

Synchronous Services Analysis (SSA) Module for NIC Platform

Advanced, cost-effective SONET/SDH testing with optional OTN and ATM

SSA MODULE INTERFACE PANEL



PLATFORMS



NIC NXG

The SSA 1220 is the industry's most cost effective SONET/SDH testing solution with optional OTN and ATM testing plus drop-insert to PDH/T-Carrier rates.

In the light and compact NIC chassis or battery-powered NIC BP, the SSA 1220 provides a fully featured SONET/SDH/ OTN/ ATM test solution and with additional module can provide PDH/T-Carrier test with drop/insert capabilities or Optical Spectrum Analyzer (OSA).



NIC Plus

In the larger 5-slot NIC Plus or NIC EP chassis, numerous configurations are available to provide the exact test solution needed. For example, a single NIC Plus or NIC EP chassis can be equipped with five SSA 1220 modules for multi-port/ simultaneous testing. Other configurations include the 40/43Gbps test module, OSA, High-Density Ethernet or other modules.



NIC EP

KEY FEATURES

- OC-3 / STM-1 (52M) interface
- OC-12 / STM-4 (622M) interface
- OC-48 / STM-16 (2.5G) interface
- OC-192 / STM-64 (10G) interface
- OTU-1 (2.66 Gbps) interface
- OTU-2 (10.7 Gbps) interface
- Investment protection - Existing NIC products can be upgraded with SSA 1220 modules
- Hot-swappable SFP/XFP optical transceiver modules
- Simultaneous testing of all HP/S TS containers/SPEs with All Path Test option.
- Auto-detection of mapping type and PRBS pattern for the entire bandwidth with All Path Test option.
- Industry-leading OTN testing with available ODU-1 to ODU-2 Mapping, Overhead Byte Capture, full overhead access/manipulation and Intrusive/non-intrusive through mode
- Advanced ATM testing with AAL0, AAL1, AAL5 support, both PVCs and SVCs and 240

SONET/SDH Testing

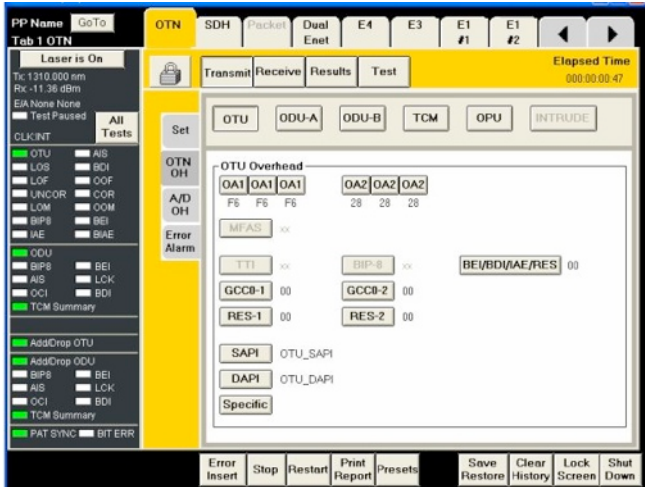
- Available with OC-192/STM-64, OC-48/STM-16, OC-12/STM-4, OC-3/STM-1, EC-3/STM-1e, OC-1/STM-0, and EC-1/STM-0e interfaces
- Complete overhead control and monitor
- Overhead Byte capture
- User-definable alarms for power level, frequency, trace and expected path label
- Line and pointer (STS, VT, AU, TU) frequency offset +/- 100ppm
- Intrusive/Passive Through Mode capability
- APS testing and Service Disruption Measurement with user-selectable criteria.



