Technical Specifications	PRODUCT RANGE		
	1G	10G	25G
Physical			
Network Interfaces	up to 16	up to 12	up to 4
Standard Network Interfaces	GbE Copper	SFP+	SFP28
Optional Network Interfaces	RJ45	SFP+	SFP28
Max. Packet Rate Per Port (bi-directional)	2.96 million	29.6 million	33.5 million
Dimensions	2u Rack	2u Rack	2u Rack
Intrinsic Latency	<20µs	<20µs	<20µs
Max. Frame Size — Jumbo Mode 9219 bytes; Non-jumbo Mode 1542 bytes	✓	✓	✓
General			
Timing Precision	10µs	10µs	10µs
Any Port to Any Port™ 4, 8, 16 ports — packets can be sent between any port for complete flexibility	✓	✓	✓
Live Changes — Real-time modification of any impairment setting or network map	✓	✓	✓
Traffic Capture and Replay with Looping Option* Volatile Storage (4G RAM) Non-volatile Storage (1TB SSD) *Max Traffic Capture Rate 1Gb/s	✓ optional	✓ optional	✓ optional
Bi-directional, Independent Emulations	✓	✓	✓
Timeline — Schedule changes to emulation settings with no manual intervention required. Option: loop timeline for continuous playback	✓	✓	✓
Link Flap	✓	✓	✓
Modes of Operation			
Virtual Routing (Simulate routers / ADSL Gateways) Protocols — DHCP, ARP, ICMP, IGMP, etc DHCP — Enable / Disable Routing Table — Auto generate, manual Multiple WAN Links	✓	✓	✓
Bridged Mode — Option to impair all traffic sent and received (protocol filtering available)	✓	✓	✓
Delay Emulation — up to 4s at 25GbE; up to 4s at 10GbE; up to 10s at 1GbE; up to 30s (all rates at reduced bandwidth)			
1GbE Delay Emulation — up to 1.25secs	✓	✓	✓
10GbE Delay Emulation — up to 0.5secs	n/a	✓	✓
25GbE Delay Emulation — up to 0.5secs	n/a	n/a	✓
Delay Emulation (at reduced bandwidth) — up to 30secs	✓	✓	✓
1GbE Extended Delay Emulation — up to 10secs	optional	optional	optional
10GbE Extended Delay Emulation — up to 4secs	n/a	optional	optional
25GbE Extended Delay Emulation — up to 4secs	n/a	n/a	optional
Fixed Latency	✓	✓	✓
Variable Latency	✓	✓	✓
Ramp	✓	✓	✓
Normal / Gaussian	✓	✓	✓
Sinusoidal Wave	✓	✓	✓
Jitter — 0.1ms to 100ms or 0.1 to 100% of constant delay	✓	✓	✓
Timing Constraints (specify start and duration of impairments activity) Start / Duration 0.1ms to 360,000ms (in 0.1ms increments)	✓	✓	✓

✓ Provided as Standard

Technical Specifications (cont'd)	PRODUCT RANGE		
	1G	10G	25G
Bandwidth Emulation (with user configurable buffer size up to 20Mbytes for video)			
Constant Throttle	500byte/sec to 1G	500byte/sec to 10G	500byte/sec to 10G
Random Range (min to max with time constraints)	500byte/sec to 1G	500byte/sec to 10G	500byte/sec to 10G
Random Range Duration — 1000ms to 60 minutes (in 0.1ms increments)	✓	✓	✓
Background Traffic Generation			
Fixed Data Rate Percentage of available link: 1 to 99% Generate broadcast packets Range (min to max with time constraints)	500byte/sec to 1G	500byte/sec to 10G	500byte/sec to 10G
Range Duration 0.1ms to 360,000ms (in 0.1ms increments)	✓	✓	✓
Reordering			
Time Based Re-order Displace packet from 0.1ms to 500 ms	✓	✓	✓
Position Base Re-order Displace packet up to 1,000,000 places	✓	✓	✓
Corruption			
Bitflips Start and end position (first byte to last byte), 1 to 100%	✓	✓	✓
Byte Overwrites Start and end position (first byte to last byte), 1 to 100%	✓	✓	✓
Ethernet Fragmentation MTU: 128 to 1580	✓	✓	✓
Bit Error Rate (Per) Simulation x bits in y received (1 bit to IE-14)	✓	✓	✓
Enable/Disable FCS	✓	✓	✓
Duplication			
Simple (single duplication) Packets received on link will be immediately duplicated once	✓	✓	✓
Timed (duplicated every x seconds) Single duplication after specified delay (1ms to 1,000ms)	✓	✓	✓
Complex (multiple, timed duplication) Specified multiple duplications after specified time delay (1ms to 1,000ms)	✓	✓	✓
Loss			
Standard — Drop x packets in y received	✓	✓	✓
Percentage — Drop 1% to 100% (in increments of 1%)	✓	✓	✓
Markov — 2 state random packet drop (as per ITU-T G.1050 Appendix II - Gilbert-Elliott model)	✓	✓	✓
Outage — Drop all packets received on specified link	✓	✓	✓
Drop Evenly — Packets will be dropped regularly throughout emulation	✓	✓	✓
Drops in Bursts — Packets will be dropped in continuous groups	✓	✓	✓
Timing Constraints — Start / Duration 0.1ms to 360,000ms (in 0.1ms increments)	✓	✓	✓

