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Configuration Guide

USB LTE Modem Support in AOS

This configuration guide provides feature-specific information and configuration examples for universal serial bus (USB) long-term evolution (LTE) modem support in ADTRAN Operating System (AOS) router products.

This guide contains the following sections:

Overview of USB LTE

The newest feature of cellular modem technologies in AOS is the use of a universal serial bus (USB) based long-term evolution (LTE) modem as a routable interface on a NetVanta router product. This feature is used to provide a wireless connection to a service provider network by routing data traffic across the service provider connection using an LTE modem over a USB connection. This type of network configuration can provide primary or failover connections utilizing existing demand routing and cellular interfaces.

Hardware and Software Requirements and Limitations

The USB LTE feature is supported on NetVanta 3140 Series products running AOS firmware release R11.9.0 or later.

Modems must be activated before they can be used in the NetVanta product.

Table 1. Supported USB LTE Modems

Modem	Supported By	Max Downstream Rate	Max Upstream Rate
Novatel USB551	Verizon	10 Mbps	5 Mbps
Netgear 341	Sprint	30 Mbps	15 Mbps
Netgear	ATT Beam Service	30 Mbps	15 Mbps

This guide covers specific configurations for USB LTE support and assumes familiarity with USB, demand, and cellular interface configurations in AOS. Refer to the *AOS Command Reference Guide*, available online at https://supportforums.adtran.com, for additional configuration information.

Configuring USB LTE Using the CLI

USB LTE is configured using the command line interface (CLI). To configure USB LTE using the CLI, you must complete the following tasks:

- Access the LTE cellular interface.
- Set the LTE cellular interface as a member of a demand routing resource pool.
- Define the interesting traffic to activate the demand routing interface.
- Configure the demand routing interface.
- Configure Network Address Translation (NAT) parameters.

Accessing the LTE Cellular Interface

To access the cellular interface, enter the **interface cellular** *<slot/port>* command from the Global Configuration mode. Slots are numbered **0** to **1**, with slot **0** being the integrated system controller slot, and ports are numbered from **1** to the number of ports on your unit. To enter the configuration mode for a cellular interface connected at slot **0**, port **1**, enter the command as follows:

```
(config)#interface cellular 0/1
(config-cellular 0/1)#
```

Configuring the LTE Cellular Interface as a Member of the Demand Routing Resource Pool

Because the demand routing interface connects with the cellular network, the cellular interface must be defined as a resource the demand routing interface can use for a connection. To configure the cellular interface as a resource, name the interface and then set it as a resource.

To configure the cellular interface as a resource in the resource pool, enter the **resource pool-member** <*name*> <*priority*> command from the cellular interface configuration mode. The <*name*> parameter in this command specifies the resource pool to which the cellular interface will be assigned. The <*priority*> parameter is optional, and specifies the priority value of using this interface as a demand routing interface resource over other interfaces in the same pool. The priority is set by using numbers between **1** and **255**, with lower numbers indicating a higher priority. Interfaces with the same priority are selected in alphabetical order by interface name. Using a **no** parameter in the command removes the interface from the resource pool.

Enter the command as follows:

```
(config-cellular 0/1)#resource pool-member CELLULAR 1
(config-cellular 0/1)#
```

The LTE cellular interface is now defined as a resource pool member for the demand routing interface to draw upon when connecting to the cellular network.

Defining Interesting Traffic for the Demand Routing Interface

After the cellular interface is defined as a resource for the demand routing interface, and prior to configuring the demand routing interface for cellular connection, interesting traffic must be defined. Interesting traffic is traffic that activates the demand routing interface. This traffic is defined as interesting by the user, and when the defined type of traffic is detected by the demand routing interface, it will attempt to connect to the cellular network.

When the demand routing interface intercepts interesting outbound traffic, it will attempt to originate a connection and will reset the idle timer on a connected link.

