



Integrator's Manual

Altus APS3G



Integrator's Manual Revision 1.1.0

Applicable to version 4.3.3 of the Altus APS3G Firmware

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1 Scope

This Integrator's Manual documents all aspects of configuring the ALTUS APS3G for functioning optimally. The document only addresses the configuration of the ALTUS APS3G in detail. Please refer to dedicated manuals and integration guide for the legacy APS-3.

The peripherals offer more functionality than what is described within the scope of this document. Section "Annex 1" on page 32 elaborates on the documents needed to use all functions of the peripherals.

1.1 Support

Do not hesitate to contact us if this Integrator's Manual does not adequately support you to get the functionality working:

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2.1 Managing the Peripherals

The GNSS receiver board inside the ALTUS APS3G does not control all the peripherals. Only the Cellular module is controlled. An application external to the receiver has to manage the other peripherals.

The controlling application configures the unit over Bluetooth or the connector SER1 connected to COM3 of the GNSS board.

The peripherals are controlled using the COM1 and COM2 ports of the GNSS board.

The GNSS receiver offers a concept called daisy-chaining to route the communication from and to the peripherals connected to COM1 & 2 to COM3.

2.2 "Selector" Logic

The Selector-logic allows the GNSS receiver board to change the routing of its COM2 port. Since the SER2 connector (for the external radio), the cell modem and the UHF radio share one serial port, only one of the peripherals can be used at a time.

The general purpose pins GP1 and GP2 determine the routing of COM2. This is described in in "Block Diagram - Table 1".

Note that the GNSS receiver board will supersede the Selector-logic when the command *setCellularParameters, on* is used. Changing GPIO parameters will have no effect if the Cellular status is not "Cellular modem disabled".

2.3 The Power Controller

The Power Controller is an autonomously running microcontroller that

1. Can read battery levels
2. Can switch off power to the GNSS receiver board
3. Can put asleep/wake up the cell modem
4. Can reset the GNSS receiver board

2.4 The BT/SER1 Logic

The goal of the BT/SER1 logic is to "route all COM3 communication over Bluetooth, unless there is a cable connected to the SER1 connector."

On the corresponding cable, CUS-ASY10029, the /SELCON is tied to ground. The presence of a cable is thus sensed by observing /SELCON being ground. So once the cable is connected, even without a device being connected to the cable, the communication will switch to the cable. Bluetooth communication will be impossible in that configuration.

3 Using 'APS3G Tools' control software

The interaction with the peripherals is demonstrated using APS3G Tools scripts installed with Septentrio control suite RxTools. The 'APS3G Tools' executable runs on Microsoft Windows.

'APS3G Tools' scripts allow:

- *strings* to be sent to the receiver,
- the definition of *macros*,
- the definition *User Interface menus*,
- insertion of *delays* between consecutive commands,
- awaiting the end of the execution of a command before starting a next command.

'APS3G Tools' does NOT support

- any flow control constructs like loops or if-then, nor
- processing the response of the receiver board.

'APS3G Tools' scripts are written as XML documents. Some default example scripts are installed together with the application.

4 The ALTUS APS3G Connectors

4.1 Connector Function



Figure 2: ALTUS APS3G Connectors

The ALTUS APS3G has three connectors for cables SER1, SER2 and PWR.

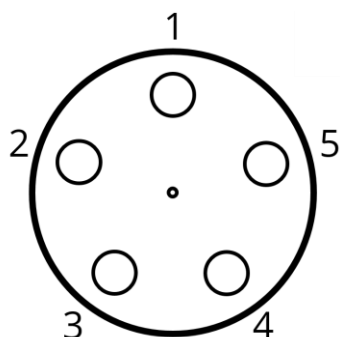
The purpose of the connectors and the corresponding cables are shown in the table below.

Connector	Corresponding Cable	Legacy Altus Name	Corresponding Plug Type	Purpose	Connected To
SER1	202200	CUS-ASY10029	FGG.0B.305.CLAD52Z	Field Controller	COM3
SER2	202199	CUS-ASY10028	FGG.1B.308.CLAD52Z	Radio	COM2
PWR	202201	CUD-ASY10031	FGG.0B.304.CLAD52Z	Battery or Power Supply	Power Controller

4.2 Connector Pin Out

4.2.1 SER1

Below is the outside view of the connector SER1.

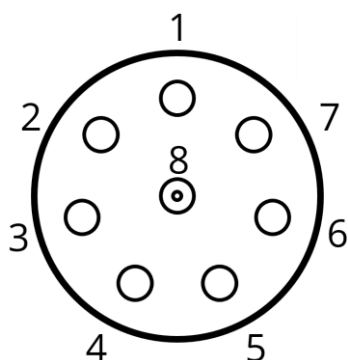


Pin	Function	I/O	
1	COM3 RxD	I	Receive by APS3G
2	COM3 TxD	O	Transmit by APS3G
3	GND	N/A	Ground
4	/SELCON	I	Connector/Bluetooth
5	GND	N/A	Ground

See section “The BT/SER1 Logic” on page 7 for the definition of /SELCON.

4.2.2 SER2

Below is the outside view of the connector SER2.



Pin	Function	I/O	
1	COM2 RxD	I	Receive by APS3G
2	COM2 /CTS	I	Clear To Send
3	GND	N/A	Ground
4	COM2 TxD	O	Transmit by APS3G
5	COM2 /RTS	O	Ready To Send
6	GND	N/A	Ground
7	NC	N/A	Reserved
8	NC	N/A	Reserved

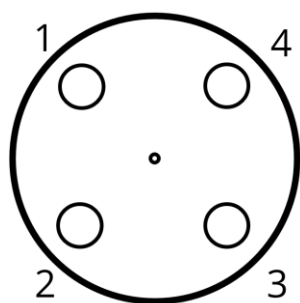
See section ““Selector” Logic” on page 7 for the routing of COM2.



On legacy APS-3 the CTS and RTS were swapped on the connector.
On ALTUS APS3G the CTS and RTS are wired correctly.

4.2.3 PWR

Below is the outside view of the PWR connector



Pin	Function	I/O	
1	ExtBat+	I	9 to 18V DC
2	Reserved		Do not connect
3	Reserved		Do not connect
4	ExtBat-	I	Ground

The pins 2 and 3 must remain unconnected.

5 Configuring the ALTUS APS3G

5.1 Configuration Basics

Details on the command and response format of the GNSS receiver inside the Altus APS3G can be found in “Communication with the GNSS board” on page 38.

5.1.1 ASCII Commands over a Daisy Chain

Some peripherals may consider small delays between bytes being sent as a delimiter of an ASCII string. This is the case for the Satel M3-TR4 UHF radio.

When a daisy chain is configured as an ASCII stream, the ALTUS APS3G will split messages based on <CR> and <LF>.

setDaisyChainMode, DC2, ASCII configures DC2 as ASCII.

When binary data is sent over the daisy chain, it is advised to configure the daisy-chain as Raw, otherwise the ALTUS APS3G will buffer the data until a <CR> or <LF> is met or the buffer runs full.

setDaisyChainMode, DC2, Raw configures DC2 as binary data.

5.1.2 Checking available functionality

This section illustrates briefly how the available functionality can be checked. A more detailed example is given in section “Annex 5: (Smart) Check for Available Functionality” on page 35.

5.1.2.1 Using *IstInternalFile, Permissions*

An alternative is to issue "*IstInternalFile, Permissions*" and parse the XML feedback.

e.g. to check whether a receiver can handle BeiDou, parse the output from "*IstInternalFile, Permissions*" with the following regular expression:

```
<cmpl1\s+val="(\d+)"
```

If the attribute "val" of the "cmpl1" node is equal to "0", BeiDou is not supported, else it is.

The command *getReceiverCapabilities* will not yield the desired result, since it lists what the receiver hardware is capable of. This may possibly not correspond with the feature set that has been purchased.

