UX400-10G Module
10G Ethernet/OTN/SDH/SONET

VeEX

VePAL UX400
Universal Test Platform

Next Generation Modular Platform for Transport, Carrier Ethernet, Mobile Backhaul, and Legacy Testing

VeEX® UX400 is the industry's most flexible, compact, and future-proof test solution for OTN, SDH, SONET, PDH, T-Carrier, Carrier Ethernet, Mobile Backhaul, Core, and Storage Area Networks[1].

10G Multi-Protocol Test Module

The UX400 10G module, with its physical interfaces for OTU2, STM-64, OC-192, 10G Ethernet, 8G/10G Fibre Channel testing, is a perfect complement to the UX400 Platform, enabling a full range of link and service testing capabilities for a complete DS1 to OTU4 and 10 Mbps to 100 GE, in a single compact unit.

Installation, commissioning, monitoring and maintenance of OTN, SDH, SONET, Ethernet and Fibre Channel networks is simplified thanks to a combination of intuitive features and powerful test functions.

Fast troubleshooting and comprehensive analysis of transmission problems can be performed using intrusive, non-intrusive and monitoring test modes. Novice users will benefit from the easy-to-use GUI, while experienced users will appreciate the array of advanced features such as test profiles, service disruption, VLAN and tributary scans, round trip delay, one-way latency and much more.

[1] Test interfaces, data rates, mappings, transmission protocols, and features depend on the availability of individual test modules

Module Highlights

General
- Single-slot test module
- Dual XFP optical ports
- Up to two independent tests per module
- SCPI-based remote control and scripting commands

OTN/SDH/SONET
- OTU2 testing with SDH/SONET and PDH/DSn payloads
- EoOTN Testing: OTU1e/2e with Bulk and Ethernet payloads
- STM-64/OC-192 testing with mapping down to VC12/VT2 and VC11/VT1.5
- PDH (E1, E3), DS1, DS3 payload analysis
- Single or Dual BERT
- External clock interfaces and TX frequency offset
- Optical power and frequency measurement
- Round trip and port 1 to port 2 one way delay measurements
- Service Disruption and APS measurements
- Path trace and pointer generation and analysis
- Overhead monitoring and byte decoding
- Tandem Connection Monitoring
- Bi-directional payload through and monitoring

Ethernet
- 10GE-LAN and 10GE-WAN testing
- Single or Dual BERT
- BERT testing at Layer 1, 2, 3 and 4

Universal Expert

- Throughput, latency, frame loss, and back to back measurement per RFC2544 and V-SAM (per ITU-T Y.1564)
- Multiple stream traffic generation and analysis for end-to-end QoS verification of multiple services
- Port 1 to Port 2 one-way latency measurement
- Service disruption measurement
- Transmit frequency offset to stress the network up to ±150 ppm
- MPLS tagging
- MAC flooding and VLAN flooding
- VLAN stacking/Q-in-Q
- IP Testing
- Wire-speed Packet Capture and Decoding

Fibre Channel
- 8G and 10G Fibre Channel
- Link verification for Storage Area Networks
- Layer 2 testing
- BERT, Throughput and RFC2544-based testing
- Buffer-to-buffer Credits
- Layer 1 and 2 Loopbacks

Test Interfaces

Dual XFP

OTU2e	11.095 Gbps
OTU1e	11.045 Gbps
OTU2	10.709 Gbps
STM-64/OC-192	9.953 Gbps
10GE LAN	10.313 Gbps
10GE WAN	9.953 Gbps
10GFC	10.52 Gbps
8GFC	8.5 Gbps

Physical Layer

Optical RX Power Monitoring
- ± 2 dB accuracy, 1 dB resolution
- LOS and Saturation indication

Frequency Measurements
- RX Frequency in bit/s (bps)
- Offset (ppm): Current, Minimum, Maximum

XFP Module*

XFP Information Display
- Vendor, P/N, Vendor revision, Wavelength, Minimum rate (Mbit/s), Maximum rate (Mbit/s), Supported interfaces

Safety: Class 1, per FDA/CDRH, EN (IEC) 60825 eye safety regulations

Operating temperature range: -10˚C to 70˚C

XFP transceivers conforming to Multi Source Agreement (MSA) specifications

Compliant to ITU-T G.957/G.691

Optical interfaces and systems relating to SDH

ROHS compliant and Lead Free per Directive 2002/95/EC

Specific data rates, performance and supported transmission protocols for the XFPs supplied by VeEX Inc. are listed in the ordering section.

