

## Cassiopeia Platform - Modules

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# Cassiopeia Module Use Cases with AT Commands



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## Document Revision History

Revision	Date	Product Application
1	December 2019	First edition of the document.

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# About this Guide

## Purpose and Scope

The purpose of this document is to provide Cassiopeia-based platforms users with practical use cases with AT Commands.

## Who Should Read this Document

This document is intended for use by by engineers or users to perform typical test with their Cassiopeia-based device.



## Changes in this Document

This is the first edition of the document.

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# Documentation Conventions

The following typographic conventions are used in this document.

General Conventions	
Note	Important information requiring the user's attention.
Caution 	A condition or circumstance that may cause damage to the equipment or loss of data.
Warning 	A condition or circumstance that may cause personal injury.
<i>Italics</i>	Italic font style denotes <ul style="list-style-type: none"><li>• Emphasis of an important word;</li><li>• First use of a new term;</li><li>• Title of a document.</li></ul>
<b>Screen Name</b>	Sans serif, bold font denotes <ul style="list-style-type: none"><li>• On-screen name of a window, dialog box or field;</li><li>• Keys on a keyboard;</li><li>• Labels printed on the equipment.</li></ul>

Software Conventions	
Code	Regular Courier font denotes code or text displayed on-screen.
<b>Code</b>	Bold Courier font denotes commands and parameters that you enter exactly as shown. Multiple parameters are grouped in brackets [ ]. If you are to choose only one among grouped parameters, the choices are separated with a pipe: [parm1   parm2   parm3] If there is no pipe separator, you must enter each parameter: [parm1 parm2 parm3]
<i>Code</i>	Italic Courier font denotes parameters that require you to enter a value or variable. Multiple parameters are grouped in brackets [ ]. If you are to choose only one among grouped parameters, the choices are separated with a pipe: [parm1   parm2   parm3] If there is no pipe separator, you must enter a value for each parameter: [parm1 parm2 parm3]

# Table of Contents

---

<b>Preface</b> . . . . .	<b>i</b>
Legal Notices . . . . .	i
Document Revision History . . . . .	i
<b>About this Guide</b> . . . . .	<b>ii</b>
Purpose and Scope . . . . .	ii
Who Should Read this Document . . . . .	ii
Changes in this Document . . . . .	ii
Documentation Conventions . . . . .	iii
<b>Chapter 1</b>	
<b>Network Connection</b> . . . . .	<b>1</b>
1.1 Check that the SIM Card is Ready . . . . .	2
1.1.1 Feature Description . . . . .	2
1.1.2 Use Cases . . . . .	2
1.1.3 Error Handling . . . . .	7
1.2 Connect to the Network and Check Attach is Done . . . . .	8
1.2.1 Feature Description . . . . .	8
1.2.2 Use Cases . . . . .	9
1.2.3 Processing Signal Quality Responses . . . . .	16
1.2.4 Error Handling . . . . .	17
<b>Chapter 2</b>	
<b>System Management</b> . . . . .	<b>18</b>
2.1 How to Get Modem Information . . . . .	18
2.1.1 Feature Description . . . . .	18
2.1.2 Use Cases . . . . .	19
2.2 How to Get System Information . . . . .	21
2.2.1 Feature Description . . . . .	21
2.2.2 Use Cases . . . . .	21
2.3 How to Upgrade the Firmware . . . . .	22
2.3.1 Feature Description . . . . .	22
2.3.2 Use Cases . . . . .	23

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<b>Chapter 3</b>		
<b>Data over UART</b>	.....	<b>26</b>
3.1	How to Send Data with TCP.....	28
3.1.1	Feature Description.....	28
3.1.2	Use Cases in Online Mode.....	29
3.1.3	Use Cases in Command Mode with Text Data.....	31
3.1.4	Use Cases in Command Mode with Hex Data.....	32
<b>Appendix A</b>		
<b>Glossary and Abbreviations</b>	.....	<b>33</b>

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# 1

## Network Connection

This section will help you to connect your Cassiopeia-based device to the network, following simple steps:

1. Confirm that the SIM card in your device works properly ([Check that the SIM Card is Ready](#))
2. Attach your device to the network ([Connect to the Network and Check Attach is Done](#))

# 1.1 Check that the SIM Card is Ready

## 1.1.1 Feature Description

This section provides instructions on how to check the SIM card state, lock or unlock the SIM card with PIN or PUK code, change the PIN code and check the remaining PIN retries.

Related AT Commands are:

- AT+CFUN
- AT+CPIN
- AT+CLCK
- AT+CPINR
- AT+CPWD

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**Note:** The following use cases require a SIM card inserted into the SIM slot connected to the Cassiopeia-based module.