Optical Transport Network (OTN) Testing

Test Option

- Supports the full range of OTN interfaces: OTU-1 (2.66Gbps), OTU-2 (10.7Gbps)
- ODU-1 to ODU-2 Mapping Test Option for OTU-2 interface
- Overhead Byte Capture
- Activation via license-based Test Option
- Full overhead access/manipulation
- Intrusive/non-intrusive through mode

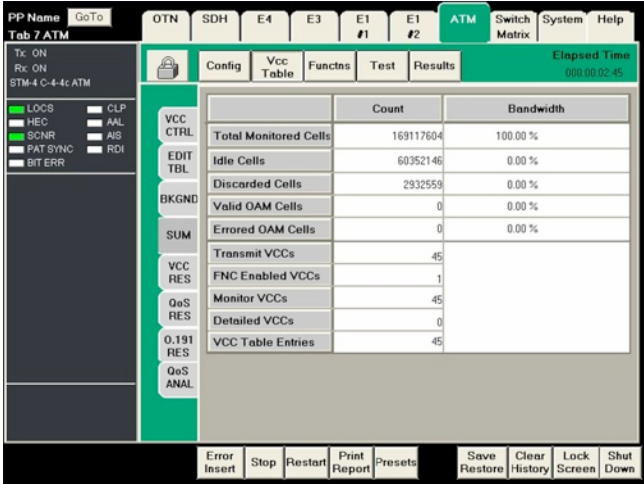


NOTE: Features listed above require specific hardware and software plus license-based Test Options in order to operate.

Asynchronous Transfer Mode (ATM) Testing

Test Option (requires ATM module)

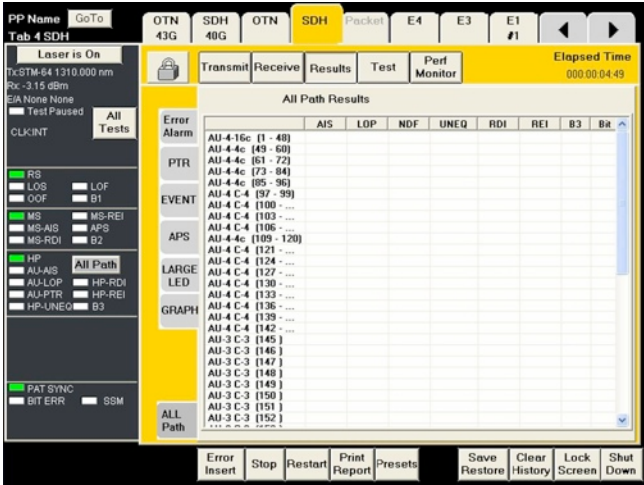
- Asynchronous Transfer Mode testing at the following rates: 622M, 155M, 52M
- UNI/NNI interface types
- AAL0, AAL1, AAL5
- PVC and SVC support
- 240 VCCs transmit/255 VCCs receive
- Bit error rate testing plus ATM alarm/error insertion and monitoring
- VCC scan for automatic detection of VCCs



All Path Testing™ (APT)

Test Option

- Simultaneous testing of all HP/STS containers/SPEs
- Each path can be configured separately with any test pattern desired
- Supports any combination of homogenous or mixed mappings
- Auto-detection of mapping type and PRBS pattern for the entire bandwidth
- Service Disruption Measurement on all containers/SPEs simultaneously. With selectable criteria, All Path Testing detects single or multiple disruptions, reporting the latest event, shortest, longest and average events.



SONET/SDH FEATURES

OPTICAL INTERFACES

Connector Type	LC
Optical module	SFP - 51/155/622 Mbps, 2.5/2.6 Gbps XFP - 10/10.7 Gbps
Bit rates:	STM-64/OC-192 9.953 Gbps STM-16/OC-48 2.488 Gbps STM-4/OC-12 622.80 Mbps STM-1/STM-1e/OC-3/EC-3 155.08 Mbps STM-0/STM-0e/OC-1/EC-1 51.84 Mbps

Automatic Protection

Switching Support for SONET/SDH transmission/reception of switching linear and ring-mode command sequences for K1/K2 bytes (per G.841); Measurement accuracy is one-frame duration; Results displayed in summary column format and decoded tabular format

