SonetExpert™ Channelized Analyzer
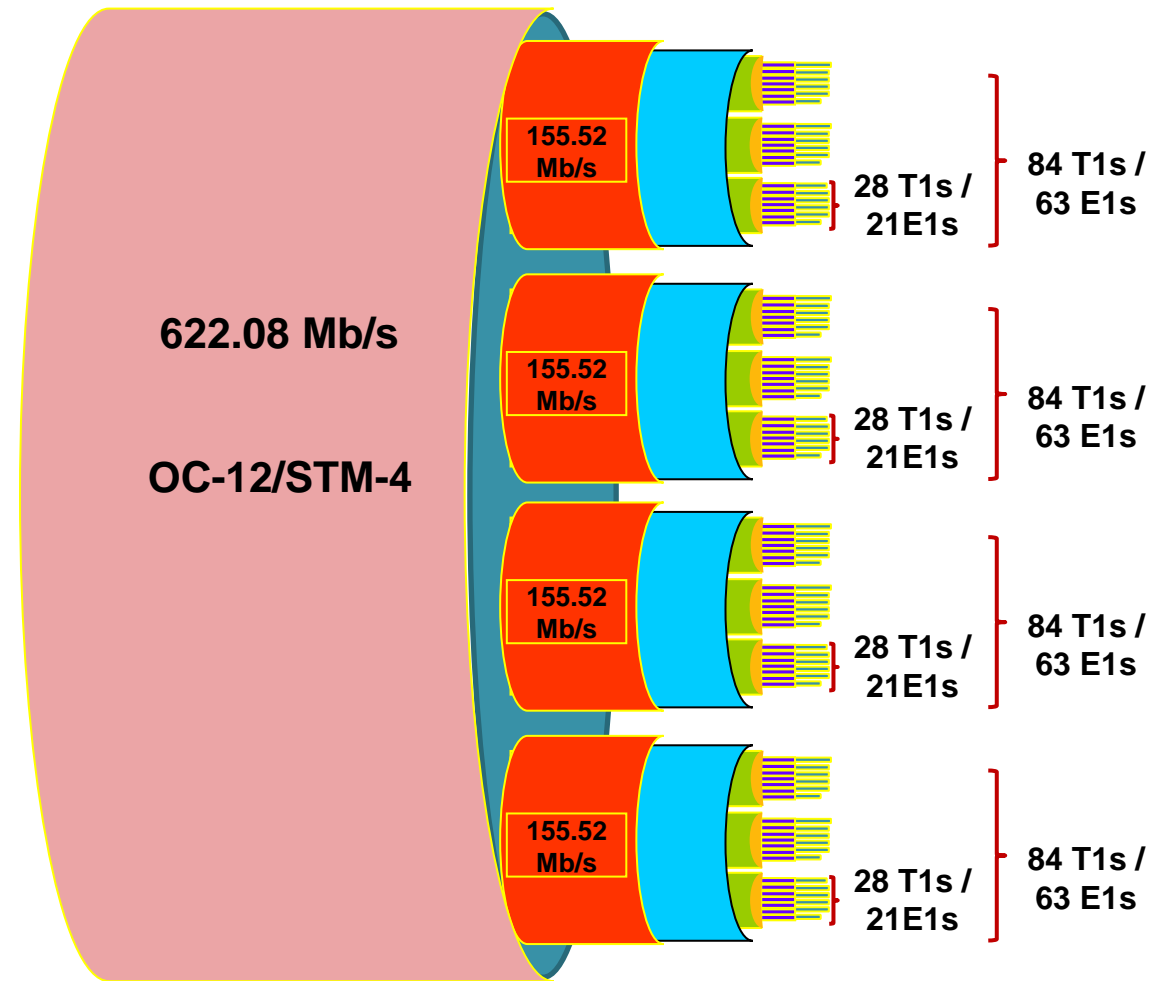
(OC-3/STM-1 and OC-12/STM-4)

Introduction

- Sonet = Synchronous optical networking. Used in North America

- SDH = Synchronous digital hierarchy. Used in the rest of the world

- Sonet and SDH are optical transmission protocols for high-speed data, voice and video traffic