5.1.2.2 Using an associated command

If the controlling software needs to check whether a functionality can be used on a specific receiver, the easiest way is to issue the corresponding command and to check the response.

e.g. to check whether a receiver can do RTK, issue *setPVTMode, Rover, +RTK*.

The command will fail if the mode is not available.

More detail is provided in the section “Annex 7: Interpreting Receiver and peripheral responses” on page 38.

5.1.3 Interrupting a data stream

The ALTUS APS3G communicates over the COM3 only to the controlling application. If the ALTUS APS3G has to be notified that the data stream will be interrupted and it has to return to the command line prompt, the escape sequence has to be issued.

The escape sequence is a sequence of ten capital ‘S’ sent within 5 seconds.

Before issuing commands, the controlling application has to await the receiver prompt.

More detail is provided in the section “Annex 7: Interpreting Receiver and peripheral responses” on page 38.

5.2 Starting up the ALTUS APS3G

When the ALTUS APS3G is started, a few settings have to be applied to allow it to communicate to its peripherals and ensure a known state.

5.2.1 Enforcing a known initial configuration

The list below only applies a limited list of settings, assuming that other settings are the same as in the RxDefault configuration.

To enforce the RxDefault configuration, issue the following command:

`exeCopyConfigFile, RxDefault, Current`

The `exeCopyConfigFile` command can only be issued when using a wired connection between the controlling application and the Altus APS3G. After issuing this command, the controlling application will not be able to access the GNSS receiver board inside the Altus APS3G over the Bluetooth connection. In the other direction the GNSS receiver board will not be able to transmit data over the Bluetooth connection.

5.2.2 Configure COM3 (SER1) for communicating with the controlling application

To be able to communicate with the Altus APS3G over Bluetooth or the SER1 connector, the following commands need to be issued.

```
setCOMSettings, COM3, baud115200, BITS8, NO, BIT1, RTS|CTS  
setDataInOut, COM3, CMD, SBF+NMEA
```

It is advised to always leave the flow control on even if the communication over a cable does not require it. If the flow control is switched off and the cable is pulled out, Bluetooth communication will not work, since the Bluetooth radio requires "RTS|CTS" to be set.

5.2.3 Select the antenna

```
setAntennaOffset, Main, 0.0000, 0.0000, 0.0000, "APSAPS-3L  NONE", "APS-3", 0
```

Any other antenna selection will result in an incorrect position reporting.

5.2.4 Set Up COM1 for the Power Controller

```
setCOMSettings, COM1, baud2400, BITS8, NO, BIT1, NONE  
setDataInOut, COM1, CMD, none
```

The input parameter of the *setDataInOut* is set to CMD, since the Power Controller will trigger a shutdown sequence when the batteries are empty or the power button is pressed by issuing commands to the GNSS board. This is detailed in section "

Controlled Shut Down" on page 26.

5.2.5 Set Up COM2 for the Modems

setCOMSettings, COM2, baud115200, BITS8, NO, BIT1, RTS|CTS

setDataInOut, COM2, auto, SBF+NMEA

The flow control RTS|CTS is required for a reliable communication with the cell and UHF modem or the external radio connected to SER2.

5.2.6 Switch off the internal UHF radio

setGPIOFunctionality, GP1, Output, none, LevelLow

setGPIOFunctionality, GP2, Output, none, LevelLow

setGPIOFunctionality, GP3, Output, none, LevelHigh

If RxDefault has been enforced the first two commands are not required, since LevelLow is the default.

5.2.7 Force Cell Modem in Stand By

The Power Controller keeps the cell modem in standby when the ALTUS APS3G is powered on. So no action is required immediately after powering the ALTUS APS3G.

If the starting state is not clear, the cell modem can be forced in standby using the following command.

setCellularParameters, on

Note that when setting the Cellular modem in stand by communication with the UHF module is not possible. The command *setCellularParameters, off* must be used when the UHF modem is required.

5.2.8 Prepare the disk for logging

setDataInOut, DSK1, none, SBF+NMEA

The input parameter is set to none since the disk does not send information to the GNSS board that the receiver has to interpret as a stream of commands, NMEA or differential corrections.

The settings below are the preferred settings for the ALTUS APS3G but are not required for proper operation.

setFileNaming, DSK1, INCREMENTAL, ALTUS

setMarkerParameters, APS_

5.2.9 Set the Elevation Masks

Since the ALTUS APS3G is capable to track all satellites of all constellations, it may see many satellites close to the horizon.

To optimize the load of the tracker, it is advised to set the tracking-elevation-mask.

setElevationMask, Tracking, 5

To avoid satellites close to the horizon negatively influencing the position calculation, it is advised to exclude them.

setElevationMask, PVT, 10

5.2.10 Set Tracking

Since the ALTUS APS3G is capable to track all satellites of all constellations, its default tracking configuration is:

setSatelliteTracking, all

It does not add value to issue *setSatelliteUsage* after issuing *setSatelliteTracking*, since whatever satellites are not tracked, are not used in the PVT calculation neither.

It is not advised to issue *setSatelliteUsage, all*

Issuing this command will introduce low quality ranging information from SBAS satellites and may degrade the PVT calculation.

5.2.11 Set the PVT modes

The default configuration for ALTUS APS3G is:

setPVTMode, Rover, all

This will activate all PVT modes that the receiver is capable (capability) of and that has been purchased (permission).

If specific modes are to be activated based on capability and needs, it is advised to first retrieve the possible and needed by reading modes by the permissions and then issuing a *setPVTMode* command with an explicit exhaustive list of needed modes.

This is elaborated in more detail in section “Annex 5: (Smart) Check for Available Functionality” on page 35.

e.g. To reduce the processor load, it may be useful to de-activate SBAS when it is not needed.

Taking the allowed PVT modes from the example in section “Annex 5: (Smart) Check for Available Functionality” on page 35.

This would result in excluding PPP (not allowed) and SBAS (not needed):

setPVTMode, Rover, StandAlone+DGPS+RTK

It is impossible to issue *setPVTMode, Rover, -SBAS* to deactivate SBAS.

The command *setPVTmode* does not support the ‘-’ prefix.

5.2.12 Avoid using the built-in geoid model

setGeoidUndulation, manual, 0.0

The receiver contains a coarse geoid model. Since it may be misleading for a user to use the orthometric height based on the embedded geoid, it is advised to explicitly switch it off.

The controlling application has to implement a more accurate geoid model when necessary.

5.2.13 Configuration script

A default configuration script containing most of the configuration tips described in the previous chapters is available on installation CD that you received with your firmware. See the document \DefaultScript\Configuration_APS3G.txt. This script can be uploaded to the ALTUS APS3G receiver using RxControl application and the menu *File->Upload script...*

6 Read the Battery Status

As shown in “Figure 1: ALTUS APS3G Block Diagram” on Page 6 the Power Controller is connected to COM1 of the GNSS.

6.1 Connect COM3 to Power Controller

To communicate from COM3 (SER1 or Bluetooth) to the Power Controller, a daisy chain is to be set up.

At the ALTUS APS3G COM3> prompt:

setDaisyChainMode, DC2, ASCII

setDataInOut, COM1, DC1 ,DC2

setDataInOut, COM3, DC2, DC1

The interpretation of the commands above is illustrated in section “

Annex 4: COM3-COM1 Daisy Chain" on page 34.

6.2 Issue a Command to the Power Controller

Table 1 and Table 2 show the battery related commands and the responses.

Command	Response	Goal
#BAFG<LF>	@BA,<f-cap>,<r-cap>,<bat-volt>,<bat-cur>,<bat-stat><LF>	Read batt A status
#BBFG<LF>	@BB,<f-cap>,<r-cap>,<bat-volt>,<bat-cur>,<bat-stat><LF>	Read bat B status

Table 1 : Power Controller – Battery Commands

Parameter	Unit	Range	Interpretation
<f-cap>	mAh	0...216-1	Capacity of full battery
<r-cap>	mAh	0...216-1	Remaining capacity
<bat-volt>	mV	0...216-1	Battery voltage
<bat-cur>	mA	0...216-1	Battery current
<bat-stat>	--		0: not present 1: in use 2: stand by 3: empty

Table 2 : Power Controller – Battery Commands - Return Values

6.3 Back to the Receiver command prompt

If after issuing the command above the controlling application needs to continue configuring the receiver, the receiver command prompt has to be forced using the escape sequence.

