EC200U&EG91xU Series

QuecCell Application Note

LTE Standard Module Series

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About the Document

Revision History

Version	Date	Author	Description
-	2021-03-10	Marvin NING	Creation of the document
1.0	2021-06-24	Marvin NING	First official release
1.1	2021-08-17	Marvin NING	Added an applicable module series EG915U.
1.2	2022-03-28	Joe TU	1. Added LTE inter-frequency neighbour cell information in the response of AT+QENG="neighbourcell" (Chapter 2.3.1). 2. Updated the example (Chapter 2.3.1).
1.3	2023-04-28	Joe TU/ Marvin NING	1. Added the applicable module EG912U-GL. 2. Updated the response of **AT+QCELLINFO?** in LTE network and added a note that <RSRQ>,<freq_band_ind>,<UL_bandwidth>,<is_tdd>,<state> can be output through AT+QCFG="qcellinfo/fmt",1 (Chapter 2.3.2).

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1 Introduction

This document is an application note for all AT commands related to QuecCell on Quectel LTE Standard EC200U and EG91xU family modules.

QuecCell is a featured function embedded in Quectel modules. It can be used to scan the detailed information of base stations.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Family	Module
-	EC200U Series
EG91xU	EG912U-GL
	EG915U Series

2 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 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 AT Command

2.3.1. AT+QENG Get Information of Primary Serving Cell and Neighbour Cells

This command gets the information of primary serving cell and neighbour cells.

AT+QENG Get Information of Primary Serving Cell and Neighbour Cells	
Test Command **AT+QENG=?**	Response **+QENG: (**list of supported **<cell_type>**s**)** **OK**
Write Command **AT+QENG="servingcell"**	Response GSM network: **+QENG: "servingcell",<state>,"GSM",<MCC>,<MNC>,<LAC>,<cellID>,<BSIC>,<ARFCN>,<GSM_band>,<RX_lev>,<TX_power>,<rla>,<DRX>,<c1>,<c2>,<GPRS_support>,<TCH>,<ts>,<ta>,<MAIO>,<HSN>,<RX_lev_sub>,<RX_lev_full>,<RX_qual_sub>,<RX_qual_full>,<voice_codec>** **OK** LTE network: **+QENG: "servingcell",<state>,"LTE",<is_tdd>,<MCC>,<MNC>,<cellID>,<PCI>,<EARFCN>,<freq_band_ind>,<UL_bandwidth>,<DL_bandwidth>,<TAC>,<RSRP>,<RSRQ>,<RSSI>,<SINR>,<srxlev>** **OK**
Write Command **AT+QENG="neighbourcell"**	Response GSM network: **[+QENG: "neighbourcell","GSM",<MCC>,<MNC>,<LAC>,<cellID>,<BSIC>,<ARFCN>,<RX_lev>,<c1>,<c2>,<c31>,<c32>**

	[…]] **OK** LTE network: **[+QENG: "neighbourcell intra","LTE",<EARFCN>,<PCI>,<RSRP>,<RSRQ>,<RSSI>,<SINR>,<srxlev>,<cell_resel_priority>,<s_non_intra_search>,<thresh_serving_low>,<s_intra_search>** **[…]]** **[+QENG: "neighbourcell inter","LTE",<EARFCN>,<PCI>,<RSRP>,<RSRQ>,<RSSI>,<SINR>,<srxlev>,<threshX_low>,<threshX_high>,<cell_resel_priority>** **[…]]** **OK**
Maximum Response Time	Determined by network.
Characteristics	/

Parameter

<cell_type>	String type. The information of different cells. "servingcell" The information of GSM/LTE serving cells. "neighbourcell" The information of GSM/LTE neighbour cells.
<state>	String type. UE state. "SEARCH" UE is searching but has not found a suitable GSM/LTE cell. "LIMSRV" UE is camping on a cell but has not registered on the network. "NOCONN" UE is camping on a cell and has registered on the network, and it is in idle mode. "CONNECT" UE is camping on a cell and has registered on the network, and a call is in progress.
<MCC>	Integer type. Mobile country code (first part of the PLMN code).
<MNC>	Integer type. Mobile network code (second part of the PLMN code).
<LAC>	Two-byte hexadecimal format. The location area code (e.g., 00C1 equals 193 in decimal) of the cell that was scanned. Range: 0–0xFFFFFFF.
<cellID>	Hexadecimal format. Cell ID. The parameter determines the 16-bit (GSM) or 28-bit (LTE) cell ID. Range: 0–0xFFFFFFF.
<BSIC>	Integer type. Base station identification code. Range: 0–63.
<ARFCN>	Integer type. Absolute radio frequency channel number. Range: 0–1023.
<GSM_band>	Integer type. GSM frequency band. 0 DCS1800 1 PCS1900

