



Configuring T1/E1 Interfaces on 48-Port T1/E1 Interface Module

This chapter provides information about configuring the T1/E1 interfaces on the 48-Port T1/E1 interface module:



Note Effective Cisco IOS XE Release 16.5.1S, E1 interface is supported.

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Information About T1/E1 Interfaces

The following sections provide information about T1/E1 interfaces.

Overview of T1/E1 Interfaces

The 48-Port T1/E1 interface module on CEM line card supports generic single or dual-port T1/E1 trunk interfaces for voice, data, and integrated voice or data applications.

Restrictions for Configuring T1/E1 Interfaces

- You can configure CEM to support serial interface configuration.
- The supported BERT patterns are 2¹¹, 2¹⁵, 2²⁰-O153, 2²⁰-QRSS, and 2²³.
- The card can be configured either in the T1 or E1 mode only but the combination of T1 and E1 ports is not supported.

How to Configure T1/E1 Interfaces

This section provides information about configuring T1/E1 interfaces on the 48-Port T1/E1 interface module.

Recommended Pattern for Linecode

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

Table 1: 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 2: 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 3: 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.

Setting the Card Type

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

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

Configuring the Controller

To configure T1 interface, use the following commands:

```
enable
configure terminal
controller t1 0/3/0
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 0/3/0
clock source internal
framing crc4
linecode hdb3
no shut
exit
```



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

Verifying the Controller Configuration

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

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 t10/0/0
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 0/0/0

CEM0/0/0, 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
```

Overview of 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 BERT is *not* supported in system direction for framed SAtOP.



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)	LOF—Starting from Cisco IOS XE Fuji 16.9.4 release	Yes	No
CESOP	LOF	Down (Data path remains up)	AIS	Yes	Yes

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

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 0/0/0
```

```

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 0/0/0

CEM0/0/0, 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

```

Performance Monitoring

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 0/2/1

T1 0/2/1 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 0/2/1

E1 0/2/1 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
```

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.

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 0/4/32  
cem-group 0 timeslots 1-10
```

Configure cross-connect:

```
enable  
configure terminal  
interface cem 0/4/32  
cem 0  
xconnect 2.2.2.2 10 encapsulation mpls
```

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

```
show running-config | sec 0/8/16  
controller T1 0/8/16  
framing esf  
linecode b8zs  
cablelength short 110  
cem-group 0 timeslots 1-10  
interface CEM0/8/16  
no ip address  
cem 0  
xconnect 2.2.2.2 10 encapsulation mpls
```

Check for cross-connect configuration using the following command:

```

Router#show xconnect all | i 0/4/32
UP pri ac CE0/4/32:0(CESoPSN Basic) UP mpls 2.2.2.2:10 UP

Router#sh controllers t1 0/4/32
T1 0/4/32 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
CE0/4/32	CESoPSN Basic 0	2.2.2.2	10	UP

```

PE1#sh mpls l2 vc 10 detail
Local interface: CE0/4/32 up, line protocol up, CESoPSN Basic 0 up
  Destination address: 2.2.2.2, VC ID: 10, VC status: up
  Output interface: Te0/0/0, imposed label stack {650}
  Preferred path: not configured
  Default path: active
  Next hop: 123.123.123.2
  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 2.2.2.2:0 up
  Targeted Hello: 1.1.1.1(LDP Id) -> 2.2.2.2, 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: 2.2.2.2/10, 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

```

Troubleshooting T1/E1 Controllers

You can use the following methods to troubleshoot the T1/E1 controllers:

Running Bit Error Rate Testing for SAToP

Bit error rate testing (BERT) is supported on T1/E1 interfaces. You can run BERTs on 16 controllers out of 48 T1/E1 controllers at a time.

The interface module contains onboard BERT circuitry. With this, the interface module 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. BERT allows you to test cables and signal problems in the field. BERT is supported for both unframed and framed modes. BERT in system side direction is not supported for framed SAToP.



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

When running a BERT test, your system expects to receive the same pattern that it is transmitting. 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 following keywords list different BERT keywords and their descriptions.

Table 7: BERT Pattern Descriptions

Keyword	Description
2^11	Pseudo-random test pattern that is 2,048 bits in length.
2^15	Pseudo-random O.151 test pattern that is 32,768 bits in length.
2^20-O153	Pseudo-random O.153 test pattern that is 1,048,575 bits in length.
2^20-QRSS	Pseudo-random QRSS O.151 test pattern that is 1,048,575 bits in length.

Keyword	Description
2^23	Pseudo-random 0.151 test pattern that is 8,388,607 bits in length.

The total number of error bits received, and the total number of 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.

BERT is supported in two directions:

- Line - supports BERT in TDM direction
- System - supports BERT in PSN direction



Note Before starting system side BERT, you must configure CEM. When the BERT is configured towards system direction, it internally loopbacks the TDM side.

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)

Bit Error Rate Testing for CESoPSN

Bit-Error Rate Testing (BERT) is used for analyzing quality and problem resolution of digital transmission equipment. BERT tests the quality of an interface by directly comparing a pseudorandom or repetitive test pattern with an identical locally generated test pattern. 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:

- T1NxDS0, DS1

- T3NxDS0, DS1 (channelised), clear channel DS3.
- OCXNxDS0, DS1 (channelised), DS3(channelised), clear channel DS3, STS1, STS-nc, VT-1.5, VT1.5 T1

Restrictions for BERT in CESoPSN

- The BERT patterns supported are 2¹¹, 2¹⁵, 2²⁰-O153, and 2²⁰-QRSS.
- For the line side BERT to be configured at timeslot level, the first CEM should be configured and it should be present at the same timeslot level where the BERT is configured.
- The system side BERT is not supported on partial timeslots. For the system side BERT, use full timeslots.

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 0/4/32
T1 0/4/32 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.

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 0/0/1
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 0/0/1
loopbackdiag
exit
```

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

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



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



Note Network payload configuration is not supported on 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.
- Loopback remote is not supported when cem-group is configured under T1.

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 0/0/1
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 0/0/1
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 0/0/1
controller T1 0/2/10
  threshold sd-ber 6
  threshold sf-ber 3
  framing sf
  linecode b8zs
  cablelength short 110
  loopback remote iboc facl
```

Use the following command to verify the loopback remote configuration:

```
router# show controller t1 0/0/1
T1 0/0/1 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

```

Associated Commands

The commands used to configure the Interfaces.

Commands	URL
card type	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2336574570
cem-group	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600
payload-size dejitter-buffer	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp3946673156
class cem	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2169323859
controller t1/e1	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1472647421
xconnect	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t2.html#wp8578094790
linecode	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-11.html#wp2312535965
framing	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-f1.html#wp2853515177
clock source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140
cable length	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2492964151
bert pattern	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-a1.html#wp3620978929

Commands	URL
channelized	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp7026926390
loopback	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l1.html#wp1033903426
show controller t1	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s3.html#wp2149471094
show controller e1	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s2.html#wp1632676058

Additional References for Configuring 48-Port T1/E1 CEM Interface Module

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Standards and RFCs

Standard/RFC	Title
—	<i>There are no standards and RFCs for this feature.</i>

MIBs

MIB	MIBs Link
—	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

