





Key Features

- Smallest and lightest solution for DS1 to 10-Gbps testing at 13 lb
- Optical testing at OC-3/12/48/192, STM-1/4/16/64, and electrical testing at E1/DS1/DS3/STS-1 rates
- Configurable for 1310 nm, 1550 nm or both wavelengths for 10-Gbps and 2.5G/622M/155M test interfaces
- SONET and SDH tributary mappings analysis from STS-192c to DS1 and AU-4-64c to AU-3
- Terminate, Monitor, and Through modes of operation to analyze circuits
- Easy-to-use touch screen and graphical user interface (GUI) simplifies and expedites testing

The JDSU FST-2510a TestPad, formerly known as the JDSU 10-Gigabit Services Module (2510), is an all-in-one test solution that performs multi-rate transmission testing in metro networks at SONET, SDH and T/E-carrier. Its scalable configuration and upgradeability to multiple technologies accommodates evolving test needs now and in the future.

Designed for mobile use, the rugged FST-2510a provides DS1 to 10-Gbps capability in a conveniently sized package for mobile applications and comprehensive test capability for in-depth central office testing.

The breadth of testing functionality that the FST platform supports illustrates why it is the standard for metro networks. Providers can now test T/E-carrier, wireless, Ethernet, SONET/SDH, DWDM, copper and DSL technologies with one standard platform.

In metro networks, the increasing deployment of high-speed optical services and multiservice provisioning platforms has created the need for a compact, multirate, transmission test solution. The FST-2510a enables the efficient turn-up and maintenance of these networks

Features

DS1/E1 to 10-Gbps BER testing

Perform BER testing on all line interfaces in end-to-end or loopback applications. Insert errors and alarms to verify network element conformance and connectivity. Measure bit error rate to ensure quality of service.

Overhead byte manipulation

Using the overhead byte manipulation and analysis capabilities of the FST-2510a, technicians can modify K1 and K2 bytes to test APS; specify and identify user-configurable path trace messages and payloads.

Round-trip delay

Immediately identify network latency with the round-trip delay pattern, at all line rates.

Through mode capability

Access to SONET/SDH circuits can be gained even when no test access is provided. Through mode capability at all rates allows advanced SONET/SDH circuits to be monitored nonintrusively by channeling network traffic through the FST-2510a.

Signal power and transmit frequency variation

Optical power and transmit frequency offset ensure that received signals are within acceptable error limits and network elements' thresholds are within manufacturers' specifications.

VT100 emulation

Direct connection to network elements allows users to provision network elements and monitor available statistics.

Summary Fran Pointer Channel	ning Pattern T Trace Laser	iming RxInput APS S1(21 C	Error Alarm
A1	A2	or	J1 ——
	E1 0x00	F1 0x00	B3 —
D1 0x00	D2 0x00	D3 0x00	C2 0x04
н1 ——	H2 ——	H0 ——	G1 0x00
	K1 0x00	K2 0x00	F2 0x00
D4 0x00	D5 0x00	D6 0x00	H4 —
D7 0x00	D8 0x00	D9 0x00	Z3 0x00
D10 0x00	D11 0x00	D12 0x00	Z4 0x00
S1 0x01	M1	E2 0x00	N1 0x00
	Be	cel	
0		C	ancel

SOH expert setup menu



SONET OC-192 test with path trace message displayed



DS1 test results summary and LED display

The FST-2510a offers an easy-to-use intuitive interface that streamlines the process of analyzing DS1 to 10G signals.

Applications

Turn-up and maintain OC-192/STM-64 rings and tributary service

As OC-192/STM-64 rings are deployed to carry traffic along capacity-starved routes, technicians can qualify SONET/SDH rings and tributary services with a traffic-simulating BERT pattern. The FST-2510a also tests lower-rate tributaries running within the OC-192/STM-64 ring, including STS-48/12/3, AU-4-16c to AU-3, STS-1/DS3, and DS1/E1.

