



Aquila Solutions Inc.

GCT LTE Module Software Development Guide

OEM/Integrators Installation Manual

V2.2

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1 Overview

1.1 Overview

This document is aimed to provide customers with GCT-CAT6 LTE module software development guide in using CPE.

1.2 Revision history

Revision	Date	Release Note
V1.0	2017/6/30	Formal release.
V2.0	2018/11/28	Add some state detection ATcommand
V2.1	2018/12/18	Modify the return value format of AT+CGCONRDP
V2.2	2018/12/27	Add dualsim and gps at commands
V2.3	2019/07/19	

2 Software Framework

2.1 Schematic software framework

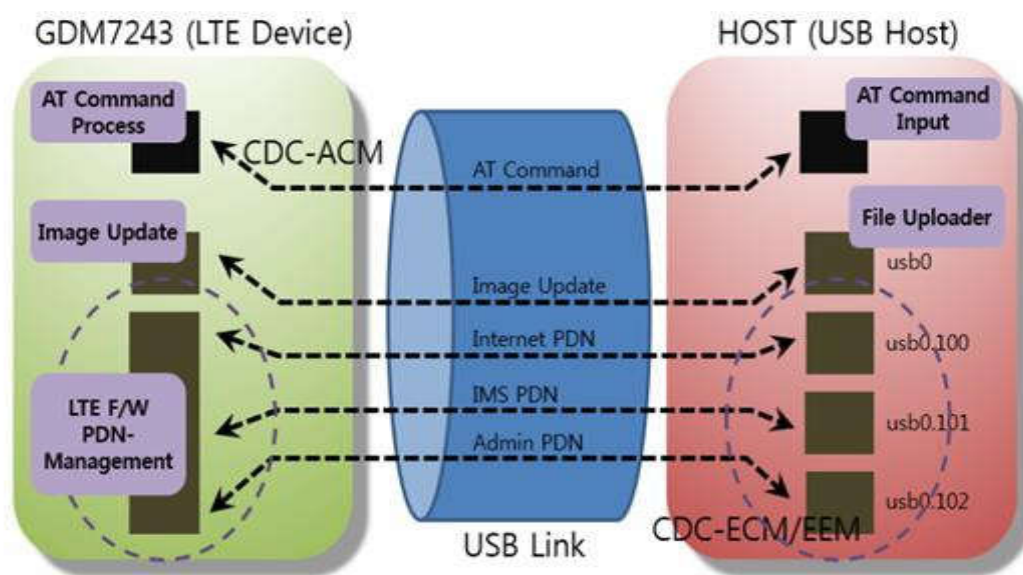


Figure 1. VLAN based System Architecture

2.2 Explain

The Figure 1 exhibits overall VLAN configuration used to communicate with host processor. The total number of feasible logical channels needed for LTE device operation is 5. Three of them are used to support LTE operation (currently destined to be used in Verizon LTE network) and two of them for the control : mage update channel and AT command processing.

1. AT Command Process:used for sending AT command
2. Image Update:Used for file updates, version upgrades, debugging, etc.
3. LTE F/W PDN-Management:
 - a. Internet PDN:this pdn is for Internet
 - b. IMS PDN: this pdn is for IMS
 - c. Admin PDN :OTA(admin)PDN for OMADM or FOTA service (Only for module FW update), GDM internal only

CDC-ACM drive kernel configuration options, and the VLAN configuration options: (different host platforms may vary)

```
CONFIG_USB_ACM= y
CONFIG_USB_USBNET= y
CONFIG_USB_NET_CDCETHER= y
CONFIG_USB_NET_CDC_EEM= y
CONFIG_VLAN_8021Q=y
```

2.3 Modle USB mode

To read current USB mode configuration:

ucfg get config lan usbeth mode (how to send ucfg command please see)

Supporting USB mode

0 : Default, Enable auto detect mode (RNDIS / EEM / ECM), Disable manual mode
1 : RNDIS (cdc_ether.ko, rndis_host.ko)
2 : EEM (cdc_eem.ko)
3 : ECM (cdc_ether.ko)

To write USB mode to '0', automatic mode.

