



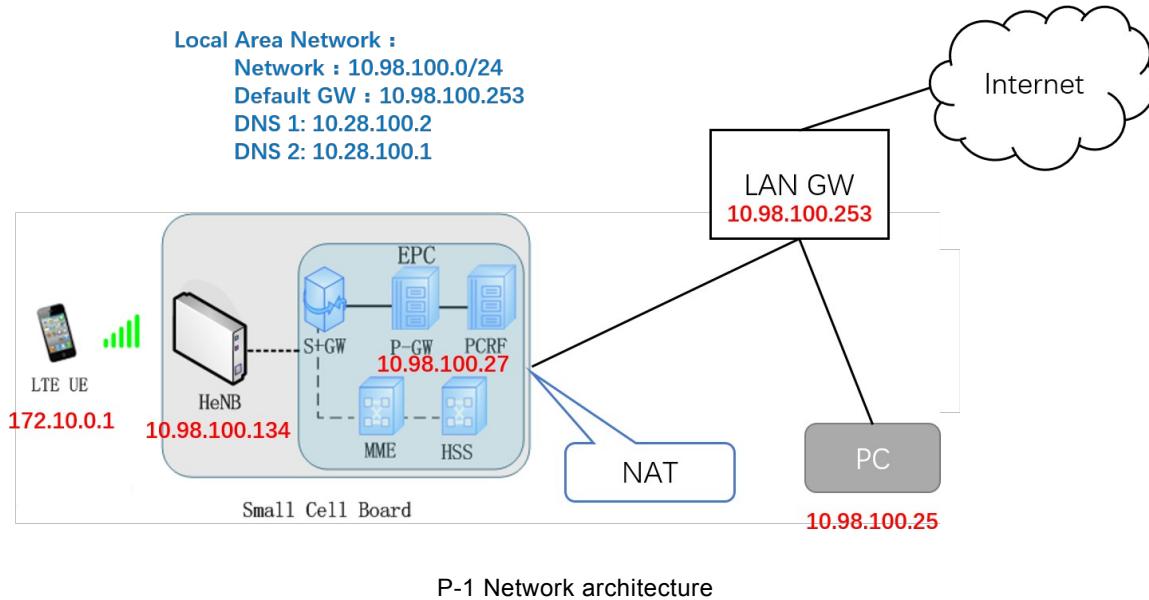
# **Intercell Build-in EPC**

## **User Guide**

# 1 Network topology

## 1.1 Description

This doc is based on below network architecture.



P-1 Network architecture

This topology shows typical Smallcell network architecture. HeNB works as LTE base station, provides LTE service to UE and the EPC is working on the same HeNB using seperate IP address.

- Small Cell IP address 10.98.100.134, login WebGUI via this IP address.
- Build-in EPC IP address 10.98.100.27

**Note:**

- ✓ This IP address should be in the same LAN as HeNB
- ✓ This IP address is static, and can not conflict with others
- Build-in EPC works as P-GW, it will forward packets to local area network and Internet.

## 1.2 Configuration data

**EPC parameters :**

Parameters	Value
Build-in EPC IP	10.98.100.27
MME port	36412(dafault)
PLMN	00666

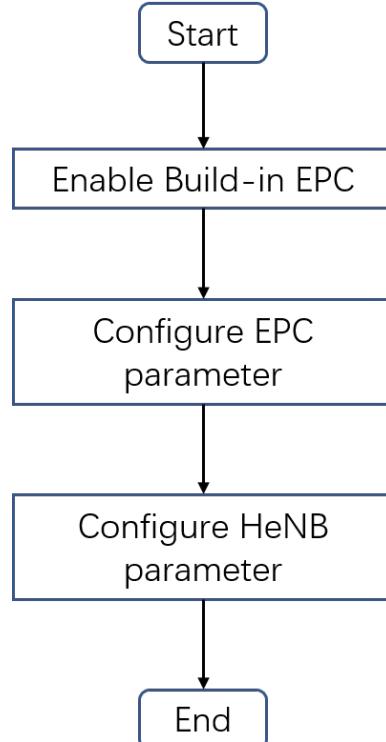
**HeNB parameters :**

Parameters	Value
IP	10.98.100.134
TAC	10
eNodeB ID	257/258

**UE :**

Parameters	Value
IMSI	006660000000001
Encryption Algorithm	Milenage
USIM Key	01020304050607080102030405060708
Op Value	01020304050607080102030405060708
IP	172.10.0.1