Overhead Control

Section/RS, Line/MS OH: A1, A2, J0(Trace)/Z0/C1, D1–D12, E1, E2, F1, K1, K2, S1, M0/M1, Z1, Z2, E2; Path/HP OH: C2, F2, G1, H4, J1 (Trace), Z3/F3, Z4/K3, Z5/N1(TCM); VT/LP OH: V5, J2 (Trace), Z6/N2(TCM), Z7/K4

Overhead Monitor

Section/RS, Line/MS OH: all bytes; Path/HP OH: all bytes; VT/LP OH: all bytes

Pointer Control

SONET STS/VT and SDH AU/TU: Increment/decrement single, increment/decrement burst 2–8, new value with NDF, new value without NDF, Pointer sequences (per standards), Payload frequency offset ± 100 ppm

Pointer Monitor

SONET STS/VT and SDH AU/TU: Positive Pointer Justification counts, Negative Pointer Justification counts, Pointer Justification seconds, NDF counts, Pointer value (decimal and hexadecimal formats)

Performance Monitoring

Calculates network performance in accordance with ITU/Telcordia standards GR-253, T1.231, G.821, G.826, G.828, G.829, M.2100, M.2101, M.2110, M.2120

ELECTRICAL INTERFACES

Connector Type	75-ohm BNCs — 51 Mbps and 155 Mbps
Line code	EC-3(STS-3)/STM-1e: CMI EC-1(STS-1)/STM-0e: B3ZS
Electrical Level (Tx)	0.5 Vpk $\pm 10\%$
Electrical Level (Rx)	Terminate and monitor mode meet ITU-T G.772

INTERFACE SPECIFICATIONS

Timing	Internal, external, recovered
Internal Clock	Stratum III compliant (± 4.6 ppm)
External Clock	1.544Mb/s, 2.048Mhz (BITS/SETS), 1.544Mhz, 2.048 Mb/s via Bantam connector (120 ohm balanced); 8KHz/1.544/2.048/10 MHz via 75-ohm TTC BNC (unbalanced)
Frequency Offset	Tx timing ± 100 ppm, in 0.1 ppm increments
Unframed	10.71/9.953/2.66/2.488 Gbps, 622.80/155.08/51.84 Mbps (what about 40G?)
Input Freq. Meas.	± 200 ppm

FUNCTIONS

SONET Mapping	EC-1/3, STS-192c Bulk, STS-48c Bulk, STS-12c Bulk/ATM, STS-3c Bulk/ATM, STS-1 Bulk/ATM, VT-6 Bulk/ATM, VT-2 Bulk/ATM, VT-1.5 Bulk/ATM, Unframed Bulk With PDH module: E4 Bulk/ATM, DS3 Bulk/ATM, DS1#1 Bulk/ATM, DS1#2 Bulk/ATM, E1#1 Bulk/ATM, E1#2 Bulk/ATM. ATM mappings require ATM module.
SDH Mapping	AU-4-64c Bulk, AU-4-16c Bulk, AU-4-4c Bulk/ATM, AU-4/C-4 Bulk/ATM, AU-4/C-3 Bulk/ATM, AU-4/C-2 Bulk/ATM, AU-4/C-12 Bulk/ATM, AU-4/C-11 Bulk/ATM, AU-3/C-3 Bulk/ATM, AU-3/C-2 Bulk/ATM, AU-3/C-12 Bulk/ATM, AU-3/C-11 Bulk/ATM, Unframed Bulk. With PDH module: E4 Bulk/ATM, E3 Bulk/ATM, E1#1 Bulk/ATM, E1#2 Bulk/ATM, DS3 Bulk/ATM, DS1#1 Bulk/ATM, DS1#2 Bulk/ATM. ATM mappings require ATM module.
Test Patterns	PRBS 9, PRBS 9 inverted, PRBS 11, PRBS 11 inverted, PRBS 15, PRBS 15 inverted, PRBS 20, PRBS 20 inverted, PRBS 23, PRBS 23 inverted, PRBS 31, PRBS 31 inverted, user-defined (32-bit), all 0's, all 1's

SONET/SDH FEATURES (CONTINUED)

