



48-Port T3/E3 CEM Interface Module Configuration Guide, Cisco IOS XE 16 (Cisco NCS 4200 Series)

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CHAPTER

1

Configuring T3 or E3 Interfaces on 48-Port T3 or E3 Interface Module

T3 or E3 interface on the 48-Port T3 or E3 Interface Module supports 48 ports. The channels on the T3 or E3 interface can be configured as either clear channel mode or channelized mode.



Note T3/E3 is supported only on Cisco ASR 900 RSP3 Module.

- [Information About T3/E3 Interfaces, on page 1](#)
- [How to Configure T3/E3 Interfaces, on page 2](#)
- [Circuit Emulation Service over Packet-Switched Network, on page 34](#)
- [Troubleshooting T3/E3 Controllers, on page 37](#)
- [Associated Commands, on page 48](#)
- [Additional References for Configuring 48-Port T3/E3 CEM Interface Module , on page 49](#)

Information About T3/E3 Interfaces

The following sections provide information about T3/E3 interfaces.

Overview of T3/E3 Interfaces

The T3 or E3 interface supports two modes, clear channel mode and channelized mode. You can enable 28T1 or 16E1 only in channelized mode. Each T1 or E1 channel can be configured to use the entire T1 or E1 bandwidth for data transmission.

Benefits of T3/E3 Interfaces

The following are the benefits of T3/E3 interfaces:

- Higher bandwidth
- Flexibility by channelization

Restrictions for Configuring T3 or E3 Interfaces

- You can configure CEM to support serial interface configuration.
- The supported BERT patterns are 2¹¹, 2¹⁵, 2²⁰-O153, 2²⁰-QRSS and 2²³. The zero patterns are not supported.
- DS0 level Channelization is *not* supported.
- The g832 framing mode is *not* supported.
- Loopback remote is *not* supported.
- Synchronization Status Message (SSM) is not supported on T3 ports.
- The interoperability of Maintenance Data Link (MDL) is not supported with earlier version interface modules.
- The T3 or E3 port does not support sending Alarm Indication Signal (AIS) when local loopback is configured.

How to Configure T3/E3 Interfaces

This section provides the information about how to configure a T3/E3 interface. The T3/E3 interface can be configured as clear channel mode or channelized mode.

Setting the Port

To enable the port on the T3/E3 interface module, follow these steps:

```
enable
configure terminal
controller mediatype 0/4/0
mode t3
exit
```

Configuring the Controller of Clear Channel T3/E3 Interfaces

Before You Begin

When the clear channel T3/E3 interface is used for the first time, the running configuration does not show the T3/E3 controller. You can use the **show platform** command to check whether the chassis recognizes the T3/E3 port and initializes the card correctly. After the port is configured for the slot, the respective controller appears in the running configuration and you can configure the clear channel T3/E3 interface.

Perform this task to configure clear channel controller as T3.

```
enable
configure terminal
controller t3 0/4/40
no channelized
clock source line
```



```
no shut
exit
```



Note By default, the T3 controller is in C-Bit framing mode. To configure CEM, the framing mode must be set to unframed.

Perform this task to configure clear channel controller as E3.

```
enable
configure terminal
controller e3 0/4/40
clock source line
no shut
exit
```

Verifying Controller Configuration of Clear Channel T3 Interfaces

Use the **show controllers** command to verify the controller configuration of clear channel T3 interface:

```
Router# show controllers t3 0/4/40
T3 0/4/40 is up.
  Hardware is ASR903-48T3E3-CE

  Applique type is Clear Channel T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  BER thresholds: SF = 10e-10 SD = 10e-10
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      0 Unavailable Secs, 0 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      0 Severely Errored Line Secs, 0 Path Failures
      0 AIS Defect Secs, 0 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      20 Unavailable Secs, 20 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      20 Severely Errored Line Secs, 1 Path Failures
      0 AIS Defect Secs, 20 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
```

```

Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

Verifying Controller Configuration of Clear Channel E3 Interfaces

Use the **show controllers** command to verify the controller configuration of clear channel E3 interface:

```

Router# show controllers e3 0/4/40
E3 0/4/40 is up.
Hardware is ASR903-48T3E3-CE

```

```

Applique type is Clear Channel e3
No alarms detected.
MDL transmission is disabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  20 Unavailable Secs, 20 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 Path Failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs

E1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Configuring the Controller of Channelized T3/T1 or E3/E1 Interfaces

Before You Begin

When the channelized T3/T1 or E3/E1 interface is used for the first time, the running configuration does not show the T3/E3 controller. You can use the **show platform** command to check if the chassis recognizes the T3/E3 port and initializes the card properly. After the port is configured for the slot, the respective controller appears in the running configuration and you can configure the channelized T3/T1 or E3/E1 interface.

Perform this task to configure channelized controller as T3/T1.

```

enable
configure terminal
controller t3 0/4/46
channelized
clock source line
no shut
exit

```



Note The channelized mode is the default mode for T3 interface.

Perform this task to configure channelized controller as E3/E1.

```

enable
configure terminal
controller e3 0/4/46
channelized mode e1

```

```
framing g751
exit
```



Note The clear channel mode is the default mode for E3 interface.

Verifying the Controller Configuration of Channelized T3 or T1 Interfaces

Use the **show controllers** command to verify the controller configuration of channelized T3 or T1 interfaces:

```
Router# show controllers t3 0/4/46

T3 0/4/46 is down.
Hardware is ASR903-48T3E3-CE

Applique type is Channelized T3
No alarms detected.
MDL transmission is disabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
```

```

    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Verifying the Controller Configuration of Channelized E3 or E1 Interfaces

Use the **show controllers** command to verify the controller configuration of channelized E3 or E1 interfaces:

```

Router# show controllers e3 0/4/46

E3 0/4/46 is down.
Hardware is ASR903-48T3E3-CE
  Applique type is Channelized E3
  No alarms detected.
  MDL transmission is disabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):

```

```

Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  20 Unavailable Secs, 20 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 Path Failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
E1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations

```

```

    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Configuring SAToP - Clear Channel T3 or E3 Interfaces

Before You Begin

Before Structure-Agnostic TDM over Packet (SAToP) is configured, the controller of clear channel T3 interface must be configured.

```

enable
configure terminal
controller t3 0/4/40
no channelized
cem-group 0 unframed
interface CEM 0/4/40
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit

```

Before You Begin

Before SAToP is configured, the controller of clear channel E3 interface must be configured.

```

enable
configure terminal
controller e3 0/4/40
no channelized
cem-group 0 unframed
interface CEM 0/4/40
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit

```

Verifying the configuration



Note The **no channelize** is displayed in show running-configuration when cem-group 0 unframed is configured.

```

Router(config-controller)# show run
controller MediaType 0/4/40
mode e3
controller 0/4/40

```



```

threshold sd-ber 6
threshold sf-ber 3
no channelized
framing g751
cablelength short
  cem-group 0 framed
controller MediaType 0/4/40
interface CEM8/1/10/4/40
  no ip address
  cem 0
!
```

Verifying CEM Configuration of Clear Channel T3 or E3 Interfaces for SAToP

Use the **show run interface** command to verify the configuration of xconnect:

```

Router# show run interface cem 0/4/40

Current configuration : 96 bytes
!
interface CEM 0/4/40
no ip address
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
!
end
```

Use the **show cem circuit int cem** command to verify the CEM interface configuration of clear channel T3 or E3 interface for SAToP:

```

Router# show cem circuit int cem 0/4/40

CEM 0/4/40, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: down, T3 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 1024
Framing: Unframed
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    1321577          Dropped:          0
Egress Pkts:    1321577          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 SAToP - Channelized T3/T1 Interfaces

Before You Begin

Before SAToP is configured, the controller of channelized T3/T1 interface must be configured.

```
enable
configure terminal
controller t3 0/4/12
channelized
t1 1 cem-group 0 unframed
interface CEM 0/4/12
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit
```

Verifying the CEM Configuration of Channelized T3 or T1 Interfaces

Use the **show run controller** command to verify the CEM configuration of channelized T3 or T1 interface:

```
Router# show run controller t3 0/4/46
```

```
Current configuration : 109 bytes
!
Controller T3 0/4/46
framing c-bit
cablelength short
t1 1 cem-group 0 unframed
end
```

Use the **show cem circuit int cem** command to verify the CEM configuration of channelized T3 or T1 interface:

```
Router# show cem circuit int cem 0/4/46
```

```
CEM0/4/46, ID: 1, 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:    105043259          Dropped:          0
Egress Pkts:    105043387          Dropped:          0

CEM Counter Details
Input Errors:    0                Output Errors:    0
Pkts Missing:   0                Pkts Reordered:  0
Misorder Drops: 0                JitterBuf Underrun: 32
Error Sec:      0                Severly Errored Sec: 0
Unavailable Sec: 0                Failure Counts:   0
```

```

Pkts Malformed: 0                               JitterBuf Overrun: 0
-
-
-
CEM0/4/46, ID: 28, 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: 136303 Dropped: 0
Egress Pkts: 0 Dropped: 0

CEM Counter Details
Input Errors: 0 Output Errors: 0
Pkts Missing: 135682 Pkts Reordered: 0
Misorder Drops: 0 JitterBuf Underrun: 137649
Error Sec: 0 Severly Errored Sec: 0
Unavailable Sec: 0 Failure Counts: 135
Pkts Malformed: 0 JitterBuf Overrun: 0

```

Configuring SAToP - Channelized E3/E1 Interfaces

Before You Begin

Before SAToP is configured, the controller of channelized E3/E1 interfaces must be configured.

```

enable
configure terminal
controller e3 0/4/46
channelized
e1 1 cem-group 0 unframed
interface CEM 0/4/46
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit

```

Verifying the CEM Configuration of Channelized E3/E1 Interfaces

Use the **show run controller** command to verify the CEM configuration of channelized E3 or E1 interface:

```

Router# show run controller e3 0/4/46

Current configuration : 109 bytes
!
Controller E3 0/4/46
framing c-bit
clock source line
cablelength short
e1 1 cem-group 0 unframed
end

```

Use the **show cem circuit int cem** command to verify the CEM configuration of channelized E3 or E1 interface:

```
Router# show cem circuit int cem 0/4/46

CEM0/4/46, ID: 1, 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: 256
Framing: Unframed
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    105043259          Dropped:          0
Egress Pkts:    105043387          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 - Channelized T3/T1 Interfaces



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

To configure the controller of channelized T3/T1 interface for framed SAToP:

```
enable
configure terminal
controller t3 0/4/46
channelized mode
framing c-bit
t1 1 cem-group 0 framed
interface CEM 0/4/46
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit
```

Verifying the CEM Configuration of Channelized T3 or T1 Interfaces for Framed SAToP

Use the **show run controller** command to verify the CEM configuration of channelized T3 or T1 interface for Framed SAToP:

```
Router# show run controller t3 0/4/46

Current configuration : 109 bytes
!
```

```

Controller T3 0/4/46
framing c-bit
cablelength short
t1 1 cem-group 0 framed
end

```

Use the **show cem circuit int cem** command to verify the CEM configuration of channelized T3 or T1 interface for Framed SAToP:

```

Router# show cem circuit int cem 0/4/46

CEM0/4/46, ID: 1, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Channelized-T1, T1: 1, 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: 27146 Dropped: 0
Egress Pkts: 27146 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

```

Configuring Framed SAToP - Channelized E3/E1 Interfaces

To configure the controller of channelized E3/E1 interfaces for Framed SAToP:

```

enable
configure terminal
controller e3 0/4/46
channelized mode e1
framing g751
e1 1 cem-group 0 framed
interface CEM 0/4/46
cem 0
xconnect 10.10.2.2 204 encapsulation mpls
exit

```

Verifying the CEM Configuration of Channelized E3 or E1 Interfaces for Framed SAToP

Use the **show run controller** command to verify the CEM configuration of channelized E3 or E1 interface for Framed SAToP:

```
Router# show run controller e3 0/4/46
```

```
Current configuration : 109 bytes
!
Controller E3 0/4/46
clock source line
cablelength short
e1 1 cem-group 0 framed
end
```

Use the **show cem circuit int cem** command to verify the CEM configuration of channelized E3 or E1 interface for Framed SAToP:

```
Router# show cem circuit int cem 0/4/46
```

```
CEM0/4/46, ID: 1, Line: UP, Admin: UP, Ckt: ACTIVE
CEM0/4/46, ID: 1, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Channelized-E1, E1: 1, CEM Mode: E1-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: 27146 Dropped: 0
Egress Pkts: 27146 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
```

Configuring MDL for T3 Interfaces

Maintenance Data Link (MDL) messages are used to communicate identification information between local and remote ports. The MDL message includes:

- Equipment Identification Code (EIC)
- Location Identification Code (LIC)
- Frame Identification Code (FIC)
- Unit
- Path Facility Identification (PFI)
- Port Number
- Generator Identification Number



Note MDL messages are only supported when the T3 framing is set for C-bit parity.