## 1.3 Configuration flow



P-2 Configuration Flow

### 1.3.1 Enable Build-in EPC

Path : Device.X\_OUI\_DebugMgmt.CnOnBoard.

1. Configure “CnIp”, for instance 10.98.100.27
2. Select“Enable
3. Press“Submit”

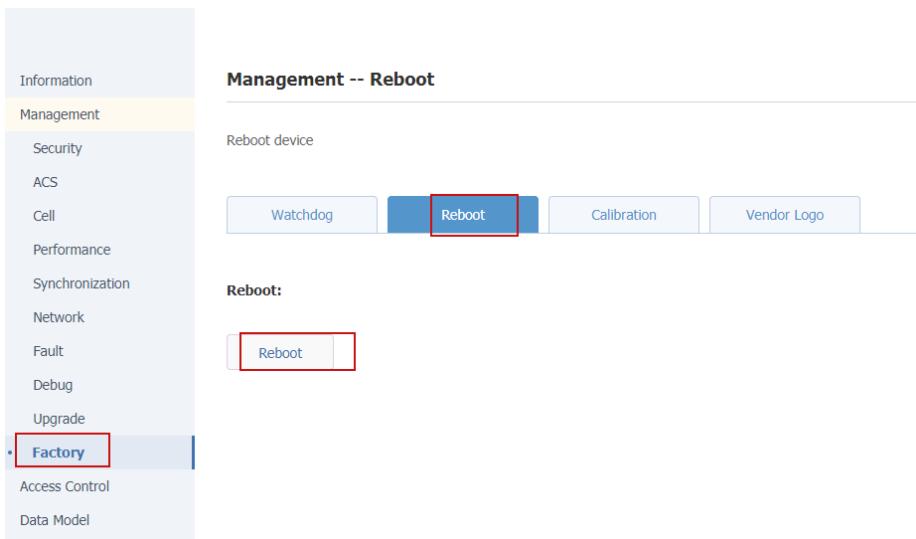
The screenshot shows a configuration interface with the following details:

- Root Path:** Device.
- DB tree:**
  - HistoryEvent
  - ExpeditedEvent
  - QueuedEvent
  - LogMgmt
  - X\_001E73\_DebugMgmt
  - CnOnBoard
  - SelfDiscovery
  - Iptables
  - PACalibration
  - TraceFilter
  - Upload
- Configuration Fields:**

Enable	<input checked="" type="checkbox"/> Enable	boolean
CnIp	10.98.100.27	string
- Buttons:** submit, drop

