The Acterna T-BERD 950 Communications Analyzer is a multi-functional instrument that combines troubleshooting and turn-up testing capabilities for digital, analog, voice, and data circuits in one unit. The T-BERD 950 thoroughly tests digital services such as T1/FT1, DDS local loop, and T1 PBX trunks. It also supports testing for analog services such as DID and analog data. Protocol services including ISDN BRI, ISDN PRI, and frame relay, in addition to other network technologies and services are also supported by the T-BERD 950. Built with the demands of the field technician in mind, the T-BERD 950 is designed to expand and support new technologies and services without sacrificing ease of use or portability.
Functions

- Perform standard T1 BER testing and signal analysis measurements
- Gain T1/FT1 access for BER testing with standard and advanced stress patterns, as well as built-in T1 smart repeater and HDSL loopcodes
- Test end-to-end WAN service through DTE/DCE equipment emulation and in-service monitoring
- Perform TIMS measurements for qualification of voice and data circuits; place, receive calls, and perform signaling event/digit analysis on analog loop start, ground start, and DID voice circuits
- Verify circuit-switched ISDN BRI voice, data, and D packet services by performing NT1 and LT BERT, or NT1/TE emulation

The T-BERD 950 can verify network/WAN connectivity from an Ethernet interface by transmitting Internet control message protocol (ICMP) echo requests (PINGs) and respond to received PINGs. Additionally, the T-BERD 950 can place, receive, and monitor ISDN PRI calls on 23 B+D, 47 B+D, and 46 B+2D circuits while viewing full layer 3 D channel decodes. When testing DS0 channels, the T-BERD 950 can place, receive, or monitor calls as well as analyze captured signaling events and digits on T1 voice trunks when performing PCM TIMS tests such as C-message noise and three tone slope over individual channels. Accessing standard BERT options such as frame relay allows the T-BERD 950 to perform dual receiver monitoring or terminated testing at the customer’s four-wire DDS 64k, 56k, or sub-rate lines. The T-BERD 950 provides complete link management at customer premises equipment (CPE) and test frame generation to verify frame relay LMI functionality, PVC status and quality of service (QoS).

Applications

T1 Testing

The T-BERD 950 T1 tester provides T1 measurements to determine frame and CRC errors, and signal level, allowing T1/FT1 access for standard BERT and testing applications such as signaling, PCM TIMS, frame relay and ISDN PRI. The two transmitters and receivers provide terminate, drop and insert, and dual receiver monitoring test mode.

Extensive, standard BERT features provide the most accurate measure of point-to-point transmission performance by stress testing circuits to ensure proper circuit configuration and identify transmission impairments. Advanced features such as automatic pattern synchronization, MULTIPAT, built-in HDSL loopcodes and T1 smart repeater loopcodes, round trip delay measurements, and G.821 performance results accompany a full range of stress patterns.

Get all of the testing power you need to turn up and troubleshoot multiple services—in one compact, rugged tester
**DDS Local Loop Testing**

The DDS local loop option provides capability for testing and analyzing the DDS four-wire local loop. The CSU/DSU emulation feature allows the user to perform the turn-up as well as verify switch parameters for the existing DDS service. In the event that the local loop is not the cause of the trouble, the OCU-DP emulation feature helps determine if possible problems reside at the CPE. In addition, dual-receiver monitoring allows for troubleshooting the DDS circuit by analyzing receive frequency, signal level, sealing current, BPVs, DDS frame errors, and timing slips.

![CSU/DSU emulation](image)

![OCU-DP emulation](image)

**ISDN PRI Testing**

The ISDN Primary Rate Interface (PRI) option enables the T-BERD 950 to emulate an NT or TE device, such as a PBX at the CPE, for verification of ISDN service and the correct switch translations for inbound and outbound calls. Call placement, receipt, and monitoring is supported on single PRI configurations as well as NFAS and NFAS with D channel back-up implementations. It also supports monitoring of D channel activity simultaneously with T1 facility conditions from a T1 access point and provides plain English descriptions for Q.931 Cause Codes. Like the frame relay option, the ISDN PRI option requires the installation of the Protocol Services Board.

