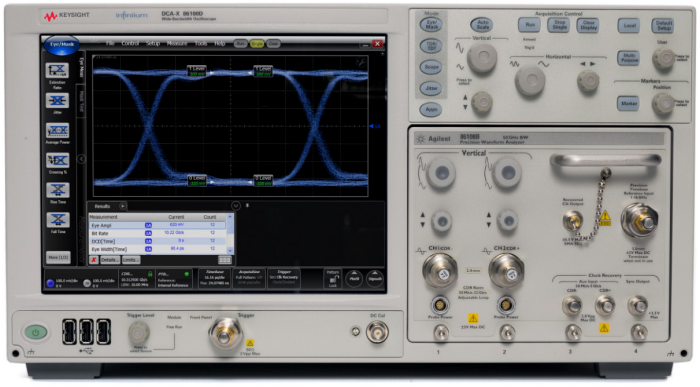
DATA SHEET

N1014A SFF-8431 (SFP+)

Compliance and Debug Application for 86100D DCA-X and N109X DCA-M Oscilloscopes

Be Confident With Compliant Measurements



KEYSIGHT TECHNOLOGIES

Easy-to-use oscilloscope application that lets you:

- Save time in understanding details of standards
- Reduce your SFP+ test times from hours to minutes
- Debug your device using custom configurations

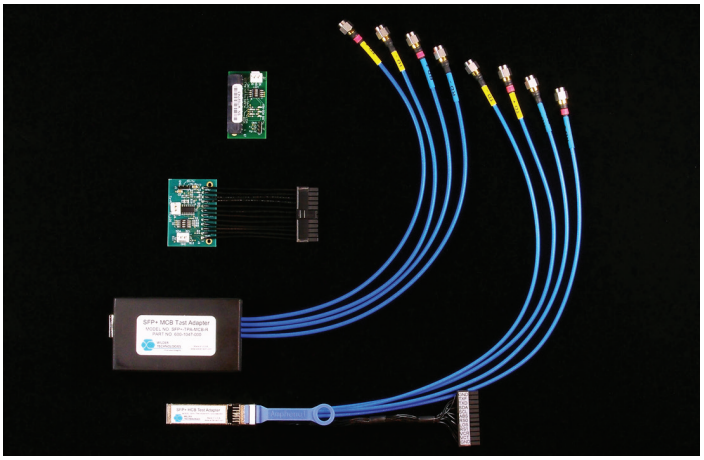
The greatly increased worldwide demand for video and data transfer has created new requirements for network expansion, driving innovative network elements for operation up to 100 Gb/s. New designs are facing more challenges while transferring these signals on printed circuit boards within hosts and modules, even for short distances. Measuring the SFF-8431 parameters can take a full day when manually characterized, and recalculating factors and equation-driven limits adds to the time the designer spends on testing.

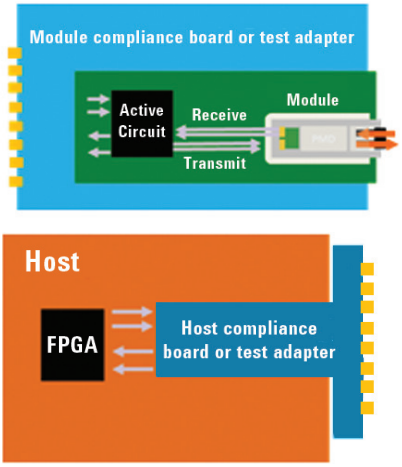
Keysight Technologies Inc. created the N1014A SFF-8431 Compliance and Debug Application to simplify measuring these transmitter parameters and to obtain full results to test limits in a few minutes. This will keep you focused on getting your products to market knowing that your results are built on the heritage and consistency of Keysight measurement technology.

Transform Complexity into Simplicity

Satisfying the broad requirements of the SFF-8431 Specifications can be very complex. The data rate for each test group varies based on which standard is being addressed in the product design. The tests between each SFF-8431 group vary, as do the test limits. An example of one group of tests is below. The time for your test development team to read and interpret the specification and then implement that understanding into test plans can take several months of effort.

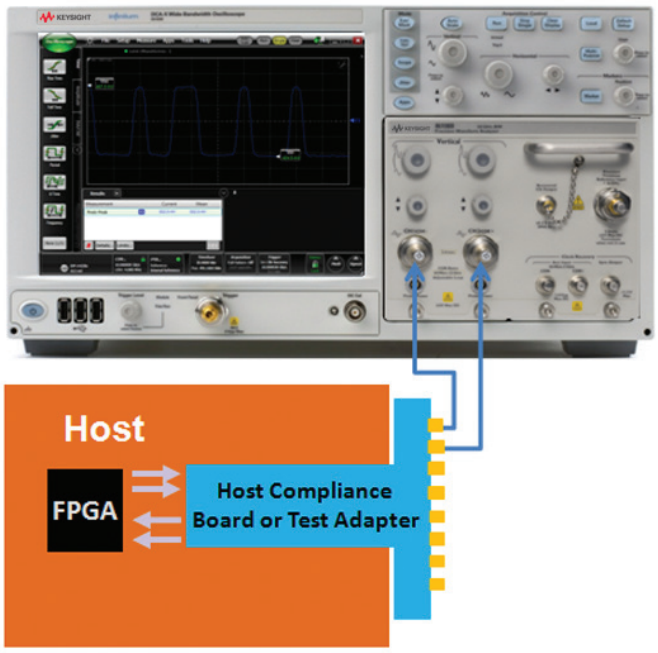
Parameters - B	Symbol	Conditions	Min	Target Value	Max	Units
Crosstalk source rise/fall time (20 to 80%)	Tr, Tf	See 1, 2, D.6		34		ps
Crosstalk source amplitude (p-p differential)		See 1, 2, D.7		1000		mV
Signal rise/fall time (20 to 80%)	Tr, Tf	See D.6	34			ps
Total jitter	TJ	See D.5			0.28	UI (p-p)
Data dependent jitter	DDJ	See D.3			0.1	UI (p-p)
Data dependent pulse width shrinkage	DDPWS				0.055	UI (p-p)
Uncorrelated jitter	UJ	See 3, 2, D.4				
Transmitter Q_{sq}	Q_{sq}	See 4	50			
Parameters - B	**Symbol**	**Conditions**	**Value**			**Units**
Eye mask	X1	Mask hit ratio of $5x10^{-5}$. See D.2 and Figure 19	0.12			UI
Eye mask	X2		0.33			UI
Eye mask	Y1		95			mV
Eye mask	Y2		350			mV