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## 1.1.2 Use Cases

- Power on the SIM slot  
Select one function mode among Airplane or Full functionality. Airplane mode disables both transmit and receive RF circuits.

Command	Response	Comment
AT+CFUN?	+CFUN: 0 OK	Read current function mode

Command	Response	Comment
AT+CFUN=4	OK	Enter Airplane mode

or

Command	Response	Comment
AT+CFUN=1	OK	Enter Full functionality mode



- Check the SIM card status after power on SIM slot

Command	Response	Comment
Check the SIM status		
AT+CPIN?		
	+CPIN: READY OK	SIM card is present and unlocked, ready to use.

- Enable SIM lock with PIN code

Command	Response	Comment
AT+CLCK="SC",1,"0000"	OK	"SC": SIM (lock SIM/UICC card installed in the currently selected card slot) (SIM/UICC asks password in MT power-up and when this lock command issued) 1: lock "0000": PIN code

- Disable SIM lock with PIN code

Command	Response	Comment
Unlock SIM with correct PIN code		
AT+CPIN="0000"	OK	"0000": PIN code
Disable SIM lock with correct PIN code.		
AT+CLCK="SC",0,"0000"	OK	"SC": SIM (lock SIM/UICC card installed in the currently selected card slot) (SIM/UICC asks for password in MT power-up and when this lock command issued) 0: unlock "0000": PIN code

- Enter PIN code to unlock SIM

Command	Response	Comment
Check current SIM card state		
AT+CPIN?		
	CPIN: SIM PIN OK	SIM PIN is required to unlock SIM card
Type PIN code to unlock with "1234" PIN code		
AT+CPIN="1234"		
	ERROR	PIN code is not correct, SIM card is still locked
Type PIN code to unlock with "0000" PIN code		
AT+CPIN="0000"		
	OK	PIN code is correct, SIM card unlocked
Check SIM card state		
AT+CPIN?		
	+CPIN: READY	SIM card is present and unlocked, ready to use

- Enter PUK code to unlock SIM

---

**Note:** If a wrong PIN code is input several times (usually 3), then the PUK code is required to unlock the SIM card. In this case the second pin code is required to replace the old pin in the SIM.

---

Command	Response	Comment
Check current SIM card state		
AT+CPIN?		
	+CPIN: SIM PUK OK	Require SIM PUK to unlock SIM card
Type PUK code to unlock with "12345678" PUK code and new PIN. Note that in this example, "1234" is the current PIN code which must be present, or you got an error even if PUK is correct.		
AT+CPIN="12345678","1234"		
	ERROR	PUK and PIN codes are not correct, SIM card is still locked
Type PUK code to unlock with "42984776" correct PUK code and PIN		
AT+CPIN="42984776","1234"		
	OK	PUK code is correct, SIM card is unlocked
Check SIM card state		
AT+CPIN?		
	+CPIN: READY OK	SIM card is present and unlocked, ready to use
Query lock state		
AT+CLCK="SC",2	+CLCK: 1 OK	1: lock is active

- Check remaining PIN retries

Command	Response	Comment
Set the initial conditions for the test		
AT+CFUN=0	OK	Disable modem
AT+CFUN=1	OK	Enable modem
AT+CPIN?	+CPIN: SIM PIN OK	Need PIN code
Read number of remaining retries		
AT+CPINR	+CPINR: SIM PIN,3,3 +CPINR: SIM PUK,10,10 +CPINR: SIM PIN2,3,3 +CPINR: SIM PUK2,10,10 OK	PIN code: 3 remaining retries, max number of retries is 3 PUK code: 10 remaining retries, max number of retries is 10
Try wrong PIN		
AT+CPIN="1234"	ERROR	PIN code not correct.
Read number of remaining retries		
AT+CPINR	+CPINR: SIM PIN,2,3 +CPINR: SIM PUK,10,10 +CPINR: SIM PIN2,3,3 +CPINR: SIM PUK2,10,10 OK	PIN code: 2 remaining retries, max number retries is 3 PUK code: 10 remaining retries, max number of retries is 10
Enter the correct PIN		
AT+CPIN="0000"	OK	
Read number of remaining retries		
AT+CPINR	+CPINR: SIM PIN,3,3 +CPINR: SIM PUK,10,10 +CPINR: SIM PIN2,3,3 +CPINR: SIM PUK2,10,10 OK	Remaining retries for PIN is back to 3

- Change Password

Execution command of AT+CPWD sets a new password for the facility lock function defined by command AT+CLCK.

Command	Response	Comment
Make sure CPIN is ready		
AT+CPIN?	+CPIN: READY OK	
Make sure facility lock is active status		
AT+CLCK="SC",2	+CLCK: 1 OK	
Change password		
AT+CPWD="SC","0000","1234"	OK	Change facility PIN from "0000" to "1234".

