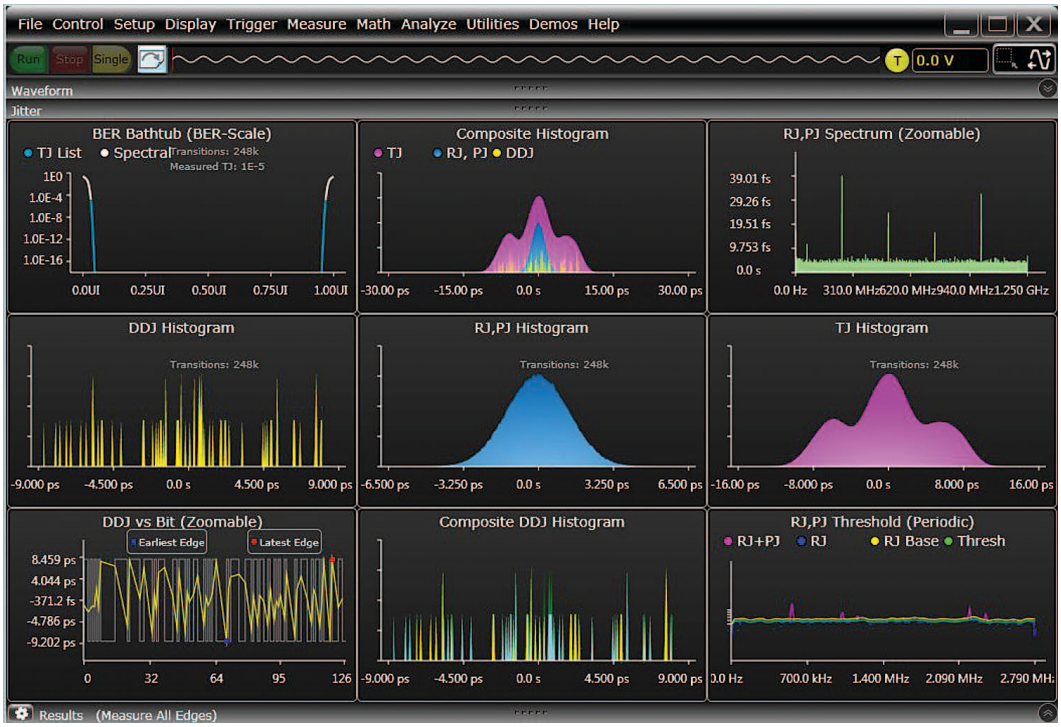
Keysight Technologies

EZJIT Plus Jitter Analysis Software for Infiniium Oscilloscopes

Data Sheet



KEYSIGHT TECHNOLOGIES

With the faster edge speeds and shrinking data valid windows in today's high-speed digital designs, insight into the causes of signal jitter is critical for ensuring the reliability of your design. Keysight Technologies, Inc. EZJIT Plus jitter analysis software for Infiniium oscilloscopes provides the advanced decomposition, analysis, and views of jitter necessary for fast and accurate insight into your signal. Decompose jitter into components, view BER bathtub curves and estimate TJ at low BER. Whether your signal is subject to channel ISI, power supply interference, or crosstalk from adjacent signal paths, EZJIT Plus enables you to accurately estimate TJ and determine the sources of jitter affecting your signal.

Easy to Use Rj/Dj Separation Wizard

Your jitter separation experience begins with the EZJIT Plus Rj/DJ jitter separation wizard. The easy-to-use wizard makes setting up jitter separation fast and easy. Walk through the step-bystep wizard to set critical parameters such as thresholds, vertical scaling, clock recovery, noise removal, and clock recovery. When you are finished with the wizard, you get fast and accurate separation of jitter.

Separate jitter on both periodic and non-periodic (arbitrary) waveforms

One of the advantages of a real time oscilloscope over other jitter analysis engines is the ability to separate jitter on arbitrary patterns, including long periodic patterns such as PRBS23 and PRBS31. Typically, jitter separation is performed on repetitive waveforms that are designed to stress the data transmission link and receivers clock recovery circuitry. However, many embedded designs using multi-vendor chipsets are limited to testing live traffic with additional align characters and packet frames that may not be repetitive. EZJIT Plus allows designers to choose between periodic and arbitrary data modes when analyzing jitter for compliance. In the arbitrary data mode, the ISI filter shows victim-aggressor relationships between each rising and falling edge that are N-edges apart in the captured waveform. By setting the filter wide enough to capture all significant relationships, designers can quickly analyze ISI problems and accurately separate RJ/DJ parameters to provide a TJ estimation at low BER.

