A76XX Series_GNSS_Dynamic_Loading_Instructions_Application Note

LTE Module

SIMCom Wireless Solutions Limited
SIMCom Headquarters Building, Building 3, No. 289 Linhong Road, Changning District, Shanghai P.R. China
Tel: 86-21-31575100
support@simcom.com
www.simcom.com

Document Title:	A76XX Series_GNSS_Dynamic_Loading_Instructions_Application Note
Version:	1.00
Date:	2021.11.10
Status:	Released

GENERAL NOTES

SIMCOM OFFERS THIS INFORMATION AS A SERVICE TO ITS CUSTOMERS, TO SUPPORT APPLICATION AND ENGINEERING EFFORTS THAT USE THE PRODUCTS DESIGNED BY SIMCOM. THE INFORMATION PROVIDED IS BASED UPON REQUIREMENTS SPECIFICALLY PROVIDED TO SIMCOM BY THE CUSTOMERS. SIMCOM 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 SIMCOM 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.

COPYRIGHT

THIS DOCUMENT CONTAINS PROPRIETARY TECHNICAL INFORMATION WHICH IS THE PROPERTY OF SIMCOM WIRELESS SOLUTIONS LIMITED COPYING, TO OTHERS AND USING THIS DOCUMENT, ARE FORBIDDEN WITHOUT EXPRESS AUTHORITY BY SIMCOM. OFFENDERS ARE LIABLE TO THE PAYMENT OF INDEMNIFICATIONS. ALL RIGHTS RESERVED BY SIMCOM IN THE PROPRIETARY TECHNICAL INFORMATION ， INCLUDING BUT NOT LIMITED TO REGISTRATION GRANTING OF A PATENT , A UTILITY MODEL OR DESIGN. ALL SPECIFICATION SUPPLIED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE AT ANY TIME.

SIMCom Wireless Solutions Limited
SIMCom Headquarters Building, Building 3, No. 289 Linhong Road, Changning District, Shanghai P.R. China
Tel: +86 21 31575100
Email: simcom@simcom.com

For more information, please visit:
https://www.simcom.com/download/list-863-en.html

For technical support, or to report documentation errors, please visit:
https://www.simcom.com/ask/ or email to: support@simcom.com

Copyright © 2021 SIMCom Wireless Solutions Limited All Rights Reserved.

About Document

Version History

Version	Date	Owner	What is new
V1.00	2021.11.02	Wenjun.cai	New version

Scope

This document can apply to the A76XX series of SIMCom ASR1603 and ASR1803 platforms.

SIMCom Confidential

Contents

1 Introduction

1.1 Purpose of the document

This document mainly introduces GNSS dynamic loading and common customer problems of GNSS.

1.2 Related documents

[1] A76XX Series_AT Command Manual

1.3 Conventions and abbreviations

In this document, the terms used in GNSS dynamic loading are as follows:

- GPS (Global navigation system);
- GNSS (Global Navigation Satellite System);
- GSV (GPS satellites in view)

SIMCom Confidential

2 Overview of GNSS Dynamic Loading

2.1 Function description

GNSS dynamic loading is a function provided by GNSS chip manufacturers to upgrade the built-in firmware of GNSS chip. In the GNSS hardware design as a non-independent GNSS solution, the GNSS dynamic loading transfers the boot load file Bootloader and firmware file Firmware provided by the GNSS manufacturer to the GNSS chip through the UART3 of the module, and the GNSS chip loads and runs the upgraded firmware version by itself. Currently, the dynamic loading supported by our SDK is limited to non-independent GNSS solutions. In the GNSS hardware design as an independent GNSS solution, the GNSS dynamic loading requires the customer to refer to the dynamic loading scheme provided by the GNSS manufacturer (the required information needs to be asked for by the software development engineer).

2.2 Reasons of GNSS dynamic loading

GNSS dynamic loading mainly solves the problems of slow positioning of the original built-in firmware of the GNSS chip, serious static drift, and inconsistent factory firmware of the GNSS chip.

2.3 GNSS dynamic loading conditions

The serial port resistance connected to the serial port of GNSS chip needs to be changed from 10K to 1K (as shown in Figure 1), because in the process of GNSS dynamic loading, high baud rate will be used for data transmission, and 10K resistance will cause distortion of the data waveform sent by uart3 to GNSS chip, resulting in dynamic loading failure.

If it is an old version that does not support GNSS dynamic loading, the resistance can also be changed, but there will be leakage current. This problem has been fixed in the new version.

SIMCom Confidential

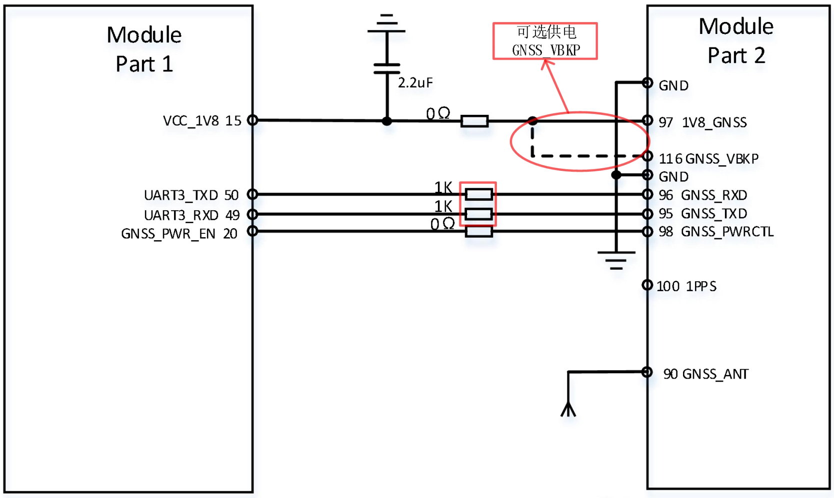


Figure 1: GNSS reference schematic diagram (non-independent GNSS solution)

SIMCom Confidential

3 The use of GNSS Dynamic Loading

3.1 Principle of operation

GNSS dynamic loading transfers the curing software package provided by the GNSS chip manufacturer to the GNSS chip through the main control module, thereby updating the original firmware of the GNSS chip. The firmware file is the curing software package. In order for the GNSS chip to correctly receive the firmware and load it, it also needs to transmit a loading file Bootloader to it. Therefore, the content of GNSS dynamic loading is to let the GNSS chip enter the upgrade window, and transmit the two files to the GNSS chip in turn, and the GNSS chip will load and run by itself.

