 40, (7200), (0), (0) OK
AT+VSM=128	The PC selects the first compression method with the intent of queuing the event detection capabilities of the modem.
OK	The modem agrees.
AT+VEM=?	Checks the modem event detection capability for the first compression method.
"C"	The modem reports Service Level C.
0A000100	
0E601800	
1A803840	
OK	
AT+VSM=132	Selects the second compression method with the intent of querying the event detection capabilities of the modem.
OK	The modem agrees.
AT+VEM=?	Checks the modem event detection capability for the second compression method.
"B"	The modem reports Service Level B.
0A000100	
04600000	
1A803040	
OK	
AT+VLS?	The modem inquires about what analog source and destinations are available. The modem reports that a microphone and speaker are available: 0, " ", 0A000100, 0E601800, 1A803840 1, " T", 0A000100, 0E601800, 1A803840 4, " S", 0A000100, 0E601800, 1A803840 6, " M", 0A000100, 0E601800, 1A803840 OK
AT+VSD=?	The modem inquires about what end-of-voice receive silence detection capabilities are available.
(127–129), (50–200)	The modem reports that three levels of sensitivity and a time interval between 5.0 and 20.0 seconds.
Some time later, the PC wants to transmit or receive a voice message. The PC selects 1) the first compression method at 7200 sampling rate, enable silence compression with nominal silence sensitivity, and no silence clipping; 2) report all modem-supported event detection; 3) set end of receive silence detection at nominal silence sensitivity setting and for 5.0 seconds:	

AT+VSM=128, 7200, 128, 0; +VEM=FFFFFFFF8; +VSD=128, 50
 OK The modem agrees.
 AT+VSM=129, 7200, 0, 0 The PC changes its PC/modem interface rate to 38400 bps and selects a compression method with the least sensitive setting, with the goal of playing a message with less distortion, and at 7200 samples per second. (Assume that the PC issued a +VSM=? command earlier.)
 OK The modem agrees.
 AT+VLS=4 The modem selects the speaker. The modem had earlier reported that a speaker was available.
 OK The modem agrees.
 AT+VTX The PC selects the Voice Transmit mode.
 CONNECT The modem agrees.
 <Data> The PC delivers <DLE> shielded and silence compressed voice data across the PC/modem interface.
 <DLE> <ETX> The PC indicates the end of the Voice data stream.
 OK The modem indicates it is in Voice Command mode.
 AT+VLS=0 The PC deselected all devices.
 OK The modem agrees.
 The PC switches to Data mode, Command mode, and autobauding enabled:
 AT+VIT=0; +VPR=0; +FCLASS=0
 OK The modem agrees.

Answer Phone, Play Greeting Message, and Record Message Example

<u>Command</u>	<u>Response</u>
AT+FCLASS=8; AT+VIT=60; +VPR=16	The DCE switches to Voice mode. The DTE selects a fixed DTE-DCE interface rate. The DTE knows from the sample rate selected earlier and the bits-per-sample that the DTE-DCE interface rate should be 38400 bps. The DTE-DCE Inactivity Timer starts with 60 seconds.
OK	DCE agrees (to the old DTE/DCE interface rate).
AT+VSM=129, 7200, 0, 0	DTE changes its DTE/DCE rate to 38400 bps and selects a compression method with the least sensitive setting, with the goal of recording a message with less distortion, and at 7200 samples per second. Assume that the DTE issued a +VSM=? command earlier.
OK	The DCE agrees.
AT+VSD=127, 20	DTE selects a silence detection period of 2 seconds.
AT+VLS=0	DTE selects a silence detection period of 2 seconds with the least sensitive setting (for detecting the end of voice recording).
OK	The DCE agrees.
AT+VIT=0;	The DTE selects the Data mode with autobauding, and disables +VPR=0; automatic DCE answering. The DCE waits for a phone call.
+FCLASS=0	(not necessarily in Data mode).
S0=0	
OK	The DCE agrees.
RING	At some time, a remote station calls.
AT+FCLASS=8;	The DCE switches to Voice mode. The DCE selects a fixed AT+VIT=60; DTE/DCE Interface Rate. The DTE knows from the sample AT+VPR=16; rate selected earlier and the bits per sample that the DTE/DCE Interface Rate should be 38400 baud. The DTE/DCE Inactivity Timer starts with a value of 60 seconds.
OK	The DCE agrees (at the old DTE/DCE Interface Rate).
AT+VLS=0	The DTE selects all devices.