TX Clock Source

Internal: ± 3.5 ppm stability per ITU-T G.812

Recovered: from the incoming RX signal

Tx Frequency Offset
- ±50 ppm for OTN
- ±150 ppm for PDH/DSn, SDH/SONET, Ethernet
- ±25,000 for E1
- Steps of 0.01 ppm

External Clock Input
- Connector: 75 Ohm BNC
- 2 MHz, 2 Mbps (AMI, HDB3)
- Terminated, Monitor, Bridge

Measurement Clock Reference

Internal: ± 3.5 ppm stability per ITU-T G.812

External Clock Input
- Connector: 75 Ohm BNC
- 2 MHz, 2 Mbps (AMI, HDB3)
- Terminated, Monitor, Bridge

OTN Functions

Key Features
- OTU2 (10.7 Gbps)
- OTU1e (11.049 Gbps) and OTU2e (11.095 Gbps) over-clocked bit rates (optional)
- EoOTN testing - internally generated Ethernet payload mapped into OTU1e, OTU2e
- Synchronous and asynchronous mapping of SONET/SDH signals, including multiplexed PDH/DSn payloads
- OTU, ODU, OPU overhead manipulation and monitoring
- OTU, ODU, OPU layer alarms/errors generation and analysis
- OTU, ODU, TCMi trace messages
- Forward error correction (FEC) testing
- Tandem Connection Monitoring
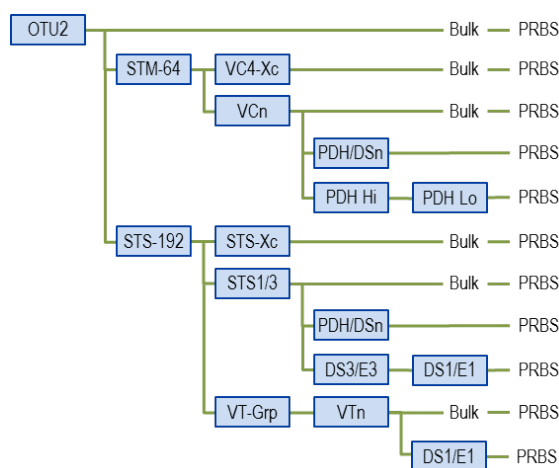- Frequency offset generation

OTN

Standards: ITU-T G.709, ITU-T G.798, ITU-T G.872

Test rates
- OTU2 (10.7 Gbps) Framed and Unframed
- OTU1e (11.049 Gbps), OTU2e (11.099 Gbps)

OTU2 Payloads

- ODU2-Bulk (test pattern)
- ODU2-STM-64 or OC-192, synchronous and asynchronous, including all supported mappings and multiplexed tributaries, down to E1/DS1 (Nx64/Nx56k)
- ODU2e-Bulk and 10GE payloads
- ODU1e-Bulk and 10GE payloads

OTU Layer

Alarm and Error Monitoring

- Alarms: LOF, OOF, LOM, OOM, OTU-AIS, OTU-IAE, OTU-BDI, OTU-TIM
- Errors: OTU-FAS, OTU-MFAS, OTU-BIP, OTU-BEI, Correctable FEC, Uncorrectable FEC

ODU Layer

Alarm and Error Monitoring

- Alarms: ODU-AIS, ODU-OCI, ODU-LCK, ODU-BDI, ODU-TIM
- Errors: ODU-BIP-8, ODU-BEI

OPU Layer

Payload Type (PT): Generates and displays received PT value
Expected Payload label setting
Enable/Disable PLM monitoring
Alarm and Error Monitoring

- Alarms: OPU-PLM

BER Test

Alarm and Error Monitoring

- Alarms: LSS (Loss Sequence Synchronization)
- Errors: Bit (Test Sequence Error)

Error Insertion

OTN

- OTU-FAS, OTU-MFAS, OTU-BIP, OTU-BEI, Correctable FEC, Uncorrectable FEC, ODU-BIP, PM-BEI
- Modes: Single, Count (# of errors), Fixed Rates (typical), Programmable Rates (X.XXE-YY)

Payload

- Bit (Pattern)
- Modes: Single, Count (# of errors), Fixed Rates (typical), Programmable Rates (X.XXE-YY)

Alarm Generation

Physical Layer

- LOS
- Modes: Continuous (manual), Count (0.1, 1, 10, 100 seconds)

OTN

- OTU-LOF, OTU-LOM, OTU-AIS, OTU-IAE, OTU-BDI, OTU-TIM, ODU-AIS, ODU-OCI, ODU-LCK, ODU-BDI, ODU-TIM, OPU-PLM
- Modes: Continuous (manual), Count (0.1, 1, 10, 100 seconds)

OTN Overhead Analysis and Generation

Analysis – Decode and Display
  Byte Decoding
  - On-screen Decode
  ODUk bytes in hexadecimal, binary or ASCII formats
  - PM-TTI (SAPI, DAPI, User), PM-BIP, PM-BEI (BEI/BIAE, BDI, IAE)
  - ODU-TCM-ACT, TCMi-TTI (SAPI, DAPI, User), TCMi-BIP, TCMi-BEI (BEI/BIAE, BDI, IAE)
  - GCC0, CCC1, GCC2 bytes
  - PCC/APS bytes
  - Reserved bytes
  OPUk bytes in hexadecimal and binary formats
  - JC1, JC2, JC3, PSI, NJO

Generation - Programmable Bytes and sequences
  OTU and ODU Trace Generation
  - SAPI (15 characters)
  - DAPI (15 characters)
  - User (31 characters)
  - Copy from received trace
  TCMi Trace Generation
  - SAPI (15 characters)
  - DAPI (15 characters)
  - User (31 characters)
  - Copy from received trace
  Set TCMi Status
  - ODU-TCM-ACT (Binary and Hex)
  Programmable Expected Traces
  - OTU and ODU SAPI, DAPI, and User
  - Copy from received trace
  - Enable/Disable TIM monitor