The **no mdl** command removes the configuration of mdl messages.



Note MDL configuration is *not* supported for E3 interfaces.

Configuring MDL for Path Transmission

To configure MDL path transmission messages on T3 controller configuration mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/17
framing c-bit
mdl string eic beic
mdl string lic beic
mdl string fic bfix
mdl string unit bunit
mdl string pfi bpfi
mdl transmit path
```

Verifying MDL for Path Transmission Configuration

For PE1 Configuration:

Use the **show controller** command to display the verification of MDL path transmission configuration.

```
Router# show controllers t3 0/0/17

T3 0/0/17 is up.
  Hardware is ASR903-48T3E3-CE

  Applique type is Channelized T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  BER thresholds: SF = 10e-10 SD = 10e-10
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      0 Unavailable Secs, 0 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      0 Severely Errored Line Secs, 0 Path Failures
      0 AIS Defect Secs, 0 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
```

```

    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs

```



```

Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

For PE2 Configuration:

Use the **show controller** command to display the verification of MDL path transmission configuration.

```

Router# show controllers t3 0/0/18

T3 0/0/18 is up.
  Hardware is ASR903-48T3E3-CE

Applique type is Channelized T3
  No alarms detected.
  MDL transmission is enabled

Far-End MDL Information Received
  EIC: beic, LIC: beic, FIC: bfix, UNIT: bunit
  Idle Signal PORT_NO: bport
FEAC code received: DS3 Out-Of-Frame
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
Clock Source is internal
Equipment customer loopback

Data in current interval (240 seconds elapsed):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs

```

```

    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Configuring MDL for Idle Signal

To configure MDL idle signal messages on T3 controller configuration mode, use the following commands:

```

enable
configure terminal
controller T3 0/0/17
framing c-bit
mdl string eic beic
mdl string lic beic
mdl string fic bfix
mdl string unit bunit
mdl string port bport
mdl transmit idle-signal

```

Verifying MDL for Idle Signal Configuration

For PE1 Configuration:

Use the **show controller** command to display the verification of MDL for idle signal configuration.

```
Router# show controllers t3 0/0/17

T3 0/0/17 is up.
  Hardware is ASR903-48T3E3-CE

  Applique type is Channelized T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  BER thresholds: SF = 10e-10 SD = 10e-10
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      0 Unavailable Secs, 0 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      0 Severely Errored Line Secs, 0 Path Failures
      0 AIS Defect Secs, 0 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      20 Unavailable Secs, 20 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      20 Severely Errored Line Secs, 1 Path Failures
      0 AIS Defect Secs, 20 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
  Total Data (last 1 15 minute intervals):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations,
      0 C-bit Coding Violations, 0 P-bit Err Secs,
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
      20 Unavailable Secs, 20 Line Errored Secs,
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      20 Severely Errored Line Secs, 1 path failures
      0 AIS Defect Secs, 20 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs

T1 1 is up
  timeslots:
  FDL per AT&T 54016 spec.
  No alarms detected.
```

```

Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

For PE2 Configuration:

Use the **show controller** command to display the verification of MDL for idle signal configuration.

```
Router# show controllers t3 0/0/18
```

```

T3 0/0/18 is up.
Hardware is ASR903-48T3E3-CE

Applique type is Channelized T3
No alarms detected.
MDL transmission is enabled

Far-End MDL Information Received
  EIC: beic, LIC: beic, FIC: bfix, UNIT: bunit
  Idle Signal PORT_NO: bport
FEAC code received: DS3 Out-Of-Frame
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
Clock Source is internal
Equipment customer loopback

Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs

```

```

    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures
```

Configuring MDL for Test Signal

To configure MDL test signal messages on T3 controller configuration mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/17
framing c-bit
mdl string eic beic
mdl string lic beic
mdl string fic bfix
mdl string unit bunit
mdl string generator bgen
mdl transmit test-signal
```

Verifying MDL for Test Signal Configuration

For PE1 Configuration:

Use the **show controller** command to display the verification of MDL for test signal configuration.

```
Router# show controllers t3 0/0/17
T3 0/0/17 is up.
Hardware is ASR903-48T3E3-CE

Applique type is Channelized T3
No alarms detected.
MDL transmission is enabled
  EIC: beic, LIC: beic, FIC: bfix, UNIT: bunit
  Test Signal GEN_NO: bgen
FEAC code received: DS3 Out-Of-Frame
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
```

```

    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,

```

```

3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
0 Unavailable Secs, 0 Path Failures

```

For PE2 Configuration:

Use the **show controller** command to display the verification of MDL for test signal configuration.

```

Router# show controllers t3 0/0/18
T3 0/0/18 is up.
  Hardware is ASR903-48T3E3-CE

  Applique type is Channelized T3
  No alarms detected.
  MDL transmission is disabled

  Far-End MDL Information Received
    EIC: beic, LIC: beic, FIC: bfix, UNIT: bunit
    Test Signal GEN_NO: bgen
  FEAC code received: DS3 Out-Of-Frame
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      0 Unavailable Secs, 0 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      0 Severely Errored Line Secs, 0 Path Failures
      0 AIS Defect Secs, 0 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
  Data in Interval 1:
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      20 Unavailable Secs, 20 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      20 Severely Errored Line Secs, 1 Path Failures
      0 AIS Defect Secs, 20 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs
  Total Data (last 1 15 minute intervals):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations,
      0 C-bit Coding Violations, 0 P-bit Err Secs,
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
      20 Unavailable Secs, 20 Line Errored Secs,
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      20 Severely Errored Line Secs, 1 path failures
      0 AIS Defect Secs, 20 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs
      0 C-bit Unavailable Secs, 0 Path Failures
      0 Code Violations, 0 Service Affecting Secs

T1 1 is up
  timeslots:

```



```

FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

Performance Monitoring

You can view the statistics or error count generated on the TDM lines for T3 interfaces.

```

enable
configure terminal
controller MediaType 0/0/0
mode t3
controller t3 0/0/0
framing c-bit
cablelength
long 224-450 ft
short 0-224 ft
controller MediaType 0/0/15
mode t3
controller T3 0/0/15
framing c-bit
cablelength short

```

To view the statistics or error count generated on the TDM lines for T3 interfaces, use the **show controller** command:

```

Router# show controller T3 0/0/0
T3 0/0/0 is up.
Hardware is ASR900-48T3E3-CE

Applique type is Channelized T3
No alarms detected.
MDL transmission is disabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  20 Unavailable Secs, 20 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 Path Failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Use Case 1

If your configuration is as follows:

- T3 is up
- No Alarms
- Framing is unframed
- Clock Source is Internal

This performance monitoring result is displayed:

```

T3 is up
No alarms detected.
Framing is unframed, Clock Source is Internal
Data in current interval (240 seconds elapsed):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations

```

```

    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,

```

```

3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
0 Unavailable Secs, 0 Path Failures

```

Use Case 2

If your configuration is as follows:

- T1 28 is up or E1 16 is up
- No alarm received
- Framing is unframed
- Clock Source is Internal

This performance monitoring result is displayed:

```

T1 28 is up
No alarms detected.
Framing is unframed, Clock Source is Internal
Data in current interval (240 seconds elapsed):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.

```

```

Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

To view the statistics or error count generated on the TDM lines for T3 interfaces, use the **show controller** command is:

```

Router# show controllers t3 0/0/0
T3 0/0/0 is down.
Hardware is ASR900-48T3E3-CE

Applique type is Channelized T3
Receiver has loss of signal.
Framing is Unknown, Line Code is B3ZS, Cablelength Short less than 225ft
Clock Source is internal
Equipment customer loopback
Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:

```

```

Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  20 Unavailable Secs, 20 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 Path Failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations

```

```

0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
3 Errored Secs, 0 Bursty Err Secs, 3 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 T3 or E3 Controller

- The maximum number of CEM interface supported is 1344.
- The change of framing from C-bit to M13 is not supported on the T3 interface, where as the change of framing from g751 to g832 is supported on the E3 interface.
- CT3-E1 and CE3-T1 is not supported and only CT3-T1 and CE3-E1 is supported.
- DS0 loopback is not supported on the T3 interface.
- Alarm forwarding is not supported on the T3 interface.
- Card protection is not supported on the T3 interface.

Configuring CESoPSN on T3 or E3 Interfaces

Before You Begin

Create CEM group for channelized T3 interface, use the following commands:

```

enable
configure terminal
controller MediaType 0/5/1
 mode t3
channelized
controller T3 0/5/1
 framing c-bit
 cablelength short
 t1 1 cem-group 1 timeslots 10
exit

```

Create CEM group for channelized E3 interface, use the following commands:

```

enable
configure terminal
controller MediaType 0/5/1
 mode e3
channelized mode e1
controller e3 0/14/0
channelized
 cablelength short
 e1 1 cem-group 0 timeslots 10
exit

```

Configure xconnect:


```
int cem 0/14/0
cem 0
xconnect 1.1.1.1 9999 encapsulation mpls
```

Verify the xconnect status:

```
sh xconnect all | i 9999
UP pri ac CE0/14/0:0(CESoPSN Basic) UP mpls 1.1.1.1:9999 UP
```

Verifying CESoPSN Configurations on E3 Interface

This section includes show commands for CESoPSN:

```
Router# show controllers e3 0/14/2
E3 0/14/2 is up.
Hardware is ASR903-48T3E3-CE
Applique type is Channelized E3
No alarms detected.
Framing is E3 G751, Line Code is HDB3, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal, National Bit 0
Equipment customer loopback
Data in current interval (240 seconds elapsed):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  0 Unavailable Secs, 0 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  0 Severely Errored Line Secs, 0 Path Failures
  0 AIS Defect Secs, 0 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
  0 Line Code Violations, 0 P-bit Coding Violations
  0 C-bit Coding Violations, 0 P-bit Err Secs
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
  20 Unavailable Secs, 20 Line Errored Secs
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 Path Failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
  0 Line Code Violations, 0 P-bit Coding Violations,
  0 C-bit Coding Violations, 0 P-bit Err Secs,
  0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
  20 Unavailable Secs, 20 Line Errored Secs,
  0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
  20 Severely Errored Line Secs, 1 path failures
  0 AIS Defect Secs, 20 LOS Defect Secs
Far End
  0 Errored Secs, 0 Severely Errored Secs
  0 C-bit Unavailable Secs, 0 Path Failures
  0 Code Violations, 0 Service Affecting Secs
```

