



BMW_{LAB} OAI Project Team

NB-IoT Commercial UE Testing

Advisor : Ray-Guang Cheng

Student : Alan Lee

Date : 2017/11/24

Outline

- NB-IoT UE & UELogviewer
- System Architecture
- MSC for AT-Commands
- Testing Result



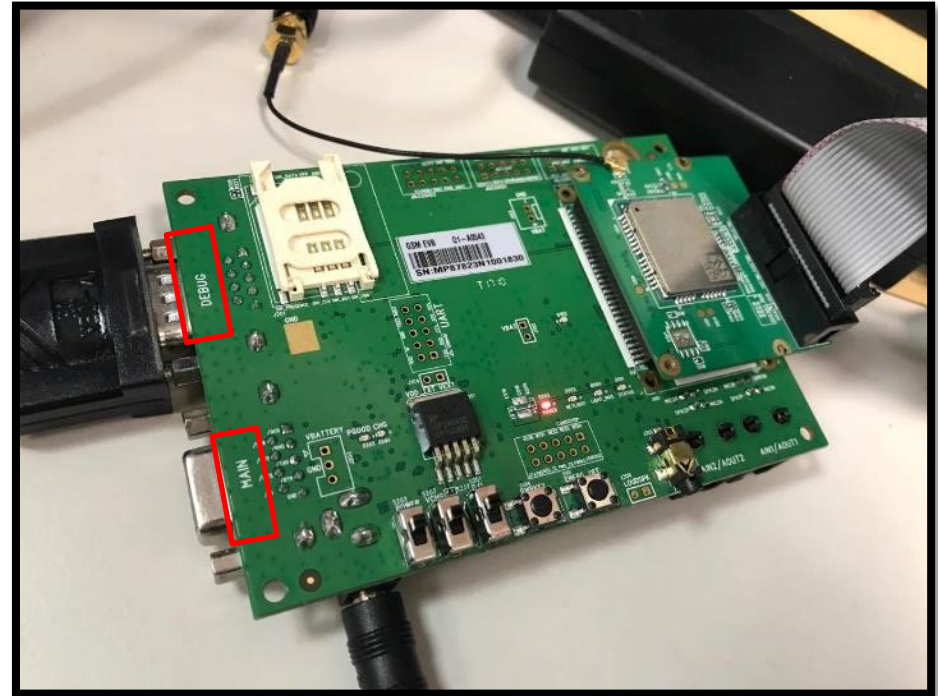
Outline

- **NB-IoT UE & UELogviewer**
- System Architecture
- MSC for AT-Commands
- Testing Result



