



Leased Line Support for Cisco 2600/3600 Series Analog Modems

This feature adds one modem AT command (**AT&L**) and two AT registers to be added to the **modemcap** for the appropriate leased lines. Several new debug messages and values for particular fields in **show modem** commands were also added. This feature module contains the following sections:

- Feature Overview, page 1
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Feature Overview

This feature requires a modem firmware upgrade to provide 2-wire leased-line support for the current Cisco analog modems (NM-8AM and NM-16AM) for enterprise customers who require point-to-point connections between locations and for enterprise customers with medium to high data transfer requirements without access to other technologies or with access to only low-grade phone lines. Loop current is required.

One modem AT command (**AT&L**) and two AT registers are configured with the **modemcap entry CLI** User Exec command for the appropriate leased lines. Several new debug messages and values for particular fields in **show modem** commands were also added.

AT&L{ 0 | 1 | 2 }—Leased Line

- **0**—Disables the leased line (enables switched line) (Default)
- **1**—Enables the leased line. The modem initiates a leased line when dial and answer commands (**ATD** and **ATA**) are issued.
- **2**—Enables the leased line. The modem goes off-hook automatically after :T57 number of seconds in:
 - Originate mode if ATSO is 0
 - Answer mode if ATSO is not equal to 0.

The following AT registers have been added:

- **AT:T57**—Number of seconds before going offhook in leased line mode when using the command **AT&L2** (defaults to 6).
- **AT:T79**—Number of auto-retrains before disconnecting (defaults to 3)

Benefits

Several features enhance the analog modem software:

1. 2-wire leased line support for both full and half-duplex connections.
2. Modem speeds up to 33.6 Kbps with support for all current analog modem protocols, compression, and error correction techniques.
3. Power-on auto-connect and loop-back testing.
4. Support for the maximum number of leased line users without data transmission loss at distances up to 2 to 5 Km.
5. In/out of band monitoring and PPP call-back.
6. Support on all Cisco 2600 and Cisco 3600 series platforms and upgradable using IOS software.
7. Compatibility with other major leased-line modem vendors.
8. Support for Easy-Config and any MIB changes.

Restrictions

- This feature works only with leased lines that provide loop current.
- Each modem used must have an RJ-11 connection to the PSTN.

Related Documents

- *AT Command Set and Register Summary for Analog Modem Network Modules*
- *Cisco IOS Dial Services Configuration Guide: Network Services*, Release 12.1
- *Cisco IOS Dial Services Configuration Guide: Terminal Services*, Release 12.1
- *Cisco IOS Dial Services Command Reference*, Release 12.1

Supported Platforms

The following platforms are supported:

- Cisco 2600 routers
- Cisco 3620 routers
- Cisco 3640 routers
- Cisco 3680 routers

The following network modules (NM) support leased lines:

- NM-8AM
- NM-16AM

Supported Standards, MIBs, and RFCs

Standards

ITU Recommendation V.34

MIBs

No new or modified MIBs are supported by this feature.

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on CCO at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

RFCs

No new or modified RFCs are supported by this feature.

Prerequisites

To use the Cisco 2600 or Cisco 3600 series routers in a leased-line environment, users must be familiar with modem configuration commands and should be comfortable with modifying modem behavior through the `modemcap` commands.

Configuration Tasks

The following sections provide the steps for configuring modems for leased line operation:

- Configuring for Leased Line Operation

Configuring for Leased Line Operation

To configure a modem for leased line operation, perform the following steps:

	Command	Purpose
Step 1	<code>modemcap entry modem-type-name:AA=S0=0&L2</code>	Sets the modemcap for leased line operation for the originating modem.
Step 2	<code>modemcap entry modem-type-name:AA=S0=1&L2</code>	Sets the modemcap for leased line operation for the answering modem

The `show modemcap` command lists all the predefined modem-types as well as any user-defined modemcaps that are currently configured on the router.

- If leased line has been configured, the modemcap information will be available.
- If the leased line has not been configured, only the predefined modem types will be displayed.

What's important for leased line support is what is **defined** in the modemcap as the key configuration item and its application to the leased line:

```
modemcap entry micro_LL_orig:AA=S0=0&L2
```

```
modemcap entry micro_LL_ans:AA=S0=1&L2
```

AA stands for autoanswer.

