



T1/E1 CEM Interface Module Configuration Guide, Cisco IOS XE 17 (Cisco ASR 920 Series)

First Published: 2023-11-28

Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Full Cisco Trademarks with Software License

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

All printed copies and duplicate soft copies of this document are considered uncontrolled. See the current online version for the latest version.

Cisco has more than 200 offices worldwide. Addresses and phone numbers are listed on the Cisco website at www.cisco.com/go/offices.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/c/en/us/about/legal/trademarks.html>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1721R)



CONTENTS

CHAPTER 1

Preface 1

- Document Organization 1
- Related Documentation 2

CHAPTER 2

Feature History 3

CHAPTER 3

Overview of the T1 or E1 Interface Module 5

- Restrictions for Configuring T1 or E1 Interfaces 6
- Circuit Emulation 7
- Overview of CEM Pseudowire 7
 - Configuring Pseudowire 7
- Framed Structure-Agnostic TDM over Packet (SAToP) 7
- Circuit Emulation Service over Packet-Switched Network 9
 - Restrictions for CESoPSN on T1 Interface 9

CHAPTER 4

Configuring T1 or E1 Interfaces 11

- Setting the Card Type 11
- Configuring the Controller 11
 - Verifying the Controller Configuration 12
- Configuring Structure-Agnostic TDM over Packet - T1/E1 Interfaces 13
 - Verifying CEM Configuration for SAToP 13
 - Configuring Framed SAToP 14
 - Verifying Framed SAToP Configuration 14
 - Verifying CEM Statistics for Framed SAToP 15

	Verifying CEM Statistics for SAToP	16
	Configuring CEM Group for SAToP for T1 Interfaces	17
	Configuring CEM Group for CESoPSN on T1 Interface	17
	Verifying CEM for CESoPSN on T1 Interface	18
	Configuring DS1 Local Connect	19
	Verifying DS1 Local Connect	19
<hr/>		
CHAPTER 5	Monitoring the T1 or E1 Interface Module	21
	Performance Monitoring	21
<hr/>		
CHAPTER 6	Troubleshooting the T1 or E1 Interface Module	33
	Overview of BERT	33
	BERT Restrictions	34
	BERT for SAToP	34
	Configuring BERT for SAToP	34
	Verifying BERT Configuration for SAToP	35
	Framed SAToP System BERT	36
	Restrictions for Framed SAToP System BERT	36
	Configuring Framed SAToP System BERT	36
	Verifying Framed SAToP System BERT	38
	BERT for CESoPSN	39
	Configuring BERT for CESoPSN	39
	Verifying BERT Configuration for CESoPSN	40
	Loopback on T1 or E1 Interfaces	41
	Configuring Loopback	41
	Loopback Remote on T1 Interfaces	42
	Restrictions for Loopback Remote	42
	Configuring Loopback Remote on a T1 Interface Module	43
	Verifying the Loopback Remote Configuration	43
	User-defined Remote Loopback on T1 Interfaces	44
	Configuring User-defined Remote Loopback on T1 Interfaces	45
	Verifying User-defined Remote Loopback on T1 Interfaces	45
<hr/>		
CHAPTER 7	Additional References	47

Linecode Configuration and Supported Patterns 47



CHAPTER 1

Preface

This guide provides an overview and explains how to configure the various features for the T1 or E1 CEM Interface Module.

This document is applicable for the following interface modules:

Table 1: Supported Interface Module

Interface Module	Part Number	Mode
48-port T1/E1 Interface module	• ASR-920-12SZ-IM	T1/E1
1-port OC48/ STM-16 or 4-port OC-12/OC-3 / STM-1/STM-4 + 12-Port T1/E1 + 4-Port T3/E3 CEM Interface Module	• ASR-920-12SZ-IM	

Circuit Emulation (CEM) is a technology that provides a protocol-independent transport over IP/MPLS networks. It enables proprietary or legacy applications to be carried transparently to the destination, similar to a leased line.

- [Document Organization, on page 1](#)
- [Related Documentation, on page 2](#)

Document Organization

Chapter	Description
Overview of the T1/E1 Interface Module	Provides a high-level overview of the interface module. Also provides additional information such as restrictions, benefits etc..
Configuring the T1/E1 Interface Module	Provides information about how to configure the interface module.
Monitoring the Interface Module	Provides information on monitoring features for the interface module.

Chapter	Description
Troubleshooting the Interface Module	Describes features that you can use to troubleshoot the operation of interface module.
Additional References	Provides information on additional features, technical details.

Related Documentation

- Alarm Configuring and Monitoring Guide
- CEM Generic Guide
- T3 or E3 CEM Interface Module Configuration Guide



CHAPTER 2

Feature History

The following table lists the new features supported in the 48-Port T1/E1 CEM Interface Module Configuration Guide in Cisco IOS XE 17 releases.

Feature	Description
Cisco IOS XE Cupertino 17.8.1	
48-Port T1/E1 CEM Interface Module support in ASR-920-12SZ-IM	<p>The router supports the following features for the 48-Port T1/E1 Circuit Emulation (CEM) interface module:</p> <ul style="list-style-type: none">• Basic mode, and T1 or E1 controller required configurations• CEM clocking, ACR, and DCR• CEM pseudowires such as Structure-Agnostic TDM over Packet (SATOP) and Circuit Emulation over Packet-Switched Network (CESoPSN)• BERT, loopback, and alarms• Performance monitoring <p>The support for the interface module provides cost-effective delivery of CEM over a packet-based network (MPLS).</p>



CHAPTER 3

Overview of the T1 or E1 Interface Module

Table 2: Feature History

Feature Name	Release Information	Description
48-Port T1/E1 CEM Interface Module support in ASR-920-12SZ-IM	Cisco IOS XE Cupertino 17.8.1	<p>The router supports the following features for the 48-Port T1/E1 Circuit Emulation (CEM) interface module:</p> <ul style="list-style-type: none"> • Basic mode, and T1 or E1 controller required configurations • CEM clocking, ACR, and DCR • CEM pseudowires such as Structure-Agnostic TDM over Packet (SATOP) and Circuit Emulation over Packet-Switched Network (CESoPSN) • BERT, loopback, and alarms • Performance monitoring <p>The support for the interface module provides cost-effective delivery of CEM over a packet-based network (MPLS).</p>

The T1 or E1 interface module delivers T1 or E1 connectivity on the router with the RSP3 module. The module can be software configured as either T1 mode or E1 mode per interface module. The module provides physical connectivity using a single high-density connector and requires a breakout cable and patch panel for individual port connections.

The T1 or E1 interface module supports the following modes:

- T1

- E1



Note Mixing T1 and E1 ports on the same interface module is not supported.

CEM configurations are supported on different modes on the interface module. The troubleshooting, monitoring, and redundancy features are supported on the module. The module can be clocked from a line or from an internal clock source. The table describes the configurations and features for the modes that are supported on the T1 or E1 interface module.

