THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

FCC ID: NBZNRM-6832
2.1033(c)(3) 1 of 2

AT Command Set Reference Guide for Vespa CDPD Modem

PS-01017800

Release 0.1

Tuesday, November 03, 1998

Table of Contents

INTRODUCTION

This document is intended to provide the serial AT Command Interface provided by Vespa CDPD Modem for embedded OEM applications. The Vespa CDPD modem provides a connection-oriented service so that existing OEM application protocols can be used. In addition, the capability to switch the unit to Serial-Line-Internet-Protocol (SLIP) or Point-to-Point-Protocol (PPP) modes are provided so that new protocols can be developed within the OEM application.

This document describes the Novatel Wireless Vespa CDPD Modem. The Vespa CDPD modem is an OEM-module designed for integration into a host product to provide wireless data communication capability via the CDPD (Cellular Digital Packet Data) Network. It features internal TCP and UDP IP stacks as well as SLIP and PPP protocols for an external stack and provisions for using "Sleep Mode" to extend the operating time of battery powered devices.

Scope

The scope of this document is limited to providing information on the various AT commands which can be used on Novatel CDPD products as well as a brief summary of some of the standard AT commands which are not supported. Internal design issues, detailed operating instructions and cost information is not included in this document.

Reference Documents

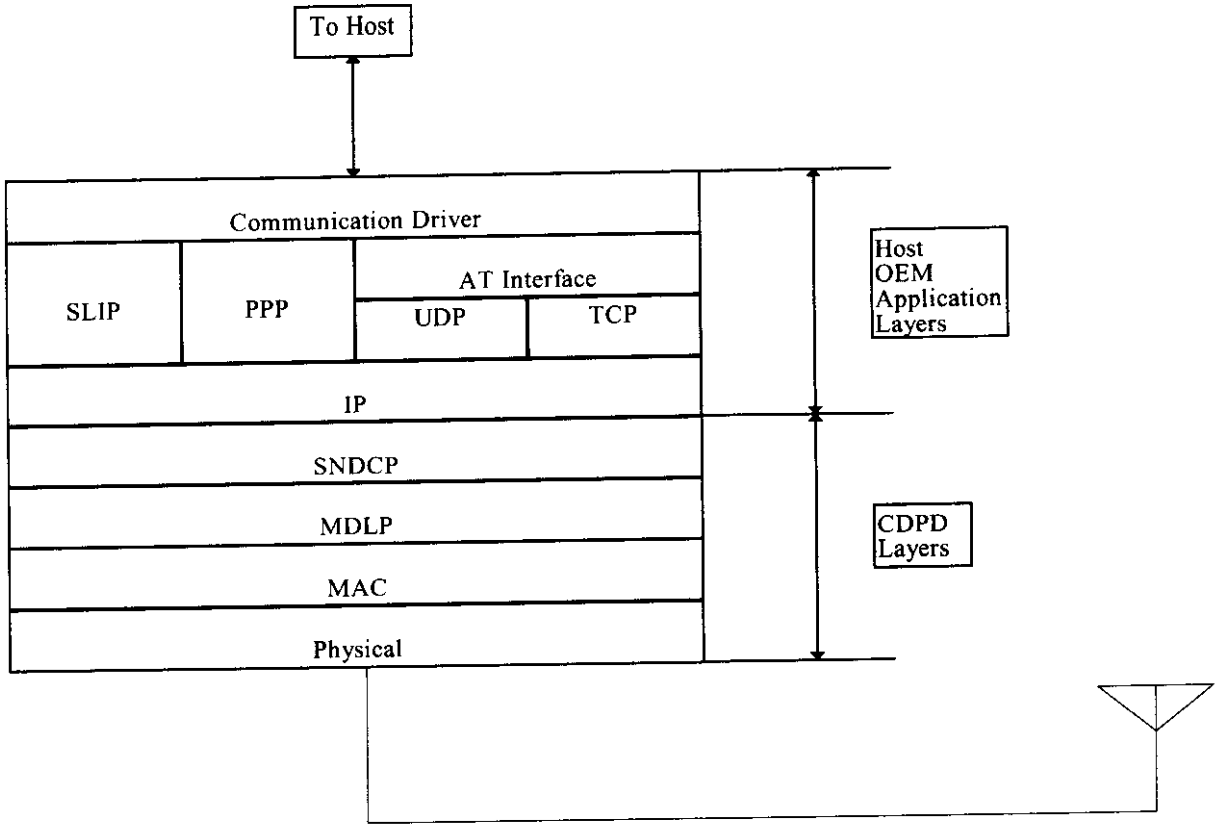
The following released documents provide additional, or more detailed information on the Vespa CDPD Modem:

TS-01016445	Technical Specification for Vespa CDPD Radio Module
OM-01016445	Host Interface Specification for Vespa CDPD Radio Module
GM-01016445	Diagnostics User's Guide for Vespa CDPD Radio Module
TP-01016445	Manufacturing Test Procedure for Vespa CDPD Radio Module
MT-01016445	Manufacturing Acceptance Requirement for Vespa CDPD Radio Module
DA-01016446	CDPD Module Modem (Vespa) Assembly
DS-01016445	Schematic Diagram Vespa CDPD Modem
DA-01016445	Assembly Drawing Vespa CDPD Modem
01016446	Bill of Materials CDPD Modem Module (Direct Mod)

PHYSICAL INTERFACE

Protocol

CDPD System Specification Part 400 Version 1.1 (CDPD Forum Inc.) This is the protocol stack for the Vespa CDPD Modem:



The Vespa CDPD Modem does not support V.42 compression in SNDCP.
The TCP/UDP interface is capable of supporting up to 3 sessions simultaneously[1].
The AT-command set described herein is derived from "CDPD Implementor Guidelines", Release 1.1[2]. It contains a subset of the commands described in Part 2014 that are supported by the Novatel Vespa CDPD Modem.
For the purposes of this specification, "NRM" refers to the Novatel Vespa CDPD Modem; "Host" refers to the OEM application controller.

[1] This is provided to solve the problem presented by delays encountered when closing a TCP session. That is, in order to process Host transactions in rapid succession (and since it is required to establish a new TCP session for each transaction) it is necessary to establish a new TCP session before the previous one has had a chance to close.

[2] CDPD Forum makes no representations about the suitability of any material, comprising the CDPD system specification (or any derivative work incorporating any element thereof) for any purpose; it being provided "as is" and without any warranties whatsoever, express or implied. The CDPD Forum shall not be responsible for any damages of any kind related to the use of the CDPD system specification (or any derivative work incorporating any element thereof), including without limitation, actual, direct, indirect, incidental, consequential, special, or general damages.

Software Interface

The software interface is described in the Host Interface Specification for Vesa CDPD Modem OM-01016445. A brief description of those functions specific to the Vespa CDPD Modem is described here.

AT Command Mode

AT commands and responses are active in command mode only; as determined by the state of the DSR line. Command mode behavior conforms to ANSI/TIA/EIA-602-1992 section 5, with the limitations stated below. The AT command set is a subset of the AT command set defined in ANSI/TIA/EIA-602 and in the CDPD System Specification Part 2014 Version 1.1, section 4.

Command format

Note the following limitations:

- The termination character is fixed as CR (ASCII 13).
- Command line editing is supported (BS, ASCII 08 only).
- Command line repeats (A/) is not supported.
- The rules described below for buffering and flow control also apply to command mode. The Host should not transmit a single AT command which exceeds the buffer length (256 characters). In addition, the Host should wait until all responses associated with an AT command string have been received before issuing another AT command.
- Abortion of command-in-progress is not supported.
- Default command parameters are accepted for the last command on a command line only.

Result format

The format of result code responses is determined by the ATV command setting.
In *terse* mode, the result code is sent as a single ASCII character followed by a carriage return (ASCII 13) character.
In *verbose* mode, a descriptive text message is sent followed by a carriage return. The following result codes are emitted by the NRM:

Terse mode	Verbose mode	Description of Command
0	OK	Command accepted.
1	CONNECT	Connection established.
2	RING	Network origination indication.
3	NO CARRIER	Connection terminated, not established or command aborted.
4	ERROR	Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.)
5	NO SOCKETS	No free TCP sockets within S7 seconds.
6	NO DIALTONE	CDPD link not established.
7	BUSY	Refused by destination or network, OR: Operation in progress.
8	NO ANSWER	No response received from the destination within S7 seconds.
9	HELLO	Issued at power on/reset.

Data Mode Description

The modem contains an integrated TCP/IP protocol stack. It is accessed via AT commands that put the modem into either a TCP or UDP data communications mode. If the application host contains a TCP/IP stack, PPP or SLIP can be used to transfer IP packets between the application host and the modem.

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

The DSR Signal is driven by the modem to indicate the existence of a data session. When the local host asserts DTR, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

The NRM provides Host and Network originated access to the connection-oriented service using TCP/IP. Host origination is accomplished via the DIAL (ATDT) command. Upon successful completion of the DIAL command (i.e. CONNECT result code), the NRM switches to TCP-Data mode. DTR must be asserted prior to issuing the ATDT, ATDP, AT\ASLIP or AT\APPP. If this is not followed the modem will not engage the session in a manner where it can be sustained. The NRM signals a network origination to the Host using the RING result code. Failure to have DTR asserted while in "Listen" mode, network origination, will result in a dropped session. The PAD functions are active during TCP-Data mode only, however, the data buffering functions apply in all modes.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of an incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. . In this mode, the NRM will "Listen" for TCPP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the Host de-asserting the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the NRM returns to AT-CDPD mode. Note that session termination is the only method to return to AT-CDPD mode[3].

For UDP/IP, a connection-oriented service is "fabricated" within the NRM. The DIAL command (ATDP) is used to place the NRM into UDP-Data mode. In this mode, the NRM will "Listen" for UDP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any UDP packets received in AT-CDPD mode, or packets received in UDP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. In UDP-Data mode, the port number for transmitted UDP packets is specified with the destination address associated with the DIAL command. Only the Host Origination and Host Termination scenarios described above apply to UDP operation. The DTR and DSR lines, and the PAD functions, operate as in TCP-Data mode.

[3] The Hayes compatible escape sequence is not supported.

Internal Stack Description

IP (Internet Protocol) is the basic network protocol that routes packets on an IP network. CDPD networks and the Internet are IP networks. Transport protocols deliver packets between applications. Transport protocols use the IP service to deliver data packets between network devices.

In order for an application to communicate across a network, it will first open a port on the local device. The IP address of the local device and this port number becomes the unique address for this application, and is sometimes referred to as a **socket**. When the local application communicates with a distant application, it will send a packet addressed to the IP address and port number of that remote application. This address is the destination address of the packet. The packet will also contain the source address, the IP address and port number of the local application. The remote application may use the source address of the packet received to communicate back to the local application.
There are two common transport protocols used in TCP/IP networks:

UDP Mode Description

User Datagram Protocol is a basic transport protocol that provides a best-effort, connectionless delivery service with minimum overhead. The protocol does not guarantee delivery of packets. There is no checking or retransmission of the data packets. It does provide minimum overhead as it only adds the source and destination port numbers to the header. Since the protocol is unreliable, the application must provide checking, acknowledgments and retransmissions if the data is critical. In many applications, the data is not critical because updates are sent periodically and occasional losses can be tolerated.

UDP sessions may be originated by the local application host or by the network. The **DTR** signal must be asserted or **S211=1** (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by dropping DTR or resetting the unit.

UDP Modes of Operation

Command: ATS83 = <mode>
Where <mode> = Timer value in seconds
0 = Regular mode
1 = Not used (reserved)
2 = Half-Open mode

Originating a UDP Session

A session is originated by the application host issuing the ATD (Dial) command:

ATDPnnn.nnn.nnn.nnn/ppppp

ATDP specifies a UDP session. **nnn.nnn.nnn.nnn** is the destination IP address and **ppppp** is the destination application port number. If no port is specified then a port number of 0 is assumed. It should be noted that UDP and TCP make extensive use of port numbers, please be aware that the modem will use the port number as a criteria for accepting and passing data to the host application.

CONNECT [terse 1] result code will be issued and all ensuing data sent from the host application will be assembled into a UDP packet and transmitted to the destination application.

ERROR [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.

PAD (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register **S50** in 1/10 seconds.

Receiving Data - Once the session is started, any packets sent to the modem's IP address with the port number specified in register **S110** will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

Termination - The session is terminated by dropping DTR or resetting the unit.

TCP Mode Description

Transport Control Protocol, is a reliable, connection-oriented transport protocol that uses acknowledgments and retransmissions to guarantee delivery. This is an obvious advantage for applications where the data is critical and the application cannot provide the required reliability. There is more overhead in the protocol to provide this reliability, making it less efficient than UDP. For larger data transfers, TCP is the easiest protocol to use to get reliable service.

TCP sessions may be originated by the local application host or by the network. The **DTR** signal must be asserted or **S211=1** (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by powering the modem off, dropping DTR or by the remote host terminating the connection. If the session is terminated by a power down, the remote host may not tear down its part of the session properly, leaving the remote host waiting for further information for that session. This can pose problems for some applications. Care in session tear down is essential for reliable operation.

TCP Modes of Operation

TCP Listen mode is established by having **S0=1** when the modem powers up. . The port specified in **S110** will be used for the TCP Listen mode. The **DTR** signal must be asserted or **S211=1** (ignore signal on DTR pin and proceed as if DTR is always asserted) for the unit to enter into a data communications session. When a connection request for the correct port is received by the modem, the modem will establish the connection notify the local host with:

Verbose	**Terse**
RING	**2**
CONNECT	**1**

and begin the TCP session.

Termination - A TCP connection is terminated by dropping DTR, or by the remote end of the TCP connection terminating the session.

Originating a TCP Session

A session is originated by the host application by issuing the ATD (Dial) command:

ATDTnnn.nnn.nnn.nnn/ppppp

ATDT specifies a TCP session. **nnn.nnn.nnn.nnn** is the destination IP address and **ppppp** is the destination application port number. The modem will attempt to establish a connection with the destination host. If it is successful, a **CONNECT** [terse 1] result code will be issued and all ensuing data sent from the app host will be assembled into a TCP packet and transmitted to the destination application.

ERROR [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.

Connection Failure will be signaled by a **BUSY** [terse 7] result code, and may be caused by one of the following:

- Wrong IP address or port number
- The destination device does not have a TCP Listen process open on the port specified.
- The destination host already has a connection established with another client on the specified port.

- Connection failed to complete within the time specified in register **S7** (sec). Normal values are about 30 seconds, but is very dependent upon the application requirements. Many applications, which provide their own time-out for connection failure, will have this value set to 60+ seconds.

PAD (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register **S50** in 1/10 seconds.

Receiving Data - Once the session is started, any packets sent to the modem's IP address with the port number specified in register **S110** will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

Termination - A TCP connection is terminated by dropping DTR or by the remote end of the TCP connection terminating the session.

DTR Control Description

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

The DSR Signal is driven by the modem to indicate the existence of a data session. When DTR is asserted by the local host, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of a incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. . In this mode, the NRM will "Listen" for TCPP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the Host using the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the NRM returns to AT-CDPD mode. Note that session termination is the only method to return to AT-CDPD mode[4].

The DTR line de-asserted can also be optionally used to power the modem off in addition to the termination of the session. If the S211 register is set to 4, then the de-asserting of the DTR line will make the modem terminate any current data session, perform a de-registration with the network and power itself off.

[4] The Hayes compatible escape sequence is not supported.

Push Technology

To receive data while the modem is unattended by the host, the modem has been incorporated with the means to receive the data packet, determine the type of message and the source IP address. This push technology feature can be enabled or disabled by setting or resetting register S250. The modem can signal the host that there are messages queued up, waiting to be retrieved by the host, using any or all of the following signals. The "message waiting" signal can be asserted when a message arrives and will be de-asserted when all messages have been retrieved or deleted. In the case of multiple messages, the "message waiting" signal will be asserted when the first arrives and will only be de-asserted when all messages have been retrieved. Another signal, the "alert" signal, can also be used to provide a 500msec pulse to the host on its associated pin for each message that arrives. These signals can be made available on any of the programmable pins of the interface. Their assignment is made using the programmable GPIO features of the Vespa CDPD Modem.

