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**SMS using AT commands with your GSM modem**

You can check and send SMS using AT commands. You can connect to your serial port via "putty" or "hyperterminal" to run these AT commands.

AT commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

Note that the starting "AT" is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. For example, D is the actual AT command name in ATD and +CMGS is the actual AT command name in AT+CMGS. However, some books and web sites use them interchangeably as the name of an AT command.

Note that mobile phone manufacturers usually do not implement all AT commands, command parameters and parameter values in their mobile phones. Also, the behavior of the implemented AT commands may be different from that defined in the standard. In general, GSM/GPRS modems designed for wireless applications have better support of AT commands than ordinary mobile phones.

In addition, some AT commands require the support of mobile network operators. For example, SMS over GPRS can be enabled on some GPRS mobile phones and GPRS modems with the +CGSMS command (command name in text: Select Service for MO SMS Messages). But if the mobile network operator does not support the transmission of SMS over GPRS, you cannot use this feature.

Introduction

Some advanced GSM modems like Huawei and Multitech, support the SMS text mode. This mode allows you to send and receive SMS messages using AT commands, without the need to decode the binairy PDU field of the SMS first. This is done by the GSM modem.

To send the commands discussed in this tutorial, you can use a terminal program, for instance Hyperterminal.

To check if your modem supports this text mode, you can try the following command:

AT+CMGF=1

If the modem reponds with "OK" this mode is supported. Please note that using this mode it is onluy possible to send simple text messages. It is not possible to send multipart, Unicode, data and other types of messages.

Setting up the modem

If the modem contains a SIM card with is secured with a PIN code, we have to enter this pin code first:

AT+CPIN="0000" (replace 0000 with your PIN code).

Please not that in most cases you have only 3 attemps to set the correct PIN code. After setting the PIN code, wait some seconds before issueing the next command to give the modem some time to register with the GSM network.

In order to send a SMS, the modem has to be put in SMS text mode first using the following command:

AT+CMGF=1

If the modem responds with error, either the modem does not support SMS text mode, or the SIM card is not ready. In this case please check that the SIM card is inserted and the pincode is entered. You can also turn on extended error reports by using the following command:

AT+CMEE=1

Instead of just an "ERROR" the modem will now respond with "+CMS ERROR: xxx" or "+CME ERROR: xxx". For a list of possible error codes please check this list.

Selecting the preferred message storage

A GSM phone or modem receives messages automatically. Basically you are just retrieving the messages from the memory of the device or SIM card. To select the message storage used to read the messages from, you have to use the "AT+CPMS" command. You can select one of the following message storages, not all storages are supported on every device.

Storage ID Description

* SM Read SMS messages from the SIM card. This storage is supported on every GSM phone, because a SIM card should always be present. Usually a SIM card can store up to 15 messages.
* ME Read SMS messages from the modem or mobile phone memory. The number of messages that can be stored here depends on the size of the phones memory.
* MT Read SMS messages from all storages on the mobile phone. For instance when the phone supports "ME" and "SM", the "MT" memory combines the "ME" and "SM" memories as if it was a single storage.
* BM This storage is only used to read stored incoming cell broadcast messages. It is normally not used to store SMS messages.
* SR When you enable status reports when sending SMS messages, the status reports that are received are stored in this memory. These reports can read the same way as SMS messages.

To find out which storages are supported by your mobile phone, use the command line below:

AT+CPMS=?

The modem will respond with a list of supported storages, for instance:

+CPMS: (("SM","BM","SR"),("SM"))

The storage can be selected using the following command:

AT+CPMS=[,,]

The first parameter sets the storage to read from the second optional specifies the storage to send messages from and the last optional parameter tells the device where to store newly received messages.

For example, to read messages from the SIM card use:

AT+CPMS="SM"

The modem should respond with the following string:

+CPMS: ,

The used\_space indicates the number of messages currently in this memory, the max\_space the number of messages that can be stored.

Listing the messages

Once you have successfully set the messages storage, you can list the messages available using the list command:

AT+CMGL="ALL"

Please not that "ALL" has to be send in uppercase on some modems. The modem will respond with a list of decoded SMS messages:

+CMGL: 1,"REC UNREAD","+31625044454",,"07/07/05,09:55:16+08"

Test message 1

+CMGL: 2,"REC UNREAD","+31625044454",,"07/07/05,09:56:03+08"

Test message 2

OK

The response messages are formatted like this:

+CMGL: <index>,<status>,<from\_address>,<mr>,<scts><CRLF><data>

* index The memory index number, use this index to read or delete this message.
* status The status of this message. For received messages this can be "REC READ" or "REC UNREAD" depending on whether the messages has been read or listed before.
* from\_address The subscriber number of the person who sent the message.
* mr The reference number of this message. Most modems keep this field empty.
* scts The time the message was forwarded to this phone or modem.
* data The actual message data in plain text

Reading a message

To list a single message, you have to use the read command. You must use the list command first, so you know the indexes of the messages in the storage. For instance, to read the message on memory location '2' use:

AT+CMGR=2

The modem will list the single message:

+CMGR: "REC READ","+31625044454",,"07/07/05,09:56:03+08"

Test message 2

OK

Please note that the status of the message is now "REC\_READ" instead of "REC\_UNREAD" because we read the message.

Deleting a message

Once you have read a message, you can free the memory by deleting the message from the storage.

For instance, to delete the message on memory location '2' use:

AT+CMGD=2

The modem will delete the single message.

More AT commands:

