GL601 @Track Protocol Pro

Release 12

Queclink

Dec 05, 2024

CONTENTS:

GL601 is a self-sustaining, zero-maintenance wireless device for container, Trailer, Rail wagon management. To deliver constant intermodal visibility, It's built-in rechargeable big battery is catering the multimodal working mode of the transportation, either real-time tracking frequently in movement or at low sending frequency when standstill, the additional energy harvesting with solar panel ensure and extend the lifecycle of the device up to 8 years. Employed LTE Cat1 technology, there is no worries about network coverage for inter-regional transportation. Apart from integrating light sensor for tamper alert and temperature sensor for ambient condition monitoring. It's capable to extend more use cases with BLE connectivity and optional Wi-Fi.

You can navigate to the detailed content of the @Track protocol from the directory tree below.

CHAPTER

ONE

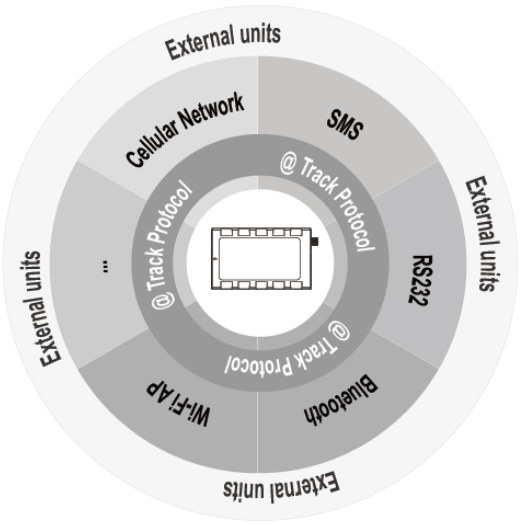
OVERVIEW

This section aims to describe the main features and some important information of the Queclink @Track protocol, in order to show you the overall appearance of it.

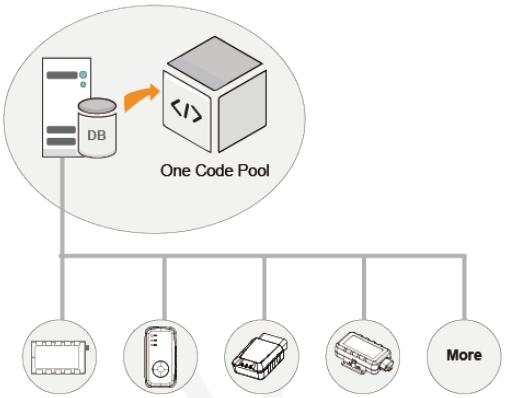
1.1 What It Is

The @Track protocol is a digital communication interface developed by Queclink, oriented to but not limited to remote telemetry servers, via but not limited to cellular network, parsing programs can be fully reused, and used for external units to communicate with terminal devices provided by Queclink.

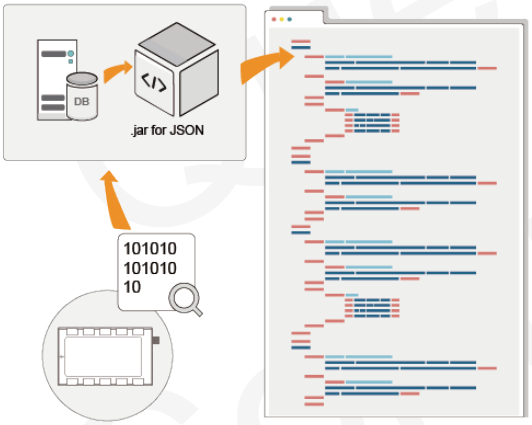
Feature 1: Multiple interfaces, one protocol.
The @Track protocol applies to all communication interfaces supported by the terminal device.



Feature 2: Adapt one,works for all.
The frame format of the @Track protocol is highly consistent, so if you adapt one device ,it is very easy to adapt other devices.



Feature 4: JSON makes building server faster.
Queclink provides a Java class library that can convert the messages reported by the terminal device into a readable JOSN string, speeding up your progress in building a telemetry server.



Feature 3: Binary reporting, less traffic.
In the @Track protocol, the message actively reported by the terminal device uses binary encoding, which significantly improves the effective utiliaztion rate of wireless traffic.

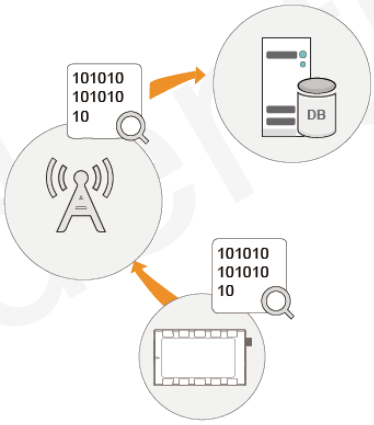


Fig. 1: Primary Features of @Track Protocol

For the terminal, the communication interfaces that support the @Track protocol are: **Cellular Network, SMS, RS232**.

1.2 Frame Types

The @Track protocol contains the following types of frames, depending on their purpose:

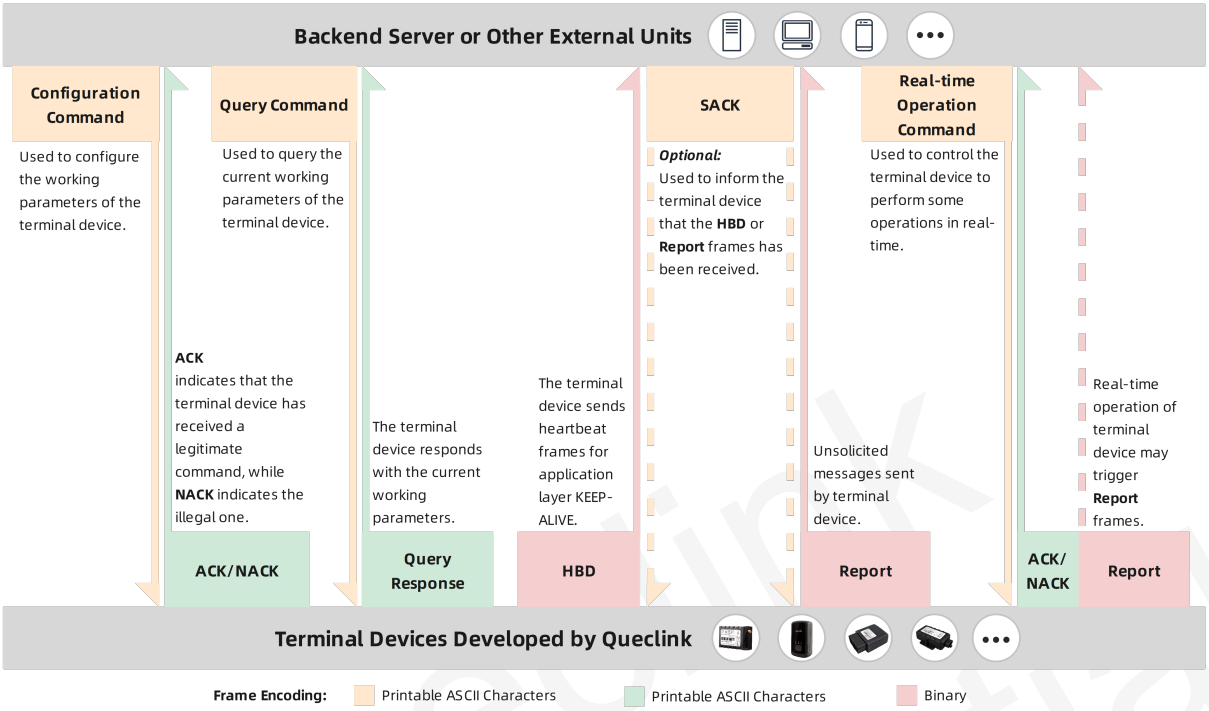
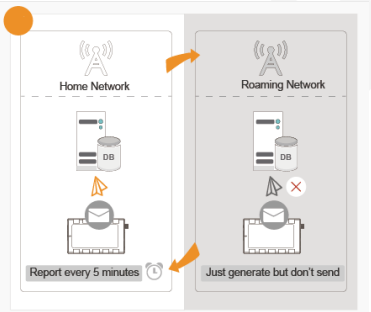


Fig. 2: Frame Types and Encoding

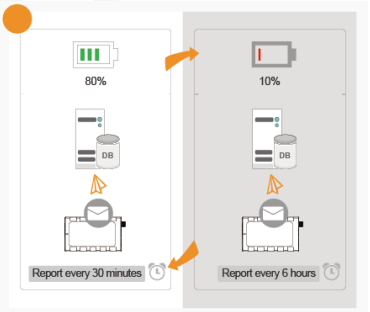
Please refer to *Frames Format* for the detailed format of the above types of frames.

1.3 Built-in Application Scenarios (Profiles)

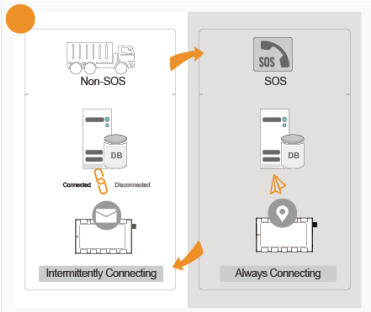
Sometimes, we hope that the terminal device can be smarter, for example, can dynamically change the working parameters according to its own working status or the external environment, like this:



When the terminal leaves the home network and enters the roaming network area , it will automatically switch to Profile 1 (Roaming) , at this time , in order to save the data usage of the roaming network , the terminal may only generate reports but not send to the backend server , and then send these reports when the terminal leaves the roaming network area and returns to the local network area.



When the power supply is sufficient , the terminal generates a location report every 30 minutes , and when it is in a low battery state , in order to save power, it will switch to Profile 10 (Low Battery) and automatically adjust to generate a location report every 6 hours.



When the SOS signal is detected ,the terminal will automatically switch to Profile 63 (Emergency), and always tries to maintain a long connection with the backend server while shortening the interval for generating location reports so that the server can know the location of the terminal in real time.

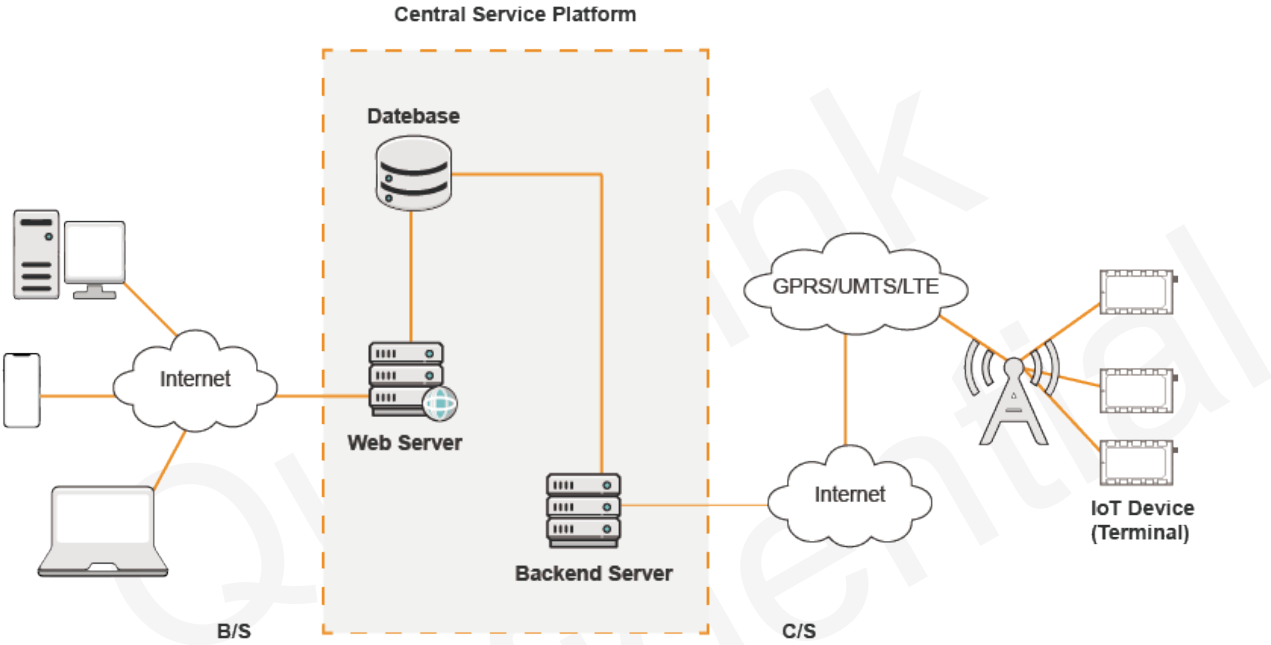
Yes, with the @Track protocol, terminal devices can easily do this.

The application scenarios supported by the terminal are: **Profile 0 (Default), Profile 1 (Roaming), Profile 4 (Motion), Profile 5 (Motionless), Profile 9 (Wi-Fi Environment), Profile 10 (Low Battery), Profile 63 (Emergency)**. For more information, please refer to *here*.

If you want the terminal device to support more profiles, please contact us.

1.4 System Architecture

For traditional TCP/UDP system architecture: The @Track protocol applies to all communication interfaces supported by the terminal device, but it is primarily oriented to the remote telemetry server based on cellular network. The figure below shows the basic architecture of the system composed of backend server and terminals.



The backend server needs to be accessed by multiple terminals and should have at least the following abilities:

- The backend server should be able to access the internet or the local area network where the terminals are located and listen for the connection from the terminals.
- The backend server should be able to support TCP/IP or UDP/IP connection with the terminal. It should be able to receive data from the terminal and send data to the terminal.
- Optional: The backend server should be able to receive and send SMS.

CHAPTER

TWO

FRAMES

As mentioned earlier, the @Track protocol contains the following types of frames:

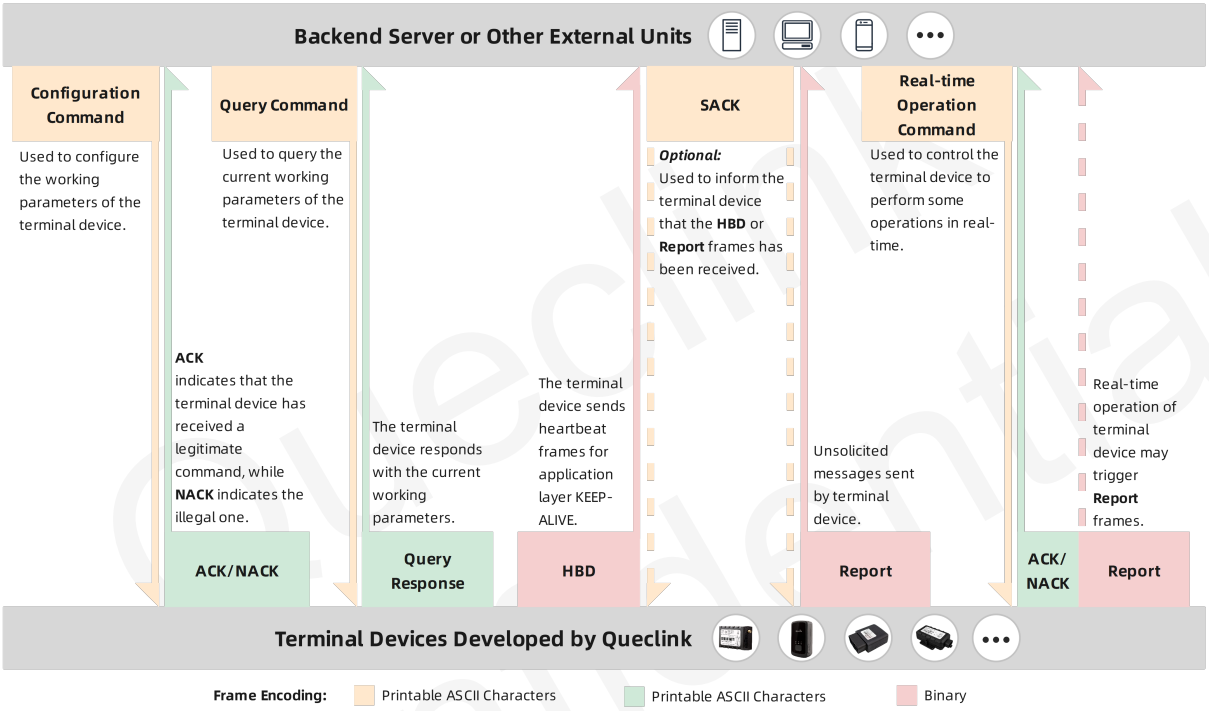


Fig. 1: Frame Types and Encoding

For the detailed format, please click on the hyperlinks below.

2.1 Configuration Command and Acknowledgement

As mentioned *earlier*, *Configuration Command*, *ACK* and *NACK* frames are often used together.

2.1.1 Configuration Command

The configuration command is used to set the working parameters of the terminal device.

All configuration commands are encoded using printable *ASCII* characters, and the character ',' is used to separate the neighboring parameter characters, as follows:

```
Example:
AT@APN=gl601###,,cmnet,,,0,,012F$
AT@TMA=gl601###,0,+32,0,,time.windows.com,123,0387$
AT@AGPS=gl601###,1,1,,,1101$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	<=10	'A'-'Z', '0'-'9'	
	Leading Symbol	1	=	=
	Password	8-16	'0'-'9', 'a'-'z', 'A'-'Z', '-', '_', '#'	gl601###
Body	Parameters	N	Refer to the detailed definition of each command.	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Command Word*

  Used to indicate which command to configure.

  Please refer to *Commands* for the command words supported by the terminal device and the definition of 'Parameters' it carries.

- *Password*

  The password of the terminal device, the default is "gl601###", which can be changed by the *AT@CFG* command.

- *Parameters*

  Corresponding to 'Command Word', that means the content, length and meaning are all determined by 'Command Word'.

  Parameters usually contains multiple fields separated by commas. And a field of length 0 is called an *empty field*, which means:

  - It may just represent a 'Reserved' field, without clear meaning and function.
  - Unless otherwise stated, an empty field means that the contents of this field are not changed, that is, the last configured value is left unchanged.

- *Sequence Number*

  The sequence number of the command. It will be included in the *ACK* or *NACK* frame (see below) of the terminal device responding to the command.

Note

'Header', 'Leading Symbol', and 'Tail' are continuous between the fields adjacent to them, not separated by commas. **THIS NOTE WILL NOT BE REPEATED ELSEWHERE**.

2.1.2 ACK and NACK

When the terminal device receives a configuration command (or real-time operation command), it will always respond with an ACK or NACK frame, where ACK indicates that the configuration command is legitimate (supported), and NACK indicates that it is illegal (unsupported).

ACK and NACK are also encoded using printable *ASCII* characters, and the character ',' is used to separate the neighboring parameter characters.

ACK Format

The frame format of ACK is as follows:

```
Example:
+ACK:APN,123456789012345,C031,12,0,,012F,20210407101530,1234$
+ACK:TMA,123456789012345,C031,12,0,,0378,20210407101540,1235$
+ACK:RTO,123456789012345,C031,12,0,1,028A,20210407101550,1236$
+ACK:QRC,123456789012345,C031,12,0,03,A052,20210407101554,1237$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	4	+ACK	+ACK
	Leading Symbol	1	:	:
	Command Word	<=10	'A'-'Z', '0'-'9'	
	IMEI	15		
	Device Type	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Protocol Version	1-5	1-65535	12
	Custom Version	1-3	0-255	0
Body	Flexible Field	N	Please see below.	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Generated Time	14	YYYYMMDDHHMMSS	
	Count Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Command Word*

  Corresponding to the 'Command Word' in the configuration command.

- *IMEI*

  The International Mobile Equipment Identity of the terminal device.

- *Device Type*

  The type of terminal device.

- *Protocol Version*

  The version number of this @Track protocol.

  For example, "1" means V1, "12" means V12, and "123" means V123.

- *Custom Version*

  This version number is reserved for user customization.

  For example, "1" means V1, "12" means V12, and "123" means V123.

  If the custom version number has not been set, it defaults to "0".

- *Flexible Field*

  This field is prepared for some special commands that need to carry additional necessary information, and the meaning is also determined by these commands.

In fact, this field is only meaningful in the following commands, and it is an empty field (length is 0) in all other commands:

Command	Parameter
AT@RTO	*Sub Command*
AT@UPD	*Sub Command*
AT@QRC	*Record ID*
AT@BTBCN	*Group ID*
AT@ETH	*Alarm ID*
AT@GEO	*GEO ID*
AT@PROFILE	*Profile ID*
AT@WIFIGEO	*GEO ID*

Some examples are given below:

- *AT@RTO*

  When responding to the AT@RTO command, this field corresponds to the **'Sub Command'** field in the command to indicate which subcommand to respond to.

  For example, *+ACK:RTO,123456789012345,C031,12,0,1,028A,20210407101550,1236$* responds to subcommand 1 (Request the terminal to report its current position).

- *AT@UPD*

  When responding to the AT@UPD command, this field corresponds to the **'Sub Command'** field in the command to indicate which subcommand to respond to.

  For example, *+ACK:UPD,123456789012345,C031,12,0,0,028A,20210407101550,1236$* responds to subcommand 0 (Start the firmware update).

- *AT@QRC*

  When responding to the AT@QRC command, this field corresponds to the **'Record ID'** field in the command to indicate which record to respond to.

  For example, *+ACK:QRC,123456789012345,C031,12,0,03,A052,20210407101554,1237$* responds to Record 03H (Connection Starts).

- *AT@PROFILE*

  When responding to the AT@PROFILE command, this field corresponds to the **'Profile ID'** field in the command to indicate which profile ID to respond to.

  For example, *+ACK:PROFILE,123456789012345,C031,12,0,0,0FFF,20240407094530,FF34$* responds to profile 0 (Default).

  For example, *+ACK:PROFILE,123456789012345,C031,12,0,0\63,0FFF,20240407094530,FF34$* responds to profile 0 (Default) and profile 63 (Emergency).

  For example, *+ACK:PROFILE,123456789012345,C031,12,0,,0FFF,20240407094530,FF34$* responds to all profiles.

- *AT@GEO*

  When responding to the AT@GEO command, this field corresponds to the **'GEO ID'** field in the command to indicate which GEO ID to respond to.

  For example, *+ACK:GEO,123456789012345,C031,12,0,1,012F,20210407101530,1234$* responds to GEO ID 1.

- *Sequence Number*

  Corresponding to the sequence number in the configuration command.

- *Generated Time*

  The UTC time when the frame was generated, in 'YYYYMMDDHHMMSS' format.

For example, “20230907105030” indicates the UTC time *September 7,2023,10:50:30*.

- *Count Number*

  A self-increasing count number in each acknowledgement message. It begins from “0000” and increases by 1 for each acknowledgement message. And it rolls back after “FFFF”.

Note

The ACK frame only indicates that the terminal device has received the command, but does not mean that the command has been successfully executed; the terminal device will send a report to inform the backend server of the execution result of the command when necessary.

NACK Format

The frame format of NACK is as follows:

```
Example:
+NACK:APN,123456789012345,C031,12,0,,0,012F,20210407101530,1234$
+NACK:TMA,123456789012345,C031,12,0,,1,0378,20210407101540,1235$
+NACK:RTO,123456789012345,C031,12,0,1,2,028A,20210407101550,1236$
+NACK:QRC,123456789012345,C031,12,0,03,1,A052,20210407101554,1237$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	5	+NACK	+NACK
	Leading Symbol	1	:	:
	Command Word	<=10	‘A’-‘Z’, ‘0’-‘9’	
	IMEI	15		
	Device Type	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Protocol Version	1-5	1-65535	12
	Custom Version	1-3	0-255	0
Body	Flexible Field	N		
	Cause	1-2	0-99	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Generated Time	14	YYYYMMDDHHMMSS	
	Count Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Cause*

  It is used to indicate the specific reason for the NACK to be triggered.

  - **0** - The password or parameter is incorrect.
  - **1** - The terminal device does not support this command.
  - **2** - The terminal device is not allowed to execute this command now, probably for security reasons.

NACK has one more ‘Cause’ field than ACK frame, and the meaning of other fields is the same.

Note

In order to avoid network attacks, the terminal device will not send a NACK to the backend server after continuously sending **5** NACKs until it receives a legitimate (supported) command, or after one hour.

2.2 Query Command and Response

The query command is used to query the current working parameters of the terminal device.

All query commands are encoded using printable *ASCII* characters, and the character ',' is used to separate the neighboring parameter characters, as follows:

```
Example:
AT@APN?gl601###,,1C06$
AT@TMA?gl601###,,13B7$
AT@AGPS?gl601###,,280F$
AT@QRC?gl601###,01,A0E1$
AT@QRC?gl601###,03,A3F2$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	<=10	'A'-'Z', '0'-'9'	
	Leading Symbol	1	?	?
	Password	8-16	'0'-'9', 'a'-'z', 'A'-'Z', '-', '_', '#'	gl601###
Body	Flexible Field	N	Please see below.	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Command Word*

  Used to indicate which command to query.

  Please refer to *Commands* for the command words supported by the terminal device.

- *Flexible Field*

  This field is prepared for some special commands that need to carry additional necessary information, and the meaning is also determined by these commands.

  In fact, this field is only meaningful in the following commands, and it is an empty field (length is 0) in all other commands:

  - *AT@QRC*

    For the QRC command, the length of this field is 2 bytes. And it is a **'Record ID'** to indicate which report configuration is to be queried.

    For example, *AT@QRC?gl601###,03,A3F2$* can query the configuration parameters of Record 03H (Connection Starts).

- *Sequence Number*

  The sequence number of the command. It will be included in the **QRY** frame (see below) of the terminal device responding to the command.

When the terminal device receives a legitimate query command, it will always respond with the current parameters of the corresponding command. The entire response frame (can be called *QRY* frame) are also encoded using printable *ASCII* characters, and the character ',' is used to separate the neighboring parameter characters, as follows:

```
Example:
+QRY:APN,123456789012345,C031,12,0,1,1,,cmnet,,,0,,1C06,20210407101530,1234$
+QRY:TMA,123456789012345,C031,12,0,1,1,0,+32,0,,time.windows.com,123,13B7,
↪20210407101540,1235$
+QRY:AGPS,123456789012345,C031,12,0,1,1,1,1,,,280F,20210407101550,1236$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	4	+QRY	+QRY
	Leading Symbol	1	:	:
	Command Word	<=10	'A'-'Z', '0'-'9'	
	IMEI	15		
	Device Type	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Protocol Version	1-5	1-65535	12
	Custom Version	1-3	0-255	0
	Total Frame	1-2	1-99	
	Current Frame	1-2	1-99	
Body	Parameters	N	Refer to the detailed definition of each command.	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Generated Time	14	YYYYMMDDHHMMSS	
	Count Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Command Word*

  Corresponding to the command word in the query command.

- *IMEI*

  The International Mobile Equipment Identity of the terminal device.

- *Device Type*

  The type of terminal device.

- *Protocol Version*

  The version number of this @Track protocol.

  For example, "1" means V1, "12" means V12, and "123" means V123.

- *Custom Version*

  This version number is reserved for user customization.

  For example, "1" means V1, "12" means V12, and "123" means V123.

  If the custom version number has not been set, it defaults to "0".

- *Total Frame*

  The total number of QRY frames.

  There are some commands (such as commands containing the 'Profile ID' field) whose parameters are not suitable for all being placed in one QRY frame. At this time, the terminal device will respond to multiple QRY frames consecutively in order to send all the parameters of the command to the inquirer. And this 'Total Frame' field is used to indicate the total number of QRY frames (the 'Current Frame' field below is used to indicate the current frame number).

- *Current Frame*

  Indicates the current number of QRY frame. It counts from 1, and the maximum value is equal to 'Total Frame'.

- *Parameters*

  The current working parameters of the corresponding command in the terminal device. Its content is determined by 'Command Word', which is consistent with 'Parameters' in *Configuration Command*.

- *Sequence Number*

  Corresponding to the sequence number in the query command.

- *Generated Time*

  The UTC time when the frame was generated, in 'YYYYMMDDHHMMSS' format.

For example, "20230907105030" indicates the UTC time *September 7,2023,10:50:30*.

- *Count Number*

  A self-increasing count number in each QRY frame. It begins from "0000" and increases by 1 for each QRY frame. And it rolls back after "FFFF".

For the meaning of other fields, please refer to *Configuration Command and Acknowledgement*.

About the query response of the Profile-related command:

The commands that contain the 'Profile ID' field in the parameters are called *Profile-related* commands (please refer to *Profiles* for more information). To query the parameters of these commands, the terminal device may respond to multiple QRY frames consecutively.

For example, for the query command *AT@QRC?gl601###,50,0C37$*, its response may be:

```
+QRY:QRC,123456789012345,C031,12,0,3,1,50,0,2,,82,10,1,600,0,0,0,0C37,
↪20210407101530,1234$
+QRY:QRC,123456789012345,C031,12,0,3,2,50,1,0,,82,10,1,300,0,0,0,0C37,
↪20210407101532,1235$
+QRY:QRC,123456789012345,C031,12,0,3,3,50,63,1,,82,10,1,60,0,0,0,0C37,
↪20210407101533,1236$
```

Note

One query command can only query the parameters of one command. If you want to get the entire configuration file of the terminal device, you can issue the *AT@GTC* command. Please refer to *Get Configurations* for more information.

2.3 Report and its Configuration Command

As mentioned *earlier*, 'Report' refers to the frame that the terminal device actively generates and sends to the back-end server when it reaches certain established conditions. And some conditions can be changed by configuration commands.

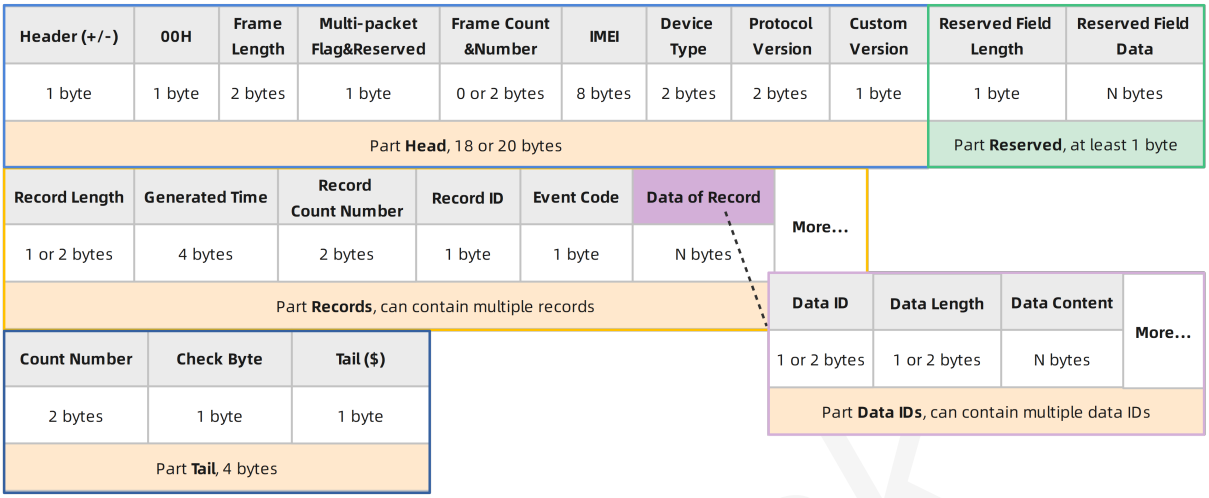
In order to reduce the frame size and increase the effective usage rate of the wireless traffic, all report frames are uniformly encoded to *Binary* frames. And the *big-endian* byte order is used for the transmission of multi-byte data types (int, float, double, etc.). For example, for the integer 305419896 (i.e., 12345678H), the byte *12H* will be sent first, and then *34H, 56H,78H*.

In order to facilitate the backend server to parse the report frame, this protocol limits the maximum length of a single report. Usually the maximum length of a report cannot exceed 1440 bytes. When the length of the original report is too long, the terminal will automatically split it into multiple reports.

Usually user data is contained in 'Records', and a report can contain multiple records. The whole frame format of the report is as follows:

Example (Total 78 bytes):

2B *00* **00 4E** *00* **01 23 45 67 89 01 23 45** *00 00* **00 1B** *00* **00** *37* **64 F9 AA F6** *00 00* **03** *00* **02** *0B 4D 79 49 6F 54 64 65 76 69 63 65* **51** *0F 09 07 3C 46 FF 01 DB 88 57 5F 17 9D A0 01 7D* **55** *0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03* **01 23 4F 24**




```
Example (Total 78 bytes):
2B 00 00 4E 00 01 23 45 67 89 01 23 45 00 00 00 1B 00 00 37 64 F9 AA F6 00 00 03␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17␣
↪9D A0 01 7D 55 0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03 01 23 4F 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head	Header		1	2BH (+) or 2DH (-)	2BH (+)
	00H		1	00H	00H
	Frame Length		2		
	Multi-packet Flag & Reserved bits		1	00H or 80H	
	Frame Count & Frame Number		0 or 2	Present when 'Multi-packet Flag' is 1	
	IMEI		8		
	Device Type		2	0000H-FFFFH	
	Protocol Version		2	0001H-FFFFH	000CH
	Custom Version		1	00H-FFH	00H
Reserved	Reserved Field Length		1	00H-FFH	00H
	Reserved Field Data		N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	00H-FFH	
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail	Count Number		2	0000H-FFFFH	
	Check Byte		1	00H-FFH	
	Tail		1	24H ($)	24H ($)

- *Header*

  1 byte. 2BH (ASCII character '+') or 2DH (ASCII character '-'):

  - 2BH indicates *Real-time Report*, which is sent successfully in time.
  - 2DH indicates *Buffer Report*, which is not sent successfully in time.

