EG06xK&Ex120K&EM060K Series Power Back-off Application Note

LTE-A Module Series

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About the Document

Revision History

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-	2021-12-16	Kevin LI	Creation of the document
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1 Introduction

This document mainly introduces how to implement the power back-off function of EG06Xk, Ex120K and EM060K series modules under the corresponding WCDMA/LTE networks through AT commands.

2 Description of AT Commands

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 to 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 corresponding Write Command and return information about the type, value, or range of its parameter.
Read Command	**AT+<cmd>?**	Check the current parameter value of a corresponding Write 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 how to use the AT commands introduced herein. The examples, however, should not be taken as Quectel's recommendation or suggestions about how you should design a program flow or what status you should set the module into. Sometimes multiple examples may be provided for one AT command. However, this does not mean that there exists a correlation among these examples and that they should be executed in a given sequence.

2.3. Usage for Power Back-off AT Commands

Step 1: Configure the SAR power back-off level and whether to save the configurations after power-off through **AT+QSAR=<level>,[<save>]**. The command takes effect immediately.

Step 2: Configure the SAR power back-off value of level 1-level 8 for WCDMA/LTE through **AT+QCFG="sar_dsi"**. The default SAR power back-off value of level 1-level 8 for WCDMA/LTE is corresponding to 23-16 dBm. Please refer to **Table 3**.

2.4. Description of Power Back-off AT Commands

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

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

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

	Or
	ERROR
	If the error is related to ME functionality:
	+CME ERROR: <err>
Write Command **AT+QSAR=<level>[,<save>]**	Response **OK** Or **ERROR** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	500 ms
Characteristics	The command takes effect immediately. **<save>** determines whether the configurations will be saved after power-off.

Parameter

<level>	Integer type. SAR power back-off level for WCDMA/LTE. Range: 0–8.
	<u>0</u> Disable power back-off function
	1–8 SAR power back-off level for WCDMA/LTE. The default maximum SAR power back-off value of level 1-level 8, please refer to *Table 3*. The maximum SAR power back-off value of level 1-level 8 can be configured through **AT+QCFG="sar_dsi"**, please refer to *Chapter 2.4.2*.
<save>	Integer type. Whether to save the configuration to NVM. If this parameter is omitted, the configuration will not be saved after power-off by default.
	<u>0</u> Not save
	1 Save

Table 2: SAR Power Back-off Level and Value

Network	<level>	Sar$_{level(n)}$
WCDMA	1	Default maximum SAR power back-off value: 23 dBm
	2	Default maximum SAR power back-off value: 22 dBm
	3	Default maximum SAR power back-off value: 21 dBm
	4	Default maximum SAR power back-off value: 20 dBm
	5	Default maximum SAR power back-off value: 19 dBm

	6	Default maximum SAR power back-off value: 18 dBm
	7	Default maximum SAR power back-off value: 17 dBm
	8	Default maximum SAR power back-off value: 16 dBm
	1	Default maximum SAR power back-off value: 23 dBm
	2	Default maximum SAR power back-off value: 22 dBm
	3	Default maximum SAR power back-off value: 21 dBm
LTE	4	Default maximum SAR power back-off value: 20 dBm
	5	Default maximum SAR power back-off value: 19 dBm
	6	Default maximum SAR power back-off value: 18 dBm
	7	Default maximum SAR power back-off value: 17 dBm
	8	Default maximum SAR power back-off value: 16 dBm

