

How to use MEK-D8945AL EVK to connect to lora server



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Background & Summary

This document is intended to help developers understand how to configure and use the MEK-D8945AL EVK through AT commands to communicate with lorawan network server.

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Revision History

Revision	Date	Author	Descriptions
V1.0	19.01.16	Michael Lee	created

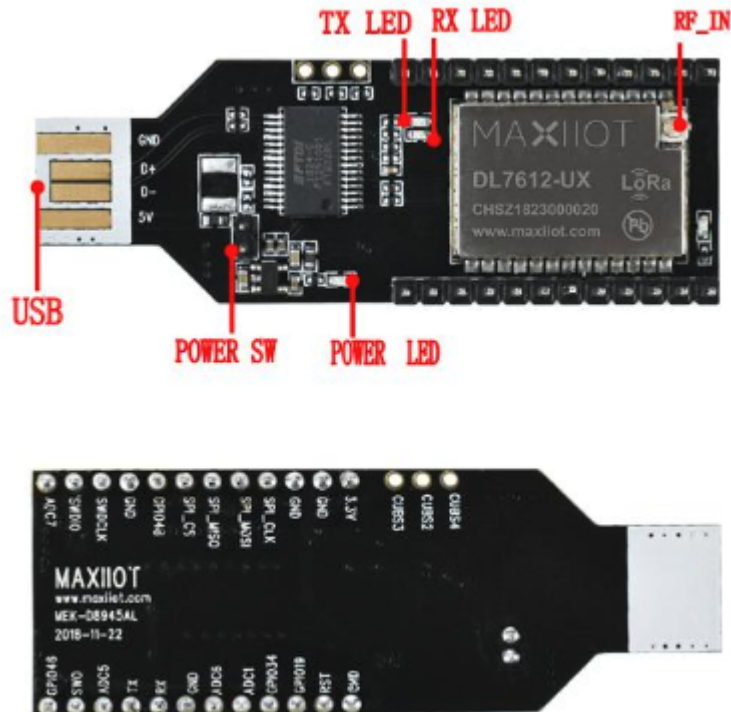
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1.Introduction