ucfg set config lan usbeth mode 0

Configured information can be found from terminal log of module:

```
g_ether gadget: high-speed config #2: RNDIS
g_ether gadget: high-speed config #1: CDC Ethernet (EEM)
g_ether gadget: high-speed config #1: CDC Ethernet (ECM)
```

Attention: The usb mode is 3 by default,as the most performance test we do are based on the driver CDC Ethernet (ECM), so we recommend you do not change USB mode of the module

2.4 Drive loading

After the drivers are loaded and the VLAN is set up correctly, the following devices will be generated at the host side (different platform drivers will vary)

1. serial port

/dev/ttyACM0

```
cdc_acm 1-1:1.2: ttyACM0: USB ACM device
```

2. wan port

eth2

used for file updates, version upgrades, debugging, etc.

```
cdc_ether 1-1:1.0: eth2: register 'cdc_ether' at usb-ehci-platform-1, CDC Ethernet Device, 00:0a:3b:ff:ff:01
cdc_acm 1-1:1.2: This device cannot do calls on its own. It is not a modem.
cdc_acm 1-1:1.2: ttyACM0: USB ACM device
```

3. Three virtual VLAN ports (vlan id of GCT module is :100 101 102 103)

eth2.100

eth2.101

eth2.102

eth2.103

```
eth2.100  Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet addr:100.0.10.141  Bcast:100.255.255.255  Mask:255.0.0.0
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:1537 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1744 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:673734 (657.9 KiB)  TX bytes:361632 (353.1 KiB)

eth2.101  Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1504  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:688 (688.0 B)

eth2.102  Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1504  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:688 (688.0 B)

eth2.103  Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1504  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:688 (688.0 B)
```

3

Host Side VLAN Construction

3.1 VLAN tag of GCT module

The vlan tag of GCT module is 100,101,102,103. When the user sets up the VLAN on the Host side, it needs to be dealt with accordingly.

3.2 Introduction of network card

After the drive is loaded normally, eth2 network card will be generated. (if want to know which network card is generated please see dmesg log, different platforms and drivers, and the resulting network card name may be different).

After network card eth2 is generated, there is no IP address on the eth2. Enter the command "ifconfig" and get information about eth2

```
eth2      Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet addr:169.254.0.100  Bcast:169.254.0.255  Mask:255.255.255.0
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1504  Metric:1
          RX packets:17471 errors:0 dropped:0 overruns:0 frame:0
          TX packets:18143 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:8583319 (8.1 MiB)  TX bytes:2741962 (2.6 MiB)
```

Figure 4 information about eth2

As the interval ip of the module is 169.254.0.1, ifconfig169.254.0.xxx (not 1) can be added to the network card to establish communication with the module for upgrades and debugging.

3.3 How to establish network communication

1.How to judge the success of the network?

(1) AT+CPIN ?

Query whether SIM CARD is ready, and whether the sim card is PIN lock or PUK lock, etc..

(2) AT+CFUN?

+CFUN:1 Query whether radio frequency is on or not, etc..

(3) AT+CGATT?

+CGATT:1Returns 1 indicating attachment and returns 0 without attachment.

(4) AT+CESQ

+CESQ: 99, 99, 255, 255, 26, 63 Query the module whether get signal

(5) AT+CGACT?

+CGACT : 1,1 PDP has been activated

example :

```
vlan_tag=100
ipaddr=10.166.194.196
netmask=255.0.0.0
gateway=10.0.0.59
device=eth2
vdevice=eth2.100
```

The steps are as follows:

1. ip link set dev eth2.100 down
2. ip link delete eth2.100
3. vconfig add eth2 100
4. ip link set vlan100 name eth2.100
5. ifconfig eth2.100 -arp
6. ifconfig eth2.100 10.166.194.196 netmask 255.0.0.0 up
7. ip link set txqueuelen 100 dev eth2.100
8. route add default gw 10.0.0.59 dev eth2.100
9. configDNS (different platform the way of config DNS will vary)

can be configured to the default files : /etc/resolv.conf

```
eth2.100  Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet addr:10.166.194.196  Bcast:10.255.255.255  Mask:255.0.0.0
          inet6 addr: fe80::20a:3bff:feff:ff01/64 Scope:Link
          UP BROADCAST RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:1018 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3767 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:100
          RX bytes:79983 (78.1 KiB)  TX bytes:605182 (590.9 KiB)
```

