

BG95-S5 NTN NB-IoT

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Hardware: Quectel BG95-S5 module, umts-lte-evb-kit-2, Telekom NTN SIM card, SMA antenna.

Firmware Version: BG95S5LAR08A01_01.201.01.201

USB Driver: Quectel_UC20&UC15&EC25&EC21&EC20_Windows_USB_Drivers

NOTE: The AT commands AT+QCFG with a Q are specific commands for Quectel modules

The communication with satellite can only be established outdoor

1. Preparation

- ensure that the firmware supports NTN NB-IoT. You can verify the firmware version with ATI or AT+QGMR
- connect the board, insert the NTN SIM card. You can verify the SIM with AT+CP
- Open QCOM to send AT commands to the target. Note the BG95 does not show AT command COM port in device manager, you can only see two ports (DM & NMEA). However in Qcom, pull down the port selection menu and you will discover the 3rd port which does not appear in device manager. That is the port you can send AT commands over.

2. AT Commands Configuration

This document introduces the NTN network-related AT commands supported by Quectel BG95-S5 module. These commands are currently available for sample testing and may be changed or improved in the future.

NOTE

When using the commands mentioned in this document on BG95-S5 module, please note the following points:

1. Like other BG95 series modules, BG95-S5 module performs network search automatically after being powered on. If you need to use BG95-S5 module to register NTN network, just execute the corresponding configuration commands of network search. For example, configure the RAT to be searched for as LTE only (including NTN NB-IoT) using **AT+QCFG="nwscanmode",3**. Then specify the network category to be searched for under LTE RAT as NTN NB-IoT only using **AT+QCFG="iotopmode",3**.
2. Compared with the commands of other BG95 series modules, the format and usage of the AT commands mentioned in this document remain consistent, with the addition of NTN-related parameters.
3. If NTN real network testing is required, you need to confirm the data services supported by the current network operator. For example, the NTN network deployed by Skylo operator only supports Non-IP service currently (For the AT commands related to Non-IP service, see **document [3]**)
4. During NTN registration, GNSS switching is automatic without need for manual intervention.
5. The format and usage of other 3GPP network commands on BG95-S5 module are consistent with those of other BG95 series modules. See **document [1]** for details about these commands.

AT+CGDCONT="IP","internet.m2mportal.de"

(Configure APN for Telekom SIM, NB-IoT)

AT+QCFG="nwscanmode",3

(Configure Radio Access Technologie to be Searched for)

<scanmode> 3: LTE only (NTN NB-IoT included)

AT+QCFG="iotopmode",3

(Configure Network Category to be Searched for under LTE RAT)

<mode> 3: NTN NB-IoT only

AT+QCFG="band",0xf,0x1000200000000f0e189f,0x1000420000000090e189f,0x4,1 (Configure Frequency Band)

AT+QCFG="band"[,<GSM_bandval>,<eMTC_bandval>,<NB-IoT_bandval>,<NTN_NB-IoT_bandval>[,<effect>]]

<GSM_bandval> 0xf: specifies the GSM frequency band. 0xF means all of the supported bands are chosen.

<eMTC_bandval> 0x1000200000000f0e189f: specifies the eMTC frequency band.
0x1000200000000F0E189F means all of the supported bands.

<NB-IoT_bandval> 0x1000420000000090e189f: specifies the NB-IoT frequency band.
0x1000420000000090E189F means all of the supported bands.

<NTN_NB-IoT_bandval> 0x4: specifies the NTN NB-IoT frequency band.
0x4 specifies BAND_PREF_LTE_BAND256 for Europe.

<effect> 1: Take effect immediately

3. Response

AT+QNWINFO (Query Network Information)

```
AT+QNWINFO
+QNWINFO: "NTN NBloT","90198","NTN NBloT BAND 256",229366
```

Response

+QNWINFO: <Act>,<oper>,<band>,<channel>

This means we have found with access technologie "NTN NB-LoT" the operator "90198". The selected frequency band is "BAND 256" for Europe and the channel ID is "229366"

AT+QENG="servingcell" (reports the information of serving cells.)

```
AT+QENG="servingcell"
+QENG: "servingcell","CONNECT","NTN NBloT","FDD",901,98,201AD5,21,229366,0,0,0,FB5,-124,-13,-111,10,
```

In the case of LTE Cat M1/Cat NB2/NTN NB-LoTmode:

Response

+QENG:

"servingcell",<state>[,<RAT>,<is_tdd>,<MCC>,<MNC>,<cellID>,<PCI>,<EARFCN>,<freq_band_ind>,<UL_bandwidth>,<DL_bandwidth>,<TAC>,<RSRP>,<RSRQ>,<RSSI>,<SINR>,<srlev>]

<state> "CONNECT": UE has camped on a cell and registered on the network, and a call is in progress

<RAT> "NTN NBloT": Radio access technologies is NTN NB-LoT

<is_tdd> "FDD": LTE network mode is LTE-FDD

<MCC> "901": A three-digit value indicating mobile country code (the first part of the PLMN code). Transatel IoT Connect uses a 901 MCC (Mobile Country Code). This means that the data connectivity is reached via roaming networks. The 901 MCC is the only international code, when usually, MCCs are attached to a specific country.

