# 2310 SONET Field Services Module

Product Highlights

- Multi-rate transmission testing from DS0 to OC-48c in a single hand-held unit
- Multi-services testing capabilities including ATM, GR-303, ISDN, signaling, voice frequency (VF), and digital data service (DDS)
- Multiple operation modes to terminate and monitor circuits from various network access points
- Easy-to-use, touch-screen graphical user interface (GUI) simplifies and expedites testing
- Modular TestPad 2000 architecture enables up-to-date support for established and emerging technologies in a single platform
- Engineered for the field with rugged construction, lightweight design, and battery-powered operation
- Automated testing features minimize training costs and testing complexity

Application Highlights

- Perform end-to-end BER testing using a wide range of stress test patterns
- Analyze network performance by simulating abnormal conditions and inserting various errors and alarms
- Perform in-service monitoring of the circuit under test to ensure quality of service
- Verify proper provisioning of network multiplexers and de-multiplexers
- Qualify protocol services such as ATM, GR-303, and ISDN and decode protocol messages
- Perform VF and signaling analysis on test circuits
- Troubleshoot performance of channelized DS0 services from an in-service circuit using the drop and insert operational mode
- Perform network timing synchronization tests and isolate timing errors

The 2310 SONET Field Services Module is an all-in-one integrated testing solution that performs multi-rate transmission testing from DS0 to OC-48/48c and supports physical layer and enhanced services testing at different network rates. Its modular architecture protects your long-term investment by providing the flexibility, scalability, and field upgradability to support evolving test needs.

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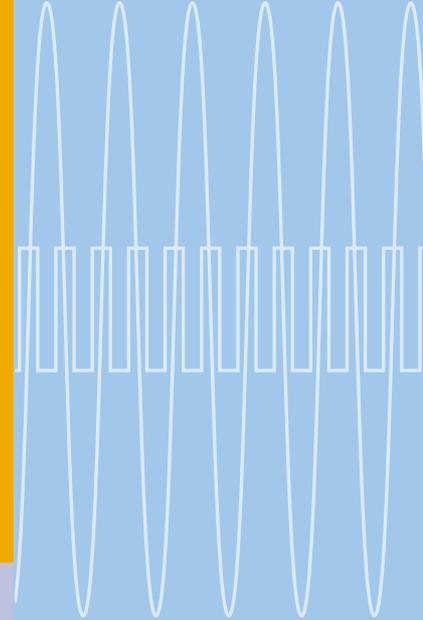
Function Highlights

- Test optical interfaces at OC-48/48c, OC-12/12c, and OC-3/3c rates

- Test electrical interfaces at STS-1, DS3, and DS1 rates

- Perform bit error rate tests on SONET/DS3/DS1 circuits

- Manipulate SONET overhead bytes with an easy-to-use interface and analyze network performance under abnormal conditions

- Perform bi-directional monitoring of STS-1/DS3/DS1 circuits

- Monitor and test ATM circuits and verify quality of service measurements

- Place and receive calls on an ISDN PRI circuit and test non-facility associated signaling (NFAS) and back-up D-Channel circuits

- Monitor GR-303 protocol links for proper configuration and collect call statistics

- Analyze signaling bits on a T1 voice trunk and place and receive calls

- Use VT100 emulation to configure and monitor network elements

Features

The 2310 meets the ever-changing needs of today's transmission test workforce with powerful features that provide streamlined, reliable functionality across all applications. With the 2310, testing and service qualification are as easy as the touch of a button. Because technicians need only minimal training to use this equipment, testing objectives are addressed more quickly and costs of ownership are significantly reduced. Key features on the 2310 include:

Application-Driven Icons—Test application buttons are labeled with icons which clearly depict the way the test is performed on the circuit (e.g., circuit monitoring tests are indicated by "MON/THRU"). The icons and quick setup buttons enable techicians to use the 2310 effectively, with very little training.