Tandem Connection Monitoring (TCM)

TCMi Monitoring (1 through 6)

- LTC, AIS, OCI, LCK, BDI, BIAE, IAE; count
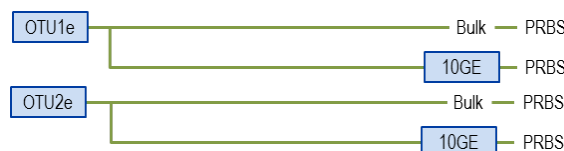- IEC, BEI; count and rate

Trace Identifier Monitoring and Generation

- Programmable SAPI, DAPI and User traces
- Copy trace from RX
- Enable/Disable TIM monitoring

Ethernet over OTN (EoOTN)

Mappings

- Direct mapping of 10G Ethernet payload into OTU1e or OTU2e, synchronous or asynchronous

Ethernet Payload

- Layer 1 Unframed or Framed
- Layer 2, 3 and 4
- VLAN: Up to 3 tags
- MPLS: Up to 3 tags
- Layer 4: TCP or UDP

Ethernet Layer Testing*

- BERT
- RFC2544
- Throughput

Test Patterns (payload)

- PRBS: $2^{11}-1$, $2^{15}-1$, $2^{23}-1$, $2^{31}-1$
- Fixed: All 1s and All 0s
- User-defined 32 bit sequence
- Normal or Inverted

Refer to the Ethernet Testing section for more details on Ethernet layer tests.

SDH/SONET Functions

SDH/SONET signals can be used as physical layer or as OTU2 payloads, and can even contain multiplexed PDH/DSn clients, providing all the flexibility to address complex test scenarios.

Key Features

- STM-64 (9.953 Gbps) Framed and Unframed
- OC-192 (9.953 Gbps) Framed and Unframed
- Bulk VC/STS/VT, PDH/DSn and multiplexed payloads
- Overhead manipulation and monitoring
- Alarms/errors generation and analysis
- Service Disruption and APS
- One-way Delay (dual mode)
- Round Trip Delay
- Tributary Scan
- Tandem Connection Monitoring
- Pointer Test Sequences

Operating Modes

Terminate Mode (Normal)

Payload Through mode (Intrusive)

- Monitors all errors and alarms as the signal passes through the test set
- Modification of SOH bytes
- Alarm Generation and Error Insertion

Line Through mode (transparent)

- Monitors all errors and alarms, as the entire signal passes through the test set, without modifying overhead bytes or the payload
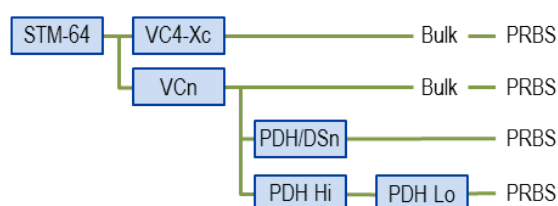
Signal Structure

VC-n, STS-n or VT-n container equipped with:

- Bulk TSS: Test sequence (patterns) per ITU-T O.181
- Structured: Unframed or framed PDH/DSn structure, down to Nx64 or Nx56 kbps, with test pattern per ITU-T O.150

SDH Mappings

According to ITU-T G.707

- C-11 (Bulk or DS1)
- C-12 (Bulk or E1 asynchronous, bit or byte synchronous)
- C-3 (Bulk, E3/DS3 or multiplexed E1/DS1/Nx64/Nx56) via AU-3 or AU-4
- C-4 (Bulk or E4)
- C-4-4c (Bulk)
- C-4-16c (Bulk)
- C-4-64c (Bulk)

SDH Overhead Analysis and Generation

Network Architectures supported

- Linear (per ITU-T G.783)
- Ring (per ITU-T G.841)

Analysis – Decode and Display

SOH/POH bytes in hexadecimal, binary or ASCII formats

- S1 synchronization status
- C2 HP signal label
- J0 trace identifier (1, 16 or 64 bytes) in ASCII format
- J1 trace identifier (16 or 64 bytes) in ASCII format
- J2 trace identifier (16 or 64 bytes) in ASCII format
- K1, K2 APS Control
- V5 LP signal label

Generation - Programmable Bytes

RSOH

- J0 trace: 1 byte (hex), 16-byte ASCII sequence with CRC-7, or 64-byte ASCII sequence with CR+LF

MSOH

- K1, K2 APS bytes per ITU-T G.783 and G.841
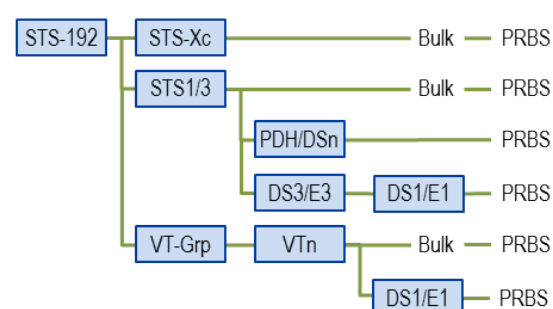- S1 synchronization status message

HO-POH (VC-4, VC-3)

- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- H4 Sequence/Multiframe Indicator
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

LO-POH (VC-3)

- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

LO-POH (VC-12, VC-11)

