

Protocol Insight®

Falcon G600R and G650R Series Instruments

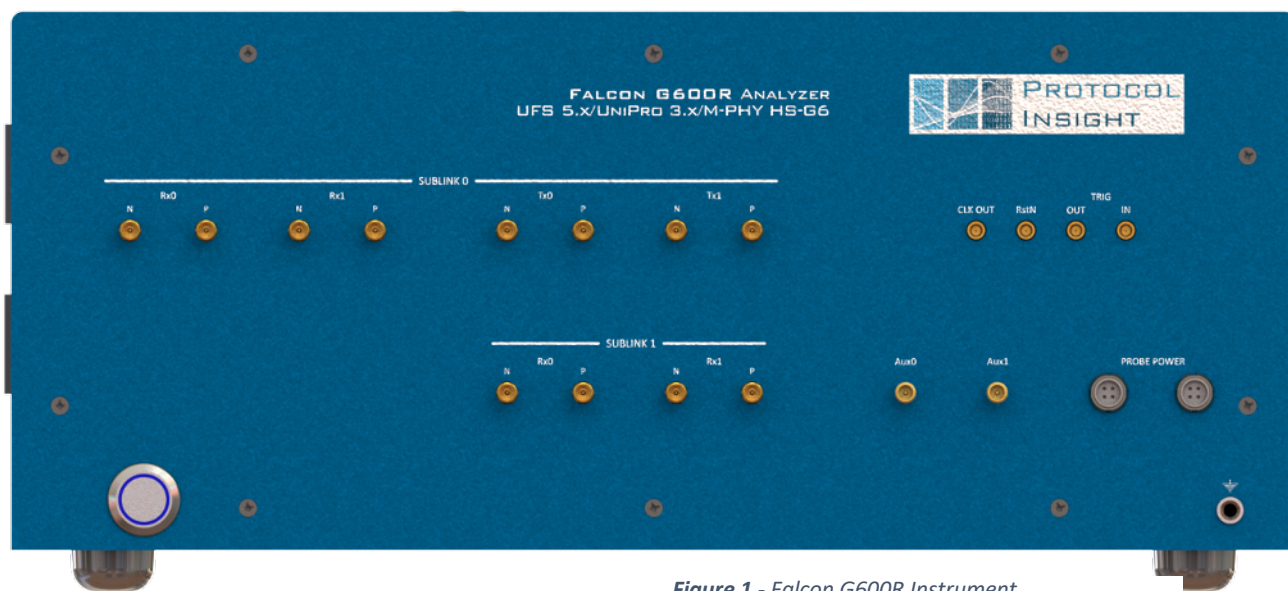


Figure 1 - Falcon G600R Instrument

UFS/UniPro Analyzers and Exerciser/Analyzers with Trace Validation™ and RAD (real-time analog display)

Protocol Insight is a recognized expert in UFS, UniPro, and M-PHY protocols. We are the market leaders in protocol analysis and traffic generation for UFS and UniPro. We have been distributing UFS and UniPro debug and analysis tools since 2014.

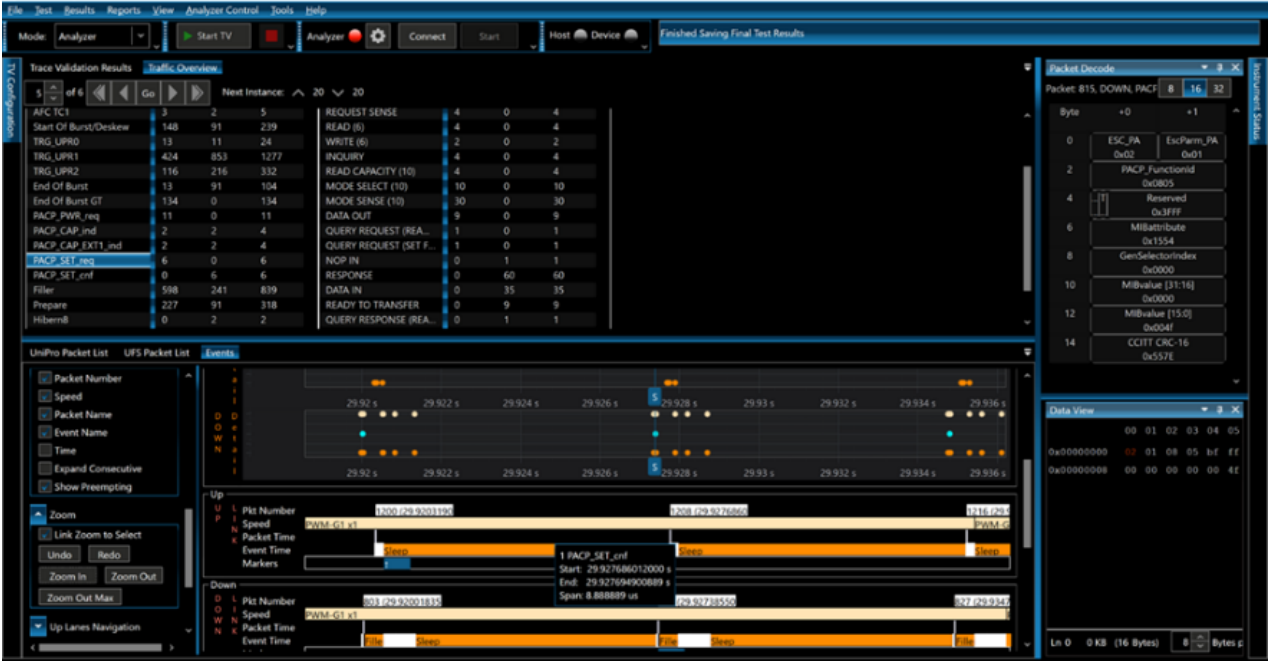
We are a contributing company to the development of the UniPro specs and Conformance Test Specs (CTS), and a member of the JEDEC J64 Embedded Memory Storage and Removable Memory Card committee.

Protocol Insight offers the only protocol test tool for verifying compliance to the UFSA Compliance Test Matrix and we have supported all UniPro and UFS Interoperability (IOT) workshops since the initial events in early 2015.

