Telit K3 Firmware Upgrade Application Note

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APPLICABILITY TABLE

PRODUCTS

- SE868-A
- SE868K3-A
- SE868K3-AL
- SE878K3-A
- SL871
- SL871L
- SL869-V2
- SL869L-V2
- SC872-A
- SC874-A
- SE868-A
- SE868K3-A
- SE868K3-AL

CONTENTS

FIGURE LIST

1. INTRODUCTION

1.1. Scope

This document describes the firmware upgrade procedure (also widely known as “flashing”) supported by Telit’s MT33xx flash-based GNSS modules (see the Applicability table above for the complete list) using the NMEA serial port.

This procedure is defined by MediaTek® and it includes the commands, data formats, and downloading protocol between a host and an MT33xx flash-based client module in a typical application environment.

It is useful for those who are interested in designing and implementing a host system that communicates with the Telit’s GNSS module families and provides the firmware update functionality.

1.2. Audience

This document is intended for public distribution to potential customers who are evaluating a GNSS module from the V13 firmware family listed in the Applicability Table. It can also be used by customers who are interested in designing and implementing a host system that communicates with the Telit’s GNSS module families and want to integrate the firmware update functionality.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:

https://www.telit.com/contact-us

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

[1] Telit SE868xx-A Family Product User Guide, 1VV0301201
[2] Telit SL871 Family Product User Guide, 1VV0301170
[3] Telit SL869x-V2 Family Product User Guide, 1VV0301175
[4] Telit SC872-A Product User Guide, 1VV0301202
[5] V13 Software User Guide, 1VV0301162

2. FIRMWARE UPDATE PROCEDURE

2.1. Overview

Telit's MT33xx flash-based GNSS module firmware can be updated using MediaTek's BROM protocol using the serial host interface. The BROM protocol splits the flash update procedure in three steps: Start procedure, Download Agent Injection, and Download BIN File.

The Firmware Update process starts with the Start procedure; this latter requires sending the NMEA_START_CMD ($PMTK180), that puts the module in binary mode, and performing a handshake in binary mode.

The Download Agent (DA) is a target side application that allows to perform the flash download via serial host interface. The Download Injection step allows to download and request the execution of the Download Agent on target side.

Finally, the Download BIN File step allows to write the firmware to target side flash.

3. START PROCEDURE

3.1. Command: CMD_Start

This is the first command sent to the GNSS module to start the update procedure.

In this command, the host will sequentially set its baud rate for serial communication and send the NMEA_START_CMD ($PMTK180) at each baud rate to force the target reset.

Then, the host settles at the highest or desirable baud rate (such as 115200) that is also supported by the GNSS module to start the update process.

The sequence is started by a number of predefined values in byte-exchange manner with the GNSS module, to ensure that the communication is established, and the update mode is set at the GNSS module.

