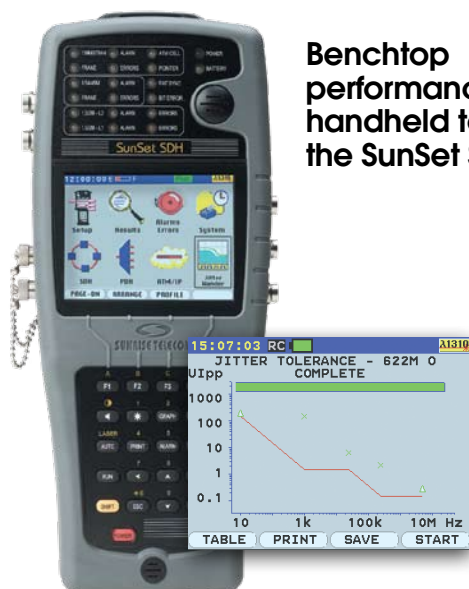




Benchtop performance in a handheld test set - the SunSet SDH

Combining the power of a benchtop SDH/PDH set and protocol analyzer into a handheld platform, the SunSet SDH offers advanced testing for SDH, PDH, and ATM networks and services. With electrical and optical interfaces, the SunSet SDH tests from 64 kbit/s to 622 Mbit/s (STM-4). Its lightweight, durability, long battery life, and low cost make it the ideal tool for field technicians in the access and metropolitan networks. And with jitter and wander testing capabilities, save time and money for installation, maintenance, troubleshooting, and commissioning tasks, either at the central office or in the field.

KEY features

- SDH testing at 52, 155, and 622 Mbit/s
- PDH & T-Carrier testing at 1.5, 2, 34, 45, and 139 Mbit/s; PDH/T-Carrier structured mode
- Bit error rate testing and error performance analysis per ITU-T G.821, G.826, G.828, G.829, M.2100, M.2101, and M.2110
- SDH-SDH, SDH-PDH MuxTest modes; Independent Tx and Rx for testing ADMs and synchronous multiplexers
- SDH/PDH MuxMode: drop and insert of 1.5/2M tributaries
- Full SDH overhead control and decode
- Tributary scan for alarm and error monitoring
- APS timing measurement and APS bytes capture
- Pointer monitoring, pointer adjustment, pointer offset and G.783 pointer test sequences
- ITU-T compliant Jitter generation, measurement, tolerance & transfer tests, pointer jitter test in MuxTest mode
- Real time wander TIE measurements and offline MTIE/TDEV analysis software conforming to ITU-T G.811, G.812, G.813, G.823
- Pulse mask analysis at 1.5, 2, 34, and 45 Mbit/s

- Tandem connections: errors, alarms, APId capture and generation
- Voice frequency testing: talk/listen, send/receive tones, noise measurements
- ATM testing at 1.5, 2, 34, 45, 155, and 622 Mbit/s
- ATM traffic generation, ATM QoS measurements, ATM Adaptation Layer (AAL0, AAL1, AAL2, AAL5) tests
- IP over ATM testing, ATM DSL DSLAM test

Benefits

- SDH/PDH/ATM feature-rich
- Lightweight and highly portable
- Eliminates the need for multiple and heavier instruments without compromising test features or accuracy
- Intuitive and easy-to-use
- Cost-effective and future-proof
- Increases efficiency
- Consolidates training and shortens the learning curve
- Handles multiple tasks including installation, maintenance, troubleshooting, and commissioning

Applications

Installation, Maintenance, Troubleshooting & Commissioning

The SunSet SDH is the ideal product for installation and bringing into service tasks in the field and central office. Commissioning and acceptance tests can be performed with the same test set, as jitter and wander features are part of the conformance procedures. Maintenance and troubleshooting in-service tasks can also be completed with the same handheld test set saving time and money.

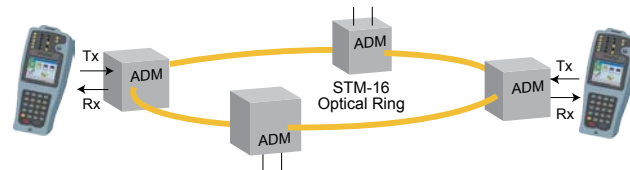
Out-of-Service Testing

- End-to-end BERT
- Bringing into Service per ITU-T M.2110
- ATM testing
- Trace generation
- Round trip delay
- NE verification
- Pulse mask analysis at 1.5M, 2M, 34M, and 45M
- Voice frequency testing: Talk/listen, send/receive tones
- MuxTest
- Jitter tests
 - Jitter generation and measurement
 - Jitter tolerance and transfer measurement
 - Pointer/mapping jitter test
- Wander tests

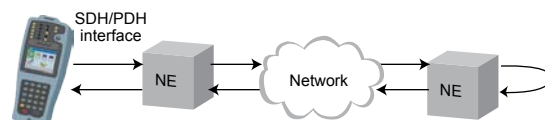
In-Service Monitoring

- Through protected monitoring points or optical splitters
- Line through and payload through mode
- Error performance analysis per G.826, G.828, G.829, M.2101
- SDH overhead bytes decode
- Pointer monitoring
- APS timing measurement and APS capture
- In-service tributary scan
- Voice traffic monitoring
- In-service jitter/wander measurements
- Troubleshooting synchronization problems