Qualify 10-gigabit signals over DWDM networks

When DWDM networks are deployed, wavelengths carrying a 10-gigabit SONET/SDH link must be qualified for traffic. Qualify channels by using the FST-2510a to terminate test patterns over each wavelength via a BER test.

Verify end-to-end network performance

The FST-2510a stresses the SONET/SDH link under test through a pseudorandom BER test pattern (a randomized bit sequence that simulates live data), offering 2^{2-1} and 2^{3-1} BERT patterns.

Perform network analysis under simulated abnormal conditions

Generate and analyze a comprehensive range of errors and alarms to simulate abnormal conditions.

Conduct in-service monitoring of optical and electrical signals

Monitor/Through mode allows visibility into the SONET/SDH signal while it carries revenue-generating customer traffic. Troubleshoot and sectionalize network problems by analyzing the overhead and payload – without incurring costs for downtime.



figure 1 Test tributaries inside 10-Gig signal

figure 2 End-to-end network performance

Specifications

General specifications	
Overall dimensions	8.5 x 13.5 x 5.0 in
	(21.6 x 34.3 x 12.7 cm)
Overall weight	13 lb (5.7 kg), with battery
Environment	
Operating temperature range	32° to 104°F
	0° to 40°C
Storage	−4° to 158°F, −20° to 70°C
Shock and vibration	Meets IEEE-743
Power requirements	
AC adapter	24 VDC, 5.4 amps
	100 to 240 VAC, 47 to 63 Hz
Display	

6-inch diagonal graphic LCD color

Optical connectors

- 1 1310 nm 1 1550 nm	1 10-Gig Receive — FC or SC 10-Gig transmit — FC or SC 10-Gig transmit — FC or SC		
Transmitter			
Singlemode fiber compatible			
Wavelength	1310 nm and/or 1550 nm		
Clock frequency accuracy	±3 ppm		
1310 nm power TX output	-1.0 dBm to -6.0 dBm		
1550 nm power TX output	+2 dBm to −1 dBm		
Receiver			
Singlemode/multimode fiber compatible			
Rx wavelength range	1100 to 1600 nm		
Rx clock frequency	±3 ppm		
Rx level sensitivity	-1.0 dBm to -14.0 dBm		
•			

-9 dBm to -23dBm

FC CC

Optical specifications for OC-48/12/3 and STM-16/4/1

Optical connectors

APD Rx level sensitivity

1 2.5-GIG RECEIVE – FC, SC, OF ST			
1 1310 nm 2.5-Gig Transmit — FC, SC, or ST			
1 1550 nm 2.5-Gig Transmit — FC, SC, or S			
Transmitter			
Singlemode fiber compatible			
Wavelength	1310 nm or 1550 nm		
Clock frequency accuracy	±3 ppm		
1310 nm power TX output	+3.0 dBm to -2.0 dBm		
1550 nm power TX output	+3.0 dBm to -2.0 dBm		
Receiver			
Singlemode/multimode fiber compatible			
Rx wavelength range	1100 to 1600 nm		
Rx clock frequency	±3 ppm		
Rx level sensitivity	-8.0 dBm to -28.0 dBm		
Rx shutdown	-6.0 dBm or higher		

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Electrical speci	fications for DS3 AND STS-1
Connector type	BNC
Transmitter	
High	Nominal 1.2 Vp; signal meets
	ANST 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	44.736 MHz ±10 ppm
STS-1 freq	51.84 MHz \pm 3 ppm \pm 1 ppm per year
Line code	B3ZS
Framing Receiver	Unframed, M13 and C-Bit Parity
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 leve	l without errors with 1.7 Vp
Minimum signal leve	l without errors with 0.025 Vp
Maximum input sign	al level with 2.5 Vp
Input impedance	75 ohms nominal,
	unbalanced to ground
Jitter tolerance	Exceeds TR-TSY-000499
Electrical spec	ifications for E1
<i>c</i> ,	