- V5 (bits 5-7) LP signal label
- J2 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- K4 (bits 3-4) LP APS signaling

SONET Mappings

According to Telcordia GR-253/ANSI T1.105

- VT-1.5 (Bulk or DS1)
- VT-2 (bulk or E1 asynchronous, bit or byte synchronous)
- STS-1 SPE (Bulk, E3/DS3 or multiplexed E1/DS1/Nx64/Nx56)
- STS-3c SPE (Bulk or E4)
- STS-12c SPE (Bulk)
- STS-48c SPE (Bulk)
- STS-192c SPE (Bulk)

SONET Overhead Analysis and Generation

Network Architectures supported
- Linear (per ITU-T G.783)
- Ring (per ITU-T G.841)

Analysis – Decode and Display

SOH/POH bytes in hexadecimal, binary or ASCII formats
- S1 synchronization status
- C2 STS path signal label
- J0 trace identifier (1, 16 or 64 bytes) in ASCII format
- J1 trace identifier (16 or 64 bytes) in ASCII format
- J2 trace identifier (16 or 64 bytes) in ASCII format
- K1, K2 APS Control
- V5 VT path signal label

Generation - Programmable Bytes

Section Overhead
- J0 trace: 1 byte (hex), 16 -byte ASCII with CRC-7, or 64-byte ASCII with CR+LF sequences

Line Overhead
- K1, K2 APS bytes per ITU-T G.783 and G.841
- S1 synchronization status message

STS-POH (STS-N SPE, STS-1 SPE)
- J1 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- C2 signal label
- H4 Sequence/Multiframe Indicator
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

STS-POH (STS-1 SPE)
- J1 trace: 16 byte ASCII with CRC-7 or 64 byte ASCII sequences
- C2 signal label
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

VT-POH (VT-1.5, VT-2)
- V5 (bits 5-7) VT signal label
- J2 trace: 16-byte ASCII with CRC-7 or 64-byte ASCII sequences
- K4 (bits 3-4) VT APS signaling

SDH/SONET Alarms

Monitoring and Detection
- SDH: LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HPUNEQ, HP-PLM, HP-TIM, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-UNEQ, LP-PLM, LP-TIM, LP-RDI, LP-RFI
- SONET: LOS, LOF-S, LOF-S, SEF-S, AIS-L, RDI-L, AIS-P, LOP-P, UNEQ-P, PLM-P, TIM-P, RDI-P, LOM-V, AIS-V, LOP-V, UNEQ-V, PLM-V, TIM-V, RDI-V, RFI-V

Generation
- SDH: LOS, LOF, MS-AIS, MS-RDI, RS-TIM, AU-LOP, AU-AIS, HP-UNEQ, HP-PLM, HP-RDI, HP-TIM, TU-LOM, TU LOP, TU-AIS, LP-UNEQ, LP-PLM, LP-RDI, LP-RFI, LP-TIM
- SONET: LOS, LOF, AIS-S, RDI-S, TIM-P, LOP-P, AIS-P, UNEQ-P, PLM-P, RDI-P, LOM-V, LOP-V, AIS-V, UNEQ-V, PLM-V, RDI-V, RFI-V, TIM-V
- Modes: Continuous, Burst (0.1s to 100s)

SDH/SONET Errors

Detection
- SDH: FAS, B1, B2, MS-REI, B3, HP-REI, LP-BIP, LP-REI, slips and bit errors
- SONET: FAS, S-BIP, L-BIP, REI-L, P-BIP, REI-P, REI-V, BIP-V, and bit errors

Insertion
- SDH: FAS, B1, B2, MS-REI, B3, HP-REI, LP-REI, LP-BIP, and bit errors
- SONET: FAS, B1, B2, REI-L, B3, REI-P, REI-V, BIP-V, slips and bit
- Mode: Single, Burst (1 to 1000), and Rate (1.00E-3 to 1.00E-9)

Tributary Scan

Automatically scans all VC-12/VC-11 and VT1.5/VT2 for errors, alarms and events using a sequential search

PDH/DSn Functions

While telecommunications network technologies have evolved to include long-distance high-capacity OTN and SDH/SONET trunks, PDH/DSn links and clients are frequently retained for access, service delivery, and other economic reasons. As such, testing PDH/DSn payloads continue to play an important role in test and measurement.

The UX400-10G Module provides PDH/DSn payload generation, access and testing capabilities for 140 Mbps (E4), 45 Mbps (DS3), 34 Mbps (E3), 2 Mbps (E1), 1.544 Mbps (DS1), down to N×64 and Nx56 kbps. PDH/DSn clients can be multiplexed into a higher PDH signal, mapped into SDH/SONET containers, and then mapped into ODU2-OTU2, giving it the flexibility to address complex test scenarios.

Operating Modes

Payload only – Internally generated and monitored PDH and DSn clients, including multiplexed signals.