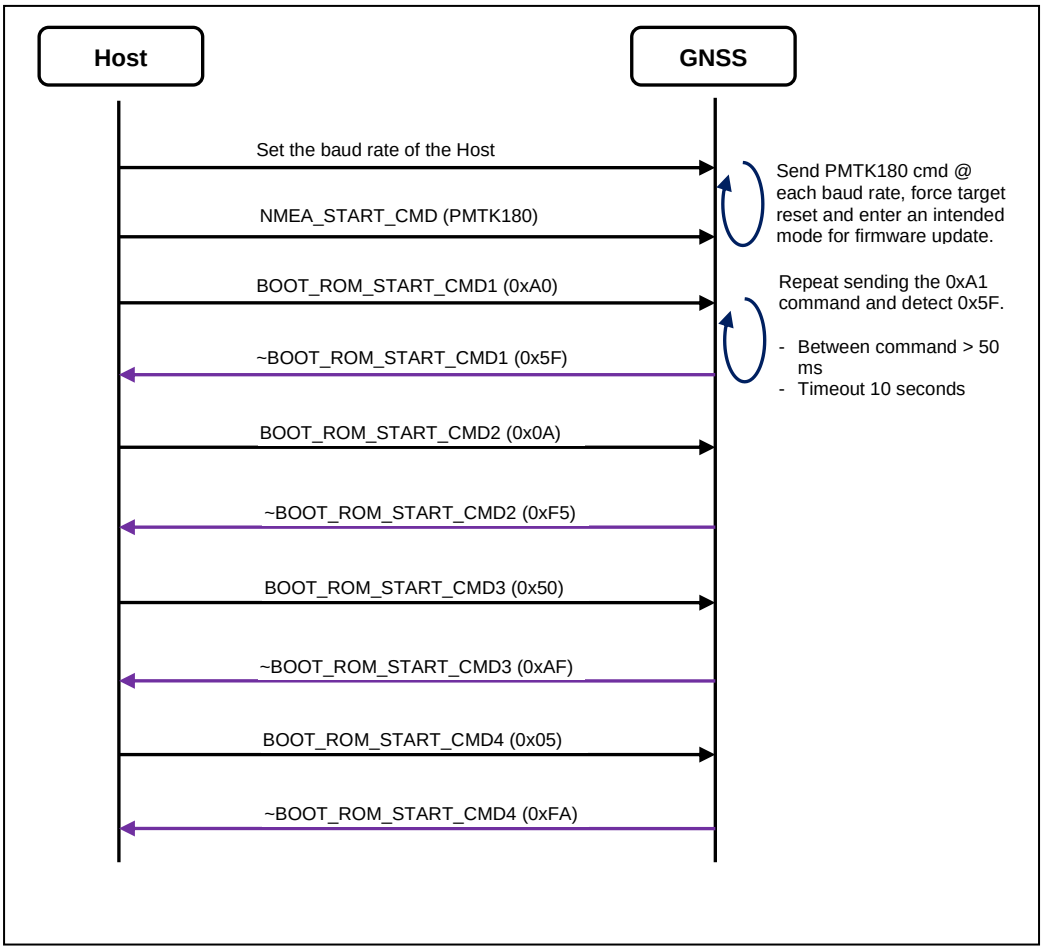

Figure 3-1 Flow of CMD_Start

Set the baud rate of the Host, to enable sending the NMEA_START_CMD to the GNSS module. Among the baud rates for serial port communication (nominal from 4800 and up), the baud rate 115200 is the recommended value.

BOOT_ROM_START_CMD1 (0xA0): This command needs to be sent repeatedly, if the expected ~BOOT_ROM_START_CMD1 (0x5F) is not received by the host. The nominal interval between each resend of the command is 50ms.