Figure 8eth2.100

4. route:

```
root@ZMWR2500:/# route
Kernel IP routing table
Destination      Gateway         Genmask         Flags Metric Ref    Use Iface
default         10.0.0.59      0.0.0.0         UG    0      0      0 eth2.100
10.0.0.0        *              255.0.0.0       U     0      0      0 eth2.100
192.168.0.0     *              255.255.255.0   U     0      0      0 eth2
192.168.1.0     *              255.255.255.0   U     0      0      0 br-lan
```

5. Ping network:

Pingip

```
root@ZMWR2500:/# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8): 56 data bytes
64 bytes from 8.8.8.8: seq=0 ttl=51 time=211.052 ms
64 bytes from 8.8.8.8: seq=1 ttl=51 time=215.311 ms
64 bytes from 8.8.8.8: seq=2 ttl=51 time=203.242 ms
```

Pingdomain name

```
root@ZMWR2500:/# ping www.baidu.com
PING www.baidu.com (61.135.169.125): 56 data bytes
64 bytes from 61.135.169.125: seq=0 ttl=50 time=46.247 ms
64 bytes from 61.135.169.125: seq=1 ttl=50 time=60.263 ms
64 bytes from 61.135.169.125: seq=2 ttl=50 time=58.791 ms
```

4 Debugging Information Output

4.1 DM tools

In some cases, such as debugging, information output, version view, version upgrade, etc. user need to access the module from an external PC or CPE. One way is provide:

The GCT module has a private IP inside: 169.254.0.1. Users can log in to 169.254.0.1 on the web page.

Access method:

1. CPE side network card needs to configure the same segment address(169.254.0.xx)

```
eth2      Link encap:Ethernet  HWaddr 00:0A:3B:FF:FF:01
          inet addr:169.254.0.100  Bcast:169.254.0.255  Mask:255.255.255.0
          inet6 addr: fe80::20a:3bff:feff:ff01/64  Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
```

then you would get a route automatic :

```
root@ZMWR2500:/www#
root@ZMWR2500:/www# route -n
Kernel IP routing table


| Destination | Gateway | Genmask       | Flags | Metric | Ref | Use | Iface  |
|-------------|---------|---------------|-------|--------|-----|-----|--------|
| 169.254.0.0 | 0.0.0.0 | 255.255.255.0 | U     | 0      | 0   | 0   | eth2   |
| 192.168.1.0 | 0.0.0.0 | 255.255.255.0 | U     | 0      | 0   | 0   | br-lan |


```

then you can ping the module interval ip:

```
root@ZMWR2500:~#
root@ZMWR2500:~# ping 169.254.0.1
PING 169.254.0.1 (169.254.0.1): 56 data bytes
64 bytes from 169.254.0.1: seq=0 ttl=64 time=0.844 ms
64 bytes from 169.254.0.1: seq=1 ttl=64 time=0.834 ms
64 bytes from 169.254.0.1: seq=2 ttl=64 time=0.664 ms
```

2. Then you can telnet to the module interval from your baseboard :

gdm7243 login: root

Password : Si8a&2vV9

```
root@ZMWR2500:~# telnet 169.254.0.1
Entering character mode
Escape character is '^]'.
gdm7243 login: root
Password:
Welcome to

  G C T   L T E   M O D E M
#
# cat /etc/version.txt
MLG5952_BYPASS_0.3.2.9_V1.3
#
```

4.2 Module log

If you want to capture the logs of the module during booting up:

- 1st. telnet to the module interval

```
root@ZMWR2500:~# telnet 169.254.0.1
Entering character mode
Escape character is '^]'.
gdm7243 login: root
Password:
welcome to
# G C T   L T E   M O D E M
#
```

then enter “dmesg” ,you will get the module boot up log :

```
#
# dmesg
Booting Linux on physical CPU 0x0
Initializing cgroup subsys cpu
Initializing cgroup subsys cpuacct
Linux version 3.10.0-uc0 (swdev@sv
CPU: ARMv6-compatible processor [4
CPU: VIPT aliasing data cache, VIF
Machine: GCT GDM7243
Boot device: nand
boot mem size: 96MB
```