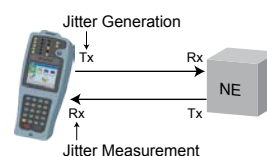
Out-of-Service testing



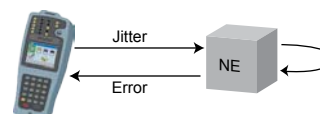
Round trip delay



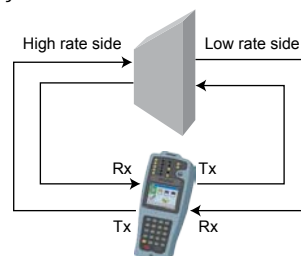
Jitter generation/measurement



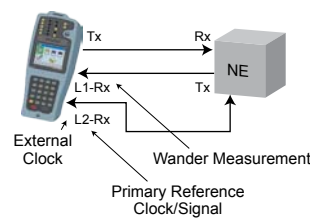
Jitter tolerance/transfer measurements



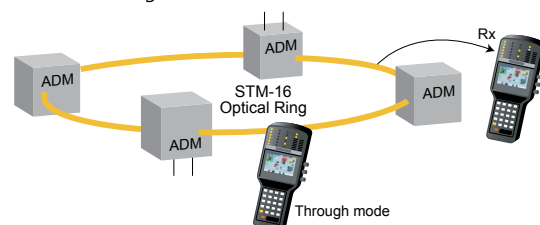
MuxTest, Pointer jitter tests



Wander testing



In-Service monitoring



SDH Specifications

622M/155M/52M Optical (STM-4/1/0)

Port/Connector: FCUPC or SCUPC

Line coding: NRZ

Mode: Single and multi-mode compatible

Complies to ITU-T G.957

Framing: Conforms to ITU-T G.707

Mapping: Conforms to ITU-T G.707

Transmitter

Clock source

Internal: ± 4 ppm

– Bit rates 622 Mbit/s, 155 Mbit/s, 52 Mbit/s: ± 4 ppm

Frequency offset

– 622.080 Mbit/s ± 50 ppm in 1, 10 ppm steps

– 155.520 Mbit/s ± 50 ppm in 1, 10 ppm steps

– 51.840 Mbit/s ± 50 ppm in 1, 10 ppm steps

Loop: Recovered from received signal

External: Synchronization to external 1.544 MHz or 2.048 MHz via 1.5/2M External Clock input

1.5/2M-L2-Rx: Synchronization to external 1.544 Mbit/s or 2.048 Mbit/s via 1.5/2M Line 2 input

Output power range

155/622 Mbit/s

– 1310 nm Intermediate Reach: -8 to -15 dBm

– 1310 nm Long Reach: +2 to -3 dBm

– 1550 nm Long Reach: +2 to -3 dBm

Laser Safety: IEC825-1, Class 1, 21 CFR 1040.10 & 1040.11

Receiver

Frequency recovery range

622.080 Mbps ± 50 ppm

155.520 Mbps ± 50 ppm

51.840 Mbps ± 50 ppm

Wavelength: 1280 -1580 nm

Input power range

155/622 Mbit/s

– 1310 nm Intermediate Reach: -30 dBm

– 1310 nm Long Reach: -30 dBm

– 1550 nm Long Reach: -30 dBm

Maximum input power

– 1310 Intermediate Reach: +3 dBm

– 1310/1550 nm Long Reach: -5 dBm

155M Electrical (STM-1)

Port/Connector: 75 Ω unbalanced BNC (f)

Line coding: CMI

Framing: Conforms to ITU-T G.707

Mapping: Conforms to ITU-T G.707

Transmitter

Clock source

Internal

– Bit rate: 155.520 Mbit/s ± 4 ppm

Frequency offset: 155.520 Mbit/s ± 50 ppm in 1, 10, 100 ppm steps

Loop: Recovered from received signal

External: Synchronization to external 1.544 MHz or 2.048 MHz via 1.5/2M External Clock input

1.5/2M-L2-Rx: Synchronization to external 1.544 Mbit/s or 2.048

Mbit/s via 1.5/2M Line 2 input

Pulse shape: 155M electrical conforms to ITU-T G.703

Receiver

Frequency recovery range: 155.520 Mbit/s ± 150 ppm

Input sensitivity

Terminate: 12.7 dB cable loss

Monitor: 20 dB resistive loss plus 12 dB cable loss

Jitter tolerance: Conforms to ITU-T G.825

Impedance: 75 Ω unbalanced

52M Electrical (STM-0)

Port/Connector: 75 Ω unbalanced BNC (f)

Line coding: B3ZS

Framing: Conforms to ITU-T G.707 Annex A

Mapping: Conforms to ITU-T G.707

Transmitter

Clock Source

Internal

– Bit rate: 51.840 Mbit/s ± 5 ppm

Frequency offset: 51.840 Mbit/s ± 500 ppm in 1, 10, 100 ppm steps

Loop: Recovered from received signal

Pulse shape: Conforms to ITU-R F.750-3

Receiver

Frequency recovery range: 51.840 Mbit/s ± 500 ppm

Input sensitivity

Terminate: 10.8 dB cable loss

Monitor: +3 to -26 dB resistive loss

Impedance: 75 Ω unbalanced (f)

Payloads

ITU-T and ETSI mapping: Manual and graphic configuration

VC4-4c Bulk, VC4 Bulk, VC3 Bulk, VC12 Bulk, VC11 Bulk, 139M,

45M, 34M, 2M Async, 1.5M Async

Framed, Unframed, Structured PDH payloads

Test Patterns

STM-4, STM-1, STM-0: 2²³-1, 2²⁰-1, 2¹⁵-1, 2¹¹-1, All 0s, All 1s, Alt 1010, 1-8, 1-16

User: 10 user patterns defined up to 16 bits

Test pattern inversion

Unselected channels: Unequipped, Broadcast

SDH Error Injection

Bit, B1, B2, B3, MS-REI, HP-REI, LP-REI, BIP-2

Programmable error burst 1 to 9999 count, or error rate 2x10⁻³ to 1x10⁻⁹

FAS error injection in periodic mode (burst of M errors every N frames)

SDH Alarm Generation

LOS, LOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, TU-AIS, TU-LOM, LP-UNEQ, TU-LOP, HP-PLM, LP-PLM, LP-RFI, LP-RDI, RS-TIM, HP-TIM, LP-TIM
Enhanced RDI [HP/LP-SRDI (Server), HP/LP-CRDI (Connectivity), HP/LP-PRDI (Payload)]
Alarm generation in continuous or repetitive mode (burst of M frames out of N frames)

SDH Measurements (622M, 155M, 52M)