```

E1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is crc4, Clock Source is Internal, National bits are 0x1F.
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations, 0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
  3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
  0 Unavailable Secs, 0 Stuffed Secs
  1 Path Failures, 2 SEF/AIS Secs
Far End
  0 Line Code Violations,0 Path Code Violations
  0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
  3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
  0 Unavailable Secs, 0 Path Failures

```

```
router# sh mpls 12 vc interface cem 0/14/0 0
```

Local intf	Local circuit	Dest address	VC ID	Status
CE0/14/0	CESoPSN Basic 0	1.1.1.1	9999	UP

```
router# sh mpls 12transport vc 9090 detail
```

```

Local interface: CE0/14/2 up, line protocol up, CESoPSN Basic 0 up
Destination address: 1.1.1.1, VC ID: 9090, VC status: up
Output interface: Te0/12/0, imposed label stack {130}
Preferred path: not configured
Default path: active
Next hop: 123.123.123.1
Create time: 00:18:44, last status change time: 00:18:30
Last label FSM state change time: 00:18:30
Signaling protocol: LDP, peer 1.1.1.1:0 up
Targeted Hello: 2.2.2.2(LDP Id) -> 1.1.1.1, LDP is UP
Graceful restart: not configured and not enabled

```

```

Non stop routing: 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 130, remote 130
Group ID: local 207, remote 220
MTU: local 0, remote 0
Remote interface description:
Sequencing: receive disabled, send disabled
Control Word: On (configured: autosense)
SSO Descriptor: 1.1.1.1/9090, local label: 130
Dataplane:
  SSM segment/switch IDs: 1237749/557811 (used), PWID: 114
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
ASR907# sh cem circuit interface cem 0/14/2 0
CEM0/14/2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Channelized-E1, E1: 1, CEM Mode: E1-CESoP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 160
Framing: Framed (DS0 channels: 1-20)
CEM Defects Set
None
Signalling: No CAS
RTP: No RTP
Ingress Pkts:   24005           Dropped:           0
Egress Pkts:   24005           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
Generated Mbits: 0             Received Mbits:    0

```

Troubleshooting T3/E3 Controllers

You can use the following methods to troubleshoot the T3/E3 controllers on the chassis:

Running Bit Error Rate Testing for SAToP

Bit error rate testing (BERT) is supported on T3/E3 interfaces. You can run 16 BERTs at a time. The test can be either of the T1/E1 or the T3/E3 interface.

The interface contains on board BERT circuitry. With this, 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.

BERT is not supported in system direction for framed SAToP. Framing type should be maintained same in all routers end to end.

When running a BERT test, your system must receive the same pattern that it is transmitting. So, ensure the two common options are available:

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

Table 1 lists different BERT keywords and their descriptions.

Table 1: 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.
2^23	Pseudo-random O.151 test pattern that is 8,388,607 bits in length.

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.

BERT is supported in two directions:

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



Note When the BERT is configured towards the system direction, it internally loopbacks the TDM side.

Configuring BERT for Clear and Channelized T3/E3 Interfaces

Before You Begin

Before you configure BERT for clear channel T3/E3 interfaces, ensure that controller and CEM are configured.

To run a BERT on clear channel T3/E3 interface, perform the following tasks in global configuration mode.

```
enable
configure terminal
controller t3 0/0/1
no channelized
bert pattern 0s interval 30 direction line
exit
```

To run a BERT on channelized T3/T1 interface or channelized E3/E1 interface, perform the following tasks in global configuration mode.

```
enable
configure terminal
controller t3 0/0/1
channelized
t1 1 bert pattern 0s interval 30 direction line
exit
```



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

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

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

Verifying the BERT Configuration for T3/E3 Interfaces

Use the **show controller** command to verify the BERT configuration for clear channel T3/E3 interfaces:

```
Router# show controllers t3 0/4/40 | sec BERT
BERT test result (running)
  Test Pattern : 2^15, Status : Not Sync, Sync Detected : 0
  DSX3 BERT direction : Line
  Interval : 5 minute(s), Time Remain : 3 minute(s)
  Bit Errors (since BERT started): 0 bits,
  Bits Received (since BERT started): 0 Kbits
  Bit Errors (since last sync): 0 bits
  Bits Received (since last sync): 0 Kbits
```

Use the **show controller** command to verify the BERT configuration of channelized T3/T1 interfaces or channelized E3/E1 interfaces:

```
Router# sh controller t3 0/3/0 | be T1 1
T1 1 is up
  timeslots:
  FDL per AT&T 54016 spec.
  Receiver is getting AIS.
  Framing is ESF, Clock Source is Internal
BERT test result (running)
  Test Pattern : 2^23, Status : Not Sync, Sync Detected : 0
  Interval : 5 minute(s), Time Remain : 00:01:44
  Bit Errors (since BERT started): 299 Mbits,
  Bits Received (since BERT started): 299 Mbits
```

```

    Bit Errors (since last sync): 0 bits
    Bits Received (since last sync): 0 Kbits
    Direction   : Line
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

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 Clear and Channelized T3/E3 Interfaces for CESoPSN

Before You Begin

Before you configure BERT for clear channel T3/E3 interfaces, ensure that the controller and CEM are configured.

To run a BERT on the T3 interface, use the following commands:

```
configure terminal
controller t3 0/5/0
t1 1 bert timeslots 1 pattern 2^15 interval 1
```

To run a BERT on the E3 interface, use the following commands:

```
config terminal
controller e3 0/5/0
e1 1 bert timeslots 1 pattern 2^15 interval 1
```



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

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

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

Verifying BERT Configuration for CESoPSN on T3 or E3 Interface

Use the following command to verify the BERT configuration for CESoPSN on T3 interfaces:

```
Router# show controllers t3 0/5/0
T3 0/5/0 is up.
  Hardware is ASR903-48T3E3-CE

  Applique type is Channelized T3
  No alarms detected.
  MDL transmission is disabled

  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  BER thresholds: SF = 10e-3 SD = 10e-6
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
```

```

    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is down
timeslots: 1-24
FDL per AT&T 54016 spec.
Receiver has remote alarm.
Framing is ESF, Clock Source is Recovered 1
BERT running on timeslots 1,
BERT test result (running)
  Test Pattern : 2^15, Status : Sync, Sync Detected : 0
  Interval : 0 minute(s), Time Remain : 00:00:37
  Bit Errors (since BERT started): 0 bits,
  Bits Received (since BERT started): 137 Kbits
  Bit Errors (since last sync): 0 bits
  Bits Received (since last sync): 137 Kbits
  Direction   : Line
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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 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 T3/E3 Interfaces

Loopback Description

You can use the following loopback on the clear and channelized T3/T1 or E3/E1 interfaces.

Loopback	Description
loopback local	Loops the transmitting signal back to the receiver.
loopback network line	Loops the incoming signal back to the interface 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 driver.

Configuring Loopback for T3/E3 Interfaces

To set a loopback local on the clear channel T3/E3 interface, perform the following tasks in global configuration mode:

```

enable
configure terminal
controller t3 0/0/1
loopback local
exit

```

To set a loopback network on the clear channel T3/E3 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t3 0/0/1
loopback network line
exit
```

To set a loopback local on the channelized channel T3/T1 or E3/E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t3 0/0/1
channelized
t1 1 loopback local
exit
```

To set a loopback network on the channelized channel T3/T1 or E3/E1 interface, perform the following tasks in global configuration mode:

```
enable
configure terminal
controller t3 0/0/1
channelized
t1 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 and T3 Interfaces

The remote loopback configuration attempts to put the far-end T1 or T3 into a loopback.

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

Restrictions for Loopback Remote

E1 and E3 loopback remote are not supported.

Configuring Loopback Remote on T1 and T3 Interface Module

To set T3 loopback remote line/payload for DS3, perform the following tasks in global configuration mode:

```
enable
configure terminal
```

```

controller t3 0/0/1
loopback remote {line | payload}
exit

```

To set T1 loopback remote iboc fac1/fac2/csu for DS3, perform the following tasks in global configuration mode:

```

enable
configure terminal
controller t3 0/0/1
t1 1 loopback remote iboc {fac1 | fac2 | csu}
exit

```

To set T1 loopback remote iboc esf line csu/esf payload for DS3, perform the following tasks in global configuration mode:

```

enable
configure terminal
controller t3 0/0/1
t1 1 loopback remote iboc esf {line csu | payload}

```

Verifying the Loopback Remote Configuration on T1/T3 Interfaces

Use the following command to check the loopback remote configuration on a T3 interface module:

```

router# show running-config | sec 0/0/1
controller MediaType 0/0/1
mode t3
controller T3 0/0/1
threshold sd-ber 6
threshold sf-ber 3
no channelized
framing c-bit
cablelength short
loopback remote line

```

Use the following command to verify the loopback remote configuration on a T3 interface module:

```

router(config-controller)# do show controller t3 0/0/1
T3 0/0/1 is up. (Configured for Remotely Looped)
  Currently in Remotely Line Looped
  Hardware is A900-48T3E3-CE
  Applique type is Subrate T3
  Receiver has no alarms.
  MDL transmission is disabled
  FEAC code received: No code is being received
  Framing is C-BIT Parity, Line Code is B3ZS, Cablelength Short less than 225ft
  BER thresholds: SF = 10e-10 SD = 10e-10
  Clock Source is internal
  Equipment customer loopback
  Data in current interval (240 seconds elapsed):
    Near End
      0 Line Code Violations, 0 P-bit Coding Violations
      0 C-bit Coding Violations, 0 P-bit Err Secs
      0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
      0 Unavailable Secs, 0 Line Errored Secs
      0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
      0 Severely Errored Line Secs, 0 Path Failures
      0 AIS Defect Secs, 0 LOS Defect Secs
    Far End
      0 Errored Secs, 0 Severely Errored Secs

```

```

    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs

```

```

    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
    0 Unavailable Secs, 0 Path Failures

```

Use the following command to check the loopback remote configuration on a T1 interface module:

```

Router#show run | sec 0/4/15
controller MediaType 0/4/15
mode t3
controller T3 0/4/15
threshold sd-ber 6
threshold sf-ber 3
framing c-bit
cablelength short
t1 1 Loopback remote iboc fac1

```

Use the following command to verify the loopback remote configuration on a T1 interface module:

```

Router#show controller t3 0/4/15 | be T1 1
T1 1 is up
timeslots:
FDL per AT&T 54016 spec.
Configured for NIU FAC1 Line Loopback with IBOC
Currently in Inband Remotely Line Looped
Receiver has no alarms.
Framing is ESF, Clock Source is Internal
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
    0 Unavailable Secs, 0 Stuffed Secs
    1 Path Failures, 2 SEF/AIS Secs
  Far End
    0 Line Code Violations,0 Path Code Violations
    0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,

```

```

3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
0 Unavailable Secs, 0 Path Failures

```

Associated Commands

The commands used to configure the interfaces.

Commands	URL
controller mediatype	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp3512725718
mode t3/e3	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l2.html#wp5688885940
controller t1	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1472647421
controller t3	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1921350260
controller e3	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp4240965734
clock source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140
channelized	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp7026926390
cem	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2184138077
cem-group	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600
xconnect	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t2.html#wp8578094790
t1/e1 cem-group	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t1.html#wp8472041760

Commands	URL
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
bert pattern	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-a1.html#wp3620978929
loopback	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-l2.html#wp2513399572
t1/e1 loopback	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-t1.html#wp3852360411
show controllers t3	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s3.html#wp1987423547

Additional References for Configuring 48-Port T3/E3 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>



CHAPTER 2

Overview of 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 Multiprotocol Label Switching (MPLS) network. The chassis encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) chassis. As a result, CEM functions as a physical communication link across the packet network.

The chassis supports the pseudowire type that utilizes CEM transport: Structure-Agnostic TDM over Packet (SAToP).