The modem can hold up to 4 messages, determined by reading register S251, before the buffer overflows and message data is lost. When the host accesses the modem to retrieve the stored messages, the host first determines which messages it wants to retrieve based upon the source IP address. The host can discard messages by setting register S254. This will cause the current message to be flushed from the queue and the next message made available to the host.

PUSH Technology Enable

ATS250?		Query Wake Up Protocol State
ATS250=1		Enable Push Technology
ATS250=0		Disable Push Technology
ATS251?		Query Number of Pending Messages
Response	[0..4]	
ATS252?		Query First Push Message
Response Format	[IPaddress/port] nnn.nnn.nnn.nnn/xxxxx	
ATS253?		Query Type of First Push Message
Response	[0, 1] 0 indicates UDP, 1 indicates TCP	
ATS254=1		Discard Current Message

Slip Mode

Description:

The command to enter Serial Line Internet Protocol mode (SLIP) is used when an external stack configuration is needed. SLIP is useful if the stack resides in the host computer, multiple sessions and complete control over all aspects of each session can be obtained. SLIP is one of the more common protocols used for splitting the functionality between the modem and the host. SLIP does, however, require certain parameters to be set up prior to activating a session. SLIP does not extract the IP address from the modem. This must be set up in dial-up-networking before starting. SLIP is less flexible than Point to Point Protocol (PPP) which is quickly winning over most users.

The SLIP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT\ASLIP can be sent without asserting DTR. To exit SLIP in this case, the host must either power down the modem or use the escape sequence. To terminate a SLIP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

Format:

AT\ASLIP	The command to enter SLIP mode

Validity:

Slip can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

Other Considerations:

While a modem can enter SLIP mode from command mode at any time, the intent of SLIP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering SLIP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a SLIP connection. The Status can be checked using the "ATS57?" command.

Related Topics:

Enter PPP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode. Checking Status, Escape Sequence

Point to Point Protocol (PPP)

Description:

The command to enter Point to Point Protocol mode (PPP) is used when an external stack configuration is needed. PPP is useful if the stack resides in the host computer, providing multiple sessions and complete control over all aspects of each session. PPP is quickly becoming the new standard for dial-in-networking. PPP provides more flexibility and less items that need to be explicitly set.

The PPP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT\APPP can be sent without asserting DTR. To exit PPP in this case, the host must either power down the modem or use the escape sequence. To terminate a PPP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

.

Format:

AT\APPP	The command to enter PPP Mode
The response will be	CONNECT or ERROR
The alternate command to use is	SERVER
The response will be	CLIENT

Validity:

PPP can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

Other Considerations:

While a modem can enter PPP mode from command mode at any time, the intent of PPP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering PPP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a PPP connection. The Status can be checked using the "ATS57?" command.

An alternate method of entering PPP mode is to send the word CLIENT to the modem. The modem will respond with SERVER and then follow with CONNECT. This is NOT an AT command. It is neither preceded by an "AT" nor succeeded by a CR. Exiting PPP mode is performed using the DTR control signal.

Related Topics:

SLIP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode. Checking Status

Data Transmission Mode

Packet Assembly

The NRM provides a local Packet Assembly and Disassembly (PAD) function. For transmission, the character stream from the Host is assembled into packets for RF transmission under the following conditions:
-Idle time-out: If the time between successive characters exceeds the time interval specified in register S50, any pending data is assembled for transmission.

Buffering and Flow Control

The NRM has an input data buffer which is intended to be set larger than the longest transmit message used by existing protocols in the Host. The size of this buffer is 578 characters.

If hardware flow control is disabled and, the NRM is formatting and transmitting data blocks associated with a packet, the Host should not send additional data as this may cause input buffer overflow. Buffer overflow will result in a loss of data with no indication to the Host. In order to avoid data loss, it is recommended (and anticipated) that the Host application protocol operates using a half-duplex ACK/NAK protocol. It should be expected that the Host acknowledgment time-out should be set greater than that required for circuit-switched modem configurations. This is to account for propagation delays through the NRM, CDPD base station and CDPD and Internet networks.

Data Reception Mode

Packet Disassembly

The NRM begins transmitting the character stream associated with a received packet to the Host as soon as all the associated blocks have been received and processed.

Buffering and Flow Control

The NRM has an output data buffer which is intended to be set larger than the longest receive message used by existing protocols in the Host application. The size of this buffer is 2144 characters.

When the NRM is sending the characters associated with a received packet to the Host, the remote host processor should not send additional data as this may result in output buffer overflow. NRM buffer overflow shall result in a loss of data with no indication to the Host or remote host. In order to avoid data loss, it is recommended (and anticipated) that the Host application protocol operates using a half-duplex ACK/NAK protocol. The remote host acknowledgment time-out should be lengthened as described above.

Sleep Mode Description

Sleep mode can be activated by sending the command AT#ZZ=1, AT#ZZ=2 or deactivated by the command AT#ZZ=0. Changes must be entered in program mode. The module should be reset after changing the sleep mode activation since the module will have registered and informed the network that it has sleep mode or not. The module will enter sleep mode, if activated, after the inactivity timer has expired and a Network TEI notification message has been received by the modem.

In areas with low signal strength or where the signal strength varies to a high degree, the unit may not enter sleep mode in a regular fashion. The unit must have conditions where the unit can decode the TEI notification messages from a reliable signal.

No notification message or signal is given to the host that sleep mode is engaged. The host must assume that if the modem has been inactive for more than the number of seconds specified in the inactivity timer that the modem has gone to sleep.

To wake the modem up from sleep mode, the wake-up signal can be asserted for a minimum of 10 ms or a break character of 20 ms in duration followed by a 2 ms pause or 2 character spaces at 19200 bps can be sent. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

No indication is given to the module that the host is in sleep mode. The module will assume the host is sleeping if the module is sleeping and send a break character to initialize communications with the host.

Related Topics:

Sleep Mode Feature Enable/Disable

Sleep Mode Feature Enable/Disable

Description:

This command permits the user to define what sleep mode the modem should use. Since various applications and host computers have different requirements for communicating with a modem that utilizes sleep mode, this command encompasses several different options that should satisfy any application. If sleep mode does not appear to work with your application, please contact Novatel Wireless for assistance. The default setting for this mode is off.

Format:

AT#ZZ?	Sleep status query command
AT#ZZ=0	Disable sleep feature
AT#ZZ=1	Enable Long cycle sleep
AT#ZZ=2	Enable short cycle sleep

Validity:

Changes must be entered in program mode.

Other Considerations:

Sleep mode can be activated by sending the command AT#ZZ=1, AT#ZZ=2 or deactivated by the command AT#ZZ=0. The module should be reset after changing the sleep mode activation since the module will have registered and informed the network that it has sleep mode or not. The module will enter sleep mode if activated after the inactivity timer has expired and a Network TEI notification message has been received by the modem. No notification message or signal is given to the host that sleep mode is engaged. The host must assume that if the modem has been inactive for more than the number of seconds specified in the inactivity timer that the modem has gone to sleep.

To wake the modem up from sleep mode, the wake-up signal can be asserted for a minimum of 10 ms or a break character of 20 ms duration followed by a 2 ms pause or 2 character spaces at 19200 bps can be sent. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

No indication is given to the module that the host is in sleep mode. The module will assume the host is sleeping if the module is sleeping and send a break character to initialize communications with the host.

Related Topics:

Power-up Default Mode

Description:

The power up default mode command permits the user to define how the modem will act after power is applied and the modem begins operating. Upon power up, the modem will perform a quick self test, determine its configuration and then enter the programmed default mode. This can be either the standard AT Command mode or PPP, SLIP or UDP data modes.

The use of PPP or SLIP as the default mode permits the user to eliminate the start up commands and hence have the unit register and activate the data mode more quickly. Since there is no requirement for data exchange to set up SLIP, the host can proceed to set up its stack once the CONNECT message is received from the modem. Because PPP requires some data to be exchanged to set up the IP and other parameters, the host must complete the PPP link before data can be sent or received.

The use of UDP as a default mode permits a host to begin sending or receiving data over the modem connection as soon as the modem has registered on the network. The modem will power up, perform the quick self test, determine its configuration, enter AT Command mode and then, once the modem has registered on the network, enter UDP mode. Upon entering UDP mode a "CONNECT" message is sent to the host. The UDP mode can make use of the half-open or standard UDP features.

Format:

ATMD0	For AT Command mode at power-up
ATMD1	For SLIP Data mode at power-up
ATMD2	For PPP Data mode at power-up
ATMD3	For UDP Data mode at power-up
ATMD13	UDP Modbus ASCII at power-up
ATMD23	UDP Modbus Binary at power-up
ATMD33	UDP Modbus Bristol Standard Async Protocol
ATMD83	UDP with no IP address verify on incoming packets

Validity:

Power-up default mode changes can be made at anytime. Default modes were introduced in software release on September 97 and are valid for all later software revisions.

Other Considerations:

Because the default mode takes effect once the modem has registered with the network, it is important to make any desired changes as soon after power up as possible.

Related Topics:

UDP, Enter PPP Mode, Enter SLIP Mode, AT Command Mode

Set Hardware Configuration

Command to set the hardware release version number, i.e. Rev 3.2, Rev 3.3, Rev SM-1 etc.. The hardware configuration setting is set at the factory and should not normally be set by the user. The hardware configuration version can only be set in Diagnostic mode.

ATI3	Set Hardware configuration
AT#NH=number	Set Hardware configuration
AT#NH?	Query Hardware configuration

Profile Configuration Commands

Description:

Upon power-on/reset, the NRM issues a *HELLO* (verbose) or a *9* (terse) result code and proceeds to register with the CDPD system. AT commands are active by default. This state is referred to as *AT-CDPD* mode.

These commands affect settings that are stored in the modems Non-Volatile Memory (NVM). These commands are used by service personnel when the unit is installed and as required thereafter to update service access information. Note that some configuration changes will not be permanently saved until they have been written to Non-Volatile Memory (NVM) with the AT&W command.

Program Mode

Description:

Program mode permits the user to change S register parameters that affect the modems operation. Program mode was created as a means of protecting the configuration of the modem from spurious or unwanted attempts to change them. The addition of the password protects the equipment from unauthorized access and modification. While in program mode, the modem is disconnected from the network. Data cannot be sent or received over the wireless link.

Format:

AT\APROG,NRM6812	Enter program mode
AT&W	Save changes and exit program mode
ATZ	Exit without saving changes

The password field is case sensitive. The modem will distinguish upper and lower case letters to be different. In the above example, NRM6812 is the default password. NRM must be entered as capital letters otherwise the password will not be accepted. Passwords should be more than six characters however the software will accept any number of characters up to 8.

Validity:

The user can enter program mode while in AT Command mode.

Other Considerations:

Besides being used as the password for entry into Program mode, the password is also used as a qualifier for the escape sequence used to exit data modes. Care should be used when changing passwords.

Related Topics:

Changing Password, Saving Settings, Soft Reset, S Registers,

Local Echo

Description:

The Set Local Echo command permits the user to select whether the modem should echo the characters sent to it back to the host. For some applications, local echo is not required as the host does not need to confirm what has been sent to the modem. For terminal operation, local echo can be used to verify what has been sent to the modem and aids in sending commands, since each keystroke is displayed on the terminal.

Format:

ATE0	Disable Local Echo
ATE1	Enable Local echo

Validity:

Changes to the local echo setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.

Other Considerations:

For a wide variety of applications, local echo is not required or desired. When using local echo with a terminal, it is wise to keep in mind that the application being used may require local echo to be off rather than on. Always ensure that the echo setting is set in the proper mode for the application when re-installing a modem.

Related Topics:

Saving Settings, AT Command Mode

Response Format

Description:

The Set Response Format command is used to define what manner the modem returns when commands are sent to it. Responses can be defined to be either plain text messages or a single numeric digit. Numeric control is better suited for machine applications while plain text is better for interpretation by humans.

Terse mode	Verbose mode (Plain Text)	Description of Response
0	OK	Command accepted.
1	CONNECT	Connection established.
2	RING	Network origination indication.
3	NO CARRIER	Connection terminated, not established or command aborted.
4	ERROR	Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.)
5	NO SOCKETS	No free TCP sockets within S7 seconds.
6	NO DIALTONE	CDPD link not established.
7	BUSY	Refused by destination or network, OR: Operation in progress.
8	NO ANSWER	No response received from the destination within S7 seconds.
9	HELLO	Issued at power on/reset.

Format:

ATV0	To enable the response to be in the numeric format
ATV1	To enable the response to be in plain text

Validity:

Changes to the Response Format setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.

Other Considerations:

Some machine applications use the plain text response as it saves reformatting the information for presentation to a human operator.

Related Topics:

Saving Settings, AT Command Mode

Programmable I/O

Description:

Commands used to configure the General Purpose I/O lines for predefined functions. Any of these signals can be associated with any of the GPIO pins on the interface. However, due to the nature of the power up state of these pins, recommendations on which signals should be associated with which pins will be provided.

Format:

All changes to the state of the GPIO signal associations will only be allowed while in Program Mode of the modem. Also, any changes will only take place only upon device power up.

To enter program mode: at\aprog,<password>

Pin Name	*Query command*	*Set Command*
GPIO1	ATIO1?	ATIO1=code
GPIO2	ATIO2?	ATIO2=code
GPIO3	ATIO3?	ATIO3=code
GPIO4	ATIO4?	ATIO4=code
GPIO5	ATIO5?	ATIO5=code
GPIO6	ATIO6?	ATIO6=code

To save the profile: at&w

Default Configuration:

OEM:

Pin	*Type*	*Signal*
GPIO1	O	RF All
GPIO2	O	Ring Indication
GPIO3	O	Service Indication
GPIO4	O	Undefined
GPIO5	O	Low Battery Indication
GPIO6	I	Power Down

Speedboat:

Pin	*Type*	*Signal*
GPIO1	O	RS232 Control
GPIO2	O	Service Indication
GPIO3	O	Hot Sync / Alert
GPIO4	O	Message Waiting Indication
GPIO5	O	Low Battery Indication
GPIO6	O	Power Fail Indication

Selection Codes

Code	Type	Pins	Description
0	--	---	Defaults by modem type
1	O	GPIO1-6	High
2	O	GPIO1-6	Low
3	O	GPIO1-6	Ready (binary, ON once registered, OFF if modem has to hunt for service).
4	O	GPIO1-6	Service (current flashing scheme for service detection).
5	O	GPIO1-6	Alert (provides positive pulse if PUSH message queued).
6	O	GPIO1,2,4,6	Ring (negative logic, OFF if RING, ON once data mode started).
7	O	GPIO1-6	RF (Tx).
8	O	GPIO1-6	RF (Rx).
9	O	GPIO1-6	RF (Rx or Tx).
10	O	GPIO1-6	Low Battery Indication. Will be asserted when first threshold in NVM is reached.
11	O	GPIO1-6	Message Waiting (like Alert, ON if PUSH message queued, OFF when last PUSH released).
12	O	GPIO1,2,4,6	RS 232 Power Down (asserted when the unit is in sleep mode, de-asserted during normal op).
13	O	GPIO1-6	Power Fail (asserted when a detection is made that the tx power is no longer in regulation).
100	I	GPIO1-6	Power Down indication (when asserted, modem will de-register and power off).
101	I	GPIO1-6	Power Boost indication (when asserted, modem will enter Power Boost mode).

Validity:

If the register is set to zero, the modem will use the default setting.
Setting can be changed at any time by the host when in Program Mode but will not be saved unless a AT&W is performed.

Other Considerations:

For additional information on the electrical characteristics of the pins and their placement on the connector, please consult the Vespa Hardware Interface Specification.