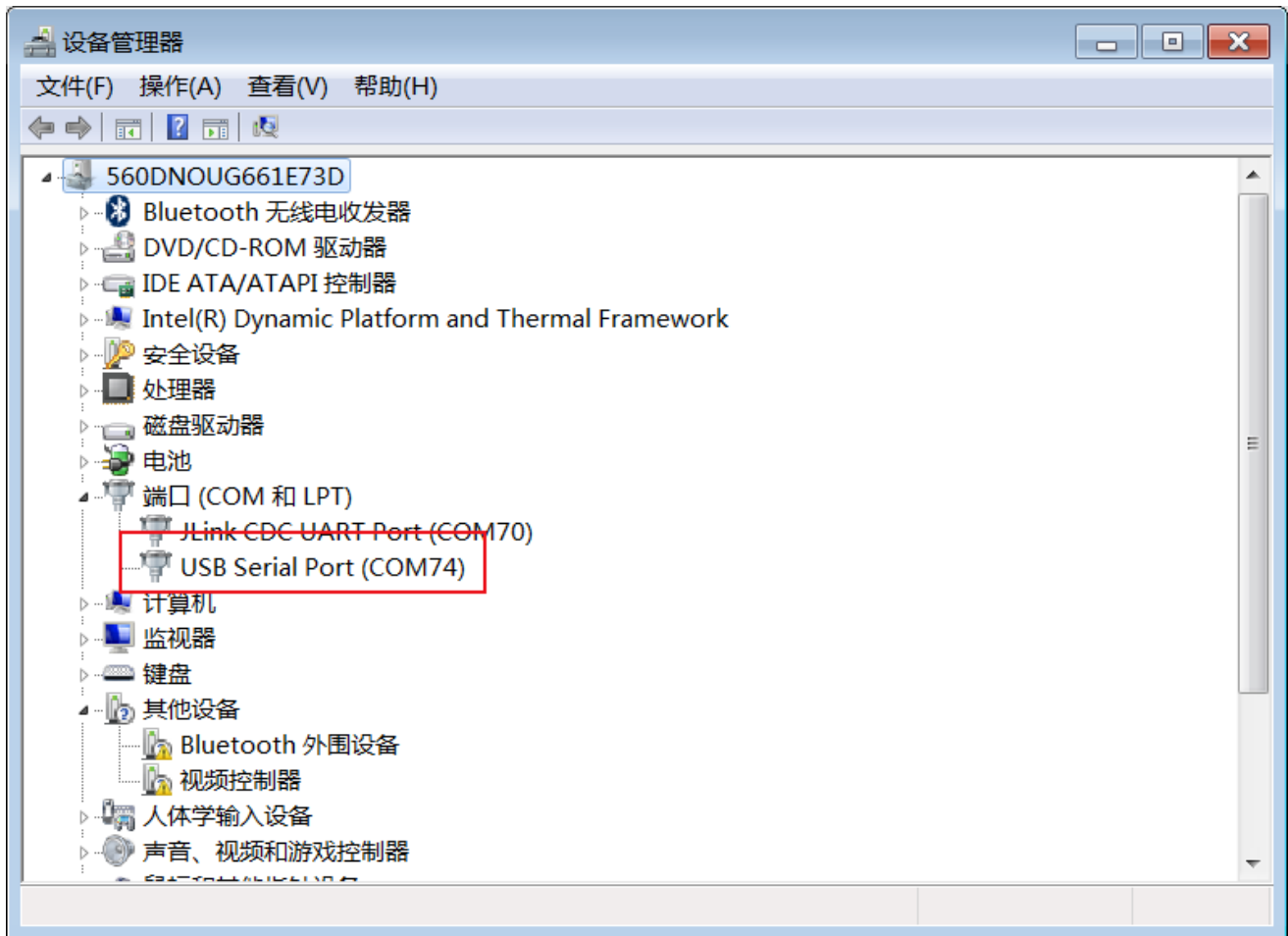
- MEK-D8945AL EVK has two versions of the AT command table, which used for LoRaWAN1.0.2 and LoRaWAN1.1 communication protocols respectively. They correspond to different firmware versions. For example, the file `<<MAXIIOT_DL7X1X-AT-CMD-LRWAN1_0_2-V1.7 >>` is prepared for LoRaWAN1.0.2 protocol, and the file `<<MAXIIOT_DL7X1X-AT-CMD-LRWAN1_1-V2.0 >>` is prepared for LoRaWAN1.1 protocol.