Signal Structure

1.544 Mbps (DS1)
- Unframed, Framed SF (D4), ESF per ANSI/Telcordia standards
- Framed Nx56k and Nx64k

2.048 Mbps (E1)
- Unframed, Framed with/without CRC per ITU-T G.704 (PCM30, PCM30C, PCM31, PCM31C)
- Framed Nx64k

34.368 Mbps (E3)
- Unframed or Framed according to ITU-T G.751
- Structured with E1/Nx64 clients

44.736 Mbps (DS3)
- Unframed or Framed M13 & C-Bit Parity per ITU-T G.752/G.704
- Structured with DS1/Nx56/Nx64 clients

139.264 Mbps (E4)
- Unframed or Framed per ITU-T G.751

PDH/DSn Errors

Monitoring and Detection
- 2.048 Mbps (E1): Code, FAS, CRC, EBIT and Bit errors
- 8.448 Mbps (E2): Code, FAS, Bit errors
- 34.368 Mbps (E3): Code, FAS, Bit errors
- 139.264 Mbps (E4): FAS, Bit errors
- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors

Insertion
- 2.048 Mbps (E1): Code, FAS, CRC, EBIT, Bit errors
- 8.448 Mbps (E2): Code, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- 34.368 Mbps (E3): Code, 34M FAS, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- 139.264 Mbps (E4): Code, FAS, Bit errors
- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors
- Modes: Single, Burst (1 to 1000), or Rate (1.00×10^{-3} to 1.00×10^{-9})

PDH/DSn Alarms

Monitoring and Detection
- 2.048 Mbps (E1): LOS, AIS, LOF, LOMF, RDI, and LSS
- 8.448 Mbps (E2): LOS, AIS, LOF, RDI, and LSS
- 34.368 Mbps (E3): LOS, AIS, LOF, RDI, and LSS
- 139.264 Mbps (E4): LOS, AIS, LOF, RDI
- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF, LSS
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity, LSS

Generation
- 2.048 Mbps (E1): LOS, AIS, LOF, RDI
- 8.448 Mbps (E2): 8M AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 34.368 Mbps (E3): 34M LOS, 34M AIS, 34M LOF, 34M RDI, 8M, AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity
- 139.264 Mbps (E4): AIS, FAS RDI
- Modes: Continuous, Burst (0.1s to 100s)

Measurement Functions

Test Results
  Error count, ES, %ES, SES, %SES, UAS, %UAS, EFS, %EFS, AS, %AS, and rate for all events: errors, alarms and pointer events

Performance Analysis
  Measurements according to:
- ITU-T G.821: ES, EFS, SES and UAS with HRP 1% to 100%
- ITU-T G.826: EB, BBE, ES, EFS, SES, UAS; HRP of 1% to 100%
- In Service Measurement (ISM) using B1, B2, B3, FAS, CRC or Code (E1)
- Out of Service measurement (OOS) using bit errors (Test Sequence Error)
- ITU-T G.828: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- ITU-T G.829: ES, EFS, SES, BBE, UAS on RSOH (B1), MSOH (B2) or TSE
- ITU-T M.2100: ES, EFS, SES, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE) and Bringing into Service (BIS) objectives
- ITU-T M.2101: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE and Bringing into Service (BIS) objectives. In service measurements on both near and far ends of path using TSE, HP-BIP (B3), MS-BIP (B2), RS-BIP (B1) and LP-BIP (V5)

E1 Frame Words

Monitor and Generates Sa bits
- SA4 to SA8
- Raw SSM Quality level message

Common Functions & Measurements

Test Patterns

The following test sequences can be generated to fill the payload
- PRBS: $2^{31}-1$, $2^{23}-1$, $2^{20}-1$, $2^{15}-1$, $2^{11}-1$, $2^{9}-1$, $2^{7}-1$, QRSS
- Fixed: 0000, 1111, 1010, 1100, 1in8, 2in8, 3in24, DALY, NET55 and OCT55
- User: 24-bit Programmable sequence

The following test sequences can be generated in Bulk mode
- PRBS: $2^{31}-1$, $2^{23}-1$

Signal and Frequency Measurements

Signal level
  Optical power in dBm and graph
Frequency (Line and Payloads)
Resolution: 1 bit/s (bps)
Frequency Offset
  Resolution: 0.1 ppm
  Current, Minimum and Maximum

One-way Delay

Available for SDH and SONET in dual port mode
Local test
- Port 2 to Port 1
- Port 1 to Port 2
Measurement Range: 1 μs to 10 seconds
Resolution: ±1 μs

Round Trip Delay

Available for SDH and SONET
Measurement Range: 1 μs to 10 seconds
Resolution: ±1 μs

Events Log

Date and time stamped record of all events occurred during a test, presented in tabular format
Includes event name, time, duration and count/severity

Histograms and Bar Graphs

Histogram: Display of related Errors and Alarms versus time
Bar Graph: Error or Alarm severity versus time
Resolution: Seconds, minutes, hours and days

Soft LED Indicators

Fixed indicators for Signal, Framing, Pattern and Errors/Alarms
Display historical events and conditions

Measurement Options

Service Disruption and APS Testing

SDH Sensors
- LOS, LOF, FAS
- B1, MS-AIS, MS-RDI, MS-REI, B2, AU-AIS, AU-LOP, B3, HP-RDI, HP-REI, TU-AIS
- PDH payload-related triggers
- LSS

SONET Sensors
- LOS, LOF, FAS
- S-BIP, AIS-L, RDI-L, REI-L, L-BIP, AIS-P, LOP-P, P-BIP, RDI-P, REI-P, AIS-V
- PDH payload-related triggers
- LSS