Development and characterization of advanced integrated circuits is time-consuming and expensive. Designers utilize test adapters to fully characterize their parts for use in their own or their customer's circuits. For more information about these adapters, please visit **http://shop.wilder-tech.com/category_s/35.htm**.

Hosts and modules have unique interface connectors and require compliance boards or test adapters to enable connection to test equipment. Designers endeavor to minimize the trace lengths on the compliance boards and cable lengths.



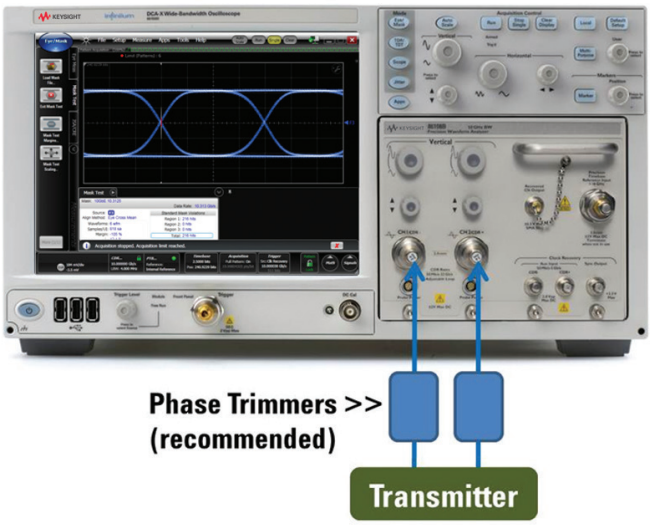
By pairing your test adapter or compliance board with the 86100D, 86108B and N1014A software, you will have the simplest and most powerful solution available to optimize your designs and offer the best products to your customers. Phase trimmers and a pair of cables complement your setup for the most consistent and accurate measurements.

The N1014A software also supports a variety of other DCA configurations (see ordering guide), including the N1094A DCA-M oscilloscope and N1076B Electrical Clock Recovery.

Debug and Verify Your Designs Quickly and Easily

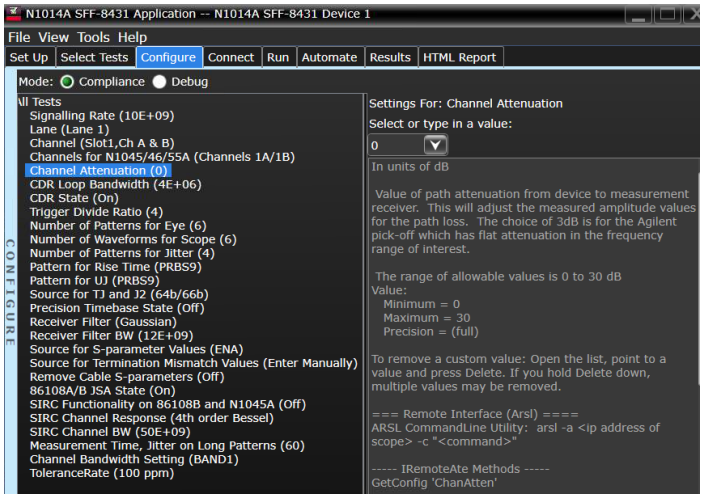
Select industry-leading hardware

Configure your oscilloscope for a single module (as below) or multi-module (listed in ordering guide). Connect your device through the recommended phase trimmers to have access to measurements with intrinsic jitter as low as 50 fs. For return loss, also connect the Economy or Performance Network Analyzer, which are controlled by the N1014A for S-parameter measurements.



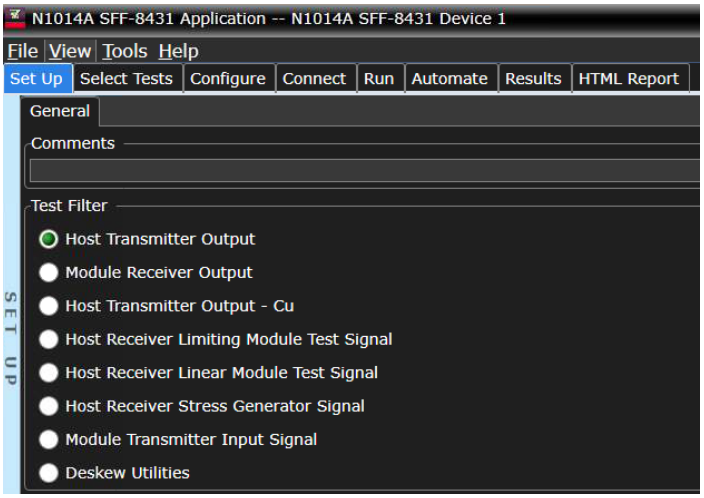
Configure your measurements

Customize parameters that are specific to your setup, such as data rate and attenuation. Use default values or enter your own settings including number of waveforms or patterns taken; type of pattern; and whether or not to remove the effects of test cables. Choose Normal mode to test within compliance limits or choose Debug mode to test to your custom limits and adjust other test parameters.