MEK-D8945AL EVK

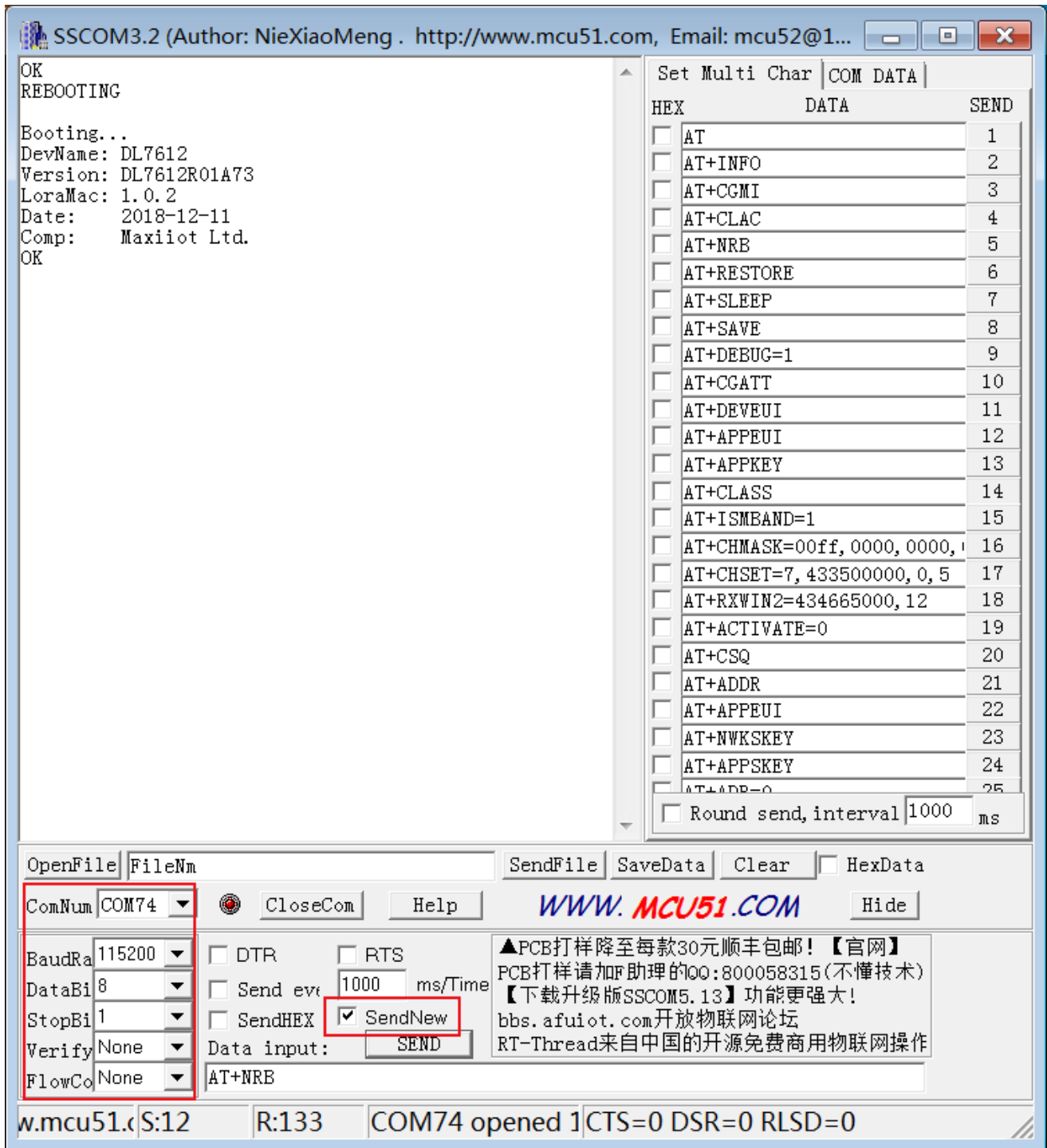
2. Development environment

- Plug MEK-D8945AL's usb connector into your computer. It will install the FT232RL driver on the computer automatically. Then you can find a new serial device in Device Manager. If not, click <https://www.ftdichip.com/Drivers/VCP.htm> to download suitable driver and install it manually.



- Install and open the software "sscom5-DL7X1X-LRWAN102" or "sscom5-DL7X1X-LRWAN110" which you download from <https://www.lpwanlab.com/products/plug-and-play-mek-d8945al-lora-evaluation-kit>.
 - UART Configuration

parameter	content
Baud Rate	115,200 bps
Data bit	8 bit
Stop bit	1 bit
Parity bit	None



Note: Remember to choose "SendNew" to add carriage returns and line feeds before sending AT commands.

3.Configuration

- Choose the appropriate ISM band , for example: AS923

- AT+ISMBAND=1
- Choose the appropriate uplink channel, for example: channel 0 to channel 7
 - AT+CHMASK=00ff,0000,0000,0000,0000,0000
- Choose CLASS mode, class A or class C
 - AT+CLASS=A
- Choose the activation way, OTAA or ABP
 - AT+ACTIVATE=1
- List all current configuration
 - AT+NCONFIG
- Enable debug mode, this can help you know the lorawan process
 - AT+DEBUG=1

4.Activation

Before using the MEK-D8945AL, you need to make sure that your lora gateway and server are suitable and usable.