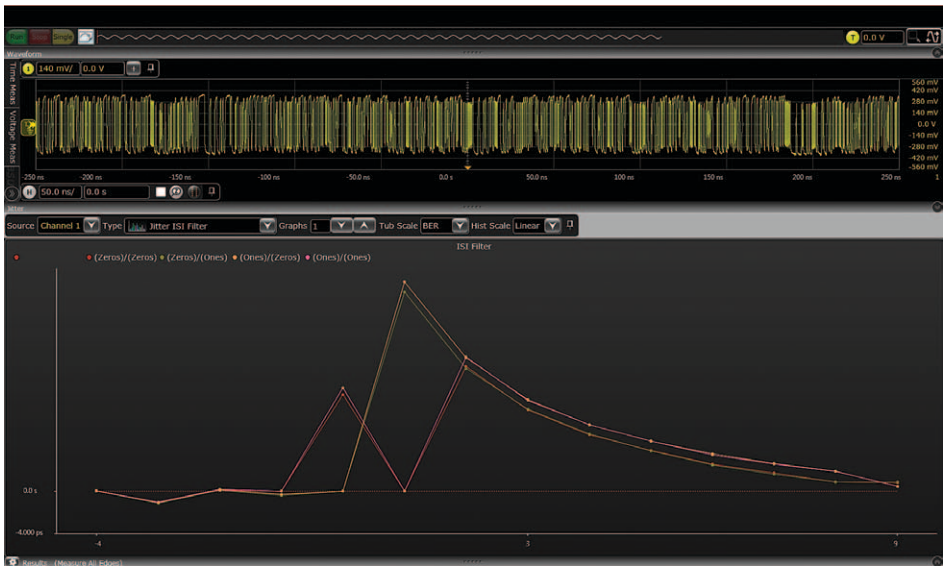


Figure 1. The ISI filter makes it possible to determine DCD in arbitrary patterns.

Easy-to-use jitter separation wizard The easy-to-use wizard built into EZJIT Plus makes setting up advanced jitter separation simple. Walk through the measurement setup step-by-step to set critical parameters such as thresholds, vertical scaling, and clock recovery. The result: fast and accurate separation of signal jitter into components and flexible jitter views to provide critical insight.

Accurate Random Jitter Separation using Spectral and Tail Fit Algorithms

Occasionally, common spectral algorithms for RJ extraction overreports RJ. The problem is that bounded uncorrelated jitter looks like RJ to a spectral jitter separation method.

Figure 2. The EZJIT Plus wizard makes separating jitter easy.

Ultimately, this means two problems occur. First, the RJ measurement can be inaccurate. Second, when measuring Total Jitter (TJ) vs. BER, TJ can be dramatically overestimated due to the RJ multiplier. For example, TJ = DJ + 14*RJ for a BER of 10^-12. This means the scope will provide an unfairly negative report of the overall jitter performance of your serial data link, even tough the real RJ is dramatically less.

To solve the BUJ problem, EZJIT Plus provides two distinct algorithms for RJ extraction to ensure you achieve accurate measurements under all signal conditions.

The Tail Fit algorithm accurately extracts RJ, even in extreme ABUJ/crosstalk environments, by fitting directly to the tail of the RJ,PJ histogram.

Figures 3 and 4 contrast the two algorithms in a contrived jitter measurement with extreme crosstalk. The tail fit algorithm in Figure 4 provides a much better fit to the BER bathtub curve in the lower left and reports significantly lower RJ and TJ.

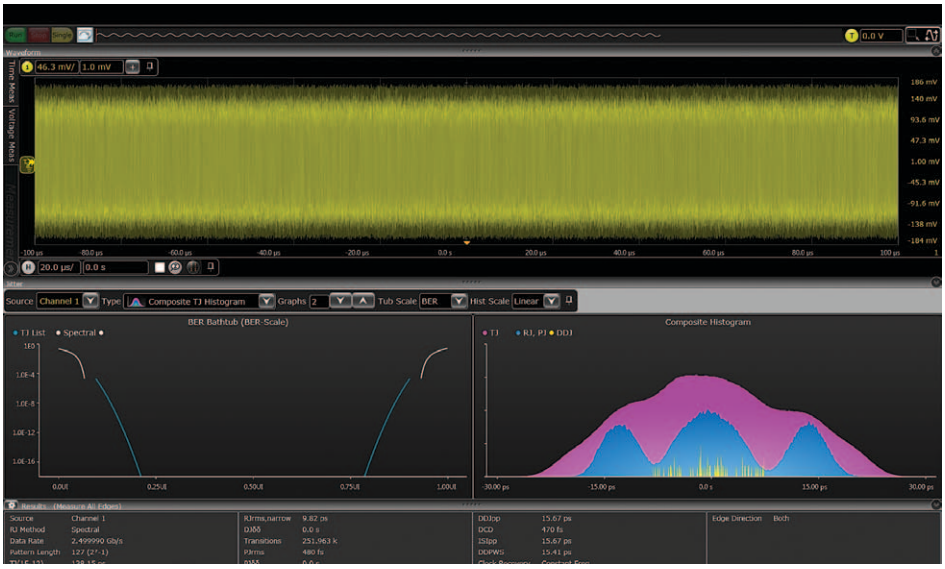


Figure 3. Jitter separation with artificially extreme crosstalk using spectral algorithm for RJ extraction. Notice the discontinuity in the BER bathtub, indicating that the extraction is getting poor convergence.