Example

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

OK
AT+QSAR?
+QSAR: 0

OK
AT+QSAR=1
OK
```

2.4.2.   AT+QCFG="sar_dsi"   Set SAR Power Back-off Value for WCDMA/LTE

This command queries and configures SAR power back-off value for WCDMA/LTE.

AT+QSAR Set SAR Power Back-off Value for WCDMA/LTE	
Write Command **AT+QCFG="sar_dsi"[,<RAT>[,<band>,<DSI1>,<DSI2>,<DSI3>,<DSI4>,<DSI5>,<DSI6>,<DSI7>,<DSI8>]]**	Response If the optional parameters are omitted, query the SAR back-off parameters for all supported WCDMA/LTE bands: **+QCFG: "SAR_DSI",<RAT>,<band1>,<DSI1>,<DSI2>,<DSI3>,<DSI4>,<DSI5>,<DSI6>,<DSI7>,<DSI8>** **…**

	OK If **<band>**, **<DSI1>**, **<DSI2>**, **<DSI3>**, **<DSI4>**, **<DSI5>**, **<DSI6>**, **<DSI7>** and **<DSI8>** are omitted, query the SAR back-off value for current LTE/WCDMA bands: **+QCFG: "SAR_DSI",<RAT>,<band1>,<DSI1>,<DSI2>,<DSI3>,<DSI4>,<DSI5>,<DSI6>,<DSI7>,<DSI8>** … **OK** If the optional parameters are specified, set SAR power backoff value for LTE/WCDMA band: **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristics	The command takes effect after rebooting. The configurations will be saved automatically.

Parameter

<RAT>	String type. Radio Access Technology.
	"lte_wcdma" LTE and WCDMA
	"lte" LTE
	"wcdma" WCDMA (not supported currently)
<band>	Integer type. Supported LTE/WCDMA bands.
<band1>	String type. The supported LTE/WCDMA bands corresponding to **<band>**.
	WCDMA (not supported currently):

<band>	**<band1>**
1	WCDMA B1
2	WCDMA B2
3	WCDMA B3
4	WCDMA B4
5	WCDMA B5
8	WCDMA B8
9	WCDMA B9
11	WCDMA B11
19	WCDMA B19

LTE:

<band>	**<band1>**
1	LTE B1
2	LTE B2

3	LTE B3
4	LTE B4
5	LTE B5
6	LTE B6
7	LTE B7
8	LTE B8
9	LTE B9
10	LTE B10
11	LTE B11
12	LTE B12
13	LTE B13
14	LTE B14
17	LTE B17
18	LTE B18
19	LTE B19
20	LTE B20
21	LTE B21
23	LTE B23
25	LTE B25
26	LTE B26
27	LTE B27
28	LTE B28
30	LTE B30
34	LTE B34
38	LTE B38
39	LTE B39
40	LTE B40
41	LTE B41
42	LTE B42
43	LTE B43
46	LTE B46
47	LTE B47
48	LTE B48
66	LTE B66
71	LTE B71
250	LTE B250

<DSI1>	Integer type. SAR back-off value corresponding to DSI1 (device status index number 1). The value should be set as a multiple of 10. Range: 60–300. Default value: 230. Unit: 0.1 dBm.
<DSI2>	Integer type. SAR back-off value corresponding to DSI2 (device status index number 2). The value should be set as a multiple of 10. Range: 60–300. Default value: 220. Unit: 0.1 dBm.
<DSI3>	Integer type. SAR back-off value corresponding to DSI3 (device status index number 3). The value should be set as a multiple of 10. Range: 60–300. Default value: 210.

	Unit: 0.1 dBm.
<DSI4>	Integer type. SAR back-off value corresponding to DSI4 (device status index number 4). The value should be set as a multiple of 10. Range: 60–300. Default value: 200. Unit: 0.1 dBm.
<DSI5>	Integer type. SAR back-off value corresponding to DSI5 (device status index number 5). The value should be set as a multiple of 10. Range: 60–300. Default value: 190. Unit: 0.1 dBm.
<DSI6>	Integer type. SAR back-off value corresponding to DSI6 (device status index number 6). The value should be set as a multiple of 10. Range: 60–300. Default value: 180. Unit: 0.1 dBm.
<DSI7>	Integer type. SAR back-off value corresponding to DSI7 (device status index number 7). The value should be set as a multiple of 10. Range: 60–300. Default value: 170. Unit: 0.1 dBm.
<DSI8>	Integer type. SAR back-off value corresponding to DSI8 (device status index number 8). The value should be set as a multiple of 10. Range: 60–300. Default value: 160. Unit: 0.1 dBm.

Example

```
AT+QCFG="sar_dsi"
+QCFG: "SAR_DSI",<RAT>,<band1>,<DSI1>,<DSI2>,<DSI3>,<DSI4>,<DSI5>,<DSI6>,<DSI7>,<DSI8>

OK
AT+QCFG="sar_dsi","lte_wcdma"
+QCFG: "sar_dsi","lte_wcdma",LTE B2,230,220,210,200,190,180,170,160
…

OK
AT+QCFG="sar_dsi","lte",1,200,180,230,230,230,230,230,230

OK
```

3 Appendix References

Table 3: Terms and Abbreviations

Abbreviation	Description
DSI	Device State Index
LTE	Long Term Evolution
ME	Mobile Equipment
RAT	Radio Access Technology
SAR	Specific Absorption Rate
TA	Terminal Adapter
WCDMA	Wideband Code Division Multiple Access