P-3 Configuration and Enable Build-in EPC

#### 4. Reboot HeNB manually

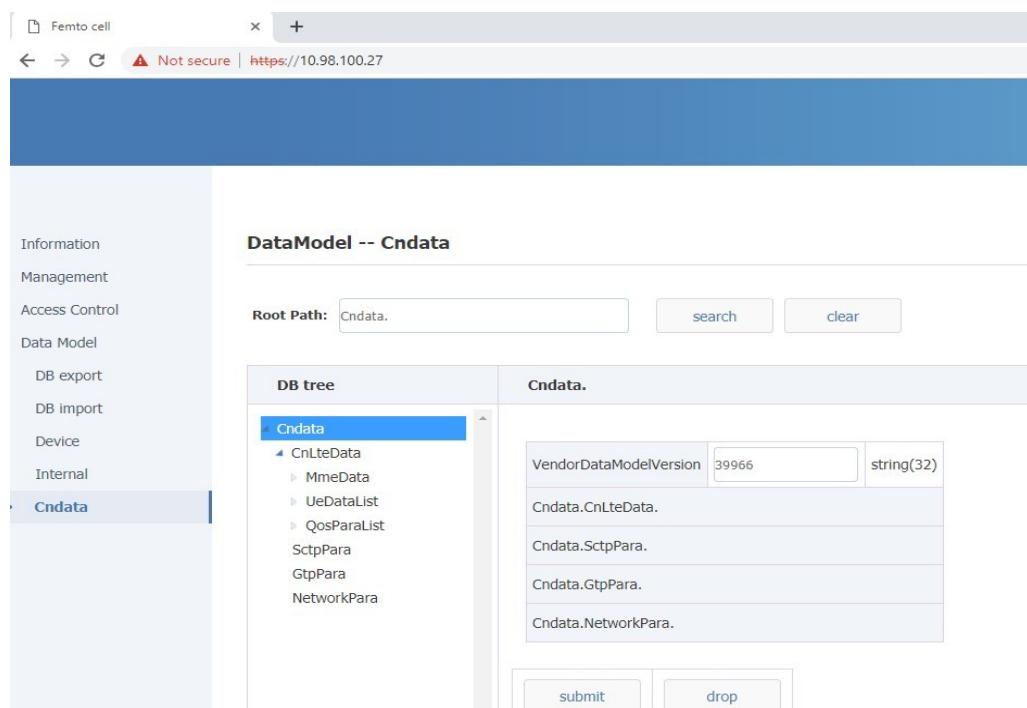


P-4 Reboot manually

### 1.3.2 Configure Build-in EPC parameters

#### 1.3.2.1 Login Build-in EPC WebGUI

- Access URL : <https://10.98.100.27/>
- User name : admin
- Pass word : MikroTik



P-5 Login Build-in EPC WebGUI

### 1.3.2.2 Configure Build-in EPC PLMN ID

Path : Cndata.CnLteData.MmeData.ServedGummei.1.ServedPlmnId.1.

- PlmnId : 0,0,6,6,6

**DataModel -- Cndata**

**Root Path:** Cndata.

DB tree		Cndata.CnLteData.MmeData.ServedGummei.1.ServedPlmnId.1.	
▲ Cndata ▲ CnLteData ▲ MmeData ▲ ServedGummei ▲ ServedGummei.1 ▲ ServedPlmnId <b>ServedPlmnId.1</b> ▲ ServedGroupId □ ServedGroupId.1 ▲ ServedMmeCode □ ServedMmeCode.1 ▶ UeDataList ▶ QosParaList		PlmnMncCount <input type="text" value="2"/> unsignedInt([2:3]) <b>PlmnId</b> <input type="text" value="0,0,6,6,6"/> string(6) <input type="button" value="submit"/> <input type="button" value="drop"/>	

P-6 Configure Build-in EPC PLMN ID

### 1.3.2.3 Configure Build-in EPC UE parameters

#### 1. Configure UE IMSI in Build-in EPC

Path : Cndata.CnLteData.UeDataList.UeData.{i}.

