

Hands-On

## T1 - T3 & T1 Spanline Combo



### Course Description

This extensive Hands-On training course combines two of our courses into one 3-day course. This course will be tailored into a 3-day format and will not completely cover the entire 4-days of materials, but will be customized to meet your specific requirements, in the time allotted. The course outlines for each course will have to be looked and marked for the level of importance from high to low, and submitted to BTS for customization.

#### T1T3

A vast majority of Telecommunications companies use T1 (DS1) and T3 (DS3) systems as the primary method of transporting voice and data on their transmission networks therefore, having well trained technicians with the ability to install, maintain and troubleshoot these systems is vital to providing high-quality reliable service to customers in a highly competitive environment.

This course is an intense training experience that combines T1 and T3 operation with troubleshooting. For this course, BTS provides a live working classroom lab with typical equipment currently deployed in the telecommunications industry. Students learn how these systems work then are required to use the knowledge to test, troubleshoot and repair the circuits.

#### T1 Spanlines & HDSL

This course will also combine T1 Spanline and HDSL operation with troubleshooting. For this course, BTS provides a live working classroom lab with typical spanline equipment currently deployed in the telecommunications industry. Students learn how these systems work then are required to use the knowledge to test, troubleshoot and repair the circuits. Troubleshooting includes equipment failures, wiring problems, field repeater problems and cable pair problems.

### Students Will Learn

- The Operations and Functions Of T1 And T3 Systems, Including Channel Banks, Muxes, and Crossconnects.
- Use T1 and T3 Test Equipment To Monitor, Troubleshoot and Repair Network Circuits.
- Understand How T1 and T3 Circuits Work On Fiber Optic Systems.
- Describe The Need For Network Synchronization (BITS) Systems.T1 Theory And Operation, Including Channel Banks Special Circuits Such As Analog Data, DDS, Fractional T-1 And ISDN Framing, Line Coding And Signaling And Alarm Signals.
- T1 Circuit Layout From The Network, Through The Central Office, The T1 Span Line,
- To The Customer Premise Including Multiplexers, Channel Banks, DSX-1 Crossconnects, T1 And HDSL Span Lines And, NIU Smart Jacks And Csus At The Customer Premise.
- Hands-On Testing Of T1 Circuits Using Current Test Sets And Standard Test Patterns At DSX-1 Crossconnects And Other Test Access Points.
- T3 Theory And Operation, Including Multiplexers, DSX-3 Crossconnects And SONET Fiber Optic Equipment.
- Hands-On Testing Of T3 Circuits Using Current Test Sets And Standard Test Patterns.
- Network Synchronization Systems Using BITS Clock Equipment In The Central Office And Stratum-1 Timing Reference Sources, Such As GPS.
- T1 And T3 Test Sets Are Covered Extensively To Give The Student Confidence In Using Their Test Equipment To Test And Troubleshoot Circuits.
- Operations and Functions of T1 and HDSL Spanline Systems
- The Functions Of T1 Equipment Located Inside the Central Office, On the Copper Spanline and at the Customer Premise.
- To use T1 Test Equipment to Monitor, Troubleshoot and Repair Network Circuits.
- To use a Voltmeter to Test and Troubleshoot Power Problems on T1 and HDSL.
- T1 Signal Makeup Including Channel Bank Operation, Framing, Line Coding and
- Signaling and Alarm Signals.
- T1 Circuit Layout from the Network, Through the Central Office and T1 Span Line, To the
- Customer Premise.
- The function of T1 Spanline Repeaters, Signal Regeneration and Repeater Spacing.
- The function of the NIUs (Smart Jack) and CSUs at the Customer Prem.
- The DC Span Power System that Provides Repeater Voltage and Sealing Current.
- Hands-On Testing of T1 Spanlines Using Current Test Sets and Standard Test Patterns at Test Access Points.
- HDSL Signal (2b1q) and Function of The HTU-C, HTU-R and Doubler.