  For more information, please refer to *Report Priority and Buffer Report* below.

- *00H*

  1 byte. Always 00H. Used as an identifier.

- *Frame Length*

  2 bytes. The length of this message from 'Header' (2BH or 2DH) to 'Tail' (24H).

  For example, 0136H represents 310 bytes.

- *Multi-packet Flag & Reserved bits*

  1 byte, the highest bit (bit7) is 'Multi-packet Flag', which is used to indicate whether this report contains the 'Frame Count & Frame Number' field: *0b0* means no, and *0b1* means yes.

  The lower 7 bits of this byte are reserved.

- *Frame Count & Frame Number*

  2 bytes. The first byte means 'Frame Count' and the second byte means 'Frame Number'.

  When the length of the message is too long, the terminal will automatically split it into multiple reports for sending. The 'Frame Count' represents the number of reports obtained by dividing the message, and the 'Frame Number' is a numeric to indicate the sequence of the current report.

  Please note that the report contains these two bytes only if 'Multi-packet Flag' is *0b1* and not so if it is 0b0.

- *IMEI*

  8 bytes. The International Mobile Equipment Identity of the terminal device.

  For example, 0123456789012345H indicates IMEI "123456789012345".

- *Device Type*

  2 bytes. The device type refers to the terminal model.

  This protocol applies to several device types, as shown in the following table:

Device Name	Device Type (Hex, 2 Bytes)	Device Type (ASCII, 4 Bytes)
GL601CEU	C031H	"C031"
GL601MG	C033H	"C033"

- *Protocol Version*

  2 bytes. The version number of this @Track protocol.

  For example, 0001H means V1, 000CH means V12, and 007BH means V123.

- *Custom Version*

  This version number is reserved for user customization.

  For example, 01H means V1, 0CH means V12, and 7BH means V123.

  If the custom version number has not been set, it defaults to 00H.

- *Reserved Field*

  1+N bytes. The reserved field is reserved for extended use. The first byte is 'Reserved Field Length', it indicates the number of bytes occupied by 'Reserved Field Data'.

  In particular, if 'Reserved Field Length' is 00H, the 'Reserved Field Data' is absent.

Note

In order to improve compatibility, the parser should decide how many bytes to skip to locate the next field based on the value of 'Reserved Field Length'.

2.3.1 Records and Data IDs

In a report, user data is always organized into records for transmission. Records are always made up of 'Record Length', 'Generated Time', 'Record ID', 'Event Code' and 'Data of Record' as described below.

Record Length	Generated Time	Record Count Number	Record ID	Event Code	Data of Record	More...
1 or 2 bytes	4 bytes	2 bytes	1 byte	1 byte	N bytes	

Data ID	Data Length	Data Content	More...
1 or 2 bytes	1 or 2 bytes	N bytes	

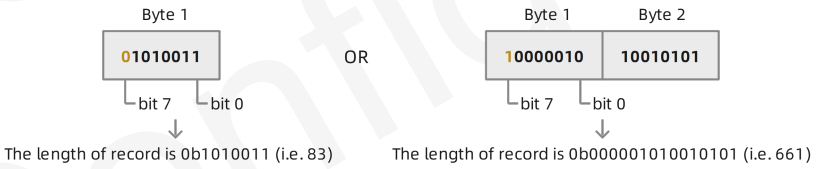
Note

A report can contain multiple records, which are next to each other, and the parser can locate the beginning of the next record through the 'Record Length' field.

- *Record Length*

  1 or 2 bytes. The number of bytes occupied by the entire record, including 'Record Length' itself.

  The highest bit of 0 means that 'Record Length' occupies only 1 byte, and the value is represented by the lowest 7 bits; The highest bit of 1 means that 'Record Length' occupies 2 bytes, and the value is represented by the lower 7 bits of the first byte and the second byte. Please see below:



- *Generated Time*

  4 bytes. The time when the record was generated, difference, in seconds, between the UTC time and midnight, January 1, 1970.

  For example, 64F9AAF6H (i.e., 1694083830) indicates the UTC time *September 7,2023,10:50:30*.

- *Record Count Number*

  2 bytes. A self-increasing count number in each record, it begins from **0000H** and increases by 1 for each record, and it rolls back after **FFFFH**.

  The record count number is accumulated according to the records are generated. After the terminal is restarted, the record count number will continue to accumulate based on the count before restarting.

- *Record ID*

  1 byte. In general, the record ID always corresponds to a specific event, such as the event of entering or exiting the Geo-fence, the event of reporting the location of terminal periodically, and so on. In other words, record ID can indicate **why the record was generated**.

Please refer to *Records* for the record IDs supported by the terminal device.

- *Event Code*

  1 byte. The event code is used to indicate the specific reason for the record to be triggered, it is determined by the specific record ID, that is, the same event code may have different meanings for different record IDs.

  The event code is defined in each record ID, please refer to *Records* for detailed definition.

- *Data of Record*

  The specific format of 'Data of Record' is as follows:

Data ID	Data Length	Data Content	Data ID	Data Length	Data Content	More...
1 or 2 bytes	1 or 2 bytes	N bytes	1 or 2 bytes	1 or 2 bytes	N bytes	
The first Data ID Unit			The second Data ID Unit			Other Data ID Units

  The 'Data of Record' consists of one or more Data ID units, and each Data ID unit contains three parts: 'Data ID', 'Data Length', and 'Data Content'.

  – *Data ID*

    This protocol assigns a unique ID to all information that needs to be sent to the backend server. Some information items are closely related to each other and always are transmitted in one piece, they also have a unique ID. These unique IDs are called Data IDs. In other words, a data ID can contain only one piece of indivisible information such as Device Name, or multiple information such as Longitude and Latitude.

    The data ID is represented by 1 or 2 bytes. Same as 'Record Length' mentioned above, the highest bit of 0 means that 'Data ID' occupies only 1 byte, and the value is represented by the lowest 7 bits; The highest bit of 1 means that 'Data ID' occupies 2 bytes, and the value is represented by the lower 7 bits of the first byte and the second byte.

    Please refer to *Data IDs* for the data IDs supported by the terminal device.

  – *Data Length*

    Length of content of Data ID. The actual length of the information represented by the data ID, occupying 1 or 2 bytes. Same as 'Record Length' mentioned above, the highest bit of 0 means that the length occupies only 1 byte, and the value is represented by the lowest 7 bits; The highest bit of 1 means that the length occupies 2 bytes, and the value is represented by the lower 7 bits of the first byte and the second byte.

    Note

    If the 'Data Length' is equal to 00H, it means that the terminal device cannot obtain the content of the 'Data ID' when the 'record' is generated, or the data ID is a special ID, which is only meaningful in a specific record (this will generally be mentioned in the definition of data ID). When 'Data Length' is 00H, the 'Data Content' field will be absent.

  – *Data Content*

    The information represented by the data ID, its meaning is determined by 'Data ID', and the length is indicated by 'Data Length'.

    Please refer to *Data IDs* for the data IDs supported by the terminal device.

The tail part of report contains three fields 'Count Number', 'Check Byte', 'Tail', as follows:

- *Count Number*

  2 bytes. A self-increasing count number in each report frame, it begins from **0000H** and increases by 1 for each report frame, and it rolls back after **FFFFH**.

The count number is accumulated according to the order in which the reports are sent, not in the order in which the reports are generated. After the terminal is restarted, the count number will continue to accumulate based on the count before restarting.

Note: If you find that the count numbers of the received reports are not consecutive, a possible reason is that the terminal has successfully sent the missing report but it was lost during network transmission or discarded by the backend server.

- *Check Byte*

  1 byte. This is an 8-bit CRC checksum, it is generated by a CRC algorithm with the properties displayed in *CRC-8 Calculation* below. The CRC covers the content of 'Header' to 'Count Number'.

- *Tail*

  1 byte. 24H (ASCII character '$').

Here is an example of parsing the report frame.

2.3.2 Report Priority and Buffer Report

Reports have three priorities: *Top*, *High* and *Normal*.

The terminal device always sends the top-priority reports preferentially, regardless of whether their generated time is before or after the high-priority and normal-priority reports. When there are many top-priority reports, they are sent in the order of the generated time.

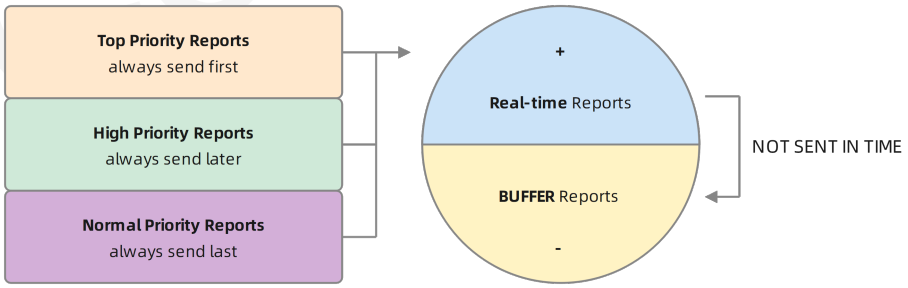
Similarly, after sending top-priority reports, the terminal device always sends the high-priority reports preferentially, regardless of whether their generated time is before or after the normal-priority reports. When there are many high-priority reports, they are sent in the order of the generated time.

By default, the normal-priority reports are sent in the order in which they are generated, unless the terminal device is set to send real-time reports preferentially in the *AT@RPS* command.

If there is no cellular network signal around or the signal is very weak, the reports will not be sent to the backend server in time, and they will stay in the terminal device until the surrounding cellular network signal is strong enough for they can be sent to the server.

To distinguish between the newly generated reports and the reports generated earlier, the reports that are successfully sent in time are called *Real-time* reports, and the reports that have not been sent successfully in time are called *Buffer* reports. The header of the real-time report is represented by character '+' (2BH), and the Buffer report is represented by character '-' (2DH). In other words, the report with the header '-' should be sent to the backend server at an earlier time.

All priority (Top, High, Normal) reports may become Buffer reports; and the *AT@RPS* command can set real-time reports to be sent first, which is only valid for reports with *Normal* priority.



2.3.3 Top and High Priority Reports list

The following are top and high priority reports supported by the terminal:

- Top-priority Reports
  - *Record 01H*
  - *Record 03H*
- High-priority Reports
  - *Record 04H*
  - *Record 05H*
  - *Record 11H*
  - *Record 12H*
  - *Record 22H*
  - *Record 81H*
  - *Record E0H*
  - *Record F1H*
  - *Record F2H*
  - *Record F3H*
- Normal-priority Reports

  The reports not mentioned above are all normal-priority reports.

2.3.4 CRC-8 Calculation

The 8-bit CRC checksum in the report should be calculated according to the properties in the table below:

```
Example:
CRC (2B 01 23 45 67 89 01 23 45 FE 01 06 01 02 01 FF 5D B3 8C 80) = FEH (0xFE)
```

Property	Value
Name	CRC-8
Width	8 bits
Polynomial	0x31 ($X^8 + X^5 + X^4 + 1$)
Initialization	FFH (0xFF)
Reflect input	False
Reflect output	False
Final XOR	00H (0x00)

Here is a corresponding CRC-8 algorithm routine written in C language:

```
#define CRC_POLYNOMIAL 0x131 // P(x) = x^8 + x^5 + x^4 + 1 = 100110001
unsigned char crc8_calc(unsigned char data[], unsigned int n) {
    unsigned char crc = 0xFF; // calculated checksum
    unsigned char bit; // bit mask
    unsigned int i; // byte counter
    for (i=0; i < n; i++) {
        crc ^= (data[i]);
        for (bit=8; bit > 0; --bit) {
            if (crc & 0x80)
                crc = (crc << 1) ^ CRC_POLYNOMIAL;
            else
```

(continues on next page)

(continued from previous page)

```
                crc = (crc << 1);
            }
        }
        return crc;
}
```

2.3.5 SACK

If the SACK function is enabled (please check the 'SACK Mode' field in the *AT@ACK* command), the terminal device will wait for the backend server to respond SACK message after sending a report. Once the terminal receives the correct SACK response message, it means that this report has been successfully received by the backend server.

The SACK is encoded using printable ASCII characters, its frame format is:

```
Example:
+SACK:0058$
+SACK:0A2F$
+SACK:D3FE$
```

Fields	Length (Byte)	Range/Format	Default
Header	5	+SACK	+SACK
Leading Symbol	1	:	:
Count Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
Tail	1	$	$

- *Count Number*

  4 bytes, ASCII characters, corresponds to the count number in the report.

  For example, the count number in the report is *01F7H*, here it is ASCII characters *"01F7"*.

If the terminal device does not receive the correct SACK message from the backend server after sending the report, the terminal will try to resend the report. After resending a few times, it still does not receive a correct SACK, it will reconnect to the backend server and try again. Please refer to *here* for the detailed processing flow.

2.3.6 Report Configuration

As mentioned earlier, user data is contained in records in the form of data ID units, and records are encapsulated as reports for transmission to the backend server. So how do we control which records need to be generated and which data ID units they contain?

The answer is the **"QRC"** (Queclink Report Configuration) command, which is specifically used to **configure the parameters associated with report's generation and transmission**, such as sending mode, sending interval, and so on, its frame format is as follows:

```
Example:
AT@QRC=gl601###,01,,1,,,012F$
AT@QRC=gl601###,17,,,1,4|81,0,012F$
AT@QRC=gl601###,50,0,1,1,2|82|88,10,,600,0,0,0,012F$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16	'0'-'9', 'a'-'z', 'A'-'Z', '-', '_', '#'	gl601###
Body	**Record ID**	2	01-FF ('0'-'9', 'A'-'F')	
	Parameters	N	Refer to the definition of each record ID.	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

It can be seen that the frame format of the QRC command is consistent with the *configuration command*, which is a subset of it; the parameters of the QRC command are defined by the 'Record ID', they can be different for different record IDs. Please refer to *Records* for the record IDs supported by the terminal device and the definition of 'Parameters' it carries.

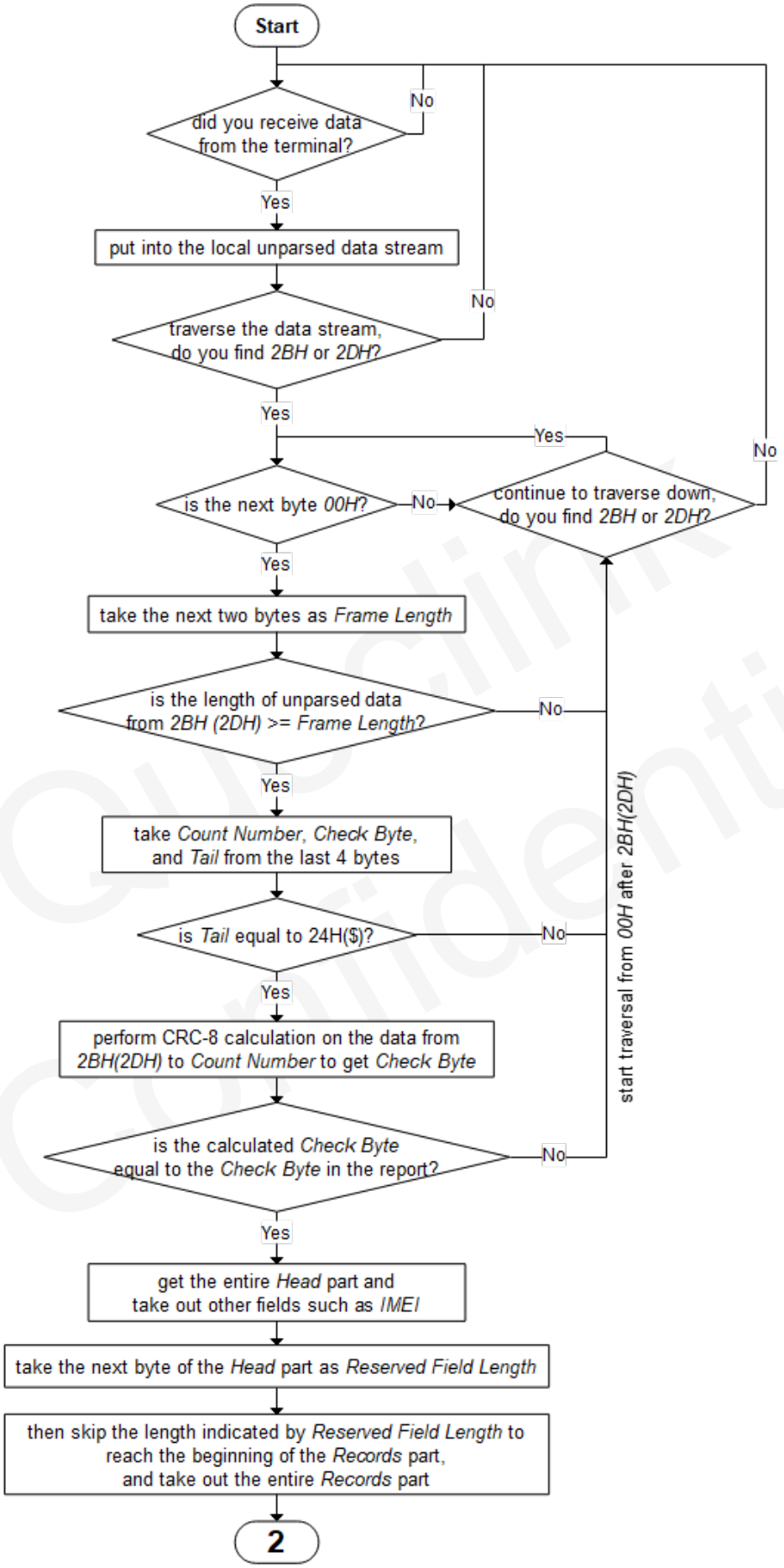
For how to query the parameters of the QRC command in the terminal device, please refer to *Query Command and Response*.

2.3.7 Example of Parsing Report

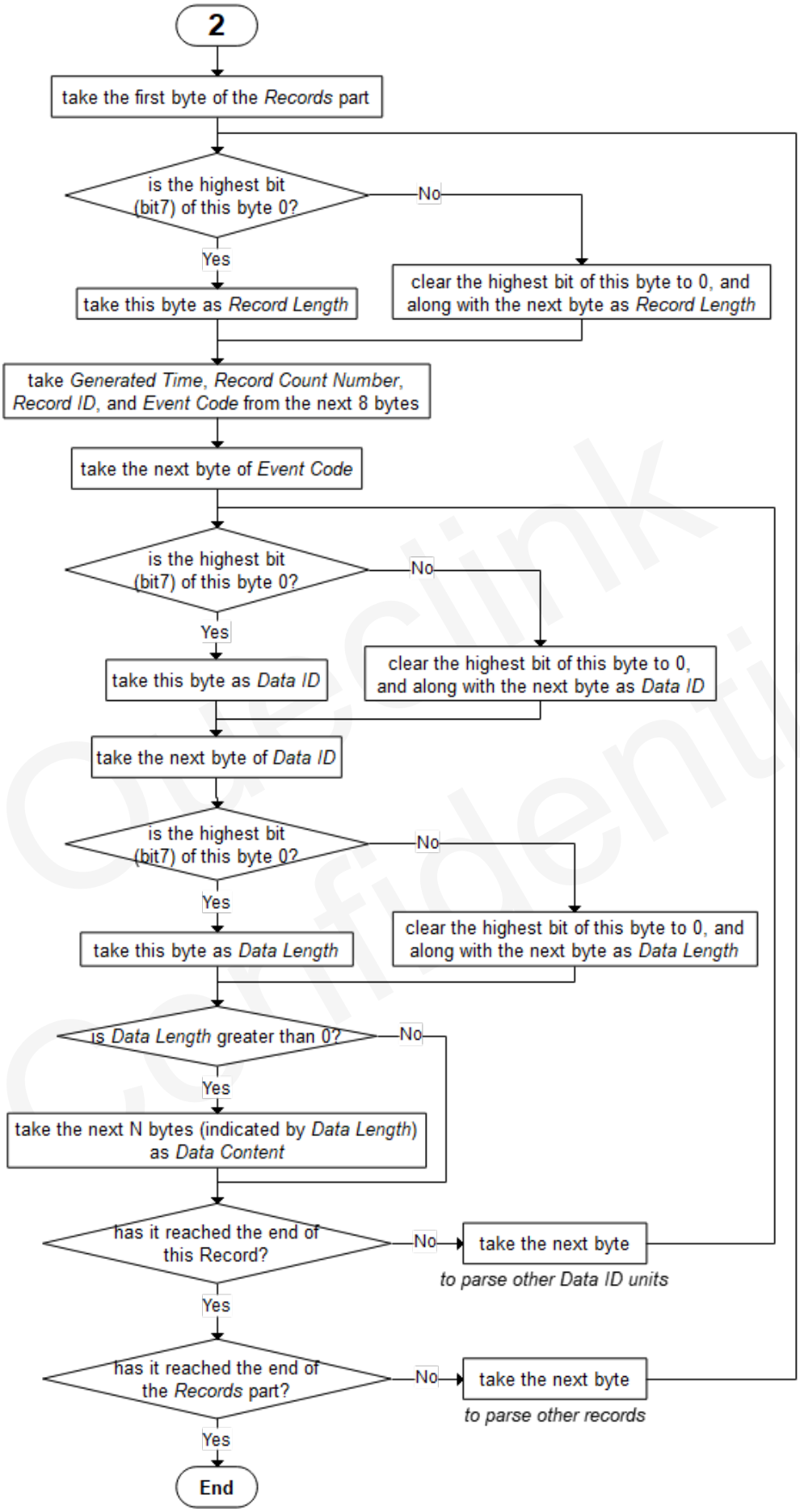
As mentioned *above*, a report consists of four parts: 'Head', 'Reserved', 'Records' and 'Tail'.

Parts	Fields	Length (Byte)	Range/Format	Default	Tot.Byte
Head	Header	1	2BH (+) or 2DH (-)	2BH (+)	18 or 20
	00H	1	00H	00H	
	Frame Length	2			
	…	12 or 14			
Reserved	Reserved Field Length	1	00H-FFH	00H	>=1
	Reserved Field Data	N			
Records	Record1 Length	1 or 2	00H-7FH or 8080H-FFFFH		N
	…	N			
	Record2 Length	1 or 2	00H-7FH or 8080H-FFFFH		
	…	N			
	…				
Tail	Count Number	2	0000H-FFFFH		4
	Check Byte	1	00H-FFH		
	Tail	1	24H ($)	24H ($)	

Please refer to the following flowchart to parse report:


Start
did you receive data from the terminal?
No
Yes
put into the local unparsed data stream
traverse the data stream, do you find 2BH or 2DH?
No
Yes
Yes
is the next byte 00H?
No
continue to traverse down, do you find 2BH or 2DH?
No
Yes
take the next two bytes as Frame Length
is the length of unparsed data from 2BH (2DH) >= Frame Length?
No
Yes
take Count Number, Check Byte, and Tail from the last 4 bytes
is Tail equal to 24H($)?
No
Yes
perform CRC-8 calculation on the data from 2BH(2DH) to Count Number to get Check Byte
is the calculated Check Byte equal to the Check Byte in the report?
No
Yes
get the entire Head part and take out other fields such as IMEI
take the next byte of the Head part as Reserved Field Length
then skip the length indicated by Reserved Field Length to reach the beginning of the Records part, and take out the entire Records part
2
start traversal from 00H after 2BH(2DH)

And refer to the following flowchart to parse the 'Records' part:


2
take the first byte of the Records part
is the highest bit (bit7) of this byte 0?
No
Yes
take this byte as Record Length
clear the highest bit of this byte to 0, and along with the next byte as Record Length
take Generated Time, Record Count Number, Record ID, and Event Code from the next 8 bytes
take the next byte of Event Code
is the highest bit (bit7) of this byte 0?
No
Yes
take this byte as Data ID
clear the highest bit of this byte to 0, and along with the next byte as Data ID
take the next byte of Data ID
is the highest bit (bit7) of this byte 0?
No
Yes
take this byte as Data Length
clear the highest bit of this byte to 0, and along with the next byte as Data Length
is Data Length greater than 0?
No
Yes
take the next N bytes (indicated by Data Length) as Data Content
has it reached the end of this Record?
No
take the next byte
to parse other Data ID units
Yes
has it reached the end of the Records part?
No
take the next byte
to parse other records
Yes
End

Here is an example of disassembling a report:

2B 00 00 4E 00 01 23 45 67 89 01 23 45 00 00 00 1B 00 00 37 64 F9 AA F6 00 00 03 00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17 9D A0 01 7D 55 0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03 01 23 4F 24

- Total 78 bytes.
- *2B* - Header '+'.
- *00* - Always be 00H.
- *00 4E* - Frame Length, 004EH (78) bytes.
- *00* - 0b00000000, Multi-packet Flag is 0b0, indicating that there is no 'Frame Count & Number' field in this report.
- *01 23 45 67 89 01 23 45* - IMEI, "123456789012345".
- *00 00* - Device Type, "0000".
- *00 1B* - Protocol Version, 001BH, means V27.
- *00* - Custom Version.
- *00* - Reserved Field Length, 0 means Reserved Field Data is absent.
- Content of Record 03H:
  - *37* - Record Length, this record has 37H (55) bytes. (Note: 37H=0b00110111, the highest bit is 0 means that 'Record Length' field occupies only 1 byte).
  - *64 F9 AA F6* - Generated Time of this record. 64F9AAF6H (i.e., Timestamp 1694083830) means UTC time 2023-09-07 10:50:30.
  - *00 00* - Record Count Number, 0000H.
  - *03* - Record ID, 03H.
  - *00* - Event Code, 00H.
  - Content of Data 02 (Device Name):
    - *02* - Data ID, 02H (2), Device Name. (Note: 02H=0b00000010, the highest bit is 0 means that 'Data ID' field occupies only 1 byte).
    - *0B* - Length of content of Data 2, 0BH (11) bytes. (Note: 0BH=0b00001011, the highest bit is 0 means that this length field occupies only 1 byte).
    - *4D 79 49 6F 54 64 65 76 69 63 65* - Device Name, "MyIoTdevice".
  - Content of Data 81 (Mini Location):
    - *51* - Data ID, 51H (81), Mini Location.
    - *0F* - Length of content of Data 81, 0FH (15) bytes.
    - *09* - 0b00001001, Fix State is 0b10 (Fix), and Fix Mode is 0b01 (3D GNSS fix).
    - *07 3C 46 FF* - Longitude, 073C46FFH (i.e., 121390847) means east longitude 121.390847 degrees.
    - *01 DB 88 57* - Latitude, 01DB8857H (i.e., 31164503) means north latitude 31.164503 degrees.
    - *5F 17 9D A0* - UTC Time. Timestamp 1595383200.
    - *01 7D* - Speed. 017DH (i.e., 381) means speed 38.1 km/h.
  - Content of Data 85 (Registered Cell):
    - *55* - Data ID, 55H (85), Registered Cell.
    - *0E* - Length of content of Data 85, 0EH (14) bytes.
    - *06 04 BC 8A* - PLMN is "310410".

    - *00 10* - LAC is “16”.
    - *00 02 10 00* - Cell ID, 00021000H (135168).
    - *10* - Access Technology & Roaming, 0b00010000, roaming status is home network (0b0) and access technology is LTE Cat-M1 (0b0010000=10H).
    - *0C* - Band, 0CH (12).
    - *13* - CSQ RSSI, 13H (19).
    - *03* - Bit Error Rate, 3% (03H).
- *01 23* - Count Number, 0123H (291).
- *4F* - Check Byte, calculated by *CRC-8 Calculation*.
- *24* - Tail, “$”.

2.4 Real-time Operation Command

The real-time operation command is used to control the terminal device to perform some operations in real time, such as restarting the device, clearing unsent reports, upgrading firmware, and so on.

Broadly speaking, the @Track protocol includes the following real-time operation commands:

- *AT@RTO* - The most commonly used real-time operation command.
- *AT@UPD* - Used to upgrade the firmware of the terminal device and its peripherals.
- *AT@UPC* - Used to update the configuration file or other files of the terminal device.
- *AT@GTC* - Used to obtain the entire configuration file of the terminal device.
- *Query Command* - Used to query a certain configuration of the terminal device.

However, when we say “real-time operation command”, we usually refer to the *AT@RTO* command.

Like other downstream commands, these real-time operation commands are encoded using printable *ASCII* characters, and the character ‘,’ is used to separate the neighboring parameter characters, for their frame format and meaning, please refer to the above hyperlinks.

2.5 Heartbeat Data

In order to let the backend server knows whether the terminal device is online when no report is generated, the terminal provides a heartbeat mechanism: When the terminal has not sent any information to the backend server for a certain period of time (refer to the *AT@HBD* command), the terminal will send the **HBD** frame to the backend server, and the server responds with a **SACK** frame to the terminal if necessary.

As same as report, the HBD message is encoded to *Binary* frame, and the *big-endian* byte order is used for the transmission of multi-byte data types (int, float, double, etc.), and the frame length is always *24* bytes, the whole frame format is as follows:

```
Example (Total 24 bytes):
2B 10 18 01 23 45 67 89 01 23 45 80 01 00 07 00 5E 36 2F 5A 10 F2 14 24
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	1	2BH (+)	2BH (+)
	10H	1	10H	10H
	Frame Length	1	18H	18H
	IMEI	8		
	Device Type	2	0000H-FFFFH	
	Protocol Version	2	0001H-FFFFH	000CH
	Custom Version	1	00H-FFH	00H
Tail	Generated Time	4		
	Count Number	2	0000H-FFFFH	
	Check Byte	1	00H-FFH	
	Tail	1	24H ($)	24H ($)

- *Header*

  1 byte. Always 2BH (ASCII character '+').