### 1.1.3 Error Handling

- SIM card is not present or not detected.

In this case, verify that the right form SIM card is inserted properly to the SIM slot, and check again.

Command	Response	Comment
Enable return final result code		
AT+CMEE=2	OK	enable +CME ERROR: <err> result code and use verbose <err> values
Check SIM card state		
AT+CPIN?		
	+CME ERROR: SIM not inserted	SIM card is not present or not detected

## 1.2 Connect to the Network and Check Attach is Done

### 1.2.1 Feature Description

This section describes how to attach to or detach from the network.

Related AT commands are:

- AT^AUTOATT
- AT+BGLTEPLMN
- AT+COPS
- AT+CEREG
- AT+CESQ
- AT+CFUN
- AT+CGACT
- AT+CGATT
- AT+CGAUTH
- AT+CGCDCONT
- AT+CGCDCONTRDP
- AT+SQNAUTOCONNECT
- URC +CEREG
- URC +IMSSTATE
- URC ^MODE
- URC +SYSSTART

## 1.2.2 Use Cases

- Autoconnect and attach to the network.

The default configuration is modem to do automatic connection and attachment after bootup. In this case, host has no action to take.

Command	Response	Comment
The following commands are used to read and set the configuration.		
AT+SQNAUTOCONNECT?	+SQNAUTOCONNECT: 1 OK	Read command returns the current autoconnect mode.
AT^AUTOATT?	^AUTOATT: 1 OK	Read command returns the current automatic attach configuration.
AT+SQNAUTOCONNECT=1	OK	Enable autoconnect mode, the UE will be set to its maximum functionality (AT+CFUN=1) after each reboot. This setting is persistent across reboot.
AT^AUTOATT=1	OK	Enable automatic EPS attach after AT+CFUN=1.
In this case, UE connect to the LTE network automatically after powered on. When connected, you would see the URC below.		
	+IMSSTATE: SIMSTORE,READY	SIM is ready and SMS storage is ready
	+SYSSTART	The modem is ready
	^MODE: 17,25	
	+CEREG: 1,0001,01A2D001,7	connected to the network

- Manual connect and automatic attach to the network

In case host hopes to set Modem to its max functionality after each reboot, and then Modem does attach automatically, they can do the following.

Check autoconnect mode and set it to 0 (disable) if needed.

**Important:** AT+SQNAUTOCONNECT setting is persistent over reboot but not persistent over firmware upgrade. It is enabled (set to 1) by default. If the host changed this setting manually, this change must be done again after a firmware upgrade.

Check automatic attach configuration and set it to 1 (enabled) if needed. Automatic attached is set to 1 (enabled) by default after each reboot.

If the configuration is correct, only do AT+CFUN=1, like the example.

Command	Response	Comment
The following commands are used to read and set the configuration.		
AT+SQNAUTOCONNECT?	+SQNAUTOCONNECT: 0 OK	Autoconnect mode is disabled.
AT^AUTOATT?	^AUTOATT: 1 OK	auto attach configuration is enabled.
AT+CFUN=1	OK	Connect to the LTE network.
	+IMSSTATE: SIMSTORE, WAIT_STORE	storage(SMS) on SIM is not ready
	+IMSSTATE: SIMSTORE, READY	SIM is ready and SMS storage is ready
	^MODE: 17,25	
	+CEREG: 1,0001,01A2D002,7	connected to the network



- Manual connect and manual attach to the network

In some cases, users hope to control network attachment manually and they can select PLMN to attach in this case.

Similar as above case, both autoconnect mode and auto attach should be disabled.

Command	Response	Comment
AT+SQNAUTOCONNECT=0	OK	Only set once, this is persistent
AT^AUTOATT=0	OK	Disable auto attach. Not persistent, to be done at each reboot.
After insert USIM card, power on UE.		
AT+CFUN=1	OK	
	+IMSSTATE: SIMSTORE,WAIT_STORE +IMSSTATE: SIMSTORE,READY ^MODE: 17,25 +CEREG: 1,0001,01A2D002,7	
Checking PLMN found, this may need some time, do not execute other AT command before you get OK or ERROR		
AT+BGLTEPLMN=?	+BGLTEPLMN: (1,,,"00101",7,-8950),,(0,1,2) OK	1: Status is available "00101": operator in number format 7: E-UTRAN -8950: RSRP value in hundredths of dBm (0,1,2): describing a supported format of network operator identifier.
Set selected PLMN		
AT+COPS=1,2,"00101",7	OK	1: manual mode 2: <oper> format is numeric "00101": oper (from the response of AT+BGLTEPLMN=?) 7: E-UTRAN
Trigger EPS attach		
AT+CGATT=1	+CEREG: 2 OK	URC, 2 means not registered, but UE is currently trying to attach.
	+CEREG: 1,0001,01A2D001,7	URC, 1 means registered home network.