3.2. Command: CMD_Write

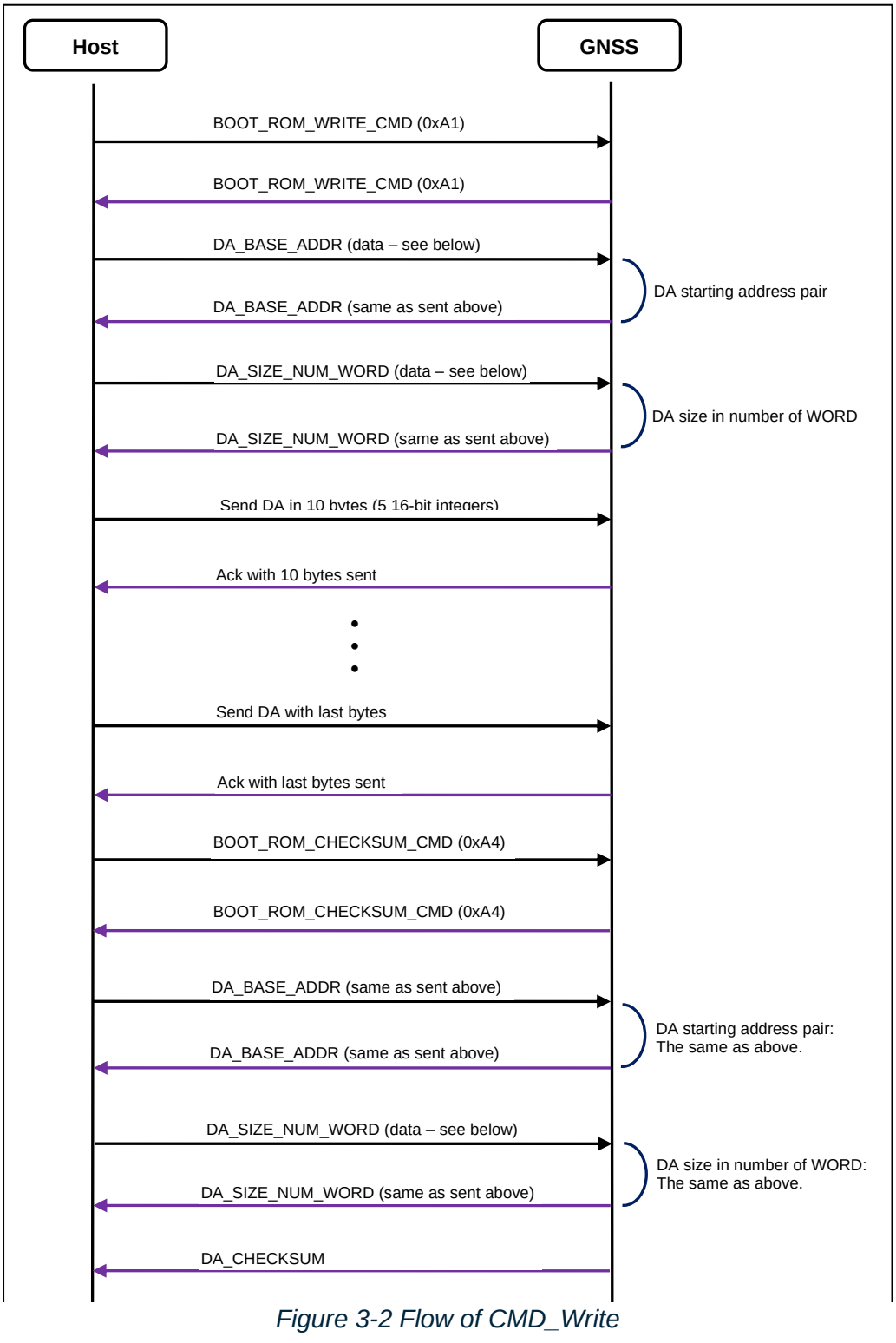

Figure 3-2 Flow of CMD_Write

Data arguments:

- DA_BASE_ADDR

For modules that are MT3329 or later, MT3333 included, the DA starting address is 3072 (0x0000 0C00):

DA_BASE_ADDR (0x00 0x00 0x0C 0x00)

- DA_SIZE_NUM_WORD

The DA size in WORDs = 5946 (0x0000 173A) (bytes = 23784)

DA_SIZE_NUM_WORD (0x00 0x00 0x17 0x3A)

- DA data format

The DA data is sent in packets of 5, 16-bit unsigned integers. This means if the size of the DA data in bytes is not an even number – there will be a solo byte to be sent at the end of the DA file - the downloading code has to form a 2-byte value with padding a 0x00 value as the high byte, to satisfy the protocol requirement.

It is not required, however, for the data sent in 5 such integers as specified above. The protocol allows that the remaining integers (the number of integers can be < 5) are sent at the end of the DA file.

- DA_CHECKSUM

A simple exclusive-OR algorithm is applied to all bytes of a DA data file that are sent to the module to get the 16-bit checksum values generated. Based on this requirement and pertaining to the flow chart above, this checksum does not apply to the DA_BASE_ADDR command and the DA_SIZE_NUM_WORD command.

4. DOWNLOAD AGENT INJECTION

4.1. Command: CMD_Jump

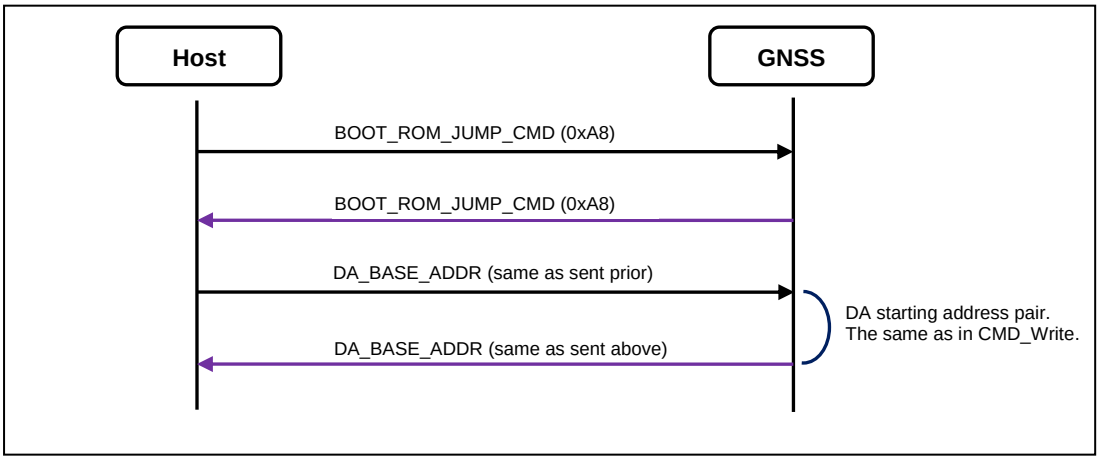

Figure 4-1 Flow of CMD_Jump

4.2. DA Information Report

When DA is downloaded and executed, it will report 20 bytes data with the following information:

(1) SYNC_CHAR (one byte)

(2) DA_VERSION (two bytes)

(3) FLASH_DEVICE_ID (one byte)

(4) FLASH_SIZE (four bytes)

(5) FLASH_HW_ID (eight bytes)

(6) EXT_SRAM_SIZE (four bytes).

- SYNC_CHAR:

When DA is executed, it will return SYNC_CHAR (0xC0). If the return byte is not SYNC_CHAR, it means it is possibly downloading a wrong DA.

- DA_VERSION:

After SYNC_CHAR, DA will return DA's version number to BROM DLL, it contains two bytes, one is major version, and the other is minor version. BROM DLL will check whether if it supports this DA.

- FLASH_DEVICE_ID:

After reporting the DA version, DA will automatically detect the flash type on target. If DA supports this flash, then the flash device id will return to BROM DLL. If DA does not support this flash, it will return 0xFF to indicate unknown flash type.

- FLASH_SIZE:

Four bytes flash size, for example: 128Mbits (16Mbytes) flash will be 0x01000000 bytes;

DA will send 0x01, 0x00, 0x00, and 0x00.

- FLASH_MANUFACTURE_CODE:

Two bytes flash manufacture code. (Users should refer to the datasheet for each flash.)

- FLASH_DEVICE_CODE:

Two bytes flash device code. (Users should refer to the datasheet for each flash.)

- FLASH_EXT_DEVICE_CODE1:

Two bytes flash extended device code1. (Users should refer to the datasheet for each flash.)

- FLASH_EXT_DEVICE_CODE2:

Two bytes flash extended device code2. (Users should refer to the datasheet for each flash.)

- EXT_SRAM_SIZE:

Four bytes external SRAM size, for example: 64Mbits (8Mbytes) external SRAM will be 0x00800000 bytes; DA will send 0x00, 0x80, 0x00, and 0x00.

4.3. Command: CMD_SetMemBlock

This command is used to notify DA, the total memory block count and the range for each block. The memory block information indicates how many BIN files will be downloaded and the range of each BIN file.

If any memory block exceeds the flash size, DA will return NACK (0xA5) immediately to indicate the DA_MEM_CMD command has failed.

If all the download memory blocks are valid, DA will return ACK (0x5A) and UNCHANGED_BLOCK_COUNT to notify PC side how many unchanged blocks should be recovered after downloading.

Data arguments:

- MEM_BLOCK_COUNT (N):

The number of ROM files to be downloaded and the same number of the memory blocks to be allocated by the module.

Where the number of the ROM file is 1, then N = 1.

- BLOCK_1: BEGIN_ADDRESS:

The starting address for the ROM file in memory, for the block 1.

- BLOCK_1: END_ADDRESS:

The end address for the ROM file in memory, for the block 1.