![Primary rate ISDN testing](image)

![Dual receiver monitoring](image)
**ISDN BRI Testing**

The ISDN Basic Rate Interface (BRI) option, in conjunction with the Protocol Services Board option, enables the T-BERD 950 to perform BER testing, protocol analysis (D channel analysis), voice and data call placement and receipt and X.25 D channel packet call analysis. The LT and the NT1 emulation features allow the user to perform BER testing on the U interface toward the NT1 and toward the LT, respectively. In addition, the NT1/TE emulation provides a tool for placing and receiving voice and data calls at the U interface.

**Analog 2-Wire/4-Wire Testing**

The T-BERD 950 Analog 2W/4W Interface Module provides technicians with the capability to perform installation and troubleshooting tests for analog voice, analog data, and digital data services. The module is an optional interface for the T-BERD 950 that can be used for the following test applications:

- TIMS pre-qualification of the copper pair for analog point-to-point service
- TIMS pre-qualification for the copper pair for digital wide band service including DDS, ISDN, HDSL, and IDSL
- Testing of analog voice services including loop start, ground start, and DID through PBX emulation. (Note: The current Analog 2-Wire/4-Wire Interface Module supports only DID PBX emulation).
Datacom Testing

The Datacom (DTE/DCE) Interface Module is an optional interface module to the T-BERD 950. With this option, the user can perform BER or frame relay testing, or emulate the CPE. The Datacom (DTE/DCE) Interface Module allows the user to emulate a DTE or DCE, while dual-receiver monitoring supports full duplex monitoring at synchronous BER testing rates from 50 bps to 10 Mbps. Overall, this module allows the user to extend end-to-end testing at synchronous data rates by supporting the most common data interfaces.

Frame Relay Testing

Frame Relay testing is an option for the T-BERD 950 that requires installation of the Protocol Services Board. It enables the user to perform frame relay service installation and maintenance from the T1, DDS-LL, and datacom interface. This option offers strong CPE emulation and dual receiver monitoring features. In addition, the frame relay option allows the user to perform link management emulation and test frame generation to verify LMI functionality, PVC status, and QoS.
**10BaseT Testing**

The T-BERD 950 10BaseT option supports the verification of IP service from 10BaseT interface. Connectivity can be verified from the CPE on the drop side of an IAD or router to various points within the network by transmitting and responding to ICMP echo requests (PINGs). The option also allows the user to transmit and receive IP traffic at user-selectable rates to verify actual throughput performance against the expected rate for the WAN access circuit in use. Additionally, basic Ethernet physical layer results and IP statistics are provided. Like the Frame Relay and ISDN PRI options, this option also requires the installation of the Protocol Services Board.
**PCM TIMS Testing**

The PCM TIMS option enables the user to perform testing on individual voice channels from a digital (T1) access point. The PCM TIMS option operates in three different T1 configuration modes: terminate, drop and insert, or monitor. End-to-end channel performance can be tested from the T1 access to ensure proper VF service quality. When this type of testing is performed on a VF channel, the T-BERD 950’s two T1 receivers allow non-intrusive PCM TIMS measurement with the presence of a variable frequency/level tone, holding tone, or quiet transmission. By performing the PCM TIMS measurement at various points along the T1 circuit, the user can differentiate between VF service and T1 transmission problems.

**Signaling**

The T-BERD 950 Signaling option allows the user to verify service when turning up a new T1 trunk and supports troubleshooting of PBX to switch connections. The entire T1 trunk can be terminated for out of service testing or drop and insert testing can be performed on a single DS0 channel. Proper PBX and switch operation can be verified through call origination, call termination, signaling verification, and in-depth event and digit measurements. With two T1 receivers, the T-BERD 950 supports full duplex monitoring of signaling events and digits associated with a specific DS0.

**TNT Task Based Testing**

The T-BERD 950 currently supports six physical interfaces for testing, including T1, DDS Local Loop, Datacom (RS-232, EIA-53, RS-449, X.21 and V.35), Analog 2-wire/4-wire, BRI (U interface), and 10BaseT. TNT Task Based Testing provides an efficient user interface, which simplifies turn-up and troubleshooting procedures for testing of services on all supported interfaces. By using the tasks and terminology typically employed by a technician, TNT Task Based Testing streamlines the testing process by reducing the number of configuration items and time required to obtain results.
# Technical Specifications