Connector	KJ-45 and BNC
	75 ohm unbalanced and 120 ohm balanced
Transmitter	
Frequency	$2.048~\mathrm{MHz}\pm50~\mathrm{ppm}$
Internal timing	\pm 4.6 ppm \pm 1 ppm per year
Line codes	HDB3 and AMI
Receiver	
Impedance	
Bridge	120 ohms minimum
Term	120 ohms ±5%
DSX	120 ohms ±5%
Range	
Bridge	+3.0 to -32.0 dBdsx
Term	+3.0 to -32.0 dBdsx
DSX	+3.0 to -32.0 dBdsx
Jitter tolerance	ITU-T G.823

Electrical specif	ications for DS1
Connector type	Bantam jack
Transmitter	
Frequency	$1.544~\mathrm{MHz}\pm50~\mathrm{ppm}$
nternal timing	± 4.6 ppm ± 1 ppm per year
Line codes	AMI or B8ZS
Pulse shape	Per applicable specifications
Receiver	
mpedance	
Bridge	100 ohms minimum
lerm .	100 ohms ±5%
DSX	100 ohms ±5%
Range	
Bridge	+6 to -35.0 dBdsx
lerm .	+6 to -35.0 dBdsx
DSX	-10 to -26.0 dBdsx of resistive loss
litter tolerance	Per Bell Pub 62411-1990
Accuracy	
Receive level measuren	nent
From 6	$_{5}$ 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 measu	rement
	+2% or +2 mA to 60 mA +3%
	or $+3$ mA from 61 mA to 175 mA
Frequency measureme	nt accuracy ± 3 ppm ± 1 ppm/year
Measurement t	ypes
APS time Criteria	for measurement: AIS and analysis rate
Maximu	m measurable switch-over time: 127 ms
	Resolution: 1 ms
Round-trip delay	1 microsecond to 5 seconds
Fransmit frequency offs	set Resolution: ±1 ppm
	Maximum: ±50 ppm
TU-T Recommendation	1 G.826 EB, ES, SES, and EBB
TU-T Recommendation	1 G.828 EB, ES, SES, and EBB
TU-T Recommendation	1 G.829 EB, ES, SES, and EBB
Results display	specifications
Fuent lea	Dienlaye all alarm and arrest suggest
Event log	uspiays an aidfin and error events
	with a time stamp of ms resolution of
	error events and parameters
	500-line memory capacity

	enor events and parameters
	500-line memory capacity
Numerical display	Display of count (absolute)
	and rate (relative) values of error type
Display update rate	1 second
Results printout	Manually triggered or timed print
Serial	V.24/RS 232
Result export	Results can be stored or
	a PCMCIA card in ASCII formation

5

Compliance

ITU

ANSI	
T1.101-1999	Synchronization interface standards
	for digital networks
T1.102-1993	Digital hierarchy –electrical interfaces
T1.102.01-1996	Digital hierarchy —
	VT1.5 electrical interface
T1.105-1995	Synchronous optical network (SONET) -
basic o	lescription including multiplex structure,
	rates and formats
T1.105.01-2000	Synchronous optical network (SONET) -
	automatic protection
T1.105.02-1995	Synchronous optical network (SONET) -
	payload mappings
T1.105.03-1994	Synchronous optical network (SONET) -
	jitter at network interfaces
T1.105.03a-1995	Synchronous optical network (SONET) -
	supplement to T1.105.03-1994
T1.105.04-1995	Synchronous optical network (SONET) -
	data communication channel
	protocol and architectures
T1.105.05-1994	Synchronous optical network (SONET) -
	tandem connection maintenance
T1.105.06-1996	Synchronous optical network (SONET) -
	physical layer specifications
T1.105.07-1996	Synchronous optical network (SONET) -
sub-STS-1	I interface rates and formats specification
T1.105.09-1996	Synchronous optical network (SONET) -
netv	work element timing and synchronization
T1.107-1995	Digital hierarchy – formats specifications
T1.107a-1990	Supplement to T1.107
T1.107b-1991	Supplement to T1.107
T1.231-1997	Layer 1 in-service digital
	transmission performance monitoring
T1.404-1994	Network (carrier)-to-customer
	installation – DS3 metallic interface
T1.404a-1996	Supplement T1.404
	ATT Pub 62508 high capacity digital
specia	access service transmission parameters,
	limits and interface combinations
GR-253-CORE, Issue 3	Transport systems generic
	requirements: common requirements