✓ Provided as Standard

Technical Specifications (cont'd)	PRODUCT RANGE		
	1G	10G	25G
Modification			
Generic Packet Modifier Modify up to 6 bit / byte sections per packet	✓	✓	✓
Analysis **(Extract analysis information from any part of the emulation)**			
Bandwidth Graph Show bandwidth utilization — export, clipboard, peak and averaging, etc.	✓	✓	✓
Packet Rates Show packet utilization, Inter Packet Gap	✓	✓	✓
RTP Analyser Output detailed information on RTP streams	optional	optional	optional
RTCP Analyser Output detailed information on RTCP streams	optional	optional	optional
Stateless load generation with multiple load distribution models			
Generic / RAW Load Generator Generic any type of load with extensive stream options	optional	optional	optional
TCP Client Simulate clients with data streams	optional	optional	optional
TCP Server Simulate servers with data streams	optional	optional	optional
DDOS Simulation Simulate extremely stressful DDOS environments	optional	optional	optional
Audio Visual (AV) Pack			
RTP Filter	optional	optional	optional
MPEG H.264 and H.265 Filter	optional	optional	optional
MPEG H.264 and H.265 Corruptor	optional	optional	optional
G.1050 Wizard (TIA-921)	✓	✓	✓
Management			
Drag and Drop User Interface Simple User Interface, allowing user to draw out their target network on screen, drop impairments as required and visualise the network-under-test	✓	✓	✓
RESTful API for Test Automation	✓	✓	✓
SNMP Operational based SNMP traps and alerts	✓	✓	✓
Smart Start-up Automatically launch previous map on boot	✓	✓	✓
Multi-user Support Unlimited users / GUI instances, share maps, assign ports to individual users	✓	✓	✓
Hardware NTP / PTPv2 Time Stamping Lock hardware and packet timings to accurate internal / external clocks	✓	✓	✓

✓ Provided as Standard

Technical Specifications (cont'd)	PRODUCT RANGE		
	1G	10G	25G
Filtering (UDP, TCP, Packet count)			
Maximum Filter — Connect multiple filters in any way to create complex filter rules	unlimited	unlimited	unlimited
IP Source / destination address filtering (impair specific traffic flows)	✓	✓	✓
TCP — Advanced: Source and destination port filtering (including range) TCP Packet length filtering	✓	✓	✓
UDP — Advanced: Source and destination port filtering (including range) TCP Packet length filtering	✓	✓	✓
MAC Address — Src / Dst single or range	✓	✓	✓
Ethernet Payload	✓	✓	✓
Packet Counting — Fail or Pass filters based on packet count or percentage	✓	✓	✓
Advanced Filtering			
Generic Filter — Filter on multiple bit / byte values with logic operations	✓	✓	✓
IP Protocol — Payload Type and Value	✓	✓	✓
MPLS — MPLS Label, QoS Value, TTL Value	✓	✓	✓
VLAN — VLAN ID, User Priority	✓	✓	✓
MPEG Video	optional	optional	optional
RTP A/V	optional	optional	optional
Reporting			
Live Monitoring — Bandwidth monitoring, packets per second, export to CSV max / average values, etc.	✓	✓	✓
Wireshark Integration (on up to 200 protocols) Allows for live traffic capture and root cause analysis; replay third-party traffic streams under impairments, record traffic and replay at a later date	✓	✓	✓

✓ Provided as Standard

NOTE:

The full set of features are available on the existing client User Interface on the SNE (SNE v7 and later). There will be a phased release of some features into the SNE Web UI over the next few months. Please contact Calnex for further details.

Calnex
Insight and Innovation