PDH (E1) Sensors
- E1-LOF, E1-AIS
- LSS

Pass/Fail range: 15 to 200 ms
Gate Time: 20 to 4000 ms
Resolution: 1 ms
Test Modes: Single and Continuous
SDH/SONET APS Byte (K1/K2) capture and decode

Pointer Analysis and G.783 Test Sequences

Pointer movements monitoring and generation for SDH and SONET

Monitor
- AU, TU, STS and VT pointer adjustments
- SS bits, LOP, New Data Flags (NDF)
- Current value, increments, decrements, sum, difference
- Tributary frequency offset (ppm of AU/TU or STS/VT)

Generation
- Pointer sequences : ITU-T G.783, Telcordia GR-253
- Pointer Types: AU, TU, STS, VT
- Single pointer, increment, decrement, or increment decrement
- Sequence: Basic, Single Alternating, Regular Additive, Regular Cancel, Double Alternating, Burst, Transient Burst, 87/3, 87/3 Additive, 87/3 Cancel, Periodic Additive, Periodic Cancel
- Programming of SS bits
- Adjustments: Increment, Decrement, New Value
- Parameters: N, T1, T2, T3, T4

Tandem Connection Monitoring (TCM)

Generation and analysis of N1 and N2 bytes

Errors generated: TC-IEC, TC-BIP, TC-REI, OEI

Alarms generated: TC-RDI, TC-UNEQ, TC-LTC, TC-AIS, TC-ODI

Detection, display, analysis and storage of events:
- TC-IEC, TC-AIS, TC-REI, TC-RDI, TC-OEI, TC-LTC, TC-UNEQ, TCODI, TC-TIM
- Analysis and generation of APId (Access Point Identifier)

Ethernet Testing

10GE Functions

Reliability, Scalability and Quality of Service are the attributes needed for Ethernet to turn into Carrier-grade Ethernet. With standard features including RFC2544, Y.1564 Service Activation Methodology, Ethernet OAM, MPLS and VLAN support, the UX400 has all the tools necessary to truly ensure end-to-end carrier-grade Ethernet services.

Key Features

- 10GE-LAN and 10GE-WAN testing
- Dual port operation with independent traffic generation and test capabilities, with pass-through monitor modes
- Transmit frequency offset to stress the network up to ±150 ppm
- Throughput, latency, frame loss, and back-to-back measurements per industry-standard RFC2544 and Advanced SLA mode
- V-SAM Service Activation Methodology test suite compliant with ITU-T Y.1564 standard
- IPv4 and IPv6 traffic generation
- Q-in-Q (VLAN stacking) and multiple MPLS tag support
- MAC flooding and VLAN flooding
- BER testing at Layer 2, Layer 3 and Layer 4, with or without VLAN and MPLS tags
- Throughput testing
- Multiple stream traffic generation and analysis for end-to-end QoS verification of multiple services

- Intelligent device discovery mode; discover other VeEX Ethernet testers or loopback devices on the network for quick and easy loopback control configuration
- Peer-to-peer symmetrical or asymmetrical test to a remote VePAL test set with measurements at each end
- Smart Loop mode for Layer 1, Layer 2, Layer 3, and Layer 4 with all key measurements on received traffic provided on the loopback unit
- VLAN Scan
- Port 1 to Port 2 one-way latency measurement
- Line rate packet capture with Wireshark decode10G
- Service and Link level OAM
- Packet Capture and Decoding

Interfaces

10G LAN (9.953 Gbps)
10G WAN (10.313 Gbps)

Operating Modes

Terminate

Monitor

Loopback

Dual port operation: Independent traffic generation and test capabilities on any two ports selected

Traffic Generation

Layer 2, Layer 3 or Layer 4

Test Frame Header
    IEEE 802.3 and Ethernet II (DIX) frames

Configurable Source and Destination MAC and Ethernet Type

VLAN stacking up to 3 VLAN tags w/configurable priority & type

Fully configurable IPv4 or IPv6 header

MPLS up to 3 labels with configurable Label/S/CoS and TTL fields (optional)

UDP/TCP header with configurable Source & Destination ports

Frame size 64 to 1518 bytes and jumbo frame up to 10000 bytes

Traffic Pattern (Throughput Test and BERT only): Constant, Ramp, Multi Bursts, Single Burst

Error Injection (Throughput Test and BERT only): Bit, CRC, PCS Errored Block, IP Checksum, TCP/UDP checksum

Alarm Injection (Throughput Test and BERT only): Local Fault, Remote Fault, PCS Hi-BER, PCS-LOBL

MAC flooding feature generates test frames with up to 4096 incremental Source and/or Destination MAC addresses (optional)

VLAN flooding feature generates test frames with up to 4096 incremental VLAN IDs (optional)

Key Measurements

Error Measurements: Bit/BER (BERT and single stream Throughput Test), CRC, PCS Errored Blocks, IP checksum, TCP/UDP checksum, jabber frames, runt frames, Frame loss (count and %), OSS

Alarm Detection: LOS, Service Disruption, Local and Remote Fault, PCS Hi-BER, PCS-LOBL