Interesting traffic is defined using the **ip access-list extended** <*name*> command. The **ip access-list extended** command is issued from the Global Configuration mode, and creates an empty ACL. The ACL is used in conjunction with the demand routing interface to determine which traffic is deemed interesting and will cause the demand interface to dial. When the **ip access-list extended** <*name*> command is entered, the extended access control list command set becomes accessible. In the extended access control list command set, specify the action, protocol, source, and destinations to be used for the ACL. To enter the extended access control list command set, enter the **ip access-list extended** command as follows:

```
(config)#ip access-list extended LOCAL_LAN_OUT
(config-ext-nacl)#
```

LOCAL_LAN_OUT is an example name, but serves to describe the type of access control list (ACL) that will be used to activate the demand routing interface. Once you have access to the extended access control list commands, enter the <*action*> <*protocol*> <*source*> <*destination*> parameters to define traffic to be observed for packet matching purposes. Enter the parameters as follows:

```
(config-ext-nacl)#<action> <protocol> <source> <destination>
(config-ext-nacl)#permit ip any any
```

In creating ACLs for cellular connection purposes, the action will be **permit**, the protocol will be **ip**, the source will be **any**, and the keyword **any** will be specified so that attempted connection to any external IP address will be deemed interesting.

> NOTE *The **ip access-list extended** command has many uses not always associated with using the demand routing interface to connect to a cellular network. The ACL examples in this configuration guide are specific to using the ACLs for demand routing interface activation and cellular connection. For more options and configurations of ACLs, refer to Configuring IP ACLs in AOS (available online at https://supportforums.adtran.com).*

Interesting traffic has now been defined, and the demand routing interface (once configured) will use detection of the specified traffic to attempt to connect to the cellular network.

Configuring the Demand Routing Interface

Configuring the demand routing interface for cellular network connection requires a number of steps and commands. To configure the demand routing interface, you will need to do the following:

- Enter the demand routing interface configuration mode (**interface demand** command).
- Specify that interesting traffic should be matched (**match-interesting ip** commands).
- Specify the resource pool that the demand routing interface will use (**resource pool** command).
- Specify the connect sequence the demand routing interface will use (**connect-sequence** commands).
- Specify the connection mode the demand routing interface will use (**connect-mode** command).
- Specify that the demand routing interface IP address will be negotiated (**ip address cellular** command).
- Activate the demand routing interface (**no shutdown** command).
- Specify optional demand routing interface parameters.

> NOTE *The following sections deal specifically with configuring the demand routing interface for cellular network connection. These sections do not address all available configurations or applications of a demand routing interface. For more information about configuring demand routing interfaces, refer to either the Demand Interface Configuration Command Set in the AOS Command Reference Guide, or the Configuring Demand Routing in AOS technical note, both available online at https://supportforums.adtran.com.*

> NOTE *To function properly, keepalive packets must not be transmitted by the USB LTE modem. The keepalive value must be set to **0**, using the **keepalive** <value> CLI command on the demand routing interface. For more details about this command, refer to the AOS Command Reference Guide, available online at https://supportforums.adtran.com.*

Accessing the Demand Routing Interface

The demand routing interface configuration mode is accessed from the Global Configuration mode using the **interface demand** <*number*> **encapsulation hdlc** command. The number parameter specifies the interface number, a range of **1** to **1024**. The encapsulation method used by the interface must also be defined as High Level Data Link Control (HDLC), using the **encapsulation hdlc** parameters. Enter the command as follows:

```
(config)#interface demand 1 encapsulation hdlc
(config-demand 1)#
```

Matching Interesting Traffic

Once you have accessed the demand routing interface configuration mode, specify the ACL that the demand routing interface will use to define interesting traffic. Use the **match-interesting ip list** <*name*> **out** and **match-interesting ip reverse list** <*name*> **in** commands to configure the demand routing interface to match outbound interesting traffic. Enter the commands as follows:

```
(config-demand 1)#match-interesting ip LOCAL_LAN_OUT out
(config-demand 1)#match-interesting ip reverse list LOCAL_LAN_OUT in
```

The <*name*> parameter is the name given to the previously configured ACL. The **out** keyword specifies that only outgoing traffic is interesting, and the **in** keyword specifies that only incoming traffic is interesting. The **reverse list** keywords specify that the demand routing interface will use an ACL with reverse (destination, source) ACL matching logic. By using the first command (**match-interesting ip list** <*name*> **out**), the demand routing interface is configured to match outbound traffic to traffic specified as interesting by an ACL using normal ACL matching logic (matches source, then destination). By using the second command (**match-interesting ip reverse list** <*name*> **in**), the demand routing interface is configured to match incoming traffic using reverse ACL matching logic (matches destination, then source). The reverse logic allows the demand routing interface to keep a call active as long as inbound interesting traffic is received.

