USRobotics®
A Division of UNICOM® Global

Courier M2M 3G Cellular Modem

USR3500

Application Guide

R24.0794.00

Revision History

Date	Reason For Changes	Version
1/28/14	Initial Release	1.0
2/25/14	Cosmetic updates	1.1

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Contact Information

Web:	http://www.usr.com/contact

Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, and troubleshooting tips: http://www.usr.com/support/3500

1 Overview

The Courier M2M software is a platform for building robust M2M solutions that must communicate with a server. A few of Courier M2M software's more important features include cellular modem control, bearer management, device management, GPS device control, and asset tracking functionality. The purpose of this document is to describe these features and AT command communication protocol of the Courier M2M software.

1.1 Definitions

In this document, the USR3500 executing the Courier M2M software is referred to as the 'device'. The remote node communicating with the device is referred to as the 'server'.

The following table shows the acronyms used in this document and their meanings:

Abbreviation	Description
ADC	A to D Converter
APN	Access Point Name
ASCII	American Standard Code for Information Interchange
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
FOTA	Firmware Upgrade Over The Air
GPRS	General Packet Radio Service
IP	Internet Protocol
NAT	Network Address Translator
NVM	Non-Volatile Memory (Flash)
PDP	Packet Data Protocol
SMS	Short Message Service
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
USB	Universal Serial Bus
WD	Watchdog

1.2 Design Principles

This document is laid out to show the device interface for each individual subsystem or feature. Within a subsystem or feature section, each "command" is defined and the ASCII command is specified. Examples are provided as appendixes.

2 Network Configurations

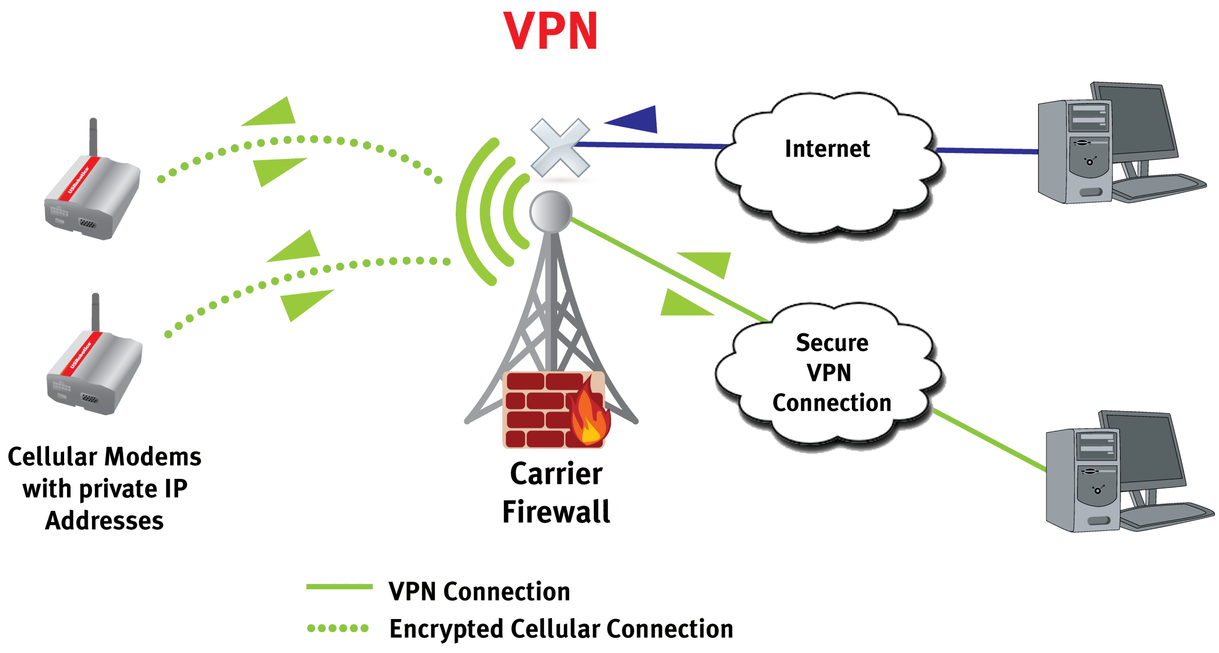
Different network configurations can be used when communicating to a remote device. The wireless provider (carrier) assigns the device an IP address when the device connects to the wireless network's data services. Depending on the network provider and desired protocol, one of the following network configurations would be used:

- Private IP with Virtual Private Network (VPN)
- Private IP Network
- Public IP Network

2.1 Private IP with VPN

Network configuration used when the device is assigned a private IP address by the carrier. The device is behind the carrier's NAT/Firewall and thus is assigned a private IP address, which is not accessible by a remote server. But if bidirectional UDP or mobile terminated TCP connections are required, then a server can use a Virtual Private Network (VPN) tunnel so it can communicate inside the firewall. This way the server and the device would be able to access each other's private IP addresses.

In this configuration both the device and the server can originate and terminate IP based messages (TCP or UDP).


VPN
Internet
Secure VPN Connection
Cellular Modems with private IP Addresses
Carrier Firewall
VPN Connection
Encrypted Cellular Connection

If your system requires the server to originate connections to the modem, and you don't wish to rely on SMS to initiate those connections, then this is a good option. The remaining option is to have the server and modem use public IP addresses.

2.2 Private IP

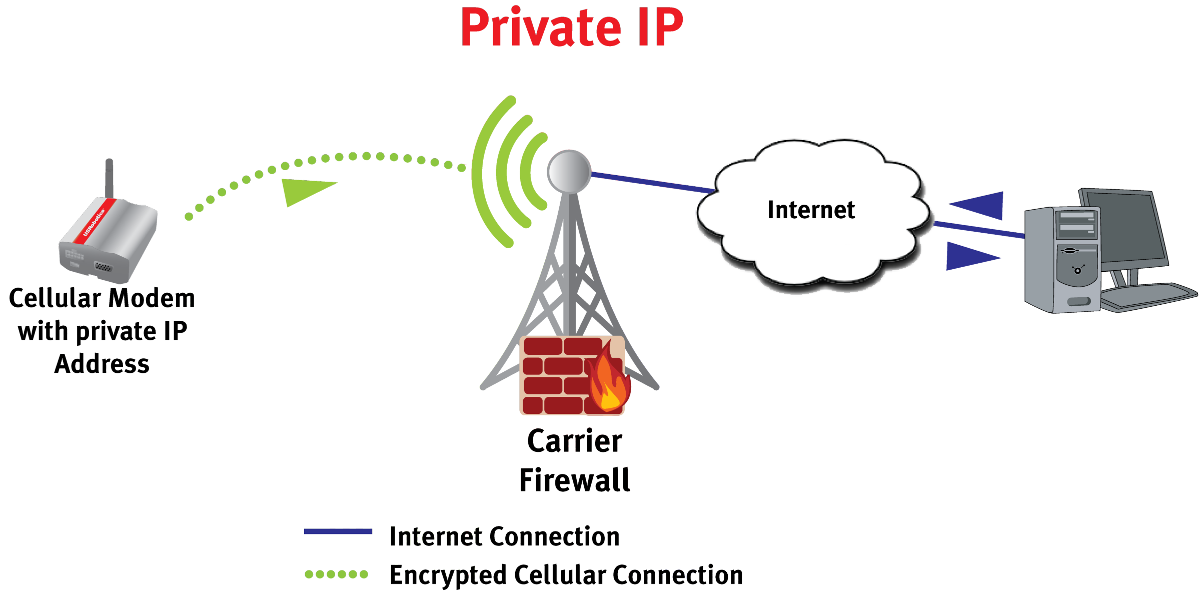
Network configuration used when the server has a public IP address, but the device is assigned a private IP address. In this configuration the device can originate any IP based messages (TCP or UDP).

2.2.1 Mobile Originated

The device is behind the carriers NAT/Firewall and thus is assigned a private IP address that is not accessible from the rest of the internet. In this scenario, the private IP address would not be accessible by a remote server.

Unfortunately, the only way IP based bidirectional communications are possible is if the modem originates a TCP connection to the server. This way the NAT will be able to manage the TCP connection so packets coming back from the server are received by the modem.

The following figure illustrates a mobile originated use case.

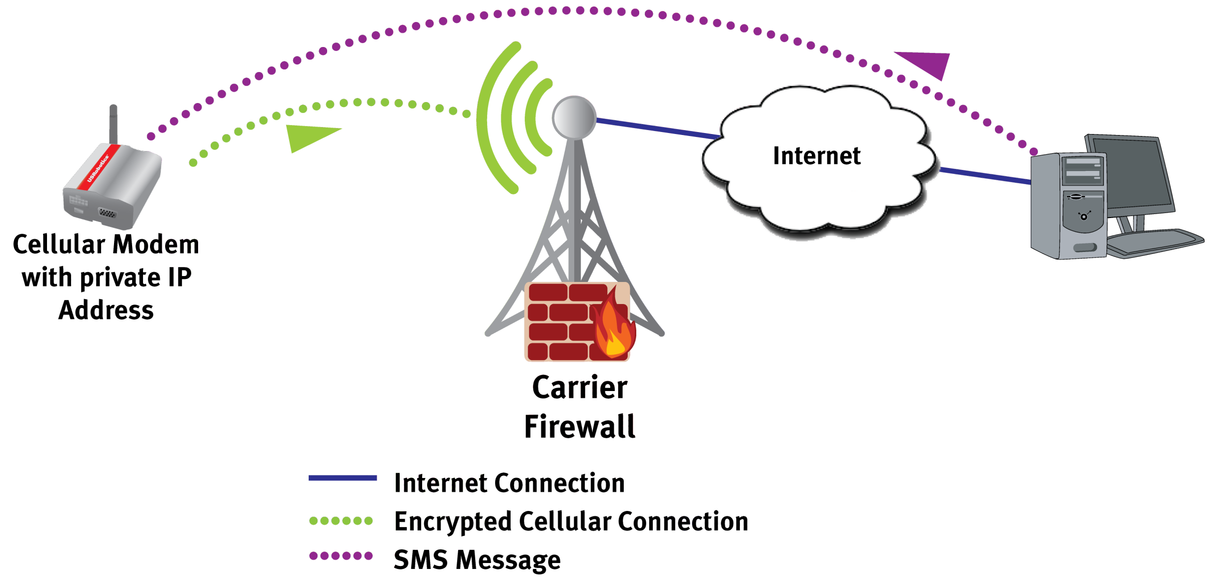

Private IP
Cellular Modem with private IP Address
Internet
Carrier Firewall
Internet Connection
Encrypted Cellular Connection

2.2.2 Mobile Originated with SMS wake up (Server initiated)

The server cannot originate TCP connections or send UDP messages to the modem. Because UDP is a connectionless protocol, UDP packets are blocked even if they are responses to packets sent by the modem. Therefore, when the server needs to initiate communications to the device, it would have to use cellular based SMS messages.

The following figure illustrates the use case for SMS messages.

Private IP - SMS

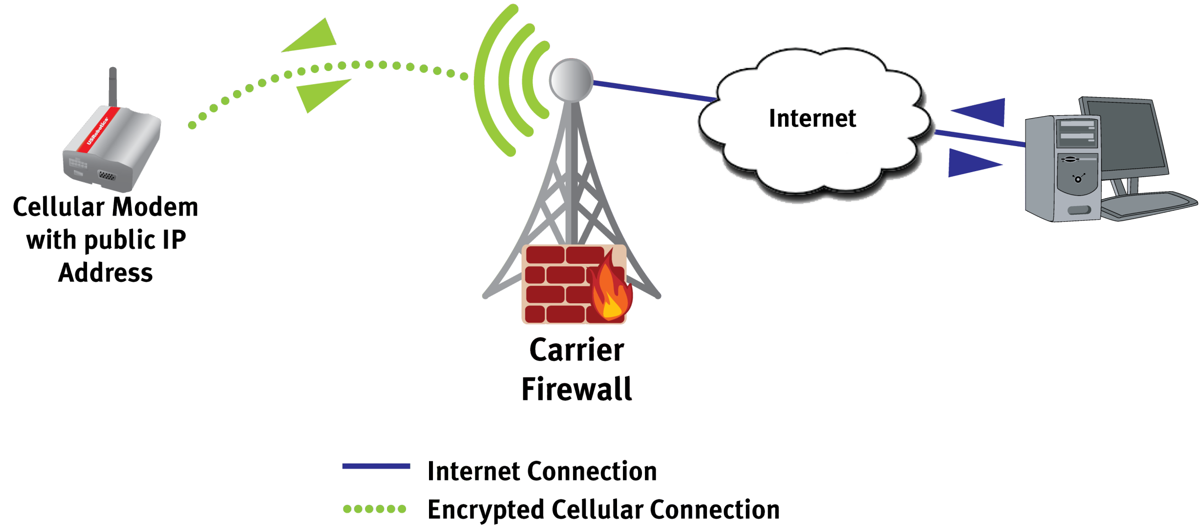

Internet
Cellular Modem with private IP Address
Carrier Firewall
Internet Connection
Encrypted Cellular Connection
SMS Message

This system is very common. It allows the modem to be protected behind the carrier's firewall. Also, if your system doesn't require the server to initiate communications with the modem then this will work well. If you do require server initiated communications, then you must support two communication paths, GPRS and SMS.

2.3 Public IP based

Network configuration used when both the device and the server have publicly accessible IP addresses. In this configuration both the device and the server are aware of each other's IP address.

Public IP


Cellular Modem with public IP Address
Carrier Firewall
Internet
Internet Connection
Encrypted Cellular Connection

When both the device and the server use public IP addresses, then both TCP and UDP messages can be transmitted in both directions between the remote server and the device.

This scenario is simple but security must be built into the system to ensure that access to the modem is restricted to only those you wish to communicate with your device. Without such security, a malicious attack could result in sensitive material being lost, the device being disabled, and/or a very high data bill.

2.4 Static vs Dynamic IP Addresses

In all three scenarios above the service can either include static or dynamic IP addressing for the modems. Static IP addresses are great because you can simplify your server application by building a static look-up table to keep track of which IP address goes with which device.

The other option is dynamic IP addresses. In this case, each time your modem activates a GPRS context, the modem may be given a different IP address. Also, the IP address may be changed from time to time even when connected to the network. Courier M2M software has the ability to help a server keep a dynamic look-up table of devices in a dynamic IP environment.

2.5 Connection Methodology

There are two methodologies for a device to communicate with a server; push or pull. Which methodology you employ will depend on your network configuration and your IP address configuration. Courier M2M software supports both methodologies.

Using the serial port, you can configure Courier M2M before you ship the device to be installed. This interface is ideal for writing a TCL, Python or Perl script. For example, if you configure Courier M2M software for an asset tracking application, you would set how often you wish the device to update the server with position information and you would need to set the IP address of the server with which you wish to communicate.

Once the device is in the field, there are two ways the device can operate. First, the device can be configured to always initiate the connection with the server, send data and then close the socket. This is the push methodology. You can also design your system so the device never initiates communications. Instead your server always initiates the connection by opening the socket, sending data to the device and then closing the socket once the transfer has completed. This is the pull methodology. Lastly, you can design your system to work with both push and pull. In all cases, there is no need to keep sockets open any longer than it takes to complete the data transfer initiated by either the device or the server.

2.6 Data Connection

Enter **AT+WOPEN=1** to start the Courier M2M application. A startup banner will display.

```
Lib Version 1.9.1
Courier M2M Wireless Device
Application Started
```

If the application is already started, the startup banner will not display and an **OK** response will be given.

To use IP data services, you need to configure an APN. Your cellular account needs to have data services, and the cellular provider must provide you with an APN string. Enter **AT$CGDCONT=1,”<cellular.apn.string>”** to set the APN. Use **AT+CGREG?** to verify GPRS registration.

```
AT+CGREG?
+CGREG: 0,1
OK
```

A response with 0,1 indicates that your device is registered on the GPRS network. A response of 0,0 would indicate not registered. Once you are registered, Courier M2M will automatically activate a PDP context. Enter **AT$IP** to verify the device’s IP address.

```
AT$IP
$IP: "<deviceID>",0,"203.0.113.1"
OK
```

3 NVM Queue

Because of the nature of wireless technologies, where the network connection may be lost from time to time, Courier M2M software has a Non-Volatile Memory Queue where all outgoing data packets are stored before transmission. This way, important data will not be lost. If, for example, the connection is lost when sending a GPS based Geofence violation message, the data will be sent immediately when the network connection is regained.

Also, if you've set any watchdog timers or a periodic reboot timer, then the stored data survives reboots as well.

4 Protocol Overview

4.1 Protocol

This document describes the different interfaces that can be used to setup and control the device via AT Command formatted messages.

The ASCII protocol is designed to be simple and human readable and is available for setting up the device either on-site via the device's serial port (USB/RS232) or remotely through raw sockets, telnet session, or SMS messages. The ASCII protocol is an AT Command (Hayes modem) based command and response interface. The advantage of the ASCII protocol is that it is human readable, simple to read and therefore, quick to implement. The ASCII commands can be sent to the UARTS, USB or Telnet ports. The commands may also be sent via SMS messages if that option is configured using the AT$SMS command. The response to the AT command is sent back to the same port from which the command was received.

4.2 ASCII Format

The ASCII protocol is designed to work across all communication bearers. It can be used over SMS, TCP/UDP or a serial interface. The interface is based on the AT command protocol (V.250 specification). Using this design principle, the same protocol can be used for communication between the server and the device, communications with a service technician over a serial interface and used at manufacturing time to test the device.

The command's intermediate and final responses are sent from the device in response to the command. In the case of "events", unsolicited responses are sent over the bearer that initiated the command. Commands are described as "Read", "Action" and "Test".

The Read commands are used to query a setting on the device. Use an ASCII “?” as the last character of the command to denote a Read command.

Action commands are used to assign values to settings on the device. The command containing an ASCII “=” is used to denote a Parameter command. The “=” can be followed by 0 or more parameters, depending on which parameters are required and which are optional.

Action commands are used to initiate an action. When the command doesn’t include parameters, the “=” or “?” after the command then it is an action command.

Test commands are used to verify the syntax of a particular command. The ASCII string “=?” as the command’s last characters is used to show the syntax of a command.

Please refer to the V.250 specification for more background on the structure of the ASCII protocol.

4.3 ASCII Command/Response Types

The following table defines the AT command based messages.

Type	Description
Events	
AT$EVENTLABEL	Encode and decode Event Labels
AT$EVENTDISPLAY	Display events when they are generated
AT$EVENTFILTER	Configure a list of events to subscribe to for use in other event capable commands
AT$EVENTSEQUENCE	Define a list of events to match to trigger a sequence event.
AT$EVENTGEN	Used to generate system or user defined events manually
Identification	
AT$APPVERSION	Get the application and hardware version
AT$FWVERSION	Get the modem firmware version
AT$MODEMID	Return the modem ID, usually the IMEI
AT$SUBSCRIBERID	Return the subscriber ID, usually the IMSI
AT$DEVICEID	Set and Get the Device Id
AT$FEATURE	Gets the build features
Time	
AT$TIME	Set and Get the current time
AT$AUTOTIME	Set and Get the Autotime Mode
AT$TIMERSTART	Start a timer
AT$TIMERSTOP	Stop a timer
AT$ALARMCLOCK	Configure or delete an alarm
Device Control	
AT$SMSFORWARD	Set and Get SMS Forward Mode
AT$RESET	Reset the device
AT$REPORT	Configures which unsolicited reports are generated by the device and report various device statuses
AT$LOWPOWERON	Enable low power mode
AT$LOWPOWEROFF	Disable low power mode
Communications	
AT$CGDCONT	Set and Get PDP context
AT$IP	Returns the network IP address of the device
AT$PING	Allows a device to ping a remote server
Ethernet	
AT$ENABLEETHERNET	Enable/Disable the Ethernet interface
AT$ETHERNETIP	Returns the Ethernet IP address of the device
AT$DHCPS	Set and Get DHCP settings for Ethernet Interface
AT$STATICIP	Set and Get static IP for Ethernet Interface

Type	Description
AT$DHCPDNS	Set and get DNS settings for the DHCP server
Endpoint / Bridge	
AT$ENDPOINT	Set and Get Endpoint used for “Pass through” routing
AT$BRIDGECREATE	Query or Connect 2 endpoints completing a “Pass through” route
AT$BRIDGEDELETE	Define or query bridge DELETE parameters.
AT$ONLINE	Return serial endpoint to online data mode.
AT$EPWRITE	Write data to an Offline Data Mode Endpoint
AT$EPREAD	Read data from an Offline Data Mode Endpoint
Email	
AT$ESERVER	Define and query Endpoint Server settings
AT$EMAILHDR	Define and query Email Header settings
Remote AT Commands	
AT$TELNETPORT	Set and Get telnet port used for AT
AT$SMS	Set and Get SMS AT command configuration
FTP Commands	
AT$FTPOPEN	Open an FTP session.
AT$FTPCLOSE	Close an FTP session.
AT$FTPMKDIR	Make a directory.
AT$FTPCWD	Change working directory.
AT$FTPDELDIR	Delete a directory.
AT$FTPDEL	Delete a file.
AT$FTPREN	Rename a file.
Tag File System	
AT$TAGFORMAT	Format the Tag file system.
AT$TAGRECOMPACT	Recompact the FLASH containing the Tag file system.
AT$TAGINSTALL	Install a Tag file as either new cellular modem firmware or software application.
AT$TAGDELETE	Delete a Tag.
AT$TAGCREATE	Create an empty tag file.
AT$TAGWRITE	Write data to a Tag.
AT$TAGCLOSE	Close a Tag file.
AT$TAGREAD	Read data from a Tag.
AT$TAGSYSINFO	Display system information on Tag file system.
AT$TAGLISTALL	List all Tag files in the file system.
AT$TAGDOWNLOADFTP	Download from FTP server to tag file.
AT$TAGDOWNLOADHTTP	Download from HTTP server to tag file.
AT$TAGUPLOADFTP	Upload from tag file to FTP server.
AT$TAGUPLOADHTTP	Upload from tag file to HTTP server.
GPIO	
AT$GPIOCONFIG	Allocate, deallocate, save and delete from flash and view the

Type	Description
	status and capabilities of GPIOs
AT$GPIOREAD	Read one or more GPIOs
AT$GPIOWRITE	Write to one or more GPIOs
AT$GPIOACTION	Allow multiple events to operate on one GPIO
AT$GPIOACTIONMULTI	Allow multiple GPIOs to be manipulated by one event.
GPS Tracking	
AT$LOCATE	Set unsolicited locate time and get current location
AT$GEOFENCE	Set and get parameters for Geofence tracking
AT$SPEED	Set and get speed settings and status
AT$LOCATEEXT	Set and get extended location filter assignments
SENSOR	
AT$SENSORCONFIG	Define a sensor driver.
AT$SENSORCALIBRATE	Define a calibration table for a sensor channel.
AT$SENSORTRIGGER	Define trigger events for reading a sensor channel.
AT$SENSORREAD	Read a sensor channel.
Config System	
AT$CONFIG	Set and get configuration settings
System Variables	
AT$VARIABLETHRESHOLD	Configure a variable threshold.
AT$VARIABLECOMPARE	Configure a variable comparison.
AT$VARIABLESET	Configure a variable to be modified.
AT$VARIABLESEND	Send a variable to an endpoint.

5 String Tokens

String tokens are placeholder variables that may be placed in any string that is passed in to any software command. At runtime the string tokens are evaluated and replaced with the appropriate values. This allows for creating dynamic strings that can be used for file and directory names, or for SMS and email messages.

String tokens are inserted into a string with a percent sign (%) before and after the name. For example, if a string contains the string token %year%, then it will be replaced with "2013". The name is case sensitive. If a string token name is not recognized, it is replaced with “%?%”. To include a percent sign in the string without referring to a string token, insert “%%”.

The token name can be used with a prefix and/or postfix number to modify its meaning. For example, if the string token “FILL” is inserted in a string as %10FILL46%, then it will be replaced with 10 of the ASCII character 46 (period), or “……….”. If either number is not included, it is assumed to be 0. Not all string tokens use the numbers.

String token processing can be enabled or disabled. When disabled, the original string is not modified.

The table below lists all the string tokens. The current list can be queried with the AT$STRINGTOKENS? Command.

Name	Description	Prefix #	Postfix #
system			
%%	Insert a single percent sign	–	–
CR	Carriage return (default count=1)	count	–
CRLF	Carriage return, line feed (default count=1)	count	–
HT	Horizontal tab (default count=1)	count	–
LF	Line feed (default count=1)	count	–
FILL	Fill string with characters (default count=1)	count	character
lowpwr	Low power mode (0=disabled, 1=enabled)	–	–
time			
year	Year (4 digits)	Min width	counter
month	Month	Min width	counter
monthname	Month name	–	counter
day	Day of the month	Min width	counter
dow	Day of the week (1=Sun, 7=Sat)	Min width	counter
downame	Day of the week name	–	counter
hourint	Hour in 24 hour format	Min width	counter
hourus	Hour in 12 hour format	Min width	counter
ampm	AM or PM	–	counter

Name	Description	Prefix #	Postfix #
minute	Minutes (2 digits)	–	counter
second	Seconds (2 digits)	–	counter
identification			
mfg	Modem manufacturer	–	–
model	Modem model	–	–
subid	Subscriber Id	–	–
modemid	Modem id	–	–
deviceid	Device id	–	–
modulefirmver	Modem firmware version	–	–
appver	Software application version	–	–
platver	Software platform version	–	–
hwver	Modem hardware version	–	–
projname	Name of the project build.	–	–
features	Feature bitmap in hex.	–	–
counter			
counter	General purpose counter. N=1-20	–	N
nvcounter	General purpose NVM counter. N=1-20	–	N
gpio			
gpio	Status of GPIO pin	–	pin
endpoint			
epbyteswritten	Bytes written to endpoint X buffer	–	X
eptransactions	Transactions written to endpoint X buffer	–	X
epbytesread	Bytes written to endpoint X buffer	–	X
ip			
telnet	Telnet server status. 0=off, 1=on, 2=client connected	–	–
tcpserver	TCP server status. 0=off, 1=on, 2=client connected	–	–
udpserver	UDP server status. 0=off, 1=on	–	–
ethernet			
etheron	Ethernet on (0-1)	–	–
etherlink	Ethernet link status (cable connected)	–	–
gatewayip	Static IP address of the local ethernet interface	–	–
network			
apn	Access Point Name for Context ID (1-4)	–	ID
sig	Signal strength	–	–
wanip	IP address from the cellular network	–	–
tag			

Name	Description	Prefix #	Postfix #
tagmemtotal	Tag memory total bytes	–	–
tagmemdel	Tag memory deleted bytes	–	–
tagmemfree	Tag memory free bytes	–	–
tagrecompact	Tag recompact flag. 1=Recompact on next reset.	–	–
gps			
longitudeF	GPS longitude, Float format	Min width	Decimal places
latitudeF	GPS latitude, Float format	Min width	Decimal places
speedF	GPS speed, Float format	Min width	Decimal places
headingF	GPS heading, Float format	Min width	Decimal places
altitudeF	GPS altitude, Float format	Min width	Decimal places
accuracyF	GPS accuracy, Float format	Min width	Decimal places
mileageF	GPS miles between updates, Float format	Min width	Decimal places
latitude	Latitude (deg*1000000)	–	–
longitude	Longitude (deg*1000000)	–	–
heading	Heading (deg*10)	–	–
speed	Current speed (mph*10)	–	–
altitude	Altitude (feet*10)	–	–
numsat	Number of GPS satellites	–	–
accuracy	Accuracy (miles*1000000)	–	–
mileage	Miles between updates (*1000)	–	–
odometer	Accumulated miles *1000	–	–
fixtime	Fix time, secs since 1/1/1970	–	–
sensor			
sensor	The current sensor stored value. Postfix # X = (Id*16) + channel.		X

5.1 STRINGSEND Events

These events are generated by the STRINGSEND commands. The EventType is 9. The ObjectId for the event is the StringSend ID. See section 7 for more about events.

Name	EventId	Description
Started	1	A STRINGSEND transfer has started.
Done	2	A STRINGSEND transfer has completed.

Error	3	A STRINGSEND transfer encountered an error.
Aborted	4	A STRINGSEND transfer was aborted.

5.2 AT$STRINGTOKENS

This Command enables or disables the string token processing, and lists all string tokens.

5.2.1 Action Command

The following shows the command (in bold) to enable or disable string token processing.

```
AT$STRINGTOKENS=<mode>
$STRINGTOKENS: ”<deviceId>”,<status>
(OK I ERROR)
```

5.2.2 Read Command

The following shows the command (in bold) to list all string tokens with a brief description.

```
AT$STRINGTOKENS?
$STRINGTOKENS: ”<deviceId>”,<status>,<mode>
$STRINGTOKENS: ”<deviceId>”,<status>,%name%,”Description”
…...(list of all string tokens)
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<mode>	0 – Disable processing 1 – Enable processing

<status>	Description
0	Success
1050	Invalid <mode>.

5.3 AT$STRINGTEST

This Command is used to test the formatting of the dynamic string tokens. A string that contains string tokens is entered and is processed. Its replacement string is displayed. This provides an aid for developing dynamic strings to be used in other system commands.

5.3.1 Action Command

The following shows the command (in bold) to test a string.

AT$STRINGTEST="<string with tokens>"
$STRINGTOKENS: ”<deviceId>”,<status>,”<replacement string>”
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.

<status>	Description
0	Success
1050	Invalid string

5.3.2 Example

```
AT$STRINGTEST="Current date and time:  %downame% %month%/%day%/%year%
%hourus%:%minute%:%second% %ampm%"

$STRINGTEST: "327004000672",0,"Current date and time:  Wednesday 6/20/2012
5:38:36 PM"

OK
```

5.4 AT$STRINGSENDEMAIL

This Command is used to send an email with a string that may contain string tokens. This command creates a temporary SMTP Email endpoint to send the email. The email may be sent immediately, or triggered by any event.

The command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

5.4.1 Action Command

The following shows the command (in bold) to send a string.

```
AT$STRINGSENDEMAIL=<strSendId>,<eServerId>,<emailHdrId>,"<msgString>"
[,<attachTagId>[,<compress>[,<eventLabel>[...,<eventLabel>]]]]
$STRINGSENDEMAIL: ”<deviceId>”,<status>
 (OK I ERROR)
```

The above command response indicates the status of the command and its parameters. If successful, then when triggered by an <eventLabel>, a connection will be established with the SMTP email server, and the <msgString> will be sent. Unsolicited messages will be output to indicate the progress:

```
$STRINGSENDEMAIL: ”<deviceId>”,<status>,< strSendId >,<transferStatus>
```

To delete a STRINGSENDEMAIL Id, enter the command with the StringSend Id as the only parameter:

```
AT$STRINGSENDEMAIL=< strSendId >
```

5.4.2 Read Command

The following shows the command (in bold) to query the STRINGSENDEMAIL settings.

```
AT$STRINGSENDEMAIL?
$STRINGSENDEMAIL: ”<deviceId>”,<status>,<strSendId>,<eServerId>,<emailHdrId>,
"<msgString>",<attachTagId>,<compress>,<eventLabel>...,<eventLabel>
…...(list of all valid records)
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<strSendId >	StringSendEmail identifier (1-20).
<eServerId>	Endpoint Server Id. The Eserver contains the SMTP server’s IP address, and optional port, username, and password.
emailHdrId	Email Header Id. The Email header contains the sender and recipient information.
<msgString>	The body of the email, which may contain string tokens. The tokens will be evaluated when the email transfer is triggered to begin.

<tagId>	Not currently supported. Tag file to be attached to the email.
<compress>	Not currently supported. Type of compression performed on the tag file before attaching to the email: 0 = None (default) 1 = zlib 2 = bzip
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the sending of the email. There may be from 0 to 10 values. A null or 0 value specifies "immediate" (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<transferStatus >	Status of the transfer process: 1 = Transfer has started. 2 = Email was sent successfully. 3 = An error was encountered. 4 = Transfer was aborted.

<status>	Description
0	Success
1050	Invalid StringSend Id
1052	Already in use
1055	Invalid Eserver Id
1056	Invalid EmailHdr Id
1100	Invalid Tag Id

5.4.3 **Example**

The following example sets up StringSendEmail Id 3 to send an email when timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 1 for Timer 1
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,1,3
$EVENTLABEL: "327004000672",0,"00020103"
OK

AT$ESERVER=1,"smtp.mail.example.com",587,"myemailid@example.com","mypasswd",2
AT$EMAILHDR=1,"myemailid@example.com","My Name","someone@example.com", ,,"My
Subject"
```

```
AT$STRINGSENDEMAIL=3,1,1,"Email body sent at %hourus%:%minute%:%second%
%ampm%",0,0,00020103
```

To test, this command creates Timer 1 with a duration of 30 seconds:

```
AT$TIMERSTART=1,300
```

Another alternative for triggering the email is to have it sent every time the modem acquires a GPRS connection. For that, use the event for IP Address Changed (see section 12.1):

Event Type = 50 for Network
Object Id = 0 (not used)
Event Id = 1 for IP Changed

```
AT$EVENTLABEL=50,0,1
$EVENTLABEL: "327004000672",0,"00320001"
```

```
AT$STRINGSENDEMAIL=3,1,1,"GPRS acquired at %hourus%:%minute%:%second%
%ampm%",0,0,00320001
```

5.5 AT$STRINGSENDSMS

This Command is used to send an SMS message with a string that may contain string tokens. This command creates a temporary SMS endpoint to send the message. The SMS may be sent immediately, or triggered by any event.

The command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

5.5.1 **Action Command**

The following shows the command (in bold) to send a string.

AT$STRINGSENDSMS=<strSendId>,"<smsPhoneNum>","<msgString>"[,<eventLabel> [...,<eventLabel>]]
$STRINGSENDSMS: ”<deviceId>”,<status>
(OK I ERROR)

The above command response indicates the status of the command and its parameters. If successful, then when triggered by an <eventLabel>, the <msgString> will be sent. Unsolicited messages will be output to indicate the progress:

```
$STRINGSENDSMS: ”<deviceId>”,<status>,<strSendId>,<transferStatus>
```

To delete a STRINGSENDSMS Id, enter the command with the StringSend Id as the only parameter:

```
AT$STRINGSENDSMS=<strSendId>
```

5.5.2 **Read Command**

The following shows the command (in bold) to query the STRINGSENDSMS settings.

```
AT$STRINGSENDSMS?
$STRINGSENDSMS:
”<deviceId>”,<status>,<strSendId>,<smsPhoneNum>,"<msgString>",
<eventLabel>...,<eventLabel>
…...(list of all valid records)
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<strSendId >	StringSendSms identifier (1-20).
<smsPhoneNum>	SMS Phone Number. This number must be a valid destination phone number.
<msgString>	The content of the SMS message, which may contain string tokens. The tokens will be evaluated when the message is sent.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the sending of the SMS. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<transferStatus >	Status of the transfer process: 1 = Transfer has started. 2 = SMS was sent successfully. 3 = An error was encountered. 4 = Transfer was aborted.