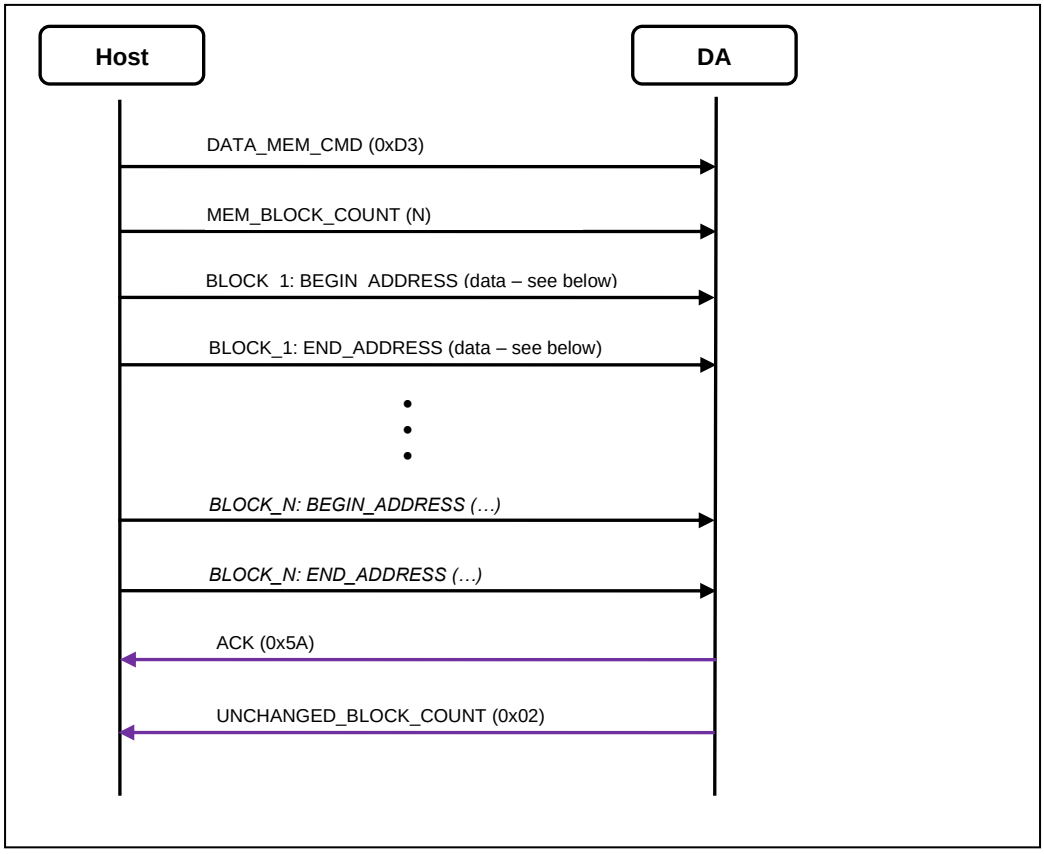

Figure 4-2 Flow of CMD_SetMemBlock

According to the protocol requirements, the ROM file is sent in packets with the fixed length of 256 bytes (plus additional checksum of 2 bytes). When there are not enough bytes of data to be sent, such as the last packet at the end of the file (the remaining bytes < 256), the downloading shall fill padding zeros for the rest of the packet.

As a result of the requirement, the END_ADDRESS of a memory block must include the additional padding bytes in size.

Example:

If the ROM file size is 500324 bytes long, there is an expected length of 156 bytes padding bytes being appended to the remaining bytes of the ROM file in the last packet. END_ADDRESS shall be the total size – 1.

5. DOWNLOAD BIN (ROM) FILE

5.1. Command: CMD_WriteData

This command is used to write all the data of BIN files to target side flash. Every packet is fixed length; that is PACKET_LENGTH plus two bytes checksum.

If DA successfully received this packet, it will return CONT_CHAR (0x69) to notify BROM DLL continues to send the next packet.

As stated in the section 4.3 Command: CMD_SetMemBlock, the last packet is usually not enough for PACKET_LENGTH, the code shall fill 0x00 as padding until it reaches PACKET_LENGTH.

Finally, DA will perform checksum of all the BIN files from flash and compare with the checksum from UART. If both checksums are the same, DA will return ACK (0x5A) that means they are successfully written to flash, otherwise, return NACK (0xA5) to indicate errors.