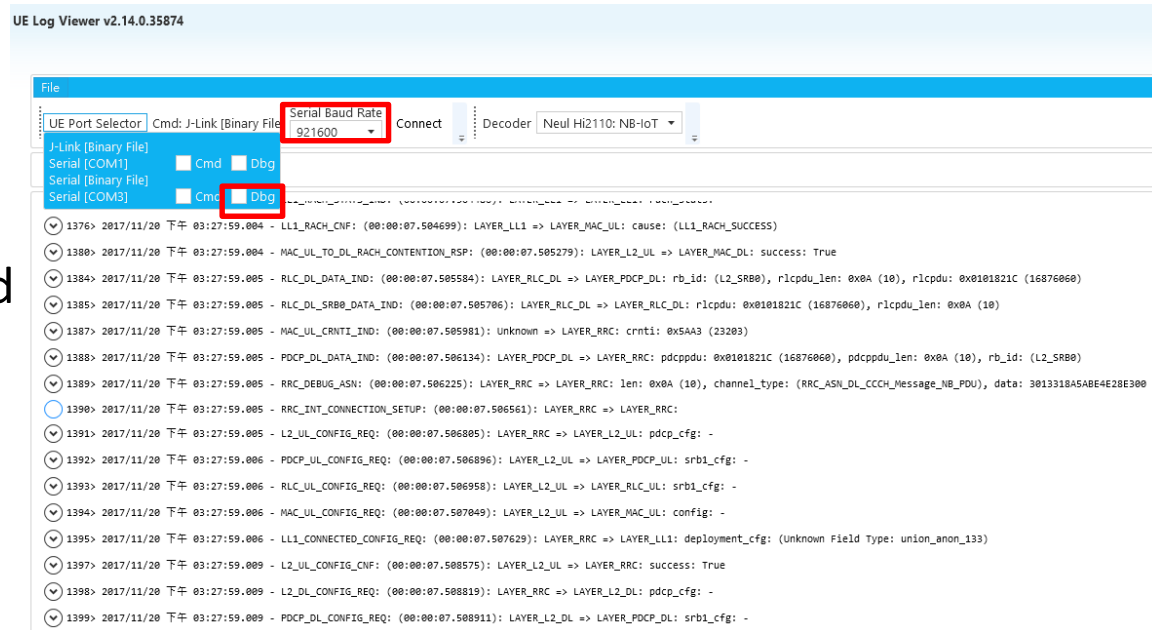
NB-IoT UE

- ➔ NB-IoT UE module is using quectel band28 chip.
- ➔ Debug port in this module is for reading log.
- ➔ Main port in this module is for sending AT-Command.



UELogviewer

- ➔ Quectel company provides the UELogViewer tool to debug.
- ➔ Select debug port and use default baud rate (921600) to read the log.



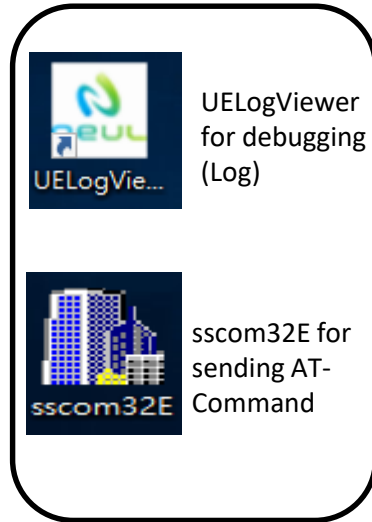
Outline

- NB-IoT UE & UELogviewer
- **System Architecture**
- MSC for AT-Commands
- Testing Result