- The answering modem AA register is set to 1 (AA=S0=1) so that autoanswer is “on”.
- The originating modem AA register is set to 0 (AA=S0=0) so that autoanswer is “off”.

If the autoanswer feature (AA) is used, both the originating and answering modem must be put into leased line mode with the **&L2** AT command.

In the examples, “micro_LL_ans” and “micro_LL_orig” are arbitrary text descriptions.



Note

For the **modemcap entry** command, one of the pre-defined modem-types may be used or a completely user-defined modemcap may be created. For leased-line, no new modem-type was added. Users may create their own modemcaps for leased-line functionality.

To configure the modem for leased line operation, use the **modemcap entry** command. For each connection, each modem must be configured as an originator or answerer.

The following example shows modemcaps for a leased-line originator and answerer and their application to specific ports:

```
modemcap entry micro_LL_orig:AA=S0=0&L2
modemcap entry micro_LL_ans:AA=S0=1&L2
line 73
no exec
modem InOut
modem autoconfigure type micro_LL_ans
transport input all
line 74
no exec
modem InOut
modem autoconfigure type micro_LL_orig
transport input all
```



Note

When configuring MLPPP using a dialer interface, the dialer configuration has a default value of 2 minutes for dialer idle timeout. For leased line connections, set the dialer idle timeout to infinity by adding **dialer idle-timeout 0** to the configuration.

Configuration Examples

In the following examples, one Cisco 3620 router and one Cisco 3640 router are connected back to back using leased lines. The Cisco 3620 router has the originating configuration and Cisco 3640 router has the answering configuration.

In the dialer interface configuration, **dialer idle-timeout 0** is added to set the dialer idle timeout to be infinity. Otherwise the leased line will go down and up every 2 minutes because the default dialer interface idle timeout is 2 minutes.

**Note**

Except for passwords and logins, the Cisco IOS CLI is case-insensitive. For this document, an upper-case “L” has been used in the command examples to avoid confusion with the numeral “1”.

Leased Line Originating Configuration

```
!  
version 12.1  
service timestamps debug uptime  
service timestamps log uptime  
!  
modemcap entry micro_LL_orig:AA=S0=0&L2  
modemcap entry micro_LL_ans:AA=S0=1&L2  
!  
interface Async33  
no ip address  
encapsulation ppp  
no ip route-cache  
no ip mroute-cache  
dialer in-band  
dialer pool-member 1  
async default routing  
async dynamic routing  
async mode dedicated  
no peer default ip address  
no fair-queue  
no cdp enable  
ppp direction callout  
ppp multilink  
!  
interface Dialer1  
ip address 1.1.24.1 255.255.255.0  
encapsulation ppp  
no ip route-cache  
no ip mroute-cache  
dialer remote-name sara40  
dialer pool 1  
dialer idle-timeout 0  
dialer max-call 4096  
no cdp enable  
ppp direction callout  
ppp multilink  
!  
dialer-list 1 protocol ip permit  
!  
line con 0  
exec-timeout 0 0  
transport input none  
line 33  
no exec  
modem InOut  
modem autoconfigure type micro_LL_orig  
transport input all  
line aux 0  
exec-timeout 0 0  
line vty 0 4  
exec-timeout 0 0  
!  
end
```

Leased Line Answering Configuration

```

!
version 12.1
service timestamps debug uptime
service timestamps log uptime
!
modemcap entry micro_LL_orig:AA=S0=0&L2
modemcap entry micro_LL_ans:AA=S0=1&L2
!
interface Async73
no ip address
encapsulation ppp
no ip route-cache
no ip mroute-cache
dialer in-band
dialer pool-member 1
async default routing
async dynamic routing
async mode dedicated
no peer default ip address
no fair-queue
no cdp enable
ppp direction callout
ppp multilink
!
interface Dialer1
ip address 1.1.24.2 255.255.255.0
encapsulation ppp
no ip route-cache
no ip mroute-cache
load-interval 30
dialer remote-name sara20
dialer pool 1
dialer idle-timeout 0
dialer load-threshold 1 either
dialer max-call 4096
no cdp enable
ppp direction callout
ppp multilink
!
dialer-list 1 protocol ip permit
!
line con 0
exec-timeout 0 0
transport input none
line 73
no exec
modem InOut
modem autoconfigure type micro_LL_ans
transport input all
line aux 0
transport input all
flowcontrol hardware
line vty 0 4
exec-timeout 0 0
!
end