- Data rates

  ➢ Sonet: Optical Carrier (OC) - N

  ➢ SDH: Synchronous Transport Module (STM) - N

- Sonet/SDH can carry channelized and unchannelized data

  ➢ Channelized = T1 E1

    ▪ OC-3/STM-1 supports 84 T1s or 63 E1s

    ▪ OC-12/STM-4 supports 336 T1s or 252 E1s

  ➢ Unchannelized = Packet over Sonet (PoS), Asynchronous Transfer Mode (ATM)
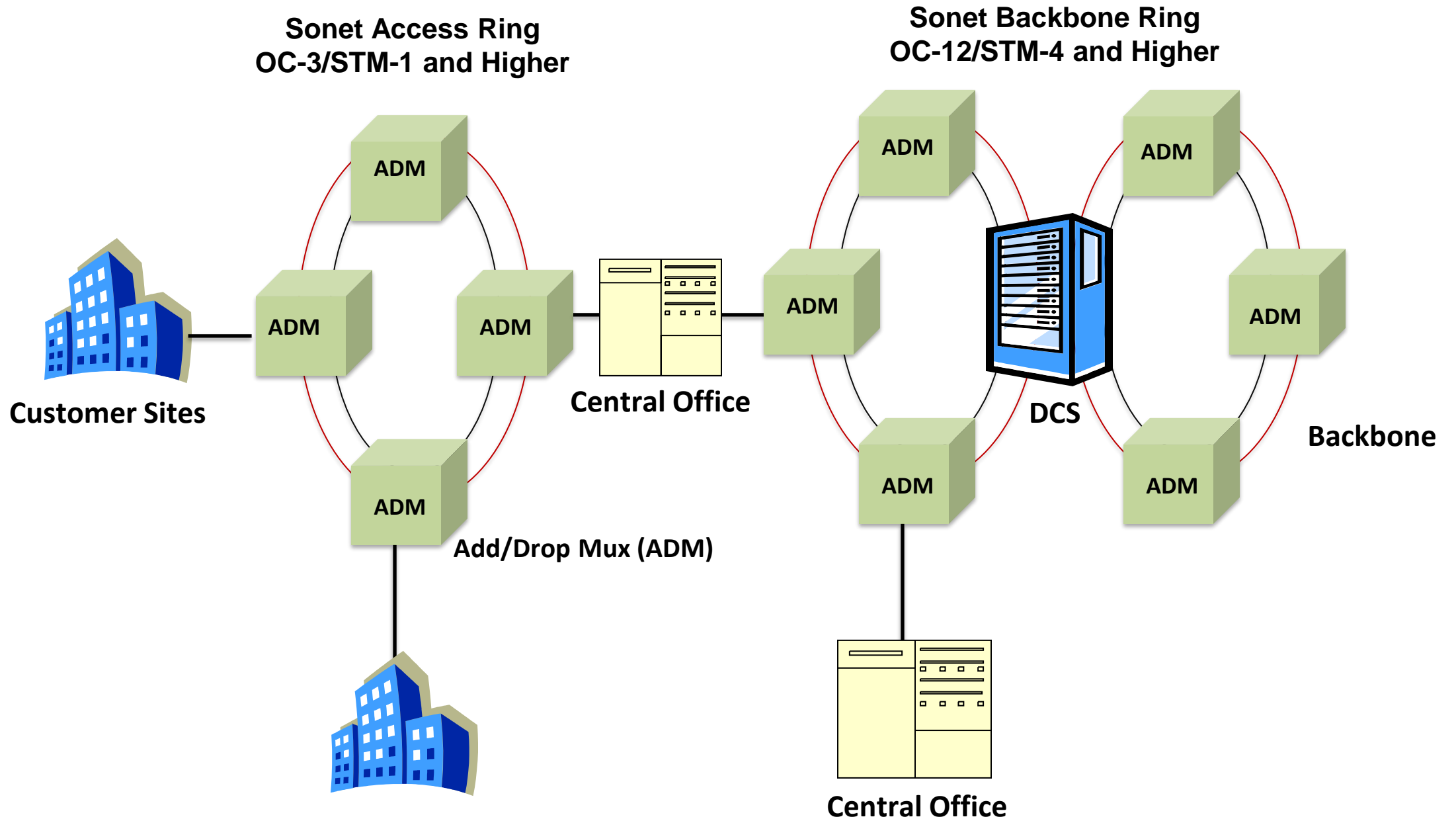
Sonet/SDH Line Rates

Electrical	Optical (Sonet)	Line Rates	SDH Equivalent
STS-1	OC-1	51.84 Mbps	___
STS-3	OC-3	155.52 Mbps	STM-1
STS-9	OC-9	466.56 Mbps	___
STS-12	OC-12	622.08 Mbps	STM-4
STS-18	OC-18	933.12 Mbps	___
STS-24	OC-24	1.2 Gbps	___
STS-36	OC-36	1.9 Gbps	___
STS-48	OC-48	2.5 Gbps	STM-16
STS-96	OC-96	5 Gbps	___
STS-192	OC-192	10 Gbps	STM-64
STS-768	OC-768	40 Gbps	___
STS-3072	OC-3072	160 Gbps	___

Channelized OC-3/STM-1 and OC-12/STM-4

- DS0 = Digital Signal 0 (64 Kbps)
  - Carries digital traffic (including voice)

- T1 = 24 DS0

- E1 = 32 DS0

- OC-3/STM-1 = 84 T1 or 63 E1

- OC-12/STM-4 = 4 STM-1/OC-3
  - OC-12/STM-4 = 336 T1
  - OC-12/STM-4 = 252 E1

- OC-12/STM-4 can support ~ 8000 data streams (voice calls)

622.08 Mb/s

OC-12/STM-4

155.52 Mb/s

28 T1s / 21E1s

84 T1s / 63 E1s

Sonet Network Elements

Sonet Access Ring
OC-3/STM-1 and Higher

Sonet Backbone Ring
OC-12/STM-4 and Higher

ADM

ADM

ADM

ADM

Customer Sites

Central Office

ADM

Add/Drop Mux (ADM)

ADM

ADM

ADM

ADM

ADM

ADM

DCS

Backbone

Central Office

GL
Communications

Sonet/SDH Testing Scenarios

- Monitor T1s, E1s, and DS0s directly without requiring physical access

  ➢ Accessing individual T1s or E1s on a Sonet/SDH link

  ➢ Readily identify traffic types within the complex Sonet/SDH structure

  ➢ Capturing and analyzing voice calls for call quality or surveillance

- Load testing Sonet/SDH network by generating the maximum number of voice calls/data streams

- Real time alarm detection and management: Send SNMP traps at the individual T1 E1 level for network management

SonetExpert™ Sonet/SDH Channelized Testing Solution

SonetExpert™

USB 3.0

SonetExpert™

GL Communications Inc.