Alarm Detection	SONET: LOS, Optical Power Hot, Optical Warm, Optical Power Low, Frequency Wide, OPU Generic AIS, LOF, AIS-L, APS(K1/ Change), SEF, RDI-L, PATT SYNC, PLM-P, CONCAT, AIS-P, LOP-P, UNEQ-P, RDI-P, TIM-P, TIM-S, AIS-V, LOP-V, LOM-V, UNEQ-V, RDI-V, RFI-V, TIM-V, PLM-V, TC-RDI-P, TC-ODI-P, TC-AIS-P, TC-UNEQ-P, TC-LOF-P, TC-TIM-P, TC-RDI-V, TC-ODI-V, TC-AIS-V, TC-UNEQ-V, TC-LOF-V, TC-TIM-V, SS MISMATCH	Error Injection	SONET: B1, B2, REI-L, B3, REI-P, BIT, TC-IEC-P, TC-REI-P, TC-OEI-P, TC-BIP-V, TC-REI-V, TC-OEI-V SDH: B1, B2, MS-REI, B3, HP-REI, BIT, HP-TC-IEC, HP-TC-REI, HP-TC-OEI, LP-TC-BIP, LP-TC-REI, LP-TC-OEI
SDH:	LOS, Optical Power Hot, Optical Power Warm, Optical Power Low, Frequency Wide, OPU Generic AIS, LOF, MS-AIS, APS(K1/K2 Change), OOF, MS-RDI, PATT SYNC, HP-PLM, CONCAT, AU-AIS, AU-LOP, HP-UNEQ, HP-RDI, HP-TIM, RS-TIM, TU-AIS, TU-LOP, TU-LOM, LP-UNEQ, LP-RDI, LP-RFI, LP-TIM, LP-PLM, HP-TC-RDI, HP-TC-ODI, HP-TC-AIS, HP-TC-UNEQ, HP-TC-LOF, HP-TC-TIM, LP-TC-RDI, LP-TC-ODI, LP-TC-AIS, LP-TC-UNEQ, LP-TC-LOF, LP-TC-TIM, SS MISMATCH	Error Injection Rate	BIT/Frame: Single, 10-10 to 10-3, user-programmable; Other errors: Single, 10-10 to maximum, user-programmable
Error Detection	SONET: BPV/LCV, Frame (A1, A2), B1, B2, REI-L, B3, REI-P, BIP-V, REI-V, BIT, TC-IEC-P, TC-REI-P, TC-OEI-P, TC-BIP-V, TC-REI-V, TC-OEI-V, NDF-P, NDF-V SDH: BPV/LCV, Frame (A1, A2), B1, B2, MS-REI, B3, HP-REI, LP-BIP, LP-REI, BIT, HP-TC-IEC, HP-TC-REI, HP-TC-OEI, LP-TC-BIP, LP-TC-REI, LP-TC-OEI, AU-NDF, TU-NDF	Intrusive Through Mode	Provides the ability to regenerate optical signal and optionally modify Section and Line overhead bytes
Alarm Generation	SONET: LOS, LOF, AIS-L, RDI-L, LOP-P, AIS-P, RDI-P, UNEQ-P, UNEQ-V, RDI-V, RFI-V, AIS-V, LOP-V, LOM-V, TC-RDI-P, TC-ODI-P, TC-AIS-P, TC-UNEQ-P, TC-LOF-P, TC-RDI-V, TC-ODI-V, TC-AIS-V, TC-UNEQ-V, TC-LOF-V SDH: LOS, LOF, MS-AIS, MS-RDI, AU-LOP, AU-AIS, HP-RDI, HP-UNEQ, LP-UNEQ, LP-RDI, LP-RFI, TU-AIS, TU-LOP, TU-LOM, HP-TC-RDI, HP-TC-ODI, HP-TC-AIS, HP-TC-UNEQ, HP-TC-LOF, LP-TC-RDI, LP-TC-ODI, LP-TC-AIS, LP-TC-UNEQ, LP-TC-LOF	Service Disruption Automatic Protection Switching Measurement	Supported for all mappings. SONET triggers: B1 error, SEF, AIS-L, AIS-P, AIS-V, PRBS, LOS, LOF, B1, SEF, AIS-L, AIS-P, AIS-V, BIT errors. SDH triggers: LOS, LOF, B1, OOF, AIS-L, AIS-P, AIS-V, BIT errors. Resolution: 125 microseconds;
		Round-Trip Delay	Supported; SONET/SDH resolution is 125 microseconds;
		Tandem Connection Monitoring	In accordance with G.707/Annex D for High Order , Errors/Alarms: TC-IEC, TC-REI, TC-OEI, TC-AIS, TC-UNEQ, TC-RDI, TC-ODI, TC-LOF, TC-API

