# Chapter 5 – 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 98/95 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 **AT*X n***, 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 (e.g., &, +, %, etc.) 2nd, alphabetized by the second command character (Except for listing of **AT**).

| Command | Description |
|---|---|
| **AT** | Attention Code |
| **A** | Answer |
| **A/** | Repeat Last Command |
| **B*n*** | Communication Standard Setting |
| **D*s*** | Dial |
| **DS=*y*** | Dial Stored Telephone Number |
| **E*n*** | Echo Command Mode Characters |
| **F*n*** | Echo Online Data Characters |
| **H*n*** | Hook Control |
| **I*n*** | Information Request |
| **M*n*** | Monitor Speaker Mode |
| **N*n*** | Modulation Handshake |
| **O*n*** | Return Online to Data Mode |

| | |
|---|---|
| **P** | Pulse Dialing |
| **Q*n*** | Result Codes Enable/Disable |
| **S*r*=*n*** | Set Register Value |
| **S*r*?** | Read Register Value |
| **T** | Tone Dialing |
| **V*n*** | Result Code Format |
| **W*n*** | Result Code Options |
| **X*n*** | Result Code Selection |
| **Z*n*** | Modem Reset |
| **&C*n*** | Data Carrier Detect (DCD) Control |
| **&D*n*** | Data Terminal Ready (DTR) Control |
| **&E*n*** | XON/XOFF Pass-Through |
| **&F*n*** | Load Factory Settings |
| **&G*n*** | V.22bis Guard Tone Control |
| **&K*n*** | Flow Control Selection |
| **&L*n*** | Leased Line Operation |
| **&P*n*** | Pulse Dial Make-to-Break Ratio Selection |
| **&Q*n*** | Asynchronous Communications Mode |
| **&S*n*** | Data Set Ready (DSR) Control |
| **&T*n*** | Loopback Test (V.54 Test) Commands |
| **&V** | Display Current Settings |
| **&W*n*** | Store Current Configuration |
| **&Zy=*x*** | Store Dialing Command |
| **\A*n*** | Select Maximum MNP Block Size |
| **\B*n*** | Transmit Break |
| **\K*n*** | Break Control |
| **\N*n*** | Error Correction Mode Selection |
| **\Q*n*** | Flow Control Selection |
| **\T*n*** | Inactivity Timer |
| **\V*n*** | Protocol Result Code |
| **-C*n*** | Data Calling Tone |
| **%A** | Adaptive Answer Result Code Enable |
| **%B** | View Numbers in Blacklist |
| **%C*n*** | Data Compression Control |
| **%DC*n*** | AT Command Control |
| **%E*n*** | Fallback and Fall Forward Control |
| **%H*n*** | Direct Connect Enable |
| **%R*n*** | Cisco Configuration |
| **%S*n*** | Command Speed Response |
| **$EB*n*** | Asynchronous Word Length |
| **$D*n*** | DTR Dialing |
| **$MB*n*** | Online BPS Speed |
| **$SB*n*** | Serial Port Baud Rate |
| **#CBA*n*** | Callback Attempts |
| **#CBD*n*** | Callback Delay |
| **# CBF?** | Callback Failed Attempts Display |
| **# CBFR** | Callback Failed Attempts Reset |
| **# CBI*n*** | Local Callback Inactivity Timer |
| **# CBN*y*=*n*** | Store Callback Password |
| **# CBP*n*** | Callback Parity |
| **# CBR*y*** | Callback Security Reset |
| **# CBS*n*** | Callback Enable/Disable |
| **#P*n*** | Set 11-bit Parity |
| **#S*x*** | Enter Setup Password |
| **#S=*x*** | Store Setup Password |
| **+VDR=*x, y*** | Distinctive Ring Report |
| **+++AT<CR>** | Escape Sequence |
| **%%%AT<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: **B*n*** **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: **D*s*** **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
Default: none
Description: Dial a number previously stored in directory number *y* by the ***&Zy=x*** command. Example: **ATDS=2**

Command: **E*n*** **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: **F*n*** **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: **H*n*** **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: **I*n*** **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: **M*n*** **Monitor Speaker Mode**
Values: *n* = 0, 1, 2, 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: **N*n*** **Modulation Handshake**
Values: *n* = 0 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: **O*n*** **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 renegotiation 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: **Q*n*** **Result Codes Enable/Disable**
Values: *n* = 0 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 S*r* 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 **S*r*** 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: **V*n*** **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: **W*n*** **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: **X*n*** **Result Code Selection**
Values: *n* = 0–7
Default: 4
Description:
X0 Basic result codes (*e.g., CONNECT*); does not look for dial tone or busy signal.
X1 Extended result codes (*e.g., 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: ***Z*n*** **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: **&C*n*** **Data Carrier Detect (DCD) Control**
Values: *n* = 0, 1, 2
Default: 1
Description:
&C0 Forces the DCD circuit to be always high.
&C1 DCD goes high when the remote modem's carrier signal is detected, and goes low when the carrier signal is not detected.
&C2 DCD drops on disconnect for time set by S18. It then goes high again (for some PBX phone systems).

