BG95-S5 Terminal Device Development Notes

Satellite Communication Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2024-07-24	Monas KONG	Creation of the document
1.0	2024-09-25	Monas KONG	First official release

Contents

Table Index

1 Introduction

This document outlines important notes and considerations for developing terminal devices that utilize the Quectel BG95-S5 module.

If you encounter any challenges during the development process, you can refer to this document to identify potential solutions to the same or similar issues and quickly solve them. This approach helps to prevent serious issues in both development and commercial deployment, ultimately enhancing the overall development efficiency.

2 Notes

During the development of the terminal device, it is recommended to thoroughly read the notes regarding key considerations for the operations listed below. Due to the limited scope of this document, detailed explanations of the underlying reasons and potential consequences are not included in this chapter. If you have any questions, please contact Quectel Technical Support. For more information about AT commands mentioned in this chapter, refer to *document [1]*, or contact Quectel Technical Support.

2.1. Software Version

Cross-baseline software version updates are not supported. To illustrate, in version "BG95S5LAR08…", "R08" represents the baseline information. Quectel modules with this software version cannot be updated to non-"R08" versions such as "BG95S5LAR09…".

When placing orders for mass production, it is necessary to specify the software version that has undergone successful debugging to avoid cross-baseline upgrades during production.

2.2. Watchdog Logic Design

To avoid extended periods of module inactivity in unforeseen scenarios, it is recommended to incorporate an external MCU watchdog into the product design. This watchdog should monitor the operational status of the module and trigger a reboot in case it detects any malfunction or improper operation.

2.3. Key File and Configuration Management

It is recommended to manage specific key files and configurations during product program design. During device upgrades and reboots, configurations should be verified to ensure they match the expected settings. In case of any discrepancies, reconfiguration should be performed. For important files stored in the module's file system, such as certificates and vital configuration files, you must back up the file system (using **AT+QPRTPARA=1** and **AT+QPRTPARA=11** commands) both when the device exits the factory and after any storage operations performed on the application side.

2.4. Storage Medium Operation

The following operations involve erasing and writing to the flash memory. To extend the service life of the flash, please minimize triggering the operations listed below. Under no circumstances should these operations be performed in an unlimited cycle. Keep the total number of daily operations within 30 times.

- Bootup/shutdown
- Executing **AT+CFUN=0**, **AT+CFUN=1** and **AT+CFUN=4** by turns
- Switching (U)SIM cards
- Repeatedly executing commands for setting the NVM

2.5. AT Command Operation

Do not send AT commands to the module in multithreading mode. Instead, send AT commands to the module in single-thread or queue mode. In addition, please do not send the next AT command until you have received the previous AT command response. AT commands should only be sent after the system reports an **APP RDY** URC.

2.6. Recommended Operation Process for Network Anomalies

If the module fails to register on the network after bootup, it is recommended to follow the operation process below:

1. In case of initial network registration failure, allow a 2-minute time window for the module to search for available networks.
2. If the registration remains unsuccessful after the initial network registration, execute **AT+CFUN=4** and **AT+CFUN=1** by turns.
3. If the registration still fails after **AT+CFUN=4** and **AT+CFUN=1** switching, introduce progressively longer waiting periods for each subsequent attempt: wait for 4 minutes for the second attempt, 8 minutes for the third attempt, 16 minutes for the fourth attempt, and 32 minutes for the fifth attempt. Repeat executing **AT+CFUN=4** and **AT+CFUN=1** by turns after each waiting period.
4. If the module fails to register on the network after five consecutive attempts with **AT+CFUN** commands, to protect the module's flash memory, please set **AT+CFUN=0** or power off the module.

2.7. DFOTA

The module supports DFOTA, enabling remote upgrading or downgrading. It is crucial to maintain a stable power supply to the module during the DFOTA process. In case of power interruption during an upgrade, there is a small probability that the flash will be damaged. To address software bugs and facilitate version updates throughout project development, it is recommended that your products retain OTA upgrade capability. For debugging purposes and mass production, please obtain the delta upgrade packages from Quectel Technical Support.

The size of the available delta firmware package is constrained by the flash memory allocated for storing the delta firmware and the DFOTA algorithm. As a result, the firmware package size may vary depending on the firmware version. The maximum flash space available for the DFOTA package is automatically calculated by the module and you can retrieve this information by the **AT+QFOTADL=12** command.

In the DFOTA mode, only the App works normally while the modem is not loaded. In this mode, the main UART cannot receive AT commands and can solely transmit DFOTA URCs at the baud rate specified by **AT+IPR**. Supported baud rates for URC reporting include 4800, 9600, 19200, 38400, 115200, 230400, 460800, and 921600 bps. If an unsupported baud rate is set, the module defaults to 115200 bps for URC reporting. Additionally, the USB port is inactive in this mode.

After a smooth "**DOWNLOADING**" process, the module resets to enter the DFOTA mode. When the "**UPDATING**" process is finished, the module restarts and starts up in a normal mode.

If the module loses power during the "**UPDATING**" process, it will automatically re-enter the DFOTA mode and resume the interrupted firmware update upon being powered on again.

If SSL certificates are required to download the firmware package from an HTTPS server, they must be uploaded to the */datatx* directory in APP EFS and renamed according to specific rules. For detailed instructions, please refer to the DFOTA function introduction document.

2.8. Secure Boot

Secure Boot can only be enabled on the production line. It cannot be enabled through OTA upgrade or AT commands.

2.9. Performance Assurance of the Integrated Device Products

To guarantee the optimal performance of the product during its commercial application, it is recommended to conduct comprehensive RF performance testing prior to commercialization.

2.10. Network registration

Once the module is powered on with a SIM card inserted, it will automatically search the network and try to register available networks.

For the BG95-S5 module, each RAT (TN or NTN) operates independently. Unless specific conditions are met, such as the expiration of the IRAT timer or HPLMN search timer, the module switches to another RAT only when the current RAT has no available network or when the signal strength is insufficient for normal communication. Additionally, certain AT commands are available to configure the enabled RATs (see *document [2]*). It is recommended to manually switch between RATs via AT commands.

During the NTN registration process, GNSS switching occurs automatically without the need for manual intervention. However, it is essential to ensure GNSS antennas are connected. This means that users only need to enable NTN RAT and wait for network registration, without using any GNSS-related AT commands.

2.11. Crash Mode

The default mode when the module crashes is the Reset mode. When the module crashes in the Reset mode, it will automatically restart. You can set the mode to Sahara mode during debugging. When the module crashes in the Sahara mode, RAM information will be collected and saved as a dump log. You can track the cause of the crash through the dump.

It is important to note that if your module is deployed in a production environment, set the mode when it crashes to the Reset mode. This precautionary measure ensures that the module does not enter the Sahara mode, which could render it unable to resume normal operations after a crash.

3 Appendix References

Table 1: Related Documents

Document Name
[1]   Quectel_BG95-S5_AT_Commands_Manual
[2]   Quectel_BG95-S5_QCFG_AT_Commands_Manual

Table 2: Terms and Abbreviations

Abbreviation	Description
App	Application
DFOTA	Delta Firmware Upgrade Over-The-Air
MCU	Microcontroller Unit
NVM	Non-Volatile Memory
OTA	Over-the-air programming
(U)SIM	(Universal) Subscriber Identity Module
RAT	Radio Access Technology
NTN	Non-terrestrial Network
TN	Terrestrial Network
HPLMN	Home Public Land Mobile Network