RGx00U&RM500U Series
Software Thermal Management Guide

5G Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2023-03-08	Achang ZHANG	Creation of the document
1.0	2023-03-30	Achang ZHANG	First official release

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1 Introduction

This document introduces related AT commands of temperature query and the cooling strategy of Quectel RG200U-CN, RG500U series and RM500U-CN modules.

2 AT Commands Description

2.1. AT Command Introduction

2.1.1. Definitions

- **<CR>** Carriage return character.
- **<LF>** Line feed character.
- **<...>** Parameter name. Angle brackets do not appear on the command line.
- **[...]** Optional parameter of a command or an optional part of TA information response. Square brackets do not appear on the command line. When an optional parameter is not given in a command, the new value equals its previous value or the default settings, unless otherwise specified.
- **Underline** Default setting of a parameter.

2.1.2. AT Command Syntax

All command lines must start with **AT** or **at** and end with **<CR>**. Information responses and result codes always start and end with a carriage return character and a line feed character: **<CR><LF><response><CR><LF>**. In tables presenting commands and responses throughout this document, only the commands and responses are presented, and **<CR>** and **<LF>** are deliberately omitted.

Table 1: Types of AT Commands

Command Type	Syntax	Description
Test Command	**AT+<cmd>=?**	Test the existence of the corresponding command and return information about the type, value, or range of its parameter.
Read Command	**AT+<cmd>?**	Check the current parameter value of the corresponding command.
Write Command	**AT+<cmd>=<p1>[,<p2>[,<p3>[...]]]**	Set user-definable parameter value.
Execution Command	**AT+<cmd>**	Return a specific information parameter or perform a specific action.

2.2. Declaration of AT Command Examples

The AT command examples in this document are provided to help you learn about the use of the AT commands introduced herein. The examples, however, should not be taken as Quectel's recommendations or suggestions about how to design a program flow or what status to set the module into. Sometimes multiple examples may be provided for one AT command. However, this does not mean that there is a correlation among these examples, or that they should be executed in a given sequence.

2.3. AT+ QTEMP Get Temperature Information

This command queries real-time temperatures of 4G RF sensor, 5G RF sensor, EVB sensor and SoC sensor.

AT+QTEMP Get Temperature Information	
Test Command **AT+QTEMP=?**	Response **OK**
Execution Command **AT+QTEMP**	Response **+QTEMP: <sensor>,<temp>** **…** **OK**
Maximum Response Time	300 ms
Characteristics	-

Parameter

<sensor>	String type. Sensor type. "soc-thermal" SoC sensor "pa-thermal" 4G RF sensor "pa5g-thermal" 5G RF sensor "board-thermal" EVB sensor
<temp>	Integer type. Temperature. Unit: ºC.

Example

```
AT+QTEMP
+QTEMP: "soc-thermal","29"
+QTEMP: "pa-thermal","29"
+QTEMP: "pa5g-thermal","29"
+QTEMP: "board-thermal","30"

OK
```

3 Cooling Strategy

RG200U-CN, RG500U series and RM500U-CN modules adopt the following strategies:

Thermal mitigation strategy in AP: AP collects soc-thermal temperature to implement the corresponding thermal mitigation strategies.

- Thermal mitigation strategy in IPA. IPA is enabled when the soc-thermal temperature reaches 70 ºC. The PID algorithm is used by reducing the CPU clock speed and the running number of CPU cores when the temperature reaches 85 ºC.
- Thermal mitigation strategy in shutdown. To protect the module, the software is powered off when the soc-thermal temperature reaches 110 ºC and the hardware is powered off when the temperature reaches 120 ºC.

Thermal mitigation strategy in CP: CP collects pa-thermal and pa5g-thermal temperatures to implement the corresponding thermal mitigation strategy.

- Thermal mitigation strategy in power back-off. The module collects the temperature of RF sensor automatically and reduces 4G/5G PA power according to the change of temperature. The thermal mitigation strategy of 4G and 5G PA are independent, but the power back-off mechanism is the same.

When PA temperature reaches 98 ºC, the module reduces the PA power by 2 dBm in a certain cycle with a cumulative maximum power back-off value of 6 dBm.
When PA temperature reaches 100 ºC, the module reduces the PA power by 8 dBm.
When PA temperature reaches 105 ºC, the module reduces the PA power by 10 dBm.

4 Appendix Reference

Table 2: Terms and Abbreviations

Abbreviation	Description
AP	Application Processor
CP	Control Plane
CPU	Central Processing Unit
EVB	Evaluation Board
IPA	Intelligent Power Allocation
PA	Power Amplifier
PID	Proportional Integral Derivative
SoC	System-on-a-Chip