- Detach from the network

Command	Response	Comment
EPS Detach from network, UE still camped on cell		
AT+CGATT=0	OK	

- Airplane mode

Command	Response	Comment
Enter Airplane mode, UE will detach from network first, then RF is turned off but USIM card is still alive.		
AT+CFUN=4	OK	

- Power off

Command	Response	Comment
Power off UE, UE will detach from network first, then it will shut down modem completely (both RF and SIM).		
AT+CFUN=0	OK	

- Check network registration status

Command	Response	Comment
Query network registration status		
AT+CEREG?	+CEREG: 0,1 OK	0: network registration, URC disabled 1: registered, home network

- Check the PDP context status.

Command	Response	Comment
Get current PDP context configuration		
AT+CGDCONT?		
	+CGDCONT: 1,"IP","test123",,,,,0,0,0,0 OK	cid 1, APN type "IP"(ipv4), APN "test123". This is configured in our Amarisoft test equipment. You can configure in the modem by AT+CGDCONT set command according to your setup, for instance : AT+CGDCONT=1,"IP","test123"
Get current PDP context activation state		
AT+CGACT?		
	+CGACT: 1,1 OK	PDP context with cid 1 is activated

- Define a new PDP context and activate it

Command	Response	Comment
define a new PDP context with cid 2, this also depends on your network configuration.		
AT+CGDCONT=2,"IP","custom"	OK	
Activate it		
AT+CGACT=1,2	OK	1: activate PDP context 2: cid 2
Query PDP context activation stat		
AT+CGACT?	+CGACT: 1,1 +CGACT: 2,1 OK	PDP context with cid 2 now is activated

- Read dynamic parameters of PDP context

Command	Response	Comment
Read all PDP contexts		
AT+CGCONTRDP	+CGCONTRDP: 1,5,"test123.mnc001.mcc001.gprs","192.168.3.2.255.255.255.255", "172.16.66.1","172.16.66.1", +CGCONTRDP: 2,6,"custom.mnc001.mcc001.gprs","192.168.18.2.255.255.255.255", "172.16.66.1","172.16.66.1", OK	
read only PDP context with cid 1		
AT+CGCONTRDP=1	+CGCONTRDP:1,5,"test123.mnc001.mcc001.gprs","192.168.3.2.255.255.255.255", "172.16.66.1","172.16.66.1", OK	cid: 1 bearerid: 5 apn: test123.mnc001.mcc001.gprs pdn IP: 192.168.3.2 mask: 255.255.255.255 gateway: null means point to point gateway primary DNS: 172.16.66.1 secondary DNS: 172.16.66.1

- Configure PDP context

Command	Response	Comment
AT+CGACT=0,2	OK	Deactivate cid 2 PDP before configure it
AT+CGDCONT=2,"IPV4V6","custo m"	OK	change cid 2 PDP to IPV4V6

- Set authentication

Note: There is no need, in normal operation, to change authentication parameters in commercial network. This is reserved for some test cases.

Command	Response	Comment
AT+CGAUTH=1,0,"", ""	OK	cid: 1 authentication type: 0 means null authentication protocol used for this PDP context. username: null password: null

- Query extended signal quality

<b>Command</b>	<b>Response</b>	<b>Comment</b>
AT+CESQ	+CESQ: 99,99,255,255,13,35 OK	Received signal strength level : not known or not detectable Channel bit error rate: not known or not detectable rscp: not known or not detectable ecno: not known or not detectable rsrq: See section <a href="#">Processing Signal Quality Responses</a> to calculate the value rsrp: See section <a href="#">Processing Signal Quality Responses</a> to calculate the value

## 1.2.3 Processing Signal Quality Responses

When you using AT+CESQ to get RSRP/RSRQ, you would get a number with range 0-255.

```
AT+CESQ
+CESQ: 99,99,255,255,13,35
OK
```

In the example above, 13 is RSRQ and 35 is RSRP.

The reporting range of RSRQ is defined from -19.5 dB to -34 dB with 0.5 dB resolution.