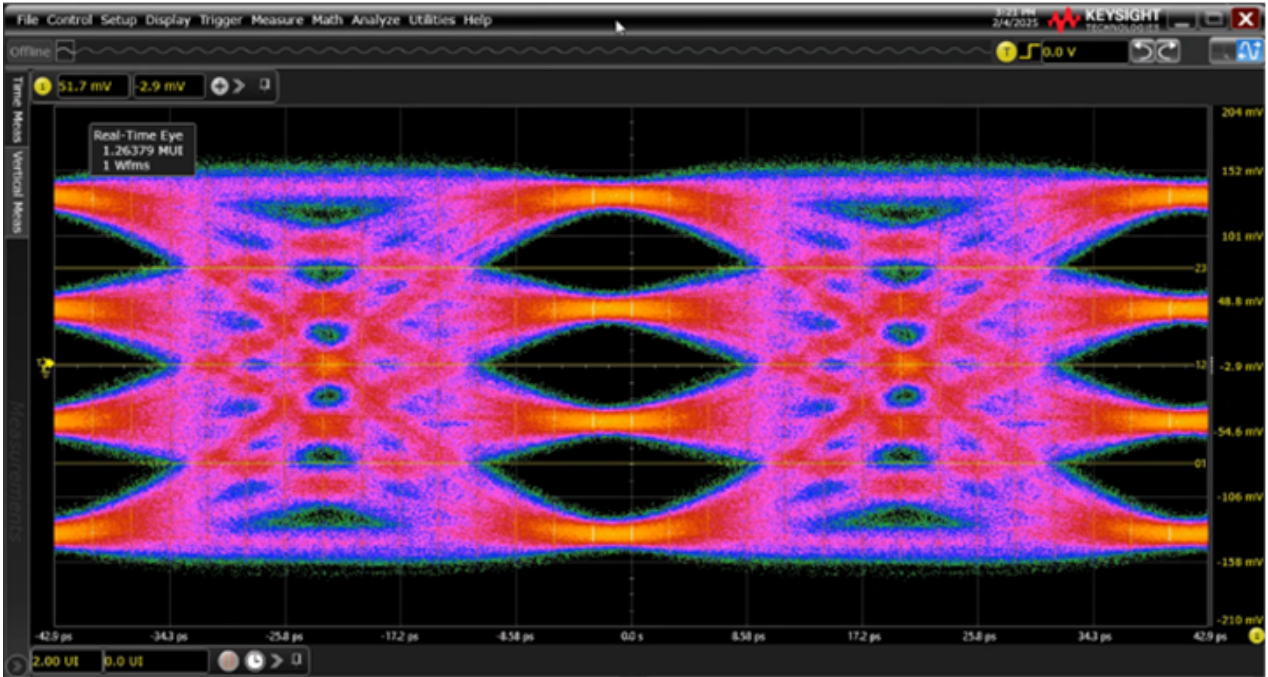
Protocol Insight offers unsurpassed product leadership across multiple product generations.

Capabilities included with the Falcon 600R and 650R series of instruments include:

- Real-time analog display, RAD, captures raw signal data on four channels at 48 Gbps, 1 Gbps capture memory per channel. This enables real-time information on overall signal quality, SNR and slicer eye viewer. This allows users to view packets and quickly identify system connectivity issues all with a single connection in one instrument. The captured analog data is displayed and centered around the instrument trigger point for all four channels. The captured analog data and UniPro and UFS packets are all time correlated together.
- SmartTune™ Calibration quickly calibrates the instrument with the customer system in under a minute, dramatically improving the SNR for captures from the target, host or device.
- An Eye Slicer provides real-time eye quality and SNR statistics. Eye Monitor constructs an eye diagram to determine relative link quality.
- Trace Validation™, a patented Artificial intelligence (AI) tool that uses complex state machine logic to analyze traces algorithmically without user inference.
- Streaming capture uses the full 40Gb/s bandwidth of Thunderbolt™ 4 to save traces to disk in real time.
- Events Views displays raw symbols as packet events in a unique time correlated display with UniPro and UFS packets. This provides a complete picture of all events with drill-down to the lowest level bytes.
- Protocol generation and exerciser capability for both UFS 5.0 and UniPro 3.0.
- Test Editors to creation custom triggers, Trace Validation, and Stimulus tests.



Analyzer debugging a PACP_SET command using Events window and Traffic Overview



Eye Monitor viewed with the offline viewer

Product Family Description

The **Falcon series** of UniPro/UFS Protocol Analyzers/Exercisers are the established industry standard with powerful protocol analyzer and exerciser capabilities and unprecedented flexibility.

- The **Falcon G600R** is an analyzer that can capture x2 bi-directional MIPI M-PHY 6.0 links. It supports UFS 5.0, UniPro 3.0 and M-PHY 6.0 HS-G6. The G600R simultaneously performs a real-time capture of the M-PHY 6.0 analog signal, known as Real-time Analog Display (RAD). This information is presented time correlated with the protocol analyzer packet data.
- The **Falcon G650R** is an exerciser/analyzer; it is identical to the G650 analyzer but is also a protocol exerciser that can generate link traffic on a x2 bi-directional link while simultaneously capturing the response traffic from the DUT. The Falcon G600 exerciser can perform host emulation and execute the UniPro and JEDEC Compliance/Conformance Test Suites (CTS). The G650R simultaneously performs a real-time capture of the M-PHY 6.0 analog signal, known as Real-time Analog Display (RAD). This information is presented time correlated with the protocol analyzer packet data.

Key Features and Benefits

Eye Monitor constructs an eye diagram of the link to determine link quality. Qualitative measurements can be done on the eye diagram for jitter, noise, and eye opening.

Real-time Analog Display (RAD) captures raw signal data on four channels at 48 Gbps, 1 Gbps capture memory per channel. This enables real-time information on overall signal quality, SNR and slicer eye viewer. This allows users to view packets and quickly identify system connectivity issues all with a single connection in one instrument. The captured analog data is displayed and centered around the instrument trigger point for all four channels.

SmartTune™ Calibration calibrates the instrument with the customer's system in under a minute, dramatically improving SNR for captures from the target, host or device.

Eye Slicer provides real-time BER, eye quality and SNR statistics, along with a rolling history of these statistics. The **Eye Monitor**, available in the offline viewer, constructs an eye diagram to determine relative link quality.

Trace Validation is an expert system that uses complex state machine logic to analyze captured traces algorithmically without user intervention. It analyzes bi-directional UniPro and UFS traffic, performing protocol sequence and timing analysis and packet header and payload inspection.

Events views displays raw UniPro symbols as packet events on the bus in a unique time-aligned display. UniPro Events view displays fillers, Prepare, SYNC, Hibern8, sleep, stall and other M-PHY level packets. UFS Events display each individual UFS packet type separately. UniPro and UFS Events view presents a complete picture of all events and allows drill-down to the lowest level bytes.

Compliance/Conformance Verification executes JEDEC and MIPI CTS test cases. Performs corner case, margin and stress testing. Users are also able to create custom test cases.

Verify compliance of UFS devices with the UFS-A UFS Compliance Test Matrix. UFS-A-certified for the UFS-A Compliance Test Matrix v1.3.

Stimulus with full UniPro stack in HW allows host emulation and the creation of specific traffic on the link and offers extensive error injection.

Run Time Control stress testing controls the DUT and executes tests automatically. Stop after any number of loops or No Result Test Cases, then analyze the results with Trace Validation.

Design custom test cases to introduce errors for corner case, margin, or stress testing.