PacketExpert 1-10G

STATUS   PORT 1   PORT 2   PORT 3   PORT 4

10/100/1000 Mbps
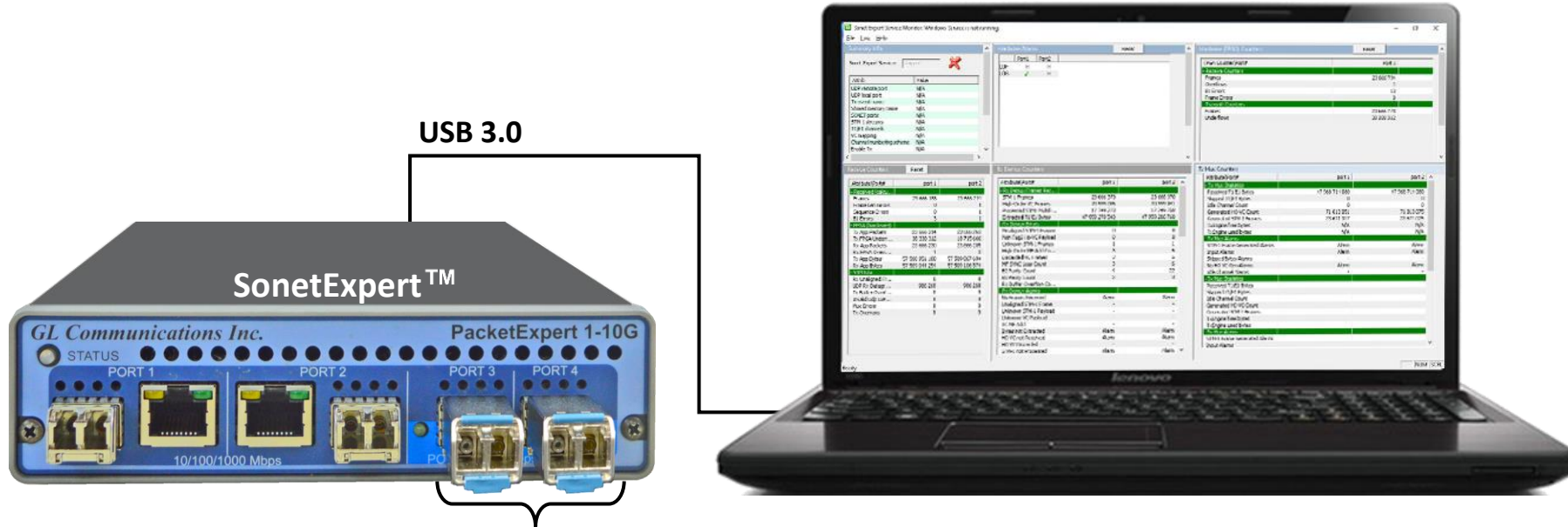
Channelized Ports (Port 1 and Port 2)
OC-3/STM-1 or OC-12/STM-4

SonetExpert™ is configured from a Windows® 10 PC via USB 3.0 port

SonetExpert™ Portable Hardware Unit

Ethernet Testing

Port 1 and Port 2 Optical Interface for OC-3/STM-1 or OC-12/STM-4 Channelized Analyzer

Front Panel

GL Communications Inc. — PacketExpert 1-10G
STATUS — PORT 1 — PORT 2 — PORT 3 — PORT 4
10/100/1000 Mbps — PORT 1 — 10 Gbps — PORT 2