<status>	Description

0	Success
1050	Invalid StringSend Id
1052	Already in use

5.5.3 Example

The following example sets up StringSendSms Id 2 to send an SMS when timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 1 for Timer 1
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,1,3
$EVENTLABEL: "327004000672",0,"00020103"
OK
```

```
AT$STRINGSENDSMS=2,”9195551234”,"SMS body sent at %hourint%:%minute%:
%second%",00020103
```

To test, this command creates Timer 1 with a duration of 30 seconds:

```
AT$TIMERSTART=1,300
```

5.6 AT$STRINGSEND

This Command is used to send a string that may contain string tokens to an existing endpoint. The transfer may be triggered immediately, or by any event.

The command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

5.6.1 Action Command

The following shows the command (in bold) to send a string.

AT$STRINGSEND=<strSendId>,<endpointId>,"<msgString>"[,<eventLabel>[...,<eventLabel>]]
$STRINGSEND: ”<deviceId>”,<status>
(OK I ERROR)

The above command response indicates the status of the command and its parameters. If successful, then when triggered by an <eventLabel>, the <msgString> will be sent to the specified endpoint. Unsolicited messages will be output to indicate the progress:

```
$STRINGSEND: ”<deviceId>”,<status>,< strSendId >,<transferStatus>
```

To delete a STRINGSEND Id, enter the command with the StringSend Id as the only parameter:

AT$STRINGSEND=< strSendId >

5.6.2 **Read Command**

The following shows the command (in bold) to query the STRINGSEND settings.

AT$STRINGSEND?
$STRINGSEND: ”<deviceId>”,<status>,<strSendId>,<endpointId>,"<msgString>",
<eventLabel>...,<eventLabel>
…...(list of all valid records)
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<strSendId >	StringSend identifier (1-20).
<endpointId>	Endpoint Id. This endpoint must already exist.
<msgString>	The string to be sent, which may contain string tokens. The tokens will be evaluated when the message is sent.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the sending of the string. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<transferStatus >	Status of the transfer process: 1 = Transfer has started. 2 = String was sent successfully. 3 = An error was encountered. 4 = Transfer was aborted.

<status>	Description

0	Success
1050	Invalid StringSend Id
1052	Already in use
1090	Invalid Endpoint Id
1091	Endpoint Id out of range

5.6.3 **Example 1: Send Email**

The following example sets up StringSend Id 4 to send the given string to endpoint 8 (which is an SMTP email endpoint) when timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 1 for Timer 1
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,1,3
$EVENTLABEL: "327004000672",0,"00020103"
OK

AT$ESERVER=1,"smtp.mail.example.com",587,"myemailid@example.com","mypasswd",2
AT$EMAILHDR=1,"myemailid@example.com","My Name","someone@example.com", ,,"My
Subject"
AT$ENDPOINT=8,8,1,1
AT$STRINGSEND=4,8,"String was sent at %hourint%:%minute%: %second%",00020103
```

To test, this command creates Timer 1 with a duration of 30 seconds:

```
AT$TIMERSTART=1,300
```

5.6.4 **Example 2: Serial to TCP Endpoint Connection**

This example shows how a string can be sent to a TCP server when the connection is first made. A pass-through connection is established between a serial endpoint and a TCP endpoint. Every time the TCP endpoint connects to the remote server, a string is sent to the server.

The following commands set up StringSend Id 5 to send a string to TCP endpoint 6 when the TCP connection is opened to its remote server. This uses the TCP Open event as the trigger to send the string. The <eventLabel> for endpoint 6 Open is 00650101 (see section 15.1.2).

Event Type = 101 for TCP endpoints
Object Id = 6 for endpoint 6
Event Id = 1 for TCP Open

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=101,1,1
$EVENTLABEL: "327004000672",0,"00650101"
OK
```

```
AT$STRINGSEND=5,6,"Connected %hourint%:%minute%:%second%%CRLF%Version
%appver%%CRLF%",00650101
```

Then the pass-through connection is set up between serial port 1 and the TCP server at www.example.com, port 2025:

```
AT$ENDPOINT=6,1,2025,www.example.com
AT$BRIDGECREATE=1,1,6,2
AT$ENDPOINT=1,3,1
```

After a power cycle, or any other time the TCP connection is established, the TCP server receives the string:

```
Connected 14:08:10
Version 1.00
```

6 System Variables

The System Variables subsystem manages two types of system variables:

1. Configuration – Configuration settings which are constant. These settings are non-volatile and stored in NVM.
2. Status – Dynamic values that change during runtime. These values may or may not be non-volatile.

System variables are signed 32-bit values, unless stated otherwise.

Events can be generated based on generic conditions such as when a variable changes, or crosses a threshold value. This subsystem also provides the ability to do generic work on any status variable at a regular interval.

6.1 Variable Identifiers

Every system variable has a unique identifier that is used manage that variable. The identifier is a 24 bit value, with the most significant 16 bits specifying the parent subsystem. The subsystem is the same as the Event Type field used by events (see Table 7.1). The lower 8-bits specify the specific variable in the subsystem.

6.2 String Tokens

Each variable's runtime value can be used in a string token. The name of the variable doubles as its string token name. This permits the value to be used in any context that accepts a string token.

In addition to each variable, the following string tokens are available:

Name	Description	Prefix #	Postfix #
varthreshold	Current state of the requested variable threshold	–	thresholdId–
varcompare	Current state of the requested variable comparison	–	compareId–

6.3 Events

The events below are generated by the system variables subsystem. They may be used to trigger any action in the software that accepts events.

See Table 7.1 for the Event Type.

Name	EventType	ObjectId	EventId	Description
SENT	System	sendId	1	Variables were sent.

	Variable			
SEND ERROR	System Variable	sendId	2	An error occurred during send.
THRESHOLD_FALSE	System Variable	thresholdId	3	Threshold became false.
THRESHOLD_TRUE	System Variable	thresholdId	4	Threshold became true.
COMPARE_FALSE	System Variable	compareId	5	Compare became false.
COMPARE_TRUE	System Variable	compareId	6	Compare became true.
STATUS_CHANGED	variableId		128	Status variable was modified.
CONFIG_CHANGED	variableId		129	Config variable was modified.

6.4 List of Status Variables

The table below lists all the status variables in the system. The current list can be queried with the AT$VARIABLESTATUS? Command.

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
endpoint				
005A00+X	epbyteswrittenX	Bytes written to endpoint X	–	yes
005B00+X	eptransactionsX	Transactions written to endpoint X	–	yes
005C00+X	epbytesreadX	Bytes read from endpoint X	–	yes
gpio				
	gpio	Status of GPIO pin		
ip				
003401	telnet	Telnet server status. 0=off, 1=on, 2=client connected		yes
003402	tcpserver	TCP server status. 0=off, 1=on, 2=client connected		yes
003403	udpserver	UDP server status. 0=off, 1=on		yes
ethernet				
003501	etherlink	Ethernet link status (cable connected)		yes
network				
003201	sig	Signal strength		yes
counter				
001000 + N	counterN	General purpose counter. N=1-20		

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
001014 + N	nvcounterN	Non-volatile counter. N=1-15	yes	
tag				
000C01	tagmemtotal	Tag memory total bytes		yes
000C02	tagmemdel	Tag memory deleted bytes		yes
000C03	tagmemfree	Tag memory free bytes		yes
000C04	tagrecompact	Tag recompact flag. 1=Recompact on next reset.	Yes	yes
gps				
00C801	longitude	Longitude (deg*1000000)		yes
00C802	latitude	Latitude (deg*1000000)		yes
00C803	heading	Heading (deg*10)		yes
00C804	speed	Current speed (mph*10)		yes
00C805	altitude	Altitude (feet*10)		yes
00C806	numsat	Number of GPS satellites		yes
00C807	accuracy	Accuracy (miles*1000000)		yes
00C808	mileage	Miles between updates (*1000)		yes
00C809	odometer	Accumulated miles * 1000	yes	yes
00C80A	fixtime	Fix time, secs since 1/1/1970 (unsigned)		yes
sensor				
0087MN	sensorX	The current sensor channel reading for sensor M, channel N. X=(M*16)+N		yes

6.5 AT$VARIABLESTATUS

This AT command displays a listing of all status variables in the system.

6.5.1 Read Command

The following shows the command (in bold) to query all status variables.

```
AT$VARIABLESTATUS?
$VARIABLESTATUS: ”<deviceId>”,<status>,<variableId>,”<variableName>”,
”<variableDesc>”,<nonVolatile>,<autoUpdt>,<avgNum>,<currentValue>
…...(list of all valid records)
 (OK I ERROR)
```

Parameters

Parameter	Description

<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<variableId>	Variable identifier
<variableName>	Short ASCII name for the variable.
<variableDesc>	Brief description of the variable.
<nonVolatile>	1 = Saved in NVM. 0 = Not saved in NVM
<autoUpdt>	1 = Updated automatically. 0 = Not updated automatically.
<avgNum>	Number of readings in rolling average. 0 – No averaging.
<currentValue>	The current value of the variable.

6.6 AT$VARIABLETHRESHOLD

This AT command configures variable thresholds. Every time the variable's value changes, it is compared with the configured threshold for the chosen condition. An event is generated when the test changes between true and false. There can be more than one threshold configured for a variable.

To prevent multiple events from being generated when a variable is teetering on the threshold value, a margin can be configured. After a threshold becomes true and generates the event, it will not generate a false event until the threshold becomes false by more than the margin amount, and vice versa from false to true.

6.6.1 Set Command

The following shows the command (in bold) to configure a variable threshold.

AT$VARIABLETHRESHOLD=<thresholdId>,<variableId>,<thresholdValue>, <compareType>[,<margin>]
$VARIABLETHRESHOLD: "<deviceId>",<status>
(OK I ERROR)

6.6.2 Delete Command

If <thresholdId> is the only parameter given, the threshold is deleted.

AT$VARIABLETHRESHOLD=<thresholdId>
$VARIABLETHRESHOLD: "<deviceId>",<status>
(OK I ERROR)

6.6.3 Read Command

The following shows the command (in bold) to query all variable thresholds.

AT$VARIABLETHRESHOLD?

$VARIABLETHRESHOLD: ”<deviceId>”,<status>,<thresholdId>,<variableId>,
<thresholdValue>,<compareType>,<margin>,<compareState>
…...(list of all valid records)
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<thresholdId>	Threshold identifier
<variableId>	Variable identifier
<thresholdValue>	Threshold value to be compared with the variable
<compareType>	Type of comparison: 1 – Variable < Threshold 2 – Variable <= Threshold 3 – Variable = Threshold 4 – Variable >= Threshold 5 – Variable > Threshold
<margin>	Margin value. New events are not generated until the comparison differs by this amount. This prevents multiple events when a threshold is teetering between true and false. Default = 0.
<compareState>	1 = The comparison is true. 0 = false

6.6.4 **Example**

The following example sets a threshold for the signal strength variable (0x3201) to be greater than or equal to 20, with a margin of 3.

```
AT$VARIABLETHRESHOLD=1,3201,20,4,3
```

When the signal strength rises to 20 or more, the comparison will be true and the TRUE event will be generated. The signal strength will have to fall to 17 or below in order to change the comparison to false and generate the FALSE event.

6.7 AT$VARIABLECOMPARE

This AT command configures variable comparisons. The values of two variables are compared for the chosen condition. An event is generated when the test changes between true and false. There can be more than one comparison configured for a variable. The comparison is reevaluated every time either variable changes.

To prevent multiple events from being generated when the variable values are making the comparison teeter between true and false, a margin can be configured. After a comparison becomes true and generates the event, it will not generate a false event until the comparison becomes false by more than the margin amount, and vice versa from false to true.

6.7.1 Set Command

The following shows the command (in bold) to configure a variable comparison.

```
AT$VARIABLECOMPARE=<compareId>,<variableId1>,<variableId2>,<compareType> [,<margin>]
$VARIABLECOMPARE: ”<deviceId>”,<status>
(OK I ERROR)
```

6.7.2 Delete Command

If <compareId> is the only parameter given, the comparison is deleted.

```
AT$VARIABLECOMPARE=<compareId>
$VARIABLECOMPARE: ”<deviceId>”,<status>
(OK I ERROR)
```

6.7.3 Read Command

The following shows the command (in bold) to query all variable comparisons.

```
AT$VARIABLECOMPARE?
$VARIABLECOMPARE:
”<deviceId>”,<status>,<compareId>,<variableId1>,<variableId2>,
<compareType>,<margin>,<compareState>
…...(list of all valid records)
 (OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<compareId>	Comparison identifier
<variableId1>	First variable identifier
<variableId2>	Second variable identifier
<compareType>	Type of comparison: 1 – Variable1 < Variable2 2 – Variable1 <= Variable2 3 – Variable1 = Variable2

	4 – Variable1 >= Variable2 5 – Variable1 > Variable2
<margin>	Margin value. New events are not generated until the comparison differs by this amount. This prevents multiple events when a comparison is teetering between true and false. Default = 0.
<compareState>	1 = The comparison is true. 0 = false

6.7.4 Example

The following example sets a comparison between counter1 and counter 2. The comparison will be true if counter1 (0x1001) is less than counter 2 (0x1002), with a margin of 5.

```
AT$VARIABLECOMPARE=1,1001,1002,1,5
```

When the counter1 is less than counter 2, the comparison will be true and the TRUE event will be generated. Counter1 will have to be 5 or more greater than counter2 in order to change the comparison to false and generate the FALSE event.

6.8 AT$VARIABLESET

This AT command changes the value of a variable whenever an event occurs. This can also be used as a counter of events by setting the command to add one each time.

The command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

6.8.1 Set Command

The following shows the command (in bold) to configure a variable update.

AT$VARIABLESET=<setId>,<variableId>,<operation>,<operand>[,<eventLabel>[…,<eventLabel>]]
$VARIABLESET: ”<deviceId>”,<status>
(OK I ERROR)

6.8.2 Delete Command

If <setId> is the only parameter given, the update object is deleted.

AT$VARIABLESET=<setId>
$VARIABLESET: ”<deviceId>”,<status>
(OK I ERROR)

6.8.3 **Read Command**

The following shows the command (in bold) to query all update objects.

AT$VARIABLESET?
$VARIABLESET: ”<deviceId>”,<status>,<setId>,<variableId>,<operation>,<operand>,
<eventLabel>…,<eventLabel>
…...(list of all valid records)
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<setId>	Set identifier
<variableId>	Variable identifier in hex.
<operation>	Operation to perform on the variable: 1 = Set to the <operand> 2 = Add <operand > 3 = Subtract <operand > 4 = Multiply by <operand > 5 = Divide by <operand > 6 = Mod by <operand> 7 = AND with <operand> 8 = OR with <operand> 9 = XOR with <operand> 10 = NOT (<operand> is ignored) Values 11-20 are the same as above, except the <operand> is interpreted as another variableId from which the value is taken. 21 = Force evaluation of COMPAREs and THRESHOLDs, and trigger an event. This is intended to be used during startup. 22 = Load the current UNIX timestamp (<operand> is ignored)
<operand>	The value of the operation may be either an actual value, or another variableId that will supply the value, depending on the operation: If operation = 1-10 this is the value for the operation. If operation = 11-20 this is variableId2 to supply the value.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the

	update. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.

6.8.4 Example

The following example shows how to keep a count of the number of system resets. The counter nvcounter1 (0x1015) is saved in NVM so it survives power cycles. For each system reset event, the count is incremented by 1.

The <eventLabel> for system reset is 00010002 (see section 7.3).

Event Type = 1 for System
Object Id = 0 (not used)
Event Id = 2 for Normal Start Up

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=1,0,2
$EVENTLABEL: "327004000672",0,"00010002"
OK
```

```
AT$VARIABLESET=1,1015,2,1,00010002
```

The counter can be manually reset to 0 with an “immediate” form of the command:

```
AT$VARIABLESET=1,1015,1,0
```

6.9 AT$VARIABLESEND

This AT command sends variables to an existing endpoint. The transfer may be triggered immediately, or by any event.

The command parameters are saved to NVM and restored after power cycles, unless there is no event specified. If the command is executed immediately, then nothing is saved to NVM.

6.9.1 Set Command

The following shows the command (in bold) to configure a variable send object.

AT$VARIABLESEND=<sendId>,<endpointId>,<endFile>,<eventLabel>,<variableId> […,<variableId>]

$VARIABLESEND: ”<deviceId>”,<status>
(OK I ERROR)

The above command response indicates the status of the command and its parameters. If successful, then when triggered by the <eventLabel>, the <variableId> list will be sent to the specified endpoint. An unsolicited message will be output to indicate the status:

$VARIABLESEND: ”<deviceId>”,<status>,<sendId>,<transferStatus>

6.9.2 Delete Command

If <sendId> is the only parameter given, the send object is deleted.

AT$VARIABLESEND=<sendId>
$VARIABLESEND: ”<deviceId>”,<status>
(OK I ERROR)

6.9.3 Read Command

The following shows the command (in bold) to query all variable send objects.

AT$VARIABLESEND?
$VARIABLESEND:
”<deviceId>”,<status>,<sendId>,<endpointId>,<endFile>,<eventLabel>,<variableId>
…,<variableId>
……(list of all valid records)
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<sendId>	Variable Send identifier
<endpointId>	Destination Endpoint Id.
<endFile>	0 = Do not close file after the Send. 1 = Close the destination file after each Send (default).
<eventLabel>	EventLabel in hex. This defines the event that triggers the transfer. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<variableId>…	Variable identifier(s) in hex to be sent to the endpoint. There may be from 1 to 10 variables in this list.
<transferStatus >	Status of the send:

	1 = String was sent successfully. 2 = An error was encountered.

6.9.4 **Example**

The following example sets up VariableSend Id 1 to send two status variables via endpoint 3 (which is a TCP client endpoint) when timer 2 expires. The two variables are “counter5” with Id 1005 and “sig” with Id 3201.

The <eventLabel> for Timer 2 expiration is 00020203 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 2 for Timer 2
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,2,3
$EVENTLABEL: “327004000672”,0,”00020203”
OK
```

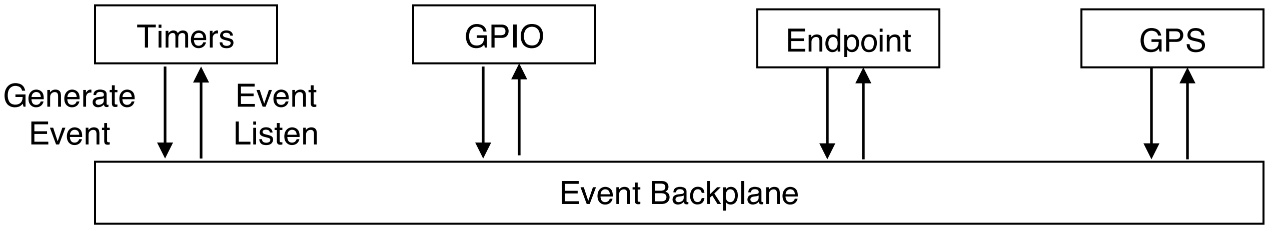
```
AT$ENDPOINT=3,1,2025,www.example.com
AT$VARIABLESEND=1,3,1,20203,1005,3201
```

To test, this command creates Timer 2 with a duration of 30 seconds:

```
AT$TIMERSTART=2,300
```

7 Events

The Event subsystem is one of the two backbones of the software (along with Endpoints and Bridges, described later). Every subsystem in The software is built on the event backplane. This allows all subsystems to generate events and listen for events from any other subsystem.



Every Event has 3 components:

- **Event Type** – This value describes which subsystem the event came from. For example, was the event generated by a timer, GPIO, Endpoint, etc.

- **Object ID** – Each subsystem has a predefined number of available Object ID on which Actions may be performed or which trigger events. In some cases, like GPIOs, the system has already defined the GPIO numbers, which are also interpreted as Object IDs. In some subsystems, for example Timers, the user is allowed to define one or more objects that may generate an event or execute an action (which may in turn, also generate events). This specifies which object ID generated the event.

- **Event ID** – The identifier for the event that occurred within a subsystem. The namespace for Event IDs are based on Event Type. In this document, Event IDs for each subsystem are defined in each section.

Below are the definitions used when discussing events:

- **Event** – A notification to the system that a system state has changed or that an action has occurred. **Examples**: Timer has expired or Device registered to the Network.

- **Action** – A definition of system setting change or process to execute. **Examples**: Write level high to GPIO23 or Start timer 1.

- **Trigger** – The act of generating an Event.

Example 1: (Action) Write level high to GPIO 23 when (Event) timer 1 expires, which Triggers
Example 2: (Action) Start timer 1 when (Event) network registration occurs

7.1 Event Types

Each subsystem in the software has an Event Type number associated with it. This value is used to interpret the context for the Object ID and Event ID.

Event Type Name	Event Type Number
System	1
Timer	2
Event System	3
GPIO	4
SIM	6
Voice Call	7
DTMF	8

String Token	9
Identity	10
Sequence	11
Tag	12
System Variable	15
Counter	16
SMS	17 (0x11)
Network	50
Network CSQ	51
Socket	52
Ethernet	53
TCP Client	54
FTP Server	55 (0x37)
Endpoint bytes written	90 (0x5A)
Endpoint transactions	91 (0x5B)
Endpoint bytes read	92 (0x5C)
Bridge	98 (0x62)
Endpoint General	100
Endpoint TCP	101
Endpoint UDP	102
Endpoint Serial	103
Endpoint SMS	104
Endpoint HTTP GET	105
Endpoint HTTP PUT	106
Endpoint HTTP POST	107
Endpoint EMAIL SMTP	108
Endpoint EMAIL POP	109
Endpoint FTP GET	110
Endpoint SSL TCP	111
Endpoint SSL HTTP GET	112
Endpoint SSL HTTP PUT	113
Endpoint SSL HTTP POST	114
Endpoint SSL FTP GET	115
Endpoint X-Modem	116
Endpoint Tag-Write	117
Endpoint SPI	118
Endpoint I2C	119
Endpoint FTP PUT	120
Endpoint SSL FTP PUT	121
Endpoint Tag Read	122
Endpoint Binary Parser	123
Endpoint AT Parser	124
Endpoint Filter	125

Endpoint Offline Data	126
Endpoint Binary Command Parser	127
Endpoint TCP Server Client Created	130
Endpoint TCP Server Client Deleted	131
Sensor Driver	135 (0x87)
GPS General	200
GPS Rectangular Geofence	201
GPS Circular Geofence	202
GPS Polygon Geofence	203
User Defined	3567

7.2 Event Labels

Even though there are three components to every event (Event Type, Object ID, and Event ID), they can be combined to create an Event Label. An event label simplifies the command line for linking events together. The Event Label is always interpreted as hexadecimal. The event label structure is described below:

Event Type			**Object ID**			**Event ID**		
31	...	16	15	...	8	7	...	0

Figure 1. **Event Label bits**

If the Event Type, Object ID and/or Event ID is 0 then this means wildcard that means “All”. An example of how to use this wildcard is, assume you wish to generate an event label that will be used to listen for any GPIO event. In this case you would make the Event Type equal to GPIO and the object ID and Event ID would be 0.

7.3 System Events

System Events apply to the whole system and are not tied to a specific subsystem.

System Event Type: 1

System Event ID	System Event Name	Description
1	Power On	The software has started.
2	Normal Start Up	All of the software subsystems have initialized.
3	Start Up from Error	CPU exception, such as null pointer or

		divide by 0.
4	Install Successful	A firmware tag file was installed and activated.
5	Install Failed	A firmware tag file failed to install.

7.4 Event Label Command

This AT command is a utility command used to encode Event Labels in order to configure the software subsystem to receive events or to decode Event Labels. This command is not really intended for use during normal operation since it doesn’t control any part of Courier M2M.

7.4.1 **AT$EVENTLABEL**

The $EVENTLABEL command is provided to allow for easy calculation of event labels for use as action triggers. An event label represents three pieces of information: an Event Type, and Object Identifier, and an Event ID.

The AT command is contextual. If you enter only one parameter it is assumed that the parameter is an Event Label that needs to be decoded. The Event Label is always interpreted as hexadecimal. If three parameters are entered then it is assumed that an Event Label needs to be encoded based on the Event Type, Object ID and Event ID. These parameters are always interpreted as decimal values.

Command:	AT$EVENTLABEL=<eventType>,<objectId>,<event>
Response:	$EVENTLABEL:“<deviceId>”,<status>,<eventLabel> OK

Command:	AT$EVENTLABEL=<eventLabel>
Response:	$EVENTLABEL: “<deviceId>”,<status>,<eventType>,<objectId>,<eventId> OK

Please refer to section 2.3.1 for the definitions of the Event Types and 2.3.2 for the definition of the Event Label.

A sample use for the $EVENTLABEL command is shown below. In this command, a timer is created, and the $EVENTLABEL command us used to calculate a label for use as a trigger in a GPIO command.

Ex 1: Sample $EVENTLABEL Usage

AT$TIMER=4,5,1	*Create periodic timer with timer ID 4 and a 500ms duration to start immediately*
OK	*Success response from $timer command*
AT$EVENTLABEL=2,4,3	*Calculate an event label for a timer Event Type 2 (timer object), object ID 4 (timer ID 4), and event ID 3 (timer expiration)*
$EVENTLABEL: "327004006981",0,"00402003" OK	*$eventlabel response with the muxed event label 00402003*
AT$GPIO=5,4,00402003,23,24	*Create a GPIO action with an ID of 5, action of 4 (toggle level), an event Id of 00402003, to act on GPIOS 23 and 24*
OK	*Success creating action from $GPIO command*

7.5 Event Display Command

The $EVENTDISPLAY command turns on unsolicited responses for desired event classes. Granularity and filtering is defined by the provided parameters. If only an Event Type is provided, all events for the provided Event Type will be returned. If an object Id is also provided, the results will be filtered by Event Type and object Id. If all three parameters are provided, only events matching all three parameters will be returned. A value of zero is used to denote all events. Only one event display setting can be active at a time.

This command is for debugging purposes.

7.5.1 AT$EVENTDISPLAY

Action command

Enable or disable display of event.

AT$EVENTDISPLAY=<on/off>,<eventType>,<objectId>,<eventId>
$EVENTDISPLAY: ”<deviceId>”,<status>
(OK I ERROR)

Read command

AT$EVENTDISPLAY?
$EVENTDISPLAY: ”<deviceId>”,<status>,<eventLabel>
(OK I ERROR)

Unsolicited response

$EVT: “<deviceId>”,<status>,<eventType>,<objectId>,<eventId>

Parameter	Description
<on/off>	0 = Unsolicited event indications are disabled (default) 1 = Unsolicited event indications are enabled
<eventType>	See table in chapter 7.1
<objectId>	Specific object ID within the referenced EventType
<eventId>	Specific event ID within the referenced EventType
<eventLabel>	The current registered event label, in hex.

Examples:

```
AT$EVENTDISPLAY=1,0,0,0           //Display all events – NOT ALLOWED!
$EVENTDISPLAY: "327004096909",1013
OK
AT$EVENTDISPLAY=1,2,0,0           //Display all Timer events
$EVENTDISPLAY: "327004096909",0
OK
AT$EVENTDISPLAY=1,2,1,0           //Display all events for Timer 1
$EVENTDISPLAY: "327004096909",0
OK
AT$EVENTDISPLAY=1,2,1,3           //Display all timer expiring events
$EVENTDISPLAY: "327004096909",0   //for Timer 1
OK
```

7.6 Event Filters

Event filters create lists of desired event labels to be passed to and used by other commands. Their primary function is for use in event sequences, but they can also be used in place of a list of events for some commands.

7.7 Events

The events below are generated by an EventFilter. They may be used to trigger any action in the software that accepts events.

The Event Type is 3 for Events. The Event ObjectId is the EventFilter Id value.

Name	EventId	Description
EVENTFILTER_TRIGGERED	1	The EventFilter was triggered. This is effectively an OR of all event labels in the EventFilter.

7.7.1 **AT$EVENTFILTER**

The event filter command is used to create an event filter Id with associated events for use by the $EVENTSEQUENCE command. Only events matching the event filter will be passed to the event sequence. Zeros can be used as wildcards to match multiple objects or event IDs for more or less granularity as needed.

Action Command

Delete an event filter

```
AT$EVENTFILTER=<objectId>
OK
```

Create and configure an event filter

```
AT$EVENTFILTER=<objectId>,<eventLabel>[,...<eventLabelN]
$EVENTFILTER: “<moduleId>”,<status>,<objectId>,”eventLabel>”{,...”<eventLabelN>”]
OK
```

objectId	ID for use when referencing the configured event filter in later commands
eventLabel	Label of event or events that are listened for by this filter

Read Command

```
AT$EVENTFILTER?
$EVENTFILTER: “<moduleId>”,<status>,<objectId>,”eventLabel>”{,...”<eventLabelN>”]
[$EVENTFILTER:“<moduleId>”,<status>,<objectId>,”eventLabel>”{,...”<eventLabelN>”]]
OK
```

Example

This example will create a filter with filter id 1 to include all DTMF tone events.

```
AT$EVENTFILTER=1,00080000
$EVENTFILTER: "327004006981",0,1,"00080000"
```

```
OK
```

Event filter 1 can now be used in an event sequence command. The event sequence will monitor all DTMF tone events, but only trigger on the specific event defined in the event sequence command.

7.8 Event Sequences

These commands allow users to create custom events based on two or more other events. Event filter commands will restrict the list of received commands to those specified in the corresponding event filter command. Event sequence commands can be paired with configured event filters to create custom events. Event sequences, for example, could be used to match a sequence of DTMF tones.

7.9 Events

The events below are generated by an EventSequence. They may be used to trigger any action in the software that accepts events.

The Event Type is 11 (0x0B) for EventSequence. The Event ObjectId is the SequenceId value.

Name	EventId	Description
SEQUENCE_MATCH	1	Complete sequence matched.
EVENT_MATCH	2	One event in the sequence matched (strict only).
SEQUENCE_FAIL	3	Sequence failed (strict only).

7.9.1 AT$EVENTSEQUENCE

The EventSequence command defines a sequence of events that must be matched to trigger an EventSequence event. Events in a sequence can be configured to be loosely interpreted (i.e. out of order, or with other events in between) or strictly interpreted (in order, no interruptions) depending on the desired application. The $EVENTSEQUENCE command is used in combination with the $EVENTFILTER command. The EventFilter defines which events to listen for, then the sequence defines the subset which will trigger the Sequence event.

For example, if a user wanted to trigger an event based on DTMF tones, an event filter would be created that would listen to all DTMF tones. Then, a strict $EVENTSEQUENCE could be created with the desired tone order.

Action Command

Delete an event sequence:

AT$EVENTSEQUENCE=<objectId>
OK

Create and configure an event sequence:

AT$EVENTSEQUENCE=<objectId>,<filterId>,<mode>,<eventLabel1>,<eventLabel2>[,...<eventLabelN>]
$EVENTSEQUENCE: "<deviceId>",<status>,<objectId>,<filterId>,<mode>,"<eventLabel1>", "<eventLabel2>"[,..."<eventLabelN>"]
OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success 1050 = Bad parameter or too many eventLabels 1065 = Invalid object
objectId	ID for use when referencing the configured event sequence in later commands
filterId	ID for an event filter created in earlier $EVENTFILTER commands. This restricts the events to consider in the sequence.
mode	Match mode: 0 – AND, non-strict. Match all the listed events in any sequence. 1 – AND, strict. Match all the listed events exactly in the defined sequence. 2 – OR. Match any one event in the defined sequence.
eventLabel1	First event in the sequence. Enter all eventLabels in hex.
eventLabel2	Second event in the sequence.
eventLableN	Nth event in the sequence. There may be up to 16 values.

Read Command

AT$EVENTSEQUENCE?
$EVENTSEQUENCE: "<moduleId>",<status>,<objectId>,<filterId>,<mode>,"<eventtLabel1>", "<eventLabel2>"[,..." <eventLabelN>"]
…[more records]…
OK

Example

This example uses the event filter id=1 created in the Event filter section (7), which filters all DTMF tone events. To further fine tune event triggers, the event sequence defines the exact events on which to trigger. This sequence will trigger if a DTMF tone 1 and DTMF tone 2 are detected, in that order.

```
AT$EVENTSEQUENCE=1,1,1,00080001,00080002
$EVENTSEQUENCE: "327004006981",0,1,1,1,"00080001","00080002"
OK
```

When DTMF tone 1 and 2 are detected, an event will be generated. This event can be used as a trigger for a command to be executed. For example, GPIO20 can be configured to go High if the sequence above happens.

```
AT$GPIOACTION=2,1,20,000B0101
GPIOACTION: "327004006981",0,2,1,20,"000B0101"
OK
```

To summarize, this configuration will cause GPIO 20 to go High when DTMF tone 1 followed by tone 2 is detected.

7.10 AT$EVENTGEN

The $EVENTGEN command allows users to trigger events manually. Triggered events can be either defined system events or custom user defined events. This is especially useful for testing the behavior of a sequence of event driven commands.

Parameter command

$EVENTGEN will accept either an event label or the corresponding separate event values. Both forms of the command are shown below. Values should be in hexadecimal format.

AT$EVENTGEN=<eventLabel>
$EVENTGEN: “<moduleId>”,<statusId>,<eventType>,<objectId>,<eventId>
OK

Or

AT$EVENTGEN=<eventType>,<objectId>,<eventId>
$EVENTGEN: “<moduleId>”,<statusId>,<eventType>,<objectId>,<eventId>
OK

8 Power Management

These commands allow the modem to be put into low power mode. In the low power state, the modem is fully powered but the internal processor is in sleep state for a low power consumption mode. The software is suspended, waiting for a timer expiration, SMS message, or data connection to wake it up. To achieve the minimum power consumption during low power mode, the following conditions must be met:

- Serial port must not be connected
- No pending AT command output can be queued
- USB port must not be connected
- Ethernet interface must be disabled (AT$ENABLEETHERNET=0)

The following commands are supported:

- AT$LOWPOWERON – Configures and queries events and time duration for enabling low power mode.
- AT$LOWPOWEROFF – Configures and queries events for disabling low power mode.

The Low Power Mode parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

8.1 Events

These system events are generated by the low power mode. The EventType is 1. The ObjectId for the event is not used. See section 7 for more about events.

Name	EventId	Description
LOW POWER ENABLED	6	Low power mode was enabled.
LOW POWER DISABLED	7	Low power mode was disabled.

8.2 String Tokens

This subsystem defines the follow dynamic string tokens:

Name	Description	Prefix #	Postfix #
lowpwr	Low power mode (0=disabled, 1=enabled)	–	–

8.3 AT$LOWPOWERON

This command configures or queries the events and time duration for low power mode. Low power mode can be enabled immediately, or triggered to be enabled later by one or more events. When low power mode is enabled, it generates a LOW POWER ENABLED event. When the time duration expires, low power mode is disabled and it generates a LOW POWER DISABLED event.