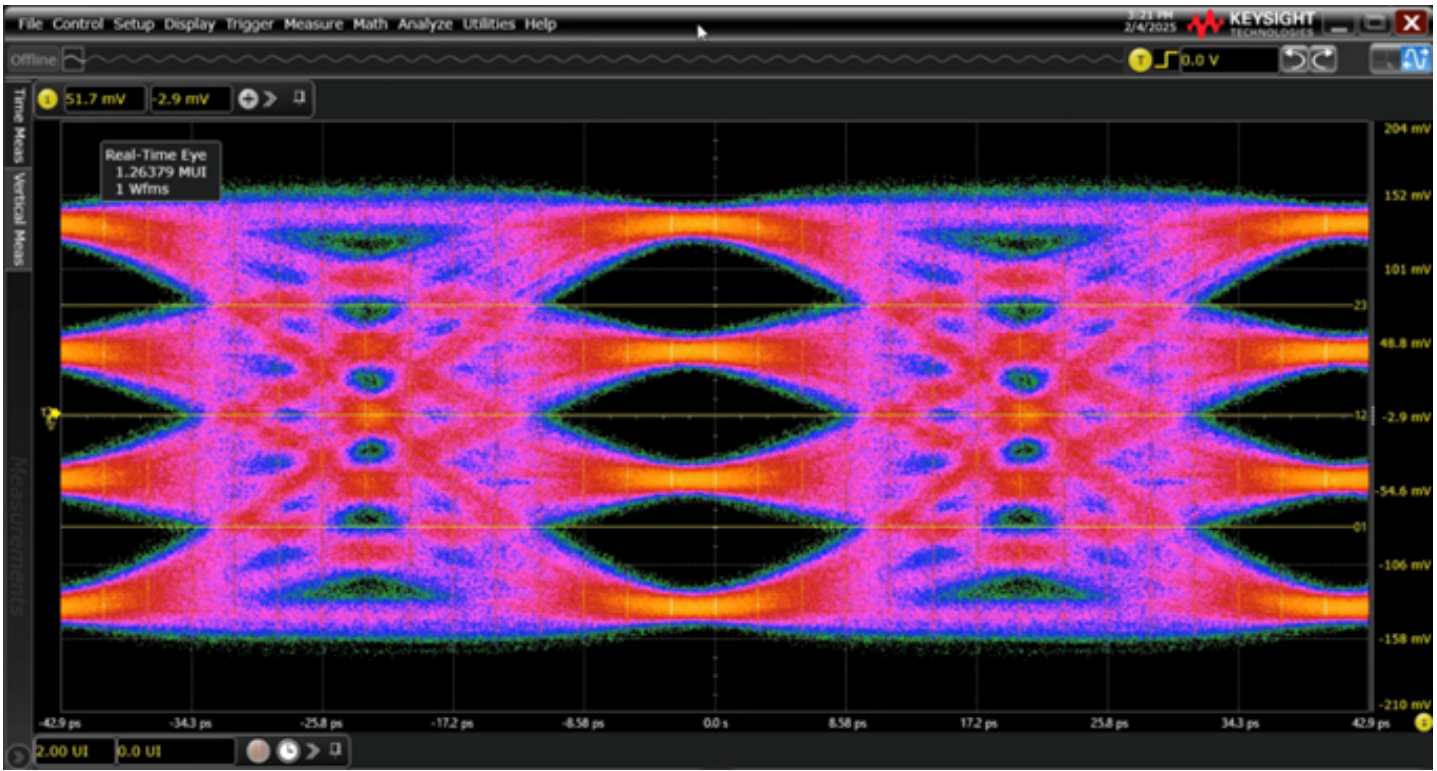
Slicer Eye and Eye Monitor

The Slicer Eye Viewer provides real-time BER, relative eye quality and SNR statistics. The Slicer Eye Viewer window shows real-time data on the varying voltage levels for PAM4 and NRZ data. The gaps between these data slices provide relative eye quality measurements. The SNR is dynamically calculated and displayed, along with a rolling history of the SNR. The Real-Time Analog Display window shows the raw signal data sampled by the 48 Gbps ADC on each channel.





Eye Monitor is used to assess the quality of the eye and can be constructed with the offline viewer. Eye Monitor constructs an eye diagram of the link to determine link quality. Quantitative measurements can be performed on the eye diagram for jitter, noise, and eye opening.

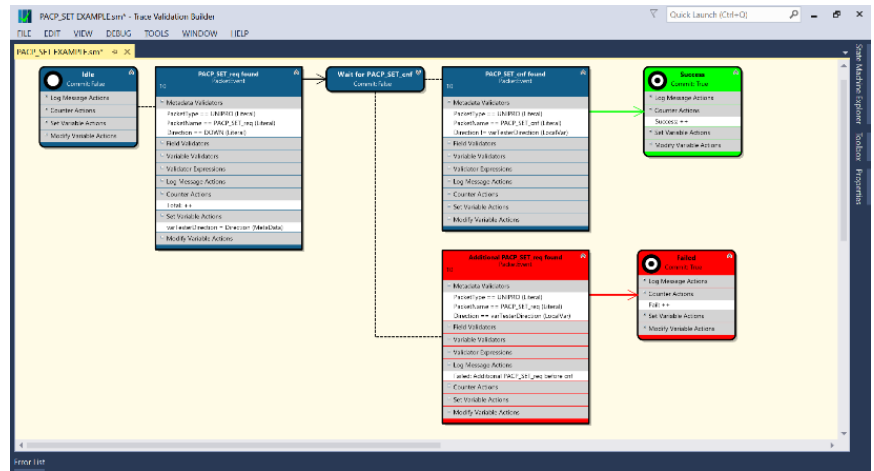




Trace Validation

Trace Validation identifies transactions on the link by analyzing millions of packets in a trace capture, then evaluates the complete protocol sequences and individual packets for conformance to the specification.

With Trace Validation, complex transactions such as power mode changes, Link Startup Sequence and NAC/Replay events can be automatically analyzed and easily debugged. Complex measurements such as UFS packet latency can also be performed and evaluated against pass/fail metrics.



Trace Validation results are flagged as follows:

- **Failure** ✖ and **Warning** ⚠ status flags
 - A Failure is a transaction or packet that does not meet a defined primary rule. This rule may be defined by the JEDEC JESD224x CTS, UniPro CTS or by the user.
 - A Warning is a transaction or packet that does not meet a defined secondary rule. This rule may be defined by the JEDEC JESD220x spec, UniPro spec or by the user.
- **Pass** ✔ and **Info** i and **Debug** Q status flags
 - Any transaction or packet that conforms the rule set is marked as Pass
 - Any packets not inspected due to run conditions are highlighted and explained with the Info flag
 - Information on state machine execution of an inspection rule can be provided with Debug messages