Errors: Bit, B1, B2, B3, BIP-2, MS REI, HP REI, LP REI
Alarms: LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-UNEQ, TU-AIS, TU-LOM, LP-UNEQ, TU-LOP, HP-TIM, LP-TIM, HP-PLM, LP-PLM, LP-RFI, LP-RDI, Enhanced RDI [HP/LP-SRDI (Server), HP/LP-CRDI (Connectivity), HP/LP-PRDI (Payload)], Extended PLM (LP-EPLM)
Performance: ITU-T G.821, G.826, G.828, G.829, M.2101/M.2110
Optical power level measurement
Accuracy: ± 1 dBm
Optical reception saturation indication
Frequency measurements (test interface and payload): Moving bar graph of slip count, max frequency, min frequency, frequency deviation in ppm, clock slips, max positive wander, max negative wander
Automatic tributary scan: 80 characters/line report of alarms/errors per tributary. In-service and out-of-service for 1.5M, VC11 Bulk, 2M, VC12 Bulk, 34M, 45M, 139M, VC3 Bulk, and VC4 Bulk inside STM1/4/16 with full report.

SDH Overhead Features

Overhead monitor and decode
Text encoding of all applicable bytes (K1, K2, S1, C2, etc.)
Full SOH/POH Overhead bytes control in binary or HEX format
Programming K1, K2 APS signalling bytes per ITU-T G.783 & G.841
Trace generation
J0 Section trace/generation: 1 byte SAPI format or 16 bytes E.164 ASCII + CRC-7
J1/J2 Path trace/generation: 16 bytes E.164 ASCII sequence + CRC-7 or 64 bytes E.164 ASCII sequence
Through mode for J0, J1, J2 bytes
Stores up to 5 traces per byte with alphanumeric labels
Programmable expected trace data for J0, J1, and J2 bytes
Path overhead monitor and decode
Text encoding of all applicable bytes (K1, K2, S1, C2, etc.)
Programmable POH bytes
DCC BER testing through D1 to D3, D4 to D12 bytes
Orderwire: Talk/listen through E1, E2 bytes
Pointer monitor
AU (bytes H1 and H2), TU (bytes V1 and V2)
Display number of pointer operations with respect to time
– Instantaneous pointer value display
– Graphical display of pointer movements with histogram format
Pointer adjustment
Programming of pointer value, NDF, and SS bits
Increase and decrease the pointer value
SONET mode: Setting SS bits to generate/detect SONET signal
Pointer offset: Line or payload offset in ± 1 , 10 ppm steps

SDH-PDH Mux/Demux Testing

Using two sets of physical ports: 2 Tx/2 Rx
The following combinations are applicable:

• 622M 0/139M	• 155M 0/139M
• 622M 0/45M	• 155M E (0)/45M
• 622M 0/34M	• 155M E (0)/34M
• 622M 0/2M	• 155M E (0)/2M
• 622M 0/1.5M	• 155M E (0)/1.5M

MuxTest: The test pattern is generated on the low or high speed port and the BERT is measured on the opposite port
MuxMode: Emulation of a mux for 1.5M/2M payloads only

SDH-SDH Mux/Demux Testing (SWSDHJ-116)

The following combinations are applicable:

• 622M 0/155M E (0)	• 155M E (0)/52M E
• 622M 0/52M E	• 155M E (0)/45M

Through Mode

Line through
Payload through
All SOH bytes can be modified except for B1, B2, H1, H2 bytes
Alarms/error insertion: LOS, LOF, MS-AIS, MS-RDI, B1, B2, MS-REI

Pointer Test Sequences

Specification: ITU-T G.783
AU or TU pointer
Sequences: Single, burst, phase, transient burst, periodic, 87-3, 26-1, opposite (increase + decrease), and custom
Movement: Increase, decrease, increase + decrease
Anomalies: Added, cancel, and none

Tandem Connections Monitoring

N1 byte for High Order Paths (VC-3/VC-4)
N2 byte for Low Order Paths (VC-11/VC-12)
Analysis of data, display of data in the form of alarms, performance figures, and APId messages as specified in ITU-T G.707
Generation and detection of the following parameters:
Loss of Tandem Connection (LTC)
Loss of Multiframe (LOM)
Incoming Error Count (IEC)
Tandem Connection Remote Error Indication (TC-REI)
Tandem Connection Alarm Indication Signal (TC-AIS)
Tandem Connection Remote Defect Indication (TC-RDI)
Tandem Connection Outgoing Defect Indication (TC-ODI)
Tandem Connection Outgoing Error Indication (TC-OEI)
Tandem Connection UnEquipped (TC-UNEQ)
Tandem Connection Errors Difference (TC-DIFF)
Graphical display

Automatic Protection Switch Time Measurement

Measures time that anomaly is present
Resolution: 1 ms
Anomaly selection: MS-AIS, B2 errors, B3 error, AU-AIS, TU-AIS, LOS
Selectable switch time to display PASS or FAIL
Selectable gate time to control the minimum interval for the circuit to be anomaly time

APS timing at 2M interfaces: 2M-AIS, 2M-LOS

APS bytes capture

Capture and decode states of K1/K2 bytes

- Store hundreds of messages
- Ring and linear decoding

125 μ s resolution

Optional trigger with wildcards

Timestamp in frames or ms

Duration in absolute or elapsed time

Save or print results

Load and decode past results

Service disruption (bulk payloads)

PDH/T-Carrier specifications

139M

Port/Connector: 75 Ω unbalanced BNC (f)

Line coding: CMI

Transmitter

Clock source

Internal

- Bit rate: 139.264 Mbit/s $\pm$ 5 ppm

Frequency offset (as test interface and as a payload): 139.264

Mbit/s $\pm$ 150 ppm in 1, 10, 100 ppm steps

Loop: Recovered from received signal

Pulse shape: Conforms to ITU-T G.703

Framing: Unframed, framed, structured per ITU-T G.751

Receiver

Frequency recovery range: 139.264 Mbit/s $\pm$ 150 ppm

Input sensitivity

Terminate: 12 dB cable loss

Monitor: 20 dB resistive loss plus 12 dB cable loss

Jitter tolerance: Conforms to ITU-T G.823

Impedance: 75 Ω unbalanced

45M

Port/Connector: 75 Ω unbalanced BNC (f)

