DS-3 Technology and Testing Overview

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Tel: 770-246-9662    Fax: 770-246-9733    www.telesync.com
• OC-48/STM-16 Optical Test System
• ISDN PRI (DS-1, E1) and BRI Remote Test and Connectivity Units
• DS-1, E1, DS-3, STS-1, OC-3, OC-12 Sources and Distribution Units
• DS-1 and DS-3 BERTS
• Centralized Modem Telephone Line Testing
• DS-1, E1 108 Digital Loopback Test Lines
• SW56/ISDN and X.21/ISDN Adapters for Video Conferencing and Internet Access
DS-3 Technology Fundamentals

- DS-3 Network Overview
- DS-3 Framing Structure
- Channelized/Non-Channelized DS-3
- Signal Formats
- Multiplexing Process
- Line Coding
DS-3 Network Elements

• M13 Mux
• DS-3 Network Interface Unit (NIU)
• Fiber Mux
• 3/3, 3/1, 3/1/0 Digital Cross-Connect Systems (DCS)
What is DS-3?

- High Capacity Private Line Service
- Data Transmission at 44.736 Mbps
- Bandwidth Equals 672 DS-0’s or 28 DS-1’s
- Channelized DS-3 Provides 28 DS-1 Channels
- Nonchannelized DS-3 Allows DS-3 End-User to Allocate Bandwidth as Needed
DS-3 Applications

• End Users
  – LAN Interconnection
  – Data-Intensive Mainframe-to-Mainframe Operations
  – Broadcast-Quality Video
  – CAD/CAM Transfer
TELESYNC®

DS-3 Applications

• Service Providers
  – Transmit Multiple DS-1’s on a Single Line
  – Interoffice Connections
  – Connection of CLEC’s to RBOC Network
  – Connection of ISP’s to Internet
DS-3 Benefits

- High Speed, Large Bandwidth Digital Signal Transport
- Can Contain 28 DS-1’s (672 DS-0’s) and Transmit Them Simultaneously
- Features More Flexibility than a Standard DS-1 Signal Transport
- Supports Wide Range of Applications
  - Video
  - CAD
  - CAM
- Formatted as Channelized or Non-Channelized
DS-1 Transport via DS-3
DS-3 and SONET
DS-3 Signal Rate
DS-1 to DS-2 (M12)

DS-1 #1
1.544 Mb/s
DS-1 #2
DS-1 #3
DS-1 #4

M12

DS-2 6.312 Mb/s
DS-3 Signal Rate
DS-2 to DS-3 (M23)
M13 Multiplexers

M13

Low Speed Cards

DS-1 #1
1.544 Mb/s

DS-1 #2

DS-1 #3

DS-1 #4

28 DS-1 Signals
Total

DS-1 #1
1.544 Mb/s

DS-1 #2

DS-1 #3

DS-1 #4

DS-2 6.312 Mb/s

High Speed Cards

M13

DS-3 44.736

M12

DS-2 6.312 Mb/s
DS-3 Framing

4704  Customer Information Bits
28    F-Bits
 2    X-Bits
 2    P-Bits
 3    M-bits
21    C-Bits
4760  Total Bits
DS-3 Overhead Bits

- F-bits are frame alignment bits
- X-bits are used for alarm signaling
- P-bits are parity bits
- M-bits identify the M-frame
- C-bits use varies depending on frame format used
DS-3 Channelized/Non-Channelized Signal Frame Format

M13 Asynchronous C-Bit Parity
DS-3 Timing
Comparison of M13 and C-Bit Framing

- M13 Framing
  - No loop code and only one Far End Alarm Interpretation (Yellow)

- C-Bit Framing
  - Can Interpret Alarms, FEOOF’s and FEBE’s, and loop individual DS-1’s and DS-3’s in the multiplexers.
Comparison of M13 and C-Bit Framing

- **M13 Framing**
  - Best In-Service measurement is Parity check (only 50% accurate) and can be altered as the signal is transported through the network.

- **C-Bit Framing**
  - In-service measurement are Parity and C-Bit Parity. C-Bit Parity will not get altered as the signal is transported through the network.
Comparison of M13 and C-Bit Framing

- C-Bit Framing
  - Has FEAC codes available for looping DS-3 muxes, individual DS-01’s, low speed cards and for sending alarm information.
DS-3 Testing Applications

- DS-3 Out-of-Service Testing
- DS-3 In-Service Monitoring
DS-3 Out-of-Service Testing

• Installation
  – DS-3 Switches
  – Muxs
  – DCSs
  – ADMs

• Testing Done at Central Office
• Testing Done at CPE
• Requires Disabling the Network and End-to-End Test
DS-3 Out-of-Service Testing

• Measure every single bit of a transmitted signal
• Ensures absolute measure of performance
DS-3 Out-of-Service Testing

• Selected pattern P1 is substituted for live traffic and then transmitted over the network

• Error detector generates identical pattern to P1. This is called the received pattern P2. P1 and P2 are then compared and any difference means a BIT ERROR.
DS-3 In-Service Monitoring

- Timely detection of performance degradation
- Performed as DS-3 circuits carry live traffic
- Performed at C.O., DSX-3, or at DCS test ports
DS-3 In-Service Monitoring