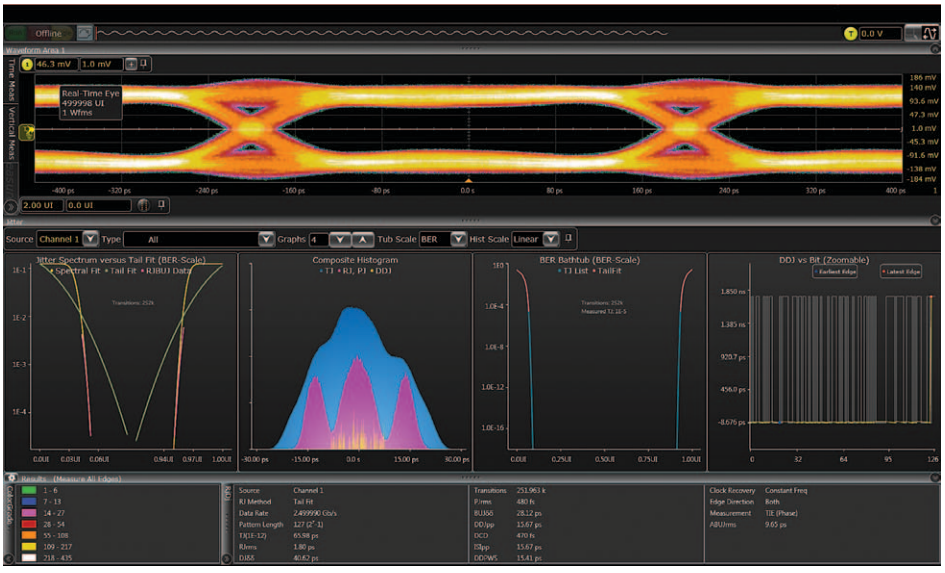


Figure 4. Jitter separation with the same artificially extreme crosstalk shown in Figure 3 using tail fit algorithm for RJ extraction. Notice the good fit to the BER bathtub and dramatically lower RJ and TJ results.

Analysis charts for separating jitter

EZJIT Plus provides numerous charts to determine the correct settings in your jitter separation. While the wizard provides a quick way to separate jitter, there are times when parameters need to be changed to make the correct answer. The EZJIT Plus analysis charts provide detailed information needed to properly separate the jitter of your design. EZJIT Plus includes the following jitter charts to help you in your analysis:

- Composite jitter histogram
- Jitter BER bathtub
- TJ histogram
- RJ/PJ threshold
- PJ threshold
- DDJ vs. bit
- ISI filter
- Tailfit versus spectral bathtub
- RJ/PJ spectrum
- DDJ histogram

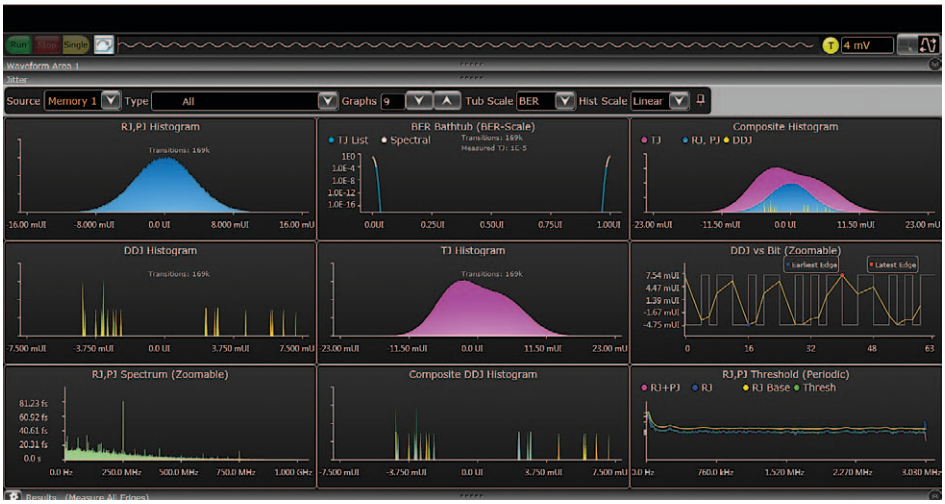


Figure 5. View up to nine analysis charts at once, undock them and move the charts to a different display