Related Topics:

Host Interface/Power Connector, Program Mode, Low Battery Warnings, Power Boost feature, Push Technology

Soft Reset

Description:

The soft reset command is used to return the modem to the initial conditions upon power up. The Soft Reset will return S Registers to their stored values, restart the channel scan process, clear all data buffers including any pending data that is still contained within the modem. The modem will shut down any existing stack in an orderly manner. A soft reset will de-register a modem from the CDPD network if necessary.

In *PROG* mode, this command may be used to exit without saving any NVM changes.

Format:

Command: ATZ

Validity:

Valid for AT Command and Program Modes.

Other Considerations:

Upon issuing a Soft Reset, the modem will disconnect from the CDPD Network and restart the channel scan procedure. This results in a temporary lapse in the modem's ability to send or receive data. Before initiating a data mode session (PPP, SLIP, UDP or TCP) immediately following a soft reset, it is recommended that the application verify that the modem is registered on the network.

Related Topics:

S Registers, Enter Program Mode, Saving Settings

Side Preference

Description:

This command allows the user to specify the CDPD Service Side preference. Since there are two sides within a CDPD service area this command makes it possible to specify one side over the other or simply force the unit to either side only. Check with your carrier to determine on which cellular side CDPD service is provided.

Format:

AT\N?	To determine current setting use
AT\N1	To set the unit to A side only
AT\N2	To set the unit to B side only
AT\N3	To set the unit to A side Preferred
AT\N4	To set the unit to B side Preferred

Validity:

The AT\N command can be used at any time while the unit is in Command or Program Mode. The unit does not need to be in Program Mode for this command to take effect. The setting is stored in NVM each time the setting is changed.

Other Considerations:

Along with the side preference, it is often recommended that a user specify a Service Provider Identifier (SPI) or Service Provider Network Identifier (SPNI) to direct the modem to search for a preferred carrier as that carrier may not be on one side throughout the country.

Related Topics:

Setting SPI, SPNI, WASI; Setting Carrier Preference;

Password

Description:

The set password command is used to change the alphanumeric password string used to secure the entry to program mode and also as a qualifier for the activation of the escape sequence. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

Format:

AT\P=oldpwd,newpwd,newpwd To change the password the command

Example AT\P=NRM6812,NEW6812,NEW6812

In the above example, NRM6812 is the old password (set at the factory) while NEW6812 is the new password being entered. Two copies are required as can be seen by the entry of NEW6812,NEW6812. To enter a null string as a password the command would take the form of

AT\P=NRM6812,,

There is no way to read back and determine the password once it has been set.

Validity:

The change password command is valid for Program mode.

Other Considerations:

Care should always be exercised when changing the password. While not all applications warrant altering the password, the need for additional security may be partly satisfied by configuring the password.

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

Related Topics:

Escape Sequence, Program Mode, Data Modes

Escape Sequence

Description:

The Data Mode Escape sequence is used to discontinue use of the internal UDP or TCP stack. The escape sequence does not cause any deviation to SLIP or PPP operation and would not normally be used in this manner. Unless the modem has been set to use the TCP Suspend feature, once the escape sequence is encountered by the modem it will terminate the current session, tear down the stack and enter AT Command mode.

If the modem has been programmed to use the TCP Suspend feature, the modem will not tear down the stack but will temporarily suspend the TCP session and enter AT Command mode. This would permit the host time to access other parameters to alter the manner of communications.

The escape sequence consists of the string "+++" followed by the program mode password (normally NRM6812). There is no requirement for a guard time or other special pauses before, after or in between escape sequence characters. The string must be an exact match, matching both letter/number and case. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

Format:

+++<password>		Escape Sequence
Example	+++NRM6812	Default Password
Hayes Compatible	+++	Password is set to null string

Validity:

The escape sequence can be used to exit the internal TCP or UDP data modes.

Other Considerations:

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

Related Topics:

Set Password, Program Mode, Data Modes

Hardware Flow Control

Description:

The set flow control command is used to configure the modem to either respond to the hardware flow control signal Request To Send (RTS) and generate Clear To Send (CTS) or ignore them and pass data without regard to the RTS input. When flow control is turned off, CTS is set active.

Format:

AT\Q?	Query current flow control setting
AT\Q0	Set flow control off (Default)
AT\Q2	Set Flow control on (Hardware)

Validity:

Flow control can be set while in AT Command Mode or Program Mode. Changes made to the flow control setting take effect immediately. There is no need to enter program mode and save the settings.

Other Considerations:

Due to the asynchronous nature of sending and receiving data over a wireless channel, it is recommended that flow control be set on so that the host and modem can eliminate data overflow problems. Should the application require only sporadic data reception and transmission of short data packets, the use of hardware flow control is considered optional.

Related Topics:

Data Mode, Program Mode, Hardware Interface.

Disconnect (Hang-up)

Description:

The Disconnect or Hang-up Command is used to end a TCP or UDP session and possibly power the modem off. When the ATH0-3 command is used, it ends the data mode session and puts the modem into AT Command mode. When the ATH4 command is used, the data mode session is terminated, the modem will perform a de-registration from the network and initiate a shutdown.

Format:

ATH0	Terminate session & return to AT Command mode
ATH1	Terminate session & return to AT Command mode
ATH2	Terminate session & return to AT Command mode
ATH3	Terminate session & return to AT Command mode
ATH4	Terminate session, de-register and shutdown

Validity:

Valid for TCP and UDP data modes.

Other Considerations:

Related Topics:

Data Mode, Program Mode, Hardware Interface.

Restore Factory Defaults

Description:

The restore factory default command sets the following S registers to their default factory setting. The settings are stored in RAM only and will not be saved unless a Save Settings command is issued before power down or a soft reset.

Format:

AT&F	Restore factory defaults

Validity:

This command is valid only in Program mode.

Other Considerations:

Not all registers are altered by the Restore factory default command. For a complete listing of S register settings see the S Register summary.

Related Topics:

Line Speed and Format

Description:

This command allows the user to specify the data bit rate or "line speed" and format of the host serial port for all subsequent communications. Some applications have the need for operating at a different line speed, other than 9600, because of existing or established wire-line software. The line speed change will not take effect until the registers have been saved and the modem reset.

Format:

To determine the current line setting

ATS23?

General format AT&L<speed>,<databits><parity><stopbits>

Where:
- <speed> = Baud rate in bits/second: [1200 | 2400 | 4800 | 9600 | 19200]
- <databits> = Number of data bits [7 | 8]
- <parity> = Parity [O | E | N | M]
- <stopbits> = Number of stop bits [1 | 2]

Examples (all have 8 bits, no parity, 1 stop bit)

For 19200 enter	AT&L19200,8N1
For 9600 enter	AT&L9600,8N1
For 4800 enter	AT&L4800,8N1
For 2400 enter	AT&L2400,8N1
For 1200 enter	AT&L1200,8N1
Default Setting	9600,8N1

Note:

When AT&L is entered the modem will interpret this as AT&L1200,7O1 (7 bits, odd parity, 1 stop)

Validity:

This command is valid only in Program Mode. Serial port change will not occur until settings are saved and a soft reset occurs.

Other Considerations:

The NRM does not support the auto-baud detection function. Characters received with parity errors are ignored by the NRM with no indication to the Host.

Related Topics:

Software Reset

View Active Profile

Description:

This command displays the current active configuration state of most NRM data registers.

Format:

AT&V	View active profile

Validity:

Valid in AT Command and Program modes.

Other Considerations:

If for some reason the NVM cannot be written to, an ERROR is returned and the soft reset is not performed.

Related Topics:

Save Current Profile

Description:

This command is used to save any changes made to register settings or configuration parameters. All values are stored in the modems Non-Volatile Memory (NVM). Upon power-up or after a soft reset, the configuration parameters are retrieved from NVM and used to determine the modem's operation. A Soft reset is generated automatically, once the values are stored in NVM. By performing the soft reset, the modem will temporarily drop its connection to the network. The modem will then scan for channels and reconnect to the network as soon as it has completed the registration process.

Format:

AT&W	Save changes

Validity:

The Save Current Profile is valid only in Program mode.

Other Considerations:

Once executed, the profile parameters are saved and the modem exits Program Mode by doing a soft reset. After Reset, the modem will first enter AT Command mode and may then carry on and enter a default mode if configured accordingly.

Related Topics:

Soft Reset, Default Mode,

Destination IP Address/Port

Description:

This command is used to store the default IP address for the remote host. When the modem is directed to establish a session using TCP, or send UDP packets, without specifying an IP address, the IP address specified by register S53 is used at the destination IP. The addition of a preceding "T" or "P" is used to define a default mode of operation when one is not supplied with the ATD command. The 'port value' is the TCP/UDP port number used to identify the application in the remote host to be used for the connection-oriented service.

The Destination IP is also used as an incoming data qualifier. When in TCP or UDP the modem will screen incoming IP packets and pass only those that were sent from the IP Source specified in S53. If the modem is in "TCP Listen" mode, the modem will permit a session connection with only the host IP as stored in register S53. When the register is programmed with a null string or a 0.0.0.0 value, the modem will accept incoming data from any IP source.

Format:

ATS53? Query destination IP Addr /Port

General Command format: AT&Z<mode><address>/<port>
Where: <mode> = Optional access mode for remote host
T = TCP (default).
P = UDP
<address> = IP address: xxx.xxx.xxx.xxx
<port> = TCP/UDP port number [1 - 65535]

Example ATS53=166.140.73.2/2100

IP = 166.140.73.2
Port = 2100

Validity:

Valid in either AT Command or Program modes. The value specified is stored immediately in NVM.

Other Considerations:

If set to a non- zero string, this port number is attached to all transmitted packets in *UDP-Data* mode.

Related Topics:

TCP mode, UDP mode, Default mode,

Debug Mode

Description:

This command sets the NRM into debug mode, sending debug information out the serial port. The debug information is generated by the "Radio Resource Manager" (RRM) portion of the modem's internal software. This piece of code oversees the operation of the modem, monitoring the physical connection, channel management and data transport. Debug information is generated only while the modem is in AT Command mode. Once the modem enters a data mode, the debug information stream is suspended since this would interfere with the data transfer operation.

An alternative to the debug mode is to use the MSCI protocol and monitor the modem's operation interactively. The MSCI protocol requires a PPP or SLIP link to be used and then sends special UDP messages directly to the modem. The modem responds to the UDP messages returning the requested modem operation data.

Format:

AT#X=1	Enter debug mode
AT#X=0	Exit debug mode

Validity:

Valid in AT Command mode only.

Other Considerations:

Debug mode cannot be entered in Program mode since the modem is disconnected from the network and the RRM is not running.

Related Topics:

Debug Mode

Description:

This command sets the NRM into debug mode, sending debug information out the serial port. The debug information is generated by the "Radio Resource Manager" (RRM) portion of the modem's internal software. This piece of code oversees the operation of the modem, monitoring the physical connection, channel management and data transport. Debug information is generated only while the modem is in AT Command mode. Once the modem enters a data mode, the debug information stream is suspended since this would interfere with the data transfer operation.

An alternative to the debug mode is to use the MSCI protocol and monitor the modem's operation interactively. The MSCI protocol requires a PPP or SLIP link to be used and then sends special UDP messages directly to the modem. The modem responds to the UDP messages returning the requested modem operation data.

Format:

AT#X=1	Enter debug mode
AT#X=0	Exit debug mode

Validity:

Valid in AT Command mode only.

Other Considerations:

Debug mode cannot be entered in Program mode since the modem is disconnected from the network and the RRM is not running.

Related Topics:

Destination IP Address/Port

Description:

This command is used to store the default IP address for the remote host. When the modem is directed to establish a session using TCP, or send UDP packets, without specifying an IP address, the IP address specified by register S53 is used at the destination IP. The addition of a preceding "T" or "P" is used to define a default mode of operation when one is not supplied with the ATD command. The 'port value' is the TCP/UDP port number used to identify the application in the remote host to be used for the connection-oriented service.

The Destination IP is also used as an incoming data qualifier. When in TCP or UDP the modem will screen incoming IP packets and pass only those that were sent from the IP Source specified in S53. If the modem is in "TCP Listen" mode, the modem will permit a session connection with only the host IP as stored in register S53. When the register is programmed with a null string or a 0.0.0.0 value, the modem will accept incoming data from any IP source.

Format:

ATS53? Query destination IP Addr /Port

General Command format: AT&Z<mode><address>/<port>

Where: <mode> = Optional access mode for remote host
T = TCP (default).
P = UDP
<address> = IP address: xxx.xxx.xxx.xxx
<port> = TCP/UDP port number [1 - 65535]

Example ATS53=166.140.73.2/2100

IP = 166.140.73.2
Port = 2100

Validity:

Valid in either AT Command or Program modes. The value specified is stored immediately in NVM.

Other Considerations:

If set to a non- zero string, this port number is attached to all transmitted packets in *UDP-Data* mode.

Related Topics:

TCP mode, UDP mode, Default mode,

Save Current Profile

Description:

This command is used to save any changes made to register settings or configuration parameters. All values are stored in the modems Non-Volatile Memory (NVM). Upon power-up or after a soft reset, the configuration parameters are retrieved from NVM and used to determine the modem's operation. A Soft reset is generated automatically, once the values are stored in NVM. By performing the soft reset, the modem will temporarily drop its connection to the network. The modem will then scan for channels and reconnect to the network as soon as it has completed the registration process.

Format:

AT&W	Save changes

Validity:

The Save Current Profile is valid only in Program mode.

Other Considerations:

Once executed, the profile parameters are saved and the modem exits Program Mode by doing a soft reset. After Reset, the modem will first enter AT Command mode and may then carry on and enter a default mode if configured accordingly.

Related Topics:

Soft Reset, Default Mode,

View Active Profile

Description:

This command displays the current active configuration state of most NRM data registers.

Format:

AT&V	View active profile

Validity:

Valid in AT Command and Program modes.

Other Considerations:

If for some reason the NVM cannot be written to, an ERROR is returned and the soft reset is not performed.

Related Topics:

Line Speed and Format

Description:

This command allows the user to specify the data bit rate or "line speed" and format of the host serial port for all subsequent communications. Some applications have the need for operating at a different line speed, other than 9600, because of existing or established wire-line software. The line speed change will not take effect until the registers have been saved and the modem reset.

Format:

To determine the current line setting

ATS23?

General format AT&L<speed>,<databits><parity><stopbits>

Where:
- <speed> = Baud rate in bits/second: [1200 | 2400 | 4800 | 9600 | 19200]
- <databits> = Number of data bits [7 | 8]
- <parity> = Parity [O | E | N | M]
- <stopbits> = Number of stop bits [1 | 2]

Examples (all have 8 bits, no parity, 1 stop bit)

For 19200 enter AT&L19200,8N1

For 9600 enter AT&L9600,8N1

For 4800 enter AT&L4800,8N1

For 2400 enter AT&L2400,8N1

For 1200 enter AT&L1200,8N1

Default Setting 9600,8N1

Note:

When AT&L is entered the modem will interpret this as AT&L1200,7O1 (7 bits, odd parity, 1 stop)

Validity:

This command is valid only in Program Mode. Serial port change will not occur until settings are saved and a soft reset occurs.

Other Considerations:

The NRM does not support the auto-baud detection function. Characters received with parity errors are ignored by the NRM with no indication to the Host.

Related Topics:

Software Reset

Restore Factory Defaults

Description:

The restore factory default command sets the following S registers to their default factory setting. The settings are stored in RAM only and will not be saved unless a Save Settings command is issued before power down or a soft reset.

Format:

AT&F	Restore factory defaults

Validity:

This command is valid only in Program mode.

Other Considerations:

Not all registers are altered by the Restore factory default command. For a complete listing of S register settings see the S Register summary.

Related Topics:

Disconnect (Hang-up)

Description:

The Disconnect or Hang-up Command is used to end a TCP or UDP session and possibly power the modem off. When the ATH0-3 command is used, it ends the data mode session and puts the modem into AT Command mode. When the ATH4 command is used, the data mode session is terminated, the modem will perform a de-registration from the network and initiate a shutdown.