8.3.1 Action Command

The following shows the command (in bold) to enable low power mode.

AT$LOWPOWERON=<duration>[,<eventLabel>[…,<eventLabel>]]
$LOWPOWERON: ”<deviceId>”,<status>
(OK I ERROR)

8.3.2 Delete Configuration

If <duration> is the only parameter given and is equal to 0, all LOWPOWERON events and the time duration will be deleted.

AT$LOWPOWERON=<0>
$LOWPOWERON: ”<deviceId>”,<status>
(OK I ERROR)

8.3.3 Read Command

The following shows the command (in bold) to query the parameters for enabling low power mode.

AT$LOWPOWERON?
$LOWPOWERON: ”<deviceId>”,<status>,<duration>,<isEnabled>[,<eventLabel>[…,
<eventLabel>]]
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<duration>	The length of time low power mode is enabled (in 100ms increments).
<isEnabled>	0 = Low power mode is disabled. 1 = Low power mode is enabled.
<eventLabel>	EventLabel. This defines the event(s) that trigger the

	enabling of a low power mode. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.

8.3.4 **Example**

The following example shows how to configure low power mode to be enabled upon receiving a GPIO event. When triggered, low power mode will stay enabled for 5 minutes (300 seconds), then it will be disabled automatically.

The <eventLabel> for GPIO pin 29 going high is 00041D02 (see section 25.1).

Event Type = 4 for GPIO
Object Id = 29 for pin 29
Event Id = 2 for input high

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=4,29,2
$EVENTLABEL: "327004000672",0,"00041d02"
OK

AT$LOWPOWERON=3000,00041D02
```

8.4 AT$LOWPOWEROFF

This command configures or queries the events for disabling low power mode. Low power mode can be disabled immediately, or triggered later by one or more events. When low power mode is disabled, it generates a LOW POWER DISABLED event.

8.4.1 **Action Command**

The following shows the command (in bold) to disable low power mode.

AT$LOWPOWEROFF=<eventLabel>[…,<eventLabel>]
$LOWPOWEROFF: ”<deviceId>”,<status>
(OK I ERROR)

8.4.2 **Delete Configuration**

If a single <eventLabel> is the only parameter given and is equal to 0, all LOWPOWEROFF events will be deleted.

AT$LOWPOWEROFF=0
$LOWPOWEROFF: ”<deviceId>”,<status>
(OK I ERROR)

8.4.3 **Immediate Disable**

To disable low power mode immediately, enter the command with 2 <eventLabel> parameters = 0:

AT$LOWPOWEROFF=0,0
$LOWPOWEROFF: ”<deviceId>”,<status>
(OK I ERROR)

8.4.4 **Read Command**

The following shows the command (in bold) to query the parameters for disabling low power mode.

AT$LOWPOWEROFF?
$LOWPOWEROFF: ”<deviceId>”,<status>,<isEnabled>[,<eventLabel>[…, <eventLabel>]]
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<isEnabled>	0 = Low power mode is disabled. 1 = Low power mode is enabled.
<eventLabel>	EventLabel. This defines the event(s) that trigger the disabling of a low power mode. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.

8.4.5 **Example**

The following example shows how to configure low power mode to be disabled when GPIO pin 28 goes high.

The <eventLabel> for GPIO pin 28 going high is 00041C02 (see section 25.1).

Event Type = 4 for GPIO
Object Id = 28 for pin 28
Event Id = 2 for input high

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=4,28,2
$EVENTLABEL: "327004000672",0,"00041c02"
OK

AT$LOWPOWEROFF=00041C02
```

9 Identification Commands

This set of commands may be used to query information that identifies the device and the device's capabilities. All of these commands are read only. There are a number of different components and the version information is distinct for each component. Here is an overview of the different components that have their own version numbers.

Application Version	The version of the hardware and application that represents the wireless embedded device.
Modem Version	The version of firmware loaded on the cellular modem.

9.1 Events

The Identification subsystem generates events.

Identification Event Type: 10

Event ID	Event Name	Description
1	Device ID Change	This Event is triggered when the Device ID is modified with AT$DEVICEID.

9.2 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
subid	Subscriber Id	–	–
modemid	Modem id	–	–
deviceid	Device id	–	–
modulefirmver	Modem firmware version	–	–
appver	Software application version	–	–
platver	Software platform version	–	–
hwver	Modem hardware version	–	–

9.3 Get Application Version Command

This command set is used to get the application, firmware, and hardware versions of the application.

The following command is supported:

- AT$APPVERSION– Read command

9.3.1 AT$APPVERSION

AT command used to get the version of the Courier M2M Application software, library software, and hardware. The version can only be read.

Read Command

The following shows the command to read the versions, followed by the expected output.

Command:	AT$APPVERSION
Response:	$APPVERSION: "<deviceId>",<status>,"<applicationVersion>","<firmwareVersion>", "<build_time>","<hardwareVersion>" OK

9.3.1.1.1.1 **Parameters**

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success
<applicationVersion>	Version string set by the application.
<firmwareVersion>	<majorNumber>.<minorNumber>.<buildNumber>
<build_time>	Date and time when software was created
<hardwareVersion>	<majorNumber>.<minorNumber>

9.4 Get Firmware Version Command

This command set describes the Commands available to get the cellular modem firmware version of the device.

The following command is supported:

- AT$FWVERSION– Read command

9.4.1 AT$FWVERSION

AT command used to get the version of the modem firmware. The version can only be read.

9.4.1.1.1 *Read Command*

The following shows the command to read the version, followed by the expected output.

Command:	AT$FWVERSION
Response:	$FWVERSION: “<deviceId>”,<status>,”<firmwareVersion>” OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success
<firmwareVersion>	The firmware version as returned by the modem

9.5 Get Modem ID Command

This command set is available to get the ID of the cellular modem, usually the device IMEI.

The following command is supported:

- AT$MODEMID– Read command

9.5.1 AT$MODEMID

AT command used to get the modem ID. The modem ID can only be read.

Read Command

The following shows the command to read the version, followed by the expected output.

Command:	AT$MODEMID
Response:	$MODEMID: “<deviceId>”,<status>,”<modemId>” OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success

<modemId>	Modem ID

9.6 Get Subscriber ID Command

This command set is available to get the Subscriber ID attached to this device. For GSM devices this value will be the IMSI. The subscriber ID should not be confused with the modem ID. For GSM devices, if the SIM card isn't inserted then no Subscriber ID will be available.

The following command is supported:

- AT$SUBSCRIBERID– Read command

9.6.1 AT$SUBSCRIBERID

AT command used to get the subscriber ID. The subscriber ID can only be read.

Read Command

The following shows the command to read the version, followed by the expected output.

Command:	AT$SUBSCRIBERID
Response:	$SUBSCRIBERID: "<deviceId>",<status>,"<subscriberId>" OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success
<subscriberId>	Subscriber ID

9.7 Device Identification

This command set is available to query and modify the ID of the device. It is important that you provision each device you send in the field to have a unique device ID.

By default, the device ID is the 12 digits of the IMEI that uniquely identify the modem. You can select to automatically generate the device ID based off the modem ID (IMEI), the subscriber ID (IMSI), or disable auto-generated and instead specify your own ID.

The following command is supported:

- AT$DEVICEID – Action and Read commands

Refer to the following table for auto-generation types:

Auto-gen Type	Description
0	Generate device ID from modem ID (IMEI)
1	Generate device ID from subscriber ID (IMSI)
2	Disable autogen and specify a custom ID

9.7.1 AT$DEVICEID

AT command used to get and set the ID of the device, along with how the device ID is auto-generated. The device ID can be set or read.

Action Command/Response

The following shows the command (in bold) to set the device ID, followed by the expected output. If Autogen_Type = 2, then the “DeviceId” must be specified.

Command:	**AT$DEVICEID=<Autogen_Type>[, “device Id”]**
Response:	$DEVICEID: “<deviceId>”,<status>,<Autogen_Type> OKIERROR

Read Command/Response

The following shows the command (in bold) to read the device ID, followed by the expected output.

Command:	**AT$DEVICEID?**
Response:	$DEVICEID: “<deviceId>”,<status>,<Autogen_Type> OKIERROR

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = OK 1012 = NV save error 1050 = Invalid parameter value
<Autogen_Type>	0 – Generate device ID from modem ID (IMEI) 1 – Generate device ID from subscriber ID (IMSI) 2 – Disable autogen and specify a custom ID

9.8 Get Build Features

This command set is available to get the application firmware build features.

The following command is supported:

- AT$FEATURE – Read command

9.8.1 **AT$FEATURE**

AT command used to get the build features of the application software. The build features can only be read.

Read Command

The following shows the command (in bold) to read the build features, followed by the expected output.

Command:	AT$FEATURE?
Response:	$FEATURE: “<deviceId>”,<status>,”<projName>”,<featureBitmap> OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 = Success
<projName>	Name of the build project
<featureBitmap>	A hex value of bits representing current features. If bit is set, the feature is enabled. Bit 0: Trial build Bit 1: Debug build. Bit 2: Model restricted Bit 3: IMEI restricted Bit 4: Ethernet interface Bit 5: GPS tracking

10 Time

This section defines the commands used to control the device clock, timers and events generated based on time.

10.1 Events

The Timer subsystem generates events.

Timer Event Type: 2

Event ID	Event Name	Description
1	Timer Start	This Event is triggered when a timer is started or restarted.
2	Timer Stop	This Event is triggered when a timer is stopped before it has a chance to expire.
3	Timer Expired	This Event is triggered when a timer expires.
4	Clock Changed	This Event is triggered when the system clock is changed.
5	Clock Alarm	This Event is triggered when the Clock has reached the time of an Alarm.

10.2 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
year	Year (4 digits)	Min width	counter
month	Month	Min width	counter
monthname	Month name	–	counter
Day	Day of the month	Min width	counter
dow	Day of the week (1=Sun, 7=Sat)	Min width	counter
downame	Day of the week name	–	counter
hourint	Hour in 24 hour format	Min width	counter
hourus	Hour in 12 hour format	Min width	counter
ampm	AM or PM	–	counter
minute	Minutes (2 digits)	–	counter
second	Seconds (2 digits)	–	counter

Some of the tokens that return a numeric parameter accept a prefix, which specifies the minimum width. If the number requires fewer characters than the minimum width, it will be padded with zeros.

10.2.1 Using a Stored Timestamp

If the optional postfix is given, a UNIX timestamp stored in a counter is used instead of the current system time. The postfix is formed from the lower 8 bits of the variable ID; the volatile counters are accessed with postfixes 1-20, and the non-volatile counters continue at 21.

When using this feature, operation 22 of the VARIABLESET command may be useful. This can be used to store the current UNIX timestamp in a system variable, either immediately or in response to an event.

Example

The following example configures a timer that expires once every minute. The timer's expire event is used to store the current timestamp in counter1, and the counter's STATUS_CHANGED event is used to send a formatted time string to an endpoint.

Generate the event label for the timer1 expire event:

```
at$eventlabel=2,1,3
$EVENTLABEL: "327004106556",0,"00020103"
OK
```

Configure timer1 to restart automatically after it expires:

```
at$timerstart=1,600,20103
$TIMERSTART: "327004106556",0
OK
```

The timer must be manually started the first time:

```
at$timerstart=1,0
$TIMERSTART: "327004106556",0
OK
```

Now that the timer is configured, use $VARIABLESET operation 22 to listen for the timer1 expire event and store the current timestamp in counter1:

```
at$variableset=1,1001,22,0,20103
$VARIABLESET: "327004106556",0
OK
```

Wait for the value in counter1 to be updated using the STATUS_CHANGED event, then send a string containing the time to endpoint1:

```
at$stringsend=1,1,"Timer expire: %monthname1% %day1% %year1%
%hourus1%:%minute1%:%second1% %ampm1%%CRLF%",100180
$STRINGSEND: "327004106556",0
OK
```

The formatted time string will now be sent to the endpoint whenever the timer expires. To watch this in real time, you can open up endpoint1 on your device's serial port (use "+++" to exit).

```
at$endpoint=1,3,1
$ENDPOINT: "327004106556",0
OK
```

10.3 Manually Set and Get Device Clock

This command set is available to get the clock on the device or manually configure the time and date on the device. The following command is supported:

- AT$TIME – Action and Read commands

10.3.1 **AT$TIME**

AT command used to get and set the current time and date on the device.

Action Command/Response

The following shows the command (in bold) to set the date and time, followed by the expected output.

Command:	AT$TIME="<time>"
Response:	$TIME: "<deviceId>",<status> OK

Read Command/Response

The following shows the command (in bold) to read the date and time, followed by the expected output.

Command:	AT$TIME?
Response:	$TIME: "<deviceId>",<status>,"<time>" OK

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success 1007 – Invalid format
<time>	12 digits: YYMMDDHHMMSS

	Where: YY – year past 2000 MM – month DD – day HH – hour MM – minute SS – second

10.4 Automatically Set Device Clock

This command set is available to setup how the time and date on the device will automatically be updated. The following command is supported:

- AT$AUTOTIME – Set and Read commands

10.4.1 **AT$AUTOTIME**

AT command used to get and set the mode for how the device sets its time.

Action Command/Response

The following shows the command (in bold) to set the autotime mode, followed by the expected output.

Command:	AT$AUTOTIME=<mode>[,<nitz_utc>]
Response:	$AUTOTIME: ”<deviceId>”,<status> OK

Read Command/Response

The following shows the command (in bold) to read the autotime mode, followed by the expected output.

Command:	AT$AUTOTIME?
Response:	$AUTOTIME: ”<deviceId>”,<status>,<mode>,<nitz_utc> OK

10.4.1.1.1 *Parameters*

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success 1050 – Invalid parameter
<mode>	Mode:

	0 – Off 1 – NITZ (default) 2 – GPS 3 – SNTP
<nitz_utc>	For NITZ only. Specifies whether to set the time as local or UTC: 0 – Local time (default) 1 – UTC

10.5 Timers

This command set allows you to configure, start and stop timers. These timers generate events that can be tied into any other software subsystem.

The following commands are supported:

- AT$TIMERSTART
- AT$TIMERSTOP

10.5.1 **Timer Events**

These events are generated by timers. The EventType is 2 for timers. The ObjectId for the event is the Timer Id. See section 7 for more about events.

Name	EventId	Description
TIMER_START	1	Timer started.
TIMER_STOP	2	Timer stopped.
TIMER_EXPIRE	3	Timer expired.

10.5.2 **AT$TIMERSTART**

This command defines a new timer, or restarts an existing timer. The timer can be started immediately, or triggered to start later by one or more events. When a timer starts, it generates a TIMER_START event. When a timer expires, it generates a TIMER_EXPIRE event.

Timers are always defined as "one-shot" timers that stop when they expire. If a periodic timer is desired, then the TIMER_EXPIRE <eventLabel> can be used as a trigger to start the timer again.

Action Command

The following shows the command (in bold) to start a timer.

AT$TIMERSTART=<timerId>[,<duration>[,<eventLabel>[…,<eventLabel>]]]

$TIMERSTART: ”<deviceId>”,<status>
(OK I ERROR)

Restart Timer

If <timerId> and <duration=0> are the only parameters given, the timer is restarted with its original duration value. If <timerId> does not exist, an error is returned.

AT$TIMERSTART=<timerId>,0
$TIMERSTART: ”<deviceId>”,<status>
(OK I ERROR)

Delete Timer

If <timerId> is the only parameter given, the timer is stopped and its START <eventLabel> list is deleted. If <timerId> does not exist, an error is returned.

AT$TIMERSTART=<timerId>
$TIMERSTART: ”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the parameters for starting timers.

AT$TIMERSTART?
$TIMERSTART:
”<deviceId>”,<status>,<timerId>,<duration>,<running>,<eventLabel>…,<eventLabel>
…(list of active timers)
(OK I ERROR)

Unsolicited Response

When a timer expires, the following unsolicited response is output.

$TMREVT: ”<deviceId>”,<status>,<timerId>

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<timerId>	The Id of the timer (1-255).
<duration>	The length of the timer (in 100ms increments). 0 = Restart existing timer with original duration value.
<running>	0 = Timer is stopped. 1 = Timer is running.

<eventLabel>	EventLabel. This defines the event(s) that trigger the starting of a timer. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.

Example

The following example shows how to create a timer that starts immediately, runs for 30 seconds, and then retriggers itself upon expiration.

```
AT$TIMERSTART=1,300,00020103
$TIMERSTART: "327004096909",0
OK
at$timerstart=1,0                  //Timer has to be started manually the
$TIMERSTART: "327004096909",0      //the first time
OK
```

10.5.3 **AT$TIMERSTOP**

This command stops a timer. The timer can be stopped immediately, or triggered to be stopped later by one or more events. When a timer stops, it generates a TIMER_STOP event.

Action Command

The following shows the command (in bold) to create timer STOP events.

AT$TIMERSTOP=<timerId>[,<eventLabel>[…,<eventLabel>]]
$TIMERSTOP: ”<deviceId>”,<status>
(OK I ERROR)

To manually stop an existing timer, enter the timer id and one event label with a value of 0:

AT$TIMERSTOP=<timerId>,0
$TIMERSTOP: ”<deviceId>”,<status>
(OK I ERROR)

Delete Timer

If <timerId> is the only parameter given, the timer is stopped and its STOP <eventLabel> list is deleted. If <timerId> does not exist, an error is returned.

AT$TIMERSTOP=<timerId>
$TIMERSTOP: ”<deviceId>”,<status>

(OK I ERROR)

Read Command

The following shows the command (in bold) to query timer STOP events.

AT$TIMERSTOP?
$TIMERSTOP:
”<deviceId>”,<status>,<timerId>,<running>,<eventLabel>…,<eventLabel>
…(list of active timers)
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<timerId>	The Id of the timer (1-255).
<running>	0 = Timer is stopped. 1 = Timer is running.
<eventLabel>	EventLabel. This defines the event(s) that trigger the stopping of a timer. There may be from 0 to 10 values. A 0 value specifies “immediate”.

Example

The following example shows how to stop a timer immediately.

```
AT$TIMERSTOP=1,0
```

10.5.4 **Watchdog Examples**

Server Connection Watchdog

The following example shows how the timer commands can be used to create a watchdog on the remote server connection. The timer is started during power up initialization and stopped when the server is connected. The timer is restarted when the connection closes. If the timer expires, the modem will be reset.

```
// Configure a remote TCP server to receive reports.
AT$SERVER=1,"24.163.92.131",2400,1,1

// Create timer 1, with duration of 10 minutes (6000 x 0.1 sec).
// The first <eventLabel> is 0 to start immediately.
// The next <eventLabel> is to restart on the server close event:
// type=52 (sockets), obj=0 (don’t care), event=3 (close), entered in hex.
// The command AT$EVENTLABEL=52,0,3 can be used as an aid to encode
// the <eventLabel> parameters.
AT$TIMERSTART=1,6000,0,00340003

// Create stop conditions for timer 1 to stop on the server connect event:
// type=52 (sockets), obj=0 (don’t care), event=1 (connect).
AT$TIMERSTOP=1,00340001

// Define a reset condition for the timer expiration:
// type=2 (timer), obj=1 (timer id), event=3 (expire).
AT$RESET=00020103
```

TCP Server Data Watchdog

The following example shows how the timer commands can be used to create a watchdog for incoming data to the local TCP server. The timer is started when a remote client connects to the local TCP server. The timer is stopped when the connection closes. The timer is restarted every time data is received from the remote client. If more than 5 minutes pass since the last data was received, the timer expires and the modem will be reset.

```
// Configure the local TCP server.
AT$TCPPORT=2010

// Create timer 2, with duration of 5 minutes (3000 x 0.1 sec).
// The first <eventLabel> is to start on the TCP connect event:
// type=52 (sockets), obj=0 (don’t care), event=4 (connect), entered in hex.
// The next <eventLabel> is to restart on the TCP read event:
// type=52 (sockets), obj=0 (don’t care), event=5 (read), entered in hex.
AT$TIMERSTART=2,3000,00340004,00340005

// Create stop conditions for timer 2 to stop on the TCP close event:
// type=52 (sockets), obj=0 (don’t care), event=6 (close).
AT$TIMERSTOP=2,00340006

// Define a reset condition for the timer expiration:
// type=2 (timer), obj=2 (timer id), event=3 (expire).
AT$RESET=00020203
```

Serial Endpoint Data Watchdog

The following example shows how the timer commands can be used to create a watchdog for data going into a serial endpoint. The timer is started when the endpoint is created. The timer is stopped when the endpoint is deleted. The timer is restarted every time data is sent through the serial endpoint. If more than 5 minutes pass since the last data was received, the timer expires and the modem will be reset.

```
// Assume the serial endpoint id is 1.
// Create timer 3, with duration of 5 minutes (3000 x 0.1 sec).
// The first <eventLabel> is to start on the endpoint create event:
// type=100 (endpoint), obj=1 (endpointId), event=1 (create), entered in hex.
// The next <eventLabel> is to restart on the serial endpoint data in event:
// type=103 (serial endpoint), obj=1 (endpointId), event=4 (data in).
AT$TIMERSTART=3,3000,00640101,00670104

// Create stop conditions for timer 3 to stop on the endpoint delete event:
// type=100 (endpoint), obj=1 (endpointId), event=2 (delete.
AT$TIMERSTOP=3,00340006

// Define a reset condition for the timer expiration:
// type=2 (timer), obj=3 (timer id), event=3 (expire).
AT$RESET=00020303
```

10.6 Alarm Clock

The alarm clock allows the user to generate events at a specified time. This event can then be used to trigger other actions in the system.

10.6.1 **Alarm Clock Events**

These events are generated by alarm clocks. The EventType is 2 for timers. The ObjectId for the event is the Alarm Id. See section 7 for more about events.

Name	EventId	Description
ALARMCLOCK_EXPIRE	5	Alarm clock expired.

10.6.2 **AT$ALARMCLOCK**

This command generates an event when the specified time is reached. This event can be used to trigger other actions such as system reset.

Action command

Delete an already defined alarm
AT$ALARMCLOCK=<alarmId>
OK

Create an alarm, one shot
AT$ALARMCLOCK=<alarmId>,<type = 1>,”<defString>”
$ALARMCLOCK:”< deviceId >”,<status>,<alarmId>,<type = 1>,”<defString>”
OK

Create an alarm, repeat
AT$ALARMCLOCK=<alarmId>,<type =0>,”<defString>”
$ALARMCLOCK:”< deviceId >”,<status>,<alarmId>,<type = 0>,”<defString>”
OK

Read command

```
AT$ALARMCLOCK?
$ALARMCLOCK:”< deviceId >”,<status>,<alarmId>,<type>,”<defString>”
OK
```

Parameter	Description
< deviceId >	The ID of the modem.
<status>	0 – Success 1007 – Invalid time format 1012 – NV save error
<alarmId>	Identifier for the alarm to be created
<type>	0 - Repeat 1 – Once
<defString>	(a) (b) (c) (d) (e) (a) minute (0 - 59) (b) hour (0 - 23) (c) day of month (1 - 31) (d) month (1 - 12) (e) day of week (1 - 7) (Monday=1) Note: Use * as wildcard (Match any value). Minute value cannot be a wildcard.

<defString examples>	
Run once a year, midnight, Jan. 1	“0 0 1 1 *”
Run once a month, midnight, first of month	“0 0 1 * *”
Run once a week, midnight on Monday	“0 0 * * 1”
Run once a day, midnight	“0 0 * * *”
Run once an hour, beginning of hour	“0 * * * *”

11 Device Configuration

This section describes general commands used to configure the device.

11.1 System Variables

This subsystem defines the following system variables:

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
003201	sig	Signal strength		yes

11.2 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
sig	Signal strength	–	–

11.3 Signal Quality

The signal quality commands return information about the current signal quality level and bit error rate. It also allows users to configure signal quality ranges for use as system events, which can be used to control various system behaviors like system signal strength LEDs.

11.3.1 **AT$CSQ**

The $CSQ command can be used to set signal level intervals, read signal level intervals or display the current signal level

Test command

AT$CSQ=?
OK

Action command

The following shows the command (in bold) to display the current signal level

AT$CSQ
$CSQ: :"<deviceId>",<status>,<rssi>,<ber>
OK

Parameter command

The following shows the command (in bold) to set CSQ level intervals. At least two and up to fifteen interval bounds must be provided.

AT$CSQ=<bound0>,<bound1>[,…boundN>]
$CSQ: :"<deviceId>",<status>,<bound0>,<bound1>[,…<boundN>]
(OKIERROR)

Read command

The following shows the command to read the current interval bounds.

AT$CSQ?
$ CSQ: :"<deviceId>",<status>,<bound0>,<bound1>[,…<boundN>]
OK

11.4 SMS Forwarding Behavior

This command set controls whether incoming SMS messages are consumed by the software or forwarded on for handling by the native AT command processor.

- AT$SMSFORWARD – command to set and read the current SMS forwarding behavior.

11.4.1 **AT$SMSFORWARD**

command to set and read the current SMS forwarding behavior. This setting is active only when the software SMS functionality is enabled, such as SMS endpoints. If the interface is turned off, all SMS messages will be forwarded for standard 3GPP handling, regardless of the setting of this command.

Action Command

The following shows the command (in bold) to configure the SMS forwarding behavior.

```
AT$SMSFORWARD=<fwdMode>
$SMSFORWARD: ”<deviceId>”,<status>
(OK I ERROR)
```

Read Command

The following shows the command (in bold) to query the SMS forwarding behavior.

```
AT$SMSFORWARD?
$SMSFORWARD: ”<deviceId>”,<status>,<fwdMode>
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<fwdMode>	0 = Do not forward SMS messages. The software consumes all SMS messages. 1 = Forward SMS messages that are not associated with an SMS endpoint. The software consumes SMS messages used by SMS endpoints (default). 2 = Forward all SMS messages.

<status>	Description
0	Success
1012	NV save error.
1035	Invalid mode parameter.

11.5 Device Reset

This command allows the user to reset the device immediately or reset the device based on a system event. It is recommended the user turn on reporting so whenever the device resets the server receives a report. See AT$RESET for an example of how to configure an alarmclock to schedule an automatic reset.

The following command is supported:

- AT$RESET – Action and Read commands

11.5.1 **AT$RESET**

AT command used to reset the device or configure the device to reset on a specified event.

Action Command

The following shows the command (in bold) to reset the device, followed by the expected output.

```
AT$RESET[=<eventLabel>,[...<eventLabelN>]]
$RESET: ”<deviceId>”,<status>
OK
```

Read command

The following shows the command (in bold) to query the reset configuration, followed by the expected output.

```
AT$RESET?
$RESET: ”<deviceId>”,<status>[,<eventLabel>,[...<eventLabelN>]]
OK
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	0 – Success. Once the success parameter is returned the device is reset.
<eventLabel>	Event that may be used to trigger the reset action.

Example

This example schedules an automatic reset for a specific time of day. See ALARMCLOCK commands for more information on configuring alarm clocks.

Command	Description
at$alarmclock=1,2,"2 30 * * 7” $ALARMCLOCK: "327004019082",0,1,0,"2 30 * * 7" OK	Alarmclock 1 expires every Sunday at 2:30 AM
at$reset=20105 $RESET: "327004019082",0 OK	Reset for alarmclock 1 expire

11.6 Device SHUTOFF

These commands allow the user to shutoff the device immediately or shutoff the device based on a system event. It is recommended the user turn on reporting so whenever the device resets the server receives a report.

The following command is supported:

- AT$SHUTOFF – Shut down the device.

11.6.1 **AT$SHUTOFF**

This command provides a method to shut off the ME when a specified event occurs, shutdown will be immediate.

Action command

```
AT$SHUTOFF[=<eventLabel>,[...<eventLabelN>]]
$SHUTOFF: ”<deviceId>”,<status>[,<eventLabel>,[...<eventLabelN>]]
OK
```

Read command

```
AT$SHUTOFF?
$SHUTOFF: ”<deviceId>”,<status>,<eventLabel>,[...<eventLabelN>]
```

Parameter	Description
< deviceId >	The ID of the modem.
<status>	0 – Success 1007 – Invalid time format 1012 – NV save error
<eventLabel>	Event to trigger ME shutoff

11.7 Device Event Reporting

The device originates unsolicited responses which are used to provide user status or to notify of events occurring within the device.

The following command is supported:

- AT$REPORT – Action commands.

NOTE: This command is currently separate from the central event system.

11.7.1 **AT$REPORT**

AT command used to configure which unsolicited reports are reported to the user.

Action Command

The following shows the command (in bold) to configure a report setting.

AT$REPORT=<ReportId>,<enabled>
$REPORT:”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the report settings. All existing report “on/off” settings are listed, starting at Report 1 and ending with the last report (in this example, report N).

AT$REPORT?
$REPORT:”<deviceId>”,<status>,<Report 1 setting>,<Report 2 setting>,<Report 3 setting>,<Report 4 setting>, … <Report N setting>
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the server command. 0 = Success 1012 = NV save error 1040 = Invalid report settings
<ReportId>	See the Report Id’s 0 = Special “wildcard” applies on/off setting to all Report Id’s.
<enabled>	On/Off setting for an Report (0=off, 1=on)

11.7.2 **Unsolicited $REPORT**

AT command used to report various status changes that occur on the device. This response is unsolicited.

Unsolicited Response

The following shows the format of the unsolicited $REPORT.

$REPORT: ”<deviceId>”,<status>,<date time>,<ReportId>,<detail>

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 – OK
<date time>	Date and Time of the report
<ReportId>	See the Report Id's
<detail>	Details about the Report.

Report Ids

Report	Description
1	Device Rebooted
2	Keep Alive
3	GPRS regained
4	FOTA download started
5	FOTA upgrade complete
6	FOTA Connection error
7	FOTA Login error
8	FOTA File not found
9	FOTA install error
10	TCP port or UDP port changed locally
11	IP address changed by the carrier
12	Reserved/Not used
13	SIM re-inserted
14	TELNET port changed
15	FOTA aborted
16-64	Reserved for future use

12 Cellular Communications

This section covers the commands required to setup the software so it may communicate over a Wide Area Network (WAN). This includes setting up the information required for the device to communicate with a server or for the server to communicate with the device.

12.1 GPRS Events

These events are generated for GPRS. The EventType is 50 (0x32) for network. The event ObjectId is not used (0). See section 7 for more about events.

Name	EventId	Description
IP_CHANGED	1	A new IP address was assigned.
GPRS_ATTACHED	2	GPRS attached
GPRS_DETTACHED	3	GPRS detached
GPRS_ACTIVATED	4	GPRS context was activated
GPRS_DEACTIVATED	5	GPRS context was deactivated

12.2 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
apn	Access Point Name. postNumber = Context ID (1-4)	–	–
wanip	IP address from the cellular network	–	–

12.3 GPRS settings

This command set allows you to modify and query the GPRS PDP Context data. Up to four PDP Contexts can be configured.

The PDP Context data provides the device with the APN specific to wireless provider and username and password needed to access the wireless network. Since most carriers do not require username and password, these settings are optional.

The APN is provided by wireless network provider carrier. Once the device registers on the network, it then connects to the first valid APN.

The following command is supported:

- AT$CGDCONT – Action and Read commands

12.3.1 **AT$CGDCONT**

AT command used to configure PDP context settings. The PDP context settings can be set or read.

Action Command

The following shows the command (in bold) to configure PDP context settings for a specified context ID, followed by the expected output. The username and password are optional parameters. When the APN is set to an empty string (“”), it in effect, clears or invalidates the specified PDP context making it no longer valid.

AT$CGDCONT=<contextId>[,”<apn>”[,”<username>”[,”<password>”]]]

```
$CGDCONT: “<deviceId>”,<status>
(OK I ERROR)
```

Delete Command

The following shows the command (in bold) to delete an existing PDP context.

```
AT$CGDCONT=<contextId>
$CGDCONT: “<deviceId>”,<status>
OK
```

Read Command

The following shows the command (in bold) to list the PDP context settings for all PDP Contexts.

```
AT$CGDCONT?
$CGDCONT: “<deviceId>”,<status>,<contextId>,”<apn>”,”<username>”,”<password>”
…(list of PDP contexts)
OK
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<contextId>	PDP context identifier. If just the context ID is entered without other parameters, then the PDP context is deleted. Range 1-4
<apn>	Access Point Name, max=32
<username>	Username, max=25
<password>	Password, max=15

<status>	Description
0	Success
21	Invalid context id
23	Memory failure
1004	Access point name too long.
1005	Username too long
1006	Password too long
1012	NV save error

Note: Most APN’s don’t use the username and password.

Note: This command is similar to the standard 27.007 command AT+CGDCONT, except it takes the <username> and <password>, and the <deviceId> and <status> are returned in the intermediate response.

12.4 Network IP

This section describes the commands available to query the IP address of the device provided by the network.

The following command is supported:

- AT$IP – Read commands

12.4.1 **AT$IP**

AT command used to query the IP address of the device provided by the network. The device IP address can only be read.

Read Command

The following shows the command (in bold) to query the IP address of the device.

```
AT$IP?
$IP: "<deviceId>",<status>,"<ipAddress>"
OK
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success
<ipAddress>	The IP Address of the device.

12.5 Ping

This command set allows the user to Ping remote servers. This command is very useful when debugging a new device or network provider to test the connectivity and latency of the cellular connection.

The following command is supported:

- AT$PING – PING command

12.5.1 **AT$PING**

Ping a remote server. This command is very similar to the Ping commands available on Unix or Windows operating systems. Once this command is started it will return the results via the “$PING:” unsolicited response.

Action Command

AT$PING=”<address>”[,<repeat>[,<interval>[,<timeout>[,<size>]]]]
$PING: “<deviceId>”,<status>
OK

Parameter	Description
<address>	The IP address or hostname for which to send the PING packets.
<repeat>	The number of times to repeat the ping request. Default = 4.
<interval>	The amount of time in milliseconds to wait between ping requests. Default = 4.
<timeout>	The amount of time in milliseconds to wait before a ping packet is considered timed out. Default = 5000 milliseconds (5 seconds)
<size>	The size of the ping requests in bytes. Default = 20 Bytes.

Unsolicited Response

Each time a ping packet is returned to the device or if the packet times out, this unsolicited response is returned.

$PINGRSP: “<deviceId>”,<status>,<index>[,<responseTime>]

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = Success 1070 = Timeout
<index>	The packet index received by the device or timed out.
<responseTime>	This value is not displayed if the packet times out. If the response is received, this is the amount of time it took to make a round trip from the device to the server and back.

13 Ethernet

This chapter covers commands relating to setting up an Ethernet interface. These commands only apply when an Ethernet card is inserted and enabled. If the Ethernet interface is not inserted, or the Ethernet interface is disabled by the AT$ENABLEETHERNET command, then these commands will not be available.