```

Verifying the Analog Leased Line Configuration

The following information is important for verifying or troubleshooting your configuration. The **show modem log** command shows the progress of leased line connections. Here is an example log for a leased line answerer. Note the "LL Answering" state and "LL Answer" in the "Direction" field of the connection report:

```
00:44:03.884 DTR set high
00:44:02.888 Modem enabled
00:43:57.732 Modem disabled
00:43:52.476 Modem State:LL Answering
00:43:52.476 CSM:event-MODEM_STARTING_CONNECT New
State-CSM_CONNECT_INITIATED_STATE
00:43:51.112 Modem State:Waiting for Carrier
00:43:43.308 Modem State:Connected
00:43:42.304 Connection:TX/RX Speed = 33600/33600,
Modulation = V34
Direction = LL Answer, Protocol = MNP, Compression =
V42bis
00:43:42.304 CSM:event-MODEM_CONNECTED New
State-CONNECTED_STATE
00:43:42.300 RS232:noCTS* DSR* DCD* noRI noRxBREAK
TxBREAK*
00:43:41.892 PPP mode active
00:43:41.892 Modem enabled
00:43:39.888 PPP escape maps set:TX map=00000000 RX
map=FFFFFFFF
00:43:39.724 PPP escape maps set:TX map=00000000 RX
map=000A0000
00:43:34.444 RS232:CTS* DSR DCD noRI noRxBREAK TxBREAK
00:43:11.716 Modem Analog Report:TX = -20, RX = -34,
Signal to noise = 61
```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **modemcap entry**
- **show modem log**

modemcap entry

To store and compress information about the capability of a specified modem, use the **modemcap entry** command in global configuration mode. Use the **no** form of this command to disable this feature.

modemcap entry *modem-type*

no modemcap entry *modem-type*

Syntax Description	<i>modem-type</i>	Type of supported modemcap entry as specified in Table 1.
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Defaults	The capability values configured in the specified modem when the command is issued.
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Command Modes	Global configuration
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Command History	Release	Modification
	11.1	This command was introduced.
	12.1(5)T	This command was modified to include support for Cisco 2600 and 3600 series routers.

Usage Guidelines

Modemcaps are displayed within the configuration file and can be edited using the **modemcap edit** command. The **modemcap entry** command does not display values that are not set in the modem.

Use the **modemcap entry** command with the **show modemcap** command to interpret the capability of the specified modem. Table 1 lists the modemcap entries for supported modems.

Table 1 Modemcap Entries for Supported Modems

Modem Type	Output
hayes_optima	FD=&F:AA=S0=1:DTR=&D2:CD=&C1:TPL=default.
codex_3260	FD=&F:AA=S0=1:CD=&C1:DTR=&D2:HFL=*FL3:SPD=*SC1:BER=*SM3:BCP=*DC1:NER=*SM1:NCP=*DC0:NEC=E0:NRS=Q1:CID=&S1.
usr_courier	HFL=&H1&R2:SPD=&B1:BER=&M4:BCP=&K1:NER=&M0:NCP=&K0:TPL=default.
usr_sportster	TPL=usr_courier.
hayes_optima	HFL=&K3:BER=&Q5:BCP=&Q9:NER=&Q0:NCP=&Q0:TPL=default.
viva	HFL=&K3:BER=&Q5:BCP=%C1:NER=&Q6:NCP=%C0:TPL=default.
telebit_t3000	HFL=S58=2:BER=S180=3:BCP=S190=1:NER=S180=0:NCP=S190=0:TPL=default.

■ modemcap entry

Related Commands	Command	Description
	modem hold-reset	Resets and isolates integrated modems for extensive troubleshooting.
	show modemcap	Displays the values set for the current modem and lists the modems for which the router has entries.

show modem log

To display the modem history event status performed on a manageable modem or group of modems, use the **show modem log** command in EXEC mode.

show modem log [*slot/port* | **group number**]

Syntax Description		
	<i>slot/port</i>	(Optional) Specifies the location of a slot and modem port. If this number is not specified, statistics for all connected modems are displayed. Remember to include the forward slash (/) when entering this variable.
	group number	(Optional) Specifies the location of a specific group of modems. If this number is not specified, statistics for all modems in the access server are displayed. The group number range is between 1 and 200.

