



## V.54/BERT, Multi-SCC for 1- and 2-Port T1/E1 Multiflex VWICs

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### Feature Overview

Cisco T1/E1 Multiflex Voice/WAN interface cards (VWICs) support voice and data applications in Cisco 2600 and 3600 series routers. The VWICs offer WAN interface card (WIC) and voice interface card (VIC) functionality in a variety of applications for enterprises and service providers who supply customer premises equipment.

The single- or dual-port T1 or E1 trunk interface in a VWIC:

- Supports voice, data, and integrated voice/data applications
- Supports structured T1, and both structured and unstructured E1 networks
- Can be used
  - For voice/data services
  - As a fractional  $n \times 64$  Kbps service for WANs (frame relay or leased line)
  - For TDM drop and insert (voice/data integration) services

At the physical layer, the one or two network interfaces provided use RJ-48C jacks with on-card TDM drop and insert capability in the VWIC with the drop and insert option. The card supports uninterrupted drop and insert operation through the Cisco IOS reload operations and unlikely router crashes.

There are four versions of the VWIC:

- One-port version supporting T1 DSU and CSU
- Two-port version supporting T1 DSU and CSU
- One-port version supporting E1 balanced and unbalanced lines
- Two-port version supporting E1 balanced and unbalanced lines

Transition cables support the different T1/E1 line configurations.

This feature's design provides for high T1/E1 port density with integrated support for voice and data applications on lines provisioned for a combination of PCM voice and either Frame Relay or Asynchronous Transfer Mode (ATM) data. Beginning in this release, BERT and V.54 capability are also supported.

When the card is initialized, the Cisco IOS software reads the VWIC's cookie ID to determine whether the card is to be used as an E1 or T1 card; then the firmware loads the proper configuration onto the card. The cookie also indicates whether the card is single or dual port and whether drop and insert is supported if it is a dual-port card. The card does not support "mixed-mode" operation, such as when one interface is E1 and the other interface is T1. Cisco IOS software recognizes the G.703 cookie ID to permit G.703 operation on E1 cards.

Each two-port model has an internal TDM bus, which can be used to handle pass-through of individual timeslots from Port 1 to Port 2 on the same card.

To support TDM switching, TDM Manager and Connection Manager modules provide the infrastructure to control the switching hardware in the system.

The reset system on the card is only activated when the card is initially powered up. From that point on, the host software determines whether the card's firmware is already running. If so, the host software initializes its own data structures and SCC hardware and resumes operation. During this sequence, the card continues to allow any timeslots designated as pass-throughs to be transferred from one port to the other.

## Benefits

### Time Division Multiplexing (TDM)

Time-division multiplexing (TDM) allows switching of channels between ports 1 and 2. The card accommodates TDM groups, which are groups of timeslots that may be sent from one E1/T1 trunk to another without being terminated. This allows you to allocate some timeslots (TDM groups) for pass-through while other timeslots (channel groups) are terminated as a serial link. By using these two abilities, you can connect traffic from any TDM-based device to any other TDM-based device in the system, as long as there is a path and enough bandwidth between the devices.

### Bit Error Rate Testing (BERT)

Bit-error-rate testing and loopbacks are used by carriers and ISPs to help resolve problems as well as test the quality of T1/E1 links. By early detection of poor quality links and quick problem isolation, network operators can improve their network's quality of service and increase their revenues:

- You can run BERT without having to initiate a remote loopback first.
- You can stop BERT tests prematurely.

**Note**

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For the Cisco 2600 and Cisco 3600 series routers and this Cisco IOS software release, BERT commands are in privileged EXEC mode rather than in the interface configuration mode.

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## Restrictions

For this Cisco IOS software release and Cisco 2600 and Cisco 3600 routers, only one BERT-related operation per physical port is supported. For example, if there are two channel groups on a T1, and you run a BERT test on one channel group, the other channel group cannot detect incoming V.54 loopback activation requests until the BERT test terminates.