13.1 Events

The ethernet interface generates events for the connection status and the link status. The EventType is 53 (0x35). The object ID used is not used.

Name	Number	Description
CONNECTED	1	IP communication ready
DISCONNECTED	2	IP communication not ready
LINK_DOWN	3	Link down, cable unplugged
LINK_UP	4	Link up, cable plugged in
DRIVER_ERROR	5	Ethernet driver not installed

13.2 System Variables

This subsystem defines the following system variables:

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
003501	etherlink	Ethernet link status (cable connected)		yes

13.3 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
etheron	Ethernet on (0-1)	–	–
etherlink	Ethernet link status (cable connected)	–	–
gatewayip	Static IP address of the local ethernet interface	–	–

13.4 Ethernet Interface

This section describes the commands available to modify and query the Ethernet mode. The Ethernet mode controls whether or not the local Ethernet interface is enabled.

The Ethernet mode is disabled by default.

The following command is supported:

- AT$ENABLEETHERNET – Action and Read commands

13.4.1 **AT$ENABLEETHERNET**

command to set and read the current Ethernet mode.

Action Command

The following shows the command (in bold) to configure the Ethernet mode.

AT$ENABLEETHERNET=<ethernetMode>[,<localMac]
$ENABLEETHERNET: ”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the Ethernet mode.

AT$ENABLEETHERNET?
$ENABLEETHERNET: ”<deviceId>”,<status>,<ethernetInitStatus>,<localMac>
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<ethernetMode>	0 = Ethernet is disabled (default). 1 = Ethernet is enabled.
<localMac>	Specifies whether to read the MAC address from an EEPROM device, or to derive a local MAC address from the modem serial number. 0 = Read MAC from EEPROM [default]
<ethernetInitStatus>	0 = Ethernet is disabled. 1 = Ethernet is operational. 2 = Ethernet is disabled because driver failed initialization.

<status>	Description
0	Success
1	Error
1012	NV save error.
1050	Invalid parameter value

13.5 Ethernet IP

This command set describes the commands available to query the IP address of the local Ethernet interface on the device.

The following command is supported:

- AT$ETHERNETIP – Read commands

13.5.1 **GETETHERNETIP**

This command gets the IP address, net mask, and link status of the Ethernet interface on the device. The message body of the command from the server is empty.

The following shows the body of the response message from the device:

Message Body Byte	Description
0	IP Address byte 1
1	IP Address byte 2
2	IP Address byte 3
3	IP Address byte 4
4	Net Mask byte 1
5	Net Mask byte 2
6	Net Mask byte 3
7	Net Mask byte 4
8	Ethernet link status: 0 = Cable not connected 1 = Cable connected

13.5.2 **AT$ETHERNETIP**

AT command used to query the IP address, net mask, and link status of the local Ethernet interface on the device. The IP address can only be read.

Read Command

The following shows the command (in bold) to query the IP address of the device.

```
AT$ETHERNETIP?
$ETHERNETIP: “<deviceId>”,<status>,”<cableConnected>,<ipAddress>”,<netmask>
OK
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command. 0 = success
<cableConnected>	0 = Ethernet cable is not connected. 1 = Ethernet cable is connected.
<ipAddress>	The IP Address of the Ethernet interface.
<netmask>	The network mask of the Ethernet interface.

13.6 DHCP Server

This section describes the commands available to modify and query the DHCP server settings.

The following commands are supported:

- AT$DHCPS – Action and Read commands
- AT$DHCPDNS – Action and Read commands

13.6.1 **AT$DHCPS**

AT command used to set DHCP host address, number of clients, first address, subnet mask, lease time, and activation. The settings can be set or read.

Action Command

The following shows the command (in bold) to configure the DHCP settings.

AT$DHCPS=<active>[,”<listenIP>”,<numClientIPs>,”<1stClientIP>”,”<subnetMask>”, <timeout>]
$DHCPS: ”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the DHCP settings.

AT$DHCPS?
$DHCPS: ”<deviceId>”,<status>,<active>,”<listenIP>”,<numClientIPs>,”<1stClientIP>”, ”<subnetMask>”,<timeout>
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<active>	True/False.
<listenIP>	Listening server's IP address (most likely the device IP. See AT$STATICIP).
<numClientIPs>	Number of clients to provide addresses to.
<1stClientIP>	First IP address to provide to the first client request.
<subnetMask>	Subnet mask.
<leaseTime>	Lease time in seconds.

<status>	Description
0	Success
1	Error

13.6.2 **AT$DHCPDNS**

command AT command to set the DNS address that will be assigned to a DHCP client. The behavior can be set or read.

Action command

The following shows the command (in bold) to configure the DHCP DNS settings.

AT$DHCPDNS=<setting>[,<DNSIpAddress>]
$DHCPDNS: "<deviceId>",<status>

Read command

The following shows the command (in bold) to query the DHCP settings.

AT$DHCPDNS?
$DHCPDNS: "<deviceId>",<status>,<setting>,"<DNSIpAddress>"

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<setting>	DNS behavior (0 – network, 1 – Initial with network overwrite, 2 –user defined, no network overwrite)
<listenIP>	DNS server's IP address

13.7 Static IP Address

This command set allows you to modify and query the static IP address of the local Ethernet interface on the device. The static IP address can be disabled, thereby enabling the DHCP client to automatically acquire an IP address.

The Static IP address should be chosen from one of the private address ranges, so it does not conflict with the GPRS IP address. Most carrier VPN networks use the private class A range (10.x.x.x). And many home routers use the class C range 192.168.x.x. Therefore, a good choice for the Static IP should would be the class B addresses in the range 172.16.x.x.

The following command is supported:

- AT$STATICIP – Action and Read commands

13.7.1 **AT$STATICIP**

AT command used to set or read the static IP address of the local Ethernet interface on the device. If the static IP address is set to 0, then it is disabled, and the DCHP client will be enabled to automatically acquire an IP address from a DHCP server. A modem restart is required for changes to take effect.

Action Command

The following shows the command (in bold) to configure the static IP address.

AT$STATICIP="<staticIP>"
$STATICIP: "<deviceId>",<status>,"<staticIP>"
(OK l ERROR)

Read Command

The following shows the command (in bold) to query the static IP address.

AT$STATICIP?
$ STATICIP: "<deviceId>",<status>,"<staticIP>"
(OK l ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<staticIP>	Static IP address. If the static IP address is set to 0, then

	it is disabled. A modem restart is required for changes to take effect.

<status>	Description
0	Success
1002	Invalid IP address
1012	NV save error
1050	Invalid parameter

13.8 Network Address Translation (NAT)

This command set allows you to turn Network Address Translation (NAT) on and off. Turning on this feature will give your cellular modem the same basic functionality as your home router (**Note: This feature is not a security feature or a replacement for a Firewall**). When NAT is turned on multiple devices may be connected to your modem's Ethernet interface and each may have independent connections to the cellular Wide Area Network (WAN) interface. This feature may be used with the DHCP Server.

The following command is supported:

- AT$NAT – Action and Read command

13.8.1 **AT$NAT**

AT command used to enable or disable the NAT feature. A reboot is currently required for this change to take effect.

Action Command

The following shows the command (in bold) to enable or disable NAT.

```
AT$NAT=<enableDisable>
$NAT: ”<deviceId>”,<status>,<enableDisable>
(OK I ERROR)
```

Read Command

The following shows the command (in bold) to query whether NAT is enabled or disabled.

```
AT$NAT?
$ NAT: ”<deviceId>”,<status>,<enableDisable>
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<enableDisable>	0 = NAT Disabled 1 = NAT Enabled

13.9 Port Forwarding

When the NAT feature is turned on, it allows devices connected to the Local Area Network (LAN) to communication to the WAN. But you will have to enable this feature if you want servers or other devices to communicate from the WAN to the devices connected on the LAN.

This feature uses the port forwarding capability of the native TCP/IP stack. This feature is equivalent to creating a TCP to TCP or UDP to UDP bridge using the Endpoint system.

The following command is supported:

- AT$PORTFORWARD – Action and Read command

13.9.1 **AT$PORTFORWARD**

AT command used to add Port Forwarding entries to the table of which WAN Port Numbers should have data forwarded to which LAN IP Address and Port Number.

Action Command

To add an entry to the port forward table, use this format:

AT$PORTFORWARD=<objectId>,<portType>,<wanPort>,<destIp>,<destPort>
$PORTFORWARD: ”<deviceId>”,<status>
(OK I ERROR)

To remove an entry from the port forward table, use this format:

AT$PORTFORWARD=<objectId>
$PORTFORWARD: ”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) used to query the Port Forward Table.

AT$PORTFORWARD?
$PORTFORWARD:
”<deviceId>”,<status>,<objectId>,<portType>,<wanPort>,<destIp>,<destPort>
$PORTFORWARD:
”<deviceId>”,<status>,<objectId>,<portType>,<wanPort>,<destIp>,<destPort>
…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<objectId>	Table Entry. Valid 1-32.
<portType>	The protocol of port to forward. 1 = TCP 2 = UDP 3 = ICMP
<wanPort>	The port number to forward to LAN devices
<destIP>	IP of LAN device to forward data from <wanPort>
<destPort>	Port of LAN device to forward data from <wanPort>

13.10 Example: How to setup an Ethernet Bridge

The command sequence is used to set up an Ethernet to GPRS bridge. The following commands would be entered one time. These settings are automatically stored across modem restarts.

Your device may come with Ethernet disabled so you must first enable Ethernet before you may use any of the Ethernet based commands:

```
AT$ENABLEETHERNET=1

AT+CFUN=1      // Restart modem
```

Now you must enable your wireless and network settings:

```
AT$CGDCONT=1,"<APN name>"    // Use your APN name

;Define the IP address for the local Ethernet interface:
AT$STATICIP="172.16.0.1"

;Activate the DHCP Server on the local Ethernet interface:
AT$DHCPS=1,"172.16.0.1",5,"172.16.0.2","255.255.255.0",500
```

```
;Setup a bridge between Ethernet and GPRS:
AT$ENDPOINT=1,1,2005[,<ipaddr>]    // Endpt 1, TCP, port 2005
AT$ENDPOINT=2,1,2006[,<ipaddr>]    // Endpt 2, TCP, port 2006
AT$BRIDGECREATE=1,1,2,2            // Bridge 1, endpts 1,2, bi-dir.

AT+CFUN=1      // Restart modem
```

When the IP Address of the remote peer is specified, the device will try and make a socket connection TO the peer on the specified port. When omitted or set to 0, the device will wait for an incoming connection on the specified port.

```
;Query the IP address of the GPRS connection:
AT$IP?
```

If you wish to turn on NAT you may do the following:

```
AT$NAT=1
AT+CFUN=1      // Restart modem
```

At this point, if you were to attach the Ethernet port to your computer or laptop, you should be able to browse the web, surf the internet, check email…

If you would like to setup a WAN TCP port to be forwarded to a port on the device connected to the Ethernet connection, here is an example:

```
; Forward external port 2023 to the telnet port of the LAN device
at$portforward=1,1,2023,"192.168.0.65",23
```

The IP addresses and ports in commands above are just examples. Use the actual values for your application needs.

14 Remote AT Command Support

Traditionally, AT commands are sent over a serial link. This option is very useful when you are testing and configuring the device at your desk. But once the device is deployed in the field you need the ability to control and configure the device. If you enable one or all of the AT command inputs before you deploy your device, you will be able to utilize an AT command interface as if it was sitting at your desk, connected using a serial cable.

14.1 TELNET Port Settings

These commands allow you to modify and query the Telnet server settings which configure the device to accept AT commands from a telnet client.

When a remote client connects to the telnet server, an optional connect message can be sent to the client. The message may contain string tokens. If not specified, the default message is sent:

*** %month%/%day%/%year% %hourint%:%minute% Courier M2M Telnet AT Command Server v%platver% ***

An example of the default message, with the string tokens expanded, is:

*** 3/14/2013 13:15 Courier M2M Telnet AT Command Server v1.9.1 ***

The following command is supported:

- AT$TELNETPORT – Action and Read commands

14.1.1 **System Variables**

This subsystem defines the following system variables:

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
003401	telnet	Telnet server status. 0=off, 1=on, 2=client connected		yes

14.1.2 **String Tokens**

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
telnet	Telnet server status. 0=off, 1=on, 2=client connected	–	–

14.1.3 **Telnet Port Events**

These events are generated when the Telnet port value is changed, and when a remote client connects or disconnects. The serverId and clientId values are the underlying endpointId's.

Name	EventType	ObjectId	EventId	Description
TELNET_PORT_CHANGE	50	port	8	Telnet port was changed.
CLIENT CREATED	130	serverId	clientId	Remote client connected.
CLIENT DELETED	131	serverId	clientId	Remote client disconnected.

Other events are generated by the underlying TCP and AT Parser endpoints. Please refer to sections 15.1.2 and 16.1 for more details.

14.1.4 **AT$TELNETPORT**

AT command used to modify or query the settings being used for incoming TELNET sessions. The TELNET port is used to process incoming AT commands from a remote location.

Action Command

The following shows the command (in bold) to configure the TELNET port.

AT$TELNETPORT=<port>[,<timeout>[,<echo>[,<maxClients>[,<binProtocol>[,"<connectMsg>"]]]]]
$TELNETPORT: "<deviceId>",<status>
(OK l ERROR)

Read Command

The following shows the command (in bold) to query the TELNET port.

AT$TELNETPORT?
$TELNETPORT: "<deviceId>",<status>,<port>,<timeout>,<echo>,<maxClients>,<binProtocol>,"<connectMsg>",<activeClients>

(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<port>	The Telnet port that accepts incoming connection requests. Setting the value to 0 turns off the Telnet server.
<timeout>	Timeout value in seconds that will disconnect the remote client after a period of inactivity (default = 300 sec).
<echo>	The echo mode: 0 = Off 1 = Echo each character as it is received (default). 2 = Echo complete lines.
<maxClients>	Maximum number of active clients (1-8). Default=1.
<binProtocol>	This flag specifies whether or not the AT commands and responses are wrapped in the binary protocol. 0 = Binary protocol is not used (default).
<connectMsg>	The ASCII text string that will be sent to each client when it connects. The message may contain string tokens. If not specified, the default message will be sent. 0 = Disable. No connect message will be sent to the client.
<activeClients>	Current number of active clients.

<status>	Description
0	Success
1012	NV save error.
1050	Invalid parameter.
1052	Server is already defined.

Example

This example sets the telnet port to 2004. The user would then use the device's IP address and port 2004 to setup a telnet session with the device.

```
AT$TELNETPORT=2004
$TELNETPORT: "327004006981",0
OK
```

This example sets the telnet port to 2004, with a timeout value of one minute. If no commands are entered for 60 seconds the client connection will close.

```
AT$TELNETPORT=2004,60
$TELNETPORT: "327004006981",0
```

14.2 SMS Command Interface

These commands allow you to modify and query SMS settings which configure the device to accept AT commands from SMS messages.

If the Mode is enabled, an AT command can be sent via an SMS message to the device. If the multiMsg option is enabled, then a single AT command may span multiple SMS messages. The end of a complete command line is indicated by a semicolon (;), <CR>, or <LF>. If the multiMsg option is disabled, then each SMS message is assumed to contain a complete AT command. After processing the AT command, the device will send an SMS message back to the originating number with the response.

To add some security to prohibit just anybody from sending an SMS to the device, a PIN code can be required. The PIN code then needs to be included as the first characters in the SMS message, before the AT command.

The device can be configured to only process SMS messages from up to three phone numbers. The configured phone number may contain wildcard characters, with "*" matching 0 or more characters, and "?" matching exactly one character. When specifying phone numbers, omit the country code. The device will remove +1 from any incoming SMS. Only US numbers are supported.

The following command is supported:

- AT$SMS – Action and Read command

14.2.1 **AT$SMS**

AT command used to set or read the parameters for AT commands being processed from incoming SMS messages. The SMS settings can be set or read.

Action Command

The following shows the command (in bold) to configure the SMS settings.

AT$SMS=<mode>[,<pinCode>[,<allowedNum1>[,<allowedNum2>[,<allowedNum3 > [,<multiMsg>]]]]]
$SMS:"<deviceId>",<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the SMS settings.

AT$SMS?
$SMS:"<deviceId>",<status>,<mode>,<pinCode>,<allowedNum1>,<allowedNum2>,
<allowedNum3>,<multiMsg>
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<mode>	0 = Interface off. AT commands NOT allowed from SMS. 1 = AT commands allowed with no checking. 2 = AT commands allowed with valid PIN code. 3 = AT commands allowed from specified phone numbers only. 4 = AT commands allowed with valid PIN and from specified phone numbers only (same as 2 and 3 combined).
<status>	The status of the server command.
<pinCode>	The string that gives a PIN code to confirm AT commands from SMS authorization (up to 6 chars).
<allowedNum1>	A string that gives a phone number that is allowed to send AT commands via SMS. Omit the country code (up to 20 chars).
<allowedNum2>	A string that gives a phone number that is allowed to send AT commands via SMS. Omit the country code (up to 20 chars).
<allowedNum3>	A string that gives a phone number that is allowed to send AT commands via SMS. Omit the country code (up to 20 chars).
<multiMsg>	Multi-message mode: 0 = Each SMS message contains a complete AT command (default). 1 = A single AT command may span multiple SMS messages The AT command must be terminated with ";", <CR> or <LF>.

<status>	Description
0	Success
1012	NV save error.
1032	Invalid PIN code parameter.
1033	Invalid phone number parameter.

1035	Invalid mode parameter.

Example

This example enables incoming SMSs that have the correct pin code included. The device first receives an SMS without the PIN, displayed as a regular incoming SMS with +CMTI. The second SMS that is sent to the device has the correct pin code, so that SMS will never be reported with +CMTI.

```
AT$SMS=2,1234
$SMS: "327004006981",0
OK
AT$SMS?
$SMS: "327004006981",0,2,"1234","","","",0

OK

+CMTI: "SM",1
```

The format of an SMS that sends the command ATI3 to the device, with the PIN, is:

1234ATI3

15 Endpoint / Bridge: “Pass Through” Routing Support

The Endpoint/Bridge system, along with the Event system, is the foundation of the software. This system enables data pipes (i.e. Endpoints) to be created and routes (i.e. Bridges) between those data pipes. The endpoints can be configured as an Ethernet socket, a GPRS based network socket, or a serial, SMS, HTTP POST, or Email connection. Once defined, the endpoints can then be connected or “bridged” forming the data pipe where data received on one endpoint is routed out through the associated endpoint.

Routes can be established between any types of endpoints. For example, an Ethernet socket can be connected to another Ethernet socket, or to a GPRS based socket; a USB serial connection can be connected to a GPRS socket. The following types can be configured:

Protocol ID	Description
1	GPRS and Ethernet TCP Sockets
2	GPRS and Ethernet UDP Sockets
3	Serial connections (USB, UART1, UART2, or Virtual (Muxed) Serial

	ports)
4	SMS
5	HTTP and HTTPS GET
6	HTTP and HTTPS PUT
7	HTTP and HTTPS POST
8	EMAIL SMTP
9	EMAIL POP
10	FTP and FTPS GET
11	FTP and FTPS PUT (not yet available)
12	GPRS and Ethernet TCP SSL Sockets
13	X-Modem
14	Tag-Write
15	Tag-Read
16	SPI (not yet available)
17	I2C (not yet available)
18	AT Parser
19	Binary Parser
22	Add ETX/DLE (not yet available)
23	Strip ETX/DLE
24	Compress
25	Decompress
26	Offline Data
27	
30	

15.1 Events

The core endpoint subsystem generates events when general endpoint actions take place such as creating an endpoint, reading, writing and deleting endpoints. The EventType is 100 (0x64) for all endpoints. The object ID used is the endpoint ID of the endpoint that caused the event.

Name	EventId	Description
Endpoint Create	1	An endpoint has been created
Endpoint Delete	2	An endpoint has been deleted
Endpoint Read	3	An endpoint has received data
Endpoint Write	4	An endpoint has written data

15.1.1 **Serial Endpoint Events**

These events are generated by serial endpoints. The EventType is 103 (0x67) for serial endpoints. The ObjectId for the event is the Endpoint Id. See section 7 for more about events.

Name	EventId	Description
ENTER_DATA_MODE	1	Endpoint entered Data Mode
EXIT_DATA_MODE	2	Endpoint exited Data Mode (+++)
OPEN	3	Serial port opened
DATA_IN	4	Data received
CLOSE	5	Serial port closed

15.1.2 **TCP/UDP Endpoint Events**

These events are generated by TCP and UDP endpoints. The EventType is 101 (0x65) for TCP endpoints and 102 (0x66) for UDP endpoints. The ObjectId for the event is the Endpoint Id. See section 5 for more about events.

Name	EventId	Description
OPEN	1	An endpoint has been opened
ERROR	2	An error occurred on the endpoint
CLOSE	3	An endpoint has been closed

These events are generated by TCP Server endpoints when a remote client connects or disconnects. The ObjectId is the server's Endpoint Id and the EventId is the new client's EndpointId.

Name	EventType	ObjectId	EventId	Description
CLIENT CREATED	130	serverId	clientId	A remote client connected.
CLIENT DELETED	131	serverId	clientId	A remote client disconnected.

15.2 System Variables

All endpoints define the following system variables:

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
005A00+X	epbyteswrittenX	Bytes written to endpoint X buffer	–	yes
005B00+X	eptransactionsX	Transactions written to endpoint X buffer	–	yes
005C00+X	epbytesreadX	Bytes written to endpoint X buffer	–	yes

"X" represents the Endpoint Id.

15.3 String Tokens

All endpoints define the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
epbyteswritten	Bytes written to endpoint X buffer	–	X
eptransactions	Transactions written to endpoint X buffer	–	X
epbytesread	Bytes written to endpoint X buffer	–	X

“X” represents the Endpoint Id.

15.4 Endpoint settings

This section describes the commands available to establish and query an endpoint used in the “Pass Through” subsystem. Endpoints are configured differently depending on the endpoint type and protocol.

Endpoints can be tied to a specific interface type. This designation is specified using the “protocol” parameter. When defining a serial port based endpoint only the “protocol” and “port” fields are used. TCP and UDP socket based endpoints can be configured to be either a client socket (connects TO a server specified by the IP address provided) or as a listening/server socket (accepts connection FROM a remote IP address). When defining client sockets, the “protocol”, “port” and “IP Address” are all required, however when defining a listening/server socket, only the “protocol” and “port” fields are used. Note that the “port” parameter takes on a different meaning when defining a Serial endpoint as opposed to a Socket endpoint.

When an endpoint is bridged to another endpoint, data is passed through from one to the other. Data that is received on an endpoint is buffered at the other endpoint before being sent out. The events that cause the data to be sent from the buffer can be configured for each endpoint:

- A number of milliseconds have elapsed since the last send.
- A number of bytes have been received.
- A control character is received. Note this event works only with ASCII data.

For serial endpoints, it is possible to exit data pass-through mode and go to the AT command mode. This is done by entering “+++”. This event also causes all buffered data to be sent out before exiting online data mode. The endpoint can be returned to online data mode with the $ATONLINE, or ATO command.

For SMS endpoints, the associated phone number can be configured as a partial number to allow matching a range of phone numbers of incoming SMS messages. For example, 919637452 will match incoming numbers 9196374520 – 9196374529. This is only useful for SMS endpoints with incoming messages only. If the endpoint needs to send a message out, then its phone number has to be a complete and valid phone number.

The following commands are supported:

- AT$ENDPOINT – Command to administer endpoints
- AT$BRIDGECREATE – Command to define and query bridge creation events.
- AT$BRIDGEDELETE – Command to define and query bridge deletion events.
- AT$ESERVER – Command to administer Endpoint Server settings.
- AT$ONLINE – Command to return a serial endpoint to data mode

15.4.1 AT$ENDPOINT

AT command used to create an “endpoint” which defines a connection used by the “Pass Through” routing subsystem. The Endpoint settings can be set or read.

Action Command

The following shows the command (in bold) to configure settings for an Endpoint. An optional parameter may be skipped by entering a comma as its placeholder. For example, to create TCP endpoint 1 on port 1234 with default values except for setting <fwdCtrlChar> to 13, enter **AT$ENDPOINT=1,1,1234,,,,,,13**

For TCP/UDP Client (has valid <IP_Address> and null <maxClients>):
AT$ENDPOINT=<endpointId>,<protocol=1|2|12>,<port>[,”<IP_Address>”[,<localPort>
[, ,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK | ERROR)

For TCP Server (has null <IP_Address> and valid <maxClients>):
AT$ENDPOINT=<endpointId>,<protocol=1|2|12>,<port>[, ,<clientTimeout>
[,<maxClients>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK | ERROR)

For UDP Server (has null <IP_Address>, <maxClients, and <maxClients>):
AT$ENDPOINT=<endpointId>,<protocol=1|2|12>,<port>[, , , ,
<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK | ERROR)

For Serial:

AT$ENDPOINT=<endpointId>,<protocol=3>,<port>[,<baud>[,<flow_by_DTE> [,<flow_by_DCE>[,<sendEsc>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize> [,<fwdCtrlChar>]]]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

AT$ENDPOINT?
If TCP/UDP client:
$ENDPOINT:”<deviceId>”,<status>,<endpointId>,<protocol=1I2I12>,<port>,”<IP Address>”, <localPort>, ,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

If TCP/UDP server:
$ENDPOINT:”<deviceId>”,<status>,<endpointId>,<protocol=1I2I12>,<port>,””, <clientTimeout>,<maxClients>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

If Serial:
$ENDPOINT: ”<deviceId>”,<status>,<endpointId>,<protocol=3>,<port>,<baud>, <flow_by_DTE>,<flow_by_DCE>,<sendEsc>,<bufferSize>,<fwdTimeout>,<fwdDataSize>, <fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of socket being created. (See section 15 for full protocol ID table)

<port>	The port associated with the Endpoint. For TCP and UDP endpoints, this is the server port. If <IP Address> is omitted, this is the local port of the listening server. If an <IP Address> is given, this is the remote server's listening port, and the local client port is defined by <localPort>. For Serial endpoints, the port can be set as follows: 1 = UART1 2 = UART2 3 = USB 4 = Mux Channel 1 on UART 1 5 = Mux Channel 2 on UART 1 6 = Mux Channel 3 on UART 1 7 = Mux Channel 4 on UART 1 8 = Mux Channel 1 on UART 2 9 = Mux Channel 2 on UART 2 10 = Mux Channel 3 on UART 2 11 = Mux Channel 4 on UART 2 12 = Mux Channel 1 on USB 13 = Mux Channel 2 on USB 14 = Mux Channel 3 on USB 15 = Mux Channel 4 on USB
<IP_Address>	For TCP and UDP, this is the IP Address of the remote server. When specified, the device will act as a client and try to make a socket connection to the server at the specified <port>. When omitted or set to 0, the device will act as a server and wait for an incoming client connection on the specified <port>. The IP Address may be entered in either a numeric form, such as "203.0.113.1", or a DNS name, such as "www.example.com".
<localPort>	Used by client definition only (a server IP Address is given). 0 = The modem will assign a value (default). If no server IP Address is given, this parameter is ignored.
<clientTimeout>	For TCP server only. Timeout value in seconds that will disconnect a remote client after a period of inactivity (default = 1800 sec).
<maxClients>	For TCP server only. Maximum number of active clients (0-8). Default=0: This is a special case in which a remote client communicates through the server endpoint, rather

	than creating a new client endpoint. 1-8: Each new remote client request causes a new endpoint to be created to handle the data. This is intended primarily for internal use, such as the TELNETPORT and TCPPORT commands. Ignored by client.
<baud>	Baud rate for the serial port: Don't change = 0 (default) Valid rates = 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600
<flow_by_DTE>	Flow control setting for the serial port DTE: 0 = None 2 = RTS 255 = Don't change (default)
<flow_by_DCE>	Flow control setting for the serial port DCE: 0 = None 2 = CTS 255 = Don't change (default)
<sendEsc>	Controls whether or not the "+++" characters to escape from online mode are sent to the destination endpoint. 0 = Do not send (default) 1 = Send
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=7250
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=100msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1450
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled

<status>	Description
0	Success
1002	Invalid IP address
1008	Invalid Port
1012	Error saving data to NVM
1050	Invalid Parameter Value
1055	Invalid Eserver Id
1090	Invalid Endpoint Id
1093	Invalid Protocol

15.4.2 **Examples**

The following example shows a simple bridge between serial port 1 and a TCP server with IP address 203.0.113.1 and port 2025.

Note: The serial endpoint is defined last so all the AT commands can be entered on serial port 1 before it is switched into data mode by its endpoint creation.

```
AT$ENDPOINT=1,1,2025,”203.0.113.1”
AT$BRIDGECREATE=1,1,2,2
AT$ENDPOINT=2,3,1
```

The following example is for a pass-through test between two UDP endpoints. Each UDP endpoint points to an instance of ClearTerminal running on a PC. The modem and PC are both on a VPN.

Since UDP is connectionless, a UDP endpoint is like both a server and a client. In order for it to know where to send outgoing data, we must configure it like a client by entering a server IP address and port. And the same time, it also acts as a listening server on the <localPort>.

When defining the endpoint’s server address, we must use the VPN IP address of the UDP host, not its public IP address. This is an important difference from TCP, which can connect to the public IP address.

For this example, the PC’s VPN address is 10.100.46.49. This can be determined by using the “ipconfig” command on the PC. The modem’s IP address is queried with:

```
AT$IP?
$IP: "327004000672",0,"10.137.216.1"
```

Here is a summary of the two UDP endpoints:

1. Send outgoing data to the PC’s VPN address and port 2001, and listening for incoming data on local port 2001.
2. Send outgoing data to the PC’s VPN address and port 2003, and listening for incoming data on local port 2003.

```
AT$ENDPOINT=1,2,2001,"10.100.46.49",2001
AT$ENDPOINT=2,2,2003,"10.100.46.49",2003
AT$BRIDGECREATE=1,1,2,2
```

On the PC we open two instances of ClearTerminal to act as our test servers:

1. A UDP connection to endpoint 1 at 10.137.216.1 port 2002, and also listening on local port 2002.
2. A UDP connection to endpoint 2 at 10.137.216.1 port 2003, and also listening on local port 2003.

Once the connections are established, all text that is typed in one ClearTerminal window will be sent to the other ClearTerminal window, and vice versa.

15.5 Bridge (route) settings

This section describes the commands available to create, delete, and query the "bridges" used to create data pipes or routes. Bridges form a route between two endpoints within the "Pass Through" routing subsystem. The "direction" parameter is used to control the flow of data through the data pipe. It can be set to "One Way", from endpoint 1 to endpoint 2, or to "Bi-Directional".

Optional event labels may be specified to trigger the bridge to be created and deleted by any system event. If the bridge already exists when a create event occurs, the creation will fail. The existing bridge will not be affected.

Using event labels, bridges can be dynamically created and deleted to redirect the flow of data according to different conditions. For example, data from a serial endpoint can be redirected from being stored in Tag 1 to Tag 2, and then back again. This will cause the data being written to "ping-pong" between two tags, so that one file can be closed and uploaded to a server while the other tag continues to receive new data.

An optional <persistent> parameter specifies whether or not the bridge runtime status (active/inactive) is saved and restored across power cycles. If not, then the status is set to inactive during system start up.

The Bridge parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

The following commands are supported:

- AT$BRIDGECREATE – Command to define and query bridge creation events.
- AT$BRIDGEDELETE – Command to define and query bridge deletion events.

15.5.1 **Bridge Events**

The events below are generated by the Bridge commands. They may be used to trigger any action in the software that accepts events.

The Event Type is 98 (0x62) for Bridges. The Event ObjectId is the BridgeId value.

Name	EventId	Description
BRIDGE_CREATED	1	Bridge was activated.
BRIDGE_DELETED	2	Bridge was deactivated.
ERROR	3	A Bridge error occurred

15.5.2 **AT$BRIDGECREATE**

AT command used to create and query the CREATE parameters for a bridge.

Action Command

The following shows the command (in bold) to configure the CREATE parameters for a Bridge.

AT$BRIDGECREATE=<bridgeId>,<endpoint1>,<endpoint2>,<direction>[,<persistent> [,<eventLabel>[…,<eventLabel>]]]
$BRIDGECREATE: “<deviceId>”,<status>
(OK I ERROR)

Immediate Command

If there is no <eventLabel> specified, then a persistent bridge is created immediately:

AT$BRIDGECREATE=<bridgeId>,<endpoint1>,<endpoint2>,<direction>
$BRIDGECREATE: “<deviceId>”,<status>
(OK I ERROR)

Static Bridge

The immediate command can be used to create what is effectively a “static” bridge. The bridge is created and activated immediately, and its state will persist across power cycles. This means it will always be active, or “static”.

Delete Command

Specifying only the Bridge ID deletes the bridge and deletes its CREATE parameters from NVM:

AT$BRIDGECREATE=<bridgeId>
$BRIDGECREATE: “<deviceId>”,<status>
(OK I ERROR)

Read Command

The following shows the command (in bold) to query the Bridge CREATE parameters. All defined records are displayed.

```
AT$BRIDGECREATE?
$BRIDGECREATE:
"<deviceId>",<status>,<bridgeId>,<endpoint1>,<endpoint2>,<direction>,
<persistent>,<bridgeStatus>,<eventLabel>…,<eventLabel>
…<more records>…
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<bridgeId>	Bridge Id (1-10)
<endpoint1>	Source Endpoint Id (1-49) specifying a connection
<endpoint2>	Destination Endpoint Id (1-49) specifying a connection
<direction>	Controls flow of data through the data pipe 1 = One Way (from endpoint 1 to endpoint 2) 2 = Bi-Directional
<persistent>	Specifies whether or not the bridge status is persistent through power cycles: 0 = Bridge status is set to inactive during system startup. An event is required to change the status to active. 1 (default) = Bridge status is saved and restored across a power cycle.
<bridgeStatus>	0 = Bridge is not active. 1 = Bridge is active.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the command. There may be from 0 to 10 values. A null or 0 value specifies "immediate", and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM
1090	Invalid Endpoint Id
1029	Invalid Bridge Id
1030	Invalid Direction

1050	Invalid parameter value
other	Refer to the appendix.

15.5.3 **AT$BRIDGEDELETE**

AT command used to define and query the DELETE parameters for a bridge.

Action Command

The following shows the command (in bold) to configure the DELETE parameters for a Bridge.

```
AT$BRIDGEDELETE=<bridgeId>,<eventLabel>[…,<eventLabel>]
$BRIDGEDELETE: “<deviceId>”,<status>
(OK I ERROR)
```

Delete Command

Specifying only the Bridge ID deletes the bridge and deletes its DELETE parameters from NVM:

```
AT$BRIDGEDELETE=<bridgeId>
$BRIDGEDELETE: “<deviceId>”,<status>
(OK I ERROR)
```

Read Command

The following shows the command (in bold) to query the Bridge DELETE parameters. All defined records are displayed.