OTN FEATURES

General

Timing	Internal, external, recovered
Internal Clock	Stratum III compliant (± 4.6 ppm)
External Clock	1.544/2.048 Mbps (BITS/SETS), 1.544/2.048 MHz via Bantam connector (balanced); 8KHz/1.544/2.048/10 MHz via 75-ohm TTC BNC (unbalanced)
Input Freq. Meas.	± 200 ppm
Receiver Pulling Range	$> \pm 100$ ppm
Line Frequency Offset	± 100 ppm, in 0.1 ppm increments
Line Scrambling	Enabled/Disabled (default is Enabled)
OPU Frequency Offset	As defined in ITU-T publication G.709/Y.1331

OPTICAL INTERFACES

Connector Type	LC; Adapters available (e.g. LC to SC, ST or FC)
Line Code	NRZ
Interface Rates	OTU-1: 2.66 Gbps; OTU-2: 10.71 Gbps,
Modules	All optical interfaces are hot-swappable . SFP: 2.66 Gbps XFP for 10.7Gbps
OTU-1 External Clock Rate	166.629 MHz
OTU-2 External Clock Rate	167.332 MHz
External Clock Amplitude	0.5v \pm 0.1v

OTN FEATURES (CONTINUED)

FUNCTIONS

OTN Mapping	Unframed BERT, Framed BERT, Null Client, Synchronous SONET/SDH, Asynchronous SONET/SDH.	Alarm Generation	LOS, LOF, OOF, LOM, OOM, OTU(SM):AIS, OTU(SM):IAE, OTU(SM):BDI, ODU(PM):AIS, ODU(PM):OCI, ODU(PM):LCK, ODU(PM):BDI, TCM(1-6):BDI
Test Patterns	PRBS 9, PRBS 9 inverted, PRBS 11, PRBS 11 inverted, PRBS 15, PRBS 15 inverted, PRBS 20, PRBS 20 inverted, PRBS 23, PRBS 23 inverted, PRBS 31, PRBS 31 inverted, user-defined (32-bit), all 0's, all 1's	Intrusive Through Mode	Provides the ability to regenerate optical signal and optionally modify OTN overhead bytes and generate errors and alarms
Error Detection	Frame (OA1, OA2), MFAS, Correctable FEC errors, Uncorrectable FEC errors, OTU(SM): BIP8, OTU(SM):BEI, ODU(PM):BIP8, ODU(PM):BEI, BIT, TCM(1-6):BIP8, TCM(1-6):BEI	Service Disruption Measurement	Criteria: OOF, OTU(SM):AIS, OTU(SM):BIP8, ODU(PM):AIS, ODU(PM):BIP8, BIT errors; Resolution (one frame duration): OTU-1 is 49µs; OTU-2 is 12µs.
Error Generation	Frame (OA1, OA2), MFAS, Correctable FEC errors, Uncorrectable FEC errors, OTU(SM): BIP8, OTU(SM):BEI, ODU(PM):BIP8, ODU(PM):BEI, BIT, TCM(1-6):BIP8, TCM(1-6):BEI	Round-Trip Delay	Supported for OTN; OTU-1 resolution is 49 microseconds; OTU-2 resolution is 12 microseconds