3.2 GNSS dynamic loading operation process

The GNSS dynamic loading operation process is roughly shown in Figure 2:

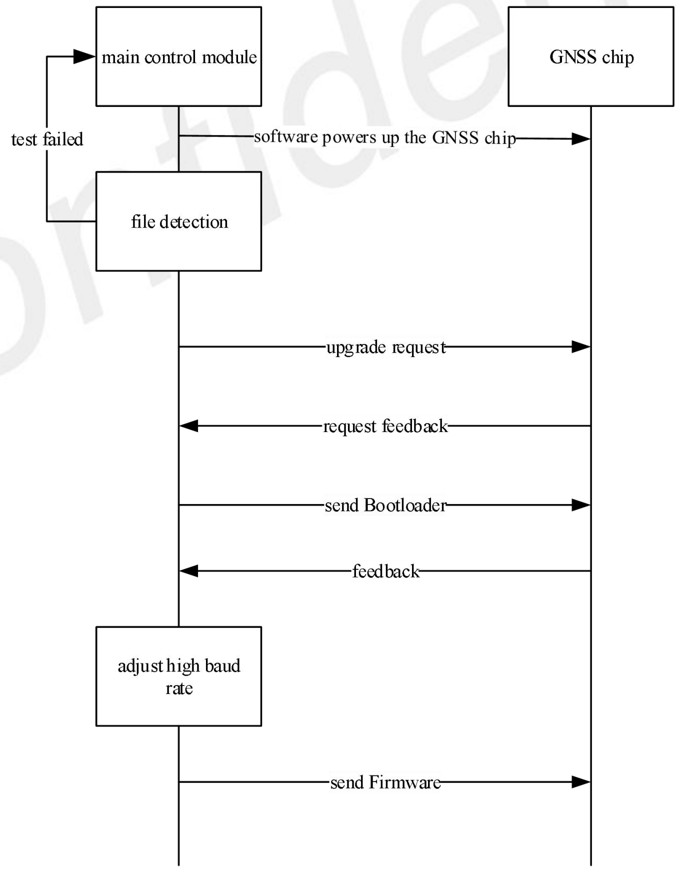


Figure 2: GNSS dynamic loading operation flow chart

1. When GNSS chip is powered on by software control, the main control module will query whether there are bootloader and firmware files required for dynamic loading in the local file system, and check their data integrity;

2. When it is detected that the two files are correct, it enters the dynamic loading process: after sending the upgrade request and receiving the feedback, the bootloader file is transmitted to GNSS chip through serial port using XMODEM protocol. After the transmission is completed, GNSS chip automatically runs the bootloader file, and the main control module detects that the bootloader is started;

3. The main control module adjusts the serial port to high baud rate mode and transmits the firmware file to GNSS chip using XMODEM protocol.

4. After the file transfer is completed, the GNSS chip starts to run with the incoming new firmware version. So far, the dynamic loading of GNSS ends, and the whole process takes about 9 seconds.

3.3 GNSS dynamic loading built-in file operation process

In the non-independent GNSS solution, the specific transmission and detection in the GNSS dynamic loading has been implemented in the version code. If you need to use this function, you need to provide the Bootloader file and the Firmware file to the main control module.

The standard version SDK package released after July 2021 already contains the two files required for dynamic loading; you only need to burn directly to the module to automatically run dynamic loading when the GNSS chip is powered on.

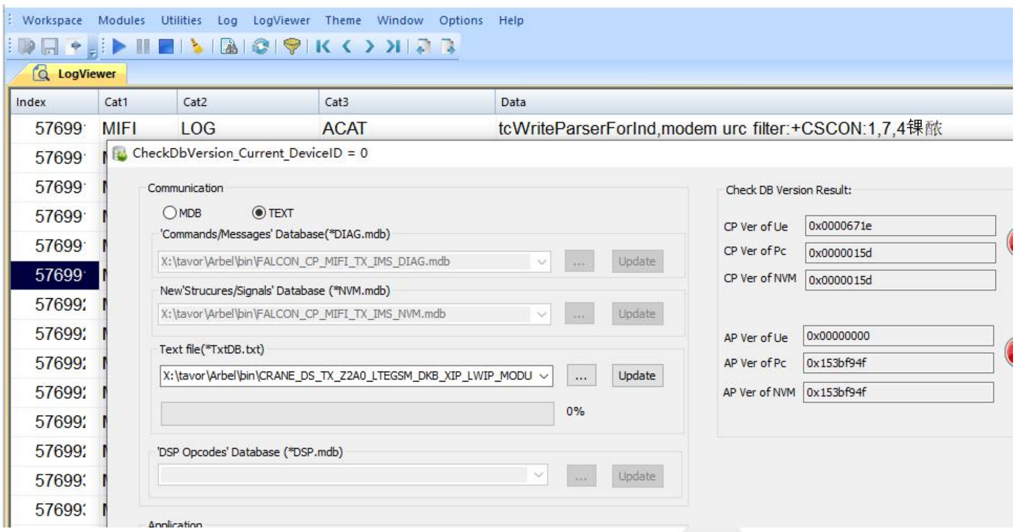
If you need to cancel the dynamic loading function, you can also refer to the following method to use the CATStudio software to delete the dynamic loading file in the file system.

The secondary development SDK package or the previous standard version SDK package needs to refer to other methods to provide dynamic loading files to the module.