```
AT$BRIDGEDELETE?
$BRIDGEDELETE: “<deviceId>”,<status>,<bridgeId>,<bridgeStatus>,<eventLabel>
…,<eventLabel>
…<more records>…
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<bridge Id>	Bridge Id (1-10)
<bridgeStatus>	0 = Bridge is not active. 1 = Bridge is active.

<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the command. There may be from 0 to 10 values. A null or 0 value specifies “immediate”, and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM
1050	Invalid parameter value
other	Refer to the appendix.

15.6 Endpoint Server

This section describes the commands available to define and query servers for some types of endpoints, such as Email endpoints. Once defined, a new endpoint can be defined that references the server by its Id. No connection is made when a server is defined. The connection is attempted when an endpoint is created that references the server.

The following command is supported:

- AT$ESERVER – Command to administer Endpoint Server settings.

15.6.1 **AT$ESERVER**

This is an AT command used to administer Endpoint Server settings.

Action Command

The following shows the command (in bold) to create an Endpoint Server.

AT$ESERVER=<eServerId>,"<server>"[,<port>[,"<username>"[,"<password>"[,<smtpAuth>]]]]
$ESERVER: ”<deviceId>”,<status>
(OK I ERROR)

Specifying only the <eServerId> deletes the Endpoint Server.

Read Command

The following shows the command (in bold) to query the Endpoint Server settings. All defined records are displayed.

AT$ESERVER?
$ESERVER: ”<deviceId>”,<status>,<eServerId>,"<server>",<port>,"<username>", "<password>",<smtpAuth>
…<more records>…

(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<eServerId>	Endpoint Server Id (1-5).
<server>	IP Address of the server. It may be entered in either a numeric form, such as “203.0.113.1”, or a DNS name, such as “www.example.com”.
<port>	The server port. The default depends on the type of endpoint. For an Email Endpoint, the default is 25.
<username>	Username
<password>	Password
<smtpAuth>	SMTP Authentication Method: 0 = None (default) 1 = Authentication with no encoding 2 = Authentication with MIME64 encoding Ignored with POP servers.

<status>	Description
0	Success
1002	Invalid IP Address
1008	Invalid Port
1012	Error saving data to NVM
1050	Invalid parameter value
1055	Invalid EServer Id

15.7 Online Data Mode

This section describes the command to switch an endpoint from AT Command mode to Online Data mode. This command would normally be used after “+++” was entered during an online session to exit data mode and return to AT Command mode.

The following command is supported:

- AT$ONLINE – Action command

15.7.1 **AT$ONLINE**

AT command used to switch the given endpoint to online data mode.

15.7.1.1.1 *Action Command*

The following shows the command (in bold) to switch to online data mode.

AT$ONLINE=<endpointId>
$ONLINE: ”<deviceId>”,<status>
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<endpointId>	Endpoint Id (1-49). Currently, only serial port endpoints are supported.

<status>	Description
0	Success
1090	Invalid Endpoint Id
1093	Invalid Protocol

15.8 Filtering Endpoints

A Filtering endpoint is a special kind of endpoint that can be thought of as a “midpoint”. It is configured to be bridged between two other endpoints, and it performs some kind of filtering operation on the data being passed through. The types of filtering endpoints currently available are:

- Strip ETX/DLE – Looks for ETX to end a file. A DLE character must be used to escape embedded ETX and DLE characters (DLE-ETX and DLE-DLE).
- Compress – Compresses data using the zlib format.
- Decompress – Decompresses data from the zlib format.

The filtering endpoints are configured with the SETENDPOINT, GETENDPOINT, and AT$ENDPOINT commands using the following values for the protocol id:

- 23 – Strip ETX/DLE
- 24 – Compress
- 25 – Decompress

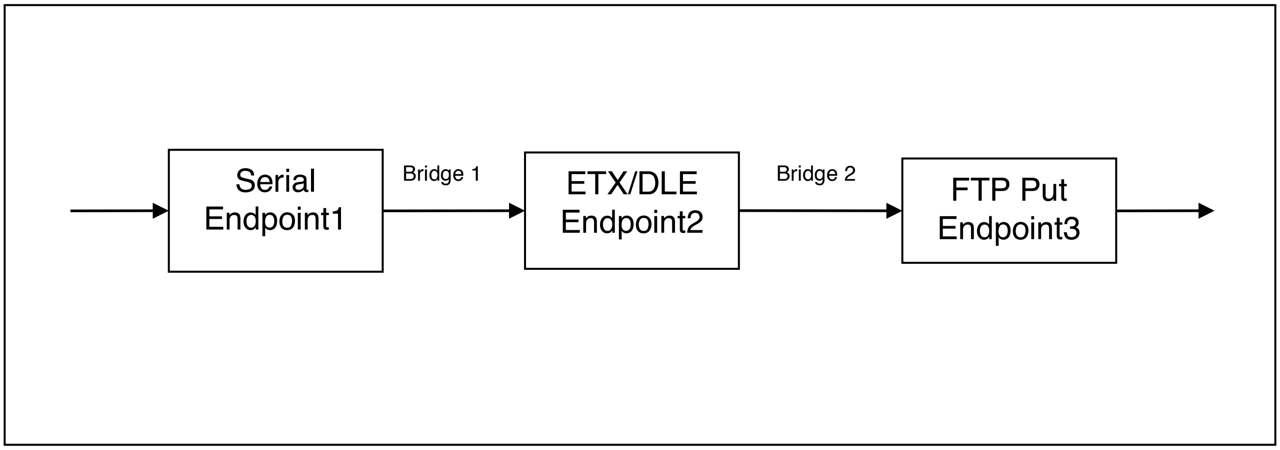
There are no other configurable parameters besides the generic optional parameters for all endpoints. Refer to section 15.4 for more details about the endpoint commands.

15.8.1 **Strip ETX/DLE**

The ETX/DLE endpoint can be used to filter data that is coming from a source endpoint that is not inherently file oriented, such as serial, and going to a file oriented endpoint, such as FTP Put. The ETX/DLE endpoint scans the incoming data and recognizes the ETX character (0x03) as the end of file. Then it signals the destination endpoint to close out the current file. If the incoming data stream contains binary data, then all embedded 0x03 bytes must be preceded with a DLE character (0x1A, 0x03) to avoid being misinterpreted as the end of file. Similarly, if a DLE character occurs in the input data stream, it must also be preceded with a DLE character (0x1A, 0x1A). The first DLE character will be stripped off so only the following character will be passed through. The end of file ETX is also stripped so it is not passed through.

Example

The following example defines three endpoints and two bridges for sending data through a serial endpoint to a file on an FTP server. The serial data is terminated with an ETX character to indicate the end of file.



Note: The serial endpoint1 is defined last so all the AT commands can be entered on serial port 1 before it is switched into data mode by its endpoint creation.

```
At$eserver=5,ftp.example.com,,”myid”,”mypwd”
at$ftpopen=5,0,00320001
at$endpoint=2,23
at$endpoint=3,11,5,”DestFile.txt”
at$endpoint=4,1,2004
at$bridgecreate=1,1,2,1
at$bridgecreate=2,2,3,1
at$endpoint=1,3,1
```

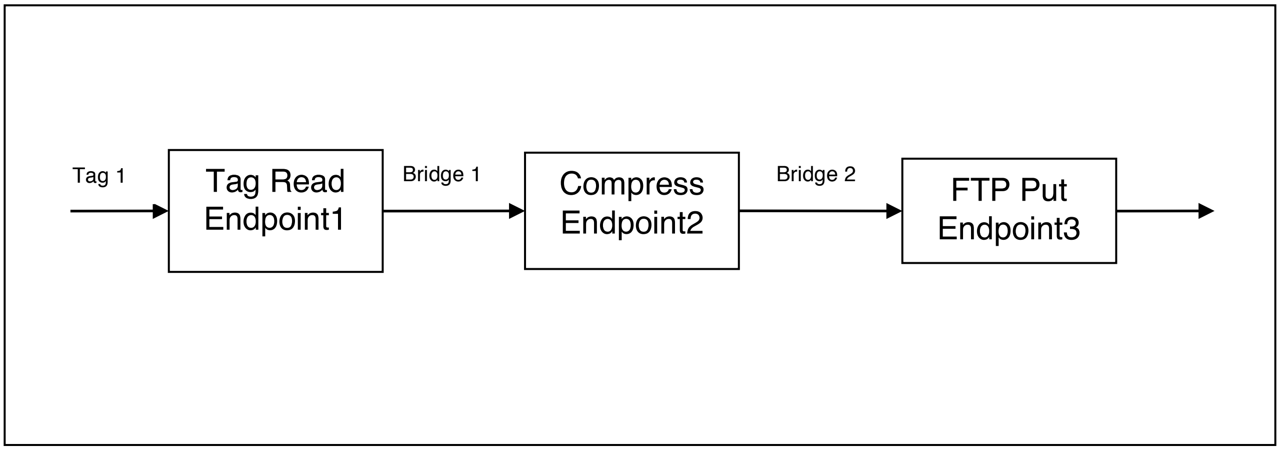
Data coming in on Serial endpoint 1 is passed through Bridge 1 to ETX/DLE endpoint 2. All data is passed through Bridge 2 to FTP-Put endpoint 3, which opens a connection to the FTP server and writes the file. All embedded DLE characters are stripped so that only the next character is passed through. When the final ETX character is detected, FTP-Put endpoint 3 is signaled to close the file and the connection to the FTP server.

15.8.2 **Compress/Decompress**

The Compress and Decompress endpoints use the zlib compression format to decrease the size of a file prior to sending to or receiving from a remote server, thereby reducing the required bandwidth. For more details about zlib, please visit the web site http://zlib.net.

Example 1

The following compression example defines three endpoints and two bridges to send a compressed tag file to a remote FTP server. Tag 1 contains the data to be sent.



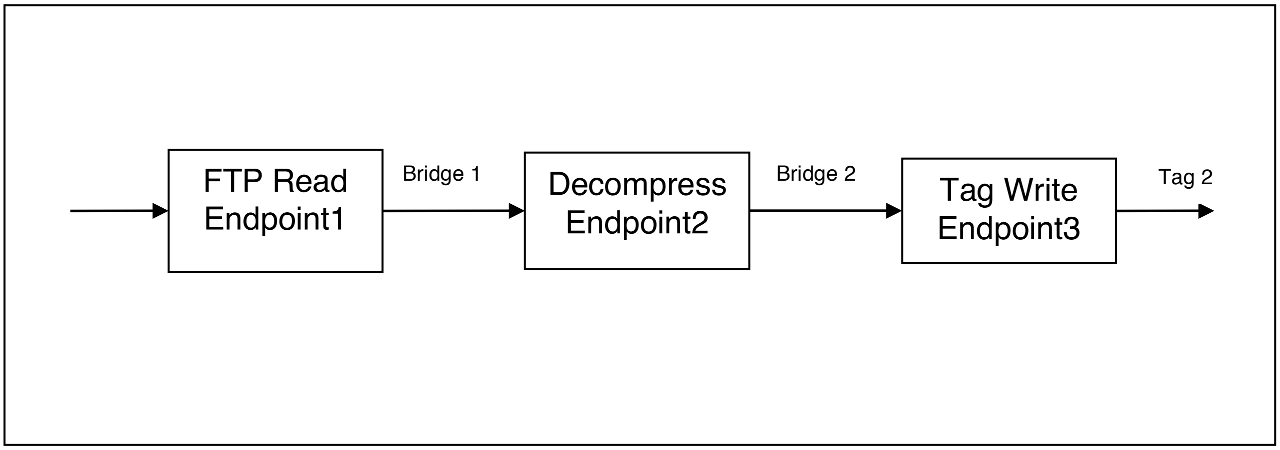
Note: The Tag-Read endpoint1 is defined last because it will trigger the data transfer to begin when it is created.

```
At$eserver=5,ftp.example.com,,”myid”,”mypwd”
at$ftpopen=5,0,00320001
at$endpoint=2,24
at$endpoint=3,11,5,"TestFile.zlib"
at$bridgecreate=1,1,2,1
at$bridgecreate=2,2,3,1
at$endpoint=1,15,1
```

Tag Read endpoint 1 reads data from tag 1 and passes it through Bridge 1 to Compress endpoint 2. The tag data is compressed and passed through Bridge 2 to FTP-Put endpoint 3, which opens a connection to the FTP server and writes the file. When all data from tag1 has been compressed and passed through, FTP-Put endpoint 3 is signaled to close the file and the connection to the FTP server.

Example 2

This example of decompression is the reverse of the previous example. It defines three endpoints and two bridges to receive a compressed file from a remote FTP server, decompress it, and write it to Tag 2.



Note: The FTP-Read endpoint1 is defined last because it will trigger the data transfer to begin when it is created.

```
At$eserver=5,ftp.example.com,,”myid”,”mypwd”
at$endpoint=3,14,2
at$endpoint=2,25
at$bridgecreate=1,1,2,1
at$bridgecreate=2,2,3,1
at$endpoint=1,10,5,"TestFile.zlib"
```

FTP Read endpoint 1 reads data from the FTP server and passes it through Bridge 1 to Decompress endpoint 2. The file data is decompressed and passed through Bridge 2 to Tag Write endpoint 3, which writes the file to tag 2. When all data from the FTP server file has been received, the connection to the remote server is closed. When all data is decompressed, and passed through, Tag Write endpoint 3 is signaled to close the tag file.

16 AT Parser Endpoints

AT Parser endpoints handle commands that arrive from an upstream endpoint. The end of a command must be indicated by a semicolon (;), <CR> or <LF>. After processing the command, the response message is sent back to the upstream endpoint. The command echo mode can be configured off or on.

Line editing with a backspace (BS) can be enabled or disabled. If the source of the AT command is from a human typing text, the edit mode can be enabled. But if the AT commands are coming from a pre-processed source, such as SMS or email, the edit mode can be disabled.

16.1 Events

The events below are generated by AT Parser Endpoints. They may be used to trigger any action in the software that accepts events.

See Table 7.1 for the Event Types. The event object Id is the endpoint Id.

Name	Number	Description
LINE	1	A command line (possibly containing concatenated commands) has been received.
START	2	A single command has started execution.
DONE	3	A single command completed successfully.
ERROR	4	An error occurred.

16.2 ASCII Commands

These are AT commands used to create an “endpoint” which defines a connection used by the “Pass Through” routing subsystem. The Endpoint settings can be set or read.

The general part of the AT$ENDPOINT command is described in section 15.4.1. This section describes the portion of the command that is specific to AT Parser endpoints.

16.2.1 **Action Command**

The following shows the command (in bold) to configure settings for AT Parser Endpoints. An optional parameter may be skipped by entering a comma as its placeholder.

AT$ENDPOINT=<endpoint>,<protocol=18>[,<echo>[,<allowEdit>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]]
$ENDPOINT: ”<deviceId>”,<status>

(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>
$ENDPOINT: "<deviceId>",<status>
(OK I ERROR)

16.2.2 **Read Command**

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

AT$ENDPOINT?

For AT Parser endpoints:
$ENDPOINT: "<deviceId>",<status>,<endpointId>,<protocol=18>,<echo>,<allowEdit>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint.
<protocol>	The type of endpoint being created. 18 = AT Parser (See section 15 for full protocol ID table)
<echo>	Indicates whether the command is echoed. 0 = No echo 1 = Echo each character as it arrives (default). 2 = Wait for complete command, then echo.
<allowEdit>	Allow Backspace to line edit: 0 = Do not allow. The BS character will be ignored. 1 = Allow editing. BS erases the previous character (default).
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=5K
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=300msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1K
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a

	decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=13 <CR>

<status>	Description
0	Success
1012	Error saving data to NVM
1050	Invalid Parameter Value
1090	Invalid Endpoint Id
1093	Invalid Protocol
other	Refer to Appendix A

16.2.3 **Example**

The following example shows a bridge between a serial endpoint and an AT Parser endpoint

```
AT$ENDPOINT=2,18
AT$BRIDGECREATE=1,1,2,2
AT$ENDPOINT=1,3,1
```

17 SMS Endpoints

SMS endpoints may be used to exchange data between SMS messages and other endpoints. Incoming SMS message data is passed through to the bridged endpoint. And data that is received from another endpoint is sent out as an SMS message to the destination phone number.

The destination phone number is determined by the source of the previous incoming SMS message. If an incoming SMS message has not been received yet, then the first configured phone number is used. In this case, the number may not contain any wildcards.

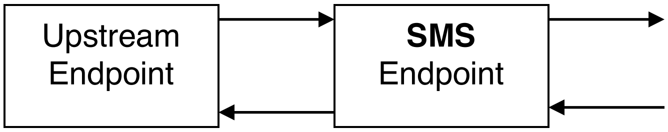
To add some security and prohibit unauthorized SMS messages to the device, a PIN code can be required. The PIN code then needs to be included as the first characters in every SMS message.

The endpoint can also be configured to only process SMS messages from up to three phone numbers. The configured phone numbers may contain wildcard characters, with "*" matching 0 or more characters, and "?" matching exactly one character. When specifying phone numbers, omit the country code. The device will remove the "+1" from all incoming SMS phone numbers. Only US numbers are supported.

SMS messages from all other phone numbers are ignored by the endpoint system and handled normally by the modem.

17.1 Endpoint Configuration

SMS Endpoint



17.2 Events

These events are generated by SMS endpoints. The EventType is 104. The ObjectId for the event is the Endpoint ID. See section 7 for more about events.

Name	EventId	Description
MESSAGE_SENT	1	A message was sent out successfully.
MESSAGE_RECEIVED	2	An incoming SMS message was received.
MESSAGE_ERROR	3	A sending error occurred.
SEND_DONE	4	Message was sent to all destinations.

17.3 ASCII Commands

AT command used to create an “endpoint” which defines a connection used by the “Pass Through” routing subsystem. The Endpoint settings can be set or read.

17.3.1 Action Command

The following shows the command (in bold) to configure settings for an SMS Endpoint. An optional parameter may be skipped by entering a comma as its placeholder. For example, to create SMS endpoint 1 with default values except for setting <fwdCtrlChar> to 13, enter **AT$ENDPOINT=1,4,,,,,,,,,13**

For Creating an SMS endpoint:
AT$ENDPOINT=<endpoint>,<protocol=4>[,<mode>[,<pinCode>[,<smsPhoneNum1>
[,<smsPhoneNum2>[,<smsPhoneNum3>[,<endMsg>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize> [,<fwdCtrlChar>]]]]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>
$ENDPOINT: ”<deviceId>”,<status>

(OK I ERROR)

17.3.2 **Read Command**

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

AT$ENDPOINT?

If SMS:
$ENDPOINT: ”<deviceId>”,<status>,<endpointId>,<protocol=4>,<mode>,<pinCode>,<smsPhoneNum1>,<smsPhoneNum2>,<smsPhoneNum3>,<endMsg>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of endpoint being created. (See section 15 for full protocol ID table)
<mode>	1 = SMS messages allowed with no checking (default). 2 = SMS messages allowed with valid PIN code. 3 = SMS messages allowed from specified phone numbers only. 4 = SMS messages allowed with valid PIN and from specified phone numbers only (same as 2 and 3 combined).
<pinCode>	The string that gives a PIN code to confirm for SMS authorization (up to 6 chars).
<smsPhoneNum1> <smsPhoneNum2> <smsPhoneNum3>	Authorized incoming SMS Phone Numbers (up to 20 chars each). Wildcards are supported. Number 1 is the default destination for outgoing SMS messages prior to the first received SMS message.
<endMsg>	Specifies how incoming SMS messages should be terminated: 0 = Nothing is appended (default). 1 = <CR> is appended to each incoming message. 2 = <CR><LF> are appended to each incoming message. 3 = A semicolon (;) is appended to each incoming

	message.
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=1600
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=750msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=160
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled

<status>	Description
0	Success
1002	Invalid IP address
1008	Invalid Port
1012	Error saving data to NVM
1050	Invalid Parameter Value
1055	Invalid EServer Id
1090	Invalid Endpoint Id
1093	Invalid mode parameter.

18 FTP Endpoints

FTP endpoints are available to read or write files on an FTP server. The remote server is configured with the EServer commands.

When an FTP Put endpoint receives data from another endpoint, it connects to the FTP server and appends the data to the end of the file on the server. For FTP-Put only, a server connection must first be opened with AT$FTPOPEN before the Put can start. When finished, other FTP operations (such as AT$FTPREN) may be performed, or the connection can be closed with AT$FTPCLOSE.

The FTP-Get does not currently have this requirement. The FTP-Get automatically opens its server connection, performs the Get, then closes its connection. An FTP Get endpoint connects to the FTP server upon receiving the configured event. The file is downloaded and the data is passed to another endpoint.

18.1 Configurations

In order to achieve bi-directional communications with FTP you must setup two separate endpoints: one to send data (PUT) and one to receive data (GET).

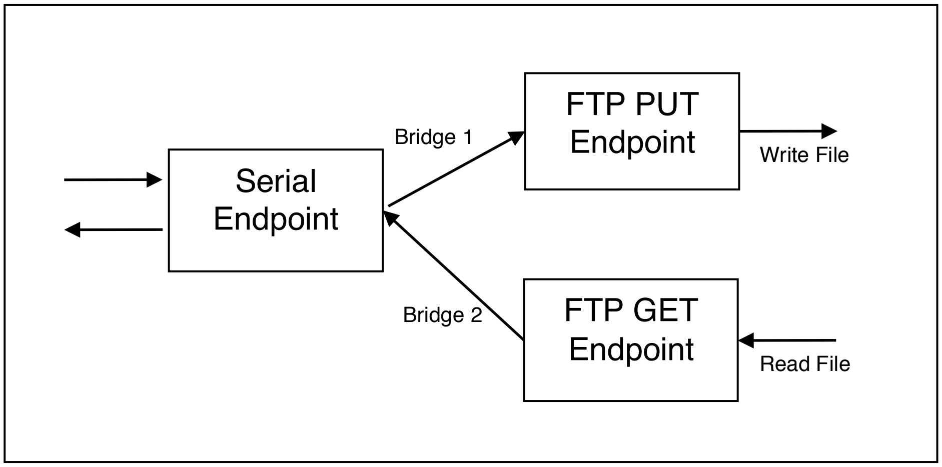


Figure 2. **FTP Endpoints**

18.2 Events

The events below are generated by FTP Endpoints. They may be used to trigger any action in the software that accepts events.

18.2.1 FTP GET

See Table 7.1 for the Event Types.

Name	Number	Description
Session Open	1	Session with FTP Server was opened.
Data Open	2	Data channel opened with the server.
File Received	3	Complete File has been received.
General Error	4	A general error occurred.
File Error	5	File not found.
Login Error	6	Username or password error
Session Closed	7	Session with HTTP Server was closed

18.2.2 **FTP PUT**

See Table 7.1 for the Event Types.

Name	Number	Description
Data Open	2	Data channel opened with the server.
File Sent	3	File has been sent successfully.
General Error	4	A general error occurred.

18.3 ASCII Commands

AT command used to create an “endpoint” which defines a connection used by the “Pass Through” routing subsystem. The Endpoint settings can be set or read.

18.3.1 **Action Command**

The following shows the command (in bold) to configure settings for a FTP Endpoints. An optional parameter may be skipped by entering a comma as its placeholder. For example, to create FTP Get endpoint 1 with default values except for setting <fwdCtrlChar> to 13, enter **AT$ENDPOINT=1,10,5,”index.html”,,,,,13**

You must define an Endpoint server and pass the ID of that server to the FTP endpoint when it is created.

For FTP Get:

AT$ENDPOINT=<endpointId>,<protocol=10>,<eServerId>,"<filename>”[,<localPort>
[,<eventFilter>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For FTP Put:

AT$ENDPOINT=<endpointId>,<protocol=11>,<eServerId>,"<filename>"[,<localPort> [,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]
$ENDPOINT: "<deviceId>",<status>
(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>
$ENDPOINT: "<deviceId>",<status>
(OK I ERROR)

18.3.2 **Read Command**

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

AT$ENDPOINT?

If FTP Get:
$ENDPOINT:
"<deviceId>",<status>,<endpointId>,<protocol=10>,<eServerId>,"<filename>",
<localPort>,<eventFilter>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

If FTP Put:
$ENDPOINT:
"<deviceId>",<status>,<endpointId>,<protocol=11>,<eServerId>,"<filename>",
<localPort>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of endpoint being created. (See section 15 for full protocol ID table)
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=7250
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=250msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1450

<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled
eServerId	Endpoint Server Id. The Eserver contains the server's IP address, port, username, and password. Note that for HTTP endpoints, the eserver IP address must include the protocol prefix, such as "http//:"!
<filename>	File path and name.
<localPort>	Client's local port. 0 = The modem will assign a value (default). 1 – 65535 = User defined port. (Not supported)
<eventFilter>	Event Filter Id. This defines the events that trigger the start of a file download. A null or value=99 specifies "immediate" (default).

<status>	Description
0	Success
1002	Invalid IP address
1008	Invalid Port
1012	Error saving data to NVM
1090	Invalid Endpoint Id
1050	Invalid Parameter Value
1055	Invalid EServer Id
1093	Invalid Protocol

18.4 GET Example

The following example shows a bridge between an FTP server and Tag 1. The file is fetched immediately from the server and stored in tag 1.

Note: The FTP Get endpoint is defined last so the "immediate" fetch has all the other objects ready to go.

```
AT$ESERVER=5,ftp.example.com,,"myid","mypwd"
AT$ENDPOINT=2,14,1
AT$BRIDGECREATE=1,1,2,1
AT$ENDPOINT=1,10,5,"somefile.dwl"
```

18.5 PUT Example

The following example shows a bridge between a USB serial endpoint and an FTP server. Input data to the serial port is sent out the FTP Put endpoint and written in a file on the FTP server.

```
AT$ESERVER=5,ftp.example.com,,"myid","mypwd"
AT$FTPOPEN=5,0,00320001
AT$ENDPOINT=1,3,3
AT$ENDPOINT=2,11,5,"myfile.txt"
AT$BRIDGECREATE=1,1,2,1
```

19 HTTP Endpoints

There are three HTTP Endpoints available, GET, PUT, and POST. These endpoints are used to receive and send files or data with an HTTP Server.

19.1 Configurations

In order to achieve bi-directional communications with HTTP you must setup two separate endpoints. One to send data (either PUT or POST) and one to receive data (GET).

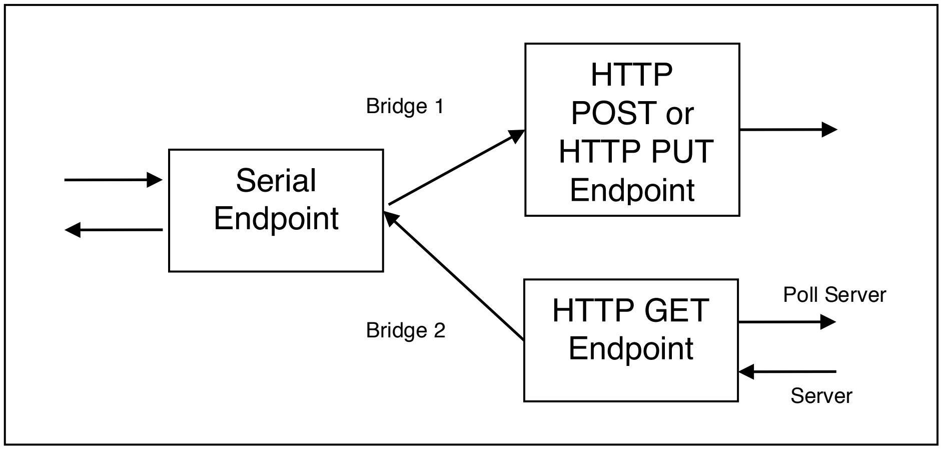


Figure 3. **HTTP Endpoints**

19.2 Events

The events below are generated by HTTP Endpoints. They may be used to trigger any action in the software that accepts events.

19.2.1 **HTTP GET**

See Section 7.1 for the Event Types.

Name	Number	Description

Session Open	1	Session with HTTP Server was opened.
Data Open	2	Data channel opened with the server.
File Received	3	The file has been received.
Error	4	An Error occurred
Session Closed	5	Session with HTTP Server was closed

19.2.2 **HTTP PUT**

See Section 7.1 for the Event Types.

Name	Number	Description
Session Open	1	Session with HTTP Server was opened.
Data Open	2	Data channel opened with the server.
File Sent	3	The file has been sent.
Error	4	An Error occurred
Session Closed	5	Session with HTTP Server was closed

19.2.3 **HTTP POST**

See Section 7.1 for the Event Types.

Name	Number	Description
Session Open	1	Session with HTTP Server was opened.
Data Open	2	Data channel opened with the server.
File Sent	3	The POST has been Sent.
Error	4	An Error occurred
Session Closed	5	Session with HTTP Server was closed

19.3 ASCII Commands

AT command used to create an “endpoint” which defines a connection used by the “Pass Through” routing subsystem. The Endpoint settings can be set or read.

19.3.1 **Action Command**

The following shows the command (in bold) to configure settings for HTTP Endpoints. An optional parameter may be skipped by entering a comma as its placeholder. For example, to create HTTP Get endpoint 1 with default values except for setting <eventFilter> to 1 and <fwdCtrlChar> to 13, enter
AT$ENDPOINT=1,5,3,”index.html”,,1,,,,13

When defining an HTTP Post connection, the “protocol”, and “URL” fields are required. Optionally, a “username” and “password” may be specified, if required by the HTTP server. One or more header,value pairs may be added at the end of the command line.

For HTTP Get:
AT$ENDPOINT=<endpointId>,<protocol=5>,<eServerId>,"<filename>”[,<localPort
> [,<eventFilter>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>
[,<headerList>]]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For HTTP Put:
AT$ENDPOINT=<endpointId>,<protocol=6>,<eServerId>,"<filename>”[,<localPort
> [,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>[,<headerList>]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For HTTP Post:
AT$ENDPOINT=<endpointId>,<protocol=7>,<http_ver>,”<url>”[,”<username>”
[,”<password>”[,<localPort>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>
[,<fwdCtrlChar>[,<headerList>]]]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

19.3.2 **Read Command**

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

AT$ENDPOINT?

If HTTP Get:
$ENDPOINT:
”<deviceId>”,<status>,<endpointId>,<protocol=5>,<eServerId>,”<filename>”,
<localPort>,<eventFilter>,<headerList>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,
<fwdCtrlChar>

If HTTP Put:

$ENDPOINT:
”<deviceId>”,<status>,<endpointId>,<protocol=6>,<eServerId>,”<filename>”,
<localPort>,<headerList>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

If HTTP Post:
$ENDPOINT: ”<deviceId>”,<status>,<endpointId>,<protocol=7>,<http_ver>,”<url>”,
”<username>”,”<password>”,<localPort>,<headerList>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of endpoint being created. (See section 15 for full protocol ID table)
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=7250
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=250msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1450
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled
<http_ver>	HTTP version: 0 = Version 1.0 1 = Version 1.1
<url>	URL to the HTTP Post server and handler file, such as http://www.example.com:1234/myfolder/myhandler.ext The IP Address portion may be entered in either a numeric form, such as “203.0.113.1”, or a DNS name, such as “www.example.com”. The port value is optional (default=80).
<username>	User name for login
<password>	Password for login
<localPort>	Client’s local port. 0 = The modem will assign a value (default). 1 – 65535 = User defined port. (Not supported)
<headerList>	Each HTTP header is entered as a “name”,”value” pair.

	Do not include a colon after the name. More pairs can be added, separated by commas.
eServerId	Endpoint Server Id. The Eserver contains the server's IP address, port, username, and password. Note that for HTTP endpoints, the eserver IP address must include the protocol prefix, such as "http//:"!
<filename>	File path and name.
<eventFilter>	Event Filter Id. This defines the events that trigger the start of a file transfer. A null or value=99 specifies "immediate" (default).

<status>	Description
0	Success
1002	Invalid IP address
1008	Invalid Port
1012	Error saving data to NVM
1050	Invalid Parameter Value
1055	Invalid EServer Id
1090	Invalid Endpoint Id
1093	Invalid Protocol

19.4 Get Example

The following example shows a bridge between serial port 1 and an HTTP server at Google.com. The default page is fetched every 30 seconds and the text is routed out serial port 1. The example below is using event Timer 1 expiration, 00020103, as a trigger for the HTTP GET to happen.

Note: The serial endpoint is defined last so all the AT commands can be entered on serial port 1 before it is switched into data mode by its endpoint creation.

```
at$eventfilter=1,00020103          // Define event filter
at$timerstart=1,300,00020103       // Restart timer every time the timer expires
at$timerstart=1,0                  // This starts the timer the first time
at$eserver=3,"http://www.example.com"
at$endpoint=1,5,3,"index.html",,1,,,,,Accept,text/html  //1 is the event filter
at$bridgecreate=1,1,2,2
at$endpoint=2,3,1                  // Serial endpoint
```

19.5 Put Example

The following example shows a bridge between serial port 1 and an HTTP server that accepts Put data on port 2025. The outgoing text is entered over serial port 1 and transferred to the HTTP server to a file named “MyFile.txt”.

```
AT$ESERVER=4,"http://203.0.113.1",2025
AT$ENDPOINT=1,6,4,"MyFile.txt",,,,,,Accept,text/html
AT$ENDPOINT=2,3,1
AT$BRIDGECREATE=1,2,1,1
```

20 Email Endpoints

Two types of endpoints allow the user to send and receive email. The SMTP endpoint sends email to the server. The POP endpoint polls the server periodically to receive email when it is available. Once received, the email can be left on the server or deleted at the server.

20.1 Configurations

Email endpoints send and receive email via other bridged endpoints. The SMTP endpoint supports data in the downstream direction, while the POP endpoint transfers data in the upstream direction (see Figure 4).

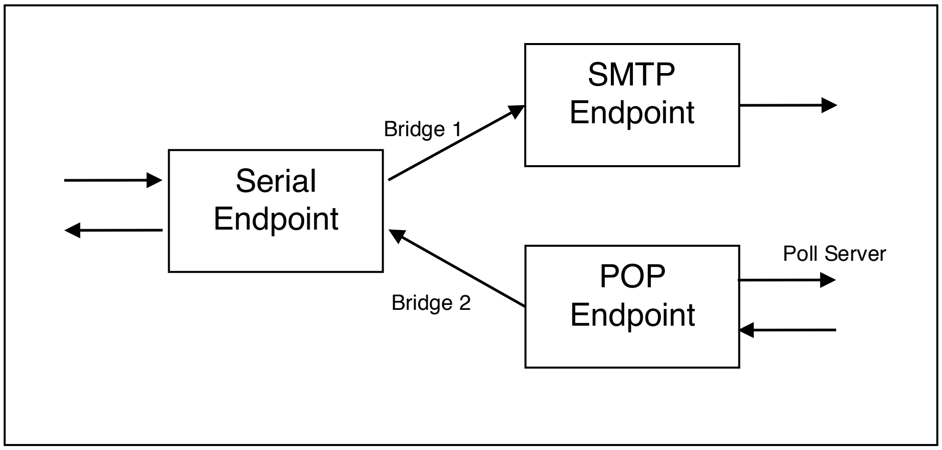


Figure 4. **Email Endpoints**

The SMTP and POP servers are configured separately using the Endpoint Server commands. Then each email endpoint is defined , including a reference to the Email Server Id.