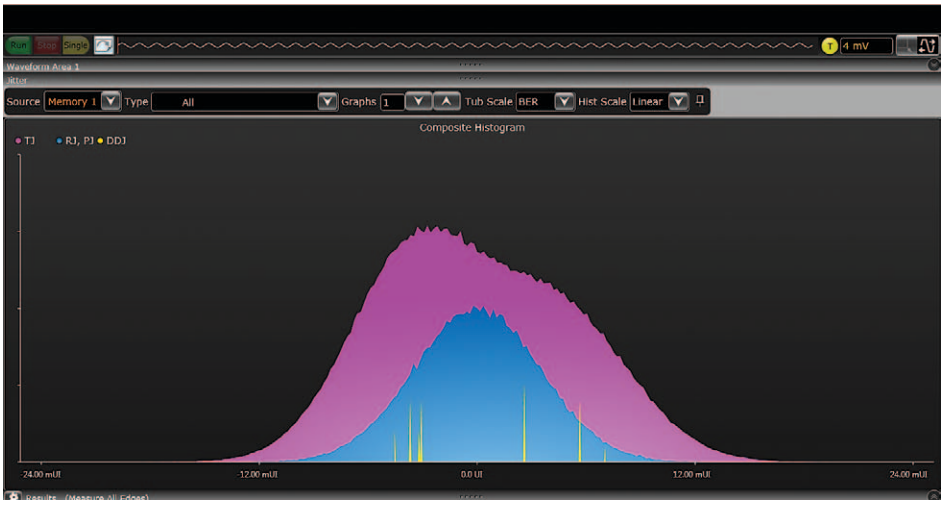


Figure 6. Composite histogram displays relative contributions of DDJ, TJ as well as RJ and PJ jitter.

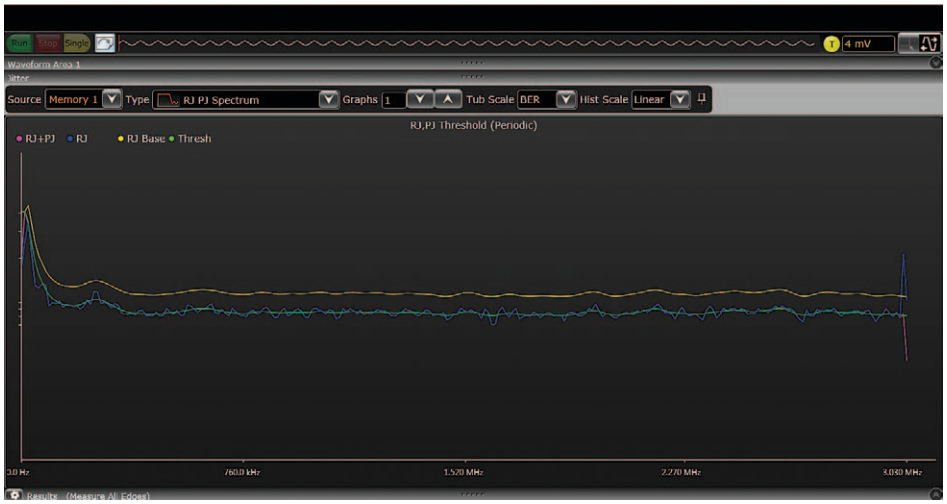


Figure 7. The RJ/PJ threshold allows you to see the exact threshold the software is using to determine RJ/PJ components.

Analysis tools for properly separating jitter

A simplified display leverages existing measurement results tabs and measurement toolbars, integrating the EZJIT Plus measurement capability into the Infiniium display window. The EZJIT Plus menu allows you to separate TIE, period, and nUI jitter into RJ/DJ components. The tools provide both periodic and arbitrary waveform analysis.

In the EZJIT Plus tab, you can easily filter the jitter (low pass, high pass, bandpass), change between BER and Q-Scale and remove or specify the Rj component of the jitter (another analysis tool for difficult jitter problems such as crosstalk).

Ultimately all these tools and charts means that Keysight's EZJIT Plus software will provide you the analysis to make the most accurate jitter measurement of any tool in the market.

EZJIT: Essential Jitter Analysis Tools

Included with EZJIT Plus

Jitter analysis made easy

A wizard in the EZJIT jitter analysis software helps you quickly set up the Infiniium oscilloscopes and begin taking measurements. With time-correlated jitter trend and signal waveform displays, the relationships between jitter and signal conditions are more clearly visible. Intuitive displays and clear labeling of information make it easy to comprehend measurement results.