Application driven icons

Dual results window
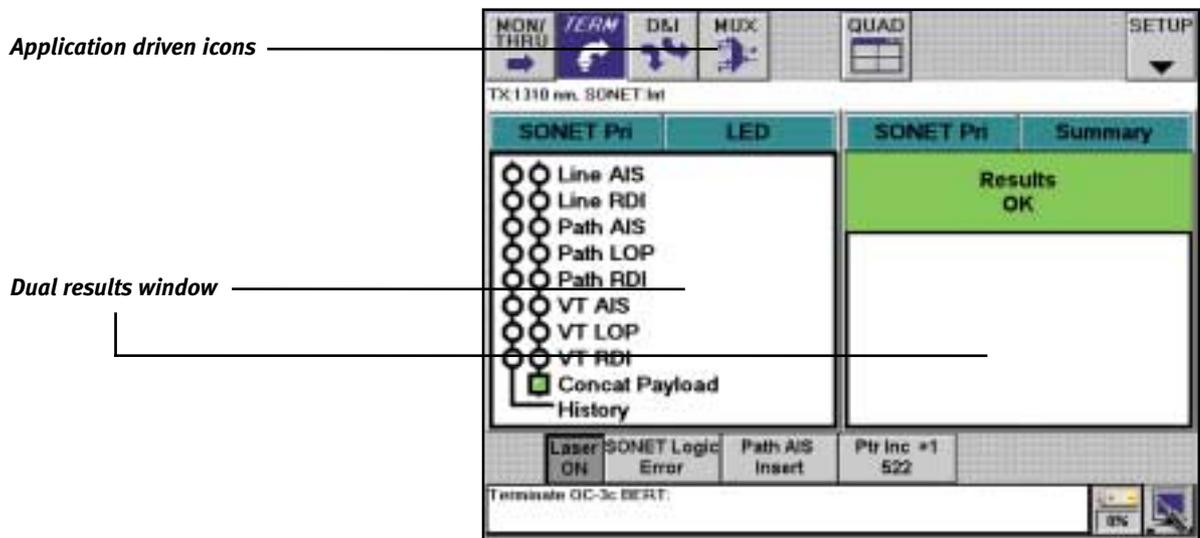
Auto Configuration—Support for auto configuration is provided in all key applications on the 2310. One-button touch configures different test parameters, such as framing, pattern, and tributary scan, and enables users to reduce the test set-up time required.

Automation—Reduce set-up time and increase efficiency of the tests performed by running pre-programmed scripts off the PCMCIA card. The command line remote control feature enables technicians to connect to the 2310 through the PCMCIA serial card or PCMCIA modem and configure tests or analyze results in detail.

Use automation scripts to verify network performance with the touch of a single button
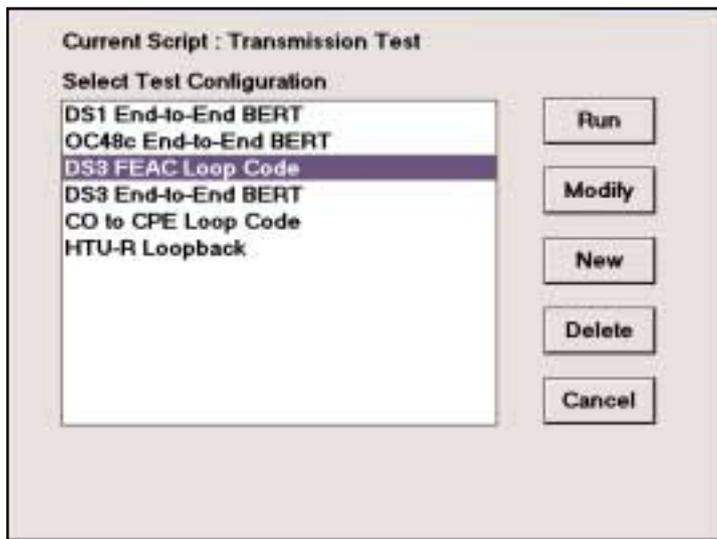
Configurable Results (Quad Results™)—Correlate results from multiple interfaces and payload mappings (SONET/DS3/DS1) and quickly assess network performance by using the 2310's configurable results features. It also provides functionality to analyze selected results simultaneously in up to four windows.

View selected results from multiple interfaces simultaneously

Physical, Active Port, and Laser Active LEDs—A bright array of physical LEDs on the front panel summarizes results and clearly identifies errors detected during a test. Active Port LEDs on the top panel display the interfaces to use for specific tests—a key consideration when performing mux tests. Laser Active LEDs indicate when the transmit laser is active and when laser pulses are received.

Simultaneous Results for Different Signal Rates—Analyze results from different signal rates simultaneously (e.g., DS1 in a muxed DS3 in an OC-3 signal) to quickly identify the source of problems and verify circuit performance. Soft LED results also provide rapid access to information on errors and alarms.

VT100 Emulation—Perform VT100 terminal emulation to connect to network elements in order to perform configurations and monitor available statistics.