Table 3: Configurations on T1 or E1 Interface Module

	T1	E1
Required Configurations		
Mode	Yes	Yes
Internal/Line Clock Source	Yes	Yes
ACR/DCR Clock	Yes	Yes
CEM Configurations		
Structure-Agnostic TDM over Packet (SATOP) (Framed/Unframed)	Yes	Yes
Circuit Emulation over Packet-Switched Network (CESoPSN)	Yes	Yes
Troubleshooting Features		
Bit Error Rate Testing (BERT)	Yes	Yes
Loopback	Yes	Yes
Monitoring Features		
Performance Monitoring	Yes	Yes

- [Restrictions for Configuring T1 or E1 Interfaces](#), on page 6
- [Circuit Emulation](#), on page 7
- [Overview of CEM Pseudowire](#), on page 7
- [Framed Structure-Agnostic TDM over Packet \(SAToP\)](#), on page 7
- [Circuit Emulation Service over Packet-Switched Network](#), on page 9

Restrictions for Configuring T1 or E1 Interfaces

- You can configure CEM to support serial interface configuration.
- The card can be configured either in the T1 or E1 mode. A combination of T1 and E1 ports is not supported.

Circuit Emulation

Circuit Emulation (CEM) is a technology that provides a protocol-independent transport over IP/MPLS networks. It enables proprietary or legacy applications to be carried transparently to the destination, similar to a leased line.

CEM provides a bridge between a Time-Division Multiplexing (TDM) network and a Multiprotocol Label Switching (MPLS) network. The router encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) router. As a result, CEM functions as a physical communication link across the packet network.

The router supports the pseudowire type that utilizes CEM transport: Structure-Agnostic TDM over Packet (SAToP) and Circuit Emulation Service over Packet-Switched Network (CESoPSN).

L2VPN over IP/MPLS is supported on the interface modules.



Note We recommend that you configure the controller in the administratively up mode. Configuration under the administratively down mode is not recommended and it might cause configuration errors.



Note The default behaviour of the CEM pseudowire is always UP irrespective of the controller alarms.

Overview of CEM Pseudowire

Pseudowires manage encapsulation, timing, order, and other operations in order to make it transparent to users. The pseudowire tunnel acts as an unshared link or circuit of the emulated service. CEM is a way to carry TDM circuits over packet switched network. CEM embeds the TDM circuits into packets, encapsulates them into an appropriate header, and then sends that through Packet Switched Network. The receiver side of CEM restores the TDM circuits from packets.

Configuring Pseudowire

Cisco Pseudowire Emulation Edge-to-Edge (PWE3) allows you to transport traffic by using traditional services such as T1/E1 over a packet-based backhaul technology such as MPLS or IP. A pseudowire (PW) consists of a connection between two provider edge (PE) chassis that connects two attachment circuits (ACs), such as T1/E1 or T3 /E3 links.

Framed Structure-Agnostic TDM over Packet (SAToP)

Framed Structure-Agnostic TDM over Packet (SAToP) is required to detect an incoming AIS alarm in the DS1 SAToP mode. An AIS alarm indicates a problem with the line that is upstream from the DS1 network element connected to the interface. Framed SAToP further helps in the detection of a packet drop.

In case of unframed mode of SAToP, data received from the Customer Edge (CE) device is transported over the pseudowire. If the Provider Edge (PE) device receives a Loss of Frame (LOF) signal or Remote Alarm Indication (RAI) signal from a CE, the PE can only transmit the signal that is detected by the CE device. With the introduction of Framed SAToP, when the PE device receives the LOF or RAI signal, the PE device can detect the alarm for SAToP. Thus, the alarm can be detected earlier in the network. This helps in enhanced performance.



Note Framing type should be maintained same in all routers end to end.

Difference between Framed and Unframed SAToP:

1. For unframed SAToP, the incoming signal is transmitted to the far end. This signal is not analyzed by the PE device. Hence, no alarm is reported.
2. For framed SAToP, the incoming signal is analyzed but is not terminated. If a LOF or RAI signal is detected, the remote PE detects the signals and transmits towards the remote CE.

Difference between Framed SAToP and CESoP:

Table 4: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on LOF Alarm

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	None	Up	LOF	No	No
Framed SAToP	LOF	Down (Data path remains up)	AIS ^{1,2}	Yes	No
CESOP	LOF	Down (Data path remains up)	AIS	Yes	Yes

¹ AIS—Cisco IOS XE Amsterdam 17.3.1 to later releases

² LOF—Support until Cisco IOS XE Amsterdam 17.2.1

Table 5: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on RDI Alarm

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	None	Up	RDI	No	No
Framed SAToP	RDI	Down (data path remains up)	RDI	No	No
CESOP	RDI	Down (data path remains up)	RDI	M-bit is set into control word	Yes

Table 6: Behaviour Difference between Unframed SAToP, Framed SAToP, and CESoP on AIS alarm

Modes	Alarm Detected at PE	Controller Status at PE	Alarm Detected at CE (Remote)	Framing Bits Generation at PE (Remote)	Framing Bits Terminated at PE (Remote)
Unframed SAToP	AIS	Down (data path remains up)	AIS	No	No
Framed SAToP	AIS	Down (data path remains up)	AIS	No	No
CESOP	AIS	Down (data path remains up)	AIS	L-bit is set into control word	Yes

Remote Loopback from CE to PE Detection:

Framed SAToP does not detect any loopback.

	Loopback Detected at PE	Controller Status at PE (Remote)	Controller Status at CE (Remote)
Unframed SAToP	No	Not in Loopback	Loopback
Framed SAToP	No	Not in Loopback	Loopback
CESOP	Yes	Loopback	Not in loopback

Circuit Emulation Service over Packet-Switched Network

CESoPSN is a method for encapsulating structured (NxDS0) TDM signals as pseudowires over packet switching networks.

Restrictions for CESoPSN on T1 Interface

- The maximum number of CEM interface supported is 192.
- DS0 loopback is not supported on the T1 interface.
- Alarm forwarding is not supported on the T1 interface.
- Card protection is not supported on the T1 interface.



CHAPTER 4

Configuring T1 or E1 Interfaces

This chapter provides the information about how to configure a T1 or E1 interface.

- [Setting the Card Type, on page 11](#)
- [Configuring the Controller, on page 11](#)
- [Configuring Structure-Agnostic TDM over Packet - T1/E1 Interfaces, on page 13](#)
- [Configuring CEM Group for CESoPSN on T1 Interface, on page 17](#)
- [Configuring DS1 Local Connet, on page 19](#)

Setting the Card Type

To set the card type for the T1/E1 interfaces, complete these steps:

```
enable
configure terminal
card type t1 0 1
exit
```

Configuring the Controller

To configure T1 interface, use the following commands:

```
enable
configure terminal
controller t1 0/1/0
clock source internal
framing esf
cablelength short 110
linecode b8zs
no shut
exit
```



Note For T1 interface, the default frame mode is Extended Super Frame (ESF).

To configure E1 interface, use the following commands:

```

enable
configure terminal
controller e1 0/1/0
clock source internal
framing crc4
linecode hdb3
no shut
exit

```



Note For E1 interface, the default frame mode is Cyclic Redundancy Check 4 (CRC4).