Compute the dB value as follows:

$$\begin{aligned} \text{RSRQ} &\sim (-19.5 + 0.5 * \text{NUMBER}) \text{ dB} \\ &= (-19.5 + 0.5 * 13) \\ &= -13 \text{ dB} \end{aligned}$$

Examples:

- NUMBER is 0: RSRQ < -19.5 dB
- NUMBER is 34: RSRQ >= -3 dB
- NUMBER is 255: RSRQ not known or not detectable

The reporting range of RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution.

$$\begin{aligned} \text{RSRP} &\sim (-140 + \text{NUMBER}) \text{ dBm} \\ &= (-140 + 35) \\ &= -105 \text{ dBm} \end{aligned}$$

Examples:

- NUMBER is 0: RSRP < -140 dBm
- NUMBER is 97: RSRP >= -44 dBm
- NUMBER is 255: RSRP not known or not detectable

## 1.2.4 Error Handling

- If CEREQ? returns status 0

The UE is not registered, and is not currently searching an operator to register to

Command	Response	Comment
AT+CEREQ?		Query network registration status
	+CEREQ: 0,0 OK	
Possible causes:		
<ul style="list-style-type: none"> <li>• SIM card error : SIM card not detected, PIN code not entered, SIM card read error ... See also Section 1.1 <a href="#">Check that the SIM Card is Ready</a> on page 2.</li> <li>• The registration is not started (+COPS=2): execute the actions below.</li> </ul>		
AT+CFUN?		Check if current CFUN state is 1
	+CFUN: 1 OK	
AT+CGATT=1	OK	Force EPS attach

- If CEREQ? returns status 4

Unknown error (for example: out of E-UTRAN coverage).

Command	Response	Comment
^MODE: 0,0		
	+CEREQ: 4	
Check current signal strength		
AT+CESQ		
	+CESQ: 99,99,255,255,255,255 OK	Signal is unknow or not detected. If the signal strength is low, change to a different position and try again.

---

# 2

# System Management

## 2.1 How to Get Modem Information

### 2.1.1 Feature Description

This section describes how to collect modem information, such as IMEI, IMSI, phone number, SW version ...

Related AT commands are:

- AT+CNUM
- AT+CIMI
- AT+CGSN
- AT+CGMM
- AT+CGMR



## 2.1.2 Use Cases

- Subscriber number

This command returns the MSISDNs related to the subscriber. This information can be stored in the SIM/UICC or in the MT.

Command	Response	Comment
AT+CNUM	+CNUM: 11000000219,1 OK	Test SIM is used

- IMSI

Command	Response	Comment
AT+CIMI	001010000000219 OK	Read IMSI

- IMEI

Command	Response	Comment
AT+CGSN	260531793113810 OK	Returns <sn>. Typically, the text will consist of a single line containing the IMEI number of the MT. Manufacturers may choose to provide more information if desired.
AT+CGSN=1	+CGSN: 260531793113810 OK	Returns the IMEI
AT+CGSN=2	+CGSN: 2605317931138100 OK	Returns the IMEISV (IMEI and Software Version Number)
AT+CGSN=3	+CGSN: 00 OK	Returns the SVN

- Model identification

Command	Response	Comment
AT+CGMM	CB610L OK	The text consists of a single line containing the name of the product, but the manufacturer may choose to provide more information.

- Revision identification

Command	Response	Comment
AT+CGMR	UE4.2.2.0-46115 OK	Return one or more lines of information text <revision>, determined by the MT manufacturer.

## 2.2 How to Get System Information

### 2.2.1 Feature Description

This section describes how to collect system information such as time zone auto update and clock.

---

**Note:** More use cases will be provided in future revision.

---

Related AT commands are:

- AT+CTZU
- AT+CCLK

### 2.2.2 Use Cases

- Time zone update

Command	Response	Comment
AT+CTZU=1	OK	Enable automatic time zone update via NITZ.

- Clock

Command	Response	Comment
Get current time		
AT+CCLK?	+CCLK: 19/10/22,10:06:03+04 OK	
Set time. Format is "yy/MM/dd,hh:mm:ss zz", where chars indicate year ,month,day,hour,minutes,seconds and time zone.		
AT+CCLK="19/05/20,22:10:00+08"	OK	

## 2.3 How to Upgrade the Firmware

### 2.3.1 Feature Description

It is possible to do firmware upgrade with an AT command.

Related AT command is:

- AT+SQNSUPGRADE

---

**Important:** After the upgrade operation, all the previous settings, such as disabling automatic connection (+SQNAUTOCONNECT) described in Section [1.2 Connect to the Network and Check Attach is Done](#) on page 8, will be reset. Any setting manually configured by the host will have to be set again after the upgrade operation.

---

It is required to setup a HTTP, HTTPS or FTP server as follows:

- If local upgrade, the server is running on the PC connected to the module by USB connection. In this case it does not matter the module attaches to the network or not.

When you connect the module to a PC by USB cable, two ECM ports and one ACM port are enumerated.

The second ECM is for debug purpose and can be used for upgrade, and the IP is assigned by the module with network address 192.168.16. This can be checked by `ipconfig` in Windows OS or by `ifconfig` in Linux OS.

---

**Note:** If windows OS, you need install USB driver.

---

ACM port is for AT command which can be used to launch the upgrade.

- If OTA upgrade, the server is on a PC connected to Internet. In this case the module **MUST** attach to the network and PDN is activated.