The escape sequence is a sequence of ten capital 'S' sent within 5 seconds.

Before issuing commands the controlling application has to await the receiver prompt.

7 Set Up a Connection with the Cell Modem

This section explains how to “

Set Up an NTRIP Connection” and “Set Up a Data Call” with the Cellular modem of your ALTUS APS3G receiver. Note that we make use of commands introduced with firmware version 4.3.3. To configure a receiver with an older firmware version please refer to chapter “Annex 8: Controlling the Cellular modem with firmware version before 4.3.3” on page 42.

7.1 Basic Cellular configuration

To use the Cellular modem embedded in the ALTUS APS3G receiver you first need to enable it and configure its PIN code. One must first define the PIN code associated to its SIM card using the command

```
setCellularPIN, <code>
```

Then use the command

```
setCellularParameters, on, off
```

to power on the Cellular modem and set it in stand by mode. Using RxControl’s message inspector or decoding directly SBF CellularStatus messages, the status of the Cellular modem can be monitored. After issuing the two commands before, the Status field should be equal to 2: Internet connection standby.

Updating the PIN code or unlocking the SIM card if needed can be done using the command *exeChangeCellularPIN* and *exeUnblockCellular*. Please refer to the Altus APS3G ReferenceGuide for further details.

When using a command terminal like Data Link, NMEA protocol can be used to get a status of the Cellular modem. Unlike SBF, this is an ASCII protocol which allows (be it difficult) human users to read it. Use the command *exeNMEAOnce, COM3, SCL* to get the current status of the Cellular module. The description of the SCL NMEA message is available in the Altus APS3G Reference Guide.

```
COM3> exeNMEAOnce, COM3, SCL
$PSSN,SCL,[0,1840,473817000,6,-87,"BEL PROXIMUS",4,0]*07
COM3>
```

7.2 Set Up an NTRIP Connection

7.2.1 Configure a base station

Before configuring an NTRIP base station you first need to ensure that your Cellular modem is powered on and has a valid PIN code. See Basic Cellular configuration chapter on previous page.

To configure a base station to be accessible via the NTRIP protocol one will need to configure an NTRIP caster and local NTRIP server. The following commands are needed to set up a proper caster.

```
setCellularParameters, on, on, , , , all
setNtripCasterSettings, on, 2101
setNtripCasterMountPoints, MP1, on, <mountpoint name>
setNtripCasterUsers, User1, <user>, <password>, MP1
setNTRIPSettings, NTR1, Server, localhost, 2101, , , <mountpoint name>
setPortFirewall, Cell, PortList, 2101
```

These commands define a <user> and <password> that can be used to access an NTRIP mountpoint <mountpoint name> on the port 2101. Afterwards you still need to configure what format/messages should be available on the mount point. If RTCM3 messages are desired the following commands can be used.

```
setRTCMv3Output, NTR1, RTCM1006+RTCM1033+RTCM1230+RTCM1004+RTCM1012
setDataInOut, NTR1, , RTCMv3
```

Do not forget to also configure your receiver as a static base using the command.

```
setPVTMode, Static, StandAlone, auto
```

With the commands above your receiver will be able to serve an NTRIP client. Note that the client will need to know the IP address of the base station. This can be retrieved with the command *lif, ipparameters*. Note that every time your Cellular modem connects to your mobile internet provider, it may receive a different IP address which can make the process of knowing your IP address fairly cumbersome. An alternative is to set up a dyndns account to have a fixed url for your base station.

7.2.2 Configure a rover receiver

Configuring an NTRIP client on your rover receiver is straightforward once your Cellular modem is powered on and has a valid PIN code. The following two commands are needed.

```
setCellularParameters, on, on, , , , all
setNtripSettings, NTR1, Client, <address>, <port>, <user>, <password>,
<mountpoint name>
```

The parameters <address>, <port>, <user>, <password> and <mountpoint name> should match with the ones defined by your base station or NTRIP caster. To retrieve the list of mount points that a specific NTRIP caster offers the command *lstNTRIPSourceTable* can be used. Refer to the Altus APS3G Reference Guide for details about this command.

In order to achieve an RTK solution do not forget to enable that PVT mode

```
setPVTMode, Rover, StandAlone+DGPS+RTK
```

7.3 Set Up a Data Call

7.3.1 Configure a base station

To configure a base station to be accessible via Data Call the following commands are used

```
setCellularParameters, on, off
setCellularDataCall, on, Accepting, , V.110_auto
```

Note that Data Call functionality is mutually exclusive with an internet connection. The first command above will disable the internet access of your receiver. Afterwards you still need to configure what format/messages should be available on the mount point. If RTCM3 messages are desired the following commands can be used.

```
setRTCMv3Output, DCL1, RTCM1006+RTCM1033+RTCM1230+RTCM1004+RTCM1012
setDataInOut, DCL1, , RTCMv3
```

Do not forget to also configure your receiver as a static base using the command.

```
setPVTMode, Static, StandAlone, auto
```

Note that Data Call functionality is a 2-ways communication between two Cellular modems. One base station can then only serve one single rover at a time. If a receiver is trying to call a base already serving a rover, that second connection will fail.

7.3.2 Configure a rover receiver

Configuring a Data Call client on your rover receiver can be done using the following commands

```
setCellularParameters, on, off  
setCellularDataCall, on, Calling, <base number>, V.110_auto
```

In order to achieve an RTK solution do not forget to enable that PVT mode

```
setPVTMode, Rover, StandAlone+DGPS+RTK
```

Note that Data Call functionality is a 2-ways communication between two Cellular modems. One base station can then only serve one single rover at a time. If a receiver is trying to call a base already serving a rover, that second connection will fail.

8 Controlled Shut Down

A shut down may be initiated by the Power Controller or triggered from the controlling application.

The Power Controller triggers a shut down if the power button is pressed or when both batteries are empty.

8.1 Triggered from Controlling Application

8.1.1 Connect to the Power Controller

For the controlling application to communicate to the power controller, COM3 has to be daisy chained to COM1.

At the ALTUS APS3G COM3> prompt:

setDaisyChainMode, DC2, ASCII

setDataInOut, COM1, DC1, DC2

setDataInOut, COM3, DC2, DC1

8.1.2 Shut Down Sequence

Since the COM3 and COM1 are daisy chained, COM3 will show all messages sent by the Power Controller.

	Controlling Application	GNSS receiver board response	Power Controller
1	#PSSD<LF>		
2			@PS,0<LF>
3			SSSSSSSSSS
4		COM1>	
5			sdio,dsk1,none,none<CR><LF>

6		DataInOut,DSK1,none,none,off	
7			sso,stream1,none,none,off<CR><LF>
8		SBFOutput,Stream1,none,none,off	
9			epwm, standby<CR><LF>
10		\$TE PowerMode Standby	
11		STOP>	

In steps 3, 5, 7 and 9, the Power Controller requires a response from the GNSS receiver before the message is sent. The power board waits for 10 seconds for a valid response. If the response is not received, the message is repeated. The power board will wait another 10 seconds for a valid response. If the response is not received, poser is switched off. Messages sent to the Power Controller are case sensitive.

8.2 Triggered by the Power Controller

As mentioned earlier this sequence is triggered if the power button is pressed or when both batteries are empty. The controlling application will only observe the messages in step 9 and 10.

	Controlling Application	GNSS receiver board response	Power Controller
1			@PS,<shut down reason><LF>
2			SSSSSSSSSS
3		COM1>	
4			sdio,dsk1,none,none<CR><LF>
5		DataInOut,DSK1,none,none,off	
6			sso,stream1,none,none,off<CR><LF>
7		SBFOutput,Stream1,none,none,off	
8			epwm, standby<CR><LF>
9		\$TE PowerMode Standby	
10		STOP>	

<shut down reason> is 1 if a button is pressed or 2 on battery low.