Format:

ATH0	Terminate session & return to AT Command mode
ATH1	Terminate session & return to AT Command mode
ATH2	Terminate session & return to AT Command mode
ATH3	Terminate session & return to AT Command mode
ATH4	Terminate session, de-register and shutdown

Validity:

Valid for TCP and UDP data modes.

Other Considerations:

Related Topics:

Data Mode, Program Mode, Hardware Interface.

Hardware Flow Control

Description:

The set flow control command is used to configure the modem to either respond to the hardware flow control signal Request To Send (RTS) and generate Clear To Send (CTS) or ignore them and pass data without regard to the RTS input. When flow control is turned off, CTS is set active.

Format:

AT\Q?	Query current flow control setting
AT\Q0	Set flow control off (Default)
AT\Q2	Set Flow control on (Hardware)

Validity:

Flow control can be set while in AT Command Mode or Program Mode. Changes made to the flow control setting take effect immediately. There is no need to enter program mode and save the settings.

Other Considerations:

Due to the asynchronous nature of sending and receiving data over a wireless channel, it is recommended that flow control be set on so that the host and modem can eliminate data overflow problems. Should the application require only sporadic data reception and transmission of short data packets, the use of hardware flow control is considered optional.

Related Topics:

Data Mode, Program Mode, Hardware Interface.

Escape Sequence

Description:

The Data Mode Escape sequence is used to discontinue use of the internal UDP or TCP stack. The escape sequence does not cause any deviation to SLIP or PPP operation and would not normally be used in this manner. Unless the modem has been set to use the TCP Suspend feature, once the escape sequence is encountered by the modem it will terminate the current session, tear down the stack and enter AT Command mode.

If the modem has been programmed to use the TCP Suspend feature, the modem will not tear down the stack but will temporarily suspend the TCP session and enter AT Command mode. This would permit the host time to access other parameters to alter the manner of communications.

The escape sequence consists of the string "+++" followed by the program mode password (normally NRM6812). There is no requirement for a guard time or other special pauses before, after or in between escape sequence characters. The string must be an exact match, matching both letter/number and case. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

Format:

+++<password>		Escape Sequence
Example	+++NRM6812	Default Password
Hayes Compatible	+++	Password is set to null string

Validity:

The escape sequence can be used to exit the internal TCP or UDP data modes.

Other Considerations:

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

Related Topics:

Set Password, Program Mode, Data Modes

Password

Description:

The set password command is used to change the alphanumeric password string used to secure the entry to program mode and also as a qualifier for the activation of the escape sequence. The password can be set to a string of alpha, the letters a to z in both upper and lower case and the numeric digits 0 to 9. Spaces are not allowed. Upper and lower case alpha characters are distinguished as different characters. A null string, one containing no alpha or numeric characters is considered valid. It is recommended that the password string be 6 to 8 characters in length for optimal security.

Format:

AT\P=oldpwd,newpwd,newpwd To change the password the command

Example AT\P=NRM6812,NEW6812,NEW6812

In the above example, NRM6812 is the old password (set at the factory) while NEW6812 is the new password being entered. Two copies are required as can be seen by the entry of NEW6812,NEW6812. To enter a null string as a password the command would take the form of

AT\P=NRM6812,,

There is no way to read back and determine the password once it has been set.

Validity:

The change password command is valid for Program mode.

Other Considerations:

Care should always be exercised when changing the password. While not all applications warrant altering the password, the need for additional security may be partly satisfied by configuring the password.

For users that make use of the Escape sequence, setting the password to the null string configures the modem to operate in a manner similar to the Hayes modems. The NRM6812 escape sequence does not support the idle time requirement. It simply scans the data stream for the escape characters followed by the password. When the password is a null string, the modem operates similar to a Hayes Modem.

Related Topics:

Escape Sequence, Program Mode, Data Modes

Side Preference

Description:

This command allows the user to specify the CDPD Service Side preference. Since there are two sides within a CDPD service area this command makes it possible to specify one side over the other or simply force the unit to either side only. Check with your carrier to determine on which cellular side CDPD service is provided.

Format:

AT\N?	To determine current setting use
AT\N1	To set the unit to A side only
AT\N2	To set the unit to B side only
AT\N3	To set the unit to A side Preferred
AT\N4	To set the unit to B side Preferred

Validity:

The AT\N command can be used at any time while the unit is in Command or Program Mode. The unit does not need to be in Program Mode for this command to take effect. The setting is stored in NVM each time the setting is changed.

Other Considerations:

Along with the side preference, it is often recommended that a user specify a Service Provider Identifier (SPI) or Service Provider Network Identifier (SPNI) to direct the modem to search for a preferred carrier as that carrier may not be on one side throughout the country.

Related Topics:

Setting SPI, SPNI, WASI; Setting Carrier Preference;

Soft Reset

Description:

The soft reset command is used to return the modem to the initial conditions upon power up. The Soft Reset will return S Registers to their stored values, restart the channel scan process, clear all data buffers including any pending data that is still contained within the modem. The modem will shut down any existing stack in an orderly manner. A soft reset will de-register a modem from the CDPD network if necessary.

In *PROG* mode, this command may be used to exit without saving any NVM changes.

Format:

Command: ATZ

Validity:

Valid for AT Command and Program Modes.

Other Considerations:

Upon issuing a Soft Reset, the modem will disconnect from the CDPD Network and restart the channel scan procedure. This results in a temporary lapse in the modem's ability to send or receive data. Before initiating a data mode session (PPP, SLIP, UDP or TCP) immediately following a soft reset, it is recommended that the application verify that the modem is registered on the network.

Related Topics:

S Registers, Enter Program Mode, Saving Settings

Selection Codes

Code	Type	Pins	Description
0	--	---	Defaults by modem type
1	O	GPIO1-6	High
2	O	GPIO1-6	Low
3	O	GPIO1-6	Ready (binary, ON once registered, OFF if modem has to hunt for service).
4	O	GPIO1-6	Service (current flashing scheme for service detection).
5	O	GPIO1-6	Alert (provides positive pulse if PUSH message queued).
6	O	GPIO1,2,4,6	Ring (negative logic, OFF if RING, ON once data mode started).
7	O	GPIO1-6	RF (Tx).
8	O	GPIO1-6	RF (Rx).
9	O	GPIO1-6	RF (Rx or Tx).
10	O	GPIO1-6	Low Battery Indication. Will be asserted when first threshold in NVM is reached.
11	O	GPIO1-6	Message Waiting (like Alert, ON if PUSH message queued, OFF when last PUSH released).
12	O	GPIO1,2,4,6	RS 232 Power Down (asserted when the unit is in sleep mode, de-asserted during normal op).
13	O	GPIO1-6	Power Fail (asserted when a detection is made that the tx power is no longer in regulation).
100	I	GPIO1-6	Power Down indication (when asserted, modem will de-register and power off).
101	I	GPIO1-6	Power Boost indication (when asserted, modem will enter Power Boost mode).

Validity:

If the register is set to zero, the modem will use the default setting.
Setting can be changed at any time by the host when in Program Mode but will not be saved unless a AT&W is performed.

Other Considerations:

For additional information on the electrical characteristics of the pins and their placement on the connector, please consult the Vespa Hardware Interface Specification.

Related Topics:

Host Interface/Power Connector, Program Mode, Low Battery Warnings, Power Boost feature, Push Technology

Programmable I/O

Description:

Commands used to configure the General Purpose I/O lines for predefined functions. Any of these signals can be associated with any of the GPIO pins on the interface. However, due to the nature of the power up state of these pins, recommendations on which signals should be associated with which pins will be provided.

Format:

All changes to the state of the GPIO signal associations will only be allowed while in Program Mode of the modem. Also, any changes will only take place only upon device power up.

To enter program mode: at\aprog,<password>

Pin Name	*Query command*	*Set Command*
GPIO1	ATIO1?	ATIO1=code
GPIO2	ATIO2?	ATIO2=code
GPIO3	ATIO3?	ATIO3=code
GPIO4	ATIO4?	ATIO4=code
GPIO5	ATIO5?	ATIO5=code
GPIO6	ATIO6?	ATIO6=code

To save the profile: at&w

Default Configuration:

OEM:

Pin	*Type*	*Signal*
GPIO1	O	RF All
GPIO2	O	Ring Indication
GPIO3	O	Service Indication
GPIO4	O	Undefined
GPIO5	O	Low Battery Indication
GPIO6	I	Power Down

Speedboat:

Pin	*Type*	*Signal*
GPIO1	O	RS232 Control
GPIO2	O	Service Indication
GPIO3	O	Hot Sync / Alert
GPIO4	O	Message Waiting Indication
GPIO5	O	Low Battery Indication
GPIO6	O	Power Fail Indication

Response Format

Description:

The Set Response Format command is used to define what manner the modem returns when commands are sent to it. Responses can be defined to be either plain text messages or a single numeric digit. Numeric control is better suited for machine applications while plain text is better for interpretation by humans.

Terse mode	Verbose mode (Plain Text)	Description of Response
0	OK	Command accepted.
1	CONNECT	Connection established.
2	RING	Network origination indication.
3	NO CARRIER	Connection terminated, not established or command aborted.
4	ERROR	Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.)
5	NO SOCKETS	No free TCP sockets within S7 seconds.
6	NO DIALTONE	CDPD link not established.
7	BUSY	Refused by destination or network, OR: Operation in progress.
8	NO ANSWER	No response received from the destination within S7 seconds.
9	HELLO	Issued at power on/reset.

Format:

ATV0	To enable the response to be in the numeric format
ATV1	To enable the response to be in plain text

Validity:

Changes to the Response Format setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.

Other Considerations:

Some machine applications use the plain text response as it saves reformatting the information for presentation to a human operator.

Related Topics:

Saving Settings, AT Command Mode

Local Echo

Description:

The Set Local Echo command permits the user to select whether the modem should echo the characters sent to it back to the host. For some applications, local echo is not required as the host does not need to confirm what has been sent to the modem. For terminal operation, local echo can be used to verify what has been sent to the modem and aids in sending commands, since each keystroke is displayed on the terminal.

Format:

ATE0	Disable Local Echo
ATE1	Enable Local echo

Validity:

Changes to the local echo setting are valid during program or AT command modes. Changes made while not in program mode will be lost upon power down. Changes made and saved while in program mode will be retained by the modem.

Other Considerations:

For a wide variety of applications, local echo is not required or desired. When using local echo with a terminal, it is wise to keep in mind that the application being used may require local echo to be off rather than on. Always ensure that the echo setting is set in the proper mode for the application when re-installing a modem.

Related Topics:

Saving Settings, AT Command Mode

Program Mode

Description:

Program mode permits the user to change S register parameters that affect the modems operation. Program mode was created as a means of protecting the configuration of the modem from spurious or unwanted attempts to change them. The addition of the password protects the equipment from unauthorized access and modification. While in program mode, the modem is disconnected from the network. Data cannot be sent or received over the wireless link.

Format:

AT\APROG,NRM6812	Enter program mode
AT&W	Save changes and exit program mode
ATZ	Exit without saving changes

The password field is case sensitive. The modem will distinguish upper and lower case letters to be different. In the above example, NRM6812 is the default password. NRM must be entered as capital letters otherwise the password will not be accepted. Passwords should be more than six characters however the software will accept any number of characters up to 8.

Validity:

The user can enter program mode while in AT Command mode.

Other Considerations:

Besides being used as the password for entry into Program mode, the password is also used as a qualifier for the escape sequence used to exit data modes. Care should be used when changing passwords.

Related Topics:

Changing Password, Saving Settings, Soft Reset, S Registers,

Profile Configuration Commands

Description:

Upon power-on/reset, the NRM issues a *HELLO* (verbose) or a *9* (terse) result code and proceeds to register with the CDPD system. AT commands are active by default. This state is referred to as *AT-CDPD* mode.

These commands affect settings that are stored in the modems Non-Volatile Memory (NVM). These commands are used by service personnel when the unit is installed and as required thereafter to update service access information. Note that some configuration changes will not be permanently saved until they have been written to Non-Volatile Memory (NVM) with the AT&W command.

Set Hardware Configuration

Command to set the hardware release version number, i.e. Rev 3.2, Rev 3.3, Rev SM-1 etc.. The hardware configuration setting is set at the factory and should not normally be set by the user. The hardware configuration version can only be set in Diagnostic mode.

ATI3	Set Hardware configuration
AT#NH=number	Set Hardware configuration
AT#NH?	Query Hardware configuration

Power-up Default Mode

Description:

The power up default mode command permits the user to define how the modem will act after power is applied and the modem begins operating. Upon power up, the modem will perform a quick self test, determine its configuration and then enter the programmed default mode. This can be either the standard AT Command mode or PPP, SLIP or UDP data modes.

The use of PPP or SLIP as the default mode permits the user to eliminate the start up commands and hence have the unit register and activate the data mode more quickly. Since there is no requirement for data exchange to set up SLIP, the host can proceed to set up its stack once the CONNECT message is received from the modem. Because PPP requires some data to be exchanged to set up the IP and other parameters, the host must complete the PPP link before data can be sent or received.

The use of UDP as a default mode permits a host to begin sending or receiving data over the modem connection as soon as the modem has registered on the network. The modem will power up, perform the quick self test, determine its configuration, enter AT Command mode and then, once the modem has registered on the network, enter UDP mode. Upon entering UDP mode a "CONNECT" message is sent to the host. The UDP mode can make use of the half-open or standard UDP features.

Format:

ATMD0	For AT Command mode at power-up
ATMD1	For SLIP Data mode at power-up
ATMD2	For PPP Data mode at power-up
ATMD3	For UDP Data mode at power-up
ATMD13	UDP Modbus ASCII at power-up
ATMD23	UDP Modbus Binary at power-up
ATMD33	UDP Modbus Bristol Standard Async Protocol
ATMD83	UDP with no IP address verify on incoming packets

Validity:

Power-up default mode changes can be made at anytime. Default modes were introduced in software release on September 97 and are valid for all later software revisions.

Other Considerations:

Because the default mode takes effect once the modem has registered with the network, it is important to make any desired changes as soon after power up as possible.

Related Topics:

UDP, Enter PPP Mode, Enter SLIP Mode, AT Command Mode

Sleep Mode Feature Enable/Disable

Description:

This command permits the user to define what sleep mode the modem should use. Since various applications and host computers have different requirements for communicating with a modem that utilizes sleep mode, this command encompasses several different options that should satisfy any application. If sleep mode does not appear to work with your application, please contact Novatel Wireless for assistance. The default setting for this mode is off.

Format:

AT#ZZ?	Sleep status query command
AT#ZZ=0	Disable sleep feature
AT#ZZ=1	Enable Long cycle sleep
AT#ZZ=2	Enable short cycle sleep

Validity:

Changes must be entered in program mode.

Other Considerations:

Sleep mode can be activated by sending the command AT#ZZ=1, AT#ZZ=2 or deactivated by the command AT#ZZ=0. The module should be reset after changing the sleep mode activation since the module will have registered and informed the network that it has sleep mode or not. The module will enter sleep mode if activated after the inactivity timer has expired and a Network TEI notification message has been received by the modem. No notification message or signal is given to the host that sleep mode is engaged. The host must assume that if the modem has been inactive for more than the number of seconds specified in the inactivity timer that the modem has gone to sleep.

To wake the modem up from sleep mode, the wake-up signal can be asserted for a minimum of 10 ms or a break character of 20 ms duration followed by a 2 ms pause or 2 character spaces at 19200 bps can be sent. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

No indication is given to the module that the host is in sleep mode. The module will assume the host is sleeping if the module is sleeping and send a break character to initialize communications with the host.

Related Topics:

Sleep Mode Description

Sleep mode can be activated by sending the command AT#ZZ=1, AT#ZZ=2 or deactivated by the command AT#ZZ=0. Changes must be entered in program mode. The module should be reset after changing the sleep mode activation since the module will have registered and informed the network that it has sleep mode or not. The module will enter sleep mode, if activated, after the inactivity timer has expired and a Network TEI notification message has been received by the modem.

