Cisco 4G LTE-Advanced Configuration

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Cisco Fourth-Generation LTE Advanced on the Cisco ESR6300 Embedded Series Router

Cisco LTE Pluggable Modules operate over Fourth-Generation Long-Term Evolution (4G LTE) cellular networks and Third-Generation (3G) cellular networks.

Cisco LTE Pluggable Module supports the following 4G/3G modes:

- **4G LTE**— 4G LTE mobile specification provides multi-megabit bandwidth, more efficient radio network, latency reduction, and improved mobility. LTE solutions target new cellular networks. These networks initially support up to 100 Mb/s peak rates in the downlink and up to 50 Mb/s peak rates in the uplink. The throughput of these networks is higher than the existing 3G networks

- **3G Evolution High-Speed Packet Access (HSPA/HSPA+)**— HSPA is a UMTS-based 3G network. It supports High-Speed Downlink Packet Access (HSDPA) and High-Speed Uplink Packet Access (HSUPA) data for improved download and upload speeds. Evolution High-Speed Packet Access (HSPA+) supports Multiple Input/Multiple Output (MIMO) antenna capability.
- **3G Evolution-Data Optimized (EVDO DOrA)**— EVDO is a 3G telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access. DOrA refers to EVDO Rev-A. EVDO uses multiplexing techniques including Code Division Multiple Access (CDMA), as well as Time Division Multiple Access (TDMA), to maximize both individual users' throughput and the overall system throughput.

It is important to understand the architecture of the ESR6300 series and the relationship between Modems, SIMs, Interface and Controller. The following table helps to illustrate these relationships.

Table 1:

Controller	SIM	Modem SubSlot	PDN Interface	Line
0/3/0	0|3	0/3	Cellular 0/3/0	N/A

Note In all instances of command examples through this chapter, the term "slot" refers to the router slot, module slot, and port separated by slashes (0/3/0).

The following table lists the supported modems and modules for the ESR6300:

Table 2: Modem Technology Supported

SKU ID	Description	Supported Technology
P-LTE-VZ	U.S. (Verizon) Single Micro SIM	LTE CAT4: B4, B13
P-LTE-US	North America (AT&T) Dual Micro SIM	LTE CAT4: B2, B4, B5, B12 HSPA+,UMTS: B2, B4, B5
P-LTE-GB	Europe Dual Micro SIM	LTE CAT4: B3, B5, B8, B20, B28 HSPA+: B1, B5, B8 EDGE: 900/1800
P-LTE-MNA	North America	LTE CAT4: B2, B4, B5, B12, B13, B14, B17, B66 3G UMTS DC-HSPA+, HSPA+, HSPA, WCDMA

SKU ID	Description	Supported Technology
P-LTEA-LA	APAC	LTE Bands: B1, B3, B5, B7, B8, B18, B19, B21, B28, B38, B39, B40, B41 Non-LTE Bands: B87 — WCDMA (Europe, Japan, and China) 2100 band B91 — WCDMA US 850 band B92 — WCDMA Japan 800 band B114 — WCDMA Europe and Japan 900 band B115 — WCDMA Japan 1700 band B125 — WCDMA Japan 850 band
P-LTEA-EA	USA, Canada, Europe, Latin America	LTE bands: Bands 1-5, 7, 12, 13, 20, 25, 26, 29, 30 Non-LTE bands: B87 — WCDMA (Europe, Japan, and China) 2100 band B88 — WCDMA US PCS 1900 band B89 — WCDMA (Europe and China) DCS 1800 band B90 — WCDMA US 1700 band B91 — WCDMA US 850 band B114 — WCDMA Europe and Japan 900 band
P-LTEAP18-GL	United States, Europe, Canada, Japan, Australia, New Zealand and Private LTE or U.S. CBRS	LTE bands: 1-5, 7, 8, 12-14, 17, 18-20, 25, 26, 28-30, 32, 38-43, 46, 48, 66, and 71. FDD LTE 600 MHz (band 71), 700 MHz (bands 12, 13, 14, 17, 28, and 29), 800 MHz (band 20), 850 MHz (bands 5, 18, 19, and 26), 900 MHz (band 8), 1500 MHz (band 32), 1700 MHz (bands 4 and 66), 1800 MHz (band 3), 1900 MHz (bands 2 and 25), 2100 MHz (band 1), 2300 MHz (band 30), 2600 MHz (band 7). TDD LTE 1900 MHz (band 39), 2300 MHz (band 40), 2500 MHz (band 41), 2600 MHz (band 38), 3500 MHz (bands 42 and 48), 3700 MHz (band 43), 5200 MHz (band 46).

For information on supported antennas and accessories, see the **Cisco Industrial Routers and Industrial Wireless Access Points Antenna Guide** https://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/antennas/installing-combined/industrial-routers-and-industrial-wireless-antenna-guide.html.

Prerequisites for Configuring Cisco 4G LTE Advanced

- If the signal is not good at the router, use the Cisco offered antenna accessories and extension cables to place the antenna away from router in a better coverage area. Please refer to the RSSI/SNT values as displayed through **show cellular 0/3/0 all** or the LED of the pluggable modem.
- You must have 4G LTE network coverage where your router is physically placed. For a complete list of supported carriers.

- You must subscribe to a service plan with a wireless service provider and obtain a Subscriber Identity Module (SIM) card. Only micro SIM is supported.
- You must install the SIM card before configuring the 4G LTE or router.
- The standalone antenna that supports GPS capabilities must be installed for the GPS feature to work.

Restrictions for Configuring Cisco 4G LTE Advanced

- Currently, cellular networks support only user initiated bearer establishment.
- Due to the shared nature of wireless communications, the experienced throughput varies depending on the number of active users or congestion in a given network.
- Cellular bandwidth is asymmetric with the downlink data rate being greater than the uplink data rate.
- Cellular networks have higher latency compared to wired networks. Latency rates depend on the technology and carrier. Latency also depends on the signal conditions and can be higher because of network congestion.
- CDMA-EVDO, CDMA-1xRTT, and GPRS technology modes are not supported.
- Any restrictions that are part of the terms of service from your carrier.
- SMS—Only one text message up to 160 characters to one recipient at a time is supported. Larger texts are automatically truncated to the proper size before being sent.
- It is strongly recommended that you configure SNMP V3 with authentication/privacy.

Features not Supported in 4G LTE Advanced

The following features are not supported on Cisco 4G LTE Advanced on the ESR6300:

- TTY support or Line
- Chat script/dialer string
- DM log output to USB flash is not supported.

4G LTE-Advanced LEDs

LED status can be obtained through the show led CLI, or visually on the pluggable modem card. The following is an example of the show led CLI:

```
Router#show led
SYSTEM LED : Green

Custom LED : Off

VPN LED : Off

ALARM LED : Off
```

```
GigabitEthernet0/0/0 LED : Off
FastEthernet0/0/1 LED : Off
FastEthernet0/0/2 LED : Off
FastEthernet0/0/3 LED : Off
FastEthernet0/0/4 LED : Off
GigabitEthernet0/0/5 LED : On

EM Module digital I/O 1 LED : Off
EM Module digital I/O 2 LED : Off
EM Module digital I/O 3 LED : Off
EM Module digital I/O 4 LED : Off

*System LTE Pluggable*
LTE module Enable LED : Green
LTE module SIM 0 LED : Green
LTE module SIM 1 LED : Off
LTE module GPS LED : Off
LTE module RSSI 0 LED : On
LTE module RSSI 1 LED : On
LTE module RSSI 2 LED : On
LTE module RSSI 3 LED : On

*EM Module LTE Pluggable*
LTE module Enable LED : Green
LTE module SIM 0 LED : Green
LTE module SIM 1 LED : Off
LTE module GPS LED : Off
LTE module RSSI 0 LED : On
LTE module RSSI 1 LED : On
LTE module RSSI 2 LED : On
LTE module RSSI 3 LED : On
```

The following table describes the LED behavior in 4G LTE-Advanced.

Table 3: 4G LTE-Advanced LED Indicators

LED	Color/Bar and Description	
LTE SIM(0) & SIM(1)	Green (Solid)	Modem up, SIM installed and active
	Off	No SIM is present
	Amber (Solid)	Modem up, SIM installed but not active
EN	Off	Pluggable is powered off.
	Amber (Solid)	Module power is on, but the module is not functioning correctly.
	Green (Solid)	Module power is on

LED	Color/Bar and Description	
RSSI - Uses Bars for LED Indication	Four Bar	High RSSI >= -69dBm
	Three Bar	Medium RSSI, -89dBm <> -70dBm
	Two Bar	Low RSSI, -99dBm <> -90dBm
	One Bar	RSSI <= -100dBm
	0 or No Bar	No Service
GPS	Green (Solid)	GPS coordinates are obtained.
	Off	GPS is disabled, GPS is enabled without GPS mode and NMEA configuration, or GPS is acquiring

Cisco 4G LTE-Advanced Features

Cisco 4G LTE-Advanced supports the following major features:

- Global Navigation Satellite System (GNSS) (requires a GNSS compliant antenna) and National Marine Electronics Association (NMEA) streaming.
- Short Message Service (SMS)
- 3G/4G Simple Network Management Protocol (SNMP) MIB
- SIM lock and unlock capabilities
- Dual SIM (Only SIM slot 0 is functional on the P-LTE-VZ pluggable)
- Auto SIM
- NeMo
- Mobile Network IPv6
- Public Land Mobile Network (PLMN) selection
- IPv6
- Multiple PDN
- LTE Link Recovery

4G GNSS and NMEA

Active GNSS is supported on the SubMiniature version A (SMA) port. Active GNSS antenna is supported only in the standalone mode. An Active GNSS antenna includes a built-in Low-Noise Amplifier that provides sufficient gain to overcome coaxial cable losses while providing the proper signal level to the GNSS receiver. Active GNSS antennae require power from the GNSS receiver SMA port to operate.

National Marine Electronics Association (NMEA) streams GNSS data either from a 4G LTE through a virtual COM port and a TCP/IP Ethernet connection to any marine device (such as a Windows-based PC) that runs a commercially available GNSS-based application.

The following GNSS and NMEA features are supported on the Cisco 4G LTE-Advanced:

- GNSS standalone mode (satellite-based GNSS)
- Cisco IOS-XE CLI display coordinates.
- External application displays router map location
- Objects in the CISCO-WAN-3G-MIB supports GNSS and NMEA features
- The Cisco 4G LTE-Advanced only support NMEA over IP and uses show commands in the platform

Note Assisted GNSS mode is not supported.

Note GPS is not supported on the P-LTEAP18-GL Cat18 module.

Example: Connecting to a Server Hosting a GPS Application

You can feed the NMEA data to a remote server that hosts the GPS application. The server can be connected to the router either directly using an Ethernet cable or through a LAN or WAN network. If the application supports serial port, run a serial port emulation program to create a virtual serial port over the LAN or WAN connection.

Note Microsoft Streets & Trips is a licensed software that you can download from the Microsoft website.

To connect a Cisco 4G LTE-Advanced through IP to a PC running Microsoft Streets & Trips, perform the following steps:

1. Connect the PC to the router using an Ethernet cable.
2. Ensure that the PC and router can ping.
3. Launch the serial port redirector on the PC.
4. Create a virtual serial port that connects to the NMEA port on the router.
5. Launch **Microsoft Streets & Trips** on your PC.
6. Select the GPS Menu.
7. Click Start Tracking.
8. If you have acquired a location fix from the **show cellular 0/3/0 gps** command output on the router, the current location is plotted on the graph, and a reddish brown dotted cursor with a circle around it is seen on the map.

Note If you have not acquired a location fix, the Microsoft application times out and disconnects.

Dual SIM Card

Note The P-LTE-VZ pluggable which supports Verizon is a single SIM.

SIM card primary slot is selected when router boots up or when NIM reloads. The default slot is 0. If SIM card is not present in the primary slot, select the alternative slot if SIM card is present.

```
controller cellular 0/3/0
lte sim primary slot <slot#>
```

If the active SIM card loses connectivity to the network a failover to the alternative SIM card slot occurs.

By default the failover timer is 3 minutes. The failover timer can be set from 3 to 7 minutes.

```
controller cellular 0/3/0
lte failovertimer <3-7>
```

You can also manually switch the SIM slot via the command line interface.

```
cellular 0/3/0 lte sim activate slot 0
```

Auto SIM

The Auto SIM feature detects the SIM and loads the corresponding firmware. For example, if an AT&T SIM is detected, the modem loads the AT&T firmware. If a carrier SIM is not supported in the list of Carrier Firmwares on modems, then the Auto SIM feature will selecte GENERIC firmware. APN may need to be specified, and modem profiles need to be assigned manually by the user.

When Auto-SIM is enabled, it is said to be in Auto-SIM mode and when disabled, it is known as Manual mode. In Auto-SIM mode, the modem selects the right carrier firmware from the list of firmware's available. When in manual mode, you can select the firmware manually. Modem resets every time you make a config change from Auto-SIM enabled to disabled or vice-versa.

Cisco cellular modules support the AUTO-SIM feature only for certain cellular carriers for which the modem carrier firmware is available on the Cisco CCO website. Other carriers, whose firmware is not available for the module, must use GENERIC firmware along with manually configured profiles with appropriate Access Point Names (APNs) as specified by the carriers.

Note Auto SIM is always enabled by default.

Enable Auto SIM

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters configuration mode.
Step 2	**cellular** *slots/sub-slots/interface* **lte firmware-auto-sim** **Example:** `Router(config)# cellular 0/3/0 lte firmware-auto-sim`	Activates the firmware index. **Note** For the 4G LTE Advanced, the *slot* argument identifies the slot, subslot, and the interface separated by slashes (0/3/0).

Example: List the firmware when Auto-SIM is Enabled

```
Device# show cellular 0/3/0
firmware          Idx Carrier      FwVersion      PriVersion   Status
 1   ATT          02.28.00.00        002.035_000  Inactive
 2   GENERIC      02.28.00.00        002.035_000  Active
 3   ROGERS       02.28.00.00        001.012_000  Inactive
 4   SPRINT       02.14.03.02        002.012_000  Inactive
 5   VERIZON      02.28.00.00        002.042_000  Inactive

Firmware Activation mode  =  AUTO
```

Note Carrier modem firmware support depends on module and modem.

Disable Auto SIM

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters configuration mode.
Step 2	**controller cellular** *slots/sub-slots/interface* **Example:** `Router(config)# controller cellular 0/3/0`	Specifies the controller interface.

	Command or Action	Purpose
Step 3	**no lte firmware auto-sim** **Example:** `Router(config-if)# no lte firmware auto-sim`	Disable auto SIM.

Example: List the firmware when Auto-SIM is Disabled

```
Device# show cellular 0/3/0 firmware
 Idx Carrier      FwVersion    PriVersion   Status
 1   ATT          02.28.00.00  002.035_000  Active
 2   GENERIC      02.28.00.00  002.035_000  Inactive
 3   ROGERS       02.28.00.00  001.012_000  Inactive
 4   SPRINT       02.14.03.02  002.012_000  Inactive
 5   VERIZON      02.28.00.00  002.042_000  Inactive


Firmware Activation mode  =  Manual
```

Using a SIM Card

Cisco 4G LTE-Advanced needs an active SIM card provided by a service provider. The SIM cards are usually provided in an unlocked state so that it can be used without a Personal Identification Number (PIN). If the SIM is unlocked, it can be inserted into a 4G LTE-Advanced and used without an authorization code.

The SIM can be initially locked with a PIN code (4 to 8 digits s long) defined by the service provider. Contact your service provider for the PIN code.

The SIM-Lock feature allows a SIM to be locked or unlocked with a PIN code so that it is used only in an authorized device. Perform the SIM lock and unlock procedures using the Cisco IOS CLI through a console or Telnet/SSH to the Router.

After the SIM is locked, it cannot initiate a call unless authentication is done using the same PIN. Authentication is done automatically by Cisco IOS through configuration of the PIN. This mandatory configuration for automatic SIM authentication is done using the Cisco IOS CLI as part of the router startup configuration.

After the Cisco IOS configuration is in place, the Router can initiate an LTE connection. The Router uses the configured PIN to authenticate prior to the LTE connection. If the Cisco IOS PIN configuration is missing or if the PIN is incorrect, the SIM authentication will fail and the connection will not be initiated.

If the locked SIM is moved to a different Router or to another device, or if the 4G LTE-Advanced in which the locked SIM resides is moved to a different 4G LTE-Advanced slot in the same Router, the Router configuration should be changed. The configuration is associated with the cellular controller that is specific to an Router 4G LTE-Advanced slot number. This will ensure that the SIM card will not be used in any unauthorized device, or, if there are multiple 4G LTE-Advanced in a single Router, that the appropriate PIN is applied to each 4G LTE-Advanced SIM. An authentication command (with the same PIN used to lock the SIM) must be defined on the new device or on the new cellular controller slot to successfully initiate the LTE connection.