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

The RSP switchover with physical SSO is above 50 ms as follows:

- R0 to R1 is 5 seconds
- R1 to R0 is 10 seconds
- [Configuring Pseudowire, on page 51](#)

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.

Information About Pseudowire

The following sections describe how to configure pseudowire on the interface module of the chassis.

Overview of 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.

How to Configure Pseudowire

The following sections describe how to configure pseudowire.

Structure-Agnostic TDM over Packet

Structure-Agnostic TDM over Packet (SAToP) encapsulates Time Division Multiplexing (TDM) bit-streams as pseudowires over public switched networks. It disregards any structure that may be imposed on streams, in particular the structure imposed by the standard TDM framing.

The protocol used for emulation of these services does not depend on the method in which attachment circuits are delivered to the Provider Edge (PE) chassis. For example, a T1 attachment circuit is treated the same way for all delivery methods, including copper, multiplex in a T3 circuit, a virtual tributary of a SONET circuit, or unstructured Circuit Emulation Service (CES).

In SAToP mode, the interface is considered as a continuous framed bit stream. The packetization of the stream is done according to IETF RFC 4553. All signaling is carried out transparently as a part of a bit stream.

Configuring CEM for SAToP

This section provides information about how to configure CEM. CEM provides a bridge between a Time Division Multiplexing (TDM) network and a packet network, MPLS. The chassis encapsulates the TDM data in the MPLS packets and sends the data over a CEM pseudowire to the remote Provider Edge (PE) chassis.

The following sections describe how to configure CEM.

Configuring CEM Restriction

- Not all combinations of payload size and dejitter buffer size are supported. If you apply an incompatible payload size or dejitter buffer size configuration, the chassis rejects it and reverts to the previous configuration.
- The dummy-pattern command is *not* supported.



Note CEM interface does *not* support idle-cas parameter.

Configuring CEM Group for SAToP

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

```
enable
configure terminal
controller t3 0/1/0
cem-group 0 unframed
end
```

Configuring CEM Classes

A CEM class allows you to create a single configuration template for multiple CEM pseudowires. Follow these steps to configure a CEM class:

**Note**

- The CEM parameters can be configured either by using CEM class or on CEM interface directly.
- The CEM parameters at the local and remote ends of a CEM circuit must match; otherwise, the pseudowire between the local and remote PE chassis does not come up.

```
enable
configure terminal
class cem mycemclass
payload-size 512
dejitter-buffer 12
exit
interface cem 0/0/1
cem 0
cem class mycemclass
xconnect 10.10.10.10 200 encapsulation mpls
exit
```

Configuring CEM Parameters

The following sections describe the parameters you can configure for CEM circuits.

Configuring Payload Size

To specify the number of bytes encapsulated into a single IP packet, use the **payload-size** command. The size argument specifies the number of bytes in the payload of each packet.

Default payload sizes for T3/E3 interface are:

- T3/E3 clear channel= 1024 bytes
- T3/E3 channelized = 192 bytes

Default payload sizes for a structured CEM channel depend on the number of time slots that constitute the channel. Payload size (L in bytes), number of time slots (N), and packetization delay (D in milliseconds) have the following relationship: $L = 8 * N * D$. The default payload size is selected in such a way that the packetization delay is always 1 millisecond.

**Note**

Both payload-size and dejitter-buffer must be configured simultaneously. When you select a value of payload-size, the acceptable range of dejitter-buffer for that payload size is displayed.

Setting the Dejitte Buffer Size

To specify the size of the dejitter-buffer used to compensate for the network filter, use the **dejitter-buffer** command. The configured dejitter-buffer size is converted from milliseconds to packets and rounded up to the next integral number of packets. Use the size argument to specify the size of the buffer, in milliseconds. The range is from 1 to 32; the default is 5.

Shutting Down a CEM Channel

To shut down a CEM channel, use the **shutdown** command in CEM configuration mode. The **shutdown** command is supported only under CEM mode and not under the CEM class.

Configuring CEM Parameter on CEM Interface

The CEM parameters can be configured directly on CEM interface. Follow these steps to configure CEM parameters:

```
enable
configure terminal
class cem mycemclass
payload-size 1024 dejitter-buffer 10
exit
interface cem 0/0/1
no ip address
cem 0
cem class mycemclass
xconnect 10.10.10.10 200 encapsulation mpls
exit
```

Verifying the Interface Configuration

Use the following commands to verify the pseudowire configuration:

- **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 **xconnect** is configured under the circuit, the command output also includes information about the attachment circuit status.

```
Router# show cem circuit
?

<0-504>      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

CEM0/13/1, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: down, T3 state: up
Idle Pattern: 0x55, Idle CAS: 0x8
Dejitter: 10 (In use: 0)
Payload Size: 1024
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
Pkts Missing: 0
Misorder Drops: 0
Error Sec: 0
Unavailable Sec: 0
Pkts Malformed: 0
Output Errors: 0
Pkts Reordered: 0
JitterBuf Underrun: 0
Severly Errored Sec: 0
Failure Counts: 0
JitterBuf Overrun: 0
```

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

```
Router# show cem circuit summary

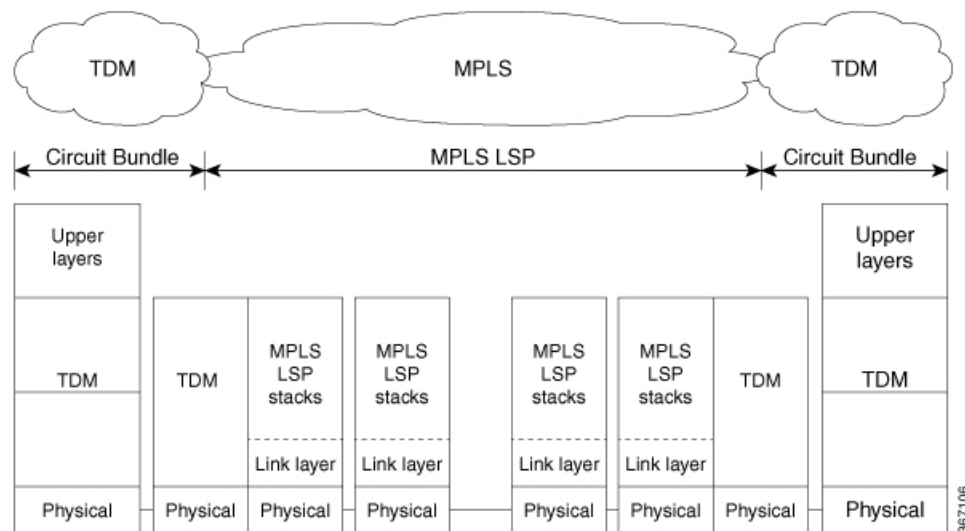
CEM Int.      Total Active Inactive
-----
CEM0/1/0      1      1      0
```

- **show running configuration**—The **show running configuration** command shows detail on each CEM group.

Overview of DS3 CEP

Effective Cisco IOS XE Fuji 16.8.1, DS3 CEP feature is introduced to achieve STS-1 or VC4 CEP configuration on the interface module. Here, T3 or E3 is mapped to STS-1 or VC4 that is emulated on a packet network.

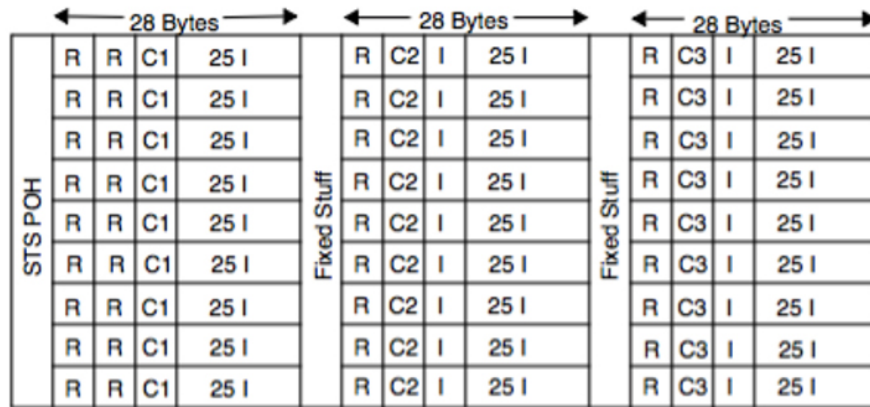
Figure 1: Network Reference Model and Protocol Layers for TDM-MPLS User Plane Interworking



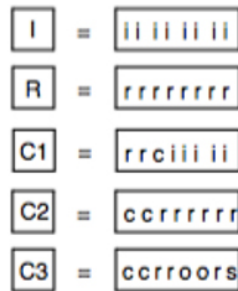
Asynchronous Mapping for DS3 CEP

An asynchronous mapping for a DS3 in the payload capacity of an STS-1 signal is defined for clear-channel transport of DS3 signals that meet the DS3 requirements in GR-499-CORE. The asynchronous DS3 mapping consists of nine subframes each of 125 μs. Each subframe contains 621 information (I) bits, a set of five stuff control (C) bits, one stuff opportunity (S) bit, and two overhead communication channel (O) bits. The remaining bits of the STS-1 payload capacity are fixed stuff (R) bits. The O-bits are reserved for future overhead communication purposes. The values of the R and O bits are undefined. In each subframe, the set of five C-bits are used to control the S-bit. CCCCC = 00000 is used to indicate that the S-bit is an information bit, while CCCCC = 11111 is used to indicate that the S-bit is a stuff bit. The value of the S-bit (if it is stuff bit) is undefined.

Figure 2: Asynchronous Mapping for DS3 CEP



Bytes



bits

- i: information (payload) bit
- r: fixed stuff bit
- c: stuff control bit
- s: stuff opportunity bit
- o: overhead communications channel bit

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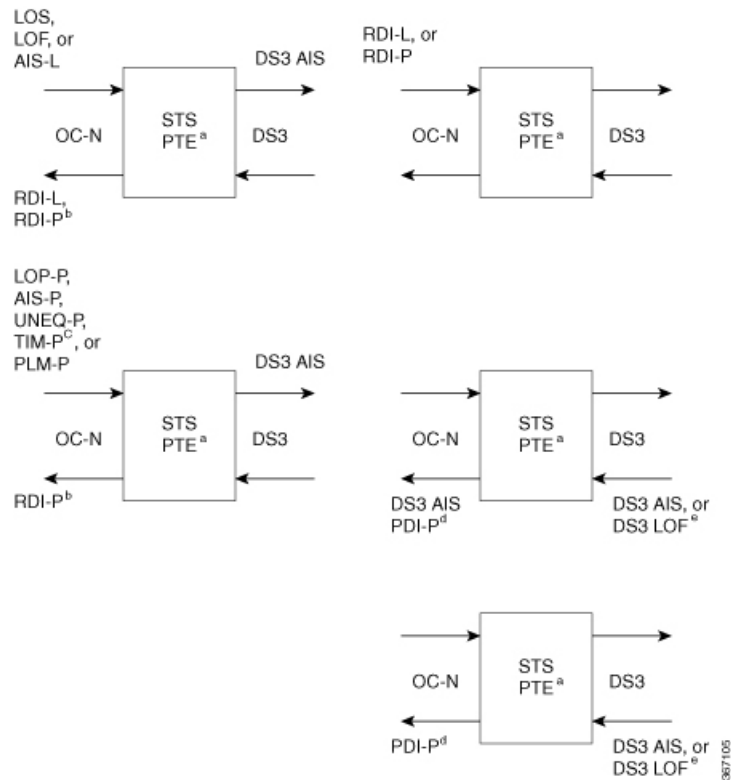
Restrictions

- BERT for both line and system directions is *not* supported.
- Card Protection is *not* supported.
- E3 CEP is not supported on optical or SDH controller.