Error Generation Rate	BIT/Frame: Single, 10 ⁻¹⁰ to 10 ⁻³ , user-programmable; Other errors: Single, 10 ⁻¹⁰ to maximum, user-programmable	Overhead Capture	Up to 255 overhead bytes can be captured and displayed in HEX and ASCII values, and can be printed or saved to a report file. Any one of the following bytes can be captured: OTU(SM):FAS OA1(1-3), OTU(SM):FAS OA2(1-3), OTU(SM):MFAS, OTU(SM):TTI, OTU(SM):BIP, OTU(SM):BEI, OTU(SM):GCC0(1-2), OTU(SM):RES(1-2), ODU(PM):TCM(1-6) TTI, OPU:RES(1-3), OPU:PSI, ODU(PM):TCM(1-6)BIP, OPU: JC(1-3), OPU:NJO, ODU(PM):TCM(1-6)BEI, ODU(PM):RES(1-9), ODU(PM):TCM ACT, ODU(PM):FTFL, ODU(PM):TTI, ODU(PM):BIP, ODU(PM):BEI, ODU(PM):EXP(1-2), ODU(PM):GCC1(1-2), ODU(PM):GCC2(1-2), ODU(PM):APS PCC(1-4)
Periodic Burst Generation	Burstable Errors: FRAME, MFAS, OTU(SM):BIP8, OTU(SM):BEI, ODU(PM):BIP8, ODU(PM):BEI, TCM(1-6):BIP8, TCM(1-6):BEI Burstable Alarms: OTU(SM):IAE, OTU(SM):BDI, ODU(PM):BDI, TCM(1-6):BDI Burst Size: 0 to 65535 Frames; OTU-1: 0 to 3209.35ms; OTU-2: 0 to 798.964ms. Burst Period: 0 to 1048575 Frames; OTU-1: 0 to 51350.392ms; OTU-2:.		Triggers: selected OTN errors or alarms, specified byte values, OPU justifications, manual
Alarm Detection	LOS, Power Hot, Power Warm, Power Low, LOF, OOF, OOM, LOM, OTU(SM):AIS, OTU(SM):IAE, OTU(SM):BDI, OTU(SM):SAPI, OTU(SM):DAPI, OTU(SM):BIAE, ODU(PM):AIS, ODU(PM):OCI, ODU(PM):LCK, ODU(PM):BDI, ODU(PM), SAPI, ODU(PM):DAPI, TCM(1-6):BDI, TCM(1-6):SAPI, TCM(1-6):DAPI, TCM(1-6):BIAE, OPU: PLM.		

ALL PATH TEST FEATURES

DESCRIPTION

Simultaneous Testing

Testing all high-path containers/SPEs simultaneously - even with STS-1 Bulk/ C-3 Bulk mappings, up to 192 simultaneous tests, including Bit Error Rate.

Each path can be configured separately with any test pattern.

Mixed Mapping Support

The All Path Testing Test Option supports any combination of high-path mapping types, homogeneous and mixed, simultaneously.

Auto-Configure

The auto config feature will detect any combination of high-path mapping types. If these AU/Containers/SPEs are bulk filled mappings with standard PRBS pattern, then payload type will also be detected. The auto-configure will then setup both transmit and receive to match the detected mapping types and begin testing.