Perform VT100 emulation to configure network elements and monitor statistics
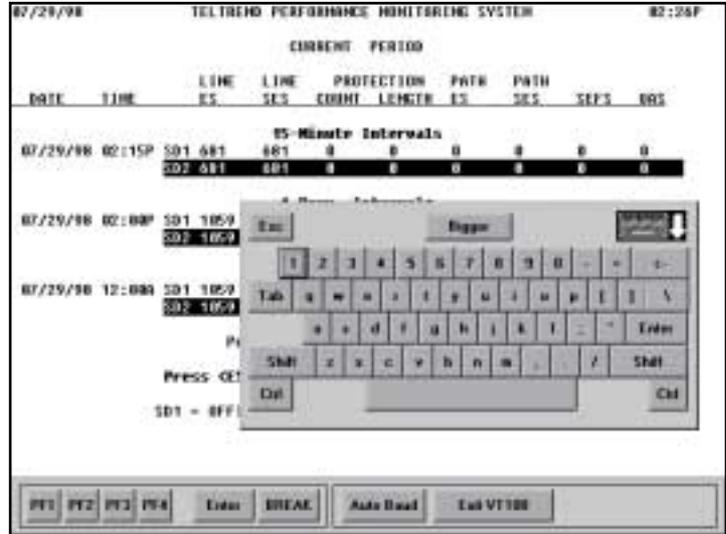
Timed Prints and Error Logs—Print results every few minutes, at the end of a test, or at the occurrence of an error using the 2310's print features.

Through Mode for All Rates—Gain access to test circuits (DS1 through OC-48) even when no test access or monitor point is provided. The 2310's Through mode capability monitors test circuits by channeling network traffic through the test equipment.

Applications

SONET Analysis

Qualify the performance of SONET networks quickly and easily with the 2310's intuitive GUI. With its support for various payload mappings, the 2310 enables testing and verification of individual payloads inside an OC-n signal (DS1, DS3, muxed DS3, VT1.5, OC-n subrates). Technicians can name and identify trace messages and payloads by using the 2310's user-configurable path trace messages. The 2310's SONET test applications can be used to:

* Verify end-to-end network performance via BER testing at optical and electrical interface rates (OC-48/48c, OC-12/12c, OC-3/3c, STS-1, DS3, DS1)
* Analyze SONET network performance under abnormal conditions by simulating pointer justifications and inserting error and alarm conditions
* Detect performance degradations and alarms and verify protection line connectivity using Monitor/Through mode
* Verify SONET network element performance by manipulating overhead bytes (e.g., pointer adjustments, alarms, K1/K2 bytes)
* Monitor individual DS1 or DS3 payloads and OC-n subrates for analysis
* Verify signal power, signal frequency, and level measurements

Verify network performance at various points of a SONET Network
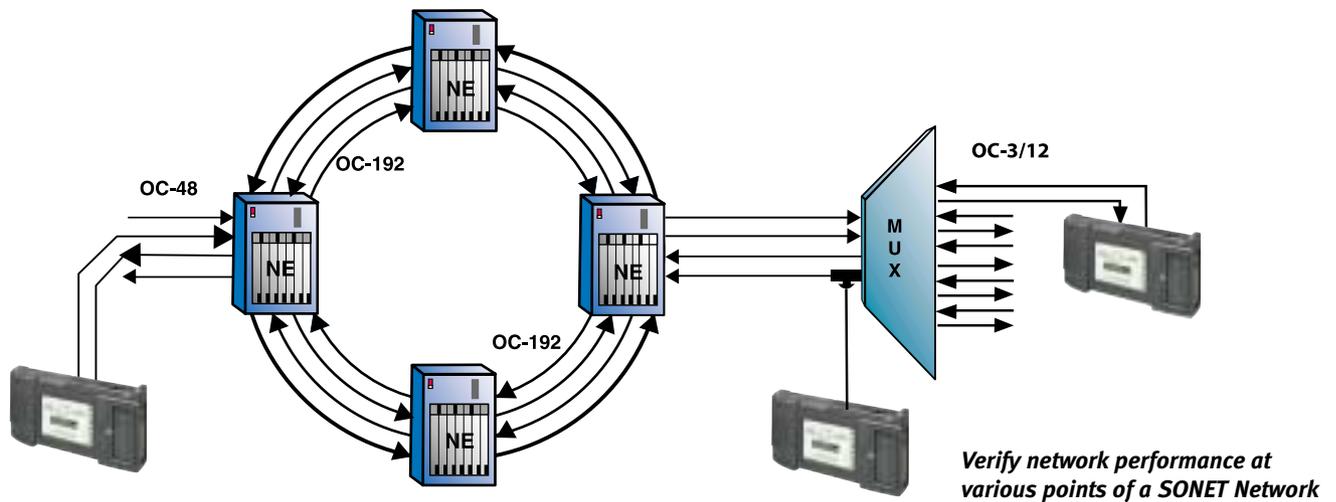
DS3 Analysis