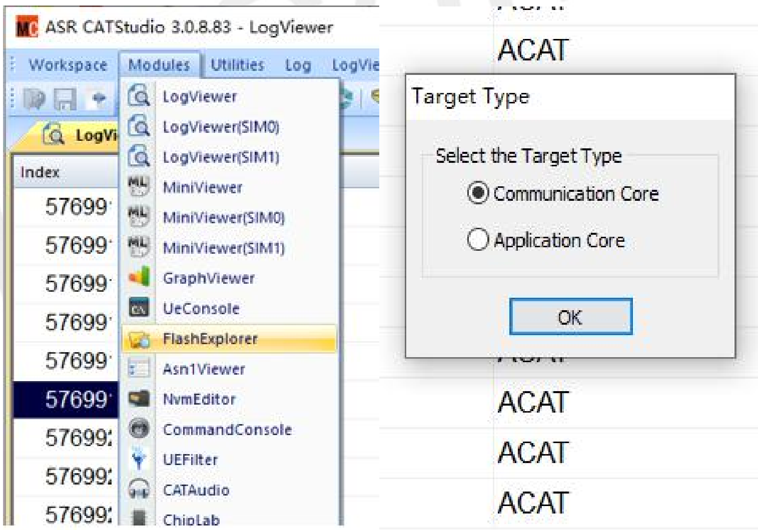
The following describes the steps of how to dynamically load files with built-in GNSS in the ASR1603 platform:

Step 1: Use the debugging tool CATStudio software to enter the file system in the module flash, and copy the two files to the file system. The specific operations are as follows:

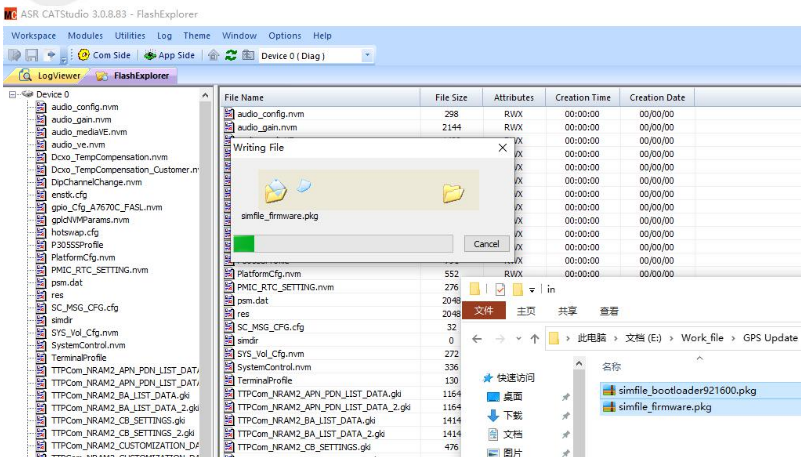
1. When the module is running normally, open the CATStudio software and configure the mdb file corresponding to the running version of the module.



2. Open "FlashExplorer" in the control bar "Module" and select Communication Core to enter the module file system.



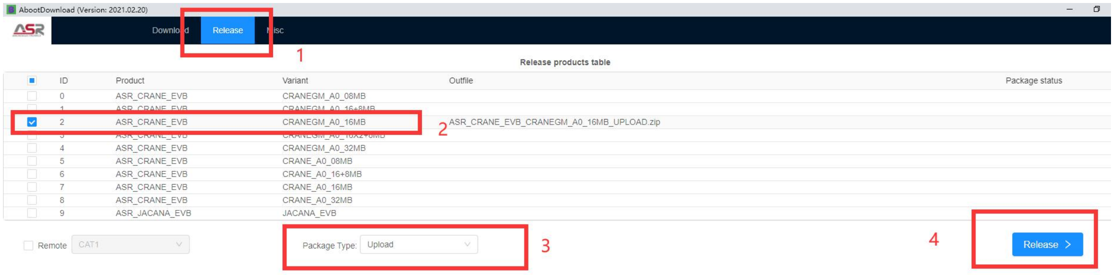
3. Copy the two files required for dynamic loading to the file system, and the dynamic loading will automatically run when the GNSS is powered on next time.



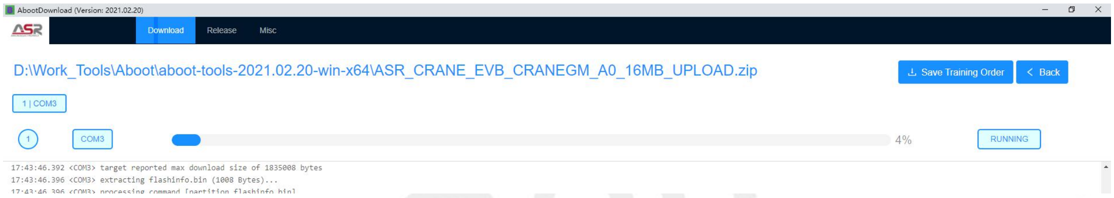
Step 2: Add built-in files to the SDK package where the required files do not exist:

SIMCom Confidential

1. Open the tool Aboot, select Release, check the corresponding module version, the Package Type is Upload, and then Release is packaged.