Frame/Packet Statistics: Multicast, broadcast, unicast, pause frames, frame size distribution

Rates (min, max, average and current): frame rate, bandwidth utilization, frame rate, line rate, data rate

Delay (min, max, average and current): round trip delay, one-way delay between ports, inter frame gap, jitter

ITU-T Y.1564 V-SAM Test

V-SAM test suite compliant with ITU-T Y.1564 standard

Support for Multi-stream traffic generation, Service Configuration and Service Performance tests

Independently configurable for each stream: Bandwidth profile parameters (CIR, EIR, Traffic Policing) and Service Acceptance criteria (FLR, FTD, IFDV, AVAIL)

Simple summary Pass/Fail results tables and drill down capability with detailed measurements (Frame Loss, Frame Transfer Delay, Frame Delay Variation, Availability) for each service

RFC2544 Compliance Testing

Automated tests compliant with RFC2544 with configurable threshold values and maximum transmit bandwidth settings

Throughput, Latency, Frame Loss, and Back-to-Back (burst) tests

Frame sizes: 64, 128, 256, 512, 1024, 1280, and 1518 bytes including 2 user configurable frames

Test can be done to a remote loopback or to a remote test set with remote control of traffic generation and measurements at each end (requires asymmetric test option)

RFC2544 Advanced SLA Mode

RFC2544 compliant test on primary test stream with up to 9 independent background traffic streams

Each background stream can be set with independent frame size, bandwidth, traffic profile, and QoS levels

Test can be done to a remote loopback or to a remote test set with remote control of traffic generation and measurements at each end (requires asymmetric test option)

Bit Error Rate Testing

Single Stream test with test pattern: PRBS 2E31 -1, PRBS 2E23 -1, PRBS 2E15 -1, PRBS 2E11 -1, Normal and inverted patterns, All 0s, All 1s and User Defined

Multiple Streams Throughput Testing

Up to 10 independent traffic streams generation and analysis, with configurable filters

Each stream can be set with independent frame size, bandwidth, traffic profile, and QoS levels

VeEX Tester Discovery Function and Remote Controls

Discovery function to all VeEX VePAL devices within subnet or manual control of VeEX VePAL devices in routed network

Remote Control of Loopback capability

Remote Control of Asymmetric test capability for end-to-end test (optional)

Loopback Mode

Layer 1: loops back all incoming traffic

Layer 2: all incoming traffic is looped back with MAC source and destination addresses swapped

Layer 3: all incoming traffic is looped back with MAC and IP source and destination addresses swapped

Layer 4: all incoming traffic is looped back with MAC, IP, and UDP/TCP ports swapped

Loopback traffic filters with all MAC/VLAN/IP/UDP parameters configurable

All key measurements on received traffic provided on the loopback port

VLAN Scan and Monitor

Scan incoming traffic and discovers all VLAN flows including Q-in-Q tagging. Key statistics on traffic rates, alarms and errors are reported for monitored streams (up to 8)

IPv6

IPv6 compliant test traffic generation and analysis for all test applications (Y.1564 V-SAM, RFC2544, BERT and Multi-stream Throughput)

IPv6 Loopback capability

IPv6 Static or Stateless Auto Configuration and Ping function

IP Test Suite

IP Configuration and validation (IPv4, IPv6, Static, DHCP, PPPoE)

MAC address (configurable or default)

Ping and trace-route tests (IP address or URL)

Network discovery/ARP wizard (optional)

Packet Capture and Decode

Packet capture at line rate

Configurable capture filters

Capture file export to PCAP format

Built-in Wireshark™ packet decode

Fibre Channel Testing

8G/10G Fibre Channel Functions

The UX400-10G Fibre Channel option addresses all the transport layers by measuring the optical power level and supporting the generation/analysis of bit errors, order sets, frame delimiters, frame transmission, and the generation of primitive sequences. User defined bytes, fixed test patterns or industry-standard PRBS patterns can be selected and inserted into the payload field depending on test layer. Bit error, CRC error and Code violation insertion are useful features to verify Mux/Demux equipment for error monitoring and detection Testing

- FC-0 addresses the physical layer: the optical fiber, connectors and associated optical signal parameters
- FC-1 addresses the transmission protocol encoding/decoding, and special characters used for protocol management
- FC-2 addresses the signaling protocol layer, which comprises the framing protocol and the flow control process

Key Features

- 8G/10G Fibre Channel support for Storage Area Networks
- Terminate and Loopback operations mode
- FC-1 and FC-2 Layer testing
- RFC2544 compliance testing
- Traffic generation from 0.01% to 100%
- Flow Control Support with configurable buffer-to-buffer credits
- FC-2 Frame Header configuration
- Primitive Sequence Protocol support, link initialization, link reset, link failure
- Frame Length configuration up to 2148 bytes
- Traffic shaping: Constant, Ramp, and Burst profiles
- Performance Measurements – Delay, Packet Jitter, Sequencing
- Automated Test Reports and Event Log based on Errors and Alarms
- Service Disruption Measurement
- FC-2 Smart Loop mode

Fibre Channel Rates
8GFC (8.5 Gbps)
10GFC (10.52 Gbps)