Back Panel

GL Communications Inc. — PacketExpert 1-10G
9V ⎓ 2A — PWR — PIO — USB 3.0

12V, 3A Power Supply — **Power LED** — **USB 3.0**
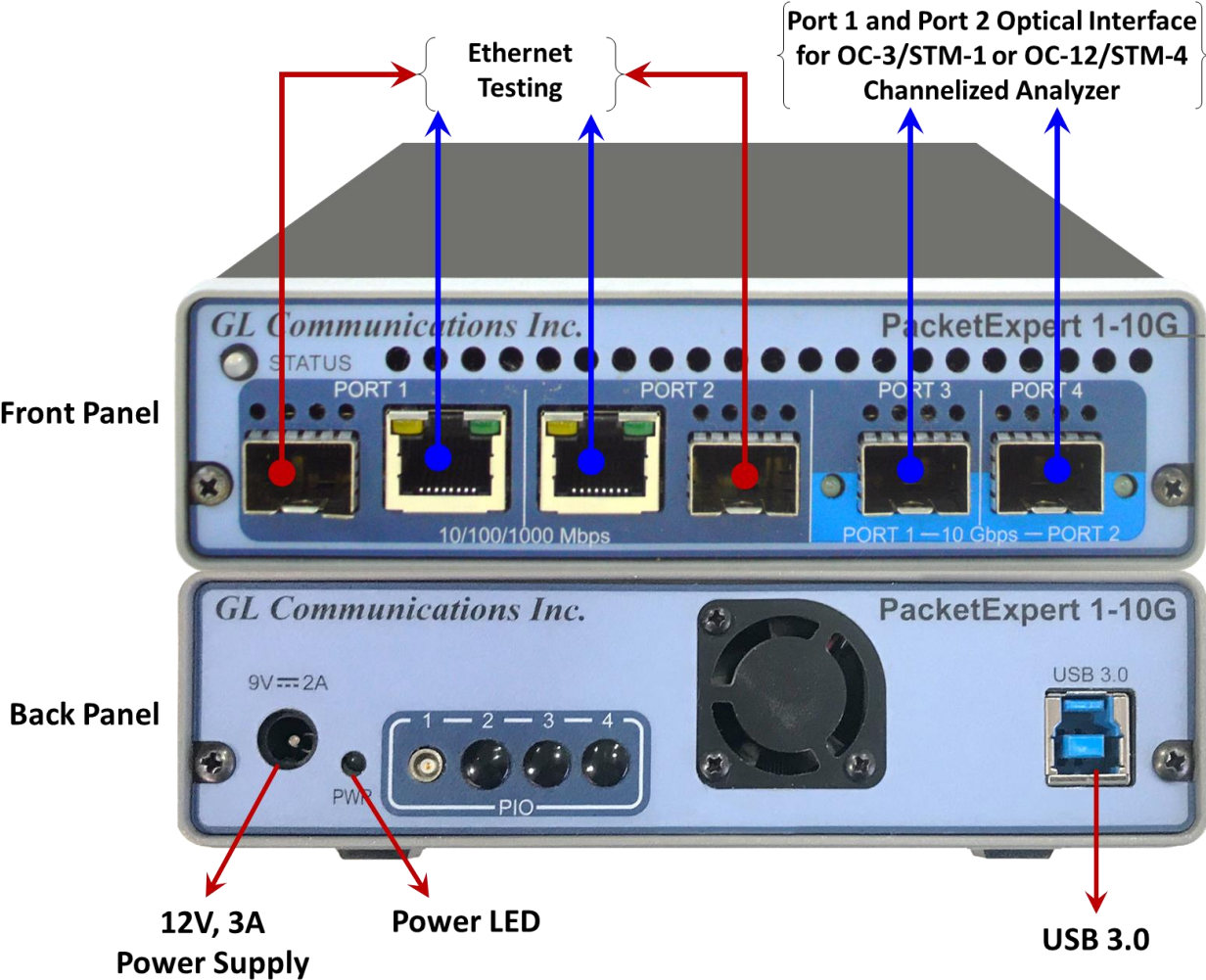
Interfaces	• 2 x Channelized Ports (OC-3/STM-1 or OC-12/STM-4)
	• Single Mode or Multi Mode Fiber SFP support with LC connector
	• USB 3.0 Port
	• External Clock: Input Port 1, Port 2 and Output Port 1, Port 2
T1 E1	• Sync Loss, HDB3 Violation, Carrier Loss, Frame Error, Remote, Distant MF, AIS, BPV Errors, CRC Errors, Frame Errors, Transmit Under Run, Receive Over Run
Dimensions	• Length: 8.45 in. (214.63 mm)
	• Width: 5.55 in. (140.97 mm)
	• Height: 1.60 in (40.64 mm)
External Power Supply	• +12 Volts (Medical Grade), 3 Amps

SonetExpert™ mTOP™ Probe unit

- PacketExpert™ hardware is used for both Packet/SonetExpert™
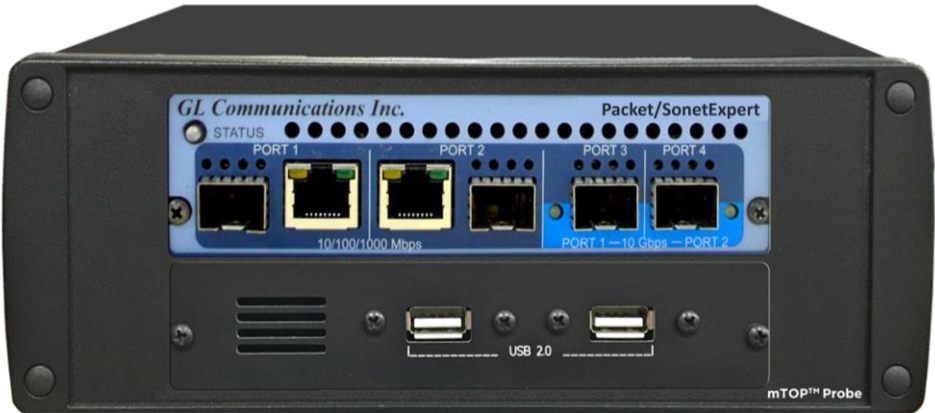
**SonetExpert™ mTOP™ Probe Solution
(Front Panel)**

