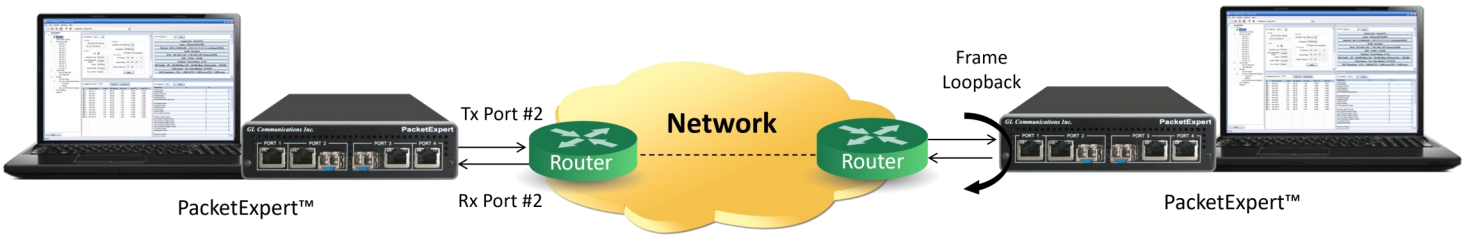
PacketExpert™ 1G - ExpertSAM™ (ITU-T Y.1564)



Overview

The **ExpertSAM™ (ITU-T Y.1564)** applications is designed for multiservice testing to measure the maximum performance of the Device or the Network Under Test. ExpertSAM™ is a set of procedures that test the ability of Ethernet-based services to carry a variety of traffic (voice, data, and video) at defined performance levels. In particular, it is aimed at addressing limitations of legacy RFC 2544 test procedures, especially for Service Level Agreements (SLA).

The **ExpertSAM™** is a basic application available within the PacketExpert™1G (PXE100). Quad Port Ethernet / VLAN / MPLS / IP / UDP tester with 4 Electrical Ethernet ports. 2 of the 4 ports includes optical ports along with electrical, enabling testing on optical fiber links. The electrical ports support 10 / 100 / 1000 Mbps. The optical ports support 1000 Mbps using SFPs. PacketExpert™ 1G is available in portable as well as Rack mount platforms. The portable PacketExpert™ 1G platform supports all the features of high-end taps providing mobility and storage capacity to reach any point in the network.

In ExpertSAM™ test methodology Bandwidth CIR / EIR /Overshoot traffic, Frame Loss, Frame Delay and Frame Delay Variation are measured and compared to the expected values for each service ensuring it is within its committed range or the threshold defined for guaranteed traffic such as CIR (Committed Information Rate).

For more information, refer to PacketExpert™ 1G - ExpertSAM™ webpage.

Features

- Complete validation of Ethernet Service-Level Agreements in a single test
- Supports Service Configuration and Service Performance tests in compliance with ITU-T Y.1564 standard
- Supports multiple services (up to 12 services) with varying performance requirements that meets full load conditions
- KPIs like Information Rate (IR) or Throughput, Frame Loss Ratio (FLR), Frame Transfer Delay (FTD) or Latency, and Frame Delay Variation (FDV) or Jitter, measured simultaneously for multi streams, and Pass/Fail verdict declared
- Capability to generate traffic at throughput of CIR (guaranteed traffic), EIR (best effort bandwidth) and Traffic Policing rates (dropped bandwidth) ensuring Key performance indicators (KPI) validation
- Color Aware mode supported-generates Green/Yellow color marked traffic at the configured rates, and provides Green and Yellow measurements separately. VLAN PCP, IP TOS and IP DSCP color marking supported
- EMIX (Ether MIX) frame sizes supported per service -up to 7 frame sizes can be defined per service
- Stacked VLAN supported-C-Tag (Customer Tag) and S-Tag (Service Tag) to simulate Carrier Ethernet traffic
- Simultaneous validation of all the services for quality over the time
- Command Line Interface for automated testing and remote accessibility using API clients C#, Python and MAPS™ Client Server architecture

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ITU-T Y.1564 ExpertSAM™ Module

The ITU-T Y.1564 is built around two key subtests, the service configuration test and the service performance test:

- **Service Configuration Test** –confirms the end to end configuration with the SLA parameters for all configured traffic streams
- **Service Performance Test** –transmits all configured traffic streams simultaneously confirming all traffic is able to transverse the network under full load with the SLA parameters