Ensure DS3 network performance by using end-to-end BER testing and by measuring frequency and signal levels on the circuit under test. Technicians can qualify networks for accurate multiplexer operation by performing BER testing on one or all DS1 channels transmitted by a DS3 multiplexer. Access to the DS3 signal is provided from the DS3 interface or a DS3 signal embedded in an STS-1, OC-3, OC-12, or OC-48 circuit. Reduce total testing time on DS3 circuits by using the dual DS3 receivers to perform bi-directional monitoring.

Perform bi-directional monitoring and BER testing on DS1 and DS3 circuits
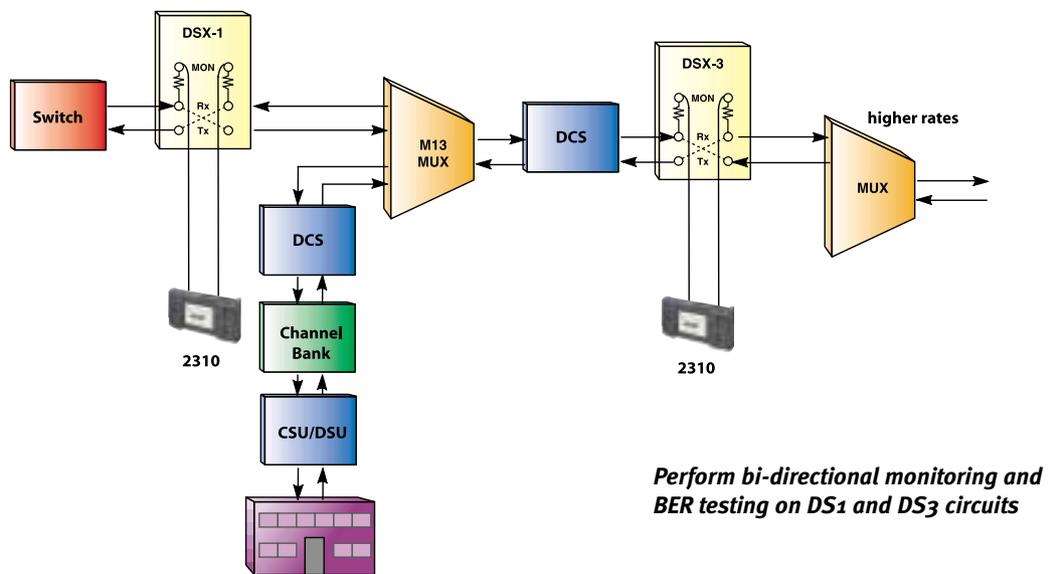
DS1 Analysis

Verify T1 network performance with the 2310's integrated BER test and with signal, alarm, and timing tests. A wide range of stress test patterns combined with bi-directional monitoring enable technicians to identify and sectionalize circuit problems and quickly qualify circuits for service acceptance. Users can perform VF analysis of voice trunks with the 2310's VF levels and tones measurement support. The drop-and-insert test feature qualifies a DS0 channel while the T1 circuit remains in service. The 2310 isolates sources of timing errors by using external bits clock input to identify network synchronization problems. Access to the DS1 signal is provided from the T1 interface or from the DS1 signal embedded in a DS3, STS-1, OC-3, OC-12, or OC-48 circuit.

ATM Analysis

Analyze ATM circuits at OC-3c and OC-12c rates and generate multiple cell-streams to perform key quality of service measurements, cell statistics, and bandwidth utilization. The 2310 also provides support to modify the VPI/VCI, PTI, CLP, and GFC fields of the cell header, and to save up to four transmit profiles.

ATM Search
[TTC #1 Test Cells]

GR-303 Protocol Link Analysis

Perform basic GR-303 protocol link analysis in Monitor/Through mode at the 64K data rate on a call processing (TMC/CSC) or operations channel (EOC). Analysis is conducted unobtrusively to decode messages at the system's protocol links. Technicians can monitor call statistics, filter call control messages based on cause code, or monitor layer-2 packet statistics to qualify proper functioning of the GR-303 interface.

