BG96 Network Searching Scheme Introduction

LTE Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2017-07-17	Walker HAN	Initial

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1 Introduction

This document introduces the supported network systems and frequency bands of BG96 module, and also describes its network searching scheme through illustrating related AT commands and network searching/registration procedure.

1.1. Supported Network Systems and Frequency Bands

Quectel BG96 module supports three network systems: LTE Cat.M1, LTE Cat.NB1 and EGPRS. The default network searching sequence is: LTE Cat.M1 → LTE Cat.NB1 → EGPRS.

The following table lists the supported frequency bands of BG96.

Table 1: Frequency Bands of BG96 Module

Network System	Frequency Band
LTE Cat.M1	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28 LTE-TDD: B39
LTE Cat.NB1	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28
EGPRS	GSM850, EGSM900, DCS1800, PCS1900

1.2. Cell Reselection/Handover/Redirection

- Under LTE Cat.M1 network

BG96 supports intra-frequency/inter-frequency cell reselection/handover/ redirection, and also supports IRAT reselection/handover/redirection.

- Under LTE Cat.NB1 network

BG96 only supports intra-frequency/inter-frequency cell reselection/handover/redirection, but not IRAT reselection/handover/redirection.

2 Network Searching Related AT Commands

In order to optimize network searching/registration time, related AT commands can be used to set the network search sequence, network system to be searched, network category to be searched under LTE network system, and preferred frequency bands to be searched.

2.1. AT+QCFG="nwscanseq" Configure Network Search Sequence

The command specifies the sequence of searching network. The configuration is valid immediately after setting.

AT+QCFG="nwscanseq" Configure Network Search Sequence	
Write Command **AT+QCFG="nwscanseq"[,<scanseq>]**	Response If **<scanseq>** is omitted, return the current configuration: **+QCFG: "nwscanseq",<scanseq>** **OK** If **<scanseq>** is not omitted, configure the network search sequence: **OK** **ERROR** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	300ms

Parameter

<scanseq>	Number format. Network search sequence. (e.g.: 020301 stands for LTE Cat.M1 → LTE Cat.NB1 → GSM) 00 Automatic (LTE Cat.M1 → LTE Cat.NB1 → GSM) 01 GSM

	02	LTE Cat.M1
	03	LTE Cat.NB1

2.2. AT+QCFG="nwscanmode" Configure Network System to be Searched

The command specifies the network system to be searched. The configuration is valid immediately after setting.

AT+QCFG="nwscanmode" Configure Network System to be Searched	
Write Command **AT+QCFG="nwscanmode"[,<scanmode>]**	Response If **<scanmode>** is omitted, return the current configuration: **+QCFG: "nwscanmode",<scanmode>** **OK** If **<scanmode>** is not omitted, configure the network system to be searched: **OK** **ERROR** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	300ms

Parameter

<scanmode>	Number format. Network system to be searched.	
	0	Automatically
	1	GSM only
	3	LTE only

2.3. AT+QCFG="iotopmode" Configure Network Category to be Searched under LTE Network System

The command specifies the network category to be searched under LTE network system. The configuration is valid immediately after setting.

AT+QCFG="nwscanseq" Configure Network Category to be Searched under LTE Network System	
Write Command **AT+QCFG="iotopmode",[,<mode>]**	Response If **<mode>** is omitted, return the current configuration: **+QCFG: "iotopmode",<mode>** **OK** If **<mode>** is not omitted, configure the network category to be searched under LTE network system: **OK** **ERROR** If there is an error related to ME functionality: **+CME ERROR: <err>**
Maximum Response Time	300ms

Parameter

<mode>	Number format. Network category to be searched under LTE network system. 0 LTE Cat.M1 1 LTE Cat.NB1 2 LTE Cat.M1 and LTE Cat.NB1

2.4. AT+QCFG="band" Configure Preferred Bands to be Searched

The command specifies the preferred frequency bands to be searched of UE. The configuration is valid immediately after setting.