20.2 Events

The events below are generated by HTTP Endpoints. They may be used to trigger any action in the software that accepts events.

20.2.1 **POP Endpoint**

See section 7.1 for the Event Type.

Name	Number	Description
Session Open	1	Session with POP Server was opened
Session Closed	2	Session with POP Server was closed
List Received	3	The email list has been received
Email Received	4	An email has been received and passed on to the next endpoint in the chain.
Email Deleted	5	An email has been deleted from the server.

20.2.2 **SMTP Endpoint**

Event Type: 108

20.3 AT$ENDPOINT

The AT command used to create an email endpoint is part of the general endpoint facility. The syntax and parameters that are unique to email endpoints are shown in the following sections. Endpoint settings can be set or read.

20.3.1 **Action Command**

The following shows the command (in bold) to configure settings for an Email Endpoint.

For SMTP Email:
AT$ENDPOINT=<endpointId>,<protocol=8>,<eServerId>,<emailHdrId>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For POP Email:
AT$ENDPOINT=<endpointId>,<protocol=9>,<eServerId>[,<eventFilter>[,<deleteOnServer>[,<fwdHeaders>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>[,<filterList>]]]]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For Deletion:

Specifying only the Endpoint ID deletes the endpoint.

```
AT$ENDPOINT=<endpointId>
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)
```

20.3.2 Read Command

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

```
AT$ENDPOINT?
If SMTP Email:
$ENDPOINT:
”<deviceId>”,<status>,<endpointId>,<protocol=8>,<eServerId>,<emailHdrId>,
<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

If POP Email:
$ENDPOINT:
”<deviceId>”,<status>,<endpointId>,<protocol=9>,<eServerId>,<eventFilter>,
<deleteOnServer>,<fwdHeaders>,<filterList>,<bufferSize>,<fwdTimeout>,<fwdDataSize
>, <fwdCtrlChar>

…<more records>…
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of email endpoint being created: 8 = SMTP 9 = POP
eServerId	Endpoint Server Id. The EServer contains the server’s IP address, port, username, and password.
emailHdrId	Email Header Id. The Email settings contain the sender and recipient information.
<deleteOnServer>	0 = Leave POP email on server. 1 = POP email will be deleted from server after being read (default).
<fwdHeaders>	Future feature, not currently supported. 0 = Header will not be forwarded (default). 1 = Headers will be forwarded along with email body.

<filterList>	Future feature, not currently supported. Only email from these addresses will be forwarded. All other email will be ignored. If the list is empty, all email will be forwarded. Multiple email addresses can be entered, separated with commas.
<eventFilter>	Event Filter Id. This defines the events that trigger the start of a file transfer. A null or value=99 specifies “immediate” (default).

<status>	Description
0	Success
1012	Error saving data to NVM
1050	Invalid Parameter Value
1090	Invalid Endpoint Id
1093	Invalid Protocol

20.4 Email Header

This section describes the commands available to define and query Email Headers for use by SMTP Email Endpoints. Parameters include the sender’s name and email address, and the recipients and subject. Once defined, a new SMTP Endpoint can be defined that references the Email Header by its Id.

The following command is supported:

- AT$EMAIL – Command to administer Email Headers.

20.4.1 **AT$EMAILHDR**

This is an AT command to administer SMTP Email Headers.

Action Command

The following shows the command (in bold) to create an Email Header.

AT$EMAILHDR=<emailHdrId>,"<senderEmail>",["<senderName>"],"<toList>"[,"<ccList>" [,"<bccList>"[,"<subject>"]]]
$EMAILHDR: ”<deviceId>”,<status>
(OK I ERROR)

Specifying only the <emailHdrId> deletes that Email Header.

Read Command

The following shows the command (in bold) to query the SMTP Email Header. All defined records are displayed.

AT$EMAILHDR?
$EMAILHDR: ”<deviceId>”,<status>,<emailHdrId>,"<senderEmail>","<senderName>", "<toList>","<ccList>","<bccList>","<subject>"
…<more records>…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<emailHdrId>	Email Header Id (1-5)
<senderEmail>	Sender’s Email Address
<senderName>	Sender’s Name
<toList>	To-List
<ccList>	CC-List
<bccList>	BCC-List
<subject>	Subject

<status>	Description
0	Success
1012	Error saving data to NVM
1050	Invalid parameter value
1056	Invalid Email Header Id

20.5 Example

The following example defines three endpoints and two bridges for sending out mail to an SMTP server and receiving email from a POP server. The text for the outgoing email is entered over serial port 1. And the incoming POP email data is also output on serial port 1. Refer to Figure 4 for a diagram of the configuration. The POP server will be queried every 600 seconds (10 minutes) and all messages will be left on the server (no delete).

Note: The serial endpoint is defined last so all the AT commands can be entered on serial port 1 before it is switched into data mode by its endpoint creation.

```
AT$ESERVER=1,"smtp-
   server.example.com",25,"myemailid@example.com","mypasswd",2
```

```
AT$EMAILHDR=1,"myemailid@example.com","My Name","someone@example.com",,,"My
   Subject"
AT$ENDPOINT=1,8,1,1

AT$ESERVER=2,"pop-server.example.com",110,"myemailid@example.com","mypasswd"
AT$ENDPOINT=2,9,2,600,0,0

AT$BRIDGECREATE=1,3,1,1
AT$BRIDGECREATE=2,2,3,1

AT$ENDPOINT=3,3,1
```

21 Offline Data Mode

The software's offline data mode endpoint and associated AT commands provide the ability to read and write binary data to an offline data mode endpoint using AT commands. By using a bridge to connect the offline data mode endpoint to any other software endpoint, the offline data mode AT commands can be used to easily and reliably send and receive data to/from any software endpoint using AT commands. The offline data mode endpoint has several advantages:

- It may be used concurrently with other AT commands.
- It intrinsically supports messages (file-oriented or packetized data).

It supports flow control, and provides events to handle flow control so polling is not required.

21.1 Events

The events below are generated by Offline Data Mode Endpoints. They may be used to trigger any action in the software that accepts events.

Name	Number	Description
Data Available	1	RX buffer has data available
Space Available	2	TX buffer has free space

21.2 AT$ENDPOINT

The AT command used to create an email endpoint is part of the general endpoint facility. The syntax and parameters that are unique to email endpoints are shown in the following sections. Endpoint settings can be set or read.

21.2.1 Action Command

The following shows the command (in bold) to configure settings for an Offline Data Mode Endpoint.

AT$ENDPOINT=<endpointId>,<protocol=26>[,<bufferSize>[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.
AT$ENDPOINT=<endpointId>

```
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)
```

21.2.2 **Read Command**

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

```
AT$ENDPOINT?
$ENDPOINT:
”<deviceId>”,<status>,<endpointId>,<protocol=26>,<bufferSize>,<fwdTimeout>,<fwdDat
aSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of email endpoint being created: 26 = Offline Data Mode
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=7250
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=250msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1450
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled

21.3 AT$EPWRITE

Writes data directly to an offline data mode endpoint’s output buffer. This data will then be forwarded over any connected bridges to other software endpoints. The data to write is hex-encoded so that binary data can be easily written. This will not wait for the data to be delivered, so if there is not sufficient room in the output buffer, then as much data as possible is written, and the command returns immediately.

21.3.1 **Action Command**

The following shows the command (in bold) to write data to an Offline Data Mode Endpoint.

AT$EPWRITE=<endpointId>,< EndOfMessage **(0 I 1)>,"<Hex-encoded data>"**
$EPWRITE: ”<deviceId>”,<status>,<bytesWritten>
(OK I ERROR)

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
< EndOfMessage >	This is 1 if the data read is the last portion of data in a packet/message/file, or 0 if it is not.
< bytesWritten >	The number of bytes that were actually written to the offline data mode endpoint.

Examples:

Write "GET\r\n" to endpoint 1 . All 5 bytes were written successfully:

```
AT$EPWRITE=1,0,"4745540D0A"
$EPWRITE: "327004000672",0,1,5
OK
```

Write "GET\r\n" to endpoint 1. The endpoint was full, so no data could be written.

```
AT$EPWRITE=1,0,"4745540D0A"
$EPWRITE: "327004000672",0,1,0
OK
```

Write "1234" to endpoint 1, and mark the data as NOT being the end of a packet so that we can continue writing the packet later. All four bytes were written successfully.

```
AT$EPWRITE=1,0,"31323334"
$EPWRITE: "327004000672",0,1,4
OK
```

Write "567" to endpoint 1, and mark the data as being the end of a packet. All three bytes were written successfully, and the entire packet consists of “1234567”, so if the offline data mode endpoint is bridged to an endpoint that supports packetization, like UDP, HTTP POST, or FTP, then the packet would be properly delineated.

```
AT$EPWRITE=1,1,"353637"
$EPWRITE: "327004000672",0,1,3
OK
```

21.4 AT$EPREAD

Reads data from an endpoint. The data is read in hex-encoded form so that binary data can be read. This command will only read data that is currently buffered in the endpoint, and will not wait on any more data to arrive.

21.4.1 **Action Command**

The following shows the command (in bold) to read data from an Offline Data Mode Endpoint.

AT$EPREAD=<endpointId>,<maxBytesToRead>
$EPREAD:
"<deviceId>",<status>,<endpointId>,<bytesRead>,<EndOfMessage>,"<hexData>"
(OK I ERROR)

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<endpoint Id>	The Id of the endpoint (1-49).
<EndOfMessage>	This is 1 if the data read is the last portion of data in a packet/message/file, or 0 if it is not.
<bytesRead>	The number of bytes that were actually read from the offline data mode endpoint.
<hexData>	The data read from the endpoint. Each byte of data will be encoded as two hex-digits, all enclosed in quotes. The total number of hex digits is 2 * Bytes read

Examples:

Read up to 256 bytes from endpoint 1. Only 5 bytes ("HELLO") were in the endpoint's buffer, and the five bytes are not the end of a packet/message/file:

```
AT$EPREAD=1,256
$EPREAD:1,5,0,"48454C4C4F"
OK
```

Read up to 256 bytes from endpoint 1. No data was available in the endpoint's buffer:

```
AT$EPREAD=1,256
$EPREAD: "327004000672",0,1,0,0,""
OK
```

Read up to 256 bytes from endpoint 1. Only 5 bytes ("HELLO") were in the endpoint's buffer, and these five bytes are the last bytes in packet/message/file.

```
AT$EPREAD=1,256
$EPREAD: "327004000672",0,1,5,1,"48454C4C4F"
OK
```

21.5 Offline Data Unsolicited Responses:

In order to allow the application to use offline data mode without resorting to polling, an unsolicited response code (URC) is provided which informs the application when an endpoint's TX buffer is no longer full, and when an endpoint's RX buffer is no longer empty. Because an application may not want to deal with URCs, choosing to poll instead, these URCs can be enabled/disabled with an AT command.

$EPDATA:<Endpoint ID>,<Endpoint URC event>

Endpoint URC Event:

0: The endpoint's RX buffer has transitioned from empty to not-empty, or offline data mode URCs have been enabled and there is data in the endpoint's RX buffer, or the end of a packet/message/file has been retrieved and there is more data to be read in the RX buffer.

1: The endpoint's TX buffer has transitioned from full to not-full, or offline data mode URCs have been enabled, and the endpoint's TX buffer is not full.

Examples:

Write the last part of a packet/message/file to an endpoint, resulting in it becoming full. Sometime later, the endpoint’s TX buffer becomes non-full, allowing more data to be written:

```
AT$EPWRITE=1,1,"4745540D0A"
$EPWRITE: "327004000672",0,1,2          (only two bytes were enqueued)
OK

(some time passes)

$EPDATA: "327004000672",0,1,1

(now the application can finish writing the rest of the data)

AT$EPWRITE=1,1,"540D0A"
$EPWRITE: "327004000672",0,1,3
OK
```

Try to read data from an endpoint, but the endpoint is empty. The application waits until some data is available and then tries again.

```
AT$EPREAD=1,256
$EPREAD: "327004000672",0,1,0,0,""
OK

(some time passes)

$EPDATA: "327004000672",0,1,0

(now the application can read some data)

AT$EPREAD=1,256
$EPREAD: "327004000672",0,1,2,0,"5441"
OK
```

Read data from an endpoint, and the last two bytes of a packet/message/file are read. There is more data in the RX buffer, so an $EPDATA URC is generated.

```
AT$EPREAD=1,256
$EPREAD: "327004000672",0,1,2,1,"0D0A"
OK
$EPDATA: "327004000672",0,1,0
```

22 FTP Operations

The FTP operations allow the user to perform simple file operations on a remote FTP server, such as Make Directory, Delete Directory, Rename File, and Delete File. The operations can be performed immediately, or triggered by any system event.

The FTP operations are performed on a remote FTP server that is configured with the EServer commands. First, a session connection must be opened. All of the FTP operations must be performed on a connection that is already opened. When finished, the connection can be closed.

The FTP command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

22.1 FTP Command Events

The events below are generated by the FTP commands. They may be used to trigger any action in the software that accepts events.

The Event Type is 55 (0x37) for the FTP Server. The Event ObjectId is the EServerId value.

Name	EventId	Description
SESSION_OPEN	1	Session opened with the server
SESSION_CLOSE	2	Session closed
MKDIR_DONE	3	MKDIR command completed
CWD_DONE	4	CWD command completed
DELDIR_DONE	5	DELDIR command completed
	6	reserved
DEL_DONE	7	DEL command completed
REN_DONE	8	REN command completed
DONE	9	Operation completed
DATA_OPEN	10	Data connection opened with the server
ERROR	11	General error occurred
FILE_ERROR	12	File unavailable
LOGIN_ERROR	13	Username or password error
PEER_CLOSE	14	Peer closed

22.2 FTP Commands

The following commands are supported:

- AT$FTPOPEN – Command to open a session connection with a remote FTP server.
- AT$FTPCLOSE – Command to close a session.
- AT$FTPMKDIR – Command to create a new directory.
- AT$FTPCWD – Command to change the current working directory.
- AT$FTPDELDIR – Command to delete a directory.
- AT$FTPDEL – Command to delete a file.
- AT$FTPREN – Command to rename a file.

22.3 AT$FTPOPEN

This command defines the parameters for opening a new session with a remote FTP server. The server address, port, username, and password are defined by the EServer commands. The EServer record does not have to exist at the time this command is entered, but must exist when the operation is triggered and performed.

A session must be opened before any of the other operations can be performed.

22.3.1 Action Command

The following shows the command (in bold) to define the parameters and event labels for the OPEN:

AT$FTPOPEN=<EServerId>,<eventLabel>[…,<eventLabel>]
$FTPOPEN: "<deviceId>",<status>
(OK I ERROR)

22.3.2 Immediate Command

If <eventLabel> is 0, then the OPEN operation is performed immediately. The EServer record must already exist:

AT$FTPOPEN=<EServerId>,0
$FTPOPEN: "<deviceId>",<status>
(OK I ERROR)

22.3.3 Delete OPEN parameters

If <EServerId> is the only parameter given, then the OPEN parameters for that server are deleted and removed from NVM:

AT$FTPOPEN=<EServerId>
$FTPOPEN: "<deviceId>",<status>
(OK I ERROR)

22.3.4 **Read Command**

The following shows the command (in bold) to query the parameters and event labels for the defined OPEN commands:

AT$FTPOPEN?
$FTPOPEN: "<deviceId>",<status>,<EServerId>,<eventLabel>…,<eventLabel>
…(list of defined OPEN commands)…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<EServerId>	The Id of the EServer which specifies the remote FTP server.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the OPEN. There may be from 0 to 10 values. A null or 0 value specifies "immediate". Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM.
1050	Invalid Parameter Value.
1052	Record already defined.
1055	Invalid EServer Id.
1066	Invalid event.
other	Refer to the appendix.

22.3.5 **Examples**

The following example opens a session on the remote server when the device acquires a GPRS connection. For that, use the event for IP Address Changed (see section 12.1):

```
AT$ESERVER=3,ftp.example.com,,"myid","mypwd"
AT$FTPOPEN=3,00320001
```

22.4 AT$FTPCLOSE

This command defines the parameters for deleting a directory folder on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed. The directory must be empty.

The command syntax and parameters are identical to the AT$FTPOPEN command. Please refer to that command for details.

22.5 AT$FTPMKDIR

This command defines the parameters for creating a new directory folder on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed.

22.5.1 **Action Command**

The following shows the command (in bold) to define the parameters and event labels for the MKDIR:

```
AT$FTPMKDIR=<EServerId>,<dirName>[,<eventLabel>[…,<eventLabel>]]
$FTPMKDIR: “<deviceId>”,<status>
(OK I ERROR)
```

22.5.2 **Immediate Command**

If <eventLabel> is omitted or is 0, then the MKDIR operation is performed immediately:

```
AT$FTPMKDIR=<EServerId>,<dirName>
$FTPMKDIR: “<deviceId>”,<status>
(OK I ERROR)
```

22.5.3 **Delete MKDIR parameters**

If <EServerId> is the only parameter given, then the MKDIR parameters for that server are deleted and removed from NVM. This command does not invoke the mkdir operation during the session:

```
AT$FTPMKDIR=<EServerId>
$FTPMKDIR: “<deviceId>”,<status>
(OK I ERROR)
```

22.5.4 **Read Command**

The following shows the command (in bold) to query the parameters and event labels for the defined MKDIR commands:

AT$FTPMKDIR?
$FTPMKDIR:
"<deviceId>",<status>,<EServerId>,<dirName>,<eventLabel>…,<eventLabel>
…(list of defined MKDIR commands)…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<EServerId>	The Id of the EServer which specifies the remote FTP server.
<dirName>	The name of the directory to be created.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the MKDIR. There may be from 0 to 10 values. A null or 0 value specifies "immediate". Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM.
1017	Invalid name.
1050	Invalid Parameter Value.
1052	Record already defined.
1055	Invalid EServer Id.
1066	Invalid event.
other	Refer to the appendix.

22.5.5 **Examples**

The following example opens a session on the remote server when the device acquires a GPRS connection. For that, use the event for IP Address Changed, 00320001 (see section 12.1):

```
AT$ESERVER=3,ftp.example.com,,"myid","mypwd"
AT$FTPOPEN=3,00320001
```

A new directory will be created every time a new session is opened. The name of the directory will include the device Id. The <eventLabel> for “Session opened” is 00370301 (see section 22.1):

```
AT$FTPMKDIR=3,"D%deviceid%",00370301
```

Change to the new directory when it is created. The <eventLabel> for “Directory created” is 00370303

```
AT$FTPCWD=3,"D%deviceid%",00370303
```

22.6 AT$FTPCWD

This command defines the parameters for changing the working directory on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed. This sets the directory that will be used for the REN and DEL commands. The directory must exist when this operation is performed.

The command syntax and parameters are identical to the AT$FTPMKDIR command. Please refer to that command for details.

22.7 AT$FTPDELDIR

This command defines the parameters for deleting a directory folder on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed. The directory must be empty.

The command syntax and parameters are identical to the AT$FTPMKDIR command. Please refer to that command for details.

22.8 AT$FTPDEL

This command defines the parameters for deleting a file on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed. The file must exist when this operation is performed.

22.8.1 **Action Command**

The following shows the command (in bold) to define the parameters and event labels for the DEL:

AT$FTPDEL=<EServerId>,<fileName>[,<eventLabel>[…,<eventLabel>]]
$FTPDEL: “<deviceId>”,<status>
(OK I ERROR)

22.8.2 **Immediate Command**

If <eventLabel> is omitted or is 0, then the Delete is performed immediately:

```
AT$FTPDEL=<EServerId>,<fileName>
$FTPDEL: “<deviceId>”,<status>
(OK I ERROR)
```

22.8.3 **Delete DEL parameters**

If <EServerId> is the only parameter given, then the DEL parameters for that server are deleted and removed from NVM:

```
AT$FTPDEL=<EServerId>
$FTPDEL: “<deviceId>”,<status>
(OK I ERROR)
```

22.8.4 **Read Command**

The following shows the command (in bold) to query the parameters and event labels for the defined DEL commands:

```
AT$FTPDEL?
$FTPDEL:
“<deviceId>”,<status>,<EServerId>,<fileName>,<eventLabel>…,<eventLabel>
…(list of defined DEL commands)…
(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<EServerId>	The Id of the EServer which specifies the remote FTP server.
<fileName>	The name of the file to be deleted.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the DEL. There may be from 0 to 10 values. A null or 0 value specifies “immediate”. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM.
1017	Invalid name.
1050	Invalid Parameter Value.
1052	Record already defined.
1055	Invalid EServer Id.
1066	Invalid event.
other	Refer to the appendix.

22.8.5 **Examples**

The following example deletes a file on the FTP server when Timer 1 expires.

Open a session on the remote FTP server when Timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1):

```
AT$ESERVER=3,ftp.example.com,,"myid","mypwd"
AT$FTPOPEN=3,00020103
```

Delete the file when the session is opened. The <eventLabel> is 00370301 (see section 22.1):

```
AT$FTPDEL=3,"destfile.dat",00370301
```

Close the session when the delete is finished. The <eventLabel> is 00370307 (see section 22.1):

```
AT$FTPCLOSE=3,00370307
```

22.9 AT$FTPREN

This command defines the parameters for renaming a file on a remote FTP server. The server is referenced with an EServer Id. A session must be opened before this operation is performed.

This command may also be used to move a file between directories on the server.

22.9.1 **Action Command**

The following shows the command (in bold) to define the parameters and event labels for the REN:

AT$FTPREN=<EServerId>,<fileName>,<newName>[,<eventLabel>[…,<eventLabel>]]

$FTPREN: “<deviceId>”,<status>
(OK I ERROR)

22.9.2 **Immediate Command**

If <eventLabel> is omitted or is 0, then the Rename is performed immediately:

AT$FTPREN=<EServerId>,<fileName>,<newName>
$FTPREN: “<deviceId>”,<status>
(OK I ERROR)

22.9.3 **Delete REN parameters**

If <EServerId> is the only parameter given, then the REN parameters for that server are deleted and removed from NVM:

AT$FTPREN=<EServerId>
$FTPREN: “<deviceId>”,<status>
(OK I ERROR)

22.9.4 **Read Command**

The following shows the command (in bold) to query the parameters and event labels for the defined REN commands:

AT$FTPREN?
$FTPREN:
“<deviceId>”,<status>,<EServerId>,<fileName>,<newName>,<eventLabel>…,<eventLa
bel>
…(list of defined REN commands)…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<EServerId>	The Id of the EServer which specifies the remote FTP server.
<fileName>	The path and name of the file to be renamed.
<newName>	The new path and name of the file.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the REN. There may be from 0 to 10 values. A null or 0 value specifies “immediate”.

	Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM.
1017	Invalid name.
1050	Invalid Parameter Value.
1052	Record already defined.
1055	Invalid EServer Id.
1066	Invalid event.
other	Refer to the appendix.

22.9.5 **Examples**

The following example uploads tag 3 to the FTP server when Timer 1 expires. When the upload is finished, the file is renamed with a name that includes the current timestamp.

Open a session on the remote server when the device acquires a GPRS connection. For that, use the event for IP Address Changed, 00320001 (see section 12.1):

```
AT$ESERVER=3,ftp.example.com,,"myid","mypwd"
AT$FTPOPEN=3,00320001
```

Start the tag upload when Timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1):

```
AT$TAGUPLOADFTP=1,3,"destfile.dat",3,0,0,00020103
```

Rename the file when it has been uploaded. The <eventLabel> for “Tag 3 Upload complete ” is 000C030F (see section 24.1):

```
AT$FTPREN=3,"destfile.dat","F%hourint%%second%.txt",000C030F
```

23 SMS Alerting

The software can send an SMS alerting message when any system event occurs. The contents of the message can contain string tokens, so the text can be variable. The SMS message can be sent to a list of phone numbers.

23.1 SMS Alerting Events

The events below are generated by the SMS Alerting commands. They may be used to trigger any action in the software that accepts events.

The Event Type is 17 (0x11) for SMS. The Event ObjectId is the SMS objectId value.

Name	EventId	Description
SENDSMS_STARTED	1	A SENDSMS process started.
SENDSMS_DONE	2	The SMS message was sent to all numbers in the list.
SENDSMS_ERROR	3	An error occurred during a send.

23.2 Commands

The following commands are supported:

- AT$STRINGLIST – Command to define a list of strings, such as phone numbers.
- AT$SENDSMSLIST – Command to send an SMS message to a list of phone numbers.

23.3 AT$STRINGLIST

This command defines and queries lists of strings.

23.3.1 **Action Command**

The following shows the command (in **bold**) to define a list of strings:

AT$STRINGLIST=<listId>,<type>,<string1>[…,<stringN>]
$STRINGLIST: "<deviceId>",<status>
(OK I ERROR)

23.3.2 **Delete**

If <listId> is the only parameter given, then that list is deleted and removed from NVM:

AT$STRINGLIST=<listId>
$STRINGLIST: "<deviceId>",<status>
(OK I ERROR)

23.3.3 **Read Command**

The following shows the command (in **bold**) to query the defined lists:

AT$STRINGLIST?
$STRINGLIST: “<deviceId>”,<status>,<listId>,<type>,“<string1>”…,“<stringN>”
…(all defined lists)…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<listId>	The Identifier of the list (1-20).
<type>	The type of string. This is used to validate the format: 0 = Free form string, no checking. 1 = Phone number. Must be numeric, first character may be ‘+’. 2 = Email address. Must be printable non-space characters. 3 = Web address. Must be printable non-space characters.
<stringN>	The strings contained in the list. There may be from 1 to 10 strings.

<status>	Description
0	Success
1012	Error saving data to NVM.
1050	Invalid Parameter Value.
1052	Record already defined.
other	Refer to the appendix.

23.3.4 **Examples**

The following example defines STRINGLIST 1 as a list of three phone numbers:

```
AT$STRINGLIST=1,1,9195551234,9195554567,9195554321
```

23.4 AT$SENDSMSLIST

This command defines the parameters for sending an SMS message to a list of phone numbers. The list of phone numbers is defined by the AT$STRINGLIST command. The string list record does not have to exist at the time this command is entered, but must exist when the operation is triggered and performed. The SMS may be sent immediately, or triggered by any event. This command creates an SMS endpoint to send the messages.

An event is generated when the send is triggered to start. Another event is generated after sending to all numbers in the list. If the send fails to one destination, the operation will continue with the remainder of the list.

The command parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

This command is similar to AT$STRINGSENDSMS, except that command only supports a single destination phone number.

23.4.1 **Action Command**

The following shows the command (in **bold**) to define the parameters and event labels for sending the SMS message:

AT$SENDSMSLIST=<sendSmsListId>,<listId>,"<msgString>"[,<eventLabel>[...,<eventLabel>]]
$SENDSMSLIST: "<deviceId>",<status>
(OK I ERROR)

23.4.2 **Immediate Command**

If no <eventLabel> is entered, or its value is 0, then the <msgString> is sent immediately. The listId record must exist:

AT$SENDSMSLIST=<sendSmsListId>,<listId>,"<msgString>"[,0]
$FTPOPEN: "<deviceId>",<status>
(OK I ERROR)

23.4.3 **Delete**

If <sendSmsListId> is the only parameter given, then that record is deleted and removed from NVM:

AT$SENDSMSLIST=<sendSmsListId>
$SENDSMSLIST: "<deviceId>",<status>
(OK I ERROR)

23.4.4 **Read Command**

The following shows the command (in **bold**) to query the defined SEND records:

AT$SENDSMSLIST?
$SENDSMSLIST: “<deviceId>”,<status>,<sendSmsListId>,<listId>,“<msgString>”,
<eventLabel>…,<eventLabel>
…(all defined records)…
(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The Id of the modem.
<status>	The status of the command.
<sendSmsListId>	The SENDSMSLIST record Identifier (1-20).
<listId>	The STRINGLIST identifier specifies the list of destination phone numbers.
<msgString>	The content of the SMS message, which may contain string tokens. The tokens will be evaluated when the message is sent.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the sending of the SMS. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1012	Error saving data to NVM.
1050	Invalid Parameter Value.
1052	Record already defined.
1066	Invalid Event.
other	Refer to the appendix.

23.4.5 **Examples**

The following example defines SENDSMSLIST 1 To send an SMS message containing the current time to StringList 1, which contains three phone numbers. The message will be sent every 60 minutes, when Timer 1 expires.

Start Timer 1 with a duration of 36000 (60 minutes). It is started immediately and upon system reboot (00010002) and re-started when it expires (00020103).

```
AT$TIMERSTART=1,36000,0,00010002,00020103
```

Define STRINGLIST 1 with the list of phone numbers.

```
AT$STRINGLIST=1,1,9195551234,9195554567,9195554321
```

Define the SMS message to be sent upon Timer 1 expiration. The SMS message will be sent to all three phone numbers.

```
AT$SENDSMSLIST=1,1,"Alert at %hourint%:%minute%",00020103
```

An example of the SMS message is: “Alert at 14:25”

24 TAG File System

The Tag file system allows the user to store files in a flat file system. The files are accessed via indexes (or Tags) between 1 and 499.

24.1 Tag Events

These events are generated by the general Tag subsystem. The EventType is 12 for tags. The ObjectId for the event is the tag id, when available. See section 5 for more about events.

Name	EventId	Description
Initialization Complete	1	Tag Subsystem initialization is complete
Format Started	2	Format of the Tag FLASH memory has started
Format Complete	3	Format of the Tag FLASH memory has completed
Recompact Started	4	Recompact of the Tag FLASH memory has started
Recompact Complete	5	Recompact of the Tag FLASH memory has completed
Tag Created	6	Tag was created. Data can now be written .
Tag Closed	7	Tag was closed. No more data can be written.
Tag Deleted	8	Tag was deleted. Space will be available after the next recompact.
Tag Download Started	9	Data is being written to the tag.
Tag Download Aborted	10	Download was aborted.
Tag Download completed	11	Download completed.
Tag Download Error	12	Download error.
Tag Upload started	13	Data is being read from the tag.
Tag Upload Aborted	14	Upload aborted.
Tag Upload completed	15	Upload completed.

Tag Upload Error	16	Upload Error.
Install Started	17	Firmware is being installed.
Install Completed	18	Install Completed.
Install Error	19	Install Error.

24.2 System Variables

This subsystem defines System Variables to hold the tag memory status. The Subsystem Id is the same as the Tag EventType (12 or 0x0C):

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
000C01	tagmemtotal	Tag memory total bytes		yes
000C02	tagmemdel	Tag memory deleted bytes		yes
000C03	tagmemfree	Tag memory free bytes		yes
000C04	tagrecompact	Tag recompact flag. 1=Recompact on next reset.	yes	yes

24.3 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
tagmemtotal	Tag memory total bytes	–	–
tagmemdel	Tag memory deleted bytes	–	–
tagmemfree	Tag memory free bytes	–	–
tagrecompact	Tag recompact flag. 1=Recompact on next reset.	–	–

24.4 Endpoint Configuration

Tags may be accessed via direct AT commands like AT$TAGREAD and AT$TAGWRITE. But they may also be accessed via Tag-Read and Tag-Write endpoints.

Tag-Write endpoints can only receive data from upstream endpoints and then write that data to the tag. Tag-Write endpoints are terminal endpoints, which means they do not return information to the upstream endpoint and do not forward data downstream. Tag-Write endpoints terminate an endpoint chain.

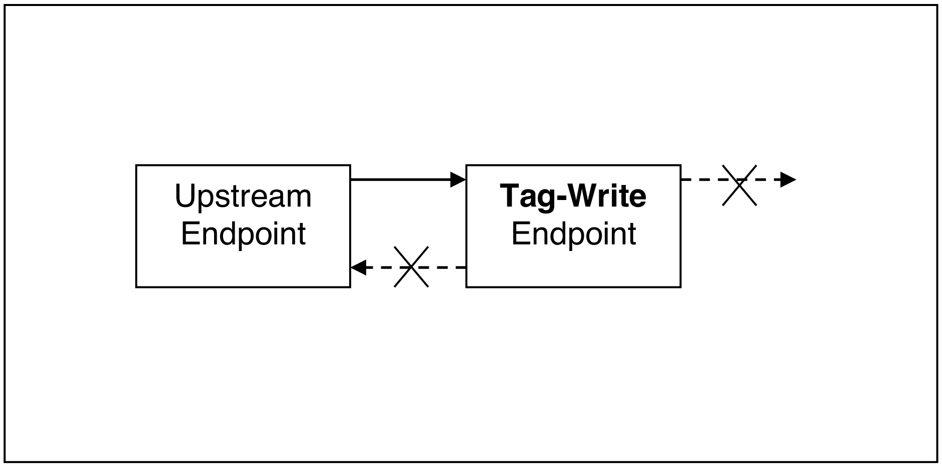


Figure 5. **Tag-Write Endpoint**

Tag-Read endpoints can only read data from a tag and then send data to downstream endpoints. Tag-Read endpoints are source endpoints, which means they do not receive information from an upstream endpoint and do not accept data from the downstream endpoint. Tag-Read endpoints begin an endpoint chain.

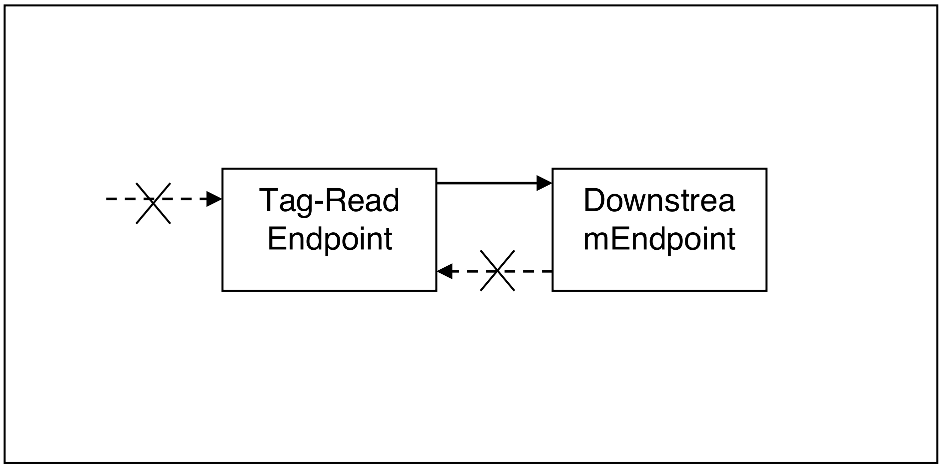


Figure 6. **Tag-Read Endpoint**

24.4.1 **Tag Endpoint Events**

These events are generated by Tag Endpoints. The EventType is 117 for Tag Write endpoints, and 122 for Tag Read endpoints. The ObjectId for the event is the tag id, when available. See section 5 for more about events.

Name	EventType	EventId	Description

Tag Write Buf Empty	117	1	Tag Write endpoint buffer is empty.
Tag Write Error	117	2	Tag write error
Tag Read Start	122	1	Tag read started.
Tag Read Done	122	2	All tag data has been read.

24.4.2 **AT$ENDPOINT**

The AT command used to create a Tag endpoint is part of the general endpoint facility. The syntax and parameters that are unique to Tag endpoints are shown in the following sections. Endpoint settings can be set or read.

When a Tag endpoint is created it results in the Tag ID also being created in flash. If the ID already exists then creating the tag endpoint will fail. Only one Tag endpoint can be opened at a time. When the endpoint is deleted, this results in the Tag being closed. At this point AT$TAGREAD may be used to read back the Tag.

Action Command

The following shows the command (in bold) to configure settings for a Tag Endpoint.

For Tag-Write:

```
AT$ENDPOINT=<endpointId>,<protocol=14>,<tagId>[,<bufferSize>[,<fwdTimeout>
[,<fwdDataSize>[,<fwdCtrlChar>]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)
```

For Tag-Read:

```
AT$ENDPOINT=<endpointId>,<protocol=15>,<tagId>[,<delete>[,<bufferSize>
[,<fwdTimeout>[,<fwdDataSize>[,<fwdCtrlChar>]]]]]
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)
```

For Deletion:
Specifying only the Endpoint ID deletes the endpoint.