In steps 3, 5, 7 and 9, the Power Controller requires a response from the GNSS receiver before the message is sent. The power board waits for 10 seconds for a valid response. If the response is not received, the message is repeated. The power board will wait another 10 seconds for a valid response. If the response is not received, power is switched off. Messages sent to the Power Controller are case sensitive.

9 Set Up a Connection with the UHF Modem

More details on the commands and responses of the UHF modem can be found in “Communication with the Satel M3-TR4 UHF radio” on page 41.

9.1 Differences between M3-TR3 and M3-TR4

The Altus APS3G is always equipped with a Satel M3-TR4. The recent legacy APS-3s are equipped with a Satel M3-TR3.

The M3-TR4 supports more modulations than the M3-TR3. These higher order modulations allow a higher data rate without requiring a higher bandwidth.

The reading and writing of the modulation is accomplished with the commands ‘SL@S=x?’ and ‘SL@S=x’.

Modulation	Index ‘x’	M3-TR3	M3-TR4
SATELLINE-3AS	0	Y	Y
PacCrest-4FSK	1	Y	Y
PacCrest-GMSK	2	Y	Y
Trimtalk450s(P) (RX fits PacCrest modems)	3	Y	Y
Trimtalk450s(T) (RX fits Trimble modems)	4	Y	Y
PacCrest-FST (Option5)	5	Y	Y
8FSK FEC OFF	20	N	Y
8FSK FEC ON	21	N	Y
16FSK FEC ON	22	N	Y

9.2 Configuring the radio

9.2.1 Connect the UHF radio modem to COM2

At the ALTUS APS3G COM3> prompt:

```
setGPIOFunctionality, GP1, Output, none, LevelHigh
```

```
setGPIOFunctionality, GP2, Output, none, LevelLow
```

Note: remember that the *setGPIOFunctionality* command will have no effect if the Cellular module was put in stand by using the command *setCellularParameters*, on. See chapter “Force Cell Modem in Stand By” on page 16.

9.2.2 Power-On the UHF radio

At the ALTUS APS3G COM3> prompt:

```
setGPIOFunctionality, GP3, Output, none, LevelLow
```

9.2.3 Route COM3 to the UHF radio

The modem is wired to COM2.

Connect COM3 (SER1) to the COM2, so the commands can be issued to the modem from the external serial port or Bluetooth.

At the ALTUS APS3G COM3> prompt:

setDatatInOut, COM2, DC1, DC2

setDatatInOut, COM3, DC2, DC1

9.2.4 Most used commands

Command	Effect	Response
SL&F?	Get active frequency	"nnn.nnnnn MHz"
SL\$C=nn	Set number of channels in channel list.	"OK" or "ERROR"
SL\$L=laa,Nbbbbbb,Fccc.cccccc,Wdd.ddd,Peeee	Define channel aa in the channel list	"OK" or "ERROR"
SL@S=x	Set radio protocol	"OK" or "ERROR"
SL\$F=y	Select channel y	"OK" or "ERROR"
SL%F=z	Switch FEC on (1) or off (0)	"OK" or "ERROR"
SL@P=p	Set the radio's output power to p mW	"OK" or "ERROR"

9.2.5 Finalize the set up

Goal	Command
Go back to receiver command line	SSSSSSSSSS

Restore COM3	sdio, COM3, CMD, SBF+NMEA
Base: Push corrections COM2→ UHF	sdio, COM2, , +RTCMv3
Rover: Receive corrections UHF → COM2	sdio, COM2, RTCMv3

10 Annex 1: Other Documents

10.1 Referred Documents

This Application Note is to be used together with:

- at-kommando-referenz-g24.pdf (only applicable for firmware revision before 4.3.3, see Annex 8)
- at-kommando-referenz-h24.pdf (only applicable for firmware revision before 4.3.3, see Annex 8)
- 'APS3G Tools' software and scripts
- Altus APS3G Quick Start Guide.pdf
- Altus APS3G User Manual.pdf

For ALTUS APS3G:

- Altus APS3G Product Family Hardware Manual
- Altus APS3G GNSS Firmware v4.3.3 Command And Log Reference Card.pdf
- Altus APS3G GNSS Firmware v4.3.3 Reference Guide

10.2 Using the Telit manuals

"at-kommando-referenz-g24.pdf" and "at-kommando-referenz-h24.pdf" are the manuals supplied by Telit Cellular modem.

The description of the commands are accurate, but the manuals do not contain clear and complete examples of command sequences.

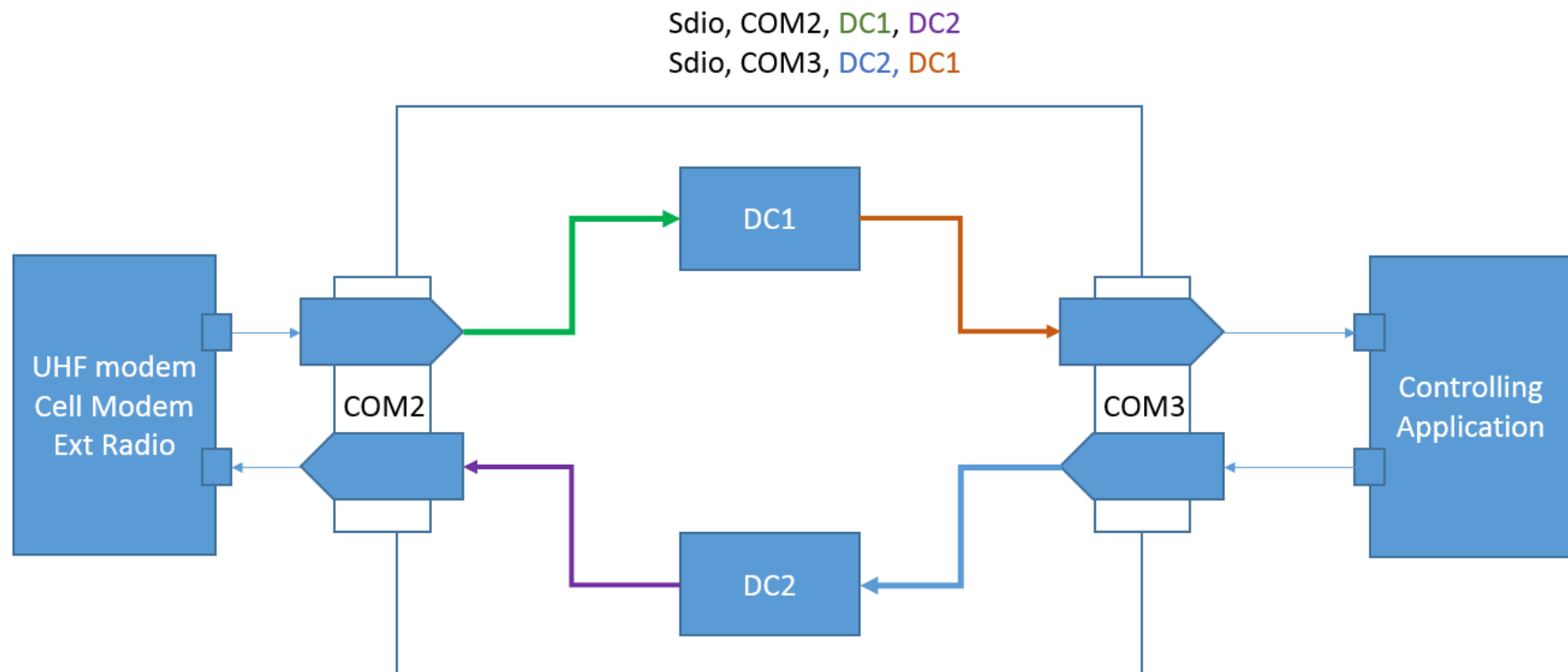
The Telit manuals are quite difficult to find your way in.