The following procedures are used to configure a SIM:

Caution It is very important to use the correct PIN after it is configured. The SIM card will be blocked if the wrong PIN is entered three consecutive times on a locked SIM during authentication or when trying to unlock a locked SIM. You can unblock a blocked SIM card using the PUK code. Contact your service provider for the PUK code. Use the **cellular** <*slot*> **lte sim unblock** <*PUK code*> <*new PIN code*> command to unblock the SIM.

Changing the PIN

Ensure that you enter the correct PIN. The SIM card gets blocked if the wrong PIN is entered three consecutive times.

Procedure

	Command or Action	Purpose
Step 1	**cellular** *interface* **lte sim change-pin** *current-pin new-pin* **Example:** `Router# cellular 0/3/0 lte sim lock 1111 1234`	Locks or unlocks the SIM card using a PIN code. **Note** Locks or unlocks the SIM card using a PIN code. *pin*—A code (4 to 8 digits long) provided by your service provider to lock or unlock the SIM card. **Note** SIM should be in locked state when the PIN is being changed.

Locking and Unlocking a SIM Card Using a PIN

Perform this task to lock or unlock a SIM card given by your service provider. Make sure you enter the correct PIN, the SIM card gets blocked if the wrong PIN is entered three consecutive times.

Procedure

	Command or Action	Purpose
Step 1	**cellular** *slot* **lte sim** {**lock** | **unlock**} *pin* **Example:** `Router# cellular 0/3/0 lte sim lock 1111`	Locks or unlocks the SIM card using a PIN code. **Note** PIN is a code (4 to 8 digits long) provided by your service provider to lock or unlock the SIM card.

Configure CHV1 for Unencrypted Levels

Use either of these commands: **lte sim authenticate 0 pin**

or **lte sim authenticate 0 pin slot 0**

Procedure

	Command or Action	Purpose

Step 1	**controller cellular** *interface*
	Example:
	`Router# controller cellular 0/3/0`
	`lte sim authenticate 7 1111 slot 0`
		Enters the cellular controller configuration mode
		or

Configure CHV1 for Unencrypted Level7

To configure an encrypted PIN, the scrambled value of the PIN must be obtained. To get the scrambled Level 7 PIN and to configure the SIM CHV1 code for verification using this encrypted PIN, enter the following commands in the EXEC mode. When obtaining the encrypted PIN for a SIM, a username and password are created by configuring password encryption, defining the username and associated password, copying the resulting scrambled password, and using this scrambled password in the SIM authentication command.

Note After the scrambled PIN has been obtained and used in SIM authentication, the username created can be deleted from the Cisco IOS configuration. A SIM should be locked for SIM authentication to work

Procedure

	Command or Action	Purpose
Step 1	**service password-encryption** **Example:** `Router (config)# service password-encryption`	Enables password encryption.
Step 2	*username* **privilege** *var* *password pin* **Example:** `Router (config)# username SIM privilege 0 password 1111`	**Note** Creates username and password. name - specifies the username.*pin*—A 4 to 8 digits PIN code.
Step 3	**do show run | i name** **Example:** `Router(config)# do show run | i SIM`	Shows the username configuration line with the encrypted level 7 PIN for the username created in Step 3 (user "SIM" in the example shown). Copy the scrambled password for use in Step 6 (as the PIN).
Step 4	*username* **privilege 0** *password* *pin* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the cellular controller configuration mode.
Step 5	**lte sim authenticate 7** *pin* `OR` **lte sim authenticate 7 pin slot 0** **Example:**	Authenticates the SIM CHV1 code by using the encrypted keyword 7 and the scrambled PIN from Step 4. The PIN is sent to the modem for authentication with each subsequent

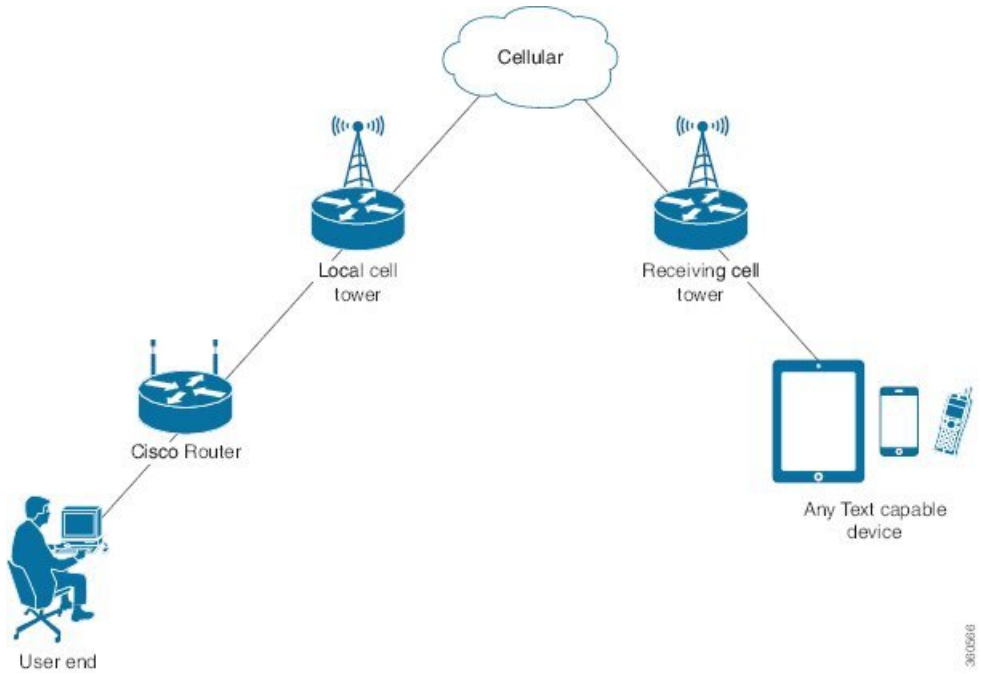
	Command or Action	Purpose
	`Device(config-controller)# lte sim authenticate 7 055A575E70`	LTE connection. If authentication passes based on the configured PIN, the data call is allowed. If authentication fails, the modem does not initiate the data call. **Note** The slot keyword and its options are available only on platforms that supports Dual-SIM feature.
Step 6	**exit** **Example:** `Router(config-controller)# exit`	(Optional) Exits the cellular controller configuration mode.
Step 7	**no username***name* **Example:** `Router(config-controller)# no username SIM`	(Optional) Removes the username and password created in Step 3
Step 8	**no service password-encryption***name* **Example:** `Router(config-controller)# no service password-encryption`	(Optional) Removes the username and password created in Step 3

Short Message Service (SMS) Capabilities

Cisco 4G LTE-Advanced support receiving, transmitting, archiving, and deleting of SMS messages. This support includes the ability to view up to 25 received texts, and archive more messages in a custom file location. SMS is supported on multiple carriers. Cisco 4G LTE-Advanced also have the capability to revert from LTE SMS to 3G technology if necessary.

A sending device behind a Cisco 4G LTE-Advanced transmits an SMS text message over the 4G cellular link through cellular towers until it the message reaches the recipient's router, which then notifies the recipient device, such as a cell phone. The receiving device uses the same process to return a reply to the sending device. The following figure describes the flow from a mobile device to a sending device. For SMS transmission to work, end users must have a text-capable device, and optionally, a text plan. If end users do not have a text plan, standard SMS rates apply to their text transmissions.

Figure 1: SMS Network



Data Account Provisioning

One or more modem data profiles can be created to provision a modem on a 4G LTE SKU. An active wireless account with a service provider with one or more (dual) SIM cards must be installed. The modem data profile is pre-configured on the modem.

The following tasks are used to verify the signal strength and service availability of the modem and to create, modify, and delete modem data profiles:

IP Multimedia Subsystem Profiles

IP Multimedia Subsystem (IMS) profiles establish a session, and are a part of the modem configuration and are stored in the modem's NVRAM. An IMS network is an access-independent and standard-based IP connectivity service that enables different types of multimedia services to end users using common Internet-based protocols.

Configuring Cisco 4G LTE Advanced

For 4G-LTE-Advanced, the numbering on the ESR6300 for slot 0, module 0, and port 0 is 0/3/0 for all commands.

Verifying Modem Signal Strength and Service Availability

For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**show cellular** *slot* **network** **Example:** `Router# show cellular 0/3/0 network`	Displays information about the carrier network, cell site, and available service.
Step 2	**show cellular** *slot* **radio** **Example:** `Router# show cellular 0/3/0 radio`	Shows the radio signal strength. **Note** The RSSI should be better than –90 dBm for steady and reliable connection.
Step 3	**show cellular** *slot* **profile** **Example:** `Router# show cellular 0/3/0 profile`	Shows information about the modem data profiles created.
Step 4	**show cellular** *slot* **security** **Example:** `Router# show cellular 0/3/0 security`	Shows the security information for the modem, such as SIM and modem lock status.
Step 5	**show cellular** *slot* **all** **Example:** `Router# show cellular 0/3/0 all`	Shows consolidated information about the modem, profiles created, radio signal strength, network security, and so on.

Guidelines for Creating, Modifying, or Deleting Modem Data Profiles

Customized profiles (Access Point Name(APN) in mobile networks) can be created and used on Cisco 4G LTE Advanced SKU's. Maximum number of profiles that can be created are 16.

Cisco SKU's shipping with specific carrier provisioning file (Can be found in Carrier label under "show cellular <slot> hardware"), default profiles are already populated and can be deployed readily.

In all other cases where profile configurations are not available, separate profiles should be created with required parameters.

You can create multiple profiles on Cisco 4G LTE Advanced. The following are the default internet profile numbers for the modems:

Modem	Profile Number
WP7607 (Global)	Profile 1

Modem	Profile Number
WP7601 (Verizon)	Both Profile 1 and Profile 3
WP7603 (AT&T or other SPs)	Profile 1

Follow these guidelines when you configure a data profile using EXEC mode or Config mode :

- You do not have to make any profile-related changes if your modem comes with a data profile, for instance, AT&T, Sprint and Verizon.
- If any profile parameter changes are required for a connection type, the changes will likely be carried out in the default profiles.
- To configure different profile types and use them for a different connection, you can create separate profiles with different parameters (for instance, APN names). Note that only one profile is active at a given time.
- Use the **show cellular <slot> profile** command to view the data profile. An asterisk(*) symbol is displayed against the data profile. Double asterisk(**) symbol is displayed against the attach profile.
- The data profile is used to set up a data call. If you want to use a different profile, that profile needs to be made the default one. Use the **lte sim data-profile** *number* command to change the default profile under **controller cellular 0/3/0**.

Creating, Modifying, or Deleting Data Profiles Using EXEC Mode

Customized profiles (Access Point Name(APN) in mobile networks) can be created and used on Cisco 4G LTE Advanced SKU's. Maximum number of profiles that can be created are 16.

Cisco SKU's shipping with specific carrier provisioning file (can be found in carrier label under **show cellular** *slot* **hardware**, default profiles are already populated and can be deployed readily.

Note For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**cellular** *slot* **lte profile** *[***create** | **delete***] profile-number [apn [authentication [username password [bearer-type]]]]* **Example:** `Router# cellular 0/3/0 lte profile create 2 apn.com pap username pwd ipv4`	Creates, modifies, or deletes a modem data profile in the privileged EXEC mode. • The *profile-number* argument specifies the profile number created for the modem. • (Optional) The *apn* argument specifies an Access Point Name (APN). An APN is provided by your service provider. Only a single APN can be specified for a single profile. • (Optional) The *authentication* parameter specifies the authentication type used. Acceptable parameters are **chap**, **none** (no authentication), **pap**, and **pap_chap** (PAP or CHAP authentication).

	Command or Action	Purpose
		• (Optional) The *username* and *password* arguments are given by a service provider. These are mandatory when an authentication type other than **none** is used. • (Optional) The *PDN* type parameter specifies the type of packet data session established with mobile network using this profile. Acceptable parameters are: **ipv4** **ipv6** and **ipv4v6** (IPv4 and IPv6). The **show cellular** *slot* profile displays configured profile list. **Note** Single asterisk(*) displayed against data profile. Double asterisk(**) displayed against attached profile.

Example

```
router# show cellular 0/3/0 profile
Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
--------
PDP Type = IPv4v6
PDP address = 100.119.136.44
PDP IPV6 address = 2600:1010:B00E:1E11:192D:3E20:199B:3A70/64  Scope: Global
Access Point Name (APN) = VZWINTERNET
Authentication = None
        Primary DNS address = 198.224.173.135
        Secondary DNS address = 198.224.174.135
        Primary DNS IPV6 address = 2001:4888:68:FF00:608:D:0:0
        Secondary DNS IPV6 address = 2001:4888:61:FF00:604:D:0:0

Profile 4 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
Authentication = None

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

Profile 6 = INACTIVE
--------
```

```
PDP Type = IPv4v6
Access Point Name (APN) = CISCO.GW4.VZWENTP
Authentication = None

  * - Default profile
 ** - LTE attach profile
```

```
#show cellular 0/3/0 profile
Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
--------
PDP Type = IPv4v6
PDP address = 100.86.69.19
PDP IPV6 address = 2600:1010:B040:DA58:1C27:D97:321E:18C4/64  Scope: Global
Access Point Name (APN) = VZWINTERNET
Authentication = None
 Primary DNS address = 198.224.173.135
 Secondary DNS address = 198.224.174.135
 Primary DNS IPV6 address = 2001:4888:68:FF00:608:D:0:0
 Secondary DNS IPV6 address = 2001:4888:61:FF00:604:D:0:0

Profile 4 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
Authentication = None

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

Profile 6 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwclass6
Authentication = None

  * - Default profile
 ** - LTE attach profile


Configured default profile for active SIM 0 is profile 3.
```

Note If data and attach profile bindings need modification, use the **controller cellular** slot.

```
router(config-controller)# lte sim data-profile 3 attach-profile 2 slot slot
```

```
Device#show cellular 0/3/0 profile
Profile 1 = INACTIVE
--------------------------------------------------
PDP Type = IPv4v6
Access Point Name (APN) = test
Authentication = None

Profile 2 = INACTIVE **
--------
PDP Type = IPv4
Access Point Name (APN) = internet
Authentication = PAP or CHAP
Username =  user@solution.com
Password =  cisco

Profile 3 = INACTIVE*
--------
PDP Type = IPv4v6
Access Point Name (APN) = basic
Authentication = None

  * - Default profile
 ** - LTE attach profile
Configured default profile for active SIM 0 is profile 2.
```

Configuration Examples

The following example shows how to change a default profile on 4G LTE Advanced:

```
router(config-controller)# lte sim data-profile 2 attach-profile 1 slot slot
```

The following example shows the output of the **show cellular** command for Verizon network service:

```
router# show cellular 0/3/0 profile
Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
--------
PDP Type = IPv4v6
PDP address = 100.119.136.44
PDP IPV6 address = 2600:1010:B00E:1E11:192D:3E20:199B:3A70/64  Scope: Global
Access Point Name (APN) = VZWINTERNET
Authentication = None
        Primary DNS address = 198.224.173.135
        Secondary DNS address = 198.224.174.135
        Primary DNS IPV6 address = 2001:4888:68:FF00:608:D:0:0
        Secondary DNS IPV6 address = 2001:4888:61:FF00:604:D:0:0

Profile 4 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
```

```
Authentication = None

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

Profile 6 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = CISCO.GW4.VZWENTP
Authentication = None

  * - Default profile
 ** - LTE attach profile
```

Configuring a SIM for Data Calls

Locking and Unlocking a SIM Card Using a PIN Code

Perform this task to lock or unlock a SIM card given by your service provider.

The SIM card gets blocked if the wrong PIN is entered three consecutive times. Make sure you enter the correct PIN the SIM is configured with. If your SIM card gets blocked, contact your service provider for a PUK code. Using the PUK code, you can unblock the SIM card.

For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**cellular** *slot* **lte sim** {**lock** | **unlock**} *pin* **Example:** `Router# cellular 0/3/0 lte sim lock 1111`	Locks or unlocks the SIM card using a PIN code. • *pin*—A code (4 to 8 digits long) provided by your carrier to lock or unlock the SIM card.

Changing the PIN Code

Perform this task to change the PIN code of a SIM.

For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**cellular** *slot* **lte sim change-pin** *pin new-pin* **Example:** `Router# cellular 0/3/0 lte sim change-pin 1111 1234`	Changes the assigned PIN code. SIM should be in locked state when the PIN is being changed.

Verifying the Security Information of a Modem

Perform this task to verify the security information of a modem.

Note For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**show cellular** *slot* **security** **Example:** `Router# show cellular 0/3/0 security`	Shows the security information of the modem, including the SIM lock status.

Configuring Automatic Authentication for a Locked SIM

An unencrypted PIN can be configured to activate the Card Holder Verification (CHV1) code that authenticates a modem.