System Architecture

PC/Laptop

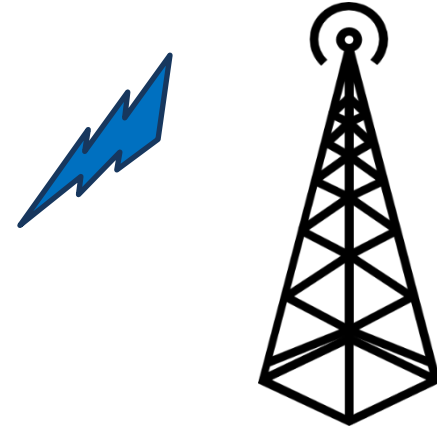


NB-IoT UE Module



Debug port
Main port

NB-IoT Base Station
& Core Network



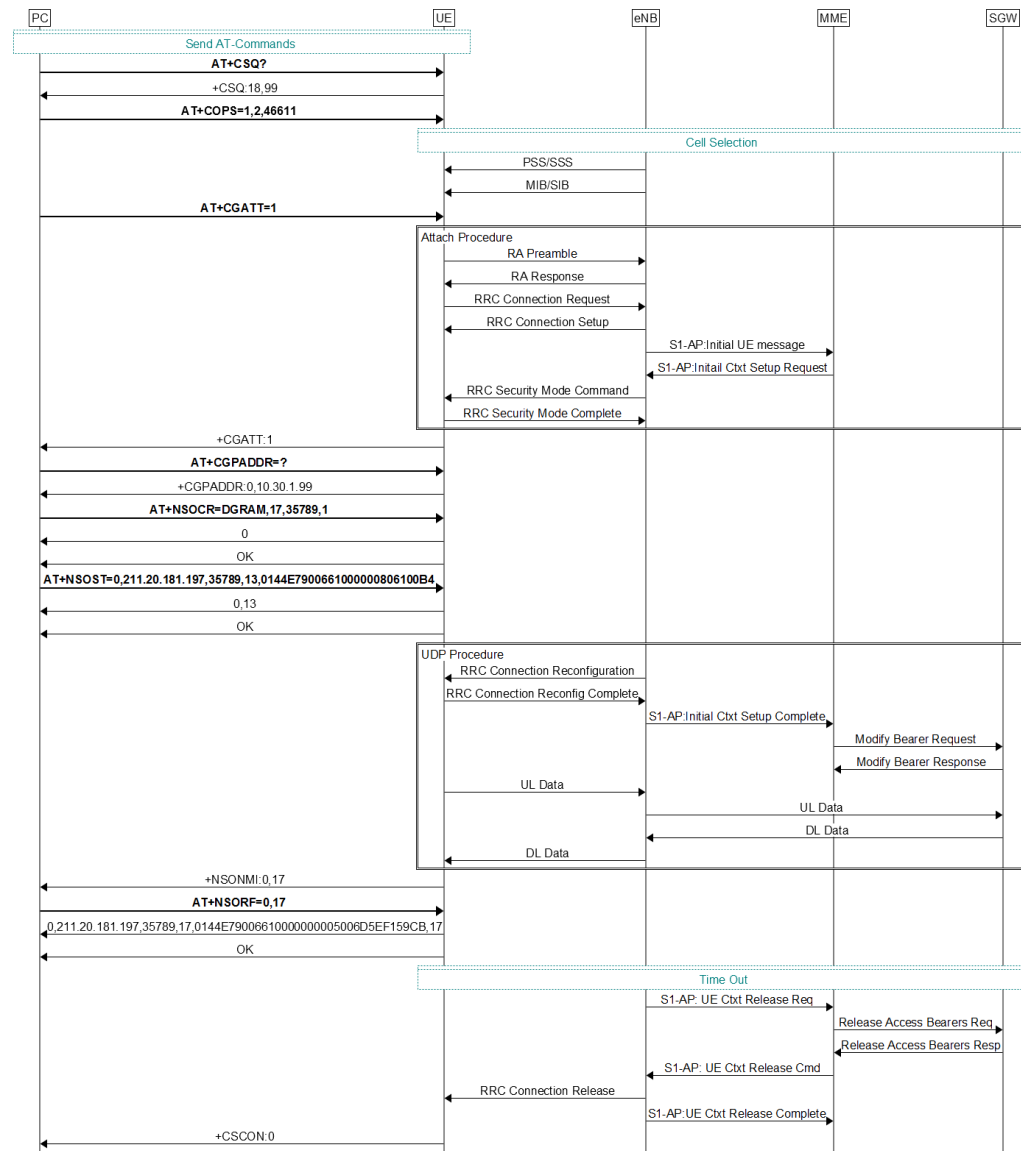
Outline

- NB-IoT UE & UELogviewer
- System Architecture
- **MSC for AT-Commands**
- Testing Result

MSC

➔ Use AT-Commands to complete attach procedure and UDP procedure.

Test Flow for NB-IoT UE Module



Outline

- NB-IoT UE & UELogviewer
- System Architecture
- MSC for AT-Commands
- **Testing Result**

Testing Result for attach procedure

- ➔ Use FarEasTone SIM card
- ➔ CGATT: 1
 - Mean that network actives
- ➔ CSCON: 1
 - Mean that RRC connected
- ➔ CREG: 1
 - Mean that register home network successfully

The screenshot displays the SSCOM3.2 software window. The main text area shows the following AT command responses:

```
OK
+CEREG:0,1
OK
+CSCON:1,0
OK
+CGATT:1
OK
0
OK
0.25
OK
+CSCON:1
+CSCON:0
+CGSN:863703031024545
OK
+CGPADDR:0.10.24.0.19
OK
```