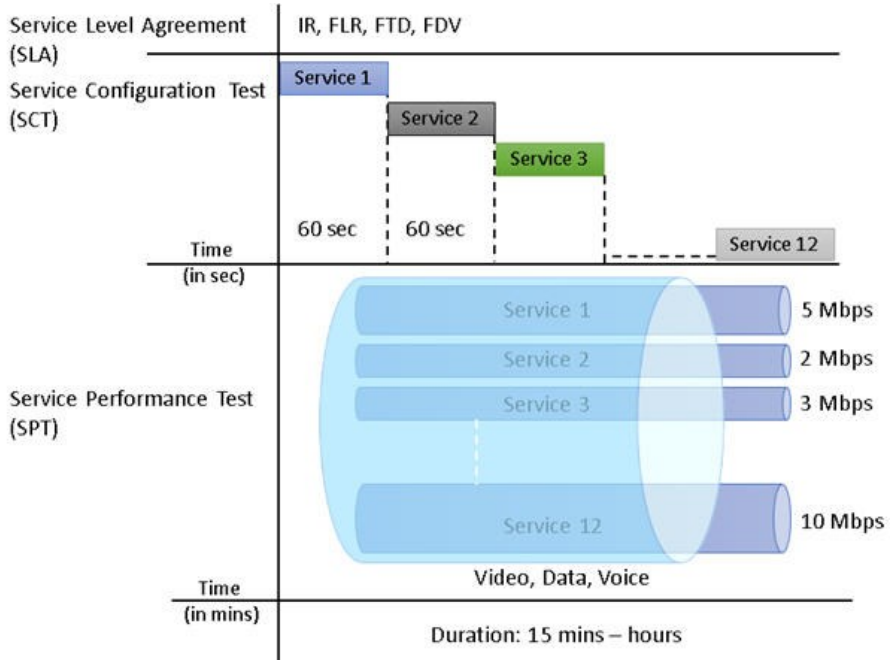


Figure: Working Principle

Service Configuration

The Service configuration summary can be viewed at a glance by collapsing the configuration panes. Each Service can be configured for various attributes like the Frame Size(s), Header Parameters (including VLAN Tag Information), the Bandwidth profile (CIR, EIR and Policing Rates), Color Method and Service Acceptance Criteria (SAC) parameters.

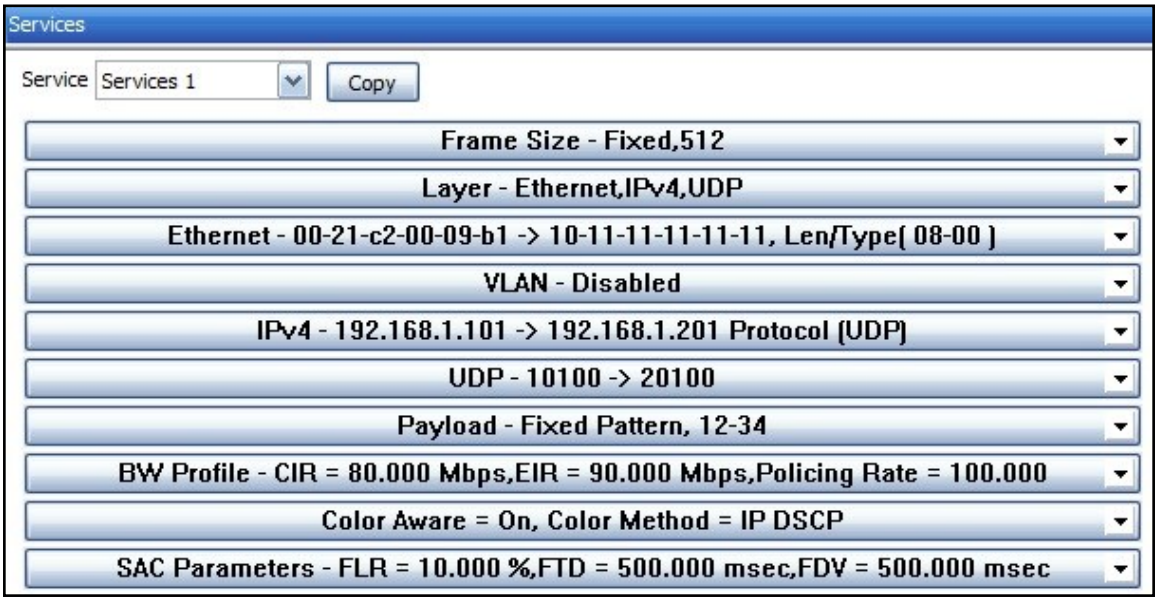
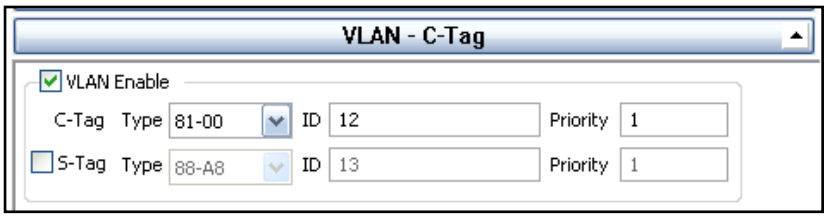


Figure: Service Configuration Collapsed Summary View

Ethernet VLAN C-TAG Configuration

User can enable VLAN configuration and set the C-Tag (Customer Tag) and S-Tag (Service Tag) Vlan Type, ID, and Priority. The 2 byte VLAN segment Tag Control Information (TCI) includes 3 bit Carry Priority Information (PCP) field which indicates traffic priorities, which the user can configure.