The SIM card gets blocked if the wrong PIN is entered three consecutive times. Make sure you enter the correct PIN the SIM is configured with. If your SIM card gets blocked, contact your service provider for a PUK code.

Follow these procedures when using an unencrypted Level 0 PIN to configure CHV1. For instructions on how to configure CHV1 using an encrypted Level 7 PIN, see the Configuring an Encrypted PIN for a SIM, on page 22.

A SIM should be locked for SIM authentication to work. To verify the SIM's status, use the **show cellular** *slot* **security** command.

For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the cellular controller configuration mode.
Step 3	**lte sim authenticate 0** *pin*	Authenticates the SIM CHV1 code by using an unencrypted (**0**) keyword and PIN. This PIN is sent to the modem for

	Command or Action	Purpose
		authentication with each subsequent LTE connection. If authentication passes based on the configured PIN, the data call is allowed. If authentication fails, the modem does not initiate the data call. **Note** This command is valid only when an unencrypted PIN is used. To configure CHV1 code using an encrypted PIN, see the Configuring an Encrypted PIN for a SIM, on page 22.

Configuring an Encrypted PIN for a SIM

To configure an encrypted PIN, the scrambled value of the PIN must be obtained. To get the scrambled Level 7 PIN and to configure the SIM CHV1 code for verification using this encrypted PIN, enter the following commands in the EXEC mode.

Note When obtaining the encrypted PIN for a SIM, a username and password are created by configuring password encryption, defining the username and associated password, copying the resulting scrambled password, and using this scrambled password in the SIM authentication command. After the scrambled PIN has been obtained and used in SIM authentication, the username created can be deleted from the Cisco IOS configuration.

Note A SIM should be locked for SIM authentication to work. To verify the SIM's status, use the **show cellular** <*slot*> **security** command.

Note For the 4G LTE SKU, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**service password-encryption** **Example:** `Router(config)# service password-encryption`	Enables password encryption.
Step 3	**username** *name* **privilege 0 password** *pin*	Creates username and password.

	Command or Action	Purpose
	Example: `Router(config)# username SIM privilege 0 password 1111`	• *name*—Specifies the username. • *pin*—Specifies the four- to eight-digit PIN code.
Step 4	**do show run** | **i** *name* **Example:** `Router(config)# do show run | i SIM`	Shows the username configuration line with the encrypted level 7 PIN for the username created in Step 3 (user "SIM" in the example shown). Copy the scrambled password for use in Step 6 (as the PIN).
Step 5	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the cellular controller configuration mode.
Step 6	**lte sim authenticate** {**0** | **7**} *pin*	Authenticates the SIM CHV1 code by using the encrypted keyword **7** and the scrambled PIN from Step 4. The PIN is sent to the modem for authentication with each subsequent LTE connection. If authentication passes based on the configured PIN, the data call is allowed. If authentication fails, the modem does not initiate the data call.
Step 7	**exit** **Example:** `Router(config-controller)# exit`	(Optional) Exits the cellular controller configuration mode.
Step 8	**no username** *name* **Example:** `Router(config)# no username SIM`	(Optional) Removes the username and password created in Step 3.
Step 9	**no service password-encryption** **Example:** `Router(config)# no service password-encryption`	(Optional) Disables password encryption.

Applying a Modem Profile in a SIM Configuration

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.

	Command or Action	Purpose
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the cellular controller configuration mode.
Step 3	**lte sim data-profile** *number* **attach-profile** *number*	Applies the configured profile number to the SIM and its slot number. The default (primary) slot is 0. The **attach profile** is the profile used by the modem to attach to the LTE network. The **data profile** is the profile used to send and receive data over the cellular network.

Data Call Setup

To set up a data call, use the following procedures:

Configuring the Cellular Interface

To configure the cellular interface, enter the following commands starting in EXEC mode.

For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

If a tunnel interface is configured with **ip unnumbered cellular 0/3/0**, it is necessary to configure the actual static IP address under the cellular interface, in place of **ip address negotiated**.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface cellular** *slot* **Example:** `Router(config)# interface cellular 0/3/0`	Specifies the cellular interface.
Step 3	**ip address negotiated** **Example:** `Router(config-if)# ip address negotiated`	Specifies that the IP address for a particular interface is dynamically obtained.
Step 4	**dialer in-band** **Example:**	Enables DDR and configures the specified serial interface to use in-band dialing.

	Command or Action	Purpose
	`Router(config-if)# dialer in-band`	
Step 5	**dialer watch-group** *group-number* **Example:** `Router(config-if)# dialer watch-group 1`	Specifies the number of the dialer access group to which the specific interface belongs.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Enters the global configuration mode.
Step 7	**ip route** *network-number network-mask* {*ip-address* | *interface*} [*administrative distance*] [**name** *name*] **Example:** `Router(config)# ip route 209.165.200.225 255.255.255.224 cellular 0/3/0`	Establishes a floating static route with the configured administrative distance through the specified interface. **Note** A higher administrative distance should be configured for the route through the backup interface so that it is used only when the primary interface is down.
Step 8	**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**} **Example:** `Router(config)# dialer-list 1 protocol ip list 1`	Creates a dialer list for traffic of interest and permits access to an entire protocol.

Configure Cellular Interface with dialer watch-group

To configure the cellular interface with dialer watch-group, enter the following commands starting in EXEC mode.

Note For the 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and port separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**interface cellular** *slot* **Example:**	Specifies the cellular interface.

	Command or Action	Purpose
	`Router(config)# interface cellular 0/3/0`	
Step 3	**ip address negotiated** **Example:** `Router(config-if)# ip address negotiated`	Specifies that the IP address for a particular interface is dynamically obtained.
Step 4	**dialer in-band** **Example:** `Router(config-if)# dialer in-band`	Enables DDR and configures the specified serial interface to use in-band dialing.
Step 5	**ip address negotiated** **Example:** `Router(config-if)# ip address negotiated`	Specifies that the IP address for a particular interface is dynamically obtained.
Step 6	**dialer idle-timeout** *seconds* **Example:** `Router(config-if)# dialer idle-timeout 30`	Specifies the duration of idle time, in seconds, after which a line has no outbound traffic. “0” second means no idle timeout. The default idle timeout is 120 seconds if there is no idle timer specified.
Step 7	**dialer watch-group** *group-number* **Example:** `Router(config-if)# dialer watch-group 1`	Enables Dialer Watch on the specific interface.
Step 8	**exit** **Example:** `Router(config-if)# exit`	Enters the global configuration mode.
Step 9	dialer-list *dialer-group* protocol *protocol-name* **{permit | deny | list** *access-list-number group-number* **Example:** `Router(config)# dialer-list 1 protocol ip list 1`	Creates a dialer list for traffic of interest and permits access to an entire protocol.
Step 10	access-list *access-list-number* **permit***ip-source-address* **Example:** `Router(config)# access-list 1 permit any`	Defines traffic of interest.
Step 11	**dialer watch-list** *watch-group number* **ip** *ip mask* **Example:**	Defines traffic of interest.

	Command or Action	Purpose
	`Router(config)# dialer watch-list 1 ip 5.6.7.8 255.255.255.255`	
Step 12	**dialer watch-list** *watch-group number***delay route-check initial** *time in seconds* **Example:** `Router(config)# dialer watch-list 1 delay route-check initial 60`	Defines traffic of interest.
Step 13	**dialer watch-list** *watch-group number* **delay connected** *seconds* **Example:** `Router(config)# dialer watch-list 1 delay connect 1`	Defines traffic of interest.

Enabling 4G GPS and NMEA Data Streaming

GPS NMEA data streaming to external NMEA 2.0-compliant GPS plotter applications can be enabled on Cisco 4G LTE Advanced.

Note For a 4G LTE-Advanced, the *slot* argument identifies the router slot, module slot, and the port, and is separated by slashes (0/3/0).

Note GPS is not supported on P-LTEAP18-GL module.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the configuration mode.
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the controller cellular configuration mode.
Step 3	**lte gps enable** **Example:** `Router(config-controller)# lte gps enable`	(Optional) GPS is enabled by default. Use this command to enable the GPS feature if GPS has been disabled for any reason.

	Command or Action	Purpose
Step 4	**lte gps mode standalone** **Example:** `Router(config-controller)# lte gps mode standalone`	Enables the standalone GPS mode.

Step 5	**lte gps nmea {ip | udp** [*source address*][*destination address*][*destination port*] }
	Example:
	`Router(config-controller)# lte gps nmea ip`
	or
	`Router(config-controller)# lte gps nmea`
		Enables NMEA. Cisco 4G LTE Advanced support only IP NMEA. Therefore, the IP interface and serial interface options are unavailable.

Step 6	**end** **Example:** `Router(config-controller)# end`	Exits the controller configuration mode and returns to the privileged EXEC mode.
Step 7	**test cellular** *slot* **modem-power-cycle** **Example:** `Router# test cellular 0/3/0 modem-power-cycle`	GPS can take effect only after modem power cycle.

Step 8	**show cellular** *slot* **gps**
	Example:
	`Router# show cellular 0/3/0 gps`
	`GPS Feature = enabled`
	`GPS Mode Configured = standalone`
	`GPS Port Selected = Dedicated GPS port`
	`GPS Status = GPS coordinates acquired`
	`Last Location Fix Error = Offline [0x0]`
	`Latitude = 37 Deg 25 Min 4.8915 Sec North`
	`Longitude = 121 Deg 55 Min 8.5627 Sec West`
	`Timestamp (GMT) = Wed Nov 7 21:54:18 2018`
	`Fix type index = 0, Height = 8 m`
	`Satellite Info`
	`----------------`
	`Satellite #1, elevation 45, azimuth 303, SNR 20 *`
	`Satellite #3, elevation 15, azimuth 296, SNR 21`
	`Satellite #8, elevation 9, azimuth 227, SNR 27 *`
	`Satellite #11, elevation 41, azimuth 270, SNR 27 *`
	`Satellite #18, elevation 64, azimuth 258, SNR 29 *`
	`Satellite #22, elevation 35, azimuth 303, SNR 22 *`
	`Satellite #31, elevation 51, azimuth 140, SNR 24 *`
	`Satellite #32, elevation 46, azimuth 43, SNR 22 *`
	`Satellite #10, elevation 25, azimuth 97, SNR 0`
	`Satellite #14, elevation 68, azimuth 26, SNR 0`
	`!!... truncated ....!!`
	`Router#`
		Displays a summary of the following GPS data:
		• GPS state information (GPS disabled, GPS acquiring, GPS enabled)
		• GPS mode configured (standalone)
		• GPS location and timestamp information
		• GPS satellite information
		• GPS feature (enabled or disabled)
		• GPS port selected (Dedicated GPS and GPS port with voltage-no-bias)

	Command or Action	Purpose

Step 9	**show cellular** *slot* **gps detail**
	Example:
	`Router# show cellular 0/3/0 gps detail`
	`GPS Feature = enabled`
	`GPS Mode Configured = standalone`
	`GPS Port Selected = Dedicated GPS port`
	`GPS Status = GPS coordinates acquired`
	`Last Location Fix Error = Offline [0x0]`
	`Latitude = 37 Deg 25 Min 4.9282 Sec North`
	`Longitude = 121 Deg 55 Min 8.5209 Sec West`
	`Timestamp (GMT) = Wed Nov 7 21:53:52 2018`
	
	`Fix type index = 0, Height = 7 m`
	`HDOP = 1.5, GPS Mode Used = standalone`
	
	`Satellite Info`
	`----------------`
	`Satellite #8, elevation 9, azimuth 227, SNR 31 *`
	`Satellite #11, elevation 41, azimuth 270, SNR 32 *`
	`Satellite #18, elevation 64, azimuth 258, SNR 33 *`
	`Satellite #22, elevation 35, azimuth 303, SNR 26 *`
	`Satellite #31, elevation 51, azimuth 140, SNR 27 *`
	`Satellite #32, elevation 46, azimuth 43, SNR 22`
	`Satellite #1, elevation 45, azimuth 303, SNR 0`
	`Satellite #3, elevation 14, azimuth 296, SNR 0`
	`!!!...truncated!!!`
	`Router#`
		Displays detailed GPS data.

Configuring 4G SMS Messaging

Note For an 4G LTE Advanced, the *slot* argument identifies the router slot, module slot, and the port, and is separated by slashes (0/3/0).

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters the configuration mode.
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters the controller cellular configuration mode.

	Command or Action	Purpose

Step 3	**lte sms archive path** *FTP-URL*
	Example:
	`Router(config-controller)# lte sms archive path ftp://username:password@172.25.211.175/SMS-LTE`
		Specifies an FTP server folder path to send all the incoming and outgoing SMS messages. After the folder path is identified, it is appended automatically with outbox and inbox folders for the path to which SMS messages are sent and received, for example:
		`ftp://172.25.211.175/SMS-LTE/outbox`
		`ftp://172.25.211.175/SMS-LTE/inbox`

Step 4	**cellular** *slot* **lte sms view** { all | *ID* | **summary** }
	Example:
	`Router# cellular 0/3/0 lte sms view summary`
	`ID FROM YY/MM/DD HR:MN:SC SIZE CONTENT`
	`0 4442235525 12/05/29 10:50:13 137 Your entry last month has...`
	`2 5553337777 13/08/01 10:24:56 5 First`
	`3 5553337777 13/08/01 10:25:02 6 Second`
		Displays the message contents of incoming texts received by a modem.
		• **all**—Displays the message contents of up to 255 incoming text messages received by the modem.
		• *ID*—Displays the message contents for a specified ID (0-255) of an incoming text message.
		• **summary**—Displays a summary of the incoming text messages received by the modem.

Step 5	**end** **Example:** `Router# end`	Exits the configuration mode and returns to the privileged EXEC mode.

Step 6	**show cellular** *slot* **sms**
	Example:
	`Router#show cellular 0/3/0 sms`
	`Incoming Message Information`
	`----------`
	`SMS stored in modem = 20`
	`SMS archived since booting up = 0`
	`Total SMS deleted since booting up = 0`
	`Storage records allocated = 25`
	`Storage records used = 20`
	`Number of callbacks triggered by SMS = 0`
	`Number of successful archive since booting up = 0`
	`Number of failed archive since booting up = 0`
	`Outgoing Message Information`
	`----------`
	`Total SMS sent successfully = 0`
	`Total SMS send failure = 0`
	`Number of outgoing SMS pending = 0`
	`Number of successful archive since booting up = 0`
	`Number of failed archive since booting up = 0`
	`Last Outgoing SMS Status = SUCCESS`
	`Copy-to-SIM Status = 0x0`
	`Send-to-Network Status = 0x0`
	`Report-Outgoing-Message-Number:`
	`Reference Number = 0`
	`Result Code = 0x0`
	`Diag Code = 0x0 0x0 0x0 0x0 0x0`
	`SMS Archive URL = ftp://lab:lab@1.3.150.1/outbox`
		Displays all the information in the text messages sent and received. Message information includes text messages sent successfully, received, archived, and messages pending to be sent. LTE-specific information on errors in case of a FAILED attempt may also be displayed.

	Command or Action	Purpose
Step 7	**cellular** *slot* **lte sms send** *number* **Example:** `Router# cellular 0/3/0 lte sms send 15554443333 <sms text>`	Enables a user to send a 4G LTE band SMS message to other valid recipients, provided they have a text message plan. The *number* argument is the telephone number of the SMS message recipient. **Note** 10-digit or 11-digit (phone) numbers are the proper numerical format for sending a text. For example, ########## or 1##########. Seven digits are not supported.
Step 8	**cellular** *slot* **lte sms delete** [**all** | *id*] **Example:** `Router# cellular 0/3/0 lte sms delete [ all | id ]`	(Optional) Deletes one message ID or all of the stored messages from memory.

Configuring Modem DM Log Collection

Diagnostic Monitor (DM) Log is a modem's feature that captures data transactions between the modem and the network over the radio frequency interface. This feature is a useful tool for troubleshooting 3G and 4G data connectivity or performance issues.

Once a DM log file is captured, diagnostic software tools, such as Sierra Wireless SwiLog and Qualcomm QXDM, can be used to decode the DM log file to understand the issues. A member of Cisco TAC can help with decoding the DM log files.

To configure DM log collection, enter the following commands, starting in privileged EXEC mode.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters cellular controller configuration mode.
Step 3	**lte modem dm-log** {**autoshop** {**link-down** | **timer** *time*} | **enable** | **filesize** *size* | **filter**} **bootflash:***file* | **flash:***file*} **rotation** | **size** *log-size*} **Example:** `Router(config-controller)# lte modem dm-log enable`	Configures DM logging for LTE modem. • **autostop**—Automatically stops DM log capturing based on: **link-down**—cellular interface link down event **timer***timer*—amount of time in minutes • **enable**—Starts DM log capturing.