## Related Features and Technologies

Digital T1 Packet Voice Trunk Network Modules require the 2-port T1 Multiflex VWIC for operation. For more information about these modules, see the online 12.0(7)T document, *Configuring Digital T1 Packet Voice Trunk Network Modules on Cisco 2600 and 3600 Routers*.

## Related Documents

The following documents provide additional information about installing and configuring T1/E1 Multiflex VWICs:

- *Cisco 2600 and 3600 Series Network Module Hardware Installation Guide*
- *Cisco 2600 and 3600 Series WAN Interface Cards Hardware Installation Guide*
- *Configuring Digital T1 Packet Voice Trunk Network Modules on Cisco 2600 and 3600 Series Routers*

The following Cisco IOS Release 12.1 documents provide information that can help you use T1/E1 Multiflex VWICs and the BERT/TDM features:

- *Cisco IOS 12.1 Multiservice Applications Configuration Guide*
- *Cisco IOS 12.1 Multiservice Applications Command Reference*
- *Cisco IOS IP and IP Routing Configuration Guide*
- *Cisco IOS 12.1 Interface Configuration Guide*
- *Cisco IOS 12.1 Interface Command Reference*
- *Cisco IOS 12.1 Dial Services Configuration Guide: Network Services*

## Supported Platforms

- Cisco 2600 series routers
- Cisco 3600 series routers

# Supported Standards, MIBs, and RFCs

## Standards

- ITU-T V.54, Loop Test Devices for Modems

## MIBs

- CISCO-ICSUDSU-MIB.my for Cisco 2524/2525 routers

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

- RFC1406—RFC-defined MIB information can be generated by processing the error counter and event information and passing this information to the host CPU every second. The driver collects and reports the following line errors:
  - Loss of Signal (LOS)
  - Out of Frame (OOF)
  - Alarm Indication Signal (AIS)
  - Remote Alarm (RA)

A host process updates the T1/E1 MIB information for network performance monitoring. In addition to periodic updates for reporting MIB data, some line state changes cause the processor to send information to the host driver asynchronously. These events require the host driver to take action with the associated multi-channel controller (if available).

## Prerequisites

For this feature to respond to a V.54 loopback activation from a *far end*, the feature must have V.54 request detection enabled.

## Configuration Tasks

See the following section for configuration tasks for the V.54 and BERT features. Each task in the list indicates if the task is optional or required.

- Configuring BERT on Cisco 2600 and Cisco 3600 VWICs

## Configuring BERT on Cisco 2600 and Cisco 3600 VWICs

Step	Command	Purpose
1.	<pre>Router&gt; enable Router&gt;&lt;password&gt; Router#</pre>	<p>Enter privileged EXEC mode. Enter your password. You have entered privileged EXEC mode when the prompt changes to Router#.</p>

Step	Command	Purpose
2.	Router# <b>bert controller T1 0/0 channel-group 0 pattern qrss interval 5</b>	For the Cisco 2600 and Cisco 3600 platform VWICs, select the type of controller you want to test and the slot/port number. The other parameters are optional.

## Verifying BERT

To verify BERT parameters, enter the **show controllers** user EXEC command:

```
Router> show controllers e1 0/0 bert
E1 0/0 is down.
BERT is done. The result of last time is
DSX1 BERT status      : done
DSX1 BERT pattern     : unknown
DSX1 BERT sync count  : 0
DSX1 BERT interval    : 0 min
DSX1 BERT time remain : 0 min 0 sec
DSX1 BERT total errs  : 0
DSX1 BERT total k bits: 0
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 0
```

## 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.

- **bert abort**
- **bert controller**
- **channel-group**
- **connect**
- **detect v54 channel-group**
- **loopback remote v54 channel-group**
- **show controller t1 | e1 bert**
- **tdm-group**

# bert abort

To stop BERT pattern generation for a particular port, use the **bert abort controller** EXEC command. There is no **no** form of this command.