Starting with Cisco IOS XE Cupertino 17.7.1, the cable length short values are modified for the following interface modules:

- ASR-920-12SZ-IM
-

Table 7: Cable Length Short Values

Cable Length Short (in ft)	Range (in ft)
110	0–133
220	134–266
330	267–399
440	400–533
550	534–655

Table 8: Cable Length Short Values - IMs

Cable Length Short (in ft)	Range (in ft)
110	0–110
220	111–220
330	221–330
440	331–440
550	441–550

Verifying the Controller Configuration

Use the **show controllers** command to verify the controller configuration:

Use the **show platform** command to verify the router information:

```

Router#show platform
Chassis type: ASR-920-12SZ-IM

Slot Type State Insert time (ago)
-----
0/0 12xGE-4x10GE-FIXED ok 01:49:48
0/1 NCS4200-48T1E1-CE ok 01:49:48
R0 ASR-920-12SZ-IM ok, active 01:56:45
F0 ok, active 01:56:45
P0 ASR920-PSU0 ok 01:54:45
P1 ASR920-PSU1 N/A never
P2 ASR920-FAN ok 01:54:44

Slot CPLD Version Firmware Version
-----
R0 2008241E 15.6(46r)S
F0 2008241E 15.6(46r)S

```

Configuring Structure-Agnostic TDM over Packet - T1/E1 Interfaces

To configure Structure-Agnostic TDM over Packet (SAToP), use the following commands:

```

enable
configure terminal
controller t10/1/0
cem-group 0 unframed
exit

```



Note To configure SAToP, the framing mode for the port is set to unframed.

Verifying CEM Configuration for SAToP

Use the following command to verify the CEM configuration for T1/E1 interfaces:

```

Router# show cem circuit interface CEM 0/1/0

CEM0/1/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    475471          Dropped:          0
Egress Pkts:    475471          Dropped:          0

```

```

CEM Counter Details
Input Errors: 0      Output Errors: 0
Pkts Missing: 0     Pkts Reordered: 0
Misorder Drops: 0   JitterBuf Underrun: 0
Error Sec: 0        Severly Errored Sec: 0
Unavailable Sec: 0  Failure Counts: 0
Pkts Malformed: 0  JitterBuf Overrun: 0

```

Configuring Framed SAToP



Note Framing type should be maintained same in all routers end to end.

To configure framed SAToP:

```

enable
configure terminal
controller t1 0/1/0
framing esf
cem-group 0 framed
exit

```

Verifying Framed SAToP Configuration

Use the following command to verify the CEM configuration for T1/E1 interfaces:

```

Router# show cem circuit interface cem 0/1/0

CEM0/1/0, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Framed SAToP
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts: 7836 Dropped: 0
Egress Pkts: 7836 Dropped: 0

CEM Counter Details
Input Errors: 0 Output Errors: 0
Pkts Missing: 0 Pkts Reordered: 0
Misorder Drops: 0 JitterBuf Underrun: 0
Error Sec: 0 Severly Errored Sec: 0
Unavailable Sec: 0 Failure Counts: 0
Pkts Malformed: 0 JitterBuf Overrun: 0
Generated Lbits: 0 Received Lbits: 0
Generated Rbits: 0 Received Rbits: 0

```

Verifying CEM Statistics for Framed SAToP

Use the following commands to verify the pseudowire configuration for SAToP:

- **show cem circuit**—Displays information about the circuit state, administrative state, the CEM ID of the circuit, and the interface on which it is configured. If cross connect is configured under the circuit, the command output also includes information about the attachment circuit status.

```
Router# show cem circuit

<0-4294967295>      CEM ID
detail             Detailed information of cem ckt(s)
interface          CEM Interface
summary           Display summary of CEM ckts
|                 Output modifiers
Router# show cem circuit

CEM Int.  ID Ctrlr Admin Circuit AC
-----
CEM0/1/0  1   UP   UP   Active UP
CEM0/1/1  2   UP   UP   Active UP
CEM0/1/2  3   UP   UP   Active UP
CEM0/1/3  4   UP   UP   Active UP
CEM0/1/4  5   UP   UP   Active UP
```

- **show cem circuit *cem-id*** — Displays the detailed information about that particular circuit.

```
Router# show cem circuit 0
CEM0/1/2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :T1, CEM Mode: T1-SAToP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Framed SAToP
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts: 167027103 Dropped: 0
Egress Pkts: 167027102 Dropped: 0

CEM Counter Details
Input Errors: 0 Output Errors: 0
Pkts Missing: 0 Pkts Reordered: 0
Misorder Drops: 0 JitterBuf Underrun: 0
Error Sec: 0 Severly Errored Sec: 0
Unavailable Sec: 0 Failure Counts: 0
Pkts Malformed: 0 JitterBuf Overrun: 0
Generated Lbits: 0 Received Lbits: 0
Generated Rbits: 0 Received Rbits: 0
```

- **show cem circuit summary** — Displays the number of circuits which are up or down per interface basis.

```
Router# show cem circuit summary

CEM Int.  Total Active Inactive
-----
```

```
CEM0/1/0 1 1 0
CEM0/1/1 1 1 0
CEM0/1/2 1 1 0
CEM0/1/3 1 1 0
CEM0/1/4 1 1 0
```

Verifying CEM Statistics for SAToP

Use the following commands to verify the pseudowire configuration for SAToP:

- **show cem circuit**—Displays information about the circuit state, administrative state, the CEM ID of the circuit, and the interface on which it is configured. If cross connect is configured under the circuit, the command output also includes information about the attachment circuit status.

```
Router# show cem circuit
```

```
<0-32000> CEM ID
detail Detailed information of cem ckt(s)
interface CEM Interface
summary Display summary of CEM ckts
|
Output modifiers
```

```
Router# show cem circuit
```

CEM Int.	ID	Line	Admin	Circuit	AC
CEM0/1/0	1	UP	UP	ACTIVE	--/--
CEM0/1/0	2	UP	UP	ACTIVE	--/--
CEM0/1/0	3	UP	UP	ACTIVE	--/--
CEM0/1/0	4	UP	UP	ACTIVE	--/--
CEM0/1/0	5	UP	UP	ACTIVE	--/--

- **show cem circuit *cem-id*** — Displays the detailed information about that particular circuit.

```
Router# show cem circuit 0
```

```
CEM0/1/2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 192
Framing: Unframed
CEM Defects Set
None
```

```
Signalling: No CAS
RTP: No RTP
```

```
Ingress Pkts: 11060 Dropped: 0
Egress Pkts: 11061 Dropped: 0
```

```
CEM Counter Details
Input Errors: 0 Output Errors: 0
Pkts Missing: 0 Pkts Reordered: 0
Misorder Drops: 0 JitterBuf Underrun: 0
Error Sec: 0 Severly Errored Sec: 0
Unavailable Sec: 0 Failure Counts: 0
Pkts Malformed: 0 JitterBuf Overrun: 0
```

- **show cem circuit summary** — Displays the number of circuits which are up or down per interface basis.

```
Router# show cem circuit summary

CEM Int.          Total Active  Inactive
-----
CEM0/1/0          1          1          0
```

Configuring CEM Group for SAToP for T1 Interfaces

To configure a CEM group for SAToP.

```
enable
configure terminal
controller t1 0/1/0
cem-group 0 unframed
end
```



Note You need metroaggrservice license to configure CEM group on the Interface Module.

Configuring CEM Group for CESoPSN on T1 Interface

The following section describes how to configure a CEM group for CESoPSN.

To configure xconnect over MPLS, use the following commands:

```
enable
configure terminal
controller t1 0/1/32
cem-group 0 timeslots 1-10
```

Configure cross-connect:

```
enable
configure terminal
interface cem 0/1/32
cem 0
xconnect 10.2.2.2 10 encapsulation mpls
```

Perform a similar configuration on the other end of the pseudowire.

```
show running-config | sec 0/1/16
controller t1 0/1/16
 framing esf
 linecode b8zs
 cablelength short 110
  cem-group 0 timeslots 1-10
interface CEM0/1/16
 no ip address
 cem 0
  xconnect 10.2.2.2 10 encapsulation mpls
```

Check for cross-connect configuration using the following command:

```

Router#show xconnect all | i 0/1/32
UP pri ac CE0/1/32:0(CESoPSN Basic) UP mpls 10.2.2.2:10 UP

Router#sh controllers t1 0/1/32
T1 0/1/32 is up
  Applique type is NCS4200-48T1E1-CE
  Cablelength is short 110
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear LOS State:Clear LOF State:Clear
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.