	Command or Action	Purpose
		• **filesize** *size*—Specifies the maximum log file size, in MB for each DM log file before creating another DM log file. Range is from 1 to 64. Default is 20. • **filter** *location*:*filename*—Specifies the DM log filter to use from the following locations: —bootflash:*file* —flash:*file* **Note** Bootflash and flash are the only valid locationsto store the DM log filter file. **Note** If the DM log filter file is not specified, the generic filter file, which comes with the router will be used. **Note** The DM log filter file needs to be in .sqf format. • **rotation**—Enables continuous DM log capturing by replacing the oldest DM log files with the latest. • **size** *log-size*—Specifies the maximum total size in MB of all DM log files that can be allowed in the bootflash or flash before modem stops capturing DM log files. If rotation is enabled, the oldest DM files is replaced with the latest DM file to meet this size configuration.
Step 4	**end** **Example:** `Router(config-controller)# end`	Returns to privileged EXEC mode.

Step 5	**show cellular** *slot* **logs dm-log**
	Example:
	`Router# show cellular 0/3/0 logs dm-log`
	`Integrated DM logging is on`
	`output path = Utility Flash`
	`filter = MC74xx generic - v11026_Generic_GSM_WCDMA_LTE_IP-no-data-packets.sqf`
	`maximum log size = 0`
	`maximum file size = 0`
	`log rotation = disabled`
	`33 packets sent to the modem, 4663 bytes, 0 errors`
	`28521 packets received from the modem, 13500758 bytes, 0 input drops`
	`28521 packets stored in utility flash, 13500758 bytes`
	`current file size = 13500758`
		(Optional) Displays DM log configuration and statistics.

	Command or Action	Purpose
	current log size = 13500758 total log size = 13500758 Utility Flash DM log files = (1) files	

Example

The following example shows how to:

- Specifies the maximum size of all DM log files that can be stored in bootflash or flash to 512 MB
- Specifies the maximum size of each DM log file to 32 MB
- Uses MC7xxx_GPS_Log.sqf DM log filter in the flash
- Enable rotation
- Enables DM log capturing

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log filesize 512

Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log filesize 32
```

The following example shows how to specify the filter file for LTE:

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log filter flash:MC7xxx_GPS_Log.sqf
```

The following example shows how to enable DM log rotation for LTE:

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log rotation
```

The following example shows how to specify the maximum log size for LTE:

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log enable
```

The following example shows how to enable DM log rotation for LTE:

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# end
```

The following example shows how to specify the maximum log size for LTE:

```
Router(config-controller)# controller cell 0/3/0
Router(config-controller)# lte modem dm-log size 1024
```

The following example shows what was configured on the router for DM log feature:

```
Router#show running-config | section controller
controller Cellular 0/3/0
 lte modem dm-log filter flash:MC7xxx_GPS_Log.sqf
 lte modem dm-log size 512
 lte modem dm-log filesize 32
 lte modem dm-log rotation
 lte modem dm-log enable
 lte modem dm-log size 1024
```

The following displays DM log configuration and statistics

```
Router#show cellular 0/3/0 logs dm-log
Integrated DM logging is on
```

```
output path = Utility Flash
filter = flash:MC7xxx_GPS_Log.sqf
maximum log size = 536870912
maximum file size = 33554432
log rotation = enabled

32 packets sent to the modem, 3879 bytes, 0 errors
158324 packets received from the modem, 75971279 bytes, 0 input drops
158324 packets stored in utility flash, 75971279 bytes

current file size = 8863042
current log size = 75971279
total log size = 75971279
Utility Flash DM log files =  (3) files
end
```

The following shows the DM log files created:

```
Router#dir flash:dmlog*
Directory of bootflash:/dmlog*

Directory of bootflash:/

   27  -rw-    33554069   Jun 7 2018 18:08:46 -08:00  dmlog-slot2-20180607-180628.bin
   28  -rw-    33554168   Jun 7 2018 18:11:25 -08:00  dmlog-slot2-20180607-180846.bin
   29  -rw-    14188544   Jun 7 2018 18:12:37 -08:00  dmlog-slot2-20180607-181125.bin
2885718016 bytes total (521891840 bytes free)
lte modem dm-log size 1024
```

The following shows hot to disable/stop DM log capturing:

```
Router(config)#controller cellular 0/3/0
Router(config-controller)#no lte modem dm-log enable
Router(config-controller)#end
```

Enabling Modem Crashdump Collection

Modem crashdump collection is useful in debugging firmware crash. To collect crash data, the modem has to be pre-configured so that it will stay in memdump mode after a crash. Memdump mode is a special boot-and-hold mode for the memdump utility to collect crash data.

To enable modem crashdump collection, perform the following steps.

Note The integrated modem crashdump collection feature is supported only on 3G HSPA and 4G LTE Advanced based SKUs.

Before you begin

The device will need to be in boot-and-hold mode.

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#controller cel 0/3/0
Router(config-controller)#lte modem crash-action ?
boot-and-hold Remain in crash state

Router(config-controller)#lte modem crash-action boot-and-hold
```

This ensures that whenever the router crashes, it will stay in that state and will not try to recover. By default the crash-action is reset which means the modem will reset and try to recover itself whenever it crashes. The above boot-and-hold command is used to keep the modem in a crashed state so that you can capture crashdump using the following command:

```
Router#test cell-cwan 0/3/0 modem-crashdump ?
off Disable Modem firmware crash dump
on Enable Modem firmware crash dump

Router#test cell-cwan 0/3/0 modem-crashdump on
```

This will capture the crashdump and store it in flash.

Procedure

	Command or Action	Purpose
Step 1	test { cell-cwan } *slot* modem-crashdump { on *location* | off } **Example:** `Router# test cell-host 0/3/0 modem-crashdump on local_uf`	Enables or disables modem crashdump collection. • **cell-host** —Keyword for fixed platform. • **cell-cwan** — Keyword for LTE on a modular inside platform. • *slot* —For LTE module, this is the router slot, module slot, and port separated by slashes (for example, 0/3/0). For fixed platform, this is the number 0. • **on** Enables crashdump log collection. • *location* —Specifies the destination URL where the modem crashdump logs will be stored. • **off** —Disables crashdump log collection.

Displaying Modem Log Error and Dump Information

As part of the 3G serviceability enhancement, commands strings (**at!err** and **at!gcdump**) can be sent to the modem using Cisco IOS CLI rather than setting up a reverse telnet session to the cellular modem to obtain log error and dump information.

To obtain log error and dump information, perform the following steps.

Note The modem log error and dump collection feature is supported only on 3G SKUs.

Procedure

	Command or Action	Purpose
Step 1	**show cellular** *slot* **log error** **Example:** `Router# show cellular 0/3/0 log error`	Shows modem log error and dump information.
Step 2	**test cellular** *slot* **modem-error-clear** **Example:** `Router# test cellular 0/3/0 modem-error-clear`	(Optional) Clears out the error and dump registers. By default, error and dump registers are not cleared out after a read. This command changes the operation so that registers are cleared once they are read. As a result, the AT command strings are changed to "**at!errclr=–1**" for CDMA and "**at!err=0**" for GSM modems.

Verifying the 4G LTE Advanced Router Information

You can verify the configuration by using the following show commands:

show version

```
Router#show version
Cisco IOS XE Software, Version BLD_V1612_THROTTLE_LATEST_20190604_050228_V16_12_0_134
Cisco IOS Software [Gibraltar], ISR Software (ARMV8EL_LINUX_IOSD-UNIVERSALK9-M), Experimental
 Version 16.12.20190604:055159
[v1612_throttle-/nobackup/mcpre/BLD-BLD_V1612_THROTTLE_LATEST_20190604_050228 226]
Copyright (c) 1986-2019 by Cisco Systems, Inc.
Compiled Tue 04-Jun-19 16:24 by mcpre


Cisco IOS-XE software, Copyright (c) 2005-2019 by cisco Systems, Inc.
All rights reserved.  Certain components of Cisco IOS-XE software are
licensed under the GNU General Public License ("GPL") Version 2.0.  The
software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY.  You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0.  For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.


ROM: IOS-XE ROMMON

IR1101 uptime is 5 minutes
Uptime for this control processor is 6 minutes
System returned to ROM by Power-on at 17:11:39 GMT Tue Jun 25 2019
System image file is
"usbflash0:ir1101-universalk9.BLD_V1612_THROTTLE_LATEST_20190604_050228_V16_12_0_134.SSA.bin"
Last reload reason: Power-on



This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
```

```
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Technology Package License Information:

------------------------------------------------------------------------------
Technology-package                                      Technology-package
Current                       Type                         Next reboot
------------------------------------------------------------------------------
network-essentials     Smart License                    network-essentials


Smart Licensing Status: UNREGISTERED/EVAL EXPIRED

cisco IR1101-K9 (ARM64) processor (revision 1.2 GHz) with 708327K/6147K bytes of memory.
Processor board ID FCW222700KS
3 Virtual Ethernet interfaces
4 FastEthernet interfaces
2 Gigabit Ethernet interfaces
1 Serial interface
1 terminal line
4 Cellular interfaces
32768K bytes of non-volatile configuration memory.
4038072K bytes of physical memory.
 --More--
 2766848K bytes of Bootflash at bootflash:.
15350496K bytes of USB Flash at usbflash0:.
0K bytes of WebUI ODM Files at webui:.

Configuration register is 0x1820
```

show platform

```
router# sh platform
Chassis type: IR1101-K9

Slot      Type                State                 Insert time (ago)
--------- ------------------- --------------------- -----------------
0         IR1101-K9           ok                    1w1d
0/0       IR1101-ES-5         ok                    1w1d
0/1       P-LTE-GB            ok                    1w1d
R0        IR1101-K9           ok, active            1w1d
F0        IR1101-K9           init, active          1w1d
```

show interfaces

```
router#sh interface cellular 0/3/0
Cellular0/3/0 is up, line protocol is up
  Hardware is LTE Adv CAT6 - Europe/North America Multimode LTE/DC-HSPA+/HSPA+/HSPA/UMTS/
  Internet address is 10.14.162.11/32
  MTU 1500 bytes, BW 50000 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
```

```
  Keepalive not supported
  DTR is pulsed for 1 seconds on reset
  Last input never, output 00:00:42, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/375/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     5 packets input, 460 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     21 packets output, 1692 bytes, 0 underruns
     0 output errors, 0 collisions, 8 interface resets
     0 unknown protocol drops
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
router#
```

show inventory

```
router# show inventory
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
INFO: Please use "show license UDI" to get serial number for licensing.
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

NAME: "Chassis", DESCR: "IR1101 Base Chassis"
PID: IR1101-K9 , VID: V00 , SN: FCW222700KS

NAME: "Module 0 - Mother Board", DESCR: "Cisco IR1101 motherboard"
PID: IR1101-K9 , VID: V00 , SN: FOC22224U22

NAME: "module subslot 0/0", DESCR: "IR1101-ES-6S"
PID: IR1101-ES-6S , VID: V01 , SN:

NAME: "subslot 0/0 transceiver 5", DESCR: "100BASE FX-GE"
PID: GLC-FE-100FX-RGD , VID: V02 , SN: FNS153304G4

NAME: "module subslot 0/1", DESCR: "P-LTEA-LA Module"
PID: P-LTEA-LA , VID: V01 , SN: FOC22287JNR

NAME: "Modem on Cellular0/3/0", DESCR: "Sierra Wireless EM7430"
PID: EM7430 , VID: 1.0 , SN: 355813070162356

NAME: "module subslot 0/3", DESCR: "P-LTEA-EA Module"
PID: P-LTEA-EA , VID: V01 , SN: FOC22170JA9

NAME: "Modem on Cellular0/3/0", DESCR: "Sierra Wireless EM7455"
PID: EM7455 , VID: 1.0 , SN: 356129070235970

NAME: "Module 2 - Expansion Module", DESCR: "IR1100 expansion module with Pluggable slot
and SFP"
PID: IRM-1100-SP , VID: V00 , SN: FCW23050014

NAME: "Module 3 - FP F0", DESCR: "Cisco IR1101 Forwarding Processor"
PID: IR1101-K9 , VID: V00 , SN: FOC22224U22
```

Configuring Cellular Modem Link Recovery

The cellular modem link recovery feature is disabled by default and it is recommended to enable the link recovery feature.

Note No manual operations or automated scripts interacting with 4G modems may be possible until and unless the modems have come fully in-service. Modems may take approximately 4 minutes after platform bootup and CLI available to be able to allow full interaction and establish IP connectivity. A typical modem power-cycle may also take approximately 4 minutes before any interaction is possible. Modems are in-service after the console displays "%CELLWAN-2-MODEM_RADIO: Cellular0/x/0 Modem radio has been turned on" – where x is the modem slot number.

To enable or disable the cellular modem link recovery feature, if required, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 2	**controller cellular** *slot* **Example:** `Router(config)# controller cellular 0/3/0`	Enters cellular controller configuration mode.

Step 3	{**lte**} **modem link-recovery disable** | **no lte** | **modem link-recoverydisable**}
	Example:
	`Router(config-controller)# lte modem link-recovery disable`
	`Router(config-controller)# no lte modem link-recovery disable`
	`Device#show run | sec controller Cellular 0/3/0`
	`controller Cellular 0/3/0`
	`lte modem link-recovery rssi onset-threshold -110`
	`lte modem link-recovery monitor-timer 20`
	`lte modem link-recovery wait-timer 10`
	`lte modem link-recovery debounce-count 6`
	`Example:`
	`Device#configure terminal`
	`Device(config)#controller Cellular 0/3/0`
	`Device(config-controller)#lte modem link-recovery`
		Enables or disables the cellular modem link recovery feature.
		Enables or disables the cellular modem link recovery feature.
		Once we enable link-recovery, the default Cisco recommended values for link-recovery parameters are populated.
		We can change the values of link-recovery parameters from the default Cisco recommended values, by using cli for each parameter like in example.
		Note Changing the default recommended cisco values is not advised as it will impact ideal performance of link-recovery feature.

	Command or Action	Purpose
	monitor-timer 30 Device(config-controller)#lte modem wait-timer 15 Device(config-controller)#lte modem debounce-count 8 Device(config-controller)#lte modem rssi onset-threshold -100	
Step 4	**end** **Example:** Router(config)# end	Exits the configuration mode and returns to the privileged EXEC mode.

Cellular Modem Link Recovery Parameters

There are four configurable parameters to adjust the behavior of cellular link recovery. The default values optimized for the best performance of the feature and changing it is not recommended unless advised by Cisco.

The following table explains the link recovery parameters.:

Table 4: Link Recovery Parameters

Parameter	Description
rssi onset-threshold	This parameter defines the RSSI value below which the link recovery feature triggers additional scrutiny to look for potential issues and take action if needed. The range of this parameter can be set from -90 dBm to -125 dBm. The recommended and default value is -110 dBm.
monitor-timer	This parameter determines how often link recovery looks for potential issues. The default value for this parameter is 20 seconds meaning that link recovery feature will be triggered every 20 seconds and look at certain parameters to determine if there is a potential issue. You can configure the monitor-timer range between 20 to 60 seconds. Increasing the monitor timer value above 20 seconds will increase the response time of the feature.

Parameter	Description
wait-timer and debounce-count	The wait-timer parameter is used in conjunction with the debounce-count parameter to perform more frequent, additional checks, once the link recovery feature has identified a potential issue that needs to be recovered from, with a modem power-cycle. The default value for wait-timer is 10 seconds and the default value for debounce- count is 6. With this setting, once link recovery has identified an inoperative modem state, it performs additional checks every 10 seconds, up to 6 times, to determine if the issue has been resolved without a modem power-cycle. Reducing the debounce-count and the wait-timer makes faster link recovery, while reducing them may increase the time for recovery. The configurable range for wait-timer is 5-60 seconds. The configurable range for debounce-count is 6-20 seconds.

Verifying the Cellular Modem Link Recovery Configuration

To determine if the cellular modem link recovery is enabled, use the **show controller cellular** *slot* command. In this example, the cellular modem link recovery feature related information is highlighted.

```
Router# show controller cellular 0/3/0 Interface Cellular0/3/0
LTE Module - Multimode LTE/DC-HSPA+/HSPA+/HSPA/UMTS/EDGE/GPRS unit 2

Cellular Modem Configuration
============================
Modem is recognized as valid
Power save mode is OFF
manufacture id =  0x00001199     product id = 0x000068C0
Sierra Wireless unknown modem
Modem Uplink Speed = 50000 kbit.
Modem Downlink Speed = 300000 kbit.

GPS Feature = enabled
GPS Status =  NMEA Disabled
GPS Mode = not configured

Cellular Dual SIM details:
--------------------------
SIM 0 is present
SIM 1 is not present
SIM 0 is active SIM

Module Reload Statistics
------------------------
Soft OIR reloads = 0
Hard OIR reloads = 0
------------------------

Modem Management Statistics
---------------------------
Modem resets = 1
Modem timeouts = 0
Link recovery is ON
```

```
Registration check is ON
RSSI threshold value is -110 dBm
Monitor Timer value is 20 seconds
Wait Timer value is 10 seconds
Debounce Count value is 6

Link recovery count is 0
```

When the cellular modem link recovery occurs and modem is power cycled, you can see the %CELLWAN-2-MODEM_DOWN message on the console logs and additionally there is a %CELLWAN-2-LINK_RECOVERY message which indicates that action has been taken by the cellular modem link recovery feature.