Select any SFP+ transmit interface

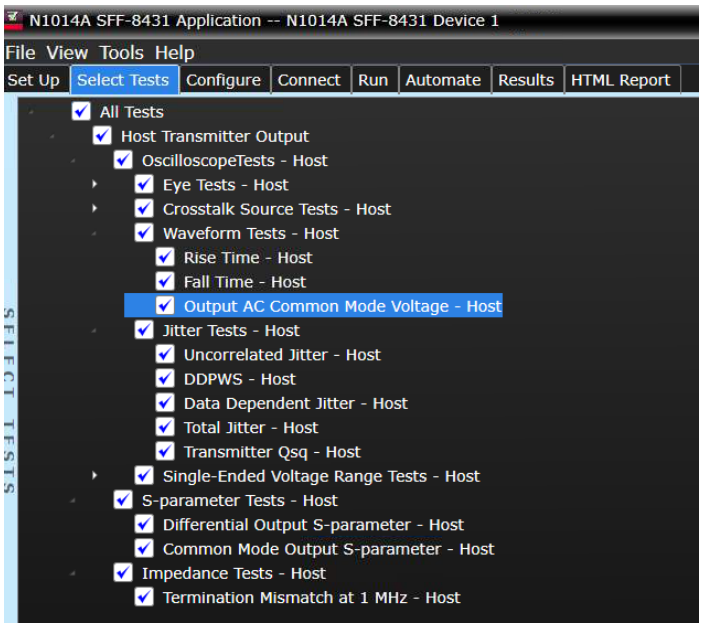
The N1014A SFF-8431 Compliance and Debug Application covers all host and module transmitter tests as well as verification of the test signals for receiver compliance. Click on the desired test group, and the appropriate tests are offered in Select Tests.



Debug and Verify Your Designs Quickly and Easily (Continued)

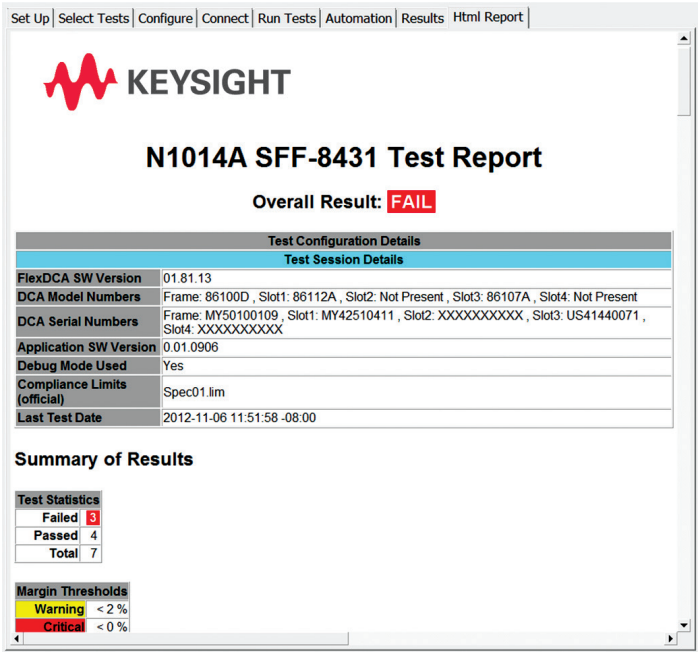
Choose from more than 70 tests

The tests required for each of the transmit and test signal groups are available. You can click on all tests, a group of tests or individual tests. The full test name appears in the test list and is shown in the test results and reports. A description of the test and reference to the SFF-8431 Specifications are shown for each test. You may also measure TWDP by interfacing with your MATLAB script.



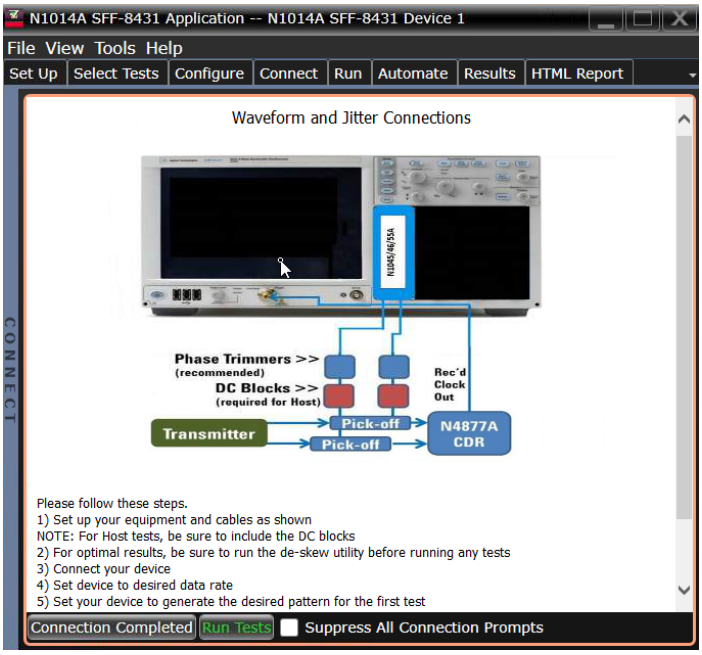
Obtain concise compliance reports

Users and customers are interested in the performance of your devices. Share a report that shows the test conditions, summary of pass/fail, summary of all tests, and details for each test. Many include the appropriate screen shot of the measured parameter.