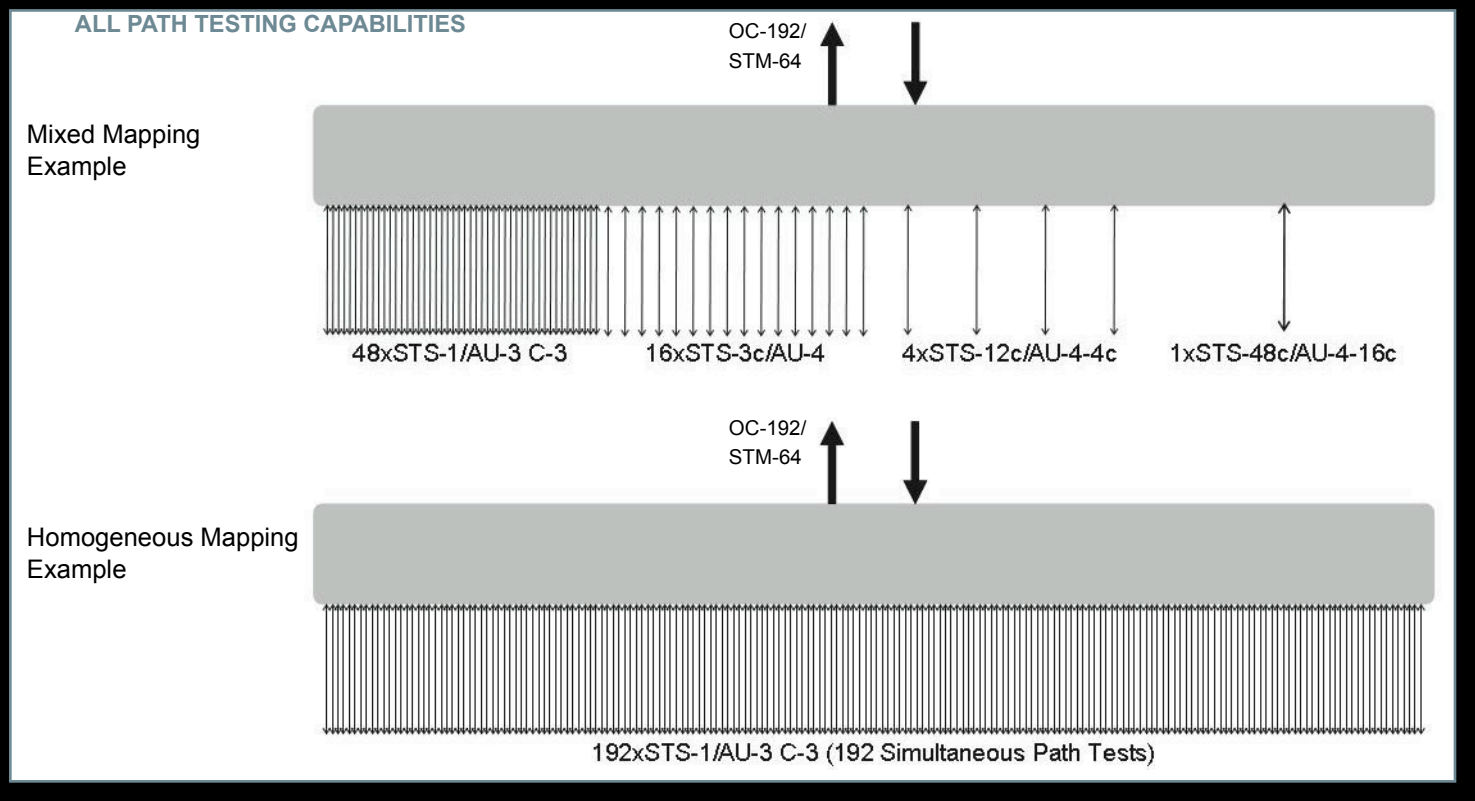
Simultaneous Service Disruption Measurement

With all Bit Error Rate tests running simultaneously, the NIC can also be configured to measure service disruption events on all paths simultaneously.