• DS-3 Point-of-Interface (POI) carrier-to-carrier interface
• DS-3 Point-of-Presence (POP)
  – Carrier-to-Customer Interface
• At customer DS-3 location
DS-3 In-Service Monitoring

- Monitoring M13 frame formats detects:
  - Frame Errors
  - Parity Errors

- Monitoring of C-Bit frame format detects:
  - C-bit parity errors
  - Far end block errors (FEBEs)
DS-3 Alarms

• LOS (Loss of Signal)
• LOF (Loss of Frame)
• AIS (Alarm Indicator Signal)
• Idle (DS-3 Idle Signal)
• Yellow (X-Bit)
DS-3 Alarms

• AIS - Alarm Indicator Signal
  – Problem on the line somewhere behind the last multiplexer (MUX), DCS, Fiber Mux

• Yellow - Far End Alarm
  – Terminating element such as an M13 Mux loses framing on its received DS-3 signal or receives an AIS signal
DS-3 Alarms

[Diagram showing DS-3 Alarms configuration]
DS-3 Alarms

• Idle Signal
  – DS-3 Idle signal allows DS-3 circuits to stay out of service without triggering network alarm
DS-3 Out-of Service Testing

• Loop the DS-3 at the far end
• Loop the DS-1s at the far end
DS-3 Out-of-Service Testing

• Perform when installing DS-3 circuits
• Prevents call-backs by proactively verifying:
  – Configuration of DS-3 NEs responsible for DS-3 signal transmission
  – Quality of transmitted signal and circuit connections
  – Correct synchronization of DS-3 circuit
Connecting TSI-4515 for Out-of-Service Testing
DS-3 Out-of-Service Testing
End-to-End

• Transmits an end-to-end or looped back PRBS pattern for commissioning
• Transmits single errors for continuity checks
DS-3 Out-of-Service Testing
End-to-End
DS-3 In-Service Performance Monitoring Using FEBEs

• FEBE - Far End Block Error
• C-Bit parity framing allows end-to-end performance monitoring of DS-3 circuits
• Verify end-to-end performance of DS-3 circuits while it is in service
DS-3 FEBE Errors
DS-3 In-Service Monitoring

• Provides in-service monitoring of F-bits, C-bits, X-bits, P-bits, C-parity bits and Far End Block Errors

• Counts all error categories simultaneously

• Notifies operator of thresholds and end of test.
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DS-3 Bi-Directional In-Service Monitoring
DS-3 In-Service Long Term Monitoring
DS-3 In-Service Circuit Test
DS-3 In-Service Test with DS-1 Drop/Insert

- Drop the DS-1 channel from the received DS-3 signal and perform complete DS-1 bit error rate testing
- Insert an internally generated DS-1 test pattern or loop code
- Perform out-of-service DS-1 testing over live DS-3 signal
DS-3 In-Service Test with DS-1 Drop/Insert

TELESYNC®

DS-1

DSX-1

M13 MUX

DSX-3

DS-3

Long Haul Fiber
Or Microwave Link

DSX-3

M13 MUX

TSI-4515

4 X DS-3 RX Signals

DS-1

DSX-1

CSU

4 DS-1's of 4 DS-3 signals

TSI-1524

4 DS-1s of 4 DS-3 signals
DS-3/DS-1 Circuit Test
Test DS-1s within DS-3 Service
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TSI-4515 DS-3/DS-1 Drop/Insert with BERTS

- Monitor and test DS-3 channels in the 3/1, 3/3, 3/1/0 DCS system
- Monitor and test DS-3 at any DSX-3 locations
- Used at DS-3 Point-of-Interface (POI) and Point-of-Presence (POP) locations for long term monitoring and testing
- Installed in an CO. 19/23” rack mount
- Optional portable chassis
TSI-4515 DS-3/DS-1 Drop/Insert with BERTS

• Provide dual DS-3 (TX/RX) performance monitoring and testing plus DS-1 Drop and Insert

• RS-232 interface for full remote control and monitoring from PC or terminal

• 15 Minute error bins over 24 hour period allows the unit to be used for long term monitoring of DS-3 and DS-1 circuits
**TELESYNC®**

**TSI-4515 DS-3/DS-1 Drop/Insert with BERTS**

- DS-1 signals can be routed to the TSI-1524 DS-1 Multichannel test unit for DS-1 measurements
- Cost effective solution of dropping and inserting DS-1 signals into the DS-3 network
- Test and monitor M13 or C-bit DS-3 signals
TSI-4515 DS-3/DS-1 Drop/Insert with BERTS

- Modular configuration can test up to 20 DS-3’s using 10 interconnecting chassis through a single RS-232 interface
- Can be used as a dual bridging repeater when the Thru Mode is selected
- Small size - 1.75”H x 11”W x 8.5”D
- Light weight - 3 pounds
- Most economical solution for dual DS-3 testing and monitoring
Thank You For Joining US!

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  • DS-1,E1, DS-3, STS-1, OC-3, OC-12 Sources and Distribution Units
  • DS-1 and DS-3 BERTS
  • Centralized Modem Telephone Line Testing
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