```

Verifying CEM for CESoPSN on T1 Interface

Use the following commands to verify the pseudowire configuration for CESoPSN:

- `show cem circuit`—Displays information about the circuit state, administrative state, the CEM ID of the circuit, and the interface on which it is configured. If cross connect is configured under the circuit, the command output also includes information about the attachment circuit status.
- `show mpls l2 vc`—Displays information about the MPLS VC.
- `show mpls l2 vc detail`—Displays detailed information about the MPLS VC.

```
PE1#show mpls l2 vc 10
```

Local intf	Local circuit	Dest address	VC ID	Status
CE0/1/32	CESoPSN Basic 0	10.2.2.2	10	UP

```

PE1#sh mpls l2 vc 10 detail
Local interface: CE0/1/32 up, line protocol up, CESoPSN Basic 0 up
Destination address: 10.2.2.2, VC ID: 10, VC status: up
Output interface: Te0/0/0, imposed label stack {650}
Preferred path: not configured
Default path: active
Next hop: 209.165.202.129
Create time: 00:21:25, last status change time: 00:21:25
Last label FSM state change time: 00:21:25
Signaling protocol: LDP, peer 10.2.2.2:0 up
Targeted Hello: 10.1.1.1(LDP Id) -> 10.2.2.2, LDP is UP
Graceful restart: configured and not enabled
Non stop routing: not configured and not enabled
Status TLV support (local/remote) : enabled/supported
LDP route watch : enabled
Label/status state machine : established, LruRru
Last local dataplane status rcvd: No fault
Last BFD dataplane status rcvd: Not sent
Last BFD peer monitor status rcvd: No fault
Last local AC circuit status rcvd: No fault
Last local AC circuit status sent: No fault
Last local PW i/f circ status rcvd: No fault
Last local LDP TLV status sent: No fault
Last remote LDP TLV status rcvd: No fault
Last remote LDP ADJ status rcvd: No fault
MPLS VC labels: local 577, remote 650
Group ID: local 238, remote 276
MTU: local 0, remote 0

```



```

Remote interface description:
Sequencing: receive disabled, send disabled
Control Word: On (configured: autosense)
SSO Descriptor: 10.2.2.2/10, local label: 577
Dataplane:
  SSM segment/switch IDs: 6893171/4140658 (used), PWID: 674
VC statistics:
  transit packet totals: receive 0, send 0
  transit byte totals:   receive 0, send 0
  transit packet drops: receive 0, seq error 0, send 0

```

Configuring DS1 Local Connet

The following section describes how to configure first segment for DS1 local connection:

```

enable
configure terminal
controller T1 0/1/0
framing unframed
clock source internal
linecode b8zs
cablelength short 110
cem-group 0 unframed
description TO_CEM_0/1/0

```

The following section describes how to configure second segment for DS1 local connection:

```

enable
configure terminal
controller T1 0/1/3
framing unframed
clock source recovered 0
linecode b8zs
cablelength short 110
cem-group 0 unframed
description TO_CEM_0/1/1

```

The following section describes how to create a DS1 local connection:

```

enable
configure terminal
connect ds1_connect CEM0/1/0 0 CEM0/1/3 0

```

Verifying DS1 Local Connet

Use the following commands to verify the DS1 local connection:

- show connection name—Displays information about the connection state and segment state.

```

Router#show connection name ds1_connect

Connection: 673 - ds1_connect
Current State: UP
Segment 1: CEM0/1/0 SATOP T1 0 up
Segment 2: CEM0/1/3 SATOP T1 0 up

```




CHAPTER 5

Monitoring the T1 or E1 Interface Module

This chapter provides information on monitoring the T1 or E1 interface module. Some of monitoring tools available are:

- Performance Monitoring
- [Performance Monitoring, on page 21](#)

Performance Monitoring

Table 9: Feature History Table

Feature Name	Release Information	Description
GR-820-CORE Performance Monitoring	Cisco IOS XE Bengaluru 17.5.1	The show controller tabular command enables you to view the performance monitoring details in tabular form as per GR-820-Core standards.

The performance monitoring result displays the statistics or error count generated on the TDM lines for DS1.

To view the performance monitoring details, use the **show controller** command:

```
Router# show controllers t1 0/1/1

T1 0/1/1 is down.
  Applique type is -48T1E1-CE
  Cablelength is short 110
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear  LOS State:Clear  LOF State:Clear
  Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (230 seconds elapsed):
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
```

```

    0 Path Failures
Data in Interval 1:
Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
Far End Data
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
    4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
    4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures

```

Router# **show controllers e1 0/1/1**

```

E1 0/1/1 is down.
Applique type is -48T1E1-CE
Cablelength is short 110
No alarms detected.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State:Clear LOS State:Clear LOF State:Clear
Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
BER thresholds: SF = 10e-3 SD = 10e-6
Data in current interval (230 seconds elapsed):
Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures, 0 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
Data in Interval 1:
Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
Far End Data
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
    4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations,

```

```

0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures

```

To view the performance monitoring details on T1 controller, use the **show controller t1 tabular** command:

```
Router#show controllers t1 0/1/0 tabular
```

```

T1 0/1/0 is up
  Applique type is -48T1E1-CE
  Cablelength is short 110
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  BER thresholds: SF = 10e-3 SD = 10e-6
  Near End Data
  INTERVAL      CV-L   ES-L   CV-P   ES-P   SES-P   CSS-P   SAS-P   UAS-P   FC-P
  09:49-10:01    0     0     0     0     0     0     0     0     0
  Far End Data
  INTERVAL      ES-LFE  ES-PFE  SES-PFE  SEFS-PFE  CSS-PFE  UAS-PFE  FC-PFE
  09:49-10:01    0       0       0       0       0       0       0

```

Starting with Cisco IOS XE 17.11.1, you can view the previous day performance monitoring details using the following **show controller** commands for the T1 or E1 controllers.

- show controllers { t1 | e1 }
- show controllers { t1 | e1 } tabular
- show controllers { t1 | e1 } remote performance
- show controllers { t1 | e1 } remote performance tabular

```

router#show controllers t1 0/5/0
T1 0/5/0 is down
  Applique type is
  Cablelength is short 110
  Receiver has loss of signal.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  BER thresholds: SF = 10e-3 SD = 10e-6
  Data in current interval (800 seconds elapsed):
  Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 799 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 799 Unavail Secs
    0 Path Failures, 0 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
    0 Path Failures
  Data in Interval 1:
  .....
  Total Data (last 24 hours)
  Near End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 86423 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 86423 Unavail Secs
    0 Path Failures, 0 SEF/AIS Secs

```

```

Far End
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
  0 Path Failures
Total (Previous Day)
Near End
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 86438 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 86438 Unavail Secs
  2 Path Failures, 0 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
  0 Path Failures