Line coding: B3ZS

Transmitter

Clock source

Internal

- Bit rate: 44.736 Mbit/s $\pm$ 5 ppm

Frequency offset (as test interface and as a payload): 44.736

Mbit/s $\pm$ 500 ppm in 1, 10, 100 ppm steps

Loop: Recovered from received signal

Pulse shape: Conforms to ITU-T G.703

Framing: Unframed, M13, and C-bit

Receiver

Frequency recovery range: 44.736 Mbit/s $\pm$ 500 ppm

Input sensitivity

Terminate: Up to -6 dB cable loss

Monitor: +6 dB to -26 dB resistive loss

Jitter tolerance: Conforms to ITU-T G.824

Impedance: 75 Ω unbalanced

34M

Port/Connector: 75 Ω unbalanced BNC (f)

Line coding: HDB3

Transmitter

Clock source

Internal

- Bit rate: 34.368 Mbit/s $\pm$ 5 ppm

Frequency offset (as test interface and as a payload): 34.368

Mbit/s $\pm$ 500 ppm in 1, 10, 100 ppm steps

Loop: Recovered from received signal

Pulse shape: Conforms to ITU-T G.703

Framing: Framed, unframed, structured per ITU-T G.751

Receiver

Frequency recovery range: 34.368 Mbit/s $\pm$ 500 ppm

Input sensitivity

Terminate: -12 dB cable loss

Monitor: -20 dB resistive loss plus -12 dB cable loss

Jitter tolerance: Conforms to ITU-T G.823

Impedance: 75 Ω unbalanced

Dual 2M

Port/Connector

120 Ω balanced RJ-45 (f) (SSSDHJ-RJ45)

120 Ω balanced bantam (SSSDHJ-BTM)

Line coding: AMI, HDB3

Transmitters (Lines 1 and 2)

Clock source

Internal

- Bit rate: 2.048 Mbit/s $\pm$ 5 ppm

Frequency offset (as test interface and as a payload): 2.048 Mbit/s

$\pm$ 5000 ppm in 1, 10, 100, 1000 ppm steps

External clock input port: 2.048 MHz

Recovered from Line 2 input (2.048 Mbit/s)

Loop: Recovered from received signal

Pulse shape: Conforms to ITU-T G.703 for balanced (120 Ω) interfaces

Framing: Unframed, PCM-30/30C, PCM-31/31C conforms to ITU-T G.704

Fractional E1

Error measurements, channel configuration verification

Nx64 kbit/s (consecutive) or Mx64 kbit/s (nonconsecutive),

N/M=1 to 30 or 1 to 31

Set Tx and Rx channels independently

Through mode: Test pattern on selected channels; all others through

Receivers (Lines 1 and 2)

Frequency recovery range: 2.048 Mbit/s $\pm$ 5000 ppm

Input sensitivity

Terminate, Bridge: +6 to -43 dB with ALBO

Monitor: -20 dB resistive loss plus -6 dB cable loss

Jitter tolerance: Conforms to ITU-T G.823

Impedance

Terminate, Monitor: 120 Ω balanced

Bridge: > 1200 Ω

Dual 1.5M

Port/Connector

100 Ω balanced RJ-45 (f) (SSSDHJ-RJ45)

100 Ω balanced bantam (SSSDHJ-BTM)

Line coding: AMI, B8ZS

Transmitters (Lines 1 and 2)

Clock source

Internal

- Bit rate: 1.544 Mbit/s $\pm$ 5 ppm

- Frequency offset (as test interface and as a payload): 1.544 Mbit/s $\pm$ 500 ppm in 1, 10, 100 ppm steps

- External clock input port: 1.544 MHz

- Recovered from Line 2 input (1.544 Mbit/s)

- Loop: Recovered from received signal

Pulse shape: Conforms to ITU-T G.703

Framing: Unframed, SF-D4, ESF. Conforms to ANSI T1.102, 107, 107A, 403, and 404. Also Telcordia TR-TSY-000009 and TR-TSY-000191.

Fractional T1

- Error measurements, channel configuration verification

- Nx64 kbit/s or Nx56 kbit/s (consecutive or nonconsecutive), N=1 to 24

- Set Tx and Rx channels independently

Through mode: Test pattern on selected channels; all others through

Receivers (Lines 1 and 2)

Frequency recovery range: 1.544 Mbit/s $\pm$ 500 ppm

Input sensitivity

- Terminate, Bridge: +6 to -36 dB cable loss

- Monitor: -15 to -25 dB, resistive loss

Jitter tolerance: Conforms to ITU-T G.824

Impedance

- Terminate, Monitor mode: 100 Ω balanced

- Bridge: > 1000 Ω

Test Patterns

2²³-1, 2²⁰-1, 2¹⁵-1, 2¹¹-1, 2⁹-1, 2⁷-1, 2⁶-1, All 0s, All 1s, Alt 1010, 20ITU, QRS, 1-8, 1-16, 3-24

User: 10 user patterns defined up to 32 bits

Test pattern inversion

PDH/T-Carrier Error Injection

139M, 34M: Code, Bit, FAS

45M: Code, Bit, Frame, C-bit, P-bit, FEBE

2M: Code, Bit, CRC-4, E-bit, FAS

1.5M: BPV, Logic, CRC-6, Frame

Programmable error burst 1 to 9999 count or error rate 2 x 10⁻³ to 1 x 10⁻⁹

PDH/T-Carrier Alarm Generation

139M, 34M: AIS, FAS RAI

45M, 1.5M: AIS, Yellow, Idle

2M: AIS, FAS RAI, MFAS RAI

PDH/T-Carrier Measurements (139M, 45M, 34M, 2M, 1.5M)

Error type

- Code, bit, FASE (2M, 8M, 34M, 139M)

- CRC-4, E-bit (2M)

- Code (BPV), F-bit, P-bit, C-bit, FEBE, CRC-6 (1.5M, 45M)