> NOTE
>
> *The **LOCAL_LAN_OUT** ACL in this case was a **permit ip any any** ACL, so **reverse list** is not necessary; however, it provides an example for when the ACLs being used are more specific.*

For more information, refer to the **match-interesting ip** command in the *AOS Command Reference Guide*, available online at https://supportforums.adtran.com.

Defining the Demand Routing Interface Resource Pool

Once matching traffic has been specified, the demand routing interface must be associated with a physical interface. In this case, the demand routing interface must be associated with the cellular interface. To associate the demand routing interface with the cellular interface, use the **resource pool** <*name*> command. Enter the command as follows:

```
(config-demand 1)#resource pool CELLULAR
```

The <*name*> parameter is the name given to the resource pool in the cellular interface when it was defined as a resource pool member (refer to *Configuring the LTE Cellular Interface as a Member of the Demand Routing Resource Pool on page 3*).

Specifying the Demand Routing Interface Connect Sequence

The **connect sequence** commands provide instructions to the demand routing interface on how to use the resource pool and dial string number to connect to the cellular network. These commands specify the number to dial for connection, the number of times the connection will be attempted, and the instructions to the interface if connection attempts fail.

To specify how the demand routing interface will use the resource pool and connect to the cellular network, use the **connect-sequence** <*value*> **dial-string** <*string*> **forced-cellular** command.

The <*value*> parameter of this command specifies the sequence number for the connection. For cellular connections, the value should be set to **1**, because this resource pool and connection sequence is for cellular connections only.

The **dial-string** indicates the number the demand routing interface will call to connect to the network. For LTE cellular connections, the dial string is **#777**.

The **forced-cellular** keyword constrains the resource pool so that this interface will only use cellular interfaces for this particular connect sequence command, and also specifies that the dial string will be overridden to be #777 for LTE modems.

Enter the command as follows:

```
(config-demand 1)#connect-sequence 1 dial-string #777 forced-cellular
```

To specify the number of times the connection to the cellular network will be attempted, use the **connect-sequence attempts** <*value*> command. The <*value*> parameter specifies the number of times the connection will be attempted. In cellular network connection attempts, the value is set to **0**, indicating the interface will attempt to connect to the cellular network an unlimited number of times. To set the number of connection attempts, enter the command as follows:

```
(config-demand 1)#connect-sequence attempts 0
```

The last of the connect sequence commands instructs the behavior of the demand routing interface should the connection attempts fail. These instructions are given through the **connect-sequence interface-recovery** command. This command specifies that the interface will go down when the **connect-sequence attempts** value is exhausted. In the case of cellular configuration, this command specifies that this demand routing interface will go down if the attempted connection to the cellular network fails. Enter the command as follows:

```
(config-demand 1)#connect-sequence interface-recovery
```

The sequence used by the demand routing interface to connect to the cellular network is now established.

Specifying the Demand Routing Interface Connection Mode

The demand routing interface has the ability to answer calls, originate calls, or do both. In the case of cellular connections, the demand routing interface is limited to only originating calls. The **connect-mode** command specifies whether the demand routing interface will answer or originate calls or do both. To set the demand routing interface to originate calls only, enter the command as follows:

```
(config-demand 1)#connect-mode originate
```

If the demand routing interface is set to answer calls, or to do both (using the **answer** or **either** keywords), the demand routing interface will only originate calls out of the cellular interface. A demand routing interface configured to use other resource types, such as analog modem or ISDN, can be set to answer calls. For more information on **connect-mode** command options, refer to the *AOS Command Reference Guide*, available online at https://supportforums.adtran.com.

Setting the Demand Routing Interface IP Address to Negotiated

The **ip address cellular** command specifies that an interface will be assigned an IP address from the network connection. To allow the demand routing interface to be assigned an IP address from the network connection for default routing purposes, enter the command as follows:

```
(config-demand 1)#ip address cellular
```

Activating the Demand Routing Interface

To activate the demand routing interface, use the **no shutdown** command. This command specifies that the interface is enabled and active, allowing data to pass through. Enter the command as follows:

```
(config-demand 1)#no shutdown
```

Specifying Optional Demand Routing Interface Commands

The demand routing interface can be configured with optional parameters, depending upon the specific configuration needs.