ISDN PRI Testing

Emulate an ISDN TE device (e.g., PBX) to place and receive voice and data calls on an ISDN PRI circuit. The 2310 enables users to monitor and capture signaling messages exchanged on the D-Channel. Call status results and progress reports provide an additional level of detail to ensure calls are successfully established. ISDN functions provided by the 2310 include:

- Support for AT&T—5ESS, DMS-100, National ISDN-II—specific call control
- Backup D-Channel testing functionality to switch between stand-by and in-service D-Channels
- Test multiple DS1 lines with NFAS testing
- Bi-directional monitoring with full text decodes for protocol messages exchanged on the D-Channel

Perform ISDN Terminal Emulation as well as monitor ISDN links from DS1, DS3 and STS-1 circuits
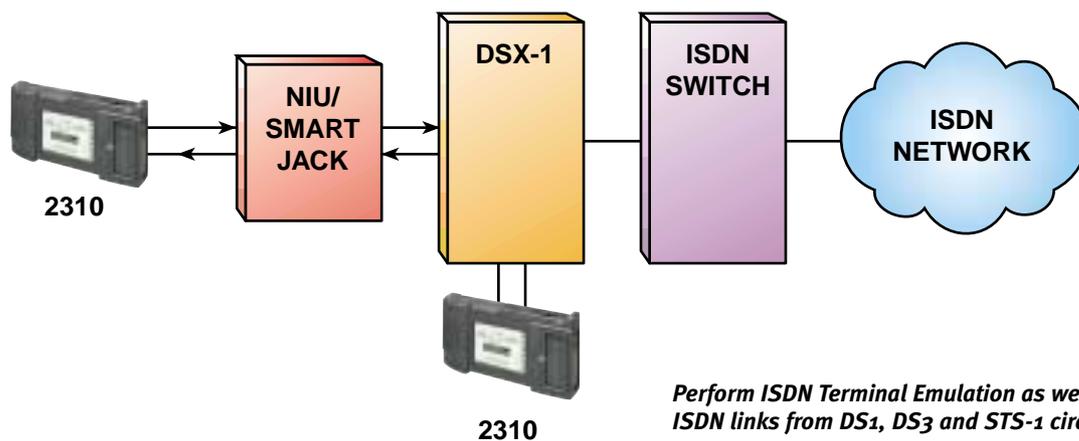
Signaling Analysis

Emulate the PBX/switch for placing and receiving calls and monitor signaling digits for detailed analysis. Key signaling features of the 2310 include:

- Emulate E&M, loop start, and ground start for placing and receiving calls
- DP, DTMF, and MF digit recognition
- Inter-event or inter-digit delay measurements
- Event and digit duration measurements
- Speaker, microphone, or handset functionality for checking voice integrity
- Signaling (ABCD) bits for all DS0s in one simple result window

Loop-Back Applications

Sectionalize T1 circuit problems with the 2310's support for NIU/CSU loop-back and user-programmable loop codes. The 2310 verifies proper functioning of Intelligent Line equipment and repeaters using its built-in support to loop-back network equipment. Technicians can also loop-back DS3 circuit network equipment using DS3 FEAC code functionality.

Send Near End Arm	
Arm	Disarm
Loop Up	Loop Down

Online Help

Easy-to-use Help screens provide information on product descriptions; quick cards; screen layouts; cabling diagrams; and contact information.
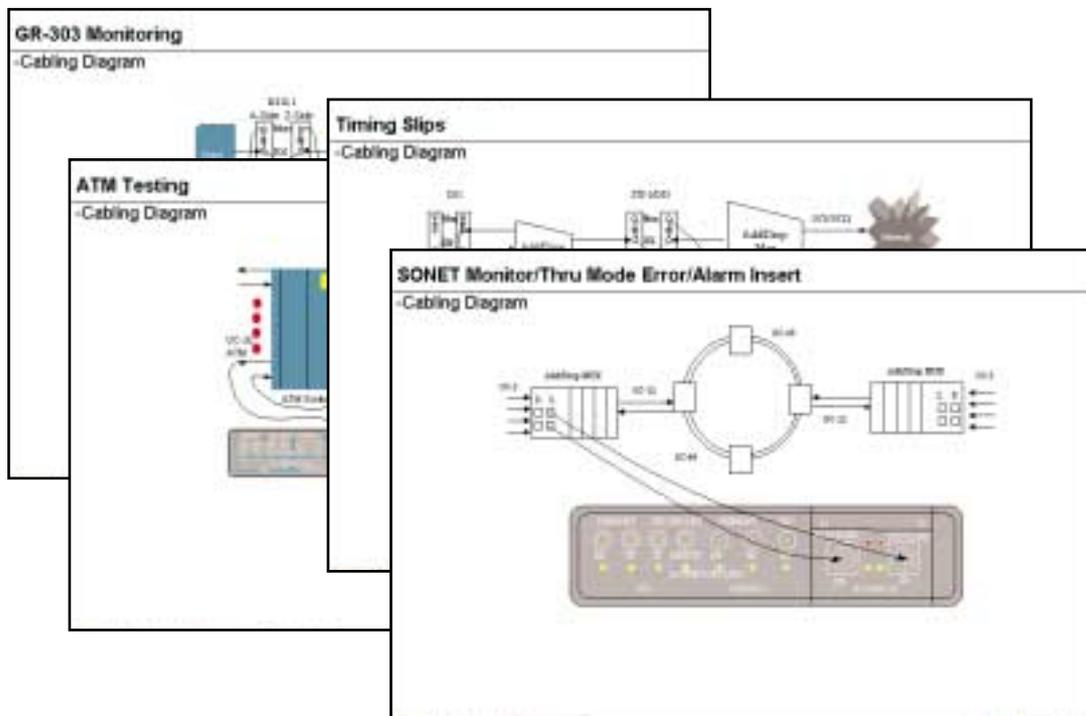
Online Help provides quick cards and cabling diagrams