Measure challenging parameters fast

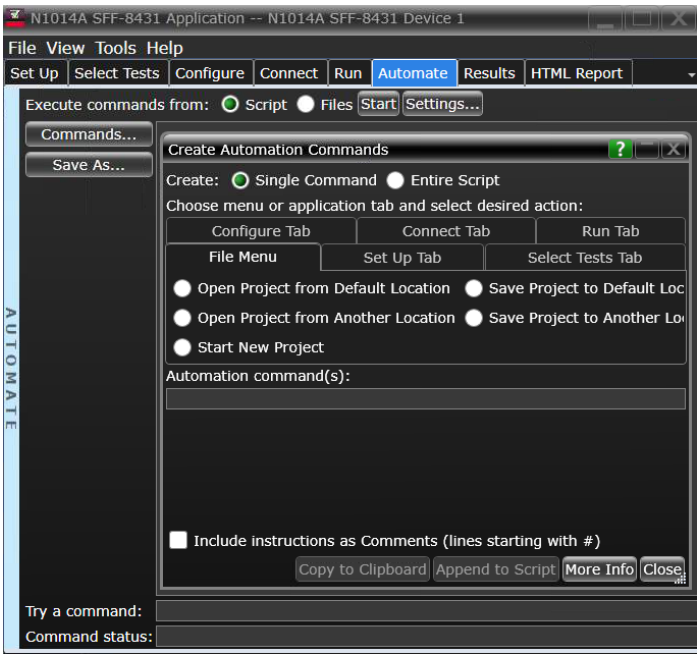
Simply follow the steps and click Run Tests. The N1014A software will control the 86100D DCA-X, N109X DCA-M, and/or ENA/PNA/TDR and readily measure your device.



Debug and Verify Your Designs Quickly and Easily (Continued)

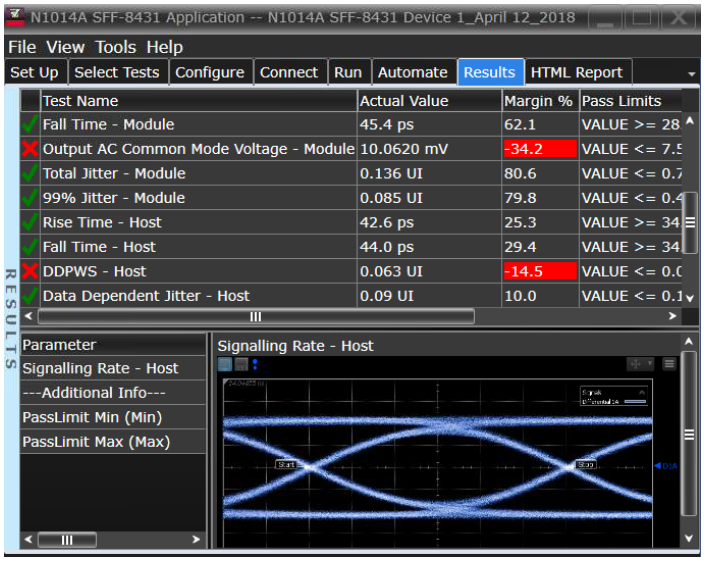
Control your device or other equipment

The Automation tab lets you enter commands to control external devices or equipment, further sequence your tests, or to control timing.



See device performance in one view

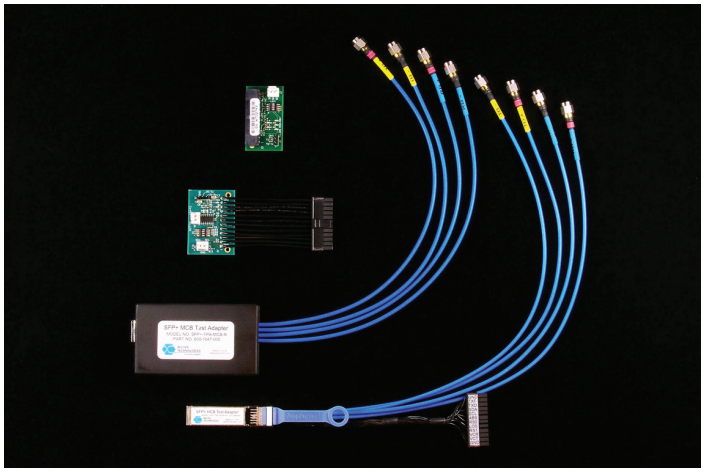
In a few minutes, you'll have test results showing which parameters passed or failed and the margin compared to limits. These results will provide immediate insight into how you'll need to improve your design to meet the challenging tests in the SFF-8431 Specifications.