The right-hand pane shows a list of AT commands and their corresponding data values, with a 'SEND' button next to each. The commands listed are:

| HEX | DATA | SEND |
|-----|------------------------------|------|
| 1 | AT+WRB | |
| 2 | AT+CSQ | |
| 3 | AT+CGP? | |
| 4 | AT+WRAND? | |
| 5 | AT+CFUR? | |
| 6 | R_0364_0338_SCRAMELING.TRUE | |
| 7 | AT+HUESTATS | |
| 8 | AT+HUESTATS | |
| 9 | CONFIG-CR_0869_ST_AVOID.TRUE | |
| 10 | AT+CDM | |
| 11 | AT+CREG? | |
| 12 | AT+CSCON? | |
| 13 | AT+CGATT? | |
| 14 | AT+MSOCR=DGRAM.17.12345.1 | |
| 15 | IT=0.140.118.122.114.12345.2 | |
| 16 | AT+CGPADDR=0 | |
| 17 | AT+CGSN=1 | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |

The bottom status bar shows the following information:

www.mcu51.com | S:2199 | R:5991 | COM6 opened 9600bps 8 | CTS=1 DSR=1 RLSD=1

Testing Result for UDP procedure

➔ AT+NSOST=0,140.118.122.114,12345,25,400241C7B17401724D0265703D3230313630383
23331363438

IP for UDP server.

Received HEX Data Log

{211 77 241 100} 40 02 41 C7 B1 74 01 72 4D 02 65 70 3D 3

SSCOM3.2 (Author: NieXiaoMeng . <http://www.mcu51.com>, Email: mcu52@163.com)2003.6.24

+CFUN:1

OK

+CSQ:21,99

OK

Signal power:-797

Total power:-716

TX power:50

TX time:544

RX time:24319

Cell ID:51345519

ECL:0

SNR:240

EARFCN:9370

PCI:163

RSRQ:-108

OK

+CEREG:0,1

OK

+CSCON:1,0

OK

+CGATT:1

OK

OpenFile|FileNn|SendFile|SaveData|Clear|HexData

ConRun|COM5|CloseCom|Help|WWW.MCU51.COM|Hide

BaudRt:9600|DTR|RTS|Serial port debug tool: SSCOM!
DataBt:8|Send eve|1000 ms/Time|Auth: NieXiaoMeng.
StopBt:1|SendHex|SendNew|Get new version:
Verify:None|Data input:SEND|http://www.mcu51.com/download/sscom.rar
FlowCo:None|AT+CGATT?|Your suggestion...

www.mcu51.com|S:2057|R:5880|COM6 opened 9600bps 8 CTS=1 DSR=1 RLSD=1

Set Multi Char|COM DATA|

HEX|DATA|SEND

AT+NRB|1

AT+CSQ|2

AT+CGSM?|3

AT+NBAND?|4

AT+CFUN?|5

R_0364_0368_SCAMELING_TRUE|6

AT+NRSTATUS|7

AT+NRCONFIG?|8

ONFIG-CR_0669_SI_AVOID_TRUE|9

AT+CDM|10

AT+CHERG?|11

AT+CSQ?|12

AT+CGATT?|13

|14

|15

|16

|17

|18

|19

|20

|21

|22

|23

|24

|25

|26

|27

|28

|29

Round send interval: 1000 ms



BMW LAB

Log Information

- ➔ EMM Layer Status
- ➔ RRC Layer Status
- ➔ Cell Measurement Status

UE Log Viewer v2.14.0.35874

File
UE Port Selector Cmd: J-Link (Binary File)