	2 GSM900 "-" Other GSM frequency bands
<RX_lev>	Integer type. RX level in the cell (see *3GPP 25.304*). Range: 0-63. Unit: dB. Subtracting 111 from the RX level value, a dBm value will be acquired.
<TX_power>	Integer type. MS maximum TX power in CCH.
<rla>	Integer type. Minimum access RX level.
<DRX>	Integer type. Cycle length of the discontinuous reception.
<c1>	Integer type. The criterion for cell selection.
<c2>	Integer type. The criterion for cell reselection.
<GPRS_support>	Whether the current cell supports GPRS or not. Currently this parameter is invalid and the fixed value is “-”.
<TCH>	Traffic Channel. Currently this parameter is invalid and the fixed value is “-”.
<ts>	Timeslot number. Currently this parameter is invalid and the fixed value is “-”.
<ta>	Integer type. Timing advance for the base station. Range: 0–63.
<MAIO>	Integer type. Mobile allocation index offset.
<HSN>	Integer type. Hopping sequence number.
<RX_lev_sub>	Integer type. RX level of discontinuous transmission. Range: 0–63.
<RX_lev_full>	Integer type. RX level of full transmission. Range: 0–63.
<RX_qual_sub>	Integer type. RX quality of discontinuous transmission. Range: 0–7.
<RX_qual_full>	Integer type. RX quality of full transmission. Range: 0–7.
<voice_codec>	Channel mode during a voice call. Currently this parameter is invalid and the fixed value is “-”.
<is_tdd>	String type. Communication mode. "TDD" Time division duplex mode "FDD" Frequency division duplex mode
<PCI>	Integer type. Physical cell ID. Range: 0–503.
<EARFCN>	Integer type. E-UTRA absolute radio frequency channel number. Range: 9–65535.
<freq_band_ind>	Integer type. E-UTRA frequency band (see *3GPP 36.101*).
<UL_band_width>	Integer type. Uplink bandwidth. 0 1.4 MHz 1 3 MHz 2 5 MHz 3 10 MHz 4 15 MHz 5 20 MHz
<DL_bandwidth>	Integer type. Downlink bandwidth. 0 1.4 MHz 1 3 MHz 2 5 MHz 3 10 MHz

	4 15 MHz 5 20 MHz
<TAC>	Hexadecimal format. Tracking area code (see *3GPP 23.003 Chapter 19.4.2.3*).
<RSRP>	Integer type. Reference signal received power. Unit: dBm. (see *3GPP 36.214 Chapter 5.1.1*)
<RSRQ>	Integer type. Reference signal received quality. Unit: dB. (see *3GPP 36.214 Chapter 5.1.3*)
<RSSI>	Integer type. Received signal strength indication. Unit: dBm.
<SINR>	Integer type. Signal noise ratio. The conversion formula for actual SINR is: **Y = X/2 – 23.5**. **X** The **<SINR>** value queried by **AT+QENG**. Range: 7 to 107. **Y** The actual value of LTE SINR after calculating with the formula. Range: -20 to 30. Unit: dB.
<srxlev>	Integer type. Cell selection Rx level value (in dB). (see *3GPP 25.304/3GPP 36.304*).
<c31>	Integer type. GPRS signal level threshold criterion parameter. Currently this parameter is invalid.
<c32>	Integer type. The cell ranking criterion which is used to select cells among those with the same priority. Currently this parameter is invalid.
<cell_resel_priority>	Cell reselection priority. Currently this parameter is invalid and the fixed value is “-”.
<s_non_intra_search>	Threshold to control non-intra-frequency searches. Currently this parameter is invalid and the fixed value is “-”.
<thresh_serving_low>	The threshold of **<srxlev>** (in dB) used by the UE on the serving cells when reselecting towards a lower priority RAT/frequency. Currently this parameter is invalid and the fixed value is “-”.
<s_intra_search>	Measurement trigger threshold for same-frequency cell reselection. Currently this parameter is invalid and the fixed value is “-”.
<threshX_low>	Integer type. It can be used as a reference when reselecting towards a lower priority RAT/frequency than the current serving frequency. The suitable receive level value of an evaluated lower priority cell must be greater than this value. Currently this parameter is invalid and the fixed value is “-”.
<threshX_high>	Integer type. It can be used as a reference when reselecting towards a higher priority RAT/frequency than the current serving frequency. The suitable receive level value of an evaluated higher priority cell must be greater than this value. Currently this parameter is invalid and the fixed value is “-”.

NOTE

1. If return "-" or -, it indicates the parameter is invalid under current condition.
2. GSM neighbour cell is only displayed when the module is in idle mode.