Access Control Policies

The demand routing interface can be connected with an access control policy (ACP) for firewall protection. To apply a configured ACP to the demand routing interface, use the **ip access-policy** <*name*> command. The <*name*> parameter indicates the name of the configured ACP. Using the **no** keyword with this command removes the association between the demand routing interface and the ACP.

Enter the command as follows:

```
(config-demand 1)#ip access-policy Public
```

For more information regarding how to configure ACPs, refer to the **ip policy-class** <*name*> <*action*> command in the *AOS Command Reference Guide*, available online at https://supportforums.adtran.com.

> *Configured ACPs will only be active if the* ***ip firewall*** *command has been entered at the Global Configuration mode prompt to enable the AOS security features. All configuration parameters are valid, but no security data processing will be attempted unless the security features are enabled.*

Timeout Parameters

The demand routing interface can also be configured to time out after a certain amount of time if no interesting traffic has been detected by using the **idle-timeout** <*value*> command. The timeout value is the number of seconds that the interface link will remain up in the absence of interesting traffic, within a range of **1** to **2147483** seconds. Using the **no** keyword with this command removes the timeout configuration and returns the timeout value to the default **120** seconds. To set a timeout value for the demand routing interface, enter the command as follows:

```
(config-demand 1)#idle-timeout 600
```

Demand Routing Interface Description

A descriptive name can be entered for the demand routing interface. This can be useful in configurations with multiple demand routing interfaces. The descriptive name, of up to 80 characters, is entered using the **description** <*text*> command. Enter the command as follows:

```
(config-demand 1)#description Cellular Demand Interface
```

Configuring NAT

NAT is a standard method of preserving valuable Internet address space. Additionally, it can be used to hide the structure of server farms behind a router, in order to provide bandwidth sharing to web, File Transfer Protocol (FTP), and application servers. To use NAT in conjunction with cellular network access, it is necessary to configure a public interface, one that makes the connection to the wide area network (WAN), and a private interface, one that is connected to the local area network (LAN). These configurations allow for communication between protected LAN environments and larger, public WAN environments.

To learn more about configuring NAT, refer to the *Configuring Internet Access (Many to one NAT) with the Firewall Wizard in AOS* training video, available online at https://supportforums.adtran.com.

USB LTE Configuration Examples

In the following configuration examples, the router is configured to use the USB-based LTE modem as a demand routing interface. These configurations include using USB LTE as a primary WAN, a failover WAN, and a secondary failover WAN.

The configuration parameters entered in these examples are sample configurations only. You should configure these applications in a manner consistent with the needs of your particular network. CLI prompts have been removed from the configuration examples to provide you with a method of copying and pasting directly from this guide into the CLI. You should make the necessary adjustments to these configurations before adding them to your configuration to ensure they will function properly in your network.

Example 1: USB LTE as Primary WAN

In the following example, USB LTE is configured as a primary WAN interface. Settings not related specifically to the USB LTE feature configuration have been removed from the example.

```
!
ip firewall
ip firewall fast-nat-failover
no ip firewall alg msn
no ip firewall alg mszone
no ip firewall alg h323
!
no dot11ap access-point-control
!
ip dhcp pool "ltePool"
 network 192.168.1.0 255.255.255.0
 dns-server 192.168.1.254
 default-router 192.168.1.254
!
interface gigabit-eth 0/1
 no ip address
 shutdown
!
interface gigabit-eth 0/2
 no ip address
 shutdown
!
interface gigabit-eth 0/3
 ip address  192.168.1.254  255.255.255.0
 ip access-policy Private
 no shutdown
!
interface cellular 0/1
 resource pool-member lteResource 1
 no shutdown
!
```

```
interface demand 1 encapsulation hdlc
  idle-timeout 3600
  resource pool lteResource
  match-interesting ip list lteTrafficList out
  match-interesting ip reverse list lteTrafficList in
  connect-sequence 1 dial-string #777 forced-cellular
  connect-sequence attempts 0
  connect-sequence interface-recovery
  connect-mode originate
  ip address cellular
  ip access-policy Public
  no shutdown
!
ip access-list standard INTERNET
  remark Internet Connection Sharing
  permit any
!
ip access-list extended lteTrafficList
  permit ip any  any
!
ip access-list extended self
  remark Traffic to NetVanta
  permit ip any  any     log
!
ip policy-class Private
  nat source list INTERNET interface demand 1 overload policy Public
  allow list self stateless
!
ip policy-class Public
  ! Implicit discard
!
ip route 0.0.0.0 0.0.0.0 demand 1
```