Command: **&D*n*** **Data Terminal Ready (DTR) Control**
Values: *n* = 0, 1, 2, or 3
Default: 2
Description:
&D0 Modem ignores the true status of the 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, the modem hangs up and resets as if an **ATZ** command were issued.

Command: **&E*n*** **XON/XOFF Pacing Control**
Values: *n* = 12 or 13
Default: 12
Description:
&E12 Disables XON/XOFF pacing.
&E13 Enables XON/XOFF pacing.

Command: **&F*n*** **Load Factory Settings**
Values: *n* = 0
Default: None
Description:
&F0 Load factory settings as active configuration.
**Note:** See also the ***Z*** command.

Command: **&G*n*** **V.22bis Guard Tone Control**
Values: *n* = 0, 1, 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: **&K*n*** **Flow Control Selection**
Values: *n* = 0, 3, or 4
Defaults: 3
Description:
&K0 Disable flow control.
&K3 Enable CTS/RTS hardware flow control.
&K4 Enable XON/XOFF software flow control.

Command: **&L*n*** **Leased Line Operation**
Values: *n* = 0, 1, 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: **&P*n*** **Pulse Dial Make-to-Break Ratio Selection**
Values: *n* = 0, 1, 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: **&Q*n*** **Asynchronous Communications Mode**
Values: *n* = 0, 5, 6, 8, or 9
Default: 5
Description:
&Q0 Asynchronous with data buffering. Same as ***\N0***.
&Q5 Error control with data buffering. Same as ***\N3***.
&Q6 Asynchronous with data buffering. Same as ***\N0***.
&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: **&S*n*** **Data Set Ready (DSR) Control**
Values: *n* = 0 or 1
Default: 0
Description:
&S0 DSR is always high (on).
&S1 DSR goes high only during a connection.

Command: **&T*n*** **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: **&W*n*** **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 also the ***&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
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: **\A*n*** **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: **\B*n*** **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: **\K*n*** **Break Control**
Values: *n* = 0–5
Default: 5
Description: Controls the response of the modem to a break received from the computer, the remote modem, or the ***\B*** command. The response is different for each of three different states.

**Data mode. The 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. The 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. The 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: **\N*n*** **Error Correction Mode Selection**
Values: *n* = 0–5, 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: **\Q*n*** **Flow Control Selection**
Values: *n* = 0, 1, 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: **\T*n*** **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: **\V*n*** **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: **\X*n*** **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: **-C*n*** **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: **%C*n*** **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: **%DC*n*** **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: **%E*n*** **Fallback and Fall Forward Control**
Values: *n* = 0, 1, or 2
Default: 2
Description: %E0 Disable fallback and fall forward.
%E1 Enable fallback, disable fall forward.
%E2 Enable fallback and fall forward.

Command: **%H*n*** **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: **%R*n*** **Cisco Configuration**
Values: *n* = 0, 1
Default: 0
Description: %R0 Disables Cisco configuration.
%R1 Sets **E0**, **Q1**, **&D0**, **\N0**, **$SB9600**, and **%S1** for operation with a Cisco router.

Command: **%S*n*** **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: **$D*n*** **DTR Dialing**
Values: *n* = 0 or 1
Default: 0
Description: $D0 Disables DTR dialing.
$D1 Dials the number in memory location 0 when DTR goes high.

Command: **$EB*n*** **Asynchronous Word Length**
Values: *n* = 0 or 1
Default: 0
Description: $EB0 Enables 10-bit mode.
$EB1 Enables 11-bit mode.

Command: **$MB*n*** **Online BPS Speed**
Values: *n* = speed in bits per second
Default: 28,800
Description:

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|---|---|
| $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: **$RP*n*** **Ring Priority vs. AT Command Priority**
Values: *n* = 0 or 1
Default: 1
Description:

| | |
|---|---|
| $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. |
| $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. **Note:** ModemModules do not detect ring cadence of TelTone telephone line simulators as a valid ring. |

Command: **$SB*n*** **Serial Port Baud Rate**
Values: *n*= speed in bits per second
Default: 115200
Description:

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|---|---|
| $SB300 | Sets serial port to 300 bps |
| $SB1200 | Sets serial port to 1200 bps |
| $SB2400 | Sets serial port to 2400 bps |
| $SB4800 | Sets serial port to 4800 bps |
| $SB9600 | Sets serial port to 9600 bpst |
| $SB19200 | Sets serial port to 19200 bps |
| $SB38400 | Sets serial port to 38400 bps |
| $SB57600 | Sets serial port to 57600 bps |
| $SB115200 | Sets serial port to 115200 bps |
| $SB230400 | Sets serial port to 230400 bps |

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.

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.

| | |
|---|---|
| +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. The RING result code is reported after the falling edge of the ring pulse (i.e., 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 hangup or reset.