Example

```
AT+QENG="servingcell"
+QENG: "servingcell","SEARCH"

OK
AT+QENG="servingcell"
+QENG:  "servingcell","NOCONN","LTE","FDD",460,01,5A23565,255,3745,8,3,3,DE10,-90,-16,-60,4
2,25

OK
AT+QENG="neighbourcell"
+QENG: "neighbourcell intra","LTE",3745,337,-90,-15,-,-,31,-,-,-,-
+QENG: "neighbourcell intra","LTE",3745,338,-91,-15,-,-,36,-,-,-,-
+QENG: "neighbourcell intra","LTE",3745,369,-94,-17,-,-,25,-,-,-,-
+QENG: "neighbourcell inter","LTE",1850,378,-71,-7,-,-,56,-,-,-
+QENG: "neighbourcell inter","LTE",100,376,-107,-10,-,-,20,-,-,-
+QENG: "neighbourcell inter","LTE",100,377,-111,-14,-,-,16,-,-,-

OK
```

2.3.2. AT+QCELLINFO Get the Information of Serving Cell and Neighbour Cells

This command gets the information of serving cell and neighbour cells.

AT+QCELLINFO Get the Information of Serving Cell and Neighbour Cells	
Test Command **AT+QCELLINFO=?**	Response **+QCELLINFO: (**list of supported **<mode>**s**),(**range of supported **<interval1>**s**),(**range of supported **<interval2>**s**),<DIS>** **OK**
Read Command **AT+QCELLINFO?**	Response GSM network: **[+QCELLINFO: <cell_type>,"GSM",<MCC>,<MNC>,<LAC>,<cellID>,<BSIC>,<RX_lev>,<RX_dbm>,<ARFCN>,-,-,-[…]]** **OK** LTE network: **[+QCELLINFO: <cell_type>,"LTE",<MCC>,<MNC>,<TAC>,<cellID>,<PCI>,<RX_lev>,<RX_dbm>,<EARFCN>,<RSRP><RSSI><SINR>[,<RSRQ>,<freq_band_ind>,<UL_ban**

	dwidth>,<is_tdd>,<state>]] **[…]]** **OK**
Write Command **AT+QCELLINFO=<mode>[,<interval1>][,<interval2>][,<DIS>]**	Response If **<mode>** is not equal to 255 and the command is executed successfully: **OK** If **<mode>** is equal to 255 and the command is executed successfully: **+QCELLINFO: <mode>[,<interval1>][,<interval2>][,<DIS>]** **OK**
Maximum Response Time	Determined by network.
Characteristics	The command takes effect immediately. The configurations are not saved.

Parameter

<mode>	Integer type. 0 Synchronous mode. When receive **AT+QCELLINFO?** command, it may take a few seconds to process the instructions and then respond. 1 Timer Mode. The cache of cell Information is refreshed periodically, **AT+QCELLINFO?** command will get cell information from the cache and respond immediately. 2 Asynchronous mode. **AT+QCELLINFO?** command respond **OK** immediately, and cell information report as URC below: 1) GSM network: **+QCELLINFO: <cell_type>,"GSM",<MCC>,<MNC>,<LAC>,<cellID>,<BSIC>,<RX_lev>,<RX_dbm>,<ARFCN>** 2) LTE network: **+QCELLINFO: <cell_type>,"LTE",<MCC>,<MNC>,<TAC>,<cellID>,<PCI>,<RX_lev>,<RX_dbm>,<EARFCN>,<RSRP><RSSI><SINR>** 3 Synchronous mode. Compared with the synchronous mode when **<mode>** is 0, it is a more power-efficient way used to obtain the serving cell. 4 Timer Mode. Compared with the timer mode when **<mode>** is 1, it is a more power-efficient way used to obtain the serving cell. 255 Query mode. Only applicable for Write Command.
<interval1>	Integer type. The time for refreshing the cached serving cell. Range: 5–65535. Default value: 5. Unit: second.
<interval2>	Integer type. The time for refreshing the cached neighbour cell. Range: 5–65535.