**bert abort controller** *type-controller slot/port*

Syntax Description	
<i>type-controller</i>	(Optional) Use either T1 or E1 depending on the type of facility.
<i>slot/port</i>	Enter the slot number and port number for the BERT pattern being stopped.

**Defaults** No default behavior or values.

**Command Modes** EXEC mode

Command History	Release	Modification
	12.0(1)T	This command was introduced in this release.
	12.1(1)T	This command was applied to VWICs for Cisco 2600 and Cisco 3600 series routers in this release.

**Usage Guidelines** This command enables you to end a BERT test early—rather than waiting for the BERT interval specified in the **bert controller** command to elapse.

**Examples** The following example shows a BERT test on T1 ports 0/0 being stopped prematurely:

```
Router> bert abort controller t1 0/0
```

Related Commands	Command	Description
	<b>bert controller</b>	Starts a bit-error-rate test (BERT).

# bert controller

To start a bit-error rate test for a particular port, use the **bert controller EXEC** command. There is no **no** form of this command.

**bert controller** *type-controller slot/port* [**channel-group** *channel-number*] [**pattern** *pattern-name*] [**interval** *1-14400*]

Syntax Description	
<i>type-controller</i>	(Optional) Use either T1 or E1 depending on the type of facility.
<i>slot/port</i>	Enter the slot and port number for the ports to be tested.
<b>channel-group</b> <i>channel-number</i>	Enter the channel group number, range 0 to 1 that you want the BERT test to run on.
<b>pattern</b> <i>pattern-name</i>	(Optional) BERT patterns available for testing are: <ul style="list-style-type: none"> <li>• 0s—repetitive pattern; all zeroes test pattern</li> <li>• 1s—<i>n</i> repetitive pattern; all ones test pattern</li> <li>• qrw—<math>2^{15}-1</math> QRW test pattern</li> <li>• qrss (default)—<math>2^{20}-1</math> Quasi-Random Signal Sample 0.151 test pattern</li> <li>• alt-0-1—alternating zeros and ones test pattern</li> <li>• 1in8—<i>n</i> repetitive pattern; 1 in 8</li> <li>• 3in24—<i>n</i> repetitive pattern; 3 in 24</li> <li>• 63—<math>2^6-1</math> 63 test pattern</li> <li>• 511—<math>2^9-1</math> 511 test pattern</li> <li>• 2047—<math>2^{11}-1</math> test pattern</li> </ul>
<b>interval</b> <i>1-14400</i>	(Optional) Enter the range (1-14400) of minutes for the test. The default duration is 1 minute.

**Defaults** Bit error rate testing (BERT) is disabled.

**Command Modes** EXEC mode

Command History	Release	Modification
	12.0(2)XD	This command was introduced.
	12.1(1)T	This command was introduced for the Cisco 2600 and Cisco 3600 series router VWICs.

**Usage Guidelines** The argument **channel-group** *channel-group-number* to specify a channel-group is optional. If the channel-group is specified, BERT will be run on the timeslots associated with the channel group only. Otherwise, BERT will run on all the timeslots of the specified controller.

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**Examples**

The following example shows a BERT test started on a T1 port 0/0 and channel group 0 with a QRSS signaling pattern for a duration of 5 minutes:

```
Router> bert controller t1 0/0 channel-group 0 pattern qrss interval 5
```

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**Related Commands**

Command	Description
<b>bert abort controller</b>	Stops a BERT test prematurely.

# channel-group

To assign a channel group, use the **channel-group** controller configuration mode command. To unassign a channel group, use the **no** form of this command.

**channel-group** *range* **timeslot** *range* **speed** [48 | 56 | 64]

**no channel-group** *range* **timeslot** *range* **speed** [48 | 56 | 64]

## Syntax Description

<b>channel-group</b> <i>range</i>	Enter a number from 0 to 1.
<b>timeslot</b> <i>range</i>	Enter a number from 1 to 24 for T1, or 1 through 31 for E1, expressed either as a range or as individual channels, such as 1-5, 16, 17-19, 22, 24.
<b>speed</b>	Enter the Kbps speed of a channel.