```

```
router#show controllers t1 0/5/0 tabular
```

```

T1 0/5/0 is down
  Applique type is
  Cablelength is short 110
  Receiver has loss of signal.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  Framing is ESF, Line Code is B8ZS, Clock Source is Line.
  BER thresholds: SF = 10e-3 SD = 10e-6
Near End Data
INTERVAL      CV-L   ES-L   CV-P   ES-P   SES-P   CSS-P   SAS-P   UAS-P   FC-P
05:56-05:58    0    119    0      0      0      0      0      119     0
05:41-05:56    0    900    0      0      0      0      0      900     0
.....
06:11-06:26    0    900    0      0      0      0      0      900     0
05:56-06:11    0    901    0      0      0      0      0      901     0
Total          0  86423    0      0      0      0      0  86423     0
Total (Previous Day)
05:26-05:26    0  86438    0      0      0      0      0  86438     2

```

```
Router#show controllers T1 0/3/0 remote performance
```

```

T1 0/3/0 is down.
  Applique type is
  Receiver has loss of signal.
  Cablelength is short 110
  Framing is ESF, FDL is ansi & att, Line Code is B8ZS, Clock Source is Line.
  Far End Data in current interval (590 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Far End Data in Interval 1:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Far End Data in Interval 2:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Far End Data in Interval 3:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Far End Data in Interval 4:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins

```

```

    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 5:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 6:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 7:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 8:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 9:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 10:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 11:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 12:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 13:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 14:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 15:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 16:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 17:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 18:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 19:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 20:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins

```



```

    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 85:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 86:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 87:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 88:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 89:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 90:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 91:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 92:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 93:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 94:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 95:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Far End Data in Interval 96:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Total Far End Data (last 24 hours)
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Total (Previous Day)
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs

```

Router#show controllers T1 0/3/0 remote performance tabular

T1 0/3/0 is down.

Applique type is

Receiver has loss of signal.

Cablelength is short 110

Framing is ESF, FDL is ansi & att, Line Code is B8ZS, Clock Source is Line.

Far End Data							
INTERVAL	ES-LFE	ES-PFE	SES-PFE	SEFS-PFE	CSS-PFE	UAS-PFE	FC-PFE
04:33-04:44	0	0	0	0	0	0	0
04:18-04:33	0	0	0	0	0	0	0
04:03-04:18	0	0	0	0	0	0	0
03:48-04:03	0	0	0	0	0	0	0
03:33-03:48	0	0	0	0	0	0	0
03:18-03:33	0	0	0	0	0	0	0
03:03-03:18	0	0	0	0	0	0	0
02:48-03:03	0	0	0	0	0	0	0
02:33-02:48	0	0	0	0	0	0	0
02:18-02:33	0	0	0	0	0	0	0
02:03-02:18	0	0	0	0	0	0	0
01:48-02:03	0	0	0	0	0	0	0
01:33-01:48	0	0	0	0	0	0	0
01:18-01:33	0	0	0	0	0	0	0
01:03-01:18	0	0	0	0	0	0	0
00:48-01:03	0	0	0	0	0	0	0
00:33-00:48	0	0	0	0	0	0	0
00:18-00:33	0	0	0	0	0	0	0
00:03-00:18	0	0	0	0	0	0	0
23:48-00:03	0	0	0	0	0	0	0
23:33-23:48	0	0	0	0	0	0	0
23:18-23:33	0	0	0	0	0	0	0
23:03-23:18	0	0	0	0	0	0	0
22:48-23:03	0	0	0	0	0	0	0
22:33-22:48	0	0	0	0	0	0	0
22:18-22:33	0	0	0	0	0	0	0
22:03-22:18	0	0	0	0	0	0	0
21:48-22:03	0	0	0	0	0	0	0
21:33-21:48	0	0	0	0	0	0	0
21:18-21:33	0	0	0	0	0	0	0
21:03-21:18	0	0	0	0	0	0	0
20:48-21:03	0	0	0	0	0	0	0
20:33-20:48	0	0	0	0	0	0	0
20:18-20:33	0	0	0	0	0	0	0
20:03-20:18	0	0	0	0	0	0	0
19:48-20:03	0	0	0	0	0	0	0
19:33-19:48	0	0	0	0	0	0	0
19:18-19:33	0	0	0	0	0	0	0
19:03-19:18	0	0	0	0	0	0	0
18:48-19:03	0	0	0	0	0	0	0
18:33-18:48	0	0	0	0	0	0	0
18:18-18:33	0	0	0	0	0	0	0
18:03-18:18	0	0	0	0	0	0	0
17:48-18:03	0	0	0	0	0	0	0
17:33-17:48	0	0	0	0	0	0	0
17:18-17:33	0	0	0	0	0	0	0
17:03-17:18	0	0	0	0	0	0	0
16:48-17:03	0	0	0	0	0	0	0
16:33-16:48	0	0	0	0	0	0	0
16:18-16:33	0	0	0	0	0	0	0
16:03-16:18	0	0	0	0	0	0	0
15:48-16:03	0	0	0	0	0	0	0
15:33-15:48	0	0	0	0	0	0	0
15:18-15:33	0	0	0	0	0	0	0
15:03-15:18	0	0	0	0	0	0	0
14:48-15:03	0	0	0	0	0	0	0
14:33-14:48	0	0	0	0	0	0	0
14:18-14:33	0	0	0	0	0	0	0
14:03-14:18	0	0	0	0	0	0	0
13:48-14:03	0	0	0	0	0	0	0
13:33-13:48	0	0	0	0	0	0	0
13:18-13:33	0	0	0	0	0	0	0

13:03-13:18	0	0	0	0	0	0	0
12:48-13:03	0	0	0	0	0	0	0
12:33-12:48	0	0	0	0	0	0	0
12:18-12:33	0	0	0	0	0	0	0
12:03-12:18	0	0	0	0	0	0	0
11:48-12:03	0	0	0	0	0	0	0
11:33-11:48	0	0	0	0	0	0	0
11:18-11:33	0	0	0	0	0	0	0
11:03-11:18	0	0	0	0	0	0	0
10:48-11:03	0	0	0	0	0	0	0
10:33-10:48	0	0	0	0	0	0	0
10:18-10:33	0	0	0	0	0	0	0
10:03-10:18	0	0	0	0	0	0	0
09:48-10:03	0	0	0	0	0	0	0
09:33-09:48	0	0	0	0	0	0	0
09:18-09:33	0	0	0	0	0	0	0
09:03-09:18	0	0	0	0	0	0	0
08:48-09:03	0	0	0	0	0	0	0
08:33-08:48	0	0	0	0	0	0	0
08:18-08:33	0	0	0	0	0	0	0
08:03-08:18	0	0	0	0	0	0	0
07:48-08:03	0	0	0	0	0	0	0
07:33-07:48	0	0	0	0	0	0	0
07:18-07:33	0	0	0	0	0	0	0
07:03-07:18	0	0	0	0	0	0	0
06:48-07:03	0	0	0	0	0	0	0
06:33-06:48	0	0	0	0	0	0	0
06:18-06:33	0	0	0	0	0	0	0
06:03-06:18	0	0	0	0	0	0	0
05:48-06:03	0	0	0	0	0	0	0
05:33-05:48	0	0	0	0	0	0	0
05:18-05:33	0	0	0	0	0	0	0
05:03-05:18	0	0	0	0	0	0	0
04:48-05:03	0	0	0	0	0	0	0
04:33-04:48	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0
Total (Previous Day)							
17:48-17:48	0	0	0	0	0	0	0



CHAPTER 6

Troubleshooting the T1 or E1 Interface Module

You can use the following methods to troubleshoot the T1 or E1 interface modules:

- Bit Error Rate Testing (BERT)
- Loopback
- [Overview of BERT, on page 33](#)
- [Loopback on T1 or E1 Interfaces, on page 41](#)
- [User-defined Remote Loopback on T1 Interfaces, on page 44](#)

Overview of BERT

Bit Error Rate Testing (BERT) is used to test the integrity of the physical line.