**SonetExpert™ mTOP™ Probe Solution
(Back Panel)**

Physical Specifications	• Height: 3.0 Inches (76.2 mm) • Length: 10.4 Inches (264.16 mm) • Width: 8.4 Inches (213.36 mm) • Optional 4-Port SMA Jack Trigger Board (TTL Input/Output) • External USB based Wi-Fi adaptor
SonetExpert™ interfaces (1 unit)	• 4x 1G Base-X Optical OR 10/100/1000 Base-T Electrical • 2x 10G Base-SR, -LR -ER Optical option • 2 x 100 Mbps Base-FX optical interface • Single Mode or Multi Mode Fiber SFP support with LC connector
External Power Supply	• +12 Volts (Medical Grade), 3 Amps
SBC Specifications	• AMD Ryzen 9 Series Processor or Intel Core i9 Equivalent • Windows® 10 and above 64-bit Pro Operating System • USB 2.0 or 3.0 Ports, ATX Power Supply • 256 GB Hard drive, 8G Memory (Min) • Two HDMI ports (Optional VGA to HDMI interface)

SonetExpert™ mTOP™ 1U Rack Solution
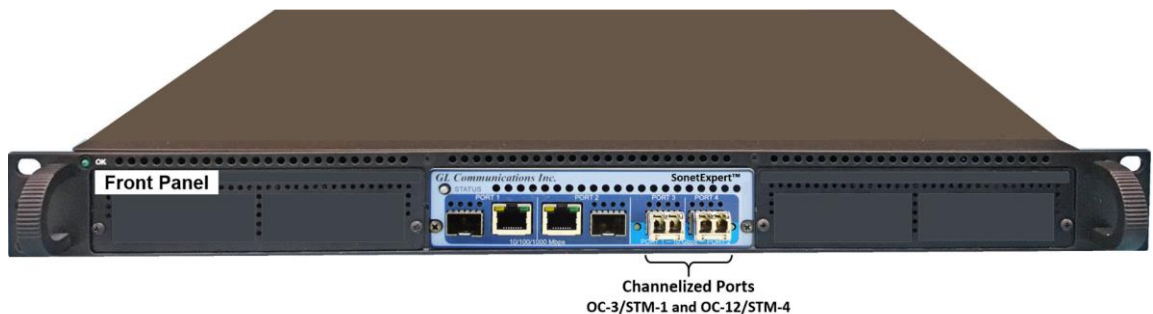
SonetExpert™ mTOP™ 1U Rack Solution (Front Panel View)
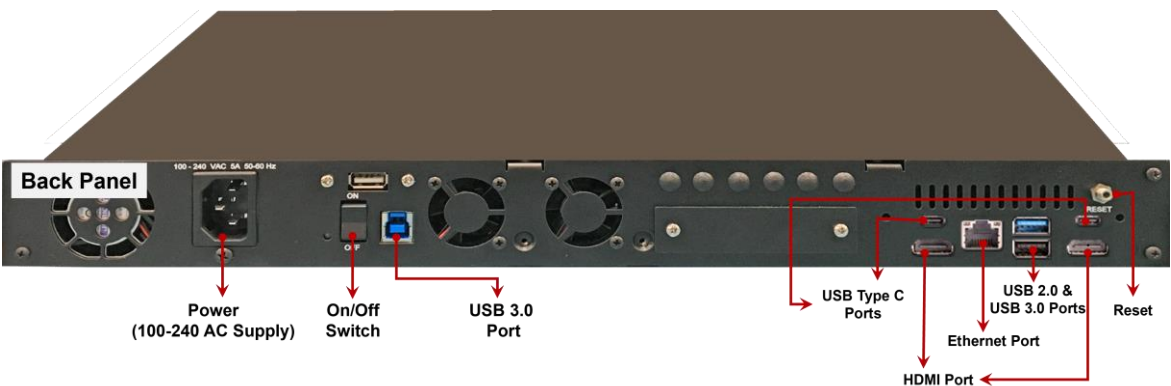
SonetExpert™ mTOP™ 1U Rack Solution (Back Panel View)

Physical Specifications	• Height: 1U Rack • Length: 16 Inches • Width: 19 Inches • mTOP™ System (embedded SBC, 1x SonetExpert™)
SonetExpert™ interfaces (1 unit)	• Two channelized Ports (OC-3/STM-1 or OC-12/STM-4) • Single Mode or Multi Mode Fiber SFP support with LC connector
SBC Specifications	• AMD Ryzen 9 Series Processor or Intel Core i9 Equivalent • Windows® 10 and above 64-bit Pro Operating System • USB 2.0 or 3.0 Ports, ATX Power Supply • USB Type C ports, Ethernet 2.5GigE port • 256GB Hard drive, 8G Memory (Min)

SonetExpert™ Features

- 2 Channelized Ports:

  - ➢ OC-3/STM-1 or OC-12/STM-4 interfaces

  - ➢ Simulate and monitor in both directions

- Configure the number of T1 E1 channels to be Multiplexed or Demultiplexed

- Analyze/emulate voice, data, fax, protocols, analog and digital signals, including echo and voice quality

- Comprehensive protocol analysis and emulation - HDLC, SS7, ISDN, CAS, PPP, Frame Relay, ATM and more

- Capture, transmit and process at wirespeed

- Broadcasts the selected T1 E1 channel data on all the 252 E1's or 336 T1's

- Direct access to any or all T1s and E1s

  - ➢ 2 x 336 T1's x 24 = 16,128 DS0s

  - ➢ 2 x 252 E1's x 31 = 15,624 DS0s

SonetExpert™ Features (Contd.)

