EC2x&EG2x&EG9x Series

Power Back-off Application Note

LTE Standard Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2022-08-18	Galen ZHOU	Creation of the document
1.0	2024-06-25	Link XUE	First official release

Contents

Table Index

1 Introduction

This document explains how to implement the power back-off function of EC2x family, EG2x family and EG9x family modules in the corresponding GSM/WCDMA/LTE network technology through AT commands.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Family	Module
EC2x	EC20-CE
	EC21 Series
	EC25 Series
EG2x	EG21-G
	EG25-G
	EG21-GL
	EG25-GL
EG9x	EG91 Series
	EG95 Series

2 Description of AT Commands

2.1. AT Command Syntax

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 2: 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. Description of Power Back-off AT Commands

2.3.1. AT+QSAR Set SAR Power Back-off Level for GSM/WCDMA/LTE

This command sets SAR power back-off level for GSM/WCDMA/LTE.

AT+QSAR Set SAR Power Back-off Level for GSM/WCDMA/LTE	
Test Command **AT+QSAR=?**	Response **+QSAR: (**list of supported **<level>**s**),(**list of supported **<save>**s**)** **OK** Or **ERROR** If there is any error related to ME functionality: **+CME ERROR: <err>**
Read Command **AT+QSAR?**	Response **+QSAR: <level>** **OK** Or **ERROR** If there is any error related to ME functionality: **+CME ERROR: <err>**
Write Command **AT+QSAR=<level>[,<save>]**	Response **OK** Or **ERROR** If there is any error related to ME functionality: **+CME ERROR: <err>**

Maximum Response Time	500 ms
Characteristics	The command takes effect immediately. **<save>** determines whether the configuration will be saved after power-off.

Parameter

<level>	Integer type. SAR power back-off level in GSM/WCDMA/LTE. Range: 0–8. 0 Disable SAR power back-off function 1–8 SAR power back-off level for GSM/WCDMA/LTE. Each SAR power back-off level has a corresponding SAR power back-off value. For the default maximum SAR power back-off value corresponding to level1–level8, please refer to ***Table 3***. The maximum SAR power back-off value of level1-level8 can be configured through **AT+QCFG="sarcfg"** in ***Chapter 2.3.2***
<save>	Integer type. Whether to save the configuration to NVM. 0 Not save 1 Save
<err>	Integer type. Error code. See ***document [1]*** for details.

Table 3: Default Maximum SAR Power Back-off Value Corresponding to <level>

Network Technology	<level>	Default Maximum SAR Power Back-Off Value
GSM	1	GMSK 28 dBm 8PSK 23 dBm
	2	GMSK 27 dBm 8PSK 22 dBm
	3	GMSK 26 dBm 8PSK 21 dBm
	4	GMSK 25 dBm 8PSK 20 dBm
	5	GMSK 24 dBm 8PSK 19 dBm
	6	GMSK 23 dBm 8PSK 18 dBm
	7	GMSK 22 dBm 8PSK 17 dBm
	8	GMSK 21 dBm 8PSK 16 dBm
WCDMA	1	23 dBm
	2	22 dBm

	3	21 dBm
	4	20 dBm
	5	19 dBm
	6	18 dBm
	7	17 dBm
	8	16 dBm
LTE	1	23 dBm
	2	22 dBm
	3	21 dBm
	4	20 dBm
	5	19 dBm
	6	18 dBm
	7	17 dBm
	8	16 dBm

Example

```
AT+QSAR=?
+QSAR: (0-8),(0,1)

OK
AT+QSAR?
+QSAR: 0

OK
AT+QSAR=1
OK
```

NOTE

You should execute this command first, and then execute **AT+QCFG="sarcfg"** referred to in ***Chapter 2.3.2***.

2.3.2. AT+QCFG="sarcfg" Set SAR Power Back-off Value for GSM/WCDMA/LTE

This command sets SAR power back-off value for GSM/WCDMA/LTE.

AT+QSAR Set SAR Power Back-off Level for GSM/WCDMA/LTE	
Write Command **AT+QCFG="sarcfg"[,<mode>[,<max_power>,<row_grads>,<column_grads>]]**	Response If the optional parameters are omitted, query the supported network technologies: **+QCFG: "sarcfg",("lte_wcdma","gsm"),max_power,row_grads,column_grads** **OK** If **<max_power>,<row_grads>** and **<column_grads>** are omitted, query SAR power back-off value for the specified network technology: **+QCFG: "sarcfg",<mode>,<max_power>,<row_grads>,<column_grads>** **OK** If the optional parameters are specified, set SAR power back-off value: **OK** If there is any error: **ERROR** If there is any error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	500 ms
Characteristics	This command takes effect after the module is rebooted. The configurations are saved automatically.

Parameter

<mode>	String type. Network technology. "lte_wcdma" LTE&WCDMA "gsm" GSM
<max_power>	Integer type. Maximum SAR power back-off value corresponding to the relevant SAR power back-off **<level>** referred to in **AT+QSAR**. If **<mode>**="gsm", the range is 600–3000. Default value: 2800. Unit: 0.01 dB. If **<mode>**="lte_wcdma", the range is 60–300. Default value: 230. Unit: 0.1 dB.

<row_grads>	Integer type. Difference between adjacent SAR power back-off levels. The value is smaller than **<max_power>**. If **<mode>**="gsm", default value is 100. Unit: 0.01 dB, i.e., approximately 1 dBm. If **<mode>**="lte_wcdma", default value is 10. Unit: 0.1 dBm, i.e., approximately 1 dBm.**<column_grads>** Integer type. SAR power back-off difference between adjacent GSM timeslots. This parameter is valid only when **<mode>**="gsm": The value is smaller than **<max_power>**. Range: 600-3000. Default value: 100. Unit: 0.01 dB. When **<mode>**="lte_wcdma", this parameter must be set to 0.

NOTE

Define Backoff(<level>) as the SAR power back-off value of **<level>** in **AT+QSAR**. **<level>** ranges from 1–8. When (**<max_power>** - **<row_grads>**) × **<level>** < 0, Backoff(<level>) = Backoff(<level>-1).

Example

```
AT+QCFG="sarcfg"
+QCFG: "sarcfg",("lte_wcdma","gsm"),max_power,row_grads,column_grads

OK
AT+QCFG="sarcfg","lte_wcdma"
+QCFG: "sarcfg","lte_wcdma",230,10,0

OK
AT+QCFG="sarcfg","lte_wcdma",230,10,0
OK
```

3 Appendix References

Table 4: Related Document

Document Name
[1] Quectel_EC2x&EG9x&EG2x-G&EM05_Series_AT_Commands_Manual

Table 5: Terms and Abbreviations

Abbreviation	Description
8PSK	8 Phase Shift Keying
GMSK	Gaussian Filtered Minimum Shift Keying
GSM	Global System for Mobile Communications
LTE	Long-Term Evolution
ME	Mobile Equipment
SAR	Specific Absorption Rate
TA	Terminal Adapter
WCDMA	Wideband Code Division Multiple Access