1> 2017/11/20 下午 03:27:55.498 - APPLI
2> 2017/11/20 下午 03:27:55.492 - LOGI
3> 2017/11/20 下午 03:27:55.493 - MONIT
4> 2017/11/20 下午 03:27:55.493 - INCDI
5> 2017/11/20 下午 03:27:55.496 - INCDI
6> 2017/11/20 下午 03:27:55.496 - NB_I
7> 2017/11/20 下午 03:27:55.496 - NAS_I
8> 2017/11/20 下午 03:27:55.496 - NAS_I
9> 2017/11/20 下午 03:27:55.496 - UICC
10> 2017/11/20 下午 03:27:55.496 - UICC
11> 2017/11/20 下午 03:27:55.496 - UICC
12> 2017/11/20 下午 03:27:55.497 - UICC
13> 2017/11/20 下午 03:27:55.497 - UICC
14> 2017/11/20 下午 03:27:55.497 - UICC
15> 2017/11/20 下午 03:27:55.497 - APPLI
16> 2017/11/20 下午 03:27:55.497 - NB_I
17> 2017/11/20 下午 03:27:55.497 - NB_I
18> 2017/11/20 下午 03:27:55.497 - NB_I
19> 2017/11/20 下午 03:27:55.497 - NB_I
20> 2017/11/20 下午 03:27:55.497 - NB_I
21> 2017/11/20 下午 03:27:55.497 - NB_I
22> 2017/11/20 下午 03:27:55.497 - NB_I
23> 2017/11/20 下午 03:27:55.497 - NB_I
24> 2017/11/20 下午 03:27:55.497 - NB_I
25> 2017/11/20 下午 03:27:55.497 - NB_I
26> 2017/11/20 下午 03:27:55.497 - NB_I
27> 2017/11/20 下午 03:27:55.497 - NB_I
28> 2017/11/20 下午 03:27:55.497 - NB_I
29> 2017/11/20 下午 03:27:55.497 - NB_I

UE data

PDP context data

| | |
|--------------|----------|
| cid | 0 |
| activated | True |
| pdn_type | IPv4 |
| pdn_len | 4 |
| IPv4 address | 0.0.0.17 |

EMM layer status

| | |
|-------------------|----------------------|
| state | PROTO_EMM_REGISTERED |
| plmn_mcc | 466 |
| plmn_mnc | 01 |
| last_reject_cause | EMM_CAUSE_UNKNOWN |

RRC layer status

| | |
|---------------|---------------|
| state | PROTO_RRC_PSM |
| earfcn | 9370 |
| pci | 163 |
| deep_coverage | False |

Cell measurement status

| | |
|---------|-------|
| earfcn | 9370 |
| cell_id | 163 |
| nrsrp | -75.6 |
| nrsrq | -10.8 |
| rssi | -69.9 |
| snr | 29.0 |

Reason: (REBOOT_CAUSE_UNKNOWN)
git_hash: (e1b1e2)
uct_version: 0x04 (4), file_version: (FILE_V1_FORMAT)
0), config: 0x04 (4), config: 0x00 (0), config: 0x00 (0), config: 0x00 (0)
(28), configured_bands: 0x0f (255), configured_bands2: 0x0f (255), configu
0x00 (0)
HARDWARE_PREFNET)
T_HARDWARE_TO_CLK_FREQ), param: 0x0f (15), param: 0x00 (0)
T_HARDWARE_TO_CLK_FREQ), param: 0x0f (15), param: 0x00 (0)
T_HARDWARE_PWR_PRC), param: 0x00 (0), param: 0x00 (0)
T_HARDWARE_CLK_FREQ)
f, pdn_len: 0x00 (0), pdn_data: 0x00 (0), pdn_data2: 0x00 (0), pdn_data3: 0
NET_EVENT)
last_reject_cause: (EMM_CAUSE_UNKNOWN)
_API_INT_BEGIN), param: 0x01 (1), param: 0x00 (0)
_HARDWARE_INT)
_HARDWARE_DEACTIVATE)
T_HARDWARE_APPLY_FREQ_VOLTAGE), param: 0x00 (0)
T_HARDWARE_INT_POWER)
T_HARDWARE_APPLY_FREQ_VOLTAGE), param: 0x00 (0)

Exclude Filter Include Filter

UE data

PDP context data

| | |
|--------------|----------|
| cid | 0 |
| activated | True |
| pdn_type | IPv4 |
| pdn_len | 4 |
| IPv4 address | 0.0.0.17 |

EMM layer status

| | |
|-------------------|----------------------|
| state | PROTO_EMM_REGISTERED |
| plmn_mcc | 466 |
| plmn_mnc | 01 |
| last_reject_cause | EMM_CAUSE_UNKNOWN |

RRC layer status

| | |
|---------------|---------------|
| state | PROTO_RRC_PSM |
| earfcn | 9370 |
| pci | 163 |
| deep_coverage | False |

