Keysight Technologies

86116C
40 to 65 GHz Optical and 80 GHz Electrical Plug-in Modules

KEYSIGHT TECHNOLOGIES

Enabling the design of next generation high-speed communication components and systems

The widest optical and electrical bandwidths with a well-designed frequency response for precision waveforms allow you to research, design, verify and troubleshoot the physical layer of today's electronic frontiers: STM-256/OC-768 telecommunication, 100 Gbps Ethernet (4x 25G variants), or 16X Fibre Channel (single-mode variants).

86116C-041 Optimized for high-speed telecom signals

- 40 G SONET/SDH and faster signals
- 70 GHz characteristic optical bandwidth displays up to 107 Gb/s NRZ
- Reference receiver for 39.81, 41.25 and 43.02 Gb/s NRZ

86116C-025 Optimized for high-speed LAN/SAN signals

- 25G Ethernet (x4 for 100 GbE) and 16X Fibre Channel (single-mode variants)
- 45 GHz characteristic optical bandwidth displays up to 40 Gb/s NRZ
- Reference receiver for 17, 25.8, and 27.7 Gb/s NRZ

Included in both options

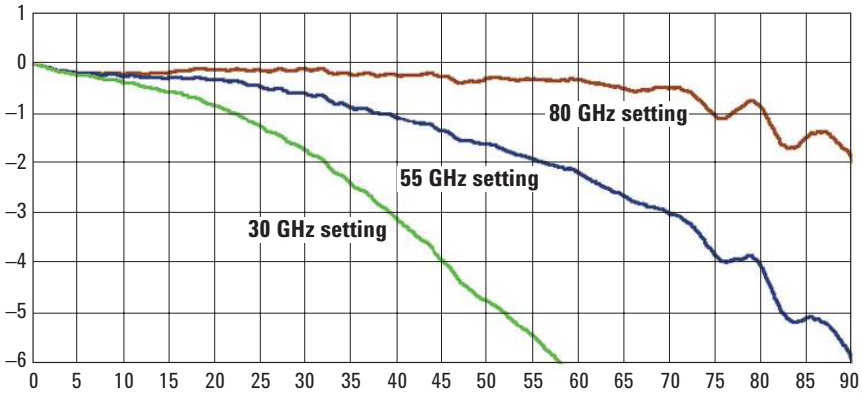
- 93 GHz characteristic electrical bandwidth
- 55, 30 GHz settings for best sensitivity (0.6, 0.5 mV_{RMS} characteristic)

86116C

Cutting edge component and subsystem designs require accurate characterization of very high-speed signals. When viewing waveforms in the 10 to 100 Gb/s range, three requirements are critical in an oscilloscope: a well-designed frequency response, a wide bandwidth, and extremely low internal jitter. The Keysight Technologies, Inc. 86116C optical and electrical modules represent some of the fastest solutions available for measuring high-speed communication signals. Characteristically with 45 or 70 GHz optical and 93 GHz electrical bandwidth, the 86116C when paired with the 86107A precision timebase module becomes the ideal solution for ultra high-speed waveform analysis. Designers will see the real performance of their devices and not aberrations created by the test equipment.

The unfiltered bandwidth settings provide the best pulse fidelity mode for measurement and display of very high-speed waveforms and provides a fast full-width, half-max (FWHM) of less than 7.4 ps (86116C-041). User selectable bandwidth settings can reduce noise when observing signals. The electrical channel features over 93 GHz bandwidth. This yields a 3.9 ps system risetime. Just as important as bandwidth, the channel has a well-controlled frequency response to minimize waveform distortion. User selectable bandwidth settings can be used for reduced instrumentation noise.