Figure 9. The setup wizard prompts you to select measurement thresholds, histogram, jitter trend, and/or spectrum displays.

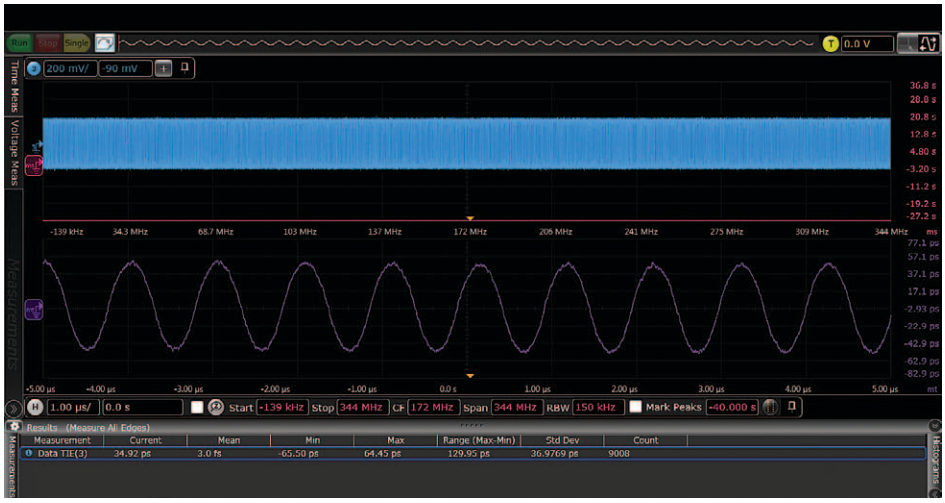


Figure 10. The EZJIT wizard simplifies jitter measurement setup, making it easy to view difficult measurements like SSC.

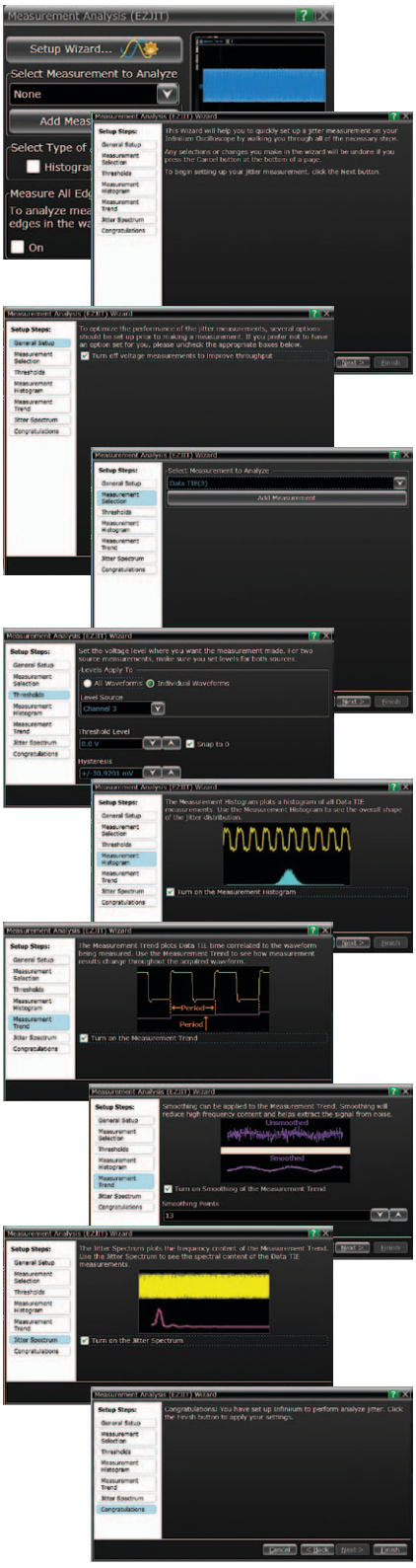


Figure 8. EZJIT's step-by-step wizard makes setting up jitter measurements quick and accurate.