* Get basic information about the mobile phone or GSM/GPRS modem. For example, name of manufacturer (AT+CGMI), model number (AT+CGMM), IMEI number (International Mobile Equipment Identity) (AT+CGSN) and software version (AT+CGMR).
* Get basic information about the subscriber. For example, MSISDN (AT+CNUM) and IMSI number (International Mobile Subscriber Identity) (AT+CIMI).
* Get the current status of the mobile phone or GSM/GPRS modem. For example, mobile phone activity status (AT+CPAS), mobile network registration status (AT+CREG), radio signal strength (AT+CSQ), battery charge level and battery charging status (AT+CBC).
* Establish a data connection or voice connection to a remote modem (ATD, ATA, etc).
* Send and receive fax (ATD, ATA, AT+F\*).
* Send (AT+CMGS, AT+CMSS), read (AT+CMGR, AT+CMGL), write (AT+CMGW) or delete (AT+CMGD) SMS messages and obtain notifications of newly received SMS messages (AT+CNMI).
* Read (AT+CPBR), write (AT+CPBW) or search (AT+CPBF) phonebook entries.
* Perform security-related tasks, such as opening or closing facility locks (AT+CLCK), checking whether a facility is locked (AT+CLCK) and changing passwords (AT+CPWD). (Facility lock examples: SIM lock [a password must be given to the SIM card every time the mobile phone is switched on] and PH-SIM lock [a certain SIM card is associated with the mobile phone. To use other SIM cards with the mobile phone, a password must be entered.])
* Control the presentation of result codes / error messages of AT commands. For example, you can control whether to enable certain error messages (AT+CMEE) and whether error messages should be displayed in numeric format or verbose format (AT+CMEE=1 or AT+CMEE=2).
* Get or change the configurations of the mobile phone or GSM/GPRS modem. For example, change the GSM network (AT+COPS), bearer service type (AT+CBST), radio link protocol parameters (AT+CRLP), SMS center address (AT+CSCA) and storage of SMS messages (AT+CPMS).
* Save and restore configurations of the mobile phone or GSM/GPRS modem. For example, save (AT+CSAS) and restore (AT+CRES) settings related to SMS messaging such as the SMS center address.

**Modem S Register Definitions**

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| **S0** | *Auto-answer* | 0 to 255 | Sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables auto-answer mode |
| **S1** | *Ring counter* | 0 to 255 | S1 is incremented each time the modem detects a ring signal on the telephone line. |
| **S2** | *Escape character* | 0 to 127  (*Default = 43*) | S2 holds the decimal value of the ASCII character used as the escape sequence. A value over 127 disables the escape process. |
| **S3** | *Carriage Return Character* | 0 to 127 ASCII decimal (*Default=13*) | Sets the command line and result code terminator character. Pertains to asynchronous operation only. |
| **S4** | *Line feed Character* | to 127 ASCII decimal (*Default=10*) | Sets the character recognised as a line feed. Pertains to asynchronous operation only. |
| **S5** | *Backspace Character* | 0 to 32 ASCII decimal (*Default=8*) | Sets the character recognised as a backspace. |
| **S6** | *Wait for dial tone* | 2 to 255 seconds | Sets the time in seconds that the modem will try to detect a dial tone (if set) and wait before starting to dial. |
| **S7** | *Wait for Carrier after dial* | 1 to 255 seconds | Sets the time in seconds that the modem will wait for a carrier before hanging up. |
| **S8** | *Pause time for delay* | 0 to 255 seconds | Sets the time the modem must pause when the ‘,’ dial modifier is used. |
| **S9** | *Carrier detect response time* | 1 to 255 tenths of a second. | Sets the time in 10th of a second, that the carrier must be present before the modem considers it valid and turns on RLSD. |
| **S10** | *Lost carrier to Hang-up delay* | 1 to 255 | Sets the time in 10th of a second, that the modem waits before hanging up after a loss of carrier. |
| **S11** | *DTMF Tone duration* | 50 to 255 milliseconds (*Default=95*) |  |
| **S12** | *Escape Prompt Delay* | 0 to 255 1/50 of a second | Defines the maximum period, in fifties of a second, allowed between receipt of the last character of the three escape character sequence and the sending of the OK message. |
| **S18** | *Test timer* | 0 to 255 seconds | Sets the length in seconds that the modem conducts a test. |
| **S25** | *Delay to DTR* | 0 to 255 seconds | Sets the time that the modem will ignore DTR before taking action specified by &Dn. |
| **S26** | *RTS to CTS delay* | 0 to 255 hundredths of a second | Sets the time delay, before the modem turns on CTS after detecting an OFF-ON transition on RTS when &R0 is commanded. |
| **S32** | *XON Character* | 0 to 255 ASCII decimal (*Default=17*) |  |
| **S33** | *XOFF Character* | 0 to 255 ASCII decimal (*Default=19*) |  |
| **S38** | *Delay Before Forced Hang-up* | 0 to 255 seconds | This register sets the delay between the modem’s receipt of the H command to disconnect and the disconnect operation. |
| **S86** | *Call Failure Reason Code* | 0,4,5,9,12,13 or 14 | When the modem issues a NO CARRIER result code, a value is written to this S-register.  0 Normal disconnect, no error occurred  4 Loss of carrier  5 V.42 negotiation failed  9 The modems could not find a common protocol  12 Normal disconnect initiated by the remote modem  13 Remote modem does not respond after ten retransmissions of the same message.  14 Protocol violation |
| **S91** | *PSTN Transmit level Attenuation* | 0 to 15dBm (Corresponding to 0 to -15dBm transmit level) Default : 10dBm | Set the transmit level attenuation level from 0 to 15dBm for the PSTN mode. Some countries may not permit changing the transmit level. |
| **S95** | Extended Result Codes |  | The bits in this register can be set to override some of the Wn command options. A bit set to a 1 in this register will enable the corresponding result code regardless of the Wn setting.  Bit 0 Connect message indicates DCE speed  Bit 1 Append /ARQ to CONNECT XXXX  Bit 2 Enable CARRIER XXXX message  Bit 3 Enable PROTOCOL message  Bit 4 Reserved  Bit 5 Enable COMPRESSION XXXX  Bit 6 Reserved  Bit 7 Reserved |

**AT Modem Command Set**

The Hayes AT command set is the industry standard method of communicating with modems. The information listed here is a general set, some modems might have some different features as well.

'AT' or 'at' always precedes a command. The modem needs these two letters to adjust itself to the settings of the PC’s comport. The modem then switches automatically to the defined baud rate and parity, until the next command is issued or the modem is turned off. The modem will not respond to any commands not preceded by an AT.

The modem recognises following formats :

1 or 0 start bits, 7 or 8 data bits, no, odd or even parity and 1 or 2 stop bits.

The commands can be issued at a rate between 300 and 115,000bps. In V.23 mode, the commands are sent at 1,200bps. The modem’s replies are then sent at 75bps to the PC.

The command interpreter recognises AT and at, but not At or aT. Both characters have to be sent in upper- or lowercase and must be sent directly after one another.