Whenever the cellular modem link recovery has occurred, it updates the Modem timeouts counter under the Modem Management Statistics section of the show controller cellular slot command output. Modem parameters at the last timeout section has information that helps to identify the cause of the issue that triggered link recovery

In the following example log, the messages, modem time out counter, and modem parameters at the last time out are highlighted.

***Jul 19 17:15:18.980 PDT: %CELLWAN-2-LINK_RECOVERY: Cellular0/3/0: Cellular Modem has been power cycled**

```
Device#show controller Cellular 0/3/0 Interface Cellular0/3/0
LTE Module - Multimode LTE/DC-HSPA+/HSPA+/HSPA/UMTS/EDGE/GPRS unit 2

Cellular Modem Configuration
============================
Modem is recognized as valid
Power save mode is OFF
manufacture id =  0x00001199     product id = 0x000068C0
Sierra Wireless unknown modem
Modem Uplink Speed = 50000 kbit.
Modem Downlink Speed = 300000 kbit.

GPS Feature = enabled
GPS Status =  NMEA Disabled
GPS Mode = not configured

Cellular Dual SIM details:
--------------------------
SIM 0 is present
SIM 1 is not present
SIM 0 is active SIM

Module Reload Statistics
------------------------
Soft OIR reloads = 0
Hard OIR reloads = 0
------------------------
 Modem Management Statistics
---------------------------
Modem resets = 1
Modem user initiated resets = 0
Modem user initiated power-cycles = 0
Modem timeouts = 1
Modem parameters at the last timeout:
         LTE first time attach State was No
         Radio Interface Technology Mode was AUTO
         Operating Mode was Online
         RSSI was -0 dBm
```

```
          Packet switch domain status was Not Attached
          Registration state(EMM) was Not Registered
          Downlink traffic was not present
Link recovery is ON
Registration check is ON
RSSI threshold value is -110 dBm
Monitor Timer value is 20 seconds
Wait Timer value is 10 seconds
Debounce Count value is 6
```

Configuration Examples for 3G and 4G Serviceability Enhancement

Example: Sample Output for the show cellular logs dm-log Command

The following shows a sample output of the **show cellular logs dm-log** command:

```
Router# show cellular 0/3/0 logs dm-log
Integrated DM logging is on
filter = generic
maximum log size = 67108864
maximum file size = 20971520
log rotation = disabled
7 packets sent to the modem, 3232 bytes, 0 errors
75 packets received from the modem, 57123 bytes, 0 input drops
75 packets stored in file system, 57123 bytes, 0 errors, 0 aborts
2 max rcv queue size
current file size = 57123
current log size = 57123
total log size = 57123
DM log files: (1 files)
```

Example: Sample Output for the show cellular logs modem-crashdump Command

The following shows a sample output of the **show cellular logs modem-crashdump** command:

```
Router# show cellular 0/3/0 logs modem-crashdump
Modem crashdump logging: off
Progress = 100%
Last known State = Getting memory chunks
Total consecutive NAKs = 0
Number of retries = 0
Memory Region Info:
1: Full SDRAM [Base:0x0, Length:0x2000000]
2: MDSP RAM A region [Base:0x91000000, Length:0x8000]
3: MDSP RAM B region [Base:0x91200000, Length:0x8000]
4: MDSP RAM C region [Base:0x91400000, Length:0xC000]
5: MDSP Register region [Base:0x91C00000, Length:0x28]
6: ADSP RAM A region [Base:0x70000000, Length:0x10000]
7: ADSP RAM B region [Base:0x70200000, Length:0x10000]
8: ADSP RAM C region [Base:0x70400000, Length:0xC000]
9: ADSP RAM I region [Base:0x70800000, Length:0x18000]
```

```
10: CMM Script [Base:0x6A350, Length:0x310]
Router#
```

Configuration Examples for 4G LTE Advanced

Configuration examples follow based upon the following hardware shown in the two examples.

```
Router#show inventory

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
INFO: Please use "show license UDI" to get serial number for licensing.
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

NAME: "Chassis", DESCR: "Embedded Services Router with 2 Gigabit Ethernet routed ports,4
Gigabit Ethernet switched ports, with cooling plate"
PID: ESR-6300-CON-K9 , VID: V01 , SN: FOC234304HF

NAME: "Power Supply Module 0", DESCR: "External Power Supply Module"
PID: PWR-12V , VID: , SN:

NAME: "module 0", DESCR: "Cisco ESR-6300-CON-K9 Fixed and pluggable Interface Module
controller"
PID: ESR-6300-CON-K9 , VID: , SN:

NAME: "NIM subslot 0/1", DESCR: "ESR-6300-ES-4"
PID: ESR-6300-ES-4 , VID: V01 , SN:

NAME: "NIM subslot 0/3", DESCR: "P-LTEAP18-GL Module"
PID: P-LTEAP18-GL , VID: V01 , SN: FOC2437447U

NAME: "Modem on Cellular0/3/0", DESCR: "Telit LM960"
PID: LM960 , VID: 1.0 , SN: 358347100146128

NAME: "NIM subslot 0/0", DESCR: "Front Panel 2 port Gigabitethernet Module"
PID: ESR-6300-2x1GE , VID: V01 , SN:

NAME: "module R0", DESCR: "Cisco ESR-6300-CON-K9 Route Processor"
PID: ESR-6300-CON-K9 , VID: V01 , SN: FOC234304HF

NAME: "module F0", DESCR: "Cisco ESR-6300-CON-K9 Forwarding Processor"
PID: ESR-6300-CON-K9 , VID: , SN:
```

```
Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0/0 175.1.1.1 YES NVRAM up up
GigabitEthernet0/0/1 172.27.167.177 YES NVRAM administratively down down
GigabitEthernet0/1/0 unassigned YES unset down down
GigabitEthernet0/1/1 unassigned YES unset down down
GigabitEthernet0/1/2 unassigned YES unset down down
GigabitEthernet0/1/3 unassigned YES unset down down
Cellular0/3/0 192.1.1.21 YES IPCP up up
Cellular0/3/1 unassigned YES NVRAM administratively down down
Async0/2/0 unassigned YES unset up down
Vlan1 unassigned YES unset up down
Router#
```

Example: Basic Cellular Interface Configuration: Cisco 4G LTE Advanced

The following example shows a dual LTE scenario configuration showing working cellular configuration for 0/3/0 with appropriate routes and dialer watch-group.

```
show run
Building configuration...


Current configuration : 8079 bytes
!
! Last configuration change at 17:33:19 GMT Tue Jun 25 2019
!
version 16.12
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
service internal
service call-home
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname IR1101
!
boot-start-marker
boot-end-marker
!
!
!
no aaa new-model
clock timezone GMT 0 0
call-home
 ! If contact email address in call-home is configured as sch-smart-licensing@cisco.com
 ! the email address configured in Cisco Smart License Portal will be used as contact email
 address to send SCH notifications.
 contact-email-addr sch-smart-licensing@cisco.com
 profile "CiscoTAC-1"
  active
  destination transport-method http
  no destination transport-method email
!
ip name-server 171.70.168.183 198.224.173.135 8.8.8.8
no ip domain lookup
ip domain name cisco.com
!
login on-success log
ipv6 unicast-routing
!
chat-script lte "" "AT!CALL" TIMEOUT 20 "OK"
chat-script hspa-R7 "" "AT!SCACT=1,1" TIMEOUT 60 "OK"
!
crypto pki trustpoint SLA-TrustPoint
 enrollment pkcs12
 revocation-check crl
!
crypto pki trustpoint TP-self-signed-756885843
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-756885843
 revocation-check none
 rsakeypair TP-self-signed-756885843
!
!
crypto pki certificate chain SLA-TrustPoint
 certificate ca 01
```

```
  30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
  32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
  6F204C69 63656E73 696E6720 526F6F74 20434130 1E170D31 33303533 30313934
  3834375A 170D3338 30353330 31393438 34375A30 32310E30 0C060355 040A1305
  43697363 6F312030 1E060355 04031317 43697363 6F204C69 63656E73 696E6720
  526F6F74 20434130 82012230 0D06092A 864886F7 0D010101 05000382 010F0030
  82010A02 82010100 A6BCBD96 131E05F7 145EA72C 2CD686E6 17222EA1 F1EFF64D
  CBB4C798 212AA147 C655D8D7 9471380D 8711441E 1AAF071A 9CAE6388 8A38E520
  1C394D78 462EF239 C659F715 B98C0A59 5BBB5CBD 0CFEBEA3 700A8BF7 D8F256EE
  4AA4E80D DB6FD1C9 60B1FD18 FFC69C96 6FA68957 A2617DE7 104FDC5F EA2956AC
  7390A3EB 2B5436AD C847A2C5 DAB553EB 69A9A535 58E9F3E3 C0BD23CF 58BD7188
  68E69491 20F320E7 948E71D7 AE3BCC84 F10684C7 4BC8E00F 539BA42B 42C68BB7
  C7479096 B4CB2D62 EA2F505D C7B062A4 6811D95B E8250FC4 5D5D5FB8 8F27D191
  C55F0D76 61F9A4CD 3D992327 A8BB03BD 4E6D7069 7CBADF8B DF5F4368 95135E44
  DFC7C6CF 04DD7FD1 02030100 01A34230 40300E06 03551D0F 0101FF04 04030201
  06300F06 03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604 1449DC85
  4B3D31E5 1B3E6A17 606AF333 3D3B4C73 E8300D06 092A8648 86F70D01 010B0500
  03820101 00507F24 D3932A66 86025D9F E838AE5C 6D4DF6B0 49631C78 240DA905
  604EDCDE FF4FED2B 77FC460E CD636FDB DD44681E 3A5673AB 9093D3B1 6C9E3D8B
  D98987BF E40CBD9E 1AECA0C2 2189BB5C 8FA85686 CD98B646 5575B146 8DFC66A8
  467A3DF4 4D565700 6ADF0F0D CF835015 3C04FF7C 21E878AC 11BA9CD2 55A9232C
  7CA7B7E6 C1AF74F6 152E99B7 B1FCF9BB E973DE7F 5BDDEB86 C71E3B49 1765308B
  5FB0DA06 B92AFE7F 494E8A9E 07B85737 F3A58BE1 1A48A229 C37C1E69 39F08678
  80DDCD16 D6BACECA EEBC7CF9 8428787B 35202CDC 60E4616A B623CDBD 230E3AFB
  418616A9 4093E049 4D10AB75 27E86F73 932E35B5 8862FDAE 0275156F 719BB2F0
  D697DF7F 28
   quit
crypto pki certificate chain TP-self-signed-756885843
 certificate self-signed 01
  3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
  30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274
  69666963 6174652D 37353638 38353834 33301E17 0D313930 35333130 30303530
  385A170D 33303031 30313030 30303030 5A303031 2E302C06 03550403 1325494F
  532D5365 6C662D53 69676E65 642D4365 72746966 69636174 652D3735 36383835
  38343330 82012230 0D06092A 864886F7 0D010101 05000382 010F0030 82010A02
  82010100 D2F61742 3B651909 95856431 9BC2CCB7 D4B04861 DD6E0924 4C3E6A51
  8BF2ABD9 5C3A597D 2EE0112C ECA615AA D0297F9E 071B6B5D 9B831332 021E61F4
  2352EEC9 EE70742E 46EFBAFC A03744D8 A22E4DA3 AAF919CC 0A7929A7 3BDB3B17
  C04DA5B9 028DD3EC 992493A6 EA864ED6 354CB3F4 094D3EBF 5307CAA3 192B5759
  E458712D 841A43CD 709D4D9E 72A9DE3E F935A688 59B6F278 65B59EE0 6B72469E
  7B97582A 64E511A6 D81735FF 117CE399 4C2A2973 F5FD407D BCEB62A6 FD7C6B08
  882E0749 ACE5BD44 32634790 3607ADEA 9F319343 4CA76B0D B1DE6A1C AD144548
  E38119E2 8B34F7AC 090C0450 03166B42 8C7C9EA7 5132687F E1F7BF6E B065CD4E
  889F02BB 02030100 01A35330 51300F06 03551D13 0101FF04 05300301 01FF301F
  0603551D 23041830 16801405 77954127 36509205 7025CF4E 84B5D4A2 A3D53730
  1D060355 1D0E0416 04140577 95412736 50920570 25CF4E84 B5D4A2A3 D537300D
  06092A86 4886F70D 01010505 00038201 01004147 49C6A0A9 56F5BD4D 4892AEE0
  22955E06 AF192FA6 868D5556 959ACF05 398F3907 DFE3148B 0E2CFC12 20BEEA05
  DC23E8D7 A47DB4AE D6CB6665 BCAE7F39 24D010F0 DB8F0E70 5E7C3F73 25AB1783
  1346D540 47BB7E89 2BB1BE4D 16990318 A4612CC5 C7CC9376 7DF1A1F4 C09C0051
  4D950D99 3CC0C65B 0A98859A 3B81E324 BAB34EDF 64CA8C38 184DC796 47DDD9DD
  F71F8D5E D3B7A962 3D0FDE44 012AC034 D0E7F75A DB1BF12A CF23E2F5 6A4FDA14
  A588DCDA 8272CE33 36ABC57A BFF52980 5FFC7C34 4D4307BB AC0C0F18 AA783B9D
  27C61E89 0EC1C6AA 6AB3F73B EF8450FD 782DFC63 038F6A27 456CA32B D3FEDB97
  C8064523 EBB93FF5 8B98B546 44F853E9 0E04
   quit
!
license udi pid IR1101-K9 sn FCW222700KS
diagnostic bootup level minimal
!
spanning-tree extend system-id
memory free low-watermark processor 50357
file prompt quiet
!
```

```
username cisco privilege 15 password 0 cisco
username lab password 0 lab123
!
redundancy
!
controller Cellular 0/3/0
 no lte firmware auto-sim
 lte modem link-recovery disable
!
controller Cellular 0/3/0
!
vlan internal allocation policy ascending


interface GigabitEthernet0/0/0
 no ip address
 shutdown
!
interface FastEthernet0/0/1
 switchport access vlan 192
 switchport mode access
!
interface FastEthernet0/0/2
 switchport access vlan 172
 switchport mode access
!
interface FastEthernet0/0/3
 switchport access vlan 172
!
interface FastEthernet0/0/4
 switchport mode access
!
interface GigabitEthernet0/0/5
!
interface Cellular0/3/0
 ip address negotiated
 load-interval 30
 dialer in-band
 dialer idle-timeout 0
 dialer watch-group 1
 ipv6 enable
 pulse-time 1
 ip virtual-reassembly
!
interface Cellular0/1/1
 no ip address
 shutdown
!
interface Cellular0/3/0
 ip address negotiated
 dialer in-band
 dialer idle-timeout 0
 dialer watch-group 2
 ipv6 enable
 pulse-time 1
 ip virtual-reassembly
!
interface Cellular0/3/1
 no ip address
 shutdown
!
interface Vlan1
 ip address 192.168.10.15 255.255.255.0
!
```

```
interface Vlan172
 ip address 172.27.167.121 255.255.255.128
!
interface Vlan175
 ip address 175.1.1.1 255.255.255.0
!
interface Async0/2/0
 no ip address
 encapsulation scada
!
ip default-gateway 172.27.167.1
ip forward-protocol nd
!
ip http server
ip http authentication local
ip http secure-server
ip route 0.0.0.0 0.0.0.0 172.27.167.1
ip route 0.0.0.0 0.0.0.0 Cellular0/3/0
ip route 0.0.0.0 0.0.0.0 Cellular0/3/0 253
ip route 8.8.4.0 255.255.255.0 Cellular0/3/0
ip route 171.70.0.0 255.255.0.0 172.27.167.1
ip route 192.1.1.0 255.255.255.0 Cellular0/3/0
ip route 192.168.193.0 255.255.255.0 192.168.10.1
!
!
ip access-list standard 1
 10 permit any
dialer watch-list 1 ip 5.6.7.8 255.255.255.255
dialer watch-list 1 delay route-check initial 60
dialer watch-list 1 delay connect 1
dialer watch-list 2 ip 5.6.7.8 255.255.255.255
dialer watch-list 2 delay route-check initial 60
dialer watch-list 2 delay connect 1
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipv6 permit
ipv6 route ::/0 Cellular0/3/0
!
!
snmp-server community public RO
snmp-server community private RW
snmp-server host 171.70.127.43 version 2c public
snmp-server host 172.27.167.220 version 2c public
snmp-server manager
!
!
control-plane
!
!
!
line con 0
 exec-timeout 0 0
 stopbits 1
 speed 115200
line 0/0/0
line 0/2/0
line vty 0 4
 exec-timeout 0 0
 password cisco
 login
 transport input none
!
!
end
```

```
Router# run int cellular 0/3/0
Building configuration...

Current configuration : 183 bytes
!
interface Cellular0/3/0
 ip address negotiated
 load-interval 30
 dialer in-band
 dialer idle-timeout 0
 dialer watch-group 1
 ipv6 enable
 pulse-time 1
 ip virtual-reassembly
end
```

```
Router# run int cellular 0/3/0
Building configuration...

Current configuration : 165 bytes
!
interface Cellular0/3/0
 ip address negotiated
 dialer in-band
 dialer idle-timeout 0
 dialer watch-group 2
 ipv6 enable
 pulse-time 1
 ip virtual-reassembly
end
```