Extensive parametric analysis

EZJIT jitter analysis software can analyze the time variability of any of the following fundamental parametric measurements:

Single-source

- Period
- Frequency
- Positive pulse width
- Negative pulse width
- Duty cycle
- Rise time
- Fall time

Dual-source

- Setup time
- Hold time
- Phase

Clock

- Time-interval error (TIE)
- N - period jitter
- Period-to-period jitter
- Pos width to pos width jitter
- Neg width to neg width jitter
- Cycle-to-cycle duty cycle

Data

- Time interval error (TIE)
- Data rate
- Unit interval
- n - UI jitter
- UI - UI jitter
- Clock recovery rate

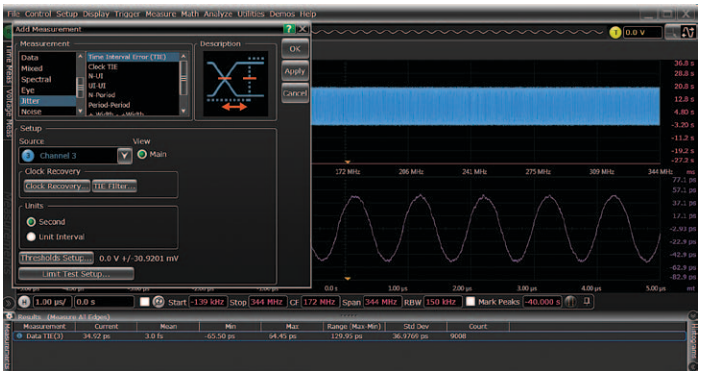


Figure 11. Extensive parametric analysis provides insight into data jitter components.

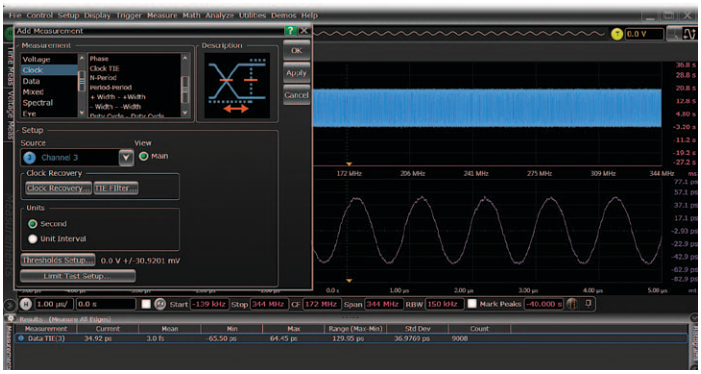


Figure 12. Clock jitter measurements provides insight into clock jitter components.

Real-time trend, histogram, and spectrum displays

Measurement data can be viewed as a trend display (Figure 13), showing a time plot of the measurement timecorrelated with the signal waveform data. This makes it easy to understand relationships between jitter and signal conditions, such as intersymbol interference (ISI). EZJIT provides up to 17 measurement trends to be analyzed at once.

The histogram display (Figure 14) plots the relative occurrence of values for the measured parameter. The histogram provides insight into the statistical nature of the jitter.

For example, the histogram shown in Figure 14 appears as two gaussian distributions. The peak-to-peak jitter between the gaussians indicates significant deterministic jitter in the signal, while the gaussians show the spread of random jitter.

The spectrum display (Figure 15) shows the spectral content of the jitter. The spectrum display can be useful for identifying sources of jitter by their frequency components. For example, if you suspect a switching power supply with a switching frequency of 33-KHz is injecting jitter, you can test your theory by examining the jitter spectrum for a peak at 33-KHz.

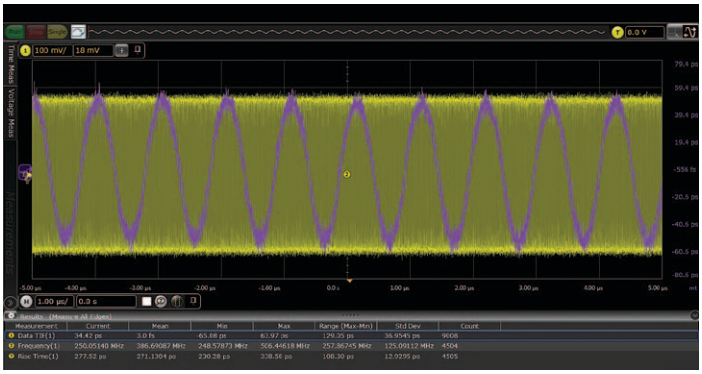


Figure 13. A trend display, showing a time plot of the measurement timecorrelated with the signal waveform data, makes it easy to understand relationships between jitter and signal conditions.

Figure 14. A histogram display plots the relative occurrence of values for the measured parameter, providing insight into the statistical nature of the jitter.

Figure 15. A spectrum display shows the spectral content of the jitter, useful for identifying sources of jitter by their frequency components.

Deep memory captures low-frequency jitter

Deep memory is especially valuable for jitter analysis. The optional 2 Gpts memory on the Keysight 90000 X-Series and 90000 Q-Series is helpful in measuring low frequency jitter. At a sample rate of 80 GSa/s and incoming data rate of 2.5 Gb/s, 2 Gpts allows you to capture jitter frequency components down to 40Hz. Comparably in the 90000A, 9000A, and 9000 H-Series, the 40 GSa/s sample rate and optional 1 Gpts memory allows you to capture jitter frequency components as low as 40 Hz.