- *10H*

  1 byte. Always 10H. Used as an identifier.

- *Frame Length*

  1 byte. The length of this message from 'Header' (2BH) to 'Tail' (24H).

  The length of the HBD frame is fixed at 24 bytes, that is, this field is always equal to 18H.

- *IMEI*

  8 bytes. The International Mobile Equipment Identity of the terminal device.

  For example, 0123456789012345H indicates IMEI "123456789012345".

- *Device Type*

  2 bytes. The device type refers to the terminal model.

- *Protocol Version*

  2 bytes. The version number of this @Track protocol.

  For example, 0001H means V1, 000CH means V12, and 007BH means V123.

- *Custom Version*

  This version number is reserved for user customization.

  For example, 01H means V1, 0CH means V12, and 7BH means V123.

  If the custom version number has not been set, it defaults to 00H.

- *Generated Time*

  4 bytes. The time when the HBD frame was generated, difference, in seconds, between the UTC time and midnight, January 1, 1970.

  For example, 64F9AAF6H (i.e., 1694083830) indicates the UTC time *September 7,2023,10:50:30*.

- *Count Number*

  2 bytes. A self-increasing count number in each HBD frame, it begins from **0000H** and increases by 1 for each report, and it rolls back after **FFFFH**.

  Once the terminal device reconnects to the backend server (restarted/socket disconnected/PDP disconnected, etc.), the count number always starts from 0000H again.

- *Check Byte*

  1 byte. This is an 8-bit CRC checksum, it is generated by a CRC algorithm with the properties displayed in *CRC-8 Calculation* below. The CRC covers the content of 'Header' to 'Count Number'.

- *Tail*

  1 byte. 24H (ASCII character '$').

2.6 Location SMS

The terminal supports sending short message with Google Maps Hyperlink (called Location SMS) to mobile phones. The format of Location SMS is as follows:

```
Example:
LBS:123456789012345
http://maps.google.com/maps?q=22.538503,114.017054
F1 D2020/10/31T17:20:45 B100% S38.6
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	SMS Type	<=15		
	Leading Symbol	1	:	:
	IMEI	15		
	LF	1	\n	\n
Location	Google Maps Hyperlink	N		
	LF	1	\n	\n
Parameters	GNSS Fix State	2	F0 or F1	
	GNSS UTC Time	20	Dyyyy/mm/ddThh:mm:ss	
	Battery Percentage	3-5	BXX%	
	Speed	4-6	SXXX.X	

- *SMS Type*

  Used to indicate the cause of the Location SMS, which includes the following types:

  - **LBS**

    Location by SMS. When receiving a **"get position"** command from the SMS, the terminal will respond to this type of Location SMS. This feature can be enabled or disabled by the *AT@GMS* command.

  - **IN GEO-i** (i means the ID of Geo-fence)

    When entering a specified Geo-fence, the terminal will send this type of Location SMS to the phone number preset using the *AT@GML* command. This feature can be enabled or disabled by the *AT@GEO* command.

  - **OUT GEO-i** (i means the ID of Geo-fence)

    When exiting a specified Geo-fence, the terminal will send this type of Location SMS to the phone number preset using the *AT@GML* command. This feature can be enabled or disabled by the *AT@GEO* command.

- *Leading Symbol*

  1 byte, ASCII character ':'.

- *IMEI*

  The IMEI of the terminal device.

- *LF*

  1 byte. Line Feed, ASCII character '\n'.

- *Google Maps Hyperlink*

  A Google Maps hyperlink representing the current location.

  For example, *http://maps.google.com/maps?q=22.538503,114.017054* represents a position of 22.538503 degrees latitude and 114.017054 degrees longitude.

- *Parameters*

  The last line contains the following parameters, separated by spaces:

  - **GNSS Fix State**

    Indicates the GNSS fix state. 'F1' means fix, 'F0' means no fix.

  - **GNSS UTC Time**

    20 bytes, the format is 'Dyyyy/mm/ddThh:mm:ss', for example, "D2019/10/26T08:12:00" indicates October 26,2019,08:12:00.

  - **Battery Percentage**

    The current volume of the internal battery in percentage, 'BXX%' format, for example, B90% means 90%.

  - **Speed**

    The current speed. Unit: km/h. Format is 'SXXX.X', for example, S38.6 means 38.6 km/h.

CHAPTER

THREE

COMMANDS

Commands are used to set the working parameters of the terminal or to cause the terminal to perform certain operations.

For the detailed definition of each command, please click on the hyperlinks below.

3.1 Network Settings

This section describes the commands related to the network, please click on the hyperlinks below for details.

3.1.1 ACK (Acknowledgement)

The *AT@ACK* command is used to configure the *SACK* feature.

When the backend server receives a report from the termainal, it will behave as defined in *AT@ACK* command.

When the terminal receives a command from a physical path (for example, Cellular Network, SMS, RS232.), it will replies ACK (or NACK) to that physical path.

```
Example:
AT@ACK=gl601###,,,,0,,012F$
+ACK:ACK,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@ACK?gl601###,,0C37$
+QRY:ACK,123456789012345,C031,12,0,1,1,,,,0,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	ACK	ACK
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Reserved	0		
	Reserved	0		
	SACK Mode	1	0-2	0
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *SACK Mode*
  - **0** - The backend server does not reply a SACK frame after receiving a report from the terminal.
  - **1** - The backend server not only replies a SACK frame after receiving a report from the terminal but also requires the device to check the count number in the SACK frame.

– **2** - The backend server replies a SACK frame after receiving a report from the terminal, but does not require the device to check the count number in the SACK frame.

3.1.2 APN (Access Point Name)

The *AT@APN* command is used to configure the APN specified by the cellular network operator.

```
Example:
AT@APN=gl601###,,testapn,,,0,,012F$
+ACK:APN,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@APN?gl601###,,0C37$
+QRY:APN,123456789012345,C031,12,0,1,1,,testapn,,,0,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	APN	APN
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	APN	<=39	'0'-'9', 'a'-'z', 'A'-'Z', '.', '-'	
	APN Username	<=32		
	APN Password	<=32		
	APN Authentication	1	0-3	0
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *APN*

  Access Point Name. It must only contain Latin letters, numbers, dot and hyphen (A-Z a-z 0-9 . -).

  Note

  (1) When sending to the terminal, if this parameter field is empty, the terminal will not change the value of APN.

  (2) When sending to the terminal, if this parameter field is the special value **%CLR%**, the terminal will clear the APN.

  (3) When reading from the terminal, if APN is not set in the terminal (or APN is cleared), this parameter field is empty.

- *APN Username*

  The user name of APN. It must only contain visible ASCII characters, and the commas and dollar signs are not allowed.

  Note

  (1) When sending to the terminal, if this parameter field is empty, the terminal will not change the value of APN Username.

  (2) When sending to the terminal, if this parameter field is the special value **%CLR%**, the terminal will clear the APN Username.

  (3) When reading from the terminal, if APN Username is not set in the terminal (or APN Username is cleared), this parameter field is empty.

- *APN Password*

  The password of APN. It must only contain visible ASCII characters, and the commas and dollar signs are not allowed.

  Note

  (1) When sending to the terminal, if this parameter field is empty, the terminal will not change the value of APN Password.

  (2) When sending to the terminal, if this parameter field is the special value **%CLR%**, the terminal will clear the APN Password.

  (3) When reading from the terminal, if APN Password is not set in the terminal (or APN Password is cleared), this parameter field is empty.

- *APN Authentication*

  Specify the APN authentication method.

  - **0** - None.
  - **1** - PAP authentication.
  - **2** - CHAP authentication.
  - **3** - PAP or CHAP authentication.

3.1.3 BSS (Backend Server Settings)

The *AT@BSS* command is used to configure the IP address (or domain name) and port of the backend server, transmission mode, connection mode, etc.

```
Example:
AT@BSS=gl601###,,,192.168.1.10,590,0,0,60,0,,,,012F$
+ACK:BSS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@BSS?gl601###,,0C37$
+QRY:BSS,123456789012345,C031,12,0,1,1,,,192.168.1.10,590,0,0,60,0,,,,0C37,
↪20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	BSS	BSS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Reserved	0		
	IP Address/Domain Name	<=128		
	Port	<=11	1-65535 or 1-65535|1-65535	30059
	Transmission Mode	1	0, 1	0
	Connection Mode	<=2	0, 1, 2, 10	0
	Stay Time	<=4	0-3600 (seconds)	10
	Connection Time	<=14	0 or HHMM|HHMM|HHMM	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *IP Address/Domain Name*

  The IPv4/IPv6 address or domain name of the backend server.

- *Port*

  The port of the backend server and local port of terminal.

  The format of this field is *Server Port* or *Server Port|Local Port*.

  If the format of this field is 'Server Port', it means that the port number of backend server is 'Server Port' and the terminal will use the automatically assigned port number for data transmission and reception.

  If the format of this field is 'Server Port|Local Port', then 'Server Port' represents the port number of the backend server and 'Local Port' represents the port number of the terminal. The terminal will use the 'Local Port' as the local port for data transmission and reception.

- *Transmission Mode*
  - **0** - TCP/IP.
  - **1** - UDP/IP.

- *Connection Mode*

  Specify the network connection mode.

  - **0** - Automatic.

    The terminal autonomously decides whether to maintain a long connection with the backend server according to its current working status.

    For example, in this mode, the terminal will try to maintain a long-term connection with the backend server after detecting motion. Otherwise, it will only connect to the backend server when it needs to send data.

  - **1** - Online on demand.

    The terminal connects to the backend server only when it needs to send data; when all the data is successfully sent, the terminal will continue to keep the connection with the server for the time indicated by 'Stay Time', after which the device will cut off the connection; in addition, the terminal will also follow the time indicated by 'Connection Time', connect to the backend server regularly every day and keep at least the time indicated by 'Stay Time'.

  - **2** - Always online.

    The terminal always tries and keeps connected to the backend server. At this point, the values of 'Stay Time' and 'Connection Time' are invalid.

  - **10** - Offline mode.

    The terminal will never connect to the backend server until this mode is changed.

    This mode does not clear the reports that have been generated, but the device does not generate any new reports.

- *Stay Time*

  The time to stay connected to the backend server.

  This field is only valid for 'Connection Mode': 0, 1.

  In order for the backend server to send commands to the terminal in time when necessary, the terminal will also keep at least the time indicated by 'Stay Time' connection with the backend server when there is no data transmission.

- *Connection Time*

  The time to connect to the backend server every day. Up to 3 time points can be specified.

  This field is only valid for 'Connection Mode' 0, 1.

In order for the backend server to send commands to the terminal in time when necessary, the terminal will connect to the server at the time HH:MM every day, and will remain connected for at least the time indicated by 'Stay Time'.

For example, 'Connection Time' is 1015 and the 'Stay Time' is 180, indicating that the terminal is connected to the backend server at 10:15 local time each day and the connection between the terminal and the backend server shall be maintained for at least 3 minutes.

For example, 'Connection Time' is 0200|1000|1800 and the 'Stay Time' is 180, indicating that the terminal is connected to the backend server at 02:00, 10:00 and 18:00 local time each day and the connection between the terminal and the backend server shall be maintained for at least 3 minutes.

In particular, this field equals 0 meaning that the terminal does not periodically connect to the backend server every day.

3.1.4 HBD (Heartbeat Settings)

The *AT@HBD* command is used to configure the *HBD* feature.

```
Example:
AT@HBD=gl601###,,,,10,,,,012F$
+ACK:HBD,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@HBD?gl601###,,0C37$
+QRY:HBD,123456789012345,C031,12,0,1,1,,,,10,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	HBD	HBD
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Reserved	0		
	Reserved	0		
	Heartbeat Interval	<=2	3 - 99 (minutes)	10
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Heartbeat Interval*

  The interval for the terminal to send the HBD frame to the backend server.

  Note: Only when the terminal has not sent any information to the backend server within the time indicated by 'Heartbeat Interval', the terminal will send the HBD frame to the backend server.

3.1.5 NET (Network Connection)

The *AT@NET* command is used to configure the network connection method between the terminal and the backend server.

```
Example:
AT@NET=gl601###,,0,0,,,,,012F$
+ACK:NET,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@NET?gl601###,,0C37$
+QRY:NET,123456789012345,C031,12,0,1,1,,0,0,,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	NET	NET
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	RAT Selection	1 or N	One or more RATs	0
	LTE RAT	1 or N	One or more LTE RATs	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *RAT Selection*

  This field is used to specify the RAT (Radio Access Technology) allowed to be searched.

  Use numbers to indicate the corresponding RATs. In particular, setting this field to **0** indicates that the terminal will automatically search for all supported RATs.

  The numbers correspond to the RATs as follows:

ID Number	RAT
2	GSM
3	UMTS
4	LTE

  If multiple RATs are configured, the RATs are separated by vertical bars 'l', and their order also determines the search order.

  For example, "4|2" means that the terminal will search LTE first, and then GSM.

  For example, "4|3" means that the terminal will search LTE first, and then UMTS.

  For example, "3|2" means that the terminal will search UMTS first, and then GSM.

  For example, "4|3|2" means that the terminal will search LTE first, and then UMTS, and then GSM.

  The terminal supports the following options:

  – **0** - Auto
  – **2** - GSM only
  – **3** - UMTS only
  – **4** - LTE only
  – **4|3** - LTE|UMTS
  – **4|2** - LTE|GSM
  – **3|4** - UMTS|LTE
  – **3|2** - UMTS|GSM
  – **2|4** - GSM|LTE
  – **2|3** - GSM|UMTS
  – **4|3|2** - LTE|UMTS|GSM
  – **4|2|3** - LTE|GSM|UMTS
  – **3|4|2** - UMTS|LTE|GSM

  - **3|2|4** - UMTS|GSM|LTE
  - **2|4|3** - GSM|LTE|UMTS
  - **2|3|4** - GSM|UMTS|LTE

> **Note**
>
> There are two device models for the GL601: GL601MG and GL601CEU. The GL601CEU supports all of the above options, while the GL601MG only supports options **0**, **2**, **4**, **4|2**, **2|4**.

- *LTE RAT*

  This field is used to specify which network category to be searched under LTE RAT. It is only valid when LTE is included in the RAT specified by 'RAT Selection'.

  Use numbers to indicate the corresponding LTE RATs. In particular, setting this field to 0 indicates that the terminal will automatically search for all supported network categories under LTE RAT. And the definition is as follows:

ID Number	LTE RAT
1	LTE Cat-M1
3	LTE Cat-NB2

  If multiple network categories for LTE RAT are configured, they are separated by vertical bars '|', and their order also determines the search order.

  For example, "1|3" means that the terminal will search LTE Cat-M1 first, then LTE Cat-NB2.

  For example, "3|1" means that the terminal will search LTE Cat-NB2 first, then LTE Cat-M1.

  The terminal supports the following options:

  - **0** - Auto
  - **1** - LTE Cat-M1
  - **3** - LTE Cat-NB2
  - **1|3** - LTE Cat-M1|Cat-NB2
  - **3|1** - LTE Cat-NB2|Cat-M1

> **Note**
>
> There are two device models for the GL601: GL601MG and GL601CEU. The parameter 'LTE RAT' is only valid for the GL601MG and is a **Reserved** field for the GL601CEU.

3.1.6 PWL (Phone Allow List)

The *AT@PWL* command is used to configure the mobile phone allowlist.

This allowlist can be used for the following functions:

- Google Maps Hyperlink for SMS. Please refer to the *AT@GMS* command.
- Limit the SMS senders when receiving @Track commands via SMS. Please refer to the *AT@CFG* command.

```
Example:
AT@PWL=gl601###,1,+8618888888888|+8612345678,012F$
+ACK:PWL,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@PWL?gl601###,,0C37$
```

(continues on next page)

(continued from previous page)

```
+QRY:PWL,123456789012345,C031,12,0,1,1,1,+861888888888|+8612345678,0C37,
↪20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	PWL	PWL
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Action*	1	0, 1, 2	
	Phone Number List	N		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Action*
  - **0**- Append the phone numbers carried in the ‘Phone Number List’ field to the terminal.
  - **1** - Replace the phone numbers in the terminal with the phone numbers carried by the ‘Phone Number List’ field.
  - **2** - Clear the phone numbers carried in the ‘Phone Number List’ field from the terminal. If the phone numbers to be deleted is not specified (that is, the ‘Phone Number List’ parameter is empty), the terminal will clear all phone numbers.

  In particular, it will be 1 when reading this field.
- *Phone Number List*

  Specify the phone number(s). The terminal supports setting up to 20 phone numbers. The characters ‘|’ are used to connect each phone number. If a phone number is an international number, remember to add “+” and the area code.

  For example, “+8618888888888” means one phone number +8618888888888.

  For example, “+8618888888888|+8612345678” means +8618888888888 and +8612345678 two phone numbers.

  Note: The length of each phone number should not exceed 20 bytes.

3.1.7 TOF (Telecom operators filtering)

The *AT@TOF* command is used to customize the telecom operators filtering.

```
Example:
AT@TOF=gl601###,1,46001|46003,,,,012F$
+ACK:TOF,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@TOF?gl601###,,0C37$
+QRY:TOF,123456789012345,C031,12,0,1,1,1,46001|46003,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	TOF	TOF
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Mode*	1	0-4	0
	PLMN Allowlist	N	PLMN1|PLMN2|PLMN3…	
	PLMN Blocklist	N	PLMN1|PLMN2|PLMN3…	
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Mode*

  Specify the working mode of filtering the telecom operators.

  – **0** - Disable. Allow the terminal to register to any cellular network.

  – **1** - Allowlist only. The terminal is only allowed to register to the cellular network of the telecom operators which in the allowlist.

  – **2** - Allowlist first. The terminal is allowed to register to any cellular network, but the telecom operators in the allowlist are preferred.

  – **3** - Blocklist only. The terminal is only allowed to register to the cellular network of the telecom operators which are not in the blocklist.

  – **4** - Both allowlist and blocklist. The order of terminal filtering telecom operators is: ‘PLMN Allowlist’, ‘PLMN Blocklist’, others.

- *PLMN Allowlist*

  Specify the PLMN(s) as telecom operators allowlist. The terminal supports setting up to 10 operators (i.e. PLMN). The characters ‘|’ are used to connect each PLMN. Each PLMN is represented by 5 or 6 digits, the first three digits represent MCC, and the remaining digits represent MNC.

  For example, “46000” means PLMN 46000, and “46000|46001” means PLMN 46000 and PLMN 46001.

  In particular, the wildcard “FF” or “FFF” (Note that ‘F’ is a capital letter) can be used to match all MNCs in the country, that is, the format can be “MCCFF” or “MCCFFF” (where MCC is the specific mobile country code). For example, “460FF” covers the telecom operators all across China.

- *PLMN Blocklist*

  Specify the PLMN(s) as telecom operators blocklist. The terminal supports setting up to 10 operators (i.e, PLMN). The characters ‘|’ are used to connect each PLMN. Each PLMN is represented by 5 or 6 digits, the first three digits represent MCC, and the remaining digits represent MNC.

  For example, “46000” means PLMN 46000, and “46000|46001” means PLMN 46000 and PLMN 46001.

  In particular, the wildcard “FF” or “FFF” (Note that ‘F’ is a capital letter) can be used to match all MNCs in the country, that is, the format can be “MCCFF” or “MCCFFF” (where MCC is the specific mobile country code). For example, “460FF” covers the telecom operators all across China.

3.2 Tracking Settings

This section describes the commands related to tracking function, please click on the hyperlinks below for details.

3.2.1 AGPS (Assisted GPS)

The *AT@AGPS* command is used to control the AGPS function. Enabling AGPS can obtain location information faster but consumes a little wireless traffic.

```
Example:
AT@AGPS=gl601###,0,,,,012F$
+ACK:AGPS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@AGPS?gl601###,,0C37$
+QRY:AGPS,123456789012345,C031,12,0,1,1,0,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	4	AGPS	AGPS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Mode*	1	0, 1	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Mode*

  Specify whether to enable the AGPS function. Enable AGPS function will help to reduce Time To First Fix (TTFF), but it will also consume network data traffic.

  - **0** - Disable the AGPS function.
  - **1** - Enable as Offline mode. The terminal device will periodically download the assistance data over the network.

3.2.2 GML (Google Maps Hyperlink Phone List)

The *AT@GML* command is used to configure the mobile phone list for receiving the *Location SMS*. Please note that this phone list is only used to receive Location SMS sent by the terminal and is not equivalent to a phone allowlist. The commands related to this Google Maps hyperlink phone list are *AT@GEO* etc.

```
Example:
AT@GML=gl601###,1,+8618888888888|+8612345678,012F$
+ACK:GML,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@GML?gl601###,,0C37$
+QRY:GML,123456789012345,C031,12,0,1,1,1,+8618888888888|+861234567,0C37,
↪20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	GML	GML
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Action*	1	0-2	
	Phone Number List	N		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Action*
  - **0** - Append the phone numbers carried in the 'Phone Number List' field to the terminal.
  - **1** - Replace the phone numbers in the terminal with the phone numbers carried by the 'Phone Number List' field.
  - **2** - Clear the phone numbers carried in the 'Phone Number List' field from the terminal. If the phone numbers to be deleted is not specified (that is, the 'Phone Number List' parameter is empty), the terminal will clear all phone numbers.

  In particular, it will be 1 when reading this field.
- *Phone Number List*

  Specify the phone number(s). The terminal supports setting up to 20 phone numbers. The characters 'l' are used to connect each phone number. If a phone number is an international number, remember to add "+" and the area code.

  For example, "+8618888888888" means one phone number +8618888888888.

  For example, "+8618888888888|+8612345678" means +8618888888888 and +8612345678 two phone numbers.

  Note: The length of each phone number should not exceed 20 bytes.

3.2.3 GMS (Google Maps Hyperlink for SMS)

The *AT@GMS* command is used to set the function of the terminal sending *Location SMS* to respond the request SMS, that is, when the terminal receives a **"get position"** SMS, it will respond the Location SMS to the phone.

```
Example:
AT@GMS=gl601###,1,0,,,012F$
+ACK:GMS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@GMS?gl601###,,0C37$
+QRY:GMS,123456789012345,C031,12,0,1,1,1,0,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	GMS	GMS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Mode*	1	0-1	0
	Location Request Number Limit	1	0-1	0
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Mode*

  - **0** - Disable this function.
  - **1** - Enable this function.

- *Location Request Number Limit*
  - **0** - No limit. No matter from which number the short message is received, it will be processed.
  - **1** - Allowlist only. Only if the received short message comes from the mobile phone allowlist (please see *AT@PWL* command), it will be processed.

3.2.4 LBS (Location Based Services)

The *AT@LBS* command is used for auxiliary positioning.

The auxiliary positioning function consists of the following two Parts:

- **Part 1**: The terminal collects the auxiliary positioning information and reports it to the backend server.
- **Part 2**: The backend server performs calculations based on the received auxiliary positioning information to obtain the positioning point.

  Regarding **Part 1**, it is realized by the terminal, while **Part 2** is realized by the backend server.

Note

For the reporting of auxiliary positioning information, it is recommended to preset the 'Data ID' related to the auxiliary positioning information into *Record 50H*. The related Data ID(s):

- *Data 100* (Wi-Fi Hotspot)

```
Example:
AT@LBS=gl601###,,1,,,,,012F$
+ACK:LBS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@LBS?gl601###,,0C37$
+QRY:LBS,123456789012345,C031,12,0,1,1,,1,,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	LBS	LBS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Mode	1	0, 1, 2	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Mode*

  Specify the working mode of reporting the auxiliary positioning information.

  - **0** - Disable. The auxiliary positioning information will not be reported, that is, the data length of the 'Data ID' related to the auxiliary positioning information is always 0.
  - **1** - Enable when GNSS positioning fails. Only when the GNSS positioning fails, the data length of the 'Data ID' related to the auxiliary positioning information in the message is not 0, otherwise, it is 0.

  - **2** - Enable always. Regardless of whether the GNSS positioning is successful or failed, the data length of the 'Data ID' related to the auxiliary positioning information in the message is not 0.

3.3 Device Configuration

This section describes some commands related to the device itself, please click on the hyperlinks below for details.

3.3.1 CFG (Global Device Configuration)

The *AT@CFG* command is used to configure the key properties (such as Password) of the terminal.

```
Example:
AT@CFG=gl601###,queclink123,MyDevice,,,,,,,012F$
+ACK:CFG,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@CFG?queclink123,,0C37$
+QRY:CFG,123456789012345,C031,12,0,1,1,,MyDevice,,,,0,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	CFG	CFG
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*New Password*	8-16	'0'-'9', 'a'-'z', 'A'-'Z', '-', '_', '#'	
	Device Name	4-16	'0'-'9', 'a'-'z', 'A'-'Z', '-'	See below
	Reserved	0		
	Reserved	0		
	Reserved	0		
	SMS Command Number Limit	1	0, 1	0
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *New Password*

  Change the current password with a new one. If this field is empty, it means no need to change the password.

  Note: In particular, it always will be empty when reading this field.

- *Device Name*

  The name of the terminal device. If this field is empty, it means no need to change the device name.

  For different device types, this parameter has different default values, as shown in the following table:

Device Name	Device Type
GL601CEU	C031
GL601MG	C033

- *SMS Command Number Limit*

  Specify whether the terminal needs to limit the SMS senders when receiving @Track commands via SMS.

  - **0** - No limit. No matter from which number the short message is received, it will be processed.
  - **1** - Allowlist only. Only if the received short message comes from the mobile phone allowlist (please see *AT@PWL* command), it will be processed.

3.3.2 DOG (Protocol Watchdog)

The *AT@DOG* command is used to restart the terminal periodically, which may help prevent the device from staying in malfunctioning state for a long time.