- Imsi: 0066600000000001

**DataModel -- Cndata**

**Root Path:** Cndata.

DB tree		Cndata.CnLteData.UeDataList.UeData.1.	
▲ Cndata ▲ CnLteData ▷ MmeData ▲ UeDataList ▲ UeData <b>UeData.1</b> ▷ Guti ▷ UeNetworkCapa ▷ MsNetworkCapa ▷ EmmPara ▷ EsmPara ▷ UeData.2 ▷ UeData.3 ▷ UeData.4 ▷ UeData.5 ▷ UeData.6 ▷ UeData.7		MmeUeId <input type="text" value="0"/> unsignedInt([0:4294967295]) EnbUeId <input type="text" value="4"/> unsignedInt([0:4294967295]) <b>Imsi</b> <input type="text" value="0066600000000001"/> string(15) Imei <input type="text" value="0000000000000000"/> string(15) Cndata.CnLteData.UeDataList.UeData.1.Guti. Cndata.CnLteData.UeDataList.UeData.1.UeNetworkCapa. Cndata.CnLteData.UeDataList.UeData.1.MsNetworkCapa. Cndata.CnLteData.UeDataList.UeData.1.EmmPara. Cndata.CnLteData.UeDataList.UeData.1.EsmPara.	

P-7 Configure Build-in EPC UE parameters

## 2. Configure Build-in EPC EMM parameters

Path : Cndata.CnLteData.UeDataList.UeData.{i}.EmmPara.

- MilenageAlgorithmEnable: Configure as “1” to enable MILENAGE Algorithm
- OpValue: Configure as “01020304050607080102030405060708”
- UsimK: Configure as “01020304050607080102030405060708”
- SQN: Configure as “000000000001”
- AMF: Configure as “8000”

The screenshot shows the DB tree interface with the path `Cndata.CnLteData.UeDataList.UeData.1.EmmPara` highlighted. The right panel displays a table with the following data:

Parameter	Value	Type
UeState	NULL	string
MilenageAlgorithmEnable	1	unsignedInt([0:1])
OpValue	01020304050607080102030405060708	string(32)
UsimK	01020304050607080102030405060708	string(32)
SQN	000000000001	string(12)
AMF	8000	string(4)

Buttons for `submit` and `reset` are visible at the bottom of the form.

P-7 Configure Build-in EPC EMM parameter

## 3. Configure Build-in EPC ESM parameters

Path : Cndata.CnLteData.UeDataList.UeData.{i}.EsmPara.ERabData.1.

- Apn: **jpspir**.
- Note:** The APN name in UE should be configured the same as this value
- UeIpAddr: 172.10.0.1

**Note:** This is the IP address which will be assigned to UE

The screenshot shows the DB tree interface with the path `Cndata.CnLteData.UeDataList.UeData.1.EsmPara.ERabData.1` highlighted. The right panel displays a table with the following data:

Parameter	Value	Type
ERabEnable	1	unsignedInt([0:1])
ERabState	NULL	string
ERabId	5	unsignedInt([0:15])
Apn	jpspir.	string(255)
ImsVoiceBearerIndicator	0	unsignedInt([0:1])
DefaultEpsBearerIndicator	1	unsignedInt([0:1])
LinkedDefaultEpsBearerId	0	unsignedInt([0:15])
UeIpType	0	unsignedInt([0:1])
UeIpAddr	172.10.0.1	string(46)
CacheDataThreshold	50	unsignedInt([0:65535])
CacheDataPagingNumber	5	unsignedInt([0:255])
CacheDataPagingInterval	5	unsignedInt([0:255])

P-8 Configure Build-in EPC ESM parameter

### 1.3.2.4 Configure Build-in EPC network parameters

1. StartIpAddr:
  - ✓ This should be the same as the IP address of the 1<sup>st</sup> UE
  - ✓ This IP address is for the Build-in EPC to add route to UE in kernel
2. “PrimDnsAddr” and“SecondDnsAddr”:
  - ✓ Configure as the DNS servers of local area network, for instance 10.28.100.2 and 10.28.100.1
3. IpForwardEnable
  - ✓ This should be configured as “1” by default, otherwise the Build-in EPC can not forward packets
4. NatEnable
  - ✓ This is switch of NAT function, it is enabled by default