The easiest to find the definition of a command is to look for the table with its parameter list.

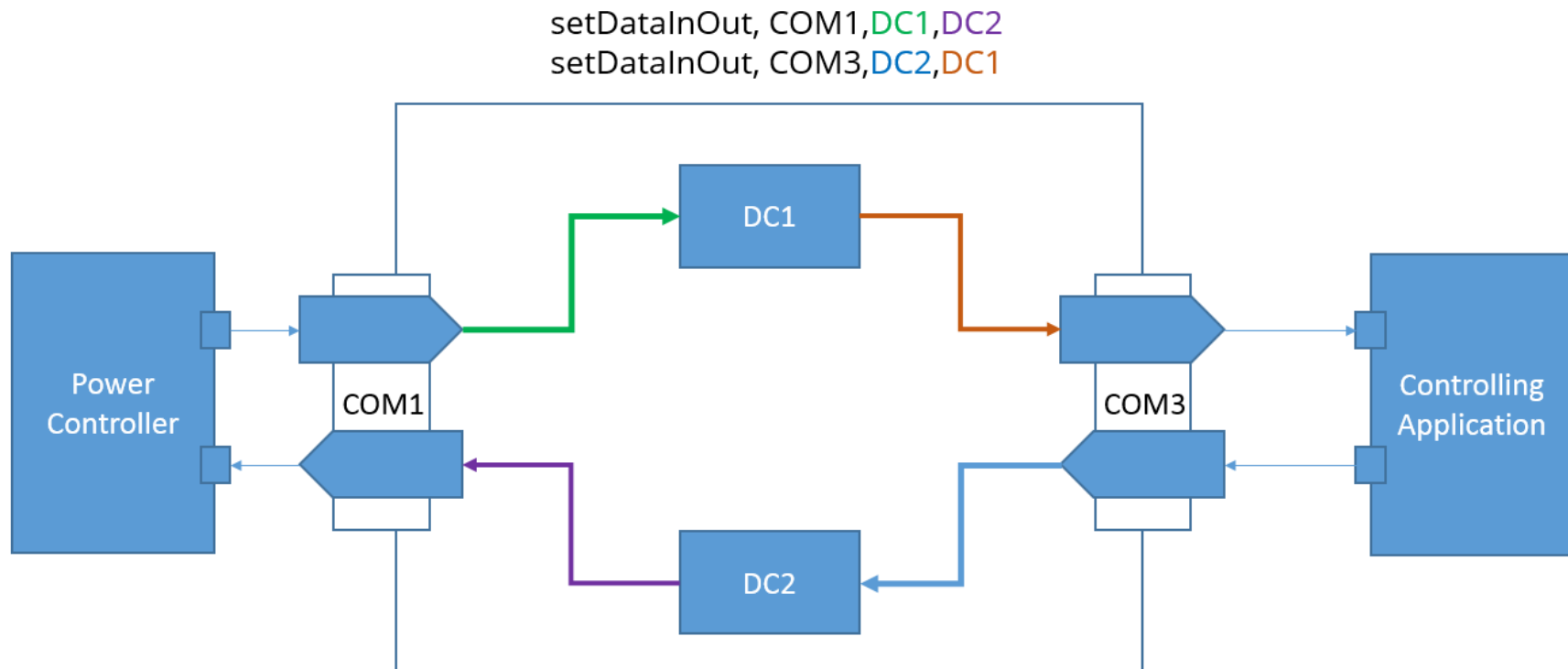
Otherwise you will first pass through all occurrences of the command in the manuals.

e.g. to search for the command "AT+CSCS", search for "+CSCS Parameters"

11 Annex 3: COM3-COM2 Daisy Chain



12 Annex 4: COM3-COM1 Daisy Chain



13 Annex 5: (Smart) Check for Available Functionality

The controlling application sometimes needs an insight in what functionality the Altus APS3G offers.

There are two basic strategies to collect that information:

- Issue a command that uses the functionality and see whether it fails,
- Retrieve Capabilities and/or Permissions and learn what is available.

The strategies will be explained with the PVT modes as an example.

13.1 Using dedicated queries

The APS3G offers two queries to learn what functionality is available.

<code>lif,permissions</code>	This shows all the functionality that has (not) been purchased
<code>getReceiverCapabilities</code>	This reports a combination of system capability and purchased options

lif,permissions shows in the most structured way what is the accessible functionality.

To learn about the available PVT modes, look for the nodes below in the XML output of *lif,permissions*

```
<dgpsrover      val="1"    descr="DGPS Rover"    valdescr="Permitted"    />
<dgpsbase       val="0"    descr="DGPS Base"    valdescr="Not permitted" />
<rtkrover       val="1"    descr="RTK Rover"    valdescr="Permitted"    />
<rtkbase        val="0"    descr="RTK Base"    valdescr="Not permitted" />
<ppp            val="0"    descr="PPP"          valdescr="Not permitted" />
```

StandAlone and SBAS are always possible.

13.2 Using Command Failure/Success

A simple check to see what PVT modes are possible:

setPVTMode, Rover, StandAlone	This must succeed on all receivers
setPVTMode, Rover, +SBAS	This must succeed on all receivers
setPVTMode, Rover, +DGPS	This only succeeds if DGPS is possible and permitted
setPVTMode, Rover, +PPP	This only succeeds if PPP is possible and permitted
setPVTMode, Rover, +RTK	This only succeeds if PPP is possible and permitted

setPVTMode, Rover, all always succeeds; it switches on all the “allowed” modes.

14 Annex 6: Querying the Permissions

Normally APS3G sold to an end customer has “eternal” permissions. Demo units and Stock Models may have “temporary” or “constrained duration” permissions.

“Temporary” permissions simply have an end date.

“Constrained Duration” permissions allow the user to use the APS3G for a certain period after activation. “Constrained Duration” permissions are activated after 15 minutes of using the APS3G.

This section illustrates how the end dates of ‘non eternal’ permissions. The information is part of the XML output *lif,permissions*. The following XML nodes are relevant for the duration of permissions.

```
<timeslice>
  <ts_beg>1970-01-01
  00:00:00</ts_beg>
  <constrained_duration>
    <cd_activated>Activated</cd_activated>
    <cd_beg>2016-03-21 15:49:00</cd_beg>
    <cd_end>2016-05-16 15:49:00</cd_end>
  </constrained_duration>
  <ts_end>2016-03-31
  23:59:59</ts_end>
</timeslice>
```

The overall permission expires on **2016-03-31 23:59:59**.

This information is in the <ts_end> element.

While the overall permission is valid, the user can only use the APS3G for 100 days.

This is the period between **2016-03-21 15:49:00** and **2016-05-16 15:49:00**.

This information is in the <cd_beg> and <cd_end> elements.

The permission will expire at the earliest time of <cd_end> and <ts_end>.

15 Annex 7: Interpreting Receiver and peripheral responses

This section adds some clarifying comments to the section “Command Line Interface Outline” in the Altus APS3G Reference Guide.

15.1 Communication with the GNSS board

15.1.1 Sending commands to the receiver

A command is concluded with <CR>, <LF> or <CR><LF>.

```
COM1>setNMEAOutput, stream1, com1, GGA, sec1 <CR>
COM1>setNMEAOutput, stream1, com1, GGA, sec1 <LF>
COM1>setNMEAOutput, stream1, com1, GGA, sec1 <CR><LF>
```

15.1.2 The response of the receiver

15.1.2.1 Successful Execution

The response to a successfully executed command

1. starts with '\$R: ',
2. followed by a repetition of the command itself,
3. then the actual response,
4. concluded with a prompt.

Each line is concluded with a <CR><LF>, except the line containing the prompt.

```
$R: setNMEAOutput, stream1, com1, GGA, sec1<CR><LF>
NMEAOutput, stream1, com1, GGA, sec1<CR><LF>
COM1>
```

15.1.2.2 Command Failure

The response to an erroneous command

1. starts with '\$R?',
2. followed by a repetition of the command itself,
3. then the actual response,
4. concluded with a prompt.