Bandwidth (BW) Profile Configuration

Customer traffic is classified into three classes, and each is assigned a specific color:

- Committed information rate (CIR), or green traffic: guaranteed bandwidth available at all times for a specific service
- Excess information rate (EIR), or yellow traffic: excess bandwidth above CIR that may be available depending on network usage
- Traffic Policing, or red traffic: traffic above the CIR or the CIR/EIR rate, and that cannot be forwarded without disrupting other services; red traffic is therefore discarded

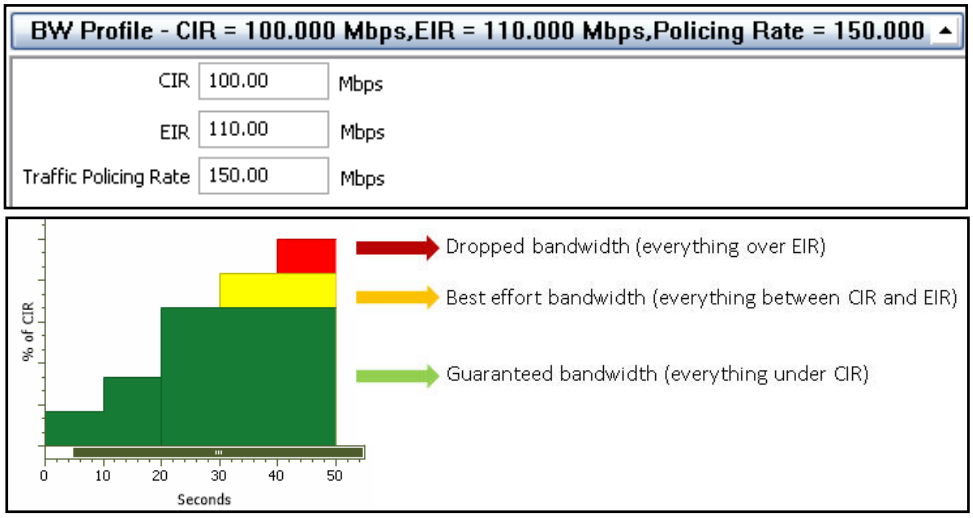


Figure: Bandwidth Profile Configuration

VLAN C-Tag Color Method Configuration

Color aware is a bandwidth profile property where a pre-determined level of bandwidth profile compliance for each service frame is taken into account when determining the level of compliance for each service frame. The VLAN C-Tag PCP field is assigned priority level from 1 to 4 to be considered as green frames equivalent to CIR and priority level from 5 to 7 to be considered as yellow frames equivalent to EIR.

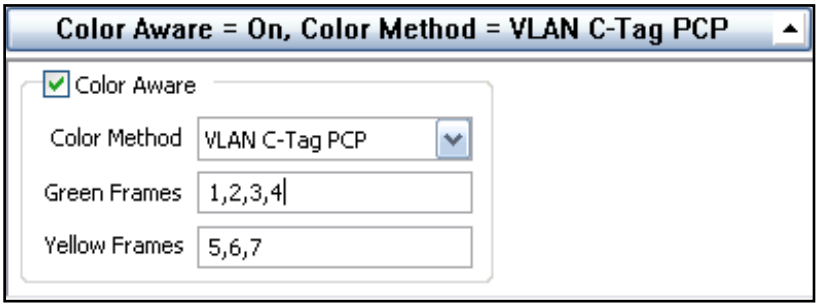


Figure: VLAN C-Tag PCP Color Method Configuration

SAC Parameter Configuration

The SAC (Service Acceptance Criteria) is the part of the network operators SLA which references the Frame Transfer Delay (FTD) in msec, Frame Delay Variations (FDV) in msec, and Frame Loss Ratio (FLR) requirements for the network path under test.

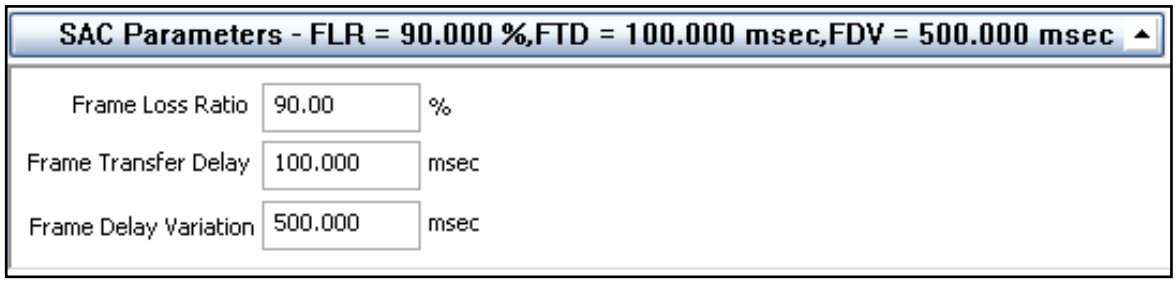


Figure: SAC Parameter Configuration

Test Selection Configuration

The CIR, EIR and Traffic Policing are the three phases of Service Configuration Test performed per service sequentially, which can be configured in steps. The Service Configuration step is executed for each service within the specified step duration. Once the configuration of each service is validated, the service performance test simultaneously validates the quality of all the services over the specified time duration.