Typical error type reports: Total error count, error rate, ES, %ES,

SES, %SES, UAS, %UAS, EFS, %EFS, AS, %AS

ITU-T G.821 analysis

ITU-T G.826 analysis: Based on anomalies, defects, far end indications

M.2100 analysis (Maintenance or BIS)

Alarm statistics

- Loss of signal seconds, Loss of Frame seconds, AIS seconds

- FAS RAI seconds (2M, 34M, 139M)

- MFAS RAI seconds (2M only)

- Yellow alarm seconds (1.5M, 45M)

Low density seconds, excess 0s seconds (1.5M)

Frequency measurements: Moving bar graph of slip count, max frequency, min frequency, frequency deviation in ppm, clock slips, max positive wander, max negative wander

Signal level measurement (1.5/2M/34M/45M)

PDH Mux/Demux Testing

Using two sets of physical ports: 2 Tx/2 Rx

The following combinations are applicable:

• 139M/34M	• 45M/2M	• 34M/2M
• 139M/2M	• 45M/1.5M	

MuxTest: The test pattern is generated on the low or high speed port and the BERT is measured on the opposite port

Voice Frequency Testing (SWSDHJ-114)

Monitor speaker with volume control

Built-in microphone/speaker

Companding: A-law, μ law

Programmable idle channel A, B (C, D) bits (1.5M)

ABCD bits transmit and monitor in selected channel (2M)

VF level measurement: +3 to -60 dBm, resolution 0.1 dBm

VF frequency measurement: 50 to 3950 Hz, resolution 1 Hz

VF tone generation

- Variable tone: 50 to 3950 Hz @ 1 Hz step. +3 to -60 dBm @ 1 dBm

Peak code and coder offset measurements

Noise measurements

Receiver filters

- 2M: 3.1 kHz, Psophometric, 1010 Hz notch

- 1.5M: 3 kHz flat, C-message, C-notch

Pulse Mask Analysis (SWSDHJ-190)

1.5M, 2M, 34M, and 45M pulse mask

Scan period: 500 ns

On screen pulse shape display with G.703 Pulse Mask verification

Displays pulse width, rise time, and fall time in ns, % overshoot, % undershoot

1.5M masks: ANSI T1.102, T1.403, AT&T TR 62411, G.703

45M masks: ANSI T1.404, G.703

Common To SDH/PDH/T-Carrier

Auto Configuration

Single button configuration
Automatically scans all test interfaces for signal
Configures test set based on received signal
Sets rate, mapping, payload, and/or test pattern

Propagation Delay Measurement

Round trip signal transmission delay
Measures in μ s and UI (Unit Intervals)

Measurement Criteria

Test results/events storage and events log capability
Stores up to 20 test results or 800 errors or alarms events with user definable labels; lock/unlock records, available to screen view or print
Stores up to 10 user configurations (profiles) with alphanumeric labels
Print on event can be enabled or disabled
Print at timed interval (settable from 2 min up to 999 hr 59 min)
Measurement duration continuous or timed (settable up to 999 hr, 59 min)
Elapsed time, remaining time
Programmable start date and time
Audible alarm: On/off switchable

Histogram Analysis

Errors/Alarms/Pointer graphic display in real-time
Stores current results with 1-second resolution for the last 60 minutes, 1-minute resolution for the last 72 hours, and 15-minute resolution for the last 57 days
CSV format storage

Status and Alarm Indicators

Power and low battery LED indicators
Pattern Sync and Bit Error
139M and STM-N (signal), Alarm, Frame, Errors, Pointer, ATM cell
8M, 34M and 45M (signal), Alarm, Frame, and Errors
1.5/2M-L2, Alarm, Errors
1.5/2M-L1, Alarm, Errors

Jitter Generation & Measurement

SDH Jitter

Jitter Measurement

Measurement range: According to ITU-T 0.172
Wideband Jitter Measurement
– 155.520 Mbit/s (500 Hz to 1.3 MHz) (SWSDHJ-155MJIT)
– 622.080 Mbit/s (1 kHz to 5 MHz) (SWSDHJ-622MJIT)
Highband Jitter Measurement
– 155.520 Mbit/s (65 kHz to 1.3 MHz) (SWSDHJ-155MJIT)
– 622.080 Mbit/s (250 kHz to 5 MHz) (SWSDHJ-622MJIT)
PASS/FAIL threshold: Per ITU-T G.825 or user defined
Test rates: 155.520 Mbit/s, 622.080 Mbit/s
Parameters: Current peak-peak, Maximum peak-peak, RMS, Maximum RMS, Current +peak and -peak, Maximum +peak and -peak,
Units: UI (Unit Interval)
Resolution: 0.01 UI
Test duration: Timed or continuous
Storage

Up to 100,000 measurement intervals
20 records

Measurement interval: 1 second
Jitter histogram

Jitter Generation

Modulation source type: Sinusoidal
Jitter amplitude/frequency: Conforms to ITU-T 0.172

Jitter Tolerance Measurement

PASS/FAIL template: Conforms to ITU-T G.825
Test frequencies: Up to 30 points
Technique: Onset of errors
Storage: Up to 20 records

Fast Jitter Tolerance Measurement

PASS/FAIL template: Set to ITU-T G.825 by default
User programmable template (frequency points & amplitude values)
Technique: Onset of errors
Storage: Up to 20 records

Jitter Transfer Measurement

PASS/FAIL template: Conforms to ITU-T G.825
155.520 Mbit/s (500 Hz to 1.3 MHz)
622.080 Mbit/s (1 kHz to 5 MHz)
Test frequencies: Up to 30 points
Storage: Up to 20 records