Over-the-Air Activation

- Make sure device is in OTAA mode
 - AT+ACTIVATE
 - return: "+ACTIVATE:1"
 - AT+ACTIVATE=1 (if not , switch to this mode)
 - AT+SAVE
- Read the DEVEUI, APPEUI and APPKEY value.
 - AT+DEVEUI
 - AT+APPEUI
 - AT+APPKEY

SSCOM3.2 (Author: NieXiaoMeng . http://www.mcu51.com, Email: mcu52@1...

```

REBOOTING
Booting...
DevName: DL7612
Version: DL7612R01A73
LoraMac: 1.0.2
Date: 2018-12-11
Comp: Maxiot Ltd.
OK
+DevEUI:24c5d9e63257f457
OK
+APPEUI:526973696e674847
OK
+APPKEY:2b7e151628aed2a6abf7158809cf4f3c
OK
  
```

HEX	DATA	SEND
<input type="checkbox"/>	AT	1
<input type="checkbox"/>	AT+INFO	2
<input type="checkbox"/>	AT+CGMI	3
<input type="checkbox"/>	AT+CLAC	4
<input type="checkbox"/>	AT+NRB	5
<input type="checkbox"/>	AT+RESTORE	6
<input type="checkbox"/>	AT+SLEEP	7
<input type="checkbox"/>	AT+SAVE	8
<input type="checkbox"/>	AT+DEBUG=1	9
<input type="checkbox"/>	AT+CGATT	10
<input type="checkbox"/>	AT+DEVEUI	11
<input type="checkbox"/>	AT+APPEUI	12
<input type="checkbox"/>	AT+APPKEY	13
<input type="checkbox"/>	AT+CLASS	14
<input type="checkbox"/>	AT+ISMBAND=1	15
<input type="checkbox"/>	AT+CHMASK=00ff,0000,0000,0	16
<input type="checkbox"/>	AT+CHSET=7,433500000,0,5	17
<input type="checkbox"/>	AT+RXWIN2=434665000,12	18
<input type="checkbox"/>	AT+ACTIVATE=0	19
<input type="checkbox"/>	AT+CSQ	20
<input type="checkbox"/>	AT+ADDR	21
<input type="checkbox"/>	AT+APPEUI	22
<input type="checkbox"/>	AT+NWKSKEY	23
<input type="checkbox"/>	AT+APPSKEY	24
<input type="checkbox"/>	AT+ADDR=0	25

Round send, interval 1000 ms

OpenFile | FileNm | SendFile | SaveData | Clear | HexData

ComNum COM74 | CloseCom | Help | WWW.MCU51.COM | Hide

BaudRa 115200 | DataBi 8 | StopBi 1 | Verify None | FlowCo None

DTR | RTS | Send evt 1000 ms/Time | SendHEX | SendNew

Data input: SEND

AT+APPKEY

w.mcu51.c | S:41 | R:235 | COM74 opened | CTS=0 DSR=0 RLSD=0

- Register the device as an OTAA device on the lora server.

Applications / 111 / Devices / Create

Device name *

DL7612-F457

The name may only contain words, numbers and dashes.

Device description *

DL7612

Device EUI *

24 c5 d9 e6 32 57 f4 57

MSB



Device-profile *

AS923-OTAA-CLASSA

Disable frame-counter validation

Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.

CREATE DEVICE

Applications / 111 / Devices / DL7612-F457

DELETE

CONFIGURATION

KEYS (OTAA)

ACTIVATION

LIVE DEVICE DATA

LIVE LORAWAN FRAMES

Application key (LoRaWAN 1.0) *

2b 7e 15 16 28 ae d2 a6 ab f7 15 88 09 cf 4f 3c

MSB



For LoRaWAN 1.0 devices, this is the only key you need to set. In case your device supports LoRaWAN 1.1, update the device-profile first.