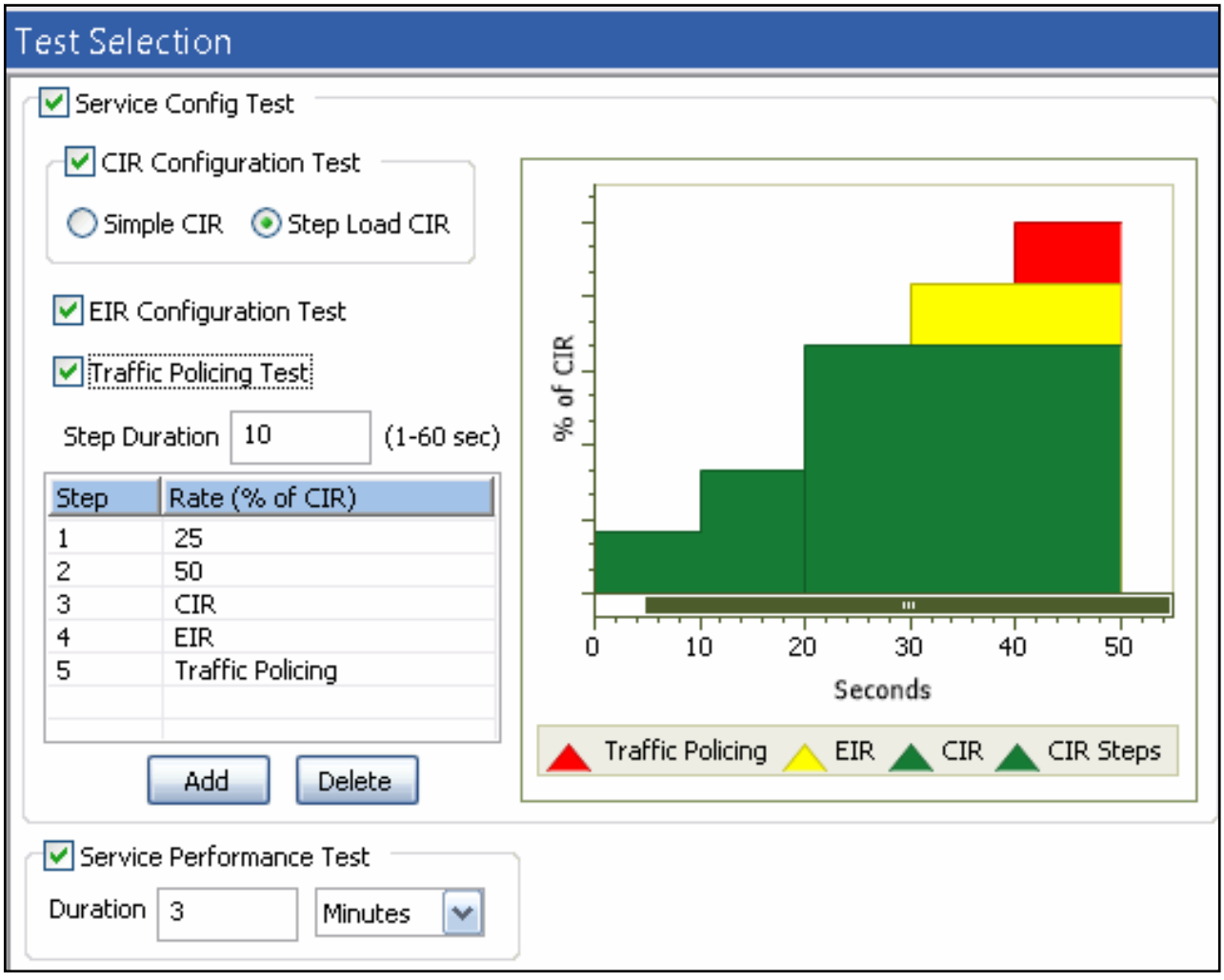
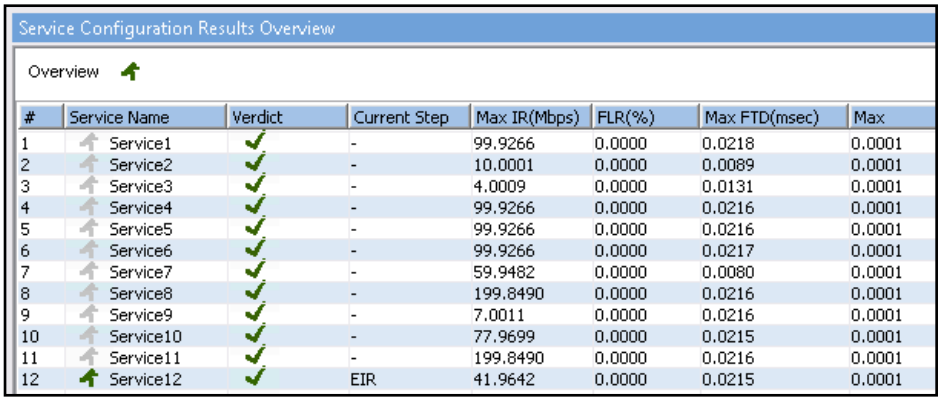


Figure: Test Selection

Results

The Service Configuration Results Overview pane displays the Service Name for which the test is running, the Verdict of the configuration test, Current Step of the service (CIR / EIR / Traffic Policing), Max IR (Mbps), FLR (%), Max FTD (msec), and Max FDV (msec) parameters for each configured service.