## Defaults

No default behavior or values.

## Command Modes

Controller configuration mode

## Command History

Release	Modification
12.0	This command was introduced.
12.1(1)T	This command was modified to accommodate two channel groups on a port on 1- and 2-port T1/E1 Multiflex VWICs on the Cisco 2600 and Cisco 3600 routers.

## Usage Guidelines

The **channel-group** command allows you to combine timeslots to create high-bandwidth pipes, which are treated as serial interfaces (a serial interface is created automatically when you create a channel group). You must enter **controller** command in config mode before the **channel-group** command can be used. The **channel-group** command accommodates two channel groups with a range of 0 to 1.

You can configure two channel groups on a one-port WAN/VICs and the first port of a two-port WAN/VIC. If you configure two channel groups on the first port of a two-port WAN/VIC card, then you can only use the second port for drop and insert applications. You can't have channel groups and TDM groups with the same number on the same T1/E1 controller.

## Examples

The following example shows the setting of channel-group 0 on timeslot 5 with a speed of 48 bps:

```
Router(config-controller)# channel-group 0 timeslot 5 speed 48
```

## ■ channel-group

Related Commands	Command	Description
	<b>tdm-group</b>	Allows specific timeslots to be used from port 0 to port 1.
	<b>connect</b>	Assigns the connection for passing data between ports of a VWIC on a Cisco 2600 and Cisco 3600 series routers.

# connect

To start passing data between ports of a VWIC on Cisco 2600 and Cisco 3600 series routers, use the **connect** global configuration command. To break this connection, use the **no** form of this command.

```
connect connection-name {t1 | e1} slot/port 1 {t1 | e1} slot/port 2
```

```
no connect connection-name {t1 | e1} slot/port 1 {t1 | e1} slot/port 2
```

## Syntax Description

<i>connection-name</i>	Enter the name you have chosen for this connection.
<b>t1/e1</b>	Choose the type of line.
<i>slot/port</i>	Choose the slot and port number to be connected.

## Defaults

Connections are not made.

## Command Modes

Global configuration

## Command History

Release	Modification
12.0	This command was introduced.
12.1(1)T	Command modified to accommodate two channel groups on a port for 1- and 2-port T1/E1 Multiflex VWICs on the Cisco 2600 and Cisco 3600 series routers.

## Usage Guidelines

Once TDM groups are created on two different physical ports, you can use the **connect** command to start the passage of data between the ports. If a crosspoint switch is provided in the AIM slot, the connections can extend between ports on different cards. Otherwise, the connection will be restricted to ports on the same VWIC card.

The VWIC card can make a connection only if the number of timeslots at the source and destination are the same. For the connection to be error-free, the two ports must be driven by the same clock source, otherwise, “slips” will occur.

**Examples**

The following example shows a fractional T1 terminated on port 0 using timeslots 1 through 8; a fractional T1 is terminated on port 1 using timeslots 2 through 12; and timeslots 13 through 20 from port 0 are connected to timeslots 14 through 21 on port 1 by using the **connect** command:

```
Router# configure terminal
Router(config)# controller t1 0/0
Router(config-controller)# channel-group 1 timeslots 1-8
Router(config-controller)# tdm-group 1 timeslots 13-20
Router(config-controller)# exit
Router(config)# controller t1 0/1
Router(config-controller)# channel-group 1 timeslots 2-12
Router(config-controller)# tdm-group 2 timeslot 14-21
Router(config-controller)# exit
Router(config)# connect exampleconnection t1 0/0 1 t1 0/1 2
```

**Related Commands**

Command	Description
<b>tdm-group</b>	Configures lists of timeslots for creating clear-channel groups (pass-through) for time-division multiplexing (TDM) cross-connect.

# detect v54 channel-group

To enable V.54 loopback detection for the command sent from the remote device, use the **detect v54 channel-group** controller configuration mode command. To disable the v.54 loopback detection, use the **no** form of this command.