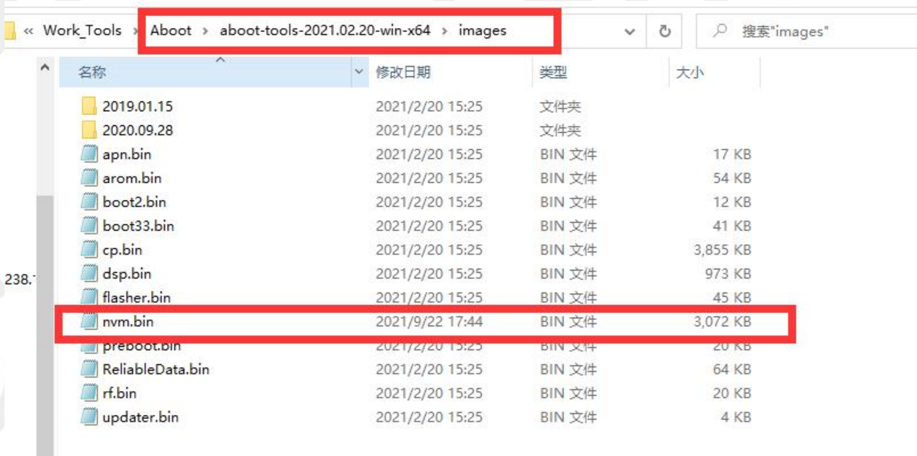


2. Burn the packed package into the module.

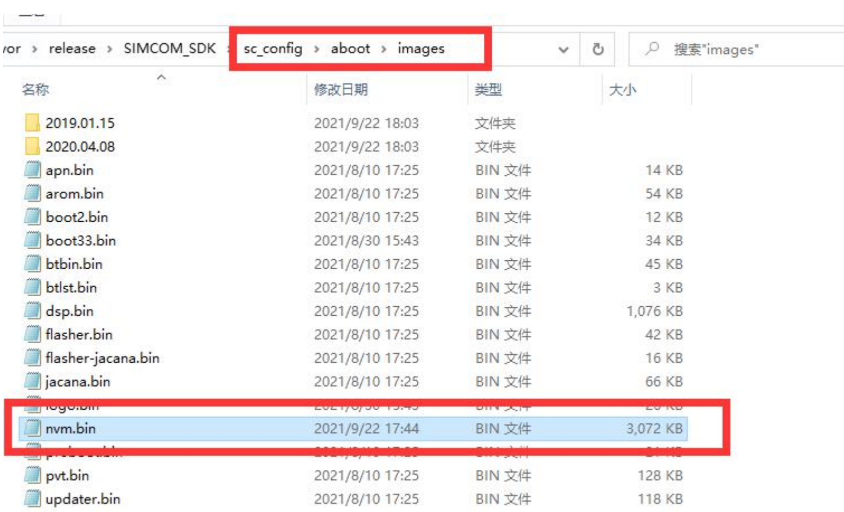


3. After the burning is completed, the Upload folder will be generated in the installation directory of the Aboot tool, take out the nvm.raw file in the folder, rename it to nvm.bin, and put it in the path corresponding to aboot. There are differences between the standard version and the secondary development placement. The specific placement directories are as follows:

   Standard version: placed in the images directory under the aboot installation directory:

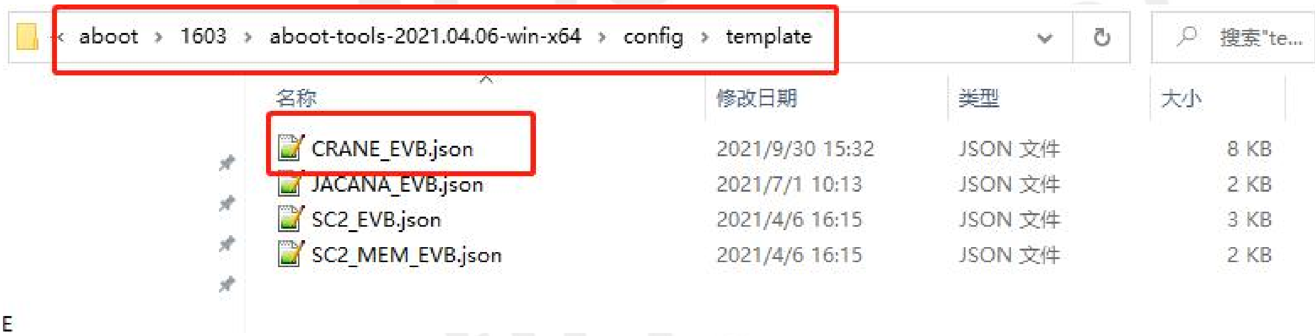


   Secondary development version: placed in the sc_config\aboot\images directory in the secondary development SDK package:

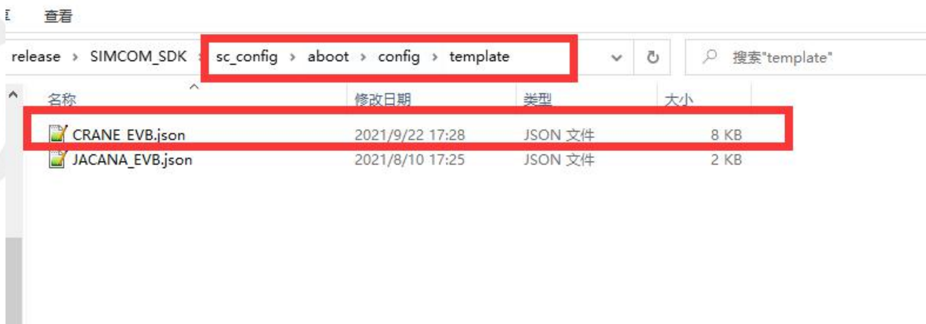


4. Modify the CRANE_EVB.json file, the standard version and the secondary development are placed in different locations. The specific placement directories are as follows:

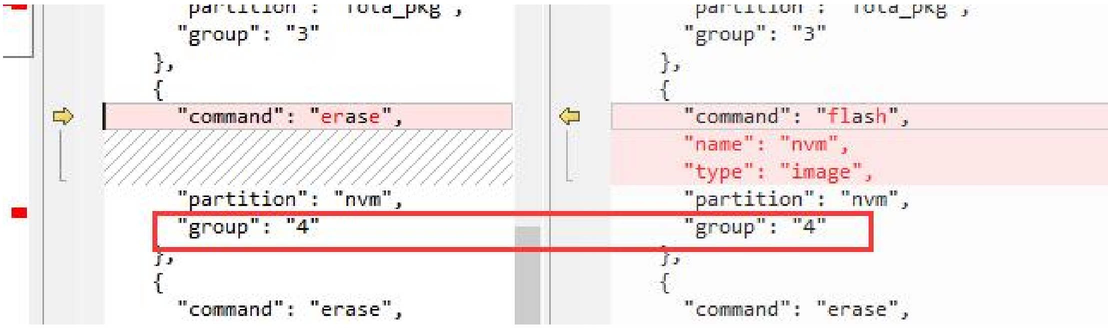
Standard version: under the config\template directory under the aboot installation directory:



Secondary development version: in the sc_config\aboot\config\template directory of the secondary development SDK package:



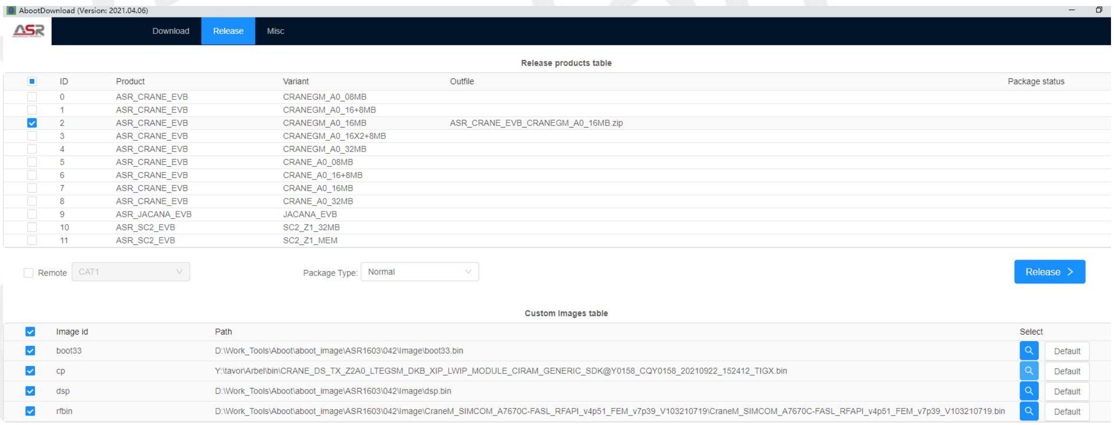
Modify the command in the CRANE_EVB.json file: "group": "4", the modified content is as follows:



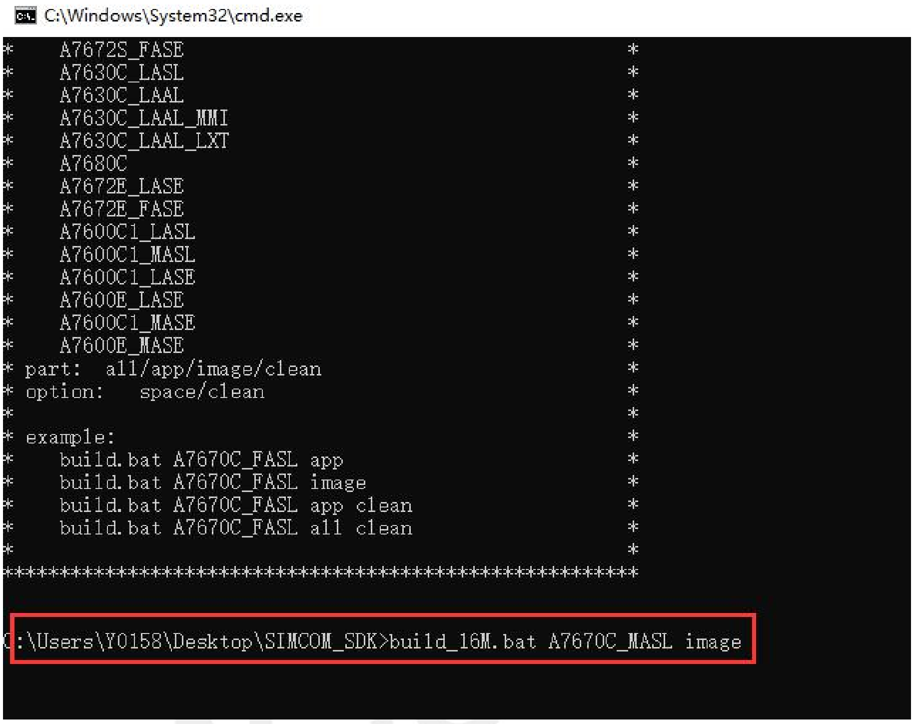
And add the following content after "name": "customer_app":

5. Repack:

Standard version: repackage with aboot:



Secondary development version: re-image in the secondary development SDK package:



So far, the repackaged software package already contains the two files required for dynamic loading. You only need to burn directly to the module to use the dynamic loading function.

3.4 GPS usage process with GNSS dynamic loading

After the two files required for dynamic loading are built into the module, the module will automatically run the GNSS dynamic loading function during the GNSS power-on operation. This function takes about 9 seconds to run alone. During the GNSS dynamic loading process, the GNSS chip cannot be operated (including using AGNSS, setting the GNSS baud rate, output frequency, etc.), but you can query the current GNSS dynamic loading status by querying the GNSS baud rate:

9600: The baud rate of serial port 3 when it is not dynamically loaded and when it is just turned on;

230400: The baud rate to start dynamic loading;

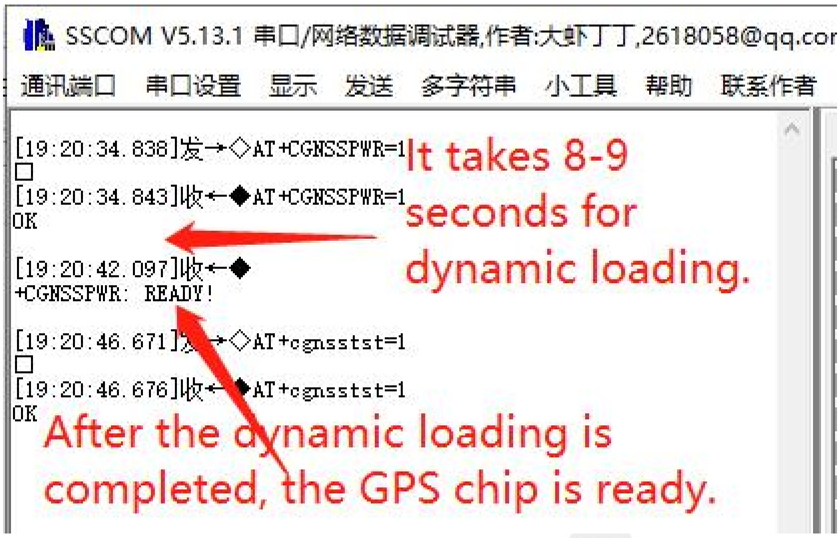
921600: During dynamic loading;

115200: Dynamic loading ends.