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| **+++** | *Switch from data mode to command mode without dropping the line.* A second before and after this command, no other character may be sent to the modem, including a <CR>. |

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| **A/** | *Repeat last command, no <CR>* |

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| **ATA** | *Answer incoming call*  When you want to answer a call manually, you type this command after a ring has appeared on the screen of your Terminal emulator. |

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| **ATBn** | *Select protocol :Bell or CCITT ( ITU-T )*  This command only affects V.22 orV.21 |
| **n=0** CCITT V.22 or V.21  **n=1** Bell212 or 103 |

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| ***ATDTn*** | *Dial a telephone number*  After issuing this command, the modem will attempt to establish a connection and dial the number n.  The call can be aborted at any stage before the connect message appears, by entering any character except Linefeed*.* |
|  | Options to the command D:  W Wait for dial tone. When using a PABX this is used to wait for the second dial tone. **Note**: not all PABXs give a second dialling tone. Consider using "@" instead.  @ Wait for silence for 5 seconds.  , Pause for 2 seconds (S8)  ! Flash (on-hook for value in S29)  ; Return to command mode after dialling.  P Pulse dial  T Tone dial  n The telephone number to be dialled  Sn Dial number stored in directory entry &Zn where n=0..19. The selected number is shown on the screen for verification.  J Perform MNP10 link negotiation at highest supported speed (for this call only).  L Redial last number.  ^ Disable calling tone, this call only. |

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| **ATEn** | *Command echo to host.*  With this command you can select if the modem should return all the commands to the screen or not. This is useful to check if all characters are received by the modem. If characters appear double on the screen, disable echoing by the modem or by your terminal. The value of ATE can be written in the RAM of the modem using AT&W. |
| **n=0** Commands are not echoed |
| **n=1** Commands are echoed |

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| **ATFn** | *Select transmission mode/speed*  These commands are not valid for V.34 modems. The equivalent command for the V.34 modems is +MS, please refer to this command. |
| n=0 Auto-mode |
| n=1 V.21 300bps |
| n=3 V.23 75Tx/1200Rx with AT%F1  V.23 1200Tx/75Rx with AT%F2 |
| n=4 V.22 1,200bps |
| n=5 V.22bis 2,400bps |
| n=6 V.32bis 4,800bps |
| n=7 V.32bis 7,200bps |
| n=8 V.32bis 9,600bps |
| n=9 V.32bis 12,000bps |
| n=10 V.32bis 14,400bps |

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| **ATHn** | *Go on-hook, hang up*. |
| n=0 Go on-hook (Hang up) |
| n=1 Go off-hook |

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| **ATIn** | *Identifiers* |
| n=0 Product code |
| n=1 Pre-computed Checksum |
| n=2 Returns OK |
| n=3 Returns OK |
| n=4 OEM String |
| n=5 .. 11 Returns OK |
| n=12 ROM Checksum |
| n=13 RC Version number |
| n=14 Shows Firmware version |
| n=15 Shows selected country |
| n=17 GSM option |
| n=18 Shows Supported GSM Kit (GSM-ready™ only) |

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| **ATLn** | *Speaker volume settings.*  With this command the speaker volume can be set. |
| n=0 Lowest speaker volume |
| n=1 Low speaker volume |
| n=2 Medium speaker volume |
| n=3 Highest speaker volume |

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| **ATMn** | *Speaker control* |
| n=0 Speaker always off |
| n=1 Speaker on until carrier detected |
| n=2 Speaker always on |
| n=3 Speaker on only while answering |

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| **ATNn** | *Select Automode*  Connection speed set to that inS37, if S37=0, DCE rate equals last DTE rate or AT command. This command is not longer valid for the V.34 modems. |
| n=0 Automode disabled |
| n=1 Automode enabled |

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| **ATOn** | *Return to data mode* |
| n=0 Return to data mode from command mode, only if on-line. |
| n=1 Return on-line and initiate retrain (2400bps or higher). |

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| **ATQn** | *Result codes.*  If the quiet mode is enabled, the responses from the modem are not sent to the PC. |
| **n=0** Modem returns result codes |
| **n=1** Quiet mode enabled. Modem gives no result codes. |

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| **ATSn** | *Sets and reads the selected register*  n is a numeric value, varying between 0 and 255 (depending on the register). |
| **ATSn=x** Sets register n to the value x |
| **ATSn?** Reads the value of register n |

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| **ATVn** | *Result codes in numerical or verbose form* |
| **n=0** Returns the code in numerical form |
| **n=1** Full-word result codes |

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| **ATWn** | *Connect messages formatting* |
| **n=0** DTE rate (connect rate) |
| **n=1** Hayes 4 line format : Carrier, Protocol, Compression, DTE rate |
| **n=2** Result code is DCE rate (carrier rate) |

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| **ATXn** | *Extended Result codes*  X3 and X1 set the modem for Blind Dialling. This option is country specific, because some countries do not allow blind dialling. |
| **n=1** Ignore dial tone and busy tone |
| **n=2** Ignore busy tone |
| **n=3** Inner dial tone |
| **n=4** Modem recognises dial tone and busy tone |

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| **ATYn** | *Long Space disconnect*  If the modem receives, after activating this function, a BREAK-signal of at least 1.6 seconds coming from the remote PC, it will send a BREAK-signal of 4seconds back to the remote PC before hanging up the telephone line. |
| **n=0** Disable long space disconnect |
| **n=1** Enable long space disconnect |

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| **ATZn** | *Resetting the modem*  If this command is issued to the modem during a connection, the modem will drop the line. According to the parameter n, the modem will restore the values stored in the non-volatile RAM (See also &W). |
| **n=0** Restore stored profile 0 |
| **n=1** Restore stored profile 1 |

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| **AT&Cn** | *Carrier-detect*  Data Carrier Detect (DCD) is a hardware signal that notifies the software that the modem is in communication with another modem. Most software will not start-up properly if the DCD is active. Default is &C1. |
| **n=0** DCD is always active |
| **n=1** DCD is active if modem is on-line |

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| **AT&Dn** | *Data Terminal Ready settings* |
| **n=0** Modem ignores DTR |
| **n=1** Go to command mode on ON-to-OFF DTR transition. |
| **n=2** Hang up on DTR-drop and go to command mode |
| **n=3** Reset (ATZ) on DTR-drop. Modem hangs up. |

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| **AT&Fn** | *Restore factory configuration* |
| **n=0** Use profile 0 |
| **n=1** Use profile 1 |

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| **AT&Gn** | *Select guard tone*  This command may not be permitted in some countries. |
| **n=0** Disables guard tone |
| **n=1** Disables guard tone |
| **n=2** Selects 1800Hz guard tone |

