BG95&BG77&BG600L Series
Jamming Detection Application Note

LPWA Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2021-07-01	Lane HAO	Creation of the document
1.0	2021-08-04	Lane HAO	First official release

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1 Introduction

A cellular communication jammer can totally paralyze all kinds of mobile and portable devices working in cellular frequency bands. Quectel BG95 series, BG77 and BG600L-M3 modules offer jamming detection function which allows the unit to sense attempts to disrupt the GSM/LTE Cat M1/LTE Cat NB2 communication by interference with the signals. The sophisticated jamming detection enables enhanced security features and immediate alarm notification if communication interference is detected. This document gives a detailed explanation on how to use the Jamming Detection function of the following Quectel modules.

Table 1: Applicable Modules

Module Series	Model	Description
BG95	BG95-M1	Cat M1 only
	BG95-M2	Cat M1/Cat NB2
	BG95-M3	Cat M1/Cat NB2/EGPRS
	BG95-M4	Cat M1/Cat NB2, 450 MHz Supported
	BG95-M5	Cat M1/Cat NB2/EGPRS, Power Class 3
	BG95-M6	Cat M1/Cat NB2, Power Class 3
	BG95-MF	Cat M1/Cat NB2, Wi-Fi Positioning
BG77	BG77	Cat M1/Cat NB2
BG600L	BG600L-M3	Cat M1/Cat NB2/EGPRS

2 Jamming Detection Overview

Quectel Jamming Detection allows modules to identify active jamming of GSM, LTE Cat M1 and LTE Cat NB2 networks. Many alarm, security and life-critical systems rely on the use of cellular networks. Quectel Jamming Detection allows the module to detect jamming signals. When jamming is detected, the module sends a notification to MCU, reporting the presence of active jamming of GSM, LTE Cat M1 and LTE Cat NB2 networks.

If the module detects high RSSI on a frequency but does not detect any cell, or PBCH decoding fails, it may imply the presence of a jammer.

2.1. Application Overview

With the Jamming Detection function, the module is able to report the presence and removal of jamming automatically via URCs to notify the MCU. Also, you can query the current jamming status via **AT+QJDR?**.

3 Description of AT Commands

3.1. AT Command Introduction

3.1.1. 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.

3.1.2. 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 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.

3.2. 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.

3.3. AT Command Description

3.3.1. AT+QJDR Enable/Disable Jamming Detection

This command enables/disables the Jamming Detection feature. When Jamming Detection is enabled, the module reports a URC.

AT+QJDR Enable/Disable Jamming Detection	
Test Command **AT+QJDR=?**	Response **+QJDR: (**list of supported **<mode>**s**)** **OK**
Read Command **AT+QJDR?**	Response If **<mode>**=1 (Jamming Detection enabled): **+QJDR: NOJAMMING** **OK** Or **+QJDR: JAMMED** **OK** If **<mode>**=0 (Jamming Detection disabled): **+QJDR: 0** **OK**
Write Command **AT+QJDR=<mode>**	Response **OK** Or **ERROR**

Maximum Response Time	300 ms
Characteristic	The command takes effect immediately; The configurations will be saved automatically.

Parameter

<mode>	Integer type. Disable or enable the Jamming Detection function. 0 Disable 1 Enable

NOTE

1. Before using Jamming Detection, please enable the log output with **AT+QCFG="dbgctl"** (see ***document [1]*** for details).
2. By default, the Jamming Detection function only works under registered state. The module implements different Jamming Detection algorithms for each different RAT. If the module supports multiple RATs, the modem cannot determine which algorithm should be loaded. Therefore, if the module is not registered on network, lock the module to a single RAT supported via **AT+QCFG="nwscanmode"** and/or **AT+QCFG="iotopmode"** (see ***document [1]*** for details) to make the Jamming Detection function work.

3.3.2. AT+QJDCFG Jamming Detection Configuration

This command configures the options of Jamming Detection feature. These options include the Jamming Detection thresholds, the jamming notification methods, etc.

AT+QJDCFG Jamming Detection Configuration	
Test Command **AT+QJDCFG=?**	Response **+QJDCFG: "urc",(**list of supported **<URC>**s**)** **+QJDCFG: "period",(**range of supported **<period>**s**)** **+QJDCFG: "mnl",(**range of supported **<mnl>**s**)** **+QJDCFG: "minch",(**range of supported **<minch>**s**)** **+QJDCFG: "rsrp",(**range of supported **<RSRP>**s**)** **+QJDCFG: "rsrq",(**range of supported **<RSRQ>**s**)** **+QJDCFG: "rssi",(**range of supported **<RSSI>**s**)** **+QJDCFG: "totalrssi",(**range of supported **<totalRSSI>**s**)** **+QJDCFG: "shakeperiod",(**range of supported **<shake_period>**s**)** **+QJDCFG: "servenable",(**list of supported **<servenable>**s**)**