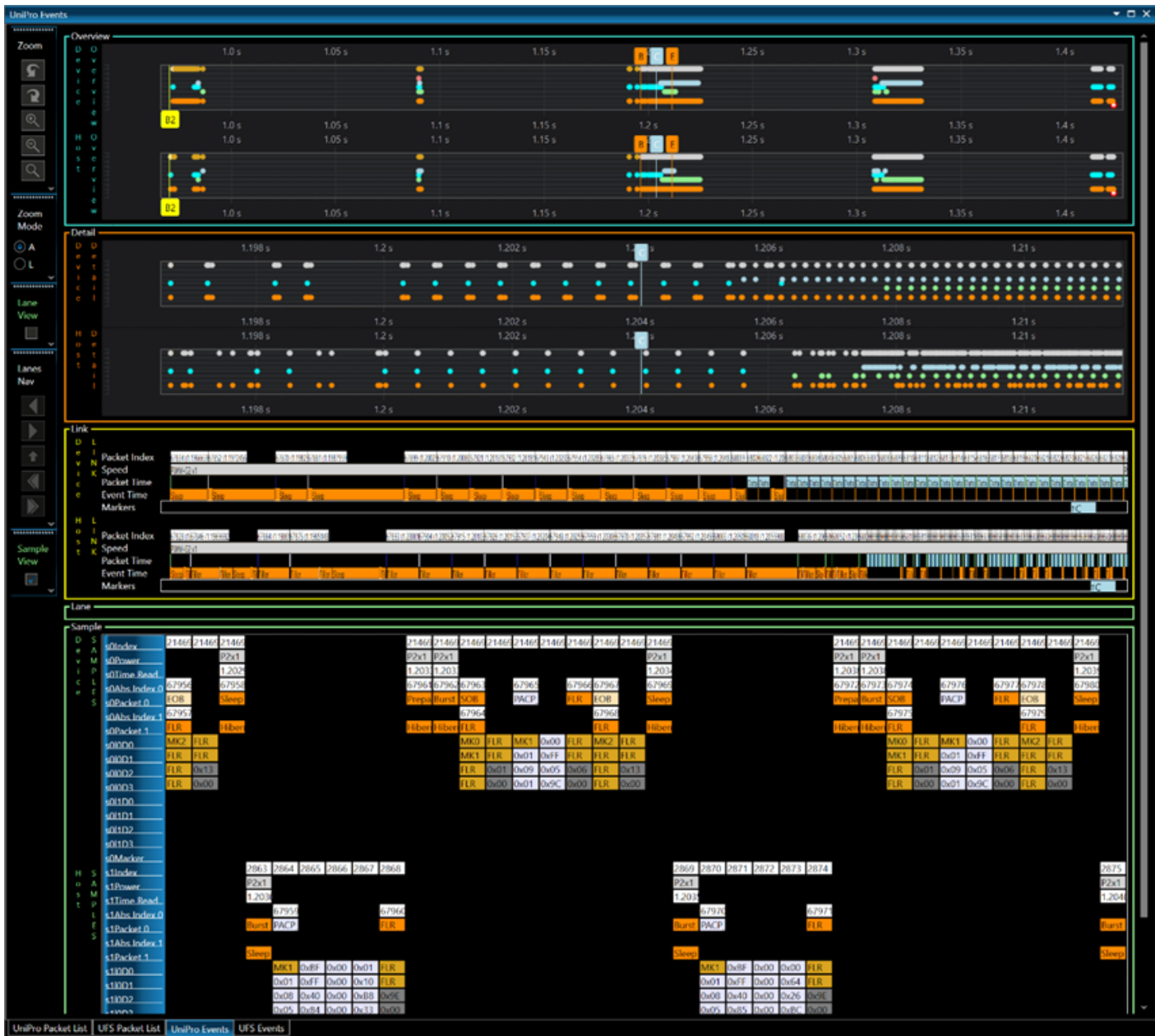
Status	Test ID	Test Name	Rule
⚠		Test Name: AFC Sequence Number Order (148 items)	
✔		Test Name: AFC with CReq Set (8 items)	
i		Test Name: Check for Packet Errors (1 items)	
✖		Test Name: CheckCredits (162343 items)	
⚠		Test Name: Data Frame TC0 Sequence Numbers (5 items)	
✖		Test Name: Link Startup Sequence (9187 items)	
⚠		Test Name: NAC Transmission Disabled (2 items)	
i		Test Name: PACP_GET_req (1 items)	
✖		Test Name: PACP_SET_req (356 items)	
✖		Test Name: PowerModeChange (594 items)	
⚠		Test Name: Verify Control Frames (4 items)	
⚠		Test Name: Verify Data Frames (4 items)	
⚠		Test Name: Verify NAC Transmission (12 items)	
✖		Test Name: Verify Outstanding Frames (400 items)	

Test Cases Completed: 434 Passed: 175 Failed: 259 Timeout: 0



Events views

UniPro and UFS Events views complement the Packet List windows, showing all events on the bus in both directions in one single snapshot linked to the selected packet and bookmarks. Zooming in on any event or series of events will show the time-aligned packet data and expanded packet information in detail down to raw trace K-Code information, including the One Hot and Hex values.



UniPro Events view



Compliance/Conformance Verification

The Falcon G650 and G650R can execute UFS and UniPro compliance test spec (CTS) tests, using Trace Validation to verify that the resulting protocol sequences and packets conform to the CTS. These exercisers will support the forthcoming MIPI UniPro 3.0 CTS. The Falcon exerciser instrument supports device verification with the UFSA Compliance Test Matrix, including preliminary test cases for UFS 3.1 JESD220D, JESD220E, JESD220-2A and planned support for UFS 5.0 test cases.

Extensive reporting and analysis tools include reports by test parameters – status, individual tests, or test rules, and within tests by packet characteristics such as packet number, byte, speed, link, etc. Summary and full reports and pass/fail reports are also provided.

The screenshot displays the Protocol Insight software interface. The top menu bar includes File, Test, Results, Reports, View, Analyzer Control, Tools, and Help. The main window is divided into several panes:

- Left Pane:** Contains a tree view for 'Simple Packet Stream' and 'Exerciser + Analyzer'. It includes checkboxes for 'Initiate Reboot Device Up Every Run', 'Protocol', 'UniPro', and 'UFS'. Below this are sections for 'Test Run Order', 'Transmission Mode', 'Scrambling', 'Rate Series', 'Traffic Class', 'Speed', 'Link Width', 'Validation Settings', and 'Tests'.
- Trace Validation Results:** A table showing test results. It includes columns for 'Test Name', 'Test ID', 'Status', and 'Rule'. The table lists various test cases, including 'AFC Sequence Number Order (148 items)', 'Check for Packet Errors (1 items)', 'CheckCredits (162343 items)', 'Data Frame TCO Sequence Numbers (5 items)', 'Link Startup Sequence (9187 items)', 'NAC Transmission Disabled (2 items)', 'PACP_GET_req (1 items)', 'PACP_SET_req (356 items)', and 'PowerModeChange (594 items)'. The bottom of this pane shows 'Test Cases Completed: 434', 'Passed: 175', 'Failed: 259', and 'Timeout: 0'.
- UFS Packet List:** A table showing packet details. It includes columns for 'In test', 'Index', 'Direction', 'Time', 'Host', and 'Device'. The table lists packets such as 'WRITE (10)', 'READ (10)', 'READ CAPACITY (10)', and 'READ (10)'.
- Packet Decode:** A pane showing the decoded structure of a packet. It includes fields like 'Transaction ID', 'LUN', 'Task Tag', 'Reserved (byte 4)', 'Reserved (byte 5)', 'Reserved (byte 6)', 'Reserved (byte 7)', 'EHS Length', 'Reserved (byte 8)', 'Data Segment Length', 'Data Buffer Offset [31:16]', 'Data Buffer Offset [15:0]', 'Data Transfer Count [31:16]', and 'Data Transfer Count [15:0]'.
- Data View:** A pane showing the raw data of a packet. It includes a hex dump and an ASCII dump.