More Features to Further Streamline Your Development

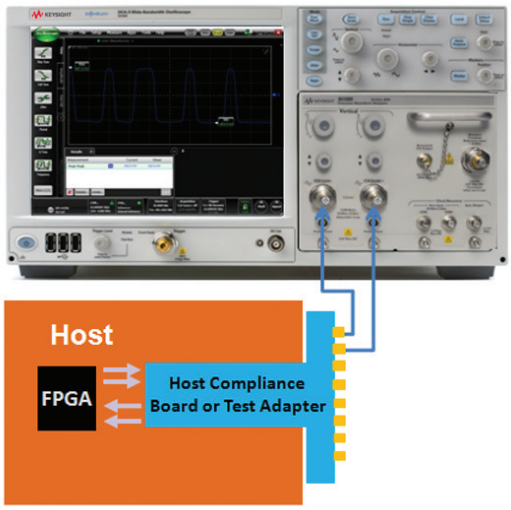
Utilize compliance boards

Development and characterization of advanced integrated circuits is time-consuming and expensive. Designers utilize test adapters to fully characterize their parts for use in their or their customer's circuits. For more information on these adapters, please visit **http://shop.wilder-tech.com/category_s/35.htm**.



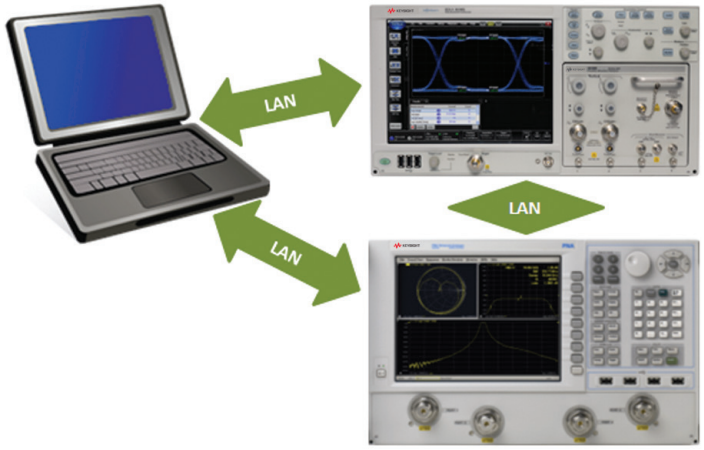
... or host and module compliance boards

Development and characterization of advanced integrated circuits is time-consuming and expensive. Designers utilize test adapters to fully characterize their parts for use in their or their customer's circuits. For more information on these adapters, please visit **http://shop.wilder-tech.com/category_s/35.htm**.



Configure your solution in three ways

The hardware and software architecture provides wide flexibility. You may install the N1014A on the mainframe, which includes FlexDCA, or the N1014A on your PC, controlling FlexDCA on the DCA, or install both N1010A FlexDCA and N1014A on your PC. This lets you use your PC for more processing power and other applications, or you can have all measurement capability consolidated into a compact solution. The ENA/PNA is controlled by the N1014A via the PC or the DCA.



Conveniently de-skew your cables

Skew between the true and complement signals will often degrade your measured performance. While you need to characterize performance with the DUT skew included, the N1014A guides you to quickly de-skew your test cables using phase trimmers or to de-skew the 86118A-H01 remote heads for best results.

Characterize More Than 70 Parameters

The SFF-8431 Specifications include many challenging tests, and the table below shows each of the transmit and test signal parameters by test group required by the Specifications. The N1014A measures all of these parameters; empty cells indicate that the parameter is not required for that test group.

	Transmit tests			Receiver test signal verification				
	Parameter	**Host output**	**Module output**	**Host output-cu**	**Host receiver limiting**	**Host receiver linear**	**Module input**	**Host receiver stress gen**
Measured on DCA	Signaling rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Eye mask	3.5.1	3.6.2		3.5.2		3.6.1	
	Crosstalk source Tr	3.5.1	3.6.2		3.5.2	3.5.2	3.6.1	
	Crosstalk source Tf	3.5.1	3.6.2		3.5.2	3.5.2	3.6.1	
	Crosstalk source amplitude	3.5.1	3.6.2		3.5.2	3.5.2	3.6.1	
	Rise time	3.5.1	3.6.2					
	Fall time	3.5.1	3.6.2					
	Voltage modulation amplitude			E.2		3.5.2 LRM/SR/LR		E.3.1
	Output AC CM voltage	3.5.1	3.6.2	E.2	3.5.2	3.5.2	3.6.1	E.3.1
	Single-ended output voltage range	3.5.1	3.6.2					
	Peak-to-peak voltage overload							E.3.1
	Total jitter	3.5.1	3.6.2		3.5.2		3.6.1	
	Uncorrelated jitter	3.5.1					3.6.1	
	Transmitter Qsq	3.5.1		E.2				E.3.1
	DDPWS	3.5.1			3.5.2		3.6.1	
	Data dependent jitter	3.5.1					3.6.1	
	99% jitter		3.6.2		3.5.2			
	Post channel fixed noise source							E.3.1
ENA/PNA	Differential output/input S-parameter	3.5.1	3.6.2		3.5.2	3.5.2	3.6.1	
	Common mode output S-parameter	3.5.1	3.6.2					
	Termination mismatch at 1 MHz	3.5.1	3.6.2					
	Reflected differential to CM conversion				3.5.2	3.5.2	3.6.1	

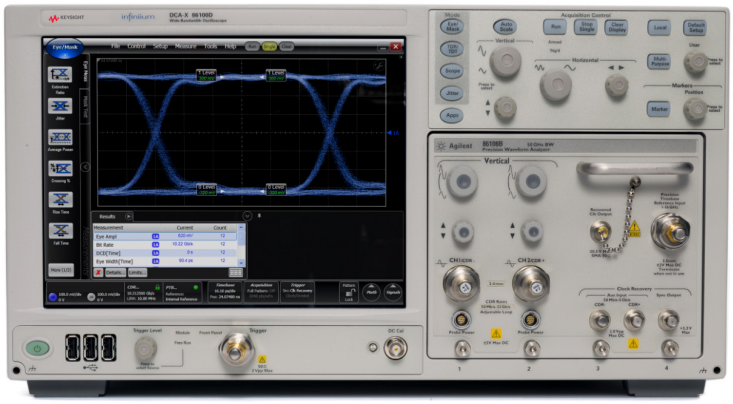
Choose Industry-Leading Solutions

Keysight offers a wide range of electrical and optical test solutions to address current and emerging communications standards. For SFF-8431 (SFP+), you may choose a hardware combination that fits the SFP+ tests and other higher rate tests for other standards.