OK	The DCE agrees.
AT+VIT=0;	The DTE selects Data mode/Command mode with
+VPR=0;	autobauding, and disables automatic DCE answering. The +FCLASS=0; DCE
S0=0	waits for a phone call (not necessarily in Data mode).
AT+FCLASS=8;	The DCE switches to Voice mode. The DCE selects a fixed
AT+VPR=16;	DTE/DCEAT+VIT=60; Interface Rate. The DTE knows from the sample rate selected earlier and the bits
	per sample that the DTE/DCE Interface Rate should be 38400 baud. The
	DTE/DCE Inactivity Timer starts with a value of 60 seconds.
OK	The DCE agrees (at the old DTE/DCE Interface Rate).
<DLE> <R>	The DCE selects another ring (at 38400 bps).
AT+VLS=2	The DCE answers the phone.
OK	The DCE indicates that it is in Voice Command mode.
AT+VTX	The DTE selects Voice Transmit mode.
CONNECT	The DCE agrees.
<Data>	The DTE plays the welcome message.
<DLE> <ETX>	The DTE indicates the end of the data stream.
OK	The DCE indicates that it is in Voice Command mode.
AT+VTS= {933, 0, 12}	The DTE annotates the greeting message with a 1.2 sec. beep.
OK	The DCE is ready for another Voice command.
AT+VSM=132, 7200, 0, 0	The DTE selects a low bit compression scheme to save disk space.
OK	The DCE agrees.
AT+VRX	The DTE selects the Voice Receive mode.
CONNECT	The DCE agrees.
<Data>	The DCE delivers <DLE> shielded and silence-compressed voice data across
	the DTE/DCE interface.
<DLE> <NUL>	The DTE strokes the Inactivity Timer.
<DLE> </>	The DCE reports the start of a possible DTMF tone.
<DLE> <5> <DLE>	<5> The DCE reports a DTMF 5 detection for 140 milliseconds (within a 70
	millisecond resolution).
<DLE> <->	The DCE reports the end of the DTMF 5 detection. For this example, DTMF 5
	means "finish with the voice message, and switch to fax mode".
<DLE> <!>	The DTE wishes to end the record by sending an abort command.
<DLE> <ETX>	The DCE indicates the end of the Voice data stream, and returns to Voice
	Command mode.
AT+VNH=1	The DTE selects to disable automatic hang-ups while in Service Class 2 +VIT=0
	(+FSK command result codes in Telco on-hook). The DTE switches the
	+FCLASS=2 DCE to Service Class 2 fax mode.
OK	The DCE agrees.
ATA	The DCE starts the fax receive process.

DTE/DCE Interface Rates

The table below indicates the anticipated modem-to-computer interface rates for both the 7.2 bits-per-sample rate and the 8 bits-per-sample rate.

Projected DTE/DCE Interface Rates for 7.2/8K Hz Sample Rates

Bits per Sample	Projected DTE/DCE I/F Rate @ 7.2K Hz	Projected DTE/DCE I/F Rate @ 8K Hz
0.5	4800	9600
1	9600	19200
2	19200	19200
3	38400	38400
4	38400	57600
5	57600	57600
6	57600	115200
7	115200	115200
8	115200	115200
9	115200	115200
10	115200	115200
11	115200	115200
12	115200	Fast
13	Fast	Fast

Chapter 5 – Remote Configuration and Country Code Configuration

Remote Configuration

Remote configuration is a network management tool that allows you to configure modems anywhere in your network from one location. With password-protected remote configuration, you can issue AT commands to a remote SocketModem for maintenance or troubleshooting as if you were on-site.