Alarms

If an alarm is detected in the DS3 end, the C2 bytes are used to inform the remote Provider Edge (PE). For this, the alarm mapping table has to be followed as shown in the figure below.

Figure 3: Alarm Mapping Table



Configuring DS3 CEP

Pre-requisites:

The default mode is channelized mode. Use **no channelized** command to change to non-channelized mode.

To configure DS3 CEP for mode T3:

```
enable
controller MediaType 0/3/0
mode t3
controller t3 0/3/0
no channelized
cem-group 0 cep
```

To configure DS3 CEP for mode E3:

```
enable
controller MediaType 0/3/0
mode e3
controller e3 0/3/0
no channelized
cem-group 0 cep
```

Configuration of Overhead C2 and J1 Bytes:

You can configure overhead C2 and J1 bytes after you configure DS3 CEP.

```
enable
controller MediaType 0/14/44
mode e3
```

```

controller e3 0/14/44
threshold sd-ber 6
threshold sf-ber 3
no channelized
framing g751
cablelength short
cem group 0 cep
overhead j1 tx length 16
overhead j1 expected length 16

```

For loopback configuration, see *Loopback on T3/E3 Interfaces* section.

Verification of DS3 CEP Configuration

Use **show controller t3 0/1/20 path** to verify DS3 CEP configuration:

```

rtr2#show controller t3 0/1/20 path

T3 0/1/20 PATH 1.

Asynchronous Mapping for DS3 into STS-1

TX : TDM to PSN direction
RX : PSN to TDM direction

Clock Source is internal

    AIS = 0          RDI = 0          REI = 349          BIP(B3) = 22
    LOP = 0          PSE = 0          NSE = 0           NEWPTR = 0
    LOM = 0          PLM = 0          UNEQ = 0

Active Defects: None
Detected Alarms: None
Asserted/Active Alarms: None
Alarm reporting enabled for: None

TCA threshold:  B3 = 10e-6
Rx: C2 = FF
Tx: C2 = 01

Tx J1 Length : 64
Tx J1 Trace

    72 74 72 32 20 30 2F 31 2F 32 30 2E 31 00 00 00      rtr2 0/1/20.1...
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....

Expected J1 Length : 64
Expected J1 Trace

    72 74 72 32 20 30 2F 31 2F 32 30 2E 31 00 00 00      rtr2 0/1/20.1...
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....

PATH TRACE BUFFER : UNSTABLE

Rx J1 Length : 64
Rx J1 Trace

    72 73 70 32 20 30 2F 35 2F 31 32 2E 31 00 00 00      rsp2 0/5/12.1...
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....

```



```
rtr2#
```



Note The verification output does not provide the alarm details.

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 T3 Interface

- The maximum scale is 1344 cem interface.
- Changing framing from C-bit to M13 not supported where as Changing framing from g751 to g832 is supported.
- CT3-E1 and CE3-T1 is not supported (only CT3-T1 and CE3-E1 is supported).
- DS0 loopback is not supported.
- The alarm forwarding is not supported on the T1 interface.
- The card protection is not supported on the T1 interface.

Configuring CEM Group for CESoPSN on T3 Interface

The following section describes how to configure a CEM group for CESoPSN on the T3 interface:

```
controller MediaType 0/5/1
 mode t3
 channelized
 controller T3 0/5/1
 framing c-bit
 cablelength short
 t1 1 cem-group 1 timeslots 1-10
```

Verifying CEM for CESoPSN on T3 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 12 vc**—Displays information about the MPLS VC.
- **show mpls 12 vc detail**—Displays detailed information about the MPLS VC.

```
Router# show controllers e3 0/14/2
E3 0/14/2 is up.
Hardware is ASR903-48T3E3-CE
```

```

Applique type is Channelized E3
No alarms detected.
Framing is E3 G751, Line Code is HDB3, Cablelength Short less than 225ft
BER thresholds: SF = 10e-10 SD = 10e-10
Clock Source is internal, National Bit 0
Equipment customer loopback
Data in current interval (240 seconds elapsed):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    0 Unavailable Secs, 0 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    0 Severely Errored Line Secs, 0 Path Failures
    0 AIS Defect Secs, 0 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Data in Interval 1:
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations
    0 C-bit Coding Violations, 0 P-bit Err Secs
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
    20 Unavailable Secs, 20 Line Errored Secs
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 Path Failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs
Total Data (last 1 15 minute intervals):
  Near End
    0 Line Code Violations, 0 P-bit Coding Violations,
    0 C-bit Coding Violations, 0 P-bit Err Secs,
    0 P-bit Severely Err Secs, 0 Severely Err Framing Secs,
    20 Unavailable Secs, 20 Line Errored Secs,
    0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
    20 Severely Errored Line Secs, 1 path failures
    0 AIS Defect Secs, 20 LOS Defect Secs
  Far End
    0 Errored Secs, 0 Severely Errored Secs
    0 C-bit Unavailable Secs, 0 Path Failures
    0 Code Violations, 0 Service Affecting Secs

E1 1 is up
timeslots: 1-20
No alarms detected.
Framing is crc4, Clock Source is Internal, National bits are 0x1F.
Data in current interval (250 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 Stuffed 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
0 Unavailable Secs, 0 Stuffed Secs
1 Path Failures, 2 SEF/AIS Secs
Far End
0 Line Code Violations, 0 Path Code Violations
0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
3 Errored Secs, 0 Bursty Err Secs, 3 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, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
2 Errored Secs, 0 Bursty Err Secs, 2 Severely Err Secs
0 Unavailable Secs, 0 Stuffed Secs
1 Path Failures, 2 SEF/AIS Secs
Far End
0 Line Code Violations,0 Path Code Violations
0 Slip Secs, 2 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
3 Errored Secs, 0 Bursty Err Secs, 3 Severely Err Secs
0 Unavailable Secs, 0 Path Failures
    
```

router# **sh mpls 12 vc interface cem 0/14/0 0**

Local intf	Local circuit	Dest address	VC ID	Status
CE0/14/0	CESoPSN Basic 0	1.1.1.1	9999	UP

Router# **sh mpls 12transport vc 9090 detail**

```

Local interface: CE0/14/2 up, line protocol up, CESoPSN Basic 0 up
Destination address: 1.1.1.1, VC ID: 9090, VC status: up
Output interface: Te0/12/0, imposed label stack {130}
Preferred path: not configured
Default path: active
Next hop: 123.123.123.1
Create time: 00:18:44, last status change time: 00:18:30
Last label FSM state change time: 00:18:30
Signaling protocol: LDP, peer 1.1.1.1:0 up
Targeted Hello: 2.2.2.2(LDP Id) -> 1.1.1.1, LDP is UP
Graceful restart: not configured and not enabled
Non stop routing: 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 130, remote 130
Group ID: local 207, remote 220
MTU: local 0, remote 0
Remote interface description:
Sequencing: receive disabled, send disabled
Control Word: On (configured: autosense)
SSO Descriptor: 1.1.1.1/9090, local label: 130
    
```

```
Dataplane:
  SSM segment/switch IDs: 1237749/557811 (used), PWID: 114
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
```

```
Router# sh cem circuit interface cem 0/14/2 0
```

```
CEM0/14/2, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Mode :Channelized-E1, E1: 1, CEM Mode: E1-CESoP
Controller state: up, T1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 5 (In use: 0)
Payload Size: 160
Framing: Framed (DS0 channels: 1-20)
CEM Defects Set
None
```

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

```
Ingress Pkts:   24005           Dropped:           0
Egress Pkts:   24005           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
Generated Mbits: 0         Received Mbits:    0
```

Configuring DS1 Local Connect on T3/E3 Interface

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

```
enable
configure terminal
controller MediaType 0/5/7
  mode e3
channelized mode e1
controller E3 0/5/7
  e1 2 cem-group 1 timeslots 1-10
```

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

```
enable
configure terminal
controller MediaType 0/5/2
  mode e3
channelized mode e1
controller E3 0/5/2
  e1 2 cem-group 1 timeslots 1-10
```

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

```
enable
```

```
configure terminal
connect ds1_connect CEM0/5/7 1 CEM CEM0/5/2 1
```

Verifying DS1 Local Connect on T3 Interface

Use the following commands to verify the DS1 local connection:

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

```
ASR907# sh xconnect all | i 0/14/7
UP pri ac CE0/14/2:2(CESoPSN Basic) UP ac CE0/14/7:2(CESoPSN Basic) UP

ASR907# sh connection all | i 0/14/7
38 local_t3 CE0/14/2 CESP 2 CE0/14/7 CESP 2 UP
```

Associated Commands

The following commands are used to configure pseudowire:

Commands	URL
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	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
show controllers t3	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s3.html#wp1987423547

Additional References for Configuring Pseudowire

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>	http://www.cisco.com/cisco/web/support/index.html



CHAPTER 3

Clock Recovery System for SAToP

The Clock Recovery System recovers the service clock using Adaptive Clock Recovery (ACR) and Differential Clock Recovery (DCR).

- [Finding Feature Information, on page 65](#)
- [Information About Clock Recovery, on page 65](#)
- [Prerequisites for Clock Recovery, on page 67](#)
- [Restrictions for Clock Recovery, on page 67](#)
- [How to Configure ACR and DCR, on page 67](#)
- [Associated Commands, on page 72](#)
- [Additional References for Clock Recovery, on page 73](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Clock Recovery

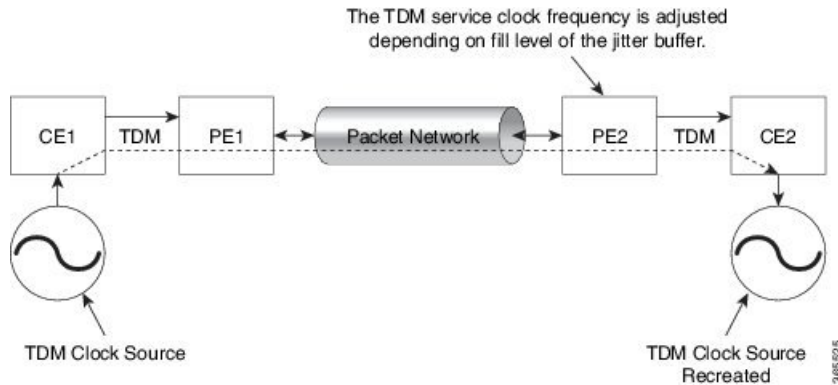
Adaptive Clock Recovery (ACR)

Adaptive Clock Recovery (ACR) is an averaging process that negates the effect of random packet delay variation and captures the average rate of transmission of the original bit stream. ACR recovers the original clock for a synchronous data stream from the actual payload of the data stream. In other words, a synchronous clock is derived from an asynchronous packet stream. ACR is a technique where the clock from the TDM domain is mapped through the packet domain, but is most commonly used for Circuit Emulation (CEM). ACR is supported on unframed and framed modes of SAToP.



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

Effective Cisco IOS XE Everest 16.5.1, ACR is supported on the 8-port T1/E1 interface module.

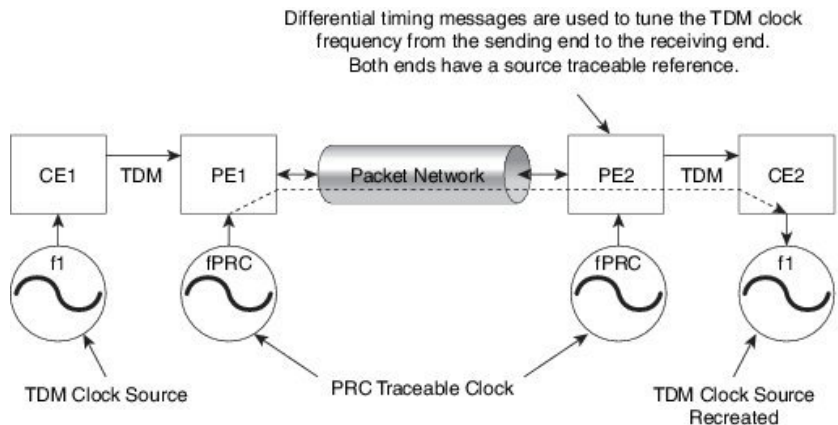


Differential Clock Recovery (DCR)

Differential Clock Recovery (DCR) is another technique used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks. TDM clock frequency are tuned to receive differential timing messages from the sending end to the receiving end. A traceable clock is used at each end, which ensures the recovered clock is not affected by packet transfer. DCR is supported on unframed and framed modes of SAToP.