The usage process of the standard version and the secondary development version is as follows:

1. Standard version:

   In the standard version, the AT command is used to operate the module, and the realization of the dynamic loading function is included in the GNSS power-on command AT+CGNSSPWR=1. The specific process is as follows:



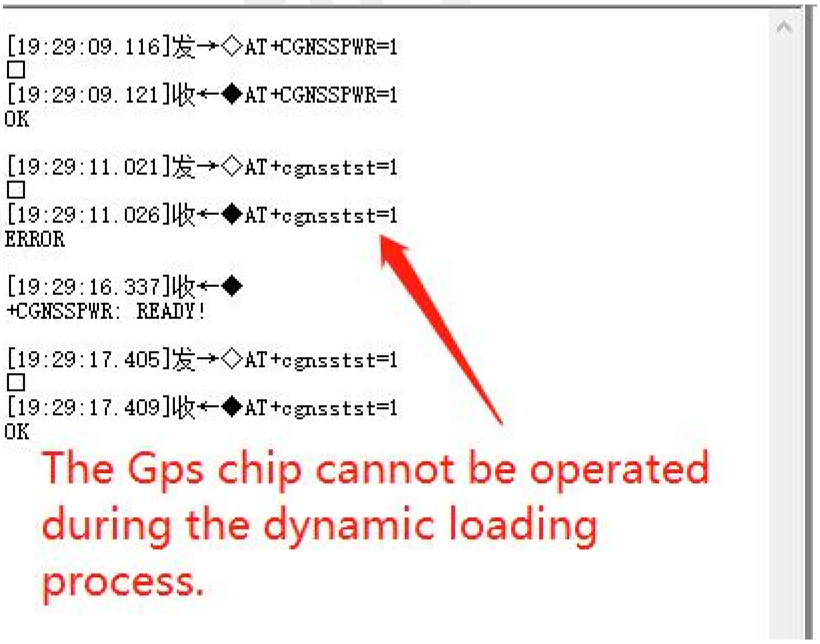
As shown above:

(1) AT+CGNSSPWR=1 //Power on the GNSS chip.

(2) Wait for the module to report: +CGNSSPWR: READY!

(3) Perform other GNSS operations, such as AT+CGNSSTST=1 (output the nmea data of the GNSS chip from the nmea port).

When the GNSS chip is in the dynamic loading process for 9 seconds, no other command control can be performed on the GNSS until the module actively reports the GNSS ready information (+CGNSSPWR: READY!):



2. Secondary development version (demo process):
   (1) After the module is turned on normally, the UI interface is output from the full-function Uart port (uart1), and input 24 to select the GNSS function:

SIMCom Confidential

```
Please select an option to test from the items listed below.

*************************************************************
1.  NETWORK                      2.  SIMCARD
3.  SMS                          4.  UART
5.  USB                          6.  GPIO
7.  PMU                          8.  I2C
9.  AUDIO                        10.  FILE SYSTEM
11.  TCPIP                       12.  HTTP
13.  FTP                         14.  MQTT
15.  SSL                         16.  FOTA
17.  LBS                         18.  NTP
19.  HTP                         20.  INTERNET SERVICE
21.  TTS                         22.  CALL
23.  WIFI                        24.  GNSS
25.  LCD                         26.  RTC
27.  FLASH                       29.  SPI
30.  CAM                         31.  APP UPDATE
32.  LE CLIENT                   33.  SPI NOR
*************************************************************
```

(2) After entering the GNSS function interface, enter 1 to enter the GNSS chip power control:

```
Please select an option to test from the items listed below, demo
just for GNSS.

*************************************************************
1.  GNSS power status             2.  Get NMEA data
3.  GNSS start mode               4.  GNSS baud rate
5.  GNSS mode                     6.  GNSS nmea rate
7.  GNSS nmea sentence            8.  GPS information
9.  GNSS information              10.  Send command to GNSS
11.  AGPS                         99.  back
*************************************************************
```

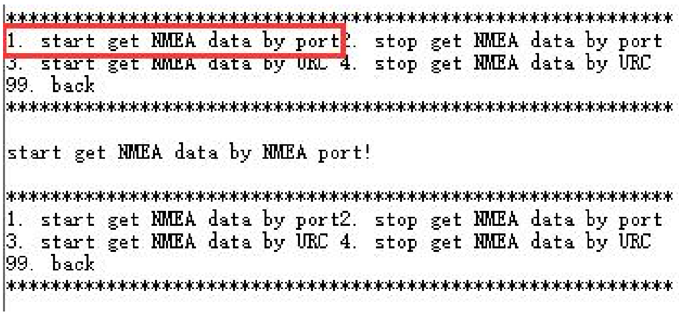
(3) After entering the GNSS chip power control interface, enter 1 to power on the GNSS chip:

```
*************************************************************
1.  power on                      2.  power off
3.  get power status              99.  back
*************************************************************

set power on!

*************************************************************
1.  power on                      2.  power off
3.  get power status              99.  back
*************************************************************
```