2nd. Also you can enter lted_cli for changing script environment to DM> environment

```
#
# lted_cli
lted_client_init_ex success
```

then enter “arm1log 2”, then you can see DM>

```
#
# lted_cli
lted_client_init_ex success

arm1log 2

DM>
DM>
```

3rd. you enter “dbg L3* -1”

```
DM>
DM> dbg L3* -1
L3_DEBUG          : ffffffff -> ffffffff
L3_WARN           : ffffffff -> ffffffff
L3_ERR            : ffffffff -> ffffffff
L3_ASN            : ffffffff -> ffffffff
L3_FSM            : ffffffff -> ffffffff
L3_RMC            : ffffffff -> ffffffff
L3_CSCSIBC        : ffffffff -> ffffffff
L3_MMC            : ffffffff -> ffffffff
L3_LLC            : ffffffff -> ffffffff
L3_TIMESTAMP      : ffffffff -> ffffffff
DM>
```

and then "q 2" (if need to shut down the print logs, need enter: q 0)

```
DM>
DM> q 2
LOG-MODE: INTERACTIVE(0) -> VERBOSE(2)
DM> [FSM] [L3<-] [MMC] [2] CPHY_MEASURE_IND
[CSC] s:[7]srxlev:25(P:-95_rxtxlevmin:-120_c
```

5 Common AT Command Description

Please refer to AT command manual for detailed AT commands. Common AT commands are shown as below:

AT Command	Description
AT+CFUN	AT command function enabled
AT%SYSINFO	Look up status: SYSINFO:para1, para2, para3, para4 para1 0: not attached, 1:attached para2 0: not roaming , 1:roaming para3 0: no uicc, 1:wait for pin12:readypara4 0:no cell, 1:tdd, 2:fdd
AT+CGATT	PS attach or detach
AT+CEREG	EPS network registration status
AT+CESQ	Extended signal quality
AT+CGPADDR	Show PDP address
AT+CGACT	PDP context activate or deactivate
AT%ZMLTEINFO	Get information about the LTE Inter, Intra, Serving Frequency Network
AT%SUPPBAND	Get support band
AT%SYSCMD	Execute shell commands. %SYSCMD = "<cmd>" Example: at%syscmd="ucfg set config wan lte vendor 4"
AT%GPDNTYPE	Get/Set PDN type of each CID
AT+ZMCGMR	Get firmware version
AT+ZMCGMM	Get module name
AT%GLOCKCELL	Set cell lists that is locked

5.1 Check attach status

(1) AT+CFUN?

+CFUN:1

(2) AT+CGATT?

+CGATT:1

OK

(3) AT+CEREG?

+CEREG: 2,5,"0001","00000007",7

OK

(4) AT+CGACT?

+CGACT : 1,3

5.2 Special status check

If the gct module can not auto attach , please check status :

AT+CGATT?

(Attach manually. When the network is available, the module can be attached manually.)

AT+CGPADDR

(Look up obtained IP address.)

5.3 PDN config

For PDN,we need to config the parameters:pdptype,apnname, auth_type, username, password

1.configpdptype, apnname

AT+CGDCONT=\${gct_cid},\${pdptype},\${ apnname }

2.configauth_type, username, password

A. when the value of auth_type is NONE , means \${auth_type}=0

AT+CGAUTH=\${gct_cid}, 0

B. when the value of auth_type is PAP, means \${auth_type}=1

AT+CGAUTH=\${gct_cid},\${auth_type},\${username},\${password}

C. when the value of auth_type is CHAP, means \${auth_type}=2

AT+CGAUTH=\${gct_cid},\${auth_type},\${username},\${password}

6 Possible Problem Description

1. Baud Rate: 921600
2. Reboot should be done after configing module parameters.
3. pdn3 is for GCT module main apn, so pdn3 should be actived first
4. For the first time insert module to baseboard, the follow information should be configured:
 - band (full band, single band, single band and frequency)
 - attach mode: automatic or manual
 - APN information (apn, pdptype, apn name, auth_type, username, password) Attention:
if the module is not the first time inserted to baseboard, the above information do not be configured.
5. AT command can not be send to module successfully

After power on, the module is connected with host and works well for the first time, including issuing the AT command. But if the USB connection breaks in between, such as host restarting or USB being disconnected and reconnected (For example, the module is connected to host through USB and then the USB line is pulled out.), AT command cannot be issued though the module can be recognized by the host. At this time the module needs to be powered on or off or the reset pin is pulled down to reset or restart the module
6. Abnormal protection on the host side

Abnormal problems possibly exist in the module to result that the module does not work and cannot communicate with the host. At this time it is recommended that time protection mechanism should be launched. The module can be judged whether the module is working well by querying status periodically. If the status is abnormal, it is needed to reset the module by reset pin or power off.