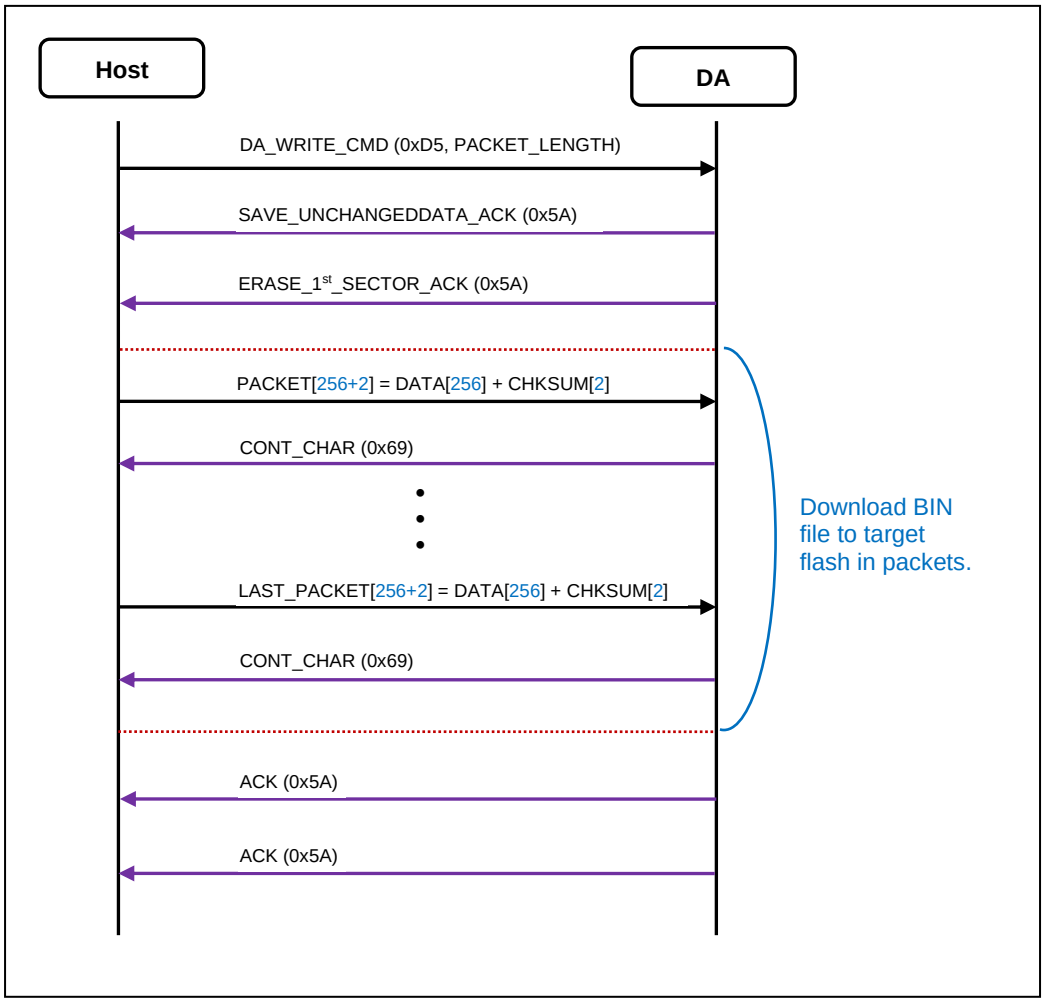

Figure 5-1 Flow of CMD_WriteData

Data:

- For PACKET_LENGTH = 256:

DA_WRITE_CMD (0xD5 0x00 0x00 0x01 0x00)

5.2. Command: CMD_Finish

This command is used to notify DA to power off target by unlocking the RTC power key. The firmware update procedure is thus complete and the GNSS module will restart automatically.

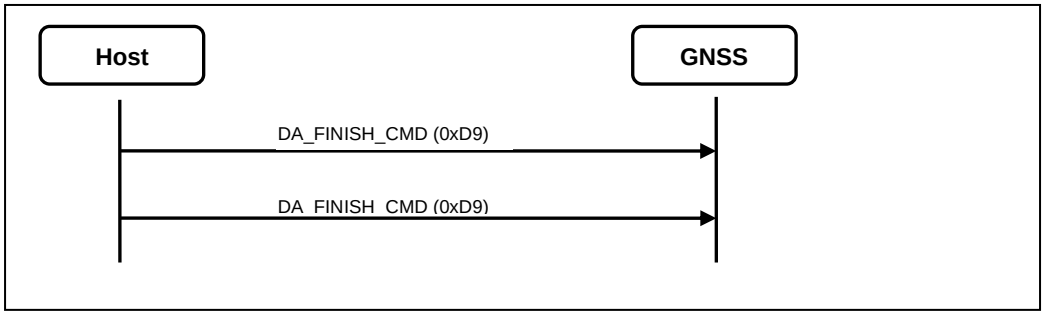

Figure 5-2 Flow of CMD_Finish

6. ACRONYMS

	Description
ASCII	American Standard Code for Information Interchange
BE	Broadcast Ephemeris
DGPS	Differential Global Positioning System
DOP	Dilution of Precision
EPO	Extended Prediction Orbit
NMEA	National Marine Electronics Association
PRN	Pseudo-Random Noise
SRAM	Static Random Access Memory
UTC	Co-ordinated Universal Time
RTC	Real Time Clock

7. DOCUMENT HISTORY

Revision	Date	Changes
0	2020-09-16	First issue

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