Basic Procedure

The following steps are valid regardless of whether the connection is established by the local or the remote Multi-Tech modem.

1. Establish a data connection with a remote SocketModem.
2. Send three remote configuration escape characters followed by **AT** and the setup password and press **Enter**. Example: **%%%ATMTSMODEM**. You have four tries to enter the correct password before being disconnected. If the password is correct, the remote modem responds with **OK**.
3. You can now send AT commands to configure the remote modem.
4. When you have finished configuring the remote modem, save the new configuration by typing **AT&W0**. Press **Enter**.
5. Type **ATO**. Press **Enter** to exit remote configuration. You can now break the connection.

Setup

Multi-Tech modems are shipped with a default setup password (MTSMODEM). Because anyone who has the User Guide knows the default setup password, you should change the password and possibly also the remote configuration escape character.

Changing the Setup Password

1. Open a data communications program such as HyperTerminal.
2. In the terminal window, type **AT#SMTSMODEM** (or **AT#Syyyyyy** if you have replaced the MTSMODEM password with yyyyyy) and press **Enter**. The modem responds with **OK** if the setup password is correct and **ERROR** if it is wrong.
3. To change the password, type **AT#S=yyyyyy**, where yyyyyy stands for the password and press **Enter**. The password can include any keyboard character and can be up to eight characters long. The modem responds with **OK**.
4. The new password is saved automatically. You can now either enter more AT commands or exit the data communications program. The next time you remotely configure the modem you must use the new setup password.

Note: You can only change the setup password locally; you cannot do it remotely. Also, passwords are case sensitive. The next time you enter the password, it must be in the same case as you set it up.

Changing the Remote Escape Character

To further improve security, you can change a remote modem's remote configuration escape character. The remote configuration escape character is stored in register **S9**. The factory default is 37, which is the ASCII code for the percent character (%). Setting **S9** to 0 (zero) disables remote configuration entirely.

Caution: If you do this remotely, you won't be able to change it back remotely!

1. Establish a remote configuration link with the remote modem as described in **Basic Procedure**.
2. Type **ATS9=*n***, where *n* is the ASCII code for the new remote configuration escape character and press **Enter**.
3. Save the new value by typing **AT&W** and pressing **Enter**.
4. Type **ATO** and press **Enter** to exit remote configuration.

Country Code Configuration

Different countries have different requirements for how modems must function. Therefore, before you use the modem, you must configure it to match the defaults of the country in which you are using it. You can use one of two configuration methods: Using the Global Wizard and Using AT Commands.

Using the Global Wizard Utility

The Global Wizard configuration utility is recommended for computers running Windows.

1. Insert the MT5634SMI system CD into the CD-ROM drive. The **Autorun** dialog box appears.
2. Click Initial Setup and Country Selection. The Global Wizard dialog box appears. Click **Next**.
3. View the Global Wizard as it searches for your modem and identifies it. Click **Next**.
4. Select the country in which the modem will be used, and then click **Next**.
5. Review your choice of country. If it is correct, click **Next** to configure the modem.
6. When Global Wizard announces that the parameters have been set, click **Finish** to exit.

Using AT Commands

If you are comfortable using AT commands, you can configure your modem using AT commands. You must enter these commands in your communication program's terminal window.

To configure the modem for a specific country, execute the following AT commands:

Type **AT%T19,0,nn** (*nn* stands for country code). Press **Enter**. **OK** is displayed.

Then save the changes by issuing the following command:

AT&F&W

To verify that the correct country has been configured, issue the following command:

ATI9

The country code is then displayed in decimal format.

The following is an example of country, AT commands, and result codes.

Country	AT Command (Hexadecimal)	Result Code (Decimal)
Euro/NAM*	At%T19,0,34 (default)	52
Australia	At%T19,0,01	1
Czech Republic	At%T19,0,25	37
Japan	At%T19,0,10	16
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For a complete listing see the Multi-Tech Web site at www.multitech.com

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