PDH/T-Carrier Jitter

Jitter Measurement

Measurement range: According to ITU-T 0.171 and 0.172
Wideband Jitter Measurement
– 1.544 Mbit/s (10 Hz to 40 kHz) (SWSDHJ-DSnJIT)
– 2.048 Mbit/s (20 Hz to 100 kHz) (SWSDHJ-PDHJIT)
– 34.368 Mbit/s (100 Hz to 800 kHz) (SWSDHJ-PDHJIT)
– 44.736 Mbit/s (10 Hz to 400 kHz) (SWSDHJ-DSnJIT)
– 139.264 Mbit/s (200 Hz to 3.5 MHz) (SWSDHJ-PDHJIT)
Highband Jitter Measurement
– 1.544 Mbit/s (8 kHz to 40 kHz) (SWSDHJ-DSnJIT)
– 2.048 Mbit/s (18 kHz to 100 kHz) (SWSDHJ-PDHJIT)
– 34.368 Mbit/s (10 kHz to 800 kHz) (SWSDHJ-PDHJIT)
– 44.736 Mbit/s (30 kHz to 400 kHz) (SWSDHJ-DSnJIT)
– 139.264 Mbit/s (10 kHz to 3.5 MHz) (SWSDHJ-PDHJIT)

PASS/FAIL threshold: Per ITU-T G.823, G.824 or user defined
Test rates

2.048, 34.368, 139.264 Mbit/s

1.544 Mbit/s, 44.736 Mbit/s

Parameters: Current peak-peak, Maximum peak-peak, RMS, Maximum RMS, Current +peak and -peak, Maximum +peak and -peak

Units: UI (Unit Interval)

Resolution: 0.01 UI_{p-p}

Accuracy: Per ITU-T 0.171 and 0.172

Test duration: Timed or continuous

Storage

Up to 100,000 measurement intervals
20 records

Measurement interval: 1 second
Jitter histogram

Jitter Generation

Modulation source type: Sinusoidal
Jitter amplitude/frequency: Conforms to ITU-T 0.171

Jitter Tolerance Measurement

PASS/FAIL template: Per ITU-T G.823, G.824

Test frequencies: Up to 30 points

Technique: Onset of errors

Storage: Up to 20 records

Fast Jitter Tolerance Measurement

PASS/FAIL template

Set to ITU-T G.823 (for 2M, 34M, 139M)

Set to ITU-T G.824 (for 1.5M, 45M)

User programmable template (frequency points & amplitude values)

Technique: Onset of errors

Storage: Up to 20 records

Jitter Transfer Measurement

PASS/FAIL template: Per ITU-T G.735, G.736, G.737, G.742, G.751, G.752

1.544 Mbit/s (from 10 Hz to 40 kHz)

2.048 Mbit/s (10 Hz to 100 kHz)

34.368 Mbit/s (100 Hz to 800 kHz)

44.736 Mbit/s (10 Hz to 400 kHz)

Test frequencies: Up to 30 points

Storage: Up to 20 records

Pointer Jitter Test

SDH-PDH MuxTest mode with Pointer Test Sequences generation on Tx side, and Jitter measurements on the Rx side

Wander Generation & Measurement

SDH/PDH Wander Measurement

Measurement range: According to ITU-T O.171 and ITU-T O.172

Test interface

2.048 Mbit/s (SWSDHJ-TIE)

1.544*, 34.368, 44.736, and 139.264 Mbit/s (SWSDHJ-PDHTIE)

155.020 Mbit/s (SWSDHJ-155MTIE)

622.080 Mbit/s (SWSDHJ-622MTIE)

Reference clock: 1.544, 2.048, 5, 10 MHz, 1.544/2.048 Mbit/s (L2-Rx)

Parameters

Real Time Measurements

Time Interval Error (TIE)

– Amplitude (ns)

– Maximum and minimum TIE value

Off-line measurements (SWSDHJ-WAN)

– Maximum Time Interval Error (MTIE)

– Time Deviation (TDEV)

– Graphic display of results according to G.810, G.811, G.812, G.813, and G.823 MTIE/TDEV masks

– TIE data transfer from test set to PC via 10Base-T port

Wander Generation

Modulation source type: Sinusoidal

Wander amplitude/frequency: According to ITU-T O.172

Test interface

2.048 Mbit/s (SWSDHJ-TIE)

155.020 Mbit/s (SWSDHJ-155MTIE)

622.080 Mbit/s (SWSDHJ-622MTIE)

Reference clock: 2.048 MHz

*Note: 1.544 Mbit/s TIE measurement accuracy does not fully meet ITU-T O.171 and O.172

ATM Testing

Mapping

1.5/2M: PLCP and HEC-based per ITU-T G.804 and also non-G.804 compliant

34M: PLCP and HEC-based per ITU-T G.804 with framing based on ITU-T G.832

45M: PLCP and HEC-based per ITU-T G.804

SDH: HEC-based per ITU-T G.707 (mapping using VC4 and VC12)

Interface: UNI and NNI per ITU-T I.361

Header control: GFC, VPI/VCI, PTI, CLP

Scrambling: On or off

Idle cells: Idle or null

C2 POH Hex: 13 (default)

Pattern truncate

Display: VPI/VCI in decimal or hexadecimal

ATM cell LED indicates presence of valid ATM cells

OAM cell generation

VCC scan: 128 independent headers

AAL 0/1/2/5 generation and analysis

Quality of Service

Timed or continuous measurement

Programmable start time and date

Traffic Supervision

8 independent VCC filters: 1 foreground, 7 background

Foreground: Full QoS, BERT, OAM counter, and statistics

Background: Traffic statistics and OAM monitoring only

Quality of Service: Errored cells and CER, lost cells and CLR, misinserted cells and CMR, SECB and SECB rate

ATM alarms: VP-/VC-LOC, AIS, RDI, LFMF (segment, end-to-end)

Global measurements: Total cells, idle cells, HEC errors (correctable and non-correctable), HEC rate

Delay measurements: Cell Transit Delay (CTD) (MEAN, MIN, and MAX) and Cell Delay Variation (CDV) Peak to Peak 2-point (MAX, MIN)

– Requires timestamp field or 0.191 test cell

Total, congested, tagged count and rate Cps (cells per second)

Bit errors and bit error rate, CRC errors

OAM cell count: F4/F5, segment/end-to-end, AIS/RDI/loopback

OAM count: Continuity check, Performance management

Graphical display in histogram format of bit errors, CHEC, NCHC, cell loss seconds, cell errors and OAM cell count (F4/F5, segment/end-to-end, AIS/RDI, loopback)