Pass/fail analysis using Trace Validation Results

Stimulus with full UniPro stack in HW

The Falcon G650 and G650R utilize a full UniPro stack embedded in hardware so the user can:

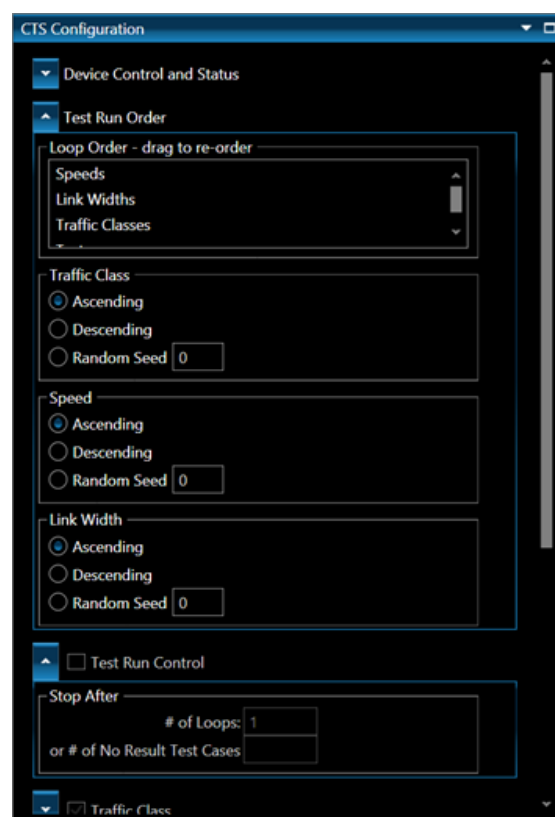
- Emulate a host
- Create specific traffic on the link
- Put the DUT into known states
- Insert errors into the UniPro or UFS traffic stream
- Create custom stimulus sequences to execute complex events, such as NAC Conditions or Power Mode Changes
- Automate with Run Control for stress testing

Run Time Control

The run time control capability included with the G550C and G450C Exerciser/Analyzer can be used for compliance and conformance testing and for stress, margin and corner case automated testing:

- UFS device CTS compliance
 - Verifies test cases defined in JESD224 for JESD220B.
 - Verifies test cases defined in JESD224A for JESD220B, JESD220C and JESD220-2.
 - Preliminary test cases for UFS 3.1 JESD220D, JESD220E and JESD220-2A and UFS 4.0 JESD220F have been added.
 - Planned support for UFS 5.0 test cases.
- UniPro CTS conformance
 - Verifies test cases as defined in the UniPro 2.0 CTS.
 - Planned support for UniPro 3.0 CTS.
- UniPro and UFS device spec conformance
 - Trace Validation engine evaluates UniPro and UFS protocol sequences, “shall” statements and logical requirements.
- Custom test cases
 - Create stimulus and Trace Validation analysis test cases
 - Executable with Run Control
 - Build tests from scratch, or use existing CTS and debug tests cases as a starting point
- Stress Testing
 - Execute any loop order by Speed, Link widths, LUNs or individual test cases
 - Each category can be run ascending, descending, or random seed order
 - Stop after a specified number of test case configuration loops or No Result Test Cases have occurred

Status	Test Name	LUN	Link Width	Speed
✓	7.1.1 UFS Inquiry 01	0	1	PWM
✓	7.1.1 UFS Inquiry 01	176	1	PWM
✓	7.1.1 UFS Inquiry 01	129	1	PWM
✓	7.1.1 UFS Inquiry 01	208	1	PWM
✓	7.1.2 UFS Inquiry 02	0	1	PWM
✓	7.1.2 UFS Inquiry 02	176	1	PWM
✓	7.1.2 UFS Inquiry 02	129	1	PWM
✓	7.1.2 UFS Inquiry 02	208	1	PWM
✓	7.1.3 UFS Inquiry 03	0	1	PWM
✓	7.1.3 UFS Inquiry 03	176	1	PWM
✓	7.1.3 UFS Inquiry 03	129	1	PWM



CTS Configuration

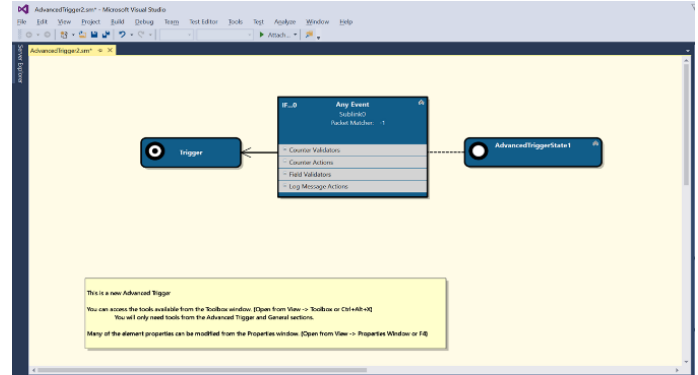
- ☒ Device Control and Status
- ☒ Test Run Order
 - Loop Order - drag to re-order
 - Speeds
 - Link Widths
 - Traffic Classes
 - Traffic Class
 - ☒ Ascending
 - ☐ Descending
 - ☐ Random Seed
 - Speed
 - ☒ Ascending
 - ☐ Descending
 - ☐ Random Seed
 - Link Width
 - ☒ Ascending
 - ☐ Descending
 - ☐ Random Seed
- ☐ Test Run Control
 - Stop After
 - # of Loops:
 - or # of No Result Test Cases:
- ☒ Traffic Class

- Group, filter and summarize test results by test parameters – status, individual tests, or test rules
- Summary reports and full file export

Custom Test Editors

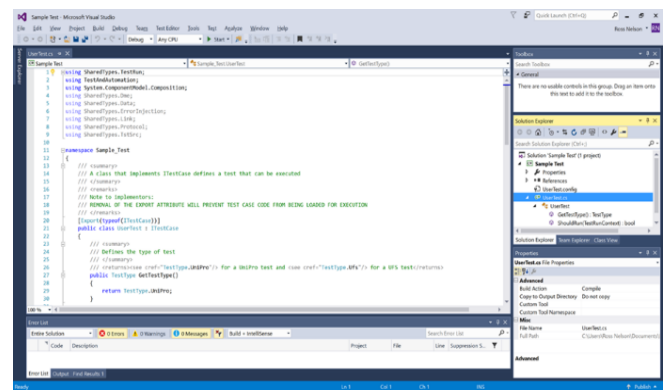
The Falcon series include Test Editors for creating advanced triggers and Trace Validation tests, and the G550C and G450C include custom stimulus Test Editors that can be used to create unique stimulus tests. Tests created with Stimulus Test Editor can be executed with Run Time Control for automated margin, corner case and stress testing.