In areas with low signal strength or where the signal strength varies to a high degree, the unit may not enter sleep mode in a regular fashion. The unit must have conditions where the unit can decode the TEI notification messages from a reliable signal.

No notification message or signal is given to the host that sleep mode is engaged. The host must assume that if the modem has been inactive for more than the number of seconds specified in the inactivity timer that the modem has gone to sleep.

To wake the modem up from sleep mode, the wake-up signal can be asserted for a minimum of 10 ms or a break character of 20 ms in duration followed by a 2 ms pause or 2 character spaces at 19200 bps can be sent. The module will de-assert CTS when entering sleep mode to inhibit the host from sending data but will periodically assert CTS and check for incoming serial data from the host to prevent any loss of data.

No indication is given to the module that the host is in sleep mode. The module will assume the host is sleeping if the module is sleeping and send a break character to initialize communications with the host.

Related Topics:

Sleep Mode Feature Enable/Disable

Data Reception Mode

Packet Disassembly

The NRM begins transmitting the character stream associated with a received packet to the Host as soon as all the associated blocks have been received and processed.

Buffering and Flow Control

The NRM has an output data buffer which is intended to be set larger than the longest receive message used by existing protocols in the Host application. The size of this buffer is 2144 characters.

When the NRM is sending the characters associated with a received packet to the Host, the remote host processor should not send additional data as this may result in output buffer overflow. NRM buffer overflow shall result in a loss of data with no indication to the Host or remote host. In order to avoid data loss, it is recommended (and anticipated) that the Host application protocol operates using a half-duplex ACK/NAK protocol. The remote host acknowledgment time-out should be lengthened as described above.

Data Transmission Mode

Packet Assembly

The NRM provides a local Packet Assembly and Disassembly (PAD) function. For transmission, the character stream from the Host is assembled into packets for RF transmission under the following conditions:
-Idle time-out: If the time between successive characters exceeds the time interval specified in register S50, any pending data is assembled for transmission.

Buffering and Flow Control

The NRM has an input data buffer which is intended to be set larger than the longest transmit message used by existing protocols in the Host. The size of this buffer is 578 characters.

If hardware flow control is disabled and, the NRM is formatting and transmitting data blocks associated with a packet, the Host should not send additional data as this may cause input buffer overflow. Buffer overflow will result in a loss of data with no indication to the Host. In order to avoid data loss, it is recommended (and anticipated) that the Host application protocol operates using a half-duplex ACK/NAK protocol. It should be expected that the Host acknowledgment time-out should be set greater than that required for circuit-switched modem configurations. This is to account for propagation delays through the NRM, CDPD base station and CDPD and Internet networks.

Point to Point Protocol (PPP)

Description:

The command to enter Point to Point Protocol mode (PPP) is used when an external stack configuration is needed. PPP is useful if the stack resides in the host computer, providing multiple sessions and complete control over all aspects of each session. PPP is quickly becoming the new standard for dial-in-networking. PPP provides more flexibility and less items that need to be explicitly set.

The PPP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT\APPP can be sent without asserting DTR. To exit PPP in this case, the host must either power down the modem or use the escape sequence. To terminate a PPP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

.

Format:

AT\APPP	The command to enter PPP Mode
The response will be	CONNECT or ERROR
The alternate command to use is	SERVER
The response will be	CLIENT

Validity:

PPP can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

Other Considerations:

While a modem can enter PPP mode from command mode at any time, the intent of PPP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering PPP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a PPP connection. The Status can be checked using the "ATS57?" command.

An alternate method of entering PPP mode is to send the word CLIENT to the modem. The modem will respond with SERVER and then follow with CONNECT. This is NOT an AT command. It is neither preceded by an "AT" nor succeeded by a CR. Exiting PPP mode is performed using the DTR control signal.

Related Topics:

SLIP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode. Checking Status

Slip Mode

Description:

The command to enter Serial Line Internet Protocol mode (SLIP) is used when an external stack configuration is needed. SLIP is useful if the stack resides in the host computer, multiple sessions and complete control over all aspects of each session can be obtained. SLIP is one of the more common protocols used for splitting the functionality between the modem and the host. SLIP does, however, require certain parameters to be set up prior to activating a session. SLIP does not extract the IP address from the modem. This must be set up in dial-up-networking before starting. SLIP is less flexible than Point to Point Protocol (PPP) which is quickly winning over most users.

The SLIP session is usually controlled by DTR, unless the modem has been configured to ignore DTR by programming register S211. DTR, when used, must be asserted to initiate a session and de-asserted to terminate a session. If the modem has been programmed not to use DTR Control, then the command AT\ASLIP can be sent without asserting DTR. To exit SLIP in this case, the host must either power down the modem or use the escape sequence. To terminate a SLIP session, DTR must be de-asserted or the escape sequence can be activated or the modem can be powered down.

Format:

AT\ASLIP	The command to enter SLIP mode

Validity:

Slip can only be entered from Command Mode. In Program or Diagnostic modes, the modem is not actively connected to the network.

Other Considerations:

While a modem can enter SLIP mode from command mode at any time, the intent of SLIP is to connect to the network. Until there is a network connection established and the modem has registered, it is better to delay entering SLIP mode as you may report errors that will only persist until the modem registers. It is generally recommended that the host check the status of the modem before proceeding with a SLIP connection. The Status can be checked using the "ATS57?" command.

Related Topics:

Enter PPP Mode, DTR Control, Program Mode, Data Mode, Diagnostic Mode. Checking Status, Escape Sequence

Push Technology

To receive data while the modem is unattended by the host, the modem has been incorporated with the means to receive the data packet, determine the type of message and the source IP address. This push technology feature can be enabled or disabled by setting or resetting register S250. The modem can signal the host that there are messages queued up, waiting to be retrieved by the host, using any or all of the following signals. The "message waiting" signal can be asserted when a message arrives and will be de-asserted when all messages have been retrieved or deleted. In the case of multiple messages, the "message waiting" signal will be asserted when the first arrives and will only be de-asserted when all messages have been retrieved. Another signal, the "alert" signal, can also be used to provide a 500msec pulse to the host on its associated pin for each message that arrives. These signals can be made available on any of the programmable pins of the interface. Their assignment is made using the programmable GPIO features of the Vespa CDPD Modem.

The modem can hold up to 4 messages, determined by reading register S251, before the buffer overflows and message data is lost. When the host accesses the modem to retrieve the stored messages, the host first determines which messages it wants to retrieve based upon the source IP address. The host can discard messages by setting register S254. This will cause the current message to be flushed from the queue and the next message made available to the host.

PUSH Technology Enable

ATS250?		Query Wake Up Protocol State
ATS250=1		Enable Push Technology
ATS250=0		Disable Push Technology
ATS251?		Query Number of Pending Messages
Response	[0..4]	
ATS252?		Query First Push Message
Response	[IPaddress/port]	
Format	nnn.nnn.nnn.nnn/xxxxx	
ATS253?		Query Type of First Push Message
Response	[0, 1] 0 indicates UDP, 1 indicates TCP	
ATS254=1		Discard Current Message

DTR Control Description

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

The DSR Signal is driven by the modem to indicate the existence of a data session. When DTR is asserted by the local host, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of a incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. . In this mode, the NRM will "Listen" for TCPP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the Host using the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the NRM returns to AT-CDPD mode. Note that session termination is the only method to return to AT-CDPD mode[4].

The DTR line de-asserted can also be optionally used to power the modem off in addition to the termination of the session. If the S211 register is set to 4, then the de-asserting of the DTR line will make the modem terminate any current data session, perform a de-registration with the network and power itself off.

[4] The Hayes compatible escape sequence is not supported.

- Connection failed to complete within the time specified in register **S7** (sec). Normal values are about 30 seconds, but is very dependent upon the application requirements. Many applications, which provide their own time-out for connection failure, will have this value set to 60+ seconds.

PAD (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register **S50** in 1/10 seconds.

Receiving Data - Once the session is started, any packets sent to the modem's IP address with the port number specified in register **S110** will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

Termination - A TCP connection is terminated by dropping DTR or by the remote end of the TCP connection terminating the session.

TCP Mode Description

Transport Control Protocol, is a reliable, connection-oriented transport protocol that uses acknowledgments and retransmissions to guarantee delivery. This is an obvious advantage for applications where the data is critical and the application cannot provide the required reliability. There is more overhead in the protocol to provide this reliability, making it less efficient than UDP. For larger data transfers, TCP is the easiest protocol to use to get reliable service.

TCP sessions may be originated by the local application host or by the network. The **DTR** signal must be asserted or **S211=1** (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by powering the modem off, dropping DTR or by the remote host terminating the connection. If the session is terminated by a power down, the remote host may not tear down its part of the session properly, leaving the remote host waiting for further information for that session. This can pose problems for some applications. Care in session tear down is essential for reliable operation.

TCP Modes of Operation

TCP Listen mode is established by having **S0=1** when the modem powers up. . The port specified in **S110** will be used for the TCP Listen mode. The **DTR** signal must be asserted or **S211=1** (ignore signal on DTR pin and proceed as if DTR is always asserted) for the unit to enter into a data communications session. When a connection request for the correct port is received by the modem, the modem will establish the connection notify the local host with:

Verbose	**Terse**
RING	**2**
CONNECT	**1**

and begin the TCP session.

Termination - A TCP connection is terminated by dropping DTR, or by the remote end of the TCP connection terminating the session.

Originating a TCP Session

A session is originated by the host application by issuing the ATD (Dial) command:

ATDTnnn.nnn.nnn.nnn/ppppp

ATDT specifies a TCP session. **nnn.nnn.nnn.nnn** is the destination IP address and **ppppp** is the destination application port number. The modem will attempt to establish a connection with the destination host. If it is successful, a **CONNECT** [terse 1] result code will be issued and all ensuing data sent from the app host will be assembled into a TCP packet and transmitted to the destination application.

ERROR [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.

Connection Failure will be signaled by a **BUSY** [terse 7] result code, and may be caused by one of the following:

- Wrong IP address or port number
- The destination device does not have a TCP Listen process open on the port specified.
- The destination host already has a connection established with another client on the specified port.

UDP Mode Description

User Datagram Protocol is a basic transport protocol that provides a best-effort, connectionless delivery service with minimum overhead. The protocol does not guarantee delivery of packets. There is no checking or retransmission of the data packets. It does provide minimum overhead as it only adds the source and destination port numbers to the header. Since the protocol is unreliable, the application must provide checking, acknowledgments and retransmissions if the data is critical. In many applications, the data is not critical because updates are sent periodically and occasional losses can be tolerated.

UDP sessions may be originated by the local application host or by the network. The **DTR** signal must be asserted or **S211=1** (pretend DTR is always asserted) for the unit to enter into a data communications session. The session is terminated by dropping DTR or resetting the unit.

UDP Modes of Operation

Command: ATS83 = <mode>
Where <mode> = Timer value in seconds
0 = Regular mode
1 = Not used (reserved)
2 = Half-Open mode

Originating a UDP Session

A session is originated by the application host issuing the ATD (Dial) command:

ATDPnnn.nnn.nnn.nnn/ppppp

ATDP specifies a UDP session. **nnn.nnn.nnn.nnn** is the destination IP address and **ppppp** is the destination application port number. If no port is specified then a port number of 0 is assumed. It should be noted that UDP and TCP make extensive use of port numbers, please be aware that the modem will use the port number as a criteria for accepting and passing data to the host application.

CONNECT [terse 1] result code will be issued and all ensuing data sent from the host application will be assembled into a UDP packet and transmitted to the destination application.

ERROR [terse 4] result code will be generated if the modem is not currently registered on a CDPD network.

PAD (Packet Assembly and Disassembly) function will transmit data when the inter-character idle time-out occurs or when the PAD buffer is full. (256 or 512 bytes). The idle time-out is specified in register **S50** in 1/10 seconds.

Receiving Data - Once the session is started, any packets sent to the modem's IP address with the port number specified in register **S110** will be processed and the data portion will be transmitted over the serial link to the host application. Any packets received with a different port number specified will be discarded.

Termination - The session is terminated by dropping DTR or resetting the unit.

Internal Stack Description

IP (Internet Protocol) is the basic network protocol that routes packets on an IP network. CDPD networks and the Internet are IP networks. Transport protocols deliver packets between applications. Transport protocols use the IP service to deliver data packets between network devices.

In order for an application to communicate across a network, it will first open a port on the local device. The IP address of the local device and this port number becomes the unique address for this application, and is sometimes referred to as a **socket**. When the local application communicates with a distant application, it will send a packet addressed to the IP address and port number of that remote application. This address is the destination address of the packet. The packet will also contain the source address, the IP address and port number of the local application. The remote application may use the source address of the packet received to communicate back to the local application.
There are two common transport protocols used in TCP/IP networks:

Data Mode Description

The modem contains an integrated TCP/IP protocol stack. It is accessed via AT commands that put the modem into either a TCP or UDP data communications mode. If the application host contains a TCP/IP stack, PPP or SLIP can be used to transfer IP packets between the application host and the modem.

The Data Terminal Ready (DTR) line is used by the modem as a qualifier for its operation in a data mode, TCP, UDP, SLIP or PPP. The DTR line is to be asserted before entering a data mode to indicate to the modem that the host computer is available for operation. The DTR line is de-asserted to terminate a data session. The modem will not sustain a data mode session without DTR being active. The use of DTR can be overridden by setting register S211 to 1: the equivalent of asserting DTR permanently.

The DSR Signal is driven by the modem to indicate the existence of a data session. When the local host asserts DTR, the modem will respond with the DSR signal to indicate that the modem has entered data mode. DSR is de-asserted to indicate that the modem has exited data mode.

The NRM provides Host and Network originated access to the connection-oriented service using TCP/IP. Host origination is accomplished via the DIAL (ATDT) command. Upon successful completion of the DIAL command (i.e. CONNECT result code), the NRM switches to TCP-Data mode. DTR must be asserted prior to issuing the ATDT, ATDP, AT\ASLIP or AT\APPP. If this is not followed the modem will not engage the session in a manner where it can be sustained. The NRM signals a network origination to the Host using the RING result code. Failure to have DTR asserted while in "Listen" mode, network origination, will result in a dropped session. The PAD functions are active during TCP-Data mode only, however, the data buffering functions apply in all modes.

For Listen mode applications, the modem must see DTR asserted when the TCP Session request is received. If DTR is not asserted the session request will be rejected. When the DTR signal is asserted, the modem will issue a RING followed by a CONNECT to indicate the beginning of an incoming data session. Here RING indicates the source of the session as being a remote server while the CONNECT indicates the transition from AT Command mode to Data mode. . In this mode, the NRM will "Listen" for TCPP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any TCP packets received in AT-CDPD mode, or packets received in TCP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. DTR can be used to terminate the session or the remote server can initiate the termination.

A session may be terminated by the Host de-asserting the DTR line. The remote host may also terminate a session. Connection status is maintained on the DSR line. Once the session has been terminated, the NRM returns to AT-CDPD mode. Note that session termination is the only method to return to AT-CDPD mode[3].

For UDP/IP, a connection-oriented service is "fabricated" within the NRM. The DIAL command (ATDP) is used to place the NRM into UDP-Data mode. In this mode, the NRM will "Listen" for UDP packets with port numbers which match that specified with the NRM's IP address (re: S110). Any UDP packets received in AT-CDPD mode, or packets received in UDP-Data mode without a matching port number, are rejected by the NRM with no indication to the Host. In UDP-Data mode, the port number for transmitted UDP packets is specified with the destination address associated with the DIAL command. Only the Host Origination and Host Termination scenarios described above apply to UDP operation. The DTR and DSR lines, and the PAD functions, operate as in TCP-Data mode.

[3] The Hayes compatible escape sequence is not supported.