Example 2: USB LTE as Failover WAN

In the following example, USB LTE is configured as a failover WAN interface. Settings not related specifically to the USB LTE feature configuration have been removed from the example.

```
!
ip firewall
ip firewall fast-nat-failover
ip firewall fast-allow-failover
no ip firewall alg msn
no ip firewall alg mszone
no ip firewall alg h323
!
no dot11ap access-point-control
!
```

```
probe PRIMARY_INTERNET icmp-echo
  destination 8.8.8.8
  period 3
  tolerance consecutive fail 5 pass 5
  no shutdown
!
track PRIMARY_TRACK
  test if probe PRIMARY_INTERNET
  no shutdown
!
ip dhcp pool "ltePool"
  network 192.168.1.0 255.255.255.0
  dns-server 192.168.1.254
  default-router 192.168.1.254
!
interface gigabit-eth 0/1
  ip address dhcp track PRIMARY_TRACK
  ip access-policy PublicPrimary
  no shutdown
!
interface gigabit-eth 0/2
  no ip address
  shutdown
!
interface gigabit-eth 0/3
  ip address  192.168.1.254  255.255.255.0
  ip access-policy Private
  no shutdown
!
interface cellular 0/1
  resource pool-member lteResource 1
  no shutdown
!
interface demand 1 encapsulation hdlc
  idle-timeout 10
  resource pool lteResource
  match-interesting ip list lteTrafficList out
  match-interesting ip reverse list lteTrafficList in
  connect-sequence 1 dial-string #777 forced-cellular
  connect-sequence attempts 0
  connect-sequence interface-recovery
  connect-mode originate
  ip address cellular
  ip access-policy PublicBkupCell
  no shutdown
!
!
```

```
route-map ProbeMap permit 10
  match ip address ProbeTest
  set interface gigabit-ethernet 0/1
!
ip access-list standard INTERNET
  remark Internet Connection Sharing
  permit any
!
ip access-list extended lteTrafficList
  permit ip any  any
!
ip access-list extended ProbeTest
  permit icmp any  host 8.8.8.8
!
ip access-list extended self
  remark Traffic to NetVanta
  permit ip any  any     log
!
ip policy-class Private
  nat source list INTERNET interface gigabit-ethernet 0/1 overload policy PublicPrimary
  nat source list INTERNET interface demand 1 overload policy PublicBkupCell
  allow list self stateless
!
ip policy-class PublicBkupCell
  ! Implicit discard
!
ip policy-class PublicPrimary
  ! Implicit discard
!
ip route 0.0.0.0 0.0.0.0 demand 1 10
```