- Pluggable SFPs allow Single Mode (SM), and Multi-mode (MM) fiber optic non-intrusive tap

- Supports any combination of DS0/64/56/16/8 kbps fractional T1 E1, and N x T1 E1 interface definitions (a total of 252 E1s or 336 T1s – in each port)

- Provides Loss of Signal (LOS) and Loss of Frames (LOF) Hardware Alarms indication, Service logging, External Clock, Line and Diagnostic Loopback options, Through mode and Port Swap Cross-port options

- Supports multiplexing multiple T1 or E1 channels to a single channelized OC-3/12 STM-1/4 line

- User configurable OC-3/STM-1 or OC-12/STM-4 mapping

- Provides an option to restart the SEC service automatically

Channelized T1 E1 Monitoring

Central Office

Customer Sites

Fiber Optic Lines

Optical Network

Emulation

Channelized SonetExpert™

Fiber Tap

STM-1 MUX

84 T1s / 63 E1s

4 Octal T1E1 Cards

• Multiple Hardware Interfaces
• Complex to Configure & Maintain
• Space Consuming & Expensive

Traditional Solution

Fiber Tap

Channelized SonetExpert™ Analyzer

Monitoring

2 x 336 T1s (16,128 DS0s)/

2 x 252 E1s (15,624 DS0s)

Windows & Linux API

New Solution

• Simple to configure
• Cost effective Solution
• Portable

n x T1 E1 — PRI ISDN, SS7, MLPPP, IMA

T1 E1 — CAS, SS7

n x 64 Kbps — Frame Relay

64 Kbps

n x 8 Kbps

BTS

GSM, TRAU

GL Communications

14

SonetExpert™ Analyzer GUI

Monitor all T1s or E1s

Protocol Analyzers

ISDN Call Capture and Analysis

SonetExpert™ Channelized T1 E1 Emulation
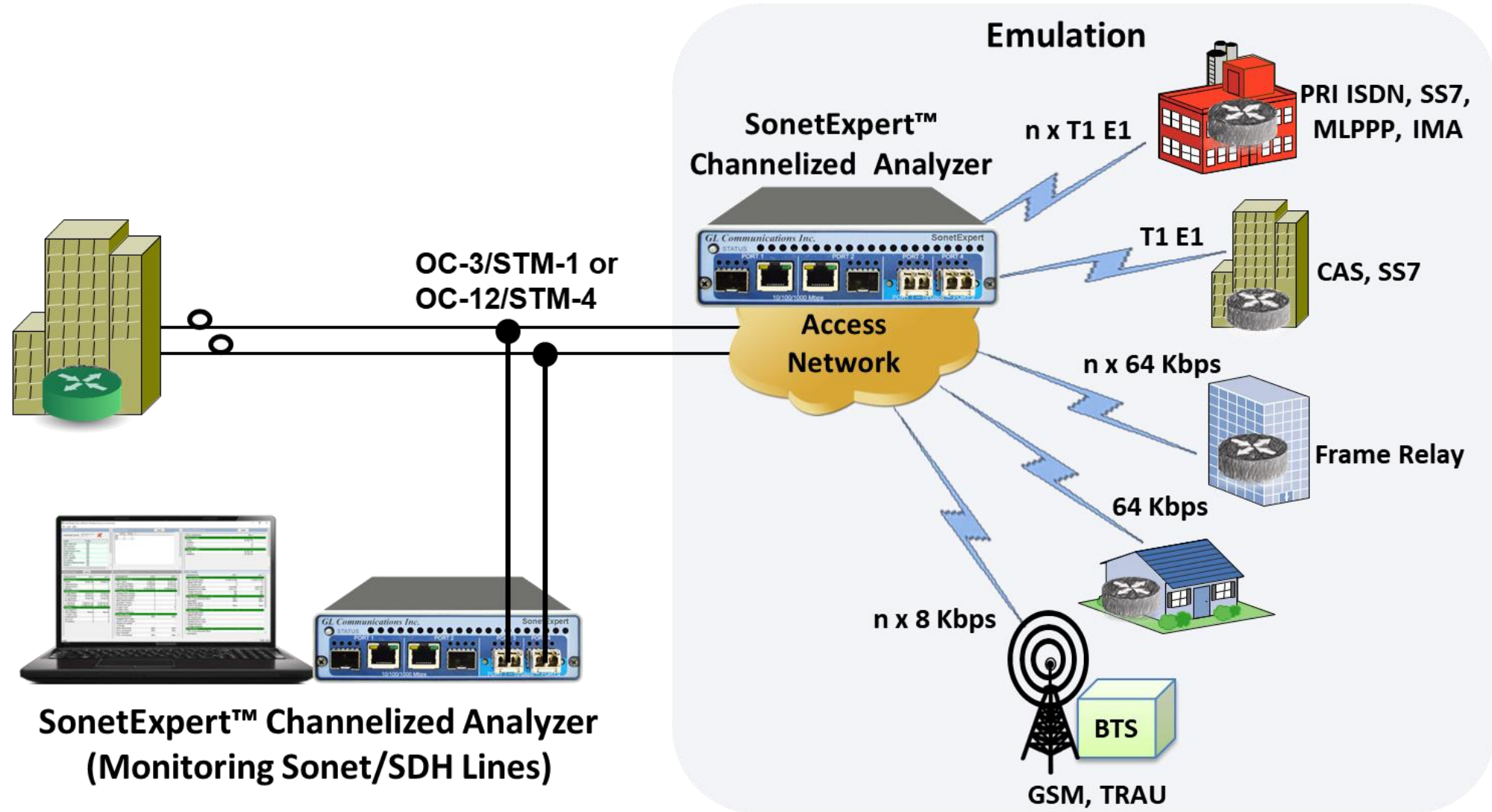
MAPS™ Call Generation, Reception, and Statistics