DB tree			Cndata.NetworkPara.
▲ Cndata	LocalIpType	0	unsignedInt([0:1])
▲ CnLteData	DeviceId	0	unsignedInt([0:1])
▶ MmeData	SubInterface	2	unsignedInt([0:8])
▶ UeDataList	IpForwardEnable	1	unsignedInt([0:1])
▶ QosParaList	NatEnable	1	unsignedInt([0:1])
SctpPara	TunName	TUN_SIMU	string(16)
GtpPara	TunIpAddr	192.168.200.30	string(46)
NetworkPara	StartIpAddr	172.10.0.1	string(46)
	PrimDnsAddr	10.28.100.2	string(46)
	SecondDnsAddr	10.28.100.1	string(46)

P-9 Configure Build-in EPC Network parameter

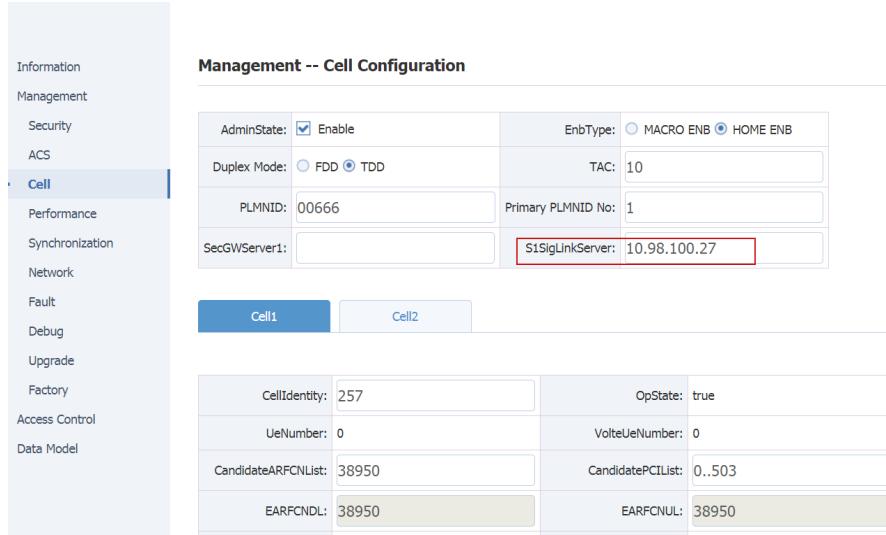
### 1.3.2.5 Reboot

Reboot manually to take above configuration into effect.

## 1.3.3 Configure Small Cell parameters

### 1.3.3.1 Configure EPC address in Small Cell

Login Small Cell WebGUI, configure “S1SigLinkServer” as the IP address of Build-in EPC.



P-10 Configure EPC Address in Small Cell

### 1.3.3.2 Configure radio parameters

On configuration of radio parameters, please refer Quick Configuration Guide.

## 1.4 Network connectivity verification

### 1.4.1 UE/CPE access local area network

UE/CPE access local area network, for instance 10.98.100.25.

Build-in EPC will forward packets with NAT, the source IP address will be transferred to 10.98.100.27, which is the address of build-in EPC.