1. 86100D DCA-X with 86108B (Integrated “One-Box” solution) - recommended
2. 86100D DCA-X with DCA module and external clock recovery
3. N109X Electrical DCA-M with external clock recovery

Solution 1: Keysight 86100D DCA-X mainframe + 86108B “MegaModule” (recommended)

- Highest accuracy
- Easy setup
- Integrated solution

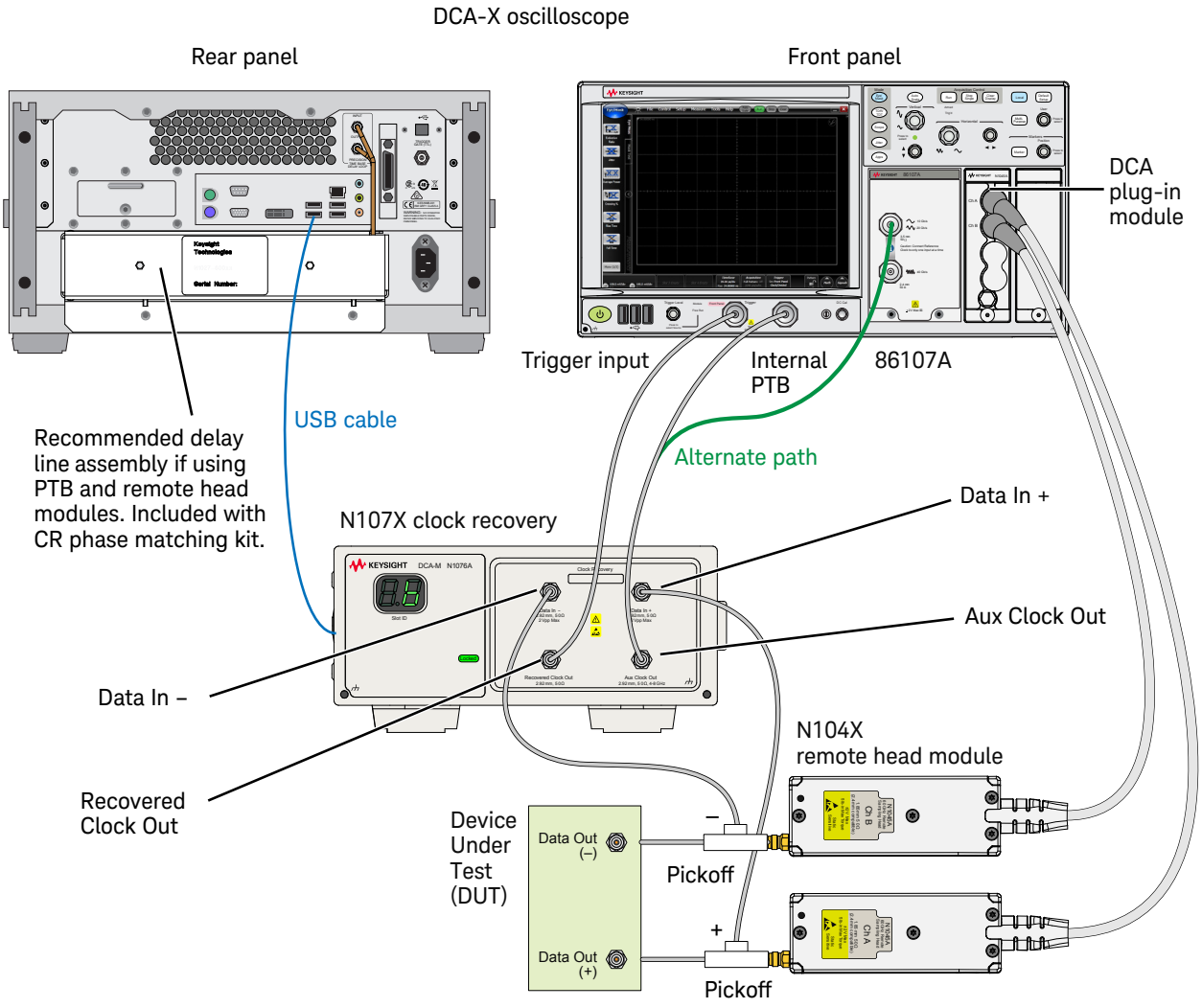


	Mainframe model number	Mainframe hardware options	Mainframe software options (Fixed or transportable licenses)
TX Test using Digital Communications Analyzer (DCA)	86100D DCA-X	Required: ETR	Required: 200, 201, 401
		Optional: PTB (not used with 86108B)	Optional: SIM (for de-embedding cables)
	Plug-in module model number	**Plug-in module options**	**Max # of modules/Diff channels**
	86108B	216/232, LBW/HBW	1/1
	Software		
	N1014A	SFF-8431 (SFP+) Compliance Application	
	N1010A	FlexDCA FW Rev 5.8 or later (included with 86100D mainframe)	
	Keysight IO Libraries	Rev 16.3 or later, automatically installed with FlexDCA installation	
	Accessories		
	86108B-PT2, N1027A-PT2	Phase trimmers (Qty 2), for modules with 2.4 mm connectors (86108B)	
	86108B-DC2, N9399F, or N9399F	DC blocks, 50 GHz (Qty 2)	
	86108B-DC3, N9398C, N9399C or 11742A	DC blocks, 26.5 GHz (Qty 2)	
	86108B-CA3	Matched cable set (Qty 1)	
Impedance measurements	**Model number (Pick ONE)**	**Description**	
	N1055A TDR/TDT	35/50 GHz 2/4 Port TDR/TDT remote sampling head for the 86100D DCA-X (any option)	
	Economy Network Analyzer (ENA)	Any 4-port model with a frequency range of at least 12 GHz (also covers the 1 MHz termination mismatch test)	
	Performance Network Analyzer (PNA)	Any 4-port model with frequency range of at least 12 GHz	

Choose Industry-Leading Solutions (Continued)

Solution 2: Keysight 86100D DCA-X mainframe with DCA module + external clock recovery

- Highest flexibility
- Scalable solution
- High fidelity – remote heads minimize loss between DUT and oscilloscope



Choose Industry-Leading Solutions (Continued)

Equipment configuration for solution 2: Keysight 86100D DCA-X mainframe with DCA module + external clock recovery

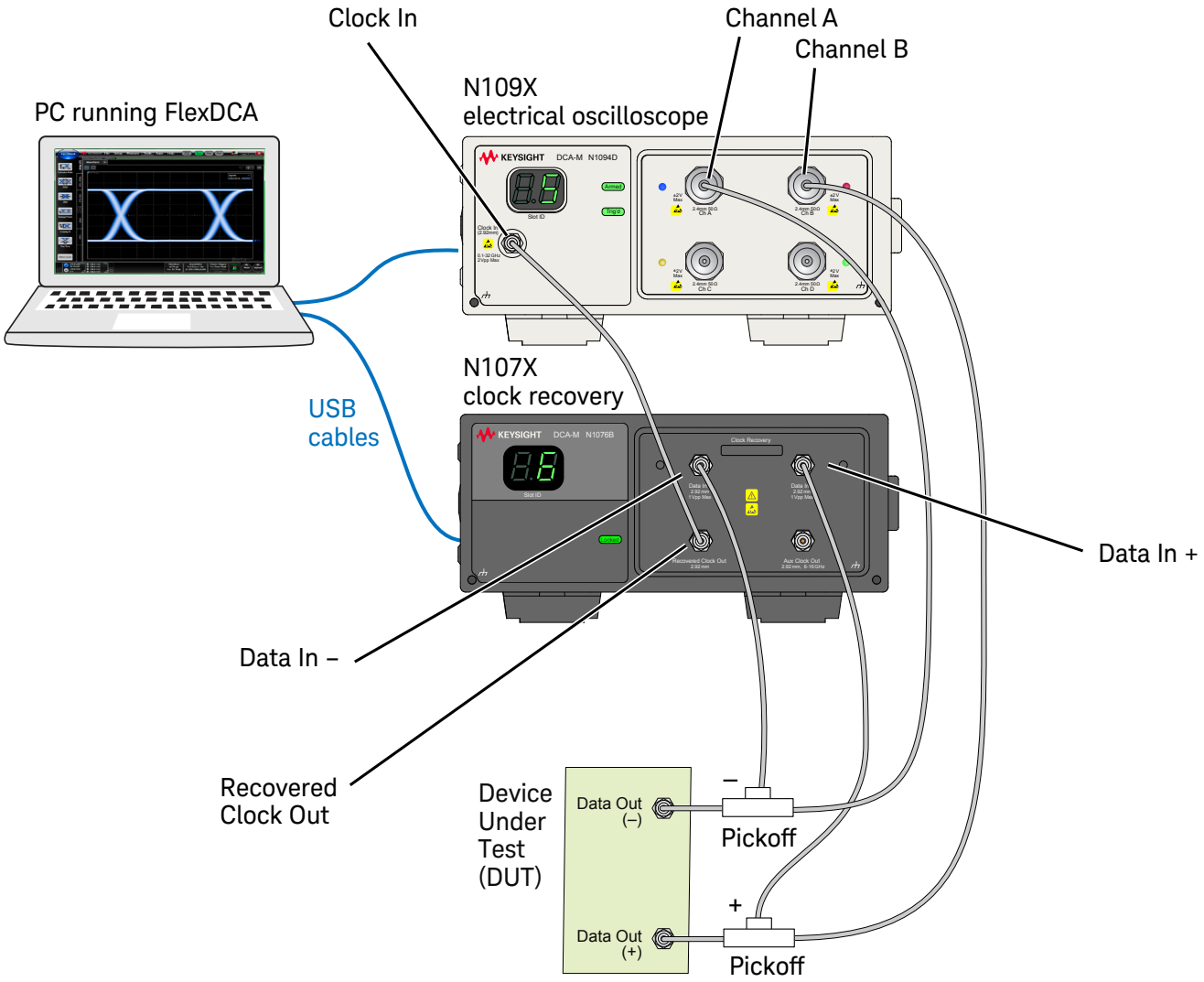