Custom tests can be created from scratch, or they can be based on the pre-defined tests provided in the software library.



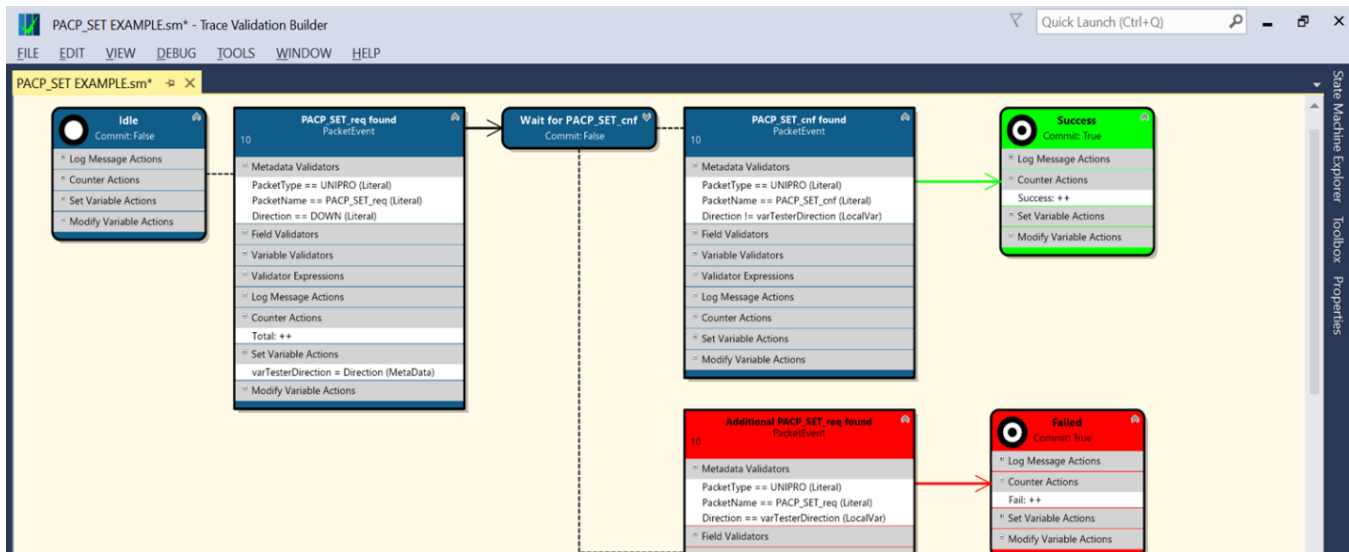
Stimulus capabilities available with custom Stimulus Editors include:

- Host emulation
- Put DUT into known states
- Create specific link traffic
- Insert errors into the traffic stream
- Create stimulus sequences to execute complex events, e.g. NAC Conditions or Power Mode Changes
- Automate with Run Control for stress testing



Analysis capabilities available with the Trace Validation Editor include:

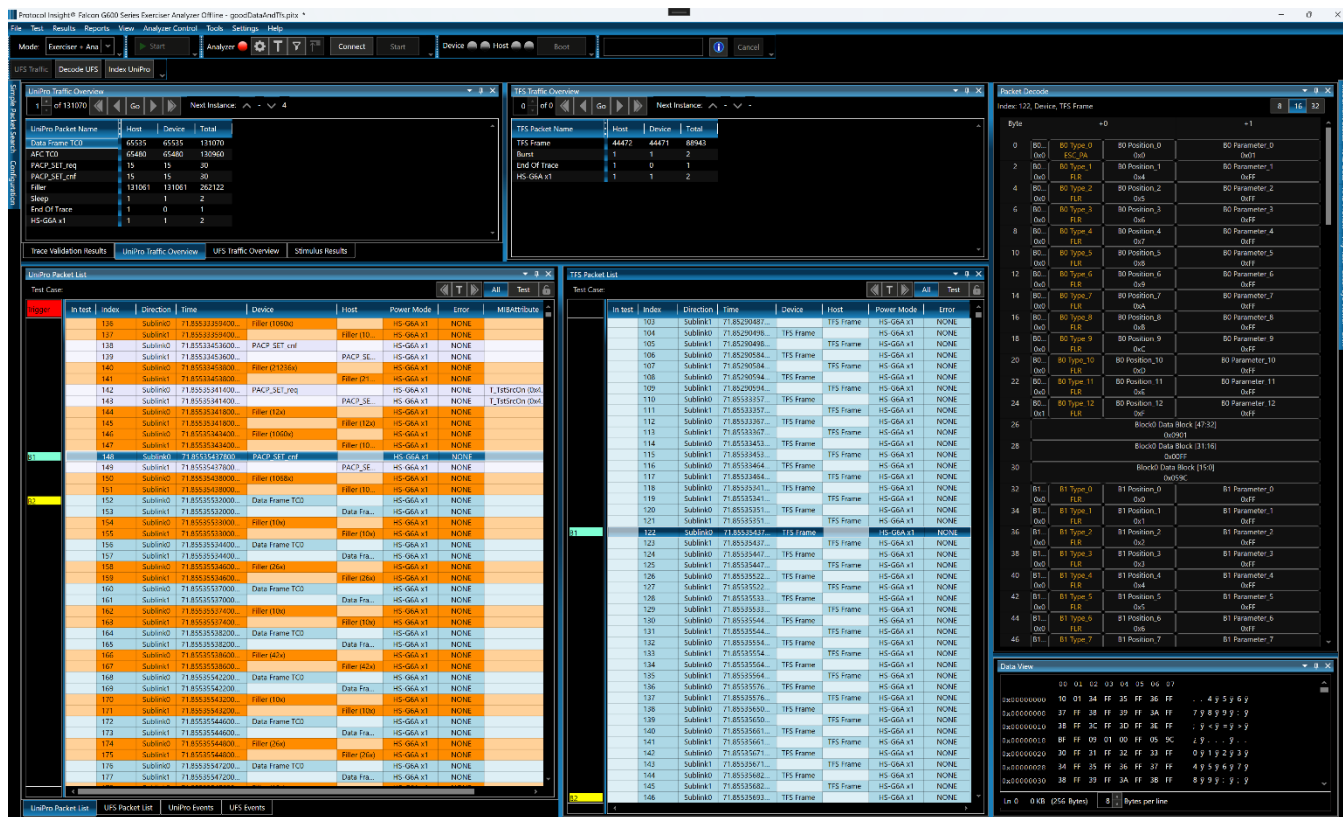
- Analyze traffic on any trace file captured “sniffer” style from any bi-directional link
- Use complex state machine logic to verify all trace attributes
- Log messages and attributes with Failure, Warning, Pass, Info and Debug flags
- Easy-to-use graphical user interface:



Powerful Debug Capabilities

The Falcon application software includes extensive general protocol analysis capabilities, including Packet List, Packet Decode and Data windows, bookmarks and navigation, triggers and pre and post capture filters.