If doing OTA upgrade, only ACM port is used to launch the upgrade.

## 2.3.2 Use Cases

- Local Synchronous upgrade with FTP server

The test is with Filezilla server (anonymous/no password) running on the PC connected to the module by USB cable.

The IP assigned on the second ECM port is 192.168.16.103.

Open ACM port, and type:

Command	Response	Comment
AT+SQNSUPGRADE="ftp://192.168.16.103/CB610L_ECM-ACM-ECM-M2M-UART-ECRIOIMS-CAT6_LR4.2.2.0-46706.sfp",1,11		"11" is report_progress which means do report every 11%.
	+SQNSUPGRADE: "downloading",0 +SQNSUPGRADE: "downloading",11 +SQNSUPGRADE: "downloading",22 +SQNSUPGRADE: "downloading",33 +SQNSUPGRADE: "downloading",44 +SQNSUPGRADE: "downloading",55 +SQNSUPGRADE: "downloading",66 +SQNSUPGRADE: "downloading",77 +SQNSUPGRADE: "downloading",88 +SQNSUPGRADE: "downloading",99 +SQNSUPGRADE: "downloading",100  +SQNSUPGRADE: "installed" +SQNSUPGRADE: "rebooting" OK	

- Local Asynchronous upgrade with HTTP server

The test is with HTTP server running on the PC connected to the module by USB cable. The IP assigned on the second ECM port is 192.168.16.103.

In this example, <reboot> is set to 0 which means that no reboot after FW is retrieved and validated. The user must reboot explicitly the device to take into account the new FW.

Command	Response	Comment
Open ACM port, and type:		
AT+SQNSUPGRADE="http://192.168.16.103/hfs_HttpServer_289/CB610L_ECM-ACM-ECM-M2M-UART-ECRIOIMS-CAT6_LR4.2.2.0-46706.sfp",0,23,1		0 : no reboot after FW is retrieved and validated. 23: report_progress every 23%. 1: asynchronous upgrade.
AT returns here immediately with OK if upgrade is started correctly or CME ERROR.		
	+SQNSUPGRADE: "downloading",0 OK	
Then the command reports upgrade progress with +SQNSUPGRADE URC.		
	+SQNSUPGRADE: "downloading",23 +SQNSUPGRADE: "downloading",46 +SQNSUPGRADE: "downloading",69 +SQNSUPGRADE: "downloading",92 +SQNSUPGRADE: "downloading",100 +SQNSUPGRADE: "installed"	
After receiving URC "installed", need reboot explicitly to take into account the new FW.		
AT^RESET	OK	

- OTA Synchronous upgrade with HTTP server  
 Make sure your HTTP server is ready and set the bypass mode as disabled.

Command	Response	Comment
AT+SQNBYPASS?	+SQNBYPASS: enable OK	Bypass mode is enabled (by default)
AT+SQNBYPASS="disable"	OK	Disable the bypass mode
Reboot manually.		
AT^RESET	OK	
	+IMSSTATE: SIMSTORE, WAIT_STORE +IMSSTATE: SIMSTORE, READY +SYSSTART ^MODE: 17,25	
	+CEREG: 1,0001,01A2D001,7	This URC shows that the module is attached to the network.
Echo the commands.		
ATE1	OK	
Check the bypass mode again.		
AT+SQNBYPASS?	+SQNBYPASS: disabled OK	Bypass mode is disabled
Launch the upgrade		
AT+SQNSUPGRADE="http://172.16.72.4/firmwares/CB610L_ECM-ACM-ECM-M2M-UART-ECRIOIMS-CAT6_LR4.2.2.0-46115.sfp",1,23		
	+SQNSUPGRADE: "downloading",0 +SQNSUPGRADE: "downloading",23 +SQNSUPGRADE: "downloading",46 +SQNSUPGRADE: "downloading",69 +SQNSUPGRADE: "downloading",92 +SQNSUPGRADE: "downloading",100  +SQNSUPGRADE: "installed" +SQNSUPGRADE: "rebooting"  OK	

---

# 3

## Data over UART

Data socket can be opened to exchange data on various modes, as detailed in the following section:

- [3.1 How to Send Data with TCP](#) on page 28

By default the modem is in bypass mode, this means LTE network IP address is assigned to USB/ECM interface connected to a host (ex: PC) and USB/ECM is used as main interface for data over LTE.

To use Data over UART feature, the bypass mode **must** be disabled with the command:

```
AT+SQNBYPASS="disable"
```

A reboot is then required for the command to take effect and the new mode will be persistent.

---

**Important:** The "disable" mode is not persistent over software upgrade. Set it again after the software upgrade's reboot if this mode is required for your operation.