The interface contains on board BERT circuitry. With this circuitry, the interface software can send and detect a programmable pattern that is compliant with CCITT/ITU O.151, O.152, O.153 pseudo-random, and repetitive test patterns. BERTs allow you to test cables and signal problems in the field.

The bit error rate (BER) is determined by comparing the erroneous bits received with the total number of bits received. You can display and analyze the total number of error bits transmitted and the total number of bits received on the link. You can retrieve error statistics anytime during the BERT.

Both the total number of bits and the error bits received are available for analysis. You can select the testing period from 1 minute to 24 hours and you can also retrieve the error statistics anytime during the BERT test.

Running a BERT Test

When running a BERT test, the system expects to receive the same pattern that it transmits. To help ensure this, two common options are available:

- Use a loopback somewhere in the link or network
- Configure remote testing equipment to transmit the same BERT test pattern at the same time.

The BERT runtime engine can be kept running until the interval completes or can be stopped by unconfiguring it anytime.

Types of BERT

BERT is supported in two directions:

- Line - supports BERT in TDM direction

- System - supports BERT in PSN direction

BERT engines uses different BERT patterns for transmission for each mode. The supported BERT patterns on each card is described.

BERT Restrictions

- BERT is not supported on the following modes:
 - T3—Framing M-13, non-channelized
 - E3—Framing G832, channelized
- When the BERT is initiated with pattern 0s and 1s from the local end and the loopback local is applied from the far end, then the BERT syncing does not happen. Since the BERT process is asserted as LOS alarms for all 0s and AIS alarms for all 1s BERT patterns. Whereas the BERT syncing behaves properly when the BERT is initiated from both the local and the far end.

For all 1s on T3 or E3, the BERT behaviour is not asserted as AIS and the BERT syncing happens as usual.

- In the unframed mode, BERT sync is not stable and may generate alarms until Cisco IOS XE Fuji 16.9.4.



Note Framing type should be similar in all routers end to end.

- System BERT is not supported for any pattern in framed SATOP for releases earlier to Cisco IOS XE 17.13.1.

Starting with Cisco IOS XE 17.13.1, system BERT is supported for any pattern in the framed SAToP on T1/E1 interface module.

- System BERT is not configurable, without cem-group configuration.
- Path modes, unframed modes, and concatenation modes are not supported.

BERT Restrictions for Cisco IOS XE Bengaluru 17.4.1 release

- When the BERT is initiated from the local end and the loopback local is applied from the far end, then BERT syncing does not happen. Since the BERT process is asserted as LOS alarms for all 0s and AIS alarms for all 1s BERT patterns. Whereas the BERT syncing behaves properly when the BERT is initiated from both the local and the far end.

BERT for SAToP

BERT is supported for both unframed and framed modes.

Configuring BERT for SAToP

Before You Begin

Before you run BERT test, you must configure card type and controller.

To run a BERT on T1/E1 interface, perform the following tasks in global configuration mode.

```
enable
configure terminal
controller t10/1/1
bert pattern 2^11 interval 5 direction line/system
exit
```



Note To terminate a BERT test during the specified test period, use the **no bert** command.

Verifying BERT Configuration for SAtOP

Use the following command to verify the BERT configuration for T1/E1 interfaces:

```
Router# show controllers t1 0/1/1

T1 0/1/1 is up.
  Applique type is -48T1E1-CE
  Cablelength is short 110
  DSX1 BERT pattern      : 2^11
  DSX1 BERT direction    : Line
  DSX1 BERT sync         : no sync
  DSX1 BERT sync count   : 0
  DSX1 BERT interval     : 5
  DSX1 BERT time remain  : 2
  DSX1 BERT total errs   : 0
  DSX1 BERT total k bits : 0
  DSX1 BERT errors (last): 0
  DSX1 BERT k bits (last): 0
  Last clearing of BERT counters never
  No alarms detected.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear  LOS State:Clear  LOF State:Clear
  Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (230 seconds elapsed):
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures, 0 SEF/AIS Secs
    Far End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
      1 Path Failures, 0 SEF/AIS Secs
    Far End Data
      0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
      4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
      0 Path Failures
```

```
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
  0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
  1 Path Failures, 0 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations,
  0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
  4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
  0 Path Failures
```

You can view the results of a BERT test at the following times:

- After you terminate the test using the **no bert** command
- After the test runs completely
- Anytime during the test (in real time)

Framed SAToP System BERT

Table 10: Feature History

Feature Name	Release Information	Description
Framed SAToP System BERT	Cisco IOS XE 17.13.1	You can configure SATOP system BERT with framing under CEM circuits on T1 or E1 interfaces and verify if the BERT is stable and transmitted end-to-end.

System BERT is used between PEs on the core side. This feature is supported only on the 48-port T1/E1 Interface module. You can run a maximum of 16 BERTs at a time.



Note For Cisco ASR 920 series aggregation services routers, the framed SAToP system BERT is supported only on the Cisco ASR-920-12SZ-IM router with A900-IMA3G-IMSG Interface Module.

Restrictions for Framed SAToP System BERT

- Framing change is not allowed while bert is running

Configuring Framed SAToP System BERT

You can configure the framed SAToP system BERT in the following scenarios:

- **Scenario 1: PE1—core—PE2**
CEM system BERT is configured on both PE1 and PE2.
- **Scenario 2: PE1—core—PE2**
CEM system BERT is configured on PE1 and loopback local is configured on PE2.

Scenario 1: PE1—CORE—PE2

1. Configure system BERT on PE1.
2. Configure system BERT on PE2.
3. Configure cross-connect on core.

Configure System BERT on PE1

```
PE1#config terminal
PE1(config)#controller T1 0/4/35
PE1(config-controller)#bert pattern 3-in-24 interval 40 direction system
PE1(config)#end
```

Configure System BERT on PE2

```
PE1#config terminal
PE1(config)#controller T1 0/3/17
PE1(config-controller)#bert pattern 3-in-24 interval 40 direction system
PE1(config)#end
```

Configure Cross Connect on Core

Ensure that the cross connection is UP before configuring BERT.

Scenario 2: PE1—core—PE2

1. Configure system BERT on T1 at the PE1 side.
2. Apply loopback local on PE2.
3. Configure cross-connect on core.

```
PE1#show run | s 0/4/35
controller T1 0/4/35
  threshold sd-ber 6
  threshold sf-ber 3
  framing esf
  linecode b8zs
  cablelength short 110
  no snmp trap link-status
  cem-group 0 framed
interface CEM0/4/35
  no ip address
  cem 0
```

Configure System BERT on PE1

```
PE1#config terminal
PE1(config)#controller T1 0/4/35
PE1(config-controller)#bert pattern 3-in-24 interval 40 direction system
PE1(config)#end
```

Apply Loopback Local on PE2

```
PE2(config-controller)#controller T1 0/4/0
PE2(config-controller)#loopback local
PE2(config-controller)#end
```

Configure Cross Connect on Core

Ensure that the cross connection is UP before configuring BERT.