Example 3: USB LTE as a Secondary Failover WAN

In the following example, USB LTE is configured as a secondary failover WAN interface. Settings not related specifically to the USB LTE feature configuration have been removed from the example.

```
ip local policy route-map ProbeMap
!
ip firewall
ip firewall fast-nat-failover
ip firewall fast-allow-failover
no ip firewall alg msn
no ip firewall alg mszone
no ip firewall alg h323
!
probe PRIMARY_INTERNET icmp-echo
  destination 8.8.8.8
  period 3
```

```
 tolerance consecutive fail 5 pass 5
 no shutdown
!
probe SECONDARY_INTERNET icmp-echo
 destination 8.8.4.4
 period 3
 tolerance consecutive fail 5 pass 5
 no shutdown
!
track PRIMARY_TRACK
 test if probe PRIMARY_INTERNET
 no shutdown
!
track SECONDARY_TRACK
 test if probe SECONDARY_INTERNET
 no shutdown
!
ip dhcp pool "ltePool"
 network 192.168.1.0 255.255.255.0
 dns-server 192.168.1.254
 default-router 192.168.1.254
!
interface gigabit-eth 0/1
 ip address dhcp track PRIMARY_TRACK
 ip access-policy PublicPrimary
 no shutdown
!
interface gigabit-eth 0/2
 ip address dhcp track SECONDARY_TRACK 5
 ip access-policy PublicSecondary
 no shutdown
!
interface gigabit-eth 0/3
 ip address  192.168.1.254  255.255.255.0
 ip access-policy Private
 no shutdown
!
interface cellular 0/1
 resource pool-member lteResource 1
 no shutdown
!
interface demand 1 encapsulation hdlc
 idle-timeout 10
 resource pool lteResource
 match-interesting ip list lteTrafficList out
 match-interesting ip reverse list lteTrafficList in
 connect-sequence 1 dial-string #777 forced-cellular
 connect-sequence attempts 0
 connect-sequence interface-recovery
 connect-mode originate
 ip address cellular
 ip access-policy PublicBkupCell
 no shutdown
!
route-map ProbeMap permit 10
 match ip address ProbeTestPrimary
 set interface gigabit-ethernet 0/1
route-map ProbeMap permit 11
 match ip address ProbeTestSecondary
 set interface gigabit-ethernet 0/2
!
ip access-list standard INTERNET
 remark Internet Connection Sharing
 permit any
!
ip access-list extended lteTrafficList
 permit ip any  any
!
ip access-list extended ProbeTestPrimary
 permit icmp any  host 8.8.8.8
!
ip access-list extended ProbeTestSecondary
 permit icmp any  host 8.8.4.4
!
ip access-list extended self
 remark Traffic to NetVanta
 permit ip any  any     log
!
ip policy-class Private
 nat source list INTERNET interface gigabit-ethernet 0/1 overload policy PublicPrimary
 nat source list INTERNET interface gigabit-ethernet 0/2 overload policy PublicSecondary
 nat source list INTERNET interface demand 1 overload policy PublicBkupCell
 allow list self stateless
!
ip policy-class PublicPrimary
 ! Implicit discard
!
ip policy-class PublicSecondary
 ! Implicit discard
!
ip policy-class PublicBkupCell
 ! Implicit discard
!
ip route 0.0.0.0 0.0.0.0 demand 1 10
```

USB LTE Configuration Command Summaries

The following tables include configuration commands necessary for configuring the USB LTE modem and cellular interface, an ACL, and the demand routing interface. **Show** and **debug** troubleshooting commands are summarized in *Troubleshooting on page 16*.

Table 2. USB WWAN NIM/Cellular Interface Command Summary

Prompt	Command	Description
(config)#	**interface cellular** <*slot/port*>	Accesses the cellular interface configuration mode.
(config-cellular 0/1)#	**resource pool-member** <*name*> <*priority*>	Assigns the cellular interface to a resource pool for the demand routing interface.

Table 3. ACL Command Summary

Prompt	Command	Description
(config)#	**ip access-list extended** <*name*>	Names an ACL to create and enters the ACL configuration mode.
(config-ext-nacl)#	<*action*> <*protocol*> <*source*> <*destination*>	Specifies the traffic that the ACL will monitor. For more information about configuring ACLs, refer to *Configuring IP ACLs in AOS*.

Table 4. Demand Routing Interface Configuration Commands

Prompt	Command	Description
(config)#	**interface demand** <*number*> **encapsulation hdlc**	Accesses the demand interface configuration mode and specifies the encapsulation mode as HDLC.
(config-demand 1)#	**match-interesting ip [reverse list]** <*name*> **[in | out]**	Specifies an ACL for interface activation and the matching logic the ACL will use.
(config-demand 1)#	**resource pool** <*name*>	Specifies the resource pool the demand interface will use.
(config-demand 1)#	**connect-sequence** <*value*> **dial-string** <*string*> **forced-cellular**	Specifies the connection method the demand interface will use when connecting to the cellular network. For LTE cellular connections, the dial string must be **#777**.