```
AT$ENDPOINT=<endpointId>
$ENDPOINT: ”<deviceId>”,<status>
(OK I ERROR)
```

Read Command

The following shows the command (in bold) to query the Endpoint settings. All defined records are displayed.

```
AT$ENDPOINT?
```

Output for a Tag-Write endpoint:
$ENDPOINT: ”<deviceId>”,<status>,<endpointId>,<protocol=14>,<tagId>,<bufferSize>,<fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Output for a Tag-Read endpoint:
$ENDPOINT: ”<deviceId>”,<status>,<endpointId>,<protocol=15>,<tagId>,<delete>,<bufferSize>, <fwdTimeout>,<fwdDataSize>,<fwdCtrlChar>

…<more records>…
(OK I ERROR)

Parameters

Command Parameter	Description
<endpoint Id>	The Id of the endpoint (1-49).
<protocol>	The type of endpoint being created: 14 = Tag-Write 15 = Tag-Read (See section 15 for full protocol ID table)
<tagId>	The tag index that you wish to operate on (1-499).
<delete>	Tag-Read only. Delete tag after successful transfer: 0 = Do not delete (default). 1 = Delete tag.
<bufferSize>	Size of the data buffer (10 – 100000 bytes). Default=7250
<fwdTimeout>	Time to wait before forwarding data (10 – 3600000 msec). Default=250msec
<fwdDataSize>	Number of bytes to buffer before forwarding data (10 – 100000). Default=1450
<fwdCtrlChar>	A control character to cause data to be forwarded. Enter a decimal value (0 – 31). For example, ETX = 3. (256+ = disabled). Default=disabled
<deviceId>	The Id of the modem.
<status>	The status of the command.

<status>	Description
0	Success
1012	Error saving data to NVM
1050	Invalid Parameter Value
1090	Invalid Endpoint Id
1093	Invalid Protocol
1100	Invalid Tag or tag does not exist
1101	Tag write in progress

1102	Tag is closed
1103	Tag memory error

24.5 Tag Commands

The following Tag commands are supported:

- AT$TAGFORMAT – command to format the tag file system.
- AT$TAGRECOMPACT – command to recompact the tag file system.
- AT$TAGINSTALL – command to install a firmware file.
- AT$TAGWRITE – command to create and write a new tag file.
- AT$TAGCLOSE – command to close a firmware file.
- AT$TAGDELETE – command to delete a tag file.
- AT$TAGREAD – command to read a tag file.
- AT$TAGSYSINFO – command to retrieve statistics for the tag file system.
- AT$TAGLISTALL – command to retrieve information on all defined tags.
- AT$TAGCREATE – command to create an empty tag file for later writing.
- AT$TAGDOWNLOADFTP – command to setup and query FTP tag downloads.
- AT$TAGDOWNLOADHTTP – command to setup and query HTTP tag downloads.
- AT$TAGUPLOADFTP – command to setup and query FTP tag uploads.
- AT$TAGUPLOADHTTP – command to setup and query HTTP tag uploads.

24.6 Tag Format

These commands allow the user to format the Tag file system. This will result in all tag files in the system being permanently deleted. The operation can take a long time. During this time no other Tag operations may take place.

24.6.1 **AT$TAGFORMAT**

Command to reformat the tag file system.

Action Command

The following shows the command (in bold) to start the format process. While the format is running, intermediate responses will be output indicating percentage completion.

AT$TAGFORMAT
$TAGFORMAT: ”<deviceId>”,<status>,<percentage>
(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.

<status>	The status of the command.
<percentage>	Percentage completion

<status>	Description
0	Success
1052	Format is already in progress.
1103	At least one tag still exists, or Recompact is in progress.

24.7 Tag Recompact

In some systems the Tag file system is implemented as a flat file system. In this case, deleting Tags can leave “holes” in the flash memory map. These commands allow the user to recompact the valid Tag files to free up FLASH memory for new files. The operation can take a long time. During this time no other Tag operations may take place. All tags must be closed before the recompact can start.

A recompact can be set up to be performed during initialization by setting the system variable “tagrecompact” flag to 1. This allows the application to control when it is performed. For example, it may be based on how much free or deleted tag memory there is. Several system variables are provided for this support (see section 24.2):

- tagmemtotal – Total number of bytes in the tag memory
- tagmemdel – Number of deleted bytes
- tagmemfree – Number of free bytes
- tagrecompact – If this flag is set to 1, then a recompact will be performed during the next restart. This will automatically close all open tags, recompact tag memory, then clear the flag after the recompact completes.

For example, the application can define VARIABLETHRESHOLDs for the memory. The threshold event can be used to trigger a VARIABLESET to set the recompact flag and cause a system reset. This will cause the recompact during the restart.

24.7.1 **AT$TAGRECOMPACT**

Command to recompact the tag file system.

Action Command

The following shows the command (in bold) to start the format process. While the recompact is running, intermediate responses will be output telling the user what percentage of the operation is complete.

AT$TAGRECOMPACT
$TAGRECOMPACT: ”<deviceId>”,<status>,<percentage>

(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<percentage>	Percentage complete with the recompact operation.

<status>	Description
0	Success
1052	Recompact is already in progress.
1103	Format is in progress, or a tag with unspecified size is open. It must be closed to allow Recompact.

24.8 Tag Install

After a file has been written to the Tag file system, it may be used to install an update of the cellular modem firmware or update the running software application. The install can be started immediately, or triggered later by any event. Only one tag install can be active at a time.

The Tag Install event labels are saved to NVM and restored after power cycles, unless there are none specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.8.1 **AT$TAGINSTALL**

Command to install a firmware update file.

Action Command

The following shows the command (in bold) to start the install process.

AT$TAGINSTALL=<tagId>[,<installType>[,<eventLabel>[…,<eventLabel>]]]
$TAGINSTALL: ”<deviceId>”,<status>
(OK I ERROR)

To delete the Install event labels for a tag, enter the command with the Tag Id as the only parameter:

AT$TAGINSTALL=<tagId>

To install a tag immediately, enter the command with the Tag Id and <eventLabel> = 0:

AT$TAGINSTALL=<tagId>,<installType>,0

Read Command

The following shows the command (in bold) to query the Tag Install settings.

AT$TAGINSTALL?
$TAGINSTALL:
”<deviceId>”,<status>,<tagId>,<installType>,<eventLabel>…,<eventLabel>

(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to install (1-499).
<installType>	The type of file to install: 0 = Modem firmware or software (*.dwl). Default. 1 = PIC firmware over UART2 (*.img).
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the install. There may be from 0 to 10 values. A 0 value specifies “immediate”, and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1052	Record is already defined, or in use.
1100	Invalid tag
1101	Tag write in progress
1103	Tag memory error

Examples

The following example installs tag 1 immediately. Tag 1 contains a dwl file for a new software version.

```
AT$TAGINSTALL=1,0,0
```

The next example configures tag 15 to be installed upon receiving the event for when tag 15 has been closed. Tag 15 contains a dwl file for a new software version. The <eventLabel> for Tag 15 Closed is 000C0F07 (see section 24.1).

Event Type = 12 for Tags
Object Id = 15 for Tag 15
Event Id = 7 for Tag Closed

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=12,15,7
$EVENTLABEL: "327004000672",0,"000c0f07"
OK

AT$TAGINSTALL=15,0,000c0f07
```

24.9 Tag Write

These commands convert the serial interface to data mode so the user can write data to a Tag, using either raw or X-Modem. If the Tag does not exist, it is created first with an unspecified size. If the Tag already exists and is still open, new data is appended. If the tag is closed, it must first be deleted using AT$TAGDELETE. Writing is terminated when X-Modem signals the end of file or when the serial port exits data mode with “+++’.

Files that are transferred with X-Modem may have file pad characters of 0x1A appended on the end. This is a result of the X-Modem protocol not supporting exact files sizes, and always sending complete block sizes. This is normally not a problem with executable or binary files because the characters will be ignored. But for text files, the application may wish to strip the characters.

Note: If a tag file is created with an unspecified size, then no other tag files may be open for writing at the same time. The file must be closed to allow other tag files to be written. A power cycle automatically closes all tags.

24.9.1 **AT$TAGWRITE**

Command to create and write a new tag.

Action Command

The following shows the command (in bold) to write to a tag.

AT$TAGWRITE=<tagId>,<xmodem>

$TAGWRITE: ”<deviceId>”,<status>
(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to write(1-499).
<xmodem>	0: No X-Modem. Just send the file direct. 1: Use X-Modem or X-Modem 1K to transfer the file.

<status>	Description
0	Success
1100	Invalid Tag
1102	Tag is closed (read-only).

Example

The following example creates tag 3 with data from the serial port.

```
AT$TAGWRITE=3,0

// To end the raw data transfer, enter:
+++

// Close the tag:
AT$TAGCLOSE=3,0
```

24.10 Tag Close

After data has been written to a Tag file, it may be closed so that no more writes are allowed to it. The close can be done immediately, or triggered later by any event. A power cycle automatically closes all tags.

The Tag Close event labels are saved to NVM and restored after power cycles, unless there are none specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.10.1 AT$TAGCLOSE

Command to close a tag file.

Action Command

The following shows the command (in bold) to define the Tag Close settings.

AT$TAGCLOSE=<tagId>[,<eventLabel>[…,<eventLabel>]]

```
$TAGCLOSE: ”<deviceId>”,<status>
(OK I ERROR)
```

To delete the Close event labels for a tag, enter the command with the Tag Id as the only parameter:

AT$TAGCLOSE=<tagId>

To close a tag immediately, enter the command with the Tag Id and <eventLabel> = 0:

AT$TAGCLOSE=<tagId>,0

Read Command

The following shows the command (in bold) to query the Tag Close settings.

AT$TAGCLOSE?

```
$TAGCLOSE: ”<deviceId>”,<status>,<tagId>,<eventLabel>…,<eventLabel>

(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to close (1-499).
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the install. There may be from 0 to 10 values. A 0 value specifies “immediate”, and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1052	Record is already defined, or in use.
1100	Invalid tag

Examples

The following example closes tag 1 immediately.

```
AT$TAGCLOSE=1,0
```

The next example configures tag 15 to be installed upon receiving the event for when tag 15 has completed being downloaded. The <eventLabel> for Tag 15 Download Complete is 000C0F0B (see section 24.1).

Event Type = 12 for Tags
Object Id = 15 for Tag 15
Event Id = 11 for Download Complete

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=12,15,11
$EVENTLABEL: "327004000672",0,"000c0f0b"
OK

AT$TAGCLOSE=15,000c0f0b
```

24.11 Tag Delete

These commands delete a Tag file. The delete can be done immediately, or triggered later by any event.

The Tag Delete event labels are saved to NVM and restored after power cycles, unless there are none specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.11.1 AT$TAGDELETE

Command to delete a tag file.

Action Command

The following shows the command (in bold) to define the tag delete settings.

AT$TAGDELETE=<tagId>[,<eventLabel>[…,<eventLabel>]]
$TAGDELETE: ”<deviceId>”,<status>
(OK I ERROR)

To remove the Delete event labels for a tag, enter the command with the Tag Id as the only parameter. Note that this does not delete the tag file:

AT$TAGDELETE=<tagId>

To delete a tag file immediately, enter the command with the Tag Id and <eventLabel> = 0:

AT$TAGDELETE=<tagId>,0

Read Command

The following shows the command (in bold) to query the Tag Delete settings.

AT$TAGDELETE?
$TAGDELETE: "<deviceId>",<status>,<tagId>,<eventLabel>…,<eventLabel>

(OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to delete (1-499).
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the delete. There may be from 0 to 10 values. A 0 value specifies "immediate", and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1052	Record is already defined, or in use.
1100	Invalid Tag

Examples

The following example deletes tag 3 immediately.

```
AT$TAGDELETE=3,0
```

The next example configures tag 5 to be deleted upon receiving the event after tag 5 has been uploaded to a server. The <eventLabel> for Tag 5 Upload Complete is 000C050B (see section 24.1).

Event Type = 12 for Tags
Object Id = 5 for Tag 5
Event Id = 15 for Upload Complete

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=12,5,15
$EVENTLABEL: "327004000672",0,"000c050f"
OK

AT$TAGDELETE=5,000c050f
```

24.12 Tag Read

These commands are used to read a tag that has been created and written. There are two modes for the Tag Read command. The partial read will just return the file status such as file size. The full read will also dump the contents of the Tag to the serial port through a data mode session.

24.12.1 AT$TAGREAD

Command to read a tag.

Action Command

AT$TAGREAD=<tagId>,<fullRead>
$TAGREAD:
”<deviceId>”,<status>,<tagId>,<tagSize>,<spaceUsed>,<spaceRemaining>,<finalized>
(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to read (1-499).
<fullRead>	0: Partial Read. Return Stats only. 1: Full Read. Dump full contents.
<tagSize>	The maximum allowed size of the tag. If tag is finalized, this is the same as <spaceUsed>.

<spaceUsed>	The amount of space currently in use.
<spaceRemaining>	The amount of space remaining in the tag. 0 if the tag is finalized.
<finalized>	Whether the tag is finalized or not.

<status>	Description
0	Success
1100	Invalid Tag

24.13 Tag System Information

These commands allow the user to receive all of the statistics for the Tag system as a whole.

24.13.1 AT$TAGSYSINFO

Command to retrieve the Tag System statistics.

Action Command

AT$TAGSYSINFO
$TAGSYSINFO: ”<deviceId>”,<status>,<totalMemory>,<freeMemory>,<usedMemory>,
<deletedMemory>,<numberUsedTags>,<numberDeletedTags>
(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<totalMemory>	The total amount of FLASH memory available for tags
<freeMemory>	The amount of FLASH memory available for creating new tags.
<usedMemory>	The amount of FLASH memory used by valid tags
<deletedMemory>	The amount of FLASH memory taken up by deleted tags.
<numberUsedTags>	The number of valid tags currently stored.
<numberDeletedTags>	The number of tags that have been deleted.

<status>	Description
0	Success
1100	Invalid Tag

24.14 Tag List All

These commands return information on all the tags stored in the system. This amounts to calling a partial Tag Read on all valid tags in the system.

24.14.1 AT$TAGLISTALL

Command to retrieve a summary of all tags.

Action Command

AT$TAGLISTALL

```
$TAGLISTALL:
”<deviceId>”,<status>,<tagId>,<tagSize>,<spaceUsed>,<spaceRemaining>, <finalized>
$TAGLISTALL:
”<deviceId>”,<status>,<tagId>,<tagSize>,<spaceUsed>,<spaceRemaining>, <finalized>
…
(OK I ERROR)
```

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to read.
<tagSize>	The maximum allowed size of the tag. If tag is finalized, this is the same as <spaceUsed>.
<spaceUsed>	The amount of space currently in use.
<finalized>	Whether the tag is finalized or not.

<status>	Description
0	Success
1100	Invalid Tag

24.15 Tag Create

These commands create an empty tag file of a specified size for later writing. The creation can be done immediately, or triggered later by any event. A maximum file size can be specified so that multiple tag files may be open for writing at the same time. The size can also be unspecified, in which case only one tag file may be open for writing at a time. A file of unspecified size must be closed to allow other tag files to be written. A power cycle automatically closes all tags.

The Tag Create event labels are saved to NVM and restored after power cycles, unless there are none specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.15.1 AT$TAGCREATE

Command to create an empty tag file of a specified size for later writing.

Action Command

The following shows the command (in bold) to define the Tag Create settings.

```
AT$TAGCREATE=<tagId>[,<fileSize>[,<eventLabel>[…,<eventLabel>]]]
$TAGCREATE: ”<deviceId>”,<status>
(OK I ERROR)
```

To remove the Tag Create settings for a tag, enter the command with the Tag Id as the only parameter. Note that this does not delete the tag file if it has already been created:

```
AT$TAGCREATE=<tagId>
```

To create a tag file immediately, enter the command with the <eventLabel> = 0:

```
AT$TAGCREATE=<tagId>,<fileSize>,0
```

Read Command

The following shows the command (in bold) to query the Tag Create settings.

```
AT$TAGCREATE?
$TAGCREATE: ”<deviceId>”,<status>,<tagId>,<fileSize>,<eventLabel>…,<eventLabel>

(OK I ERROR)
```

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagId>	The ID of the tag to create (1-499).
<fileSize>	Maximum file size. If null or 0, then no other tag files may be written until this

	one is closed.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the create. There may be from 0 to 10 values. A 0 value specifies “immediate”, and can appear by itself or anywhere in the list. Use the AT$EVENTLABEL command to aid with encoding this parameter.

<status>	Description
0	Success
1052	Record is already defined, or in use.
1100	Invalid Tag
1103	Tag memory error

Examples

The following example creates tag 3 immediately.

```
AT$TAGCREATE=3,0
```

The next example configures tag 5 to be created upon receiving the event after tag 5 has been deleted, such as after an upload. The <eventLabel> for Tag 5 deleted is 000C0508 (see section 24.1).

Event Type = 12 for Tags
Object Id = 5 for Tag 5
Event Id = 8 for Tag Deleted

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=12,5,8
$EVENTLABEL: "327004000672",0,"000c0508"
OK
```

```
AT$TAGCREATE=5,000c0508
```

24.16 Tag Download

These commands initiate the download of data from an FTP or HTTP server to a newly created tag file. The download can be started immediately, or triggered by any event. Other optional parameters allow the file to be unzipped before writing to the tag file.

The Tag Download parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.16.1 AT$TAGDOWNLOADFTP and AT$TAGDOWNLOADHTTP

These commands initiate a download of data from an FTP or HTTP server to a newly created tag file. Both commands are identical, except for the type of server that is connected:

- AT$TAGDOWNLOADFTP – Connects to an FTP server.
- AT$TAGDOWNLOADHTTP – Connects to an HTTP server.

In the following sections, the command is shown as AT$TAGDOWNLOADxxx, where the "xxx" can be either "FTP" or "HTTP".

Action Command

The following shows the commands (in bold) to initiate a Tag Download session.

```
AT$TAGDOWNLOADxxx=<tagDownloadId>,<eServerId>,"<filename>",<tagId>
[,<decompress>[,<eventLabel>[…,<eventLabel>]]]
$TAGDOWNLOADxxx: "<deviceId>",<status>
OK I ERROR
```

The above command response indicates the status of the command and its parameters. If successful, then when triggered by an <eventLabel>, a connection will be established with the server, and the file transfer will begin. Unsolicited messages will be output to indicate the progress:

```
$TAGDOWNLOADxxx: "<deviceId>",<status>,<tagDownloadId>,<downloadStatus>
[,<detail>]
```

To delete a Tag Download Id, enter the command with the Tag Download Id as the only parameter:

```
AT$TAGDOWNLOADxxx=<tagDownloadId>
```

To abort an active download session, enter the command with <eServerId> = 0:

```
AT$TAGDOWNLOADxxx=<tagDownloadId>,0
```

Read Command

The following shows the command (in bold) to query the Tag Download settings.

```
AT$TAGDOWNLOADxxx?
$TAGDOWNLOADxxx:
"<deviceId>",<status>,<tagDownloadId>,<eServerId>,"<filename>",
<tagId>,<decompress>,<eventLabel>…,<eventLabel>

(OK I ERROR)
```

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagDownloadId>	Tag Download identifier (1-20).
<eServerId>	Endpoint Server Id. The Eserver contains the server's IP address, and optional port, username, and password. If <eServerId> = 0, it is a special case used to abort an download process already in progress.
<filename>	File path and name.
<tagId>	Tag file to be downloaded.
<decompress>	Not currently supported. Type of decompression performed on the tag file before writing to the tag file: 0 = None (default) 1 = zlib 2 = bzip
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the starting of the download. There may be from 0 to 10 values. A null or 0 value specifies "immediate" (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<downloadStatus>	Status of the download process: 1 = Connected to server and transfer is starting. 2 = Done. Tag file written. 3 = Login error. 4 = File not found. 5 = Server connection error. 6 = Startup error. 7 = Transfer aborted.
<detail>	Extra detail for <downloadStatus>: If <downloadStatus> = 1, 2, or 6 then <detail> = Tag Id.

<status>	Description
0	Success
1017	Invalid Filename
1052	Download session is active
1055	Invalid EServer Id
1100	Invalid Tag Id
1101	Tag write in progress
1102	Tag is closed
1103	Tag memory error

Examples

The following example creates TagDownload 1 that reads a file from the FTP server referenced by EServer 5 and writes it to Tag 3. Since no <eventLabel> is specified, the transfer begins immediately.

```
AT$ESERVER=5,ftp.example.com,,”myid”,”mypwd”
AT$TAGDOWNLOADFTP=1,5,"destfile.dat",3
```

The next example is the same as above, except that it does not begin the transfer until timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 1 for Timer 1
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,1,3
$EVENTLABEL: "327004000672",0,"00020103"
OK
```

```
AT$TAGDOWNLOADFTP=1,5,"destfile.dat",3,0,00020103
```

This command creates Timer 1 with a duration of 30 seconds:

```
AT$TIMERSTART=1,300
```

24.16.2 Firmware Upgrade (FOTA)

A special case for using the Tag Download and Install commands is to upgrade the device firmware over the air (FOTA). The AT Tag Download command can be used to setup the download session to be performed immediately or later when a system event occurs. The firmware file will be downloaded from the server and stored in a tag file. Then, to have the new firmware activated, the AT Tag Install command is used to load the tag file into execution memory and restart the device.

The device uses unsolicited REPORT messages to provide the status of the firmware upgrade process. Once the device starts the upgrade, it sends a REPORT message with an event indicating “FOTA download started”. After the upgrade is complete and the device has rebooted, it will send a REPORT message with an event indicating “FOTA upgrade complete”. See section 11.7 for details of the REPORT message.

Example

The following example creates TagDownload 1 that reads a firmware file from the FTP server referenced by EServer 5 and writes it to Tag 3. Since no <eventLabel> is specified, the transfer begins immediately.

```
AT$ESERVER=5,ftp.example.com,,”myid”,”mypwd”
AT$TAGDOWNLOADFTP=1,5,"newfirmware.dwl",3
```

After the download has completed, the new firmware file is installed and activated by the following command:

```
AT$TAGINSTALL=3,0,0
```

24.17 Tag Upload

These commands initiate the upload of data from a tag file to an FTP or HTTP server, or to a remote server using the binary protocol. The upload can be started immediately, or triggered by any event. Other optional parameters allow the file to be compressed before sending to the server, and to delete the tag after successful upload. The tag file must be closed before uploading it.

The uploads are performed on a remote server that is configured with the EServer commands. Currently, for FTP only, a server connection must be opened with AT$FTPOPEN before the upload can start. When finished, other FTP operations (such as AT$FTPREN) may be performed, or the connection can be closed.

The Tag Upload parameters are saved to NVM and restored after power cycles, unless there are no events specified. If the command is entered to be executed immediately, then nothing is saved to NVM.

24.17.1 AT$TAGUPLOADFTP and AT$TAGUPLOADHTTP

These AT commands initiate the upload of data from an existing tag file to an FTP or HTTP server. Both commands are identical, except for the type of server that is connected:

- AT$TAGUPLOADFTP – Connects to an FTP server.
- AT$TAGUPLOADHTTP – Connects to an HTTP server.

In the following sections, the command is shown as AT$TAGUPLOADxxx, where the "xxx" can be either "FTP" or "HTTP".

Action Command

The following shows the commands (in bold) to initiate a Tag Upload session.

AT$TAGUPLOADxxx=<tagUploadId>,<eServerId>,"<filename>",<tagId>[,<compress> [,<delete>[,<eventLabel>[…,<eventLabel>]]]]
$TAGUPLOADxxx: "<deviceId>",<status>
OK I ERROR

The above command response indicates the status of the command and its parameters. If successful, then when triggered by an <eventLabel>, a connection will be established with the server, and the file transfer will begin. Unsolicited messages will be output to indicate the progress:

$TAGUPLOADxxx: "<deviceId>",<status>,<tagUploadId>,<uploadStatus>[,<detail>]

To delete a Tag Upload Id, enter the command with the Tag Upload Id as the only parameter:

AT$TAGUPLOADxxx=<tagUploadId>

To abort an active upload session, enter the command with <eServerId> = 0:

AT$TAGUPLOADxxx=<tagUploadId>,0

Read Command

The following shows the command (in bold) to query the Tag Upload settings.

AT$TAGUPLOADxxx?

$TAGUPLOADxxx:
”<deviceId>”,<status>,<tagUploadId>,<eServerId>,”<filename>”,<tagId>,
<compress>,<delete>,<eventLabel>…,<eventLabel>

(OK I ERROR)

Parameter	Description
<deviceId>	The ID of the modem.
<status>	The status of the command.
<tagUploadId>	Tag Upload identifier (1-20).
<eServerId>	Endpoint Server Id. The Eserver contains the server’s IP address, and optional port, username, and password. If <eServerId> = 0, it is a special case used to abort an upload process already in progress.
<filename>	File path and name.
<tagId>	Tag file to be uploaded.
<compress>	Not currently supported. Type of compression performed on the tag file before uploading to the server: 0 = None (default) 1 = zlib 2 = bzip
<delete>	Delete the tag after successful transfer: 0 = Do not delete (default). 1 = Delete tag.
<eventLabel>	EventLabel in hex. This defines the event(s) that trigger the starting of the upload. There may be from 0 to 10 values. A null or 0 value specifies “immediate” (default). Use the AT$EVENTLABEL command to aid with encoding this parameter.
<uploadStatus>	Status of the upload process: 1 = Connected to server and transfer is starting. 2 = Done. Tag file written to server. 3 = Login error. 4 = File not found. 5 = Server connection error. 6 = Startup error. 7 = Transfer aborted.
<detail>	Extra detail for <uploadStatus>: If <uploadStatus> = 1, 2, or 6 then <detail> = Tag Id.

<status>	Description

0	Success
1017	Invalid Filename
1052	Upload session is active
1055	Invalid EServer Id
1100	Invalid Tag Id
1101	Tag is still open for writing. Must be closed before upload.
1103	Tag memory error

Examples

The following example creates TagUpload 1 that reads data from Tag 3 and sends it to an FTP server referenced by EServer 5. Since no <eventLabel> is specified, the transfer begins immediately.

```
AT$ESERVER=5,ftp.example.com,,”myid”,”mypwd”
AT$FTPOPEN=5,0
AT$TAGUPLOADFTP=1,5,"destfile.dat",3
```

The next example is the same as above, except that it does not begin the transfer until timer 1 expires. The <eventLabel> for Timer 1 expiration is 00020103 (see section 10.5.1).

Event Type = 2 for Timers
Object Id = 1 for Timer 1
Event Id = 3 for Timer Expiration

The AT$EVENTLABEL command can be used to assist with encoding the correct hex value:

```
AT$EVENTLABEL=2,1,3
$EVENTLABEL: "327004000672",0,"00020103"
OK
```

```
AT$TAGUPLOADFTP=1,5,"destfile.dat",3,0,0,00020103
```

This command creates Timer 1 with a duration of 30 seconds:

```
AT$TIMERSTART=1,300
```

25 GPIO

These commands are used to manipulate GPIOs.

- AT$GPIOCONFIG
- AT$GPIOREAD
- AT$GPIOWRITE
- AT$GPIOACTION
- AT$GPIOACTIONMULTI

25.1 Events

The GPIO subsystem generates events that may be used to trigger actions in other subsystems. These are the GPIO events available:

Event ID	Event Name	Description
1	Input Low	This Event is triggered when a GPIO input changes from High to Low.
2	Input High	This Event is triggered when a GPIO input changes from Low to High.
3	Output Low	This event is triggered when a GPIO output is changed to low
4	Output Hi	This event is triggered when a GPIO output is changed to high

25.2 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
gpio	Status of GPIO pin	–	pin

25.3 AT$GPIOCONFIG

The $GPIOCONFIG command allocates and configures system GPIOs. It has five modes, mode 0 deallocates a GPIO, mode 1 allocates and configures a GPIO, modes 2 and 3 show status and capabilities, and modes 4 and 5 save and delete the current GPIO configuration to and from flash.

25.3.1 **Action Command**

Mode = 0: Deallocate the GPIO
AT$GPIOCONFIG=<mode>[,<gpioId>]

(OK I ERROR)

Mode=1: Allocate and set the GPIO configuration
AT$GPIOCONFIG=<mode>,<gpioId>,<gpioDir>[,<gpioVal>]
(OK I ERROR)

Mode=2: List the current GPIO status for all GPIO (allocated or not)
AT$GPIOCONFIG=<mode>
$GPIOCONFIG: "<deviceId>",<status>,<gpioId>,<gpioStatus>
[$GPIOCONFIG: <gpioId>,<gpioStatus>[…]]
(OK I ERROR)

Mode=3: List the GPIO capabilities for all GPIO (allocated or not)
AT$GPIOCONFIG=<mode>
$GPIOCONFIG: "<deviceId>",<status>,<gpioId>,<gpioAccess>
[$GPIOCONFIG: <gpioId>,<gpioAccess>[…]]
(OK I ERROR)

Mode=4: Save the current GPIO configurations to NVM
Mode=5: Delete the current GPIO configuration from NVM
AT$GPIOCONFIG=<mode>
(OK I ERROR)

25.3.2 **Read Command**

AT$GPIOCONFIG?
$GPIOCONFIG: "<deviceId>",<status>,<gpioId>,<gpioVal>
(OK I ERROR)

Parameters

Parameter	Description
<mode>	0 = Delete GPIO configuration 1 = Configure GPIO 2 = List current status for all GPIOs (allocated or not) 3 = List the GPIO capabilities for all GPIO (allocated or not) 4 = Save the current gpio configurations to NVM 5 = Delete the current gpio configuration from NVM
<gpioId>	GPIO name. See product specification for supported GPIOs.
<status>	The status of the command.
<gpioDir>	0 = Input

	1 = Output
<gpioVal>	0 = Low 1 = High
<gpioStatus>	0 = Input 1 = Output 3 = Not available 4 = Available
<gpioAccess>	Bit 1 Output is readable Bit 2 Input is writable
<deviceId>	The ID of the modem.

<status>	Description
0	Success

25.4 AT$GPIOREAD

The $GPIOREAD command is used to read the level of one or more allocated GPIOs.

25.4.1 **Action Command**

AT$GPIOREAD=<gpioId>[,...<gpioIdN>]
$GPIOREAD:"<deviceId>",<status>,<gpioId>,<gpioVal>
[$GPIOREAD:"<deviceId>",<status>,<gpioId>,<gpioVal>]
(OK I ERROR)

25.4.2 **Read Command**

None

See AT$GPIOCONFIG for definition of parameters.

25.5 AT$GPIOWRITE

The $GPIOWRITE command is used to set the value for one or more allocated GPIO outputs.

25.5.1 **Action Command**

AT$GPIOWRITE=<level>,<gpioId>[,...<gpioIdN>]
$GPIOWRITE:"<deviceId>",<status>,<GpioId>,<level>

[$GPIOWRITE:“<deviceId>”,<status>,<GpioId>,<level>]
(OK I ERROR)

25.5.2 **Read Command**

None

See AT$GPIOCONFIG for definition of parameters

25.6 AT$GPIOACTION

This command allows you to define the read or write actions on a single GPIO based on one or more events. If no events are defined the action is taken immediately. This command requires that the GPIOs first be configured by the $GPIOCONFIG or SETGPIOCONFIG command.

AT$GPIOACTION=<ID>[,<action>,<gpioID1>,<eventLabel1>,[,...<eventLabelN>]
$GPIOACTION: “<deviceId>”,<status>,<gpioActionId>,<action>,
<gpioId>,<eventLabel1>[,...<eventLabelN>]]
(OK I ERROR)

Parameter	Description
<ID>	User designated value for this GPIO action
<action>	Operation to be performed by GPIO: 0 - Write output level LOW 1 - Write output level HIGH 2 - Toggle output level 3 - READ
<eventLabel>	Event to trigger the GPIO action.

See AT$GPIOCONFIG for more definition of parameters.

25.7 AT$GPIOACTIONMULTI

This command allows you to define the read or write actions on multiple GPIOs based on one event. This command requires that the GPIOs first be configured by the $GPIOCONFIG or SETGPIOCONFIG command.

Command:	AT$GPIOACTIONMULTI=<ID>,<action>,<eventLabel>,<gpioId1>[,...<gpioIdN>]
Response:	AT$GPIOACTIONMULTI=“<deviceId>”,<status>,<gpioActionId>,<action>,<eventLabel>,<gpioId1>[,...<gpioIdN>]] (OK I ERROR)

Unsolicited response (read action)	$GPIORDEVT:“<deviceId>”,<status>,<ID>,<gpioId>,<gpioVal>

See AT$GPIOACTION and AT$GPIOCONFIG for definition of parameters.

25.8 Examples

This example defines GPIO 29 to go high when an incoming call event is detected. It also reads the GPIO and stores the configuration.