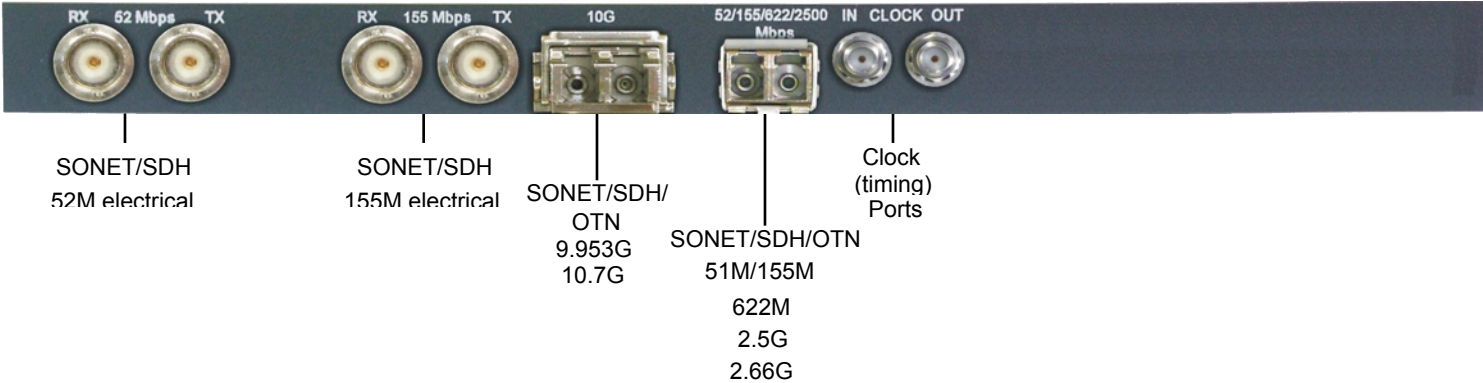
With selectable criteria, All Path Testing detects single or multiple disruptions, reporting the latest event, shortest, longest and average events.

FUNCTIONS

Rates	STM-64/OC-192, STM-16/OC-48, STM-4/OC-12, STM-1/OC-3
Mapping	AU-4-64c, AU-4-16c, AU-4-4c, AU-4, AU-3 C-3, STS-192c, STS-48c, STS-12c, STS-3c, STS-1
TX Payload	Payload may be specified for each container: PRBS9, PRBS9inv, PRBS11, PRBS11inv, PRBS15, PRBS15inv, PRBS20, PRBS20inv, PRBS23, PRBS23inv, PRBS31, PRBS31inv, User Defined.
RX Payload	Payload may be specified for each container: PRBS9, PRBS9inv, PRBS11, PRBS11inv, PRBS15, PRBS15inv, PRBS20, PRBS20inv, PRBS23, PRBS23inv, PRBS31, PRBS31inv, User Defined
Simultaneous Error Detection	On all paths: Bit, B3, REI, TC-IEC, TX-REI, TC-OEI
Simultaneous Alarm Detection	On all paths: AIS, RDI, LOP, UNEQ, TC-RDI, TC-ODI, TC-AIS
Simultaneous Monitoring	Of all paths: Overhead, J1 Trace, Tandem Connection Trace, Pointer justifications, NDF
Parallel Service Disruption Criteria	For individual paths: AIS-P, PRBS independently selected per container/SPE



CONNECTOR PANEL LAYOUTS



ORDERING INFORMATION

Base Modules:

- SSA 1220 155M to 52M, 1310nm SFP - [J26](#)
- SSA 1220 622M to 52M, 1310nm SFP - [J27](#)
- SSA 1220 2.5G to 52M - [J30](#)(1310), [J30b](#)(1550)
- SSA 1220 10G to 52M, [J31](#)(1310/1310), [J31b](#)(1310/1550), [J31c](#)(1550/1550)
- SSA 1220 10G only - [J32](#)(1310), [J32b](#)(1550)

ATM Module (add to any SSA module):

ATM Testing daughter board - [C9](#)

Optical modules available:

- SONET/SDH/OTN 52M to 2.66G - 1310nm SFP
- SONET/SDH/OTN 52M to 2.66G - 1550nm SFP
- SONET/SDH/OTN 10/10.7G - 850nm XFP
- SONET/SDH/OTN 10/10.7G - 1310nm XFP
- SONET/SDH/OTN 10/10.7G - 1550nm XFP

Test Options:

- OTU-1 (2.66G) Test Option
- OTU-2 (10.7G) Test Option
- ODU-1 to ODU-2 Mapping Test Option
- All Path Testing™ Test Option



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