In some cases, measuring low-frequency jitter is not required; for example, the clock recovery PLL in most serial data receivers can reject jitter very effectively at moderately low frequencies. But sometimes an event occurring at a low repetition rate can cause bursts of jitter or noise with higher frequencies that the PLL cannot reject.

For even deeper insight, apply the same deep analysis and component separation to the vertical noise affecting your signal using Keysight's N8813A EZJIT Complete software.

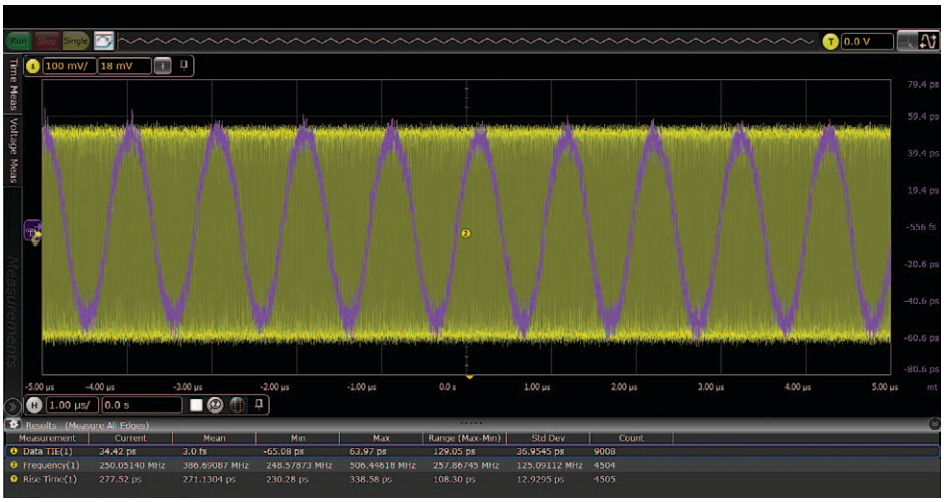


Figure 16. Use the measurement trend to remove spread spectrum clocks from your signal and make measurements on it.

Ordering information

To order the EZJIT jitter analysis software with an oscilloscope, please order the option indicated in the table:

License type		Infiniium Z-Series	Infiniium S-Series	Infiniium 90000A and X Series	Infiniium 9000 Series
Fixed	Factory-installed	N5400A-1FP	N5400B-1FP	Option 004	Option 004
	User-installed	N5400A-1FP	N5400B-1FP	N5400A-1NL	N5400B-1NL
Floating	Transportable	N5400A-1TP	N5400B-1TP	N5400A-1TP	N5400B-1TP
	Server-based	N5435A-001			
Infiniium Offline	DSA package	Part of the N8900A-002 DSA package			

To order the EZJIT jitter analysis software for an existing oscilloscope, please order the following:

Model number	Description
E2681A	After-purchase EZJIT jitter analysis software for Infiniium oscilloscopes
N5400A	After-purchase EZJIT Plus jitter analysis software for Infiniium oscilloscopes
N5401A	After-purchase EZJIT Plus upgrade from existing EZJIT installation for oscilloscopes
N8813A	After-purchase EZJIT Complete upgrade from existing EZJIT Plus installation for oscilloscopes

Other Measurement Software for High Speed Digital Data Analysis

Model Number	Title	Description
	Realtime Oscilloscopes: DSO/DSA90000A Series, 90000X Series, 90000Q Series	
E2681A	EZJIT	Trending of Measurements, clock recovery, and fundamental jitter measurements such as total jitter and N cycle jitter.
N5400A	EZJIT Plus	Jitter Decomposition using dual dirac technique. Predict total jitter to low BERs
N5461A	Equalization	Select from CTLE, FFE and DFE equalization types and various clock topologies to understand what equalization will do to a signal, or to model voltage eye internal to receiver device.
N2809A & N2807A	Precision Probe Software and Hardware Kit	Measure and remove effects of cable and switch paths in front of the oscilloscope, measure and ac calibrate probes for greatest accuracy and bandwidth.
N5465A	InfiniiSim Waveform Transformation Toolset	Creates transfer functions for implementing De-Embedding of Fixtures and cables, Embedding, general simulation, removing probe loading and changing observation point of measurement.
E2688A	Serial Data Analysis	Create eye diagrams of total captured waveform or of particular filtered portions of it (i.e bit sequence dependence). Includes standard masks and 8b/10b protocol analysis.
	Sampling Oscilloscopes: 86100D Series Digital Communication Analyzer	
86100D-300	Advanced Amplitude Analysis	Infiniium DCA software option that performs the highest accuracy amplitude analysis available.
86100D-200	Advanced Jitter Analysis	Jitter Decomposition using dual dirac technique. Predict total jitter to low BERs
86100D-201	Advanced Jitter Analysis	Equalize signals using software CTLE and FFE/LFE models.
86100D-202	Enhanced Impedance and S-Parameter SW	Single-ended and differential S-parameter measurements.
86100D-300	Advanced Amplitude Analysis	Infiniium DCA software option that performs the highest accuracy amplitude analysis available.
86100DU-401	Advanced Eye Analysis	Jitter and amplitude/noise analysis on long patterns such as PRBS31. Eye contour and eye/mask testing.
86100D-SIM	InfiniiSim-DCA	Creates transfer functions used to de-embed/embed fixtures and cables, general simulation, removing probe loading and changing observation point of measurement.