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| **AT&Kn** | *Flow Control*  Flow control is the use of characters or RS232 signals to start and stop the flow of data to avoid data loss during buffering. This is extremely important when the DTE/DCE rate is different from the line speed, e.g. when data compression is used. The DTE/DCE rate must be higher then the line speed.  **RTS/CTS flow control** (Hardware flow control)  The PC will send data to the modem. The modem will store this data in a buffer. When this buffer is full, the modem will drop the CTS-line, telling the PC that it has to stop transmitting data until the signal raises again. If the RTS-signal is OFF, transmitting data to the PC is stopped until the signal switches to ON.  **XON/XOFF flow control** (Software flow control)  If the modem receives an XON-character (S32) from the PC, it stops transmitting data to the PC until it receives a XOFF-character (S33). The process is similar if the PC is sending data to the modem.  **NOTE :** The preferable setting is RTS/CTS flow control |
| **n=0** Flow control disabled |
| **n=3** RTS/CTS flow control (Hardware) |
| **n=4** XON/XOFF flow control (Software) |
| **n=5** Transparent XON/XOFF flow control |
| **n=6** RTS/CTS and XON/XOFF flow control |

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| **AT&Pn** | *Pulse dial make-break*  Settings may be locked depending on country selection. Default is also country dependent. |
| **n=0** 61/39 ratio at 10pps |
| **n=1** 67/33 ratio at 10pps |
| **n=2** 39/61 ratio at 20pps |
| **n=3** 33/67 ratio at 20pps |

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| **AT&Qn** | *Sync Async Mode*  This command is used to control the connection modes permitted. |
| **n=0** Selects direct async operation. |
| **n=1** Selects synchronous connect mode with async off-line command mode. |
| **n=2** Selects synchronous connect mode with async off-line command mode and enables DTR dialling. |
| **n=4** Selects Autosync™mode |
| **n=5** The modem will try to negotiate an error corrected link. |
| **n=6** Selects async operation in normal mode. |

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| **AT&Rn** | *CTS/RTS option*  This selects how the modem controls CTS. CTS operation is modified if hardware FC is selected (AT&Kn). |
| **n=0** In sync mode, CTS tracks the state of RTS. In async mode, CTS acts according V.25 bis handshake. |
| **n=1** In sync mode CTS is always on. In asynchronous mode, CTS will drop only if required by flow control. |

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| **AT&Sn** | *DSR Override*  This command selects how the modem will control DSR. |
| **n=0** DSR will remain on at all times. |
| **n=1** DSR will become active after answer tone has been detected and inactive after the carrier has been lost. |

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| **AT&Tn** | *Test and diagnostics*  The modem will perform selected test and diagnostic functions according to the parameter supplied. A test can be run only when in an asynchronous operation in non-error-correction mode. To terminate a test in progress, the escape sequence must be entered first, except for parameters 7 and 8. |
| **n=0** Terminates test |
| **n=1** Initiates local analogue loop-back |
| **n=2** Returns ERROR |
| **n=3** Initiates local digital loop-back |
| **n=4** Enables digital loop-back acknowledgement for remote request. |
| **n=5** Disables digital loop-back acknowledgement for remote request. |
| **n=6** Requests a remote digital loop-back without self test. |
| **n=7** Requests a remote digital loop-back with self test. |
| **n=8** Initiates local analogue loop-back with self test. |

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| **AT&Vn** | *Display current configuration and stored profiles*  Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers. |

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| **AT&Wn** | *Store current configuration* |
| **n=0** Store current configuration in profile 0 |
| **n=1** Store current configuration in profile 1 |

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| **AT&Xn** | *Select Synchronous Clock Source*  Selects the source of the transmit clock for the synchronous mode of operation. |
| **n=0** Selects internal timing |
| **n=1** Selects external timing |
| **n=2** Selects slave receive timing |

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| **AT&Yn** | *Designate a default reset profile*  Selects which user profile will be used after a hard reset. |
| **n=0** The modem will use profile 0 |
| **n=1** The modem will use profile 1 |

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| **AT&Zn=x** | *Store telephone number* |
| **n=0** to **3** and **x=** dial string |

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| **AT%En** | *LQM and Auto-retrain or FB/FF*  Controls whether or not the modem will automatically monitor the line quality and request a retrain or fall back/fall forward depending on the line quality. |
| **n=0** Disable Line Quality Monitor and auto-retrain |
| **n=1** Enable Line Quality Monitor and auto-retrain |
| **n=2** Enable Line Quality Monitor and fall back/fall forward. (V.34 only) |

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| **AT%Cn** | *Enable/Disable data compression*  Enables or disables data compression negotiation. The modem can only perform data compression on an error corrected link. |
| **n=0** Disables data compression |
| **n=1** Enables MNP5 |
| **n=2** Enables V.42bis |
| **n=3** Enables both V.42bis andMNP5 data compression. |

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| **AT\Gn** | *Modem to modem flow control*  In non-error correction mode, the modem enables or disables the generation or recognition of modem to modem XON/XOFF flow control according to the parameter supplied. In error correction mode, the setting of \G is ignored. |
| **n=0** Disables modem-to-modem flow control |
| **n=1** Enables modem-to-modem flow control |

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| **AT n** | *Operating mode*  This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. |
| **n=0** Normal speed buffered mode.(&Q6) |
| **n=1** Serial interface selected.(&Q0) |
| **n=2** Reliable connection ( FirstV.42 the MNP4). Failure to make a reliable connection results in modem hanging up. |
| **n=3** Auto reliable mode ( FirstV.42, then MNP4 then speed buffered ) |
| **n=4** V.42 (LAPM) . If connection fails, modem hangs up. |
| **n=5** MNP4 EC mode. Failure results in hanging up. |

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| **\An** | *Select maximum MNP block size* |
| **n=0** 64 characters |
| **n=1** 128 characters |
| **n=2** 192 characters |
| **n=3** 256 characters |

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| **)Mn** | *Enable cellular power level adjustment*  Enables or disables automatic adjustment of the transmit power level to accommodate the signalling requirements of cellular telephone equipment. |
| **n=0** Disables transmit power level adjustment during MNP10 link negotiation. |
| **n=1** Enables transmit power level adjustment during MNP10 link negotiation. V.34 : Uses the @Mn value to establish initial cellular connection. After connection power level is determined by modem. |
| **n=2** Enables transmit power level adjustment during MNP10 link negotiation. Uses the @Mn value to establish initial cellular connection. After connection power level is fixed. (V.34 only) |

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| **-Kn** | *MNP Extended Services*  Enables or disables conversion of a V.42 connection to a MNP10 connection. |
| **n=0** Disables V.42 LAPM to MNP10 conversion |
| **n=1** Enables V.42 LAPM to MNP10 conversion |
| **n=2** Enables V.42 LAPM to MNP10 conversion, inhibits MNP ES initiation during V.42 LAPM answering mode detection Phase (V.34 only) |

**V.34 Commands**

Following commands are valid only for V.34 modems.