Each line is concluded with a <CR><LF>, except the line containing the prompt.

15.1 Communication with the Telit H24 modem

This section adds some clarification to the section “AT Command Structure” in the Telit H24 Command Reference document.

The Telit modem allows commands to be concatenated on one line, separated by semicolon (;) or a space. Since this complicates debugging problems, this is not advised.

A single command or a concatenation of commands is concluded with a <CR>

The following table shows the regular expression matching all the different commands of the Telit H24 modem, separating them in seven categories using named groups.

The table is offered 'as-is' and can be used as a starting point for processing the responses of the Telit H24, without claiming to be complete.

A top level view of the command response combinations is that each response consists of

- A repetition of the command closed with a <CR>
- One or more response blocks, constructed as:
<CR><LF>Response<CR><LF>

The 'Response' can be any reported data, an 'OK' or an error message.

Typically, the response to a successful 'set' command starts with OK followed by a detailed response. The response to set command is reported asynchronously.

For that reason, the response blocks of most 'set' commands contain a repetition of the command without parameters and without the 'AT' prefix so the controlling application can link the responses to commands

The response to a successful 'get' ends with an OK. The 'OK' is then followed by one or more response blocks containing the information.

Concatenating all sub expressions in the first column results in a regular expression matching all possible Telit H24 commands

Command	Response
(?<at>\$)	(\r\n)+OK(\r\n)
(?<ath>H)	[aA][tT][hH](.*)(\r \n)*(?<ALL>(?(SUCCESS>(\r\nNO\sCARRIER\r\n)+\r\nOK) (?(FAIL>\s+CM(E\sERROR\s(.+))))\r\n
(?<ata>(A D*99))	[aA][tT](.*)(\r \n)+(?(ALL>(?(SUCCESS>(OK CONNECT)) (?(FAIL>(NO CARRIER ERROR ERROR\s(.+) \s+CM(E S)\sERROR\s(.+))))\r\n
(?<atd>(D DL D\>))	[aA][tT][dD](.*)(\r \n)+(?(ALL>(?(SUCCESS>CONNECT\s(.*){0,1}) (?(FAIL>NO\sCARRIER BUSY NO\sANSWER ERROR\s(.+){0,1} UNKNOWN\sCALLING\sERROR CM(E S)\sERROR\s(.+))))\r\n
(?<ati>[A-Z0-9]+)	[aA][tT][iI](.*)(\r \n)+(?(ALL>(?(SUCCESS>(?(BODY>.*(\r \n)+)*(\r\nOK\r\n)) (?(FAIL>\s+CM(E S)\sERROR\s(.+) ERROR\s(.+){0,1})\r\n
(?<get>\S)	[aA][tT](.*)(\r \n)*(?<ALL>(?(SUCCESS>(\r\n(.+)\r\n)*(\r\nOK\r\n)) (?(FAIL>(\s+CM(E S)\sERROR\s(.+) ERROR\s(.+){0,1})\r\n
(?<ats>S.d{1,3}\$)	[aA][tT][sS](.*)(\r \n)+(?(ALL>(?(SUCCESS>OK) (?(FAIL>\s+CM(E\sERROR\s(.+))))\r\n
(?<get>S.d{1,3}\? \$)	
(\s+ &)((?<set>[A-Z0-9]+\s+=.+))	[aA][tT](.*)(\r \n)*(?<ALL>(?(SUCCESS>(\r\nOK\r\n)(\r\n(.+)\r\n)* (?(FAIL>(\s+CM(E S)\sERROR\s(.+) ERROR\s(.+){0,1})\r\n
(?<get>[A-Z0-9]+\s+(\?){0,1})	
(?<tst>[A-Z0-9]+\s+=\s+(\?)))	[aA][tT](.*)(\r \n)*(?<ALL>(?(SUCCESS>(\r\n(.+)\r\n)*(\r\nOK\r\n)) (?(FAIL>(\s+CM(E S)\sERROR\s(.+) ERROR\s(.+){0,1})\r\n

Note: In .NET a named group is indicated with (?<name> expression). This is the format of the first column in the previous table.

15.2 Communication with the Satel M3-TR4 UHF radio

Starting from firmware version 4.3.3 the GNSS receiver board controls the Satel M3-TR4 Cellular modem. The controlling application should not try to control this modem. The protocol described in this chapter is only relevant for older firmware versions of the ALTUS APS3G.

The commands sent to the radio are concluded with <CR>.

The set commands end in "=" followed by the parameters of the set command.

e.g. SL@D=50 <CR>

When a command can be executed the response is 'OK'.

This response is *not* terminated by <CR>, nor <LF>, nor <CR><LF>.

```
SL@D=50<CR>
```

```
OK
```

When the command fails, the radio responds with 'ERROR'.

This response is *not* terminated by <CR>, nor <LF>, nor <CR><LF>.

```
SL@D=99999<CR>
```

```
ERROR
```

There's no uniform structure of the response to get commands.

The only way is to wait for the expected number of characters and expected structure.

Two checks can be executed to identify the connected radio

Command sent	Satel response
+++	OK
SL!V?	M3-TR3 or M3-TR4

Note that the Satel M3-TR3/4 does not respond at all when it receives unrecognized commands. Sending invalid commands to the modem is not a proper way to test if a connection to the modem is available. For the Satel radio to respond to the escape sequence +++, sufficient delay has to be added between the pluses. The timing is defined in Satel integration guide.

16 Annex 8: Controlling the Cellular modem with firmware version before 4.3.3

When using a firmware version before 4.3.3 the Cellular modem is not controlled by the GNSS receiver board. In that case the controlling application has to implement logic to set up a call or an internet connection. This chapter is written for legacy. If your Altus APS3G receiver has a firmware version above or equal to 4.3.3 please refer to Chapter 7 Set Up a Connection with the Cell Modem on page 21.

16.1 Force Cell Modem in Stand By

The Power Controller keeps the cell modem in standby when the ALTUS APS3G is powered on. So no action is required immediately after powering the ALTUS APS3G.

If the starting state is not clear, the cell modem can be forced in standby using the following procedure.

Connect COM3 (SER1) to the COM1, so the power on command can be issued from the external serial port.

At the ALTUS APS3G COM3> prompt:

setDaisyChainMode, DC2, ASCII

setDataInOut, COM1, DC1, DC2

setDataInOut, COM3, DC2, DC1

The interpretation of the commands above is illustrated in section “

Annex 4: COM3-COM1 Daisy Chain” on page 34.

Talking to the power controller:

```
#PSPO,0<LF>
```

If after issuing the commands above the controlling application needs to continue configuring the receiver, the receiver command prompt has to be forced using the escape sequence.

The escape sequence is a sequence of ten capital ‘S’ sent within 5 seconds.

Before issuing commands the controlling application has to await the receiver prompt.

16.2 Set Up a Connection with the Cell Modem

This section explains how to “Set Up an Ntrip Connection” and “Set Up a Data Call” with the Cell Modem.

16.1 Power Up and Prepare the Modem

This section described the steps needed to prepare the modem before establishing a connection. These steps have to be repeated each time the Altus APS3G has been switched on.

16.1.1 Connect the COM2 to the GSM Modem

The “Selector Logic” has to be configured to route the COM2 to the modem.

At the ALTUS APS3G COM3> prompt:

```
setGPIOFunctionality, GP1, Output, none, LevelLow  
setGPIOFunctionality, GP2, Output, none, LevelHigh  
setGPIOFunctionality, GP3, Output, none, LevelHigh
```

16.1.2 Power-On the GSM Modem

Connect COM3 (SER1) to the COM1, so the power on command can be issued from the external serial port.

At the ALTUS APS3G COM3> prompt:

```
setDaisyChainMode, DC2, ASCII  
SetDataInOut, COM1, DC1, DC2  
SetDataInOut, COM3, DC2, DC1
```

Talking to the power controller:

```
#PSPO,1<LF>
```

To power off the modem the command #PSPO,0 is to be issued to the power controller.