SET DEVICE-KEYS

- Restart the device , it will join the network automatically. If the activation is successful, the device will print "+CGATT:1". If fail after one minute, the device will print "+CGATT:0".
 - AT+NRB
 - AT+CGATT (option) : check the status of activation
 - "+CGATT:1"


```

REBOOTING
Booting...
DevName: DL7612
Version: DL7612R01A73
LoraMac: 1.0.2
Date: 2018-12-11
Comp: Maxiot Ltd.
OK

- OTAA-Try
- CH7 924600000 DR2
- TXDONE
- RXWIN1 924600000 DR2
radio rx:17,20 22 1e 3b e0 b9 b3 5e 0f ce c2 28 7b f0
55 81 47
- OTAA-OK
+CGATT:1
    
```

HEX	DATA	SEND
<input type="checkbox"/>	AT	1
<input type="checkbox"/>	AT+INFO	2
<input type="checkbox"/>	AT+SAVE	3
<input type="checkbox"/>	AT+CLAC	4
<input type="checkbox"/>	AT+NRB	5
<input type="checkbox"/>	AT+RESTORE	6
<input type="checkbox"/>	AT+SLEEP	7
<input type="checkbox"/>	AT+DEBUG=1	8
<input type="checkbox"/>		9
<input type="checkbox"/>	AT+CGATT	10
<input type="checkbox"/>	AT+DEVEUI	11
<input type="checkbox"/>	AT+APPEUI	12
<input type="checkbox"/>	AT+APPKEY	13
<input type="checkbox"/>	AT+CLASS	14
<input type="checkbox"/>	AT+ISMBAND=1	15
<input type="checkbox"/>	AT+CHMASK=00ff,0000,0000,0	16
<input type="checkbox"/>	AT+CHSET=7,433500000,0,5	17
<input type="checkbox"/>	AT+RXWIN2=434665000,12	18
<input type="checkbox"/>	AT+ACTIVATE=0	19
<input type="checkbox"/>	AT+CSQ	20
<input type="checkbox"/>	AT+ADDR	21
<input type="checkbox"/>	AT+APPEUI	22
<input type="checkbox"/>	AT+NWKSKEY	23
<input type="checkbox"/>	AT+APPSKEY	24
<input type="checkbox"/>	AT+ADDR=0	25

Round send, interval 1000 ms

OpenFile FileNm SendFile SaveData Clear HexData

ComNum COM74 CloseCom Help WWW.MCU51.COM Hide

BaudRa 115200 DTR RTS
 DataBi 8 Send evt 1000 ms/Time
 StopBi 1 SendHEX SendNew
 Verify None Data input: SEND
 FlowCo None AT+NRB

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w.mcu51.c S:8 R:285 COM74 opened 1 CTS=0 DSR=0 RLSD=0

DOWNLINK	7:04:21 PM	JoinAccept	
UPLINK	7:04:21 PM	JoinRequest	24c5d9e63257f457
<pre> ▼ rxInfo: [] 1 item ▼ 0: {} 12 keys gatewayId: "24c5d9e63257f39f" time: "2019-01-18T11:04:49Z" timeSinceGpsEpoch: null timestamp: 3943618596 rssi: -58 loraSnr: 11.2 channel: 0 rfChain: 1 board: 0 antenna: 0 ▼ location: {} 5 keys latitude: 22.5 longitude: 113.9 altitude: 52 source: "UNKNOWN" accuracy: 0 fineTimestampType: "NONE" ▼ txInfo: {} 3 keys frequency: 924200000 modulation: "LORA" ▼ loRaModulationInfo: {} 4 keys bandwidth: 125 spreadingFactor: 10 codeRate: "4/5" polarizationInversion: false ▼ phyPayload: {} 3 keys ▼ mhdr: {} 2 keys mType: "JoinRequest" major: "LoRaWANR1" ▼ macPayload: {} 3 keys joinEUI: "526973696e674847" devEUI: "24c5d9e63257f457" devNonce: 7287 mic: "d00dd611" </pre>			

Activation by Personalization

- Make sure device is in ABP mode
 - AT+ACTIVATE
 - return: "+ACTIVATE:1"
 - AT+ACTIVATE=0 (if not , switch to this mode)
 - AT+SAVE
- Read the DEVEUI, Device Address, NWKSKEY and APPSKEY value.
 - AT+DEVEUI
 - AT+ADDR
 - AT+NWKSKEY
 - AT+APPSKEY