Service Configuration Results Overview

Overview

#	Service Name	Verdict	Current Step	Max IR(Mbps)	FLR(%)	Max FTD(msec)	Max
1	Service1	✓	-	99.9266	0.0000	0.0218	0.0001
2	Service2	✓	-	10.0001	0.0000	0.0089	0.0001
3	Service3	✓	-	4.0009	0.0000	0.0131	0.0001
4	Service4	✓	-	99.9266	0.0000	0.0216	0.0001
5	Service5	✓	-	99.9266	0.0000	0.0216	0.0001
6	Service6	✓	-	99.9266	0.0000	0.0217	0.0001
7	Service7	✓	-	59.9482	0.0000	0.0080	0.0001
8	Service8	✓	-	199.8490	0.0000	0.0216	0.0001
9	Service9	✓	-	7.0011	0.0000	0.0216	0.0001
10	Service10	✓	-	77.9699	0.0000	0.0215	0.0001
11	Service11	✓	-	199.8490	0.0000	0.0216	0.0001
12	Service12	✓	EIR	41.9642	0.0000	0.0215	0.0001

Figure: Service Configuration Test Result

The service performance results display includes all Key Performance Indicators (KPIs) parameter results for each service - IR, FLR, FTD, FDV (Current, Minimum, Mean, and Maximum).

Service Performance Results

IR(Mbps), FLR(%), FTD(msec), FDV(msec) | Test Time 00:01:09 | Vertical | FTD Unit msec | FDV Unit usec

Service	Verdict	IR (Curr)	IR (Min)	IR (Avg)	IR (Max)	FL (Count)	FLR (Rate)	FTD (Curr)	FTD (Min)	FTD (Avg)	FTD (Max)	FDV (Curr)	FDV (Min)	FDV (Avg)	FDV (Max)
1	PASS	79.90	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
2	PASS	79.90	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
3	PASS	79.91	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
4	PASS	79.91	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
5	PASS	79.91	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
6	PASS	79.91	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
7	PASS	79.91	79.90	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
8	PASS	79.90	79.89	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
9	PASS	79.90	79.89	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
10	PASS	79.90	79.89	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
11	PASS	79.90	79.89	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000
12	PASS	79.90	79.89	79.94	79.95	0	0.000	0.002	0.002	0.002	0.002	0.003000	0.003000	0.003000	0.016000

Figure: Service Performance Test Result

Over all test status provides a quick view of the test in the form of Alarm LEDs. Green LED indicates that the tests meet the Frame Loss Ratio (FLR), Frame Transfer Delay (FTD), and Frame Delay Variations (FDV) defined criteria. The overall global verdict (PASS/FAIL) of the tests is also reported.

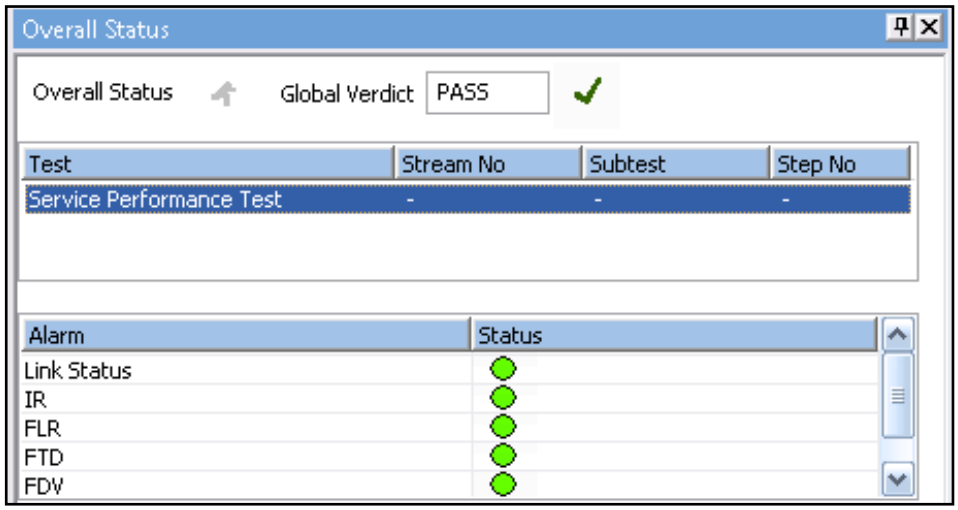


Figure: Service Performance Test Overall Status

Tx and Rx Frame Statistics

The detailed statistics per port are provided, parameters include Frame Count, Frame Rate, Link Utilization, others are provided based on various categories like Frame Type (Unicast/Broadcast/Multicast, VLAN), frame lengths (64, 65-127, 1024-1518, Oversized, Undersized), Protocol Type (IPv4, IPv6, UDP, TCP, ICMP, IGRP, etc.). VLAN Statistics (per Stack position), are also displayed for the configured stacks.