Operating Modes
Terminate
Loopback

Fibre Channel Topology
Point-to-Point

Primitive Sequence Protocols
Link Protocols: Link initialization, link rest, link failure

Flow Control
Buffer-to-Buffer Credit Configuration: 1-65535
Buffer-to-buffer credit

Traffic Generation
FC-1 (with SOF and EOF frame delimiters) and FC-2 Frames
Class 3 Service frames
Configurable Header fields
Configurable EOF, SOF
Traffic Shaping: constant, ramp, burst
Frame Length Configuration: 2148 bytes maximum

Key Measurements
Error Measurements: Bit, BER, CRC, symbol, Oversize, Undersize, Frame loss (count and %)
Alarm Detection: LOS, pattern loss, service disruption
Traffic Statistics: Bandwidth utilization, data rate, frame count, byte count, frame size distribution, buffer-to-buffer credit count, RR_RDY count, frame loss count and round trip delay
Rates (min, max, average and current): frame rate, bandwidth utilization, frame rate, line rate, data rate
Delay (min, max, average and current): round trip delay, inter frame gap

RFC2544 Compliance Testing
Automated tests compliant with RFC2544 with configurable threshold values and maximum transmit bandwidth settings
Throughput, Latency, Frame Loss, and Back-to-Back (burst) tests
Frame sizes: 64, 128, 256, 512, 1024, 1280, and 2000 bytes including 2 user configurable frames

Bit Error Rate Testing
NCITS-TR-25-1999 Patterns (FC-1): CRPAT, CSPAT, CJTPA
PRBS Patterns (FC-2): 231-1, 223-1, 215-1, 211-1, normal and inverted selections, and user defined patterns
Error Injection: Bit and CRC

Loopback Mode
FC-1
FC-2 (Layer 2): swaps the destination and source IDs (D-ID and S_ID)

Optical SFP Options

Transceiver		XFP		
Data rate	10GE LAN and WAN only	10GE LAN and WAN OC-192; STM-64 (9.953 Gbps) OTU-2 (10.7 Gbps) , OTU-1e (11.049 Gbps), OTU-2e (11.095 Gbps)		
Part No.	301-04-001G	301-04-002G	301-04-003G	301-04-004G
Wavelength (nm)	850	1310	1550	1550
Range (km)	300 m	10 km	40 km	80 km
Connector	LC	LC	LC	LC
Line coding	NRZ	NRZ	NRZ	NRZ
Tx Laser	VCSEL	DFB	DFB	DFB
Tx Spectral width (nm)	0.4	1	1	1
Tx Power (dBm)	-5 to -1	-6 to -1	-1 to +2	0 to +4
Rx Detector	PIN	PIN	PIN	APD
Rx Sensitivity				
STM-64/OC-192 9.953 Gbps		-14.4 to +0.5	-16 to -1	-24 to -7
10GE WAN 9.953 Gbps	-11.1 to +0.5	-14.4 to +0.5	-16 to -1	-24 to -7
10GE LAN 10.313 Gbps	-11.1 to +0.5	-14.4 to +0.5	-16 to -1	-24 to -7
OTU2 10.709 Gbps		-14.4 to +0.5	-16 to -1	-24 to -7
OTU1e 11.049 Gbps		-13.4 to +0.5	-15 to -1	-22 to -7
OTU2e 11.095 Gbps		-13.4 to +0.5	-15 to -1	-22 to -7

*Data rates, performance, and supported transmission protocols are only guaranteed for SFPs and XFPs supplied by VeEX Inc. If selecting or using other vendors, users should exercise caution.

Ordering Information

Z22-00-004P   UX400 10G Test Module Dual 10G XFP port, supports OTU2e, OTU1e, OTU2, STM-64, OC-192, 10GE, 8G FC, 10G FC (protocols not included)

Software Options

499-05-005	8G Fibre Channel
499-05-060	10GE WAN
499-05-122	10GE LAN
499-05-139	10G Fibre Channel
499-05-221	10G SDH/SONET
499-05-222	OTU2 (requires 499-05-221)

OTN Options

499-05-223	OTU1e (requires 499-05-221 and 499-05-122)
499-05-224	OTU2e (requires 499-05-221 and 499-05-122)

SDH/SONET Options (499-05-221 is required)

499-05-109	10G Service Disruption and APS
499-05-110	10G Tandem Connection Monitoring
499-05-111	10G ITU.783 Pointer Test Sequences

Ethernet Options (499-05-122 is required)

499-05-066	10GE Layer 1 Unframed BERT
499-05-090	10GE IP Connectivity (Ping, ARP and Trace Route)
499-05-105	10GE Packet Capture with Wireshark Decode
499-05-130	10GE Multiple Streams
499-05-131	10GE MPLS
499-05-132	10GE Jitter
499-05-133	10GE MAC Flooding
499-05-134	10GE VLAN Flooding
499-05-135	10GE Asymmetric Testing

General

Power Consumption	29 watts (max)
Environmental	
Operating temperature	0 to 40°C (32 to 104°F)
Storage temperature	-20 to 70°C (-4 to 158°F)
Humidity	5% to 90% non-condensing

ROHS compliant and Lead Free per Directive 2002/95/EC

*Some of the test rates, mappings, features and fuctions described in this document are optional, may be linked to, or require the support of other software options.

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