```
Example:
AT@DOG=gl601###,1,,7,0300,,,,,012F$
+ACK:DOG,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@DOG?gl601###,,0C37$
+QRY:DOG,123456789012345,C031,12,0,1,1,1,,7,0300,0,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	DOG	DOG
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Mode*	1	0, 1	0
	Reserved	0		
	Interval	<=2	1-30 (days)	7
	Time	4	HHMM	0300
	Time Randomness	1	0, 1	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Mode*
  - **0** - Disable. The terminal does not restart periodically.
  - **1** - Enable. The terminal will automatically restart periodically according to the following parameters.
- *Interval*

  The interval to restart the terminal.
- *Time*

  At what time to perform the restart operation when ‘Interval’ (unit is day) is met.

  For example, ‘Interval’ is “7”, ‘Time’ is “0300”, which means that every 7 days, and the terminal will restart at 03:00:00 in the morning.
- *Time Randomness*

  Specify whether to enable the randomness of reboot time.
  - **0** - Disable. When this function is disabled, the restart action is allowed to be executed at a random moment within 5 minutes after the scheduled time has been reached.
  - **1** - Enable. When this function is enabled, the restart action is allowed to be executed at a random moment within one hour after the scheduled time has been reached.

3.3.3 GSENSOR (G-Sensor Motion Detection)

The *AT@GSENSOR* command is used to configure the motion detection parameters of the G-sensor (Accelerometer).

When the terminal detects the motion state is changed, it will generate and send the report carrying *Record 21H* to the backend server.

```
Example:
AT@GSENSOR=gl601###,,2,3,30,,,012F$
+ACK:GSENSOR,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@GSENSOR?gl601###,,0C37$
+QRY:GSENSOR,123456789012345,C031,12,0,1,1,,2,3,30,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	7	GSENSOR	GSENSOR
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Motion Sensitivity	1	1-5	2
	Motion Duration	<=3	1 - 999 (*100 ms)	3
	Motionless Duration	<=3	1 - 999 (seconds)	30
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Motion Sensitivity*

  The sensitivity level for the motion sensor to determine whether the terminal is in movement status. The smaller the value, the easier it is for the terminal to detect movement.

- *Motion Duration*

  A time parameter to determine whether the terminal enters movement status. If the motion sensor detects that the device has been moving for a period of time specified by ‘Motion Duration’, the device will be considered to be in movement status.

- *Motionless Duration*

  A time parameter to determine whether the terminal enters motionless status. If the motion sensor detects that the device has been motionless for a period of time specified by ‘Motionless Duration’, the device will be considered to be in motionless status.

3.3.4 MAG (Magnetic Function Settings)

The *AT@MAG* command is used to configure the magnetic function of the terminal.

```
Example:
AT@MAG=gl601###,,1,,,,,012F$
+ACK:MAG,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@MAG?gl601###,,0C37$
+QRY:MAG,123456789012345,C031,12,0,1,1,,1,,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	MAG	MAG
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Magnetic Shutdown	1	0, 1	1
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Magnetic Shutdown*

  Specify whether to enable the magnetic shutdown feature.

  - **0** - Disable.
  - **1** - Enable. When the terminal detects that the magnet is attached for 2 minutes, the terminal will automatically power off. When the magnet is removed, the terminal will automatically power on again.

3.3.5 RPS (Report Priority Settings)

The *AT@RPS* command is used to set the priority of report.

```
Example:
AT@RPS=gl601###,,0,100,,,012F$
+ACK:RPS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@RPS?gl601###,,0C37$
+QRY:RPS,123456789012345,C031,12,0,1,1,,0,100,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	RPS	RPS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Report Priority	1	0-2	0
	Number of BUFFER Reports	<=3	9 - 999	100
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Report Priority*

  - **0** - BUFFER report first. The terminal device always sends reports according to the order in which they were generated. Reports generated earlier are sent first.
  - **1** - Real-time reports first. The terminal will send the real-time reports first, and then send the history reports.
  - **2** - Automatic. When the number of BUFFER reports reaches the value set by 'Number of BUFFER Reports', the terminal will work in the mode 1 (Real-time reports first), otherwise it will work in the mode 0 (BUFFER reports first).

  About the BUFFER report and real-time report, please see BUFFER Report for more information.

Note: In emergency mode (Profile 63), the terminal always sends real-time reports first (equivalent to setting 'Report Priority' to 1).

- *Number of BUFFER Reports*

  The threshold of the number of BUFFER reports. This field is valid only when 'Report Priority' is 2 (Automatic).

3.3.6 TMA (Time Adjustment)

The *AT@TMA* command is used to help the terminal calibrate the local time. The terminal always automatically performs time synchronization.

The terminal can automatically obtain UTC time from the base station, NTP server or GNSS, and then uses the 'Time Zone' and 'Daylight Saving' parameters to calculate the local time.

Note: In the case that the terminal cannot obtain the real UTC time through GNSS or network, the user can issue subcommand **98** of the *AT@RTO* command to calibrate the UTC time. Once the terminal obtains the real UTC time through GNSS or network, it will automatically calibrate the UTC time.

```
Example:
AT@TMA=gl601###,,+32,0,,time.windows.com,123,012F$
+ACK:TMA,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@TMA?gl601###,,0C37$
+QRY:TMA,123456789012345,C031,12,0,1,1,,+32,0,,time.windows.com,123,0C37,
↪20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	TMA	TMA
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Time Zone	<=3	-48 to +48 (*15 minutes)	0
	Daylight Saving	1	0-1	0
	Reserved	0		
	NTP Server IP or Domain Name	<=64		time.windows.com
	NTP Server Port	<=5	1 - 65535	123
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Time Zone*

  Time zone, a signed integer, indicates the difference, expressed in quarters of an hour, between the local time (excluding daylight saving time) and UTC.

  For example, the value of this field is "+32", which means UTC+08:00.
  For example, the value of this field is "-8", which means UTC-02:00.
  For example, the value of this field is "-10", which means UTC-02:30.

Note

This parameter follows the following conventions:

(1) If the value is zero, then no plus or minus sign (+/-) is displayed before the value.

(2) If the value is below zero, then the minus sign (-) is displayed before the value.

(3) If the value is above zero, then the plus sign (+) is displayed before the value.

- *Daylight Saving*
  - **0** - Disable. There is no need to add 1 hour to local time.
  - **1** - Enable. The local time needs to be added by 1 hour.
- *NTP Server IP or Domain Name*

  The IP or domain name of the NTP server.

  The terminal will only try to access the NTP server when it cannot obtain the UTC time via the GNSS chip and the base station, and access it at most once within 24 hours.
- *NTP Server Port*

  The port of the NTP server.

3.4 Alarm Settings

This section describes the commands related to alarm, please click on the hyperlinks below for details.

3.4.1 BPL (Internal Battery Power Low Alarm)

The *AT@BPL* command is used to configure the alarm threshold of the Internal Battery of the terminal.

The terminal supports setting two low battery levels: 'Alarm Percentage 1' and 'Alarm Percentage 2'. The value of 'Alarm Percentage 2' is required to be lower than 'Alarm Percentage 1', that is, 'Alarm Percentage 2' is a more serious low battery level. And when the battery is low to 'Alarm Percentage 1', it means that the terminal is in a **Low Battery** state.

```
Example:
AT@BPL=gl601###,,20,10,,012F$
+ACK:BPL,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@BPL?gl601###,,0C37$
+QRY:BPL,123456789012345,C031,12,0,1,1,,20,10,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	BPL	BPL
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Alarm Percentage 1	<=2	5-50 (*1%)	20
	Alarm Percentage 2	<=2	0 or 5-20 (*1%)	10
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Alarm Percentage 1*

  Specify the low battery alarm threshold.

  When the percentage of battery remaining is equal or less than this value, the battery is low.
- *Alarm Percentage 2*

  Specify the lower battery alarm threshold.

When the percentage of battery remaining is equal or less than this value, the battery is extremely low. The battery needs to be charged or replaced as soon as possible.

In particular, a **0** in this field indicates that this low battery level is not used.

3.4.2 ETH (External Temperature and Humidity)

The *AT@ETH* command is used to configure the external temperature and humidity alarm detection.

The terminal obtains information through the temperature and humidity sensor. When the alarm event is detected, the terminal will generate and send the *Record 80H* to the backend server.

```
Example:
AT@ETH=gl601###,0,0,,0,0,60,5,0,0,20,80,5,0,5,012F$
+ACK:ETH,123456789012345,C031,12,0,0,012F,20210407101530,1234$
AT@ETH?gl601###,,0C37$
+QRY:ETH,123456789012345,C031,12,0,10,1,0,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1234$
+QRY:ETH,123456789012345,C031,12,0,10,2,1,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1235$
+QRY:ETH,123456789012345,C031,12,0,10,3,2,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1236$
+QRY:ETH,123456789012345,C031,12,0,10,4,3,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1237$
+QRY:ETH,123456789012345,C031,12,0,10,5,4,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1238$
+QRY:ETH,123456789012345,C031,12,0,10,6,5,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,1239$
+QRY:ETH,123456789012345,C031,12,0,10,7,6,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,123A$
+QRY:ETH,123456789012345,C031,12,0,10,8,7,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,123B$
+QRY:ETH,123456789012345,C031,12,0,10,9,8,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,123C$
+QRY:ETH,123456789012345,C031,12,0,10,10,9,0,,0,0,60,5,0,0,20,80,5,0,5,0C37,
↪20210407101530,123D$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	ETH	ETH
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Alarm ID*	1	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	
	Type	<=2	Please see below.	0
	Sensor ID			
	Temperature Mode	1	0-1	0
	Low Temperature	<=3	-40 to 80 (°C)	0
	High Temperature	<=3	-40 to 80 (°C)	60
	Temperature Validity	<=5	0 - 30 (seconds)	2
	Temperature Alarm Interval	<=5	0 or 30-43200 (seconds)	0
	Humidity Mode	1	0-1	0
	Low Humidity	<=3	0-100 (*1% RH)	20
	High Humidity	<=3	0-100 (*1% RH)	80
	Humidity Validity	<=5	0 - 30 (seconds)	2
	Humidity Alarm Interval	<=5	0 or 30-43200 (seconds)	0
	Check Interval	<=5	1-86400 (seconds)	5
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Alarm ID*

  Indicates the ID of the alarm.

- *Type*

  This field indicates what type of the sensor will be used for the specified 'Alarm ID'. If set to **0**, it means that the specified 'Alarm ID' is disabled.

  - **0** - None.
  - **32** - WMS301. Temperature and humidity (Bluetooth).
  - **33** - WTH301. Temperature and humidity (Bluetooth).
  - **80** - Eddystone. Temperature (Bluetooth).

- *Sensor ID*

  This field indicates which sensor will be detected. Its length and content are determined by 'Type'. For 'Type' that does not need to carry parameters, the length of this field is 0.

  For the following 'Type', the meaning of this field is as follows:

  - **Type 32 (WMS301)**

    Length: 12 bytes

    Format: It must only contain numbers and letters 'ABCDEFabcdef'.

    Description: The MAC address of the Bluetooth beacon. For example, "1234567890AB" indicates that the MAC address 12:34:56:78:90:AB.

  - **Type 33 (WTH301)**

    Length: 12 bytes

    Format: It must only contain numbers and letters 'ABCDEFabcdef'.

    Description: The MAC address of the Bluetooth beacon. For example, "1234567890AB" indicates that the MAC address 12:34:56:78:90:AB.

  - **Type 80 (Eddystone)**

    Length: 12 bytes

    Format: It must only contain numbers and letters 'ABCDEFabcdef'.

    Description: The MAC address of the Bluetooth beacon. For example, "1234567890AB" indicates that the MAC address 12:34:56:78:90:AB.

- *Temperature Mode*

  The working mode of the temperature alarm detection.

  - **0** - Disable.
  - **1** - Enable. Detect high temperature alarm and low temperature alarm.

- *Low Temperature*

  Specify the lower limit temperature. When the terminal detects that the temperature is below this value more than validity time, a low temperature alarm event will be triggered.

  Please note that the 'Low Temperature' value must be less than the 'High Temperature'.

- *High Temperature*

  Specify the upper limit temperature. When the terminal detects that the temperature is upper this value more than validity time, a high temperature alarm event will be triggered.

- *Temperature Validity*

  Specify the validity time, it is used to confirm the temperature alarm event.

- *Temperature Alarm Interval*

  When the temperature alarm event is detected, the terminal will enter temperature alarm state. In the alarm state, the terminal will send *Record 80H* to backend server at this interval. In particular, **0** means no need to send the reports periodically.

- *Humidity Mode*

  The working mode of the humidity alarm detection.

  - **0** - Disable.
  - **1** - Enable. Detect high humidity alarm and low humidity alarm.

- *Low Humidity*

  Specify the lower limit humidity. When the terminal detects that the humidity is below this value more than validity time, a low humidity alarm event will be triggered.

  Please note that the 'Low Humidity' value must be less than the 'High Humidity'.

- *High Humidity*

  Specify the upper limit humidity. When the terminal detects that the humidity is upper this value more than validity time, a high humidity alarm event will be triggered.

- *Humidity Validity*

  Specify the validity time, it is used to confirm the humidity alarm event.

- *Humidity Alarm Interval*

  When the humidity alarm event is detected, the terminal will enter humidity alarm state. In the alarm state, the terminal will send *Record 80H* to backend server at this interval. In particular, **0** means no need to send the reports periodically.

- *Check Interval*

  Set the interval for the terminal to read the sensor data from the sensor.

  Note: When multiple 'Alarm IDs' are configured as Blutooth sensors, in order to minimize power consumption while ensuring proper functionality, the terminal will pick the minimum value from these 'Check Interval' values as the Bluetooth detection interval.

3.4.3 GEO (Geo-fence Settings)

The *AT@GEO* command is used to set the area of Geo-fence (a virtual geographical fence) and its scanning method.

```
Example:
AT@GEO=gl601###,1,3,,,60,,1,0.000000|0.000000,012F$
+ACK:GEO,123456789012345,C031,12,0,1,012F,20210407101530,1234$
AT@GEO?gl601###,,0C37$
+QRY:GEO,123456789012345,C031,12,0,20,1,1,3,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1234$
+QRY:GEO,123456789012345,C031,12,0,20,2,2,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1235$
+QRY:GEO,123456789012345,C031,12,0,20,3,3,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1236$
+QRY:GEO,123456789012345,C031,12,0,20,4,4,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1237$
+QRY:GEO,123456789012345,C031,12,0,20,5,5,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1238$
+QRY:GEO,123456789012345,C031,12,0,20,6,6,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1239$
+QRY:GEO,123456789012345,C031,12,0,20,7,7,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,123A$
+QRY:GEO,123456789012345,C031,12,0,20,8,8,0,,0,60,100,1,0.000000|0.000000,0C37,
```

(continues on next page)

(continued from previous page)

```
↪20210407101530,123B$
+QRY:GEO,123456789012345,C031,12,0,20,9,9,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,123C$
+QRY:GEO,123456789012345,C031,12,0,20,10,10,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,123D$
+QRY:GEO,123456789012345,C031,12,0,20,11,11,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,123E$
+QRY:GEO,123456789012345,C031,12,0,20,12,12,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,123F$
+QRY:GEO,123456789012345,C031,12,0,20,13,13,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1240$
+QRY:GEO,123456789012345,C031,12,0,20,14,14,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1241$
+QRY:GEO,123456789012345,C031,12,0,20,15,15,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1242$
+QRY:GEO,123456789012345,C031,12,0,20,16,16,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1243$
+QRY:GEO,123456789012345,C031,12,0,20,17,17,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1244$
+QRY:GEO,123456789012345,C031,12,0,20,18,18,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1245$
+QRY:GEO,123456789012345,C031,12,0,20,19,19,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1246$
+QRY:GEO,123456789012345,C031,12,0,20,20,20,0,,0,60,100,1,0.000000|0.000000,0C37,
↪20210407101530,1247$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	GEO	GEO
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*GEO ID*	<=2	1 - 20	
	Mode	1	0, 1, 2, 3	0
	Reserved	0		
	Location SMS Enable	1	0-1	0
	Check Interval	<=5	5-86400 (seconds)	60
	Radius	<=6	100-100000 (meters)	100
	Point Number	<=2	1 - 10	1
	Longitude|Latitude		One or more points	0.000000|0.000000
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *GEO ID*

  Which Geo-fence to configure.

- *Mode*

  - **0** - Disable. Disable the Geo-fence of specified ‘GEO ID’.
  - **1** - Entering the zone. The terminal will only scan whether it enters this Geo-fence.
  - **2** - Exiting the zone. The terminal will only scan whether it exits this Geo-fence.
  - **3** - Both entering and exiting. The terminal will scan whether it enters or exits this Geo-fence.

  When this ‘Mode’ is not equal to 0, the terminal will generate *Record 17H* according to its configuration command.

- *Location SMS Enable*

  Specify whether needs to send the Location SMS when the GEO event is detected. If this function is enabled, the Location SMS will be sent to the phone list in *AT@GML* command when the GEO event is detected.

  - **0** - Disable.
  - **1** - Enable.

- *Check Interval*

  The checking interval for the Geo-fence event. When multiple Geo-fences are enabled, the terminal will pick the minimum value from these 'Check Interval' values as their detection interval. For power consumption reasons, the terminal will turn off GNSS without affecting the application, in which case the terminal will temporarily stop detecting Geo-fence events until this interval is reached.

- *Radius*

  The radius of the circular Geo-fence region. This field is only valid when 'Point Number' is **1**.

- *Point Number*

  The number of location points that make up this Geo-fence.

  When this field is **1**, it means that this is a circular Geo-fence. At this time, the terminal will use 'Longitude|Latitude' as the center and 'Radius' as the radius to form a circular Geo-fence.

  When this field is **2**, it means that this is a rectangular Geo-fence, followed by the first 'Longitude|Latitude' is the position of the upper-left corner of the rectangle, and the second 'Longitude|Latitude' is the position of the lower-right corner of the rectangle.

  When this field is greater than 2, the terminal will line up in the following order of location points indicated by 'Longitude|Latitude' to form a polygon Geo-fence.

- *Longitude|Latitude*

  The location information. Each location point is composed of longitude and latitude, and the two are connected by vertical bar '|'. Please note that if there are multiple location points, use commas to separate the location points.

  For **longitude**, the data format is -xxx.xxxxxx or xxx.xxxxxx, and the value range is from -180.000000 to 180.000000. The unit is degree. West longitude is defined as negative starting with "-" and east longitude is defined as positive without "+".

  For **latitude**, the data format is -xx.xxxxxx or xx.xxxxxx, and the value range is from -90.000000 to 90.000000. The unit is degree. South latitude is defined as negative starting with "-" and north latitude is defined as positive without "+".

3.4.4 ITMP (Internal Temperature Detection)

The *AT@ITMP* command is used to configure the internal temperature alarm detection.

When the internal temperature alarm event is detected, the terminal will generate and send the report carrying *Record 79H* to the backend server.

```
Example:
AT@ITMP=gl601###,,1,-10,65,10,0,5,012F$
+ACK:ITMP,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@ITMP?gl601###,,0C37$
+QRY:ITMP,123456789012345,C031,12,0,1,1,,1,-10,65,10,0,5,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	4	ITMP	ITMP
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Mode	1	0-1	0
	Low Temperature	<=3	-40 to 79 (°C)	0
	High Temperature	<=3	-39 to 80 (°C)	60
	Alarm Validity	<=5	0-86400 (seconds)	5
	Alarm Interval	<=5	0 or 30-43200 (seconds)	0
	Check Interval	<=5	1-86400 (seconds)	5
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Mode*
  - **0** - Disable. The terminal will not detect the internal temperature alarm events.
  - **1** - Enable. The terminal will detect the internal temperature alarm events.
- *Low Temperature*

  Specify the lower limit temperature. When the terminal detects that the temperature is below this value for the time more than the 'Alarm Validity', a low temperature alarm event will be triggered.

  Please note that the 'Low Temperature' value must be less than the 'High Temperature'.
- *High Temperature*

  Specify the upper limit temperature. When the terminal detects that the temperature is upper this value for the time more than the 'Alarm Validity', a high temperature alarm event will be triggered.
- *Alarm Validity*

  Specify the validity time, it is used to confirm the temperature alarm event.
- *Alarm Interval*

  When the temperature alarm event is detected, the terminal will enter temperature alarm state. In the alarm state, the terminal will send the report carrying *Record 79H* to backend server at this interval.

  In particular, **0** means no need to send the reports periodically.
- *Check Interval*

  Set the interval for the terminal to read the sensor data from the sensor.

3.4.5 SHOCK (Shock Detection)

The *AT@SHOCK* command is used to detect shock events. Usually refers to a sudden strong vibration in a short period of time. The terminal will generate and send the report carrying *Record 28H* to backend server when the shock event is detected.

Note

In order to avoid too many shock event messages in a short period of time, when the terminal detects a shock event, it will only allow a new shock event to be triggered after 10 seconds.

```
Example:
AT@SHOCK=gl601###,,1,3,10,,,,012F$
+ACK:SHOCK,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@SHOCK?gl601###,,0C37$
+QRY:SHOCK,123456789012345,C031,12,0,1,1,,1,3,10,,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	5	SHOCK	SHOCK
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Mode	1	0-1	1
	Sensitivity	1	1-5	3
	Validity	<=3	1-500 (*10 ms)	10
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Mode*
  - **0** - Disable. The terminal will not detect the shock events.
  - **1** - Enable. Then terminal will detect the shock events.

  Note: Only when this field is 1, the following parameters are valid.
- *Sensitivity*

  The sensitivity level for detecting shock events. The smaller the value, the easier it is for the terminal to detect shock.
- *Validity*

  A time parameter which is used to confirm shock events and avoid false detections. If the motion sensor detects that the device is continuously vibrating and the duration reaches this value, it will be confirmed as a shock event.

3.5 Bluetooth Settings

This section describes the Bluetooth-related functions and commands, please click on the hyperlinks below for details.

3.5.1 BTBCN (Bluetooth Beacon)

This command is used for the terminal to scan nearby Bluetooth Beacon accessories.

```
Example:
AT@BTBCN=gl601###,0,0,0,,0,5,2400,012F$
+ACK:BTBCN,123456789012345,C031,12,0,0,012F,20210407101530,1234$
AT@BTBCN?gl601###,,0C37$
+QRY:BTBCN,123456789012345,C031,12,0,3,1,0,0,0,,0,5,2400,0C37,20210407101530,1234$
+QRY:BTBCN,123456789012345,C031,12,0,3,2,1,0,0,,0,5,2400,0C37,20210407101530,1235$
+QRY:BTBCN,123456789012345,C031,12,0,3,3,2,0,0,,0,5,2400,0C37,20210407101530,1236$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	5	BTBCN	BTBCN
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Group ID*	<=2	0, 1, 2	
	Type	<=2	0, 13, 80, 81	0
	Filter Type	1	0, 1, 2	0
	Filter Data	N	Please see below.	
	Detection Mode	1	0, 1, 2	0
	Detection Duration	<=2	30 - 600 (seconds)	30
	Low Voltage Threshold	<=4	0-5000 (mV)	2400
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Group ID*

  Indicates the group ID of the Beacons. Each group contains up to 10 Beacons.

  Note: Only the Beacons of the same type can be assigned to the same group, otherwise the Beacons may not be correctly identified.

- *Type*

  This field indicates what type of the Beacon will be used for the specified 'Group ID'. If set to **0**, it means that the specified 'Group ID' is disabled.

  - **0** - None.
  - **13** - WID310. Supports 'Filter Type' 0, 1 and 2.
  - **80** - Eddystone-UID. Supports 'Filter Type' 0, 1 and 2.
  - **81** - iBeacon. Supports 'Filter Type' 0, 1 and 2.

- *Filter Type*

  Specify the filter type.

  - **0** - No Filter. If 'Type' is not 0 (None), the terminal will scan and collect information on all nearby Bluetooth accessories that match the type specified in the 'Type' parameter.
  - **1** - MAC. If 'Type' is not 0 (None), the terminal will scan for nearby Bluetooth accessories that match the type specified in the 'Type' parameter, and collect accessory information by filtering based on the MAC address.
  - **2** - OUI. Organization Unique Identifier. If 'Type' is not 0 (None), the terminal will scan for nearby Bluetooth accessories that match the type specified in the 'Type' parameter, and collect accessory information by filtering based on the OUI.

- *Filter Data*

  Specify which Beacon will be detected.

  The length and content of this field are determined by 'Filter Type' parameter. Multiple data elements are separated with vertical bar ('|').

  For different filter types, the maximum number of data elements supported by this field is shown in the table below:

Filter Type	Max Number	Bytes of an element	Example of an element
MAC	10	12	"1234567890AB" means that the MAC address is *12:34:56:78:90:AB*
OUI	10	6	"123456" indicates the OUI *12:34:56*

- *Detection Mode*

  The working mode of the Beacon detection.

  - **0** - Disable.
  - **1** - Enable once detection. After entering ignition on and moving state, the terminal will detect Beacons one time for the duration specified by 'Detection Duration' parameter, and then will send the *Record 95H* with event code 00H to report information of Beacon(s).
  - **2** - Enable continuous detection. After entering ignition on and moving state, the terminal will detect Beacons continuously. If the terminal detects Beacon(s) or change of available Beacon(s), it will send the *Record 95H* with event code 00H to report information of Beacon(s).

- *Detection Duration*

  Specify the duration for Beacon detection.

- *Low Voltage Threshold*

  Specify the lower limit voltage for Beacon. When the voltage of Beacon is below this value, the terminal will report message *Record 95H* with event code 01H to backend server.

  In particular, **0** means disable low voltage detection.

  Note: This parameter will invalid when the Beacon can not broadcast voltage.

3.6 Peripheral Interfaces

This section describes the commands related to peripheral interfaces of the terminal device, please click on the hyperlinks below for details.

3.6.1 WIFIGEO (Wi-Fi Geofence)

This command is used to configure the parameters of the Wi-Fi geofence function. When the terminal enters/exits the signal coverage area of the specified Wi-Fi hotspot, the terminal will generate and send a *Record 63H* message to the backend server.

```
Example:
AT@WIFIGEO=gl601###,1,1,C8D3A34C6400,,120,,,012F$
+ACK:WIFIGEO,123456789012345,C031,12,0,1,012F,20210407101530,1234$
AT@WIFIGEO?gl601###,,0C37$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,1,1,0,C8D3A34C6400,,120,,,0C37,
↪20210407101530,1234$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,2,2,0,,,120,,,0C37,20210407101530,1235$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,3,3,0,,,120,,,0C37,20210407101530,1236$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,4,4,0,,,120,,,0C37,20210407101530,1237$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,5,5,0,,,120,,,0C37,20210407101530,1238$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,6,6,0,,,120,,,0C37,20210407101530,1239$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,7,7,0,,,120,,,0C37,20210407101530,123A$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,8,8,0,,,120,,,0C37,20210407101530,123B$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,9,9,0,,,120,,,0C37,20210407101530,123C$
+QRY:WIFIGEO,123456789012345,C031,12,0,10,10,10,0,,,120,,,0C37,20210407101530,123D$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	7	WIFIGEO	WIFIGEO
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*GEO ID*	<=2	1 - 10	
	Mode	1	0, 1	0
	MAC	0 or 12	'0'-'9', 'A'-'F', 'a'-'f'	
	Reserved	0		
	Check Interval	<=5	60-86400 (seconds)	120
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *GEO ID*

  Which Wi-Fi Geofence to configure.

- *Mode*

  Specify the working mode of Wi-Fi Geofence.

  - **0** - Disable.
  - **1** - Enable.

- *MAC*

  The MAC of a Wi-Fi hotspot. The MAC address must only contain numbers and letters 'ABCDEFabcdef'.

  For example, "C8D3A34C6400" indicates that MAC address "C8-D3-A3-4C-64-00".

- *Check Interval*

  The checking interval for the Wi-Fi geofence detection. When multiple Wi-Fi geofences are enabled, the terminal will pick the minimum value from these 'Check Interval' values as their detection interval.

  Note: This parameter only works when the terminal is in movement status. That is, in movement status, the terminal will detect Wi-Fi geofences at this time interval, while in motionless status, the terminal will stop detecting Wi-Fi geofences.

3.7 Profile Configuration

This section describes the commands related to **Profile**, please click on the hyperlinks below for details.

For more information, please refer to sections *overview* and *features*.

3.7.1 PROFILE (Profile Settings)

The *AT@PROFILE* command is used to set the working mode for the specified profile.

```
Example:
AT@PROFILE=gl601###,0,1,,,,012F$
+ACK:PROFILE,123456789012345,C031,12,0,1,012F,20210407101530,1234$
AT@PROFILE?gl601###,,0C37$
+QRY:PROFILE,123456789012345,C031,12,0,7,1,0,1,,,,0C37,20210407101530,1234$
+QRY:PROFILE,123456789012345,C031,12,0,7,2,1,1,,,,0C37,20210407101530,1235$
+QRY:PROFILE,123456789012345,C031,12,0,7,3,4,1,,,,0C37,20210407101530,1236$
+QRY:PROFILE,123456789012345,C031,12,0,7,4,5,1,,,,0C37,20210407101530,1237$
+QRY:PROFILE,123456789012345,C031,12,0,7,5,9,1,,,,0C37,20210407101530,1238$
```

(continues on next page)

(continued from previous page)

```
+QRY:PROFILE,123456789012345,C031,12,0,7,6,10,1,,,,0C37,20210407101530,1239$
+QRY:PROFILE,123456789012345,C031,12,0,7,7,63,1,,,,0C37,20210407101530,123A$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	7	PROFILE	PROFILE
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Profile ID*		all supported profiles	
	Mode	1	0-2	0
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Profile ID*

  Specify which profile ID will be configured.

  For more information, please refer to the *Profiles* section.

- *Mode*

  The working mode of the specified profile.