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| **@Mn** | *Initial Cellular Power Level setting*  Sets the initial power level for up shift at connect until line conditions can be determined. |
| **n=0** -26dBm (Default) |
| **n=1** -30dBm |
| **n=2** -10dBm |
| **n=3**..**10** -10dBm |
| **n=11**..**31** -11dBm.. -31dBm |

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| :**En** | *Compromise Equaliser Enable command*  Enables or disables the V.32compromise equaliser. This command can be used when the modem is attached to either a flat line or a cellular connection. |
| **n=0** Disables the equaliser |
| **n=1** Enables the equaliser |

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| **+MS** | *Select Modulation* |
| **+MS=**<mod>[,[<automode>][,[<min-rate>][,[max\_rate>]]]]  response : +MS:11,1,300,28800 (example)  **Sub-parameter definitions:**  <mod>   |  |  |  | | --- | --- | --- | | **<mod>** | **Modulation** | **Bps** | | 0 | *V.21* | 300 | | 1 | *V.22* | 1200 | | 2 | *V.22bis* | 2400 or 1200 | | 3 | *V.23* | 1200/75 | | 9 | *V.32* | 9600,4800 | | 10 | *V.32bis* | 14400,9600,7200, 4800,1200 | | 11 | *V.34* | 33600,31200,28800,26400,24000, 21600, 19200, 16800, 14400,9600,7200, 4800, 2400 | | 64 | *Bell 103* | 300 | | 69 | *Bell 212* | 1200 | | 74 | *V.FC* | 28800,26400,24000,21600, 19200, 16800, 14400,9600,7200,4800,2400 |   <Automode>  This is an optional numeric value which enables or disables automatic modulation negotiation using V.8 or V.32bis Annex A. The options are :  0 Automode disabled  1 Automode enabled using V.8 orV.32bis Annex A    The default value is 1, which enables automode. Note, however, there are modulations for which there is no automatic negotiation, e.g., Bell 212.  **<Automode>=1**  The modem connects at the highest possible rate in accordance with V.8 or V.32bis Annex A if V.8 is not supported by the remote modem.  A. If <max\_rate> is greater than the highest speed supported by then modulation specified by <mod>, the modem automodes down from the highest rate to the selected modulation. For example : +MS=10,1,1200,24000 selects automoding down from V.32bis 14400bps.   B. To emulate issuance of the N1S37=x sequence command, specify the modulation and the rate to start automoding down from using <mod> and<max\_rate>, respectively.  Examples :  +MS=11,1,300,16800 automode at V.34 16800bps (S37=?)  +MS=9,1,300,12000 automode at V.32bis 12000bps (N1S37=10).  <Min\_rate>  is an optional number which specifies the lowest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g. 2400 specifies the lowest rate to be 2400. The default is 300 for 300bps.   <Max\_rate>  is an optional number which specifies the highest rate at which the modem may establish a connection. The value is decimal coded, in units of bps, e.g. 14400 specifies the lowest rate to be 14400. The default is 33600 for 33600bps. |
| +MS? Reports selected options  response :+MS:(0,1,2,3,8,9,10,13,64,69,74),(0,1),(300-28800),(300-28000) |

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| **AT+CBST** | *Select Bearer Service*  Set command selects the bearer service <name> with data rate <speed>, and the connection element <ce> to be used when data calls are originated |
| +CBST=[<speed>[,<name>[,<ce>]]]  <speed>  0 autobauding (automatic selection of the speed)  2 1200 bps (V.22) 66 1200 bps(V.110)  4 2400 bps (V.22bis) 68 2400bps (V.110)  6 4800 bps (V.32) 70 4800 bps(V.110)  7 9600 bps (V.32) 71 9600 bps(V.110)  <name>  0 asynchronous modem  <ce>  0 transparent  1 non-transparent |

|  |  |
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| **\*NCnn** | *Country select*  To change the country settings, use following procedure :  AT\*NCnn  Modem responds with OK  ATZ  Modem responds with OK   Note : Some counties do not allow their country settings to be altered. |
| nn= 40 Australia |
| nn=1 Austria |
| nn=2 Belgium |
| nn=3 Denmark |
| nn=4 Finland |
| nn=5 France |
| nn=6 Germany |
| nn=17 Greece |
| nn=10 Netherlands |
| nn=7 Ireland |
| nn=8 Italy |
| nn=43 Japan |
| nn=26 Namibia |
| nn=11 Norway |
| nn=12 Portugal |
| nn=27 South Africa |
| nn=13 Spain |
| nn=14 Sweden |
| nn=15 Switzerland |
| nn=16 U.K. |
| nn=22 United States |

http://www.dataIP.co.uk/style/dot.jpg[**Products**](http://shop.dataip.co.uk/products.html) http://www.dataIP.co.uk/style/dot.jpg[**Site Search**](http://www.dataip.co.uk/cgi-bin/search1/search.cgi) http://www.dataIP.co.uk/style/dot.jpg[**Network**](http://www.dataip.co.uk/Network/) http://www.dataIP.co.uk/style/dot.jpg[**Reference**](http://www.dataip.co.uk/Reference) http://www.dataIP.co.uk/style/dot.jpg[**Download**](http://www.dataip.co.uk/Download/) http://www.dataIP.co.uk/style/dot.jpg[**Privacy**](http://www.dataip.co.uk/privacy.php) http://www.dataIP.co.uk/style/dot.jpg[**Terms**](http://www.dataip.co.uk/terms.php) http://www.dataIP.co.uk/style/dot.jpg[**Contact**](http://www.dataip.co.uk/Contact.php)

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When you think you've got a connection, try entering **AT+GMI** and press [enter]. It should reply "huawei". Other harmless commnds to try include:

AT+GMM (returns model)

AT+GMR (returns firmware)

AT+CSQ (returns some numbers relating to the signal strength)

AT+COPS? (returns some numbers relating to the cell / operator code)

AT+COPS=? (may take a half a minute or so - returns info on available networks)

A web-search will reveal a whole host of 'AT' modem-control commands which you can try on 3G modems.

For the unlocking part, try entering:

AT^CARDLOCK?

It should return something like

^CARDLOCK: 2,10,0

where apparently the first digit, a 2, means that the current SIM/network is not blocked by the modem. Apparently the 10 means that 10 PIN-entry tries remain.

If you now insert a 3rd party SIM (i.e. one from a network other than that to which it is locked) into the dongle at this point, and again try:

AT^CARDLOCK?