Software Interface

The software interface is described in the Host Interface Specification for Vesa CDPD Modem OM-01016445. A brief description of those functions specific to the Vespa CDPD Modem is described here.

AT Command Mode

AT commands and responses are active in command mode only; as determined by the state of the DSR line. Command mode behavior conforms to ANSI/TIA/EIA-602-1992 section 5, with the limitations stated below. The AT command set is a subset of the AT command set defined in ANSI/TIA/EIA-602 and in the CDPD System Specification Part 2014 Version 1.1, section 4.

Command format

Note the following limitations:

- The termination character is fixed as CR (ASCII 13).
- Command line editing is supported (BS, ASCII 08 only).
- Command line repeats (A/) is not supported.
- The rules described below for buffering and flow control also apply to command mode. The Host should not transmit a single AT command which exceeds the buffer length (256 characters). In addition, the Host should wait until all responses associated with an AT command string have been received before issuing another AT command.
- Abortion of command-in-progress is not supported.
- Default command parameters are accepted for the last command on a command line only.

Result format

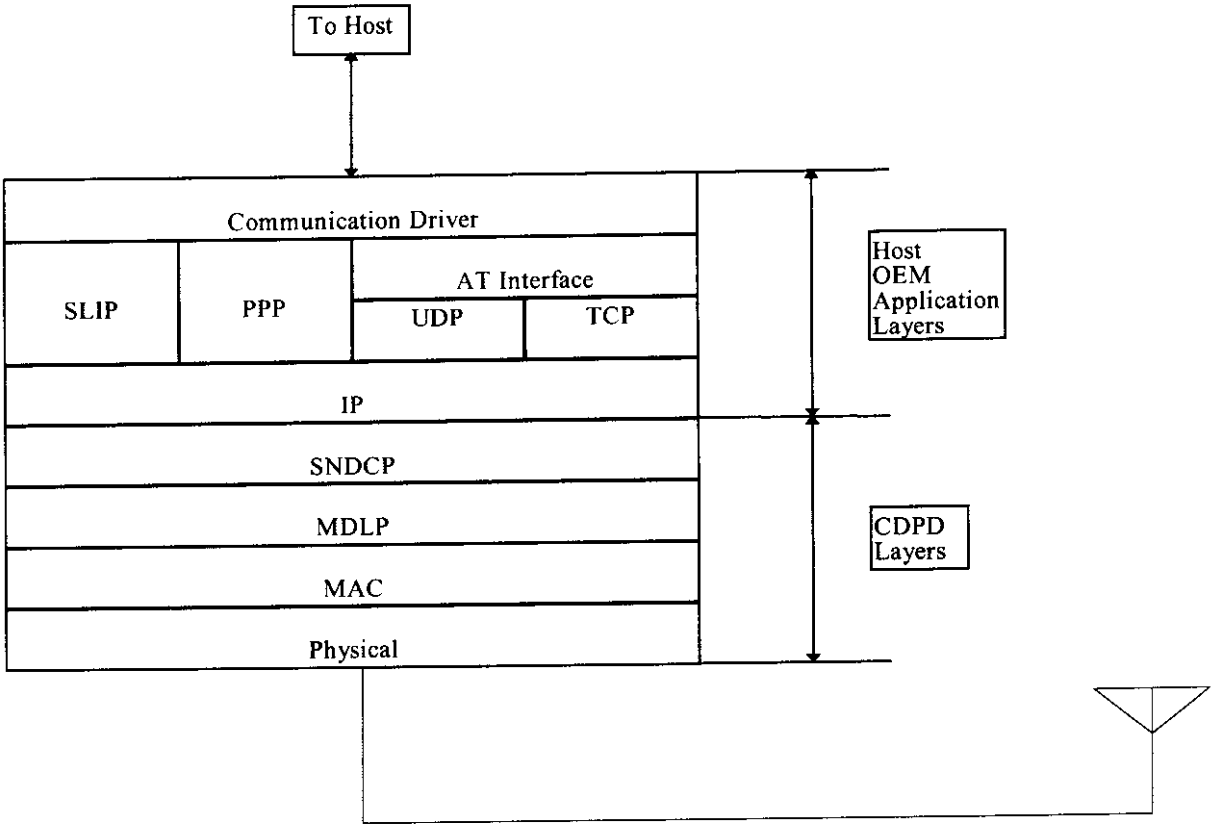
The format of result code responses is determined by the ATV command setting.
In *terse* mode, the result code is sent as a single ASCII character followed by a carriage return (ASCII 13) character.
In *verbose* mode, a descriptive text message is sent followed by a carriage return. The following result codes are emitted by the NRM:

Terse mode	Verbose mode	Description of Command
0	OK	Command accepted.
1	CONNECT	Connection established.
2	RING	Network origination indication.
3	NO CARRIER	Connection terminated, not established or command aborted.
4	ERROR	Invalid command parameter/state (e.g. DTR must be active before ATD can be accepted.)
5	NO SOCKETS	No free TCP sockets within S7 seconds.
6	NO DIALTONE	CDPD link not established.
7	BUSY	Refused by destination or network, OR: Operation in progress.
8	NO ANSWER	No response received from the destination within S7 seconds.
9	HELLO	Issued at power on/reset.

PHYSICAL INTERFACE

Protocol

CDPD System Specification Part 400 Version 1.1 (CDPD Forum Inc.) This is the protocol stack for the Vespa CDPD Modem:



The Vespa CDPD Modem does not support V.42 compression in SNDCP.
The TCP/UDP interface is capable of supporting up to 3 sessions simultaneously[1].
The AT-command set described herein is derived from "CDPD Implementor Guidelines", Release 1.1[2]. It contains a subset of the commands described in Part 2014 that are supported by the Novatel Vespa CDPD Modem.
For the purposes of this specification, "NRM" refers to the Novatel Vespa CDPD Modem; "Host" refers to the OEM application controller.

[1] This is provided to solve the problem presented by delays encountered when closing a TCP session. That is, in order to process Host transactions in rapid succession (and since it is required to establish a new TCP session for each transaction) it is necessary to establish a new TCP session before the previous one has had a chance to close.

[2] CDPD Forum makes no representations about the suitability of any material, comprising the CDPD system specification (or any derivative work incorporating any element thereof) for any purpose; it being provided "as is" and without any warranties whatsoever, express or implied. The CDPD Forum shall not be responsible for any damages of any kind related to the use of the CDPD system specification (or any derivative work incorporating any element thereof), including without limitation, actual, direct, indirect, incidental, consequential, special, or general damages.

INTRODUCTION

This document is intended to provide the serial AT Command Interface provided by Vespa CDPD Modem for embedded OEM applications. The Vespa CDPD modem provides a connection-oriented service so that existing OEM application protocols can be used. In addition, the capability to switch the unit to Serial-Line-Internet-Protocol (SLIP) or Point-to-Point-Protocol (PPP) modes are provided so that new protocols can be developed within the OEM application.

This document describes the Novatel Wireless Vespa CDPD Modem. The Vespa CDPD modem is an OEM-module designed for integration into a host product to provide wireless data communication capability via the CDPD (Cellular Digital Packet Data) Network. It features internal TCP and UDP IP stacks as well as SLIP and PPP protocols for an external stack and provisions for using "Sleep Mode" to extend the operating time of battery powered devices.

Scope

The scope of this document is limited to providing information on the various AT commands which can be used on Novatel CDPD products as well as a brief summary of some of the standard AT commands which are not supported. Internal design issues, detailed operating instructions and cost information is not included in this document.

Reference Documents

The following released documents provide additional, or more detailed information on the Vespa CDPD Modem:

TS-01016445	Technical Specification for Vespa CDPD Radio Module
OM-01016445	Host Interface Specification for Vespa CDPD Radio Module
GM-01016445	Diagnostics User's Guide for Vespa CDPD Radio Module
TP-01016445	Manufacturing Test Procedure for Vespa CDPD Radio Module
MT-01016445	Manufacturing Acceptance Requirement for Vespa CDPD Radio Module
DA-01016446	CDPD Module Modem (Vespa) Assembly
DS-01016445	Schematic Diagram Vespa CDPD Modem
DA-01016445	Assembly Drawing Vespa CDPD Modem
01016446	Bill of Materials CDPD Modem Module (Direct Mod)

Table of Contents

FCC ID: NBZNRM-6832
2.1033(c)(3) 1 of 2

AT Command Set Reference Guide for Vespa CDPD Modem

PS-01017800

Release 0.1

Tuesday, November 03, 1998

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Auto Answer (TCP Listen)

Description:

Register S0 is used to put the NRM into a state where the modem will accept a TCP session request from a remote server or another modem. The modem can remain in AT Command mode while the modem is waiting for a session request to be received.

The session activation process begins when the host asserts DTR (if DTR operation is selected) to inform the modem that it can accept the session request.

The modem will issue a "RING" string to the host to indicate that a session has been initiated. The modem may also generate a CMOS and/or a RS-232 RING signal coincident with sending the RING string if programmed to do so. The IP address port number, stored in register S53, is used as a qualifier for the session request.

Format:

ATS0?	Auto Answer Query
ATS0=1	Set Auto Answer mode ON
ATS0=0	Set Auto Answer mode OFF

Validity:

Auto answer mode can be set in either AT Command or Program mode. Setting changes to auto answer are saved immediately.

Other Considerations:

Related Topics:

Register S53

Connection Establishment Time-out

Description:

When initiating a session request as a remote client, attempting to talk to a server, a time-out limit for establishing the connection can be specified by setting register S7 to the appropriate value. When a TCP session request is sent out by the modem, the server being called will respond with either an acceptance or busy message. If the server does so before the time-out limit is reached, the modem will respond with the acceptance string "CONNECT" or the declining string "BUSY. The server will usually return a "BUSY" message when it is overloaded and cannot accept further sessions. If the server being called does not respond in the time allowed, the modem will respond with an ERROR message to indicate that it could not establish a session.

Format:

ATS7?	Connection Timeout value	
General Command format	ATS7=<time-out>	
Where:	<time-out> = time-out value in seconds [0 - 255]	
Default	60 seconds	
Example command	ATS7=45	programs a value of 45 seconds for the time-out value.

Validity:

This command is valid only in Program mode. The value must be saved with the AT&W command.

Other Considerations:

Related Topics:

Data Forwarding Idle Time-out

Description:

When using the internal stack either UDP or TCP, the data being sent to the modem is automatically encapsulated in an IP packet using the preset protocol. The packet size may vary depending upon the rate at which the data characters are received. If the data is received in a very sporadic manner, the modem will assemble and send a packet after an idle period has elapsed, no data is received in this interval. This keeps the data moving, retaining some time relevance instead of waiting for a specific number or a full buffer. The modem will also send a packet if a return character is encountered in the data stream.

The timer value is programmable from 0.1 to 25.5 seconds in $1/10^{th}$ of a second resolution.

Format:

ATS50?	Data Forwarding Idle Time-out
General command format Where:	ATS50=<time-out value> <time-out value> = Time-out value in $1/10^{th}$ seconds [0 - 255]
Example command	ATS50=15 the time out value is set to 1.5 seconds
Default factory setting is	0.5 seconds

Validity:

Other Considerations:

For most applications, data is sent in bursts, with each burst of data having relevance within the application. To define the length of each packet, it is recommended to send the data in bursts followed by a return. Packet length will vary as both UDP and TCP include overhead information in each packet. Typically TCP will include a 40 byte header while UDP uses less than 20 bytes for header information. UDP is generally used to reduce data transmission costs but requires the application to handle lost packets and retries.

Related Topics:

Data Forwarding Idle Character

Description:

When using the internal stack either UDP or TCP, the data being sent to the modem is automatically encapsulated in an IP packet using the preset protocol. The packet size may vary depending upon the rate at which the data characters are received. If the data is received in a very sporadic manner, the modem will assemble and send a packet after a specific character is encountered in the data stream. A normal idle character configuration would be a CR or NL character. This register will configure which idle character to forward information on.

Format:

ATS51?	Query Data Forwarding Idle Character
ATS51=0	Disabled Data Forwarding Idle Character
ASS51=aa	Data Forwarding Idle Character values of 1-255

Validity:

Other Considerations:

Related Topics:

UDP Half Open Mode

Description:

Once the modem is configured to operate in the half-open mode, it can accept AT commands from the keyboard, it can also receive UDP packets through the RF channels for the duration specified by the user without performing and ATD command.

If the destination IP address (ATS53) is set to 0.0.0.0, it can accept UDP packets from any destination. But once it receives a packet, it locks onto that destination and automatically goes into the regular UDP mode. It stays in that mode until either the DTR is dropped, the escape sequence is sent or the Half-Open timer expires. The timer restarts every time a packet is received or sent. For example, if the timer is set to 30, the Monitor will stay in the UDP mode until 30 seconds after the last UDP packet is received or sent. Once the modem exits active UDP, it returns to the Half-Open mode.

If the destination address is set to a nonzero value, everything will work the same as the above except that it will only accept UDP packets from that specific destination and ignore the rest.

Format:

ATS82=0	regular mode
ATS82=1	not used (reserved)
ATS82=2	Half-Open mode enabled

Query: ATS82?

Command: ATS82=<mode>
Where <mode> 0 = Regular mode
1 = Not used (reserved)
2 = Half-Open mode

Validity:

This command can only be issued in command mode.

Other Considerations:

Register S83 is used as the half-open timer. Setting this register to a non-zero value permits the automatic UDP stack to remain active for that amount of time (measured in seconds).

ATS83?	Query UDP Open Timeout
ATS83=60	Set UDP Open Timeout

sets the timer to 60 seconds.

Related Topics:

Status Reporting

Description:

The CDPD Status Reporting feature provides a status code to be automatically issued each time the modems connection status changes. The status message is encoded using a string of five letters. Each letter position indicates the current status of a particular condition or phase in the modems operation.

A or I	RSSI, received signal strength intensity, A = >-100 dBm I = <-100 dBm	. "A" indicates a signal strength in excess of –100 dBm while an "I" indicates a signal strength below –100 dBm. It is generally found that modem operation is most reliable when the signal strength is above –100 dBm.
B or J	Current forward channel error rate B = < 3% J = > 3%	The second letter is used to indicate the current error rate on the forward channel (modem receiver). The letter "B" indicates an error rate lower than 3%, which is considered acceptable in most applications since it can be easily corrected within the Reed Solomon coding scheme. The letter "J" is used to indicate an error rate above 3%. Errors above 3% can cause delays in data reception and may require retransmission of data between the modem and the base station.
C or K	Found CDPD Service C = Service found K = No Service yet	The third letter is used to indicate that the modem has found a cellular channel with CDPD service. The modem indicates the existence of the available channel using a "C". Until a channel is found the modem will issue a "K" in the third letter position. Should the modem not establish a connection it will hunt for another channel, putting out a "K" until a new channel is found.
D or L	Registration indicator D = Registered L = Not Registered	The fourth letter is the registration indicator. A "D" indicates that the modem has successfully acquired a channel and registered with the network. Data modes can then be used. An "L" in this position indicates that the modem has not yet registered.
E or M	Scan Mode E = Set on Channel M = Scanning	The fifth and final letter is used to indicate when the modem is scanning and when the modem is fixed on a channel. An "E" indicates that the modem is fixed on a channel while an "M" indicates the modem is searching for channels. As defined within the CDPD specification the modem will periodically scan other channels trying to find a stronger signal or one that is not as heavily used.

Format:

ATS103?	To determine the current setting
ATS103=1	To enable status reporting
ATS103=0	To disable status reporting

Validity:

The status reporting can be enabled or disabled in either AT Command or Program modes. Changes made in AT Command mode and not saved with the AT&W command in Program mode will not be retained after power down.

Other Considerations:

Status reporting, if enabled, will continue to operate in PPP and SLIP modes but will be suspended in TCP and UDP modes.