New TFS Packet List view, time correlated with the UFS 5.0 and UniPro 3.0 Packet Lists and the RAD Data.



Packet List windows display all packets in a trace. The information displayed in the Packet List can be changed by right-clicking in the column header bar and selecting different columns from the list available.

In test	Packet	Index	Time	Time Relative Previous	Packet Name	Device	Host	Direction	Power Mode	Preempting	Gear	Link Width	Speed	MIBAttribute
	32268	128034	909.140255053 s	698.133 us	End Of Burst	Start Of Burst/Deskew	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	PWM	
	95766	128035	909.140922084 s	667.031 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95767	128036	909.140922444 s	2.360 us	AFC TC1	AFC TC1	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95768	128037	909.1409911524 s	7.080 us	AFC TC0	AFC TC0	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95769	128038	909.140990516 s	58.992 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32269	128039	909.141134583 s	144.067 us	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32270	128040	909.141167511 s	32.928 us	AFC TC1	AFC TC1	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32271	128041	909.141200442 s	32.931 us	AFC TC0	AFC TC0	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32272	128042	909.141898576 s	698.134 us	End Of Burst	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32273	128043	909.1325626308 s	183.927732 ms	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32274	128044	909.1325646068 s	19.760 us	PACP_SET_req	PACP_SET_req	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	PA_TxTrailingClocks
	82 to B1 = 909.1325846068 s	70	128045	909.132616336 s	317.468 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	PWM	
	82 to B1 = 183.947492 ms	71	128046	909.1326165092 s	2.356 us	PACP_SET_conf	PACP_SET_conf	UP	PWM-G1 x1	NO	0x1	0x1	PWM	
	32275	128047	909.1326227121 s	61.229 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32276	128048	909.132644201 s	317.080 us	End Of Burst	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32277	128049	909.1407962449 s	14.438248 ms	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32277	128050	909.141002209 s	19.760 us	PACP_SET_req	PACP_SET_req	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	TX_HS_SYNC_LENGTH
	95773	128051	909.141293995 s	291.786 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95774	128052	909.141296355 s	2.360 us	PACP_SET_conf	PACP_SET_conf	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95775	128053	909.141351662 s	61.307 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32278	128054	909.141700342 s	342.680 us	End Of Burst	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32279	128055	909.1357781755 s	16.081413 ms	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32280	128056	909.1357801515 s	19.760 us	PACP_SET_req	PACP_SET_req	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	PA_TxHS15syncLength
	95776	128057	909.1358093224 s	291.709 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95777	128058	909.1358095384 s	2.360 us	PACP_SET_conf	PACP_SET_conf	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95778	128059	909.1358156887 s	61.303 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32281	128060	909.1358499948 s	342.761 us	End Of Burst	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32282	128061	909.1372845150 s	14.345502 ms	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32283	128062	909.1372864910 s	19.760 us	PACP_SET_req	PACP_SET_req	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	PA_TxHS2syncLength
	95779	128063	909.1373156534 s	291.624 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95780	128064	909.1373158894 s	2.360 us	PACP_SET_conf	PACP_SET_conf	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95781	128065	909.1373220239 s	61.345 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32284	128066	909.1373630081 s	342.804 us	End Of Burst	End Of Burst	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32285	128067	909.1387912222 s	14.349178 ms	Start Of Burst/Deskew	Start Of Burst/Deskew	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	32286	128068	909.1387931978 s	19.756 us	PACP_SET_req	PACP_SET_req	DOWN	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	PA_TxHS3syncLength
	95782	128069	909.1388223648 s	291.670 us	Start Of Burst/Deskew	Start Of Burst/Deskew	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95783	128070	909.1388226005 s	2.357 us	PACP_SET_conf	PACP_SET_conf	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	
	95784	128071	909.1388287334 s	61.329 us	End Of Burst	End Of Burst	UP	PWM-G1 x1	NO	0x1	0x1	0x1	PWM	

The **Packet Decode** window displays the packet header information and the **Data View** window displays the entire packet, including header and payload for a selected packet.

Navigation within the windows can be accomplished with **Bookmarks**. Bookmarks can be added to any packet in a Packet List window by right-clicking and selecting Add Bookmark. By right-clicking and selecting Edit Bookmark an existing bookmark can be renamed or given a different color.

Hovering over a bookmark will display a tooltip indicating timestamp and delta time to other bookmarks.

B1 = 909.141898576 s
B1 to B2 = 183.947492 ms

Create Marker

Marker Text:

Marker Color:

OK

Cancel

Simple and **Advanced Triggers** monitor all sublinks for any packet type, packet header or payload value and trigger the analyzer to stop capturing when the trigger criteria are met.

Choose Trigger: Use Advanced Trigger

Trigger Position: 50%

Advanced Trigger

Simple Trigger

Refresh

New

Edit

Load

Test

Reverse Packet Directions

Double-click or Drag Event to Trigger

AdvancedTrigger1

AdvancedTrigger2

AdvancedTrigger4

AdvancedTrigger5

AdvancedTrigger5

This trigger is not editable

Advanced Trigger Logic Preview (Read Only):

AdvancedTrigger5

State 0: AdvancedTriggerState1

If Sublink0 Packet == AFCTC0

Then Counter++

Goto State 1

State 1: AdvancedTriggerState2

If !Counter0 >= 10

Then Goto State 0

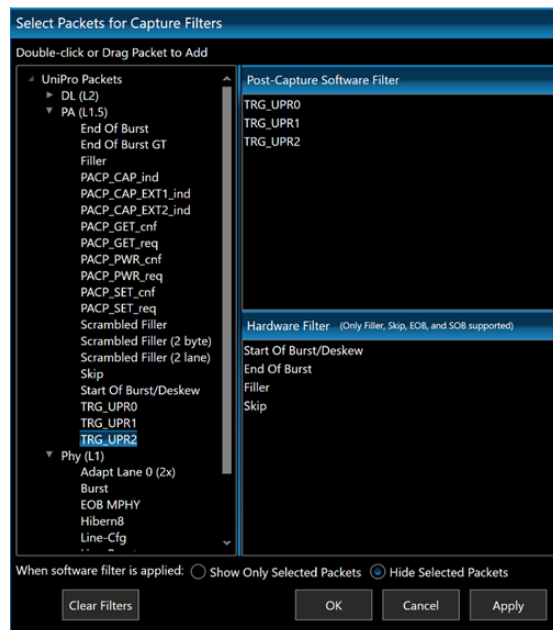
Else If Counter0 >= 10

Then Trigger Out

Filters permit the filtering of specific packet types either before or after the trace has been stored and saved.