Table 4. Demand Routing Interface Configuration Commands *(Continued)*

Prompt	Command	Description
(config-demand 1)#	**connect-sequence attempts** *<value>*	Specifies the number of times the demand interface will attempt to connect to the cellular network. Range is **0** to **65535**. Zero indicates unlimited attempts will be made and should be used for cellular applications.
(config-demand 1)#	**connect-sequence interface-recovery**	Specifies the interface will go down if attempted connections to the cellular network fail.
(config-demand 1)#	**connect-mode [answer | originate | either]**	Specifies that the demand interface will answer or originate calls, or both. For cellular connections, the demand routing interface should be set to **originate**.
(config-demand 1)#	**ip address cellular**	Specifies that the demand interface will be assigned an IP address from the network connection.
(config-demand 1)#	**no shutdown**	Specifies that the interface is enabled.
(config-demand 1)#	**ip access-policy** *<name>*	Assigns an access control policy to the demand interface.
(config-demand 1)#	**idle-timeout** *<value>*	Specifies the amount of time before the demand routing interface times out if no interesting traffic is detected. Range is **1** to **2147483** seconds.
(config-demand 1)#	**description** *<text>*	Creates a descriptive name to identify the interface (up to 80 alphanumeric characters).

Troubleshooting

Troubleshooting the USB LTE configuration can be accomplished by using various **show** or **debug** commands. These commands can provide information about the configuration and operation of USB LTE.

Show Commands

The **show interface cellular** <*slot/pot*> **[version | hardware]** command describes the cellular service type, connection state, input and output rates, and if the optional **version** parameter is used, the modem hardware and firmware are displayed. If the optional **hardware** parameter is used, the mobile directory number is displayed. Enter the command from the Enable mode prompt as follows:

```
>enable
#show interface cellular 0/1
cell 0/1 is UP
    Service type is LTE, RSSI is -90 dBm, SNR is 7.1 dB
    Connection state is IDLE
    Current connection uptime is 0 sec
    5 minute input rate 0 bits/sec, 0 packets/sec
    5 minute output rate 0 bits/sec, 0 packets/sec
        0 packets input, 0 bytes, 0 no buffer
        0 runts, 0 giants, 0 throttles
        0 input errors, 0 CRC, 0 frame
        0 abort, 0 discards, 0 verruns
        0 packets output, 0 bytes, 0 underruns
```

The signal to noise ratio (SNR) information is not available on the USB551 modem.

```
>enable
#show interface cellular 0/1 version
Modem Hardware: NOVATEL WIRELESS INC. 210
Modem Firmware: MDM9600-1.48 1 [2012-04-30 18:44:34]
```

```
>enable
#show interface cellular 0/1 hardware
Mobile Directory Number (MDN): +1234567890
```

Debug Commands

Several different **debug** commands can be issued from the Enable mode in the CLI to assist in troubleshooting. The **debug** commands send messages when certain types of activity are detected on the interface, and work hand-in-hand with the **show** commands to verify proper configuration and performance. The **debug** commands are detailed in *Table 5 on page 18*.

Table 5. Cellular and Demand Routing Interface Debug Command Summary

Command	Explanation
#debug demand-routing	Activates debug messages for demand routing errors and events.
#debug data-call	Activates debug messages for data call errors and events.
#debug dialup-interfaces	Activates debug messages to aid in troubleshooting dial-up interfaces.
#debug interface cellular *<slot/port>*	Activates debug messages to aid in troubleshooting cellular interfaces.
#debug inteface cellular modem messaging [detail] [include-polled]	Activates debug messages for cellular modem messaging errors and events, displaying summary information about messages sent to and from the modem and AOS. The optional **detail** parameter displays the contents of those messages. The optional **include-polled** parameter displays messages related to polled statistics. This parameter should be used with caution; it can cause a flood of output on the CLI. It can be useful, however, to determine if messaging with the modem is functioning.

By enabling **debug** commands, debug messages are sent to alert you whenever specified events take place. These messages can be beneficial when you are troubleshooting your configuration.

NOTE *Using **debug** commands can be very processor intensive, and should be used with caution.*

