SUNRISE TELECOM®

SunSet® SDH

with Jitter and Wander

Data Sheet

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 2.5 Gbit/s (STM-16). 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, 622 Mbit/s and 2.5 Gbit/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, 622 Mbit/s and 2.5 Gbit/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.

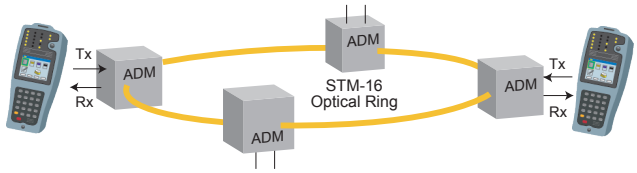
Out-of-Service Testing

- 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

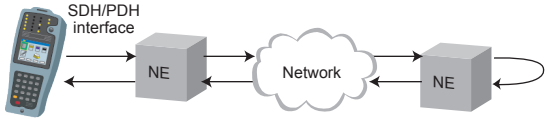
In-Service Monitoring

- 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

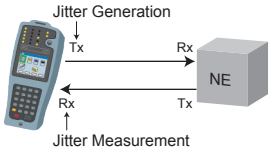
Out-of-Service testing



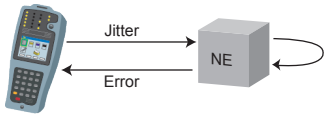
Round trip delay



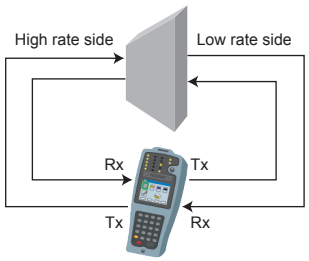
Jitter generation/measurement



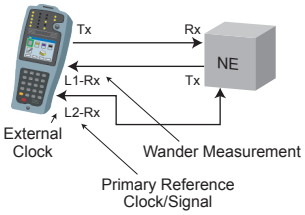
Jitter tolerance/transfer measurements



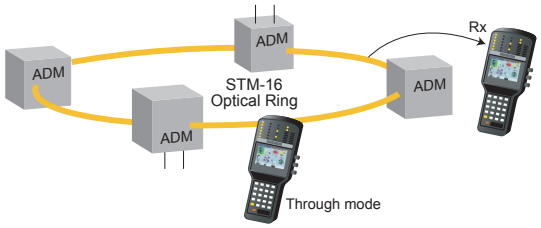
MuxTest, Pointer jitter tests



Wander testing



In-Service monitoring



SDH SPECIFICATIONS

2.5G/622M/155M/52M Optical (STM-16/4/1/0)

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 2.5 Gbit/s, 622 Mbit/s, 155 Mbit/s, 52 Mbit/s: ± 4 ppm
- Frequency offset
  - 2.488 Gbit/s ± 50 ppm in 1, 10 ppm steps
  - 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
- 2.5 Gbit/s
  - 1310 nm Short Reach: -3 to -10 dBm
  - 1310 nm Intermediate Reach: 0 to -5 dBm
  - 1310 nm Long Reach: +3 to -2 dBm
  - 1550 nm Intermediate Reach: 0 to -5 dBm
  - 1550 nm Long Reach: +3 to -2 dBm
- Laser Safety: IEC825-1, Class 1, 21 CFR 1040.10 & 1040.11

Receiver

Frequency recovery range
- 2.48832 Gbps ± 50 ppm
- 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
- 2.5 Gbit/s
  - 1310 nm Short Reach: -18 dBm
  - 1310 nm Intermediate Reach: -18 dBm
  - 1310 nm Long Reach: -28 dBm
  - 1550 nm Intermediate Reach: -18 dBm
  - 1550 nm Long Reach: -28 dBm

Maximum input power
- 1310/1550 nm Short or Intermediate Reach: +3 dBm
- 1310/1550 nm Long Reach: -5 dBm

155M Electrical (STM-1)

Port/Connector: 75Ω 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: 75Ω unbalanced

52M Electrical (STM-0)

Port/Connector: 75Ω 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: 75Ω unbalanced (f)

Payloads

ITU-T and ETSI mapping: Manual and graphic configuration
VC4-16c Bulk, 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-16 (VC4-16c): 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, All 0s, All 1s, Alt 1010, 1-8, 1-16
STM-16 (VC4-4c and below): 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, All 0s, All 1s, Alt 1010, 1-8, 1-16
STM-4, STM-1, STM-0: 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-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 (2.5G, 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:

• 2.5G 0/139M	• 622M 0/139M	• 155M 0/139M
• 2.5G 0/45M	• 622M 0/45M	• 155M E (0)/45M
• 2.5G 0/34M	• 622M 0/34M	• 155M E (0)/34M
• 2.5G 0/2M	• 622M 0/2M	• 155M E (0)/2M
• 2.5G 0/1.5M	• 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:

• 2.5G 0/622M 0	• 622M 0/155M E (0)	• 155M E (0)/52M E
• 2.5G 0/155M E (0)	• 622M 0/52M E	• 155M E (0)/45M
• 2.5G 0/52M E		

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 µs 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: 75Ω unbalanced BNC (f)
Line coding: CMI

Transmitter

Clock source
- Internal
- – Bit rate: 139.264 Mbit/s ± 5 ppm
- Frequency offset (as test interface and as a payload): 139.264 Mbit/s ± 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 ± 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: 75Ω unbalanced

45M

Port/Connector: 75Ω unbalanced BNC (f)
Line coding: B3ZS

Transmitter

Clock source
- Internal
- – Bit rate: 44.736 Mbit/s ± 5 ppm
- Frequency offset (as test interface and as a payload): 44.736 Mbit/s ± 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 ± 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: 75Ω unbalanced

34M

Port/Connector: 75Ω unbalanced BNC (f)
Line coding: HDB3

Transmitter

Clock source
- Internal
- – Bit rate: 34.368 Mbit/s ± 5 ppm
- Frequency offset (as test interface and as a payload): 34.368 Mbit/s ± 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 ± 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: 75Ω unbalanced

Dual 2M

Port/Connector
- 120Ω balanced RJ-45 (f) (SSSDHJ-RJ45)
- 120Ω balanced bantam (SSSDHJ-BTM)

Line coding: AMI, HDB3

Transmitters (Lines 1 and 2)

Clock source
- Internal
- – Bit rate: 2.048 Mbit/s ± 5 ppm
- Frequency offset (as test interface and as a payload): 2.048 Mbit/s ± 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 (120Ω) 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 ± 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: 120Ω balanced
- Bridge: > 1200Ω

Dual 1.5M

Port/Connector
- 100Ω balanced RJ-45 (f) (SSSDHJ-RJ45)
- 100Ω balanced bantam (SSSDHJ-BTM)

Line coding: AMI, B8ZS

Transmitters (Lines 1 and 2)

Clock source
- Internal
  - Bit rate: 1.544 Mbit/s ± 5 ppm
- Frequency offset (as test interface and as a payload): 1.544 Mbit/s ± 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 ± 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: 100Ω balanced
- Bridge: > 1000Ω

Test Patterns

2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{9}-1, 2^{7}-1, 2^{6}-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 μs 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 O.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)
- 2.488 Gbit/s (5 kHz to 20 MHz) (SWSDHJ-25GJIT)

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)
- 2.488 Gbit/s (1 MHz to 20 MHz) (SWSDHJ-25GJIT)

PASS/FAIL threshold: Per ITU-T G.825 or user defined
Test rates: 155.520 Mbit/s, 622.080 Mbit/s, 2.488 Gbit/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 O.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)
2.488 Gbit/s (5 kHz to 20 MHz)
Test frequencies: Up to 30 points
Storage: Up to 20 records

PDH/T-Carrier Jitter

Jitter Measurement

Measurement range: According to ITU-T O.171 and O.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 O.171 and O.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 O.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 Mbits/s (SWSDHJ-622MTIE)
2.488 Gbit/s (SWSDHJ-2.5GTIE)
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)
2.488 Gbit/s (SWSDHJ-2.5GTIE)
Reference clock: 2.048 MHz

***Note:** 1.544 Mbit/s TIE measurement accuracy does not fully meet ITU-T O.171 nd 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 O.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, NCHEC, 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, 155M test interfaces. RS-232C & 10Base-T ports. *[Includes 1.5M, 45M, 52M electrical and 139M test interfaces, PDH Mux-Demux Testing, Histogram Analysis, Windows Remote Control, APS Timing, Pointer Test Sequences, Tandem Connections Monitoring, & standard warranty]*

Optics Options

SSSDHJ-NONE	Electrical only unit. (BNC) No optical Connectors
SSSTM1-13IR	Optical Interface, STM-0/1 1310 nm Intermediate Reach
SSSTM1-13L/15L	Optical Interface, STM-0/1 1310 nm/1550 nm Long Reach
SSSTM4-13IR	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
SSSTM16-13IR	Optical Interface, STM-0/1/4/16 1310 nm Intermediate Reach
SSSTM16-13I/15I	Optical Interface, STM-0/1/4/16 1310 nm/1550 nm Intermediate Reach
SSSTM16-13L/15L	Optical Interface, STM-0/1/4/16 1310/1550 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-W3	Standard 3 year warranty
SSSDHC-W4	Extends standard warranty to 4 years *[Excludes Battery and Accessories, which are warranted for one year]*

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-25GJIT	STM-16 Jitter Generation and Measurement
SWSDHJ-SDHJIT	SDH Jitter Generation and Measurement Package *[Includes SWSDHJ-155MJIT, SWSDHJ-622MJIT, and SWSDHJ-25GJIT]*
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-2.5GTIE	2.5G TIE Generation and Measurement
SWSDHJ-SDHTIE	SDH TIE Measurement Package
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-134	2.5 Gbps 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