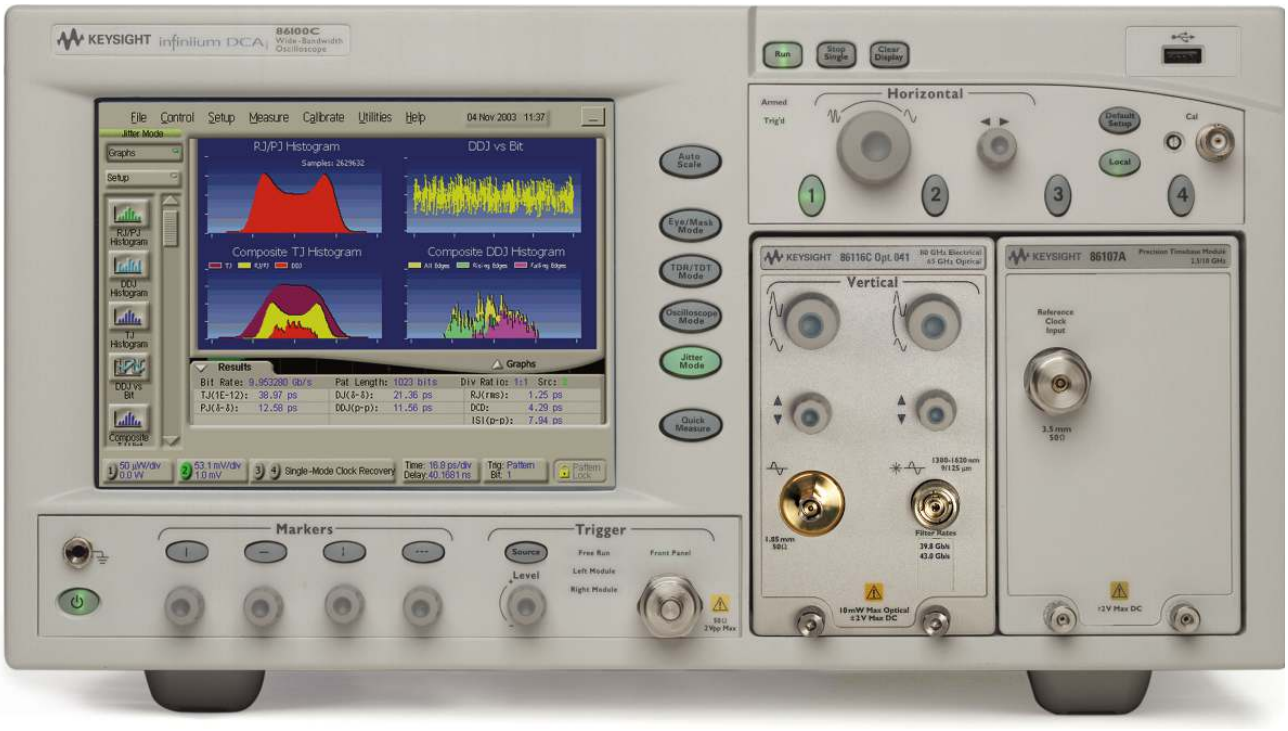
The 86116C integrates with the 86100C Infiniium DCA-J wideband oscilloscope mainframe. The 86100C can hold up to two modules for a total of four measurement channels. In addition, the 86100C has a comprehensive set of waveform[1] and jitter analysis[2] tools that decompose the jitter components. They provide extremely valuable insights when troubleshooting or optimizing the jitter performance of a component or a system.



Characteristic electrical channel frequency responses

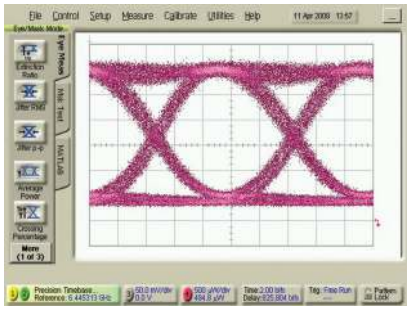
1. *86100C-201 Advanced Waveform Analysis (includes interface to MATLAB)*
2. *86100C-200 Advanced Jitter Analysis and 86100C-300 Advanced Amplitude Analysis*

Complete Solutions for 17 to 43 Gb/s Signals

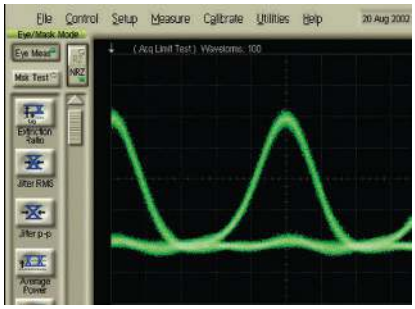


An invaluable companion to the 86116C, the 86107A precision timebase (right module) significantly reduces the 86100C's intrinsic jitter to less than 250 fs, allowing you to quickly make accurate waveform and jitter analyses.

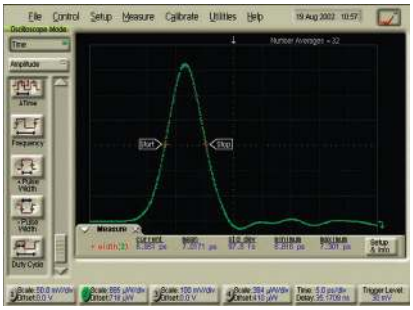
Characteristic optical unfiltered eye measurement (86116C-041).



Characteristic optical 25.8 Gb/s eye diagram (86116C-025).



Characteristic RZ optical eye measurement (86116C-041) Note the FWHM pulse width of less than 7 ps. This fast response is vital for accurate characterization of very high-speed signals. Note the absence of pulse distortion due to the well-designed frequency response of the oscilloscope channel.



Characteristic optical impulse response: pulse width < 7 ps, very low aberrations (86116C-041)

86116C Optical and Electrical Specifications

Specifications describe warranted performance over the temperature range +10 °C to +40 °C unless otherwise noted. Characteristics provide useful, non-warranted information about the functions and performance of the instrument. Characteristics are printed in italics.