## PHYSICAL CHARACTERISTICS

**Overall dimensions**: 10.5 x 13.25 x 4 in. (26.8 x 33.66 x 10.17 cm)

**Weight**: 10 lbs (4.55 kg) without batteries, 13 lbs (5.9 kg)

## ENVIRONMENTAL

**Temperature Range**
- **Operating**: 32° F to 122° F (0° C to +50° C)
- **Non-Operating**: -4° F to 140° F (-20° C to +60° C)

**Humidity**: 10% to 90% Relative Humidity, non

**Vibration**: Per BellCore NEBS TR-EOP-000063

**Shock**: Per IEEE-743-1985

## ALTITUDE

**Operating**: 200 ft. (61 m) below sea level to 16,400 ft (49,210 ft)

**Non-operating storage or transportation**: 49,210 ft, (15,000 m)

## POWER REQUIREMENTS

**AC Power**
- **Input Voltage**: 90 to 240 VAC, 47 to 63 Hz, autodetected
- **Power Dissipation**: 30 watts (typical), 68 watts (peak - two batteries receiving initial charge)
- **Fuse Type**: 250 Volt, 1 Amp Slo-Blo (LittleFuse p/n 218001)

**DC Power**
- **Battery Type**: Panasonic LCS-2012DP (2 required)
- **Operating Time**: Depends on configuration, up to 4 hours

## T1 SPECIFICATIONS

**Operating Modes**: Terminate (TERM), Drop & Insert (D&I), Monitor (MON), Line Loopback (LLB)

**Framing**: ESF, SF, SLC, Unframed, Auto

### T1 Input

**Frequency**: 1.544 MHz ±5000 Hz

**Input Impedance**
- **TERM**: 100 ohms ±5%
- **BRIDGE**: 1000 ohms minimum
- **DSX-MON**: 100 ohms ±5%

**Operating Range**
- **TERM**: +6 dBdsx to -35.0 dBdsx cable attenuation
- **DSX-MON**: +6 dBdsx to 35.0 dBdsx cable attenuation

### T1 Output

**Frequency**: 1.544 MHz ±7 Hz

**Clock Sources**
- Internal Oscillator, Recovered (from associated path receiver)
- Line Build Out (LBO): 0, -7.5, -15, -22.5 dB ± 1 dB at 772kHz

**Operating Range**: -10 dBdsx to -30 dBdsx resistive attenuation

**Line Coding**: AMI, B8ZS

**Error Insert Type**: BPV, Logic, Frame, L&BPV (Logic and BPV errors)

**Indicators**: Signal Present, Frame Sync, Pattern Sync, B8ZS Detect, AIS (Alarm Indication Signal) and Yellow Alarm

## DDS SPECIFICATIONS

**Data Formats**: Standard DDS and DDS with Secondary Channel

**Primary Channel Data Rates**: 2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 kbps

**Secondary Channel Data**: Idle, 511, and 2047

**BER testing patterns are available**

**Clock Source**: Internal Oscillator, Recovered timing from received signal

## RECEIVE SIGNAL

**Connection**: OCU-DP mode: RJ-45 pins 1 & 2, DSU/CSU mode: RJ-45 pins 7 & 8

**Termination Impedance**: Balanced, 135 Ω ±5%

**Bridging Impedance**: Greater than 1900 Ω

**Operating Range**: +6.0 dB to -45 dB minimum (56 kbps and 64 kbps) -OR- +6.0 dB to -40 dB minimum (all other data rates)
Transmit Signal
Connection: OCU-DP mode: RJ-45: pins 7 & 8

Termination Impedance
Output Levels: Balanced, 135 W, ±5%
Output Levels: 0, -3, -6, and -9 dB of simulated cable attenuation
Test Modes: TERMINATE, MONITOR, Line Loop Back (LLB)
Emulation Modes: DSU/CSU, OCU-DP or Metallic

Simplex Current
Input Level: ±30 mA maximum
Measurement range: ±26 mA with an accuracy of ±10% or 2mA
OCU-DP mode current output: ≥ 4 mA to 20 mA depending on span length

Error Insertion
Operation: Single or continuous
Error insert type: Logic, BPV, L&BVP, or Frame
Loop Response: V.54, DSU/CSU, Disabled