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



Benefits of Clock Recovery

- Customer-edge devices (CEs) can have different clock from that of the Provide-edge devices (PEs).

Scaling Information

IM Card	Pseudowires Supported (Number of Clocks Derived)
48-Port T3/E3 CEM Interface Module	1344

Prerequisites for Clock Recovery

- The clock of interface modules must be used as service clock.
- CEM must be configured before configuring the global clock recovery.
- RTP must be enabled for DCR in CEM, as the differential clock information is transferred in the RTP header.

Restrictions for Clock Recovery

- The reference clock source is used and locked to a single clock.
- The clock ID should be unique for a particular interface module for ACR or DCR configuration.
- When CEM group is configured, dynamic change in clock source is not allowed.
- ACR clock configuration under each controller should be performed before configuring CEM group.

How to Configure ACR and DCR

Configuring ACR for T3/E3

Configuring Adaptive Clock Recovery of T3/E3 Interfaces for SAToP

Before You Begin

- The node (router) on which the 48-Port T3/E3 interface module is configured for ACR, must have its own clock derived from BITS/GPS/Stratum clock.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure the clock on T3/E3 interfaces for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```

To configure the clock recovery on T3/E3 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 adaptive cem 1 0
exit
```



Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying Adaptive Clock Recovery Configuration of T3/E3 Interfaces for SAToP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T3/E3 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
-----
Clock      Type      Mode      CEM      Status      Frequency Offset (ppb)  Circuit-No
-----
0          DS3      ADAPTIVE  0        ACQUIRED    n/a                0 (Port)
```

Use the **show running-config | section** command to verify the configuration of adaptive clock of T3/E3 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
 cem-group 0 unframed
 clock source recovered 1
 cablelength 224
interface CEM0/0/1
 no ip address
 cem 0
```

Use the **show running-config | section recovered-clock** command to verify the recovery of adaptive clock of T3/E3 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 adaptive cem 1 0
```

Configuring DCR for T3/E3

Configuring Differential Clock Recovery of T3/E3 Interfaces for SAToP

Before You Begin

- Before you start configuring DCR, RTP must be enabled on the CEM interface. The RTP is used to carry the differential time.

- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure differential clock recovery on T3/E3 interface for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
clock source recovered 1
cem-group 0 unframed
exit
```

To configure RTP header under interface, use the following commands:

```
interface cem 0/0/1
cem 0
rtp-present
```

To configure differential clock recovery of T3/E3 interface in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 differential cem 1 0
exit
```



Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying the Differential Clock Recovery Configuration of T3/E3 Interfaces for SAToP

Use the **show recovered-clock** command to verify the differential clock recovery of T3/E3 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
-----
Clock      Type      Mode          CEM      Status      Frequency Offset (ppb)  Circuit-No
-----
0          DS3      DIFFERENTIAL  0        ACQUIRED    n/a          0 (Port)
```

Use the **show running-config | section** command to verify the configuration of differential clock of T3/E3 interfaces for SAToP:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
  cem-group 0 unframed
  clock source recovered 1
  cablelength 224
interface CEM0/0/1
 no ip address
```

```
cem 0
 rtp-present
```

Use the **show running-config | section recovered-clock** command to verify the recovery of differential clock of T3/E3 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
clock recovered 1 differential cem 1 0
```

Configuring ACR for Channelized T3/T1 or E3/E1

Configuring Adaptive Clock Recovery of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Before You Begin

- The node (chassis) on which the T3/T1 or E3/E1 is configured for ACR, has to have its own clock derived from BITS/GPS/Stratum clock.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure adaptive clock on a channelized T3/T1 or E3/E1 interfaces under controller for SAToP in controller mode, use the following commands:

```
enable
configure terminal
controller t3 0/0/1
t1 1 clock source recovered 1
t1 1 cem-group 0 unframed
exit
```

To configure recovery of adaptive clock of channelized T3/T1 or E3/E1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 adaptive cem 1 0
exit
```



Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

To remove the clock configuration in ACR and DCR, you must remove the recovery clock configuration in global configuration mode and then remove the controller configuration.

Verifying the Adaptive Clock Recovery Configuration of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the adaptive clock recovery of T3/T1 or E3/E1 interfaces for SAToP:

```
Router# show recovered-clock
```

```
Recovered clock status for subslot 0/4
```

```
-----
```

Clock	Type	Mode	CEM	Status	Frequency Offset(ppb)	Circuit-No
0	DS3-ds1	ADAPTIVE	0	ACQUIRED	n/a	0/1 (Port/t1)

Use the **show running-config | section** command to verify the configuration of adaptive clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
 framing c-bit
 cablelength 224
 t1 1 cem-group 0 unframed
 t1 1 clock source recovered 1
interface CEM0/0/1
 no ip address
 cem 0
```

Use the **show running-config | section recovered-clock** command to verify the recovery of adaptive clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
 clock recovered 1 adaptive cem 1 0
```

Configuring DCR for Channelized T3/T1 or E3/E1

Configuring Differential Clock Recovery of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Before You Begin

- Before you start configuring DCR, RTP must be enabled on the CEM interface. The RTP is used to carry the differential time.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 256 bytes.

To configure differential clock on a channelized T3/T1 or E3/E1 interfaces under controller in controller mode, use the following commands:

```
enable
configure terminal
controller t30/0/1
t1 1 clock source recovered 1
t1 1 cem-group 0 unframed
exit
```

To configure RTP header under channelized T3/T1 or E3/E1 interfaces, use the following commands:

```
interface cem 0/0/1
cem 0
rtp-present
```

To configure recovery of differential clock of channelized T3/T1 or E3/E1 interfaces in global configuration mode, use the following commands:

```
recovered-clock 0 0
clock recovered 1 differential cem 1 0
exit
```



Note The clock configuration on controller must be done before configuring the clock recovery on global configuration mode.

Verifying the Differential Clock Recovery Configuration of Channelized T3/T1 or E3/E1 Interfaces for SAToP

Use the **show recovered-clock** command to verify the differential clock recovery of T3/T1 or E3/E1 interfaces for SAToP:

```
Router# show recovered-clock

Recovered clock status for subslot 0/4
-----
Clock      Type      Mode      CEM      Status      Frequency Offset(ppb)  Circuit-No
-----
0          DS3-ds1   DIFFERENTIAL  0        ACQUIRED    n/a              0/1 (Port/t1)
```

Use the **show running-config | section** command to verify the configuration of differential clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section 0/0/1
controller MediaType 0/0/1
 mode t3
controller T3 0/0/1
 framing c-bit
 cablelength 224
 t1 1 cem-group 0 unframed
 t1 1 clock source recovered 1
interface CEM0/0/1
 no ip address
 cem 0
 rtp-present
```

Use the **show running-config | section recovered-clock** command to verify the recovery of differential clock of channelized T3/T1 or E3/E1 interfaces:

```
Router# show running-config | section recovered-clock
recovered-clock 0 0
clock recovered 1 differential cem 1 0
```

Associated Commands

The commands used to adaptive clock recovery and differential clock recovery on 48-Ports T3/E3 Interface Module.

Commands	URL
clock recovered adaptive cem	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp8894393830
cem-group	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp2440628600
recovered-clock	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-o1.html#wp8262293900
controller t3/e3	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp1921350260
clock-source	http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c2.html#wp6081785140

Additional References for Clock Recovery

Related Documents

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

Standards and RFCs

Standard/RFC	Title
ITU -T G.8261	<i>Timing and synchronization aspects in packet networks</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>



CHAPTER 4

Clock Recovery System for CESoPSN

The Clock Recovery System recovers the service clock using Adaptive Clock Recovery (ACR) and Differential Clock Recovery (DCR).

- [Finding Feature Information, on page 75](#)
- [Information About Clock Recovery, on page 75](#)
- [Prerequisites for Clock Recovery, on page 77](#)
- [Restrictions for Clock Recovery, on page 77](#)
- [How to Configure ACR and DCR, on page 78](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Clock Recovery

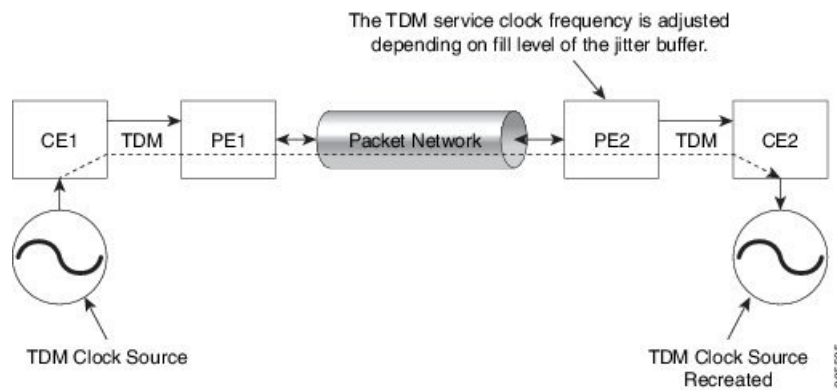
Clock Recovery System in CESoPSN

The Clock Recovery System is able to recover the service clock using two methods, the Adaptive Clock Recovery and Differential Clock Recovery.

Adaptive Clock Recovery in CESoPSN

When emulating TDM over PSNs, the physical layer clock is sometimes not available to both ends. Adaptive Clock Recovery (ACR) is a technique where the clock from the TDM domain is mapped through the packet domain. The sending Inter Working Function (IWF) processes outgoing packets with an internal free-running clock, and the receiving IWF creates a clock based on packet arrival. The service clock frequency is adjusted depending on fill level of the jitter buffer.

- When sending TDM digital signal over PSN, the TDM data is inserted into packets in the master IWF and sent to the desired destination (slave IWF).
- The rate at which the packets are transmitted to the PSN is constant. Due to the nature of the PSN, the packets might arrive to the destination in bursts and with varying rate.
- The long-term average of this rate is equal to the insertion rate at the master IWF. Moreover, the packets in the PSN might switch their order and even be lost.
- The IWF at the far end of the PSN (slave IWF) recovers the service clock (E1/T1) used by the master IWF.
- The recovered clock is used by the slave IWF for the transmission of the data back into the TDM lines.
- The master IWF aggregates the TDM data and creates the PWE packets; these packets are transmitted to the PSN.
- The packets are received by the slave IWF and stored in a jitter buffer designed to absorb the packet delay variation (PDV).
- The packets are extracted from the jitter buffer and the clock recovery algorithm updates the service clock based on the timing information available.

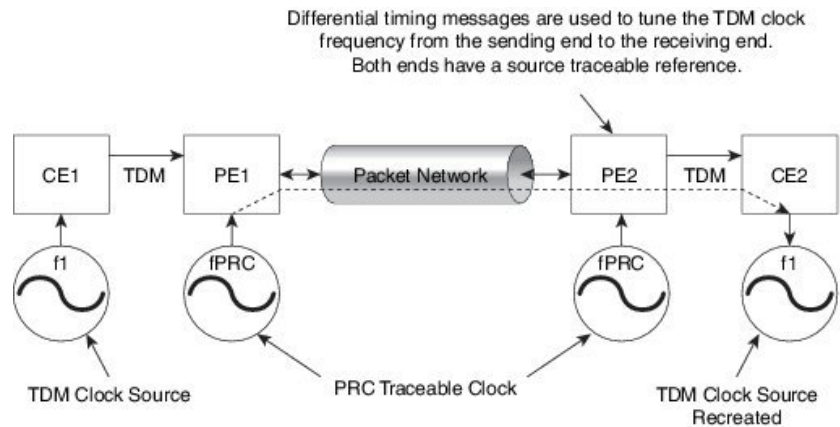


Differential Clock Recovery in CESoPSN

DCR (Differential Clock Recovery) is another technique used for Circuit Emulation (CEM) to recover clocks based on the difference between PE clocks. The clock from the TDM domain is mapped through the packet domain. It differs from ACR in that a PRC traceable clock is used at each end. Differential timing messages are used to tune the TDM clock frequency from the sending end to the receiving end. Both ends have a source traceable reference. Because of this, the recovered clock is not affected by PDV when using DCR.

In contrast with DCR, a PRC traceable clock source is available at each end. ACR is used when a traceable source is not available at both ends of the PSN link.

The recreated service clock accuracy is dependent on the accuracy between the sending and receiving PRC frequencies.



Benefits of Clock Recovery

- Customer-edge devices (CEs) can have different clock from that of the Provide-edge devices (PEs).
- In CESoPSN, a slave clock is supported for clock redundancy.

Scaling Information

IM Card	Pseudowires Supported (Number of Clocks Derived)
48-Port T1/E1 CEM Interface Module	48

Prerequisites for Clock Recovery

- The clock of interface modules must be used as service clock.
- CEM must be configured before configuring the global clock recovery.
- RTP must be enabled for DCR in CEM, as the differential clock information is transferred in the RTP header.

Restrictions for Clock Recovery

- The reference clock source is used and locked to a single clock.
- The clock ID should be unique for a particular interface module for ACR or DCR configuration.
- When CEM group is configured, dynamic change in clock source is not allowed.
- ACR clock configuration under each controller should be performed before configuring CEM group.

How to Configure ACR and DCR

Configuring ACR for T3/E3

Configuring Adaptive Clock Recovery of T3/E3 Interfaces for CESoPSN

Before You Begin

Before configuring Adaptive Clock Recovery, CEM must be configured. Below are the guidelines to configure clock recovery:

- The node (chassis) on which the DS1 is configured for ACR, must have its own clock derived from BITS/GPS/Stratum clock.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 64 bytes.

To configure the clock on T3/E3 interfaces for CESoPSN in controller mode, use the following commands:

```
enable
configure terminal
controller t3 <slot>/<bay>/<port>
t1 <t1_num> clock source recovered <clock-id>
t1 <t1_num> cem-group < cem-group-no > timeslots <1-24>
exit
```

To configure the clock recovery on T3/E3 interfaces in global configuration mode, use the following commands:

```
recovered-clock <slot> <bay>
clock recovered <clock-id> adaptive cem <port-no> <cem-group-no>
exit
```

To remove the clock configuration in ACR and DCR, you must remove the recovery clock configuration in global configuration mode and then remove the controller configuration.

Configuring DCR for T3/E3

Configuring Differential Clock Recovery of T3/E3 Interfaces for CESoPSN

Before You Begin

Before configuring Differential Clock Recovery, CEM must be configured. Below are the guidelines to configure clock recovery:

- The node (chassis) on which the DS1 is configured for DCR, must have its own clock derived from BITS/GPS/Stratum clock.
- The minimum packet size of CEM pseudowires on the network that delivers robust clock recovery is 64 bytes.

To configure the clock on T3/E3 interfaces for CESoPSN in controller mode, use the following commands:

```
enable
configure terminal
controller t3 <slot>/<bay>/<port>
t1 <t1_num> clock source Recovered <clock-id>
t1 <t1_num> cem-group < cem-group-no> timeslots <1-24>

interface cem <slot>/<bay>/<port>
cem < cem-group-no>
rtp-present

recovered-clock <bay> <slot>
clock recovered <clock-id> differential cem <port-no> <cem-group-no> priority <1|2>
exit
```



Note To remove the clock configuration in ACR and DCR, perform the following steps:

- Use the **no clock source recovered** command.
 - Remove the global clock.
 - Remove CEM configuration, if required.
-

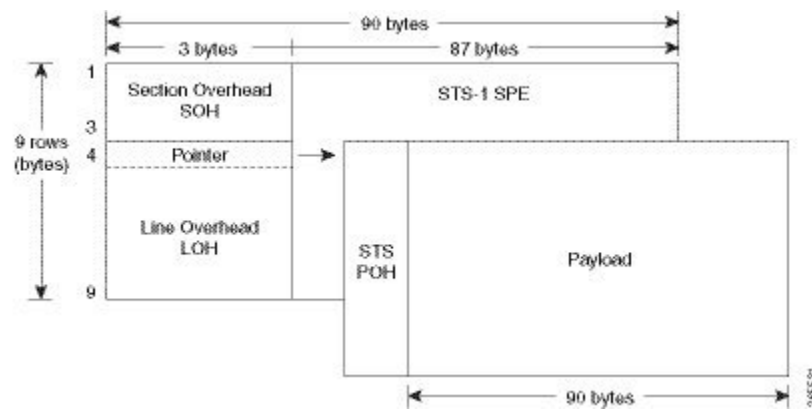


CHAPTER 5

STS-1 Electricals

A standard STS-1 frame is nine rows by 90 bytes. The first three bytes of each row represent the Section and Line overhead. These overhead bits comprise framing bits and pointers to different parts of the STS-1 frame.

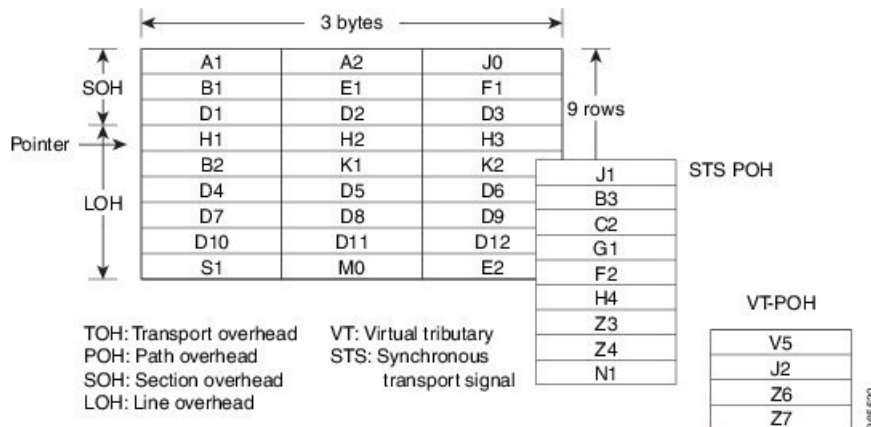
Figure 4: STS-1 Frame Structure



There is one column of bytes in the payload that represents the STS path overhead. This column frequently "floats" throughout the frame. Its location in the frame is determined by a pointer in the Section and Line overhead.

The combination of the Section and Line overhead comprises the transport overhead, and the remainder is the SPE.

Figure 5: STS-1 Overhead



For STS-1, a single frame is transmitted in 125 microseconds, or 8000 frames per second. $8000 \text{ fps} * 810 \text{ B/frame} = 51.84 \text{ Mbs}$, of which the payload is roughly 49.5 Mbs, enough to encapsulate 28 DS-1s, a full DS-3, or 21 CEPT-1s.

STS-1electrical ports are also supported. 48 STS-1 electrical ports are supported per card. Each port operates at 51.840 Mbps over a single 75-ohm, 728A or equivalent coaxial span. All the ports are supported.

- [Restrictions for STS-1e, on page 82](#)
- [Prerequisites for Configuring STS-1e, on page 83](#)
- [Configuring MediaType Controller, on page 83](#)
- [Configuring STS-1e Modes, on page 83](#)
- [Configuring Line and Section Overhead, on page 85](#)
- [Configuring Line Loopback, on page 85](#)
- [Configuring AIS Shut, on page 85](#)
- [Configuring Shut, on page 85](#)
- [Configuring Clock, on page 86](#)
- [Verification of STS-1e Configuration, on page 86](#)

Restrictions for STS-1e

- Only 16 BERT Patterns can be configured at a time.
- PMON fields are not supported for VT1.5 VT and DS3 or T3.
- PMON Far-end parameters are not supported.
- APS and card-protection are not supported for STS-1e port.
- In unframed mode, ACR and DCR are not supported.
- CESoPSN is not supported.
- Framed SAToP is not supported.

Restrictions for Clock Source Configuration

- Only 4 ports can be configured in STS-1e line for clock source configuration per chassis.

- You should configure the clock source line and network-clock sync together to receive the clock from a remote port that is connected to the STS-1e port.

Prerequisites for Configuring STS-1e

You must select the MediaType controller to configure and enter the controller configuration mode.

You must configure the controller as a STS-1e port.

Configuring MediaType Controller

To configure MediaType Controller, use the following commands:

```
enable
configure terminal
controller MediaType 0/0/16
mode STS-1e
end
```

Configuring STS-1e Modes

To configure STS-1e modes, use the following commands:

```
enable
configure terminal
controller sts-1e 0/0/16
sts-1 1
mode vt-15
end
```



Note There is no default mode. The following modes are supported:

- mode vt-15
- mode ct3
- mode t3
- mode unframed



Note To restore the system to its default condition, use the **no** form of the command.

Configuring VT-15 Mode of STS-1e

```
enable
configure terminal
```

```

controller STS1E 0/3/14
no ais-shut
alarm-report all
clock source internal
!
sts-1 1
clock source internal
mode vt-15
vtg 1 t1 1 framing unframed
vtg 1 t1 1 cem-group 0 unframed

```

Configuring DS1/T1 CT3 mode of STS-1e

To configure DS1/T1 CT3 mode of STS-1, you can configure the T1 link using the following steps:

```

enable
configure terminal
controller sts-1e 0/0/16
sts-1 1
mode ct3
t1 1 clock source internal
t1 1 framing unframed
end

```



Note To restore the system to its default condition, use the **no** form of the command.

Configuring T3 mode of STS-1e

```

controller STS1E 0/3/14
no ais-shut
alarm-report all
clock source internal
!
sts-1 1
clock source internal
mode t3
cem-group 0 unframed
t3 clock source internal

```

Configuring Unframed Mode of STS-1e

```

controller STS1E 0/3/14
no ais-shut
alarm-report all
clock source internal
!
sts-1 1
clock source internal
mode unframed
cem-group 0 cep

```

Configuring Line and Section Overhead

To configure line and section overhead, use the following commands:

```
enable
configure terminal
controller MediaType 0/0/16
mode sts-1e
controller sts-1e 0/0/16
overhead s1s0 2
overhead j0 tx length 1-byte
end
```



Note To restore the system to its default condition, use the **no** form of the command.

Configuring Line Loopback

To configure loopback, use the following commands:

```
enable
configure terminal
controller sts-1e 0/0/16
loopback local
end
```



Note To restore the system to its default condition, use the **no** form of the command.

Configuring AIS Shut

To configure AIS-Shut, use the following commands:

```
enable
configure terminal
controller sts-1e 0/0/16
ais-shut
end
```



Note The **no ais-shut** command will not send AIS.

Configuring Shut

To configure Shut, use the following commands:

```
enable
configure terminal
controller sts-1e 0/0/16
shutdown
end
```



Note Use the **no shutdown** command to disable the interface.

Configuring Clock

To configure clock, use the following commands:

```
enable
configure terminal
controller MediaType 0/0/16
mode sts-1e
controller sts-1e 0/0/16
clock source line
end
```



Note The default mode is internal.



Note ACR and DCR clock recovery are also supported. Refer to [Clock Recovery System for SAToP, on page 65](#) for more information.



Note To restore the system to its default condition, use the **no** form of the command.

Configuring Network-Clock STS-1e

To configure network-clock STS-1e, use the following commands:

```
enable
configure terminal
network-clock input-source 1 controller STS-1e 0/0/16
end
```

Verification of STS-1e Configuration

The following sample output shows the verification of STS-1e configuration in unframed mode:

```
router#show controllers sts1e 0/3/14
STS1E 0/3/14 is up.                    =====> this is the controller/port status.