16.1.3 Initialize the Modem

More details on the commands and responses of the cell modem can be found in “Communication with the Telit H24 modem” on page 38.

The modem is wired to COM2 as shown in the “

ALTUS APS3G Architecture” on page 6.

Connect COM3 (SER1) to the COM2, so the commands can be issued to the modem from the external serial port.

At the ALTUS APS3G COM3> prompt:

setDaisyChainMode, DC2, ASCII

setDataInOut, COM2, DC1, DC2

s, COM3, DC2, DC1

16.1.3.1 Telit H24 specific initialization

at+mconn=3	UART 1 of the Telit H24 is used for both data and control. USB and UART2 are not used
at+cmee=2	Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use verbose <err> values The default value is 0.

If the +mconn command is not issued, it is not possible to set up an IP connection.

16.2 Set Up an Ntrip Connection

16.2.1 Check the current status

AT+MIPCLOSE?	Which sockets are open? 0 = no active sockets
AT+CSQ	Get reception quality and error rate
AT+CPIN?	Repeat until READY is returned

16.2.2 Confirm the modem type

To be able to adapt the software to handle both modems, the following command is to be issued:

```
AT+CGMM?

+CGMM: "GSM1800","GSM900","GSM1900","WCDMA2100","MODEL=H24"

OK
```

The +MIPOPEN command has a parameter `TransferDataMode` that can be used to select the raw transfer mode.

+MIPOPEN requires a `<CallID>`.

A `<CallID>` is defined within a context.

A context is created with +CGDCONT and is identified with a context ID `<CID>`.

This results in the command sequence below:

<p>AT+MIPCALL?</p> <p>Response: OK +MIPCALL: <CallID>,<CID>[,<LocalIP>] +MIPCALL: <CallID>,<CID>[,<LocalIP>] (example for 2 open calls)</p> <p>e.g. AT+MIPCALL=1,1,1</p>	<p>Are there open calls? Returns a list of open calls with their associated context</p>
<p>AT+CGDCONT?</p> <p>Response: +CGDCONT: <cid>, ..., <APN>, ... +CGDCONT: <cid>, ..., <APN>, ... (example for 2 defined contexts) OK</p>	<p>Which contexts are in use? Returns all contexts in use</p>
<p>AT+CGDCONT=[<cid> [,<PDP_type>[,<APN> [,<PDP_addr>[,<d_com p> [,<h_comp>]]]]]]</p> <p>Response: OK e.g. AT+CGDCONT=1,"IP","internet.proximus.be"</p>	<p>Connects context <cid> to service provider <APN></p>
<p>AT+MIPCALL=<CallID>,<Operation>,<CID>,[<Phone Number>]</p> <p>Response: +MIPCALL: <CallID>,<CallStatus>[,<LocalIP>]</p> <p>e.g. AT+MIPCALL=1,1,1</p>	<p>Now create a call <CallID> in the context <cid> After issuing this command wait for the +MIPCALL response</p>
<p>AT+MIOPEN=<CallID> , <SocketID>, <SourcePort>, <RemoteIP>, <RemotePort>,<SocketType>[,<TransferDataMode>] , [,<PseudoCommandMode>]</p> <p>OK</p> <p>+MIOPEN: <CallID>,<SocketID>,<SocketStatus>[,<RemoteIP>,<RemotePort>]1</p> <p>e.g. AT+MIOPEN=1,1,8000,"ntrip.flepos.be",2101,0,1,0</p>	<p>Now use the <CallID> to connect to the <RemoteIP></p> <p>For ALTUS APS3G the following settings should explicitly applied:</p> <p>TransferDataMode=1 (on line) PseudoCommandMode=0 (enabled)</p>

16.2.3 Connect to mount point

The following Ntrip command is to be issued to connect to an Ntrip mount point

```
GET /<mountpoint> HTTP/1.0  
User-Agent: <User Agent>  
Authorization: <Authorization Info>  
Accept: */*
```

An Ntrip v1 caster responds with

```
ICY 201  
OK
```

When the connection is successfully made, the RTCM packages will be streamed through the modem.

16.2.4 Interrupting online data mode

After issuing the +MIOPEN command, the modem is in 'On Line Mode' and will not respond to commands. To send commands without canceling the online data mode, the mode must be escaped. If the escape sequence is sent to the modem outside of the online mode, the modem does not respond.

Command	Response	Description
+++		Escape, leave data transfer <CR><LF> must NOT be sent after the +++ for Telit H24
	Online mode: OK<CR><LF> else: no response	Wait for the modem to respond (OK) before issuing new commands. It may take several seconds for the modem to respond.
AT<CR><LF>		Are we talking to the modem?
	OK	Yes, we are.

16.2.4.1 Interrupting from an unknown state

Command and Response	Description
Send "+++<CR><LF>"	Send the escape sequence
Wait until "OK" is returned OR 3 seconds have passed	
	If "OK" was received the modem has left the "on line mode" If nothing was received the modem was already in a state where it could receive commands
Send "AT<CR><LF>"	Send AT to confirm the modem can be accessed for commands
Wait until "OK" is returned OR 3 seconds have passed	
	If no OK was returned the modem is in an uncontrollable state and has to be power cycled

16.2.5 Back to the Receiver command prompt

If after issuing the command above the controlling application needs to continue configuring the receiver, the receiver command prompt has to be forced using the escape sequence.

The escape sequence is a sequence of ten capital 'S' sent within 5 seconds.

Before issuing commands the controlling application has to await the receiver prompt.

16.3 Set Up a Data Call

Follow the steps described in “Power Up and Prepare the Modem” on page 43.

Referring to the Telit H24 manual page 4-11:

Dialing a call is possible under two conditions,

first the correct bearer service has to be set, see +CBST command. ()*

The second condition is that the RAT has to be GSM;

A data call is not supported in WCDMA RAT.

*In order to manually switch to GSM RAT the +COPS command should be used. (**)*

Command	Response	Description
at+COPS=1,0,"BEL PROXIMUS",0	OK	Force the modem in 2G (**)
at+ws46?	12 OK	Check whether switched to 2G
at+CBST=0,0,1	OK	set bearer service (*)
atd+498924207999	CONNECT Trying mobil64 (10.192.99.112, 10434)... Open [Connection to mobil64 closed by foreign host] NO CARRIER	Initiate data call

Referring to the Telit H24 Manual page 2.6 section 2.4.3 Technical Description:

Network operators typically support the asynchronous CSD (Circuit Switched Data) bearer service through a modem interworking function.

This means that a H24 initiates a data call and the network routes the call to the modem interworking function, which is located at the Mobile Switching Center (MSC) of the network.

The modem interworking function then dials the number supplied by the mobile station.

This is different from voice calls, where the network itself routes the call. ...

16.3.1 Data Call Rover Set Up

This section simply lists all the commands to set up a data call from a rover to a base.
For more details please refer to the sections earlier in the document.

16.3.1.1 Changing communication between Receiver and peripheral

16.3.1.2 Restoring the Receiver Prompt on the Receiver's COM3

When the controlling application needs communication with the peripheral, a daisy chain has to be set up. When that communication has finished and the communication has finished, the daisy chain has to be broken

To recover receiver the command line on COM3, a sequence of ten 'S' is to be sent over COM3:

SSSSSSSSSS<CR>

The receiver responds with

COM3>

When the daisy chain has to be broken it is indicated as *"Precondition: at receiver prompt COM3>"*

16.3.1.3 Restoring the Command Line on the Cell Modem

When a data path has been opened over the modem and the controlling application needs to issue commands to the peripheral the data stream has to be interrupted.

To interrupt a data stream: see section "Interrupting online data mode" on page 62.

When the controlling application has to set the daisy chain and possibly interrupt the data flow from the modem, this is indicated as *"Precondition: talking to the modem"*.