No.	Time	Source	Destination	Protocol	Length	Info
348	2019-01-11 10:45:15.574531	10.98.100.25	10.98.100.27	FTP	209	Response: 220-FileZilla Server 0.9.53 beta
350	2019-01-11 10:45:15.614358	10.98.100.27	10.98.100.25	FTP	78	Request: USER admin
351	2019-01-11 10:45:15.614589	10.98.100.25	10.98.100.27	FTP	99	Response: 331 Password required for admin
352	2019-01-11 10:45:15.654291	10.98.100.27	10.98.100.25	FTP	78	Request: PASS admin
353	2019-01-11 10:45:15.654514	10.98.100.25	10.98.100.27	FTP	81	Response: 230 Logged on
361	2019-01-11 10:45:15.695239	10.98.100.27	10.98.100.25	FTP	72	Request: FEAT
362	2019-01-11 10:45:15.695411	10.98.100.25	10.98.100.27	FTP	188	Response: 211-Features:
363	2019-01-11 10:45:15.735238	10.98.100.27	10.98.100.25	FTP	79	Request: CLNT AndFTP
364	2019-01-11 10:45:15.735393	10.98.100.25	10.98.100.27	FTP	82	Response: 200 Don't care
366	2019-01-11 10:45:15.775275	10.98.100.27	10.98.100.25	FTP	71	Request: PWD
367	2019-01-11 10:45:15.775455	10.98.100.25	10.98.100.27	FTP	97	Response: 257 "/" is current directory.
368	2019-01-11 10:45:15.834217	10.98.100.27	10.98.100.25	FTP	72	Request: NOOP
369	2019-01-11 10:45:15.834349	10.98.100.25	10.98.100.27	FTP	74	Response: 200 OK
370	2019-01-11 10:45:15.910227	10.98.100.27	10.98.100.25	FTP	73	Request: CWD /
371	2019-01-11 10:45:15.910459	10.98.100.25	10.98.100.27	FTP	113	Response: 250 CWD successful. "/" is current directory.
373	2019-01-11 10:45:15.949232	10.98.100.27	10.98.100.25	FTP	72	Request: PASV
374	2019-01-11 10:45:15.949546	10.98.100.25	10.98.100.27	FTP	115	Response: 227 Entering Passive Mode (10,98,100,25,239,56)
388	2019-01-11 10:45:16.265209	10.98.100.27	10.98.100.25	FTP	72	Request: MLSD
389	2019-01-11 10:45:16.265574	10.98.100.25	10.98.100.27	FTP	121	Response: 150 Opening data channel for directory listing of "/"
392	2019-01-11 10:45:16.265631	10.98.100.25	10.98.100.27	FTP	100	Response: 226 Successfully transferred "/"

P-11 UE access local area network

### 1.4.2 UE/CPE acccess Internet

UE/CPE access Internet, for instance "www.google.com". Build-in EPC forward packets to the default GW of local area network.

### 1.4.2.1 Check route list of Small Cell board

To make sure that UE/CPE packets can be forwarded to default GW of local area network, the small cell should have a default route whose Gateway is the the default GW of local area network.

# route -n Kernel IP routing table						
Destination	Gateway	Genmask	Flags	Metric	Ref	Use Iface
0.0.0.0	10.98.100.253	0.0.0.0	UG	0	0	0 eth0
10.98.100.0	0.0.0.0	255.255.255.0	U	0	0	0 eth0
127.0.0.0	0.0.0.0	255.0.0.0	U	0	0	0 lo
172.10.0.0	192.168.200.30	255.255.0.0	UG	0	0	0 TUN_SIMU
192.168.200.0	0.0.0.0	255.255.255.0	U	0	0	0 eth0

P-12 Check default route

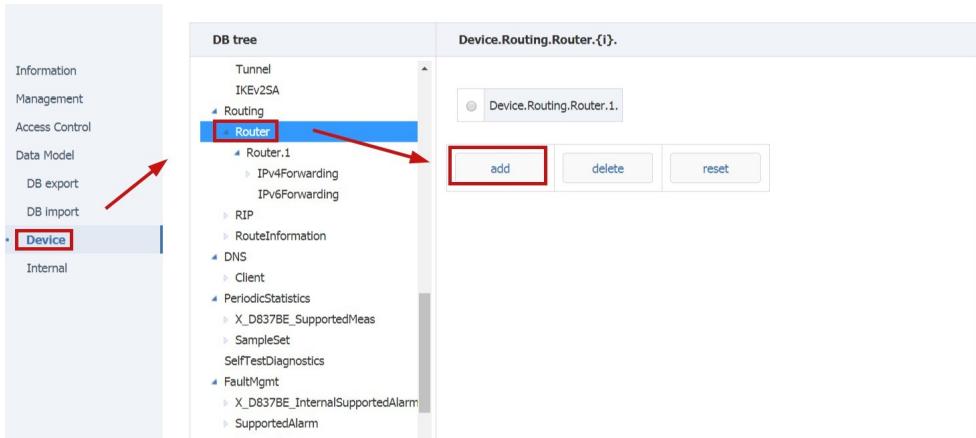
#### 1. DHCP method

If small cell get its IP address by DHC, the default route is configured by DHCP server automatically.