	Electrical channel	**Optical channel**	
	86116C-025, 86116C-041	86116C-025	86116C-041
Nominal inputs	50 Ω, 1.85 mm (m)	9/125 µm, straight, FC/PC[1]	9/125 µm, straight, FC/PC[1]
Wavelength range		1300 to 1620 nm	1300 to 1620 nm
Average optical power factory of user calibrated accuracy[2]		±5% ±100 nW	±5% ±100 nW
Unfiltered bandwidth	80 GHz (–3 dB_{el}) *93 GHz (–3 dB_{el})*	40 GHz (–3 dB_{opt}) *45 GHz (–3 dB_{opt})*	65 GHz (–3 dB_{opt})[3] *70 GHz (–3 dB_{opt})*
Bandwidth settings	80, 55, 30 GHz	40 GHz (Filter off)	65, 60, 55 GHz (Filter off)
Reference receiver Data rates	–	17.000, 25.781, 27.739 Gb/s (filter on)	39.81, 41.25 and 43.02 Gb/s (filter on)
Max. non-destructive signal Average Peak	 ±2 V ±2 V	 *10 mW* *< 40 mW and* *< 0.25 pJ*	 *10 mW* [4] *< 40 mW and* *< 0.25 pJ*

	Electrical	**1310 nm**		**1550 nm**	
	86116C-025, 86116C-041	86116C-025	86116C-041	86116C-025	86116C-041
Maximum MS Noise	2.2 mV (80 GHz) 1.1 mV (55 GHz) 0.8 mV (30 GHz)	120 µW (40 GHz) 30 µW (27.7 Gb/s) 20 µW (25.8 Gb/s) 18 µW (17 Gb/s)	300 µW (65 GHz) 225 µW (60 GHz) 127 µW (55 GHz) 102 µW (39.8/43.0 Gb/s)	80 µW (40 GHz) 21 µW (27.7 Gb/s) 18 µW (25.8 Gb/s) 15 µW (17 Gb/s)	200 µW (65 GHz) 150 µW (60 GHz) 85 µW (55 GHz) 68 µW (39.8/43.0 Gb/s)
Characteristic RMS Noise	1.1 mV (80 GHz) 0.6 mV (55 GHz) 0.5 mV (30 GHz)	60 µW (40 GHz) 20 µW (27.7 Gb/s) 17 µW (25.8 Gb/s) 13 µW (17 Gb/s)	187 µW (65 GHz) 105 µW (60 GHz) 75 µW (55 GHz) 54 µW (39.8/43.0 Gb/s)	40 µW (40 GHz) 14 µW (27.7 Gb/s) 12 µW (25.8 Gb/s) 10 µW (17 Gb/s)	125 µW (65 GHz) 70 µW (60 GHz) 50 µW (55 GHz) 36 µW (39.8/43.0 Gb/s)
Sensitivity	–	–7 dBm (27.7 Gb/s) –8 dBm (25.8 Gb/s) –9 dBm (17 Gb/s)	–3 dBm (39.8/43.0 Gb/s)	–8 dBm (27.7 Gb/s) –9 dBm (25.8 Gb/s) –10 dBm (17 Gb/s)	–5 dBm (39.8/43.0 Gb/s)

1. *Ships with one 86100FI FC/PC connector interface. Other types can be ordered separately.*
2. *20 °C to 30 °C, excludes connector uncertainty*
3. *Calculated from 0.48/FWHM using optical impulse at 1550 nm*
4. *Using a 20% filled 40 Gb/s pulse train (5 ps FWHM, 25 ps period)*

86116C Ordering Information

86116C[1]	**40 to 65 GHz optical / 80 GHz electrical sampling module, 1300 to 1620 nm**
Select exactly one reference receiver option:	
86116C-025:	40 GHz opt./80 GHz elec. channels, 17.0/25.8/27.7 Gb/s reference receiver
86116C-041:	65 GHz opt./80 GHz elec. channels, 39.81/41.25/ 43.02 Gb/s reference receiver
86100C	**Infiniium DCA-J mainframe**
86100C-001	Enhanced trigger, 13 GHz bandwidth
86100C-200	Jitter analysis software
86100C-201	Advanced waveform analysis software
86100C-300	Amplitude analysis/RIN/Q-factor
86107A	**Precision timebase reference module**
Select exactly one clock input capability:	
86107A-010	2.5 and 10 GHz clock input capability
86107A-020	10 and 20 GHz clock input capability

See also www.keysight.com/find/dcaj for other modules, options and accessory.
To upgrade an 86100A/B or older DCAs contact Keysight Technologies, Inc. to discuss current trade-in deals.

1. *Requires 86100C with firmware revision A.08.00 or greater (available from www.keysight.com/find/dcaj).*
2. *Recommended for data rates 25.8 G and higher.*

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(BP-07-10-14)

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Published in USA August 2, 2014
5989-8359EN
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