Configuration Examples for Cisco 4G LTE Advanced

The following example shows how to configure Cisco 4G LTE Advanced:

```
!
! Last configuration change at 19:14:26 UTC Fri Oct 19 2018
!
version 16.10
service timestamps debug datetime msec
service timestamps log datetime msec
service internal
service call-home
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
no platform punt-keepalive settings
!
hostname IR1101
!
boot-start-marker
boot system flash ir1101-universalk9.16.10.SSA.bin
boot-end-marker
!
!
!
no aaa new-model
call-home
 ! If contact email address in call-home is configured as sch-smart-licensing@cisco.com
 ! the email address configured in Cisco Smart License Portal will be used as contact email
 address to send SCH notifications.
 contact-email-addr sch-smart-licensing@cisco.com
```

```
 profile "CiscoTAC-1"
  active
  destination transport-method http
  no destination transport-method email
!

ip admission watch-list expiry-time 0
!
!
login on-success log
!
!
crypto pki trustpoint TP-self-signed-2240381033
 enrollment selfsigned
 subject-name cn=IOS-Self-Signed-Certificate-2240381033
 revocation-check none
 rsakeypair TP-self-signed-2240381033
!
crypto pki trustpoint SLA-TrustPoint
 enrollment pkcs12
 revocation-check crl
!
!
crypto pki certificate chain TP-self-signed-2240381033
 certificate self-signed 01
  30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
  31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
  69666963 6174652D 32323430 33383130 3333301E 170D3138 30373131 32323035
  35315A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
  4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 32343033
  38313033 33308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201
  0A028201 0100C598 B656D13D 293941CF C7FE4E28 C5BB1356 029E3121 371AB009
  BE4FBD67 47E4252B F5922BD4 8CD4F7F2 390FEB7E C8EC2034 63EA8796 E91B796C
  36032BBA 20688D62 774D131C C907AA3C 530A88BB 5ABABB0D 5F59951E 613B6EE4
  EC608F11 E92D43A8 3C306FBA 76C2DFF5 2BA3FE66 FD49C40F 299B8755 ADBB9896
  CDF197C6 6BC2B7DE CEA29350 35A520B9 7D0B436C 20408476 671680C6 1FCD2B1B
  90067B65 E398BC80 1D20EFE7 62995271 88D12026 178F9D8D FDC9F210 8379598F
  109B52A7 5C8C71C9 C5706526 44044193 1CC86D69 66AF7CD5 D6404B55 502CBC62
  8222C80A 52570945 CAFAAA96 88728572 05F45E80 7A9F2E9D 4185DA04 939E0C5B
  D4770CB7 C3630203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
  301F0603 551D2304 18301680 142B78CA B9B8EF61 3EC23015 83E0FE12 0CD474C6
  E1301D06 03551D0E 04160414 2B78CAB9 B8EF613E C2301583 E0FE120C D474C6E1
  300D0609 2A864886 F70D0101 05050003 82010100 9F1269A8 349CFE9D E2801B79
  4F82F1ED 44F8E434 E62A6432 F20B9779 F6B885D0 9942E0F8 FFC2F433 A0FA7A08
  EE0F521B BF9A7FEA 51563827 7D85417E CBDE865F 9C7B3E76 54D2AB69 046FDF4E
  3406A83F 6CCAF0DB AC5BF38C 49CA95C9 5EA5E099 6A92122D 8B64412D 9972FFB9
  21818E47 E1EA44D6 A522B16A DA2AEE76 9868C116 0932EFE4 9A86FAD2 F394C361
  A7D4A982 94942BB0 52CAD033 7636DCCA E6F687C2 28E1015B F380E17D A88548E9
  FA2F1E76 0EC08853 ECC0BB86 B134A2CF 20046280 F908883D 51EF66A1 719D19E9
  110ACDE3 D8772A6B 0BA457F3 76D3364A 594246E9 3EC92ADA 2D34DE52 F97588E8
  E060B27E 01BC2E1C 7375F6B3 5584E740 BE2A54DE
   quit
crypto pki certificate chain SLA-TrustPoint
 certificate ca 01
  30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
  32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
  6F204C69 63656E73 696E6720 526F6F74 20434130 1E170D31 33303533 30313934
  3834375A 170D3338 30353330 31393438 34375A30 32310E30 0C060355 040A1305
  43697363 6F312030 1E060355 04031317 43697363 6F204C69 63656E73 696E6720
  526F6F74 20434130 82012230 0D06092A 864886F7 0D010101 05000382 010F0030
  82010A02 82010100 A6BCBD96 131E05F7 145EA72C 2CD686E6 17222EA1 F1EFF64D
  CBB4C798 212AA147 C655D8D7 9471380D 8711441E 1AAF071A 9CAE6388 8A38E520
  1C394D78 462EF239 C659F715 B98C0A59 5BBB5CBD 0CFEBEA3 700A8BF7 D8F256EE
  4AA4E80D DB6FD1C9 60B1FD18 FFC69C96 6FA68957 A2617DE7 104FDC5F EA2956AC
```

```
  7390A3EB 2B5436AD C847A2C5 DAB553EB 69A9A535 58E9F3E3 C0BD23CF 58BD7188
  68E69491 20F320E7 948E71D7 AE3BCC84 F10684C7 4BC8E00F 539BA42B 42C68BB7
  C7479096 B4CB2D62 EA2F505D C7B062A4 6811D95B E8250FC4 5D5D5FB8 8F27D191
  C55F0D76 61F9A4CD 3D992327 A8BB03BD 4E6D7069 7CBADF8B DF5F4368 95135E44
  DFC7C6CF 04DD7FD1 02030100 01A34230 40300E06 03551D0F 0101FF04 04030201
  06300F06 03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604 1449DC85
  4B3D31E5 1B3E6A17 606AF333 3D3B4C73 E8300D06 092A8648 86F70D01 010B0500
  03820101 00507F24 D3932A66 86025D9F E838AE5C 6D4DF6B0 49631C78 240DA905
  604EDCDE FF4FED2B 77FC460E CD636FDB DD44681E 3A5673AB 9093D3B1 6C9E3D8B
  D98987BF E40CBD9E 1AECA0C2 2189BB5C 8FA85686 CD98B646 5575B146 8DFC66A8
  467A3DF4 4D565700 6ADF0F0D CF835015 3C04FF7C 21E878AC 11BA9CD2 55A9232C
  7CA7B7E6 C1AF74F6 152E99B7 B1FCF9BB E973DE7F 5BDDEB86 C71E3B49 1765308B
  5FB0DA06 B92AFE7F 494E8A9E 07B85737 F3A58BE1 1A48A229 C37C1E69 39F08678
  80DDCD16 D6BACECA EEBC7CF9 8428787B 35202CDC 60E4616A B623CDBD 230E3AFB
  418616A9 4093E049 4D10AB75 27E86F73 932E35B5 8862FDAE 0275156F 719BB2F0
  D697DF7F 28
   quit
!
license udi pid IR1101-K9 sn FCW2227XXXX
license boot level network-advantage
license smart transport callhome
diagnostic bootup level minimal
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
memory free low-watermark processor 50290
!
redundancy
!
controller Cellular 0/3/0
 lte sim data-profile 3 attach-profile 1 slot 0
 no lte firmware auto-sim
 lte gps mode standalone
 lte modem link-recovery disable
!
controller Cellular 0/3/0
 no lte firmware auto-sim
 lte gps mode standalone
 lte modem link-recovery disable
!
!
vlan internal allocation policy ascending
!
!
interface GigabitEthernet0/0/0
 ip address 175.1.1.1 255.255.255.0
!
interface FastEthernet0/0/1
 shutdown
!
interface FastEthernet0/0/2
 shutdown
!
interface FastEthernet0/0/3
 shutdown
!
interface FastEthernet0/0/4
 switchport access vlan 168
 switchport mode access
!
interface GigabitEthernet0/0/5
!
interface Cellular0/3/0
 ip address negotiated
```

```
 load-interval 30
 dialer in-band
 dialer idle-timeout 0
 dialer watch-group 1
 ipv6 enable
 pulse-time 1
 ip virtual-reassembly
!
interface Cellular0/3/1
 no ip address
 shutdown
!
interface Vlan1
 no ip address
!
interface Vlan168
 ip address 192.168.10.22 255.255.255.0
!
interface Async0/2/0
 no ip address
 encapsulation slip
!
!
ip default-gateway 172.27.138.129
ip forward-protocol nd
!
ip http server
ip http authentication local
ip http secure-server
ip route 0.0.0.0 0.0.0.0 Cellular0/3/0
ip route 172.27.0.0 255.255.0.0 172.27.138.129
!
access-list 1 permit any
access-list 2 permit any
dialer watch-list 1 ip 5.6.7.8 255.255.255.255
dialer watch-list 1 delay route-check initial 60
dialer watch-list 1 delay connect 1
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipv6 permit
dialer-list 2 protocol ip permit
dialer-list 2 protocol ipv6 permit
ipv6 route ::/0 Cellular0/3/0
!
control-plane
!
line con 0
 exec-timeout 0 0
 transport input none
 stopbits 1
 speed 115200
line 0/2/0
line vty 0 4
 password cisco
 login
 transport input all
 transport output all
!
end
```

Cellular Back-off

Cellular Backoff is a feature introduced in IOS which addresses the concerns about Cisco LTE router not performing backoff in error handling. When PDP Context activation is failing, modems may receive from a cellular service provider. As a result, when some specific error codes (for example: 29, 33) are received by the modem from a cellular network, the router's IOS incrementally adds interval in sending PDP Context Activation requests and any IP traffic such as not to load service provider network with requests that are known to IOS as failing. Once PDP Context is established and IP traffic is successful, the Cellular Backoff is removed for normal operation.

This back-off implementation will be a generic design and will NOT be specific to a particular service provider. There will be NO IOS CLI command to disable this new feature either.

Example: GRE Tunnel over Cellular Interface Configuration

The following example shows how to configure the static IP address when a GRE tunnel interface is configured with **ip address unnumbered** *cellular interface*:

Note The GRE tunnel configuration is supported only if the service providers provide a public IP address on the LTE interface.

Note For service providers using a private IP address, the point-to-point static GRE tunnel cannot be set up with a private IP address at one end and a public IP address on the other end.

```
interface Tunnel2
ip unnumbered <internal LAN interface GE0/0 etc.>
tunnel source Cellular0/3/0
tunnel destination a.b.c.d
interface Cellular0/3/0
ip address negotiated
no ip mroute-cache
dialer in-band
dialer-group 1
```

Example: 4G LTE Advanced as Backup with NAT and IPSec

The following example shows how to configure the 4G LTE Advanced on the router as backup with NAT and IPsec:

The receive and transmit speeds cannot be configured. The actual throughput depends on the cellular network service.

For service providers using a private IP address, use the **crypto ipsec transform-set esp** command (that is, esp-aes esp-sha256-hmac...).

```
ip dhcp excluded-address 10.4.0.254
!
ip dhcp pool lan-pool
   network 10.4.0.0 255.255.0.0
```

```
   dns-server 10.4.0.254
   default-router 10.4.0.254
!
!
crypto isakmp policy 1
 encr 3des
 authentication pre-share
crypto isakmp key  address a.b.c.d
!
!
crypto ipsec transform-set  ah-sha-hmac esp-3des
!
crypto map gsm1 10 ipsec-isakmp
 set peer a.b.c.d
 set transform-set
 match address 103
!
interface interface Gi 0/0/0
 no ip address
 ip virtual-reassembly
 load-interval 30
 no atm ilmi-keepalive
 dsl operating-mode auto
!
 backup interface Cellular0/3/0
ip address negotiated
ip mtu 1492
ip nat outside
ip virtual-reassembly
encapsulation ppp
load-interval 30
dialer pool 2
dialer-group 2
ppp authentication chap callin
ppp chap hostname cisco@dsl.com
ppp chap password 0 cisco
ppp ipcp dns request
crypto map gsm1

 ip nat outside
 ip virtual-reassembly
 no snmp trap link-status
 pvc 0/35
  pppoe-client dial-pool-number 2
 !
!
interface Cellular0/3/0
 ip address negotiated
 ip nat outside
 ip virtual-reassembly
no ip mroute-cache
 dialer in-band
 dialer idle-timeout 0
dialer watch-group 1
 crypto map gsm1
!
interface Vlan1
 description used as default gateway address for DHCP clients
 ip address 10.4.0.254 255.255.0.0
 ip nat inside
 ip virtual-reassembly
!
ip local policy route-map track-primary-if
ip route 0.0.0.0 0.0.0.0 Dialer2 track 234
```

```
ip route 0.0.0.0 0.0.0.0 Cellular0/3/0 254
!
!
ip nat inside source route-map nat2cell interface Cellular0/3/0 overload
ip nat inside source route-map nat2dsl overload
!
ip sla 1
 icmp-echo 2.2.2.2 source
 timeout 1000
 frequency 2
ip sla schedule 1 life forever start-time now
access-list 1 permit any
access-list 101 deny ip 10.4.0.0 0.0.255.255 10.0.0.0 0.255.255.255
access-list 101 permit ip 10.4.0.0 0.0.255.255 any
access-list 102 permit icmp any host 2.2.2.2
access-list 103 permit ip 10.4.0.0 0.0.255.255 10.0.0.0 0.255.255.255
dialer-list 1 protocol ip list 1
dialer-list 2 protocol ip permit
!
!
route-map track-primary-if permit 10
 match ip address 102
!
route-map nat2dsl permit 10
 match ip address 101
!
route-map nat2cell permit 10
 match ip address 101
 match interface Cellular0/3/0
!
exec-timeout 0 0
login
 modem InOut
```

Example: SIM Configuration

This section provides the following examples:

Locking the SIM Card

The following example shows how to lock the SIM. The italicized text in this configuration example is used to indicate comments and are not be seen when a normal console output is viewed.

```
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router# !SIM is in unlocked state.!

Router# cellular 0/3/0 lte sim lock 1111
!!!WARNING: SIM will be locked with pin=1111(4).
Do not enter new PIN to lock SIM. Enter PIN that the SIM is configured with.
Call will be disconnected!!!
Are you sure you want to proceed?[confirm] <enter>
Router#
Apr 26 19:35:28.339: %CELLWAN-2-MODEM_DOWN: Modem in NIM slot 0/2 is DOWN
Apr 26 19:35:59.967: %CELLWAN-2-MODEM_UP: Modem in NIM slot 0/2 is now UP
Router#
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Enabled
```

```
SIM Status = Locked
SIM User Operation Required = Enter CHV1
Number of CHV1 Retries remaining = 3
Router# !! SIM is in locked state.!
```

Unlocking the SIM Card

The following example shows how to unlock the SIM. The italicized text throughout this configuration example is used to indicate comments and will not be seen when a normal console output is viewed.

```
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Enabled
SIM Status = Locked
SIM User Operation Required = Enter CHV1
Number of CHV1 Retries remaining = 3
Router# !!SIM is in locked state.!

Router# cellular 0/3/0 lte sim unlock 1111
!!!WARNING: SIM will be unlocked with pin=1111(4).
Do not enter new PIN to unlock SIM. Enter PIN that the SIM is configured with.
Call will be disconnected!!!
Are you sure you want to proceed?[confirm] <enter>
Router#
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router# !! SIM is in unlocked state.!
```

Automatic SIM Authentication

The following example shows how to configure automatic SIM authentication. The italicized text throughout this configuration example is used to indicate comments and will not be seen when a normal console output is viewed.

```
Router# show cellular 0/3/0 security
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router# !!SIM is in unlocked state.!

Router# cellular 0/3/0 lte sim lock 1111
!!!WARNING: SIM will be locked with pin=1111(4).
Do not enter new PIN to lock SIM. Enter PIN that the SIM is configured with.
Call will be disconnected!!!
Are you sure you want to proceed?[confirm] <enter>
Router#
Apr 26 21:22:34.555: %CELLWAN-2-MODEM_DOWN: Modem in NIM slot 0/2 is DOWN
Apr 26 21:23:06.495: %CELLWAN-2-MODEM_UP: Modem in NIM slot 0/2 is now UP
Router#
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Enabled
SIM Status = Locked
SIM User Operation Required = Enter CHV1
Number of CHV1 Retries remaining = 3
Router#
!!SIM is in locked state.!
Router#
```

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# controller cellular 0/3/0
Router(config-controller)# lte sim authenticate 0 1111
CHV1 configured and sent to modem for verification
Router(config-controller)# end
Router#
Apr 26 21:23:50.571: %SYS-5-CONFIG_I: Configured from console by console
Router#
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Enabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router#!! SIM is now in locked state but it can be used for connectivity since authentication
is good. Authentication can be saved in the router configuration so that when you boot
up the router with the same locked SIM, connection can be established with the correct
Cisco IOS configuration.!
```

Changing the PIN Code

The following example shows how to change the assigned PIN code. The italicized text throughout this configuration example is used to indicate comments and will not be seen when a normal console output is viewed.