Command: **#Pn** **Set 11-bit Parity**
Values: n = 0 or 1
Default: 2
Description:
#P0 No parity.
#P1 Odd parity.
#P2 Even parity.

Command: **#S*x*** **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>** **Escape Sequence**
Values: n/a
Description: Puts the modem in command mode (and optionally issues a command) while remaining online. Type **+++AT** and up to two optional command characters; then press ENTER. Used mostly to issue the hang-up command: **+++ATH<CR>**.

Command: **%%%AT<CR>** **Remote Configuration Escape Sequence**
Values: n/a
Description: 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.

| ***mod*** | **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 |
| V90[3] | 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 the 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 result in longer connect times, in which case 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.

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.

| | |
|---|---|
| +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. The RING result code is reported after the falling edge of the ring pulse (i.e., 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 hangup or reset.

Command: **#Pn Set 11-bit Parity**
Values: n = 0 or 1
Default: 2
Description:
#P0 No parity.
#P1 Odd parity.
#P2 Even 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<br>128–255 | 43 (+) | Sets ASCII code for the escape sequence character.<br>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<br>33–127 | 8 (^H) | Sets the ASCII code for the backspace character.<br>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 | Sets the maximum V.34 “upstream” speed at which the modem attempts to connect.<br>0 = maximum speed<br>1 = reserved<br>2 = 1200/75 bps<br>3 = 300 bps<br>4 = reserved<br>5 = 1200 bps<br>6 = 2400 bps<br>7 = 4800 bps<br>8 = 7200 bps<br>9 = 9600 bps<br>10 = 12000 bps<br>11 = 14400 bps<br>12 = 16800 bps<br>13 = 19200 bps<br>14 = 21600 bps<br>15 = 24000 bps |

16 = 26400 bps
17 = 28800 bps
18 = 31200 bps
19 = 33600 bps

***S38*** decimal 0–23 1

Sets "downstream" data rate where V.90 provides rates of 28,000 to 56,000 bps in increments of 1,333 bps.
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
**Upstream data rates:** Upstream V.90 data rates are 4800 to 33,600 bps in 2400 bps increments.

***S43*** decimal 0–1 1

*For testing and debugging only.* Enables/disables V.32bis start-up auto mode operation. 0 = disable; 1 = enable.

***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.

| Terse | Verbose | Description |
|---|---|---|
| 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 6 - 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.

| S-Register | Description |
|---|---|
| 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

| Command | Description |
|---|---|
| ***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 command 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, 3–255
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., Modem*Module*).

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, 3–255Result 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: The +VRX command 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. The +VRX commands are as follows.

| | |
|---|---|
| +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).

**Warning:** 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: The +VLS= command causes the modem to select one or more source and destination devices for the analog data to be transmitted. The parameter <label> is used to identify 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, and the 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 is off-hook. Modem is 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>,trasmit 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 Ringbacks 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).

| +VSD 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:<br><sds> = 128; nominal level of silence detection sensitivity<br><sds> > 128; more aggressive level of silence detection sensitivity (less sensitive, higher noise levels considered to be silence).<br><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: 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.

The parameter meanings are described below.

<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.

<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.

<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.

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.

<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).

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 co-operative 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 Quantizier |
| 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 Exitation 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.

| **<enable>** | **<report>** | **Description** |
|---|---|---|
| 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.

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

| <enable> | <report> | Description |
|---|---|---|
| 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 Modem*Module* 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 <SITT><=><data><cr>, where <data> can mean:<br>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 Modem*Module* 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.<br>The modem reports two compression methods:<br>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;<br>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.<br>128, "SIGNED PCM", 12, 40, (7200-8000, 11025), (127-129), (0-50)<br>129, "SIGNED PCM", 12, 0, (7200-8000, 11025), (0), (0)<br>132, "ADPCM/AQ", 2, 40, (7200), (0), (0)<br>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"<br>0A000100<br>0E601800<br>1A803840<br>OK | The modem reports Service Level C. |
| 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"<br>0A000100<br>04600000<br>1A803040<br>OK | The modem reports Service Level B. |
| AT+VLS? | The modem inquires about what analog source and destinations are available.<br>The modem reports that a microphone and speaker are available:<br>0, " ", 0A000100, 0E601800, 1A803840<br>1, " T", 0A000100, 0E601800, 1A803840<br>4, " S", 0A000100, 0E601800, 1A803840<br>6, " M", 0A000100, 0E601800, 1A803840<br>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 deselects 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

| **Command** | **Response** |
|---|---|
| AT+FCLASS=8;<br>AT+VIT=60;<br>+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<br>S0=0 | (not necessarily in Data mode). |
| 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;<br>+VPR=0;<br><br>S0=0 | The DTE selects Data mode/Command mode with autobauding, and disables automatic DCE answering. The +FCLASS=0; DCE waits for a phone call (not necessarily in Data mode). |
| AT+FCLASS=8;<br><br>AT+VPR=16; | The DCE switches to Voice mode. The DCE selects a fixed DTE/DCEAT+VIT=60;<br>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. |