Hardware is A900-IMA3G-IMSG
```



```

AIS = 0          RDI = 0          REI = 0          BIP(B3) = 0
LOP = 0          PSE = 0          NSE = 0          NEWPTR = 0
LOM = 0          PLM = 0          UNEQ = 0
    
```

```

Active Defects: None
Detected Alarms: None
Asserted/Active Alarms: None
Alarm reporting enabled for: PAIS PRDI PUNEQ PLOP PPLM LOM B3-TCA
    
```

```

TCA threshold: B3 = 10e-6
Rx: C2 = 04
Tx: C2 = 01
    
```

```

Tx J1 Length : 64
Tx J1 Trace
    
```

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00      RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

```

Expected J1 Length : 64
Expected J1 Trace
    
```

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00      RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

PATH TRACE BUFFER : UNSTABLE

```

Rx J1 Length : 64
Rx J1 Trace
    
```

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

SONET Path Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE
05:26-05:28	0	0	0	48	0	0	0	0

```

STS1E 0/3/14.1 PATH mode UNFRAMED is up
cep is configured: TRUE cem_id :0
clock source internal
    
```

The following sample output shows the verification of STS-1e configuration in VT-15 mode:

```

router#show controllers sts1e 0/3/14
STS1E 0/3/14 is up.
Hardware is A900-IMA3G-IMSG

Port configured rate: OC1
Applique type is Channelized STS1E
Clock Source is Internal
Medium info:
Type: STS1E, Line Coding: NRZ,
Alarm Throttling: OFF
SECTION:
LOS = 0          LOF = 0          BIP(B1) = 0

STS1E Section Tables
    
```

```

INTERVAL          CV     ES     SES     SEFS
05:33-05:33      0     0     0       0

LINE:
  AIS = 0           RDI = 0           REI = 0           BIP(B2) = 0
Active Defects: None
Detected Alarms: None
Asserted/Active Alarms: None
Alarm reporting enabled for: SLOS SLOF LAIS SF SD LRDI B1-TCA B2-TCA
BER thresholds:   SF = 10e-3  SD = 10e-6
TCA thresholds:   B1 = 10e-6  B2 = 10e-6
Rx: S1S0 = 00
    J0 = 00

    RX S1 = 00

Tx: S1S0 = 00
    J0 = 04

Tx J0 Length : 64
Tx J0 Trace :

 52 53 50 32 20 20 20 20 20 20 20 20 20 20 20 20 20 20      RSP2
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00      ..

Expected J0 Length : 64
Expected J0 Trace :

 52 53 50 32 20 20 20 20 20 20 20 20 20 20 20 20 20 20      RSP2
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00      ..

Rx J0 Length : 16
Rx J0 Trace :
CRC-7: 0xD8 ERROR

BC 4B 69 CC 79 24 1B 01 E8 EB 9C 36 FC 29 A9 00      .Ki.y$.6.....)..

STS1E Line Tables
INTERVAL          CV     ES     SES     UAS     CVFE     ESFE     SESFE     UASFE
05:33-05:33      0     0     0       0       0       0       0       0

High Order Path:

PATH 1:
Clock Source is internal

  AIS = 0           RDI = 0           REI = 0           BIP(B3) = 0
  LOP = 0           PSE = 0           NSE = 0           NEWPTR = 0
  LOM = 0           PLM = 0           UNEQ = 0

Active Defects: None
Detected Alarms: None
Asserted/Active Alarms: None
Alarm reporting enabled for: PAIS PRDI PUNEQ PLOP PPLM LOM B3-TCA

TCA threshold:   B3 = 10e-6
Rx: C2 = 02
Tx: C2 = 02

```

Tx J1 Length : 64
Tx J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00      RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

Expected J1 Length : 64
Expected J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00      RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

PATH TRACE BUFFER : UNSTABLE

Rx J1 Length : 64
Rx J1 Trace

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

SONET Path Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE
05:33-05:33	0	0	0	0	0	0	0	0

STS1E 0/3/14.1 PATH is up.
Hardware is A900-IMA3G-IMSG

Applique type is VT1.5

STS-1 1, VTG 1, VT 1 (STS1E 0/3/14.1/1/1 VT) is up
No VT alarms detected.

cep is configured: FALSE cem_id (0)
fwd_alarm_ais :0 fwd_alarm_rai :0
Framing is unframed, Clock Source is Internal
BIP2-tca:6, BIP2-sf:3, BIP2-sd:6

Tx V5:1

Rx V5:2

Tx J2 Length=64

TX J2 Trace Buffer:

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

Expected J2 Length=64

Expected J2 Trace Buffer:

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00      .....
    
```

Rx J2 Length=16

RX J2 Trace Buffer:

CRC-7: 0x80 OK

```

4A 44 53 55 00 00 00 00 00 00 00 00 00 00 00 00      JDSU.....
    
```



```

Data in cureent interval (1 seconds elapsed)
Near End
 0 CodeViolations, 0 ErrorSecs, 0 Severly Err Secs, 0 Unavailable Secs
Far End
 0 CodeViolations, 0 ErrorSecs, 0 Severly Err Secs, 0 Unavailable Secs

STS-1 1, VTG 1, T1 1 (STS1E 0/3/14.1/1/1 T1) is up
No alarms detected.
Framing is unframed, Clock Source is Internal
Data in current interval (0 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 Unavail Secs, 0 Stuffed 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

```

The following sample output shows the verification of STS-1e configuration in T3 mode:

```

router#show controllers sts1e 0/3/14
STS1E 0/3/14 is up.
Hardware is A900-IMA3G-IMSG

Port configured rate: OC1
Applique type is Channelized STS1E
Clock Source is Internal
Medium info:
Type: STS1E, Line Coding: NRZ,
Alarm Throttling: OFF
SECTION:
LOS = 0          LOF = 0          BIP(B1) = 0

STS1E Section Tables
INTERVAL   CV    ES   SES  SEFS
05:35-05:35  0    0    0    0

LINE:
AIS = 0          RDI = 0          REI = 0          BIP(B2) = 0
Active Defects: None
Detected Alarms: None
Asserted/Active Alarms: None
Alarm reporting enabled for: SLOS SLOF LAIS SF SD LRDI B1-TCA B2-TCA
BER thresholds: SF = 10e-3 SD = 10e-6
TCA thresholds: B1 = 10e-6 B2 = 10e-6
Rx: S1S0 = 00
J0 = 00

RX S1 = 00

Tx: S1S0 = 00
J0 = 04

Tx J0 Length : 64
Tx J0 Trace :

52 53 50 32 20 20 20 20 20 20 20 20 20 20 20 20 20 20  RSP2
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00      ..

Expected J0 Length : 64

```

Expected J0 Trace :

```

52 53 50 32 20 20 20 20 20 20 20 20 20 20 20 20 RSP2
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00 ..

```

Rx J0 Length : 16

Rx J0 Trace :
CRC-7: 0xD8 ERROR

```

BC 4B 69 CC 79 24 1B 01 E8 EB 9C 36 FC 29 A9 00 .Ki.y$.6)...

```

STS1E Line Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE
05:35-05:35	0	0	0	73	0	0	0	0

High Order Path:

PATH 1:

Clock Source is internal

```

AIS = 0           RDI = 0           REI = 0           BIP(B3) = 0
LOP = 0           PSE = 0           NSE = 0           NEWPTR = 0
LOM = 0           PLM = 0           UNEQ = 0

```

Active Defects: None

Detected Alarms: None

Asserted/Active Alarms: None

Alarm reporting enabled for: PAIS PRDI PUNEQ PLOP PPLM LOM B3-TCA

TCA threshold: B3 = 10e-6

Rx: C2 = 04

Tx: C2 = 04

Tx J1 Length : 64

Tx J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00 RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

Expected J1 Length : 64

Expected J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00 RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

PATH TRACE BUFFER : UNSTABLE

Rx J1 Length : 64

Rx J1 Trace

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

SONET Path Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE

Verification of STS-1e Configuration

```

20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00 ..

```

Expected J0 Length : 64
 Expected J0 Trace :

```

52 53 50 32 20 20 20 20 20 20 20 20 20 20 20 20 RSP2
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00 ..

```

Rx J0 Length : 16
 Rx J0 Trace :

```

CRC-7: 0xD8 ERROR

BC 4B 69 CC 79 24 1B 01 E8 EB 9C 36 FC 29 A9 00 .Ki.y$.....6.)..

```

STS1E Line Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE
05:41-05:42	0	0	0	10	0	0	0	0

High Order Path:

PATH 1:
 Clock Source is internal

```

AIS = 0          RDI = 0          REI = 0          BIP(B3) = 0
LOP = 0          PSE = 0          NSE = 0          NEWPTR = 0
LOM = 0          PLM = 0          UNEQ = 0

```

Active Defects: None
 Detected Alarms: None
 Asserted/Active Alarms: None
 Alarm reporting enabled for: PAIS PRDI PUNEQ PLOP PPLM LOM B3-TCA

TCA threshold: B3 = 10e-6
 Rx: C2 = 04
 Tx: C2 = 04

Tx J1 Length : 64
 Tx J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00 RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

Expected J1 Length : 64
 Expected J1 Trace

```

52 53 50 32 20 30 2F 33 2F 31 34 2E 31 00 00 00 RSP2 0/3/14.1...
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

PATH TRACE BUFFER : UNSTABLE

Rx J1 Length : 64
 Rx J1 Trace

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

```
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
```

SONET Path Tables

INTERVAL	CV	ES	SES	UAS	CVFE	ESFE	SESFE	UASFE
05:42-05:42	0	0	0	0	0	0	0	0

STS1E 0/3/14.1 T3 is up.
Hardware is A900-IMA3G-IMSG

Applique type is Channelized T3 to T1
No alarms detected.
MDL transmission is disabled

FEAC code received: No code is being received
Framing is C-BIT Parity, Cablelength is 224
BER thresholds: SF = 10e-3 SD = 10e-6
Clock Source is internal
Equipment customer loopback
Data in current interval (60 seconds elapsed):
Near End
0 Line Code Violations, 0 P-bit Coding Violation
0 C-bit Coding Violation, 0 P-bit Err Secs
0 P-bit Severely Err Secs, 0 Severely Err Framing Secs
25 Unavailable Secs, 0 Line Errored Secs
0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
0 Severely Errored Line Secs, 0 Path Failures
0 AIS Defect Secs, 0 LOS Defect Secs
Far End
0 Errored Secs, 0 Severely Errored Secs
0 C-bit Unavailable Secs, 0 Path Failures
0 Code Violations, 0 Service Affecting Secs

STS-1 1, T1 1 (STS1E 0/3/14.1/1 T1) is up
No alarms detected.
Framing is unframed, Clock Source is Internal
Data in current interval (60 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
25 Unavail Secs, 0 Stuffed 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

STS-1 1, T1 2 (STS1E 0/3/14.1/2 T1) is up
timeslots:
FDL per AT&T 54016 spec.
No alarms detected.
Framing is ESF, Clock Source is Internal
Data in current interval (60 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
26 Unavail Secs, 0 Stuffed 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