It will probably return something like

^CARDLOCK: 1,10,0

where apparently the first digit, a 1, means that the current SIM/network is blocked by the modem. Apparently the 10 means that 10 PIN-entry tries remain.

Now enter

AT^CARDLOCK="nnnnnnnn"

where *nnnnnnnn* is the unlock code we obtained before.   
With any luck this will unlock your modem, and a repeat of

AT^CARDLOCK?

should return something like

^CARDLOCK: 2,10,0

even with the 3rd-party SIM. Congrats - it's unlocked!

I was able to prove that the device was unlocked, by making a connection to Vodafone on the (formerly Orange-locked) E1752 from a Netgear MBR624GU 3G router.

Later I was also able to make a basic 'dial up networking' connection from the newer laptop (in which I'd used the E1752 on Orange, and had all the correct drivers installed).

However, I couldn't get the E1752 to be recognised properly by the older desktop computer on which I regularly used the E220 and Vodafone Mobile Connect software. The modem 'virtual CD' would kick in and begin to start the software installer (which I cancelled), but the modem part of the device wasn't being recognised...

You have to do this by entering an AT command using the terminal emulator as above... on a system which *does* recognise the device.

AT^U2DIAG=0 (makes the device modem-only in future)

AT^U2DIAG=255 (makes the device fully-featured in future)

(other variations on the parameters will enable different permutations of the device components). ArchLinux (ref below) reckons:

AT^U2DIAG=0 - the device is only Modem  
AT^U2DIAG=1 - device is in modem mode + CD ROM  
AT^U2DIAG=255 - the device in modem mode + CD ROM + Card Reader  
AT^U2DIAG=256 - the device in modem mode + Card Reader

AT command to list supported commands

AT+CLAC

# Voice modem command set

From Wikipedia, the free encyclopedia

Jump to: [navigation](http://en.wikipedia.org/wiki/Voice_modem_command_set#mw-head), [search](http://en.wikipedia.org/wiki/Voice_modem_command_set#p-search)

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| http://upload.wikimedia.org/wikipedia/en/thumb/9/99/Question_book-new.svg/50px-Question_book-new.svg.png | This article **needs additional** [**citations**](http://en.wikipedia.org/wiki/Wikipedia:Citing_sources#Inline_citations) **for** [**verification**](http://en.wikipedia.org/wiki/Wikipedia:Verifiability). Please help [improve this article](http://en.wikipedia.org/w/index.php?title=Voice_modem_command_set&action=edit) by adding citations to [reliable sources](http://en.wikipedia.org/wiki/Wikipedia:Identifying_reliable_sources). Unsourced material may be [challenged](http://en.wikipedia.org/wiki/Template:Citation_needed) and [removed](http://en.wikipedia.org/wiki/Wikipedia:Verifiability#Burden_of_evidence). *(August 2010)* |

Main article: [Modem](http://en.wikipedia.org/wiki/Modem)

**Voice modem** is a term commonly used to describe an analog telephone data modem with a built-in capability of transmitting and receiving voice recordings over the phone line. Voice modems are used for telephony and [answering machine](http://en.wikipedia.org/wiki/Answering_machine) applications. Similar to the [Hayes command set](http://en.wikipedia.org/wiki/Hayes_command_set) used for data modems, in which the host PC commands the modem via a series of commands known as [AT commands](http://en.wikipedia.org/wiki/AT_commands), there exists a well-defined set of common voice AT commands that are somewhat consistent throughout the industry.

Because voice mode is not the prototypical use for a modem, many modems on the market have poor or buggy support for their voice modes. Characteristics of a good voice modem depend greatly upon the intended application, and include:

* Reliable operation. Many modems simply "lock up" or crash the host PC - though this is more common with [Winmodems](http://en.wikipedia.org/wiki/Winmodem). Others have flow control bugs and other implementation bugs, possibly causing calls to hang, audio to skip, or audio to keep playing after an attempted abort.
* Good audio characteristics. Some modems have an uncorrectably low signal volume or produce audio noise. Some modems are unable to recognize all but the best [DTMF](http://en.wikipedia.org/wiki/DTMF) signals. Some modems do a poor job of recording, or detecting and reporting silence or the end-of-call voltage reversal, which some applications need.
* Support for [Caller ID](http://en.wikipedia.org/wiki/Caller_ID), if needed. "Type-1 caller ID" as used in North America is missing from the vast majority of modems. Nearly all modem chipsets support caller ID, but because the typical dial-up Internet user doesn't need caller ID, the extra components needed to support caller ID are often omitted for cost reasons.
* Support for multiple instances. The drivers for many internal modems (typically Winmodems) cannot tolerate more than one of the same device inside a single computer. Symptoms of incompatibility include crashes, [blue screens of death](http://en.wikipedia.org/wiki/Blue_screen_of_death), or simple inoperability of all but a single modem. External [RS232](http://en.wikipedia.org/wiki/RS232)-based (serial) modems do not have this limitation because each modem contains its own [microprocessor](http://en.wikipedia.org/wiki/Microprocessor) and is unaware of other modems on the same host. [USB](http://en.wikipedia.org/wiki/USB) modems may or may not have this problem, because some USB modems are simply serial modems with a "USB-to-serial" converter chipset (in which case there should be no problem), and other USB modems are "host-controlled" and are essentially externally-attached Winmodems (in which case the problem may persist).

|  |
| --- |
| Contents  * [1 Plus versus Hash](http://en.wikipedia.org/wiki/Voice_modem_command_set#Plus_versus_Hash) * [2 Detecting voice mode](http://en.wikipedia.org/wiki/Voice_modem_command_set#Detecting_voice_mode) * [3 Entering voice mode](http://en.wikipedia.org/wiki/Voice_modem_command_set#Entering_voice_mode) * [4 Querying the modem's capabilities](http://en.wikipedia.org/wiki/Voice_modem_command_set#Querying_the_modem.27s_capabilities) * [5 Answering calls](http://en.wikipedia.org/wiki/Voice_modem_command_set#Answering_calls) * [6 Transmitting audio data](http://en.wikipedia.org/wiki/Voice_modem_command_set#Transmitting_audio_data)   + [6.1 Throttling playback](http://en.wikipedia.org/wiki/Voice_modem_command_set#Throttling_playback) * [7 Recording audio data](http://en.wikipedia.org/wiki/Voice_modem_command_set#Recording_audio_data) * [8 Terminating a voice call](http://en.wikipedia.org/wiki/Voice_modem_command_set#Terminating_a_voice_call) * [9 References](http://en.wikipedia.org/wiki/Voice_modem_command_set#References) * [10 See also](http://en.wikipedia.org/wiki/Voice_modem_command_set#See_also) |

## Plus versus Hash

Each voice modem platform tends to support either one of two sets of voice commands - in particular, one flavor of the command set contains a + sign, and the other contains a # sign.