AT+QCFG="band" Configure Preferred Bands to be Searched	
Write Command **AT+QCFG="band",[,<gsmbandval>,<catm1bandval>,<catnb1bandval>]**	Response If all configuration parameters are omitted (that is, only execute **AT+QCFG="band"**), return current configuration: **+QCFG: "band",<gsmbandval>,<catm1bandval>,<catnb1bandval>** **OK** If configuration parameters are all entered:

	OK **ERROR** If there is an error related to ME functionality : **+CME ERROR: <err>**
Maximum Response Time	300ms

Parameter

<gsmbandval> A hexadecimal value that specifies the GSM frequency band. If it is set to 0, it means not to change GSM frequency band. (eg.: a=2(GSM1800)+ 8(GSM1900))

00000000	No change
00000001	GSM 900MHz
00000002	GSM 1800MHz
00000004	GSM 850MHz
00000008	GSM 1900MHz
0000FFFF	Any frequency band

<catm1bandval> A hexadecimal value that specifies the LTE Cat.M1 frequency band. If it is set to 0 or 0x40000000, it means not to change the frequency band. (eg.: 0x15=0x1(LTE B1)+0x4(LTE B3)+0x10(LTE B5))

0x1 (CM_BAND_PREF_LTE_EUTRAN_BAND1)	LTE B1
0x2 (CM_BAND_PREF_LTE_EUTRAN_BAND2)	LTE B2
0x4 (CM_BAND_PREF_LTE_EUTRAN_BAND3)	LTE B3
0x8 (CM_BAND_PREF_LTE_EUTRAN_BAND4)	LTE B4
0x10 (CM_BAND_PREF_LTE_EUTRAN_BAND5)	LTE B5
0x80 (CM_BAND_PREF_LTE_EUTRAN_BAND8)	LTE B8
0x800(CM_BAND_PREF_LTE_EUTRAN_BAND12)	LTE B12
0x1000 (CM_BAND_PREF_LTE_EUTRAN_BAND13)	LTE B13
0x20000 (CM_BAND_PREF_LTE_EUTRAN_BAND18)	LTE B18
0x40000(CM_BAND_PREF_LTE_EUTRAN_BAND19)	LTE B19
0x80000 (CM_BAND_PREF_LTE_EUTRAN_BAND20)	LTE B20
0x2000000 (CM_BAND_PREF_LTE_EUTRAN_BAND26)	LTE B26
0x8000000(CM_BAND_PREF_LTE_EUTRAN_BAND28)	LTE B28
0x4000000000(CM_BAND_PREF_LTE_EUTRAN_BAND39)	LTE B39
0x400A0E189F (CM_BAND_PREF_ANY)	Any frequency band

<catnb1bandval> A hexadecimal value that specifies the LTE Cat.NB1 frequency band. If it is set to 0 or 0x40000000, it means not to change the frequency band.

0x1 (CM_BAND_PREF_LTE_EUTRAN_BAND1)	LTE B1
0x2 (CM_BAND_PREF_LTE_EUTRAN_BAND2)	LTE B2
0x4 (CM_BAND_PREF_LTE_EUTRAN_BAND3)	LTE B3
0x8 (CM_BAND_PREF_LTE_EUTRAN_BAND4)	LTE B4
0x10 (CM_BAND_PREF_LTE_EUTRAN_BAND5)	LTE B5
0x80 (CM_BAND_PREF_LTE_EUTRAN_BAND8)	LTE B8

	0x800(CM_BAND_PREF_LTE_EUTRAN_BAND12)	LTE B12
	0x1000 (CM_BAND_PREF_LTE_EUTRAN_BAND13)	LTE B13
	0x20000 (CM_BAND_PREF_LTE_EUTRAN_BAND18)	LTE B18
	0x40000(CM_BAND_PREF_LTE_EUTRAN_BAND19)	LTE B19
	0x80000 (CM_BAND_PREF_LTE_EUTRAN_BAND20)	LTE B20
	0x2000000 (CM_BAND_PREF_LTE_EUTRAN_BAND26)	LTE B26
	0x8000000(CM_BAND_PREF_LTE_EUTRAN_BAND28)	LTE B28
	0xA0E189F (CM_BAND_PREF_ANY)	Any frequency band

3 Network Searching/Registration Procedure

The network searching/registration procedure of BG96 is illustrated below:

1. **UE initialization**

   Including (U)SIM card recognition and reading of NV related to network searching.

2. **Network mode selection**

   Set the network search sequence and the network system to be searched according to network searching related NV.

3. **PLMN selection**

   Including automatic and manual modes.

4. **ARFCN scan**

   LTE EARFCN/UARFCN scan includes system scan and band scan steps.
   EGPRS ARFCN scan mainly refers to power scan.

5. **Acquisition**

   Refers to cell recognition and downlink synchronization.

6. **System information analyze**

   Refers to system information reading.

7. **Cell selection**

   If the acquired band satisfies the signal strength requirement of UE, then go to the next step (cell residence) directly. Otherwise continue band scan.

8. **Cell camp**

   Starts cell camp after successful cell selection.

9. Attach request/location update request

After cell camp, the UE will send the attach request/location update request.

10. Random access

UE performs uplink synchronization (random access) after sending attach request/location update request.

11. RRC connection request

12. Network sends attach accept/location update accept