  - **0** - Disable. The terminal will never switch to this profile.
  - **1** - Normal. The terminal will normally generate records or reports according to the configuration of this profile, and send these reports to the backend server in time.
  - **2** - High Priority Only. The terminal will normally generate records or reports according to the configuration of this profile, but only the top and high priority reports will be sent to the backend server until the terminal leaves this profile. Please refer to *here* for the priority of report.

> **Note**
>
> For Profile 0 (Default) and Profile 63 (Emergency), always work in Mode 1 (Normal). This **CAN NOT BE CHANGED**.

3.7.2 PPS (Profile Priority Settings)

The *AT@PPS* command is specially used to adjust the priority of the profiles.

By default, the lower the value of the profile ID, the lower the priority, that is, Profile 0 (Default) has the lowest priority and Profile 63 (Emergency) has the highest priority. And in particular, the priority of Profile 0 and Profile 63 cannot be changed, while the priority of other profiles can be changed through this command.

```
Example:
AT@PPS=gl601###,0<1<4<5<9<10<63,,,012F$
+ACK:PPS,123456789012345,C031,12,0,,012F,20210407101530,1234$
AT@PPS?gl601###,,0C37$
+QRY:PPS,123456789012345,C031,12,0,1,1,0<1<4<5<9<10<63,,,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	PPS	PPS
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Profile IDs*	1 or N	0 < X1 < X2 < X3 …	
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Profile IDs*

  Configure the priority of the specified profile IDs.

  Use the ‘<’ symbol to connect specified profile IDs, the priority of the profile ID on the right side of the symbol is higher than the one on the left.

  Since Profile 0 is always the lowest priority, 0 can only appear on the far left.

  The default prioritization is **0<1<4<5<9<10<63**.

  In particular, if you want to set the priority of one certain profile ID to be greater than 0 but less than other IDs, you can omit “0<” and just fill in its ID.

  For example, if this field is set to “0<4”, it means that the priority is sorted from low to high, in order 0, 4, and then other IDs.

  For example, if this field is set to “4”, it means that the priority is sorted from low to high, in order 0, 4, and then other IDs.

  Additional Example:

  In addition, when this parameter is filled with multiple IDs and the ID on the far left is not 0, it means that a subsequence of prioritization is set. To better explain the usage, an example is given below. Please note that the Profile IDs in the example below may not be supported by the project, but don’t be too concerned, they are there only to facilitate example.

  Assuming that the current priority order is 0,1,3,10,7,6,63 in the terminal, and if “10<1<6” is set, then the priority order will become 0,3,10,1,6,7,63.

  Please check the table below to known the changing process:

Step	Step Description	Process
1	Current priority order	0 , **1** , 3 , **10** , 7 , **6** , 63
2	Received a specific order	10 < 1 < 6
3	Split into two sorts	“0 , 3 , **10** , 7 , 63” and “**10** , 1 , 6”
4	Merge into a final new sort	0 , 3 , **10** , **1** , **6** , 7 , 63

3.8 Real-time Operation Commands

This section describes the commands related to real-time operation, please click on the hyperlinks below for details.

3.8.1 RTO (Real Time Operation)

The real-time operation command *AT@RTO* is used to control the terminal to perform some operations in real time, such as restarting the device, clearing unsent reports, and so on. For those subcommands used to query data (such as subcommand 0, 1, 8, etc.), the total time for the terminal to perform a query operation will not exceed 150 seconds.

Broadly speaking, there is more than one AT@RTO command for real-time operation, please see *here* for more information.

```
Example:
AT@RTO=gl601###,14,,,,,1718$
+ACK:RTO,123456789012345,C031,12,0,14,1718,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	RTO	RTO
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Sub Command*	1 or 2	Please see below	
	Parameters			
	Expire UTC Time	0 or 14	YYYYMMDDhhmmss	
	Commands for Restore	N	CMD1|CMD2|CMD3…	
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Sub Command*

  A numeral to indicate the sub command to be executed.

  - **0** - Request the terminal to report the specified information (*Record 22H*). For this subcommand, the ‘Parameters’ is used to specify Data IDs that will be queried.
  - **1** - Request the terminal to report its current position (*Record 12H*).
  - **3** - Reboot the terminal remotely.
  - **5** - Power off the terminal remotely.
  - **8** - Request the terminal to report its basic information (*Record 11H*).
  - **14** - Delete all reports stored in the terminal.
  - **92** - Enter emergency mode (Profile 63) for a period of time indicated by ‘Parameters’. After the time expires, the terminal will automatically return to its current working status.
  - **93** - Immediately expire the time set by the subcommand 92 to enter emergency mode, and make the terminal return to previous profile. And even if no subcommand 92 has been issued before, as long as the terminal is working in **Profile 63**, this command will still cause it to return to the previous profile.
  - **94** - Restore factory settings, that is, reset all parameters to the factory defaults for all configuration commands except the following:
    - *AT@ACK*
    - *AT@APN*
    - *AT@BSS*
    - *AT@HBD*
    - *AT@NET*
    - *AT@TOF*
    - *AT@CFG*

  - *AT@DOG*
  - *AT@TMA*

  Note: After this command is completed, the terminal may restart if necessary.

- **95** - Force restore factory settings, that is, reset all parameters of all commands contained in the 'Commands for Restore' field (can include commands listed in subcommand 94).

  Note

  This subcommand may be dangerous. Please ensure the correctness of the command and be responsible for the execution results of the command. After this command is completed, the terminal may restart if necessary.

- **98** - UTC time calibration. For this subcommand, the 'Parameters' is used to specify a UTC time.
- **99** - Self-Test. Query the terminal self-test result. The terminal will report the self-test result via *Record E0H*.

- *Parameters*

  The parameters of 'Sub Command'. Its length and content are determined by 'Sub Command'. For 'Sub Command' that does not need to carry parameters, the length of this field is 0.

  For the following 'Sub Command', the meaning of this field is as follows:

  - Sub Command **0**

    Length: 1 or N bytes

    Format: ID1|ID2|ID3…

    The Data IDs will be queried and contained in the *Record 22H*. It is allowed to specify one or more Data IDs. Separate multiple Data IDs with '|'.

    For example, "86" means Data 86 (Surrounding Cells), "88|89" means Data 88 (SIM Card) and Data 89 (GSV).

    Note: For subcommand 0, the Data ID must be specified (i.e, it cannot be empty), otherwise the command is invalid.

  - Sub Command **92**

    Length: <=4 bytes

    Range: 0 or 3-1440 (minutes)

    During this time (in minutes), the terminal will work in Profile 63 (Emergency).

    In particular, this field is 0 or empty to indicate that the terminal will not automatically exit the emergency mode until it receives a AT@RTO command with 'Sub Command' being 93.

  - Sub Command **98**

    Length: 14 bytes

    Format: YYYYMMDDhhmmss

    Specify a UTC time for time calibration. This value is only valid when the terminal cannot obtain the UTC time automatically.

    For example, "20191120135807" indicates November 20, 2019, 13: 58:07.

    Note: In the case that the terminal cannot obtain the real UTC time through GNSS or network, the user can issue subcommand **98** of the AT@RTO command to calibrate the UTC time. Once the terminal obtains the real UTC time through GNSS or network, it will automatically calibrate the UTC time.

- *Expire UTC Time*

  The deadline for receiving this command, in UTC time, for example, “20191120135807” indicates November 20, 2019, 13: 58:07.

  If this field is not empty, this AT@RTO command will only be valid before the time indicated by this field.

  If the terminal receives a AT@RTO command after this time, the command will not be executed and the terminal will reply a *NACK* frame to the backend server.

- *Commands for Restore*

  Only valid when ‘Sub Command’ is 95. It indicates the commands that need to be restored to the factory default.

  For example, this field is “APN|DOG|QRC”, which indicates that all parameters in the *AT@APN*, *AT@DOG*, *AT@QRC* commands need to be restored.

  Note: The inclusion of “QRC” in this field means restoring the configuration of all reports supported by the terminal to the factory defaults.

CHAPTER

FOUR

RECORDS

As mentioned *earlier*, the payload of **Report** is contained in **Records**, and each record has a specific ID and Event Code; and the payload of the record is contained in **Data IDs**, the information contained in each data ID is different; you can configure which Data IDs the record should carry through the *AT@QRC* command.

This chapter aims to describe the detailed definitions of the record IDs supported by the terminal and their configuration commands, please click on the hyperlinks below for details.

4.1 Tracking Settings

This section describes the records related to tracking function, please click on the hyperlinks below for details.

4.1.1 12H (Real-time Location)

When the terminal receives a valid *AT@RTO* command with a subcommand of 1, it will respond to this message to the backend server.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **12H** record is as follows:

```
For example (Total 72 bytes):
2B 00 00 48 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 31 66 8E 47 F7 00 00 12␣
↪00 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A 00 25 00 01 B3 0C 55 0E␣
↪06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03 01 23 0B 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**12H**	**12H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 82* - Full Location.
  - *Data 85* - Registered Cell.

Configuration

The parameters related to the generation and transmission of **12H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,12,,,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,12,012F,20210407101530,1234$
AT@QRC?gl601###,12,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,12,,,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	12	12
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “12” here.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 12H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.1.2 50H (Fixed Report Information)

This message is used to report the location information of the terminal to the backend server.

The frame format of a report that only carries **50H** record is as follows:

```
For example (Total 56 bytes):
2B 00 00 38 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 21 66 8E 47 F7 00 00 50␣
↪00 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A 00 25 00 01 B3 0C 01 23␣
↪F5 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**50H**	**50H**
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - Report at a fixed time.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 82* - Full Location.

Configuration

The parameters related to the generation and transmission of **50H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,50,0,1,1,82,,,,,,,,012F$
+ACK:QRC,123456789012345,C031,12,0,50,012F,20210407101530,1234$
AT@QRC?gl601###,50,0C37$
+QRY:QRC,123456789012345,C031,12,0,7,1,50,0,1,1,82,,,600,,,,,,0C37,20210407101530,
↪1234$
+QRY:QRC,123456789012345,C031,12,0,7,2,50,1,0,1,82,,,600,,,,,,0C37,20210407101530,
↪1235$
+QRY:QRC,123456789012345,C031,12,0,7,3,50,4,0,1,82,,,600,,,,,,0C37,20210407101530,
↪1236$
+QRY:QRC,123456789012345,C031,12,0,7,4,50,5,0,1,82,,,600,,,,,,0C37,20210407101530,
↪1237$
+QRY:QRC,123456789012345,C031,12,0,7,5,50,9,0,1,82,,,600,,,,,,0C37,20210407101530,
↪1238$
```

(continues on next page)

(continued from previous page)

```
+QRY:QRC,123456789012345,C031,12,0,7,6,50,10,0,1,82,,,600,,,,,,0C37,20210407101530,
↪1239$
+QRY:QRC,123456789012345,C031,12,0,7,7,50,63,0,1,82,,,600,,,,,,0C37,20210407101530,
↪123A$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	50	50
	Profile ID		All supported profiles	
	Mode	<=2	0, 1	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
	Reserved	0		
	Reserved	0		
	Time Interval	<=5	0 or 10 - 86400 (seconds)	600
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always "50" here.

- *Profile ID*

  Specify which profile ID will be configured.

  For more information, please refer to the *Profiles* section.

- *Mode*

  - **0** - Disable. The terminal no longer generates and sends the 50H record.
  - **1** - Enable Report. The terminal generates and sends the 50H report. If the location information needs to be included, the terminal will turn on the power supply of the GNSS chip in advance to ensure that the location information is real-time.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 50H record. The characters 'I' are used to connect each data ID.

  For example, "2|88" means Data 2 (Device Name) and Data 88 (SIM Card).

- *Time Interval*

The terminal will periodically generate a 50H record according to this interval. And a value of **0** in this field means that no records will be generated at this interval.

4.2 Device Configuration

This section describes the records related to the terminal device itself, please click on the hyperlinks below for details.

4.2.1 01H (Device Startup)

After the terminal startup, this is always the first message sent to the backend server after it is powered on or reset.

Report carrying this record is a top-priority report, please see *here* for more information.

The frame format of a report that only carries **01H** record is as follows:

```
For example (Total 154 bytes):
2B 00 00 9A 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 80 83 66 8E 47 F7 00 00␣
↪01 00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 04 0F 4D 50 30 39 39 32 31 44 38 30␣
↪30 30 31 33 33 16 02 00 0C 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A␣
↪00 25 00 01 B3 0C 55 0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03 58 12 01 23 45␣
↪67 89 01 23 45 01 23 45 67 89 01 23 45 67 89 5A 13 80 08 10 42 47 39 36 4D 41 52␣
↪30 34 41 30 34 4D 31 47 00 13 04 5F 17 9D A0 01 23 D0 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**01H**	**01H**
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - Normal.
  - **01H** - Restart periodically. Please refer to the *AT@DOG* command for details.
  - **02H** - The terminal receives a *AT@RTO* command with a subcommand 3.
  - **03H** - The terminal receives a *AT@RTO* command with a subcommand 94.
  - **04H** - The terminal receives a *AT@RTO* command with a subcommand 95.
  - **07H** - Restart due to firmware update.
  - **17H** - Magnet removed. Please refer to the *AT@MAG* command for details.
- *Data of Record*

  It consists of one or more *Data ID units*.

By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

- *Data 2* - Device Name.
- *Data 4* - Device Serial Number.
- *Data 19* - Triggered Time (means Startup Time). The local time when the terminal is powered on.
- *Data 22* - Report Count.
- *Data 82* - Full Location.
- *Data 85* - Registered Cell.
- *Data 88* - SIM Card.
- *Data 90* - Versions.

Configuration

The parameters related to the generation and transmission of **01H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,01,,1,,,012F$
+ACK:QRC,123456789012345,C031,12,0,01,012F,20210407101530,1234$
AT@QRC?gl601###,01,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,01,,1,1,2|3|4|22|82|85|88|90|19,0C37,
↪20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	01	01
	Reserved	0		
	Mode	<=2	0, 1, 12	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “01” here.

- *Mode*
  - **0** - Disable. The terminal no longer generates and sends the 01H record.
  - **1** - Enable Report. The terminal generates and sends the 01H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
  - **12** - Enable Report (Event first). In order to report the event in time, the terminal immediately generates and sends a report. If the location information contained in this sent report has expired, the terminal will wait for real-time positioning, then generate and send one more report (**Note**: To distinguish between the two reports, the highest bit of the event code for the appended report is set to 1, i.e. plus **80H**).

> **Note**
>
> For Mode **12**, if the report does not need to carry location information, it is equivalent to Mode **1**.

- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.
- *Data IDs*

  The data IDs contained in the 01H record. The characters 'I' are used to connect each data ID.

  For example, "2I88" means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.2 03H (Connection Starts)

When the terminal is connected to the backend server, this message is always sent to the backend server first when the device has just connected to the server.

Report carrying this record is a top-priority report, please see *here* for more information.

> **Note**
>
> When the terminal is connected to the backend server for the first time after power-on or reset, the terminal will send a *Device Startup* report instead of this 'Connection Starts' report.

The frame format of a report that only carries **03H** record is as follows:

```
For example (Total 78 bytes):
2B 00 00 4E 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 37 66 8E 47 F7 00 00 03␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17␣
↪9D A0 01 7D 55 0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03 01 23 7E 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**03H**	**03H**
	Event Code		1	00H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 2* - Device Name.
  - *Data 81* - Mini Location.
  - *Data 85* - Registered Cell.

Configuration

The parameters related to the generation and transmission of **03H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,03,,1,,,012F$
+ACK:QRC,123456789012345,C031,12,0,03,012F,20210407101530,1234$
AT@QRC?gl601###,03,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,03,,1,1,2|3|80|85,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	03	03
	Reserved	0		
	Mode	<=2	0, 1, 12	0
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “03” here.

- *Mode*

  - **0** - Disable. The terminal no longer generates and sends the 03H record.
  - **1** - Enable Report. The terminal generates and sends the 03H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
  - **12** - Enable Report (Event first). In order to report the event in time, the terminal immediately generates and sends a report. If the location information contained in the report sent this time has expired, the terminal will generate and send an 03H report, then continue to wait for real-time positioning, and once the positioning is successful, it will send an appended 03H report, or will not send an appended 03H report if it still fails until the positioning timeout. (**Note**: To distinguish between the two reports, the highest bit of the event code for the appended report is set to 1, i.e. plus **80H**).

> **Note**
>
> For Mode **12**, if the report does not need to carry location information, it is equivalent to Mode **1**.

- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.
- *Data IDs*

  The data IDs contained in the 03H record. The characters 'I' are used to connect each data ID.

  For example, "2I88" means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.3 04H (Connection Ends)

This message is used to inform the backend server that the terminal is ready to disconnect from the backend server.

Report carrying this record is a high-priority report, please see *here* for more information.

> **Note**
>
> If the terminal is disconnected to backend server because it is preparing for device shutdown, the terminal will send a *Device Shutdown* report instead of this 'Connection Ends' report.

The frame format of a report that only carries **04H** record is as follows:

```
For example (Total 62 bytes):
2B 00 00 3E 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 27 66 8E 47 F7 00 00 04␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17␣
↪9D A0 01 7D 01 23 FC 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**04H**	**04H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 2* - Device Name.
  - *Data 81* - Mini Location.

Configuration

The parameters related to the generation and transmission of **04H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,04,,1,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,04,012F,20210407101530,1234$
AT@QRC?gl601###,04,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,04,,1,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	04	04
	Reserved	0		
	Mode	<=2	0, 1	0
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “04” here.

- *Mode*

  - **0** - Disable. The terminal no longer generates and sends the 04H record.
  - **1** - Enable Report. The terminal generates and sends the 04H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 04H record. The characters ‘|’ are used to connect each data ID.

For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.4 05H (Device Shutdown)

When the terminal is about to shutdown, it will first try to send this message to the backend server. If the device fails to send the shutdown report after trying for 60 seconds, it will store the report and then perform a shutdown. The shutdown report will be re-sent at the next startup.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **05H** record is as follows:

```
For example (Total 69 bytes):
2B 00 00 45 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 2E 66 8E 47 F7 00 00 05␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 16 02 00 0C 51 0F 09 07 3C 46 FF 01 DB␣
↪88 57 5F 17 9D A0 01 7D 0A 01 1F 01 23 3E 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**05H**	**05H**
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts ‘Head’, ‘Reserved’, and ‘Tail’ are *here*.

- *Event Code*
  - **00H** - Normal.
  - **01H** - The volume of the internal battery is too low for the terminal to continue to work properly.
  - **03H** - Magnet attached. Please refer to the *AT@MAG* command for details.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 2* - Device Name.
  - *Data 22* - Report Count.
  - *Data 81* - Mini Location.
  - *Data 10* - Internal Battery Percentage.

Configuration

The parameters related to the generation and transmission of **05H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,05,,1,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,05,012F,20210407101530,1234$
AT@QRC?gl601###,05,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,05,,1,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	05	05
	Reserved	0		
	Mode	<=2	0, 1, 12	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “05” here.

- *Mode*

  - **0** - Disable. The terminal no longer generates and sends the 05H record.
  - **1** - Enable Report. The terminal generates and sends the 05H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
  - **12** - Enable Report (Event first). In order to report the event in time, the terminal immediately generates and sends a report. If the location information contained in this sent report has expired, the terminal will wait for real-time positioning, then generate and send one more report (**Note**: To distinguish between the two reports, the highest bit of the event code for the appended report is set to 1, i.e. plus **80H**).

  Note

  For Mode **12**, if the report does not need to carry location information, it is equivalent to Mode **1**.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 05H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.5 11H (Device Basic Information)

When the terminal receives a valid *AT@RTO* command with a subcommand of 8, it will respond to this message to the backend server.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **11H** record is as follows:

```
For example (Total 107 bytes):
2B 00 00 6B 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 54 66 8E 47 F7 00 00 11␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 04 0F 4D 50 30 39 39 32 31 44 38 30 30␣
↪30 31 33 33 16 02 00 0C 58 12 01 23 45 67 89 01 23 45 01 23 45 67 89 01 23 45 67␣
↪89 5A 13 80 08 10 42 47 39 36 4D 41 52 30 34 41 30 34 4D 31 47 00 01 23 E5 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**11H**	**11H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 2* - Device Name.
  - *Data 4* - Device Serial Number.
  - *Data 22* - Report Count.
  - *Data 88* - SIM Card.
  - *Data 90* - Versions.

Configuration

The parameters related to the generation and transmission of **11H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,11,,,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,11,012F,20210407101530,1234$
AT@QRC?gl601###,11,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,11,,,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	11	11
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “11” here.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 11H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.6 21H (Motion Information)

This message is used to report the motion status of the terminal. This message is only generated when the motion state of the terminal is changed. Please see the *AT@GSENSOR* command for more information.

The frame format of a report that only carries **21H** record is as follows:

```
For example (Total 56 bytes):
2B 00 00 38 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 21 66 8E 47 F7 00 00 21␣
↪00 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17 9D A0 01 7D 5B 05 00 00 02 00 01 01 23␣
↪57 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**21H**	**21H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 81* - Mini Location.
  - *Data 91* - Basic Motion.

Configuration

The parameters related to the generation and transmission of **21H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,21,,1,1,81|91,012F$
+ACK:QRC,123456789012345,C031,12,0,21,012F,20210407101530,1234$
AT@QRC?gl601###,21,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,21,,1,1,81|91,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	21	21
	Reserved	0		
	Mode	<=2	0, 1, 12	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always "21" here.

- *Mode*
  - **0** - Disable. The terminal no longer generates and sends the 21H record.
  - **1** - Enable Report. The terminal generates and sends the 21H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
  - **12** - Enable Report (Event first). In order to report the event in time, the terminal immediately generates and sends a report. If the location information contained in this sent report has expired, the terminal will wait for real-time positioning, then generate and send one more report (**Note**: To distinguish between the two reports, the highest bit of the event code for the appended report is set to 1, i.e. plus **80H**).

> **Note**
>
> For Mode **12**, if the report does not need to carry location information, it is equivalent to Mode **1**.

- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.
- *Data IDs*

  The data IDs contained in the 21H record. The characters 'I' are used to connect each data ID.

  For example, "2I88" means Data 2 (Device Name) and Data 88 (SIM Card).

4.2.7 22H (Real-time Customization)

This message is a real-time custom report. There is no corresponding report setting command for this report.

When the terminal receives the *AT@RTO* command with subcommand 0, it will query the specified data information, and then send a *22H report* containing the data information to the backend server.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **22H** record is as follows:

```
For example (Total 65 bytes):
2B 00 00 41 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 2A 66 8E 47 F7 00 00 22␣
↪00 02 0B 4D 79 49 6F 54 64 65 76 69 63 65 58 12 01 23 45 67 89 01 23 45 01 23 45␣
↪67 89 01 23 45 67 89 01 23 6B 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**22H**	**22H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

By default, this report does not contain any data. And the data content of this report is specified in real-time by the 'Parameters' in *AT@RTO* command (with subcommand 0).

4.2.8 E0H (Self-Test Notification)

The terminal generates and sends the message in the following cases:

- The terminal will automatically perform self-test (i.e., monitor the status of components) while the software is running. If the result of the self-test changes, the terminal will send a notification report to the backend server.
- When the terminal executes the subcommand 99 of *AT@RTO* command from the backend server, the terminal will send a resulting report to the backend server.
- When the subcommand 99 of *AT@RTO* command is initiated by other channels (not backend server), the terminal will respond with a resulting report to the initiator after executing the command, and the terminal will also send the resulting report to the backend server.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **E0H** record is as follows:

```
For example (Total 42 bytes):
2B 00 00 2A 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 13 66 8E 47 F7 00 00 E0␣
↪00 78 08 5D B3 8C 80 00 00 00 00 01 23 0F 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**E0H**	**E0H**
	Event Code		1	00H, 01H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - Normal.
  - **01H** - Abnormal.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 120* - Self-Test Status.

Configuration

The parameters related to the generation and transmission of **E0H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,E0,,,1,120,012F$
+ACK:QRC,123456789012345,C031,12,0,E0,012F,20210407101530,1234$
AT@QRC?gl601###,E0,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,E0,,,1,120,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	E0	E0
	Reserved			
	Reserved			
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always "E0" here.

- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.
- *Data IDs*

  The data IDs contained in the E0H record. The characters 'I' are used to connect each data ID.

  For example, "2I88" means Data 2 (Device Name) and Data 88 (SIM Card).

4.3 Alarm Settings

This section describes the records related to alarm, please click on the hyperlinks below for details.

4.3.1 17H (GEO Information)

When the terminal detects entering or exiting Geo-fence according to the settings of the *AT@GEO* command, it will use this message to report to the backend server.

The frame format of a report that only carries **17H** record is as follows:

```
For example (Total 60 bytes):
2B 00 00 3C 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 25 66 8E 47 F7 00 00 17␣
↪01 5C 02 01 00 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A 00 25 00 01␣
↪B3 0C 01 23 B5 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**17H**	**17H**
	Event Code		1	01H, 02H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **01H** - The terminal enters the Geo-fence area.
  - **02H** - The terminal exits the Geo-fence area.
- *Data of Record*

  It consists of one or more *Data ID units*.

By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

- *Data 92* - GEO Status.
- *Data 82* - Full Location.

Configuration

The parameters related to the generation and transmission of **17H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,17,,,1,2|88,0,012F$
+ACK:QRC,123456789012345,C031,12,0,17,012F,20210407101530,1234$
AT@QRC?gl601###,17,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,17,,,1,2|88,0,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	17	17
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
	Ignore Event When Geo-fence Initialized	1	0-1	0
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “17” here.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 17H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

- *Ignore Event When Geo-fence Initialized*

  - **0** - Not ignore. An event is detected when the Geo-fence is initialized, the terminal does not ignore this event and will generate a Rocord 17H.
  - **1** - Ignore. An event is detected when the Geo-fence is initialized, the terminal ignores this event and will not generate a Rocord 17H.

  In other words, in mode 0 (Not ignore), when the terminal receives the *AT@GEO* command to enable Geo-fence detection, and if the current location meets the detection condition, the terminal will immediately generate a Rocord 17H, while mode 1 (Ignore) will not.

4.3.2 20H (Internal Battery Information)

This message is used to report the Internal Battery information of the terminal. Please see *AT@BPL* command for more information.

The frame format of a report that only carries **20H** record is as follows:

```
For example (Total 52 bytes):
2B 00 00 34 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 1D 66 8E 47 F7 00 00 20␣
↪00 51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17 9D A0 01 7D 0A 01 1F 01 23 92 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**20H**	**20H**
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - The battery has just started to charge.
  - **01H** - The battery has just been fully charged.
  - **02H** - The battery has stopped charging but has not been fully charged.
  - **03H** - The battery is low to 'Alarm Percentage 1' (please see the AT@BPL command).
  - **04H** - The battery is low to 'Alarm Percentage 2' (please see the AT@BPL command).
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 97* - Internal Battery Status.

Configuration

The parameters related to the generation and transmission of **20H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,20,,1,1,97,012F$
+ACK:QRC,123456789012345,C031,12,0,20,012F,20210407101530,1234$
AT@QRC?gl601###,20,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,20,,1,1,97,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	20	20
	Reserved	0		
	Mode	<=2	0, 1	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “20” here.

- *Mode*

  - **0** - Disable. The terminal no longer generates and sends the 20H record.
  - **1** - Enable Report. The terminal generates and sends the 20H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 20H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.3.3 28H (Shock Alarm)

This message is used to report the shock alarm information when the terminal is in shock state. Please refer to the *AT@SHOCK* command for the shock detection.

The frame format of a report that only carries **28H** record is as follows:

```
For example (Total 60 bytes):
2B 00 00 3C 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 25 66 8E 47 F7 00 00 28␣
↪00 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A 00 25 00 01 B3 0C 28 02␣
↪07 08 01 23 C1 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**28H**	**28H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  - *Data 82* - Full Location.
  - *Data 40* - Shock Value.

Configuration

The parameters related to the generation and transmission of **28H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,28,,1,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,28,012F,20210407101530,1234$
AT@QRC?gl601###,28,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,28,,1,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	28	28
	Reserved	0		
	Mode	<=2	0, 1	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always "28" here.

- *Mode*
  - **0** - Disable. The terminal no longer generates and sends the 28H record.
  - **1** - Enable Report. The terminal generates and sends the 28H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.
- *Data IDs*

  The data IDs contained in the 28H record. The characters 'I' are used to connect each data ID.

  For example, "2I88" means Data 2 (Device Name) and Data 88 (SIM Card).

4.3.4 79H (Internal Temperature Alarm)

This message can be sent to the backend server when an internal temperature alarm event is detected. For the internal temperature alarm event detection, please refer to *AT@ITMP* command.

The frame format of a report that only carries **79H** record is as follows:

```
For example (Total 40 bytes):
2B 00 00 28 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 11 66 8E 47 F7 00 00 79␣
↪02 79 06 01 90 5D D5 2E FA 01 23 DB 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**79H**	**79H**
	Event Code		1	00H, 01H, 02H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - Intenal temperature returns to normal.
  - **01H** - Internal temperature is low.
  - **02H** - Internal temperature is high.
- *Data of Record*

  It consists of one or more *Data ID units*.

By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

- *Data 121* - Internal Temperature.

Configuration

The parameters related to the generation and transmission of **79H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,79,,,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,79,012F,20210407101530,1234$
AT@QRC?gl601###,79,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,79,,,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	79	79
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “79” here.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 79H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.3.5 80H (External Temperature and Humidity Alarm)

This message can be sent to the backend server when an external temperature/humidity alarm event is detected. For the temperature/humidity alarm event detection, please refer to *AT@ETH* command.