The **pre-capture Hardware Filter** can eliminate Fillers, Skips, Start of Bursts, End of Bursts and AFC_TC0 packets. The UFS payload can also be filtered out. Since these are filtered out prior to trace capture they are not stored or saved with the pitx trace.

Post-Capture Software Filter captures and stores all packets, but suppresses the selected UniPro packet types from the UniPro List window. The Traffic Summary window will still display all packets but it highlights and deactivates those that have been filtered.



Specifications

Product specifications are subject to change without notice.

Falcon G600, G600R, G650 and G650R

Supports up to UFS 5.x, UniPro 3.x and M-PHY 6.0 HS-G6.

Available Upgrade:

- Trace capture memory depth: 8 GB (default), upgrade to 15 GB.
- Real-time Analog Display memory depth: 1 Gpt per channel (4 channels, 2 channels per sublink, two sublinks)

G600R Analyzer

M-PHY 6.0, speeds:

- High-Speed (HS) Gear1, Gear2, Gear3, Gear4, and Gear5, Gear 6 Rate Series A/B
- Low-speed Pulse-width Modulation (PWM) Gear1 in Type-I LS implementation
- Support for LS LSS and HS LSS.
- Link Width: x1 and x2
- Trace capture memory depth: 8 GB, upgradeable to 16GB.
- Probing options: SMP and solder-down available.

G650R Exerciser

- Includes all features of the G600R Analyzer
- Compliance support: UFS 5.x (preliminary)
- Conformance support: UniPro 3.x (preliminary)

Orderable Accessories

- HS-G6 Solder-down probe x2 bundle (FG6PSD2)
- HS-G6 High Speed Break-out board (FG6HSBO)
- HS-G6 Interposer (FG6AMPGR)
- Enhanced connectivity option – includes Thunderbolt 4 6ft/2m 40Gbps active cable and cable retention device
- Offline Viewer software with Trace Validation and TV Editor
- Offline Viewer software with Trace Validation and all Editors (TV, advanced trigger and UniPro and UFS stimulus)

DUT Requirements to sync analyzer to a UniPro link:

Attribute	Spec	Typical
TxHsG1SyncLength (0x1552)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG2SyncLength (0x1555)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG3SyncLength (0x1556)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG4SyncLength (0x15D0)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG5SyncLength (0x15D6)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG6SyncLength (0x15DA)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG1PrepareLength(0x1553)	0xA Capability value	0x3 Capability value
TxHsG2PrepareLength(0x1554)	0xA Capability value	0x3 Capability value
TxHsG3PrepareLength(0x1557)	0xA Capability value	0x3 Capability value
TxHsG4PrepareLength(0x15D1)	0xA Capability value	0x3 Capability value
TxHsG5PrepareLength(0x15D7)	0xA Capability value	0x3 Capability value
TxHsG6PrepareLength(0x15DC)	0xA Capability value	0x3 Capability value
RxLsPrepareLength	0xA Capability value	0x1 Capability value
RxPwmBurstClosureLength	0x1F Capability value	0x1 Capability value
To sync to existing link	One Start of Burst	One Start of Burst

The typical settings assume configuration with supported accessories and recommended cables. Actual performance may vary depending on the probing and the signal integrity of the DUT.

DUT Requirements to establish a UniPro link with the Falcon exerciser:

The device must execute a UniPro 3.0 compliant Link Startup Sequence.

General Characteristics

System requirements:

Basic PC configuration:

- Intel® Core™ i7 or i9 processor or equivalent.
- 32 GB RAM recommended, 16 GB minimum.
- NVMe solid state drive with 500GB free space recommended, 256GB minimum free space.
- Thunderbolt 4 enabled type-c connector required.

To take full advantage of streaming capture with v2.0.0 and later FW/SW:

- The fastest processor available, e.g. Intel i9-8950HK Processor (4.8GHz turbo)
- 64GB of RAM recommended, 32GB minimum
- **1TB NVMe SSD with Sustained Write Bandwidth of 5.0GB/s recommended, 2.5GB/s minimum**
- Thunderbolt 3 enabled type-c connector required.

For streaming capture with existing PCs you can verify if your SSD has acceptable Sustained Write Bandwidth at <https://ssd.userbenchmark.com>, which provides a good tool for SSD Sustained Write Bandwidth benchmarking.

Software requirements

- Windows 11 64-bit operating system
- Microsoft Visual Studio 2022 Community or Professional editions
- Protocol Insight application software and firmware version 6.0 or later

Physical Characteristics

Dimensions	15" x 15" x 7", 38.1cm x 38.1cm x 17.8cm
Weight	22 lbs, 10kg

Patents: This product is protected under US Patent No. 10,613,963

Export Control Classification Number (ECCN): 3A992.a, No License Required

US Export Schedule-B harmonization code: 9030.89.0100

Safety, Compliance and Environmental Information



Intertek



Falcon 600R and 650R Series
Conforms to UL STD 62368-1
Certified to CSA STD C22.2 No. 62368-1
ETL Control Number: xxxxxxxxx

Complies with IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013
Manufacturer's Declaration of Conformity to European Directive 2014/35/EU (Low Voltage Directive)
Compliant with the European Union directive 2002/95/EC and 2011/65/EU on the Restriction of the use of certain hazardous substances in electrical and electronic equipment and components (RoHS).

Compliant with

CISPR 16-2-3:2016 – radio disturbance and immunity measuring apparatus and methods

CISPR 16-2-1: 2014/AMD 1:2017 – specifies the methods of measurement of disturbance phenomena in general in the frequency range 9 kHz to 18 GHz

FCC 47CFR 15: 2012 – radio frequency devices

EN 55032:2015, A11:2020 - Electromagnetic compatibility of multimedia equipment

EN 55035:2017, A11:2020

IEC 61000-3-2:2020 – limits For Harmonic Current Emissions

IEC 61000-3 Ed: 5.1, 2020-07-14

IEC 61000-3-3:2021

IEC 61000-3 Ed. 3.2, 2021-03-25

ICES-003: 2020 - Information Technology Equipment - Limits and Methods of Measurement

ANSI C63.4:2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment

IEC 61000-4-2:2008 – (EMC) discharge immunity

IEC 61000-4-3:2006 – (EMC) Radiated, radio-frequency, electromagnetic field immunity

IEC 61000-4-5:2 – (EMC) surge immunity test

IEC 61000-4-6:2008 – (EMC) immunity to conducted disturbances

IEC 62368-1:2020+A11:2020 – Audio/video, information and communication technology equipment

Contact Information

For additional information, to request a demonstration or quote, or place an order, please contact your local Protocol Insight representative or sales@protocolinsight.com

Support materials, application notes and examples files are available at
<https://www.protocolinsight.com/support-materials/>

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