ATM View Test Records

Stores up to 20 ATM test results with user definable labels

Lock/unlock records, available to screen view or print

Transferable to PC in CSV format by using Windows Remote Control

VCC Scan

Up to 128 independent headers: GFC, VPI, VCI, PTI, CLP, AAL type

AAL scan

Save up to 8 VCC configurations

Utilization %

Cell Capture & Decode

Cell type capture selection: User, OAM, USER + OAM

Full buffer option to cycle or stop

Timed or continuous capture

Programmable start time and date

Display cell header and payload of 4096 cells

Header decode: GFC, VPI/VCI, PTI, CLP

OAM decode per ITU-T I.610

Fault management

AIS/RDI: Defect type, defect location

Loopback: Loopback ID, correlation tag, loopback location ID, source ID

Performance management

Forward and backward

MCSN, BEDC, BLER, TUC (0+1), TUC (0), TRCC (0+1), TRCC (0), timestamp

Activation/deactivation: Message, direction, correlation tag, PM block size A-B & B-A

System management

Cell storage

Save up to 10 cell capture screens

Print

Traffic Generation

8 independent VCCs: 1 foreground, 7 background

Foreground VCC

Traffic: Constant Bit Rate (CBR), Unspecified Bit Rate (UBR)

Burst, Variable Bit Rate (VBR), and Sequential Cells

Cell Type: User, O.191 Test Cell, OAM-B Cell Performance

Patterns: $2^{23}-1$, $2^{20}-1$, $2^{15}-1$, All 1s, All 0s, and 16-bit user patterns

Background VCCs

Traffic: CBR

Cell type: User

Patterns: 16-bit User patterns

AAL 0

Traffic: CBR, VBR/UBR, Sequential Cells

Patterns: $2^{23}-1$, $2^{20}-1$, $2^{15}-1$, All 1s, All 0s, and 16-bit user patterns

PCR: %, Mbps, Cps

AAL 1

SRTS (Synchronous Residual Time Stamp): On, Off

Clock recovery adaptive method

PDH: 1.5M, 2M

Frame

– For 1.5M: Unframe, SF-D4, ESF

– For 2M: Unframe, PCM-30, PCM-30C, PCM-31, PCM-31C

Traffic

– Fixed at T1 (PCR: 1.741 Mbps [4106 Cps])

– Fixed at E1 (PCR: 2.309 Mbps [5446 Cps])

Patterns: $2^{23}-1$, $2^{20}-1$, $2^{15}-1$, All 1s, All 0s, and 16-bit user patterns

AAL 2

Length

CID (Channel Identifier)

Traffic: CBR, VBR/UBR, Sequential Cells

Patterns: $2^{23}-1$, $2^{20}-1$, $2^{15}-1$, All 1s, All 0s, and 16-bit user patterns

PCR: %, Mbps, Cps

AAL 5

CPCS-UU (Common Part Convergence Sublayer-User to User)
indication number

CPI (Common Part Indicator)

Frame rate: 0 – 50

Error injection: Bit, HEC, and NC-HEC errors, burst and rate

Alarm generation: F4/F5, segment/end-to-end, AIS, RDI, loopback, continuity check

DSLAM Testing

ATM end-to-end connectivity test between customer premises (SSxDSL/MTT) and CO (SSSDH); back-to-back with SunSet xDSL/MTT ATU-R Module

– SunSet xDSL/MTT requires software option SWxDSL-xxATM

– Auto detection of SSxDSL/MTT at far end

Bidirectional, asymmetric DSL throughput testing

Upstream and downstream statistics

Tx and Rx cell rates

Cell loss %

Bit error count, BER, and bit error injection

Clear Pass/Fail indication

Test results available on both units

ATM/IP PING Test

Protocols

RFC 1483: LCC-Bridge (static & dynamic [DHCP]) & LCC-Route

RFC 2364: PPP over ATM (PPPoA)

RFC 2516: PPP over Ethernet (PPPoE)

RFC 2225: Classical IP and ARP over ATM

InARP

– In ARP Request to Far End

– In ARP Request Sent, Received

– In ARP Response Received, Sent

– In ARP Response from

– In ARP Request from

Number of PINGs: Up to 65535

PING length: 1 to 1500 bytes

User selectable bit rate down to 1 kbit/s

Clear Pass/Fail indication

Statistics

PINGs sent, state, received, unreachable, missing

Round trip: Current, average, maximum, and minimum

PING response/echo: Time, IP addresses, total PINGs

Product Description

Upgrades: SW options upgradeable via software in-field cartridge replacement

Display: Backlit 320 x 240 pixels STN indoor/outdoor Color screen with CFL Backlight

Printer: Report printing via serial port, RS-232 DIN-9

Network: 10Base-T DIN-9

Battery: Built-in NiMH rechargeable battery pack

Power: AC operation w/100 to 240 VAC, 50/60 Hz universal charger

Environmental

Operating temperature: 32 to 113°F (0 to 45°C)

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

Humidity: 5% to 90% noncondensing

Dimensions

Size: 4.3 x 2.8 x 10.6 in (11 x 7 x 27 cm)

Weight: 3.3 lb (1.5 kg)

Ordering Information

SSSDHC-STM16J . . . SunSet SDHC Jitter and Wander, 2M, 34M and 155M test interfaces. RS232 and 10Base-T ports. [Includes Certificate of Calibration, Windows Remote Control, Histogram Analysis, 1.5 Mbps Testing, 45 Mbps Testing, 139 Mbps Testing, PDH MUX-DEMUX Testing, 52 Mbps Testing, G.783 Pointer Test Sequences, Tandem Connections Monitoring, APS Switching Timing, SA295 and 1 year standard warranty. (Excludes Battery and Accessories, which are warranty for one-year)]