Cell measurement status

| | |
|---------|-------|
| earfcn | 9370 |
| cell_id | 163 |
| nrsrp | -75.6 |
| nrsrq | -10.8 |
| rssi | -69.9 |
| snr | 29.0 |

Users\Alan\Downloads\NB-101-2017-8-11

BMW LAB

Log Information (1)Power on

- ➔ Check the UE log in the following figure
- ➔ Filter condition : ERRC_INIT 、 usim_read

22> 2017/11/20 下午 03:27:55.477 - ERRC_INIT_REQ: (00:00:04.016815): LAYER_EMMSM => LAYER_RRC: dummy: 0x00 (0)

123> 2017/11/20 下午 03:27:56.255 - ERRC_INIT_CNF: (00:00:04.748504): LAYER_RRC => LAYER_EMMSM: status: (ACT_STATUS_OK)
status: (ACT_STATUS_OK)

252> 2017/11/20 下午 03:27:56.345 - USIM_READ_PART_1_DATA_REQ: (00:00:04.851654): LAYER_EMMSM => LAYER_SIM: dummy: 0x00 (0)

860> 2017/11/20 下午 03:27:56.776 - USIM_READ_PART_1_DATA_CNF: (00:00:05.286285): LAYER_SIM => LAYER_EMMSM: card_present: True
card_present: True, admin_data0: 0x00 (0), admin_data1: 0x00 (0), admin_data2: 0x01 (1), admin_data3: 0x02 (2)
imsi: -
len: 0x08 (8) imsi: 0x010182BC (16876220)



Log Information (2) Search network

- ➔ Check the UE log in the following figure
- ➔ Filter condition : ERRR_CELL_SELECT、LL1_FREQ_SEARCH、cell_suit、asn

871> 2017/11/20 下午 03:27:56.777 - ERRR_CELL_SELECT_REQ: (00:00:05.292755): LAYER_EMMSM => LAYER_RRC: search_type: (SCS_SEARCH_TYPE), deep_coverage: True

873> 2017/11/20 下午 03:27:56.778 - LL1_FREQ_SEARCH_REQ: (00:00:05.294433): LAYER_RRC => LAYER_LL1: earfcn: 0x249A (9370), slow_search: False, freq_offset_p

1106> 2017/11/20 下午 03:27:57.308 - LL1_FREQ_SEARCH_CNF: (00:00:05.832214): LAYER_LL1 => LAYER_RRC: earfcn: 0x249A (9370)

1157> 2017/11/20 下午 03:27:57.659 - RRC_DBG_CELL_SUITABILITY: (00:00:06.196502): LAYER_RRC => LAYER_RRC: earfcn: 0x249A (9370), pcid: 0xA3 (163), rrc_state
earfcn: 0x249A (9370), pcid: 0xA3 (163), rrc_state: 0x00 (0) **suitable: True**, s_failed: False, forbidden: False, reserved: False, barred: False, barred_timer_running: False,

1237> 2017/11/20 下午 03:27:58.660 - ERRR_CELL_SELECT_CNF: (00:00:07.182342): LAYER_RRC => LAYER_EMMSM: shared_nw_plmn_list: -

13835> 2017/11/20 下午 03:28:10.822 - RRC_DBG_CELL_SUITABILITY: (00:00:19.351715): LAYER_RRC => LAYER_RRC: earfcn: 0x249A (9370), pcid: 0xA3 (163), rrc_stat

13859> 2017/11/20 下午 03:28:10.832 - ERRR_CELL_SELECT_IND: (00:00:19.359527): LAYER_RRC => LAYER_EMMSM: shared_nw_plmn_list: -