7 AT Commands Description

PROPRIETARY AT COMMANDS

7.1 System at commands

7.1.1 AT%GIMEISV

Command	Possible response(s)
%GIMEISV=<item>,<value>	OK or ERROR
%GIMEISV?	%GIMEISV: <IMEISV value>

Descriptions:

Set command changes the value of IMEI or SVN.

Read command returns the current IMEISV.

Parameter definition:

<item> String,

- "IMEI" : Set IMEI , this case is same at%gimei="value".
- "SVN_VAL" : Set Software Version Number S

<value> String,

- In case of "IMEI": The International Mobile station Equipment Identity(14 digit) and the check digit (1 digit, total 15 digits).
- In case of "SVN_VAL": Software Version Number. (2 digits)

< IMEISV value >

String, The International Mobile station Equipment Identity (14 digits) and Software Version Number (2 digits)

Example:

AT%GIMEISV?

%GIMEISV: 3564320588115700

OK

AT%GIMEISV="IMEI","353376050126587"

OK

7.1.2 AT%GPDNTYPE

Command	Possible response(s)
%GPDNTYPE = <cid> , <type>	OK or ERROR
%GPDNTYPE?	%GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type> %GPDNTYPE: <cid>, <type>

Descriptions:

Set command registers PDN type of each CID

Read command returns the current set PDN type

Parameter definition:

<cid> integer,

1 ~ 8 : context ID.

<type> integer,

1 - IMS PDN

2 – ADMINISTRATION PDN

3 – INTERNET PDN

4 – APPLICATION PDN

5 – EMERGENCY PDN

Example:

AT%GPDNTYPE =1, 3

OK

AT%GPDNTYPE =2, 2

OK

AT% GPDNTYPE?

%GPDNTYPE: 1,3

%GPDNTYPE: 2,2

%GPDNTYPE: 3,0

%GPDNTYPE: 4,0

%GPDNTYPE: 5,0

%GPDNTYPE: 6,0

%GPDNTYPE: 7,0

%GPDNTYPE: 8,0

OK

7.1.3 AT%GFREQRNG

Command	Possible response(s)
AT%GFREQRNG=<BAND1>,<ST_EARFCN1>,<ED_EARFCN1> [,<BAND2>,<ST_EARFCN2>,<ED_EARFCN2>,...,<BAND8>,<ST_EARFCN8>,<ED_EARFCN8>]	OK or ERROR
AT%GFREQRNG?	%GFREQRNG: <BAND1>,<ST_EARFCN1>,<ED_EARFCN1> [,<BAND2>,<ST_EARFCN2>,<ED_EARFCN2>,...,<BAND8>,<ST_EARFCN8>,<ED_EARFCN8>]

Descriptions:

Set command sets frequency range for band respectively..

Read command returns the current setting value.

Parameter definition:

<BAND>

Band number

< ST_EARFCN>

Start EARFCN of Downlink

< ED_EARFCN>

End EARFCN of Downlink

7.1.4 AT%GLOCKCELL

Command	Possible response(s)
%GLOCKCELL = <NumCell>,<erfcn1>,<pci1> [,<erfcn2>,<pci2>...]	OK or ERROR

Descriptions:

Set command set cell lists that is locked

Parameter definition:

<numCell> Integer,

Number of Cell list. Max value is 30. It means Cell list locked can be registered up to 30 lists.

<earfcn> Integer,

E-UTRA absolute radio frequency channel number of the serving cell. Range: 0 to 65535.

<PCI> Integer,

Physical cell ID to which the UE is locked. Range: 0 to 503.