#### 2. Static method

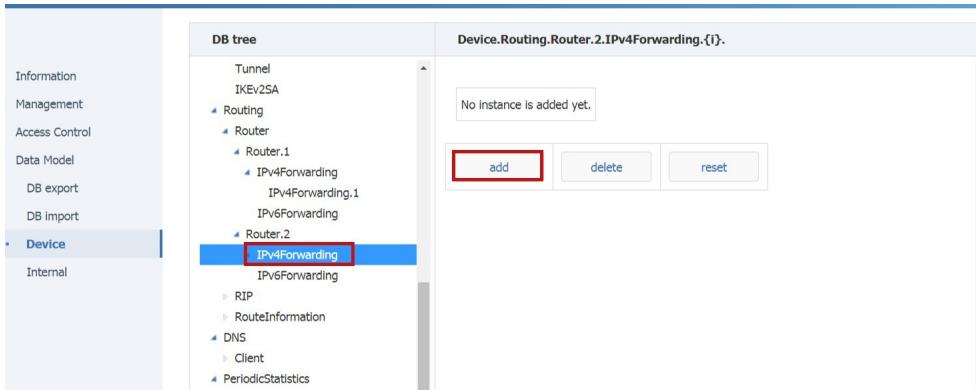
If IP address of small cell is static, need to configure default route manually.

##### 1) Adding one route instance



P-13 Adding one route instance

##### 2) Adding IPv4 forwarding instance in the newly added route instance



P-14 Adding one IPv4 forwarding instance

### 3) Configure default GW

- Enable: Select to enable
- DestIPAddress: Destination network address, for default route, this should be “0.0.0.0”
- DestSubnetMask: Destination network mask, for default route, this should be “0.0.0.0”
- GatewayIPAddress: IP address of default GW, for instance 10.98.100.253
- Interface: Index of WAN interface, configure as “Device.IP.Interface.1.”