- Hands-On Testing Of HDSL Spanlines Using Current Test Sets.
- HDSL-2 and HDSL-4 Spanlines.
- Extensive Troubleshooting Of T1 and HDSL I Spanlines.
- And More...

## Target Audience

Outside Plant and Central Office Technicians.

## Prerequisites

Basic Telephony.

## Course Outline

The course outlines for each course will have to be looked and marked for the level of importance from high to low, and submitted to BTS for customization:

Hands-On T1-T3:

Module I: T1 Operation, Maintenance and Troubleshooting

- Circuit Layout and Circuit ID Numbers
- Binary Numbers
- T1 Channel Bank Operation
- Special Circuits (Analog Data, DDS, Frac. T-1, ISDN, T1 HiCap)
- Analog-to-Digital Conversion
- Signaling (SF and ESF)

- Line Coding (AMI and B8ZS)
- T1 Signal Specs.
- T1 Signal Errors and Alarms
- T1 Stress Test Patterns
- DSX-1 Crossconnects
- 1/0 DCS Systems
- T1 Traditional Spanlines, including span power and repeaters.
- HDSL, HDSL-2 and HDSL-4 Spanlines
- Customer Prem. Equipment (NIU Smartjacks, CSUs, RJ48 Jacks)
- Loop Codes for Customer Premise Equipment
- Troubleshooting techniques and step-by-step procedures
- And more...

#### Module II: T3 Operation, Maintenance and Troubleshooting

- M13 Multiplexer Operation and Equipment
- T3 Signal Characteristics
- T3 Signal Errors and Alarms
- T3 test signals and stress patterns
- DSX-3 Crossconnects
- 3/1 DCS
- SONET Technology and Fiber Optic Terminal Equipment
- Digital Bit Rates from DS0 to OC192
- WDM and DWDM Transport Technology
- Fiber Optic Patch Panels and Connectors
- Fiber Optic Ring Technology
- Frame Relay and ATM Networks
- And More...

#### Module III: Network Synchronization

- Stratum Clock Reference
- BITS Clocks
- Timing Distribution within the Central Office
- GPS Stratum-1 Reference
- And More...

## Hands-On T1 Spanlines:

### Module I: T1 and Signal Characteristics

Circuit Layout and Circuit ID Numbers

Binary Numbers

T1 Channel Bank Operation

Signaling (SF and ESF)

Line Coding (AMI and B8ZS)

T1 Signal Specs.

T1 Signal Errors and Alarms

T1 Stress Test Patterns

DSX-1 Crossconnects

And More...

### Module II: T1 Spanline Operation

Central Office Repeater functions and signal levels

Spanline Field Repeater functions and signal levels

Remote Repeater functions

NIU and CSU functions at the Customer Prem.

Measuring signal levels on the T1 Spanline

DC Power loop for repeater power and sealing current

Measuring DC voltage, current and resistance on the T1 Spanline

Troubleshooting T1 Spanline signal trouble

Troubleshooting T1 Spanline DC power loop troubles

And More...

### Module III: HDSL Spanline Operation

HTU-C functions and signal levels

HTU-R (NIU; Smart Jack) functions and signal levels

Doubler functions and signal levels

DC Power loop for repeater power and sealing current  
Connecting to HDSL equipment with a Laptop for analysis and troubleshooting.  
Troubleshooting HDSL Spanline signal trouble  
And More...

Module IV: HDSL-2 and HDSL-4 Spanline Operation  
HTU-C, HTU-R (NIU; Smart Jack), and Doubler functions and signal levels  
Connecting to HDSL-2 and HDSL-4 equipment with a Laptop for analysis and troubleshooting.  
Troubleshooting HDSL-2 and HDSL-4 Spanline signal trouble  
And More...

## Delivery Method

Hands-On Instructor Lead.

## Equipment Requirements

(This apply's to our hands-on courses only)

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

## Course Length

3 Days