FRAME RELAY SPECIFICATIONS
Test Modes: Terminate, Drop & Insert (T1 Interface only), Monitor
Link Management Analysis: LMI Rev.1, T1.617 Annex D, Auto, None
PING Testing: ICMP Echo Test

ISDN BRI U INTERFACE SPECIFICATIONS
Interface: U Interface with To LT and To NT
Devices: NT1
Physical Configuration: Point to Point, Synchronous and Full-Duplex
Bit Rate: 160 kbps
User Data Rate: 144 kbps
Line Coding: 2B1Q
Line Rate: 192 kbps
Maximum Voltage: ± 2.5 V

10BASET/ETHERNET SPECIFICATIONS
Test Modes: Terminate
DHCP Implementation: RFC 2131
PING Testing: ICMP Echo Test
Traffic Generation
Load Rate: 1 kbps to 10 Mbps (User Selectable)
Packet Length: 70 to 1518 bytes (User Selectable)

ANALOG MODULE SPECIFICATIONS
Interfaces
Two Bantam connectors: 2-wire alternate Transmit and Receive on the 2W/4W Tx connector. 4-wire simultaneous Transmit on the 2W/4W Tx connector and Receive on the 4W Rx connector
Termination Impedance: 135 Ω, 600 Ω, or 900 Ω
Loopbacks: Tx VF Loop Up, Tx VF Loop Down
2713 Hz Loopback response
Level: 10 dB to -30 dB
Frequency: 2706 Hz to 2720 Hz

Receive Holding Tone
Frequency: 1004 Hz
Level: Controllable from +10 dBm to -40dBm
Stability: ±0.005 Hz
Ring Detection (2 Wire Only): 40 V to 150 V
RMS ringing signal, 16 Hz to 68 Hz
Line Holding Current: 26 mA DC, -8.6 V to -56.7 V
(Signaling or Signaling plus TIMS)

Dial and Receive Digit Types
DP: Dial Pulse
DTMF: Dual Tone Multifrequency
MF: Multifrequency (DID only)

DATACOM MODULE SPECIFICATIONS
Interface
EIA-530: Supports EIA-422-B for BA, BB, CA, CB, CC, CD, CF, DA, DB, and DD
RS-449: Supports EIA-422-B for SD, RD, RS, CS, DM, TR, RR, RT, ST and TT
V.35/306: Supports balanced clock and data circuits, and EIA-232/V.24/V.28 control circuits
V.28 - BA, BB, CA, CB, DD, CF, DA, DB, and DD
X.21: Supports V.11 for R, I, S, T and C
Data Rates: EIA-232
Max. Synchronous Data Rate: 128 kbps
Max. Recovered Data Rate: 128 kbps
RS-449 Terminated
Max. Synchronous Data Rate: 10 Mbps
Max. Recovered Data Rate: 512 kbps RS-449 Unterminated
Max. Synchronous: with cable characteristics
Max. Recovered .................................. 512 kbps

**EIA-530 Terminated**
Max. Synchronous Data Rate .................... 10 Mbps
Max. Recovered Data Rate .................... 512 kbps

**EIA-530 Unterminerated**
Max. Synchronous .............................. Varies with cable characteristics
Max. Recovered .................................. 512 kbps, X.21
Max. Synchronous .............................. Varies with cable characteristics
Max. Recovered ................................. Varies with cable characteristics, V.35
Max. Synchronous .............................. Varies with cable characteristics
Max. Recovered ................................. 512 kbps, V.35-306 Max. Synchronous
Data Rate ................................. 5 Mbps Max. Recovered Data Rate: 512 kbps

Test Modes ..................................... BERT,
Frame Relay

**Clock Source**
Tx Timing ..................................... Interface, internal synthesizer
recovered from received data
Rx Timing ..................................... Interface, internal
synthesizer recovered from the received data or automatic

**Operation Modes** ............................ DCE Emulation,
                          DTE Emulation,
                          Monitor

**Ordering Information**

*Mainframe/Interface Modules*
TB950-ANLG Analog (2W/4W) Interface Module
TB950-DATA Datacom (DTE/DCE) Interface Module

*Options*
TB950-BRI* Basic Rate ISDN
TB950-LL DDS Local Loop
TB950-10BT* Ethernet 10BaseT
TB950-FR* Frame Relay
TB950-SIG PCM Signaling
TB950-TIMS PCM TIMS