	OK
Read Command **AT+QJDCFG?**	Response **+QJDCFG: "urc",<URC>** **+QJDCFG: "period",<period>** **+QJDCFG: "mnl",<mnl>** **+QJDCFG: "minch",<minch>** **+QJDCFG: "rsrp",<RSRP>** **+QJDCFG: "rsrq",<RSRQ>** **+QJDCFG: "rssi",<RSSI>** **+QJDCFG: "totalrssi",<totalRSSI>** **+QJDCFG: "shakeperiod",<shake_period>** **+QJDCFG: "servenable",<servenable>** **OK**
Write Command **AT+QJDCFG="urc",<URC>**	Response **OK** Or **ERROR**
Write Command **AT+QJDCFG="period",<period>**	Response **OK** Or **ERROR**
Write Command (For GSM network only**)** **AT+QJDCFG="mnl",<mnl>**	Response **OK** Or **ERROR**
Write Command **AT+QJDCFG="minch",<minch>**	Response **OK** Or **ERROR**
Write Command (For LTE network only) **AT+QJDCFG="rsrp",<RSRP>**	Response **OK** Or **ERROR**
Write Command (For LTE network only) **AT+QJDCFG="rsrq",<RSRQ>**	Response **OK** Or **ERROR**
Write Command (For LTE network only) **AT+QJDCFG="rssi",<RSSI>**	Response **OK** Or **ERROR**
Write Command	Response

(For LTE network only) **AT+QJDCFG="totalrssi",<totalRSSI>**	**OK** Or **ERROR**
Write Command (For LTE network only) **AT+QJDCFG="shakeperiod",<shake_period>**	Response **OK** Or **ERROR**
Write Command (For LTE network only) **AT+QJDCFG="servenable",<servenable>**	Response **OK** Or **ERROR**
Maximum Response Time	300 ms
Characteristic	The command takes effect immediately; The configurations will be saved automatically.

Parameter

<URC>	Integer type. Whether to enable URC reporting. For details about URCs, see ***Chapter 3.4***. 0 Disable 1 Enable
<period>	Integer type. Whether to enable periodic URC reporting. Valid only when **<URC>**=1. 0 Disable 1–120 Enable, and the value is the interval for URC reporting. Unit: second.
<mnl>	Integer type. The minimum RxLev threshold (for GSM network only). Default value: 17. Range: 0–31.
<minch>	Integer type. The minimum channel number or ARFCN number which is jammed. Default value: 5. Range: 0–254.
<RSRP>	Integer type. The reference signal received power threshold (for LTE network only). Default value: -105. Range: -140 to -44. Unit: dBm.
<RSRQ>	Integer type. The reference signal received quality threshold (for LTE network only). Default value: -15. Range: -19 to -3. Unit: dB.
<RSSI>	Integer type. The received signal strength indication threshold (for LTE network only). Default value: -40. Range: -90 to -25. Unit: dBm.
<totalRSSI>	Integer type. The total received signal strength indication threshold (for LTE network only). Default value: -40. Range: -127 to -5. Unit: dBm.
<shake_period>	Integer type. Jamming detection period, which prevents false alarms resulted from network jitter (for LTE network only). Default value: 3. Range: 1–10. Unit: second.
<servenable>	Integer type. Enable/disable jamming detection report when the module is out of service (for LTE network only). 0 Disable 1 Enable

NOTE

The default values of all parameters except **<URC>** and **<period>** are verified to be the optimal ones through Quectel's tests in different scenarios. Therefore, it is recommended to use the Jamming Detection function with default settings, otherwise the function may not work well. If you have any special requirement, contact Quectel Technical Supports for the appropriate setting of threshold values in **AT+QJDCFG**.

3.4. URC Description

3.4.1. Indicate the Presence of Jamming

After Jamming Detection is enabled with **AT+QJDR=1** and URC reporting is enabled with **AT+QJDCFG="urc",1**, the module automatically reports the URC **+QJDR: JAMMED** when it detects the presence of jamming. If periodic URC reporting is enabled in this case, the module will report the URC periodically in an interval set by **<period>** of **AT+QJDCFG="period"**.

Indicate the Presence of Jamming	
+QJDR: JAMMED	The module reports this URC when it detects the presence of jamming.

3.4.2. Indicate the Removal of Jamming

After the jamming is removed, the module reports the URC **+QJDR: NOJAMMING**.

Indicate the Removal of Jamming	
+QJDR: NOJAMMING	The module reports this URC when the jamming is removed.