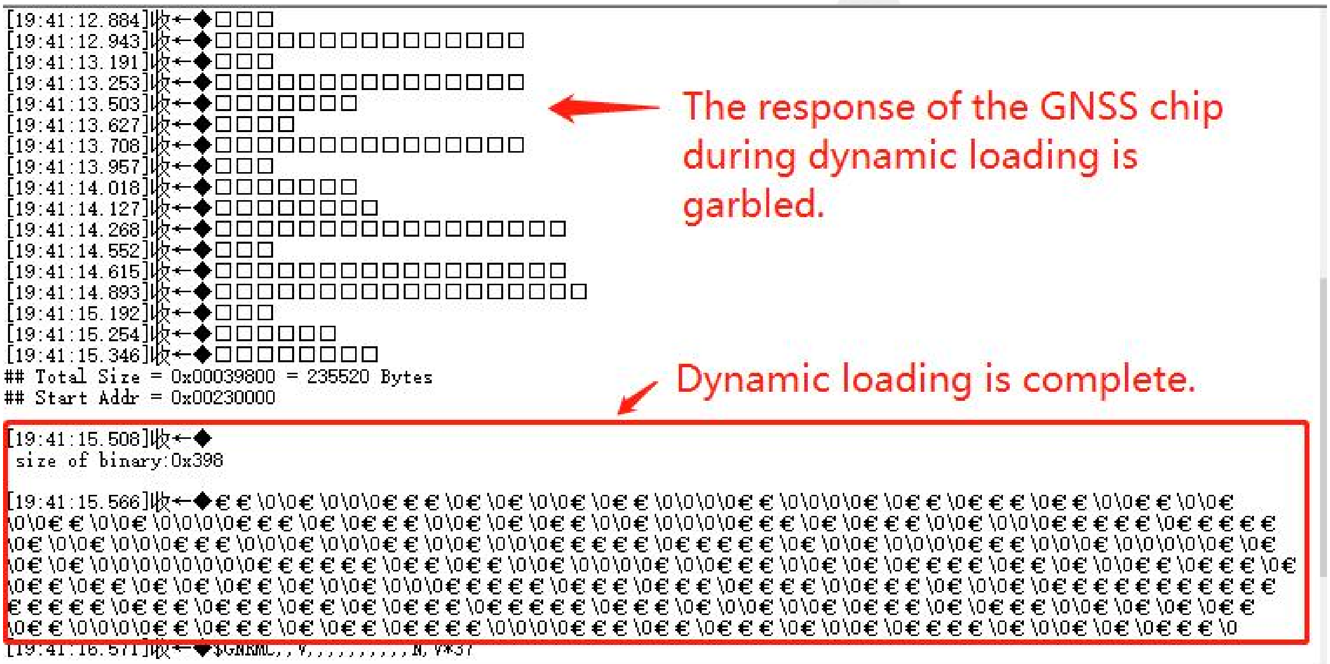
(4) After powering on the GNSS, enter 99 to return to the GNSS function UI interface, and enter 2 to enter the GNSS chip data output control function:

```
Return to the previous menu!

*************************************************************
1.  GNSS power status             2.  Get NMEA data
3.  GNSS start mode               4.  GNSS baud rate
5.  GNSS mode                     6.  GNSS nmea rate
7.  GNSS nmea sentence            8.  GPS information
9.  GNSS information              10.  Send command to GNSS
11.  AGPS                         99.  back
*************************************************************
```

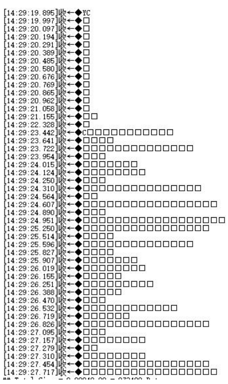
(5) After entering the GNSS chip data output control interface, enter 1 to choose to output the GNSS chip data to the NMEA port:



(6) At this time, you can see the data receiving information (unparsed garbled) fed back by the GNSS during the dynamic loading process in the NMEA port:



Due to the time delay caused by the switching between the functions of the UI interface, most of the time you can see the dynamic loading garbled as above. When the garbled is output, the dynamic loading function is completed, and the GNSS chip starts to output NMEA data normally. The garbled response generated during the entire dynamic loading process is as follows (the entire dynamic loading time is approximately 8-9 seconds):