**detect v54 channel-group** *channel-number*

**no detect v54 channel-group** *channel-number*

## Syntax Description

*channel-number* Enter the channel number from 1 to 24 (T1) or 1 to 31 (E1).

## Defaults

V.54 loopback detection is disabled.

## Command Modes

Controller configuration mode

## Command History

Release	Modification
12.1(1)T	This command was introduced.

## Usage Guidelines

Use the **detect v54 channel-group** controller configuration mode command to enable v.54 loopback detection. The remote device should send a loopup inband payload command sequence in fractional T1 (FT1).

## Examples

The following example shows the loopback detection being set for channel-group 1; then the loopback detection is disabled for channel-group 1:

```
Router(config-controller)# detect v54 channel-group 1
Router(config-controller)# no detect v54 channel-group 1
```

## Related Commands

Command	Description
<b>loopback remote v54 channel-group</b>	Activates a remote V.54 loopback for the channel-group on the far end.

## loopback remote v54 channel-group

To activate a remote V.54 loopback, use the **loopback remote v54 channel-group** controller-configuration mode command. To deactivate the remote V.54 loopback, use the **no** form of this command.

**loopback remote v54 channel-group** *channel-number*

**no loopback remote v54 channel-group** *channel-number*

### Syntax Description

<i>channel-number</i>	Select a channel-group number in the range of 0 to 1.
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### Defaults

V.54 loopbacks are not activated.

### Command Modes

Controller configuration mode

### Command History

Release	Modification
12.1(1)T	This command was introduced.

### Usage Guidelines

Use the **loopback remote v54 channel-group** controller-configuration mode command to activate a remote V.54 loopback.

### Examples

The following example shows the loopback for the remote V.54 being set for channel group 1:

```
Router(config-controller)# loopback remote v54 channel-group 1
```

### Related Commands

Command	Description
<b>detect v54 channel-group</b>	Enables detection of a V.54 loopback signal for the channel-groups on the far end.

## show controller t1 | e1 bert

To view the network loopback status, use the **show controller t1/e1 bert** EXEC command. To disable the network loopback status viewing option, use the **no** form of this command.

**show controller {t1 | e1} [slot/port] bert**

**no show controller {t1 | e1} [slot/port] bert**

Syntax Description	Parameter	Description
	<b>t1/e1</b>	Enter the type of controller.
	<i>slot/port</i>	(Optional) Enter the slot number and port number for the controller if you want to see only the information for the specified controller.
	<b>bert</b>	Specify that the <b>show</b> command will display only the BERT statistics and parameters.

**Defaults** The network status viewing option is disabled.

**Command Modes** User EXEC

Command History	Release	Modification
	12.0(2)XD	This command was introduced.
	12.1(1)T	This command was modified to include the Cisco 2600 and Cisco 3600 series routers.

**Usage Guidelines** If BERT is running, this command shows the real-time results up to the last second. Otherwise, the command shows the results of the previous BERT test that was run. If you specify the controller number (s/p), only the BERT result of this controller will appear. Otherwise, the BERT results for all the T1 or E1 controllers will be displayed.

**Examples** The following example shows the output for the **show controllers** command for a specific controller:

```
Router> show controllers e1 0/0 bert
E1 0/0 is down.
BERT is done. The result of last time is
DSX1 BERT status      : done
DSX1 BERT pattern     : unknown
DSX1 BERT sync count  : 0
DSX1 BERT interval    : 0 min
DSX1 BERT time remain : 0 min 0 sec
DSX1 BERT total errs  : 0
DSX1 BERT total k bits: 0
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 0
```

# tdm-group

To configure a list of time slots for creating clear channel groups (pass-through) for time-division multiplexing (TDM) cross-connect, use the **tdm-group** command in controller configuration mode. Use the **no** form of this command to delete a clear channel group.