```
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router# !! SIM is in unlocked state.!
Router#
Router# cellular 0/3/0 lte sim lock 1111
!!!WARNING: SIM will be locked with pin=1111(4).
Do not enter new PIN to lock SIM. Enter PIN that the SIM is configured with.
Call will be disconnected!!!
Are you sure you want to proceed?[confirm] <enter>
Router#
Apr 26 21:58:11.903: %CELLWAN-2-MODEM_DOWN: Modem in NIM slot 0/2 is DOWN
Apr 26 21:58:43.775: %CELLWAN-2-MODEM_UP: Modem in NIM slot 0/2 is now UP
Router#
Router# sh cellular 0/3/0 security
Card Holder Verification (CHV1) = Enabled
SIM Status = Locked
SIM User Operation Required = Enter CHV1
Number of CHV1 Retries remaining = 3
Router#!!!SIM is in locked state. SIM needs to be locked state to change its PIN.!
Router#
Router# cellular 0/3/0 lte sim change-pin 1111 0000
!!!WARNING: SIM PIN will be changed from:1111(4) to:0000(4)
Call will be disconnected. If old PIN is entered incorrectly in 3 attempt(s), SIM will be
blocked!!!
Are you sure you want to proceed?[confirm]<enter>
Resetting modem, please wait...
CHV1 code change has been completed. Please enter the new PIN in controller configuration
for verfication
Router#
Apr 26 21:59:16.735: %CELLWAN-2-MODEM_DOWN: Modem in NIM slot 0/2 is DOWN
Apr 26 21:59:48.387: %CELLWAN-2-MODEM_UP: Modem in NIM slot 0/2 is now UP
Router#
Router#
Router# sh cellular 0/3/0 security
```

```
Card Holder Verification (CHV1) = Enabled
SIM Status = Locked
SIM User Operation Required = Enter CHV1
Number of CHV1 Retries remaining = 3
Router#!!SIM stays in locked state, as expected, but with new PIN.!

Router# cellular 0/3/0 lte sim unlock 0000
!!!WARNING: SIM will be unlocked with pin=0000(4).
Do not enter new PIN to unlock SIM. Enter PIN that the SIM is configured with.
Call will be disconnected!!!
Are you sure you want to proceed?[confirm] <enter>
Router#
Router# show cellular 0/3/0 security
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3
Router#!! Unlock with new PIN is successful. Hence, changing PIN was successful.!
```

Configuring an Encrypted PIN

The following example shows how to configure automatic SIM authentication using an encrypted PIN. The italicized text throughout this configuration example is used to indicate comments and will not be seen when a normal console output is viewed.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# service password-encryption
Router(config)# username SIM privilege 0 password 1111
Router(config)# do sh run | i SIM
username SIM privilege 0 password 7 055A575E70.
!!Copy the encrypted level 7 PIN. Use this scrambled PIN in the SIM authentication command.!

Router(config)# controller cellular 0/3/0
Router(config-controller)# lte sim authenticate 7 055A575E70
CHV1 configured and sent to modem for verification
Router(config-controller)# exit
Router(config)# no username SIM
Router(config)# end
May 14 20:20:52.603: %SYS-5-CONFIG_I: Configured from console by console
```

Upgrading the Modem Firmware

The ESR6300 uses Sierra Wireless and Telit (IRMH-LTEAP18-GL) modems that are supported on Cisco 4G LTE Advanced. The firmware for the modem is upgradable using Cisco IOS commands. The firmware is typically a Crossword Express (cwe) file and can be downloaded from the wireless software download page on Cisco.com. For some modems, such as the EM74XX series, the file type is an *.spk file.

Prior to performing the cellular modem firmware upgrade, make sure of the following rules apply.

For modems vendor SWI:

- The "microcode reload …" command is issued only from router's base directory.
- The modem firmware directory must contain the following:

  Only the *.spk file
  Only the *.cwe file
  Only the *.nvu file

Only a matching pair of *.cwe and *.nvu files for the exact same version

- The modem firmware directory MUST NOT contain any other files

For modems vendor Telit:

- The "microcode reload …" command is issued only from router's base directory.
- The modem firmware directory must contain the following:

  The +LM960 will have one *.bin file for bundled firmware

- The modem firmware directory MUST NOT contain any other files

Note Firmware upgrade is supported on utility flash.

Use only Cisco certified firmware. Using a firmware version not certified by Cisco may impact the wireless service provider network adversely.

Caution Do not disconnect power or switch the router off during the firmware upgrade process. This may result in permanent modem failure.

Note Firmware downgrade is not supported.

Note Not all ESR6300 cellular interfaces can support 2G (only P-LTE-GB), and may not support 3G (P-LTE-VZ).

You can determine which radio bands are supported by using the the following command:

```
ESR6300#show cellu 0/3/0 radio band

LTE bands supported by modem:
- Bands 1 3 7 8 20 28.
LTE band Preference settings for the active sim(slot 0):
- Bands 1 3 7 8 20 28.

Non-LTE bands supported by modem:
Index:
72 - GSM DCS band (1800)
73 - GSM Extended GSM (E-GSM) band (900)
87 - WCDMA (Europe, Japan, and China) 2100 band
114 - WCDMA Europe and Japan 900 band
Non-LTE band Preference settings for the active sim(slot 0):
Index:
72 - GSM DCS band (1800)
73 - GSM Extended GSM (E-GSM) band (900)
87 - WCDMA (Europe, Japan, and China) 2100 band
114 - WCDMA Europe and Japan 900 band

==========================================

Band index reference list:
```

```
Indices 1-64 correspond to LTE bands 1-64.

Indices 65-128 correspond to Non-LTE bands.

IR1101#
```

Upgrading the Modem Firmware Manually With CLI

Procedure

	Command or Action	Purpose
Step 1	Go to the Cisco Wireless WAN software download website at: http://software.cisco.com/download/navigator.html	Provides access to Cisco Wireless WAN software downloads page to select the firmware for Cisco 4G. **Note** This website is only available to registered Cisco.com users.
Step 2	On the Cisco Wireless WAN software page, go to **Products** -> **Cisco Interfaces and Modules** -> **Cisco High-Speed WAN interface Cards** and select your product from the list of available cards.	Select your product for firmware upgrade.
Step 3	Select and download the appropriate firmware.	Download the modem firmware file to flash memory on the router.
Step 4	**terminal monitor** **Example:** `Router# terminal monitor`	Enables the logging console in privileged EXEC mode.
Step 5	**microcode reload cellular** pa-bay slot **modem-provision** [**flash**: **Example:** Router# microcode reload cellular 0 *slot* modem-provision bootflash:	Initiates the firmware upgrade process. **Note** Modem firmware upgrade may take 10-15 mins from issuing the **microcode reload** command to the modem coming up. The router console will display 'FW_UPGRADE: Firmware upgrade success.....' message to indicate the firmware upgrade completed. The modem will reset itself and may take an additional 5 minutes to be up in-service. • pa-bay—Use 0 for 4G LTE Advanced. • slot—For 4G LTE Advanced, slot number, 0 to 3, where the 4G LTE Advanced is plugged in. • For remote download, you can transfer this using the wireless link from Cisco.com onto flash.
Step 6	**show cellular** *0/3/0* **hardware**	Verifies the cellular modem type, model, carrier, firmware, PRI, SKU, IMEI and other modem details.

Manual Modem Firmware Upgrade: Example

The following example is for an EM7XXX Modem:

```
Router# sh cellu 0/3/0 hardware
Modem Firmware Version = SWI9X30C_02.20.03.00
Modem Firmware built = 2016/06/30 10:54:05
Hardware Version = 1.0
Device Model ID: EM7455
International Mobile Subscriber Identity (IMSI) = <imsi>
International Mobile Equipment Identity (IMEI) = <imei>
Integrated Circuit Card ID (ICCID) = <iccid>
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) =
Modem Status = Modem Online
Current Modem Temperature = 44 deg C
PRI SKU ID = 1102526, PRI version = 002.020_000, Carrier = AT&T
OEM PRI version = 006

Router#cd fw_22_vzw
Router# dir
Directory of bootflash:/fw_22_vzw/

227586  -rw-         64389490  Jun 30 2000 10:21:29 +00:00  74XX_02.20.03.22.cwe
227587  -rw-            16951  Jun 30 2000 10:22:10 +00:00
7455_02.20.03.22_Verizon_002.026_000.nvu

6816092160 bytes total (5965422592 bytes free)

Router#cd
Router#microcode reload cellular 0 2 modem-provision bootflash:/fw_22_vzw/
Reload microcode? [confirm] <enter>
Log status of firmware download in router flash?[confirm] <enter>
Firmware download status will be logged in bootflash:fwlogfile
Microcode Reload Process launched for cwan slot/bay =0/3; hw type=0x102download option = 0

Router#Success !! send FW Upgrade command to card!

*****************************************************
 The interface will be Shut Down for Firmware Upgrade
 This will terminate any active data connections.
*****************************************************
*************************
 Modem will be upgraded!
 Upgrade process will take up to 15 minutes. During
 this time the modem will be unusable.
 Please do not remove power or reload the router during
 the upgrade process.
*************************
*Jul  6 10:19:34.701: %LINK-5-CHANGED: Interface Cellular0/3/0, changed state to
administratively down

----------------------------
FIRMWARE INFO BEFORE UPGRADE:
Modem Device ID: EM7455     MODEM F/W Boot Version: SWI9X30C_02.20.03.00
Modem F/W App Version: SWI9X30C_02.20.03.00     Modem SKU ID: 1102526
Modem Package Identifier:      Modem Carrier String: 4
Modem PRI Ver: 000.006     Modem Carrier Name: ATT
Modem Carrier Revision: 002.020_000
----------------------------
FW_UPGRADE: Modem needs CWE, PRI
*Jul  6 10:19:57.978: %CELLWAN-2-MODEM_DOWN: Modem in NIM slot 0/3 is DOWN
FW_UPGRADE: Upgrade begin at Thu Jul  6 10:20:01 2000
FW_UPGRADE: Upgrade end at Thu Jul  6 10:21:14 2000
```

```
FW_UPGRADE: Firmware upgrade success.....
FW_UPGRADE: Waiting for modem to become online
----------------------------
FIRMWARE INFO AFTER UPGRADE:
Modem Device ID: EM7455     MODEM F/W Boot Version: SWI9X30C_02.20.03.22
Modem F/W App Version: SWI9X30C_02.20.03.22     Modem SKU ID: 1102526
Modem Package Identifier:      Modem Carrier String: 5
Modem PRI Ver: 000.006     Modem Carrier Name: VERIZON
Modem Carrier Revision: 002.026_000
----------------------------
F/W Upgrade: Firmware Upgrade has Completed Successfully
*Jul  6 10:21:55.275: %CELLWAN-2-MODEM_RADIO: Cellular0/3/0 Modem radio has been turned on
*Jul  6 10:21:57.276: %LINK-3-UPDOWN: Interface Cellular0/3/0, changed state to down

Router#
Router# sh cellu 0/3/0 hardware
Modem Firmware Version = SWI9X30C_02.20.03.22
Modem Firmware built = 2016/10/11 16:03:14
Hardware Version = 1.0
Device Model ID: EM7455
International Mobile Subscriber Identity (IMSI) =<imsi>
International Mobile Equipment Identity (IMEI) = <imei>
Integrated Circuit Card ID (ICCID) = <iccid>
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) = <msisdn>
Modem Status = Modem Online
Current Modem Temperature = 0 deg C
PRI SKU ID = 1102526, PRI version = 002.026_000, Carrier = Verizon
OEM PRI version = 006
```

The following section is for an IRMH-LTEAP18-GL with Tleit LM960 modem:

```
Router #sh cell 0/3/0 firm
Idx Carrier FwVersion PriVersion Status
1 Generic 32.00.114 1023 Inactive
2 Verizon 32.00.124 2020 Active
3 ATT 32.00.143 4021 Inactive

Firmware Activation mode = AUTO
Router#
Router #
Router #sh cellular 0/3/0 hardware
Modem Firmware Version = 32.00.124
Host Firmware Version = 32.00.004_2
Device Model ID = LM960A18
International Mobile Subscriber Identity (IMSI) =
International Mobile Equipment Identity (IMEI) = 358347100022402
Integrated Circuit Card ID (ICCID) =
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) =
Modem Status = Modem Online
Current Modem Temperature = 29 deg C
PRI version = 2020, Carrier = Verizon
OEM PRI version = 32101006
Router #
Router #
Router #dir FW_Cat18
Directory of bootflash:/FW_Cat18/

260270 -rw- 253660205 Feb 16 2021 21:33:32 +00:00 LM960A18_Bundle_HO6_AT6_GN6_TM6_VZ6.bin

7961473024 bytes total (5906620416 bytes free)
Router #

Router #microcode reload cellular 0 2 modem-provision flash:/FW_Cat18/
```

```
Reload microcode? [confirm]<Enter>
Log status of firmware download in router flash?[confirm]<Enter>
Firmware download status will be logged in bootflash:fwlogfile
Microcode Reload Process launched for cwan slot/bay =0/3; hw type=0x102download option = 0

Router #
**************************************************
The interface will be Shut Down for Firmware Upgrade
This will terminate any active data connections.
**************************************************Success !! send FW Upgrade command to
 card

*************************
Modem will be upgraded!
Upgrade process will take up to 15 minutes. During
this time the modem will be unusable.
Please do not remove power or reload the router during
the upgrade process.
*************************
*Feb 16 21:43:22.866 GMT: %LINK-5-CHANGED: Interface Cellular0/3/0, changed state to
administratively down
*Feb 16 21:43:34.868 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[unbind]
State[1]
*Feb 16 21:43:35.884 GMT: %CELLWAN-2-MODEM_DOWN: Modem in slot 0/3 is DOWN
*Feb 16 21:43:35.871 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[remove]
State[2]
*Feb 16 21:43:35.963 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[add] State[0]
*Feb 16 21:43:35.982 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[bind]
State[0]
*Feb 16 21:51:08.295 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[unbind]
State[0]
*Feb 16 21:51:09.308 GMT: %CELLWAN-2-MODEM_DOWN: Modem in slot 0/3 is DOWN
*Feb 16 21:51:09.300 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[remove]
State[2]
F/W Upgrade: Firmware Upgrade has Completed SuccessfullyInterface 1 not present in whitelist
 (0x80000004). Exit...
Interface 6 not present in whitelist (0x80000004). Exit...

*Feb 16 21:51:21.616 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 1 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:51:22.061 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 6 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:51:22.051 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[add] State[1]
*Feb 16 21:51:22.122 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[bind]
State[1]
*Feb 16 21:51:53.789 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[unbind]
State[1]
*Feb 16 21:51:54.794 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[remove]
State[2]Interface 1 not present in whitelist (0x80000004). Exit...
Interface 6 not present in whitelist (0x80000004). Exit...

*Feb 16 21:52:12.162 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 1 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:52:12.528 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 6 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:52:12.591 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[add] State[1]
*Feb 16 21:52:12.648 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[bind]
State[1]
*Feb 16 21:52:26.055 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: modem qmi fds failed to
initialize
*Feb 16 21:52:26.055 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: CWAN:dev_ready_handler:QMI
channels initialization failed...retry_count[0] vendor:Telit
*Feb 16 21:52:55.921 GMT: %CELLWAN-2-MODEM_DOWN: Modem in slot 0/3 is DOWN
*Feb 16 21:52:56.125 GMT: %CELLWAN-2-SIM_NOT_PRESENT: [Cellular0/3/0]: SIM is not present
```

```
in Slot 0
*Feb 16 21:52:58.608 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: Telit_ExtractFwSwitchInfo:
Error. ret_val = 1094
*Feb 16 21:53:00.117 GMT: %CELLWAN-2-SIM_NOT_PRESENT: [Cellular0/3/0]: SIM is not present
in Slot 0
*Feb 16 21:53:02.479 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: Telit_ExtractFwSwitchInfo:
Error. ret_val = 1094
*Feb 16 21:54:08.928 GMT: %CELLWAN-2-MODEM_UP: Modem in slot 0/3 is now UP
*Feb 16 21:54:12.130 GMT: %CELLWAN-2-MODEM_RADIO: Cellular0/3/0 Modem radio has been turned
 on
*Feb 16 21:54:12.143 GMT: %CELLWAN-5-FIRMWARE_SWITCH: Firmware switchover initiated for
modem in slot 0/3
*Feb 16 21:54:18.145 GMT: %CELLWAN-4-MODEM_RESTART_IND: Cellular0/3/0 Modem restart reason:
 Request Modem Reset
*Feb 16 21:54:56.213 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[unbind]
State[1]
*Feb 16 21:54:57.225 GMT: %CELLWAN-2-MODEM_DOWN: Modem in slot 0/3 is DOWN
*Feb 16 21:54:57.215 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[remove]
State[2]Interface 1 not present in whitelist (0x80000004). Exit...
Interface 6 not present in whitelist (0x80000004). Exit...

*Feb 16 21:55:06.513 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 1 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:55:06.944 GMT: %IOSXE-2-PLATFORM: R0/0: kernel: Interface 6 not present in
whitelist (0x80000004). Exit...
*Feb 16 21:55:06.945 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[add] State[1]
*Feb 16 21:55:07.004 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: WWAN modem Action:[bind]
State[1]
*Feb 16 21:56:11.416 GMT: %IOSXE-3-PLATFORM: R0/0: ngiolite: Telit_ExtractFwSwitchInfo:
Error. ret_val = 1094
*Feb 16 21:57:17.921 GMT: %CELLWAN-2-MODEM_UP: Modem in slot 0/3 is now UP
*Feb 16 21:57:21.124 GMT: %CELLWAN-2-MODEM_RADIO: Cellular0/3/0 Modem radio has been turned
 on
*Feb 16 21:57:23.123 GMT: %LINK-3-UPDOWN: Interface Cellular0/3/0, changed state to down
*
Router #
Router #

Router #sh cellular 0/3/0 hardware
Modem Firmware Version = 32.00.126
Host Firmware Version = 32.00.006_3
Device Model ID = LM960A18
International Mobile Subscriber Identity (IMSI) =
International Mobile Equipment Identity (IMEI) = 358347100022402
Integrated Circuit Card ID (ICCID) =
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) =
Modem Status = Modem Online
Current Modem Temperature = 31 deg C
PRI version = 2022, Carrier = Verizon
OEM PRI version = 32101006
Router #

Router #sh cell 0/3/0 hard firm
Idx Carrier FwVersion PriVersion Status
1 Generic 32.00.116 1026 Inactive
2 Verizon 32.00.126 2022 Active
3 ATT 32.00.146 4024 Inactive
4 TMUS 32.00.156 5005 Inactive

Firmware Activation mode = AUTO
Router #
Router #
```