```
AT$GPIOCONFIG=1,29,1,0              //Configure GPIO29 as an output with
OK                                  //value 0
AT$GPIOACTION=1,1,29,00070004       //Configure GPIO29 to go high when an
                                    //incoming call is detected
$GPIOACTION: "327004006981",0,1,1,29,"00070004"
OK
AT$GPIOREAD=29                       //Read GPIO 29
$GPIOREAD: "327004006981",0,"GPIO29",0
OK
AT$GPIOCONFIG=4                      //Save the current GPIO configuration
OK
```

26 Voice Call System

26.1 Overview

The Voice Call system provides commands to originate, answer, and hang up voice calls. It also offers a subscription to unsolicited voice call events, such as incoming calls.

The software event system used together with the Voice Call commands, enables a user to configure simple or complex scenarios such as:

- Make a voice call when a specified sequence of GPIO state changes have occurred
- Answer a call if the call comes from a list of specified phone numbers

To use the Voice Call commands, the Voice Call system must first be enabled with the command AT$VOICECALL. This command also enables and disables unsolicited Voice Call event responses.

This is a list of the Voice call system's AT commands:

- AT$VOICECALL
- AT$CALLSTART
- AT$CALLANSWER
- AT$CALLHANGUP

26.2 Event Ids

Below is a list of all the events that are generated by the Voice Call system.

Event Id	Event Name
1	Call dialing (originated OK)
2	Call origination failed
3	Call alerting (ringing at the other end)
4	Incoming call
5	Call ended (any reason)
6	Call is in active state
7	Audio path opened

26.3 AT$VOICECALL

This command has two purposes; Enables or disable the Voice call system which activates the Voice Call commands, and enables or disables unsolicited Voice Call events and responses.

This command has two purposes; Enable or disable the Voice call system which activates the Voice Call commands, and enable or disable unsolicited Voice Call events and responses.

After the Voice call system is activated, it is not recommended to use the “standard” voice call commands, such as ATD, ATA, etc.

26.3.1 **Action Command/Response**

Sets the current settings.

Command:	AT$VOICECALL=<mode>[,<monitor>]
Response:	$ VOICECALL: “<deviceId>”,<status> OK

26.3.2 **Read Command/Response**

Returns the current settings.

Command:	AT$VOICECALL?
Response:	$ VOICECALL: “<deviceId>”, <mode>,<monitor> OK

26.3.3 **Test Command/Response**

Returns the allowed parameters

Command:	AT$VOICECALL=?
Response:	$ VOICECALL: “<deviceId>”, (0-1),(0-1) OK

26.3.4 **Unsolicited response**

When <monitor> is enabled, the following unsolicited response will be sent when a Voice Call event occurs:

$VOICECALLIND: “<deviceId>”,<status>,<event>

Parameters

Parameter	Value	Description
<mode>	0	Disable Voice Call system
	1	Enable Voice Call system
<monitor>	0	Disable Voice Call unsolicited responses
	1	Enable Voice Call unsolicited responses
<event>	1-7	Voice Call event Id. See table in chapter 26.2
<deviceId>	string	The ID of the modem
<status>		0 = Success 1 = Failed to start the Voice call system 1012 = Failed to save configuration to memory 1050 = Invalid parameter value

26.4 AT$CALLSTART

This command is a request to originate a call. The <objectId> is used for identifying the call.

It is possible to associate with an <eventLabel> (see AT$EVENTLABEL) to allow the command to be executed only if a certain event occurs. If the <eventLabel> is omitted, the command will execute immediately.

To delete the association, issue the command with <objectId> as the only parameter.

26.4.1 **Action Command/Response**

Command:	AT$CALLSTART=<objectId>,<phonenumber>[,<eventLabel>[,<eventLabel> ..]]
Response:	$CALLSTART: “<deviceId>”,<status> OK

26.4.2 **Read Command/Response**

If one or more <eventLabels> are associated with the command, the Read command will display these commands.

Command:	AT$CALLSTART?
Response:	$ CALLSTART: “<deviceId>”,<status>,<objectId>[,<phonenumber>[,<eventLabel>[,<eventLabel>]]]]

	“<deviceId>”,<status>,<objectId>[,<phonenumber>[,<eventLabel>[,<eventLabel>]]]] .. OK

26.4.3

Parameters

Parameter	Value	Description
<objectId>	1-255	Identification for the Call Start instance
<phonenumber>	0-9, *, #	String with max 20 digits
<eventLabel>	00000000 - FFFFFFFF	See AT$EVENTLABEL for more details. Several <eventLabel>s can be associated with a command.
“<deviceId>”	String	
<status>		0 = Success 1012 = Failed to save configuration to memory 1050 = Invalid parameter value 1052 = Could not store request 1066 = Error occurred while handling the event

26.5 AT$CALLANSWER

This command can be used to answer an incoming call with or without checking and matching the phone number. If a <phonenumber> is specified, the call will be answered only if the <phonenumber> matches the incoming phone number. To immediately answer the call, an <objectId> of 0 can be used, or the <objectId> can be omitted.

The command can be associated with one or several <eventLabel>s which allows a user to configure events that have to happen in order for the command to be executed. A non-zero <objectId> is required. For example:

- Answer when there is an incoming voice call with a specific phone number
- Answer when there is an incoming call and a specified GPIO is set to High

If it is desired to have more than one phone number, several instances of this command can be configured. Just use different <objectId>s. If all voice calls are to be answered, omitting the <phonenumber> parameter will answer any call.

The <objectId> is used to identify this configuration. To delete the configuration, issue the command with just the <objectId> as parameter.

Wildcards (*, #) are allowed in the <phonenumber> parameter. The * means any numbers of digits, and # means one digit. Examples:

919123*	means any phone number starting with 919123.
919123#567	means 919123**1**567, 919123**2**567, or 919123**3**567 ..etc.

26.5.1 **Action Command/Response**

Answer an incoming call, or configure the device to answer a call at a later time using the <eventLabel> parameter.

Command:	AT$CALLANSWER[=<objectId>[,<phonenumber>[,<eventLabel>[,<eventLabel> ..]]]]
Response:	$CALLANSWER: “<deviceId>”,<status> OK

26.5.2 **Read Command/Response**

If one or more <eventLabels> are associated with the command, the Read command will display these commands.

Command:	AT$CALLANSWER?
Response:	$ CALLANSWER: “<deviceId>”,<status>,<objectId>,<phonenumber>,<eventLabel>[,<eventLabel> ..] OK

26.5.3

Parameters

Parameter	Value	Description
<objectId>	0-255	Call answer configuration identifier
<phonenumber>	0-9, *, #	String with max 20 digits
<eventLabel>	00000000 - FFFFFFFF	See AT$EVENTLABEL for more details. Several <eventLabel>s can be associated with a command.
“<deviceId>”	String	
<status>		0 = Success 1 = Failed to answer the call 1012 = Failed to save configuration to memory 1050 = Invalid parameter value

		1052 = Could not store request 1066 = Error occurred while handling the event

26.6 AT$CALLHANGUP

This command ends a call. If the command is issued when there is an active call in progress, the call in progress will be ended.

It is possible to associate this command with an eventLabel (see AT$EVENTLABEL) to allow the command to be executed only if a certain event occurs. If the <eventLabel> is omitted or if <objectId>=0 or omitted, the command will execute immediately.

If the command is used with an <eventlabel>, scenarios like the following can be configured:

- Hang-up any call in progress when GPIO 5 goes high
- Hang-up any incoming calls

The <objectId> is used for identifying an instance of a saved AT$CALLHANGUP configuration. To delete a configuration, issue the command with <objectId> as the only parameter.

26.6.1 **Action Command/Response**

Command:	AT$CALLHANGUP[=<objectId>[,<eventLabel>[,<eventLabel> ..]]]
Response:	$CALLHANGUP: “<deviceId>”,<status> OK

26.6.2 **Read Command/Response**

If one or more <eventLabel>s are associated with the command, the Read command will display these commands.

Command:	AT$CALLHANGUP?
Response:	$ CALLHANGUP: “<deviceId>”, <objectId>,<eventLabel>[,<eventLabel>]]] OK

26.6.3

Parameters

Parameter	Value	Description
<objectId>	0-255	Call answer configuration identifier
<eventLabel>	00000000 - FFFFFFFF	See AT$EVENTLABEL for more details. Several <eventLabel>s can be associated with a command.
“<deviceId>”	String	
<status>		0 = Success 1 = Failed to answer the call 1012 = Failed to save configuration to memory 1050 = Invalid parameter value 1052 = Could not store request 1066 = Error occurred while handling the event

26.7 Voice Call Examples

This example illustrates how to originate a voice call immediately, and also how to configure the device to answer any incoming calls automatically.

In these examples, the device id is 327004006981.

```
AT$VOICECALL=1,1                          //Enable Voice Call system
$VOICECALL: "327004006981",0
OK
AT$CALLSTART=0,”1234567”                  //Originate call
$CALLSTART: "327004006981",0
OK
$VOICECALLIND: "327004006981",0,7,0       //Audio path opened

$VOICECALLIND: "327004006981",0,3,0       //Alerting

$VOICECALLIND: "327004006981",0,1,0       //Voice originated successfully

AT$CALLHANGUP                             //Hang up call
$CALLHANGUP: "327004006981",0
OK
AT$CALLANSWER=1,1,00070004                //Configure device to answer any
$CALLANSWER: "327004006981",0             //incoming call
OK
$VOICECALLIND: "327004006981",0,4,0       //Incoming call event

RING                                      //RING indication

$VOICECALLIND: "327004006981",0,7,0       //Audio path opened

$VOICECALLIND: "327004006981",0,6,0       //Call is in active state

AT$CALLHANGUP                             //Hang up call
$CALLHANGUP: "327004006981",0
```

```
OK

$VOICECALLIND: "327004006981",0,5,0       //Call ended
```

27 DTMF Tone System

27.1 Overview

The DTMF system provides the ability to play and detect DTMF tones on the speaker/microphone or over the network during an active voice call.

The DTMF commands can be executed immediately, or they can be combined with the Event system. The Event system allows a user to configure the commands to be executed when one or more events occurs. For example:

- Play a DTMF tone when a voice call is active and a specified GPIO goes high
- Cause an action when a specific DTMF tone has been detected

The following commands are supported:

- AT$DTMFPLAY – Action and Read commands
- AT$DTMFDETECT – Action and Read commands

27.2 DTMF Event Ids

The DTMF system will generate the events in the table below.

Note! When a tone starts playing, there will be a DTMF Play Start event generated, but there will not be a DTMF Play Tone Stop event, unless the user explicitly issues the DTMF Detect command with mode set to Stop.

Event Id	Event Name
0	DTMF tone ‘0’ detected
1	DTMF tone ‘1’ detected
2	DTMF tone ‘2’ detected
3	DTMF tone ‘3’ detected
4	DTMF tone ‘4’ detected
5	DTMF tone ‘5’ detected
6	DTMF tone ‘6’ detected
7	DTMF tone ‘7’ detected
8	DTMF tone ‘8’ detected
9	DTMF tone ‘9’ detected
10	DTMF tone ‘A’ detected
11	DTMF tone ‘B’ detected
12	DTMF tone ‘C’ detected
13	DTMF tone ‘D’ detected
16	DTMF tone ‘*’ detected

17	DTMF tone ‘#’ detected
20	DTMF play tone stop
21	DTMF play tone start
23	DTMF Detection mode disabled
24	DTMF Detection mode enabled

27.3 AT$DTMFPLAY

This command will play a DTMF tone on the speaker or send the tone over the network

The DTMF Play tone event will be generated when the mode parameter is set to start playing, and a DTMF Play Stop event will be generated if the command is issued with mode set to Stop playing. There will not be an unsolicited DTMF Stop Play event generated when the tone has finished playing.

27.3.1 **Action Command/Response**

Command:	AT$DTMFPLAY=<objectId>[,<mode>,<path>,[,<tone>[,<gain>[,<duration>[,<eventLabel>[,<eventLabel>]]]]]]]
Response:	$DTMFPLAY: “<deviceId>”,<status> OK

If the eventLabel is omitted, and <objectId> is set to 0, the command will be executed immediately.

If one or more <eventLabel>s are provided and <objectId> is not 0, the command will execute when one of the events, specified in the <eventLabel>, has occurred. The command will remain associated with the event, and execute the next time any of the events occur.

To delete an association, issue the command with just the <objectId>, AT$DTMFPLAY=<objectId>

27.3.2 **Read Command/Response**

The read command will display all DTMFPLAY requests that are associated with an eventLabel.

Command:	AT$DTMFPLAY?
Response:	$DTMFPLAY: “<deviceId>”,<status>,<objectId>,<mode>,<path>,<tone>,<gain>,<duration>,<eventLabel> [,<eventLabel> …]

	…. OK

Parameters

Parameter	Value	Description
<objectId>	0-20	0 = Execute command immediately 1 - 20 = Associate the command with an <eventLabel>
<mode>	0,1	0 = Stop playing tone 1 = Start playing tone
<path>	0,1	Output path 0 = Speaker 1 = Sent over the network. This option is only valid if a voice call is active.
<tone>	0-9, *,#,A,B,C,D	DTMF tones
<duration>	1-65353	Number of 20 ms units
<gain>		Tone gain (dB) for the speaker.
<eventLabel>		See AT$EVENTLABEL for more details.
<devideId>	String	The ID of the modem
<status>		0 = Success 1012 = Failed saving to permanent memory 1050 = Invalid parameter value 1066 = The <eventLabel> format incorrect 1071 = Failed to initialize the Audio system 1072 = Failed to Play tone

27.4 AT$DTMFDETECT

This command will put the device into DTMF listening mode.

If the <tone> parameter is included, the device will only be listening for that <tone>. If all tones are to be detected, specify X as the tone parameter. All tones are also the default value, if this parameter is omitted.

If the <eventLabel> is omitted, and <objectId> is set to 0, the command will be executed immediately.

If one or more <eventLabel>s are provided and <objectId> is not 0, the command will execute when one of the events has occurred. The command will remain associated with the event(s), and execute the next time any of the events occur.

To delete an association, issue the command with just the <objectId>, AT$DTMFDETECT=<objectId>

If DTMF detection is started, and a power cycle occurs, the device will not remain in listening mode. The DTMF detection has to be requested again.

27.4.1 **Action Command/Response**

Command:	AT$DTMFDETECT=<objectId>[,<mode>,<path>[,<tone>[,<blank>[,<unsolRsp>[,<eventLabel> [,<eventLabel>]]]]]]
Response:	$DTMFDETECT: "<deviceId>",<status> OK

27.4.2 **Read Command/Response**

The read command will return the current <mode>, and it will also list any commands that are waiting for trigger events to execute.

Command:	AT$DTMFDETECT?
Response:	$DTMFDETECT: "<deviceId>",<status>,<objectId>,<mode>,<unsolRsp> "<deviceId>",<status>,<objectId>,<mode>,<path>,<tone>,<blank>,<unsolRsp>,<even OK

27.4.3 **Unsolicited Response**

When the <unsolRsp> parameter is set to 1, an unsolicited AT response will be sent when a DTMF tone is detected. The format of the response is:

$DTMFDETECT: "<deviceId>",<status>,<tone>

Parameters

Parameter	Value	Description
<objectId>	0-20	0 = Execute immediately
<mode>	0-1	0 = DTMF detection not active 1 = DTMF detection active
<path>	0,1	0 = Microphone 1 = Network (A voice call has to be active)
<tone>	0-9,A-D,*,#,X	DTMF tone to detect. X means All tones. If parameter is omitted, all tones will be

		detected.
<blank>		TBD
<unsolRsp>	0,1	0 = Unsolicited AT response will not be sent when a tone is detected 1 = Unsolicited AT response will be sent when a tone is detected If parameter is omitted, no response will be sent.
<deviceId>	string	Device id of the modem
<status>		0 = Success 1012 = Failed saving to permanent memory 1050 = Invalid parameter value 1066 = The <eventLabel> format incorrect 1071 = Failed to initialize the Audio system

27.5 DTMF Tone examples

This example first configures the device to play tone 5 when it detects an incoming call. The device is configured to listen for all DTMF tones on the network path

```
AT$DTMFPLAY=1,1,0,1,,, 00070004        //Play tone “1” on the speaker when
$DTMFPLAY: "327004006981",0            //an incoming call is detected
OK
AT$DTMFPLAY=2,1,0,0,,, 00070004        //Play tone “0” on the speaker when
$DTMFPLAY: "327004006981",0            //a call ends
OK
AT$DTMFDETECT=0,1,1,X,100,1            //Start DTMF detection on the network
$DTMDETECT: "327004006981",0
OK
RING                                   //RING indication

$VOICECALLIND: "327004006981",0,7,0    //Audio path opened

$VOICECALLIND: "327004006981",0,6,0    //Call is in active state

$DTMFDETECT: "327004006981",0,5        //DTMF tone 5 detected
$DTMFDETECT: "327004006981",0,1        //DTMF tone 1 detected
$DTMFDETECT: "327004006981",0,2        //DTMF tone 2 detected

$VOICECALLIND: "327004006981",0,5,1    //Voice call ended
```

28 GPS Tracking

28.1 Overview

The software provides several useful GPS related features. When configured, the device can be used to provide the following functionality:

- To monitor and report the current location of the device via periodic location updates
- To monitor and report when the device enters or leaves a specified area (GEOFENCE)
- To monitor and report when the device goes above a specified speed
- To report the current location in response to a set of chosen events

28.2 GPS Events

These events are generated by the GPS general subsystem. The EventType is 200. The ObjectId for the event is not used and will always be 0. See section 5 for more about events.

Name	EventId	Description
Start	3	Starting GPS
Start Successful	6	GPS startup completed successfully
Start Failed	7	GPS startup failed
Stop	8	Begin process to stop GPS
Stop Successful	10	GPS stopped successfully
Fix found	14	Got a GPS fix
Fix lost	15	Lost the GPS fix
Update Speed	16	Speed has changed
Update Location	17	Location has changed
Update Time	18	Time has changed
Update Altitude	19	Altitude has changed
Update Heading	20	Heading has changed
Update satellites	21	Number of satellites has changed

28.3 System Variables

This subsystem defines the following system variables:

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
00C801	longitude	Longitude (deg*1000000)		yes
00C802	latitude	Latitude (deg*1000000)		yes

Identifier (hex)	Name	Description	nonVolatile	autoUpdt
00C803	heading	Heading (deg*10)		yes
00C804	speed	Current speed (mph*10)		yes
00C805	altitude	Altitude (feet*10)		yes
00C806	numsat	Number of GPS satellites		yes
00C807	accuracy	Accuracy (miles*1000000)		yes
00C808	mileage	Miles between updates (*1000)		yes
00C809	odometer	Accumulated miles * 1000	yes	yes
00C80A	fixtime	Fix time, secs since 1/1/1970 (unsigned)		yes

28.3.1 **Example**

This example shows how the odometer can be manually reset:

```
AT$VARIABLESET=1,C809,1,0
```

28.4 String Tokens

This subsystem defines the following dynamic string tokens:

Name	Description	Prefix #	Postfix #
longitudeF	GPS longitude, Float format	Min width	Decimal places
latitudeF	GPS latitude, Float format	Min width	Decimal places
speedF	GPS speed, Float format	Min width	Decimal places
headingF	GPS heading, Float format	Min width	Decimal places
altitudeF	GPS altitude, Float format	Min width	Decimal places
accuracyF	GPS accuracy, Float format	Min width	Decimal places
mileageF	GPS miles between updates, Float format	Min width	Decimal places
latitude	Latitude (deg*1000000)	–	–
longitude	Longitude (deg*1000000)	–	–
heading	Heading (deg*10)	–	–
speed	Current speed (mph*10)	–	–
altitude	Altitude (feet*10)	–	–
numsat	Number of GPS satellites	–	–
accuracy	Accuracy (miles*1000000)	–	–
mileage	Miles between updates (*1000)	–	–

Name	Description	Prefix #	Postfix #
odometer	Accumulated miles *1000	–	–
fixtime	Fix time, secs since 1/1/1970	–	–

28.5 GPS Configuration

This section describes the commands used to setup and provision the GPS subsystem.

The following command is supported:

- AT$GPS – Action and Read commands

28.5.1 **AT$GPS**

This command is used to set which GPS protocol to use and which port to use. By default, the GPS is disabled by setting the port and protocol to zero.

A modem restart is required for changes to take effect.

Action Command

The following shows the command (in bold) to configure the GPS mode.

Command:	AT$GPS=<Port>,<Protocol>[,<Baud>]
Response:	$GPS: "<deviceId>",<status> (OK I ERROR)

Read Command

The following shows the command (in bold) to query the GPS mode.

Command:	AT$GPS?
Response:	$GPS: "<deviceId>",<status>,<port>,<protocol>,<baud> (OK I ERROR)

Parameters

Parameter	Description
<deviceId>	The ID of the modem.
<port>	0 = None. No serial port is used. (default). 1 = UART1 2 = UART2 3 = USB

<protocol>	0 = GPS is disabled (default). 1 = NMEA 9 = Location Plugin for GpsOne
<baud>	Baud rate for <port>: 0 = Do not change (default)

<status>	Description
0	Success
1	Error
1012	NV save error.
1050	Invalid parameter value

28.6 Location Monitoring

The device location (GPS location) can be queried at any time. The device can also be configured to periodically report its GPS location to the server.

The GPS location is reported as a set of latitude and longitude coordinates. The reported longitude and latitude values are each 4 bytes and each represents the 32 bit integer equivalent to a floating point number (type Float). The “direction” (East/West for longitude, North/South for latitude) can also be derived from the same value. The value will be positive for northern latitudes and negative for southern latitudes. The value will be positive for eastern longitudes and negative for western longitudes.

The following command is supported:

- AT$LOCATE – Action commands

28.6.1 **AT$LOCATE**

AT command used to configure or query the location settings. The device location information can be set or read.

Action Command

The following shows the command (in bold) to set the reporting time period (in seconds). A <timer> value of 0 will disable automatic $LOCATE response generation.

Command:	**AT$LOCATE=<timer>**
Response:	$LOCATE:”<deviceId>”,<status>

	OK

Read Command

The following shows the command (in bold) to query the location report time and current location. The "longitude" and "latitude" values are signed. The "direction" (East/West for longitude, North/South for latitude) can also be derived from the "longitude" and "latitude" values. The value will be positive for northern latitudes and negative for southern latitudes. The value will be positive for eastern longitudes and negative for western longitudes. "Heading" is in degrees. "Speed" is in Miles per Hour. "Altitude" is defined as feet above sea level. Accuracy is in miles.

Command:	**AT$LOCATE?**
Response:	$LOCATE:"<deviceId>",<status>,<timer>,longitude>,<latitude>,<heading>,<speed>,<altitude>,<numSatellites>,<accuracy>,<mileage>,<date>,<time> OK

Unsolicited Response

The device location data can be generated and sent automatically (unsolicited) based on the value set in the AT$LOCATE command. When a time value has been set, an unsolicited $LOCATE response is generated periodically based on the defined time period. The following shows the unsolicited response:

$LOCATE:"<deviceId>",<status>,<timer>,<longitude>,<latitude>,<heading>,<speed>,<altitude>,<numSatellites>,<accuracy>,<mileage>,<date>,<time>

Parameters

Parameter	Description
<timer>	The number of seconds which to send a $LOCATE report. If set to 0 then periodic reporting is turned off.
<deviceId>	The ID of the modem.
<status>	The status of the server profile.
<longitude>	Longitude
<latitude>	Latitude
<heading>	Heading in degrees (0-360, 0 = North, 90 = East)
<speed>	Speed in miles/hour
<altitude>	Altitude in feet above sea level
<numSatellites>	Number of satellites
<accuracy>	Accuracy in miles
<mileage>	Not supported
<date>	Date given as ddmmyy (dd=day, mm=month, yy=year)

<time>	Time given as hhmmss (hh=hour, mm=minute, ss=seconds)

Status	Description
0	Success
1024	GPS is not locked

28.7 Extended Location Monitoring

The device can be configured to monitor and report location data when the device is triggered by a specified event. Any events that are included in the event filter will cause the data location to be sent. Multiple event filters can be utilized by assigning each to a unique LocateExt object ID.

The location data sent by the LocateExt system contains additional fields to indicate which event and LocateExt object ID is responsible for the message. These fields replace the <timer> field in the $LOCATE response message.

28.7.1 **AT$LOCATEEXT**

AT command used to configure or query the extended location settings. The assigned event filter information can be set or read.

Action Command

The following shows the command (in bold) to set the currently assigned event filter for a specific extended location object ID. The action command with only the object ID will remove the event filter and stop sending extended location messages for the selected object ID.

Command:	**AT$LOCATEEXT=<object ID>[,<event filter ID>]**
Response:	$LOCATEEXT:”<deviceId>”,<status> OK

Read Command

The following shows the command (in bold) to query the extended location filter assignments. Extended location object IDs and event filters IDs will be displayed.

Command:	**AT$LOCATEEXT?**
Response:	$LOCATEEXT:”<deviceId>”,<status>,<object ID>,<event filter ID> OK

Parameters

Parameter	Description

<object ID>	The selected extended location object ID
<event filter ID>	The selected event filter ID

28.8 NMEA Output

28.8.1 **AT$NMEA**

Enable or disable raw NMEA output strings to a selected port. The type of strings can be filtered using a bit mask to represent which messages will be output.

Action Command

The following shows the command (in bold) to change the raw NMEA output settings. The action command takes the port and mask.

Command:	**AT$NMEA=<port>,<mask>**
Response:	$NMEA:"<deviceId>",<status> OK

Read Command

The following shows the command (in bold) to query the current port setting and mask value.

AT$NMEA?
$NMEA:"<deviceId>",<status>,<port>,<mask>
OK

Parameters

Parameter	Description
<port>	0 = NMEA output is disabled 1 = UART1 2 = UART2 3 = USB

<mask>	Hex bitmask value of GPS NMEA strings to enable. 0 Disables all messages and FFFF enables all messages.
	`GPS_NMEA_GGA_EN  =   (1 << 0),`
	`GPS_NMEA_GSA_EN  =   (1 << 1),`
	`GPS_NMEA_RMC_EN  =   (1 << 2),`
	`GPS_NMEA_VTG_EN  =   (1 << 3),`
	`GPS_NMEA_GLL_EN  =   (1 << 4),`
	`GPS_NMEA_GST_EN  =   (1 << 5),`
	`GPS_NMEA_GSV_EN  =   (1 << 6),`
	`GPS_NMEA_ZDA_EN  =   (1 << 7),`
	`GPS_NMEA_PROP_EN =  (1 << 15),`
	`GPS_NMEA_ALL_EN  =   0xFFFF`

28.9 GEOFENCE Control

The device can be configured to monitor and report when the device enters or exits a specified area. This area is called a “geofence”. The “geofence” boundary is defined by an upper left corner and lower right corner of a rectangle. The corners are defined by a set of latitude and longitude coordinates.

A “geofence” notification (an unsolicited GEOFENCE message) can be triggered when the device enters and/or exits the boundary. The notification can be sent as a Binary message to a server or as an AT response.

Multiple “geofence” entries can be active on the device at one time.

28.9.1 **AT$GEOFENCE**

AT command used to configure or query the “geofence” settings. The settings can be set or read.

Action Command

The following shows the command (in bold) to configure the “geofence” settings. If only the <geofenceId> parameter is specified, that Id is cleared and disabled. The following shows the command (in bold) to configure the “geofence” settings:

AT$GEOFENCE=<geofenceId>[,<type>,<topLeftX>,<topLeftY>,<bottomRightX>,<bottomRightY>]
$GEOFENCE:”<deviceId>”,<status>
OK

Read Command

The following shows the command (in bold) to query the “geofence” settings:

```
AT$GEOFENCE?
$GEOFENCE:”<deviceId>”,<status>,<geofenceId>[,<type>,<topLeftX>,<topLeftY>,<bott
omRightX>,<bottomRightY>]
OK
```

Unsolicited Response

The “geofence” status can be generated and sent automatically (unsolicited) based on the value set in the AT$GEOFENCE command. The following shows the unsolicited response:

```
$GEOFENCE: ”<deviceId>”,<status>,<GeofenceId>, <condition>
```

Parameters

Parameter	Description
<geofenceId>	Id of Geofence reported or configured
<type>	0 – Disabled 1 – Enter Geofence 2 – Leave Geofence 3 – Both
<deviceId>	The ID of the modem.
<status>	0 = Success 1012 = NV save error 1027 = Invalid Geofence
<condition>	Geofence status. 1025 = Enter Geofence 1026 = Exit Geofence
<topLeftX>	Upper Left corner - Longitude
<topLeftY>	Upper Left corner - Latitude
<bottomRightX>	Lower Left corner - Longitude
<bottomRightY>	Lower Left corner - Latitude

28.10 SPEED Monitoring

The device can be configured to monitor and report when the device exceeds a configured speed (in MPH).

An unsolicited message is generated by the device when the device exceeds the configured value.

Note: Speed monitoring is not available in the current version

28.10.1 AT$SPEED

AT command used to configure and query the “Speed” threshold setting.

Action Command

The following shows the command (in bold) to configure the setting:

AT$SPEED=<threshold>
$SPEED:”<deviceId>”,<status>
OK

Read Command

The following shows the command (in bold) to query the setting:

AT$SPEED?
$SPEED:”<deviceId>”,<status>,<threshold>
OK

Parameters

Parameter	Description
<threshold>	Speed Threshold in MPH
<deviceId>	The ID of the modem.
<status>	The status of the server profile. 0 = Success 1012 = NV save error

29 Configuration System

29.1 Overview

The configuration system presents a simple to use way to view or modify values that determine behavior in other parts of the software. System settings are saved in non-volatile memory and stored across reboots. Values can be changed and stored by system components or by the user directly.

Configuration parameters are arranged into systems, items, and values. All systems and items can be referenced by string name from the ASCII command. Values are stored as strings but can contain either numeric data or string data. Configuration values all need a default setting. When no values are stored in non-volatile memory, the default settings will be used. Clearing configuration settings will also erase the stored values and return to the default setting.

29.2 AT$CONFIG

This command is used to view the configuration systems, items associated with each system and their current values, and to change values of configuration items.

AT$CONFIG – Display a list of configuration system names
AT$CONFIG=”<system name>” – Display a list of items for the system and the current values
AT$CONFIG=”<system name>”,”<item name>” – Display a specific item and value in a system
AT$CONFIG=”<system name>”,”<item name>”,”<value>” – Saves a value to the system item

30 Firmware and Software Updates

Modem firmware and application software can be downloaded using a local AT command method. A terminal software capable of xmodem file transfers is required.

30.1 Downloading modem firmware

In addition to the firmware file, you will also need a bootloader file. Both files have a .dwl file extension.

In your terminal window, do the following:
Set the device in download mode:

```
AT+WDWL
+WDWL: 0
---
```

1. *Select Send/Transfer file in your Terminal program.*
2. *Browse to the file bootloader file (typically named dwl.dwl).*
3. *Select xmodem1k or xmodem.*
4. *When the file has completed downloading ...*
5. *Select Send/Transfer again, but this time select the firmware file (*.dwl).*
6. *Select xmodem1k or xmodem*

`AT+CFUN=1` *This will reset the device and also exit download mode*
`OK`

30.2 Downloading application software

Application software is downloaded the same way as modem firmware.
Set the device in download mode:

```
AT+WDWL
+WDWL: 0
---
```

1. *Select Send/Transfer file in your Terminal program.*
2. *Browse to the file (*.dwl).*
3. *Select xmodem1k or xmodem.*
4. *When the file has completed downloading ...*

`AT+CFUN=1` *This will reset the device and also exit download mode*
`OK`

31 Appendix A – Status Codes

31.1 <status> Parameter

This section defines the various values for the <status> parameter. This parameter is used in instead of using CME errors. It is the intent that the <status> parameter will be the same as the CME errors defined in 27.005, 27.007, in addition to errors that can occur in setting up and maintaining the application.

<status>	Description
0	When used in a response to a command this value means Success. In an unsolicited response this value means that all is normal. Also, this value may mean the parameter is not used.
1	Unspecified error
21	Invalid Index. The PDP context number is out of range. (27.007 standard)
23	Memory (Flash) error
1001	Can't delete server context since server communications is in use.
1002	IP address is malformed
1003	<tcpUdp> type is invalid
1004	Access point name too long.
1005	Username too long
1006	Password too long
1007	Invalid time format
1008	Invalid port
1009	Invalid flag
1010	Invalid Period
1011	Invalid password for AT access
1012	Cannot save to NV
1013	Command not supported
1014	Invalid server ID
1015	Invalid username
1016	Invalid password
1017	Invalid filename
1018	FTP connection failed. GPRS not started or FTP not supported
1019	Invalid profile id
1021	Invalid Range
1022	Invalid sector
1023	LOCATE timer error – timer not set
1024	GPS is not locked
1025	Enter GEOFENCE
1026	Exit GEOFENCE

1027	Invalid GEOFENCE
1029	Invalid Bridge
1030	Invalid Bridge Direction
1035	Invalid SMS mode
1036	Invalid SMS pin code
1037	Invalid SMS number
1040	Invalid report settings
1041	Platform error
1050	Invalid parameter value
1051	Invalid Record
1052	Already In Use
1053	List Error
1054	Connect Error
1055	Invalid EServer Id
1056	Invalid Email Id
1057	Invalid Recipient
1060	GPIO Error
1061	GPIO Unallocated
1062	GPIO In Use
1063	GPIO Invalid Range
1065	Invalid Object
1066	Invalid Event
1070	Timeout
1071	Audio initialization failed
1072	Audio play failed
1080	Object Id out of range
1081	Feature unavailable
1082	Invalid number of parameters
1083	Object table full
1084	Duplicate entry
1085	Overflow
1090	Invalid Endpoint Id
1091	Endpoint Id out of range
1092	Id is unavailable
1093	Invalid Endpoint type
1100	Invalid Tag
1101	Tag write in progress
1102	Tag is closed
1103	Tag memory error
1110	NVM Error
1111	NVM memory full
1130	Server is blocked

31.2 Standard CME Errors

Error	Description
1	no connection to phone
2	phone-adaptor link reserved
3	operation not allowed
4	operation not supported
5	PH-SIM PIN required
6	PH-FSIM PIN required
7	PH-FSIM PUK required
10	SIM not inserted
11	SIM PIN required
12	SIM PUK required
13	SIM failure
14	SIM busy
15	SIM wrong
16	incorrect password
17	SIM PIN2 required
18	SIM PUK2 required
20	memory full
21	invalid index
22	not found
23	memory failure
24	text string too long
25	invalid characters in text string
26	dial string too long
27	invalid characters in dial string
30	no network service
31	network timeout
32	network not allowed - emergency calls only
40	network personalization PIN required
41	network personalization PUK required
42	network subset personalization PIN required
43	network subset personalization PUK required
44	service provider personalization PIN required
45	service provider personalization PUK required
46	corporate personalization PIN required
47	corporate personalization PUK required
48	hidden key required (NOTE: This key is required when accessing hidden phonebook entries.)
100	unknown