Technical Specifications

PHYSICAL CHARACTERISTICS

Overall dimensions ....7.5 x 11.5 x 2.25 inches
(19 x 29.2 x 5.7 cm)

Weight ....5 lbs (2.27 kg), with battery

Charge LED

Power LED

Dual-PCMCIA Card Slot

Speaker

Printer Connector

Battery Door

Microphone

Low Battery LED

Dual DS1 Tx/Rx

Dual DS3 Rx, Single TX

Optical Connectors for OC-3/12/48

Rx Pulse and TX Laser LEDs

Active Port LEDs

LED Display Panel

Touch Sensitive LCD
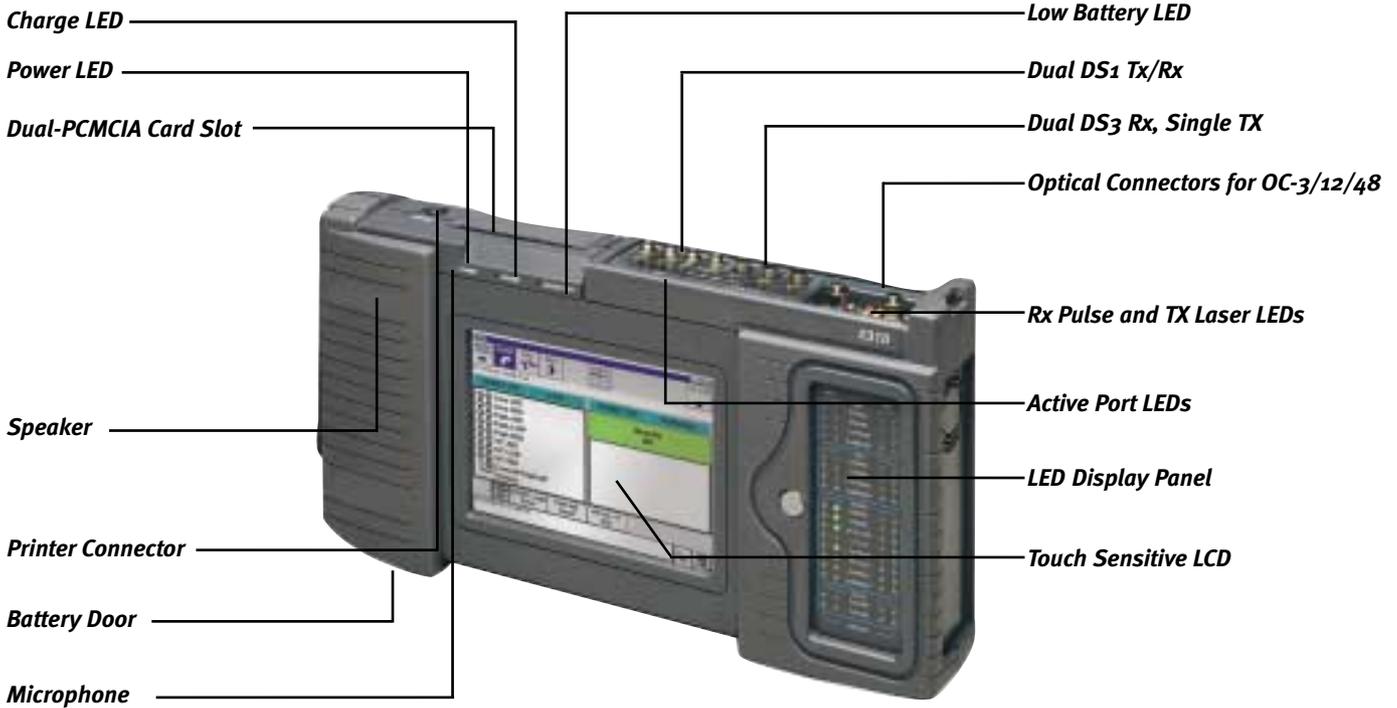
ENVIRONMENT

Temperature range

Operating ....32° F to 113° F (0° C to 45° C)