- Generating 1890 calls continuously

Working Principle

SonetExpert™ Monitor and Control Application (OC-3)

SonetExpert™ Monitor and Control Application (STM-1)

SonetExpert™ Channelized Configuration Utility

- Sonet/SDH parameters

- OC-3/STM-1, T1 E1 ports, Channels and Mapping

- Clock setting of Sonet/SDH ports

- Cross port and loopback settings

OC-3 Configuration Utility

STM-1 Configuration Utility

Optical Connectors and SFP Modules
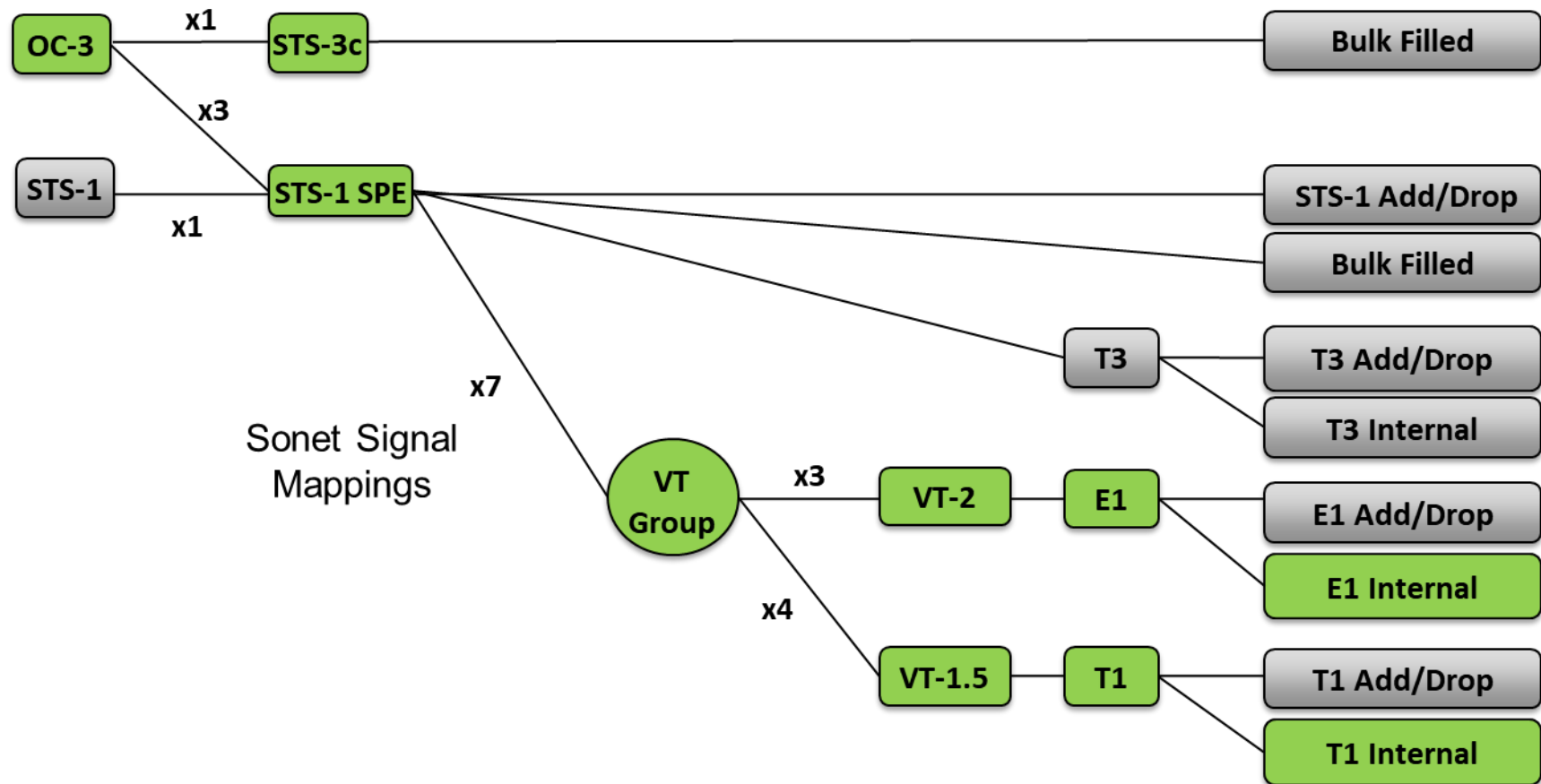

LC Connectors

850 1310 1550 nm SFP Module
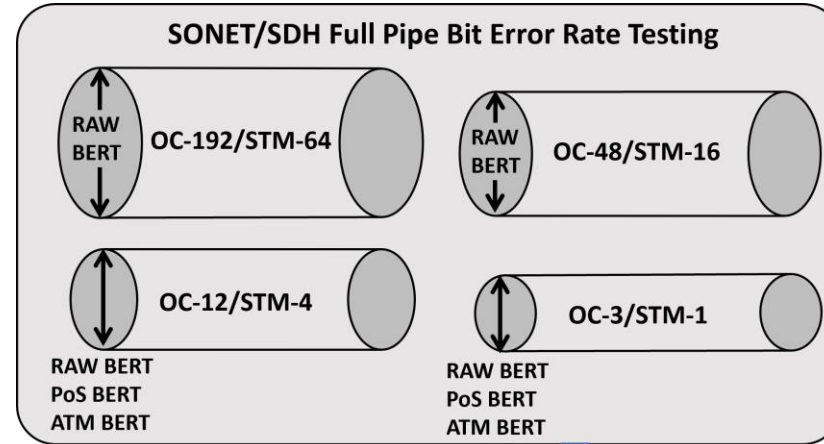
VC Mapping and Channel Numbering Scheme

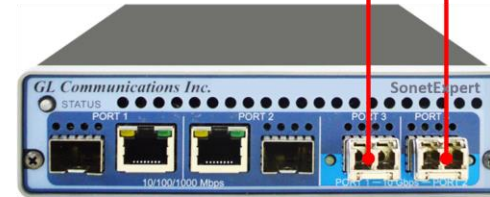- The paths colored in green are currently supported on the GL's SonetExpert™ hardware

VT – Virtual Tributary
VTG – Virtual Container Group
STS – Synchronous Transport Signal
SPE – Synchronous Payload Envelope
STS-3c – Synchronous Transport Signal 3, Concatenated

Unchannelized Analyzer

- Wirespeed processing of ATM, PoS or RAW data for Tx and Rx for both ports

- Supports BERT testing at rates from OC-3/STM-1 to OC-192/STM-64

- Ability to capture/playback to/from disk at full rate in both directions for all ports for detailed offline analysis

- Comprehensive transmit/receive testing capabilities; transmitting and verifying data with incrementing sequence numbers with each packet/cell