<MNC> "98": A two-digit value indicating the mobile network code (the second part of the PLMN code).

MCC	MNC	Brand	Operator	Status	Bands (MHz)	References and notes
901	98		Skylo Technologies, Inc.	Unknown	Satellite	[118]

➔ The MCC and MNC verify that we have successfully connected with one Skylo satellite. (https://en.wikipedia.org/wiki/Mobile_country_code#cite_note-itu_ob_1266-118)

<MNC> "201AD5": Cell ID. Range: 0–0xFFFFFFFF.

<PCI> "21": Physical cell identity.

<EARFCN> "229366": E-UTRA absolute radio frequency channel number.

<freq_band_ind> "0": E-UTRA frequency bands (see 3GPP 36.101).

<UL_bandwidth> "0": UL bandwidth. 0 means 1.4 MHz

<DL_bandwidth> "0": DL bandwidth. 0 means 1.4 MHz

<TAC> "FB5": Tracking area code in hexadecimal format (see 3GPP 23.003 subclause 19.4.2.3).

<RSRP> "-124": Reference signal received power (see 3GPP 36.214 subclause 5.1.1). Unit: dBm.

<RSRQ> "-13": Reference signal received quality (see 3GPP 36.214 subclause 5.1.3). Unit: dB.

<RSSI> "-111": The received signal strength indication. Unit: dBm.

<SINR> "10": A converted value of SINR. The actual SINR = $(1/5) \times \text{<SINR>} - 20$.
Range: 0–250 (that is, the actual SINR ranges between -20 dB and 30 dB)..

AT+COPS=? AT+CEREG?

(Search for operator. Display Network registration status)

```
AT+COPS=?
+COPS: (2,"901 98","901 98","90198",14),(2,"901 98","901 98","90198",14),(0,1,2,3,4),(0,1,2)
OK

AT+COPS?
+COPS: 0,0,"901 98",14

OK
AT+CEREG?
+CEREG: 0,5
```

- ➔ Successfully find operator (Skylo) with access technologie 14.
Network registered, roaming.

Reference:

Quectel_BG95&BG77&BG600L_Series_NIDD_Application_Note_V1.0

Quectel_BG95_Series_Hardware_Design_V1.7.0_Preliminary_20231215

Quectel_BG95-S5_Non-Terrestrial_Network_Application_Note_V1.0.0_Preliminary_20231228

QCom used AT command: Overview

COM Port Setting

COM Port: Baudrate: StopBits: Parity:

ByteSize: Flow Control: **Open Port**

```

OK
AT+COPS?
+COPS: 0,0,"901 98",14

OK
AT+CEREG?
+CEREG: 0,5

OK
AT+QNWINFO
+QNWINFO: "NTN NBIoT","90198","NTN NBIoT BAND 256",229366

OK
AT+QENG="servicingell"
+QENG: "servicingell","CONNECT","NTN NBIoT","FDD",901,98,201AD5,21,229366,0,0,0,FB5,-124,-13,-111,10.

OK
AT+QENG="servicingell"
+QENG: "servicingell","CONNECT","NTN NBIoT","FDD",901,98,201AD5,21,229366,0,0,0,FB5,-124,-13,-111,10.

OK
AT+COPS=?
+COPS: (2,"901 98","901 98","90198",14),(2,"901 98","901 98","90198",14),(0,1,2,3,4),(0,1,2)
                
```

[2024-04-03_12:25:00:233] Open COM Port Success
 [2024-04-03_12:26:56:276] Open COM Port Success
 [2024-04-03_12:31:21:827] Open COM Port Success
 [2024-04-03_12:35:34:350] Open COM Port Success

Operation

DTR
 RTS
 View File
 Show Time

HEX String
 Show In HEX
 Send With Enter

Input String:

Command List

	Choose All Commands	HEX	Enter	Delay(mS)
1:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1
2:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2
3:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	3
4:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4
5:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5
6:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	6
7:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	7
8:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8
9:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	9
10:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10
11:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	11
12:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12
13:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13
14:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14
15:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15
16:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	16
17:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	17
18:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	18
19:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	19
20:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	20
21:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	21
22:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	22
23:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	23
24:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	24
25:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	25
26:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	26
27:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	27
28:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	28
29:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	29