Defaults There are no default behaviors or values for this command.

Command Modes EXEC

Command History	Release	Modification
	11.2	This command was introduced.
	12.1(5)T	This command was modified to include output displays for Cisco 2600 and 3600 series routers that support leased line operation.

Examples The **show modem log** command shows the progress of leased line connections. Here is an example log (Note the "LL Answering" state and "LL Answer" in the "Direction" field of the connection report:

```
Router# show modem log
00:44:03.884 DTR set high
00:44:02.888 Modem enabled
00:43:57.732 Modem disabled
00:43:52.476 Modem State: LL Answering
00:43:52.476 CSM: event-MODEM_STARTING_CONNECT New State-CSM_CONNECT_INITIATED_STATE
00:43:51.112 Modem State: Waiting for Carrier
00:43:43.308 Modem State: Connected
00:43:42.304 Connection: TX/RX Speed = 33600/33600, Modulation = V34
Direction = LL Answer, Protocol = MNP, Compression = V42bis
00:43:42.304 CSM: event-MODEM_CONNECTED New State-CONNECTED_STATE
00:43:42.300 RS232: noCTS* DSR* DCD* noRI noRxBREAK TxBREAK*
00:43:41.892 PPP mode active
00:43:41.892 Modem enabled
00:43:39.888 PPP escape maps set: TX map=00000000 RX map=FFFFFFFF
00:43:39.724 PPP escape maps set: TX map=00000000 RX map=000A0000
00:43:34.444 RS232: CTS* DSR DCD noRI noRxBREAK TxBREAK
00:43:11.716 Modem Analog Report: TX = -20, RX = -34, Signal to noise = 61
```

Table 2 *show modem log* Field Descriptions

Field	Description
Modem <slot/port> Events Log:	The modem for which log events are currently displayed.
Startup Response:	List of information describing the modem type, modem firmware, and DSP controller version (for 56K modems only).
Control Reply	Indicates the events the modem will be monitoring.
RS232 event	Detected modem signaling.
Modem State event	Current state of the modem, which can be any of the following: <ul style="list-style-type: none"> • Conn—Modem is connected to a remote host. • Bad—Inoperable state, which is configured by the modem bad command. • Bad*—Inoperable state, which is configured by the modem startup-test command during initial power-up testing. • Reset—Modem is in reset mode. • D/L—Modem is downloading firmware. • Bad FW—Downloaded modem firmware is not operational. • Busy—Modem is out of service and not available for calls. • Idle—Modem is ready for incoming and outgoing calls.
End connection event	Descriptions or reasons why a connection was terminated: <ul style="list-style-type: none"> • Duration—Time a connection was up between the local and remote devices. • Number of TX/RX char—Transmit and receive characters exchanged during the connection time. • Local or remote disc reason—Reason why the local or remote modem disconnected: <ul style="list-style-type: none"> – Lost Carrier—The modem firmware detects a drop in Carrier Detect during a connection. – DSP Task Hung—The DSP chip malfunctioned and failed to reset. – Phone number event— Descriptive information about the last dialed or current phone number.

Related Commands

Command	Description
show modem configuration	Displays the current modem configuration for digital MICA modems loaded inside access servers or routers.
show modem mica	Displays information about MICA digital modems.
show modem operational-status	Displays the current modem operational status for MICA digital modems loaded in access servers or routers.
show modemcap	Displays the values set for the current modem and lists the modems for which the router has entries.

Glossary

AT command—Attention Command. All modem configuration commands that start with the attention (AT) code.

MLPPP—Multilink Point-to-Point Protocol.

PPP—Point-to-Point Protocol.

PSTN—Public Switched Telephone Network.

**Note**

For a list of other internetworking terms, see the Internetworking Terms and Acronyms document available on the Documentation CD-ROM and Cisco Connection Online (CCO) at the following URL: <http://www.cisco.com/univercd/cc/td/doc/cisintwk/ita/index.htm>.