The frame format of a report that only carries **80H** record is as follows:

```
For example (Total 43 bytes):
2B 00 00 2B 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 14 66 8E 47 F7 00 00 80␣
↪10 7A 09 01 00 02 8A 1E 5D D5 2E FA 01 23 9F 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**80H**	**80H**
	Event Code		1		
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  Use a byte to indicate the event code. The byte is defined as follows:

  – **Appended Report (Bit7)**

  Always 0 for 80H report.

  – **Event (Bit6 to Bit4)**

  Indicates which event caused the message to be generated.

  * **0b000** - Reserved.
  * **0b001** - External temperature returns to normal.
  * **0b010** - External temperature is low.
  * **0b011** - External temperature is high.
  * **0b100** - External humidity returns to normal.
  * **0b101** - External humidity is low.
  * **0b110** - External humidity is high.
  * **0b111** - Reserved.

  – **Alarm ID (Bit3 to Bit0)**

  Indicates which alarm ID triggers the alarm.

  – **0b0000** - Alarm ID 0.

  – **0b0001** - Alarm ID 1.

  – **0b0010** - Alarm ID 2.

  – **0b0011** - Alarm ID 3.

  – **0b0100** - Alarm ID 4.

  – **0b0101** - Alarm ID 5.

  – **0b0110** - Alarm ID 6.

  – **0b0111** - Alarm ID 7.

  – **0b1000** - Alarm ID 8.

  – **0b1001** - Alarm ID 9.

  – **Others** - Reserved.

- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.

  – *Data 122* - External Temperature and Humidity.

Configuration

The parameters related to the generation and transmission of **80H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,80,,,1,2|88,012F$
+ACK:QRC,123456789012345,C031,12,0,80,012F,20210407101530,1234$
AT@QRC?gl601###,80,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,80,,,1,2|88,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	80	80
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “80” here.

- *Action*

  – **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.

  – **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.

  – **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.

  – **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 80H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.3.6 81H (Tamper Alarm)

This message can be sent to the backend server when a tamper alarm event is detected.

Report carrying this record is a high-priority report, please see *here* for more information.

The frame format of a report that only carries **81H** record is as follows:

```
For example (Total 64 bytes):
2B 00 00 40 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 29 66 8E 47 F7 00 00 81␣
↪00 7D 06 00 01 00 00 01 2C 52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A␣
↪00 25 00 01 B3 0C 01 23 B8 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**81H**	**81H**
	Event Code		1	00H, 01H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - The tamper alarm has been released.
  - **01H** - The tamper alarm has been triggered.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 82* - Full Location.
  - *Data 125* - Tamper Status.

Configuration

The parameters related to the generation and transmission of **81H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,81,,1,1,2|88,0,012F$
+ACK:QRC,123456789012345,C031,12,0,81,012F,20210407101530,1234$
AT@QRC?gl601###,81,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,81,,1,1,2|88,0,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	81	81
	Reserved	0		
	Mode	<=2	0, 1, 12	1
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
	Time Interval	<=4	0 or 10-3600 (seconds)	0
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always "81" here.

- *Mode*
  - **0** - Disable. The terminal no longer generates and sends the 81H record.
  - **1** - Enable Report. The terminal generates and sends the 81H record. If the location information needs to be included, the terminal directly uses the currently existing location information (even if the location information has expired).
  - **12** - Enable Report (Event first). In order to report the event in time, the terminal immediately generates and sends a report. If the location information contained in this sent report has expired, the terminal will wait for real-time positioning, then generate and send one more report (**Note**: To distinguish between the two reports, the highest bit of the event code for the appended report is set to 1, i.e. plus **80H**).

  Note

  For Mode **12**, if the report does not need to carry location information, it is equivalent to Mode **1**.

- *Action*
  - **Empty** - No change the data IDs in the terminal. If this field is empty, the 'Data IDs' field will be ignored.
  - **0** - Append the data IDs carried in the 'Data IDs' field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the 'Data IDs' field.
  - **2** - Clear the data IDs carried in the 'Data IDs' field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 81H record. The characters 'I' are used to connect each data ID.

  For example, "2|88" means Data 2 (Device Name) and Data 88 (SIM Card).

- *Time Interval*

  When the terminal is in tamper alarm state, the terminal will periodically generate a Record 81H at this interval to repeat the tamper alarm. And a value of 0 in this field means that no need to generate and report the tamper alarm repeatedly.

4.4 Bluetooth Settings

This section describes records related to the bluetooth functions, please click on the hyperlinks below for details.

4.4.1 95H (Beacon Event)

When the terminal detects the Beacon event, it will generate and send the message to the backend server. For the Beacon detection, please refer to the *AT@BTBCN* command.

The frame format of a report that only carries **95H** record is as follows:

```
For example (Total 122 bytes):
2B 00 00 7A 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 63 66 8E 47 F7 00 00 95␣
↪00 80 B2 09 01 0C 12 34 56 78 90 AB BB 80 B3 1D 01 0C 12 34 56 78 90 AB BB 0C 80␣
↪01 18 00 11 22 33 44 55 66 77 88 99 00 AA BB CC DD EE 80 B4 1D 01 0C 12 34 56 78␣
↪90 AB BB 11 22 33 44 AA BB 11 22 CC DD 00 11 22 33 44 55 00 01 00 01 80 B2 0B 01␣
↪0C 12 34 56 78 90 AB BB 0C 80 01 23 BB 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**95H**	**95H**
	Event Code		1	00H, 01H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **00H** - Detected Beacon(s).
  - **01H** - The voltage of the Beacon is low.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 178* - Scanned Base Beacon Data.
  - *Data 179* - Scanned Eddystone Beacon Data.
  - *Data 180* - Scanned iBeacon Beacon Data.
  - *Data 181* - Scanned WID3xx Beacon Data.

Configuration

The parameters related to the generation and transmission of **95H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,95,,,1,178|179|180|181,012F$
+ACK:QRC,123456789012345,C031,12,0,95,012F,20210407101530,1234$
AT@QRC?gl601###,95,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,95,,,1,178|179|180|181,0C37,20210407101530,
↪1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	95	95
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “95” here.

- *Action*

  - **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.
  - **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.
  - **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.
  - **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 95H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

4.5 Peripheral Interfaces

This section describes the records related to peripheral interfaces of the terminal device, please click on the hyperlinks below for details.

4.5.1 63H (Wi-Fi Geofence Notification)

When the terminal enters/exits the signal coverage area of the specified Wi-Fi hotspot, the terminal will generate and send this message to the backend server. For the Wi-Fi Geofence function, please refer to the *AT@WIFIGEO* command.

The frame format of a report that only carries **63H** record is as follows:

```
For example (Total 37 bytes):
2B 00 00 25 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 0E 66 8E 47 F7 00 00 63␣
↪01 80 9A 02 01 00 01 23 BB 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record Count Number		2	0000H-FFFFH	
	Record ID		1	**63H**	**63H**
	Event Code		1	01H, 02H	
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*
  - **01H** - The terminal enters the Wi-Fi Geofence area.
  - **02H** - The terminal exits the Wi-Fi Geofence area.
- *Data of Record*

  It consists of one or more *Data ID units*.

  By default, this record contains only the data IDs listed below, which can be changed by the *AT@QRC* command described below.
  - *Data 154* - Wi-Fi Geofence Status.

Configuration

The parameters related to the generation and transmission of **63H** record are controlled by the following *QRC* command:

```
Example:
AT@QRC=gl601###,63,,,1,154,012F$
+ACK:QRC,123456789012345,C031,12,0,63,012F,20210407101530,1234$
AT@QRC?gl601###,63,0C37$
+QRY:QRC,123456789012345,C031,12,0,1,1,63,,,1,154,0C37,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	QRC	QRC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Record ID*	2	63	63
	Reserved	0		
	Reserved	0		
	Action	1	0-2	
	Data IDs	N	ID1|ID2|ID3…	
Tail	Sequence Number	4	0000-FFFF (‘0’-‘9’, ‘A’-‘F’)	
	Tail	1	$	$

- *Record ID*

  Which record to configure. Always “63” here.

- *Action*

  – **Empty** - No change the data IDs in the terminal. If this field is empty, the ‘Data IDs’ field will be ignored.

  – **0** - Append the data IDs carried in the ‘Data IDs’ field to the terminal.

  – **1** - Replace the data IDs in the terminal with the data IDs carried by the ‘Data IDs’ field.

  – **2** - Clear the data IDs carried in the ‘Data IDs’ field from the terminal.

  Note: In particular, it always will be 1 when reading this field.

- *Data IDs*

  The data IDs contained in the 63H record. The characters ‘|’ are used to connect each data ID.

  For example, “2|88” means Data 2 (Device Name) and Data 88 (SIM Card).

CHAPTER

FIVE

DATA IDS

As mentioned *earlier*, the payload of the record is contained in **Data IDs**, the information contained in each data ID is different, you can configure which Data IDs the record should carry through the *AT@QRC* command.

This chapter aims to describe the detailed definitions of the Data IDs supported by the terminal, please click on the hyperlinks below for details.

5.1 Location Care

This section describes the Data IDs related to the location of terminal, please click on the hyperlinks below for details.

5.1.1 Data 81 (Mini Location)

The mini location information, only provides 6 parts information of fix state, fix mode, longitude, latitude, UTC time and speed.

The frame format of the Data **81** unit is as follows:

```
For example (Total 17 bytes):
51 0F 09 07 3C 46 FF 01 DB 88 57 5F 17 9D A0 01 7D
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	51H (81)	51H (81)
Length	Data Length	1	00H or 0FH	
Content	*Fix State & Fix Mode*	1		
	Longitude	4		
	Latitude	4		
	UTC Time	4		
	Speed	2	0000H-FFFFH (*0.1 km/h)	

- *Fix State & Fix Mode*

  The upper 4 bits (bit7 to bit4) represent satellites signal strength level, the next 2 bits (bit3 to bit2) represent the fix state, and the lowest 2 bits (bit1 to bit0) represent the fix mode. Details are as follows.

  - **Signal Strength Level** (Bit7 to Bit4)

    Indicates the signal strength level of the satellites in use.

    * **0b0000** - Unknown.
    * **0b0001** - Great.
    * **0b0010** - Good.
    * **0b0011** - Normal.
    * **0b0100** - Weak.

Typical values are as follows:

Value	Signal Strength (C/N0)	Level
0	Unknown	Unknown
1	C/N0 >= 40	Great
2	33 <= C/N0 < 40	Good
3	28 <= C/N0 < 33	Normal
4	C/N0 < 28	Weak

– **Fix State** (Bit3 to Bit2)

Indicates the current positioning status of the GNSS chip.

* **0b00** - Off. GNSS is not working at the moment. In this case, the 'longitude', 'latitude', 'speed', 'UTC time' etc. are the same as the last valid positioning.
* **0b01** - No fix. GNSS worked but could not get the position. In this case, the 'longitude', 'latitude', 'speed', 'UTC time' etc. are the same as the last valid positioning.
* **0b10** - Fix. GNSS worked and got the accurate location. The values of all fields are reliable to use.

– **Fix Mode** (Bit1 to Bit0)

Indicates in which positioning mode the following position information (longitude, latitude, etc.) was obtained.

* **0b00** - 2D GNSS fix.
* **0b01** - 3D GNSS fix.
* **0b11** - Unknown.

- *Longitude*

The longitude is converted to an integer with 6 implicit decimals and this integer is reported in HEX format; if its value is negative, it is represented in 2's complement format. For the converted longitude, a positive number indicates the east longitude and a negative number indicates the west longitude.

For example, 073C46FFH (i.e., 121390847) means longitude 121.390847 degrees, and F920A8E1H (i.e., -115300127) means longitude -115.300127 degrees.

- *Latitude*

The latitude is converted to an integer with 6 implicit decimals and this integer is reported in HEX format; if its value is negative, it is represented in 2's complement format. For the converted latitude, a positive number indicates the north latitude and a negative number indicates the south latitude.

For example, 01DB8857H (i.e., 31164503) means latitude 31.164503 degrees, and FF2DC096H (i.e., -13778794) means latitude -13.778794 degrees.

- *UTC Time*

The UTC time obtained from the GNSS chip, difference, in seconds, between the current time and midnight, January 1, 1970.

For example, 5DD52EFAH (i.e., 1574252282) means November 20, 2019, 20:18:02.

- *Speed*

The speed is obtained from the GNSS chip. Speed over ground, expressed as a 16-bit unsigned integer and the unit is 0.1 km/h.

For example, 017DH (i.e., 381) means speed 38.1 km/h.

5.1.2 Data 82 (Full Location)

The full location information, provides following information: fix state, fix mode, longitude, latitude, UTC time, speed, HDOP, azimuth, altitude, satellite count.

The frame format of the Data **82** unit is as follows:

```
For example (Total 24 bytes):
52 16 09 F9 20 A8 E1 FF 2D C0 96 5F 17 9D A0 01 7D 0A 00 25 00 01 B3 0C
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	52H (82)	52H (82)
Length	Data Length	1	00H or 16H	
Content	*Fix State & Fix Mode*	1		
	Longitude	4		
	Latitude	4		
	UTC Time	4		
	Speed	2	0000H-FFFFH (*0.1 km/h)	
	HDOP	1		
	Azimuth	2	0000H-0167H (degrees)	
	Altitude	3	000000H-FFFFFFH (*0.1 meters)	
	Satellite Count	1		

- *Fix State & Fix Mode*

  The upper 4 bits (bit7 to bit4) represent satellites signal strength level, the next 2 bits (bit3 to bit2) represent the fix state, and the lowest 2 bits (bit1 to bit0) represent the fix mode. Details are as follows.

  – **Signal Strength Level** (Bit7 to Bit4)

  Indicates the signal strength level of the satellites in use.

  * **0b0000** - Unknown.
  * **0b0001** - Great.
  * **0b0010** - Good.
  * **0b0011** - Normal.
  * **0b0100** - Weak.

  Typical values are as follows:

Value	Signal Strength (C/N0)	Level
0	Unknown	Unknown
1	C/N0 >= 40	Great
2	33 <= C/N0 < 40	Good
3	28 <= C/N0 < 33	Normal
4	C/N0 < 28	Weak

  – **Fix State** (Bit3 to Bit2)

  Indicates the current positioning status of the GNSS chip.

  * **0b00** - Off. GNSS is not working at the moment. In this case, the 'longitude', 'latitude', 'speed', 'UTC time' etc. are the same as the last valid positioning.
  * **0b01** - No fix. GNSS worked but could not get the position. In this case, the 'longitude', 'latitude', 'speed', 'UTC time' etc. are the same as the last valid positioning.
  * **0b10** - Fix. GNSS worked and got the accurate location. The values of all fields are reliable to use.

  - **Fix Mode** (Bit1 to Bit0)

    Indicates in which positioning mode the following position information (longitude, latitude, etc.) was obtained.

    * **0b00** - 2D GNSS fix.
    * **0b01** - 3D GNSS fix.
    * **0b11** - Unknown.

- *Longitude*

  The longitude is converted to an integer with 6 implicit decimals and this integer is reported in HEX format; if its value is negative, it is represented in 2's complement format. For the converted longitude, a positive number indicates the east longitude and a negative number indicates the west longitude.

  For example, 073C46FFH (i.e., 121390847) means longitude 121.390847 degrees, and F920A8E1H (i.e., -115300127) means longitude -115.300127 degrees.

- *Latitude*

  The latitude is converted to an integer with 6 implicit decimals and this integer is reported in HEX format; if its value is negative, it is represented in 2's complement format. For the converted latitude, a positive number indicates the north latitude and a negative number indicates the south latitude.

  For example, 01DB8857H (i.e., 31164503) means latitude 31.164503 degrees, and FF2DC096H (i.e., -13778794) means latitude -13.778794 degrees.

- *UTC Time*

  The UTC time obtained from the GNSS chip, difference, in seconds, between the current time and midnight, January 1, 1970.

  For example, 5DD52EFAH (i.e., 1574252282) means November 20, 2019, 20:18:02.

- *Speed*

  The speed is obtained from the GNSS chip. Speed over ground, expressed as a 16-bit unsigned integer and the unit is 0.1 km/h.

  For example, 017DH (i.e., 381) means speed 38.1 km/h.

- *HDOP*

  Horizontal Dilution of Precision. It is converted to an integer with 1 implicit decimal and this integer is reported in HEX format.

  For example, 0AH (i.e., 10) means HDOP 1.0, 1CH (i.e., 28) means HDOP 2.8. And FFH (i.e., 255) means HDOP 25.5 or more.

- *Azimuth*

  Azimuth is the angle a line makes with a meridian, measured clockwise from north.

  For example, 0025H (i.e., 37) means azimuth 37 degrees.

- *Altitude*

  The altitude is converted to an integer with 1 implicit decimal and this integer is reported in HEX format; if its value is negative, it is represented in 2's complement format.

  For example, 0001B3H (i.e., 435) means altitude 43.5 meters.

- *Satellite Count*

  The number of satellites in use.

  For example, 0CH means 12 satellites.

5.1.3 Data 85 (Registered Cell)

The current network registration information.

The frame format of the Data **85** unit is as follows:

```
For example (Total 16 bytes):
55 0E 06 04 BC 8A 00 10 00 02 10 00 10 0C 13 03
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	55H (85)	55H (85)
Length	Data Length	1	00H or 0EH	
Content	*PLMN*	4		
	LAC	2	0000H-FFFFH	
	Cell ID	4	00000000H-0FFFFFFFH	
	Access Technology & Roaming	1		
	Band	1		
	CSQ RSSI	1	00H-1FH, 63H	
	Bit Error Rate	1	00H-07H, 63H	

- *PLMN*

  Public Land Mobile Network, composed by MCC (Mobile Country Code) and MNC (Mobile Network Code).

  The first byte (the highest byte) represents the length of the PLMN, and the next 3 bytes are the hexadecimal expression of the PLMN converted to an integer.

  For example, 0500B3B1H means PLMN “46001”, and 0604BC8AH means PLMN “310410”.

- *LAC*

  Location Area Code in hexadecimal format.

  For example, 0010H means LAC “0010”.

- *Cell ID*

  Cell ID in hexadecimal format.

  For example, 00021000H means Cell ID “00021000”.

- *Access Technology & Roaming*

  The upper 1 bit represents roaming status and the lower 7 bits represent access technology.

  - **Roaming** (Bit7)
    - **0b0** - Registered to the home network.
    - **0b1** - Registered to a roaming network.
  - **Access Technology** (Bit6 to Bit0)
    - **0b0000000** - GSM
    - **0b0000001** - UMTS
    - **0b0000101** - LTE Cat-1
    - **0b0010000** - LTE Cat-M1
    - **0b0010010** - LTE Cat-NB2

- *Band*

  If the value of ‘Access Technology’ is **GSM** or **UMTS**, the meaning of this field is as follows:

  - **00H** - 800MHz
  - **01H** - 850MHz

- **02H** - 900MHz
- **03H** - 1800MHz
- **04H** - 1900MHz
- **05H** - 2100MHz

If the value of 'Access Technology' means "LTE X", this field indicates the LTE Band. For example, 05H indicates Band5, 0CH indicates Band12, and 14H indicates Band20.

Note: In particular, FFH means that the terminal can not obtain the Band value.

- *CSQ RSSI*

  The received signal strength:

CSQ RSSI	Signal Strength (dBm)
00H (0)	-113 or less
01H (1)	-111
02H to 1EH (2 to 30)	-109 to -53
1FH (31)	-51 or greater
63H (99)	Not known or not detectable

- *Bit Error Rate*

  Channel bit error rate (in percent). In particular, 63H (i.e. 99) means "Not known or not detectable".

5.1.4 Data 89 (GSV)

The information of GSV (GNSS Satellites in View).

Each SV occupies 6 bytes, including 'GNSS ID', 'SV ID', 'Signal Strength', 'Elevation' and 'Azimuth'.

The frame format of the Data **89** unit is as follows:

```
For example (Total 21 bytes):
59 13 03 03 02 24 11 00 37 03 05 30 45 01 02 03 06 28 18 00 9A
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		1	59H (89)	59H (89)
Length	Data Length		1 or 2	00H or 01H-7FH or 8085H-8181H	
Content	*Number*		1	00H-15H or 16H-40H	
	The first SV	*GNSS ID*	1	00H-06H	
		SV ID	1	00H-FFH	
		Signal Strength	1	00H-63H (dBHz)	
		Elevation	1	00H-5AH (degrees)	
		Azimuth	2	00000H-0167H (degrees)	
	…				

- *Number*

  Indicates how many satellites the following data comes from. If the value of this field is 00H, no other data is included (such as 'GNSS ID', 'SV ID', 'Signal Strength', 'Elevation', 'Azimuth', etc.).

- *GNSS ID*

  GNSS ID indicates the GNSS type.

  - **00H** - GPS.
  - **01H** - SBAS.
  - **02H** - Galileo.

  - **03H** - BeiDou.
  - **05H** - QZSS.
  - **06H** - GLONASS.

- *SV ID*

  Satellite Vehicle ID.

- *Signal Strength*

  Signal strength (C/N0). In particular, FFH means invalid value.

- *Elevation*

  Elevation. In particular, FFH means invalid value.

- *Azimuth*

  Azimuth. In particular, FFFFH means invalid value.

5.1.5 Data 92 (GEO Status)

The status of the Geo-fence ID that triggered the event.

Note: If this data is not included in the *Record 17H*, it will indicate the GEO status of the previously triggered Geo-fence event.

The frame format of the Data **92** unit is as follows:

```
For example (Total 4 bytes):
5C 02 01 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	5CH (92)	5CH (92)
Length	Data Length	1	00H or 02H	
Content	*GEO ID*	1	01H-14H	
	GEO Status	1	00H, 01H	

- *GEO ID*

  The ID of Geo-fence. Refer to the 'GEO ID' of *AT@GEO* command.

- *GEO Status*

  The current status of Geo-fence.

  - **00H** - The terminal is inside of Geo-fence now.
  - **01H** - The terminal is outside of Geo-fence now.

5.1.6 Data 93 (All GEO Status)

The current status of all enabled Geo-fences.

Each GEO occupies 2 bytes, including GEO ID and GEO Status.

The frame format of the Data **93** unit is as follows:

```
For example (Total 5 bytes):
5D 03 01 01 00
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		1	5DH (93)	5DH (93)
Length	Data Length		1	00H or 01H-51H	
Content	*Number*		1	00H-28H	
	The first GEO	*GEO ID*	1	01H-14H	
		GEO Status	1	00H, 01H, 02H	
	…				

- *Number*

  Indicates how many Geo-fences the following data comes from. If the value of this field is 00H, no other fields are included.

- *GEO ID*

  The ID of Geo-fence. Refer to the 'GEO ID' of *AT@GEO* command.

- *GEO Status*

  The current status of Geo-fence.

  - **00H** - The terminal is inside of Geo-fence now.
  - **01H** - The terminal is outside of Geo-fence now.
  - **02H** - Unknown. The terminal is scanning the Geo-fencing status now.

5.1.7 Data 100 (Wi-Fi Hotspot)

The Wi-Fi hotspot information collected by terminal scanning.

Each Wi-Fi hotspot occupies 7 bytes, including MAC and RSSI.

The frame format of the Data **100** unit is as follows:

```
For example (Total 17 bytes):
64 0F 02 C8 D3 A3 4C 64 00 B0 C2 D3 A3 88 45 99 B3
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		1	64H (100)	64H (100)
Length	Data Length		1	00H or 01H-47H	
Content	*Number*		1	00H-0AH	
	The first hotspot	*MAC*	6		
		RSSI	1	80H-FFH (dBm)	
	…				

- *Number*

  Indicates how many Wi-Fi hotspots the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *MAC*

  The MAC of a Wi-Fi hotspot.

  For example, C8D3A34C6400H means MAC "C8-D3-A3-4C-64-00".

- *RSSI*

  The received signal strength.

  Expressed as an 8-bit signed integer and the unit is dBm. When the RSSI value is less than -128 (80H), it is also filled in as 80H, and when the RSSI value is greater than -1 (FFH), it is also filled in as FFH. In particular, 63H means the signal strength is not known or not detectable.

Typical values are as follows:

Value	Signal Strength (dBm)	Level
A7H to 80H	-89 or less	0
A8H to ADH	-88 to -83	1
AEH to B4H	-82 to -76	2
B5H to BEH	-75 to -66	3
BFH to FFH	-65 or greater	4
63H	Not known or not detectable	/

5.1.8 Data 154 (Wi-Fi Geofence Status)

The status of the Wi-Fi Geofence ID that triggered the event.

Note: If this data is not included in the *Record 63H*, it will indicate the Wi-Fi Geofence status of the previously triggered Wi-Fi Geofence event.

The frame format of the Data **154** unit is as follows:

```
For example (Total 5 bytes):
80 9A 02 01 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	2	809AH (154)	809AH (154)
Length	Data Length	1	00H or 02H	
Content	*GEO ID*	1	01H-0AH	
	GEO Status	1	00H, 01H	

- *GEO ID*

  The ID of Wi-Fi Geofence. Refer to the 'GEO ID' of *AT@WIFIGEO* command.

- *GEO Status*

  The current status of Wi-Fi Geofence.

  - **00H** - The terminal is inside of Wi-Fi Geofence now.
  - **01H** - The terminal is outside of Wi-Fi Geofence now.

5.1.9 Data 155 (All Wi-Fi Geofence Status)

The current status of all enabled Wi-Fi Geofences.

Each Wi-Fi Geofence occupies 2 bytes, including 'GEO ID' and 'GEO Status'.

The frame format of the Data **155** unit is as follows:

```
For example (Total 6 bytes):
80 9B 03 01 01 00
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		2	809BH (155)	809BH (155)
Length	Data Length		1	00H or 01H-51H	
Content	*Number*		1	00H-0AH	
	The first GEO	*GEO ID*	1	01H-0AH	
		GEO Status	1	00H, 01H, 02H	
	…				

- *Number*

  Indicates how many Wi-Fi Geofences the following data comes from. If the value of this field is 00H, no other fields are included.

- *GEO ID*

  The ID of Wi-Fi Geofence. Refer to the 'GEO ID' of *AT@WIFIGEO* command.

- *GEO Status*

  The current status of Wi-Fi Geofence.

  - **00H** - The terminal is inside of Wi-Fi Geofence now.
  - **01H** - The terminal is outside of Wi-Fi Geofence now.
  - **02H** - Unknown. The terminal is scanning the Wi-Fi Geofence status now.

5.2 Behaviors Notifications

This section describes the Data IDs related to behaviors detection, please click on the hyperlinks below for details.

5.2.1 Data 23 (Motion Status)

The frame format of the Data **23** unit is as follows:

```
For example (Total 3 bytes):
17 01 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	17H (23)	17H (23)
Length	Data Length	1	00H or 01H	
Content	*Motion Status*	1	00H, 01H, 02H	

- *Motion Status*

  The current motion status of the terminal.

  - **00H** - The terminal is motionless now.
  - **01H** - The terminal is being moved now.
  - **02H** - Unknown.

5.2.2 Data 40 (Shock Value)

The frame format of the Data **40** unit is as follows:

```
For example (Total 4 bytes):
28 02 07 08
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	28H (40)	28H (40)
Length	Data Length	1	00H or 02H	
Content	*Shock Value*	2	0000H-FFFFH (mg)	

- *Shock Value*

  The shock value when a shock event is detected. The maximum acceleration value when the shock event occurred. Expressed as a 16-bit unsigned integer and the unit is mg.

  For example, 0708H means the acceleration value is 1800mg.

5.2.3 Data 91 (Motion Information)

The basic information of the motion sensor.

The frame format of the Data **91** unit is as follows:

```
For example (Total 7 bytes):
5B 05 00 00 02 00 01
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	5BH (91)	5BH (91)
Length	Data Length	1	00H or 05H	
Content	*Motion Status*	1	00H, 01H, 02H	
	Current Duration	2	0000H-FFFFH (*10 seconds)	
	Previous Duration	2	0000H-FFFFH (*10 seconds)	

- *Motion Status*

  The current motion status of the terminal.

  - **00H** - The terminal is motionless now.
  - **01H** - The terminal is being moved now.
  - **02H** - Unknown. The terminal is detecting motion now.

- *Current Duration*

  The duration of the current state. Expressed as a 16-bit unsigned integer and the unit is 10 seconds.

- *Previous Duration*

  The duration of the previous state. Expressed as a 16-bit unsigned integer and the unit is 10 seconds.

  If the 'Motion Status' is 00H, it means that the previous state was 01H, and if it is 01H, it means that the previous state was 00H.

5.2.4 Data 101 (Upgrade Information)

The upgrade information is used for reporting upgrade status. Please check *Record F1H* for more information.

The frame format of the Data **101** unit is as follows:

```
For example (Total 9 bytes):
65 07 01 00 01 00 00 00 00

For example (Total 9 bytes):
65 07 02 00 01 00 00 00 00

For example (Total 9 bytes):
65 07 03 00 01 00 00 00 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	65H (101)	65H (101)
Length	Data Length	1	00H or 07H	
Content	*Code*	1	01H-08H	
	Sub Code	1	00H-FFH	
	Update Type	1		
	Sub Update Type	1	00H-FFH	00H
	Reserved	1	00H-FFH	00H
	Sequence Number	2	0000H-FFFFH	

- *Code*

  Indicates the status of updating.

  - **01H** - Start to download. The terminal successfully connected to the file server and started to download the file.
  - **02H** - Start to update. The terminal has successfully downloaded the file from the file server and started to perform the update.
  - **03H** - Success to update.
  - **04H** - Refused. The terminal refuses to execute the update command.
  - **05H** - Canceled. The update command was cancelled by the user.
  - **06H** - Failed to connect. The terminal cannot connect to the file server.
  - **07H** - Failed to download. The terminal cannot download the file from the file server.
  - **08H** - Fail to update.

- *Sub Code*

  Supplementary notes on the status of updating.