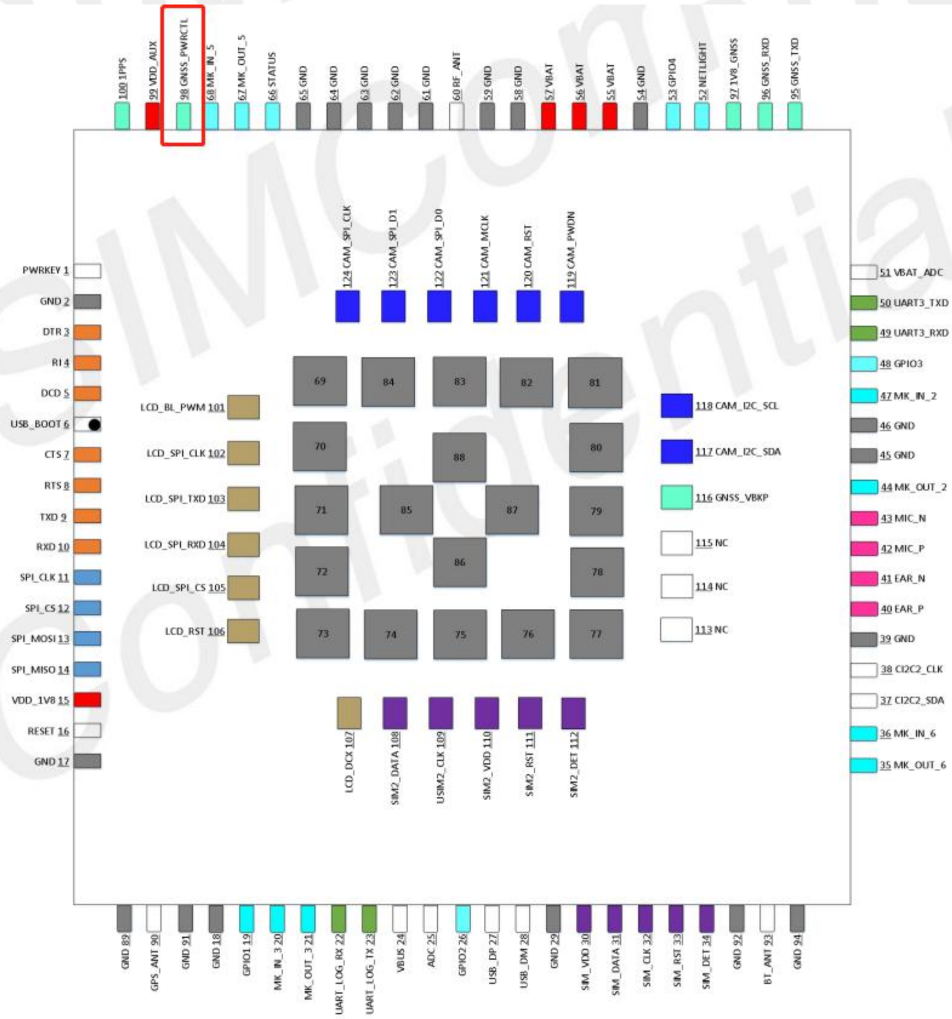
4 Common Problems in the Use of GNSS

4.1 Why can't I see nmea sentence output after waiting for a while after powering on the GPS?

Answer: Generally, it is because the dynamic loading fails. The common problems are divided into the following situations:

(1) The resistance between TX RX of GPS and RX TX of UART3 is not replaced with 1K, or 10K resistance. At this time, replacing the resistance with 1K can be solved.

(2) After calling the GPS power API in the secondary development or after inputting AT+CGNSSPWR=1 in the standard version, measure whether the GPS power pin is powered on with a voltage of 1.8v. The pin diagram is as follows:



(3) In the secondary development, let the customer check whether the GPS power pin is pulled up twice. The GPS power pin is low by default when the power is turned on, and the dynamic loading will fail when the power is turned on twice.

4.2 The GPS antenna is connected, but the GPS cannot be located for a long time, why?

Answer: (1) GPS antennas are divided into active antennas and passive antennas. The TE board of the ASR1603 module only supports passive antennas by default. If you want to use an active antenna, you need to modify the TE board, short-circuit L1 at the GPS antenna port of the TE board, refer to the following figure:

(2) After the antenna is tested correctly, check the GPS signal-to-noise ratio (GSV field in the nmea sentence). If the signal-to-noise ratio is too bad, it indicates environmental impact. Generally, the signal-to-noise ratio below 30 cannot be located.

4.3 After dynamic loading, the GNSS module still shows serious static drift after positioning.

Answer: Because the GNSS module is not in static hold mode by default, after the GPS is running normally, the standard version sends the command: AT+CGNSSCMD=0," $CFGDYN,h02,1,100". Call API for secondary development: sAPI_SendCmd2Gnss("$CFGDYN,h02,1,100"), where parameter 100 is the set speed threshold in static holding mode, the unit is cm/s, this value 0 will close the static holding mode. This command can be saved when the GPS chip model is UC6226NIS, but cannot be saved when the model is UC6228CI.

SIMCom Confidential

4.4 How to check the software version of the current GPS chip?

Answer: Standard version: AT+CGNSSCMD=0, "$PDTINFO". Call api for secondary development: sAPI_SendCmd2Gnss("$PDTINFO"). After sending, the GPS chip model can be viewed in the nmea sentence.

4.5 How to check whether AGPS is successfully downloaded to the GPS chip?

Answer: Method 1 Send the command to check whether the injection is successful: Standard version: AT+CGNSSCMD=0, "$AIDINFO". Call api for secondary development: sAPI_SendCmd2Gnss("$AIDINFO"). The detailed fields are explained as follows:

$AIDINFO,GPSRS,GPSUS,BDSRS,BDSUS,GALRS,GALUS,GLORS,GLOUS,AType		
Example: **$AIDINFO,003FFFFFF7,000000FA00,0000003F7F,0000001A3F,0000000000,0000000000,,,7**		
Name	**Example**	**Description**
GPSRS	003FFFFFF7	For GPS ephemeris reception status, as long as the received data passes the check, the corresponding bit is set to 1. If the GPS system is not enabled, this field is empty.
GPSUS	000000FA00	If the GPS ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the GPS system is not enabled, this field is empty.
BDSRS	0000003F7F	For the receiving state of the BDS ephemeris, as long as the received data passes the check, the corresponding bit is set to 1. If the BDS system is not enabled, this field is empty.
BDSUS	0000001A3F	If the BDS ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the BDS system is not enabled, this field is empty.
GALRS	0000000000	For the receiving state of the GAL ephemeris, as long as the received data passes the check, the corresponding bit is set to 1. If the GAL system is not enabled, this field is empty.
GALUS	0000000000	If the GAL ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the GAL system is not enabled, this field is empty.
GLORS		For the receiving state of the GLO ephemeris, as long as the received data passes the check, the corresponding bit is set to 1. If the GLO system is not enabled, this field is empty.
GLOUS		If the GLO ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the GLO system is not enabled, this field is empty.
Atype	7	Auxiliary type bit0-3: with GPS/BDS/GAL/GLO ephemeris assistance.

		bit4: the auxiliary position is valid. bit5: use auxiliary positions. bit6-7: reserve. bit8: the auxiliary time is valid. bit9: use auxiliary time. bit10-15: reserve.

Method 2 is to grab the catstudio log to check whether it is successful, search the keyword aGPS_handle_thread, and check whether there is "received data over, colse socket" printed. If there is a print, it is successfully downloaded to the GPS chip.

4.6 How long is the validity of AGPS real-time ephemeris data?

Answer:

GPS satellite ephemeris is valid for 4 hours;

BDS satellite ephemeris is valid for 2 hours;

The validity period of the GLO satellite ephemeris is 0.5 hours;

The GAL satellite ephemeris is valid for 4 hours.

It is recommended that customers update once every hour.

SIMCom Confidential