**tdm-group** *tdm-group-no* **timeslot** *timeslot-list* [**type** {**e&m** | **fxs** [**loop-start** | **ground-start**] | **fxo** [**loop-start** | **ground-start**] | **fxs-melcas** | **fxo-melcas** | **e&m-melcas**}]

**no** **tdm-group** *tdm-group-no* **timeslot** *timeslot-list* [**type** {**e&m** | **fxs** [**loop-start** | **ground-start**] | **fxo** [**loop-start** | **ground-start**] | **fxs-melcas** | **fxo-melcas** | **e&m-melcas**}]

## Syntax Description

<i>tdm-group-no</i>	Time Division Multiplexing (TDM) group number.
<b>timeslot</b>	Timeslot number.
<i>timeslot-list</i>	Timeslot list. The valid range is from 1-24 for T1, and from 1-15 and 17-31 for E1.
<b>type</b>	<p>(Optional) (Valid only when the mode cas command is enabled.) Specifies the voice signalling type of the voice port. If configuring a TDM group for data traffic only, do not specify the type keyword.</p> <p>Choose from one of the following options:</p> <ul style="list-style-type: none"> <li>e&amp;m—for E&amp;M signalling</li> <li>fxo—for Foreign Exchange Office signalling (optionally, you can also specify loop-start or ground-start)</li> <li>fxs—for Foreign Exchange Station signalling (optionally, you can also specify loop-start or ground-start)</li> <li>e&amp;m-melcas—for E&amp;M Mercury Exchange Limited Channel-Associated Signalling (MEL CAS)</li> <li>fxs-melcas—for Foreign Exchange Station MEL CAS</li> <li>fxo-melcas—for Foreign Exchange Office MEL CAS</li> </ul> <p>The MEICAS options apply only to E1 lines and are used primarily in the United Kingdom.</p>

## Defaults

No TDM group is configured.

## Command Modes

Controller configuration

## Command History

Release	Modification
11.3(1)MA	This command was introduced.
12.1(1)T	This command was modified to include VWICs for Cisco 2600 and Cisco 3600 series routers.

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**Usage Guidelines**

The **tdm-group** command allows specific timeslots to switch from port 0 to port 1 and vice-versa. This command is similar to the **channel-group** command, but it does not create a serial interface to terminate the specified channels.

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**Examples**

The following example shows a TDM group 1 being set up to include timeslots 13 through 20:

```
Router(config-controller)# tdm-group 1 timeslots 13-20
```

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>connect</b>	Starts passage of data between ports for cross-connect TDM.

# Glossary

**Channelized T1/E1**—A configuration in which multiple groups of timeslots are interpreted as individual streams. Each group is sent to a separate HDLC controller.

**BERT**—Bit error rate testing. The DS2172 BERT chip is used to do BERT testing on T1, E1, and serial interfaces associated with channel groups. The BERT chip detects V.54 LoopUp and LoopDown activation codes. The bit-error-rate test (BERT) feature enables you to test the quality of the connected channel group on T1 links by comparing a pseudo-random or a repetitive test pattern with an identical locally generated test pattern.

**Drop and Insert**—Also known as time-division multiplexing (TDM) cross-connect. A configuration in which a T1/E1 is connected to each data port. Some of the DS0s are transferred from one T1/E1 to the other without modification. The remaining DS0s are interpreted as one or more HDLC channel groups. Allows DS0 channels from one T1 or E1 facility to be digitally cross-connected to DS0 channels on another T1 or E1. By using this method, channel traffic is sent between a PBX and CO PSTN switch or other telephony device, so that some PBX channels are directed for long-distance service through the PSTN while the router compresses others for interoffice VoIP calls. In addition, drop and insert can cross-connect a telephony switch (from the CO or PSTN) to a channel bank for external analog connectivity.

**Fractional T1/E1**—A configuration which uses from 1 or more timeslots as a single data stream. The resulting stream is sent to an HDLC controller to be interpreted. Any timeslots not included in the fractional stream are ignored.

**Framer**—A hardware device which converts between the raw E1 or T1 bitstream and 8-bit DS0 streams. The framer also extracts and inserts signalling information.

**TDM**—Time-division multiplexing.