Related Topics:

Local IP Address/Port

Description:

Since the modem connects directly to the Internet, it needs to have an IP address to define where data destined for it can be sent. The two methods for defining IP addresses are static and dynamic. Dynamic IP addresses are assigned to the modem each time the modem connects to the network. Dynamic IP addressing poses several disadvantages with messaging services. These difficulties are overcome with Static IP addressing which is used by the Vespa CDPD Modem. Register S110 is reserved for specifying the IP address for the NRM. The optional 'port extension' is the TCP/UDP port number used to further identify the Host application for the connection-oriented service.[5]

The IP address must be specified before the modem can register with the network. Please contact your network provider to receive your IP address. This number is assigned to the modem and must remain unique; you cannot load the same IP address into more than one modem and have them work. The IP address cannot be ported or transferred to another modem without alerting your issuing carrier of the change and the associated Electronic Identifier (EID) numbers of the modems.

Once registered on the Network, the EID and IP must remain in the same modem until the Network is told to "Trust enable" the modem or "Reset Authentication Parameters" for the modem. During initial registration of the modem, first time registration, the typical process has the Network accepting the modem's EID without checking it and henceforth using that value along with the IP and authentication keys. This will remain in effect until the Network administrator is instructed to change the IP, EID or reset the credentials.

Format:

ATS110?	IP Address and Port
To set the IP address General Command format: Where:	ATS110 = <address>/<port> <address> = IP address: xxx.xxx.xxx.xxx <port> = TCP/UDP port number [1 - 65535]
Example command	ATS110=207.107.0.35/2014 IP address is 207.107.0.35 Port number is 2014

This port number is used for "listening" in *UDP-Data* mode.

Validity:

The IP address can only be changed in Program mode.

Other Considerations:

An IP address consists of 4 numbers, 0 to 255, separated by dots (periods). For IP addresses that contain zero as one of the numbers, you must enter the zero as part of the IP address as shown in the

[5] This address/port combination is used when the NRM opens the TCP port for listening.

example above. An IP address must have four numbers to be valid. Numbers must be limited to 0 to 255 in value. Check with your carrier before making any changes to your IP address setting.

Related Topics:

Service ID Preference

Description:

In addition to being able to set the side preference, and specifying the cellular channel side used by the modem, the user can also specify the preferred carrier that the connection should be made with. Parts of the information broadcast by the network may include three pieces of information used to identify the carrier. These identifiers are the Service Provider Identifier (SPI) the Service Provider Network Identifier (SPNI) and the Wide Area Service Identifier (WASI).

All of these parameters do not need to be sent by the carrier. Each carrier configures their network to use some or all of these to identify themselves in the various regions of the country where they operate. Some settings are specific to each region while others are fixed for the entire country. Please contact your carrier before setting these values.

The Service ID Preference settings work in conjunction with register S116. Unless register S116 is set properly, the values of register 111 may not have the desired effect.

Format:

ATS111? ATS111=<SPI>/<SPNI>/<WASI>	Query Service ID Preferences Set Service ID Preferences
Acceptable range of values	0 to 65535
Don't care value setting	0
Example	ATS111=0/1206/12300 SPI = Don't care SPNI = 1206 WASI = 12300

Validity:

Other Considerations:

For version 1.0 networks (in the process of being phased out) the Service Provider Identifier should be set to 0 if service provider ID preferences are used.

Related Topics:

Channel Scan Mode

Description:

The Vespa CDPD Modem modems can be programmed to scan for available CDPD channels in three different manners. Each manner has different operating characteristics and is targeted for specific applications.

Channel scan mode 0 has the NRM performing an initial scan of all cellular channels associated with the selected side preference (see AT\N). Service is initially obtained on the CDPD channel with the highest RSSI. This mode was the first mode developed and was the default mode until mode 2 was developed. New issue modems default to mode 2 operation.

Channel scan mode 1 has the NRM using only those cellular channels defined in the channel scan list, regardless of which side they are on. Service is initially obtained on the CDPD channel with the highest RSSI. This is useful in restricting the modem to obtaining service on only a selection of channels. Once service is obtained, automatic handoffs may occur sending the modem to a channel not present in the channel list. If the modem looses the channel, it will only re-scan those channels present in the channel list.

Channel scan mode 2 has the NRM using the channel list as a "Hot List" scanning those channels first before scanning outside the list. If service cannot be found on a channel contained in the channel list the modem will perform a wide scan in an effort to located a suitable channel. If a channel is found which is not present in the list, it is appended to the list for future use. The modem automatically updates and maintains the channel list.

The addition of mode 2 operation also expanded the channel list from 16 to 32 entries. The use of the "Hot List", offers the advantage of faster connection times since there is a good chance that the channel list will contain an active channel. Because the modem maintains this list itself, there is no need for the operator to initialize the modem channel list, the modem will do this itself. When the modem has filled the 32 location list the software will overwrite the oldest entry in the list and continue rewriting old values with new ones.

Format:

ATS112?	To determine the current channel scan mode
ATS112=0	Any channel
ATS112=1	Hot List Only
ATS112=2	Hybrid

Validity:

The channel scan mode can only be altered in Program mode.

Other Considerations:

To optimize performance for mobile applications which use many channels and may roam from city to city, it may be advantageous to clear the channel scan list when entering a new area. This would eliminate channels that are not active in one city from affecting the operation of the modem. Doing this will result in a longer time for primary initialization of the modem as it refills the channel list.

Related Topics:

Channel List

Description:

Register S113 is used to contain the channel list. This is the list of cellular channels on which the NRM may use to search for CDPD service, depending on the setting of S112. Up to 32 channel numbers may be entered. If no channel numbers are entered, the NRM will scan the entire CDPD channel set associated with the side preference.

Format:

ATS113?	Channel List query
ATS113=<chan1>,<chan2>,etc.	Set channel list
Where:	<chan1-32> = All valid CDPD channels [1-799, 991-1023]
To zero the channel list	ATS113=
No value is entered	

Validity:

The channel scan list can only be altered in Program mode.

Other Considerations:

A channel number of zero is not valid.

Related Topics:

Service ID Preference

Description:

Register S116 is reserved for the service ID preference mode.

Format:

ATS116?	Query Service ID preference
ATS116=0	To only use S111 service ID
ATS116=1	To prefer S111 service ID
ATS116=2	To not use S111 service ID
ATS116=3	To use any service ID
Default setting	3, use any service

Validity:

This command is valid in Program mode only.

Other Considerations:

Contact your carrier before altering this register value.

Related Topics:

CDPD Operating Version

Description:

The CDPD specification has gone through two revisions; the first established version 1.0 networks using dedicated channels. The second version introduced channel hopping and maintained dedicated channels.

Format:

ATS117?	CDPD Operating Version
ATS117=10	To set it for Version 1.0
ATS117=11	To set it for Version 1.1

Validity:

This command is valid in Program mode only.

Other Considerations:

Version 1.0 systems are quickly being replaced with version 1.1 systems. Please check with your local carrier before altering this value.

Related Topics:

Wireline Compatibility

Description:

In order to accommodate certain host computer systems and their expected responses from the NRM6812 modem, a register is provided which enables the trailing line feed character to be stripped off. The default setting for the modem is to send the line feed, which is contrary to what some wire-line modems do. Standard modems operate in the same manner as the NRM. When set to suppress the line feed character, the modem will send no leading line feed on terse responses and only one response for an ATD command entry.

Format:

ATS210?	Query Wireline Compatibility setting
ATS210=0	To enable the line feed character
ATS210=1	To suppress the line feed character

Validity:

This command is valid in Program mode only.

Other Considerations:

Related Topics:

Set DTR Control

Description:

For applications or situations where hardware control of the modem is not possible, DTR control can be over-ridden and the host can avoid the necessity of adding extra control lines. Negating DTR control poses a problem for exiting a data mode as the normal manner is to de-assert DTR to exit. To exit a data mode while DTR control is off, the escape sequence can be used.

Format:

ATS211?	Query DTR control setting
ATS211=0	To set DTR control ON
ATS211=1	To set DTR control OFF
ATS211=2	Always assert DSR
ATS211=4	Dropping DTR gracefully powers off modem
ATS211=8	DSR Control asserted after registration

0: Default behavior (not 4)
1: Ignore DTR
2: Always assert DSR
4: Asserting DTR does nothing. Dropping DTR gracefully powers off modem.
8: Delay assertion of DSR (when entering data modes) until modem has registered.

Validity:

This command is valid in Program mode only.

Other Considerations:

As stated above, when DTR control is over-ridden, the only way to exit from a data mode is with the escape sequence. When using TCP auto answer, once a session tear down command is received from the remote host, the modem will revert to AT Command mode. This transition from data mode to AT Command mode was initiated remotely, not locally.

Related Topics:

DTR Mode Setting, DSR Mode control

DTR Mode Setting

Description:

The DTR control can be used to power off the modem in situations where it is desired. This setting is similar to that of setting register S211 to 4. That is, when DTR is de-asserted, the modem will terminate any current data mode session, perform a system de-registration and power itself off. This setting can also configure the unit to ignore DTR, or identical to setting S211 to 1.

Format:

AT&D?	Queries DTR mode setting
AT&D0	ignore DTR transitions (S211 = 1)
AT&D2	de-asserted DTR powers modem off (S211 = 4)

Validity:

Other Considerations:

Related Topics:

DTR Control

DSR Control Setting

Description:

This setting provides more complete control of the DSR configuration. The DTR mode and control settings provide inferred control of the DSR pin, but this control register allows more specific control of the DSR configuration.

Format:

AT&S?	To query the current DSR control setting
AT&S 0	No control of DSR. It is asserted all of the time
AT&S1	Control of DSR is enabled after modem registration.

Validity:

This register is available only in AT Command mode.

Other Considerations:

This register may perform corresponding configuration of the S211 register to reflect any changes here. As an example, if the current S211 is 2 and this register is set to 1, the S211 will be returned to a value of 8.

Related Topics:

TCP Timer

Description:

When using TCP, a session is initiated by one party calling and the other party accepting or declining the session request. Once a session is established, the two parties listen only to one another (unless multiple sessions are permitted). After a session is completed and both parties want to disengage, a session tear down message is sent from one to the other. Both parties tear down the stack and are then available to set up another session with someone else. In the event that a tear down message is not received by a modem, an idle timer is available which will tear down the session after a predetermined interval of inactivity by either party. The values setting for this timer is specified in the TCP Timer register, TCPT.

Format:

ATTCPT?	Query TCP Timer setting
ATTCPT=value [0 to 255 minutes]	To set the timer value (minutes)
ATTCPT=0	To disable the timer

Validity:

Other Considerations:

A setting of 0 indicates the timer is not used. The minimum setting is 1 minute. It should be noted that when using a sleep mode modem, care should be taken in the selection of an appropriate value, as sleep intervals may create a longer interval of inactivity.

Related Topics:

Identity Registers

Description:

The identity registers are used to identify the modem to the host. These read only registers present the following information:

The modems Electronic Identifier Number (EID)
The Software Version, creation date and time
The copyright header
The modem manufacturer
The model and hardware revision number

Format:

ATI0	To determine the EID
ATI1	To determine sw version & copyright information
ATI2	To determine the manufacturer
ATI3	To determine the hardware version

Validity:

This command is valid in AT Command and Program modes.

Other Considerations:

Related Topics:

Query Network Connection Status

Description:

The command to determine the current network connection status is used to determine is it is acceptable for the host to go into a data mode and reliably exchange data over the CDPD network. The status message returned is encoded using a string of five letters. Each letter position indicates the current status of a particular condition or phase in the modems operation.

A or I	RSSI, received signal strength intensity, A = >-100 dBm I = <-100 dBm	. "A" indicates a signal strength in excess of –100 dBm while an "I" indicates a signal strength below –100 dBm. It is generally found that modem operation is most reliable when the signal strength is above –100 dBm.
B or J	Current forward channel error rate B = < 3% J = > 3%	The second letter is used to indicate the current error rate on the forward channel (modem receiver). The letter "B" indicates an error rate lower than 3%, which is considered acceptable in most applications since it can be easily corrected within the Reed Solomon coding scheme. The letter "J" is used to indicate an error rate above 3%. Errors above 3% can cause delays in data reception and may require retransmission of data between the modem and the base station.
C or K	Found CDPD Service C = Service found K = No Service yet	The third letter is used to indicate that the modem has found a cellular channel with CDPD service. The modem indicates the existence of the available channel using a "C". Until a channel is found the modem will issue a "K" in the third letter position. Should the modem not establish a connection it will hunt for another channel, putting out a "K" until a new channel is found.
D or L	Registration indicator D = Registered L = Not Registered	The fourth letter is the registration indicator. A "D" indicates that the modem has successfully acquired a channel and registered with the network. Data modes can then be used. An "L" in this position indicates that the modem has not yet registered.
E or M	Scan Mode E = Set on Channel M = Scanning	The fifth and final letter is used to indicate when the modem is scanning and when the modem is fixed on a channel. An "E" indicates that the modem is fixed on a channel while an "M" indicates the modem is searching for channels. As defined within the CDPD specification the modem will periodically scan other channels trying to find a stronger signal or one that is not as heavily used.

Format:

ATS57? To determine current network status

Validity:

This command is valid in AT Command mode only.

Other Considerations:

Because the modem is disconnected from the network in Program mode, this command will return an ERROR code if used in program mode.

Related Topics:

Registration Process

Background
Registration involves 4 message exchanges, all of which have to be successful:

M-ES		MD-IS	
TEI REQ	->		
	<-	TEI ASSIGN	(MDLP TEI assignment)
SABME	->		
	<-	UA	(MDLP link reset)
	<-	IKE	
EKE	->		(SNDCP key exchange)
ESH	->		
	<-	ISC	(MNRP registration)

This is the system's response to a registration request, and is basically an accept or deny (refer to Table 507-6 in the CDPD specification for all possible responses). The modem will simply pass the information ("insufficient credentials" in this case) along to the user.

Different MD-IS manufacturers may treat the same condition differently, and may return different responses in their ISC's. The CDPD specification provides a substantial amount of guidance but some aspects are left to the discretion of the implementor.

Last network registration error code

Description:

Should the modem fail to register within a sizable window of opportunity, typical times vary from 3 to 5 seconds for a "Hot List" match to 30 seconds for a "Wide Scan" match, it may have encountered a network registration error. To determine if this is the case, the network registration error register can be read to see if there is a non-zero value. If the value is zero, then the modem has yet to attempt to register on a valid channel as it has yet to find a channel or form a link to the network.

For non-zero values consult the table below.

Response	Meaning
1	No particular reason given
2	MD-IS not capable of handling the M-ES at this time
3	NEI is not authorized to use this subnetwork
4	M-ES gave insufficient authentication credentials
5	M-ES gave unsupported authentication credentials
6	NEI has exceeded usage limitations
7	Service denied on this subnetwork; service may be obtained on alternate Service Provider network
8-255	Reserved

For further assistance if a non-zero value is present, please contact your carrier and provide them with this information.

Format:

ATS200?	To determine last registration error

Validity:

Valid for AT Command mode only.

Other Considerations:

Most Network Registration problems are due to a mismatch of the authentication credentials. These values are stored in both the modem and the Network MDIS Information database. If these values get out of sync, registration may not be possible. Problems can be experienced when trying to register on an alternate carrier through an "interop" agreement link. Because the modems use the internet for communications, information may be slow in arriving at the intended destination or may be lost along the way. Interop links introduce additional delays in delivering registration information that can result in temporary failure to register. This situation should typically not persist for more than 2 minutes.

Related Topics:

Authentication Parameter

Description:

The Authentication Parameters can be set to zero using the AUTH command. This command is only used if the network equipment requires the modem to start service using a zero key value. If this command is entered after the modem has successfully registered on the network, the authentication parameters will not match the value stored on the network and the modem will not be able to re-register with the network.

Format:

ATAUTH	To reset authentication keys to zero

Validity:

This command id valid for AT Command mode only.