Storage ....-4° F to 158° F (-20° C to 70° C)

Shock and vibration.............................Meets IEEE-743

Electrical

Battery type ......10.8 V Nickel-Metal-Hydride (NiMH)

Operating time ....Up to 1.5 hours for performing DS3/DS1 tests

Recharging period...Maximum 1.5 hours with unit off

AC adaptor ....19 VDC, 2.6 amps
90-240 VAC, 45-65 Hz

OPTICAL SPECIFICATIONS FOR OC-3/12

Optical connectors

1 OC-3/12 Receive - FC, SC, or ST

1 OC-3/12 Transmit - FC, SC, or ST

Transmit signal

Average output power ....–8 dBm to –15 dBm

Eye diagram ....Per BELL CORE GR-253-C-1995

Clock frequency accuracy...± 3 ppm ± 1 ppm per year

Receive signal

Average input power receive level ....–8 dBm to –28 dBm

Frequency range ....± 500 ppm

Clock frequency accuracy ....± 3 ppm
± 1 ppm per year

Jitter tolerance...Per BELL CORE GR-253-CORE-1995

Level measurement

Range...-5 to –45 dBm

Accuracy...± 2 dB

Resolution...± 0.1 dB

Multimode receiver

Single mode transmitter

OPTICAL SPECIFICATIONS FOR OC-48

Optical connectors

1 OC-48 Receive - FC, SC, or ST

1 OC-48 High-Power Transmit - FC, SC, or ST

1 OC-48 Low-Power Transmit - FC, SC, or ST

Transmitter

Single/multimode fiber compatible

Dual wavelength.................................1310 nm/1550 nm

Clock frequency accuracy..................................± 3 ppm

High-power TX output.............+2.0 dBm to –4.3 dBm

Low-power TX output.............–8.0 dBm to –15.0 dBm

Receiver

Single/multimode fiber compatible

Dual wavelength.................................1310 nm/1550 nm

Rx clock frequency.......................................± 3 ppm

Receive level sensitivity...................–8 dBm to –28 dBm

Receiver shutdown.............................–6 dBm or higher

INPUT SPECIFICATIONS FOR DS3 AND STS-1

Connector type...................................WECO 560A jack

Input level

High...................................Accepts nominal 1.2 Vp, 0 ft
of cable from High Source

DSX ....Accepts nominal 0.6 Vp, 450 ft
of cable from High Source

Low................................Accepts nominal 0.3 Vp, 900 ft
of cable from High Source

Maximum signal level without errors with 1.7 Vp

Minimum signal level without errors with 0.025 Vp

Maximum input signal level with 2.5 Vp

Input impedance ....75 ohms nominal,
unbalanced to ground

Jitter tolerance.........................Exceeds TR-TSY-000499

OUTPUT SPECIFICATIONS FOR DS3 AND STS-1

Connector type...................................WECO 560A jack

Output level

High.................................Nominal 1.2 Vp; signal meets
ANSI T1.102-1993 and ITU-T G.703
when subject to 450 ft of cable loss

DSX ....Nominal 0.61 Vp; signal meets
ANSI T1.102-1993 and ITU-T G.703

Low ....Nominal 0.31 Vp

Output impedance ....75 ohms nominal,
unbalanced to ground

Jitter tolerance................................Per TR-TSY-000499

Frequency

DS3 ....44.736 MHz ± 10 ppm

STS-1 ....51.84 MHz ± 3 ppm ± 1 ppm per year

INPUT SPECIFICATIONS FOR DS1

Connector type ....Bantam jack

Frequency.....................................1.544 MHz ± 50 ppm

Impedance

BRIDGE ....1000 ohms minimum

TERM..100 ohms ± 5%

DSX-MON...100 ohms ± 5%

Range

BRIDGE..+6 to –35.0 dBdsx

TERM..+6 to –35.0 dBdsx

DSX-MON ....–10 to –26.0 dBdsx of resistive loss

Jitter tolerance.........................Per Bell Pub 62411-1990

Accuracy

Receive Level Measurement ....From 6 dBdsx to
–15 dBdsx, accuracy of ± 1 dB

....From –16 dBdsx to
–30 dBdsx, accuracy of ± 2 dB

....From –31 dBdsx to
–40 dBdsx, accuracy of ± 3 dB

Simplex current measurement..........................± 2% or
± 2 mA to 60 mA
± 3% or ± 3 mA from 61 mA to 175 mA