Port Statistics

Port Selection: Port 2 | Reset

Description	Tx	Rx
Total Frames	6157414	6152797
Valid Frames	6157467	6152797
Number Of Bytes	2335085440	2333069556
Link Utilisation	-	-
DataRate(Mbps)	58.329959	58.281340
Frame Rate(Frames\Second)	72898.084815	72848.257006
Broadcast Frames	0	0
Multicast Frames	122240	1946424
Control Frames	0	0
VLAN Frames	0	1020982
Pause Frames	0	0
Wrong Opcode Frames	0	0
64 Byte Length Frames	0	0
65-127 Byte Length Frames	1377637	1377170
128-255 Byte Length Frames	570060	569547
256-511 Byte Length Frames	122240	122132
512-1023 Byte Length Frames	4088110	4084429
1024-1518 Byte Length Frames	0	0
Oversized Frames	0	0
Undersized Frames	-	0
FCS Error Frames	-	0
Non Test Frames	-	0
Non Test VLAN Frames	-	0
Non Test MPLS Frames	-	0
1 Level Stacked VLAN Frames	-	1020982
2 Level Stacked VLAN Frames	-	0
3 Level Stacked VLAN Frames	-	0
1 Level Stacked MPLS Frames	-	0
2 Level Stacked MPLS Frames	-	0
3 Level Stacked MPLS Frames	-	0
IP Checksum Errors	-	0
IPv4 Packets	-	0
IPv6 Packets	-	0
IP Non Test Packets	-	0
IP in IP Packets	-	0
UDP in IP Packets	-	0
TCP in IP Packets	-	0
ICMP in IP Packets	-	0
IGMP in IP Packets	-	0
IGRP in IP Packets	-	0
Other Protocol in IP Packets	-	0
UDP Checksum Errors	-	0
UDP Packets	-	0
UDP Non Test Packets	-	0

Figure: General Port Statistics

Report Generation

The Report Generation option allows to create detailed test report in PDF and CSV formats. This window lets the user configure the report file details.

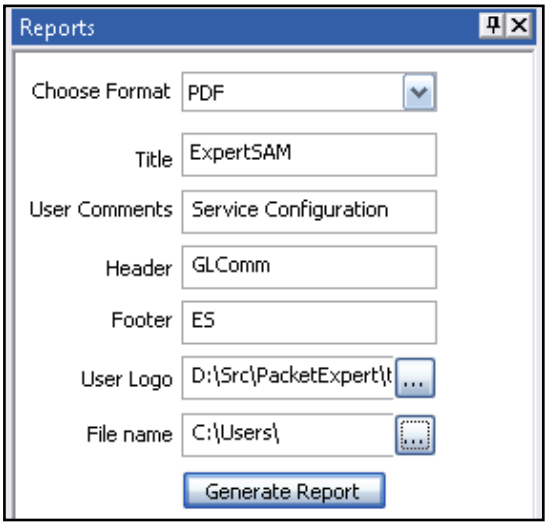


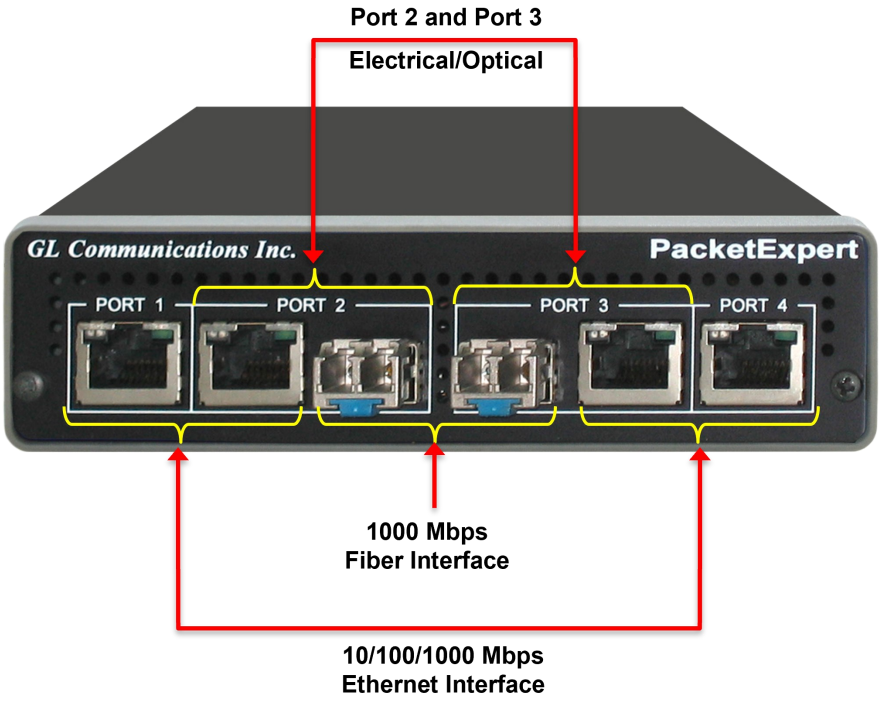
Figure: Report Generation

Command Line Interface (CLI)