Other Considerations:

Related Topics:

Query Current RSSI Value

Description:

To determine the current Receive Signal Strength Intensity, RSSI, value for the current channel being scanned, register S202 can be read. The RSSI value is presented as the relative signal strength above the modem noise floor. The absolute value is determined by adding the relative value from register S202 to the noise floor value of –115 dBm.

It is important to remember that the modem can be scanning while this inquiry is made, thus the value read back may not be valid for the channel that is later retrieved from the current channel register.

Format:

ATS202?	To determine the current RSSI value

Validity:

This command id valid for AT Command mode only.

Other Considerations:

Related Topics:

Query Current Block Error Rate (BLER)

Description:

The modem maintains statistics on its performance and operation. One of the parameters measured and maintained is the block error rate. This measurement is derived by examining the Reed Solomon algorithm, that part of the modem's software that can detect and correct errors in the data stream. Data errors that cannot be corrected result in a re-transmission of the bad segment while errors that can be corrected do not result in data re-transmissions. The modem measures the errors and, based upon an error rate threshold, then uses this measurement to decide when to change channels. The block error rate can rise to 3% before the effect becomes noticeable by the user. The block error rate is updated approximately every second or two when the modem is connected to the network.

Format:

ATS203?	To determine the current Block Error Rate

The response will be in the form of a percentage [0 to 100%]

Validity:

This command is valid for AT Command mode. For use in data modes, the MSCI protocol is preferred.

Other Considerations:

Related Topics:

Current RF Channel in use

Description:

To determine the current channel that the modem is currently locked to, the contents of register S204 can be read. This value represents the cellular channel number and does not, by itself, indicate that this is a CDPD channel, a voice channel or even if there is any RF signal being received. Because the modem periodically scans for better channels trying to improve service, the channel number returned may not be a valid CDPD channel. The modem will eventually scan all channels on the desired side or sides, even those which are not CDPD enabled. This results in the channel value being returned by the modem may have been one which was being scanned when the command was accepted by the modem. This means that the user must take care in interpreting the channel number as being a CDPD channel as it may not be.

Format:

ATS204?	To determine the current channel

Validity:

This command is valid in AT Command mode only.

Other Considerations:

Frequency and Channel Assignments

Mobile Transmit	Base Transmit	Channel	Use	Band
824.04 – 825.00	869.04 - 870.00	991 - 1023	Voice	A
825.03 – 834.36	870.03 - 879.36	1 - 312	Voice	A
834.39 – 834.99	879.39 - 879.99	313 - 334	Control	A
835.02 – 835.62	880.02 - 880.62	335 - 356	Control	B
835.65 – 844.98	880.65 - 889.98	357 - 666	Voice	B
845.01 – 846.48	890.01 - 891.48	667 - 716	Voice	A
846.51 – 848.97	891.51 - 893.97	717 - 799	Voice	B

Related Topics:

Cell Site ID in Use

Description:

The CDPD Network is composed of a multitude of cellular towers transmitting their signals over a portion of the total coverage area. By reusing frequencies, a greater density of coverage can be maintained and more calls supported. To make each tower identifiable to remote terminals (modems), an identifying ID number is sent in the forward data stream. This number, [0 to 65535] is useful in reporting problems to the cellular carrier when the cellular signal is in question.

Format:

ATS205?	To determine the current Cellular ID

Validity:

This command is valid in AT Command mode only.

Other Considerations:

Related Topics:

Area Color Code in Use

Description:

The CDPD Network is composed of a multitude of cellular towers transmitting their signals over a portion of the total coverage area. By reusing frequencies, a greater density of coverage can be maintained and more calls supported. To distinguish the same channel frequency used on two towers, carriers assign each one a different color code. The color code is a number from zero to seven. This information assists the network in routing the information being sent to the modem through the right cell site tower.

Format:

ATS206?	To determine the current color code

Validity:

Other Considerations:

Related Topics:

Power Level Query

Description:

The Power Level query will return the current transmit power level being used by the modem on the current CDPD system. This power level is a product of the proposed power level and received signal strength values at the modem.

Format:

ATS207?	To determine the current power level

Validity:

Other Considerations:

Related Topics:

Symbol Error Rate Query

Description:

A percentage rate of symbol errors encountered by the modem on the Forward channel is provided to assist in identifying sub-optimal signal conditions. The value returned is a percentage representing the number of symbol errors per 100.

Format:

ATS208?	To query the current Symbol Error Rate.

Validity:

Other Considerations:

Related Topics:

Power Product

Description:

The Power Product is a CDPD system parameter that ultimately determines the power level used by the modem for transmissions. This value is transmitted by the CDPD system and can reported in this register.

Format:

ATS209?	To query the current power product

Validity:

This register is read-only.

Other Considerations:

Related Topics:

Authentication Failures Query

Description:

The number of authentication failures is available here in a register. The concept is to track the number of times that the authentication credentials were invalid since the last known point as a means of identifying any unusual behavior of the modem firmware, or failures in the EE device. There are set and query commands that can be used to "reset" the count back to zero at the factory if problems have been encountered.

Format:

ATAF?	Query the authentication failures.
ATAF=0	To reset the register to zeros.

Validity:

Other Considerations:

Related Topics:

Dial (Connection Setup)

Description:

In wire-line modems a connection s made when the modem is instructed to dial a telephone number for the desired computer service. This dial command ATD provides the user with the means of using either tone dialing, ATDT, or pulse dialing, ATDP. For wireless Internet modems using CDPD technology, the ATD command is used to initiate a session with a remote Internet server using either TCP/IP or UDP. Instead of a phone number, an IP address is used instead. It is here that the use of the Internet makes CDPD easy to use as there are no area codes, no country codes, no need to access an outside line. All IP addresses currently use a fixed length series of four numbers separated by dots.

The Dial Connection Setup command causes the NRM to establish a connection with the host at the specified IP address/port. For any fields that are left blank, values are taken from those stored in the default destination register. The NRM will not process this command if the DTR line is not asserted (i.e. an ERROR response is issued). It is recommended that the host application make sure the modem is connected to the network before issuing a Dial command.

Format:

ATDT<IPaddress>/<port#>	To initiate a TCP Session
ATDP<IPaddress>/<port#>	To initiate a UDP Connection
ATDN<Ipaddress>	To initiate a Telnet Session. Port 23 is assumed.
ATD	To use the Default Register
IPaddress format	XXX.XXX.XXX.XXX where XXX is a number [0 to 255]
port# format	XXXXX where XXXXX is a number [0 to 65535]
Examples	
TCP Connect	ATDT166.1.109.3 (no port given, 0 assumed) IP = 166.1.109.3 Port = 0
UDP Connect	ATDP166.1.109.3/55000 (Port number specified) IP = 166.1.109.3 Port = 55000
Default Connection	ADT (S53=P166.1.109.3/55000) Same effect as above

Validity:

This command is valid for AT Command mode only.

Other Considerations:

Related Topics:

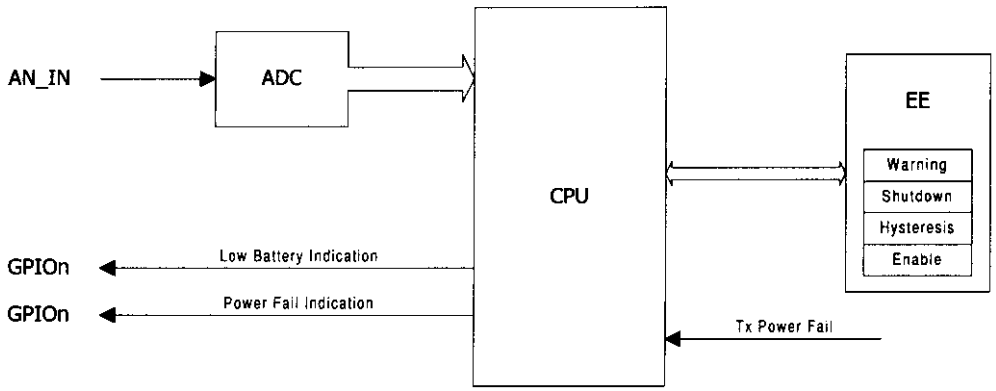
Power Condition

Description:

It is anticipated that many of the users of the Vespa will wish to do so in a mobile environment, and thus one where the supply voltage may not be constant. To that end, a power condition control system has been provided.

A block diagram of the battery/power condition system is shown below. It contains:

a. A method of voltage measurement on the modem. This is represented by the AN_IN input, which is routed on the Vespa board to the input of ADC channel 1.
b. A method of reading the voltage measurement from the modem. This is effectively the reading of the ADC channel 1.
c. A method of identifying when the measurement crosses a threshold. The ability to read the voltage is matched with the entry in the EE device representing a warning ADC value. If the voltage read from the ADC is lower than this EE warning value, the warning indication is asserted.
d. A method of specifying the hysteresis associated with the measurements. Once the warning indication has been asserted, it will only be de-asserted once the ADC measurement is >= Warning + Threshold.
e. A method of modem shutdown when a critical voltage measurement is reached. If the voltage read from the ADC is lower than the EE shutdown value, the modem will initiate a de-registration and shut off.
f. A method of enabling/disabling this monitoring feature. All of these features can be enabled/disabled with an entry in the EE.



Given the monitoring functions have been enabled, the signals associated with these functions can be selectively enabled on any of the GPIO pins on the interface connector. Obviously, if the associated signals with this feature are not provided on the interface, external devices will not see any of the warnings and must simply identify when the modem has shutdown.

Signal Name : Low Battery Indication

Asserted when the first threshold is reached. After assertion, it will be de-asserted only if the voltage measurement is >= low battery threshold + hysteresis count

Signal Name : Power Fail Indication

Asserted immediately when the Transmit Power detection indicates a loss of regulation on the transmit power. Once it is asserted, it will not be de-asserted.

Format:

AT#LBM?	Queries the current power condition mode setting
AT#LBM=0	No power condition monitoring
AT#LBM=1	Enable power condition monitoring
AT#LBT?	Query power condition thresholds
AT#LBT=x,y	Set the thresholds for the power condition monitor.
AT#LBH=x	Sets the hysteresis value
AT#LBR?	Queries the current AN_IN reading from ADC.

In the case of the thresholds, the values entered will represent the raw ADC readings at which the Low Battery Indication and the modem shutdown will occur, respectively. The hysteresis value entered is a representation of how much the voltage reading must rise once the Low Battery Indication has been given before the Low Battery Indication will be de-asserted.

There will be cases where the AN_IN measurement would be useful to customers/users as an extra ADC measurement block, but where the power condition monitoring use of the readings are not desired. In this case, the configuration would be to disable the power condition mode (AT#LBM=0) but still use the AT#LBR? queries to identify the reading at the ADC in raw form. The host software is then free to use this reading however they wish.

Example:
As an example of how this may be used, we will assume the following conditions:

- the supply voltage on the board is externally connected to the AN_IN pin on the connector
- an LED is connected to GPIO 2, which we want to use for Low Voltage indications.
- we wish for the Low Voltage indication to trigger at 3.5V, from a regulated 4.OV regulator.
- we wish to initiate a shutdown of the modem if the modem identifies a voltage of 3.3V.
- we wish to de-assert any Low Voltage indication if the voltage rises to 3.6V.

In order to use these features, we must perform some configuration of the system to reflect our desires. The order of events to configure the system is as follows:

```
AT\APROG,NRM6812                *enter program mode
```

< feed in a 3.5V signal to AN_IN >

```
AT#LBR?                         * queries the ADC reading representing this voltage
```
< note the return reading. For the sake of this example, assume that this read value is 180>

< feed in a 3.3V signal to AN_IN >

```
AT#LBR?                         * queries the ADC reading representing this voltage
```
< note the returned reading. For the sake of this example, assume that the read value is 160>

```
AT#LBT=180,160                  * configures the warning and shutdown thresholds
```

< feed a 3.6V signal on AN_IN >

```
AT#LBR?                         * queries the ADC reading representing this voltage
```
< note the returned reading. For the sake of this example, assume that the read value is 200>

```
AT#LBT=20                       * configures the hysteresis according to the formula of
                                  3.6V reading – 3.5V reading = 200 – 180 = 20
```

`AT#LBM=1`	* enables the low voltage monitor
`ATIO2=10`	* enables the Low Battery Indication signal on GPIO2.
`AT&W`	* saves all settings.

This completes all configuration functions associated with the desired power monitoring system that we defined. The system will now perform the following monitoring:

If voltage is >= 3.5V, no indications
If voltage is 3.3V <= v <= 3.5, low battery indication is given and LED lights
If voltage rises above 3.6V then, low battery indication is removed and LED turns off
If voltage falls below 3.3V, unit powers off.

Validity:

This command is valid for AT Command mode only.
Once the monitoring functions have been enabled, the shutdown functions will operate. However, the signals associated with the warnings will only appear on the interface if the Programmable GPIO pins have been configured to report the associated signals.

Other Considerations:

Related Topics:

General Purpose IO, Program Mode, Save Profile command

Ping Command

Description:

The Ping command causes the modem to transmit a single ICMP packet of the specified size to the ICMP/PING entity of the specified address. The data sent is a simple random pattern that the targeted destination will return in the same format as it was sent. If the packet is returned, then the path from the modem to the destination address location is intact. If the message is not returned then the path may not be intact or the destination address may not be able to respond. The Ping command is a very useful tool in trouble shooting problems and confirming the modems operation.

Upon issuing the Ping command the modem will send the ICMP Ping message to the destination address. The modem will wait for a return message. If the destination address returns the Ping message before 20 seconds has elapsed, an OK result code is emitted. If the Ping message is not returned in less than 20 seconds, an ERROR result code is emitted. Additional PING commands must not be issued if a PING command is already in progress, you must wait for either the OK or the ERROR response.

The ping command can be used to send messages up to 128 bytes in length by adding a forward slash and a number, 1 to 128, afterwards. If no forward slash is included the Ping message will be 32 bytes in length.

Format:

ATPING<XXX.XXX.XXX.XXX>/<Length>	To send a ICMP Ping message
IPaddress format	XXX.XXX.XXX.XXX where XXX is a number [0 to 255]
Length value range	[1 to 128]

Validity:

Other Considerations:

In earlier versions of the modem software a BUSY result code was emitted upon transmitting the ICMP Ping message. There is currently no trace route function within the modem. This function is resident in Windows 95 and can be run using PPP or SLIP and the external stack.

Related Topics:

Antenna Compensation

Description:

This feature provides antenna compensation. If an external antenna is connected to the Vespa, the type of antenna can be compensated for in the firmware, provided its characteristics are known.

Format:

ATAC?	To query the configuration
ATAC=0	Assume a 1.2 dB antenna
ATAC=1	Configuration for unity gain antenna
ATAC=2	Configuration for 3 watt booster compatible antenna

Validity:

Other Considerations:

Related Topics:

Message Waiting

Description:

This command turns on the Message Waiting signal if it exists.

Format:

ATMW?	To query the state of the signal
ATMW1	To turn on the Message Waiting signal
ATMW0	To turn off the Message Waiting signal

Validity:

Obviously, this feature is only valid if there is an output pin associated with this signal.

Other Considerations:

Related Topics:

Internal MRU Setting

Description:

This feature defines the maximum negotiated MRU size during a PPP session. In many host systems, the host stack will configure a default MRU size from its own defaults, but this may not be the optimum size for the CDPD network. Further, some implementations of host TCP/IP stack do not allow the modification of this default by the users. Therefore, in order to properly support these stacks in a wireless CDPD environment, the ability to dictate the negotiated MRU size to an optimum value regardless of host configuration will be supported in this register.

Format:

AT#MRU?	To query the current setting
AT#MRU=xxx	Set the MRU value

By default, the MRU recommended by the CDPD system is approximately 512 bytes.

To set the default MRU size to 512, you would enter the following:

AT\APROG,NRM6812	- enter PROGRAM mode of operation
AT#MRU=512	- set the value to 512
AT&W	- to save it

Validity:

This value is configurable in PROGRAM mode only.

Other Considerations:

Related Topics:

Appendix A: AT Command Set Quick Reference