SSCOM3.2 (Author: NieXiaoMeng . http://www.mcu51.com, Email: mcu52...)

```

REBOOTING
Booting...
DevName: DL7612
Version: DL7612R01A73
LoraMac: 1.0.2
Date: 2018-12-11
Comp: Maxiiot Ltd.
OK
+DevEUI:24c5d9e63257f457
OK
+ADDR:3257f457
OK
+APPSKEY:6e07676f020cceb58c60b57744303353
OK
+NWKSKEY:f6d9841cbd8e82d6e5de4894b005898a
OK
  
```

HEX	DATA	SEND
<input type="checkbox"/>	AT	1
<input type="checkbox"/>	AT+INFO	2
<input type="checkbox"/>	AT+SAVE	3
<input type="checkbox"/>	AT+CLAC	4
<input type="checkbox"/>	AT+NRE	5
<input type="checkbox"/>	AT+RESTORE	6
<input type="checkbox"/>	AT+SLEEP	7
<input type="checkbox"/>	AT+DEBUG=0	8
<input type="checkbox"/>		9
<input type="checkbox"/>	AT+CGATT	10
<input type="checkbox"/>	AT+DEVEUI	11
<input type="checkbox"/>	AT+APPEUI	12
<input type="checkbox"/>	AT+APPKEY	13
<input type="checkbox"/>	AT+CLASS	14
<input type="checkbox"/>	AT+ISMBAND=0	15
<input type="checkbox"/>	AT+CHMASK=00ff,0000,0000,0	16
<input type="checkbox"/>	AT+CHSET=7,433500000,0,5	17
<input type="checkbox"/>	AT+RXWIN2=434665000,12	18
<input type="checkbox"/>	AT+ACTIVATE=0	19
<input type="checkbox"/>	AT+CSQ	20
<input type="checkbox"/>	AT+ADDR	21
<input type="checkbox"/>	AT+APPSKEY	22
<input type="checkbox"/>	AT+NWKSKEY	23
<input type="checkbox"/>	AT+PORT	24
<input type="checkbox"/>	AT+ADR	25
<input type="checkbox"/>	AT+DR=2	26
<input type="checkbox"/>	AT+CFM=1	27
<input type="checkbox"/>	AT+NMGS=5,AA112233BB	28
<input type="checkbox"/>	AT+NCMGS=5,HELLO	29
<input type="checkbox"/>	AT+NQMGS	30

Round send, interval 1000 ms

OpenFile FileNm SendFile SaveData Clear HexData

ComNum COM74 CloseCom Help WWW.MCU51.COM Hide

BaudRa 115200 DTR RTS
 DataBi 8 Send evt 1000 ms/Time
 StopBi 1 SendHEX SendNew
 Verify None Data input: SEND
 FlowCo None AT+NWKSKEY

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w.mcu51.c S:52 R:273 COM74 opened 1 CTS=0 DSR=0 RLSD=0

- Register the device as an ABP device on the lora server.

Device name*

DL7612-F457

The name may only contain words, numbers and dashes.

Device description*

DL7612

Device EUI*

24 c5 d9 e6 32 57 f4 57

MSB



Device-profile*

AS923-ABP-CLASSA

Disable frame-counter validation

Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.

CREATE DEVICE

DELETE

CONFIGURATION

KEYS (OTAA)

ACTIVATION

LIVE DEVICE DATA

LIVE LORAWAN FRAMES

Device address*

32 57 f4 57

MSB



Network session key (LoRaWAN 1.0)*

2b 7e 15 16 28 ae d2 a6 ab f7 15 88 09 cf 4f 3c

MSB



Application session key (LoRaWAN 1.0)*

2b 7e 15 16 28 ae d2 a6 ab f7 15 88 09 cf 4f 3c

MSB



Uplink frame-counter*

0

Downlink frame-counter (network)*

0

(RE)ACTIVATE DEVICE

- Restart the device , then device is in ABP mode.