Related Literature

Publication title	Publication type	Publication number
Infiniium DSO90000 and DSA90000 Series Oscilloscopes	Data Sheet	5989-7819EN
Infiniium 90000 X Series Oscilloscopes	Data Sheet	5990-5271EN
Infiniium 90000 Q Series Oscilloscopes	Data Sheet	5990-5299EN
Infiniium S-Series Oscilloscopes	Data Sheet	5991-3904EN
Infiniium Z-Series Oscilloscopes	Data Sheet	5991-3868EN
EZJIT Plus	Data Sheet	5990-6541EN
EZJIT Complete	Data Sheet	5991-0523EN
EZJIT	Data Sheet	5989-5483EN
Information on Jitter Measurement	White Paper	5989-5483EN
86100D Wide-Bandwidth Oscilloscop Mainframe and Modules	Data Sheet	5990-5822EN
86100C Jitter/Amplitude	Product Note	5989-1146EN

For copies of this literature, contact your Keysight representative or visit www.keysight.com/find/scope-apps.

Choosing your Jitter Analysis Software for Infiniium Oscilloscopes

	EZJIT	EZJIT Plus	EZJIT Complete
Model number **Option number**	**E2681A** **002**	**N5400A** **004**	**N8813A** **057**
Advanced Clock Recovery	Requires Serial Data Analysis, option -003	Requires Serial Data Analysis, option -003	Requires Serial Data Analysis, option -003
Basic Jitter Views			
Jitter trend	●	●	●
Jitter histogram	●	●	●
Jitter spectrum	●	●	●
Multi-acquisition	●	●	●
Jitter Clock Measurements			
Period	●	●	●
Pulse width (+, –, both)	●	●	●
Frequency	●	●	●
Duty cycle (+, –)	●	●	●
Time-interval error	●	●	●
Cycle-cycle jitter	●	●	●
N-cycle jitter	●	●	●
Cycle-cycle +/– width	●	●	●
Cycle-cycle duty cycle	●	●	●
Jitter Data Measurements			
Time-interval error	●	●	●
Data rate	●	●	●
Unit interval	●	●	●
Delay/Edge Measurements			
Setup/hold	●	●	●
Phase	●	●	●
Rise/fall time	●	●	●
Jitter Separation			
Random jitter (RJ)		●	●
Deterministic jitter (DJ)		●	●
Data dependent jitter (DDJ)		●	●
Inter-symbol interference (ISI)		●	●
Duty cycle distortion (DCD)		●	●
Bounded uncorrelated jitter (BUJ)		●	●
Periodic jitter (PJ)		●	●
Aperiodic bounded uncorrelated jitter (ABUJ)		●	●
Total jitter (TJ) estimation		●	●
BER range		●	●
Max pattern length periodic mode		●	●
Max pattern length arbitrary mode		●	●

Choosing your Jitter Analysis Software for Infiniium Oscilloscopes *(Continued)*

	EZJIT	EZJIT Plus	EZJIT Complete
Model number **Option number**	**E2681A** **002**	**N5400A** **004**	**N8813A** **057**
Real-time Eye	Requires Serial Data Analysis, option -003	Requires Serial Data Analysis, option -003	Requires Serial Data Analysis, option -003
Advanced Jitter Views			
BER bathtub		●	●
DDJ vs bit		●	●
Composite histograms		●	●
TJ histogram		●	●
DDJ histogram		●	●
RJ/PJ histogram		●	●
RJ/PJ spectrum		●	●
Vertical Noise Analysis			
Vertical noise decomposition			●
Total interference estimation			●
Separate analysis of one and zero levels			●
Advanced noise views			●

Keysight Oscilloscopes

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