ITU-T Rec. G.703-1998	Physical/electrical characteristics of
	hierarchical digital interfaces
ITU-T Rec. G.707-2000	Network node interface for the
	synchronous digital hierarchy (SDH)
ITU-T Rec. G.709-2001	Network node interface
	for the optical transport network (OTN)
ITU-T Rec. G.783-2000	Characteristics of
	synchronous digital hierarchy (SDH)
	equipment functional blocks
ITU-T Rec.G.813-1996	Timing characteristics
	of SDH equipment slave clocks (SEC)
ITU-T Rec. G.825-2000	The control of jitter and
wa	nder within digital networks which are
base	d on the synchronous digital hierarchy
ITU-T Rec. G.957-1999	Optical interfaces for equipment
	and systems relating to the
	synchronous digital hierarchy
ITU-T Rec. G.958-1994	Digital line systems based on the
	synchronous digital hierarchy
	for use on optical fiber cables
TU-T Rec. 0.150-1996	General requirements for
instrumer	tation for performance measurements
	on digital transmission equipment
ITU-T Rec. 0.181-1996	Equipment to assess error
	performance on STM-N interfaces
ITU-T Rec. G.826-1999	Error performance parameters and
	objectives for international,
	constant bit rate digital paths at or
	above the primary rate
ITU-T Rec. G.828-2000	Error performance parameters and
	objectives for international
constar	t bit rate and synchronous digital path
ITU-T Rec. M2100-1995	Bringing-into-service
	of international PDH paths, sections
	and transmission systems and
	SDH paths and multiplex sections
ITU-T Rec. M2101.1-199	7 Performance limits for bringing-
	into-service and maintenance of
internati	onal SDH paths and multiplex sections
110-1 Rec. M.2101-2000	Performance limits for bringing-
• • •	into-service and maintenance of
Internat	onal SDH paths and multiplex sections
110-1 Kec. G.829-2000	Error performance parameters and
	objectives for international constant
	bit rate and synchronous digital path

Ordering information

User Interface Module	
Description	Part number
FST-2000 color display	2000-V6
Package descriptions	
Description	Part number
1550 nm 10-Gig only	2510a-P1-IR2
1310 and 1550 nm 10-Gig only	2510a-P2-IR2
1310 nm 2.5-Gig to DS1	2510a-P3-LR2
1310 and 1550 nm 2.5-Gig to DS1	2510a-P4-LR2
1550 nm 10-Gig and 1310 nm	
2.5-Gig to DS1	2510a-P5-IR2
1310 and 1550 nm 10-Gig and 1310 nm	
2.5-Gig to DS1	2510a-P6-IR2
1310 nm 10-Gig and 1310 and 1550 nm	
2.5-Gig to DS1	2510a-P7-IR2
1310 and 1550 nm 10-Gig and 1310 and 155	0 nm
2.5-Gig to DS1	2510a-P8-IR2
NOTE: High sensitivity receiver option availab	le for all packages

Additional JDSU Testpad application modules available

Description	Part number
T1/T3 Wireless Module	FST-2207
T1/T3 Module	FST-2209
SONET Services Module	FST-2310
SDH Services Module	FST-2416
DSL Broadband Services Module	FST-2357
Copper Analyzer Module	FST-2109
E1 Data Communications Module	FST-2230
Gigabit Ethernet Services Module	FST-2802
Base Station and Air Interface Test Module	BAT-2700

Other related products

JDSU T-BERD Communications Analyzer 310 JDSU ANT-20 Advanced Network Tester

Optional accessories

Description	Pai
Carrying case, multimodule, soft	

Part number CC-45158



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