  - **00H** - Normal.
  - **10H** - Low battery.
  - **14H** - Failed to communicate with the module.
  - **20H** - No network connection.
  - **21H** - Can't connect to the specific URL.
  - **30H** - File not found. There is no such file on the server.
  - **31H** - File CRC error. The CRC check of the downloaded file failed.
  - **32H** - File type error. The file type does not match.
  - **33H** - File size error. The file size does not match.
  - **34H** - Incompatible version. Update to this version is not allowed.
  - **F0H** - Operation is in progress.
  - **FFH** - Unknown.

- *Update Type*

  Indicates the type of firmware being updated, corresponding to the 'Update Type' in the *AT@UPD* command.

- *Sub Update Type*

  Indicates the subtype of firmware type, corresponding to the 'Sub Update Type' in the *AT@UPD* command.

  If the firmware type has no subtype, then this field is filled in with the default value **00H**.

- *Sequence Number*

  Indicates which upgrade command triggered this upgrade. Corresponding to the sequence number in the *AT@UPD* command.

5.2.5 Data 102 (Update Configuration)

The update information is used for reporting configuration update process. Please check *Record F2H* for more information.

The frame format of the Data **102** unit is as follows:

```
For example (Total 9 bytes):
66 07 01 00 00 00 00 00 00

For example (Total 9 bytes):
66 07 02 00 00 00 00 00 00

For example (Total 9 bytes):
66 07 03 00 00 00 00 00 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	66H (102)	66H (102)
Length	Data Length	1	00H or 07H	
Content	*Code*	1	01H-08H	
	Sub Code	1	01H-FFH	
	Reserved	3	000000H	000000H
	Sequence Number	2	0000H-FFFFH	

- *Code*

  Indicates the status of updating.

  - **01H** - Start to download. The terminal successfully connected to the file server and started to download the file.
  - **02H** - Start to update. The terminal has successfully downloaded the file from the file server and started to perform the update.
  - **03H** - Success to update.
  - **04H** - Refused. The terminal refuses to execute the update command.
  - **06H** - Failed to connect. The terminal cannot connect to the file server.
  - **07H** - Failed to download. The terminal cannot download the file from the file server.
  - **08H** - Fail to update.

- *Sub Code*

  Supplementary notes on the status of updating.

  - **00H** - Normal.
  - **10H** - Low battery.
  - **14H** - Failed to communicate with the module.
  - **20H** - No network connection.
  - **21H** - Can't connect to the specific URL.
  - **30H** - File not found. There is no such file on the server.
  - **31H** - File CRC error. The CRC check of the downloaded file failed.

  - **32H** - File type error. The file type does not match.
  - **33H** - File size error. The file size does not match.
  - **34H** - Incompatible version. Update to this version is not allowed.
  - **35H** - Device type error.
  - **F0H** - Operation is in progress.
  - **FFH** - Unknown.

- *Sequence Number*

  Indicates which update command triggered this configuration update. Corresponding to the sequence number in the *AT@UPC* command.

5.2.6 Data 103 (Get Configuration)

This combined data is used for reporting the process of getting configuration. Please check *Record F3H* for more information.

The frame format of the Data **103** unit is as follows:

```
For example (Total 9 bytes):
67 07 01 00 00 00 00 00 00

For example (Total 75 bytes):
67 49 02 00 00 00 00 00 00 68 74 74 70 3A 2F 2F 31 39 32 2E 31 36 38 2E 31 2E 33␣
↪30 30 3A 35 39 30 2F 47 56 35 30 31 4C 47 2F 43 6F 6E 66 69 67 2F 47 56 35 30 31␣
↪4C 47 5F 32 30 32 30 30 39 30 31 31 30 32 34 31 31 2E 63 66 67
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	67H (103)	67H (103)
Length	Data Length	1 or 2	00H-7FH or 8080H-80FFH	
Content	*Code*	1	01H-07H	
	Sub Code	1	01H-FFH	
	Reserved	5	0000000000H	0000000000H
	File URL	N		

- *Code*

  Indicates the status of processing.

  - **01H** - Start to upload. The terminal successfully connected to the file server and started to upload the configuration file.
  - **02H** - Success to upload. The terminal has successfully uploaded the configuration file.
  - **04H** - Refused. The terminal refuses to execute the configuration upload command.
  - **06H** - Failed to connect. The terminal cannot connect to the file server.
  - **07H** - Failed to upload. The terminal cannot upload the configuration file to the file server.

- *Sub Code*

  Supplementary notes on the status of processing.

  - **00H** - Normal.
  - **10H** - Low battery.
  - **20H** - No network connection.
  - **21H** - Can't connect to the specific URL.
  - **F0H** - Operation is in progress.

  - **FFH** - Unknown.

- *File URL*

  It specifies the URL of the uploaded configuration file. The content of this field is to append "/FileName" (file name of uploaded file) after 'Upload Directory' (which in *AT@GTC* command).

  Note: This field is only be included when the 'Mode' is 2 (which in *AT@GTC* command) and the 'Code' is 02H.

5.2.7 Data 125 (Tamper Status)

Identifies the status information of the tamper.

The frame format of the Data **125** unit is as follows:

```
For example (Total 8 bytes):
7D 06 00 01 00 00 01 2C
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	7DH (125)	7DH (125)
Length	Data Length	1	00H or 06H	
Content	*Current Status*	1	00H, 01H, FFH	
	Previous Status	1	00H, 01H, FFH	
	Previous Status Duration	4	00000000H-FFFFFFFFH (seconds)	

- *Current Status*

  The current status of the tamper alarm detection.

  - **00H** - Normal.
  - **01H** - Tamper alarm.
  - **FFH** - Unknown.

- *Previous Status*

  The previous status of the tamper alarm detection.

  - **00H** - Normal.
  - **01H** - Tamper alarm.
  - **FFH** - Unknown.

- *Previous Status Duration*

  Indicates how long the 'Previous Status' remains. Expressed as a 32-bit unsigned integer and the unit is second. In particular, FFFFFFFFH means invalid value.

5.3 Device Itself Related

This section describes the Data IDs related to the terminal device itself, please click on the hyperlinks below for details.

5.3.1 Data 1 (Profile ID)

Identifies the current Profile. For more information, please see the *Chapter Profiles*.

The frame format of the Data **1** unit is as follows:

```
For example (Total 3 bytes):
01 01 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	01H (1)	01H (1)
Length	Data Length	1	00H or 01H	
Content	*Profile ID*	1		

- *Profile ID*

  Used to indicate the profile the terminal was in when the record or report was generated.

  For example, 00H means the Profile 0.

  For example, 3FH means the Profile 63.

5.3.2 Data 2 (Device Name)

The frame format of the Data **2** unit is as follows:

```
For example (Total 13 bytes):
02 0B 4D 79 49 6F 54 64 65 76 69 63 65
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	02H (2)	02H (2)
Length	Data Length	1	00H or 04H-10H	
Content	*Device Name*	4-16		

- *Device Name*

  The name of the terminal device. It is defined in the *AT@CFG* command.

  For example, “MyIoTdevice” is represented by 4D 79 49 6F 54 64 65 76 69 63 65.

5.3.3 Data 4 (Device Serial Number)

The frame format of the Data **4** unit is as follows:

```
For example (Total 17 bytes):
04 0F 4D 50 30 39 39 32 31 44 38 30 30 30 31 33 33
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	04H (4)	04H (4)
Length	Data Length	1	00H-14H	
Content	*Device Serial Number*	0-20		

- *Device Serial Number*

  The unique serial number of the terminal device.

  For example, “MP09921D8000133” is represented by 4D 50 30 39 39 32 31 44 38 30 30 30 31 33 33.

5.3.4 Data 10 (Internal Battery Percentage)

The frame format of the Data **10** unit is as follows:

```
For example (Total 3 bytes):
0A 01 1F
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	0AH (10)	0AH (10)
Length	Data Length	1	00H or 01H	
Content	*Percentage*	1	00H-64H (*1%)	

- *Percentage*

  The current volume of the internal battery in percentage.

  For example, 1FH means 31%.

5.3.5 Data 19 (Triggered Time)

The frame format of the Data **19** unit is as follows:

```
For example (Total 6 bytes):
13 04 5F 17 9D A0
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	13H (19)	13H (19)
Length	Data Length	1	00H or 04H	
Content	*Triggered Time*	4		

- *Triggered Time*

  Used to record the time when the event occurred.

  Difference, in seconds, between the current local time and midnight, January 1, 1970.

  For example, 5DD52EFAH (i.e., 1574252282) indicates November 20, 2019, 12:18:02, and 5DB38C80H (i.e., 1572048000) indicates October 26, 2019, 00:00:00.

Note

This data ID may have different meanings in different reports or records. Please refer to the corresponding record ID for the specific meaning. If there is no clear description, it indicates when the report or record was generated.

5.3.6 Data 22 (Record Count)

The frame format of the Data **22** unit is as follows:

```
For example (Total 4 bytes):
16 02 00 0C
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	16H (22)	16H (22)
Length	Data Length	1	00H or 02H	
Content	*Record Count*	2	0000H-FFFFH	

- *Record Count*

  The number of records stored in the terminal that were not sent to the backend server. Expressed as a 16-bit unsigned integer.

5.3.7 Data 88 (SIM Card)

The information of SIM card in the terminal.

The frame format of the Data **88** unit is as follows:

```
For example (Total 20 bytes):
58 12 01 23 45 67 89 01 23 45 01 23 45 67 89 01 23 45 67 89
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	58H (88)	58H (88)
Length	Data Length	1	00H-7FH	
Content	*IMSI*	8		
	ICCID	N		

- *IMSI*

  International Mobile Subscriber Identity. Expressed in packed BCD (Binary-Coded Decimal), where each decimal digit is represented by a 4-bit field. Since IMSI has 15 digits, a 0 is added at the beginning so that it can be represented by a BCD code with a length of 8 bytes.

  For example, 0123456789012345H indicates IMSI "123456789012345".

- *ICCID*

  Integrated Circuit Card Identity.

  This field supports two expressions to represent the ICCID:

  (1) The ICCID usually consists of 20 digits, so it can be expressed in a 10 bytes packed BCD (Binary-Coded Decimal) code, where each decimal digit is represented by a 4-bit field. For example, the ICCID "01234567890123456789" is represented by 01 23 45 67 89 01 23 45 67 89.

  (2) The ICCID may also contains letters, so it can be expressed as a string, with the first byte fixed as FFH, the second byte being the length of the ICCID string, and the ICCID string starting at the third byte. For example, the ICCID "898600801919C5600800" is represented by FF 14 38 39 38 36 30 30 38 30 31 39 31 39 43 35 36 30 30 38 30 30.

5.3.8 Data 90 (Versions)

Information about the hardware and firmware versions supported by the terminal.

Note: In particular, the length of this data ID is uncertain and variable, which is closely related to the 'Version Mask' field, and the mask can also reflect the meaning of "version information supported by the terminal".

The frame format of the Data **90** unit is as follows:

```
For example (Total 21 bytes):
5A 13 80 08 10 42 47 39 36 4D 41 52 30 34 41 30 34 4D 31 47 00
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		1	5AH (90)	5AH (90)
Length	Data Length		1	00H or 09H-7FH	
Content	*Version Mask*		1	00H-FFH	
	Version Expression	Type	1	00H-FFH	
		Length	1	00H-FFH	
		Value	N		
	…				

- *Version Mask*

  This value indicates the format of the 'Version Expression' field.

  For this project, the value of *Version Mask* is fixed to **80H**.

- *Version Expression*

  If the value of *Version Mask* is **80H**, then the *Version Expression* field consists of one or more TLV (Type-Length-Value) expressions, each TLV expression representing a verison number.

  For 'Type', 'Length' and 'Value' in TLV are defined as follows:

  – *Type*

    It occupies one byte, and the value range is 00H-FFH. It is used to indicate which type of version it is.

    * **05H** - 'Bootloader Version'. The bootloader version of the terminal's CPU.
    * **06H** - 'Firmware Version'. The firmware (application) version of the terminal's CPU.
    * **07H** - 'Hardware Version'. The hardware version of the terminal.
    * **08H** - 'Modem Firmware Version'. The firmware version of cellular network module in the terminal.
    * **09H** - 'BLE Bootloader Version'. The bootloader version of the Bluetooth chip in the terminal.
    * **0AH** - 'BLE Firmware Version'. The firmware (application) version of the Bluetooth chip in the terminal.

  – *Length*

    It occupies one byte, and the value range is 00H-FFH. Indicates the size of the *Value* field (in bytes).

  – *Value*

    Specific version number information, expressed as a string (including the string terminator 00H).

    For example, "BG96MAR04A04M1G" is represented by `08 10 42 47 39 36 4D 41 52 30 34 41 30 34 4D 31 47 00`.

5.3.9 Data 97 (Internal Battery Status)

The current status of the internal battery.

The frame format of the Data **97** unit is as follows:

```
For example (Total 7 bytes):
61 05 01 0D 20 50 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	61H (97)	61H (97)
Length	Data Length	1	00H or 05H	
Content	*Basic Status*	1	00H-FFH	
	Voltage	2	0000H-FFFFH (mV)	
	Percentage	1	00H-64H (*1%)	
	Charging	1	00H-FFH	

- *Basic Status*

  The lowest bit is used to indicate the connection status, while the other bits are reserved and default to 0.

  - **Connection Status** (Bit0)

    Indicates whether the internal battery is connected.

    * **0b0** - Not connected.
    * **0b1** - Connected.

- *Voltage*

  The internal battery voltage of the terminal device. Expressed as a 16-bit unsigned integer and the unit is mV. This field is only valid when Connection Status is 01H (Connected).

- *Percentage*

  The current volume of the internal battery in percentage.

  For example, 1FH means 31%.

- *Charging*

  Whether the internal battery is being charged. For non-rechargeable battery, the value of this field is 02H.

  - **00H** - Not charging.
  - **01H** - Charging.
  - **02H** - Not support.
  - **11H** - Charging (Solar).

Note

The terminal supports two charging methods: USB charging and solar charging, and the terminal prioritizes USB charging. When the device is charged by USB power or solar power, the value of 'Charging' will be 01H or 11H, respectively.

5.3.10 Data 120 (Self-Test Status)

After the terminal performs self-test, the data information will be updated. The terminal will automatically perform a self-test every time it is powered on or restarted. The terminal also performs self-test when the terminal receives the subcommand 99 of *AT@RTO* command.

Please check *Record E0H* for more information.

The frame format of the Data **120** unit is as follows:

```
For example (Total 10 bytes):
78 08 5D B3 8C 80 00 00 00 00
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	78H (120)	78H (120)
Length	Data Length	1	00H or 08H	
Content	*Time*	4		
	Connectivity	4	00000000H-FFFFFFFFH	

- *Time*

  Record the moment the data is updated.

  Difference, in seconds, between the current local time and midnight, January 1, 1970.

For example, 5DD52EFAH (i.e., 1574252282) indicates November 20, 2019, 12:18:02, and 5DB38C80H (i.e., 1572048000) indicates October 26, 2019, 00:00:00.

- *Connectivity*

  Used to indicate the connectivity of the corresponding component.

  Different bits correspond to different components. A bit value of 1 means that the connectivity of the corresponding component is abnormal, otherwise it means that the connectivity of the corresponding component is normal.

  The components corresponding to the bits are as follows:

  - **Bit1** - Modem.
  - **Bit2** - Reading IMEI.
  - **Bit3** - SIM/eSIM.
  - **Bit4** - GNSS.
  - **Bit5** - G-Sensor.
  - **Bit7** - Bluetooth.
  - **Bit16** - Wi-Fi module.
  - **Other bits** - Reserved, set to 0 by default.

5.3.11 Data 121 (Internal Temperature)

The internal temperature detected by the terminal.

The frame format of the Data **121** unit is as follows:

```
For example (Total 8 bytes):
79 06 01 90 5D D5 2E FA
```

Parts	Fields	Length (Byte)	Range/Format	Default
ID	Data ID	1	79H (121)	79H (121)
Length	Data Length	1	00H or 06H	
Content	*Temperature*	2	0000H-FFFFH (*0.1°C)	
	Time	4		

- *Temperature*

  Temperature detected from inside the terminal.

  Expressed as a 16-bit signed integer and the unit is 0.1°C.

  For example, 0190H means the internal temperature is 40.0°C, and FF43H means the internal temperature is -18.9°C.

- *Time*

  Record the moment when the 'Internal Temperature' is updated.

  Difference, in seconds, between the current local time and midnight, January 1, 1970.

  For example, 5DD52EFAH (i.e., 1574252282) indicates November 20, 2019, 12:18:02, and 5DB38C80H (i.e., 1572048000) indicates October 26, 2019, 00:00:00.

5.4 Peripherals and Environment

This section describes the Data IDs related to peripherals and environment of the terminal device, please click on the hyperlinks below for details.

5.4.1 Data 122 (External Temperature and Humidity)

The external temperature and humidity detected by the terminal.

Each sensor data occupies 8 bytes, including 'Alarm ID', 'Temperature', 'Humidity' and 'Time'.

The frame format of the Data **122** unit is as follows:

```
For example (Total 11 bytes):
7A 09 01 00 02 8A 1E 5D D5 2E FA
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		1	7AH (122)	7AH (122)
Length	Data Length		1	00H or 01H-51H	
Content	*Number*		1	00H-0AH	
	The first sensor data	*Alarm ID*	1		
		Temperature	2	0000H-FFFFH (*0.1°C)	
		Humidity	1	00H-64H (%RH)	
		Time	4		
	…				

- *Number*

  Indicates how many external temperature and humidity sensors the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *Alarm ID*

  The alarm ID of the external temperature and humidity. Refer to *AT@ETH* command.

- *Temperature*

  Temperature detected from outside the terminal.

  Expressed as a 16-bit signed integer and the unit is 0.1°C. In particular, 8000H means that the terminal cannot obtain this data currently.

  For example, 0100H means the external temperature is 25.6°C, and FFCEH means the external temperature is -5.0°C.

- *Humidity*

  Humidity detected by the terminal. In particular, FFH means that the terminal cannot obtain this data currently.

  For example, 1EH means the relative humidity is 30%RH, and 50H means the relative humidity is 80%RH.

- *Time*

  Record the moment when the 'Temperature' and 'Humidity' are updated.

  Difference, in seconds, between the current local time and midnight, January 1, 1970.

  For example, 5DD52EFAH (i.e., 1574252282) indicates November 20, 2019, 12:18:02, and 5DB38C80H (i.e., 1572048000) indicates October 26, 2019, 00:00:00.

5.5 Bluetooth

This section describes the Data IDs related to the bluetooth of terminal, please click on the hyperlinks below for details.

5.5.1 Data 178 (Scanned Base Beacon Data)

The Beacons information collected by terminal. Each Beacon occupies 8 bytes, including Type, MAC, RSSI.

The frame format of the Data **178** unit is as follows:

```
For example (Total 12 bytes):
80 B2 09 01 0C 12 34 56 78 90 AB BB
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		2	80B2H (178)	80B2H (178)
Length	Data Length		1 or 2	00H-7FH or 8080H-80FFH	
Content	*Number*		1	00H-FFH	
	The first Beacon	*Type*	1		
		MAC	6		
		RSSI	1	80H-FFH (dBm)	
	…				

- *Number*

  Indicates how many Beacons the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *Type*

  Indicates the type of the Beacon. It is refer to the parameter 'Type' in *AT@BTBCN* command.

  For example, 0DH (i.e, 13) means the type is WID310.

  For example, 50H (i.e, 80) means the type is Eddystone-UID.

  For example, 51H (i.e, 81) means the type is iBeacon.

- *MAC*

  The MAC address of a Beacon.

  For example, 1234567890ABH means the MAC address 12:34:56:78:90:AB.

- *RSSI*

  The received signal strength.

  Expressed as an 8-bit signed integer and the unit is dBm. When the RSSI value is less than -128 (80H), it is also filled in as 80H, and when the RSSI value is greater than -1 (FFH), it is also filled in as FFH. In particular, 63H means the signal strength is not known or not detectable.

  Typical values are as follows:

Value	Signal Strength (dBm)	Level
A7H to 80H	-89 or less	0
A8H to ADH	-88 to -83	1
AEH to B4H	-82 to -76	2
B5H to BEH	-75 to -66	3
BFH to FFH	-65 or greater	4
63H	Not known or not detectable	/

5.5.2 Data 179 (Scanned Eddystone Beacon Data)

The Beacons information collected by terminal. Each Beacon occupies 28 bytes, including Type, MAC, RSSI, etc.

The frame format of the Data **179** unit is as follows:

```
For example (Total 32 bytes):
80 B3 1D 01 0C 12 34 56 78 90 AB BB 0C 80 01 18 00 11 22 33 44 55 66 77 88 99 00␣
↪AA BB CC DD EE
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		2	80B3H (179)	80B3H (179)
Length	Data Length		1 or 2	00H-7FH or 8080H-80FFH	
Content	*Number*		1	00H-FFH	
	The first Beacon	*Type*	1		
		MAC	6		
		RSSI	1	80H-FFH (dBm)	
		Voltage	2	0000H-FFFFH (mV)	
		Temperature	2	0000H-FFFFH (*0.1°C)	
		NID	10		
		BID	6		
	…				

- *Number*

  Indicates how many Beacons the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *Type*

  Indicates the type of the Beacon. It is refer to the parameter 'Type' in *AT@BTBCN* command.

  For example, 50H (i.e, 80) means the type is Eddystone-UID.

- *MAC*

  The MAC address of a Beacon.

  For example, 1234567890ABH means the MAC address 12:34:56:78:90:AB.

- *RSSI*

  The received signal strength.

  Expressed as an 8-bit signed integer and the unit is dBm. When the RSSI value is less than -128 (80H), it is also filled in as 80H, and when the RSSI value is greater than -1 (FFH), it is also filled in as FFH. In particular, 63H means the signal strength is not known or not detectable.

  Typical values are as follows:

Value	Signal Strength (dBm)	Level
A7H to 80H	-89 or less	0
A8H to ADH	-88 to -83	1
AEH to B4H	-82 to -76	2
B5H to BEH	-75 to -66	3
BFH to FFH	-65 or greater	4
63H	Not known or not detectable	/

- *Voltage*

  The current battery voltage of the Beacon.

  Expressed as a 16-bit unsigned integer and the unit is mV. In particular, 7FFFH means that the terminal cannot obtain this data currently.

For example, 0C80H means 3200mV.

- *Temperature*

  The current Temperature of the Beacon.

  Expressed as a 16-bit signed integer and the unit is 0.1°C. In particular, the value will be 7FFFH when the Beacon cannot broadcast temperature.

  For example, 0190H means the internal temperature is 40.0°C, and FF43H means the internal temperature is -18.9°C.

- *NID*

  Indicates the Namespace ID of the Beacon.

  For example, 00112233445566778899H means the Namespace ID "00112233445566778899".

- *BID*

  Indicates the Instance ID of the Beacon.

  For example, 00AABBCCDDEEH means the Instance ID "00AABBCCDDEE".

5.5.3 Data 180 (Scanned iBeacon Beacon Data)

The Beacons information collected by terminal. Each Beacon occupies 28 bytes, including Type, MAC, RSSI, etc.

The frame format of the Data **180** unit is as follows:

```
For example (Total 32 bytes):
80 B4 1D 01 0C 12 34 56 78 90 AB BB 11 22 33 44 AA BB 11 22 CC DD 00 11 22 33 44␣
↪55 00 01 00 01
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		2	80B4H (180)	80B4H (180)
Length	Data Length		1 or 2	00H-7FH or 8080H-80FFH	
Content	*Number*		1	00H-FFH	
	The first Beacon	*Type*	1		
		MAC	6		
		RSSI	1	80H-FFH (dBm)	
		UUID	16		
		Major	2	0000H-FFFFH	
		Minor	2	0000H-FFFFH	
	…				

- *Number*

  Indicates how many Beacons the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *Type*

  Indicates the type of the Beacon. It is refer to the parameter 'Type' in *AT@BTBCN* command.

  For example, 51H (i.e, 81) means the type is iBeacon.

- *MAC*

  The MAC address of a Beacon.

  For example, 1234567890ABH means the MAC address 12:34:56:78:90:AB.

- *RSSI*

  The received signal strength.

Expressed as an 8-bit signed integer and the unit is dBm. When the RSSI value is less than -128 (80H), it is also filled in as 80H, and when the RSSI value is greater than -1 (FFH), it is also filled in as FFH. In particular, 63H means the signal strength is not known or not detectable.

Typical values are as follows:

Value	Signal Strength (dBm)	Level
A7H to 80H	-89 or less	0
A8H to ADH	-88 to -83	1
AEH to B4H	-82 to -76	2
B5H to BEH	-75 to -66	3
BFH to FFH	-65 or greater	4
63H	Not known or not detectable	/

- *UUID*

  Indicates the proximity UUID (Universally Unique Identifier) of the Beacon.

  For example, 11223344AABB1122CCDD001122334455H means the UUID "11223344-AABB-1122-CCDD-001122334455".

- *Major*

  Indicates the Major value of the Beacon.

  For example, 0001H means the Major "0001".

- *Minor*

  Indicates the Minor value of the Beacon.

  For example, 0001H means the Minor "0001".

5.5.4 Data 181 (Scanned WID3xx Beacon Data)

The Beacons information collected by terminal. Each Beacon occupies 10 bytes, including Type, MAC, RSSI, Voltage.

Note: WID3xx Beacon refers to WID310.

The frame format of the Data **181** unit is as follows:

```
For example (Total 14 bytes):
80 B2 0B 01 0C 12 34 56 78 90 AB BB 0C 80
```

Parts	Fields		Length (Byte)	Range/Format	Default
ID	Data ID		2	80B5H (181)	80B5H (181)
Length	Data Length		1 or 2	00H-7FH or 8080H-80FFH	
Content	*Number*		1	00H-FFH	
	The first Beacon	*Type*	1		
		MAC	6		
		RSSI	1	80H-FFH (dBm)	
		Voltage	2	0000H-FFFFH (mV)	
	…				

- *Number*

  Indicates how many Beacons the following data comes from.

  If the value of this field is 00H, no other fields are included.

- *Type*

  Indicates the type of the Beacon. It is refer to the parameter 'Type' in *AT@BTBCN* command.

  For example, 0DH (i.e, 13) means the type is WID310.

- *MAC*

  The MAC address of a Beacon.

  For example, 1234567890ABH means the MAC address 12:34:56:78:90:AB.

- *RSSI*

  The received signal strength.

  Expressed as an 8-bit signed integer and the unit is dBm. When the RSSI value is less than -128 (80H), it is also filled in as 80H, and when the RSSI value is greater than -1 (FFH), it is also filled in as FFH. In particular, 63H means the signal strength is not known or not detectable.

  Typical values are as follows:

Value	Signal Strength (dBm)	Level
A7H to 80H	-89 or less	0
A8H to ADH	-88 to -83	1
AEH to B4H	-82 to -76	2
B5H to BEH	-75 to -66	3
BFH to FFH	-65 or greater	4
63H	Not known or not detectable	/

- *Voltage*

  The current battery voltage of the Beacon.

  Expressed as a 16-bit unsigned integer and the unit is mV. In particular, 7FFFH means that the terminal cannot obtain this data currently.

  For example, 0C80H means 3200mV.

CHAPTER

SIX

MANAGEMENT

This chapter aims to describe how to manage terminal devices, including upgrading firmware, updating and obtaining configuration file, and more. User can complete these services remotely without bringing device to the service center. Thus, the service provider of terminal can conveniently promote new features or carry out debugging for the end users to improve the customer experience.

During the firmware or configuration update, the three roles mentioned below are usually involved:

- **The terminal**: Whose firmware or configuration is to be updated.
- **The backend server**: The server which remotely controls the terminal and receives report messages from the terminal.
- **The file server**: A server that supports the **HTTP** protocol for storing target files to be updated. It can be hosted on the same machine with the backend server.

Please click on the hyperlinks below for more details.

6.1 Firmware Over The Air

This section describes how to use the *AT@UPD* command to upgrade the terminal firmware over the air.

6.1.1 Update Process

The firmware update process includes four steps: start the update, check security, download the update package and perform the update.

Here is a flowchart of successful update:

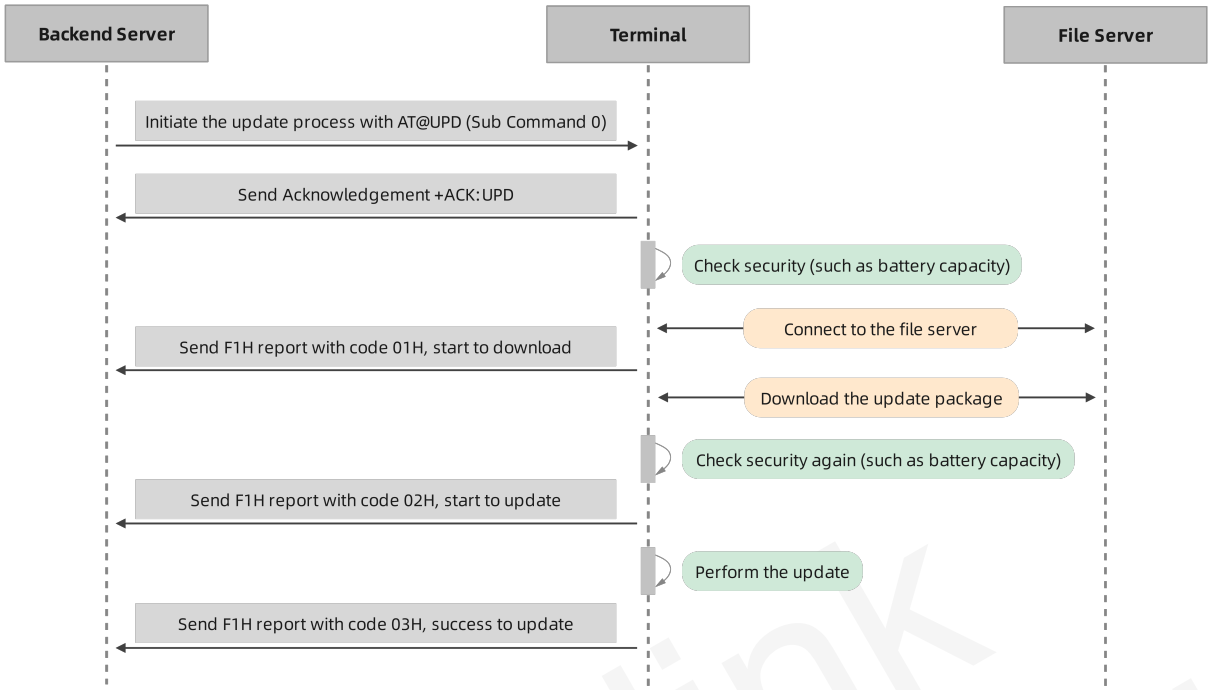


Fig. 1: Flowchart of Successful Update

Please see below for more detailed information for each update step.

- **Start the Update**

  The backend server sends the AT@UPD (sub-command 0) command to the terminal to initiate the update process. Along with this command, necessary information is sent to the terminal to start the update process.

  Backend server decides when and how to initiate the firmware update process of all the terminals it controls. As the response message receiver and the controller, the backend server has all the information (including the current firmware version of the terminal, the version of the latest available firmware and the location of the proper update packages) it needs to start an update process.

- **Check Security**

  After receiving the valid AT@UPD (sub-command 0) command, the terminal will first check the security of the system. If the terminal is not currently in a secure environment, it will send a **F1H** report (code 04H) to inform the backend server that the update process is to be aborted. If the current terminal is in a state that allows the update, the terminal will connect to the file server. If the connection successful, the terminal will send a F1H report (code 01H) to the backend server and then start to download the update package.

  For GL601, the default security item to check is “the battery is sufficient”.

- **Download the Update Package**

  If the terminal downloading the update package failed, it will retry until it succeeds or times out. If the downloading is successful, the terminal will check the downloaded file, after confirming that the file is right, the terminal will send a **F1H** report (code 02H) to the backend server and the update process proceeds to the next step.

  Before the “Perform the Update” step, if the terminal receives AT@UPD (sub-command 1) to cancel current update process, then the terminal will terminate the update process. In addition, if the terminal is in the process of downloading the file package when receiving the cancel command, then the terminal may send the **F1H** report (code 05H) to the backend server after the download process is completed (before “Perform the Update”).

- **Perform the Update**

  After downloading the package successfully, the terminal will check the system security again. If the terminal is not currently in a secure environment, the terminal will send a **F1H** report (code 08H) to inform the backend

server that the update process is to be aborted. Otherwise, the terminal will start updating. After the update, whether successful or not, the terminal will reboot automatically. After that, it will send a F1H report (if successful, the code is 03H) with update information to the backend server and work as usual.

The AT@UPD command and F1H report are described in detail below.

6.1.2 UPD (Upgrade Firmware)

The *AT@UPD* command is used to update the firmware of terminal via network.

Note

Download files from the specified URL. After the terminal fails to connect to the file server (which specified by 'Download URL'), a gradual delay retry strategy will be adopted.