Sample Debug Output

The following are samples of output from various **debug** commands, including the **debug demand-routing** and **debug dialup-interfaces** commands. Each command is entered from the Enable mode prompt.

```
#debug demand-routing
2010.02.19 16:08:34 DEMANDROUTING.Demand Interface Demand 1 interesting traffic packet saved
2010.02.19 16:08:34 DEMANDROUTING.Demand Interface Demand 1 dialing *****
2010.02.19 16:08:45 DEMANDROUTING.Demand Interface Demand 1 no authentication passed
2010.02.19 16:08:45 PPP.NEGOTIATION LCP up
2010.02.19 16:08:45 DEMANDROUTING.Demand Interface Demand 1 - interface connected
2010.02.19 16:08:45 PPP.NEGOTIATION demand 1: IPCP up
2010.02.19 16:08:45 INTERFACE_STATUS.demand 1 changed state to up
2010.02.19 16:08:47 DEMANDROUTING.Demand Interface Demand 1 bundle is up !!!!!
```

```
#debug dialup-interfaces
2010.02.19 16:11:54 DIALUP_INTERFACE.cellular 0/1 Usb Device Has Been Removed***
2010.02.19 16:12:01 DIALUP_INTERFACE.cellular 0/1 Usb 3G Device Found**
2010.02.19 16:12:03 INTERFACE_STATUS.cellular 0/1 changed state to up*****
2010.02.19 16:12:15 DIALUP_INTERFACE.cellular 0/1 Dialing #777***
2010.02.19 16:12:20 DIALUP_INTERFACE.cellular 0/1 Connect (CONNECT)***
2010.02.19 16:12:25 PPP.NEGOTIATION LCP up
2010.02.19 16:12:25 PPP.NEGOTIATION demand 1: IPCP up
2010.02.19 16:12:26 INTERFACE_STATUS.demand 1 changed state to up**!!!!!!!!
```

Additional Troubleshooting Information

The following section outlines typical troubleshooting measures for common problems you might experience with your USB LTE modem or cellular interface. Troubleshooting topics included in this section are:

- Ping and connectivity failures
- Low throughput or dropped calls

The first step in troubleshooting your cellular connection is to verify that your USB LTE modem is functioning properly. The best way to check its functionality is to remove it from the NetVanta product and connect it to your PC. If it is not recognized by or is not functioning correctly with your PC, you will need to contact your service provider and/or your modem manufacturer's Technical Support. If the device functions correctly with your PC, you can additionally troubleshoot connection issues by following the steps in the sections below.

Ping and Connectivity Failures

If you are experiencing ping and connectivity failures, you should verify the following cellular connection information and configuration:

1. That you have a good signal. Check the Received Signal Strength Indicator (RSSI) value using the **show interface cellular** <*slot/port*> command (detailed on *page 17*). This value should be between -60 and -90 dB (-60 dB is best, -90 dB is minimum).
2. That the modem is activated. Use the **show interface cellular** <*slot/port*> command to check the RSSI value and verify the modem is activated. If the modem is not activated, run automatic activation using OTASP or OMA-DM. If the modem is still not activated, contact the service provider to ensure that your account has been created and is active.
3. That the modem is receiving an IP address. To view the IP address, issue the **show interface demand** <*number*> command and check the local IP address. You can also verify here that the demand interface is connected by making sure the interface has an IP address.
4. That your cellular configurations are correct. Verify these configurations using the **show running-config interface cellular** <*slot/port*> **verbose** command and the **show running-config interface demand** <*number*> command.

After you have verified the preceding information, and you are still having ping and connectivity failures, use the following **debug** utilities to verify your cellular configurations.

1. Debug the cellular interface using the **debug interface cellular** <*slot/port*> **data** command (detailed in *Table 5 on page 18*).
2. Debug demand routing using the **debug demand-routing** command (detailed in *Table 5 on page 18*).
3. Debug the data call using the **debug data-call** command (detailed in *Table 5 on page 18*).
4. Debug the dialup interfaces using the **debug dialup-interfaces** command (detailed in *Table 5 on page 18*).

Low Throughput or Dropped Calls

If you are experiencing low throughput or dropped calls with your USB LTE modem or cellular interface, verify the following information:

1. That the cellular modem is connected to the network and there is a good signal. Check the RSSI value using the **show interface cellular** <*slot/port*> command (detailed on *page 17*). This value should be between -60 and -90 dB.
2. That LTE service is available in the area. To check this information, use the **show interface cellular** <*slot/port*> command (detailed on *page 17*).
3. That keepalives enabled on the demand interface are not contributing to dropped calls. To check this information, use the **show interface demand** <*number*> command. Refer to the Note on *page 4* for more information about keepalives and the demand interface.
4. That your AOS unit and cellular modem are in a good location. Sometimes moving the unit around can significantly boost signal strength.

NOTE *If the RSSI values are higher than optimal, you might be experiencing high levels of noise in your environment. This can cause packet retransmissions, lower throughput, and dropped calls.*

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