Verifying Framed SAToP System BERT

Use the following **show** commands to verify the framed SAToP system BERT configuration:

Scenario 1: PE1—CORE—PE2

Verify the configuration on PE1

```
PE1#show xconnect all
Legend:  XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
         UP=Up                DN=Down                AD=Admin Down    IA=Inactive
         SB=Standby           HS=Hot Standby       RV=Recovering    NH=No Hardware

XC ST Segment 1                               S1 Segment 2                               S2
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
UP pri mpls 2.2.2.2:500                        UP   ac CE0/4/35:0 (SATOP T1)  UP
```

```
PE1#show controller T1 0/4/35 | sec BERT
DSX1 BERT test result: (running)
DSX1 BERT pattern      : 3-in-24
DSX1 BERT direction    : System
DSX1 BERT sync        : sync
DSX1 BERT sync count   : 1
DSX1 BERT interval     : 100
DSX1 BERT time remain  : 01:39:52
DSX1 BERT total errs   : 0
DSX1 BERT total k bits: 10759
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 10759
Last clearing of BERT counters never
```

Verify the configuration on PE2

```
PE1#show xconnect all
Legend:  XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
         UP=Up                DN=Down                AD=Admin Down    IA=Inactive
         SB=Standby           HS=Hot Standby       RV=Recovering    NH=No Hardware

XC ST Segment 1                               S1 Segment 2                               S2
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
UP pri mpls 3.3.3.3:500                        UP   ac CE0/3/17:0 (SATOP T1)  UP
```

```
PE1#show controller T1 0/3/17 | sec BERT
DSX1 BERT test result: (running)
DSX1 BERT pattern      : 3-in-24
DSX1 BERT direction    : System
DSX1 BERT sync        : sync
DSX1 BERT sync count   : 1
DSX1 BERT interval     : 100
DSX1 BERT time remain  : 01:39:52
DSX1 BERT total errs   : 0
DSX1 BERT total k bits: 10759
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 10759
Last clearing of BERT counters never
```

Scenario 2: PE1—CORE—PE2

Verify the configuration on PE1

```

PE1#show xconnect all
Legend:   XC ST=Xconnect State   S1=Segment1 State   S2=Segment2 State
          UP=Up                   DN=Down              AD=Admin Down       IA=Inactive
          SB=Standby              HS=Hot Standby      RV=Recovering       NH=No Hardware

XC ST Segment 1                               S1 Segment 2                               S2
-----+-----+-----+-----+-----+-----+-----+-----+-----+
UP pri mp1s 2.2.2.2:500                        UP ac CE0/4/35:0 (SATOP T1) UP

PE1#show controller T1 0/4/35 | sec BERT
DSX1 BERT test result: (running)
DSX1 BERT pattern : 3-in-24
DSX1 BERT direction : System
DSX1 BERT sync : sync
DSX1 BERT sync count : 1
DSX1 BERT interval : 100
DSX1 BERT time remain : 01:39:52
DSX1 BERT total errs : 0
DSX1 BERT total k bits: 10759
DSX1 BERT errors (last): 0
DSX1 BERT k bits (last): 10759
Last clearing of BERT counters never

```

BERT for CESoPSN

BERT is supported at the TDM side and pseudowire side. BERT can be used either at NxDS0 or DS1 but not together.

BERT is supported on following controllers:

- T1—NxDS0, DS1
- T3—NxDS0, DS1 (channelised), clear channel DS3.
- OCX—NxDS0, DS1 (channelised),DS3(channelised), clear channel DS3,STS1,STS-nc,VT-1.5,VT1.5 T1

Configuring BERT for CESoPSN

Before You Begin

Before you run BERT test, you must configure card type and controller.

To run a BERT on T1/E1 interface for CESoPSN, perform the following tasks in global configuration mode.

```

enable
configure terminal
controller t10/1/1
bert pattern 2^11 interval 5 direction line/system timeslots value speed
exit

```



Note To terminate a BERT test during the specified test period, use the **no bert** command.

Verifying BERT Configuration for CESoPSN

Use the following command to verify the BERT configuration for CESoPSN on T1 interfaces:

```
Router# show controllers t1 0/1/32
T1 0/1/32 is up
  Applique type is NCS4200-48T1E1-CE
  Cablelength is short 110
  DS0 Bert enabled on the following timeslots : 1-2
  Speed : 64 kpbs
  DSX1 BERT test result: (running)
  DSX1 BERT pattern      : 2^15
  DSX1 BERT direction   : Line
  DSX1 BERT sync        : sync
  DSX1 BERT sync count  : 1
  DSX1 BERT interval    : 1
  DSX1 BERT time remain : 00:00:55
  DSX1 BERT total errs  : 0
  DSX1 BERT total k bits: 512
  DSX1 BERT errors (last): 0
  DSX1 BERT k bits (last): 512
  Last clearing of BERT counters never
No alarms detected.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
AIS State:Clear  LOS State:Clear  LOF State:Clear
Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
BER thresholds: SF = 10e-3 SD = 10e-6
Data in current interval (230 seconds elapsed):
  Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures, 0 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
  Far End Data
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
    4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
    1 Path Failures, 0 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
    4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
    0 Path Failures
```

You can view the results of a BERT test at the following times:

- After you terminate the test using the **no bert** command
- After the test runs completely
- Anytime during the test (in real time)

Loopback on T1 or E1 Interfaces

You can use the following loopback on the T1 or E1 interfaces. Loopback is supported on both unframed and framed modes.

Restrictions

- Framing type should be maintained same in all routers end to end .
- AIS alarm is not transmitted to the connected peer port with **loopback local line** configuration until Cisco IOS XE 16.9.4 Fuji Release.

Loopback	Description
loopback local line	Loops the outgoing transmit signal back to the receive signal. This is done using the diagnostic loopback feature in the interface module’s framer. Set the clock source command to internal for this loopback mode.
loopback network line	Loops the incoming signal back in the interface module using the line loopback mode of the framer. The framer does not reclock or reframe the incoming data. All incoming data is received by the interface module driver. Loopback network line is supported on E1 interface.



Note Starting Cisco IOS Release 16.8.1, the following loopback commands are not supported.

- loopback diag
- loopback local
- loopback local payload

Configuring Loopback

Before You Begin

Before you configure loopback, you must configure the controller and the CEM.

To set a loopback local on the T1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/1/1
loopback local line
exit
```

To set a loopback diag on the T1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/1/1
loopback diag
exit
```

To set a loopback local on the E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller e1 0/1/1
loopback local
exit
```

To set a loopback network on the E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller e1 0/1/1
loopback network line
exit
```



Note To remove a loopback, use the **no loopback** command.



Note Network payload configuration is not supported on the port configured with SAToP. To configure loopback network payload when SAToP is configured, you need to remove the CEM configuration and then configure the loopback.

Loopback Remote on T1 Interfaces

The remote loopback configuration attempts to put the far-end T1 into a loopback.

The remote loopback setting loops back the far-end at line or payload, using IBOC (in-band bit-orientated CDE) or the ESF loopback codes to communicate the request to the far-end.

For releases later than Cisco IOS XE Fuji 16.8.x, we recommend that you use ESF loopback codes with ESF framing and IBOC loopback codes with SF framing.

Restrictions for Loopback Remote

- E1 loopback remote is not supported until Cisco IOS XE 16.9.4 Fuji Release. Starting from Cisco IOS XE Fuji 16.9.5 release, E1 loopback remote is supported.

- Loopback remote is not supported when cem-group is configured under T1 until Cisco IOS XE 16.9.4 Fuji Release.
- IBOC loopcode configuration is not supported when CESoP or SATOP (framed or unframed) is configured.
- ESF loopcode configuration is not supported when SAToP is configured.