PacketExpert™ is enhanced to support Command Line Interface (CLI) requires additional license (CXE100) to access all the functionalities remotely using C# or Python clients and MAPS™ CLI Server / Client architecture.

The CLI supports all the PacketExpert™ test modules including - All Port Bert, Bert Loopback, All Port Loopback, RFC 2544, Record Playback, PacketBroker, Multi Stream Traffic Generator and Analyzer, and ExpertTCP™.

Portable PacketExpert™ 1G Specifications



Interfaces	• 2 x 10 / 100 / 1000 Base-T Electrical only • 2 x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical • Single Mode or Multi Mode Fiber SFP support with LC connector
Protocols	• RFC 2544 compliance
Bus Interface	• USB 2.0 or USB 3.0
Power	• +12 Volts (Medical Grade), 3 Amps
Temperature	• Operating Temperature: +5 to +40C • Non-Operating Temperature: -30 to +60C
Humidity	• Operating Humidity: 0% to 80% RH • Non-Operating Humidity: 0% to 95% RH
Altitude	• Operating Altitude: Up to 10,000 feet • Non-Operating Altitude: Up to 50,000 feet
Physical Specification	• Length: 8.45 in. (214.63 mm) • Width: 5.55 in. (140.97 mm) • Height: 1.60 in (40.64 mm) • Weight: 1.66 lbs. (0.75 kg)

mTOP™ PacketExpert™ 1G Rack Specifications

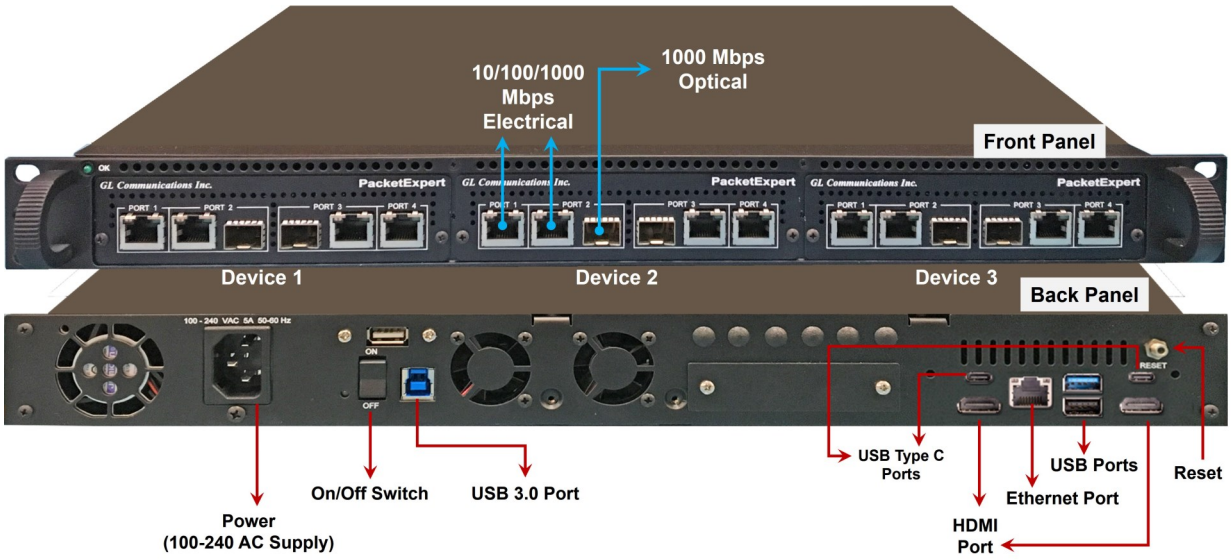


Figure: 1U mTOP™ Rack Based 1G Hardware Unit (3 PXE100s)