	Default value: 5. Unit: second. If this parameter is omitted, the time for refreshing the cached neighbour cell is equal to **<interval1>**.
<DIS>	Integer type. Enable/disable to refresh the cell information automatically during sleep in the timer mode. 0 Enable 1 Disable If **<DIS>** is omitted, it means to refresh the cell information automatically during sleep in the timer mode.
<cell_type>	String format. The information of different cells. "servingcell" The information of GSM/LTE serving cells. "neighbourcell" The information of GSM/LTE neighbour cells.
<MCC>	Integer type. Mobile country code (first part of the PLMN code).
<MNC>	Integer type. Mobile network code (second part of the PLMN code).
<LAC>	Hexadecimal format. Location area code. The parameter determines the two-byte location area code in hexadecimal format (e.g., 00C1 equals 193 in decimal) of the cell that was scanned. Range: 0–0xFFFFFFF.
<TAC>	Hexadecimal format. Tracking area code (refer to *3GPP 23.003*).
<cellID>	Hexadecimal format. Cell ID. The parameter determines the 16-bit (GSM) or 28-bit (LTE) cell ID. Range: 0–0xFFFFFFF.
<BSIC>	Integer type. Base station identification code. Range: 0–63.
<PCI>	Integer type. Physical cell ID. Range: 0–503.
<RX_lev>	Integer type. RX level in the cell (see *3GPP 25.304*). Range: 0-63. Unit: dB.
<RX_dbm>	Integer type. A dBm value of received power.
<ARFCN>	Integer type. The parameter determines the ARFCN of the cell that was scanned. Range: 0–1023.
<EARFCN>	Integer type. E-UTRA absolute radio frequency channel number. Range: 9–65535.
<RSRP>	Integer type. Reference signal received power (see *3GPP 36.214 Chapter 5.1.1*).
<RSSI>	Integer type. Received signal strength indication.
<SINR>	Integer type. Signal noise ratio. The conversion formula for actual SINR is: **Y = X/2 – 23.5**. **X** The **<SINR>** value queried by **AT+QENG**. Range: 7 to 107. **Y** The actual value of LTE SINR after calculating with the formula. Range: -20 to 30. Unit: dB.
<RSRQ>	Integer type. Reference signal receiving quality. Unit: dB. (see *3GPP 36.214 Chapter 5.1.3).*
<freq_band_ind>	Integer type. E-UTRA frequency band (see *3GPP 36.101*).
<UL_bandwidth>	Integer type. Uplink bandwidth. 0 1.4 MHz 1 3 MHz 2 5 MHz 3 10 MHz 4 15 MHz

	5 20 MHz
<is_tdd>	String type. Communication mode. "TDD" Time division duplexing mode "FDD" Frequency division duplexing mode
<state>	String type. UE state. "SEARCH" UE is searching but has not found a suitable GSM/LTE cell. "LIMSRV" UE is camping on a cell but has not registered on the network. "NOCONN" UE is camping on a cell and has registered on the network, and it is in idle mode. "CONNECT" UE is camping on a cell and has registered on the network, and a call is in progress.

NOTE

1. If return "-" or -, it indicates the parameter is invalid under current condition.
2. The parameter **<interval>** takes effect only when **<mode>** is equal to 1. If **<mode>** is not equal to 1, the parameter **<interval>** is omitted and defaults to 5.
3. **<RSRQ>,<freq_band_ind>,<UL_bandwidth>,<is_tdd>,<state>** are not output by default, but they can be output by executing **AT+QCFG="qcellinfo/fmt",1**. For more details about **AT+QCFG="qcellinfo/fmt",1**, refer to ***document [1]***.

Example

```
AT+QCELLINFO=1,10                    //Set it to timer mode and update the cell information every 10 seconds.
OK
AT+QCELLINFO=255                     //Query the current setting.
+QCELLINFO: 1,10,10,0                //<interval2> is equal to <interval1> when omitted in write command; <DIS> is equal to 0 when omitted in write command.

OK
AT+QCELLINFO?
+QCELLINFO: "servingcell","LTE",460,00,268a,6e68c49,316,37,179,38950,-90,-55,42
+QCELLINFO: "neighbourcell","LTE",460,00,268a,8dff3c2,222,49,-,40936,-,-,-
+QCELLINFO: "neighbourcell","LTE",460,00,268a,6e66141,101,43,-,40936,-,-,-
+QCELLINFO: "neighbourcell","LTE",460,00,268a,8abc585,321,53,-,38544,-,-,-
+QCELLINFO: "neighbourcell","LTE",460,00,268a,8abc584,322,51,-,38400,-,-,-
+QCELLINFO: "neighbourcell","LTE",460,00,268a,8abc58e,322,52,-,38544,-,-,-

OK
```

3 Appendix References

Table 3: Related Document

Document Name
[1] Quectel_EC200U&EG91xU_Series_AT_Commands_Manual

Table 4: Terms and Abbreviations

Abbreviation	Description
3GPP	The 3rd Generation Partnership Project
ARFCN	Absolute Radio Frequency Channel Number
BSIC	Base Station Identification Code
CCH	Control Channel
DCS	Distributed Control System
DL	Downlink
DRX	Discontinuous Reception
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
E-UTRA	Evolved-Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
LAC	Location Area Code
LTE	Long Term Evolution
MAIO	Mobile Allocation Index Offset

MCC	Mobile Country Code
MNC	Mobile Network Code
MS	Mobile Station
PCI	Physical Cell ID
PCS	Personal Communications Service
PLMN	Public Land Mobile Network
RSRP	Reference Signal Receiving Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
RX	Receive
SINR	Signal to Interference Plus Noise Ratio
TA	Terminal Adapter
TAC	Tracking Area Code
TCH	Traffic Channel
TDD	Time Division Duplex
TX	Transmit
UE	User Equipment
UL	Uplink