P-15 Configure default GW

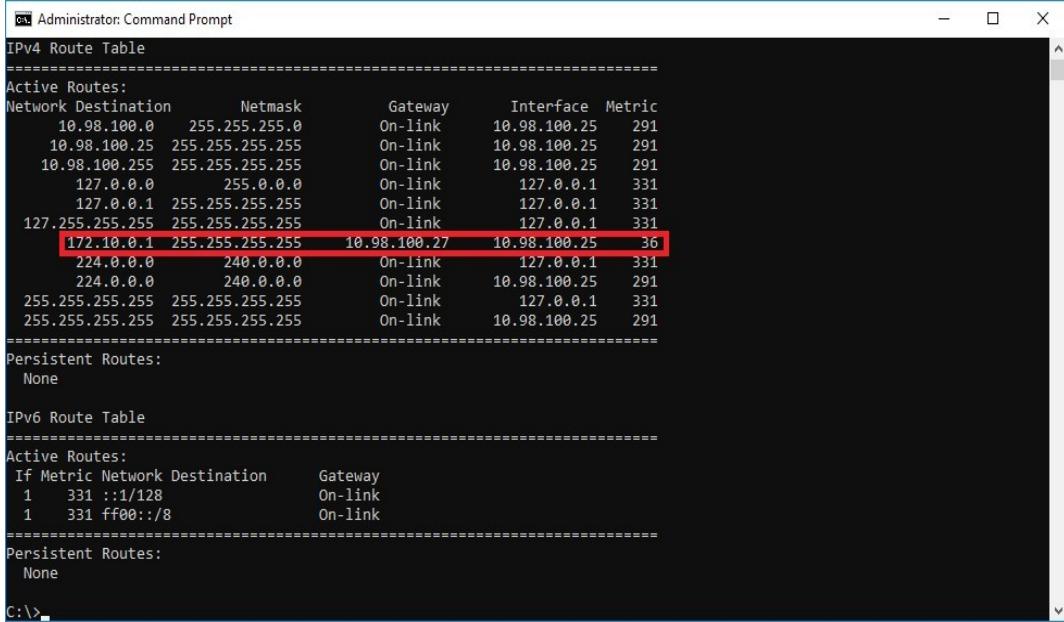
### 1.4.3 LAN PC access UE/CPE

#### 1.4.3.1 Adding route to UE/CPE

UE/CPE is behind a NAT network, the LAN PC should add route to access UE.

```
C:\>route add 172.10.0.1 mask 255.255.255.255 10.98.100.27
OK!
C:\>
```

P-16 Adding route to UE



```

Administrator: Command Prompt
IPv4 Route Table
=====
Active Routes:
Network Destination      Netmask        Gateway       Interface Metric
          10.98.100.0    255.255.255.0   On-link      10.98.100.25  291
          10.98.100.25   255.255.255.255  On-link      10.98.100.25  291
          10.98.100.255  255.255.255.255  On-link      10.98.100.25  291
          127.0.0.0       255.0.0.0     On-link      127.0.0.1    331
          127.0.0.1       255.255.255.255  On-link      127.0.0.1    331
          127.255.255.255 255.255.255.255  On-link      127.0.0.1    331
          172.10.0.1      255.255.255.255  10.98.100.27 10.98.100.25  36
          224.0.0.0       240.0.0.0     On-link      127.0.0.1    331
          224.0.0.0       240.0.0.0     On-link      10.98.100.25  291
          255.255.255.255 255.255.255.255  On-link      127.0.0.1    331
          255.255.255.255 255.255.255.255  On-link      10.98.100.25  291
=====
Persistent Routes:
  None

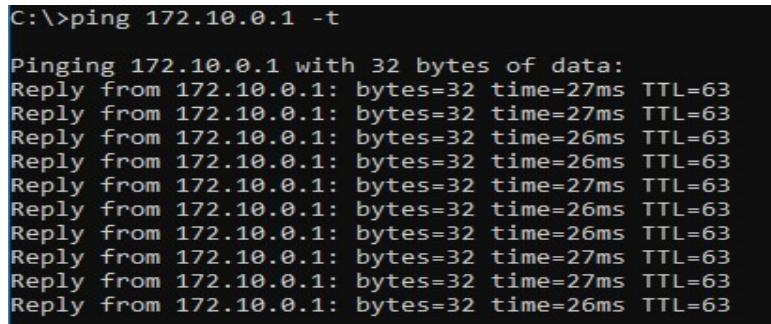
IPv6 Route Table
=====
Active Routes:
If Metric Network Destination      Gateway
  1     331 ::1/128        On-link
  1     331 ff00::/8       On-link
=====
Persistent Routes:
  None
C:\>_

```

P-16 Check route to UE

#### 1.4.3.2 Check connectivity

Ping UE/CPE from LAN PC.



```

C:\>ping 172.10.0.1 -t

Pinging 172.10.0.1 with 32 bytes of data:
Reply from 172.10.0.1: bytes=32 time=27ms TTL=63
Reply from 172.10.0.1: bytes=32 time=27ms TTL=63
Reply from 172.10.0.1: bytes=32 time=26ms TTL=63
Reply from 172.10.0.1: bytes=32 time=26ms TTL=63
Reply from 172.10.0.1: bytes=32 time=27ms TTL=63
Reply from 172.10.0.1: bytes=32 time=26ms TTL=63
Reply from 172.10.0.1: bytes=32 time=26ms TTL=63
Reply from 172.10.0.1: bytes=32 time=27ms TTL=63
Reply from 172.10.0.1: bytes=32 time=26ms TTL=63

```

P-17 Ping UE/CPE from LAN PC.