16.3.1.4 Power On

Precondition: at receiver prompt COM3>

setGPIOFunctionality,GP1,Output,none,LevelLow

setGPIOFunctionality,GP2,Output,none,LevelHigh

setGPIOFunctionality,GP3,Output,none,LevelHigh

setDaisyChainMode,DC2,ASCII

setDataInOut,COM1,DC1,DC2

setDataInOut,COM3,DC2,DC1

#PSPO,1

Postcondition: on power controller's command line

16.3.1.5 Daisy Chain COM3-COM2

Precondition: at receiver prompt COM3>

```
setDaisyChainMode,DC2,ASCII  
setDataInOut,COM2,DC1,DC2  
setDataInOut,COM3,DC2,DC1
```

Precondition: talking to the modem

16.3.1.6 Read the cell modem's status

Precondition: talking to the modem

```
at+creg?  
at+cops?
```

16.3.1.7 Configure modem's IO ports

Precondition: talking to the modem

```
at+mconn=3
```

16.3.1.8 Set error Reporting

Precondition: talking to the modem

```
at+cmee=2
```

16.3.1.9 Read/Set/Validate Pin Status

Precondition: talking to the modem

```
at+cpin?  
at+cpin=xxxxx  
at+cpin?
```

16.3.1.10 *Create a Session*

Precondition: talking to the modem

AT+CGDCONT=1,"IP","internet.proximus.be"	Define network APN
--	--------------------

Postcondition: a session is created

16.3.1.11 *Call the base*

Precondition: talking to the modem

atd+324712689999	No semicolon Telit H24 manual section: "Call Control AT Commands"
------------------	---

PostCondition: if connection successful, the modem is in data mode

16.3.1.12 *COM Configuration and Send GGA to Base*

Precondition: at receiver prompt COM3>

setDataInOut,COM3,CMD,SBF+NMEA	Receiver Output to COM3
setDataInOut,COM2,RTCMv3,SBF+NMEA	Corrections arriving on COM2
setNMEAOutput,stream9,COM2,GGA,on	GGA to caster

16.3.1.13 *Hang-up*

Precondition: talking to the modem

ath	No semicolon Telit H24 manual section: "H, Hang-up Call"
-----	--

PostCondition: talking to the modem

16.3.1.14 *Stop Sending GGA to Base*

Precondition: at receiver prompt COM3>

setNMEAOutput,stream9,COM2,GGA,off	Stop sending GGA to caster
------------------------------------	----------------------------

16.3.2 Data Call Base Set Up

This section simply lists all the commands to set up a data call from a rover to a base.
For more details please refer to the sections earlier in the document.

16.3.2.1 Power On

Precondition: at receiver prompt COM3>

```
setGPIOFunctionality,GP1,Output,none,LevelLow  
setGPIOFunctionality,GP2,Output,none,LevelHigh  
setGPIOFunctionality,GP3,Output,none,LevelHigh  
setDaisyChainMode,DC2,ASCII  
setDataInOut,COM1,DC1,DC2  
setDataInOut,COM3,DC2,DC1  
#PSPO,1
```

Postcondition: on power controller's command line

16.3.2.2 Daisy Chain COM3-COM2

Precondition: at receiver prompt COM3>

```
setDaisyChainMode,DC2,ASCII  
setDataInOut,COM2,DC1,DC2  
setDataInOut,COM3,DC2,DC1
```

Precondition: talking to the modem

16.3.2.3 Read the cell Modem's Status

Precondition: talking to the modem

```
at+creg?  
at+cops?
```

16.3.2.4 Configure Modem's IO Ports

Precondition: talking to the modem

```
at+mconn=3
```

16.3.2.5 Set Error Reporting

Precondition: talking to the modem

at+cmee=2

16.3.2.6 Read/Set/Validate Pin Status

Precondition: talking to the modem

at+cpin?

at+cpin=xxxxx

at+cpin?

16.3.2.7 Create a Session

Precondition: talking to the modem

AT+CGDCONT=1,"IP","internet.proximus.be"	Define network APN
--	--------------------

Postcondition: a session is created

16.3.2.8 Answer the call

Precondition: talking to the modem, "RING" is received

(RING received)	Telit H24 Manual section:
ATA	"Answering a Circuit Switched Call"

Postcondition: if connection successful, the modem is in data mode

16.3.2.9 Set COM configuration

Precondition: at receiver prompt COM3>

setDataInOut,COM3,CMD,SBF+NMEA	Receiver Output to COM3
setDataInOut,COM2,NMEA,RTCMv3	Corrections sent to COM2, GGA incoming
sr3o,com2,RTCM1006+RTCM1033+RTCM1230	Selects RTCMv3 correction messages
+RTCM1074+RTCM1084+RTCM1094+RTCM1124	

RTCMv3 messages are sent to COM2

16.3.2.10 Hang-up

Precondition: talking to the modem

ath	No semicolon
	Telit H24 manual section:
	"H, Hang-up Call"

PostCondition: talking to the modem

16.3.2.11 Stop sending RTCM

Precondition: at receiver prompt COM3>

setDataInOut, COM2,,none	Stop sending RTCM to rover
--------------------------	----------------------------

16.4 Differences between Telit G24 and H24

This section elaborates the differences between the two modems, so a driver can be built supporting both legacy APS-3 with a Telit G24 and the new Altus APS3G with Telit H24.

Recent legacy-APS3Gs are equipped with a Telit H24 too.

16.4.1.1 Telit G24 specific initialization

at+cmee=2	Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use verbose <err> values or +STK ERROR: <err> result codes and use numeric <err> values. The default value is 0.
at+mgeer=2	2 =Returns error cause in text format. The default value is 2. The command is optional since the default is 2

The +MGEER is used to retrieve the PDP context activation reject cause.

The Telit H24 does not support the +MGEER command.

16.4.2 Discriminate the modems

To be able to adapt the software to handle both modems, the following command is to be issued:

Telit G	Telit H
AT+CGMM? +CGMM: "GSM900", "GSM1800", "GSM1900", "GSM850", "MODEL=G24" OK	AT+CGMM? +CGMM: "GSM1800", "GSM900", "GSM1900", "WCDMA2100", "MODEL=H24" OK

16.4.2.1 Set Up an Ntrip connection

The Telit H24 does not have a +MIPODM command. Therefore the +MIPOPEN command is to be used.

AT+MIPCALL? Response: +MIPCALL: <status>[,<IP>]	Is there an open call? get status of PPP connection status = 0 = disconnected if connected returns the IP address of the modem
+MIPCALL= <Operation>[<APN>/<phone number>, [<Username>, <Password>]] Response: OK +MIPCALL: <"local IP address"> e.g. AT+MIPCALL=1,"internet.proximus.be"	If <Operation> =1, connects to <APN> The +MIPCALL command does not return the prompt to the terminal until the IP is received from the provider, or time out has occurred, therefore, no other commands can be issued in the meantime.
AT+MIPODM=<Socket ID>,<Source Port>,<Remote IP>,<Remote Port>,<Protocol>,<Pseudo-CommandMode On/Off> Response: OK e.g. AT+MIPODM=1,2101,"ntrip.flepos.be",2101,0,0	MIPODM opens a raw data transfer connection to <Remote IP> After issuing the commands, wait for the data to arrive

16.4.2.2 Interrupting online data mode

Command	Response	Description
+++<CR><LF>		Escape, leave data transfer <CR><LF> must be sent after the +++ for Telit G24
	Online mode: OK<CR><LF> else: no response	Wait for the modem to respond (OK) before issuing new commands It may take several seconds for the modem to respond.
AT<CR><LF>		Are we talking to the modem?
	OK	Yes, we are.

16.4.2.3 Interrupting from an unknown state

Telit G	Telit H	Description
Send "+++<CR><LF>"	Send "+++"	Send the escape sequence
Wait until "OK" is returned OR 3 seconds have passed		
		If "OK" was received the modem has left the "on line mode" If nothing was received the modem was already in a state where it could receive commands
Send "AT<CR><LF>"		Send AT to confirm the modem can be accessed for commands
Wait until "OK" is returned OR 3 seconds have passed		
		If no OK was returned the modem is in an uncontrollable state and has to be power cycled