Log Information (3) Connection process

- ➔ Check the UE log in the following figure
- ➔ Filter condition : ERRC_EST 、 asn
- ➔ ERRC_EST_CNF -> for retransmission

```
1243> 2017/11/20 下午 03:27:58.680 - ERRC_EST_REQ: (00:00:07.183593): LAYER_EMMSM => LAYER_RRC: est_cause: (ORIGINATING_SIGNALLING_EST_CAUSE), plmn_id0: 0x64 (100),  
est_cause: (ORIGINATING_SIGNALLING_EST_CAUSE), plmn_id0: 0x64 (100), plmn_id1: 0xF6 (246), plmn_id2: 0x10 (16)  
mme_id: -  
  plmn_id0: 0x80 (128), plmn_id1: 0x80 (128), plmn_id2: 0x01 (1), mme_group_id0: 0x01 (1), mme_group_id1: 0x00 (0), mme_code: 0xF4 (244)  
gummei_type: (INVALID_GUMMEI_TYPE)  
s_tmsi: -  
  valid: True, mme_code: 0x68 (104), m_tmsi0: 0xD9 (217), m_tmsi1: 0x3F (63), m_tmsi2: 0x89 (137), m_tmsi3: 0xAD (173)  
relay_node_active: False, msg_id: 0x00 (0)  
nas_data: -  
  len: 0x39 (57), ptr: 0x01018080 (16875648)  
attach_without_pdn_connectivity: False  
1425> 2017/11/20 下午 03:27:59.054 - ERRC_EST_CNF: (00:00:07.517974): LAYER_RRC => LAYER_EMMSM: msg_id: 0x00 (0)
```



Log Information (4) Attach process

➡ Check the UE log in the following figure

➡ Filter condition : dbg_N

```
1240> 2017/11/20 下午 03:27:58.680 - NAS_DBG_NAS_MSG: (00:00:07.183013): LAYER_EMMISM => LAYER_EMMISM: direction: (UL_PDU), msg_type: (L3_EMM_ATTACH_REQ), len: 0x39 (57), data: 0741710BF664F610FFFD68D93F89AD06F0F00
1694> 2017/11/20 下午 03:27:59.224 - NAS_DBG_NAS_MSG: (00:00:07.734527): LAYER_EMMISM => LAYER_EMMISM: direction: (DL_PDU), msg_type: (L3_EMM_AUTH_REQ), len: 0x24 (36), data: 0752067E437BAAEA7C0740DEE17DF9431286C21
2249> 2017/11/20 下午 03:27:59.622 - NAS_DBG_NAS_MSG: (00:00:08.095336): LAYER_EMMISM => LAYER_EMMISM: direction: (UL_PDU), msg_type: (L3_EMM_AUTH_RSP), len: 0x08 (11), data: 0753089C48A091C0B68309
2698> 2017/11/20 下午 03:28:00.014 - NAS_DBG_NAS_MSG: (00:00:08.531372): LAYER_EMMISM => LAYER_EMMISM: direction: (DL_PDU), msg_type: (L3_EMM_SECURITY_MODE_CMD), len: 0x08 (8), data: 075D220602F0F0C1
2702> 2017/11/20 下午 03:28:00.014 - NAS_DBG_NAS_MSG: (00:00:08.535217): LAYER_EMMISM => LAYER_EMMISM: direction: (UL_PDU), msg_type: (L3_EMM_SECURITY_MODE_COMPLETE), len: 0x0D (13), data: 075E23098336070313205404F
3216> 2017/11/20 下午 03:28:00.462 - NAS_DBG_NAS_MSG: (00:00:08.985687): LAYER_EMMISM => LAYER_EMMISM: direction: (DL_PDU), msg_type: (L3_EMM_ATTACH_ACCEPT), len: 0x51 (81), data: 0742015F060064F6102849002A5201C101
3222> 2017/11/20 下午 03:28:00.463 - NAS_DBG_NAS_MSG: (00:00:08.987091): LAYER_EMMISM => LAYER_EMMISM: direction: (UL_PDU), msg_type: (L3_EMM_ATTACH_COMPLETE), len: 0x07 (7), data: 074300035200C2
3406> 2017/11/20 下午 03:28:00.596 - NAS_DBG_NAS_MSG: (00:00:09.107238): LAYER_EMMISM => LAYER_EMMISM: direction: (DL_PDU), msg_type: (L3_EMM_INFORMATION), len: 0x15 (21), data: 076143018045018046234771110270824223
```