4 Examples

4.1. Report the Jamming Status via URC

```
AT+QJDR=1                   //Enable Jamming Detection.
OK

//If jamming is not existing:
AT+QJDR?                    //Query the current jamming status.
+QJDR: NOJAMMING            //No jamming is detected.

OK

//If jamming is existing:
AT+QJDR?                    //Query the current jamming status.
+QJDR: JAMMED               //Jamming is detected.

OK

//If jamming is removed:
AT+QJDR?                    //Query the current jamming status.
+QJDR: NOJAMMING            //No jamming is detected.

OK

//Automatically report URC to show the current jamming status.
AT+QJDR=1                   //Enable Jamming Detection.
OK
AT+QJDCFG="urc",1           //Enable automatic URC reporting.
OK

//If jamming is existing:
+QJDR: JAMMED               //When jamming is detected, the URC is reported automatically.

//If jamming is removed:
+QJDR: NOJAMMING            //When jamming is removed, the URC is reported automatically.
```

4.2. Report the Jamming Status via URC Periodically

```
AT+QJDR=1                    //Enable Jamming Detection.
OK
AT+QJDCFG="urc",1            //Enable automatic URC reporting.
OK
AT+QJDCFG="period",5         //Set <period> as 5. URC will be reported every 5 seconds when jamming
                               is detected.
OK

//If jamming is existing:
+QJDR: JAMMED                //The URC will be reported automatically every 5 seconds, to indicate
                               jamming is detected.
…
+QJDR: JAMMED
….

//If jamming is removed:
+QJDR: NOJAMMING             //When jamming is removed, the URC is reported automatically.

AT+QJDCFG="period",0         //Disable reporting URC periodically.
OK
```

4.3. Enable and Disable Jamming Detection

```
AT+QJDR=?                    //Test command.
+QJDR: (0,1)

OK
AT+QJDR?                     //Query the current jamming status.
+QJDR: NOJAMMING             //No jamming is detected.

OK
AT+QJDR=1                    //Enable Jamming Detection function.
OK
AT+QJDCFG="urc",1            //Enable automatic URC reporting.
OK

//If jamming is existing:
+QJDR: JAMMED                //When jamming is detected, the URC is reported automatically.
```

```
//If jamming is removed:
+QJDR: NOJAMMING          //When jamming the removed, the URC is reported automatically.

AT+QJDR=0                 //Disable Jamming Detection function.
OK
```

4.4. Configure Jamming Detection

```
AT+QJDCFG=?               //Test command.
+QJDCFG: "urc",(0,1)
+QJDCFG: "period",(0-120)
+QJDCFG: "mnl",(0-31)
+QJDCFG: "minch",(0-254)
+QJDCFG: "rsrp",(-140~-44)
+QJDCFG: "rsrq",(-19~-3)
+QJDCFG: "rssi",(-90~-25)
+QJDCFG: "totalrssi",(-127~-5)
+QJDCFG: "shakeperiod",(1-10)
+QJDCFG: "servenable",(0,1)

OK
AT+QJDCFG?                //Query the current parameter configuration.
+QJDCFG: "urc",0
+QJDCFG: "period",0
+QJDCFG: "mnl",17
+QJDCFG: "minch",5
+QJDCFG: "rsrp",-105
+QJDCFG: "rsrq",-15
+QJDCFG: "rssi",-40
+QJDCFG: "totalrssi",-40
+QJDCFG: "shakeperiod",3
+QJDCFG: "servenable",0

OK
AT+QJDCFG="period",5      //Set the value of <period> as 5. It represents that jamming status is
                            reported via URC through serial port every 5 seconds.
OK
AT+QJDCFG="rsrp",-110     //Set the value of <RSRP> as -110. It represents that Jamming Detection
                            function will consider -110 dBm as the threshold of <RSRP>.
OK
AT+QJDR=1                 //Enable Jamming Detection function.
OK
```

```
AT+QJDCFG="urc",1
OK

//If jamming is existing:
+QJDR: JAMMED                 //When jamming is detected, the URC is reported automatically .

//If jamming is removed:
+QJDR: NOJAMMING              //When jamming the removed, the URC is reported automatically.

AT+QJDR=0                     //Disable Jamming Detection function.
OK
```

5 Appendix References

Table 3: Related Document

Document Name	
[1]	Quectel_BG95&BG77&BG600L_Series_QCFG_AT_Commands_Manual

Table 4: Terms and Abbreviations

Abbreviation	Description
ARFCN	Absolute Radio-Frequency Channel Number
GSM	Global System for Mobile Communications
MCU	Microcontroller Unit
LPWA	Low-Power Wide-Area
LTE	Long Term Evolution
RAT	Radio Access Technology
PBCH	Physical Broadcast Channel
RxLev	Received Signal Level
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indication
URC	Unsolicited Result Code