7.1.5 AT%GLOCKSCCELL

Command	Possible response(s)
<code>%GLOCKSCCELL = <NumCell>,<erfcn1>,<pci1> [,<erfcn2>,<pci2>...]</code>	OK or ERROR

Descriptions:

Set command set secondary cell lists that is locked

Parameter definition:

<numCell> Integer,

Number of Cell list. Max value is 8.

<earfcn1> Integer,

E-UTRA absolute radio frequency channel number of the serving cell. Range: 0 to 65535.

<PCIi> Integer,

Physical cell ID to which the UE is locked. Range: 0 to 503.

Remarks:

- If "RRC Locked Cell List Set" is configure, "RRC Locked Secondary Cell List Set" information included in "RRC Locked Cell List" is only configured.

7.1.6 AT%SYSCMD

Command	Possible response(s)
<code>%SYSCMD = "<cmd>"</code>	<code>%SYSCMD: "<rtn_str>"</code>

Descriptions:

Set command would be used to execute shell commands.

Parameter definition:

<cmd> String.

Shell commands

Example:

at%syscmd="ucfg set config wan lte vendor 4"

%SYSCMD: vendor=4

OK

at%syscmd="ucfg get config wan lte apntable apn1"

%SYSCMD: ENABLE=1

%SYSCMD: pdn_label=ims

%SYSCMD: apn_name=otasn

%SYSCMD: pdn_type=2

...

OK

7.1.7 AT%GRRCRINFO

Command	Possible response(s)
%GRRCRINFO	%GRRCRINFO: <info1>, <info2>, <info3>

Descriptions :

Execution command returns the RRC information

Parameter definition:

<info1> Integer,

Number of RRC Connection requests.

<info2> Integer,

Number of RRC Connection reestablishment requests.

<info3> Integer,

Number of Radio Link Failures.

7.2 Dual sim at commands

7.2.1 AT%SIMSLOT

Command	Possible response(s)
%SIMSLOT = <slot>	OK OR ERROR
%SIMSLOT?	%SIMSLOT: <slot> OK

Descriptions :

Set command set which sim slot to use and setting will be saved in the config file, this command will reboot module.

Read command returns current use sim slot

Parameter definition:

<slot >Integer

0 –sim slot 0

1 –sim slot 1

7.3 GPS at commands

7.3.1 AT%SYSCMD="zm_gps set gnss<parameter>"

Command	Possible response(s)
%SYSCMD="zm_gps set gnss <parameter>"	%SYSCMD: ok or %SYSCMD: nok

Descriptions :

Set command set what kind of position system supported by module.

Parameter definition:

<parameter>String

gps_glonass_galileo– make module support gps/glonass/galileo position system

gps_beidou_galileo– make module support gps/beidou/galileo position system

7.3.2 AT%SYSCMD="zm_gps get location_time"

Command	Possible response(s)
%SYSCMD="zm_gps get location_time"	%SYSCMD: time= <UTC time> latitude= <Latitude value> longitude= <Longitude value> altitude= <Altitude value> or %SYSCMD: fail

Descriptions :

Get command get location and time

Example:

AT%SYSCMD="zm_gps get location_time"

uart port[1] fc=0 cr=0000002b

%SYSCMD: time=34004.000000 latitude=31.167280 longitude=121.400146 altitude=-7.000000

OK

OEM/Integrators Installation Manual

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).
The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2ASRY-LG750"
The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
 - (2) The transmitter module may not be co-located with any other transmitter or antenna.
 - (3) Only antennas of the same type and with equal or less gains as shown below may be used with this module.
- Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	LTE band 48 Gain (dBi)				
PCB	2.5				

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/IC authorization is no longer considered valid and the FCC ID/IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC/IC authorization.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a

residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of applicable FCC rules

This module has been tested and found to comply with FCC part 96 requirements for Modular Approval. The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
 - 2) The transmitter module may not be co-located with any other transmitter or antenna.
- As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Industry Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

The device could automatically discontinue transmission in case of absence of information to transmit, or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

L'appareil peut interrompre automatiquement la transmission en cas d'absence d'informations à transmettre ou de panne opérationnelle. Notez que ceci n'est pas destiné à interdire la transmission d'informations de contrôle ou de signalisation ou l'utilisation de codes répétitifs lorsque cela est requis par la technologie.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.