	Mainframe model number	Mainframe hardware options	Mainframe software options (Fixed or transportable licenses)
TX Test using Digital Communications Analyzer (DCA)	86100D DCA-X	Required: ETR, PTB	Required: 200 201, 401 Optional: SIM (for de-embedding cables)
	Plug-in module model number (Pick ONE)	**Plug-in module options**	**Max # of modules/Diff channels**
	86112A	Any	2/2
	86117A	Any	2/2
	86118A	H01	2/2
	54754A	Any	2/2
	N1045A	Any	4/8
	N1055A	Any	4/8
	N1046A	12F, 14F, 72F, 74F, 82F, 84F (any 2 or 4 channel config)	4/8
	Clock recovery model number (Pick ONE)	**Clock recovery options (Pick ONE)**	
	N4877A	216/232	
	N1076A	216/232	
	N1076B	216/232/264	
	N1077A	216/232	
	N1078A	216/232/264	
	Software		
	N1014A	SFF-8431 (SFP+) compliance application	
	N1010A	FlexDCA FW Rev 5.8 or later (included with 86100D mainframe)	
	Keysight IO Libraries	Rev 16.3 or later, automatically installed with FlexDCA installation	
	Accessories [1]		
	N1027A-76B (recommended)	Clock Recovery Phase Matching Kit for use with N104XA remote head and external N4877A/ N107X clock recovery	
	N1027A-76A	Clock Recovery Phase Matching Kit for use with N104XA remote head and external N4877A/ N107X clock recovery	
	N1027A-MC1	Clock Recovery Phase Matching Kit for use with N104XA remote head and external N4877A clock recovery	
	N1027A-2P2	Pick-Off Tees (Qty 2), for remote head modules with 1.85 mm/2.4 mm connectors (N1045A, N1046A, N1055A), (included in N1027A-76A/76B Kit)	
	N1027A-PT2	Phase trimmers,50 GHz (Qty 2), for 861XX DCA modules with 2.4 mm connectors (86117A)	
	N1027A-PT3	Phase trimmers, 26.5 GHz (Qty 2), for 54754A/861XX DCA modules with 3.5 mm connectors (54754A, 86112A)	
	N9399F, N9399F	DC block, 50 GHz (Qty 2)	
	N9398C, N9399C or 11742A	DC block, 26.5 GHz (Qty 2)	
Impedance measurements	**Model number (Pick ONE)**	**Description**	
	N1055A TDR/TDT	35/50 GHz 2/4 Port TDR/TDT Remote Sampling Head for the 86100D DCA-X (any option)	
	Economy Network Analyzer (ENA)	Any 4-port model with a frequency range of at least 12 GHz (also covers the 1 MHz termination mismatch test)	
	Performance Network Analyzer (PNA)	Any 4-port model with frequency range of at least 12 GHz	