```
Example:
AT@UPD=gl601###,0,1,,,10,http://218.17.46.11:979/GL601/deltabin/GL601_R00A01V02.
↪enc,,,,,1234$
+ACK:UPD,123456789012345,C031,12,0,0,1234,20210407101530,1234$
+NACK:UPD,123456789012345,C031,12,0,0,0,1234,20210407101530,1234$
AT@UPD=gl601###,1,,,,,,,,,0125$
+ACK:UPD,123456789012345,C031,12,0,1,0125,20210407101530,1234$
+NACK:UPD,123456789012345,C031,12,0,1,2,0125,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	UPD	UPD
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Sub Command*	1	0-1	
	Update Type	<=2	Please see below.	
	Sub Update Type	<=2	Please see below.	
	Reserved	0		
	Download Timeout	<=2	10 - 60 (minutes)	10
	Download URL	<=150	A valid URL.	
	Authentication Username	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Authentication Password	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Sub Command*

  A numeral to indicate the sub command to be executed.

  - **0** - Start the firmware update.
  - **1** - Stop the firmware update.

  Note

  If this field is 1, the other fields below can be empty.

- *Update Type*

  The type of the firmware to be updated.

  - **1** - Tracker firmware.
  - **2** - Bluetooth firmware.
  - **6** - Modem firmware.
  - **8** - GNSS firmware.

- *Sub Update Type*

  The sub-type of the firmware to be updated. Need to specify sub type for the following types, and set it to empty for others.

- *Download Timeout*

  If downloading is not finished within this time, it will be regarded that the downloading failed.

- *Download URL*

  It specifies the URL to download the package.

  The terminal supports the following URL types:

  - **HTTP URL**

- *Authentication Username*

  If the server (that corresponding to URL) uses authentication, the username is specified here.

- *Authentication Password*

  If the server (that corresponding to URL) uses authentication, the password is specified here.

6.1.3 F1H (UPD Status)

During the firmware update process, the device reports its status including the update confirmation information, package downloading information and firmware update information to the backend server via this message (a report that only carries Record F1H) at different phases.

```
For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F1␣
↪00 65 07 01 00 01 00 00 00 00 01 23 1A 24

For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F1␣
↪00 65 07 02 00 01 00 00 00 00 01 23 F4 24

For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F1␣
↪00 65 07 03 00 01 00 00 00 00 01 23 41 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record ID		1	**F1H**	**F1H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  Fixedly, this record contains only the following *Data ID units*:

  – *Data 101* - Upgrade Information.

6.2 Update Configurations

This section describes how to use the *AT@UPC* command to update the entire configuration file of the terminal.

Note

The terminal always verifies that all the configuration commands in the configuration file are valid before updating. As long as the configuration file contains an invalid command (unsupported or invalid parameters), the terminal will not perform any updates.

The process of updating the configuration file is similar to that of upgrading the firmware. Please refer to *here* for more information, the following is intended to describe the format of configuration file, AT@UPC command and F2H report.

6.2.1 Configuration File Format

The terminal supports configuration files in **JSON** format.

The configuration file in JSON format includes CRC check and file generation time (UTC time, can be used as a configuration version), and it can only be exported by the **Manage Tool** running on the computer provided by Queclink.

The configuration file in JSON format looks like this:

```
{
    "DeviceType": "8001",
    "ConfigGenerationTime": "20210601101030",
    "ProtocolVersion": 15,
    "CustomVersion": 0,
    "ConfigurationCommands": {
        "ACK": "AT@ACK=*,,,0,0,,FFFF$",
        "AGPS": "AT@AGPS=*,1,1,,,FFFF$",
        "APN": "AT@APN=*,,cmnet,,,0,,FFFF$",
        "CFG": "AT@CFG=*,,MyDevice,,,,FFFF$",
        "NET": "AT@NET=*,,0,0,,,1,,FFFF$",
        "PROFILE": [
            "AT@PROFILE=*,0,1,,,,FFFF$",
            "AT@PROFILE=*,1,2,,,,FFFF$",
            "AT@PROFILE=*,63,1,,,,FFFF$"
        ],
        "TMA": "AT@TMA=*,,+32,0,,time.windows.com,123,FFFF$",
        "QRC": {
            "01H": "AT@QRC=*,01,,1,,,FFFF$",
            "03H": "AT@QRC=*,03,,1,,,FFFF$",
            "50H": [
                "AT@QRC=*,50,0,1,0,,,,600,,,,FFFF$",
                "AT@QRC=*,50,1,1,,,10,0,600,0,0,0,FFFF$",
```

(continues on next page)

(continued from previous page)

```
                "AT@QRC=*,50,63,1,,,10,0,600,0,0,0,FFFF$"
            ],
            "E0H": "AT@QRC=*,E0,,,1,2|88,FFFF$"
        }
    },
    "CRC": "44E2"
}
```

Note

When the device generates the configuration file, the password will be masked for security reasons.

6.2.2 UPC (Update Configurations)

The *AT@UPC* command is used to update the configuration file of terminal via network.

```
Example:
AT@UPC=gl601###,,10,http://218.17.46.11:979/GL601/deltabin/GL601_C031_
↪20211017034742_NA.cfg,,,,,,,,1234$
+ACK:UPC,123456789012345,C031,12,0,,1234,20210407101530,1234$
+NACK:UPC,123456789012345,C031,12,0,,0,1234,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	UPC	UPC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	Reserved	0		
	Download Timeout	<=2	10 - 60 (minutes)	10
	Download URL	<=150	A valid HTTP URL.	
	Authentication Username	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Authentication Password	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Download Timeout*

  If downloading is not finished within this time, it will be regarded that the downloading failed.

- *Download URL*

  It specifies the URL to download the package.

- *Authentication Username*

  If the server (that corresponding to URL) uses authentication, the username is specified here.

- *Authentication Password*

  If the server (that corresponding to URL) uses authentication, the password is specified here.

6.2.3 F2H (UPC Status)

During the configuration file update process, the device reports its status including the update confirmation information, package downloading information and configuration update information to the backend server via this message (a report that only carries Record F2H) at different phases.

```
For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F2␣
↪00 66 07 01 00 00 00 00 00 00 01 23 9C 24

For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F2␣
↪00 66 07 02 00 00 00 00 00 00 01 23 72 24

For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F2␣
↪00 66 07 03 00 00 00 00 00 00 01 23 C7 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record ID		1	**F2H**	**F2H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  Fixedly, this record contains only the following *Data ID units*:

  – *Data 102* - Update Configuration.

6.3 Get Configurations

This section describes how to use the *AT@GTC* command to obtain the entire configuration file or its content of the terminal.

The terminal has several ways to output the configuration file or its content:

- Print the configuration file content through the serial port.
- Send the query response messages to backend server via *QRY* frames.
- Upload the configuration file through the POST request of HTTP protocol.

The process of uploading the configuration file is similar to that of upgrading the firmware. Please refer to *[Update Process]* for more information, the following is intended to describe the AT@GTC command and F3H report.

6.3.1 GTC (Get Configurations)

The *AT@GTC* command is used to get all configurations of the terminal.

There are two sets of configurations in the terminal device, the factory configurations and the application configurations:

- When production, the configurations written to the terminal device is the **factory** configurations, which will also be used as the application configurations.
- The user can only modify the application configurations through the configuration commands and the *AT@UPC* command, which has no effect on the factory configurations.
- When the terminal receives a subcommand **94** or **95** of the *AT@RTO* command, the relevant parameters of the current configurations will be changed to the same as the factory configurations.

```
Example:
AT@GTC=gl601###,2,,3,http://218.17.46.11:964/GL601/Config,,,,,1234$
+ACK:GTC,123456789012345,C031,12,0,,1234,20210407101530,1234$
+NACK:GTC,123456789012345,C031,12,0,,0,1234,20210407101530,1234$
```

Parts	Fields	Length (Byte)	Range/Format	Default
Head	Header	3	AT@	AT@
	Command Word	3	GTC	GTC
	Leading Symbol	1	=	=
	Password	8-16		gl601###
Body	*Mode*	1	Please see below.	
	Type	<=2	Please see below.	
	Upload Timeout	<=2	3-10 (minutes)	3
	Upload Directory	<=150	A valid HTTP URL.	
	Authentication Username	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Authentication Password	<=6	'0'-'9', 'a'-'z', 'A'-'Z'	
	Reserved	0		
	Reserved	0		
Tail	Sequence Number	4	0000-FFFF ('0'-'9', 'A'-'F')	
	Tail	1	$	$

- *Mode*

  A numeral to specify how to get the configurations.

  - **0** - Print out file. Print the configuration file content directly from the serial port.
  - **1** - Send query responses. Send all query responses for current applicaton configurations to backend server via *QRY* frames.
  - **2** - Upload file. Upload the file to the directory which is specified by 'Upload Directory' via HTTP POST.

- *Type*

  It specifies which set of configurations will be obtained.

  - **Empty** - All configurations.
  - **0** - Factory configurations.
  - **1** - Application configurations.

  Note: This parameter is invalid for Mode 1.

- *Upload Timeout*

  If uploading is not finished within this time, it will be regarded that the uploading failed.

  Note: This parameter is only valid for Mode 2.

- *Upload Directory*

  It specifies the directory to upload the configuration file.

  Note: This parameter is only valid for Mode 2. And for Mode 2, this field must be filled with a valid directory, and is not allowed to be empty.

- *Authentication Username*

  If the server (which is specified by 'Upload Directory') uses authentication, the username is specified here.

  Note: This parameter is only valid for Mode 2.

- *Authentication Password*

  If the server (which is specified by 'Upload Directory') uses authentication, the password is specified here.

  Note: This parameter is only valid for Mode 2.

6.3.2 F3H (GTC Status)

When the 'Mode' field in the AT@GTC command is **1** or **2**, during performing the process of getting configuration, this message (a report that only carries Record F3H) will be sent to backend server to inform the performing status.

```
For example (Total 41 bytes):
2B 00 00 29 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 12 66 8E 47 F7 00 00 F3␣
↪00 67 07 01 00 00 00 00 00 00 01 23 56 24

For example (Total 107 bytes):
2B 00 00 6B 00 01 23 45 67 89 01 23 45 C0 31 00 0C 00 00 54 66 8E 47 F7 00 00 F3␣
↪00 67 49 02 00 00 00 00 00 00 68 74 74 70 3A 2F 2F 31 39 32 2E 31 36 38 2E 31 2E␣
↪33 30 30 3A 35 39 30 2F 47 56 35 30 31 4C 47 2F 43 6F 6E 66 69 67 2F 47 56 35 30␣
↪31 4C 47 5F 32 30 32 30 30 39 30 31 31 30 32 34 31 31 2E 63 66 67 01 23 94 24
```

Parts	Fields		Length (Byte)	Range/Format	Default
Head			18 or 20		
Reserved			1 or 1+N		
Records	Record Length		1 or 2	00H-7FH or 8080H-FFFFH	
	Generated Time		4		
	Record ID		1	**F3H**	**F3H**
	Event Code		1	00H	00H
	Data of Record	Data ID	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Length	1 or 2	00H-7FH or 8080H-FFFFH	
		Data Content	N		
		…			
	…				
Tail			4		

The definitions of parts 'Head', 'Reserved', and 'Tail' are *here*.

- *Event Code*

  The default is **00H**.

- *Data of Record*

  Fixedly, this record contains only the following *Data ID units*:

  – *Data 103* - Get Configuration.

Note

This document describes the firmware update process and the necessary messages that are exchanged during the update process, but does not cover the information below:

- The time and the method that the backend server initiates the update.
- The deployment method of the update package.
- How to set up a file server.
- The communication between the backend server and the file server.

CHAPTER

SEVEN

FEATURES

This chapter aims to describe the details of some functions involved in the protocol, and some behaviors of the terminal that are not clearly defined in configuration commands.

Please click on the hyperlinks below for details, and if you want to know more, please contact us.

7.1 Profiles

As mentioned *earlier*, **Profiles** refer to some built-in application scenarios of the terminal device, the purpose is to conveniently realize that when the terminal is in a specific scenario, the working mode can be automatically switched.

In different profiles, the terminal can have different behaviors. **Here are some examples:**

- When the terminal leaves the home network and enters the roaming network area, it will automatically switch to **Profile 1 (Roaming)**, at this time, in order to save the data usage of the roaming network, the terminal may only generate reports but not send to the backend server, and then send these reports when the terminal leaves the roaming network area and returns to the local network area.
- When the power supply is sufficient, the terminal generates a location report every 30 minutes, and when it is in a low battery state, in order to save power, it will switch to **Profile 10 (Low Battery)** and automatically adjust to generate a location report every 6 hours.
- When the terminal receives the *AT@RTO* command with the subcommand 92, the terminal will automatically switch to **Profile 63 (Emergency)**, and always tries to maintain a long connection with the backend server while shortening the interval for generating location reports so that the server can know the location of the terminal in real time.

The different behaviors of the terminal under different profiles can be realized through the multi-profile commands (containing the 'Profile ID' field). And the profile related commands supported by the terminal are listed *below*.

Note

(1) Not all configuration commands support multiple profiles, that is, some commands are valid regardless of which profile the terminal is in, such as *AT@CFG* command.

(2) For a command that supports multiple profiles (e.g., *Record 50H*): The parameters of each profile are independent. Changing the parameters of one profile will not affect the parameters of other profiles. By default, all parameters of all profiles are the same.

The terminal works in Profile 0 (Default) when it is started, and only when the trigger conditions of other profiles are met, the terminal will switch to other profiles. And when the conditions of other profiles disappear, the terminal will switch back to Profile 0 to work.

7.1.1 Priority

Sometimes the terminal may be in multiple profiles at the same time, for example, the terminal is in the area of the roaming network (Profile 1) and the battery is low (Profile 10).

The terminal assigns different priorities to different profiles to clarify the behavior of the terminal when it is in multiple profiles at the same time: The terminal will work according to the parameters of the higher priority profile.

By default, the lower the value of the profile ID, the lower the priority, that is, Profile 0 (Default) has the lowest priority and Profile 63 (Emergency) has the highest priority. And in particular, the priority of Profile 0 and Profile 63 cannot be changed, while the priority of other profiles can be changed through the *AT@PPS* command.

Note

The priority of each profile is different, that is, one profile corresponds to one priority. There will be no different profiles using the same priority.

7.1.2 Commands

The priority of the profiles can be adjusted with the *AT@PPS* command.

The commands that support multiple-profiles are listed below:

- *AT@PROFILE*
- *50H Settings*

For multiple-profiles commands, the options supported by the *Profile ID* field are defined as follows:

- **0** : Profile 0 (Default)
- **1** : Profile 1 (Roaming)
- **4** : Profile 4 (Motion)
- **5** : Profile 5 (Motionless)
- **9** : Profile 9 (Wi-Fi Environment)
- **10** : Profile 10 (Low Battery)
- **63** : Profile 63 (Emergency)

For example, "0" means Profile 0 (Default).

Note: In particular, the *Profile ID* field is **empty** to indicate that all profiles are configured. And connecting multiple profile IDs with the **'|'** symbol means that the same configuration is applied to multiple Profiles.

7.1.3 Supported Profiles

The profiles supported by the terminal are as follows:

- **Profile 0 (Default)**

  When a terminal is first powered on, it always works in this profile. When the terminal restarts, it will work in the profile before the restart.

  The terminal will only switch to other profiles when it is satisfied to switch to other profiles, otherwise it will always work in this profile.

  Profile 0 (Default) is the lowest priority profile, and this is unchangeable.

- **Profile 1 (Roaming)**

  Since the terminal may be often used across regions, in order to reduce the data usage when using a roaming network, the terminal supports appropriately reducing the number of messages sent to the backend server when using a roaming network. This can be achieved by changing the configuration of the Profile 1.

  This profile is disabled by default, you can enable it through the *AT@PROFILE* command.

- **Profile 4 (Motion)**

  Sometimes the terminal is likely to be moved during vibration. In order to more timely inform the backend server that the location of the terminal has changed, it is necessary to speed up the transmission of location information after detecting vibration. This can be achieved by changing the configuration of the Profile 4.

  The parameters of motion detection can be set in the *AT@GSENSOR* command.

  This profile is disabled by default, you can enable it through the *AT@PROFILE* command.

- **Profile 5 (Motionless)**

  The terminal also supports motionless detection, in order to save power, some reports need to be turned off or reduced when the terminal is motionless. This can be achieved by changing the configuration of the Profile 5.

  The parameters of motionless detection can be set in the *AT@GSENSOR* command.

  This profile is disabled by default, you can enable it through the *AT@PROFILE* command.

- **Profile 9 (Wi-Fi Environment)**

  The terminal supports Wi-Fi environment detection. When the terminal detects that it is in a known Wi-Fi hotspot coverage, the terminal will switch to this profile, and exit the profile on the contrary.

  This profile is disabled by default, you can enable it through the *AT@PROFILE* command.

- **Profile 10 (Low Battery)**

  When the terminal is only powered by the internal battery and the battery power is low, in order to extend the working time as much as possible, the terminal supports running with different configuration parameters at this time, which can be achieved by changing the configuration of Profile 10.

  The low power threshold of the internal battery can be set in the *AT@BPL* command.

  This profile is disabled by default, you can enable it through the *AT@PROFILE* command.

- **Profile 63 (Emergency)**

  In order to allow the user to know the current location and other information of the terminal in a more real-time way when necessary, the terminal supports the Profile 63 (Emergency).

  This profile is also called **emergency mode**, and it contains these features:

  – When the terminal enters the emergency mode, the GNSS and cellular network are always on, and the terminal will always stay connected to the backend server.

  – In emergency mode, the terminal always sends real-time reports first (equivalent to 'Report Priority' in the *AT@RPS* command is set to 1).

  – In emergency mode, the terminal may send some reports to the backend server more frequently. This can be achieved by changing the configuration of the Profile 63.

  Note

  The Profile 63 is always enabled and has the highest priority, which cannot be changed.

  How to Enter Profile 63

  When one of the following conditions is met, the terminal will switch to Profile 63 (Emergency).

  – When the terminal receives the *AT@RTO* command with the subcommand 92.

How to Exit Profile 63

When the terminal detects that the conditions for entering Profile 63 (Emergency) have disappeared, or the specified duration has elapsed, the terminal will exit Profile 63 and switch to other profiles. For example, the terminal receives a command to end the emergency state from the backend server.

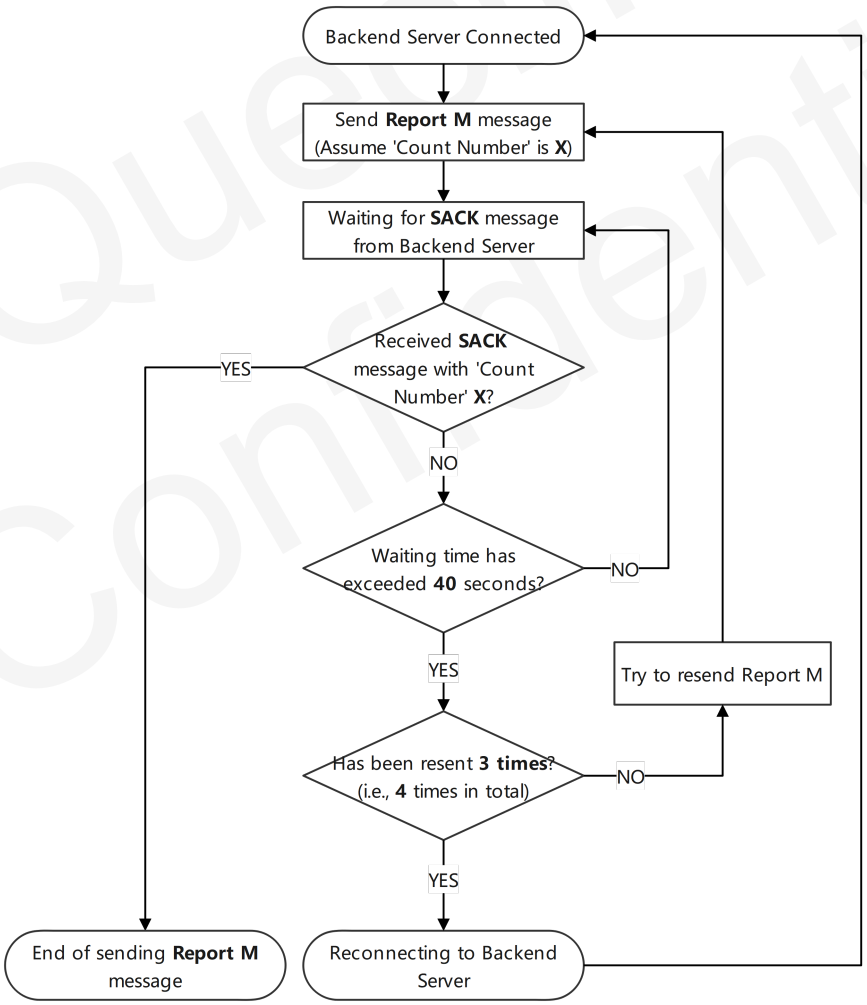
7.2 SACK Mechanism

The frame format of SACK is *here*.

If the SACK function is enabled (please check the 'SACK Mode' field in the *AT@ACK* command), the terminal will perform a special mechanism:

1. Terminal will wait for the backend server to respond SACK message after sending a report. The maximum timeout for each waiting is 40 seconds.
2. Once the terminal receives the correct SACK response message, it means that this report has been successfully received by the backend server. The terminal will end the sending process of this report.
3. If the terminal does not receive the correct SACK message within the waiting time from the backend server, the terminal will try to resend the report. After resending 3 times (i.e., sent a total of 4 times), it still does not receive a correct SACK, it will reconnect to backend server.

The flowchart is shown below:



CHAPTER

EIGHT

APPENDICES

Here are the appendices of the @Track protocol, including the modification history of this protocol, copyright notice, etc., please click on the hyperlinks below for details.

8.1 General Notes

Queclink offers this information as a service to its customers, to support application and engineering efforts that use the products designed by Queclink. The information provided is based upon requirements specifically provided to Queclink by the customers. Queclink has not undertaken any independent search for additional relevant information, including any information that may be in the customer's possession. Furthermore, system validation of this product designed by Queclink within a larger electronic system remains the responsibility of the customer or the customer's system integrator. All specifications supplied herein are subject to change.

8.2 Revision History

Version	Date	Author	Description of Change
V12	2024/12/04	Kerwin Shen	1. Assigning different device types to the GL601MG and GL601CEU. 2. Modify the description of AT@CFG command.
V11	2024/11/22	Kerwin Shen	1. Modify the Notes for APN parameters. 2. Modify AT@WIFIGEO command.
V10	2024/08/12	Kerwin Shen	1. Modify Data 120. 2. Add 'Update Type 8' in AT@UPD command. 3. Delete 'Type 12' from AT@BTBCN command. 4. Add event code 17H into Record 01H. 5. Add event code 03H into Record 05H. 6. Add Profile 9. 7. Delete Filter Type 3/4 from AT@BTBCN command.
V9	2024/07/18	Kerwin Shen	1. Optimize chapter structure and report examples. 2. Add AT@MAG command.

continues on next page

Table 1 – continued from previous page

Version	Date	Author	Description of Change
V8	2024/07/05	Kerwin Shen	1. Add subcode 35H into Data 102. 2. Define 'Sequence Number' in Data 101/102. 3. Add Bit5 definition for 'Connectivity' in Data 120. 4. Add Type 2 into AT@UPD command. 5. Modify AT@NET command. 6. Add AT@TOF command. 7. Add AT@LBS command. 8. Delete Data 86.
V7	2024/06/07	Kerwin Shen	1. Add a description for the 'Flexible Field' in ACK/NACK. 2. Modify AT@CFG command. 3. Add Bit5 definition for 'Connectivity' in Data 120.
V6	2024/04/26	Kerwin Shen	1. Add AT@LBS command. 2. Add Data 86. 3. Add Data 100. 4. Add AT@WIFIGEO command. 5. Add Record 63H. 6. Add Data 154. 7. Add Data 155.
V5	2024/04/10	Kerwin Shen	1. Add AT@BTBCN command. 2. Add Record 95H. 3. Add Data 178. 4. Add Data 179. 5. Add Data 180. 6. Add Data 181. 7. Add AT@ETH command. 8. Add Record 80H. 9. Add Data 122.
V4	2024/04/01	Kerwin Shen	1. Modify Data 97.
V3	2024/01/24	Kerwin Shen	1. Add 'Battery Percentage' parameter to Location SMS. 2. Add Record 05H. 3. Modify Data 97. 4. Correct some descriptions.
V2	2023/09/22	Kerwin Shen	1. Add 'Record Count Number' into report frame. 2. Modify the description of 'Generated Time' in report frame. 3. Modify Data 22. 4. Modify AT@CFG command.
V1	2023/09/11	Kerwin Shen	Initial.

8.3 Terms and Abbreviations

In this document, unless otherwise specified, **"terminal"** and **"device"** both refer to terminal device designed by Queclink. In addition, this document also contains the following terms and abbreviations:

Abbreviations	Description
ACK	Acknowledgement
AGPS	Assisted Global Position System
APN	Access Point Name
ASCII	American National Standard Code for Information Interchange
BER	Bit Error Rate
BLE	Bluetooth Low Energy
CPU	Central Processing Unit
DTC	Diagnostic Trouble Code
ECU	Electronic Control Unit
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Position System
GSM	Global System for Mobile Communication
HDOP	Horizontal Dilution of Precision
HTTP	HyperText Transfer Protocol
ICCID	Integrated Circuit Card Identity
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IoT	Internet of Things
IP	Internet Protocol
LAC	Location Area Code
LTE	Long Term Evolution
MCC	Mobile Country Code
MCU	Micro Controller Unit
MIL	Malfunction Indicator Lamp
MNC	Mobile Network Code
MO	Mobile Originated
MQTT	Message Queuing Telemetry Transport
MT	Mobile Terminated
NFC	Near Field Communication
NTP	Network Time Protocol
OBD	On-Board Diagnostics
PID	Parameter ID
PLMN	Public Land Mobile Network
RAT	Radio Access Technology
RSSI	Received Signal Strength Indicator
RPM	Revolutions per Minute
RTMP	Real Time Messaging Protocol
SIM	Subscriber Identity Module
SMS	Short Message Service
SN	Serial Number
SSID	Service Set Identifier
SVOD	Streaming Video On Demand
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
UTC	Coordinated Universal Time

continues on next page

Table 2 – continued from previous page

Abbreviations	Description
VIN	Vehicle Identification Number
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity

8.4 Copyright