- Easy to use and flexible Bit Error Rate Test (BERT) application for ATM and POS

- ATM (AAL2, AAL5) Protocol Analyzer, UMTS Protocol Analyzer, PPP (IP and higher layer protocols) Protocol Analyzer

- ATM

  ➤ ATM Forum User Network Interface Specification

  ➤ ATM physical layer for Broadband ISDN according to CCITT Recommendation I.432

- PPP over Sonet (PoS)

  ➤ Point-to-Point Protocol (PPP) over Sonet/SDH specification according to RFC 2615 (1619) / 1662 of the PPP Working Group of the Internet Engineering Task Force (IETF)

- OC-3/STM-1, OC-12/STM-4 Transparent Payload

  ➤ Analyzer processes Sonet/SDH payload in transparent (RAW) mode without any transport protocols

SONET/SDH Full Pipe Bit Error Rate Testing

RAW BERT — OC-192/STM-64
RAW BERT — OC-48/STM-16
OC-12/STM-4
OC-3/STM-1

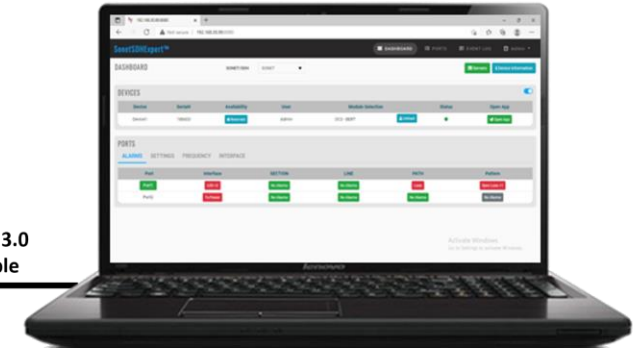RAW BERT
PoS BERT
ATM BERT

RAW BERT
PoS BERT
ATM BERT

Port 1 and Port 2 Unchannelized Ports OC-3/STM-1 to OC-192/STM-64

USB 3.0 Cable

SonetExpert™ Unchannelized Analyzer (Portable)

SonetExpert™ Monitor and Control GUI Functionalities

- Starting and stopping the SEC service

- Configuring SEC service

- Launching Soft T1 E1 Analyzer

- Viewing and clearing the SEC service log

- Displaying alarms, error counters and operational statistics

Thank you