1. For more information on clock-to-data delay matching, refer to the Keysight N1076A/B, N1077A, and N1078A Clock Recovery DCA-M User Guide.

Choose Industry-Leading Solutions (Continued)

Solution 3: Keysight N109X electrical DCA-M + external clock recovery

- Flexible configuration
- Lowest cost
- Scalable



Choose Industry-Leading Solutions (Continued)

Equipment configuration for solution 3: Keysight N109X electrical DCA-M + external clock recovery

TX Test using Digital Communications Analyzer (DCA)	**Software model number (For user-supplied PC)**	**Software options (Install on PC, or purchase fixed SW licenses for the DCA-M)**	
	N1010A FlexDCA	Required: 200, 201, 401	
		Optional: SIM (for de-embedding cables)	
	Model number (Pick ONE)	**DCA-M options**	**# of diff channels**
	N1092C	Required: LOJ, PLK	1
		Optional: FS1	
	N1092E	Required: LOJ, PLK	1
		Optional: FS1	
	N1094A	Required: LOJ, PLK, 030 or 050	1
		Optional: FS1	
	N1094B	Required: LOJ, PLK, 030 or 050	2
		Optional: FS1	
	Clock recovery model number (Pick ONE)	**Clock recovery options (Pick ONE)**	
	N4877A	216/232	
	N1076A	216/232	
	N1076B	216/232/264	
	N1077A	216/232	
	N1078A	216/232/264	
	Software		
	N1014A	SFF-8431 (SFP+) compliance application	
	N1010A	FlexDCA FW Rev 5.8 or later (included with 86100D mainframe)	
	Keysight IO libraries	Rev 16.3 or later, automatically installed with FlexDCA installation	
	Accessories [1, 2]		
	N1027A-2P2	Pick-off tees (Qty 2), for remote head modules with 1.85 mm/2.4 mm connectors (N1045A, N1046A, N1055A), (included in N1027A-76A/76B Kit)	
	N9399F, N9399F	DC block, 50 GHz (Qty 2)	
	N9398C, N9399C or 11742A	DC block, 26.5 GHz (Qty 2)	
Impedance measurements	**Model number (Pick ONE)**	**Description**	
	N1055A TDR/TDT	35/50 GHz 2/4 Port TDR/TDT Remote Sampling Head for the 86100D DCA-X (any option)	
	Economy Network Analyzer (ENA)	Any 4-port model with a frequency range of at least 12 GHz (also covers the 1 MHz termination mismatch test)	
	Performance Network Analyzer (PNA)	Any 4-port model with frequency range of at least 12 GHz	

1. For more information on this hardware configuration, including clock-to-data delay matching, refer to the Keysight N1076A/B, N1077A, and N1078A Clock Recovery DCA-M User Guide.
2. No clock-to-data delay phase matching kit is available for this hardware configuration.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

KEYSIGHT TECHNOLOGIES