## Detecting voice mode

Support for voice mode can be detected on a modem by issuing the following command: **AT+FCLASS=?**

This command is usually supported containing the plus sign whether a modem supports "plus" or the "hash" command set, because the command (which stands for "fax class") is part of the industry-standard [fax](http://en.wikipedia.org/wiki/Fax) commands which *always* use the plus.

A modem supporting voice will respond with a comma-delimited list of numbers that includes the number 8. A modem not supporting voice will respond with **ERROR**, or with a list of numbers not including 8. (Many modems will report *0,1,2* indicating support for data (0), and class 1 and 2 faxes - this is an indication that voice support is not present.)

Modems supporting the "hash" command set usually respond to **AT#CLS=?** as well.

## Entering voice mode

The command **AT+FCLASS=8** or **AT#CLS=8** will put the modem in voice mode. Most modems still remain on-hook and respond with **OK**. Once this command has been accepted, most modems will respond with [Data Link Escape](http://en.wikipedia.org/wiki/Data_Link_Escape) (DLE) messages instead of or in addition to normal modem responses. For example, instead of reporting a phone line ringing with the **RING** message, many modems will instead send the DLE ASCII character, followed by the letter R. The specific set of DLE events reported by each modem is specific to its chipset and documented in its reference guide.

## Querying the modem's capabilities

The command **AT+VLS=?** or **AT#VLS=?** usually returns a list of operating modes that are specific to each modem. Each of these numbered modes determines the telephone line's on-hook or off-hook status, as well as sound routing between each of the following:

* Recording/playback
* Telephone handset
* Speakerphone jack (which could simply be hard-wired as an audio input on the PC's sound card instead of being a discrete jack)
* Microphone jack (available on some voice modems)

Many chipsets offer a listing of all the possible combinations of modes even if the specific modem board doesn't support them all. That's because the board manufacturer is almost always different from the chipset maker, and the chipset comes pre-configured to support all possible hardware, even if not implemented on the circuit board.

Example of response to AT+VLS=? from a modem on the market in 2006:

AT+VLS=?

0,"",0000000000,0000000000,B084008000

1,"T",0B8418E000,0FE418E000,0B8419E000

2,"L",0884008000,0CE4008000,0884018000

3,"LT",0B8418E000,0FE418E000,0B8419E000

4,"S",0084008000,0484008000,3084018000

5,"ST",0B8418E000,0FE418E000,0B8419E000

6,"M",0084008000,04E4008000,3084008000

7,"MST",0B8418E000,0FE418E000,0B8419E000

8,"S1",0084008000,0484008000,3084018000

9,"S1T",0B8418E000,0FE418E000,0B8419E000

10,"MS1T",0B8418E000,0FE418E000,0B8419E000

11,"M1",0084008000,04E4008000,3084008000

13,"M1S1T",0B8418E000,0FE418E000,0B8419E000

14,"H",0084008000,04E4008000,3084018000

15,"HT",0B8418E000,0FE418E000,0B8419E000

16,"MS",0084008000,04E4008000,3084018000

17,"MS1",0084008000,04E4008000,3084018000

19,"M1S1",0084008000,04E4008000,3084018000

20,"t",0B8418E000,0FE418E000,BB8419E000

While every modem is different, usually mode 0 means on-hook (hung up) and mode 1 is sufficient to pick up the phone, record/playback audio, and detect [DTMF](http://en.wikipedia.org/wiki/DTMF) (touch tones).

The command **AT+VSM=?** or **AT#VSM=?** usually returns a list of audio data formats supported by the modem. Each format includes a name (such as [PCM](http://en.wikipedia.org/wiki/PCM), [ADPCM](http://en.wikipedia.org/wiki/ADPCM), [μ-law](http://en.wikipedia.org/wiki/%CE%9C-law), [A-law](http://en.wikipedia.org/wiki/A-law)), a number of bits per sample (usually 2, 3, 4, 8, or 16) and an audio sampling rate (usually 7200, 8000, or 11025 [Hertz](http://en.wikipedia.org/wiki/Hertz)). These are industry-standard audio [codecs](http://en.wikipedia.org/wiki/Codecs) whose implementations are well published. The ADPCM standard is an exception. Modems claiming to support ADPCM almost always support [Dialogic ADPCM](http://en.wikipedia.org/wiki/Dialogic_ADPCM), also known as "VOX", which is similar but not compatible with other ADPCM implementations, including [Interactive Multimedia Association](http://en.wikipedia.org/wiki/Interactive_Multimedia_Association) (IMA) ADPCM as well as MS ADPCM (a Microsoft implementation used in [WAV](http://en.wikipedia.org/wiki/WAV) files). Modems may support these as well, if a qualifier is listed - otherwise, by default, ADPCM means Dialogic.

Example response to AT+VSM=? from a modem on the market in 2006:

AT+VSM=?

1,"UNSIGNED PCM",8,0,8000,0,0

129,"IMA ADPCM",4,0,8000,0,0

130,"UNSIGNED PCM",8,0,8000,0,0

140,"2 Bit ADPCM",2,0,8000,

141,"4 Bit ADPCM",4,0,8000,0,0

The desired audio data format is selected using the same command but with a number instead of a question mark. It is used for both sending and receiving.

## Answering calls

Answering calls is usually done with either the **AT+VLS=n** or **AT#VLS=n** commands, where *n* is a number representing the modem's mode. For the vast majority of modems, this number will be 1 to answer a telephone call, and 0 to hang up; other numbers activate other functionality when present, such as speakerphone. Some modems answer in response to **ATA** - the standard data-mode answer command - but other modems will interpret this as a command to actually answer in data and not voice mode.

## Transmitting audio data

To begin transmitting audio data, the host sends the command **AT+VTX** or **AT#VTX**. This results in a response from the modem of **CONNECT** or **VCON**. (Modems using the "plus" command set usually respond CONNECT, while those using the "hash" set respond VCON, which stands for voice connect).

From then on, the modem interprets any data sent from the computer as wave audio data, using the codec selected by the AT+VSM or AT#VSM command.