Interfaces	12 Total Ethernet Ports (HD-PacketExpert-12) • mTOP™ System (embedded SBC, 3x PXE100) • PacketExpert™ 1G (PXE100) interfaces - – 6x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical – 6x (10/100/1000) Base-T Electrical 24 Total Ethernet Ports (HD-PacketExpert-24) • mTOP™ System (embedded SBC, 6x PXE100) • PacketExpert™ 1G (PXE100) interfaces - – 12x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical
SBC Specifications	• Intel Core i3 or optional i7 NUC Equivalent, • Windows® 11 64-bit Pro Operating System • USB 3.0 and USB 2.0 Ports, ATX Power Supply • USB Type C Ports, Ethernet 2.5GigE port • 256 GB Hard drive, 8G Memory (Min) • Two HDMI ports
External Dimension	• Length: 16 Inches • Width: 19 Inches • Height: 2x 1U mTOP™ (HD-PacketExpert-24) or 1U mTOP™ (HD-PacketExpert-12)
Power Supply	• ATX Power Supply
Order Information	• PXE100 - PacketExpert™ Options • MT001/MT001E (1U) • MT001+MT002/ MT001E+MT002 (Stacked 1U)

mTOP™ 1G Probe Specifications

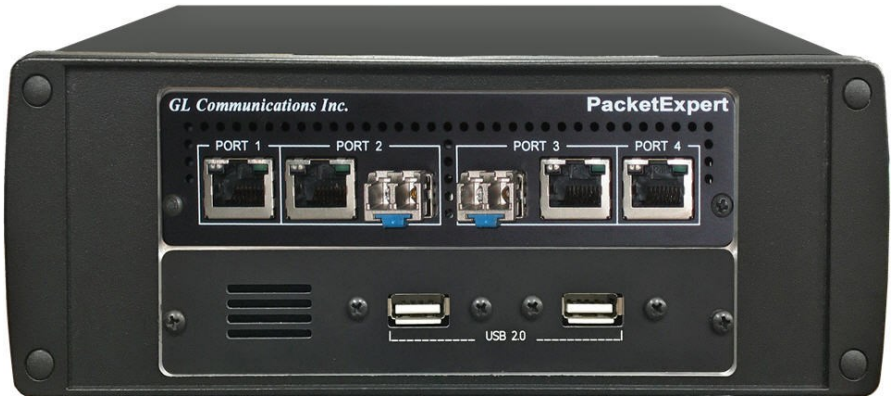


Figure: mTOP™ Probe with 1G Hardware Unit + SBC

Interfaces	• 4x Total Ethernet ports • 2x 10/100/1000 Base-T Electrical only • 2x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical • Single Mode or Multi Mode Fiber SFP support with LC connector
SBC Specifications	• Intel Core i3 or optional i7 NUC Equivalent, • Windows® 11 64-bit Pro Operating System • USB 3.0 and USB 2.0 Ports, 12V/9A Power Supply • USB Type C Ports, Ethernet 2.5GigE port • 256 GB Hard drive, 8G Memory (Min) • Two HDMI ports
External Dimension	• Length: 10.4 inches • Height: 3 inches • Width: 8.4 inches
Power Supply	• 12 Volts (Medical Grade), 3 Amps
Order Information	• PXE100 • MT005/MT005E

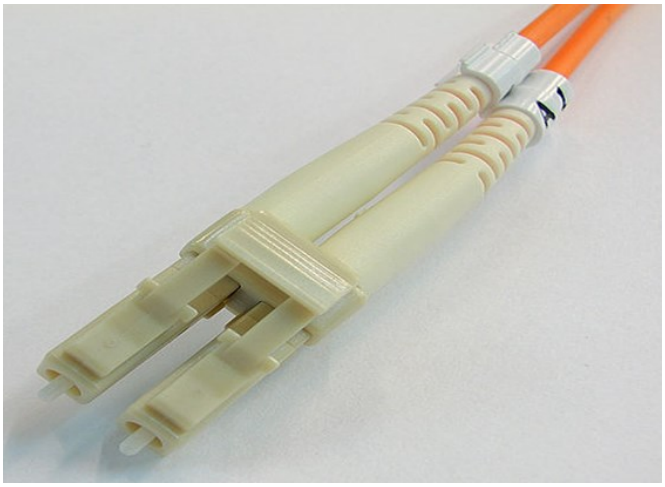
Pelican Carry On Case

Supported SFP Modules

PacketExpert™ supports LC connectors and 850/1310 nm SFP (Small Form-Factor Pluggable) modules. For users with different connector types, appropriate adapters such as LC-to-SC, LC-to-FC, or their reverse equivalents are required.

The following SFP modules are supported in 1G:

- **1000BaseLX** - Long range, MM and SM
- **1000BaseSX** - Short range, MM and SM
- **1000BaseT** - Copper and many more



LC Connectors

850/1310 nm SFP Module

Buyer's Guide

Item No	Product Description
PXE100	PacketExpert™ 1G
CXE100	CLI support for PXE100

Item No	Related Software
PXE105	Wire speed Record /Playback 1G
PXE107	PacketBroker 1G
PXE108	Multi Stream Traffic Generator and Analyzer 1G
PXE108	ExpertTCP™ 1G
ETH100	PacketCheck™

Item No	Related Hardware
PXE104	PacketExpert™ - SA (4 ports) 1G
PXE112	PacketExpert™ -SA (12 Ports) 1G
PXE124	PacketExpert™ -SA (24 Ports) 1G

Note: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more information, refer to PacketExpert™ 1G - ExpertSAM™ webpage.

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