5.Transmission

Uplink transmission

- Choose confirm frame mode or unconfirm frame mode
 - confirm frame mode: AT+CFM=1
 - unconfirm frame mode: AT+CFM=0
- Device sends an uplink frame. If tx done, device will print "+NMGS:0" . In confirm frame mode, If receive "ACK" from server, device will print "+NSMI:1" , if not, print "+NSMI:0".
 - send by hex format: AT+NMGS=5,AA112233BB
 - send by char format: AT+NCMGS=5,HELLO

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

```

REBOOTING
Booting...
DevName: DL7612
Version: DL7612R01A73
LoraMac: 1.0.2
Date: 2018-12-11
Comp: Maxiot Ltd.
OK

- OTAA-Try
- CH6 924400000 DR2
- TXDONE
- RXWIN1 924400000 DR2
radio rx:17,20 43 c6 cd 4a fc 16 bb b2 f4 e2 36 a3 bc
41 68 c6
- OTAA-OK
+CGATT:1
- LoRaMacBuffer:80 aa f9 31 07 80 01 00 02 37 28 d9 a2
15 f4 2f 2f b6
- CH3 923800000 DR2
+NMGS:0
OK
- TXDONE
- RXWIN1 923800000 DR2
radio rx:17,60 aa f9 31 07 a5 00 00 03 52 03 00 01 ee
da 0b 91
+ACK
+FOptsLen > 0, into mac command
+NSMI:1
  
```

HEX	DATA	SEND
<input type="checkbox"/>	AT	1
<input type="checkbox"/>	AT+INFO	2
<input type="checkbox"/>	AT+SAVE	3
<input type="checkbox"/>	AT+CLAC	4
<input type="checkbox"/>	AT+NRB	5
<input type="checkbox"/>	AT+RESTORE	6
<input type="checkbox"/>	AT+SLEEP	7
<input type="checkbox"/>	AT+DEBUG=1	8
<input type="checkbox"/>		9
<input type="checkbox"/>	AT+CGATT	10
<input type="checkbox"/>	AT+DEVEUI	11
<input type="checkbox"/>	AT+APPEUI	12
<input type="checkbox"/>	AT+APPKEY	13
<input type="checkbox"/>	AT+CLASS	14
<input type="checkbox"/>	AT+ISMBAND=1	15
<input type="checkbox"/>	AT+CHMASK=0off, 0000, 0000,	16
<input type="checkbox"/>	AT+CHSET=7, 433500000, 0, 5	17
<input type="checkbox"/>	AT+RXWIN2=434665000, 12	18
<input type="checkbox"/>	AT+ACTIVATE=0	19
<input type="checkbox"/>	AT+CSQ	20
<input type="checkbox"/>	AT+ADDR	21
<input type="checkbox"/>	AT+APPSKEY	22
<input type="checkbox"/>	AT+NWKSKEY	23
<input type="checkbox"/>	AT+PORT	24
<input type="checkbox"/>	AT+ADR	25
<input type="checkbox"/>	AT+DR=2	26
<input type="checkbox"/>	AT+CFM=1	27
<input type="checkbox"/>	AT+NMGS=5, AA112233BB	28
<input type="checkbox"/>	AT+NCMGS=5, HELLO	29
<input type="checkbox"/>	AT+NMGS	30