---

After this, the modem is in router mode, a local IP address is assigned to USB/ECM interface, and the LTE network IP address is assigned to the modem. In this case you can still access network by USB/ECM (if not, check the route table on your host).

If you want to go back to bypass mode, you need to enter the following command and then proceed with a reboot of the device:

```
AT+SQNBYPASS="enable"
```

Data over UART will then not be possible until bypass mode is disabled again.

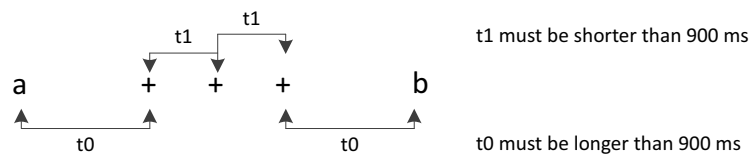


**Note on TCP:** two modes can be selected for TCP

- Command mode: in this mode, the UART transmits AT commands and responses, and no raw data.
- Online mode: in this mode, the UART is not able to transmit AT commands. All data is treated as pure data and is transferred to the other side.

You can suspend the direct interface to the socket connection (the socket remaining open during suspension) with the escape sequence `+++`. The device enters command mode and the result code `OK` is received when the suspension is complete.

The suspend pattern (escape sequence `+++`) should comply with the requirements illustrated on [Figure 3-1](#). Other timing configuration will lead the sequence to be sent as raw data.



**Figure 3-1: Escape Sequence from Online Mode to Command Mode**

You can resume the socket mode at any moment (unless the socket inactivity timer timeouts, see `+SQNSCFG`) by using the `+SQNSO` command with the corresponding `<connId>`.

For more details on the AT commands, please refer to *AT Commands Reference Manual*.

## 3.1 How to Send Data with TCP

### 3.1.1 Feature Description

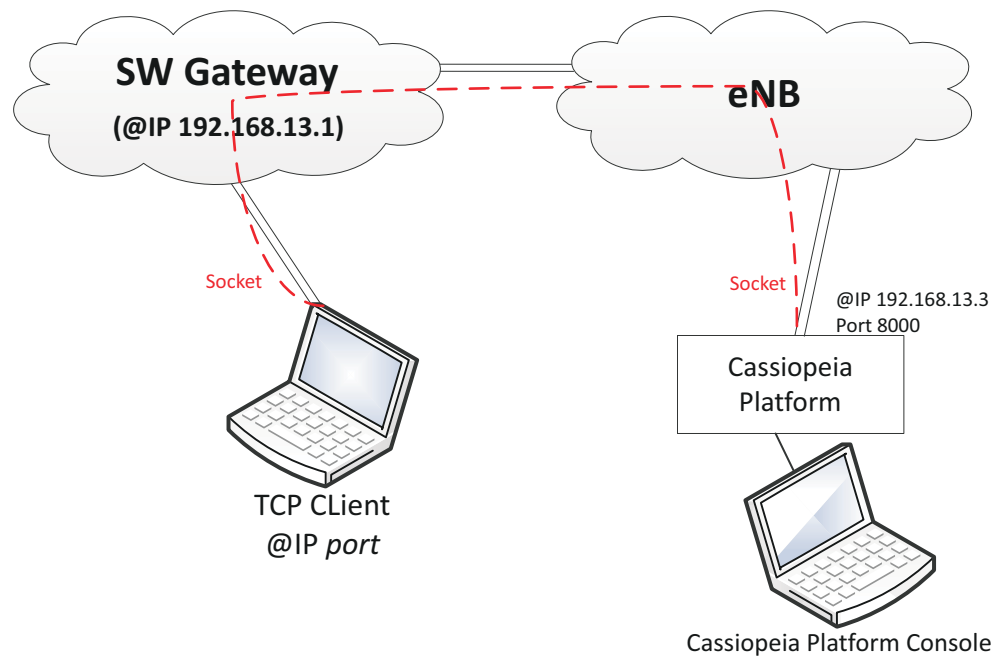
The user can to open TCP socket and send data in two different modes, online mode and command mode.

Related AT commands are:

- AT+SQNSD  
Use parameter <TxProt> of AT+SQNSD to configure the transmission protocol (TCP).
- AT+SQNSSEND
- AT+SQNSSENDEXT
- AT+SQNSRECV
- AT+SQNSH
- URC +SQNSRING

TCP typical setup is illustrated on [Figure 3-2](#).

**Note:** The connection to the server is opened from another machine by running netcat (shorten as nc) program as follows: "nc -l 8008". Data from the server are also typed manually.