Configuring dm-log to Utility Flash: Example

```
Router(config)#controller cellular 0/3/0
Router(config-controller)#lte modem dm-log enable
Router(config-controller)#
*May 8 17:57:09.905: %SYS-5-CONFIG_I: Configured from console by console
Router#
Router#show cellular 0/3/0 log dm-log
Integrated DM logging is off
Output path = bootflash:
Filter Type = Default
Filter Name = v11026_Generic_GSM_WCDMA_LTE_IP-no-data-packets.sqf
Maximum log size = 0 MB
Maximum file size = 0 MB
Log rotation = Disabled

Router#show cellular 0/3/0 log dm-log details
Integrated DM logging is off
Output path = bootflash:
Filter Type = Default
Filter Name = v11026_Generic_GSM_WCDMA_LTE_IP-no-data-packets.sqf
Maximum log size = 0 MB
Maximum file size = 0 MB
Log rotation = Disabled

0 Packets sent to the modem, 0 Bytes, 0 Errors
0 Packets received from the modem, 0 Bytes, 0 Input drops
0 Packets stored in file system, 0 Bytes, 0 Errors, 0 Aborts
0 Max rcv queue size

Current file size = 0 MB
Current log size = 0 MB
Total log size = 0 MB
Router#
```

SNMP MIBs

A Management Information Base (MIB) is a database of the objects that can be managed on a device. The managed objects, or variables, can be set or read to provide information on the network devices and interfaces.

You can find complete information on MIBS and the MIB locator here: https://mibs.cloudapps.cisco.com/ITDIT/MIBS/servlet/index

Note It is recommended that you configure SNMP V3 with authentication/privacy when implementing SNMP SET operation.

Refer to the **SNMP Configuration Guide, Cisco IOS XE Release 3E** here: https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/snmp/configuration/xe-3e/snmp-xe-3e-book.html

The following Simple Management Network Protocol (SNMP) MIBs are supported on Cisco 4G LTE Advanced:

- IF-MIB
- ENTITY-MIB
- CISCO-WAN-3G-MIB

- CISCO-WAN-CELL-EXT-MIB

For the CISCO-WAN-3G-MIB, the following tables and sub-tables are supported for 3G and LTE technologies:

- ciscoWan3gMIB(661)
- ciscoWan3gMIBNotifs(0)
- ciscoWan3gMIBObjects(1)
- c3gWanCommonTable(1)
- c3gWanGsm(3)
- c3gGsmIdentityTable(1)
- c3gGsmNetworkTable(2)
- c3gGsmPdpProfile(3)
- c3gGsmPdpProfileTable(1)
- c3gGsmPacketSessionTable(2)
- c3gGsmRadio(4)
- c3gGsmRadioTable(1)
- c3gGsmSecurity(5)
- c3gGsmSecurityTable(1)

For the CISCO-WAN-CELL-EXT-MIB, the following tables and sub-tables are supported for LTE technology only:

- ciscoWanCellExtMIB(817)
- ciscoWanCellExtMIBNotifs(0)
- ciscoWanCellExtMIBObjects(1)
- ciscoWanCellExtLte(1)
- cwceLteRadio(1)
- cwceLteProfile(2)

You can download the MIBs from the Cisco MIB Locator at http://www.cisco.com/go/mibs.

SNMP 4G LTE Advanced Configuration: Example

The following example describes how to configure 3G 4G MIB trap on the router:

```
controller Cellular 0/3/0
 lte event rssi onset mib-trap All-lte
 lte event rssi onset threshold -100
 lte event rssi abate mib-trap All-lte
 lte event rssi abate threshold -90
 lte event temperature onset mib-trap
 lte event temperature onset threshold 55
 lte event temperature abate mib-trap
```

```
lte event temperature abate threshold 50
lte event modem-state mib-trap all
lte event service mib-trap
lte event network mib-trap
lte event connection-status mib-trap All-lte
lte event rsrp onset mib-trap All-lte
lte event rsrp onset threshold -85
lte event rsrp abate mib-trap All-lte
lte event rsrp abate threshold -80
lte event rsrq onset mib-trap All-lte
lte event rsrq onset threshold -8
lte event rsrq abate mib-trap All-lte
lte event rsrq abate threshold -6
```

The following example describes how to configure SNMP capability on the router:

```
snmp-server group neomobilityTeam v3 auth notify 3gView
snmp-server view 3gView ciscoWan3gMIB included
snmp-server community neomobility-test RW snmp-server community public RW
snmp-server enable traps c3g
snmp server enable traps LTE
snmp-server host 172.19.153.53 neomobility c3g snmp-server host 172.19.152.77 public c3g
snmp-server host 172.19.152.77 public udp-port 6059
```

The following example describes how to configure an external host device to communicate with the router through SNMP:

```
setenv SR_MGR_CONF_DIR /users/<userid>/mibtest
setenv SR_UTIL_COMMUNITY neomobility-test
setenv SR_UTIL_SNMP_VERSION -v2c
setenv SR_TRAP_TEST_PORT 6059
```

Troubleshooting

This section provides the essential information and resources available for troubleshooting the Cisco 4G LTE Advanced feature.

Verifying Data Call Setup

To verify the data call setup, follow these steps:

1. After you create a modem data profile using the cellular profile create command and configuring DDR on the cellular interface, send a ping from the router to a host across the wireless network.
2. If the ping fails, debug the failure by using the following debug and show commands:
3. **debug chat**
4. **debug modem**
5. **debug dialer**
6. **show cellular all**
7. **show controller cell***0/3/0*
8. **show interface cellular**
9. **show running-config**

10. **show ip route**
11. **show platform**
12. Save the output from these commands and contact your system administrator.

Checking Signal Strength

If the Received Signal Strength Indication (RSSI) level is very low (for example, if it is less than –110 dBm), follow these steps:

Procedure

	Command or Action	Purpose
Step 1	Ensure at least one antenna is connected to the 'MAIN' RF port on the 4G module. Preferably both MAIN and DIV RF ports should be connected to antenna for better RF signal. Check to ensure the antenna are threaded and tightened.	
Step 2	If you are using a remote antenna, move the antenna cradle and check if the RSSI has improved.	
Step 3	Contact your wireless service provider to verify if there is service availability in your area.	

Verifying Service Availability

The following is a sample output for the **show cellular all** command for a scenario where the antenna is disconnected and a modem data profile has not been created.

```
Router# show cellular 0/3/0 all
Hardware Information
====================
Modem Firmware Version = SWI9X07Y_02.18.05.00
Device Model ID =  WP7603
International Mobile Subscriber Identity (IMSI) = 001012345678901
International Mobile Equipment Identity (IMEI) = 359528080002501
Integrated Circuit Card ID (ICCID) = 89860000502000180722
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) =
Factory Serial Number (FSN) = U3734285450506
Modem Status = Modem Online
Current Modem Temperature = 49 deg C
PRI SKU ID = 1103507, PRI version = 002.041_002, Carrier = GENERIC
OEM PRI version = 002.000

Profile Information
====================

Profile 1 = ACTIVE* **
--------
PDP Type = IPv4v6
PDP address = 192.1.1.21
PDP IPV6 address = FC01:ABAB:CDCD:EFE0:7DC4:256:B64F:22F8/64  Scope: Global
```

```
Access Point Name (APN) = broadband
Authentication = None
        Primary DNS address = 192.1.1.2
        Primary DNS IPV6 address = FC01:CAFE:0:0:0:0:0:1
        Secondary DNS IPV6 address = 0:0:0:0:0:0:0:0

  * - Default profile
 ** - LTE attach profile


Configured default profile for active SIM 0 is profile 1.


Data Connection Information
===========================
Profile 1, Packet Session Status = ACTIVE
        Cellular0/3/0:
        Data Packets Transmitted = 31546 ,  Received = 57008
        Data Transmitted = 5049096 bytes, Received = 7702570 bytes
        IP address = 192.1.1.21
        IPV6 address = FC01:ABAB:CDCD:EFE0:7DC4:256:B64F:22F8/64  Scope =  Global
        Primary DNS address = 192.1.1.2
        Primary DNS IPV6 address = FC01:CAFE:0:0:0:0:0:1
        Secondary DNS IPV6 address = 0:0:0:0:0:0:0:0
Profile 2, Packet Session Status = INACTIVE
Profile 3, Packet Session Status = INACTIVE
Profile 4, Packet Session Status = INACTIVE
Profile 5, Packet Session Status = INACTIVE
Profile 6, Packet Session Status = INACTIVE
Profile 7, Packet Session Status = INACTIVE
Profile 8, Packet Session Status = INACTIVE
Profile 9, Packet Session Status = INACTIVE
Profile 10, Packet Session Status = INACTIVE
Profile 11, Packet Session Status = INACTIVE
Profile 12, Packet Session Status = INACTIVE
Profile 13, Packet Session Status = INACTIVE
Profile 14, Packet Session Status = INACTIVE
Profile 15, Packet Session Status = INACTIVE
Profile 16, Packet Session Status = INACTIVE

Network Information
===================
Current System Time = Thu Jan 10 8:31:28 1980
Current Service Status = Normal
Current Service = Packet switched
Current Roaming Status = Home
Network Selection Mode = Automatic
Network = Test PLMN 1-1
Mobile Country Code (MCC) = 1
Mobile Network Code (MNC) = 1
Packet switch domain(PS) state = Attached
Registration state(EMM) = Registered
EMM Sub State = Normal Service
Tracking Area Code (TAC) = 1
Cell ID = 256
Negotiated network MTU = 1500

Radio Information
=================
Radio power mode = online
LTE Rx Channel Number =  2175
LTE Tx Channel Number =  20175
LTE Band =  4
LTE Bandwidth = 20 MHz
```

```
Current RSSI = -68 dBm
Current RSRP = -102 dBm
Current RSRQ = -13 dB
Current SNR = 19.4  dB
Physical Cell Id = 0
Number of nearby cells = 1
Idx      PCI (Physical Cell Id)
--------------------------------
1              0
Radio Access Technology(RAT) Preference = AUTO
Radio Access Technology(RAT) Selected = LTE

LTE bands supported by modem:
- Bands 2 4 5 12.
LTE band Preference settings for the active sim(slot 0):
- Bands 2 4 5 12.

Non-LTE bands supported by modem:
Index:
  88 - WCDMA US PCS 1900 band
  90 - WCDMA US 1700 band
  91 - WCDMA US 850 band
Non-LTE band Preference settings for the active sim(slot 0):
Index:
  88 - WCDMA US PCS 1900 band
  90 - WCDMA US 1700 band
  91 - WCDMA US 850 band

==========================================

Band index reference list:

Indices 1-64 correspond to LTE bands 1-64.

Indices 65-128 correspond to Non-LTE bands.


Modem Security Information
==========================
Active SIM = 0
SIM switchover attempts = 0
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3

Cellular Firmware List
==========================
 Idx Carrier      FwVersion    PriVersion   Status
 1   ATT          02.18.04.00  002.039_000  Inactive
 2   GENERIC      02.18.05.00  002.041_002  Active
 3   VERIZON      02.17.01.00  002.036_000  Inactive

Firmware Activation mode  =  MANUAL

FOTA Information
================
FOTA server poll timer (mins) = Disable
FOTA server connection retry value = 0
FOTA status = Please re-configure FOTA poll timer


GPS Information
==========================
```

```
GPS Feature =  enabled
GPS Mode Configured =  not configured
GPS Status =  NMEA Disabled

SMS Information
===============
Incoming Message Information
----------------------------
SMS stored in modem = 7
SMS archived since booting up = 0
Total SMS deleted since booting up = 0
Storage records allocated = 25
Storage records used = 7
Number of callbacks triggered by SMS = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0

Outgoing Message Information
----------------------------
Total SMS sent successfully = 0
Total SMS send failure = 0
Number of outgoing SMS pending = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0
Last Outgoing SMS Status = SUCCESS
Copy-to-SIM Status =     0x0
Send-to-Network Status = 0x0
Report-Outgoing-Message-Number:
  Reference Number =     0
  Result Code =          0x0
  Diag Code =            0x0 0x0 0x0 0x0 0x0

SMS Archive URL =

Modem Crashdump Information
===========================
Modem crashdump logging = off
```

Successful Call Setup

The following is a sample output when a call is set up. It shows a received IP address from the network. Call setup is successful and data path is open.

```
debug cellular 0/3/0 messages callcontrol
```

Modem Troubleshooting Using Integrated Modem DM Logging

As part of the 3G and 4G serviceability enhancement in Cisco IOS, DM log collection has been integrated into Cisco IOS, eliminating the need for an external PC and simplifying the DM log collection process. The lte modem dm-log command can be used in controller cellular configuration mode to configure integrated DM logging to monitor traffic on the modem. See the Cisco 3G and 4G Serviceability Enhancement User Guide for more information on configuring Integrated DM Logging parameters.

Modem Settings for North America and Carriers Operating on 700 MHz Band

For LTE-EA deployments in North America and for carriers operating in the 700 MHz band, the following changes to the modem settings are required to prevent long network attach times.

The output of show cellular 0/3/0 all command shows the following:

- Current RSSI is –125 dBM
- LTE Technology Preference = No preference specified (AUTO)

The following sections explain useful commands for changing modem settings:

Changing Modem Settings

To change the modem settings to force the modem to scan different technologies, use the following Cisco IOS command:

```
Router# cellular 0/3/0 lte technology ?
auto  Automatic LTE Technology Selection
  lte   LTE
  umts  UMTS
```

Electronic Serial Number (ESN)

The ESN number is located directly on the modem label in hexadecimal notation. It can also be retrieved using the Cisco IOS CLI using the show cellular *slot/port/module* **hardware** command.

The sample output below shows the ESN number:

```
Hardware Information
====================
Electronic Serial Number (ESN) = 0x603c9854 [09603971156]
Electronic Serial Number (ESN) = <specific ESN in hexadecimal> [specific ESN in decimal]
```