Round send, interval 1000 ms

OpenFile FileNm SendFile SaveData Clear HexData

ComNum COM74 CloseCom Help WWW.MCU51.COM Hide

BaudRa 115200 DTR RTS Send ev 1000 ms/Time SendNew Data input: SEND

DataBi 8 StopBi 1 Verify None FlowCo None AT+NMGS=5, AA112233BB

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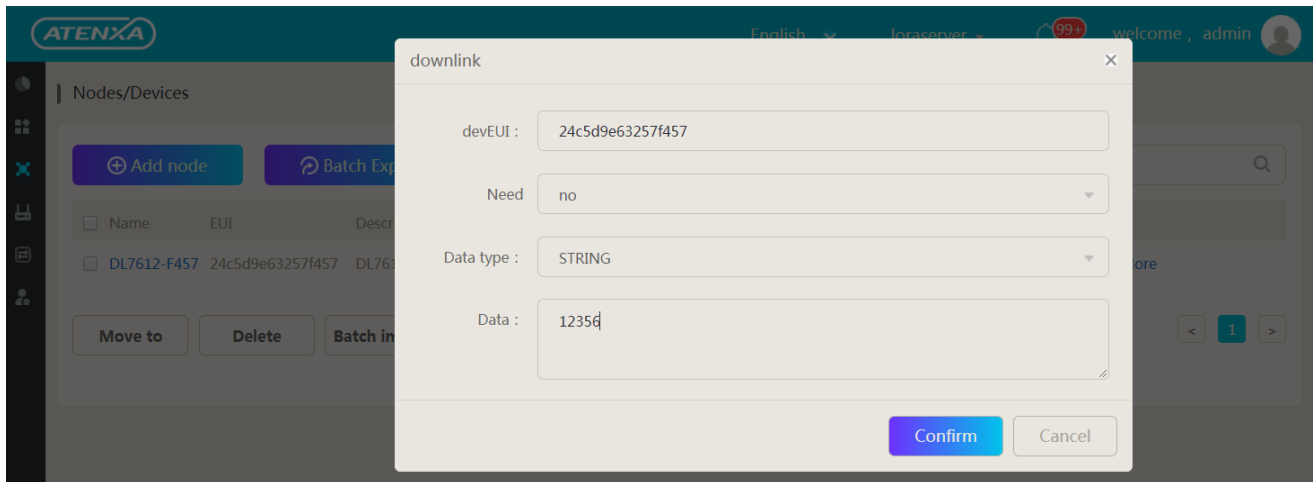
w.mcu51.c S:30 R:541 COM74 opened 1 CTS=0 DSR=0 RLSD=0

DOWNLINK	7:01:46 PM	UnconfirmedDataDown	0731f9aa
UPLINK	7:01:46 PM	ConfirmedDataUp	0731f9aa
<pre> ▼ rxInfo: [] 1 item ▼ 0: {} 12 keys gatewayId: "24c5d9e63257f39f" time: "2019-01-18T11:02:14Z" timeSinceGpsEpoch: null timestamp: 3788512276 rssi: -53 loraSnr: 10.5 channel: 7 rfChain: 0 board: 0 antenna: 0 ▼ location: {} 5 keys latitude: 22.5 longitude: 113.9 altitude: 52 source: "UNKNOWN" accuracy: 0 fineTimestampType: "NONE" ▼ txInfo: {} 3 keys frequency: 923800000 modulation: "LORA" ▼ loRaModulationInfo: {} 4 keys bandwidth: 125 spreadingFactor: 10 codeRate: "4/5" polarizationInversion: false ▼ phyPayload: {} 3 keys ▼ mhdr: {} 2 keys mType: "ConfirmedDataUp" major: "LoRaWANR1" ▼ macPayload: {} 3 keys ▼ fhdr: {} 4 keys devAddr: "0731f9aa" ▼ fCtrl: {} 5 keys adr: true adrAckReq: false ack: false fPending: false classB: false fCnt: 1 fOpts: null fPort: 2 ▼ frmPayload: [] 1 item ▼ 0: {} 1 key bytes: "NyjZohU=" mic: "f42f2fb6" </pre>			

- Uplink transmission statistical
 - AT+NQMGS

Downlink transmission

- Sending a downlink frame by lora server. If device is in class A mode, device need to send an uplink frame and then receives the downlink frame. If device is in class C mode, it will receive immediately. When device receives the frame, it will print it or cache up.



```

- LoRaMacBuffer:80 d4 4e 6d 06 82 02 00 03 07 02 0d da 3a ac
bc d8 92 4c 9b
- CH1 923400000 DR5
+NMGS:0
OK
- TXDONE
- RXWIN1 923400000 DR5
radio rx:23,60 d4 4e|6d 06 a5 01 00 03 53 03 00 01 02 8d 72 d1
bf e3 0e 9f 6f 5d
+ACK
+FOptsLen > 0, into mac command
-NNMI:5, 3132333536
+Size:5
+Decode FRMPayload: 31 32 33 35 36
+RSSI:-62 SNR:26
+NSMI:1

```

- Downlink transmission statistical
 - AT+NQMGR
- Read device receiving signal strength
 - AT+CSQ