Optics Options

SSSDHJ-NONE . . . Electrical only unit. (BNC) No optical Connectors

SSSTM1-131R Optical Interface, STM-0/1 1310 nm Intermediate Reach

SSSTM1-13L/15L . . . Optical Interface, STM-0/1 1310 nm/1550 nm Long Reach

SSSTM4-131R Optical Interface, STM-0/1/4 1310 nm Intermediate Reach

SSSTM4-13L/15L . . . Optical Interface, STM-0/1/4 1310 nm/1550 nm Long Reach

Optical Interface Connector Options

SSSDHJ-FC FCUPC Optical Connectors

SSSDHJ-SC SCUPC Optical Connectors

Electrical Interface Connector Options

SSSDHJ-RJ45 1.5/2M RJ-45 Connectors

SSSDHJ-BTM 1.5M/2M Bantam Connectors

Standard & Configurable Accessories Options

SSSDHC-101 SunSet SDH User's Manual

SA904 Training CD

SS138E SunSet AC Adapter, 100-240 VAC, 50/60 Hz, 3-prong input, Output 15 VDC @ 3.3A [Only for use with SunSets with NiMH battery pack]

Power Cord

SA155-EU 2-prong power cord plus ground for use in Europe (Except UK)

SA155-NA 3-prong power cord for use in Latin America, North America, and Asia

SA155-UK 3-prong power cord for use in United Kingdom

Warranty

SSSDHC-W1 SunSet SDHC-W1, Standard Warranty

SSSDHC-EW1 SunSet SDHC, 1 Yr Extended Warranty

SSSDHC-EW2 SunSet SDHC, 2 Yr Extended Warranty

SSSTM1-131R-W1 . . . OPTICAL INTERFACE,STM-0/1 1310NM IR, Standard Warranty

SSSTM1-131R-EW1 . . . OPTICAL INTERFACE,STM-0/1 1310NM IR,1 Yr Extended Warranty

SSSTM1-131R-EW2 . . . OPTICAL INTERFACE,STM-0/1 1310NM IR,2 YRS Extended Warranty

STM1-13L15L-W1 OPTICAL INTERFACE,STM-0/1 1310NM/1550NM LR,STD WR

STM1-13L15L-EW1 OPTICAL INTERFACE,STM-0/1 1310NM/1550NM LR,1 YR EXTD WR

STM1-13L15L-EW2 OPTICAL INTERFACE,STM-0/1 1310NM/1550NM LR,2YRS EXTD WR

STM4-131R-W1 OPTICAL INTERFACE,STM-0/1/4 1310NM IR,STD WR

STM4-131R-EW1 OPTICAL INTERFACE,STM-0/1/4 1310NM IR,1 YR Extended Warranty

STM4-131R-EW2 OPTICAL INTERFACE, STM-0/1/4 1310NM IR,2YRS Extended Warranty

STM4-13L15L-W1 OPTICAL INTERFAC,STM-0/1/4 1310NM/1550NM Extended Warranty

STM4-13L15L-EW1 OPTICAL INTERFAC,STM-0/1/4 1310NM/1550NM LR,1 YR Extended Warranty

STM4-13L15L-EW2 OPTICAL INTERFAC,STM-0/1/4 1310NM/1550NM LR,2YRS Extended Warranty

Calibration Data Document

SSSDHC-CCM . . . Calibration Test Measurement Data

Software Packages

SWSDHJ-PDHJIT	PDH Jitter Generation and Measurement
SWSDHJ-DSnJIT	T-Carrier Jitter Generation and Measurement
SWSDHJ-155MJIT	STM-1 Jitter Generation and Measurement
SWSDHJ-622MJIT	STM-4 Jitter Generation and Measurement
SWSDHJ-TIE	2M TIE Generation and Measurement
SWSDHJ-PDHTIE	PDH TIE Measurements
SWSDHJ-155MTIE	155M TIE Generation and Measurement
SWSDHJ-622MTIE	622M TIE Generation and Measurement
SWSDHJ-WAN	MTIE/TDEV Wander Measurements
SWSDHJ-114	Voice Frequency Testing
SWSDHJ-116	SDH-SDH Mux/Demux Testing
SWSDHJ-129	1.5 Mbps ATM Testing [Includes User's Manual SSSDHC-101-3]
SWSDHJ-130	2 Mbps ATM Testing [Includes User's Manual SSSDHC-101-3]
SWSDHJ-131	45 Mbps ATM Testing [Includes User's Manual SSSDHC-101-3]
SWSDHJ-132	34 and 155 Mbps ATM Testing [Includes User's Manual SSSDHC-101-3]
SWSDHJ-133	622 Mbps ATM Testing [Includes User's Manual SSSDHC-101-3]
SWSDHJ-ATM	ATM Software Package [Includes SWSDH-130 and SWSDH-132]
SSSDHJ-ATM	VC12 ATM Testing
SWSDHJ-190	Pulse Mask Analysis

Optical Accessories

SA501	Optical Patch Cord, SMF, FCUPC to FCUPC, 6'
SA502	Optical Patch Cord, SMF, FCUPC to SCUPC, 6'
SA503	Optical Patch Cord, SMF, FCUPC to STUPC, 6'
SA508	Optical Patch Cord, LCUPC to SCUPC, 6'
SA509	Optical Patch Cord, LCUPC to FCUPC, 6'
SA511	Optical Patch Cord, SCUPC to SCUPC, 6'
SA512	Optical Patch Cord, SCUPC to STUPC, 6'
SA521	Optical Attenuator, FC-PC, -10 dB
SA523	Optical Connector Adapter, FCUPC to SCUPC [Changes a FC (f) appearance to a SC (f)]
SA524	Optical Connector Adapter, SCUPC to FCUPC [Changes a SC (f) appearance to a FC (f)]
SA531	Optical Attenuator, SC-PC, -10 dB
SA541	Optical Splitter, FC-PC, 90/10
SA545	Optical Splitter, FC-PC, 50/50
SA551	Optical Splitter, SC-PC, 90/10
SA555	Optical Splitter, SC-PC, 50/50



Supplied and supported in the UK & Ireland by Phoenix Datacom
tel: 01296 397711 - info@phoenixdatacom.com - www.phoenixdatacom.com