Configuring Loopback Remote on a T1 Interface Module

To set T1 loopback remote iboc fac1/fac2/csu for DS1, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/1/1
loopback remote iboc {fac1 | fac2 | csu}
exit
```

To set T1 loopback remote esf line csu/payload on the DS1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t1 0/1/1
loopback remote esf {line csu | payload}
exit
```



Note loopback remote esf line niu is not supported.

Verifying the Loopback Remote Configuration

Use the following command to check the loopback remote configuration:

```
router# show running-config | sec 0/1/1
controller T1 0/1/10
threshold sd-ber 6
threshold sf-ber 3
framing sf
linecode b8zs
cablelength short 110
loopback remote iboc fac1
```

Use the following command to verify the loopback remote configuration:

```
router# show controller t1 0/1/1
T1 0/1/1 is up (NIU FAC1 Line Loopback with IBOC)
  Currently in Inband Remotely Line Looped
  Applique type is
  Cablelength is short 110
  Receiver has no alarms.
  alarm-trigger is not set
  Soaking time: 3, Clearance time: 10
  AIS State:Clear  LOS State:Clear  LOF State:Clear
  Framing is ESF, FDL is ansi, Line Code is B8ZS, Clock Source is Line.
  BER thresholds:  SF = 10e-3  SD = 10e-6
  Data in current interval (230 seconds elapsed):
  Near End
```

```

0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
0 Path Failures, 0 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavailable Secs
0 Path Failures
Data in Interval 1:
Near End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
1 Path Failures, 0 SEF/AIS Secs
Far End Data
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures
Total Data (last 1 15 minute intervals):
Near End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 0 Fr Loss Secs, 14 Line Err Secs, 0 Degraded Mins,
0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 15 Unavailable Secs
1 Path Failures, 0 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations,
0 Slip Secs, 4 Fr Loss Secs, 2 Line Err Secs, 0 Degraded Mins,
4 Errored Secs, 0 Bursty Err Secs, 4 Severely Err Secs, 0 Unavailable Secs
0 Path Failures
    
```

User-defined Remote Loopback on T1 Interfaces

Table 11: Feature History

Feature Name	Release Information	Description
User-defined Remote Loopback on T1 Interfaces	Cisco IOS XE 17.13.1	You can customize the loopback codes on T1 in a 16-bit format in contrast to the standard 6-bit loop code on the 48-port T1 interface module.

For this release, you can configure the custom code only in the transmit direction (Tx) with ESF framing. The user-defined loop codes are supported only on the ASR-920-12SZ-IM module.

The list of supported loop codes are:

- 0xFF48, 0xFF24, 0xD3D3, 0x3F02, 0x9393, 0xD5D5, 0xD5D6, and 0x6767
- 0xDBDB, 0xC741, 0xC754, 0xC743, 0xC742, 0xFF1E, 0xC541, and 0x12FF
- 0x5F5F, 0x56D7, 0x56D8, 0x56DF, 0x56FB, 0xD5D6, 0xD5D5, and 0x5688
- 0x5687, 0xC564, 0x9393, 0x24FF, 0xC741, 0xC742, 0xC743, and 0xC744
- 0xC745, 0xC746, 0xC747, 0xC748, 0xC749, 0xC74A, 0xC74B, and 0xC74C
- 0xC74D, 0xC74E, 0xC74F, 0xC750, 0xC751, 0xC752, 0xC753, and 0xC754

Configuring User-defined Remote Loopback on T1 Interfaces

You can configure a T1 remote loopback with ESF framing and 16-bit custom code on PE router.

```
PE1#config terminal
PE1(config)#controller T1 0/4/47
PE1(config-controller)#loopback remote esf line custom_code 0x9393
PE1(config-controller)#end
```

You can verify the remote loopback configuration using the following **show** command:

```
PE1#show run | sec 0/4/47
controller T1 0/4/47
threshold sd-ber 6
threshold sf-ber 3
framing esf
linecode b8zs
cablelength short 110
loopback remote esf line custom_code 0x9393
no snmp trap link-status
```

Verifying User-defined Remote Loopback on T1 Interfaces

Use the following **show** commands to verify the user-defined remote loopback:

```
PE1#show controller T1 0/4/47
T1 0/4/47 is up (Far End Line Loopback with ESF BOC Custom Code)
Currently in FDL Custom Code Remotely Line Looped
Applique type is
Cablelength is short 110
Receiver has no alarms.
alarm-trigger is not set
Soaking time: 3, Clearance time: 10
Framing is ESF, Line Code is B8ZS, Clock Source is Line.
BER thresholds: SF = 10e-3 SD = 10e-6
Data in current interval (870 seconds elapsed):
Near End
```

```
PE1#show facility-alarm status | i 0/4/47
T1 0/4/47 May 10 2023 14:13:54 MINOR LOOPBACK_REMOTE_FDL_CUSTOM_COD
Loopback Remote Line FDL Custom Code Alarm [22]
```




CHAPTER 7

Additional References

This appendix describes additional CEM features that are used on the router. This appendix describes the following topics:

- [Linecode Configuration and Supported Patterns, on page 47](#)

Linecode Configuration and Supported Patterns

The following pattern for linecode configuration is supported for T1 or E1.

Table 12: Linecode Configuration and Pattern Supported on T1 or E1 Controllers

Part Number	Linecode Configuration	T1 or E1	Random Pattern
XRT83VSH316 LIU	B8ZS/AMI	T1	QRSS
	HDB3/AMI	E1	PRBS15

Configuration Using AMI Linecodes at Both Ends (UUT (AMI) and TESTER (AMI))

When both sides are configured as AMI, the linecodes match and the T1 or E1 controller is always UP with a smooth traffic flow.

Configuration Using Different Linecodes at Both Ends (UUT (AMI) and TESTER (B8ZS or HDB3))

- The line codes do not match when one side is configured with AMI and other side is configured with non-AMI codes such as B8ZS or HDB3. Based on the pattern that is inserted, there is change in the behavior.
- For 511 QRSS pattern, although the line codes do not match, the controller is UP. The controllers go DOWN for other patterns.
- Each pattern is unique and contains a combination of ones and zeros. Only the pattern 511 QRSS is supported. If patterns other than 511 QRSS are used, then LOS is generated, and controller goes to the DOWN state.

The following table details the configuration using same and different linecodes at both ends and the pattern that is supported on T1 (UUT mode) controller:

Table 13: Configuration Using Linecodes for T1 Controllers

Pattern Mode (ANSI)	Pattern with UUT (AMI) and TESTER (B8zS)	UUT(AMI) and TESTER (AMI)
511 QRSS	Controller is UP. Linecodes do not match.	T1 controller is UP on UUT. Linecodes match.
QRSS	UUT controller is DOWN.	T1 controller is UP on UUT. Linecodes match.
2047 QRSS	UUT controller is DOWN.	T1 controller is UP on UUT. Linecodes match.

The following table details configuration using same and different linecodes at both ends and the pattern that is supported on E1 (UUT mode) controller:

Table 14: Configuration Using Linecodes for E1 Controllers

Pattern Mode (ANSI)	Pattern with UUT (AMI) and TESTER (B8zS)	UUT(AMI) and TESTER (AMI)
2^15- 1	Controller is DOWN.	E1 controller is UP on UUT. Linecodes match.
2^15- 1 INV	Controller is DOWN.	E1 controller is UP on UUT. Linecodes match.