The audio data is always sent to the modem slightly faster than it can play it, so the modem may [buffer](http://en.wikipedia.org/wiki/Data_buffer) a small portion of it and play it smoothly with no clicks or pops caused by delays in the computer's operating system. For example, during playback of an 8 kHz audio file at 8-bit resolution (which creates 8,000 bytes, or 80,000 bits when including start/stop bits, per second), the data must travel over the serial port at a minimum of 115,200 bits per second. (115,200 bit/s is the first setting of a typical computer serial port that's greater than 80,000). In addition, due to some extra overhead involved in doubling DLE bytes in the stream (mentioned below), a small amount of extra bandwidth is mandatory to allow for this.

When the modem wants the computer to temporarily pause so the playback can catch up, it temporarily lowers the CTS ([Clear to Send](http://en.wikipedia.org/wiki/RS-232_RTS/CTS)) signal on the RS232 serial port. The modem re-raises the signal in time for the computer to resume sending audio data before the playback buffer becomes completely empty.

When the computer wants to signal the end of audio data, most modems expect to see an ASCII DLE character (0x10), followed by the ! character.

Because the DLE byte can and often does occur in normal audio data, it must be sent twice to the modem when it is to be interpreted as a byte of audio data.

Most modems also accept a sequence of DLE + CAN (cancel) as a signal to *cancel* audio playback. The distinction is that the modem is to understand that it is to immediately abort playback now, rather than let remaining data in the playback buffer run to completion.

When the modem is done playback, it responds **OK**.

### Throttling playback

During playback, it is necessary to send the audio data at a rate that keeps the audio playing smoothly, but without sending it faster than the modem can handle it. It is also desirable to make sure the modem can always abort playback and discard any buffered audio in case a message is to be canceled. Message cancellation is expected by callers who already know the answers to voice prompts and provide their answer early (and who would become irritated at being forced to listen to a prompt they've already responded to).

There are several ways to keep the computer sending audio data to the modem at a rate to keep up with playback without overrunning the audio buffer.

The most straightforward is to use CTS flow control. The following caveats exist.

* Some voice modems have bugs in their implementation of flow control. In particular, a large number of [Conexant](http://en.wikipedia.org/wiki/Conexant) chipsets will sometimes drop their CTS line and never bring it back up during playback. Conexant is a hugely popular chipset in voice modems today and they otherwise implement voice commands well, making it worthwhile to consider working around this bug. Some Conexant chipsets will also not bring CTS back up if the "playback abort" command is sent or processed by the modem while CTS is down.
* Some voice modems offer a very large transmit buffer (for example, 4 seconds worth of audio) coupled with a bug that prevents the host from requesting an "abort playback". The result is that if a caller presses a touch-tone that's supposed to interrupt a message, and the host is providing unlimited audio data mediated by CTS alone, the end result is that the message can't be interrupted for at least 4 seconds.

A second way to throttle playback involves polling a "tick" timer provided by the host computer's operating system and based on a hardware clock that's independent of the host's CPU load. This may or may not be available, and it depends entirely on the host operating system. However, when available, it is extremely reliable. It is reasonable to assume that the PC needs to stay ahead of the playback by a couple of hundred bytes and that the modem will buffer this. (The commands AT+VBQ or AT#VBQ on voice modems will often reveal the size of the buffer in bytes, and 1-2 kilobytes is a typical response).

A third way to throttle playback involves inserting dummy DLE messages into the output stream such that the audio data takes a known amount of time to transmit through the serial port, and the playback is essentially clocked by the [UART](http://en.wikipedia.org/wiki/UART) in the serial port.

For example, when considering using dummy DLE stuffing, a few things must first be noted. In a typical scenario, one second of audio might be 8000 one-byte samples, and with a small percentage of the samples being equal to the [DLE](http://en.wikipedia.org/wiki/C0_and_C1_control_codes) byte and must be doubled, a typical second of audio might be 8050 bytes. The trick involves inserting enough meaningless DLE messages into the bytes that the modem will discard (that is, a DLE followed by a byte without any specific meaning) so that there are exactly 11520 bytes (assuming a serial port locked at 115200 bit/s) which will take exactly 1 second to transmit through the serial port. Although it is possible that interrupt latency on the host PC may cause slightly less than 11520 bytes to be sent per second, most voice modems will buffer enough bytes before actually starting playback to permit a small skew here. Also the PC can be programmed to convert a second of audio into slightly fewer than 11520 bytes (all voice modems will buffer a small [overrun](http://en.wikipedia.org/wiki/Buffer_overrun) without the need for flow control as long as it is no more than a few hundred bytes).

Dummy DLE stuffing is unlikely to work with "Winmodems" that have no physical UART. It makes sense only with external serial modems that are physically clocked to a specific bit rate by a [clock generator](http://en.wikipedia.org/wiki/Clock_generator) behind the external serial port.

## Recording audio data

The method for recording audio data is the same, except that the command is **AT+VRX** or **AT#VRX**, and the modem transmits audio data while the computer receives it. The RTS/CTS flow control are not used here (the computer must accept all the audio data it receives, and the modem automatically paces its transmission to match the audio sampling rate).

The modem never stops transmitting until the computer tells it to stop, which is usually with CTRL-C. The data is always terminated with DLE+!, and all DLE bytes naturally occurring in the stream are sent twice to differentiate them from normal DLE messages.

Before, during, and after recording, the modem may notify the computer host of specific events including, but not limited to, the following:

* Touch-tone keypresses detected
* Silence detected
* Line polarity reversal detected (often meaning caller hung up)
* Dial tone detected
* Fax tone detected

When the modem wants to tell the host about these, it sends a DLE byte, plus a (usually) 1-byte message describing the event. The list of supported events varies by modem, but usually a digit (as well as \* and #) mean touch-tones pressed, and the letter "s" means silence detected. Some modems report only one event for each touch-tone keypress, while others report a keypress repeatedly until the key is released, and then a special "key released" event.

## Terminating a voice call

Any of the following commands usually cause the modem to hang up and terminate a voice call: **AT+VLS=0**, **AT#VLS=0**, **ATH**, **ATZ**. Dropping the [RS232](http://en.wikipedia.org/wiki/RS232) [DTR](http://en.wikipedia.org/wiki/Data_Terminal_Ready) (data terminal ready) signal often accomplishes this as well. The modem remains in voice mode (except in the case of ATZ).

Voice modems do not automatically hang up even when the caller on the other end does. They may report the hangup, dialtone, or silence events, but it is up to the computer to act upon them. If when the modem is recording, the caller hangs up and the computer doesn't react, the modem will continue providing the audio recording everything else heard on the line, such as dial tones, telephone company error messages, and so forth.