**Figure 3-2: TCP Typical Setup**

## 3.1.2 Use Cases in Online Mode

Command	Response	Comment
Ensure that UE is attached to LTE network. You can then configure the socket.		
AT+SQNSCFG=1,1,0,0,600,50	OK	The second parameter is <cid> for PDP context identifier. Use Internet Cid for the test.
AT+SQNSCFGEXT=1,0,0,0	OK	Apply extended configuration: URC format, send/receive data mode, ....
AT+SQNSD=1,0,8008,"192.168.13.1",0,8000,0		Type socket dial command. Parameter <commMode> is 0 for online mode. <TxProt>=0 for TCP.
	CONNECT	Intermediate result code if the socket is opened successfully.
Hello this is from client		Type string, and press <enter> when complete.
You should see this string on server side. If remote host sends any data back to UE, this data shall be received over serial link.		
+++		Suspend online mode.
	OK	The UART is back to AT command mode. The socket is suspended.
AT+SQNSS		Check socket status.
	+SQNSS:1,2,"192.168.13.3",49165,"192.168.13.1",8008 +SQNSS:2,0 +SQNSS:3,0 +SQNSS:4,0 +SQNSS:5,0 +SQNSS:6,0	
AT+SQNSO=1		Restore the socket in online mode.
	CONNECT	Success indication
+++	OK	Suspend the socket.
Got again		Send data again from the server.
	+SQNSRING: 1	URC to indicate data from remote host.

<b>Command</b>	<b>Response</b>	<b>Comment</b>
AT+SQNSRCV=1,1500		Receive data. The max bytes received once is 1500.
	+SQNSRCV: 1,10 Got again OK	10 bytes to receive, string received.
AT+SQNSH=1	OK	Shutdown the socket

### 3.1.3 Use Cases in Command Mode with Text Data

Command	Response	Comment
Ensure that UE is attached to LTE network. You can then configure the socket.		
AT+SQNSCFG=1,1,0,0,600,50	OK	The second parameter is <cid> for PDP context identifier. Use Internet Cid for the test.
AT+SQNSCFGEXT=1,0,0,0	OK	Configure extra socket parameters with default configuration
AT+SQNSD=1,0,8008,"192.168.13.1",0,8000,1	OK	Type TCP socket dial command. Configure socket connection id 1 and open socket connect to 192.168.13.1
AT+SQNSSEND=1		
> Hello extend from client		Send Data In Command Mode through socket connection id 1,
Type Ctrl+Z to confirm or ESC to cancel.		
	OK	
AT+SQNSSENDEXT=1,24		Configure how many bytes to be sent,
maximum number of bytes to send is 1500.		
> Hello extend from client	OK	
	+SQNSRING: 1	There is incoming connection on 1st socket.
AT+SQNSRECV=1,100		Receive up to 100 bytes from 1st socket.
	+SQNSRECV: 1,24	24 bytes are actually received.
	Hello extend from client OK	
AT+SQNSH=1	OK	Shutdown connection

## 3.1.4 Use Cases in Command Mode with Hex Data

In hex mode (configured by AT+SQNSCFGEXT), data is represented as a sequence of hexadecimal numbers (from 00 to FF). This is usually used to send a binary file.

**Note:** In this case, AT+SQNSSENDEXT usage is suggested, since all data can be sent without any limitation. AT+SQNSSEND would process 0x1A (CTRL+Z) and 0x1B (ESC) as control chars.

Command	Response	Comment
Ensure that UE is attached to LTE network. You can then configure the socket.		
AT+SQNSCFG=1,1,0,0,600,50	OK	The second parameter is <cid> for PDP context identifier. Use Internet Cid for the test.
AT+SQNSCFGEXT=1,0,0,0,0,1	OK	Set <sendDataMode> to HEX mode
This is to set URC format, send/receive data mode and so on.		
AT+SQNSD=1,0,8008,"192.168.13.1",0,8000,1	OK	Type TCP socket dial command. The parameter <commMode> to indicate which mode to use, 1 is command mode. The UART is in command mode, means you are able to send AT by it.
AT+SQNSSENDEXT=1,10		Type command to begin sending data.
	>	You would see the prompt:
7D000015116000050010	OK	Send data in HEX mode.
And should see message code on client side.		
AT+SQNSH=1	OK	Shutdown the socket.

# A

## Glossary and Abbreviations

Term	Description
Airplane mode	Device mode where the modem is ON but the RF functions are OFF
AT	Prefix for AT commands. Historical prefix for Hayes commands, meaning "Attention"
DUP	File extension used for Sequans upgrade procedures
EPS	Evolved Packet System
FTP	File Transfer Protocol
Full function mode	Device mode where all the functions are ON
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IMSI	International Mobile Subscriber Identity
MCC	Mobile Country Code
MNC	Mobile Network Code
PIN	Personal Identification Number
PUK	Personal Unblocking Key
RF	Radio Frequency
SIM	Subscriber Identity Module
TAU	Target Acquisition and Tracking Unit
UE	User Equipement
USIM	Universal Subscriber Identity Module