Frequency measurement accuracy ....± 3 ppm
± 1 ppm/year

OUTPUT SPECIFICATIONS FOR DS1

Connector type ....Bantam jack

LBO level

Line build-out of 0, –7.5, –15.0, and –22.5 dB of cable
loss at 772 Hz

LBO tolerance

....± 2 dB for –22.5 at 772 kHz

..........................± 1 dB for 0, –7.5, and –15 at 772 kHz

Internal timing ....± 3 ppm ± 1 ppm per year

Line codes ....AMI or B8ZS

Error insert type...........................Logic, BPV, or Frame

Pulse shape ....Per applicable specifications

SOURCES

Specifications/recommendations used

....IEEE 743

..................................ITU-T recommendation G.703

........AT&T publications CB113, CB119, CB132, CB143

....ANSI T1.403-1995

....................AT&T publications PUB62508, PUB62411

.....................................ITU-T recommendation G.824

....TR-TSY-000499, category 1.2

....ANSI T1.102-1993

....Bellcore GR253-Core-1995

....Bell Pub 62411-1990

Ordering Information

User Interface Module

2000-V3   TestPad 2000 (includes soft carrying case, kickstand, AC adapter/charger, printer cable)

Application Modules

TB2310-DS1   DS1 Communications Analyzer

TB2310-DS3   DS3/DS1 Communications Analyzer

TB2310-STS1   STS-1/DS3/DS1 Communications Analyzer

TB2310-OC3XX *   OC3/3c, STS-1/DS3/DS1 Communications Analyzer

TB2310-OC12XX *   OC12/12c, OC3/3c, STS-1/DS3/DS1 Communications Analyzer

TB2310-OC48XX *   OC48/48c, OC12/12c, OC3/3c, STS-1/DS3/DS1

Communications Analyzer

TB2310-OC48DXX *   OC48/48c, OC12/12c, OC3/3c, STS-1/DS3/DS1

Communications Analyzer with both 1310 nm and 1550 nm laser

* Specify type of optical connector: FC, SC, or ST

Analyzer Options

TB2310-ASP   Advanced stress patterns

TB2310-ATM-OC3   ATM analysis for OC3c

TB2310-ATM-OC12   ATM analysis for OC12c

TB2310-DDS   Digital data services (DDS) analysis

TB2310-DUALRX   Secondary receiver for DS3 and STS-1 interfaces

TB2310-FT1   Fractional T1

TB2310-GR303   GR-303 analysis

TB2310-ILE   Intelligent Line equipment

TB2310-PRI   Primary Rate ISDN

TB2310-SIG	Signaling
TB2310-TIM	VF PCM TIMS
TB2310-VT100	VT100 emulation

Packages

	DS1	DS3	STS1	OC3	OC12	OC48	OC48D	UIM	VT100	Dual Rx
TB2310-P1	X	X	X					X	X	X
TB2310-P2	X	X	X	X				X	X	X
TB2310-P3	X	X	X	X	X			X	X	X
TB2310-P4	X							X	X	X
TB2310-P5	X	X						X	X	X
TB2310-P6	X	X	X	X	X	X		X	X	X
TB2310-P7	X	X	X	X	X		X	X	X	X

	FT1	TIM	SIG	ASP	ILE	DDS	PRI
TB2310-SW1	X	X	X	X			
TB2310-SW2	X	X	X	X	X	X	
TB2310-SW3	X	X	X	X			X
TB2310-SW4	X	X	X	X	X	X	X

Optional Accessories

AC-31705	External Battery Charger
AC-31891	Hanging Strap
BA-014081	Replacement Battery
CC-44605	Carrying Case, Large, Soft
CC-451-58	Carrying Case, Multi-module, Soft
RM-TTC2000	Rack mount for TestPad

Additional Application Modules Available
Optical Modules
2510 10-Gig Field Services Module
2416 SDH Field Services Module

Access Modules
2209 T1/T3 Field Services Module
2230 E1 Data Communications Analyzer
2207 T1/T3 Wireless Field Services Module

Copper Modules
2109 Copper Analyzer Module
2357 DSL Broadband Services Module

2310SE/PRE/TR/IND/03-01

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